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Surgical Service Journeyman

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THE FIRST TWO VOLUMES of this course primarily focused on the basic information and background material you need to be an effective surgical technician. In this volume we begin dealing with hands-on patient care.

Surgical care involves much more than just performing an operation. It refers to all aspects of perioperative care—the care given before, during, and after surgery. Much of this care is beyond the scope of your primary duties, but as a surgical technician, you'll be asked to assist surgeons, operating room nurses, anesthesia staff, and postanesthesia care nurses with nearly all aspects of perioperative care.

Unit 1 covers preoperative physical preparation and care (psychological prep was covered in volume 1). This unit covers the preparation considerations and assessment of the patient, documentation, and the procedures for transporting patients to the operating room.

Unit 2 covers the administration of anesthesia, from the premedication until they are transferred to the recovery room.

The last unit, unit 3, deals with immediate postoperative nursing care rendered in the postanesthesia care unit.

A glossary of abbreviations and acronyms is included at the end of this volume.

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NOTE:

In this volume, the subject matter is divided into self-contained units. A unit menu begins each unit, identifying the lesson headings and numbers. After reading the unit menu page and unit introduction, study the section, answer the self-test questions, and compare your answers with those given at the end of the unit. Then complete the unit review exercises.

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Unit 1. Preoperative Patient Preparation

BY NOW YOU ARE WELL ON THE WAY to becoming a fully competent member of the surgical team. You are familiar with your surgical suite, the personnel you work with, some of the patient's psychological fears and needs, and the basic aseptic principles and guidelines you are expected to follow. This leads us to a discussion of the numerous tasks and considerations that are part of preoperative patient care. What physical preparations are required before surgery to ensure that a patient's operation and postoperative recovery are safe and uneventful? What is your role in preparing a patient for surgery?

1–1. Preparation and Evaluation Factors

Many tests and special procedures are performed by the laboratory, medical and nursing staffs, radiology department, dietary department, and other hospital units before a patient is ready for surgery. Sometimes these preparations take several days; in an emergency, they may be accomplished in hours or even minutes. Regardless of the time span, there are some basic essential routines to be completed before an operative procedure can be performed safely on a patient.

This section provides you with information about the common physical preparations accomplished before a patient arrives in the operating room. Included is information on what factors affect the type of preparation for a particular patient, what special procedures and laboratory tests are routinely accomplished, the legal aspects of obtaining consent for an operation, and an overview of the items on the surgical checklist. There is also a discussion of the basic sequence of events from the time a patient enters the hospital until the patient is ready for transport to the surgical suite.
Many factors play a role in determining the preoperative preparations required for a particular patient.

401. Factors that affect preoperative patient preparation

The nature and amount of preoperative preparation required for each patient depends on a number of factors. The type of surgical procedure, the type of anesthesia to be administered, the age and physical condition of the patient, and the urgency of the surgery are primary considerations. The surgeon's particular routines and the number and complexity of the laboratory or other diagnostic tests required also play a role.

Type of procedure

By now you have enough operating room experience to realize that, normally, the amount of supplies, instruments, and equipment needed to perform a minor surgical procedure is much less than for a major procedure. The same principle usually applies to the physical preparation of the patient.

The surgeon routinely requests more lab tests and special diagnostic studies prior to performing a major procedure than before a minor procedure. This makes sense because any disease or injury

requiring a major operation usually affects a greater number of body systems. The surgeon needs to know the status of the different systems to make decisions about the type of surgical treatment that is best for the patient. For example, a patient with suspected lung cancer has not only extra chest X-rays taken but may also have extensive chemistry studies done to determine if the cancer has spread to other areas.

Sometimes the surgeon schedules a preliminary minor surgical procedure, such as a tissue biopsy, to gain more information about the patient's condition before performing a major corrective procedure. Results of these preoperative tests may indicate that surgery is not the best course of action, or that the patient's physical condition is so poor that surgery would be too risky.

Additional tests may indicate a disease process or injury in another area of the body that may be correctable at the same time the primary problem is being treated. On the other hand, if the patient's problem is minor, the surgeon usually orders only the basic lab tests and studies dictated by hospital policy and standards of medical practice.

Type of anesthesia

The type of anesthesia that the anesthesia staff, surgeon, and patient decide upon also dictates some of the preparation before surgery. Most patients are given some type of preoperative tranquilizer or sedative to lessen anxiety, some receive analgesics to reduce pain, and some receive amnesia-inducing drugs. Patients remaining awake during the procedure under local or regional anesthetics may receive stronger doses or different medications from patients receiving a general anesthetic. In addition to a sedative, general anesthesia patients usually receive an *anticholinergic* agent to reduce oral secretions and gastric juices. There is a more in depth discussion of preoperative medication in the next unit—*Anesthesia*.

Age and physical condition of the patient

The age of the patient plays a major role in determining required preparations. As we mentioned earlier in this text, pediatric patients and geriatric patients require special considerations because of their different physical and psychological needs.

Pediatric patients

In addition to their size, pediatric patients are physiologically and physically different from adults in many ways. First, their body temperature is subject to greater fluctuation than an adult's; they lose body heat much faster and overheat more quickly. This is particularly true in infants. Because the temperature control center in their brain is not fully developed, newborns do not shiver when they get cold. This prevents them from generating their own heat (shivering is uncontrolled muscle contraction that generates heat and helps your body stay warm). Also, infants do not have the natural insulation that adults have, such as body hair, fat, heavy muscle tissue, and thick skin. This places their blood vessels closer to the body surface and causes them to lose heat rapidly.

Another physiological difference that causes infants and small children to lose body heat rapidly stems from the fact that they have a larger body surface area in proportion to their body size than do adults. Knowing these facts is important because it definitely influences the type of physical preparations you'll perform before the surgeon can operate on infants and children. Because children lose body heat so rapidly, you must constantly monitor their temperature and make special efforts to keep them warm during surgery. To significantly reduce the chances of rapid heat loss occurring during surgery, you may need to turn up the room temperature, use warm irrigating and skin prep solutions, use special warming devices such as hyperthermia or hypothermia units, and keep them covered with warm blankets.

Children also have a smaller circulating blood volume than adults. Consequently, they cannot afford to lose very much blood during surgery without going into shock. To illustrate this point, consider the comparison of a seven-pound baby with a full-grown adult. The baby will have a blood volume of approximately 250 to 350 ml (about a half-pint). This baby can afford to lose only about 10 percent of

total blood volume before requiring a blood transfusion. Ten percent of 250 to 300 is 25 to 30 ml. This is roughly equivalent to one ounce, which is less than a medicine glass! Because blood loss is so critical in pediatric surgery, the circulator must closely monitor the wound suction container and you as the scrub must keep track of the amount of irrigation fluids used. All bloody sponges should also be weighed to help keep an accurate accounting of total blood and fluid loss. Preoperatively, the surgeon may request special blood tests that indicate how fast the child's blood clots and if the child has any bleeding problems. Halfway through an operation is no time for the surgeon to discover the child is a hemophiliac (bleeder)!

Because their immune systems are not fully developed, children are much more susceptible to respiratory infections and pneumonia than adults. Most children receive a general anesthetic, so it is very important that the child's respiratory tract is unobstructed. If you are transporting an infant or child to the operating room (OR) and notice the child has "sniffles" or sounds congested, tell the OR nurse or one of the anesthesia staff. The child's lungs and nasal passages may have been clear the day before surgery, but he or she could have come down with a cold overnight. This condition could make it very risky to administer a general anesthetic.

Since young children and infants grow and develop rapidly, their bodies need lots of energy. To get this energy, they need to eat frequently. When a baby is scheduled for surgery, give special consideration to avoid interrupting the feeding schedule for longer than is absolutely necessary. Interrupting food for several hours might weaken and dehydrate the infant, increasing the risk of performing the surgery. Adults are usually given nothing by mouth (NPO) after midnight. Infants, on the other hand, may be fed up to a couple of hours before the scheduled surgery because they absorb formula or milk faster than adults digest solid food. The time of the last feeding before surgery is based on the age of the infant or child and the scheduled surgery time. Also, to further reduce interruption of food, pediatric surgery is usually scheduled to start earlier than adult surgery.

Because infants and children are physically smaller than adults, pay special attention to instrument and suture selection, the size and type of surgical draping material, and the surgical positioning techniques employed. Obviously, you cannot use instruments, sutures, drapes, and positioning devices designed for adult patients. For once—think small!

Geriatric patients

You also must consider many factors when preparing elderly patients for surgery. Some of the more common factors are:

- Elderly patients generally heal more slowly than young people. As a result, the surgeon may change wound closure routines and surgical technique. The patient may also receive special food and supplements to enhance the healing processes.
- Geriatric patients may have arthritis, greatly reducing the range-of-motion of their joints. Consider this when moving a patient and during surgical positioning to avoid injuring the patient. Use special support devices and extra pillows to avoid stressing the joints and to provide comfort.
- Sedatives and narcotics are used with extreme caution, and when drugs are given, the normal dosages are reduced. Minimum dosages are given because elderly patients often have a reduced tolerance to medications; the effects of drugs and anesthetic agents increase in elderly patients. Monitor geriatric patients very closely for possible drug reactions and adverse side effects.
- Keep elderly patients warm. This is absolutely necessary because they have slower blood circulation, thinner skin, and less body hair than younger adults to keep them from losing heat.

There are many other physical and physiological problems that affect the type of preoperative preparations required. It is your job to check the nurse's preoperative assessment and the nursing care plan for the individual needs of each patient.

Categories of surgery

Another factor that plays an important role in determining preoperative preparation is the urgency of the surgery. Surgical procedures are usually classified into two categories elective, and emergency or emergent.

Elective

Elective surgery includes any procedure where the approximate date and time of the surgery are determined at the patient's convenience. Surgery is scheduled entirely at the preference of the patient. The patient may have a condition requiring surgical treatment, but failure to have the surgery immediately will not be harmful. Examples of elective procedures include removal of warts, excision of a sebaceous cyst, and cosmetic surgery such as a facelift. Vasectomies and tubal ligations are also considered elective procedures. You can rest assured that if the surgical case is same day surgery, it is elective.

Elective-urgent

This category is being used by some facilities to describe procedures that are not immediately life threatening but require surgery to correct a problem that could be life threatening if left untreated. Cardiac bypass and mastectomy for cancer are examples of elective-urgent surgical procedures.

Emergency

The best definition of an emergency procedure might be to say: emergency surgery is performed to correct a life or limb threatening condition. Operations to correct a ruptured appendix or a bowel obstruction are considered emergency surgery, as are open reductions of fractured bones. The most critical emergency surgery is called a "stat" procedure. When a surgeon indicates a procedure is stat, IMMEDIATE surgery is necessary to correct a life-threatening condition. If a stat C-section is called, either the mother's or the baby's life is in jeopardy—get there yesterday!

Surgeon's preferences

Another factor affecting preoperative preparation is the surgeon's preferences. Each surgeon has individual preferences derived from training and experience. There are many different techniques and methods to perform most operations. To ensure all required equipment and supplies are available, a surgeon's preference card or procedure card is developed and maintained for each type of operation the surgeon routinely performs. This card (sometimes a computer-generated list) is the primary source of information you'll use to determine the physical preparation a surgeon desires for a particular operation. The card lists the instruments, supplies, and equipment the doctor uses for a specific operation. This includes information about the skin prep, doctor's glove size, special positioning requirements, and drugs that may be used during the procedure. All members of the surgical team should check the card prior to setting up a case.

Number and complexity of tests

The number and complexity of laboratory and other diagnostic tests also influence preoperative preparation. Depending on the patient's overall health and the nature of the problem, the surgeon requests a variety of laboratory studies and special tests. The more tests ordered, the more time required to perform them before surgery. Extensive testing may increase the patient's preoperative stay in the hospital, add to his or her anxieties and fears, and subject him or her to greater risk of infection by weakening the immune system. The surgeon and anesthesia staff decide the type and number of tests necessary to physically evaluate the patient and to accurately diagnose and treat the patient's medical condition.

402. Evaluation of the surgical patient

To help evaluate the patient's physical condition and the specific nature of his or her problems, surgeons may order several laboratory tests and special diagnostic procedures. These tests and procedures include: urinalysis, hematology (blood studies), X-rays, electrocardiograms (ECG), and

special chemistry studies. When you transport a patient to the surgical suite, review his or her chart and the surgical checklist. You should know how to identify and understand the tests and examinations ordered as part of the patient's preoperative preparation.

NOTE: The Chief of Anesthesia at each facility determines the minimum preoperative requirements for the facility.

Laboratory tests

Two laboratory tests that may be ordered by the surgeon preoperatively to assess the patient's overall health are urinalysis and hematology studies. Healthy patients, less than 40 years old, typically do not require any laboratory tests preoperatively. *(Exception)* All females of childbearing age must have a complete blood count (CBC) and human chorionic gonadtropin (hCG) pregnancy test unless they are menopausal or have had a hysterectomy.

Urinalysis

A urinalysis consists of chemical and microscopic examination of urine. A urinalysis is not required for most surgical patients. It is usually required on selected patients such as patients who are having bladder or total joint replacement surgery. Urinalysis indicates how well the patient's kidneys function and also provides information about other metabolic processes in the body. It also indicates the presence or absence of infection in the urinary tract. The surgeon requests this test by computer. The results reported usually include the following:

- The *pH* is a measure of the acidity or alkalinity of a substance. A solution with a pH of 7 is considered neutral (not acidic or alkaline). Solutions with a pH below 7 are acidic; those above 7 are alkaline. The normal pH of urine ranges from 4.6 to 8, but averages about 6. If the pH is high (above 7), the patient's metabolism may be in a state of alkalosis (too much alkaline and an elevated amount of carbon dioxide). If the pH is below 6, the patient's body may be in a state of acidosis (too much acid in the body cells).
- *Specific gravity* of urine is a basic indicator of kidney function. Normal range of specific gravity is 1.016 to 1.022. A high specific gravity indicates the urine is concentrated and may mean the patient is dehydrated. A low specific gravity may indicate fluid overload or kidney disease.
- *Glucose* (sugar) is not normally found in urine. A urinalysis with a positive glucose is usually an indicator of diabetes.
- *Protein or protein-related substances* are also not normally found in urine. Their presence is a broad indicator of kidney disease, and the patient usually requires further testing.
- If *white blood cells (WBCs)* are found in the urine, the patient probably has a urinary tract infection.
- *Red blood cells (RBCs)* in urine indicate bleeding. This may be caused by inflammation, a stone in the kidney, or other conditions.
- *Casts* are pieces of fibrous material shed from the internal walls of the kidney. If casts are found in urine, additional tests are indicated.

Hematology

The most common routine hematology study is the complete blood count (CBC). This test evaluates the components of the blood. Hematology studies are requested by computer. The CBC includes a white blood cell (WBC) count, a red blood cell (RBC) count, a platelet count, hematocrit (Hct), hemoglobin (Hgb), and a differential white cell count (WBC Diff).

The following table gives the normal ranges for CBC values.

Complete Blood Count (CBC) Normal Values		
Blood Component	**Normal Male Range**	**Normal Female Range**
White Blood Cells (WBC) per cubic millimeter (cu mm)	4,000 - 11,000	4,000 - 11,000
Red Blood Cells (RBC) million per cu mm	4.6 - 6.2	4.2 - 5.4
Hemoglobin (Hgb) grams per 100 milliliter (ml)	13.0 - 18.0	12.0 - 16.0
Hematocrit (Hct) % volume of packed RBC per 100 ml	40 - 54	38 - 47
Platelet Count per cu mm	150,000 - 400,000	150,000 - 400,000

The differential count is not listed. WBC-Diff indicates the percentage of each type of white blood cell in the WBC count, and explanation and ranges are beyond the scope of this text.

The CBC can tell the surgeon much about the patient's physiological status. For instance, a WBC count over 11,000 usually indicates the patient has an infection; below 4000 can indicate leukemia or other immune system diseases. The hemoglobin in the RBCs carries oxygen to all tissues of the body. If the RBC count and Hgb values are low, the patient may be anemic. The hematocrit measures the volume of packed red blood cells in 100 ml of blood. A low Hct may also indicate anemia or internal bleeding; a high Hct indicates a fluid deficit, such as from dehydration or shock. Platelets play a vital role in blood clotting. If the platelet count is low, the patient may hemorrhage during surgery. An abnormal platelet count may also point to a disease or condition requiring treatment before surgery.

Blood coagulation studies

The surgeon may request tests to measure the blood's ability to clot. A simple bleeding time test involves pricking the patient's finger or ear lobe, then measuring how long it takes to stop bleeding. A plasma clotting time test may be done in conjunction with the bleeding time test. A few drops of blood are collected in a clean container, and the time it takes the blood to coagulate is measured. If either of these tests is abnormal, more extensive testing is ordered. The prothrombin time (PT) and partial thromboplastin time (PTT) tests measure how much of these vital blood clotting substances are present in the blood. These tests can help determine the necessity for the *type*, and *amount* of blood or blood products transfused.

Typing and crossmatching

If the surgeon anticipates requiring a blood transfusion, he or she will submit a request to the laboratory blood bank for typing and crossmatching of the patient's blood. Blood is drawn from the patient, then tested to determine the A, B, or O blood group and Rh factor (positive or negative), or blood type. Crossmatching refers to the procedures used to determine compatibility of both the patient's blood and the donor blood unit. After typing and crossmatching, the compatible units of donor blood are reserved for the patient. This is usually indicated on the surgical checklist and surgical schedule. (This is discussed more thoroughly later.)

Pathology studies

Preoperative pathology studies are usually referred to as biopsies. Tissue, bone marrow, or fluid is removed by the surgeon usually in the clinic. Commonly used collection methods include excision (surgically cutting out the tissue), aspiration (using a needle and syringe to suck out the fluid or tissue), and needle biopsy (using a specially designed needle to take a plug of tissue). The biopsy is then sent to the clinical pathology department in the laboratory for diagnosis.

Radiographic studies

The studies discussed here may also be ordered by the surgeon prior to surgery.

Chest X-rays

Patients younger than 40 years of age that do not have evidence of chest disease are not typically required to have a chest x-ray. Elderly patients and those who have a history of smoking, chronic lung disease, or pulmonary problems routinely have a chest X-ray, even if they are not slated for a general anesthetic. Obviously, anyone scheduled for chest or heart surgery also requires a chest X-ray.

Other radiographic studies

The type of procedure usually dictates any additional X-rays. Fracture reductions require X-rays of the fracture site. Mammograms are needed for breast biopsies and mastectomies. Xeroradiography may be used to detect foreign objects. Neurosurgeons may order computerized tomography (CT) or computerized axial tomography (CAT) scans. Radiopaque dyes are injected into veins or arteries, and then X-rays are taken to diagnose vascular abnormalities.

Ultrasound

Ultrasound involves using sonic energy echoes to see or hear anatomical structures. It is frequently used for prenatal diagnosing and monitoring during pregnancy. It is also used for diagnosing stones in the bladder, kidneys, and gallbladder. Ultrasound can also detect pulmonary embolism. Cardiovascular defects are detected using a form of ultrasound called *echocardiography*. A Doppler is basically an ultrasonic stethoscope and can be used to determine blood flow, identify vascular disease, and monitor fetal heart tones.

Magnetic resonance imaging

For magnetic resonance imaging (MRI), the patient is placed in a large horizontal electromagnet tube (bore of the magnet) and radiowaves are shot through the desired area. MRI produces color video or film that distinguishes different types of tissue. It is used to diagnose torn ligaments or cartilage, herniated nucleus pulposis, tumors, and abnormalities of organs or other structures.

Electrocardiogram

Surgical patients 40 years old and over are recommended to have a preoperative electrocardiogram (ECG/EKG). This is done to diagnose any heart problem that could influence the choice of anesthesia or change the surgeon's choice of treatment. If a significant abnormality is discovered, the surgeon may postpone the surgery until further studies are done. All patients with a history of cardiovascular disease have a preoperative ECG.

Other tests and special procedures

There are many other special tests that the surgeon can order to evaluate the patient. For instance, if the patient has a history of hepatitis, a liver function study is requested. Patients suspected of having syphilis require serology tests. Blood and urine chemistry studies may be indicated if the results of the routine hematology and urinalysis are abnormal. Craniotomy patients may have a preoperative electroencephalogram (EEG), which shows the patterns of brain waves.

The surgeon, anesthesia staff, and nursing personnel must know and consider the physiological status of the patient when planning treatment and care. As a surgical technician, you are not expected to interpret test reports or results, but you should at least be familiar with them. Understanding some of the tests and preparations can help you empathize with your patients.

403. Typical preoperative preparation of an elective surgical patient

As stated previously, the preoperative preparations required for each patient vary depending on a number of factors. This lesson is not a step-by-step guide to patient preparation, but it gives you an overview of the elective surgical patient's typical preoperative experience. Since the majority of you

will now be involved with same day or ambulatory surgery, we will primarily discuss preparation of a patient admitted to the hospital, or inpatient, so that you may become familiar with these procedures. Of course we will also look at the routine same day surgery. The routine is similar, but the timing is different, and the patient performs most of the preparation before entering the hospital.

Preadmission

Before being admitted to the hospital, the patient visits the doctor's office or clinic for a complete physical examination and medical history. Many of the procedures and tests discussed in the previous lesson are ordered and done during this visit. The consent form and other documentation (discussed in the next section) are also often initiated during this office or clinic visit. Then, the patient usually goes to the preadmission clinic or office. In the preadmission area, the following takes place:

1. Admissions and Dispositions (A&D) personnel obtain initial patient information and begin the paperwork. This reduces administrative time and patient stress on the actual day of admission.
2. A member of the clinical nursing staff (usually a registered nurse) conducts a preliminary nursing interview and works with the patient to formulate a nursing care plan. This plan becomes part of the patient's medical record and helps establish priorities, goals, and nursing interventions. Any required preoperative teaching is usually done at this time. The nurse also ensures the patient understands and agrees to the procedures involved and tries to establish realistic expectations of the outcome.
3. An OR nurse interviews the patient and formulates a perioperative nursing care plan. Also, the nurse discusses the various procedures and events the patient will experience in the OR, tries to physically and psychologically prepare the patient, and answers as many of the patient's questions as possible.
4. An anesthetist or anesthesiologist also interviews the patient and makes an anesthesia assessment; sometimes this involves a brief physical exam. The patient and anesthetist review and consider all realistic anesthesia options and then decide upon the best anesthesia method for the patient. The anesthetist ensures that the patient understands all risks and consequences of the anesthetic chosen before obtaining the patient's informed consent for anesthesia.
5. The patient is given written instructions for any special procedures to accomplish beforehand, as well as how, when, and where to report for admission.

Day before surgery

Inpatients are usually admitted to the hospital the day before the scheduled surgery. They report to the A&D office to finish admission paperwork, receive their patient identification bands, and then go to the patient-care unit. In some hospitals and most medical centers, the patient is assigned to a patient-care unit according to the type of surgery he or she is scheduled to have (the surgical specialty he or she falls under). For example, a patient scheduled for a total joint replacement of the knee is assigned to the orthopedic care unit; a patient scheduled for a hysterectomy is normally assigned to the gynecology unit. Each surgical patient-care unit is equipped and staffed to deal with the special care and treatment required for patients admitted under the particular surgical specialty. Smaller hospitals usually have only one surgical ward for all patients.

Once on the nursing unit, the patient is assigned a particular room and bed and interviewed to reinforce the preadmission interview and update the nursing care plan. The patient is oriented to the unit's policies for such things as visitation, use of day rooms, unit sign-in and sign-out policies, fire safety and evacuation procedures, patient passes, physical layout of the unit, etc. Nursing personnel on the unit complete the patient's chart by adding the necessary inpatient record forms, and then begin implementing the nursing care plan. Any last minute lab work or other tests are now accomplished, and any treatment required to regulate a disease or other condition before surgery is begun. If any postoperative exercises are ordered, the nurse or medical technician usually begins teaching the patient at this time. Teaching patients these exercises before surgery increases the

likelihood they will remember how to do them properly after the surgery, even if they are disoriented or in pain.

The evening before surgery, the patient usually showers or bathes using an antiseptic soap such as povidone-iodine (Betadine) to reduce the number of microorganisms on his or her skin. (Before showering or bathing, some doctors or local policy may require the patient to have his or her hair removed from the incision site, which is usually done by the circulator in the operating room.) If ordered, an enema is administered to cleanse and empty the bowel. This decreases the risk of peritonitis (infection of the abdominal cavity) if the lower intestinal tract is opened and prevents the patient from having accidental bowel movements during the procedure. The surgical patient is NPO after midnight, which means no food or drink from midnight until after the surgical procedure is finished. This reduces the chances of vomiting and aspirating emesis into the lungs. At bedtime, the nurse usually administers a sedative (sleeping pill) to help the patient relax and fall asleep. (Pediatric patients are usually not given a sedative the night before surgery.)

Day of surgery

On the morning of surgery, the patient is awakened and vital signs are taken. The patient is asked to void and encouraged to attempt a bowel movement. Another antiseptic shower or bath may be ordered to further reduce the level of transient and resident bacteria. The adult patient usually dons a clean hospital gown or pajama top secured only at the neck. This facilitates easy removal to place electrodes and perform the skin "prep" once the patient is in the operating room. (The pediatric patient may remain in his or her own pajamas until after anesthesia induction.) Apply elastic *antiembolism* stockings, if ordered. Sometimes, surgeons order special procedures such as insertion of a catheter into the bladder, or insertion of a nasogastric tube. These procedures are usually done after the patient is anesthetized in the operating room, but sometimes conditions dictate they be performed before transport.

The nursing unit staff ensures completion of all procedures listed on the surgical checklist (discussed in the next section). A last set of vital signs is taken and recorded; then, the preoperative medication is administered at the specified time. After the premed is given, the nurse pulls up the *bed side rails and they remain up* until the surgical technician arrives to transport the patient to the surgical suite. The unit nurse reviews, checks off, and initials all completed items on the surgical checklist. The patient's chart and any X-ray films (or other large diagnostic test reports) needed in the OR are collected and given to the surgical technician transporting the patient. Finally, nursing personnel assist the surgical technician with moving the patient to the transport gurney or bed and annotate the time of transport in the chart; the patient is then wheeled to the operating room.

Ambulatory

Ambulatory or "Same Day" surgery is becoming the most common type of surgery you will see in the Air Force and is performed on a same-day, outpatient basis. Patients are not admitted to the hospital for an overnight stay. The medical history, physical, lab work, and other tests are done before the day of surgery. The patient reports to the Same Day Surgical Center (SDSC) at a designated time, preoperative preparations are completed, and the procedure is performed. After surgery, the patient is recovered, observed until stable, and then released from the hospital. Ambulatory surgery was originally used for minor procedures, such as myringotomy, odontectomy (tooth removal), and cystoscopy, on low-risk patients. This type of surgery is becoming more prevalent and popular as medical facilities and practitioners try to control costs, and the operations performed are more complex. Many facilities now use ambulatory surgery for relatively major procedures such as arthroscopic ligament repair, laparoscopic cholecystectomy, and nasal or sinus surgery. Some healthcare professionals estimate as much as 60 percent of all surgery will be performed on an ambulatory basis in the future.

We have covered a lot of behind-the-scenes information—the area of surgery you rarely see in the course of your duties as an OR tech. Just because you do not see the patient preparation does not

make it less important. You must know these procedures to be able to identify when they have not been properly completed and to fully round out your surgical knowledge. The next section covers some of the documentation you must be familiar with, but first, make sure you know what we've just covered.

Self-Test Questions

After you complete these questions, you may check your answers at the end of the unit.

401. Factors that affect preoperative patient preparation

1. List four factors that can affect preoperative patient preparation.

2. Specify two ways preparing for a major surgical procedure can differ from preparing for a minor procedure.

3. Cite the five physical or physiological differences between pediatric patients and adult patients which influence preoperative preparations.

4. Give the three reasons why infants and children lose body heat faster than an adult.

5. Why is it so important that a pediatric patient's respiratory tract be unobstructed before surgery?

6. Why is pediatric surgery usually scheduled before adult surgery?

7. Identify three factors that must be considered during preoperative preparation for surgery on an elderly patient, and briefly describe how preparations are affected.

8. Define the following types of surgery:

   a. Elective.

   b. Emergency.

9. What is the primary source of information used to determine physical preparation desired by the surgeon?

10. Describe some of the effects increasing the number and complexity of preoperative tests may have on a surgical patient.

402. Physical evaluation of the surgical patient

1. What is the normal range and average pH of urine?

2. What might a low specific gravity indicate? What about a high specific gravity?

3. If the urinalysis shows the presence of red blood cells (RBCs), what could this mean?

4. What is the most common routine hematology study, and what does it include?

5. What does a white blood cell count over 11,000 usually indicate?

6. What does the hematocrit measure?

7. Name the four blood tests used to determine how well a patient's blood clots.

8. What is crossmatching of blood?

9. What are biopsies?

10. Cite the four types of patients who will normally require a preoperative chest X-ray.

11. What patients are routinely required to have an ECG before surgery?

403. Typical preoperative preparation of an elective surgical patient

1. List three procedures usually done in the preadmission area.

2. What is the purpose of having a patient shower or bathe with an antibacterial soap the evening prior to surgery?

3. What is the purpose of giving a patient a cleansing enema before surgery?

4. Why are adult patients usually required to don a clean hospital gown or pajama top backwards and secured only at the neck?

5. What safety precautions does the unit nurse take after giving the patient preoperative medications?

1–2. Preoperative Administration and Documentation

Have you ever heard or read a news report about a patient having the wrong operation? In the past, hospital staff have amputated the wrong leg, operated on the wrong side of the brain, replaced the wrong hip, and even operated on the wrong patient! How would you feel if you were partly responsible for any of these acts? What can you do to prevent this from happening to one of your patients?

One of the things you can do is make sure you know and understand the preoperative documentation required for a surgical procedure. If you know what forms to look for, how to read them, what they are supposed to say, AND you thoroughly check them, you'll never transport the wrong patient to the operating room. Checking all the paperwork will also help you to identify discrepancies—for example, if the patient tells you he is having his gallbladder out, and the chart says abdominal hysterectomy, you know there is a problem, so find the nurse—quickly!

404. Informed consent for surgery, anesthesia, and other procedures

Before any surgical or special procedure is performed, anesthetic administered, photographs taken, or specimens from the patient disposed of, a licensed practitioner must obtain the informed consent of the patient. If the patient is a minor, unconscious, or incompetent, informed consent must be given by someone legally responsible for the patient. Before you transport a patient to surgery, check the chart for accurate and appropriate informed consent.

Definition

Informed consent is simply the patient fully understanding and voluntarily giving the health-care provider permission, in writing, to perform the treatment specified. The most common informed consent document you'll see and must be familiar with is the OF 522, Medical Record - Request for Administration of Anesthesia and for Performance of Operations and Other Procedures. The OF 522 is commonly referred to as the operation permit or simply the op permit.

Purpose

Informed consent must be granted before any surgical treatment or anesthesia administration. This consent must be written in plain language (lay terms) and be witnessed by someone who is not a member of the surgical team.

The consent:

- Ensures the patient understands the nature and purpose of the proposed treatment; its potential or anticipated complications, risks, and benefits; and any alternative procedures available, along with their risks and benefits.
- Protects the patient from nonapproved or experimental procedures and unnecessary surgery.
- Ensures nursing and surgical personnel know exactly which procedures the patient has agreed to have perfomed.
- Protects the patient's right of self-determination and participation in decisions involving his or her care.
- Protects the medical staff (surgeons, anesthesiologists, etc.), nursing staff (including surgery personnel), and hospital from legal claims of unauthorized operations and other procedures. It also prevents patient claims filed for invasion of privacy, assault, and battery.

NOTE: Obtaining a patient's consent does not protect from lawsuits resulting from negligent acts.

Responsibilities for obtaining consent

The surgeon and anesthesia staff is primarily responsible for obtaining the patient's consent. As a surgical technician, you must also understand the legal requirements and procedures for obtaining, documenting, and witnessing informed consent. You'll review the consent forms as part of your patient transport duties and witness a consent form upon request. As a circulating specialist or technician, you and the nurse share the responsibility for doublechecking the consent forms prior to surgery and advising the surgeon and OR supervisor of any discrepancies. An alert specialist or technician may prevent an operation on the wrong part of a patient's body by checking the operation permit thoroughly. In this age of increased emphasis on quality assurance and risk management, every member of the surgical team must comprehend the legal implications of their actions.

Surgeon

The attending provider documents informed consent on OF 522 and makes a handwritten entry in the medical record (usually on the SF 509, Medical Record - Progress Notes) noting the date and time of the patient's counseling. This note should indicate:

- The patient and surgeon have discussed the disease process.
- The surgeon has explained the nature and purpose of the proposed procedures, its anticipated risks and benefits, and alternative treatments with their risks and benefits.
- The patient has indicated that he or she understands the matters discussed and consents to the procedures.
- All procedures the surgeon anticipates performing during the course of an operation have been discussed.

The surgeon may have the patient countersign and note the date and time of the consent statement in the Progress Notes. After the patient has given consent to the procedure(s), the surgeon usually cannot legally exceed the scope of the consent. The exception to this is when, in the surgeon's professional opinion, the additional procedure is required to protect the patient from death or disability. For example, if a patient has consented to a colon resection, and the surgeon wants to remove the normal appendix to avoid future problems, he or she cannot legally do so because the patient did not consent to the additional procedure. If the appendix is inflamed, failure to remove it would subject the patient to harm, so the surgeon can legally remove it despite the lack of informed consent.

Anesthesia staff

Informed consent is also obtained and documented for administration of anesthesia. OF 522 serves as the basic written document for anesthesia consent. Like the surgeon, the anesthesiologist or anesthetist also must make a separate, handwritten entry in the patient's Progress Notes, but this

statement pertains specifically to the proposed anesthetic. This statement should also show the date and time of entry to document the patient was coherent when informed consent was obtained. If a nurse anesthetist makes this entry, it must be countersigned by an anesthesiologist or the operating surgeon.

Legal requirements

For legal, informed consent, the patient must be mentally competent, of legal age, and physically able to understand the consent and to sign the consent forms. If the patient is a minor, unconscious, sedated, physically unable to sign, or declared mentally incompetent or insane, a parent, legal guardian, or court-appointed representative may sign the forms.

Legal age

The legal age varies from state to state, but normally 18 years of age is considered legal adulthood. Some exceptions to legal-age status include:

- Any active duty service member or former service member is considered of legal age, even if the member is a minor (under 18).
- Any married or divorced minor is considered of legal age.
- Emancipated minors are considered of legal age. An emancipated minor is a person under legal age who obtains a court order legally relinquishing him or her from the care and custody of his or her parents.

Other exceptions to the legal age requirement of informed consent vary with the laws of individual states. Consult the base staff judge advocate (legal office) if there are any questions about the legal age requirements for informed consent.

Understanding the procedure

To ensure patients understand exactly what they are consenting to have performed, the procedure is described using lay terminology. For example, the surgical procedure known in medical terms as cholecystectomy with choledochojejunostomy might be described as: “We will make an incision in the abdomen to remove the gallbladder; then we will make an opening into the small intestine and attach the common bile duct so it drains into it.”

If you ever have the impression or even suspect a patient does not know what is happening, or if the patient describes a procedure different from the one on the permit, notify the nurse, anesthetist, or surgeon immediately. A patient who thinks he or she is simply having his or her bunions removed will be “rather upset” if he or she wakes up and finds his or her toes missing!

Required signatures

The following signatures are required on a legal operation permit:

- The attending physician’s (usually the operating surgeon’s) signature.
- The patient’s signature, and the date and time of the signature. The patient signs only after completely understanding the procedures involved. The patient’s signature must be obtained BEFORE any preoperative sedative medications are given and secured without pressure or duress. When the patient cannot legally sign the consent, the legal sponsor, guardian, or next of kin must give permission and sign the form.
- A witness’s signature. The patient’s, or the legal representative’s, signature must be witnessed. Anyone can witness the signature—*except for members of the surgical team who will assist with the patient’s operation*.

Implied consent

If the patient is incapable of, and if no legal representative can be found, an emergency procedure required to save a person’s life or limb may be performed without consent. This *implied consent*

applies to situations where a reasonable adult would normally give his or her consent for an emergency procedure but is incapable of doing so. This rule applies to minors and incompetent patients as well.

Patient's right to refuse treatment

All patients have the right to refuse any form of medical or surgical treatment. Even if written consent has already been given, the patient may still withdraw permission prior to the operation. If this occurs, the surgeon is notified immediately and the surgery is postponed until the patient is willing.

If a military member refuses medical, surgical, or dental treatment, the provider may refer him or her to a medical evaluation board (MEB). This board decides if the procedure is required for the member to perform his or her military duties and if the member meets the established medical qualifications for continued military service. The board also determines if the procedure would probably produce the desired results. If the board decides the procedure is required, and would be effective, the member is notified of the decision. If he or she still refuses treatment, the MEB may recommend administrative discharge.

405. Surgical checklist

The surgical checklist is one of the most important documents you'll use when assigned to transport patients to the operating room. If you use this form properly, you'll avoid delaying surgery by ensuring all ordered preparations are completed and all requested documents and test results are transported to the OR with the patient.

Purpose

When you are assigned to transport patients to the operating room, it is your responsibility to check the patient's chart. DD Form 1924, Surgical Checklist, serves to remind personnel of, and to document completion of, the routine procedures involved in preoperative patient preparation. By using the surgical checklist properly, you ensure all required forms, reports, and consent statements are included in the patient's chart. The checklist also shows you which preparatory procedures have been done and which ones do not apply.

Location and use

DD Form 1924 is attached to the front cover of each surgical patient's chart. It is best used exactly as the title indicates—as a checklist. As each item on the surgical checklist is completed, the person who completes the task initials the block next to the item. If a listed item does not apply, "N/A" or "none" is written in the initials block. If the item should be, but cannot be completed, the initials block is left blank, and the reason noted in the "Comments" section (or next to the item if space allows). For example, if the patient does not have dentures, "none" is written in the initials block. If the patient wears dentures but absolutely refuses to take them out, the initials block is left blank, and "patient refuses" is written next to "Dentures/Bridge Removed."

When you check the chart before transporting a patient to surgery and you notice an item not initialed, ask the unit nurse about it; he or she should complete it, or document the reason for not doing so. Unless the OR supervisor or designee says otherwise, do not transport any patient until all items are either completed or properly documented on the checklist.

Checklist items

Items listed on the surgical checklist can be grouped into two categories—clinical records and patient-care procedures.

Clinical records

A list of clinical records (forms) normally included in the patient's chart before transport to the OR is found on the left side of the Surgical Checklist. The patient identification section of each record should be complete; usually it is stamped with the patient identification card. Local policy dictates the

exact forms and number required in each chart—some of these forms may be replaced by computer forms. The records, as they are listed on the checklist, include:

SF 515, Medical Record - Tissue Examination

At least two blank SF 515 forms should be located in the front (top) section of the patient's chart. These forms are filled out by the circulating nurse and surgeon to record all tissue specimens removed from the patient and then sent to pathology with the specimens.

SF 516, Medical Record - Operation Report

If this form is used in your facility, three copies of it should also be in the front of the chart. This form is completed by the circulating nurse to document significant facts related to the operative procedure. SF 516 serves as a summary of the operation.

OF 517, Medical Record - Anesthesia

Two copies of this form should be included with the operation report and tissue exam. This form is completed by the anesthetist to document the administration of anesthesia. OF 517 is a summary of the patient's vital signs and anesthetic agents used. In some hospitals, the anesthesia record is completed by the circulating nurse for procedures performed under local infiltration with no anesthetist present.

SF 518, Blood or Blood Component Transfusion

This form is NOT usually in the patient's chart before surgery. If the surgeon does not order blood, "N/A" is written on the checklist. If the surgeon orders blood, three copies of SF 518 are prepared for each unit of blood requested. The number of units ordered is written on the surgical checklist, and then the SF 518s are sent to the blood bank. The blood bank technician uses these forms to document the typing and crossmatching of the units of blood. The SF 518s are kept with each unit of blood until it is actually transfused. The transfusion is also documented on the same SF 518s; then the completed copies are placed in the chart. We discuss blood transfusion later in this volume.

NOTE: The number of units listed on the surgical checklist should correspond to the number listed on the surgery schedule; report any discrepancy to the nurse or anesthetist.

OF 522, Medical Record - Request for Administration of Anesthesia and Performance of Operations and Other Procedures (signed and witnessed)

This form is usually called simply "op permit." We have already discussed this form in detail, but we emphasize the importance of this consent. Remember, you must ensure the accuracy and completeness of this form. The patient must know exactly what is involved and agree to the procedure.

Ensure the op permit is signed and witnessed correctly. The time and date the consent was given should also be noted. Many hospitals establish a specific timeframe for consent (i.e., local policy may consider a consent form more than 24 hours old invalid). Check the description of the surgical procedure and the identification of the patient against the rest of the information in the chart (progress notes) and with the information on the surgery schedule. Report any discrepancy to the unit and the OR nurses.

SF 509, Medical Record - Progress Note (contains physician's informed consent)

The progress notes are usually in the middle of the chart, marked by an index tab. The main thing you check is the surgeon's written informed-consent statement. Verify it matches the operation permit.

Blood transfusion consent

If the surgeon anticipates a blood transfusion during the procedure, he or she must obtain specific permission from the patient. This consent is usually documented on AF 1225, Informed Consent for

Blood Transfusion. Many physicians routinely obtain this consent in case of emergency, so it may be in the patient's chart even if no blood has been ordered.

Medication Administration Record

Any time a patient is administered a medication, it must be recorded. AF 3069, Medication Administration Record, and AF 3068, PRN Medication Administration Record, are usually used for this documentation. These forms are usually kept with the medications in the nurses' station, but when a patient is transported to surgery, the medication record(s) should be in the chart. Check the medication record for documentation of the preoperative medication.

IV flow sheet

If the patient has an IV line, all intravenous fluid administrations are recorded, usually on AF Form 3067, Intravenous Record. This record should also be in the chart if applicable.

History and physical

The examining physician (usually the surgeon) documents the patient's history on SF 504, Medical Record—History, and SF 505, Medical Record—History, Parts 2 and 3. The record of the patient's physical examination is recorded on SF 506, Medical Record—Physical Examination. Ensure these records are in the chart.

SF 511, Vital Signs Record

SF 511 is used by nursing personnel to document vital signs (temperature, pulse, respiration, and blood pressure) during the patient's hospital stay. This form is not used to document vital signs during or immediately after surgery. The anesthesia and recovery room records are used for this purpose. Once again, your job is to make sure one of these forms is in the chart.

Nurse notes

Nursing notes are documented using SF 509, Medical Record - Progress Report. In most hospitals, before the patient is transferred to the OR, the unit nurse records:

- The date and time the patient is transported to the OR.
- The transport device used.
- Safety methods or devices (side rails, safety straps, etc.) in place.
- Name and rank of the transporting technician.

Some hospitals require the transporting technician to make these entries.

Doctor's orders

Doctor's orders are usually written on AF Form 3066, Doctor's Orders, or on the electronic version, AF Form 3066–1, Doctor's Orders. Items on this form that concern the surgery staff are the:

- Surgeon's orders regarding preoperative skin preparation.
- Preoperative medication order.
- Surgeon's orders for preoperative patient care.
- Postoperative orders that govern the care provided in the recovery room.

Each order is signed-off by the nurse as it is carried out.

X-ray films and reports

Most of the time X-ray films and the radiologist's reports the surgeon wants available in the OR are brought to the OR the night before the scheduled operation. Sometimes the films are at the nurses' station on the patient-care unit. Always check with unit personnel for any films that should accompany the patient to the OR. Many radiology reports are computer generated.

Laboratory reports (only the required)

As the block says, only the lab reports requested or required by the surgeon are filed in the patient's chart. Most of these are computer generated, but the forms mentioned in the previous discussion are still valid.

Electrocardiogram

An ECG/EKG report should be in the charts of all patients over 40 years old and may be included for younger patients if heart disease or ailment is suspected. The report is recorded on OF 520, Medical Record—Electrocardiographic Record and consists of cut strips of ECG printouts and a cardiologist or internist report of interpretation.

Patient-care procedures

The procedures listed on the right side of the checklist should be done and documented by nursing unit personnel before the patient is transported to surgery. These procedures listed on the checklist include preoperative counseling; A.M. care and preperation; valuables and jewelry removal; hairpins, makeup, and nail polish removal; dentures/bridges removal; contact lenses/glasses, glass eye, hairpiece, prosthesis removal; voiding; enemas; and allergy/ID bands on the non-operative arm.

Patient preoperative counseling

This refers to the counseling nurses on the unit provide to the patients regarding preoperative and postoperative regimens on the unit and not in the operating room or recovery room.

NOTE: The perioperative nursing record is used to record the OR nurse's preoperative counseling.

A.M. care and preparation

This includes all the procedures we discussed previously, including vital signs, the antiseptic shower, encouraging the patient to attempt a bowel movement, hair removal (if ordered), anti-embolism stocking application, and donning the pajama top backwards.

Remove valuables and jewelry

The patient is not normally allowed to wear any jewelry to the operating room. The exception is a wedding ring, if it cannot be easily removed. Most hospitals allow the patient to wear a wedding ring *if it is taped in place*. If a patient is having hand or arm surgery, the ring must be removed even if it involves cutting it off. One arm will be operated on; the other will have an IV. If the ring is left in place, swelling of the patient's fingers may cause it to act as a tourniquet.

Valuables and jewelry are usually left with a family member. If no family is available, or if the patient prefers, most hospitals have a safe or vault to safeguard patient valuables. The only time you'll normally be involved with handling patient's personal property or other valuables is when the patient is brought to the OR directly from the emergency room. If this happens, surgery personnel must safeguard all patient property, including clothes, money, wallets, purses, or any other items that were brought to the OR with the patient. These items should be inventoried and handled in accordance with local policy.

Remove hairpins, makeup, and nail polish

Hairpins are removed because they are a potential safety hazard in the operating room. They may become loose and injure the patient's eyes, ears, nose, or mouth. They can also puncture drapes and contaminate the field, or they can find their way into a wound (particularly if the patient is scheduled for surgery of the head and neck). All makeup (especially lipstick and fingernail polish) is removed so the patient's color can be monitored to assess circulation. Makeup and nail polish are also removed to prevent flakes or chips that may contaminate the field.

Remove dentures and bridges

Normally false teeth, full dentures, and partial plates are removed before transporting the patient to surgery. The main reason for this is to allow medical personnel to maintain a patient's airway during anesthesia administration, postoperative recovery, or cardio respiratory emergency. Also, they are very expensive pieces of the patient's personal property. You do not want to risk losing or damaging them.

NOTE: Some anesthetists request patients retain their dentures to help maintain the airway.

Remove contact lenses/glasses, glass eye, hairpiece, and prosthesis

All of these items should be removed, not only for safety reasons, but because they are the patient's personal property and should be protected from damage or loss.

Voiding

All patients are encouraged to void (urinate) the morning of surgery, preferably just before they are transported to the surgical suite. The time should be noted on the checklist.

Enemas

If an enema is ordered, record the time it is administered. Most patients are not given enemas prior to surgery. This is usually reserved for patients scheduled for major abdominal surgery, gastrointestinal, perianal, or perineal surgery.

ID/allergy band(s) on nonoperative arm

This is a "biggy!" The information on the ID band must EXACTLY match:

- The information on the patient's identification stamp plate.
- The consent form and the other records in the chart (Table 1–1).
- The name plate on the patient's bed.
- The information on the surgery schedule or the pickup slip you get from the OR.
- The name that the patient tells you (full name).

Any discrepancy between the information on the ID band and other references—even if it is something simple like a middle initial—must be brought to the attention of the unit nurse and corrected immediately.

If the patient has known allergies, an allergy band is placed on the same arm as the identification band. To check if the patient has allergies, look at the "Known Allergies" block or "History and Physical" section on the checklist.

There is a lot more documentation and paperwork involved in preparing the patient for surgery. Some of it is covered in other areas of this course, and some you'll learn on the job. We have covered the two most important pieces of paper used to identify and prepare the surgical patient; now it is time for you to "document" what you learned.

Consent Form and Other Records in the Chart	
Block	**Explanation**
Inpatient ident plate on chart to OR	This is usually a small, rectangular, plastic credit-card plate with raised letters. This plate contains identification, blood type, religious preference, and other background information on the patient and is used to stamp all the forms found in the chart. It must accompany the patient to and from the OR.
NPO since	The time the patient was placed NPO is written in this block.
Preoperative medication	The unit nurse gives the patient's "preop meds" per the doctor's orders and checks the YES block and annotates the kind of medication and the time given. **NOTE:** More on preoperative medication later.

Consent Form and Other Records in the Chart	
Block	**Explanation**
Catheter in place	Most patients do not have a catheter in place before surgery. On the rare occasion a patient does, the YES block should be checked, and the block indicating whether it is clamped or connected to a drainage bag should be checked. The location, type, and size catheter should be listed on the checklist. Any urine (or other drainage) should be emptied and recorded before transfer to surgery.
T, P, R, BP, and WT	These abbreviations stand for temperature, pulse, respiration, blood pressure, and weight. The last set of vital signs, taken just before the preoperative medication is given, is recorded here.
Known allergies	This block lists any allergies the patient identifies. The allergies listed are not limited to medications; if the patient declares sensitivity to any substance (soaps, drugs, foods, etc.), it should be listed on the checklist. If the patient claims no allergies, "NKDA," which stands for no known declared allergies, is usually written in the block.
Comments	The COMMENTS block is used to explain any checklist item not completed or to provide additional information regarding an item.
Date and time released to OR	This block is self-explanatory. The unit nurse usually completes this just before signing the checklist; if not, ensure you note the date and time.
Signature of nurse releasing patient to operating room	This block is self-explanatory—but make sure this block is signed!

Table 1–1. Consent Form and Other Records in the Chart.

Self-Test Questions

After you complete these questions, you may check your answers at the end of the unit.

404. Informed consent for surgery, anesthesia, and other procedures

1. What is informed consent?

2. What are the five reasons for informed consent?

3. Who is primarily responsible for obtaining a patient's written consent?

4. What are the four things the provider's handwritten informed consent entry in the Progress Notes indicate?

5. What are the legal requirements for informed consent?

6. What type of terminology must be used on all consent forms to ensure that a patient understands exactly what he or she is consenting to have done?

7. What signatures are required on a legal operation permit?

8. Describe *implied consent*.

9. What can the provider do if a military member refuses to submit to medical, surgical, or dental treatment? What are the potential consequences?

405. Surgical checklist

1. What is the purpose of the surgical checklist?

2. Where is the surgical checklist located?

3. Items on the checklist can be grouped into two categories. What are they?

4. List five of the forms, listed on the surgical checklist, that are normally located in the surgical patient's chart.

5. Where can you find the surgeon's orders for patient skin preparation and preoperative medication?

6. What is the only type of jewelry a patient normally is allowed to wear to the operating room, and what special provision must be made to allow this?

7. Why must makeup and nail polish be removed before surgery?

8. Give two reasons why dentures, false teeth, and partial plates are removed preoperatively.

9. What must the information on the patient's ID band match?

10. When are the vital signs noted on the surgical checklist usually taken?

11. What is the meaning of NKDA?

12. What information is recorded in the “Comments” section of the surgical checklist?

1–3. Transportation and Admission of Patients to the Surgical Suite

Transporting the surgical patient involves more than simply wheeling the patient down the corridor on a stretcher. You have to prepare the gurney, positively identify the patient, move the patient safely from the bed to the gurney, and ensure the patient’s safety, comfort, and warmth during transport to the surgical suite. After entering the surgical suite, several procedures must be accomplished before the patient is wheeled into the operating room and transferred to the operating bed.

NOTE: Medical facilities use different terms to describe their patient transport devices. In this course, we use the terms stretcher, litter, and gurney interchangeably.

You have spent a lot of time on preoperative physical preparation of the patient, the tests involved, and the proper documentation. In this section we tie it all together. We walk through procedures for transporting and admitting patients to the OR. Then, we cover some of the activities that occur from the time the patient enters the surgical suite until he or she is transferred to the operating bed.

406. Transferring patients to the operating room

Patients are usually sent for or brought to the surgical suite about 45 minutes before they are scheduled for surgery. This allows enough time for their preoperative medications to take effect and to do the last minute things necessary to get the patient ready for anesthesia administration and surgery. As a surgical technician, you’ll probably be assigned to pick up patients, and this assignment must never be taken lightly or performed in a haphazard fashion. THERE IS ABSOLUTELY NO EXCUSE FOR TRANSPORTING THE WRONG PATIENT TO THE OPERATING ROOM!

Receiving the transport assignment

The OR supervisor, or a senior staff nurse, usually controls the “who and when” of patient pickup. At the proper time, the nurse calls the patient unit to order the premed. After allowing enough time for the unit staff to administer the medication, the nurse assigns a technician to transport the patient to surgery.

NOTE: If the patient is the first one of the day, he or she receives the premed at a specified time.

When you are assigned to pick up a patient, you must have some type of written identification of the patient to compare with the unit identification. For simplicity, we refer to this as a “pickup slip” throughout this course. Local policy dictates the exact method used, but some of the more common ones include:

- Cutting a typed surgery schedule into individual strips.
- Using an index card or label stamped with the patient’s identification plate. This is usually prepared by the nurse conducting the preop interview.
- Transferring patient information from the surgery schedule to a separate card or label.
- Using a computer to generate a patient identification/retrieval sheet.

Remember—regardless of the system used, you must have basic patient information. You should know the patient’s full name, rank (if applicable) or status, age, sex, hospital register or social security number, type of surgery, surgeon’s name, type of anesthetic projected, and the patient-care unit of admission.

You should also know about any special considerations influencing the mode of transportation. Most patients are transported on a wheeled gurney, litter, or recovery room bed. Small children may be transported in their cribs, and infants in their isolette or incubator. Orthopedic patients may be transported to the surgical suite in their beds, particularly if they are in traction. Do not let the weights swing during transport; it hurts the patient. Patients coming from a special care unit (SCU), intensive care unit (ICU), or other specialty units are also transported in their beds. Never attempt to move a patient in a specialized bed unless you are trained in its use and operation. Never overextend yourself; if a bed is large, if multiple pieces of apparatus are involved, or if you are unfamiliar with the equipment—GET HELP! It is better to delay surgery for the few minutes it takes to get extra personnel than to risk harming your patient or breaking a critical piece of equipment.

Prepare the transport device

After receiving the pickup slip, ensure the gurney is clean and covered with clean (usually green-colored) sheets. At least three sheets are needed to prepare the litter—a bottom sheet, a wrap or "mummy" sheet, and a patient coversheet. The specific way the gurney is made up is determined by local policy, but we describe one of the most common methods used, the *mummy wrap*—

1. Cover the mattress with a bottom sheet tucked in on all sides.
2. Fully open a sheet, centering it from side to side, with the top edge of the sheet aligned with the head of the mattress, and the bottom of the sheet hanging over the foot. Place a fully opened blanket over the previous sheet, and then sandwich the blanket with another sheet.
3. Holding the overhanging sides of the sheet-blanket-sheet together, fanfold each side until it aligns with the edges of the mattress. Then, tuck the overhanging end at the foot under the mattress.
4. Place an unopened folded sheet at the head of the bed. This is used as a patient cover sheet. A small pillow is sometimes placed on the bed and used for preop comfort while the patient is transported and waiting for surgery.

The primary advantage of this method is patient comfort. You can wrap cold patients and bundle them in layers, or wrap only the sheet around warm patients. The main disadvantage is the amount of linen it requires.

Prior to transporting a patient, inspect the gurney. Ensure you have an intravenous (IV) pole that attaches to the gurney; the patient may already have an intravenous line in place. Check all safety devices and restraints. There must be at least one safety strap to secure the patient above the knees. Both side rails must raise and lock into position, and the gurney's floor or wheel locking device(s) must firmly anchor the gurney when engaged. The head and foot of the gurney should be able to be raised independently. The litter's raising or lowering mechanism should operate smoothly and slowly, moving the mattress up or down evenly. Finally, as you push the litter to the nursing unit, check the "ride" of the gurney. A bumpy ride can indicate cracking of or worn spots in the rubber on the litter's wheels, and you do not want to get a flat on the way to the OR.

Check the chart and obtain assistance

When you arrive on the patient-care unit, report to the nurses' station. Identify yourself and tell the nursing staff who you are picking up; ask if there are special or nonroutine conditions. Obtain and check the patient's chart. First, check the chart's identification information to ensure it matches the pickup slip. Then, review the surgical checklist to ensure it is complete. Next, using the surgical checklist as a guide, verify the contents to ensure all required items and records are in the chart. Pay particular attention to the informed-consent forms and the patient identification data. Bring any discrepancies to the attention of the unit nurse for correction; if it cannot be resolved, notify the OR supervisor.

After checking the chart, ask one of the technicians or nurses on the unit to help you identify the patient and transfer him or her from the bed to the gurney. NEVER ATTEMPT TO MOVE A

PATIENT BY YOURSELF! Another important point—you must have a chaperone when picking up patients of the opposite sex, except in emergency situations. This chaperone should be the same gender as the patient. This is important because it not only ensures protection of the patient's privacy but also protects you from a claim of sexual impropriety.

Introduction

As you approach the patient's bedside, you must orient the patient to the who, what, and why of his or her experience. Start by introducing yourself to the patient and any family members present. Tell the patient who you are and why you are there. To avoid startles or surprises, tell the patient what you're doing and why you're doing it. Instruct the patient to remain in the bed until you specifically ask him or her to move to the stretcher. Explain that should the patient start to move before you are ready, he or she may fall and be injured. Take your time, and ensure you treat the patient as a person, *not* as a procedure or an object. *You* are the first contact most patients associate with their surgery.

Your conversation with the surgical patient and relatives/friends of the patient may go something like this.

> Good morning, Mrs. Miller, I'm Airman Wheeler, one of the surgery techs, and I'm here to take you to the operating room. How are you doing this morning? Are you ready to go?
>
> Are you Mr. Miller, sir? You may come with us to the operating room doors, and from there I'll be glad to show you the waiting room.
>
> Mrs. Miller, please don't try to get out of bed or try to get on the stretcher until I tell you to do so. It is possible that the stretcher may not be secure and you could fall and injure yourself. Once I have secured the stretcher I will let you know and assist you if necessary.
>
> Now, before we do anything else, I have a couple of questions for you. I know you've heard these before, and you'll hear them at least one more time, but we always doublecheck our work.

If your introduction is personal and professional, you can greatly reduce the patient's anxiety and help make the patient aware of the need to cooperate with the safety precautions and other procedures involved in the transport process.

NOTE: The monologue we use in this text is for example only. You can best gain the confidence of the patient by being professional, courteous, and confident, and not by reading a script—it's always better to just be yourself!

Verify patient identity

I repeat. There is no excuse for transporting the wrong patient to surgery! This is often the subject of jokes, but the sad fact is that mistakes do happen and have extremely serious consequences. To prevent such errors, we use as many methods as possible to check, doublecheck, and triplecheck the patient's identity. Some methods of verifying a patient's identity are as follows:

Compare the pickup slip with the chart identification

We just discussed this, but stress—all information should match EXACTLY. Typos and other errors to the pickup slip should have been corrected after the OR nurse's preop interview.

Ask nursing unit personnel to identify the patient

A responsible nursing staff member, one who knows the patient by sight, should accompany the surgical technician to the bedside and identify the patient. This should be done for all patients, but is critical if the patient is unconscious, is a child, or is legally incompetent. Even the conscious patient is usually sedated and not fully responsible for his or her actions.

Check the chart against the name on the patient's bed

Most patient beds have a nameplate attached to the footboard. This nameplate contains patient identification information, and this should exactly match the identification data in the chart. NEVER

use this method as the sole means of identifying the patient; these nameplates are easily removed and can be accidentally placed on the wrong bed.

Ask the patient to say his or her full name

Do NOT ask a patient, "Are you Mrs. Patricia E. Miller?" Most patients have already received their preoperative medication; they may agree with anything! Instead, ask—

> Can you tell me your full name? Middle initial? I also need to see your patient ID band, please.

Asking him or her to state his or her *full* name makes the patient think before responding. It is important to check the full name. There may be two patients named Pat Miller on the same ward, but it is unlikely they will both have the same middle initial.

Check the patient's ID band against the chart

All patients must have a hospital identification band, usually placed on the nonoperative wrist. Check this band to ensure it has the IDENTICAL name, rank, social security number, and hospital number as is on the patient's chart. The bands are designed to be secure once applied, and they can be removed only by cutting them.

If the patient does not have an identification band, hospital policy usually requires the unit nurse to specifically identify the patient and apply the band before transport. If this happens, take extra care to identify the patient by other means, such as asking for the social security number.

NOTE: IF YOU ARE NOT 100 PERCENT SURE YOU HAVE THE RIGHT PATIENT, DO NOT TRANSFER HIM OR HER UNTIL YOU ARE SURE.

Prepare the patient for transfer to the stretcher

The following is an example of the types of questions you need to ask the patient in preparation for patient transfer:

> Are you wearing any watches, rings, necklaces, or other jewelry? They've taped your wedding ring, so it's OK.
>
> No hairpins or other sharp objects? How about makeup? No nail polish on the fingers or toes, is there?
>
> You're not wearing dentures or a bridge are you? What about contact lenses?
>
> When was the last time you had anything to eat or drink?
>
> Is your pajama top or gown on backwards?

Briefly verify the procedures on the checklist are complete. Be tactful, but thorough.

Always explain to the patient what you will do next and give them instructions regarding what you want them to do:

> We always use only fresh, clean, sheets in the OR, so I'll cover you with this green sheet now. Can you hold the top of the sheet and keep covered as I pull your bed sheets and blankets down?

Take the green folded sheet from the litter and open it halfway lengthwise. Lay the green sheet over the patient's bed sheets, covering the patient. Ask the patient to hold the top, and slide the bed sheets down toward the foot, leaving the patient covered with only the green sheet.

NOTE: If the patient has any drains, catheters, or other device that may get caught on the sheet, the chaperone should help to ensure they do not get tangled.

Before proceeding, LOCK THE WHEELS ON THE PATIENT'S BED. Provide the patient with instructions on gurney placement prior to transfer.

> I'm going to lower the side rail on your bed and place the gurney next to it, but please, don't move or try to get on the gurney until I tell you to. Do you understand?

Place the gurney next to the patient's bed and APPLY THE LOCKING DEVICE. Adjust the height of the gurney or the patient bed until they are approximately the same level. Unfold the edges and foot of the gurney's mummy sheet so they hang down the sides of the gurney.

Help the patient move from the bed to the gurney

Provide the patient with instructions on how to transfer from the bed to the gurney.

> Mrs. Miller, the beds are locked, and Airman Johnson and I will keep them together. Can you slide over towards me? Take your time and move slowly and carefully. We'll help keep the green sheet over you.

Ask the unit staff member to stand on the side of the patient's bed opposite the gurney, and instruct him or her to help keep the bed and gurney from moving apart. You stand next to the gurney, and prevent it from moving. As the patient moves, give assistance and support as needed. Again, you or the chaperone should ensure any drainage tubes or IV lines do not become snagged during the transfer. IV containers are suspended from a pole at the side or foot of the litter (away from the patient's head) to prevent the patient from being hit in the head should the bag or bottle fall. Catheter drainage bags and other such devices are secured to the gurney below the patient's level to facilitate gravity drainage.

Before strapping the patient in, let him or her know what you are going to do next.

> I'm going to wrap these bottom sheets around you and then place a safety strap over your thighs. I'm also going to put the side rails up, then I'll unlock the gurney and we'll be on our way.

Once on the gurney the patient will be lying on the open mummy sheet. Wrap the sheets up, around, and over the patient. This cover helps keep the patient warm and can be used to secure the arms inside the gurney. If the patient is uncomfortable with his or her arms secured, allow the patient to remove them on the condition that they be kept inside the gurney at all times. Next, fasten the restraint straps. There should be at least one strap on the gurney that will be applied loosely over the patient's thighs, 1 to 3 inches above the knee. An additional strap is sometimes placed across the chest. Raise and lock the side rails on the gurney. Finally, unlock the gurney wheels and head to the operating room.

Only two people are normally required to safely transfer a conscious patient, because, in most instances, the patient is able to move under his or her own power. More help may be required if the patient, although conscious, is incapacitated in some way (broken leg, extra tubes and drains, etc.).

Transferring an unconscious or anesthetized patient from bed to gurney (or the reverse) requires a minimum of four people—sometimes more. To move an unconscious patient, place a draw or lift sheet under him or her (if there is not such a sheet already in place). The draw or lift sheet is a sheet folded into quarters and then placed under the patient so it extends approximately from mid-back to mid-thigh. It is used to lift the patient's torso and buttocks during transfer.

The patient's bed and the gurney are prepared in the same manner described for the conscious patient. The sides of the draw sheet are freed up and rolled next to the patient's side. The gurney is positioned next to the bed and all wheels are locked. Transfer personnel position themselves as follows:

1. One person stands at the head to support the head and shoulders.
2. One person stands at the foot and controls the feet and legs.
3. One (or more) person(s) stands at the side of the gurney, faces the patient, and grasps the closest side of the draw sheet.
4. One (or more) person(s) stands at the side of the bed, faces the patient, and grasps the other side of the draw sheet.

The person controlling the patient's head gives the directions to lift. The patient is usually lifted on a "three count." The lift and transfer should be done smoothly and slowly with all four people acting in unison. After transfer the patient is covered, secured, and transported the same way as the conscious patient.

Safely transporting the patient

After transferring, covering, and securing the patient to the gurney, transport him or her to the surgical suite. During transport, follow these guidelines:

- Maintain body alignment in a normal position, whenever possible. This is particularly important when transporting unconscious patients, as they have no voluntary control and will remain in the same position that you originally placed them.
- Make sure the patients' arms remain within the confines of the gurney. Do not let patients put their hands behind their heads (they love to do this!) because this makes their elbows stick out beyond the side rails. A corner cut a bit too sharp or a bump against the wall could result in a broken arm or a mashed elbow. Gurneys are not usually very comfortable, so patients may try to turn or change position; try to encourage them to lie still until you reach the operating room.
- Allow sufficient time. The old cliché "haste makes waste" is true here. When you start rushing, you start making mistakes and cutting corners. The few minutes you may save hurrying through the halls are completely negated if you injure the patient, or if you forget something on the unit (like the chart!). Murphy's law applies; the one time you get in a hurry and forget to check informed consent is the one time the permit will not be signed! Allowing sufficient time does NOT mean taking too much time. There is a lot of patient preparation still to do in the OR before the procedure actually begins. This is not the time for socializing on the units or in the hallways.
- Always push the gurney from the head end with the patient's feet first except when entering an elevator. When entering an elevator, push the head end of the gurney into the elevator first. If the elevator does not have a switch or button to hold the door open, block the safety bar to keep the door from closing against the gurney.
- If you must go down an incline (ramp), move to the foot of the gurney and guide it down the slope. Ideally, two people roll the patient down an incline; one stabilizes head; the other holds the weight of the litter.
- When going through a door (or doors) designed to stay closed, block the doors with your foot or body and pull the gurney through rather than pushing it through. NEVER push doors open with the gurney.

Ensure you follow and apply all safety methods and all local policies, and you will safely arrive at the operating room doors.

Upon arrival at the operating room doors, explain to the patient what will happen next.

> OK Mrs. Miller, these are the doors to the operating room. Mrs. Miller, we're going to go through these doors. Your nurse or anesthetist will meet you and start to help you get ready for surgery. If you get cold or have any questions at all, don't be afraid to ask. We'll try to make you as comfortable as we can.

Also, if accompanied by the patient's relatives or friends, provide them with useful information or directions to a waiting area.

> Mr. Miller, I'm sorry, but this is far as you can go; only patients and staff can enter the OR. The waiting room is through the double doors to your left; a Red Cross volunteer will keep you posted. Would you like a few moments?

When you arrive in the surgical suite, the patient will be greeted by a nurse, anesthetist, or technician assigned to admit and watch him or her in the holding area. At this point, you should introduce the patient to the person accepting the transfer and ensure the patient that either you or one of your co-workers will be there to help them in the recovery room.

> Mrs. Miller, this is Lt Col Richardson, one of our OR nurses. I can't go any farther without changing my clothes, but Lt Col Richardson will take good care of you. Remember, if you need anything at all, just ask, and I'll be looking for you in the recovery room soon.

Other transport devices—cribs and wheelchairs

Small children, up to approximately age four or five, are usually transported in their pediatric nursing unit cribs. Most of these cribs do not have safety straps. When using a crib, ensure the sides are fully up and locked in position. Also, ensure you know exactly how the sides raise and lower and are comfortable doing so. When a child is vomiting or "having a conniption" is no time to be fumbling around trying to get the crib sides down! To minimize these fits and reduce stress, some facilities allow very small children to be carried to surgery; ONLY do this if local policy allows.

Occasionally, patients are transferred to or from the operating room in a wheelchair. If you are required to assist them to a gurney, do the following:

1. Ensure you have plenty of room.
2. Lower the gurney as far as it will go, then place it so the head of the gurney is next to the wheelchair.
3. Lock the gurney and the wheelchair; be sure both are firmly anchored to the floor.
4. Stand in front of the patient, and then assist him or her to stand.
5. Support and help the patient to turn until he or she can safely sit.
6. Have the patient scoot to the center of the gurney.
7. Have him or her lie on his or her side.
8. Have the patient roll onto his or her back.
9. Raise the rails on the gurney.
10. Secure the safety straps.

Reverse steps 4 through 8 of the procedure to transfer a patient from the gurney to the wheelchair. When transporting a patient in a wheelchair, ensure his or her feet remain on the foot rests and that all safety straps are secure.

407. Immediate preanesthesia and preoperative preparations

Preparation of the patients does not end when they are wheeled through the surgical suite doors. There are still a few procedures and tasks to complete before the anesthetic is administered and the operation begins.

Introduction and reverification of identity

After the patient is greeted and brought to the holding area, the operating room nurse assigned to the procedure greets and then reverifies the identity of the patient. The nurse uses some of the same methods you used on the unit. The patient is asked his or her full name, and then the identification band is checked against the chart and the surgery schedule. The nurse then asks the patient about the operation he or she is having and what part of the body is be involved. The patient's response is checked against the surgery schedule and the consent forms. This ensures the patient understands exactly what is going to be done, and it matches what he or she has agreed to have done. Any discrepancy is reported to the surgeon and the OR supervisor immediately. Local policy determines how this is resolved, but usually the procedure is postponed until valid consent is obtained.

Verification and completion of preoperative preparation procedures

The nurse then checks and reverifies all items on the surgical checklist are completed. Any records or forms missing are obtained. Procedures not completed on the patient-care unit are now done by the surgical staff, if possible. A surgical cap is placed on the patient's head. This covers the hair to reduce chances of shed hair contaminating the field and prevents the hair from being soiled by blood or emesis. The perioperative nursing record (initiated during the preop interview) is consulted, and preoperative preparations listed on it are completed. The perioperative nursing record is then placed in the patient's chart for completion during the operation. All safety devices on the gurney are double-checked.

The anesthetist or anesthesiologist also greets the patient and reviews the chart. The history, physical, and laboratory reports are reviewed, and the anesthetic choice is reverified with the patient. The intravenous lines are started on, cardiac electrodes attached to, and blood pressure cuff applied to the patient. If possible the IV is started as soon as possible after the patient arrives in the surgical suite. This allows the patient to relax and adapt to the surgical environment after this relatively traumatic procedure is completed. The anesthetist also checks all catheters, intravenous lines, drains, monitoring devices, etc., for proper function.

Other considerations

During the waiting period and immediately before the patient is brought into the operating room, the nurse should stay close to the patient. If the nurse cannot remain with the patient, a surgical technician stands by to attend to the patient's needs. The nurse or technician closely watches the patient for signs of a drug reaction or excessive anxiety and makes every effort to ensure the patient is comfortable and warm.

UNDER NO CIRCUMSTANCES SHOULD THE PATIENT BE LEFT ALONE.

Whoever stays with the patient should make every effort to be positive, cheerful, and friendly. The patient must always be treated with respect and should never be ignored during this crucial period. If the patient is drowsy, avoid unnecessary conversation and let the patient sleep. But if the patient is awake and has questions, try to answer him or her within the scope of your training. If the patient asks a question you are not qualified to answer, ask the nurse or anesthetist to respond. Treat the patient as you would want to be treated—put yourself in his or her place. How would you feel if you were waiting outside an operating room about to undergo a major surgical procedure? What kind of care would you want *and expect* from the surgical staff?

Usually, the patient is not moved into the operating room until the last minute. This avoids a prolonged, uncomfortable wait on the OR bed, and helps keep the patient's anxiety level from increasing. When all is ready and preparations are complete, the patient is wheeled into the room and transferred to the operating bed. The procedures and safety precautions used to transfer the patient from the unit bed to the transport gurney are also used for transfer from the gurney to the OR bed.

Self-Test Questions

After you complete these questions, you may check your answers at the end of the unit.

406. Transferring patients to the operating room

1. Specify two reasons why patients are brought to the operating room approximately 45 minutes before their scheduled surgery.

2. What basic information about the patient should the transport specialist or technician be provided with before going to pick up a patient?

3. As a minimum, how many litter sheets are required for patient transport?

4. Prior to patient transport, what do you inspect on the gurney?

5. What is the first thing you check on the patient's chart?

6. Why should nursing personnel accompany you to the patient's room?

7. What is the first thing you should do when you approach the patient?

8. List five methods used to positively identify a patient before transport to surgery.

9. Where should IV containers be placed on the gurney? Why?

10. How many people are required to safely transfer a conscious patient from a bed to a gurney? How many for an unconscious patient?

11. Why should you NOT allow patients to place their hands under their head?

12. In which direction is the gurney normally pushed? What is the usual exception to this rule?

407. Immediate preanesthesia and preoperative preparations

1. When reverifying the identity of the patient, why does the nurse usually ask the patient about the operation he or she is going to have?

2. Why is a surgical cap placed on the patient's head?

3. Why is the IV started as soon as possible after the patient arrives in the surgical suite?

4. When attending a drowsy patient awaiting surgery, what rule should you follow?

5. Why is the patient not moved into the operating room until the last minute before surgery is scheduled to start?

Answers to Self-Test Questions

401

1. Any four of the following:
   (1) Type of surgical procedure.
   (2) Type of anesthesia.
   (3) Age and physical condition of the patient.
   (4) Urgency of the surgery.
   (5) Surgeon's preferences.
   (6) Number and complexity of tests.
2. Any two of the following:
   (1) More supplies, instruments, and equipment are needed for a major procedure.
   (2) The surgeon will usually order more lab tests and diagnostic studies before performing major surgery than before minor surgery.
   (3) The surgeon may perform preliminary minor surgery to gain information on the patient's condition before undertaking a major operation.
3. (1) Infants and children are subject to greater fluctuations in body temperature than adults.
   (2) Pediatric patients have a smaller circulating blood volume than adults.
   (3) Pediatric patients are more susceptible to respiratory infections and pneumonia than adults.
   (4) Infants and children need to eat more frequently than adults because they need more energy.
   (5) Pediatric patients are usually smaller than adults, and their smaller size necessitates special supplies, and techniques.
4. (1) The temperature control center in their brain is not fully developed, so they are unable to shiver to generate heat.
   (2) They do not have the natural body insulation adults have in the form of thick skin, fat, muscle tissue, and body hair.
   (3) They have a larger body surface area in proportion to their size, than adults.
5. Because pediatric patients are usually given general anesthesia.
6. To further reduce interruption of food intake.
7. Any three of the following:
   (1) Elderly patients generally heal more slowly than young people. As a result, the surgeon may change wound closure routines and surgical technique. The patient may also receive special food and supplements to enhance the healing processes.
   (2) Elderly patients may have arthritis, which can limit the range of joint motion. Special care must be taken not to injure the patient when moving and during positioning.
   (3) Elderly patients may have a reduced tolerance to certain drugs due to impaired circulation and liver function. For this reason, the anesthetist must select preoperative medications and anesthetic agents with great care.
   (4) Elderly patients must be kept warm. This is absolutely necessary because they have slower blood circulation, thinner skin, and less body hair than younger adults to keep them from losing heat.
8. (a) Elective surgery includes any procedure where the approximate date and time of the surgery are determined at the patient's convenience. The patient may have a condition that requires surgical treatment, but failure to have the surgery immediately will not be harmful.
   (b) Surgery performed to correct a life or limb threatening condition.
9. The surgeon's preference card or list.
10. The more tests ordered, the more time is required to perform them before surgery. Extensive testing may increase the patient's preoperative stay in the hospital, add to the patient's anxieties and fears, and subject him or her to greater risk of infection by weakening their immune system.

402

1. Between 4.6 and 8; average pH of urine is 6.
2. A low specific gravity may indicate fluid overload or kidney disease. A high specific gravity indicates the urine is concentrated.
3. Red blood cells (RBCs) in urine indicate bleeding. This may be caused by inflammation, a stone in the kidney, or other conditions.
4. A complete blood count (CBC), which includes white blood cell count, red blood cell count, platelet count, hematocrit, hemoglobin, and differential white blood cell count.
5. The patient has an infection.
6. The volume of packed red blood cells in 100 ml of blood.
7. (1) Bleeding time.
   (2) Plasma clotting time.
   (3) Prothrombin time (PT).
   (4) Partial thromboplastin time (PTT).
8. Crossmatching refers to the procedures used to determine compatibility of both the patient's blood and the donor blood unit.
9. Preoperative pathology studies.
10. (1) Patients who will be given a general anesthetic.
    (2) Elderly patients.
    (3) Smokers.
    (4) Patients with chronic lung disease or pulmonary problems.
    (5) Patients scheduled for chest or heart surgery.
11. Patients 40 years old and over.

403

1. Any three of the following:
   (1) Admissions and Dispositions (A&D) personnel obtain initial patient information and begin the paperwork.
   (2) A member of the clinical nursing staff (usually a registered nurse) conducts a preliminary nursing interview and works with the patient to formulate a nursing care plan.
   (3) An operating room (OR) nurse interviews the patient and formulates a perioperative care plan.
   (4) An anesthetist or anesthesiologist also interviews the patient and makes an anesthesia assessment.
   (5) The patient is given written instructions for any special procedures to accomplish before, as well as how, when, and where to report for admission.
2. To reduce the number of microorganisms on the patient's skin.
3. To cleanse and empty the bowel, decrease the risk of peritonitis, and prevent accidental bowel movements during the procedure.
4. To facilitate removal for placement of electrodes and to perform the skin prep once the patient is in the operating room.
5. The nurse pulls up the bed side rails, and they remain up until surgical personnel come to transport the patient to the operating room.

404

1. The patient fully understands and voluntarily gives the health-care provider permission, in writing, to perform the treatment specified.
2. (1) To ensure that the patient understands the nature and purpose of the treatment, including complications and alternatives.
   (2) To protect the patient from nonapproved or experimental surgery and unnecessary surgery.
   (3) To ensure nursing and surgical personnel know exactly what procedures the patient has agreed to have done.

(4) To protect the patient's right to self-determination and participation in decisions involving his or her care.

(5) To protect the medical staff (surgeons, anesthesiologists, etc.), nursing staff (including surgery personnel), and the hospital from legal claims of unauthorized operations and other procedures. It also prevents patient claims filed for invasion of privacy, assault, and battery.

3. The surgeon and anesthesia staff.
4. (1) The patient and surgeon have discussed the disease process.

(2) The surgeon has explained the nature and purpose of the proposed procedures, its anticipated risks and benefits, and alternative treatments with their risks and benefits.

(3) The patient has indicated that he or she understands the matters discussed and consents to the procedures.

(4) All procedures the surgeon anticipates performing during the course of an operation.

5. For a legal, informed consent, the patient must be mentally competent, of legal age, and physically able to understand the consent and to sign the consent forms. If the patient is a minor, unconscious, sedated, physically unable to sign, or declared mentally incompetent or insane, a parent, legal guardian, or court-appointed representative may sign the forms.
6. Lay terminology.
7. The attending physician's(usually the operating surgeon's)signature, the patient's signature, and a witness's signature.
8. If the patient is incapable, and if no legal representative can be found, an emergency procedure required to save a person's life or limb may be performed without consent. This *implied consent* applies to situations where a reasonable adult would normally give his or her consent for an emergency procedure but is incapable of doing so. This rule applies to minors and incompetent patients as well.
9. The provider may refer him or her to a medical evaluation board (MEB). This board decides if the procedure is required for the member to perform his or her military duties and if he or she meets the established medical qualifications for continued military service. The board also determines if the procedure would probably produce the desired results. If the board decides the procedure is required and would be effective, the member is notified of the decision. If he or she still refuses treatment, the MEB may recommend administrative discharge.

405

1. It serves to remind personnel of, and document completion of, the routine procedures involved in preoperative patient preparation.
2. On the front of the patient's chart.
3. Clinical records and patient-care procedures.
4. Any five of the following:

(1) SF 515, Tissue Examination.

(2) SF 516, Operation Report.

(3) SF 517, Anesthesia.

(4) SF 522, Operative Permit (signed and witnessed).

(5) SF 509, Progress Note.

(6) AF 1225, Informed Consent for Blood Transfusion(sometimes).

(7) SF 3069, Medication Administration Record and, sometimes, SF 3068, PRN Medication Administration Record.

(8) AF Form 3067, Intravenous Record.

(9) AF Form 3066, or AF Form 3066–1, Doctor's Orders.

(10) SF 504, Clinical Record–History, Part 1.

(11) SF 505, Medical Record–History, Parts 2 and 3.

(12) SF 506, Medical Record–Physical Examination.

(13) SF 511, Medical Record–Vital Signs Record.

5. AF Form 3066, or AF Form 3066–1, Doctor's Orders.
6. A wedding ring, if it is taped in place. If a patient is having hand or arm surgery, the ring must be removed.
7. So the patient's color can be monitored to assess circulation. Makeup and nail polish are also removed to prevent flakes or chips that may contaminate the field.
8. They might interfere with maintaining a patient's airway, and they are very expensive pieces of the patient's personal property. You don't want to risk losing or damaging them.
9. (1) The information on the patient's identification stamp plate.
   (2) The consent form and the other records in the chart.
   (3) The name plate on the patient's bed.
   (4) The information on the surgery schedule or the pickup slip you got from the OR.
   (5) The name that the patient tells you (full name).
10. Just before the preoperative medication is given.
11. No known declared allergies.
12. The "Comments" block is used to explain any checklist item not completed or to provide additional information regarding an item.

406

1. Allows enough time for preoperative medications to take effect and time to do the last minute things necessary to get the patient ready for anesthesia administration and surgery.
2. The patient's full name, rank (if applicable) or status, age, sex, hospital register or social security number, type of surgery, surgeon's name, type of anesthesia, patient-care unit designation, and any special transport considerations.
3. At least three sheets.
4. Ensure you have an IV pole that attaches to the gurney. Check all safety devices and restraints. There must be at least one safety strap to secure the patient above the knees. Both side rails must raise and lock into position, and the gurney's floor or wheel locking device(s) must firmly anchor the gurney when engaged. The head and foot of the gurney should be able to be raised independently. The litter's raising or lowering mechanism should operate smoothly and slowly, moving the mattress up or down evenly. Finally, as you push the litter to the nursing unit, check the "ride" of the gurney.
5. Check the chart's identification information to ensure it matches the pickup slip.
6. To help you identify and transfer the patient from the bed to the gurney.
7. Tell the patient who you are and why you are there. Tell him or what you are doing before you do it and why to avoid startles or surprises.
8. (1) Compare the pickup slip with the chart identification.
   (2) Ask nursing unit personnel to identify the patient.
   (3) Check the chart against the name on the patient's bed.
   (4) Ask the patient to say his or her full name.
   (5) Check the patient's ID band against the chart.
9. IV containers are suspended from a pole at the side or foot of the litter away from the patient's head to prevent the patient from being hit in the head should the bag or bottle fall.
10. Conscious—at least two; unconscious—at least four.
11. It makes their elbows stick out beyond the side rails. A corner cut a bit too sharp or a bump against the wall could result in a broken arm or a mashed elbow.
12. Feet first. When entering an elevator, push the head end of the gurney into the elevator first.

407

1. This ensures the patient understands exactly what is going to be done and it matches what he or she has agreed to have done.
2. This covers the hair to reduce chances of shed hair contaminating the field and prevents the hair from getting soiled by blood or emesis.

3. To allow the patient to relax and adapt to the surgical environment after this relatively traumatic procedure is completed.
4. Avoid unnecessary conversation and let the patient sleep.
5. To avoid a prolonged, uncomfortable wait on the OR bed and to prevent patient anxiety from increasing.

Do the unit review exercises before going to the next unit.

Unit Review Exercises

Note to Student: Consider all choices carefully, select the *best* answer to each question, and *circle* the corresponding letter. When you have completed all unit review exercises, transfer your answers to the Field Scoring Answer Sheet.

Do not return your answer sheet to the Air Force Career Development Academy (AFCDA).

1. (401) The physical preparations for operating on a geriatric patient are influenced by all of the following factors *except* elderly patients
   a. tend to heal more slowly than younger patients.
   b. may have arthritis that reduces their joints' range of motion.
   c. usually have a higher tolerance to drugs and anesthetic agents.
   d. often have slower blood circulation, thinner skin, and less body hair than younger adults.

2. (401) Cosmetic surgery falls under which classification of surgery?
   a. Urgent.
   b. Elective.
   c. Optional.
   d. Emergent.

3. (402) A complete blood count (CBC) includes all of the following *except* the
   a. hematocrit value.
   b. hemoglobin value.
   c. white blood cell count.
   d. prothrombin time value.

4. (402) If the patient's red blood cell (RBC) count and hemoglobin (Hgb) value is low, what could that indicate?
   a. the patient may hemorrhage during surgery.
   b. the patient may have internal bleeding.
   c. the patient has a fluid deficit.
   d. the patient is anemic.

5. (403) Who formulates the perioperative nursing care plan?
   a. Surgeon.
   b. Operating room nurse.
   c. Post anesthesia care unit nurse.
   d. Anesthesiologist or nurse anesthetist.

6. (403) What factor usually determines which nursing care unit a patient initially will be assigned to after being admitted to the hospital?
   a. Patient's sex.
   b. Patient's status in the military.
   c. Order or time the patient was admitted.
   d. Surgical specialty the patient falls under.

7. (403) Why are adult patients usually required to don a clean hospital gown or pajama top, secured only at the neck?
   a. Facilitate nursing procedures such as taking rectal temperatures and giving enemas.
   b. Facilitate easy removal once the patient arrives in the operating room.
   c. Prevent soiling an excessive amount of hospital-provided clothing.
   d. Prevent the patient from becoming overheated during surgery.

8. (404) Which individual *could not* legally sign a written consent for his or her surgery?
   a. An active duty military female under 18 years old.
   b. A 17-year-old, married female who is in early labor.
   c. The emancipated 16-year-old son of an Air Force captain.
   d. A 21 year-old dependent son who has been given preoperative sedatives.

9. (404) Who *cannot* legally witness the surgical consent form?
   a. The ward clerk on the nursing unit.
   b. An admissions and dispositions clerk.
   c. The scrub technician for the patient's surgery.
   d. A medical service technician in the emergency room.

10. (404) What action, if any may the provider take if an enlisted military member refuses surgical treatment?
   a. Refer them to a medical evaluation board.
   b. Obtain consent from the member's commander.
   c. Use the provider's authority as an officer to order the treatment.
   d. None; military members are protected by the Privacy Act from any repercussions.

11. (405) What is the purpose of the DD Form 1924, Surgical Checklist?
   a. Serves to remind personnel of, and document completion of, the routine procedures involved in preoperative patient preparation.
   b. Used to ensure that all equipment, instruments, and supplies for a particular procedure are available in the operating room.
   c. Provides detailed written explanation of all preoperative nursing care completed in the nursing unit.
   d. It shows the results of all laboratory tests and special examinations done prior to surgery.

12. (405) Who documents the patient's history on the SF 504, Clinical Record; or the SF 505, Clinical Record - History, Parts 2 and 3?
   a. Admissions and dispositions (A&D) clerk.
   b. Post anesthesia care unit nurse.
   c. Operating room nurse.
   d. Examining physician.

13. (405) What form is *not* usually in the patient's chart before surgery?
   a. Standard Form (SF) 509, Medical Record – Progress Report.
   b. Optional Form (OF) 517 Medical Record - Anesthesia.
   c. SF 518, Blood or Blood Component Transfusion.
   d. SF 511, Vital Signs Record.

14. (406) When preparing a gurney for patient transport using the *mummy wrap* method, what is the very *last step*?
   a. Sandwich the blanket on the gurney with another sheet.
   b. Place an unopened folded sheet at the head of the gurney.
   c. Tuck the overhanging sheet at the foot of the gurney under the mattress.
   d. Fanfold the overhanging sides of the sheets until they align with the edges of the gurney mattress.

15. (406) When preparing the patient for transfer from a bed to a gurney, what is the *first* thing you must do?
   a. Lower the side rails on the bed.
   b. Lock the wheels on the gurney.
   c. Lock the wheels on the patient's bed.
   d. Adjust the height of the bed or the gurney so they are the same level.

16. (406) When transferring a patient from a wheelchair to a gurney, what should you do after the patient is on the gurney and has rolled onto her or his back?
    a. Cover the patient.
    b. Raise the rails on the gurney.
    c. Secure the gurney's safety straps.
    d. Have the patient scoot to the center of the gurney.

17. (406) What is the *best* method to verify a surgical patient?
    a. Compare the "pick-up slip" with the name on the bed, check the chart against the name on the bed, ask the patient "Are you Mrs. Miller?", then check the ID band against the chart.
    b. Compare the "pick-up slip" to the ID band, check the ID band against the name on the bed, ask nursing unit personnel to identify the patient, then ask the patient "What is your name?"
    c. Compare the "pick-up slip" with the chart identification, ask nursing unit personnel to identify the patient, ask the patient "Are you Mrs. Miller?", then check the ID band against the chart.
    d. Compare the "pick-up slip" with the chart identification, ask nursing unit personnel to identify the patient, check the chart against the name on the patient's bed, ask the patient "What is your name?", then check the ID band against the chart.

18. (406) If the patient has been premedicated and does not have an identification band, hospital policy usually requires
    a. the unit nurse to identify the patient and apply the band.
    b. a family member to identify the patient and check the information on the chart and "pick-up slip".
    c. Admissions and Dispositions personnel to identify the patient using the admission records, then apply the band.
    d. the surgical procedure be postponed until the pre-med effects diminish and the patient can identify himself or herself, then the band is applied.

19. (406) How do you make, place, and use a draw sheet?
    a. Fold a sheet into quarters, place it under the patient so it extends approximately from mid-back to mid-thigh. It is used to lift the patient's torso and buttocks when four people transfer an unconscious or anesthetized patient from bed to gurney (and reverse).
    b. Fold a sheet into quarters, place it under the patient so it extends approximately from mid-back to mid-thigh. It is used to lift the patient's torso and buttocks when two people transfer an unconscious or anesthetized patient from bed to gurney (and reverse).
    c. Fold a sheet in half, place it under the patient so it extends approximately from above the shoulders to below the knees. It is used to lift the patient's torso and buttocks when four people transfer an unconscious or anesthetized patient from bed to gurney (and reverse).
    d. Fold a sheet in half, place it under the patient so it extends approximately from above the shoulders to below the knees. It is used to lift the patient's torso and buttocks when two people transfer an unconscious or anesthetized patient from bed to gurney (and reverse).

20. (407) During the patient's admission to the surgical suite, why does the admitting nurse ask the patient what operation he or she is having and what part of the body is involved?
    a. To make sure that the perioperative nursing record contains the right information.
    b. To obtain information that will be used by the operating supervisor in filling out the surgical case log.
    c. To ensure the surgical checklist was completed accurately before the patient received the preoperative medication**.**
    d. To ensure the patient understands exactly what is going to be done, and it matches what he or she has agreed to have done.

21. (407) If the patient asks a question you are not qualified to answer,
    a. give them your best "educated guess."
    b. ask the nurse or anesthetist to respond.
    c. try to find the answer in the patient's chart or in a medical text book.
    d. ignore it; premedicated patients usually do not remember the answer.

Please read the unit menu for unit 2 and continue ➔

Student Notes

Unit 2. Anesthesia

LACK OF EFFECTIVE PAIN CONTROL was a major deterrent to surgical treatment for years. Before the advent of anesthesia, successful surgery depended on how fast the surgeon could work and how well the patient could tolerate the psychological and physiological shock associated with the operation. Early attempts to render the patient insensitive to pain using opium and alcohol were not only ineffective but unsafe as well. Although ether and nitrous oxide had been discovered during the Renaissance, their potential pain relieving value was not appreciated by surgeons until October 16, 1846. On this date, William Morton provided the first clinical demonstration of anesthesia at Massachusetts General Hospital. Without doubt, the sophisticated anesthetic agents and techniques developed since 1846 revolutionized surgical practice. Effective use of anesthetics provides surgeons much more time to operate and allows them to perform previously impossible surgical procedures.

Modern anesthesia involves much more than just eliminating the patient's sensation of pain. It encompasses both the physical comfort and mental health of the patient, as well as the physiological support measures necessary to make the operative procedure possible. The anesthesia staff is responsible for administering the anesthetic agents and ensuring the patient's safety and comfort and medical maintenance during and immediately after a surgical procedure. However, the anesthesia staff cannot accomplish these functions without help. Anesthesiologists (physicians) and certified registered nurse anesthetists (CRNA) rely heavily on surgical technicians and nurses to assist them with activities ranging from starting IVs and preparing anesthesia supplies, to postanesthesia recovery of surgical patients. For this reason, it is important that all surgical nursing personnel have a basic understanding of modern anesthesia and how it relates with perioperative nursing.

This unit will help you understand what anesthesia is, how a particular agent is selected for a patient, and what preoperative medications are commonly administered to surgical patients. It will also help you become familiar with the different types of anesthesia, some common anesthetic agents, and your role in assisting anesthesia personnel during anesthesia administration. Finally, we focus on common anesthesia complications and how they are managed.

Throughout this unit, we use the term *anesthetist* when referring to the anesthesia provider, whether it is an anesthesiologist or CRNA.

2–1. Preanesthetic Considerations and Preparations

In the previous unit, we discussed the various physical considerations and preparations required to prepare a patient for surgery. These preoperative preparations also include the anesthetic. We have already mentioned some of the preparation associated with anesthesia; now it's time to look at other aspects of anesthesia preparation. It is appropriate to begin by defining anesthesia and citing the factors that affect the choice of anesthesia. Then, we'll concentrate on preoperative medications, a subject we briefly touched on in Unit 1.

408. Definition and choice of anesthesia

As with most subjects you must first know basic terms, definitions, and facts before you can understand the advanced concepts of anesthesia.

Anesthesia terms

The word anesthesia was first introduced by Oliver Wendell Holmes in 1846, 4 weeks after Morton's demonstration of anesthesia. Holmes derived this English word from the Greek word *anaisthesis,* which means "not sensation." Anesthesia is simply defined as insensibility or loss of sensation with or without loss of consciousness. In modern terms, anesthesia is usually divided into two types.

General anesthesia

This type of anesthesia is clinically defined by four criteria: amnesia (unable to recall the event), analgesia (insensibility to pain), hypnosis (unconsciousness), and muscle relaxation. Patients refer to general anesthesia as "going to sleep" or "being knocked out"; in other words, anesthesia is produced throughout the entire body.

Conduction or regional anesthesia

This type of anesthesia is typically involves the injection of a local anesthetic agent close to a nerve or nerves to provide analgesia to a specific area of the body without the loss of consciousness. When these agents are applied to a small surface or tissue area, it is described as "local anesthesia."

When the anesthetist gives small amounts of medication to sedate or relax a patient for a minor procedure, it is considered *monitored anesthesia care* (MAC). For practical purposes, we are not going discuss this as a major type of anesthesia since MAC is usually combined with local or regional anesthesia.

Now that you know the basic meaning of the word anesthesia and the two major types of anesthesia, let's look at the factors that affect the selection of anesthesia for a particular patient.

Factors affecting the choice of anesthesia

After conducting the preoperative patient interview, the anesthetist considers several factors before choosing the type of anesthetic best suited for that patient. These factors include but are not limited to the patient's: age; physical condition; uncommon medical conditions; allergies or sensitivity to drugs; personal preference; previous experience with anesthesia; medical contraindications to a particular technique; and/or results of laboratory or other diagnostic tests.

Patient's age

Physical size, development, maturity, and ability to take directions and cooperate during anesthesia administration effects the type of anesthetic used. The anesthetist selects different agents and techniques to suit the patient's age. For example, a pediatric patient may be unable to cooperate or tolerate administration of a regional anesthetic, but this method may be ideal for a geriatric patient.

Patient's physical condition

The presence of a secondary disease condition or physical disability (i.e., chronic cardiopulmonary disease, obesity, diabetes, hypertension, or severe spinal deformity) also influences the anesthetic

agents and technique used. The patient may be taking medication which influences or interacts with anesthetic agents. If the patient is pregnant, the anesthetic selected must suit the needs of the mother and not negatively affect the baby.

Patient's uncommon medical conditions

There are many unique medical conditions that directly impact anesthesia. Some examples are myasthenia gravis, Duchenne's muscular dystrophy, malignant hyperthermia, atypical plasma cholinesterase, Down's syndrome, and acute intermittent porphyria. If a patient has one of these conditions, the wrong anesthetic agent can cause serious injury or even death.

Patient's allergies or sensitivity to drugs

Patients with a history of allergic reactions, chronic asthma, hay fever, or food allergy may be sensitive to certain drugs, even in small doses. The anesthetist may have to avoid using drugs containing certain preservatives or causing histamine release. Some people are sensitive to narcotics, such as morphine, or to local anesthetics, which precludes their use.

Patient's personal preference

A patient may be extremely afraid of a certain type of anesthetic. For example, many patients have heard stories about the headache that may occur after a spinal anesthetic and want general anesthesia, regardless of where or how minor the procedure—remember, the procedure is seldom *minor* from the patient's perspective. Other patients are afraid to be "knocked out" and want to stay awake if at all possible. The anesthetist and patient should try to reach an agreement, selecting a method that reduces anxiety while ensuring the patient's safety.

Patient's previous experience with anesthesia

Obviously, if a patient did not tolerate the administration of certain agents very well during a previous operation, the anesthetist will not usually attempt to use them again. For example, if after general anesthesia a patient experienced nausea and vomiting, regional anesthesia is considered as an alternative.

Patient's specific medical contraindications to a particular technique

As discussed above, some medical conditions greatly reduce the anesthetist's choice of technique. Systemic infection, abnormal blood clotting, or hypovolemia may eliminate spinal or epidural anesthetics as options; severe asthma may rule out general anesthesia.

Results of laboratory or other diagnostic tests

The anesthetist reviews test results and investigates any abnormalities that may impact anesthesia. For example, if prothrombin time/partial thromboplastin time (PT/PTT), a test to determine blood clotting time, has a result that is abnormally long, regional anesthesia may not be an option.

Other factors

Other factors anesthesia personnel must take into consideration include the type of surgery to be performed, the surgical position used, the degree of muscle relaxation the surgeon requires, and the surgical technique used (laparotomy vs. laparoscopy). The urgency of the procedure is also a factor; a true "stat" emergency may require a "crash" or rapid sequence induction. Finally, the choice of anesthetic is influenced by the operating environment and the skill and experience of the anesthetist.

American Society of Anesthesiologists physical status code

To assist anesthesia providers in selecting the best anesthetic, the American Society of Anesthesiologists (ASA) devised a system to classify patients by physical status. Under this system, the anesthetist uses available test results, the patient's medical history, and the preoperative interview to assign a numerical risk code of 1 through 5 to the patient. This physical status (PS) code helps

anesthesia personnel select the best anesthetic and communicate the patient's anesthesia risk with other providers. The following table lists the ASA/PS codes and their descriptions.

American Society of Anesthesiologists Physical Status Codes	
ASA Class	**Description**
1	Completely healthy patient. No anatomical, physiological, or psychological problems noted.
2	Mild to moderate systemic disease under medical control (obesity, well-managed diabetes, hypertension, asthma).
3	Severe or unstable condition or disease (severe heart disease, poorly managed diabetes, poorly controlled hypertension).
4	Severe life-threatening disease (advanced kidney or liver disease, severe heart disease).
5	Critical patient not expected to survive (ruptured abdominal aneurysm with shock, massive cerebral hemorrhage).
E	If procedure is an emergency, E is added to the code (ASA=3E).

409. Premedicating the surgical patient

As stated in Unit 1, most patients receive some type of preoperative medication. Let's look at the purpose of premedicating the patient, some of the drugs used to do so, and some reasons for not administering a routine premedication.

Purpose of preoperative medication

The anesthesia provider selects preoperative medication to meet the unique needs of each patient. Premedication is given for two basic reasons—psychological and physiological. Psychological premedication refers to drugs used to reduce a patient's anxiety; physiological premedication agents are used to affect one or more body systems to help medically maintain the patient during the procedure. The anesthetist's goal is to choose the combination of medications that make the patient most comfortable while maintaining the best physiological balance possible. Medication for existing medical conditions is usually given in conjunction with the premedication. The factors used to determine the anesthetic of choice are also considered when determining premedication, in particular, the patient's level of anxiety, the type of surgery, allergies, age, weight, and existing medical conditions.

Drugs used for preoperative medication

A typical combination of drugs used as preoperative medication consists of a sedative or tranquilizer, drugs to reduce the acids and contents of the stomach, and an anticholinergic (drying) agent. Since surgery patients are normally not allowed to take anything by mouth (NPO—usually 6 to 8 hours before surgery), oral medications are given with just a sip of water.

Sedatives and tranquilizers

In addition to being used as a premedication, sedatives (sleeping pills) are often given to the patient the evening before surgery. They are usually administered orally in tablet form to help the patient sleep and to reduce anxiety or pre-op "jitters." Barbiturates used include such drugs as secobarbital (Seconal), pentobarbital (Nembutal), and phenobarbital. In addition to their sedative effect, the barbiturates also act as a hypnotic, and they only minimally depress the respiratory and circulatory systems.

Nonbarbiturate sedatives and tranquilizers include such drugs as promethazine (Phenergan), hydroxyzine (Vistaril), lorazepam (Ativan), and the ever-popular diazepam (Valium). Another tranquilizer (technically a benzodiazepine) called midazolam (Versed) is frequently used for

intravenous sedation and to induce mild amnesia after the patient arrives in the surgical suite holding area. An advantage to midazolam is it can be also given orally or in nose drops for sedation of children. Droperidol (Inapsine) is a sedative that is also useful to treat nausea and vomiting after surgery.

Narcotics (opiates)

True narcotics are naturally derived from the opium extracted from poppy plants. They include drugs such as morphine sulfate and codeine. Synthetic narcotics include drugs like meperidine (Demerol). Narcotics are used primarily as painkillers (analgesics) and are usually administered via intramuscular (IM) injection. They may have the unfortunate side effects of depressing respiration, dilating peripheral blood vessels (which causes a lowering of blood pressure or *hypotension*), and inducing nausea. A patient who has been administered a narcotic (particularly the true opiates) must be closely monitored for complications. Narcotics are useful premedications when the patient is in pain or must undergo a painful procedure (such as arterial or central line placement) before anesthesia induction.

Anticholinergic (drying) agents

Anticholinergic drugs are administered to dry up mucous secretions in the oral cavity and upper respiratory tract. Atropine sulfate and scopolamine are the most common naturally derived (from the belladonna plant) anticholinergic drugs. These drugs are especially useful for oral and throat surgery as they provide the surgeon with a “dry field.” A side effect of the natural anticholinergics, increasing the patient’s heart rate (tachycardia), is useful for anesthesia induction of children.

A patient who has been given an anticholinergic drug will often complain of a very dry mouth. Glycopyrrolate (Robinul) is a synthetic anticholinergic that not only dries mucous secretions, but also reduces the acidity of digestive and gastric secretions, much like the next group of drugs.

Adjunct preoperative medications

Preoperative medications that serve as adjuncts (accessory or auxiliary agents) are commonly used to suppress or neutralize digestive acids. They are usually given to a patient who is high-risk for aspiration because these acids can severely damage his or her respiratory tract if aspirated. Some examples of such patients are those who *have not been* NPO, nothing by mouth, before surgery; patients with a history of ulcers, heartburn, or obesity; and pregnant females. The three most common categories are the H2 antagonists, the antacids, and the antiemetics. *H2 antagonists* suppress the secretion of gastric acids in the stomach. Commonly used H2 agents are cimetidine (Tagamet), ranitidine (Zantac), and famotidine (Pepcid). *Antacids* are usually given orally 15 to 30 minutes before surgery to effectively neutralize the stomach acids. The antacid used must be a nonparticulate clear solution such as sodium citrate (Bicitra). *Antiemetics* prevent or relieve nausea and vomiting. A particularly useful drug of this class is metoclopramide (Reglan).

Preoperative medication is only effective if the drug or agent is used properly. One of the critical elements in effective premedication is timing.

Timing of preoperative medication

Generally, the patient receives preoperative medications 45 to 60 minutes prior to surgery. When assigned to transport a patient to surgery, always be alert to his or her reaction to the drugs. If the premedication was given on time, the patient will hopefully be relaxed and a little sleepy. If premedicated too early or too late, the desired effect may not be present. Remember, be alert for unusual reactions and immediately report them to a nurse or physician.

Exceptions to preoperative medication routines

Many times, the elderly, extremely ill, or patients with uncommon diseases are not given preoperative medications because their response to the drugs may be unpredictable. The anesthetist will usually medicate them after they arrive in the surgical suite, so they can be closely monitored. Healthy

patients who are comfortable and not very anxious may receive no premedication; the anesthetist will sometimes sedate them intravenously immediately before surgery.

In contrast, heavy smokers, alcohol consumers, and highly emotional or mentally ill patients may require more premedication than is normally required. This is partially due to their accelerated metabolism rate, which causes the drugs to be assimilated and dissipated by the body much faster than normal.

There are two schools of thought on premedicating ambulatory surgical patients. Since the goal of ambulatory surgery is rapid discharge of the patient, many anesthetists do not give premedications because they may increase recovery time. Other anesthetists believe the use of short-acting premedications does not significantly increase recovery time and makes the experience more comfortable for the patient. As with most medical treatment, the patient's needs should dictate the approach used to premedicate ambulatory surgical patients.

We've covered all you never wanted to know about the definition of anesthesia, factors that influence the selection of anesthesia, and preoperative medications. Now it's time to see if you were awake!

Self-Test Questions

After you complete these questions, you may check your answers at the end of the unit.

408. Definition and choice of anesthesia

1. What is the definition of anesthesia?

2. List four criteria that define general anesthesia.

3. What is conduction anesthesia?

4. Identify five factors not specifically related to the patient that affect the choice of anesthesia.

5. What is the purpose of the ASA or PS code?

409. Premedicating the surgical patient

1. Describe the two reasons for premedicating a patient before surgery.

2. Match the descriptive statements in column A with the types of drugs in column B. Items in column B may be used more than once.

Column A	Column B
____ (1) Primarily used for analgesia.	a. Sedatives and tranquilizers.
____ (2) Reduce preoperative anxiety.	b. Narcotics.
____ (3) Depress respiration, lower blood pressure, cause nausea.	c. Anticholinergic agents.
____ (4) Dry up mucous secretions in the mouth and respiratory tract.	d. H2 Antagonists.
____ (5) Reduce preoperative anxiety and act as a hypnotic.	
____ (6) Suppress gastric secretions.	

3. When are preoperative medications generally administered?

4. What may happen if preoperative medications are not given at the proper time?

5. What types of patients may not receive preoperative medications?

6. What are the two schools of thought on preoperative medication for ambulatory surgery patients?

2–2. Anesthesia Types and Methods of Administration

In the first part of this unit, we defined the two main categories of anesthesia—general and conduction. Now let's look at how these types of anesthesia work and are administered. We start with general anesthesia.

410. General anesthesia

As medics, we know there are many anesthetic methods, but most people think of "going to sleep" as the normal way to do surgery, so we'll start our discussion with general anesthesia.

Mechanism of action

As we said earlier, general anesthesia affects the entire body; anesthesia personnel control pain by literally "knocking out" the patient. Besides rendering the patient unconscious, general anesthesia can also depress unwanted reflexes and relax muscles (a key factor during surgery). The specific action of general anesthetic agents varies, but all concentrate in the blood supplying the brain and work by disrupting normal brain functions until the patient lapses into unconsciousness. The level or depth of anesthesia depends on the type and amount of the anesthetic used and the individual patient. The anesthetist must constantly monitor the patient throughout the entire operation to ensure the patient's vital signs remain stable, the amount of oxygen they are receiving is adequate, and the desired anesthetic effects are maintained until the operation is complete.

Methods of administration

General anesthesia may be administered by inhalation, intravenously, or a combination of the two.

Inhalation method

The inhalation method uses either volatile liquid or compressed gas agents. The inhaled agents enter the bloodstream via the lungs and are carried to the brain, producing anesthesia. As long as the inhalation agent enters the bloodstream and exerts gas pressure or partial pressure of the agent on the brain, the desired effect is maintained. The effects of an inhalation agent are reversed by turning off the supply and allowing the lungs to eliminate the agent from the blood through respiration.

Agents

Potent, nonflammable, volatile, liquid agents are vaporized (changed from liquid to gas) in special, closed containers called vaporizers. A selected mixture of gases (such as oxygen, nitrous oxide, and air) is delivered into the vaporizer containing a liquid agent which picks up the potent vapor and produces an accurate concentration of volatile agent and gas. Because of the potency, a very small concentration (1 to 2 percent) of agent is all that is required to produce anesthesia; this concentration is usually controlled by a dial on the vaporizer. The vapor and gas mixture is then delivered to the lungs via the anesthesia machine. If you hear anesthesia personnel refer to the MAC (minimum alveolar concentration) of an inhalation agent, they are referring to its potency. Do not confuse this MAC with monitored anesthesia care.

The most commonly used volatile liquid agents are isoflurane (Forane), enflurane (Ethrane), and halothane (Fluothane). Each agent provides a smooth induction, rapid recovery, and good relaxation; all three are widely used. Isoflurane provides the quickest induction and recovery. Halothane is the least pungent and often selected for mask induction and administration. Also, inhalation agents are continuously being developed. Desflurane (Suprane) is structurally similar to isoflurane, but has a faster “wash-in, wash-out” time than any of the previous agents—even nitrous oxide.

The anesthetist commonly uses three compressed gases—oxygen, nitrous oxide, and air. Various mixtures are chosen by the anesthetist and delivered to the patient under controlled flow and pressure. Oxygen (essential for life) is always delivered to the patient. Nitrous oxide (laughing gas) is a relatively weak anesthetic used to supplement other inhalation or intravenous agents. It is probably the most commonly used anesthetic gas. Air is used to dilute nitrous oxide or oxygen when high concentrations are not desirable.

Delivery systems

An anesthesia machine is used to administer inhalation anesthetic agents and oxygen to the patient. In modern operating rooms, compressed gases are supplied to the anesthesia machine through wall outlets or ceiling columns. The outlets deliver the gases from a central bank of compressed-gas tanks to the operating room through a regulated system of pipes and tubes. The anesthesia machine also has small compressed gas cylinders connected to it for backup if the main gas supply system fails.

The anesthetist controls the flow and mixture of gas and anesthetic agents by regulating the anesthesia machine’s valves (flowmeters for gases) and dials on vaporizers for volatile agents. A breathing circuit connects the machine to a face mask or endotracheal tube and delivers the anesthetic mixture to the patient.

The anesthetist usually starts inhalation anesthesia by selecting the proper size mask, and then holding it over the patient’s mouth and nose until the anesthetic takes effect. If the anesthetist chooses to mask the patient throughout the procedure, an oral airway is usually placed in the patient’s mouth to prevent obstruction of his or her airway by the tongue. The anesthetist may also use gentle head tilt (hyperextension) and jaw lift to help maintain the airway. During the procedure, the mask may be held in place by straps wrapped behind the patient’s head and secured to the sides of the mask.

For most procedures, an endotracheal tube (ET-tube) is used because it provides a more "patent" or secured airway. The ET-tube is inserted into the patient's mouth, or occasionally the nose, and threaded through the patient's trachea to just above the point where the bronchi branch off (also called the carina). This procedure is referred to as *endotracheal intubation*. The tube usually has a small, inflatable, balloon-like cuff near the distal end. When inflated, the cuff helps hold the tube in place, prevents back flow of gases around the tube, and keeps the patient from aspirating secretions and emesis into the lungs. Once the cuff is inflated, the anesthetist usually further secures the tube with tape. Pediatric tubes are usually cuffless because tracheal pressure from an inflated cuff can cause airway swelling in infants and children; these ET-tubes are secured with tape alone. At the end of the procedure, after the patient's reflexes return and vital signs are stable, the anesthetist *extubates* or removes the tube from, the patient.

Corrugated plastic or rubber tubes called *breathing circuits* carry the gases from the anesthesia machine to the mask or ET tube. The circuit usually has a balloon-like rebreathing or reservoir bag that collects the patient's exhaled gas and helps the anesthetist to breathe for, or *ventilate,* the patient by squeezing the bag. A pressure relief valve that prevents the buildup of excessive pressure is located either in the circuit or the ventilator. The exhaled gas is collected by a *scavenger system* on the anesthesia machine and either actively suctioned out or passively vented out of the hospital to prevent surgical team members from inhaling potentially harmful gases. There are many configurations of circuits; each one is selected based on the patient's age, type of procedure, and anesthetist's preference. The circuit's tubing, bag, and connectors usually come in sterile, disposable sets. You may be asked to change these items, so it is imperative you become familiar with each type of circuit used in your facility.

Inhalation anesthetics are administered using *total rebreathing* (closed), *partial rebreathing* (semiclosed or semiopen) or *nonrebreathing* (open) methods. In a closed system, the patient's exhaled air is filtered through canisters containing a chemical carbon dioxide (CO_2) absorber (usually soda lime), and then all anesthetic agents and gases are mixed with fresh oxygen and rebreathed. The total rebreathing system reduces the amount of gases and volatile agents consumed, the chances of contaminating the operating room air, and the patient's loss of body heat and moisture. The most common method used is the partial rebreathing system. With this system, some of the patient's expired air and gas is filtered through the CO_2 absorber (semiclosed) or is released through the pressure relief valve (semiopen) into the scavenger system; the rest is rebreathed by the patient. This method uses more agent and gas than the closed system, but allows the anesthetist greater control over the mixture. The patient loses more heat and moisture than in the closed system, but not as much as when using the nonrebreathing method. In the open method, all the exhaled air and gas is released into the scavenging system; the patient does not rebreathe any expired gas. This method uses the greatest volume of agent, increases chances of operating room air contamination, and results in the most heat and moisture loss in the patient.

Intravenous (IV) method

Intravenous agents are drugs used to safely and rapidly (practically in seconds!) induce or maintain anesthesia. They are usually introduced into a peripheral vein in the arm through an intravenous catheter. The catheter is connected to flexible IV tubing, then to a bottle or bag of intravenous solution. The agent may be injected directly into the vein through a stopcock on the IV tubing, or it may be mixed with the IV solution and dripped into the patient's bloodstream throughout the operation. Unlike the inhalation agents, intravenous agents are not rapidly eliminated through the lungs. They must have time to leave the brain and other blood-rich organs, and then be metabolized by the liver or kidneys before they leave the body.

Agents

Short-duration barbiturates, such as thiopental sodium (Sodium Pentothal), are commonly used for rapid induction of anesthesia. They are not complete general anesthetic agents and must be

supplemented with other agents because they do not provide muscle relaxation or analgesia, but only hypnosis and amnesia (remember the four criteria of general anesthesia).

Propofol (Diprivan) is a very short-duration, intravenous, anesthetic agent used for rapid induction and continuous maintenance of general anesthesia. This drug has desirable characteristics such as a quick recovery and a low incidence of nausea and vomiting, but may cause more cardiovascular depression than the barbiturates. This drug is especially useful for ambulatory surgery because it allows the patient to rapidly recover from the anesthesia and be quickly discharged from the hospital.

Narcotics (opioids) may be used for induction and maintenance of anesthesia, but, even in high doses, narcotics do not produce dependable unconsciousness or amnesia. They are frequently used in combination with other anesthetic agents. Three of the most commonly used narcotics are fentanyl (Sublimaze), sufentanil (Sufenta), and alfentanil (Alfenta). Each of these agents has different characteristics such as duration of action and potency, so the anesthetist will choose a narcotic to fit the particular procedure and patient. Narcotics are useful for heart surgery and other major procedures because they do not produce significant cardiac depression, but they do result in lingering respiratory depression and nausea, so close postoperative observation is essential.

Muscle relaxants are used because anesthetic agents alone may not relax the jaw and laryngeal muscles enough for intubation or may not produce the muscle paralysis or relaxation the surgeon needs for exposure and wound closure. Succinylcholine (Anectine) is frequently used for endotracheal intubation because of its short duration, about 10 minutes, and excellent paralysis. The intermediate-duration muscle relaxants, lasting 15 to 45 minutes, are atracurium (Tracrium), vecuronium (Norcuron), and mivacurium (Mivacron). The long-duration muscle relaxants, lasting more than one hour, are pancuronium (Pavulon), pipecuronium (Arduan), and doxacurium (Nuromax). Other long-acting agents, such as tubocurarine, gallamine, and metocurine, have been in use for many years and are still widely used. When you see an anesthetist use a peripheral nerve stimulator or “twitch monitor,” he or she is electrically stimulating a nerve to determine the degree of muscle relaxation. An important characteristic of muscle relaxants is, they may be reversed using the anticholinesterases (neostigmine) and anticholinergics (glycopyrrolate).

Balanced anesthesia

General anesthesia is seldom induced and maintained strictly by the inhalation or intravenous methods; the anesthetist usually strives to provide *balanced anesthesia*. This is a combination of several types of intravenous and inhalation anesthetic agents to produce a general anesthesia to meet the needs of the individual patient and procedure. This combination helps to lower the total amount or dose of each agent, hopefully reducing the undesirable side effects of each individual agent. Balanced anesthesia allows the anesthetist to use a drug to fulfill each of the criteria for general anesthesia. There are numerous variations the anesthetist can select. A typical balanced anesthesia routine may involve a benzodiazepine (e.g., Versed) or other suitable tranquilizer for amnesia, a potent narcotic (e.g., Sublimaze) for analgesia, an inhalation agent (e.g., Nitrous Oxide) for hypnosis or unconsciousness and a muscle relaxant (e.g., Norcuron) for paralysis; additional narcotic may be given near the end of the procedure to help manage postoperative pain. Before the patient is fully awakened, some anesthetists may administer conduction anesthesia to help provide immediate postoperative analgesia.

Other methods or measures

While inhalation and intravenous administrations are the most common methods of general anesthesia administration, anesthesia providers do use other methods or measures. These other methods are primarily used only when the patient’s physical condition rules out using a more conventional anesthetic.

Dissociative anesthesia

Dissociative anesthesia is not a true form of general anesthesia because it only provides analgesia and amnesia; the patient appears awake, but is actually unaware of or dissociated from his or her surroundings. Ketamine hydrochloride (Ketalar) is almost exclusively used to produce this effect; it works by selectively blocking sensory receptors in the brain without depressing the entire central nervous system. A primary disadvantage is vivid hallucinations and delirium (unpleasant dreams)—especially in adults—it is extremely important to provide a quiet, calm atmosphere for recovery. Diazepam (Valium) or midazolam (Versed) is sometimes given to help reduce the negative effects.

Hypnoanesthesia

Like dissociative anesthesia, hypnosis used for anesthesia provides analgesia and amnesia (if desired), but the patient appears awake. Hypnoanesthesia is time consuming, unreliable, and has a history of abuse, so is very rarely used. It has been successfully used to treat burn patients and patients with multiple allergies or extreme fear of anesthesia.

Induced hypothermia

Induced hypothermia involves deliberately lowering the patient's body temperature to reduce the oxygen needed by vital organs when blood circulation is expected to be decreased or interrupted. It is used in conjunction with general anesthetics for cardiac (open-heart) surgery, organ transplants, and to lower intracranial pressure during some neurosurgery procedures. Methods used include:

- Surface-induced hypothermia uses an external device such as a cooling blanket to lower body temperature. For infants, ice or alcohol baths may be used.
- Internal cooling involves cooling a specific body area or organ using sterile "slush" solutions or cold irrigation. During heart surgery, the cold cardioplegia method involves a combination of drugs and slush solution to reduce the heart's metabolism.
- Systemic hypothermia cools the entire body by intravenous infusion of cold solutions, or, in cardiac surgery, the use of a heart bypass machine to cool the blood before returning it to the body.

When the procedure is complete, the patient is rewarmed gradually, usually by reversing the method used to induce it.

Induced hypotension

Induced hypotension is deliberate lowering of the patient's arterial blood pressure to reduce blood loss when major hemorrhage or oozing of blood is expected. It is attained by using deep anesthesia and vasodilating drugs such as nitroglycerin. Induced hypotension is very risky since it may compromise blood flow to vital organs.

Normovolemic hemodilution

This method is also rarely used, but is useful when transfusion of blood products is contraindicated or when a clear, bloodless surgical field is essential. Before the procedure, the anesthetist withdraws and stores enough of the patient's blood to reduce hematocrit to about 15 percent. The blood is replaced with approximately three times the volume of electrolyte IV solution. This results in the blood being clear throughout the procedure. After surgery, the patient's blood is reinfused.

411. Conduction anesthesia—regional and local

While general anesthesia has been the norm, the popularity of ambulatory surgery and the development of new techniques and agents, make conduction anesthesia the choice for a growing number of surgical procedures.

Mechanism of action

As we mentioned earlier, conduction anesthesia produces analgesia in a specific area of the body without loss of consciousness. A conduction anesthetic eliminates pain by deadening the sensory nerves, or pain receptors, in a specific body area and blocking the conduction of sensory and motor impulses to the brain. Since these impulses are not transmitted to the brain, the patient senses no pain. Conduction anesthesia is usually divided into two major categories—local and regional. An agent used as a local anesthetic blocks pain impulses from the immediate source, usually a small, superficial area; regional agents block receptors from a single nerve or a group of nerves in the entire region of the source. Conduction anesthesia is used on major and minor surgical procedures, on patients who cannot be given or do not want a general anesthetic, and when the surgeon wants the patient to remain conscious and able to cooperate. Because the patient is awake and may be anxious during the procedure, tranquilizers or narcotics may be used to sedate the patient and produce mild amnesia.

Methods of administration

Although the mechanism of action is similar for conduction anesthetic agents, the methods of administration differ. Conduction anesthesia is generally divided into two classifications—local anesthesia and regional anesthesia.

Local anesthesia

The term local anesthesia is used in many ways. To avoid confusion, we use it to describe blocking the nerve impulses from peripheral nerves, or nerve ends, located in superficial, or outermost, body tissues. Cryoanesthesia blocks nerve impulses by using a gas or liquid agent to induce subfreezing temperatures over a small local area. It is used in the clinical environment for procedures like wart removal, but is seldom used in the operating room. The two most commonly used methods of local anesthesia administration are topical application and local infiltration of liquid agents.

Topical application

Topical anesthesia is the direct application of anesthetic agents on the tissue surfaces. The most commonly used topical anesthetics are solutions, ointments, and gels containing cocaine, lidocaine, tetracaine, or benzocaine. The agents can be applied using sprays, gargles, drops, swabs, or agent-impregnated packs. Topical anesthetic agents anesthetize mucous membranes of the nose, throat, and urethra; conjunctiva of the eye; perineal area and rectum; and occasionally the skin.

Common Uses of Topical Anesthetics

Method	Explanation
Spraying a patient's larynx and throat prior to endotracheal intubation and before endoscopy procedures involving the larynx, trachea, bronchi, and esophagus	This preparation helps reduce the patient's gag and cough reflex, which could trigger laryngospasm.
Spreading topical anesthetic ointments and jellies on endotracheal tubes, urinary catheters, laryngoscopes, bronchoscopes, and cystoscopes	The agent then acts not only as an anesthetic but also as a lubricant to reduce patient discomfort.
Injecting topical anesthetic into a body orifice	Urologists usually inject a numbing jelly into the urethra prior to cystoscopic examinations; proctologists may use the anesthetic jelly for rectal examinations or endoscopies.
Saturating gauze or cotton-tipped applicators with a topical agent to apply in or to pack a mucosal cavity	The nasal mucosa may be anesthetized prior to nasal intubation or during nasal surgery to help the patient tolerate injections and the use of instruments. The dentist sometimes applies topical anesthetic to the gums before injections
Using eye drops to reduce sensitivity	This allows removal of foreign bodies or the use of a tonometer (a device that measures pressure within the eye). Drops may also help prepare the eye for

	more extensive anesthesia or surgery.

Local infiltration

Local infiltration involves the injection of a conduction anesthetic agent beneath the skin or directly into the tissue at the operative site. It is the technique used before suturing superficial lacerations or removing moles, cysts, and small lesions. Local infiltration is also commonly used for nasal surgery, vasectomies, dental procedures, and adult circumcisions. Anesthetists use local infiltration before starting IVs and before spinal and epidural anesthetics. Agents commonly used for local infiltration include lidocaine, procaine, tetracaine, mepivacaine, and bupivacaine.

Epinephrine is often mixed with local anesthetic agents to prolong the effect of the anesthetic and decrease its absorption rate. Epinephrine also constricts small peripheral blood vessels (vasoconstriction), which aids in controlling bleeding. Local anesthetics containing epinephrine must be used with caution; too much epinephrine can cause a dramatic increase in blood pressure and heart rate. For this reason, it is necessary to verify that the surgeon desires a local anesthetic containing epinephrine, and, if so, keep track of the amount of local anesthetic, so the surgeon will know when the maximum safe dosage is approached.

Regional anesthesia

Regional nerve blocks produce a wider and more extensive area of anesthesia than local infiltration. Acupuncture is a form of regional anesthetic because it triggers the brain to release pain relieving endorphins to block a desired body area, but it is not widely used in western culture. The regional anesthesia we discuss involves injection of a local anesthetic agent near a specific nerve or group of nerves to block receptors from the entire area. There are several different kinds of regional blocks, including field blocks, peripheral nerve blocks, IV regional blocks, and the major conduction blocks or *central blocks*—spinal, epidural and caudal.

Field blocks

A field block involves the numbing of a body area by infiltrating large amounts of a local anesthetic agent into the general operative area to numb the nerve branches and ends that serve the area. It can be compared to a large, local infiltration anesthetic, as described above, but is considered a regional due to the size of the affected area. This type of block may cause the patient more initial discomfort than others because it requires several needle punctures.

Peripheral nerve block

A peripheral nerve block involves injection of the anesthetic next to the trunk of a major nerve to interrupt nerve function in all branches of this nerve. The injection site may be some distance from the operative site, and it may take several minutes for the blocked area to become completely anesthetized. When an extremity is blocked, the patient loses all sensory and motor control of the limb; the surgical team must control and secure the extremity at all times, and particularly when the patient is moved.

Only the anesthetist determines when the operative site can be prepped, draped, or manipulated. Some of the more common blocks performed are listed in the following table:

Common Anestetic Blocks	
Blocks	**Explanation**
Brachial plexus blocks	The brachial plexus is a group of nerves that exit the cervical spine and supply the shoulder and arm. Depending on the exact location of the surgical site, this block will be performed using an axillary, supraclavicular, or interscalene (neck) approach.
Cervical plexus blocks	Used for surgical procedures on one side of the neck, such as a left (or right) carotid endarterectomy.
Median, radial, or ulnar	Used for operations of the hand and wrist, and digital blocks for

nerve blocks	surgery of the fingers and toes.
Ankle blocks	Used for operations on the foot consist of blocking the following five nerves: the posterior tibial, sural, saphenous, deep peroneal, and superficial peroneal.
Eye blocks	Used for ophthalmologic procedures such as cataract extraction. The retrobulbar block or the peribulbar block produces anesthesia and akinesia (paralysis) to the eye. To prevent facial and eyelid movement, the facial nerves are also sometimes blocked.

To help clarify the difference between a field block and a peripheral nerve block, imagine a tree. The small branches at the top of the tree represent the small terminal nerve branches that are numbed or "cut off" when a field block is used. It is possible to cut selected areas at the top of the tree without affecting the rest. The trunk of the tree represents the trunk of the nerve affected by a peripheral nerve block. When you "cut off" the trunk, the whole tree is affected. Keeping this in mind, you can see how a peripheral block cuts off the conduction of pain sensations not only in the section of the nerve trunk where the anesthetic was injected, but also in all the terminal nerve branches that run from the nerve trunk distal to the site of injection.

IV regional block (Bier block)

Intravenous regional anesthesia, commonly known as a Bier block, is accomplished by injecting a local anesthetic agent into the veins of a limb that has been exsanguinated (rendered bloodless) by the application of an Esmarch bandage and inflation of a pneumatic tourniquet. It may be used on any extremity, but is predominantly used on the arms only.

A Bier block of an arm involves:

1. Inserting a small IV catheter into a distal vein of the arm to be operated on.
2. Capping the IV catheter.
3. Elevating the arm and exsanguinating it using an Esmarch (or other elastic) bandage by tightly wrapping it from the fingers toward the shoulder.
4. Inflating the proximal (closest to the heart) cuff of a (pneumatic) double-bladder, double-cuffed tourniquet to approximately 50 to 100 mm Hg above the patient's systolic blood pressure.
5. Removing the Esmarch.
6. Uncapping the IV catheter and injecting approximately 40 to 50 ml of 0.5 percent lidocaine or prilocaine into the bloodless arm.

Onset of anesthesia is very fast and lasts until the tourniquet is deflated and the anesthetic is released into the circulatory system. A Bier block of the leg follows the same sequence but uses more anesthetic agent.

If the patient complains of pain from the tourniquet (which may happen 20 to 30 minutes after initial inflation), the anesthetist *first inflates* the distal tourniquet (which lies over an anesthetized area), *then deflates* the proximal tourniquet. If this sequence is not followed, local anesthetic is suddenly released into the circulatory system, resulting in immediate loss of anesthesia and potential adverse patient reaction.

After surgery is completed, the anesthetist alternately deflates and inflates the tourniquet to allow a gradual release of the anesthetic agent into the circulatory system and the return of blood to the extremity. This reduces the possibility of a toxic reaction.

Spinal blocks

Spinal anesthesia involves blocking the ganglia and motor nerve roots of the spinal cord *before* they exit the dura. Spinal anesthesia, also known as subarachnoid block (SAB) or intrathecal block, is attained by injection of a small amount, 1 to 2 milliliters, of local anesthetic agent into the

subarachnoid space. The subarachnoid space is in the spinal canal between the dura mater (outer membrane) and the pia mater (inner membrane) surrounding the spinal cord; this space contains cerebrospinal fluid (CSF). Because the spinal cord ends at approximately the first to second lumbar vertebrae, the anesthetist inserts the spinal needle at a relatively safe level of the spinal column below the second lumbar vertebrae (usually between the third and fourth or fourth and fifth lumbar vertebra). This type of regional anesthesia provides excellent analgesia and muscle relaxation for surgical procedures involving areas of the body below the level of the diaphragm.

Before the anesthetic is injected, the patient is positioned in a hunched-over, sitting position or in a lateral, fetal position with the chin on the chest, the legs drawn up, and the lumbar area of the back pushed out "like a scared or mad cat." Spinal anesthesia may be, but rarely is, administered with the patient in the prone position. The anesthetist preps and drapes the needle insertion site, then inserts a long, thin, spinal needle (usually a 25-gauge diameter, 3.5-inches long) until it penetrates the dura and enters the subarachnoid space. Correct needle placement is determined by feeling a distinct "pop" as the needle enters the subarachnoid space or by watching for a backflow of clear CSF into the hub of the needle. After ensuring the needle is positioned, the anesthetist attaches a syringe filled with a local anesthetic agent, aspirates to confirm the presence of CSF, and then injects. Onset of anesthesia is quick—usually within 5 to 10 minutes.

As soon as the anesthetic is administered, the patient is placed in the desired surgical position. The *level* of anesthesia is monitored by touching the patient's skin with a sharp or cold object (at progressive intervals) and determining when the patient senses the object normally. The distribution of the local anesthetic relies on the CSF, and the level of the block is determined mainly by the specific gravity, or weight, of the local anesthetic solution, curvatures of the spinal canal, and patient's position within the first 5 to 10 minutes after administration. The anesthetist controls the level of the block by tilting the table or positioning the patient in the direction the agent solution should flow. A hyperbaric solution, which is heavier than the CSF, sinks or flows downward; a hypobaric solution, which is lighter than CSF, floats or rises; and an isobaric solution, which is the same weight as CSF, is stationary. For example, if the anesthetist wants to primarily affect the legs and pelvis, a hyperbaric anesthetic can be administered with the patient in the sitting position; then, if after placing the patient in the supine position, the level of anesthesia is only in the legs, the operating table can be tilted head down until the anesthetic reaches the pelvic region.

The dose and volume of the local anesthetic are also significant factors. The intensity and length of anesthesia is determined by the type of local anesthetic and the dose in milligrams. Several local anesthetic agents are used for spinal anesthesia, and each is usually available in different preparations (hyperbaric or isobaric). For example, lidocaine lasts about 75 minutes to 2 hours; tetracaine and bupivacaine last about 2 to 4 hours. A vasoconstrictor, such as epinephrine, can be added to the anesthetic agent to prolong the duration of anesthesia, and a narcotic, such as morphine, can be added to prolong and intensify the analgesic effect.

Epidural and caudal anesthesia

Epidural anesthesia involves blocking the spinal cord's nerve roots *after* they emerge from the dura. It is attained by injection of the anesthetic agent between the vertebrae in much the same manner that spinal anesthetic is administered, but the agent of epidural anesthesia is introduced into the epidural space rather than the subarachnoid space. The epidural space lies between the dura and the ligaments connecting the spinal column, and runs the length of the spine. Because the nerve roots that supply various areas of the body exit the spinal cord at different levels, the epidural injection can be administered in the cervical, thoracic, lumbar, and caudal regions, depending on the area of the body requiring anesthesia. Cervical and thoracic epidural anesthetic is primarily used for controlling postoperative pain after thoracic surgery. Lumbar epidural is the most commonly used technique and can anesthetize areas from the upper abdomen down to the lower legs. Caudal anesthesia is sometimes used for pediatric patients and for adult surgery involving the perineal region.

The anesthetist locates the epidural space with an epidural needle, using either a “hanging drop” or a “loss-of-resistance” technique, and then injects the local anesthetic agent. The needle is then either immediately removed for a single shot epidural, or a long thin catheter is introduced through the needle and into the epidural space, and then the needle removed, for a continuous epidural. The continuous epidural allows the anesthetist to administer agents intermittently, or continuously, as needed to preserve the block for the duration of the surgery or for postoperative pain relief.

Unlike spinal anesthesia, there is no direct mixing of the anesthetic with the CSF. The anesthetic agent fills the epidural space and bathes the nerve roots of the spinal cord as they exit from the dura. Because the local anesthetic has to diffuse into the smaller nerve roots, the onset of an epidural block is much slower than that of a spinal, often taking 10 to 20 minutes for the complete effects. Also, a larger volume of local anesthetic solution, 10 to 30 milliliters, is required to fill the epidural space.

The level or spread of an epidural block is determined primarily by the area of injection, but just as with the spinal anesthetic, the specific gravity of the agent also influences the level. The volume and concentration of the agent are also important; if only a small quantity is administered, the drug may not diffuse properly and evenly; if the agent concentration is weak, incomplete sensory and/or motor anesthesia results. Epidural blocks do not always produce a solid motor block or the intense a muscle relaxation as spinal blocks do; patients are sometimes able to move their legs and feet. The duration and intensity of anesthesia depend primarily on the type and concentration of anesthetic agent used and the presence or absence of epinephrine in the agent. Several local anesthetic agents are used for epidural anesthesia. Chloroprocaine has a fast onset and short duration; prilocaine has a fast onset and medium duration. Lidocaine and mepivacaine provide intermediate onset; lidocaine has a medium duration and mepivacaine a long one. Bupivacaine has a slow onset, but provides an extended duration. Like spinal anesthesia, a narcotic can be added to the epidural agent to prolong and intensify the analgesic effect.

Epidural anesthesia administered in the caudal area of the spinal canal is commonly referred to as a caudal block. Using this approach, the local anesthetic is injected into the epidural space via the caudal canal in the sacrum. This block requires more anesthetic agent than other regional blocks because a larger space must be filled. Caudal anesthesia is usually administered with the patient in the prone position and the operating bed slightly flexed.

We have covered the basics of general and conduction anesthesia, including the types of each category and methods of administering each type. Hopefully, most of the information reached your brain without encountering any “blocks.” Understanding this material will help you anticipate the needs of the patient and the anesthesia staff and, also, to understand how and why some anesthesia-related procedures are performed.

Self-Test Questions

After you complete these questions, you may check your answers at the end of the unit.

410. General anesthesia

1. How do general anesthetic agents produce analgesia, reduce unwanted reflexes, and relax muscles?

2. What determines the level or depth of general anesthesia?

3. What are the two basic methods used to administer general anesthetic agents?

4. What two types of agents are used for inhalation anesthesia?

5. Describe how volatile liquid agents are administered to a patient.

6. Name three commonly used volatile liquid anesthetic agents.

7. What is probably the most commonly used anesthetic gas?

8. In your own words, describe endotracheal intubation.

9. What is the purpose of the cuff on an endotracheal tube?

10. What is the term used to describe removal of an endotracheal tube?

11. What is the purpose of the rebreathing bag?

12. What does the scavenger system on the anesthesia machine do, and why is this important?

13. What is the difference between a total (closed) and partial rebreathing inhalation anesthesia system?

14. How are intravenous anesthetic agents usually administered?

15. What is required before the effects of intravenous anesthetic agents begin to diminish?

16. Why must short-duration barbiturates be supplemented with other agents?

17. Why are muscle relaxants often used in conjunction with general anesthesia?

18. Identify three commonly used muscle relaxants.

19. Briefly describe the term dissociative anesthesia.

20. What is balanced anesthesia?

411. Conduction anesthesia—regional and local

1. How does a conduction anesthetic eliminate pain?

2. What are the two main categories of conduction anesthesia?

3. Define topical anesthesia.

4. Describe the most commonly used topical anesthetic agents.

5. What is local infiltration?

6. Name three commonly used local anesthetic drugs.

7. Why is epinephrine often mixed with local anesthetic agents?

8. Briefly describe regional nerve blocks.

9. What is the difference between a field block and a peripheral nerve block?

10. What is a Bier block?

11. What kind of tourniquet is used on a Bier block?

12. When a Bier block is used, why does the anesthetist alternately deflate and inflate the two tourniquet cuffs at the end of the surgical procedure?

13. Match the descriptive statements in column A with the types of spinal blocks in column B. Items in column B may be used once, more than once, or not at all.

Column A

____ (1) Anesthesia attained when agent is injected into the space between the dura and the ligaments of the spinal column.

____ (2) Block attained when anesthetic agent is injected into subarachnoid space.

____ (3) Procedure involved agent being injected into the sacrum.

____ (4) May be administered with patient in prone position.

____ (5) Level of anesthesia may be raised by tilting operating table or bed head-down.

____ (6) Proper needle position determined by a backflow of cerebrospinal fluid into the hub of the needle.

____ (7) Anesthesia produced by agent bathing nerve roots of spinal cord as they exit from dura.

____ (8) Local anesthetic has a specific gravity greater than cerebrospinal fluid.

Column B

a. Spinal anesthesia.
b. Epidural block.
c. Caudal block.
d. Isobaric spinal anesthesia.
e. Hyperbaric anesthetic agent.

2–3. Administration of Anesthesia

One of your most important duties, both as a scrub and as a circulating technician, is to assist anesthesia personnel and, occasionally, the surgeon with administering an anesthetic. Like all other activities in surgery, anesthesia administration is a team effort requiring the coordinated activities of the anesthesia staff, surgeon, circulators, and scrub. To ensure that anesthesia is administered in a safe, effective, and expeditious manner, each member of the team must know his or her duties and responsibilities.

This section discusses some of the activities and precautions you must be aware of during anesthesia preparations and administration. Most of our discussion focuses on the circulator's role, but we also mention the scrub technician's role when applicable. We begin by discussing venipuncture and intravenous fluid administration, and then cover the preparation of anesthesia supplies and equipment and how to help anesthesia personnel prepare for anesthesia.

412. Venipuncture and other preanesthetic preparations

As previously mentioned, you may be called to help the anesthetist with several activities. One of the first things done to prepare the patient for anesthesia is to perform venipuncture to start an intravenous (IV) line. In some places, you'll be trained and certified to start the patient's IV; in others, you may only assist anesthesia personnel with starting it. In either case, you must know how, when, and why the IV is used.

Administration of IV fluids

Intravenous fluids are used to supplement or replace body fluids lost before, during, and after a surgical procedure. The IV line provides direct venous access, enables the anesthetist to replace the fluids lost or the fluid deficit while the patient receives nothing by mouth, and controls the amount and type of solution the patient requires. The IV line also provides a rapid-acting, open route to administer drugs and other medication. The IV site is selected based on patient needs and the surgical procedure involved, but is most commonly inserted in a distal vein (metacarpal vein) of the patient's nondominant hand. The vein selected should be fairly straight and large enough to accommodate the

size of IV catheter. It should *not* be in an area that flexes, such as the wrist or elbow as bending the catheter may obstruct it. The discussion of the types and actions of the intravenous solutions commonly used in surgery is in the lesson Surgical Pharmacology, in Volume 5 of this course; for now, we are going to concentrate on the supplies and procedures involved.

Solution containers and administration sets

Most IV solutions come in flexible plastic bags or plastic bottles; a few are in glass containers. The plastic bags collapse under atmospheric pressure as the solution is infused, but the bottles do not collapse, so they must be air vented to allow air to enter the bottle and replace the draining fluid. These containers are transparent. Always check the solution for sediment or discoloration before connecting the IV administration tubing to the solution bag and administering it to the patient; if present, do not use the solution unless specifically directed to do so by the anesthetist.The solution is infused from the container to the patient's IV catheter via sterile, disposable, IV tubing. The tubing has a trocar on one end that is inserted into the solution container. Directly below the trocar is usually a drip chamber that helps regulate the number of drops per minute infused. Some type of mechanism is normally located between the drip chamber and the patient to regulate the flow of solution. The other end of the tubing has a small plastic connector designed to fit the hub of the IV extension set, catheter, or needle. The anesthetist often connects an extension set on the end of the primary IV tubing. This is usually a short length of IV tubing with a stopcock on one end and a needle-hub connector on the other; it allows easy changing of IV administration sets (e.g., regular tubing to blood administration tubing) without disconnecting the primary tubing from the IV catheter.

To prepare the solution and administration set for use, remove the outer packaging and inspect the container and tubing for obvious defects or leaks. Ensure the regulating device on the administration set is closed. Remove the protective cover or cap from the insertion point of the container and, then, from the administration set trocar. Without touching the trocar or the insertion point with your hands, push the trocar into the container as far as it will go; then invert the container and hang it from the IV pole. It is very important to remove all air from the IV tubing to prevent the air from entering the patient's venous system and causing *air emboli* (discussed later in this unit). To remove the air, prime the line by aseptically removing the protective cap from the catheter connector, opening the regulating device, and allowing the IV solution to flow until no visible air bubbles remain. A small waste can or kickbucket is helpful to catch the solution. After the air is flushed from the line, the IV is ready for infusion. Close the regulator and replace the cap over the connector to prevent contamination until it can be connected to the patient.

Intravenous catheters and needles

A needle or catheter must be inserted into the patient's vein for IV infusion. Several types of IV needles and catheters are available. They include, but are not limited to, rigid steel needles, over-the-needle catheter, "butterfly" or scalp vein needle, central vein catheters, and cutdown catheters. An over-the-needle IV catheter is simply a small diameter plastic tube mounted over a beveled needle or inserted through a needle for insertion into the vein. The over-the-needle catheter is most commonly used for adult patients while short, beveled needles with single or double plastic "butterfly" tabs are routinely used for pediatric patients. You will commonly be required to use these types of IV catheters/needles whereas the cutdown and central type catheters are inserted by the anesthesia staff.

The diameters of the needles or catheters range from 14-(about the diameter of a pencil lead) to 26-gauge (about the size of a standard paper staple). The larger the diameter, the faster the infusion, so the anesthetist chooses the catheter size based on the patient and the type of surgery. For example, if a hemorrhaging patient arrives in the operating room, the anesthetist will insert the largest possible catheter (e.g., 14-gauge). Smaller sizes, such as 22- to 26-gauge, are usually used in pediatric patients to accommodate their small veins. For most adult, generally healthy, nonemergency patients, a 19- to 21-gauge catheter is used; a 16- to 18-gauge catheter is selected if blood transfusion is anticipated.

Other supplies

In addition to the supplies just mentioned, before starting the IV, you'll need gloves (local policy determines the type), a small tourniquet (such as a penrose drain), antibacterial swabs (alcohol or iodophor impregnated), 2 or 3 sterile gauze sponges, dressing material, and tape. You may also need a pen (to label start time), local anesthetic, and a small syringe (1–3-cc) with a small 26- to 30-gauge needle attached. Local policy dictates the specific methods used to start, dress, tape, secure, and label the IV.

Typical procedure for starting an IV

As stated above, local policy determines who may start an IV and how IVs are started, but a typical procedure using an over-the-needle catheter involves the following:

Typical IV Procedure Using an Over-the-Needle Catheter

Action	Description
Preparing patient	• Place the patient in a semisitting position with the arm slightly extended and resting in a natural position on a firm but padded surface, palm down. • Don a pair of exam gloves and eye protection. • Secure the tourniquet around the patient's arm a few inches above the intended insertion site to occlude venous flow and distend, or bulge, the veins. • Prep the skin with an antiseptic swab; if the site is very hairy, you may have to shave the immediate insertion site before the prep. • Inject, if requested, a small dose of local anesthetic, such as lidocaine, intradermally to numb the insertion site. • Aseptically open the catheter-needle package and save the paper label.
Inserting the IV catheter	• If the vein diameter is larger than the catheter, insert the catheter needle with the bevel up, so you can see the needle lumen. If the vein is smaller or the same diameter as the catheter, insert the needle bevel down to avoid going all the way through the vein. • Pierce the skin at a 30° to 45° angle approximately 1/2-inch below the point you want to enter the vein, and then decrease the angle as you aim for it. • When the needle pierces the vein, you will see blood backflow into the needle hub (or view chamber if it has one); slowly advance the needle, gently lifting to prevent completely puncturing the vein, until the catheter is well within the vein. • Place a sterile gauze sponge under the hub to catch any blood spillage and act as a sterile field. • Now firmly hold the needle in place and advance the catheter until it is securely in place. • After the catheter is inserted, remove the tourniquet; then hold the catheter hub with one hand and with the other, remove the needle using a slight rotation. • Connect the previously primed IV tubing to the catheter and fully open the flow control for a few seconds to ensure the catheter is placed properly; then adjust to a slow-flow rate while you secure and dress the IV.

Typical IV Procedure Using an Over-the-Needle Catheter	
Action	**Description**
Securing catheter	• Secure the catheter to the skin with a transparent adhesive sterile dressing, or apply a small amount of antiseptic agent such as povidone-iodine ointment to the catheter insertion site; then dress and secure it with sterile gauze and strips of tape. • Tape the extension set to the catheter hub to secure it. Also, tape the catheter-needle package label (Remember, you saved it!) to the tubing close to the insertion site to show all personnel the type and size catheter inserted. • On the label or on the tape, write your initials, the date, and the time you started the IV. • If you have not saved the catheter package, also note the size and type of the catheter you inserted.

Regulating, maintaining, and discontinuing the IV

If the catheter is properly placed, the solution will flow or drip at the set rate and the insertion site will not swell or discolor. The anesthetist or surgeon determines how much and how fast solution is infused (the volume and rate of administration). The rate of flow is determined by multiplying the number of milliliters to be administered per hour by the number of drops per milliliter indicated on the administration set (drop factor), and then dividing by 60 (minutes) to determine the number of drops per minute. For example, if the anesthetist tells you to set the IV rate for 100 ml per hour, and the administration set drop factor is 20 drops per milliliter:

$$100(\text{ml/hr}) \times 20(\text{drops/ml}) = 2{,}000(\text{drops/hr}) \div 60(\text{min}) = 33.3(\text{drops/min})$$

You regulate the IV flow to 33 or 34 drops per minute.

Swelling or discoloration indicates the catheter may not be within the vessel, and the IV solution is infiltrating the surrounding soft tissue. Report this to the anesthetist immediately and prepare to insert a new IV in a different area. If you discover blood backed up in the tubing and the solution not dripping, the catheter is blocked. It may be bent or kinked, or the IV solution container is not high enough above the patient. Many times, changing the position of the patient's arm will unkink the catheter, or raising the solution will restore flow. When a solution container is nearly empty, or when the anesthetist asks for a different type of solution, you may be asked to change the solution container. Local procedures vary, but a typical routine follows these steps:

1. Switch containers when the drip chamber still contains fluid.
2. Slow the infusion rate enough to keep solution flowing, but not enough to empty the drip chamber and allow air in the line.
3. Remove the empty container from the IV pole. Lower the container and remove the administration set spike WITHOUT TOUCHING THE TIP. Ensure the drip chamber stays vertical but tip (bottles) or fold (bags) the container being changed to avoid spilling any remaining contents.
4. Remove the seal from the new container and immediately insert the spike into the fresh solution. Hang the container from the IV pole.
5. Check the IV tubing for air bubbles and displace them as necessary. To displace air bubbles, use one of these methods:
   a. Stop the flow below the bubbles and, then, tap the tubing until the air rises into the drip chamber or solution container.
   b. "Milk" the tubing by squeezing the air up the tubing towards the container.
   c. Wrap the tubing below the air bubbles around a pencil or similar object for two or three revolutions and twist the pencil up towards the container.

d. As a last resort, insert a small diameter needle into a rubber-stopper injection port below the air bubbles. As the air or solution passes the port, the air will escape through the needle and the solution will continue to flow.

If you are ordered to discontinue an IV, don gloves, clamp or shut off the tubing, and carefully remove any tape or dressing securing the catheter. Gently apply pressure on the insertion site with a sterile 2×2 or folded 4×4 gauze pad. Grasp the catheter by the hub, and quickly, yet smoothly, pull it out in the direction of the vein. Do not twist, raise, or lower the catheter as you may damage the vein. Elevate the insertion site above the heart while continuing to apply pressure for about 30 seconds or until bleeding from the site stops. Local policy determines how you dress the insertion site. After dressing the site, record the date and time the infusion was stopped and the total amount of fluid given. Also, list any reaction the patient had and the name or initials of the person discontinuing the IV. Safely dispose of the solution and infusion supplies.

We must emphasize! Local policies and procedures dictate specifically what you can and cannot do in relation to starting or helping start IV lines. Regardless of policy, NEVER attempt to perform a procedure without proper training and certification.

Additional preanesthetic preparations

Once the patient's IV has been started, continue with other anesthesia preparations. Never leave the patient unattended while he or she is waiting to be transferred into the operating room. Keep the patient comfortable and warm by covering him or her with a warm blanket. If the patient needs to void obtain a bedpan or urinal, provide as much seclusion and privacy as possible, and assist as needed. Remember to record the amount of urine voided. If the patient feels nauseous or light-headed, elevating the patient's legs and administration of oxygen may help. Make sure there are an emesis basin and towels available in case the patient vomits. Again, the amount should be recorded. At all times keep anesthesia personnel informed of the patient's condition, remain alert, and be prepared to assist with any emergency. Know the location of the "crash cart" and where additional anesthesia drugs, supplies, and equipment are stored.

As the patient enters the operating room, assist with the transfer of the patient from the gurney to the operating table. Be observant of the IV; don't allow the solution container to fall or run dry or the tubing to stretch or become dislodged. Help the OR nurse and anesthetist position the patient on the operating table, and ensure all safety restraints are secure. Provide a warm blanket or sheet for the patient, and respect their personal dignity by maintaining as much privacy as possible. Stay close to the patient during preinduction and induction phases to ensure the patient's physical safety and provide emotional support. Holding a patient's hand can sometimes provide comfort and reassurance. Also at this time, assist the anesthetist with attaching the necessary monitors required for induction. This includes application of the blood pressure cuff, electrocardiogram monitor, and pulse oximeter. The anesthetist will frequently administer oxygen by mask before the induction. A weighted precordial stethoscope is sometimes taped to the chest to allow the anesthetist to constantly monitor respirations and heart tones. After intubation, an esophageal stethoscope may be inserted. To avoid unnecessary patient anxiety, calmly and sensitively explain to him or her what is happening and what you are doing.

413. Preparing anesthesia supplies and equipment

Most of the materials used for anesthesia are prepared by the anesthetist; however, you must be ready to assist as necessary.

Preparation guidelines

Just as each operative procedure requires specific sterile supplies and equipment, each anesthetic procedure needs specific supplies such as an endotracheal tube or regional block tray and equipment such as the anesthesia machine or laryngoscope. As circulator, you may have to get and pass sterile items to the anesthetist as well as assist with patient positioning for a conduction anesthetic. You

must be familiar with the particular types of trays used for spinal or epidural administration; these trays are usually sterile, prepackaged, disposable sets with just about everything needed to perform the block. You must always use aseptic technique when opening and preparing these trays and when handling intravenous sets, catheters, syringes, and needles. The inner surfaces of tubing and syringes, as well as stopcocks, needles, and other supplies, must be kept sterile to keep bacteria from being introduced into the body.

Equipment

The more complex pieces of anesthesia equipment are usually those associated with inhalation or general anesthesia. These include the anesthesia machine, delivery system components, and intubation equipment. You may be required to change gas tanks, the excess carbon dioxide ($CO_{2)}$ absorbing chemical compound (soda lime) canisters, or breathing circuits on the machine. NEVER attempt to do any of these procedures unless you are trained and thoroughly familiar with them; observe all safety precautions, and follow any directions specific to the machine. NEVER touch an anesthesia machine unless you know exactly what you are doing and have specific permission from the anesthesia staff to do so. The machine is adjusted to deliver a precise flow of gases and anesthetic agents, and even a small change in rate or volume of gas flow can have a significant effect on the patient.

A critical piece of equipment is the laryngoscope. The laryngoscope consists of a flashlight-like, battery-containing handle that accepts a lighted laryngoscope blade. There are different types and sizes of laryngoscope blades available to adapt to the patient's differing anatomy and provide adequate exposure. You must know the names and sizes of the blades and how to change the blade and test the light so the anesthetist will not have to waste time and divert attention from the patient during a difficult intubation.

Supplies

Before inducing general anesthesia, the anesthetist must assemble all the supplies and equipment required to intubate the patient. To save time and help the anesthetist, you may obtain and prepare some of these items—know where they are stored and how they are used. The anesthetist usually selects at least two different sizes of ET-tubes (sizes 7.0 to 8.0 French are commonly used for adults) and an assortment of oral airways, nasal airways, and face masks. Other supplies that should be immediately available include strips of tape to secure the ET-tube, a small syringe (usually a 5- or 10-cc size) to inflate the cuff, and a blunt, flexible, metal stylet that can be inserted to guide or stiffen the ET-tube if necessary.

You may be asked to coat the end of an ET-tube with one of the topical anesthetic gels we discussed earlier; the gel acts as a lubricant to help reduce laryngeal and tracheal irritation and reduce risk of laryngospasm. To further reduce the incidence of intubation-induced laryngospasm, some anesthetists use a laryngotracheal anesthesia (LTA) kit to numb the vocal cords. This kit consists of a special disposable cartridge-type syringe with a long flexible plastic tip that enables the anesthetist to spray a local anesthetic on the vocal cords or exactly where he or she desires without obstructing the view.

You should become familiar with the most commonly used masks, bags, tubes, scopes, connectors, airways, and other supplies used by the anesthesia staff. You may be asked to get or set up such an item for the anesthetist. Knowing what these items are, where they are stored, and how the anesthetist uses them can be vital to the patient—an emergency or "crash" situation is not the time to be figuring out where the endotracheal tubes are stored or how a mask attaches to a breathing circuit!

414. Assisting with administration of general anesthesia

After the patient is transferred to the operating room (OR) bed, the circulating nurse or technician plays an important role in helping the anesthetist administer general anesthesia. General anesthesia is usually divided into three major phases—induction, maintenance, and emergence. An understanding

of each phase prepares you to assist the anesthetist in providing optimal care during the patient's surgical experience. We begin with the phase many consider the most critical—induction.

Induction of anesthesia (phase I)

The induction phase of general anesthesia consists of getting the patient safely into an unconscious state and ensuring the airway remains open and ventilation is possible. This phase begins with administering the agents and ends when the patient can be safely manipulated for surgery. To fully understand general anesthesia induction and the responsibilities during this critical period, you should be familiar with the four stages of induction and the symptoms the patient may exhibit as anesthetic agents are administered.

Stae of Induction	
Stage	**Explanation**
Induction or amnesia (stage I)	This stage starts with the administration of the first anesthetic or induction agent and lasts until the patient loses consciousness. This may take from 30 seconds to 1 minute. The patient may feel dizzy and euphoric. In addition, he or she will also be extremely sensitive to sounds and touch.
Excitement or delirium (stage II)	This stage lasts from the moment the patient loses consciousness until the onset of stage III; the length varies from patient to patient and with the agents used. This is an extremely critical stage for the patient because vital functions are very unstable, with high blood pressure and heart rate, irregular respirations, and uncontrolled extremity movements. The pupils are often dilated and divergent. The patient is at risk for vomiting and laryngospasm. This stage simply represents "the brain fighting to stay awake."
Surgical or relaxation anesthesia (stage III)	This stage is also called the relaxation stage. It begins with the start of regular automatic breathing and absence of undesirable responses to painful stimulation (such as high heart rate and blood pressure), and ends with the cessation of respiration. The pupils are constricted and have a central gaze. This is the level at which the anesthetist maintains the patient during the operation. The patient is fully unconscious, feels no pain, is relaxed, and vital signs are stable.
Overdose or danger stage (stage IV)	This stage begins with respiratory paralysis, hypotension, dilated and nonreactive pupils, and ends with cardiorespiratory failure. This is caused by an overdose of anesthetic agents. The anesthesia personnel monitor the patient very closely during general anesthesia so as to avoid this stage. The use of intravenous induction agents, such as sodium Pentothal or Propofol, induce general (stage III) anesthesia and bypass stage II. The patient usually "goes asleep" rapidly and calmly. However, at the emergence phase or waking-up of the patient, some variation of stage II is frequently observed, regardless of the general anesthetic technique.

When inhalation agents are used for induction, as is frequently done for pediatric anesthesia, stage II is often observed because an inhalation agent may take several minutes to produce the surgical stage.

Why use an inhalation "mask induction" technique? A mask induction is useful in two situations. First, for a short uncomplicated procedure, such as PE tubes, an IV may be unnecessary. Second, if an IV is required, the painful needle insertion can be eliminated by starting the IV after the general anesthesia induction.

Assisting during induction

The process of being put to sleep can cause the patient a great deal of anxiety. Also, as previously mentioned, the patient is extremely sensitive to stimuli during stage I of induction. All personnel in the operating room share the responsibility for creating and maintaining an atmosphere that will relax the patient, help reduce fear, and prevent any sudden stimuli that could startle him or her. To

accomplish this, open and set up all instruments and supplies prior to anesthesia induction. Suspend all nonessential activities, and be especially careful not to drop items on the floor. Avoid unnecessary conversation and movement, and keep overhead surgical lights off the patient's face and eyes.

As a circulator, you also should assist the anesthetist, as needed, during administration of the anesthetic. This may only involve staying close to and reassuring the patient or it may include hands-on assistance. You may help by monitoring the IV solution, retrieving and passing instruments or supplies used for endotracheal intubation or assisting with suctioning of the patient's airway. If an inhalation mask induction technique is used, you may have to gently restrain the patient during the excitement stage (stage II).

Once stage III is reached, the patient's airway relaxes, the jaw and tongue fall back, and the airway is obstructed unless the anesthetist prevents obstruction by supporting the jaw and hyperextending the head and neck. A nasal or oral airway may be inserted, and the patient is ventilated via mask. Mask ventilation alone is generally used only for short, uncomplicated procedures on healthy patients. The majority of patients are intubated at this time.

Endotracheal intubation

This procedure consists of inserting an ET-tube into the patient's trachea to provide an unobstructed route for administering oxygen and inhalation agents during the maintenance phase of anesthesia. The anesthetist uses a laryngoscope to retract the patient's tongue and provide exposure and illumination of the anatomical structures of the throat and larynx. The ET-tube is then inserted into the patient's mouth and passed through the trachea until the cuff is approximately 1/2- inch below the vocal cords. In cases involving the oral cavity, a nasal intubation may be required; the same procedure is followed, but the tube is initially inserted through the patient's nose. When the anesthetist is sure the ET-tube is in place, the cuff is inflated to secure the airway, and the breathing circuit is attached to the tube. Securing the airway refers to maintaining the ability to ventilate the patient and to preventing aspiration of emesis or saliva into the bronchi and lungs. Occasionally, intubation is difficult for the anesthetist and extremely critical for the patient. Also, if attempted *before* the surgical stage (stage III), complications such as laryngospasm or bronchospasm may occur. Although the anesthetist is responsible for intubation, there are a number of things the circulator can do to ensure it is accomplished smoothly and effectively; remember—just like when assisting during surgery—pass items in the position of use.

Assisting with intubation

As we just mentioned, intubation is not attempted until the patient reaches stage III. To facilitate intubation, the anesthetist frequently administers a muscle relaxing agent. When the agent takes effect, the anesthetist then saturates the patient's lungs with oxygen by manually ventilating using the mask and rebreathing bag. Next, he or she removes the mask from the patient's nose and mouth, hyperextends and elevates the patient's head to allow visualization of the larynx, and inserts the laryngoscope that is always held in the left hand. At this point, you should assist the anesthetist by rapidly performing the following tasks:

- Pass the laryngotracheal anesthesia (LTA) syringe (if used).
- Pass the ET-tube to the anesthetist's right hand.
- Apply pressure to the cricoid cartilage as directed. The anesthetist may ask you to press down gently on the cricoid cartilage, which is located approximately one finger width below the patient's Adam's apple when the neck is hyperextended. This is done to help the anesthetist visualize the vocal cords and reduce chances of aspiration, especially during difficult intubations. If a stylet is used, slowly remove it when the anesthetist tells you to do so. Ensure you do not move the ET-tube as you remove the stylet.
- Inflate the ET-tube cuff with air when the anesthetist directs you to do so. The volume of air a cuff requires varies, so always ask the anesthetist for the correct volume to inject.

- Remove the mask from the anesthesia breathing circuit and give the connector end to the anesthetist for connection to the ET-tube.
- If the ET-tube is improperly positioned or slips out of place, be prepared to replace the mask on the anesthesia breathing circuit and repeat the intubation process.
- If the ET-tube is correctly positioned, hold the tube in place while the anesthetist secures it with tape.

To confirm the ET-tube is in the correct position, the anesthetist ventilates the patient and watches for the patient's chest to rise, and uses a stethoscope to check for breath sounds in the lungs. The anesthetist usually confirms the presence of carbon dioxide by checking the end-tidal carbon dioxide monitor (capnograph). If the anesthetist determines the ET-tube is actually in the esophagus, he or she will quickly remove the ET-tube and start over.

If a general anesthetic is required for a patient with a suspected full stomach, such as emergency surgery, a Cesarean section, a bowel obstruction, or other disease or injury that may disrupt normal gastric or bowel functioning, the anesthetist may ask you to assist in a "crash" or *rapid sequence induction***.** This technique is designed to protect the lungs from aspiration of gastric contents or emesis that can occur once the patient is asleep and before the ET-tube is secured. The sequence for induction is the same except for the following modifications:

1. The anesthetist administers oxygen for three to five minutes prior to induction.
2. As the anesthetist administers the IV induction agent and muscle relaxant, you will be instructed to apply very firm cricoid pressure. This occludes the esophagus and helps prevent aspiration if emesis occurs. There is no manual patient ventilation before intubation unless absolutely necessary.
3. As soon as the patient loses consciousness, the anesthetist begins the intubation. You may help as described above while still maintaining cricoid pressure.
4. The anesthetist confirms correct position of the ET-tube in the usual manner. Only after the correct position is confirmed is the cricoid pressure released!

As you observe multiple induction and endotracheal intubations, you'll notice the various types of ET-tubes such as the curved RAE or protected laser tube. You may also see different techniques for intubation—the use of a fiberoptic laryngoscope or intubation scope, or the intubation of an awake, but sedated, patient. No matter which method or what tube is used, a smooth flowing, rapid induction and intubation best assure the patient's safety and expedite the start of the operation. These very important procedures require close teamwork between the anesthetist and circulating personnel.

After the patient is induced, there are several activities circulators are involved with to help maintain anesthesia during the course of the operation.

Assisting with maintaining anesthesia during surgery (phase II)

As stated above, the patient is maintained at stage III of induction, sometimes called the *surgical plane*, for the duration of the operation. This stage is the maintenance phase, or phase II, of general anesthesia. Some of the anesthesia related responsibilities you may have during the maintenance phase of general anesthesia administration are:

- Assist the anesthetist, surgeon, and nurse with positioning the patient. Positioning is discussed in detail later in this course, but we touch briefly on some of the more important points to remember. Remember, never touch or move a patient without the anesthetist's consent. The patient's position must allow adequate surgical exposure, ensure the patient's vital functions are not impeded, and prevent the patient from being injured. When positioning the patient, be careful not to apply excessive pressure to or stress on any area of the body; this can cause pressure sores or peripheral nerve injury. Keep in mind, anesthetized patients have absolutely no control over their bodies; they rely on you to ensure their safety.

- Assist the anesthetist with monitoring blood and body fluid loss. This may include activities such as accurately measuring blood loss in infants by weighing soiled sponges, monitoring and recording the volume of irrigation fluids used, and measuring the amount of fluid collected in the suction containers. In most cases, sponges are not weighed, but you should ensure the anesthetist sees them to estimate blood loss. All wound or urinary-bladder drainage devices should be monitored, and the drainage periodically measured at the direction of the anesthetist. These actions help the anesthetist keep up with the patient's body fluid losses and replenish them as necessary.
- Obtain additional anesthesia supplies as needed. As circulator, you are required to obtain additional supplies needed by the anesthetist, but should promptly return to the operating room in case an emergency situation arises.
- Retrieve blood or blood components and assist the anesthetist in setting up and administering the transfusion. If blood has not been previously typed and cross matched for the patient, the circulator must fill out the transfusion request forms, help the anesthetist draw blood from the patient for typing and cross matching, and forward the required forms and blood sample to the lab immediately.

NOTE: This subject is discussed in more detail later in this unit.

- Assist the anesthetist or surgeon with starting and monitoring special invasive lines, such as central venous pressure (CVP), pulmonary artery pressure (Swans-Ganz line), or arterial pressure (A-line). This usually involves helping to prepare hemodynamic monitoring equipment, such as the transducer and cable, special tubing and stopcocks, heparinized saline, and the desired type of catheter and introducer set. Occasionally, a vein or artery cutdown is required.
- Assist with emergency resuscitative procedures. You may have to retrieve the resuscitation equipment (crash cart) or specialty medications, transport blood gases, or perform CPR.

NOTE: A detailed discussion of this comes later in this unit.

As you can see, the circulator may be relied on to perform virtually any task that would involve the anesthetist leaving the patient, so be alert and a willing team player.

Emergence from general anesthesia (phase III)

Emergence is the final phase of general anesthesia, and the term used to describe the patient's awakening from general anesthesia. As the operation draws to a close, the anesthetist gradually reduces the amounts of anesthetic agents until all agents are discontinued and the patient is breathing 100 percent oxygen. If a muscle relaxant has been used, reversal agents may be administered, and nerve-function return tested with the twitch monitor. As the effects of the anesthetic wear off, the patient begins to arouse, leaving the surgical plane, stage III, and re-entering the excitement stage, stage II. The patient may be restless, may attempt to move, or may gag or vomit. This is when you may see a patient "fight the tube," but it is too soon to remove it without risk of aspiration or laryngospasm. The patient does not have physical or mental control, so it is important to gently restrain him or her to prevent injury. Depending on the patient and the type of anesthetic drugs used, this stage may be very apparent or very mild.

Once the patient is breathing spontaneously, or unassisted, and normal reflex activity returns, stage II is achieved and the patient is *extubated*. The anesthetist then applies the face mask to the patient and continues to administer 100 percent oxygen. Just as during intubation, this period is very critical. Suction equipment and supplies for reintubation should always be available in case of emergency.

After extubation, whenever the patient's vital signs are stable, he or she is transported to the postanesthesia care unit—the recovery room. All movements should be gentle and slow; rapid movement can cause nausea and vomiting after anesthesia. Cover the patient with a warm blanket

since anesthetic agents may affect his or her temperature-regulating mechanisms and cause the patient to chill easily and shiver.

Assisting during emergence

Assisting the anesthetist during emergence is similar to assisting with administration of the anesthetic. This may only involve staying close to and reassuring the patient or it may include hands-on assistance. You may have to gently restrain the patient, retrieve a basin to catch any emesis, or obtain a warm blanket for the patient. Stay close to anesthetist and patient to provide any emergency help—this can be critical if reintubation becomes necessary. When the anesthetist is ready, get the transport bed or gurney, and then prepare the patient for transport. Ensure all drains and catheters are secured; empty drainage containers and measure contents for the anesthetist. NEVER disconnect suction or breathing apparatus until the patient is out of the operating room. As the circulating technician, you help the scrub technician with case breakdown and room turnover. The circulating nurse usually accompanies the anesthetist and patient to the recovery room.

Quite different from assisting with a general anesthetic is assisting with the administration of a conduction anesthetic. As previously discussed, there are several methods of administering conduction anesthetic agents. Each method requires different preanesthetic preparations and routines. The next lesson explains your role in assisting with the administration these anesthetics.

415. Assisting with administration of local anesthetics and nerve blocks

The circulator plays a major role in helping prepare the supplies, equipment, and patient for administration of local anesthetics, particularly when the surgeon administers the anesthetic agents rather than anesthesia personnel. Procedures are sometimes, though rarely, done without an anesthetist monitoring the patient; in these circumstances the circulator assumes a dual role, and many duties normally assumed by the anesthetist become the responsibility of the circulator. The scrub technician also has additional responsibilities when the surgeon administers the anesthetic.

In this lesson, we concentrate on administration of the anesthetic by the surgeon for procedures such as those that may be performed in a clinic environment, like vasectomy or nail removal. When complex or major peripheral nerve blocks (axillary, brachial) are involved, an anesthetist administers the block and monitors the patient throughout the operation. All information concerning preparation of supplies and patient care in this lesson applies regardless of who administers the block. Remember, injections penetrate the skin, so use aseptic technique to reduce chances of infection from the administration of the anesthetic.

Circulator's responsibilities

When anesthesia personnel are not involved with a local anesthesia or nerve block, you, as the circulator, obtain all the required supplies, equipment, and medications the surgeon needs to anesthetize the patient. You also have many special, patient-care responsibilities during the administration of local anesthesia.

Selecting and assembling local anesthetic agents and supplies

As circulator, check the surgeon's preference card and surgery scheduling form to determine what supplies and drugs are needed. If there are any questions about the items selected, contact the surgeon before the procedure. Whenever a drug is selected from storage, properly identify it as being the right agent, in the right concentration, and in the desired amount.

Pay particular attention to expiration dates and additives such as epinephrine. As mentioned earlier, a local anesthetic containing epinephrine should be used only on the surgeon's specific request. Epinephrine is a potent vasoconstrictor, and if injected into the wrong area or given to the wrong patient, could lead to serious injury.

Also, assemble a variety of sterile needles and syringes a surgeon may use for injecting a local anesthetic agent. The four main factors that determine the size and type of syringe used are the following:

- Type of medication to be administered.
- Volume of medication to be administered.
- Degree of accuracy required in measuring the dosage of the medication.
- Surgeon's preference based on experience and training.

Most surgeons will use a 10- or 20-cc disposable syringe for injecting local anesthetic agents. Some prefer the "three-ring" type because it provides better control, and others prefer a cartridge-type syringe. In addition, disposable syringes come with either a Luer-lock tip or plain tip; cartridge syringes may have a screw-on tip. The Luer-lock tip allows the surgeon to twist and lock the hub of the needle to the tip of the syringe.

There are also many different types, diameters, and lengths of needles for injection. Needle selection is normally based on the viscosity (thickness) of the solution; the volume of solution; the depth and extent of the injection site; and the discomfort the patient may experience when a particular needle is used. Most local anesthetic agents are of about the same viscosity as water, so this is not a major concern; however, the patient's potential discomfort and extent of the injection certainly are. For example, if the surgeon plans to remove a mole from the skin, a 3–1/2-inch large-bore (18- to 20-gauge) needle is overkill; a small diameter (25- to 30-gauge), short (1/2- to 1-inch) needle is more appropriate.

If the surgeon needs to inject larger volumes of anesthetic into deeper tissues and over a larger area (such as for a field block), obtain progressively longer and larger bore needles. The surgeon can then anesthetize the superficial tissues using short, small diameter needles, and then use the larger needles to increase the block area without subjecting the patient to unnecessary pain. For infiltrating and blocking nerves in deeper tissues, the surgeon may use needles that range in size from 23-gauge by 1-inch to 18-gauge by 2-inch. Occasionally, a 3-inch spinal needle may be requested. When the anesthetist performs a peripheral nerve block, specially designed needles may be requested. Some examples include the retrobulbar block and brachial plexus block needles. These needles have specially designed bevels that are shorter and slightly blunted. They are usually kept in the anesthesia supply area.

Occasionally, the surgeon may want two "local" setups, one for use immediately before the operation and one to use on the sterile field during the operation. In this instance, you, the circulator, must ensure that additional syringes, needles, and anesthetic agents are available to meet the surgeon's needs. Some operating rooms assemble and sterilize local anesthesia sets that contain small quantities of gauze sponges, cotton-tipped applicators, medicine glasses, reusable syringes, and even special nondisposable hypodermic needles. These sets are opened on a table to create a small sterile field the surgeon works from when injecting local anesthetics. These sets may also be opened and used on the sterile field during the operation.

The supplies required for administering *topical* anesthetics depend on the type of anesthetic and purpose for which it will be used. If the surgeon wishes to use a topical anesthetic *gel* to lubricate an endoscope before insertion, the only preparation necessary is to squirt the gel on a sterile gauze sponge or disposable towel on the sterile field. The surgeon or scrub technician then applies it to the scope. Some urology procedures call for injection of local anesthetic gel into the urethra; most of these gels are dispensed directly from the tube through a funnel-type tip packaged with the tube.

If a topical anesthetic *liquid* is used, you, the circulator, may have to assemble various cotton-tipped applicators, gauze packs, sponges, or even special spray bottles called atomizers. Topical anesthetic spray is commonly used to anesthetize a patient's throat before tonsillectomies, laryngoscopies, bronchoscopies, esophagoscopies, and endotracheal intubation. These sprays may also be used with

anesthetic-soaked packs and swabs to anesthetize the nasal passages of patients scheduled for nose surgery.

Cocaine is frequently used as a topical anesthetic for ear, nose, and throat (ENT) procedures. Cocaine is a federally controlled substance and requires special handling. Cocaine solution must be stored in a locked drug cabinet, and only a licensed practitioner may dispense it. The amount dispensed is recorded on AF Form 579, Controlled Substances Register, along with the date, time, patient's hospital register number or social security number, patient's name, and pharmacy control number (or prescription number) assigned to the cocaine solution. At the end of the procedure, the unused portion is verified by the OR nurse or anesthetist and the balance recorded on the AF Form 579. Never leave cocaine or other controlled substances lying around. If a controlled substance is found unattended, notify the OR supervisor or the anesthesia staff. Normally surgical technicians have little or no involvement in handling controlled drugs, but you must be aware of the policies and procedures for handling them. Always follow the guidelines of your local instructions or policies.

Patient-care guidelines

Patients anesthetized via conduction anesthetics are often awake and aware of their surroundings. Many are apprehensive about what is happening to them and what they see and hear; some medications (such as ketamine) can intensify these effects. Surgical personnel, especially circulators, must provide additional psychological support and closely monitor these patients. Before touching or moving patients, always tell them what you are doing and why you are doing it. Maintaining a supportive, patient-friendly atmosphere in the operating room is very important. Conversation should be kept to a minimum and not contain casual remarks or gossip—be professional and patient-centered. The room should be quiet, or if desired by the patient, soft music may be provided. Traffic should be kept to a minimum; and technicians, doctors, and nurses that enter the room during the procedure should be informed that the patient is awake (signs may be posted on the operating room doors).

During positioning, make the patient as comfortable as possible; provide a pillow for the head if the procedure allows. Ensure potential pressure points are well padded and rolled sheets or pillows support areas subject to muscle strain. A privacy sheet may be fastened between two IV poles at the head of the bed to screen the view of the operative site and prevent the patient from becoming embarrassed at the exposure during the skin prep and operation. This sheet also prevents the surgical drapes from covering the patient's face. One of the simplest things you can do—and the one thing patients often remember—is provide the patient with warm sheets or blankets.

If the drapes must be placed over the patient's head, as often occurs in eye and ENT surgery, you, the circulator, provide a gentle flow of oxygen or compressed air under the drapes via a hose or tube taped to the OR bed and directed at the face. This not only helps the patient breathe more easily, it also keeps them cool, reduces the incidence of nausea and fainting, and eases the claustrophobia that affects many people in this situation.

Extra sensitivity for your patient is the rule when performing the cleansing skin prep. Remember, he or she is awake and can feel everything you are doing. Tell the patient exactly what you are doing, how long it will take, and what he or she may feel before starting the prep. Keep him or her informed as you proceed through each step. The patient may be hypersensitive to touch and temperature change. Always use warm solutions, and be careful not to exert too much pressure, especially over sensitive areas. If a patient's genitals or perineal area must be prepped, limit exposure to the absolute minimum required to safely perform the procedure. If possible, a surgical team member of the same sex as the patient should perform the prep.

If anesthesia personnel are not monitoring the patient, you, the circulator fill this role. After the prep, position yourself close to the patient, usually at the head, and where you can continuously observe him or her and monitor vital signs. As always, tell the patient what the surgeon is doing before it

actually happens. This is particularly important just before injection of the local anesthetic and the start of the operation. When talking to the patient, avoid terms that may increase anxiety. Instead of,

"They are going to cut you now, tell me when it hurts."

Try,

"They're getting ready to start the procedure now; let me know if you feel anything."

Talk to the patient, as necessary, to provide support and reassurance. Remain patient centered—keep your focus on the patient.

The circulating nurse monitors the patient's vital signs at regular intervals, usually at 5 or 15 minutes. The nurse also observes the patient's emotional and physiological response to the surgery and the drugs administered. The patient is usually connected to an electrocardiogram (ECG) monitor, an automated blood pressure monitor, and a pulse oximeter. Oxygen is administered as needed. If an IV is present, it should be checked at the same time vital signs are taken. The entire surgical team must remain alert for symptoms of toxicity or allergic reactions. We discuss these adverse reactions and symptoms in detail when we cover anesthesia complications later in this unit.

As the circulator, you must also complete the SF 517, Medical Record—Anesthesia, or locally approved anesthesia record on all cases where an anesthetist is not present. Information recorded on this form includes the patient's vital signs, the type and quantity of all drugs given, the route and time of drug administration, remarks concerning the patient's overall condition and responses during the procedure, the operation performed, the operation start and finish times, and the name of the surgeon.

If the surgeon requests additional drugs to be administered during the procedure, a registered nurse (RN) or anesthesia staff member usually performs this task. SURGICAL TECHNICIANS DO NOT GIVE MEDICATIONS TO THE PATIENT UNLESS THEY HAVE BEEN TRAINED AND SIGNED OFF ACCORDING TO THEIR FACILITY'S POLICIES. If circulating on a local case and the nurse is out of the room, you must call for a nurse or other licensed provider if the surgeon requests a drug be given to the patient and you have not been trained or your facility does not allow you to administer medications. On local anesthesia cases without anesthesia support, an OR nurse is responsible for monitoring the patient's vital signs and ECG readings. Your job is to assist the nurse as needed so that he or she can focus on the patient.

Resuscitation equipment and supplies must be readily available; the circulating nurse should be familiar with the operation of the anesthesia machine and all other resuscitation equipment. Suction apparatus, emesis basins, and towels should be patient-ready and kept close to the patient's head to handle unexpected emesis. Anesthesia personnel should be summoned immediately in the event of any patient reaction.

At the end of the procedure, take a final set of vital signs, record all IV fluids administered during the procedure, and prepare the patient for transport. All monitors are disconnected, and a warm blanket offered to the patient. Then assist the patient to move from the OR bed to the gurney. (Remember there should be at least one other person on the other side of the gurney.)

Unless heavily sedated during surgery, most local anesthesia patients return directly to the nursing or ambulatory surgery unit. You, the circulator, call the unit and give a patient condition report before the patient is released from the surgical suite. This report is quite detailed and usually includes the patient's name; type of surgery; last vital signs; type, location, and condition of dressings, drains, and special appliances; the types and amounts of drugs given; the types and amount of IV fluids administered; the type, size, and location of intravenous infusion catheters; a description of how the patient tolerated the procedure, including comments about any unusual occurrences; and the patient's level of consciousness and responsiveness.

As you can see, your role as circulator is critical during local anesthesia, especially when anesthesia staff are not involved. The scrub also has some additional responsibilities and duties.

Scrub's responsibilities

You, as scrub technician, have duties that range from standing by during administration of a topical anesthetic to receiving, preparing, and monitoring the quantity of the agent. During topical administration, you may be asked to assemble an atomizer, apply the topical gel to an endoscope or other instrument, or pass cocaine soaked applicators to the surgeon. During local infiltration or field blocks, you play a critical role. You must identify and maintain the anesthetic agent, keep track of the amount used, and anticipate the surgeon's needle selections. As when handling any drug or agent, follow the safety guidelines outlined in the first volume of this course and all local policies and procedures. In addition to those guidelines, the following procedures and precautions apply:

- Do *not* use metal containers such as prep cups or round bowls as containers for local anesthetic solutions. Some drugs may interact with the metal, so use a glass or plastic medicine cup. These containers are specifically manufactured for medications and usually have marked graduations to assist you with tracking the amount of anesthetic solution received and used. Also, never use the same syringe for different agents (unless specifically instructed to mix them) because the residual agent may interact with the new one. For example, if you have just used a syringe to inject a radiopaque dye, do not refill the syringe to infiltrate a local anesthetic.
- LABEL the medicine cup or container and any syringes used with the agent, concentration, and amount received to avoid mixups or mistakes. You can use a sterile skin marking pen to write on a skin closure strip if your facility does not have sterile labels. During some procedures, you may have containers of saline, alcohol, radiopaque dye, and sterile water. If you pass the surgeon a syringe full of saline instead of radiopaque dye, you may only irritate the surgeon; if you pass a syringe full of alcohol, you can seriously injure your patient.
- Anticipate the gauge and length of the needle the surgeon needs. To begin a field block or local infiltration, start with a small diameter (usually a 25- or 26-gauge), short needle. As the anesthetic takes effect and the surgeon progresses to deeper tissues, increase the needle length and diameter. If you are unsure, ask the surgeon what size needle is needed.
- To fill the syringe or draw up the solution, insert the tip (without the needle) into the solution container and pull back on the syringe plunger until slightly more than the desired amount of anesthetic fills the barrel. Then, attach the needle and flush the air from the syringe and needle by pointing the tip toward the ceiling and pushing the plunger until the air is gone and a few drops of solution squirt out of the needle.
- Use a hands-free method to pass the syringe and needle. If the surgeon requires you to pass the syringe, pass it in the position of use—plunger end facing the surgeon. Ensure the surgeon has the syringe before releasing it; otherwise, the syringe could be dropped and injure the patient. Tell the surgeon what agent and what concentration is contained in the syringe. When the surgeon is finished injecting, carefully retrieve the syringe from the field.

  NOTE: NEVER LEAVE A NEEDLE AND SYRINGE LYING ON THE DRAPES!

  If a large amount of anesthetic is required, prepare two syringes, and pass a full one when the first one is emptied.

- During the administration of the anesthetic, keep track of the volume of anesthetic the surgeon is injecting. A good idea is to use a sterile marking pen to write the amount on a sterile piece of paper such as a disposable hand towel. Do not write on the table cover or drapes—the ink may strike through or you may puncture them. To avoid having to pause and write every time you hand the surgeon a syringe, write down the volume of solution you started with, and then add the amount of any additional solution obtained from the circulator. Besides saving time, another advantage of this method is that if you lose track of the amount injected during the procedure,

all you have to do is subtract the volume you have left in the syringe(s) and container from the total amount you received. The difference should be the amount of anesthetic the surgeon injected into the patient. If you must do this, tell the anesthetist or circulator it is an estimate, not an exact amount.

NOTE: If anyone is accidentally stuck by a hypodermic needle, immediately pass the contaminated needle off the field. Follow local procedures for needle stick.

So far, most of our discussion has centered on administration of local anesthetic by the surgeon. We now move on to the way local anesthetic agents are more commonly used in the operating room—the administration of major conduction (nerve) blocks and IV regional blocks by anesthesia personnel.

416. Assisting with IV regional blocks and major conduction anesthesia

When anesthesia personnel administer regional anesthetics, the circulator plays an important role, especially in providing patient support.

IV regional blocks

Anesthesia personnel usually administer IV regional blocks. As previously discussed, a Bier block involves placing a small intravenous catheter into a vein in the desired extremity, exsanguinating the extremity, inflating a special double-cuff pneumatic tourniquet (to keep blood out of the extremity and the anesthetic from mixing with the circulating blood), and injecting the anesthetic into the veins of the bloodless limb. A Bier block requires more preparation than some other methods of regional anesthesia, so help from you, the circulating technician, is usually appreciated.

First, help obtain the supplies for the procedure. These include the double-cuff tourniquet and pneumatic inflating device, webril cotton wrap, and Esmarch bandage or latex rubber ace wrap. The tourniquet must wrap around the extremity enough for the ends to overlap and be fastened with the Velcro strips. The anesthetist usually collects the other supplies such as the IV catheter (20- to 22-gauge), IV extension tubing, large syringes (30- to 50-cc), and the local anesthetic (0.25 percent to 0.5 percent lidocaine).

After the IV access is obtained, you can assist the anesthetist by padding the tourniquet site with webril, and then applying the tourniquet. Ensure the connecting hoses of the tourniquet point away from the injection site, and tell the anesthetist which controller inflates which bladder of the tourniquet. The anesthetist now elevates the limb and wraps the Esmarch from the distal to the proximal end to squeeze the blood out of the extremity. You can help by holding up the limb, and, if the syringe filled with the local anesthetic is attached to the IV extension tubing, by controlling the syringe. When the limb is exsanguinated and the proximal tourniquet cuff is inflated, the circulator notes and documents the time of inflation. The Esmarch is removed, and the anesthetic is then injected in the catheter.

Immediately after the operation, the patient will not be able to control the anesthetized extremity. Control and protect the limb as the patient is transferred from the OR bed to the gurney. If an arm is anesthetized, instruct the patient to hold onto it with his or her “good” arm to protect it until control and sensation return. These rules apply to any type of peripheral nerve block of an extremity.

Other types of conduction anesthesia that require teamwork between the anesthetist and circulator are the central blocks, spinal, and epidural.

Spinal, epidural, and caudal nerve blocks

The most important thing you can do as circulator to assist during administration of spinal, epidural, or caudal blocks is to help the patient maintain position and provide physical and emotional support. You may also assist the anesthetist with preliminary preparations.

While the anesthetist is preparing the patient, open the desired regional administration set, either a spinal or epidural tray, on a small stand or table. These sets usually contain most of the drugs,

needles, syringes, and other supplies the anesthetist needs to perform the block. Some sets are not complete, or the anesthetist may need extra items, so you may be asked to retrieve them. The trays usually have a reservoir for the skin antiseptic solution, and if the solution is not included in the set, you may have to pour it from a bottle. You may also open the anesthetist's sterile gloves on a table to speed things along.

After the regional administration set is prepared, help the anesthetist position the patient. Keep the lines to the monitors untangled and intact as the patient moves, and ensure the IV continues to run properly. You recall that the patient is usually placed in either a sitting or lateral recumbent position with the head bent forward, the legs drawn up, and the lower back pushed out. Most patients are sedated and need help maintaining the position throughout the administration procedure. Regardless of the position, always stand in front of the patient to provide support.

The patient should be positioned with his or her buttock and back even with the side of the OR bed closest to the anesthetist. This provides the anesthetist easy access to the patient's lower back without having to reach over the bed. Keep as much of the patient covered with a warm blanket as possible while still providing exposure of his or her back.

If using a sitting position, place a stool under the patient's feet to support his or her legs and to reduce the strain on the lower back muscles. Place a folded sheet or blanket on the stool so the patient's bare feet do not rest on a cold metal surface. Support the upper body by standing directly in front of the patient and grasping both shoulders. Tell the patient to cross both arms, relax or drop the shoulders, and tuck the chin to the chest.

If the patient is placed in the lateral recumbent position, your job will be to help the patient maintain a fetal position. Place one of your arms behind the patient's knees and the other behind his or her neck. Do not pull the patient into an extremely tucked position, as an injury or strain could occur.

After positioning, the anesthetist paints the skin with the prep solution and drapes the injection site. Keep the patient informed; the prep solution may be cool, and the pressure from applying the drape may not be expected. After draping, the anesthetist injects a local anesthetic intradermally, subcutaneously, and into the deeper tissues around the patient's spine to reduce pain during the insertion of the spinal or epidural needle. This initial injection is usually the most painful part of the procedure, so warn the patient and provide extra support. Sometimes the patient begins to feel light-headed and nauseous. If so, inform the anesthetist and prepare to administer oxygen. Continue to hold the patient, so he or she doesn't fall.

Tell the patient what is happening during each step of the procedure; an informed patient is usually cooperative and relaxed. Also, caution the patient not to move during the insertion of the spinal or epidural needle. A sudden flinch can disrupt the position of the needle and injure a nerve or blood vessel. Instruct the patient to tell you or the anesthetist if he or she feels any sudden "electrical shooting" sensations in the legs or hips, similar to the sensation felt when hitting the funny bone in your elbow. These sensations are called *paresthesias*, and the patient's feedback helps the anesthetist to properly position the needle between the vertebrae.

Once the needle is in the correct position, the anesthetist administers a test dose and, if no adverse reactions occur, then injects the agent. The needle is usually removed immediately after injection of a spinal anesthetic, and may be removed after injection for a "single-shot" epidural. However, to provide continuous epidural, a catheter is threaded through the needle. Some anesthetists occasionally use a technique known as continuous spinal anesthesia. This involves inserting an extremely thin (32-gauge) catheter into the subarachnoid or spinal space for the duration of surgery. Continuous central blocks allow the anesthetist to inject the anesthetic solution into the epidural or subarachnoid space as needed. The anesthetist may ask you to control the end of the catheter while he or she secures it in place.

Finally, after the injection is complete and when the anesthetist gives permission, help move the patient into the surgical position. Do this slowly and carefully. When moving the patient's legs hold

the legs together and move them as a unit. Apply safety straps as directed. The anesthetist may also ask you to adjust the table tilt (head up or head down) in order to help control the level and location of the anesthesia.

Caudal epidural blocks are administered with the patient in the prone position, the OR bed slightly flexed, and a pillow under the patient's pubic bone. The patient's legs are slightly spread, with the heels of the feet rotated outward. To ensure comfort and safety, place a pillow under the patient's head. Position the arm boards on the OR bed so that the patient's arms are above the head of the bed and flexed at the elbows. Place a warm blanket or sheet over the patient's back and shoulders, but leave the buttocks exposed. Apply the safety straps as directed. Patients undergoing caudal anesthesia are usually scheduled for anorectal surgery, so no repositioning is necessary. The anesthetist may also choose this "jackknife" position to administer a spinal anesthetic for anorectal surgery.

After the anesthetic is administered, clear away the regional tray so the anesthetist can devote full attention to the patient. Always wear gloves and eye protection when breaking down a regional tray, and be careful when handling the needles. Give any unopened drug vials or ampoules to the anesthetist. Follow local policies and safety guidelines for disposing of all needles and syringes in the set.

NOTE: NEVER THROW NEEDLES OR SYRINGES IN THE TRASH.

As the anesthetic takes effect, the anesthetist closely monitors the level of anesthesia and the patient's blood pressure. This is an extremely critical time, so be alert. When a major conduction anesthetic is administered, the patient's blood pressure is likely to decrease because the spinal sensory and motor nerve roots also contain the sympathetic nerves that control and maintain blood pressure. The anesthetic agent "blocks" these nerves. The anesthetist maintains a normal blood pressure by administering IV fluids and, if necessary, using drugs such as ephedrine. If blood pressure gets too low, the patient may become nauseated and lightheaded. Have an emesis basin and suction equipment available. If the patient is pregnant, this can cause fetal distress, so scrub technicians should be ready for a stat Caesarean section.

Congratulations! You made it through another section. By now you should have a pretty fair idea about what you can do to make your patient safer and more comfortable and the anesthesia staff's job a little easier. You should also know what special patient-care considerations and activities are required during the administration of various types of anesthetics.

Self-Test Questions

After you complete these questions, you may check your answers at the end of the unit.

412. Venipuncture and other preanesthetic preparations

1. Why are intravenous fluids routinely used during surgery?

2. What is the most common IV insertion site?

3. In what types of containers do intravenous solutions usually come?

4. Why is it important to remove all air from the IV tubing?

5. What types of IV catheters are most commonly used on adults? On pediatric patients?

6. When inserting an IV in a vein with a diameter larger than the catheter, how should the needle be inserted?

7. Why should you immediately report swelling or discoloration at the IV site?

8. What do you normally record after discontinuing an IV?

413. Preparing anesthesia supplies and equipment

1. What are some of the procedures you may perform to prepare the anesthesia machine?

2. What requirements must you meet before you may assist with preparing the anesthesia machine?

3. Why would you use an ET-tube stylet?

4. Why might you coat the end of an ET-tube with a topical anesthetic gel?

5. What is an LTA kit? How and why is it used?

414. Assisting with administration of general anesthesia

1. Match the descriptive statements in column A with the stages of general anesthesia induction in column B. Items in column B may be used more than once.

Column A

____ (1) Lasts from loss of consciousness until automatic breathing begins.
____ (2) The relaxation stage.
____ (3) Begins with respiratory paralysis and ends with cardiorespiratory failure.
____ (4) The stage the patient is maintained in during an operation.
____ (5) Begins with administration of the first anesthetic agent and ends with loss of consciousness.
____ (6) The stage where the patient may have uncontrolled movements and unstable vital signs.
____ (7) The patient may feel dizzy and will be very sensitive to sounds and touch.

Column B

a. Stage I.
b. Stage II.
c. Stage III.
d. Stage IV.

2. State four ways surgical team members can create and maintain a safe, relaxing environment in the operating room prior to anesthesia induction.

3. When is endotracheal intubation usually attempted?

4. Where should you press on the patient's neck if the anesthetist asks you to apply cricoid pressure during intubation?

5. Immediately after the endotracheal tube is positioned and the cuff is inflated, what should you do to help the anesthetist?

6. List four ways that circulating personnel may assist the anesthetist during the maintenance phase of general anesthesia.

7. When is the patient extubated?

8. Why is it important to cover the patient with a warm blanket as soon as possible after surgery?

9. What should the circulator do prior to transporting a patient to the recovery room if the patient has any type of drainage devices inserted?

415. Assisting with administration of local anesthetics and nerve blocks

1. What two sources of information should the circulator check to determine what additional drugs and supplies a surgeon will need for a procedure done under local anesthesia?

2. Besides checking the name, concentration, and amount of a local anesthetic agent, to what other items should you pay particular attention when pulling the drug from storage?

3. List the four main factors that will determine the size and type of syringe the surgeon will use.

4. What advantage does the Luer-lock tip syringe have over a plain tip syringe?

5. What criteria are used to determine needle selection?

6. What size needles are commonly used to inject a local anesthetic into superficial tissues?

7. Where is the cocaine solution used for topical anesthesia stored in the operating room? Why is this required?

8. What information is recorded on the AF Form 579, Controlled Substances Register, when cocaine is obtained from the drug cabinet?

9. What must be done with any unused cocaine solution?

10. Why should circulators provide additional psychological support and closely monitor local anesthesia patients?

11. List some of the actions the circulator can take to ensure the patient is safe and comfortable after initial positioning on the OR bed.

12. What can the circulator do to lessen a local patient’s anxiety, discomfort, and embarrassment during the cleansing skin prep?

13. How often should the circulator monitor and record a patient's vital signs during a local anesthesia case when no anesthesia personnel are in the room?

14. What information is the circulator required to annotate on the SF 517, Clinical Record—Anesthesia, during a local anesthesia case when no anesthesia personnel are present?

15. Identify five tasks the circulator must perform at the end of a local anesthetic procedure.

16. Why should you not use metal containers for local anesthetic solutions?

17. How should air be flushed from a syringe and needle?

18. How should the scrub pass a syringe and needle to the surgeon?

19. How can you figure out how much local anesthetic was injected into a patient if you lose track of the amount during the operation?

416. Assisting with IV regional blocks and major conduction anesthesia

1. When assisting anesthesia personnel with Bier block preparations, what should you do before applying the tourniquet cuff around the extremity?

2. How is an extremity usually exsanguinated before the injection of the Bier block?

3. Describe how the circulator assists with positioning a patient in the sitting and lateral recumbent positions during administration of a spinal anesthetic or epidural anesthetic.

4. When helping the anesthetist with spinal or epidural anesthesia administration, why should you caution the patient not to move when the spinal or epidural needle is inserted?

5. List four ways a circulator can ensure the patient's comfort and safety during administration of a caudal block?

2–4. Anesthesia Complications

Just as a surgical operation, anesthesia administration is never a minor procedure. All methods of anesthesia are subject to complications. The patient may experience unexpected physiological reactions from the anesthetic agents, other drugs, or the surgical procedure. Problems with faulty anesthesia equipment, defective supplies, or environmental controls are also possible. Human error, poor technique or inexperience also contributes to the patient's risk.

The primary goal of the anesthesia staff is to *prevent* complications or emergencies by eliminating the causes, but despite all the advances in modern anesthesia, they still occur. Most complications are detected and remedied by the anesthetist before they become severe enough to cause an emergency or life-threatening situation, but when major problems occur, the entire surgical team must be prepared to act to minimize adverse effects and to help the anesthetist regain control of the situation.

417. Respiratory complications: causes and management

One of the anesthetist's primary concerns during the administration of a general anesthetic is maintenance of the patient's airway. Although many respiratory complications may develop, the three we're covering here are loss of airway or obstructed airway, bronchospasm or laryngospasm, and aspiration.

Obstructed or nonpatent airway

The most common, and potentially fatal, complication of anesthesia is the loss of a patent airway. Patent means wide open, unobstructed, and evident. A nonpatent airway, or obstructed airway, prevents the intake of oxygen and the release of carbon dioxide, and prevents the inhaled anesthetic agents from reaching the lungs.

Causes

There are numerous causes of airway loss. They vary with the anesthetic agent and technique used, and often relate to the patient's anatomy, physical condition, and posture or position. Some of the likely causes of airway loss or obstruction during anesthesia administration are as follows:

Causes of Airway Loss

Causes	Explanation
Excessive relaxation and backward displacement of the jaw and tongue	Sedation agents may produce enough relaxation to cause the tongue to fall back into the throat or for the jaw to sink back and block the airway. As you learned in basic cardiac life support (BCLS), the most common cause of airway obstruction in an unconscious patient is the tongue.
Inadequate relaxation or premature attempt at intubation	The airway may be compromised if the jaw and neck muscles are not relaxed enough to allow intubation. The intubation attempt may also lead to airway obstruction after laryngospasm or bronchospasm as described later in this unit.
Pre-existing physiological conditions or anatomical structure	Some pre-existing factors may interfere with adequate airway control and make intubation extremely difficult. These conditions include edema (swelling) of anatomical structures (larynx, glottis, or epiglottis) in the throat; enlarged tonsils; nasal or vocal cord polyps; stenosis (narrowing) of respiratory passages; injuries to the mouth, nose, and throat; epistaxis (nose bleed); morbid obesity; and chronic lung disease or asthma. Certain congenital deformities of the face, jaw, and neck also may increase chances of an obstructed airway.
Vomitus or excessive secretions	These conditions may obviously cause obstructed airway if the patient is not intubated, and thick mucosal secretions can also obstruct the endotracheal tube.

Causes of Airway Loss	
Causes	**Explanation**
Hyperextension, hyperflexion, and anatomical pressure	If the neck is hyperextended (head extremely tilted up), particularly in children, the trachea may collapse; if hyperflexed (head extremely tilted down), the tongue and jaw may occlude the airway as described above. If the patient is prone, under regional anesthetic, and sedated, the mouth and nose may be obstructed by folded sheets or pillows. Though not technically airway obstructions, hyperflexion of the legs when the patient is in the lithotomy position and excessive weight on the chest when prone can exert enough pressure on the diaphragm to inhibit respiration.
Accidental or premature extubation	Accidental extubation during surgery is rare, but is most likely to occur if: (1) the patient was initially a difficult intubation (Murphy's law), (2) the patient is in the prone, lateral, or sitting position and the anesthetist has minimal access to the airway, or (3) the surgical procedure involves the airway or respiratory system. If the patient is still in the surgical stage or the excitement stage of anesthesia when extubated, the airway may be occluded by the tongue and jaw as described above, but more likely, by laryngospasm or bronchospasm as described later in this unit.

Management

When a patient's airway is lost or becomes obstructed, the anesthetist and circulating personnel must react quickly. The cause must be immediately determined because the cause usually dictates the treatment. Immediate availability of a properly functioning anesthesia machine, adequate intubation supplies, and an effective suction device is vital to relieving obstructions and regaining control of a nonpatent airway.

If the obstruction is caused by muscle relaxation in the jaw and throat, the anesthetist can usually open the airway by using the same maneuvers taught in basic cardiac life support (BCLS) classes—the head-tilt/chin-lift or head-tilt/jaw thrust. An oral airway may be inserted to keep the tongue from falling backwards; the patient may also be intubated.

Airway problems caused by inadequate relaxation or premature intubation attempts usually require administration of additional muscle relaxants and drugs to control nausea and dry up secretions. Laryngospasm and bronchospasm treatment is discussed in the next area covered in this unit.

Whenever a physical disease, injury, or deformity threatens airway obstruction, the anesthetist and surgeon must work closely together. Preoperative preparation is usually the key. Treatment of obstruction caused by a disease varies according to the nature of the problem. For instance, if the patient has asthma, certain drugs are administered preoperatively, intraoperatively, and postoperatively to open the patient's bronchi. A patient who has malignant cancer of or has sustained injuries to the mouth, nose, or throat may require a tracheotomy or cricothyroidotomy to bypass the damaged upper airway. Tracheostomy involves creating an opening through the neck into the anterior trachea, and then inserting a tube to provide ventilation. Tracheostomy tubes have a relatively large internal diameter to allow large volume air exchange and may be inserted or placed for an extended period. Cricothyroidotomy is the insertion of a large bore (usually 10- to 16-gauge) needle just above the cricoid cartilage to provide emergency respiration and immediately restore breathing and stabilize the patient. It is used only when an endotracheal intubation fails and tracheostomy is not indicated.

When nausea or vomiting is a concern, such as when a patient has not been kept NPO, the anesthetist will probably perform a rapid sequence induction to reduce risk of airway obstruction. Antiemetics and anticholinergic agents are given as far in advance of induction as possible, and may be supplemented during the procedure. If the patient does vomit, suctioning of the airway usually clears the blockage. If the patient vomits after intubation, or if the patient has excessive mucosal secretions, suctioning is the first remedy; if it fails, a rapid extubation-reintubation may be the best solution. Treatment for aspiration is discussed later in this unit.

Postural problems are usually easily remedied. A simple readjustment of the head position usually eliminates obstruction caused by abnormal extension or flexion of the neck. Pressure on the patient's chest or abdomen and subsequent respiratory impairment can be avoided by careful surgical positioning; if impairment occurs, reposition the patient. In all cases of airway obstruction, the patient is thoroughly reassessed after treatment, and oxygen and ventilation are provided as necessary.

Laryngospasm and bronchospasm

Laryngospasm is the involuntary contraction of the vocal cords; bronchospasm is the contraction of the muscle layer of the bronchi. Either may result in partial or total obstruction of the airway. A partial spasm consists of rapid contraction and relaxation of the muscles, and is characterized by wheezing, gasping, labored breathing, and increased resistance to mechanical ventilation. If a partial spasm is not treated, total spasm may result. A total laryngospasm is complete muscle contraction; the glottis clamps shut causing total obstruction of the airway and cessation of spontaneous breathing.

Causes

Laryngospasm most often occurs during induction of or emergence from general anesthesia, particularly during or immediately after intubation or extubation. Bronchospasm may occur at any time during anesthesia administration, but is most likely during general anesthesia induction. While not direct causes, cigarette smoking and chronic bronchitis cause patients to be highly susceptible to spasm.

Some of the causes of laryngospasm or bronchospasm are as follows:

- Reaction of the pulmonary (respiratory) system to drugs, especially drugs that promote histamine release and those classified as beta-blockers.
- Anaphylactic (allergic) reaction to a drug or a blood transfusion.
- Irritation or stimulation of the pharynx, larynx, or trachea from oral or nasal airways, secretions, emesis, blood, inhalation agents, suction tips, laryngoscopes, or endotracheal tubes (especially if misplaced). Spasm likelihood from stimulation is increased during light anesthesia and during procedures involving excessive head and neck movement.
- Surgical stimulation of or traction of the vagus nerve or abdominal viscera (peritoneum, omentum, mesentery, intestine, etc.).
- Positive-pressure ventilation.
- Disturbing or painful stimuli during induction or emergence.
- Diseases such as emphysema, reactive airway disorders, or asthma.

Management

If a bronchospasm or laryngospasm occurs, routine activities should cease until the situation is resolved; the circulator should assist the anesthetist in identifying the cause (if possible) and treating the condition. The following steps are commonly taken:

1. The anesthetist administers oxygen under gentle pressure by manually squeezing the rebreathing bag. If the anesthetist is temporarily unable to "bag" the patient, the circulator performs this task. Techniques to open the airway, as previously discussed during obstruction, are utilized.
2. The anesthetist administers additional medications or anesthetic agents to deepen the anesthesia. Muscle relaxants, bronchial dilators (such as aminophylline, epinephrine, or albuterol), antihistamines, and steroids may be administered depending on the determined cause of the spasms. Assist with obtaining and preparing medications.
3. If irritation or stimulation is the suspected cause, the anesthetist clears the irritant using suction apparatus.

4. If the patient is not already intubated, emergency endotracheal intubation is performed to establish the airway.
5. If all measures fail and laryngospasm is not arrested, a tracheotomy or cricothyroidotomy may be performed.

The term aspiration has been mentioned in the preceding discussions, so you should have a basic understanding of what it is and why it can be a problem during anesthesia administration. The next section expands on this information and also explains why aspiration is a major concern of the anesthetist.

Aspiration

Aspiration of gastric contents into the breathing passages and lungs is one of the greatest potential problems, and one of the most dangerous associated with anesthesia administration. Gastric contents are acidic, and aspiration causes severe chemical irritation (chemical pneumonitis) and damage to the lungs; it is potentially fatal. The aspiration of solid particles may result in complete airway obstruction or fatality if not relieved. Aspirated solids may also block the bronchi or bronchioles, resulting in an *atelectasis*, or incomplete expansion (collapsed lung). Postaspiration complications include pneumonitis, abscess formation, or pneumonia.

Causes

Obviously, patients with food in their stomachs have the greatest risk of regurgitating and aspirating gastric contents. Even if the patient has vomited or a nasogastric tube has been inserted, enough acidic secretions and solid matter remain to cause serious problems. Patients at risk include trauma patients, patients requiring emergency surgery, pregnant patients (Mendelson's Syndrome), and diabetic patients. Conditions that increase susceptibility to aspiration include bowel obstruction, gastrointestinal bleeding, hiatal hernia, pyloric stenosis, or morbid obesity. These patients are usually considered to have a "full stomach" regardless of how long they have been NPO. Preoperative anxiety and certain narcotics, such as morphine, may cause spasms of the pyloric valve at the base of the stomach. This may cause the valve to remain closed and result in the retention of food, gastric juices, and gas in the stomach.

Large amounts of anesthetic gas can collect in the stomach and increase the risk of aspiration. The gas can cause pressure in the stomach and literally "blow" gastric contents into the esophagus; it can also impair respiration by causing excessive pressure on the diaphragm.

Gas in the stomach can result from several conditions. It may be forced through the esophagus into the stomach during positive pressure ventilation using a face mask, particularly if the anesthetist has difficulty maintaining the airway or ventilating the patient. Extended use of nitrous oxide may result in the gas diffusing through the gastrointestinal tissues and accumulating in the stomach and intestines.

Regurgitation of gas and gastric contents can happen at any time, from the moment the patient is given preoperative medications through postoperative recovery. Aspiration may occur while the patient is conscious or during the operation as a result of "silent regurgitation."

Management

Aspiration of gastric contents is a serious complication, so anesthetists focus on prevention for primary management. Some of the preventative measures used on high-risk patients include performing an awake intubation (very rarely), using a rapid sequence induction (emergency), administering preoperative anticholinergics and antiemetics (common), utilizing regional anesthesia (if practical), or delaying surgery until the stomach has emptied (ideal). Anytime anesthesia—especially general anesthesia—is administrated to a patient, be prepared for potential aspiration. Ensure a fully functional suction device is ready for immediate use! A delay of just

seconds for untangling the tubing or attaching a suction catheter may determine whether the patient lives or dies! If a patient aspirates, help the anesthetist immediately:

1. Place the OR bed in the Trendelenburg (head down) position, and turn the patient's head to the side to allow gravity to help drain aspirate from the respiratory tract.
2. Suction the patient's oropharynx, trachea, and bronchial tree to remove as much of the aspirate as possible and to prevent it from spreading into the lungs.
3. Set up and perform an emergency bronchoscopy *if* solid aspirate is obstructing the airway.
4. Provide continuous positive-pressure ventilation (of 100 percent oxygen) between suctioning to prevent hypoxia and atelectasis. The patient must usually be intubated.
5. Administer drugs and IV fluids to cause bronchial dilation (open constricted airways) and to maintain blood pressure. Some anesthesiologists give steroids to attempt to reduce inflammation; some give antibiotics to stave off bacterial infection.

Rapid response to this anesthetic emergency is essential! Circulators must remain alert and be ready to help in any way necessary when a patient aspirates.

Respiratory complications are not the only problems patients may develop during anesthesia administration; we now turn to some of the major cardiovascular emergencies.

418. Cardiovascular complications: causes and management

Numerous complications directly or indirectly relate to a patient's heart and vascular system. Many of these problems are beyond the scope of this text, so we're limiting the discussion to the basic causes and treatment of some of the major cardiovascular problems.

Shock

Shock is basically the body's reaction to insufficient blood circulation or circulatory collapse. Shock is usually caused by a decrease in blood return to the heart, which naturally results in decreased blood flow from the heart. This reduced blood flow results in inadequate *cellular perfusion*, which is the exchange of oxygen for carbon dioxide and nutrients for waste products in the lungs and vital organs. The lack of oxygen leads to cellular hypoxia, to excessive waste build-up or metabolic acidosis, and eventually to cell, and patient, death. The classic signs and symptoms of shock are hypotension (low blood pressure); weak, rapid pulse; pale, clammy skin; shallow, irregular breathing; restlessness, confusion, and weakness; and decreased urine output.

Causes

Shock may be caused by severe trauma, burns, drug reactions or poisoning, massive hemorrhage, myocardial infarction (heart attack), dehydration, or severe infection (sepsis). Several conditions may lead to shock in the surgical patient, including:

- Overdose of anesthetic agents (stage IV) leading to cardiovascular collapse.
- Aggravation of a preexisting condition—such as anemia, diabetes, cardiovascular or lung disease—by the stress of a surgical procedure.
- *Hypovolemia* (decreased volume of circulating blood and fluids) caused by severe hemorrhage or insensible losses. Insensible losses refer to body fluid loss through the respiratory tract, urine, and evaporation from open body cavities. Hemorrhage decreases circulating blood volume due to loss of blood, plasma, and extracellular fluid. This is the most likely cause of shock during surgery.
- Inadequate venous return to the heart causing *hypotension* (low blood pressure) due to poor positioning of the surgical patient. For example, if a pregnant woman is placed flat in a supine position, the large, heavy uterus can interfere with the normal flow of blood by compressing the vena cava and aorta in the abdomen. This also compromises the flow of blood to the placenta and unborn infant, leading to fetal distress. This is known as *Supine*

Hypotension Syndrome. It is prevented simply by placing a wedge under the right hip and back and tilting the patient to the left to attain "left uterine displacement" and to take the pressure off these major vessels. Remember this during Caesarean sections!

Management

Even though the effects of anesthesia sometimes mask the initial signs of shock, the patient's vital signs are fully monitored, and a perceptive anesthetist recognizes the symptoms and immediately alerts the surgeon. The anesthetized patient is actually in the best possible place to receive prompt and effective treatment. Basic treatment of shock includes maintaining an open airway and providing oxygen, restoring the fluid balance using intravenous fluids or blood products, placing the patient in the supine position with feet elevated, keeping the patient warm and quiet, and controlling hemorrhage.

The anesthetized patient is usually intubated to maintain the airway and is connected to an anesthesia machine that is capable of delivering 100-percent oxygen. Intravenous access lines are already established and can be used to deliver appropriate IV fluids and blood products. The patient is on an OR table (often in the supine position) which can be tilted to elevate the feet. Warm sheets and blankets are usually available to cover the patient, and warm saline is available for irrigation; a high-risk patient may be placed in or on an external warming device. General anesthesia keeps the patient as quiet as possible. An entire surgical team is present with equipment and instruments specifically designed for hemostasis or control of hemorrhage. Treatment of advanced shock consists of maintaining circulation using vasopressor medications and cardiopulmonary resuscitation. Anesthetists usually have vasopressors in their drug arsenal, and all surgical personnel are trained in cardiopulmonary resuscitation.

Control of hemorrhage

To arrest and reverse the effects of *hypovolemic shock* (shock caused by excessive bleeding), the surgeon must find the source and stem the blood flow. This is usually done by clamping and ligating damaged blood vessels or by cauterizing them with an electrosurgical device. If the immediate source cannot be located, other hemorrhage control measures include:

- Use of topical hemostatic agents such as absorbable gelatin sponges (Gelfoam), oxidized cellulose (Surgicel), collagen hemostat powders or sponges (Avitene, Superstat, Helistat), and thrombin USP topical solutions (Thrombostat). These topical agents are used mainly when a relatively large area is oozing blood, and the bleeding cannot be controlled by clamping, ligation, or cauterization.
- Direct pressure over the wound. The surgeon may use surgical sponges to pack inside the wound or to apply pressure onto the site. If hemorrhage is severe, the surgeon will need many sponges; the scrub and circulator must anticipate this need and open and count the sponges before they are needed.
- Applying pressure to pressure points. If you remember your first aid, you recall pressure points are located where superficial arteries can be compressed between the skin and bone. The most important pressure points are the inside of the upper thigh over the femoral artery, the inside of the upper arm over the brachial artery, and the top of the foot over the dorsalis pedis artery. The carotid arteries in the neck can be used in extreme situations, but with caution, as these arteries supply the brain.
- Application of a tourniquet. This is always used as a last resort. Whenever a tourniquet is used, the time of application must be recorded. The tourniquet can be used only to control bleeding from an extremity, and should be applied as low on the extremity and as close to the wound as possible to avoid cutting off blood flow to undamaged, healthy tissues. As soon as the bleeding is located and controlled, the tourniquet is removed and the time of removal is recorded.

Fluid replacement and blood transfusions

While the surgeon controls the hemorrhage, the anesthetist saturates the remaining circulating blood as much as possible by giving the patient additional oxygen. As the volume of circulating blood decreases, the anesthetist attempts to supplement it with large transfusions of standard IV solutions such as Lactated Ringer's or Normal Saline, or may infuse electrolyte solutions. If bleeding persists and the patient begins showing signs of vascular instability, infusion of plasma volume expanders, such as dextran, plasma protein fraction, or human albumin, may expand the fluid volume enough to stabilize the patient. It is very important for you to know exactly where the various intravenous fluids and blood volume expanders are stored, and if a specific infusion set is required to administer the prescribed solution. Rapid infusion may be essential, and the anesthetist cannot leave the patient. If you waste looking for supplies, this may mean the difference between the patient being stabilized with these relatively low-risk measures or the need for more extensive treatment. If hemorrhage or fluid loss persists, and the patient's condition deteriorates, the anesthetist and surgeon must decide if a blood or blood product transfusion is warranted.

The decision to transfuse blood or blood products is not made lightly. It is based on the patient's hemoglobin and hematocrit (H&H) laboratory test results, and on the estimated blood loss and its effects on the patient's condition. If blood loss is large (more than 25 to 30 percent) and the patient is symptomatic, a transfusion of whole blood, of packed red blood cells (PRBC), or of other blood products is usually administered. However, blood product transfusions can cause adverse patient reactions and major complications. Immediate symptoms of a transfusion reaction include some or all of the following: chills (patient tremors or shivering); fever; hives; dyspnea (difficult breathing), bronchospasm, wheezing; and chest or back pain. Reactions that may be more difficult to detect include hemolytic reactions (blood component separation) such as hemoglobinuria (hemolyzed blood cells in the urine) or hemoglobinemia (presence of hemoglobin in the blood plasma from hemolyzed blood cells). Also, though modern procedures greatly reduce the likelihood, transfusions have also resulted in transfer of diseases such as hepatitis or viruses such as HIV (AIDS).

A transfusion reaction can occur in spite of the most careful type matching and cross matching. For this reason, blood is administered slowly whenever possible.

NOTE: If a reaction occurs, the transfusion is immediately stopped and the blood bank is notified. The anesthetist then begins the appropriate treatment for the specific type of reaction.

The risk of blood transfusion complications is greatly reduced if an *autotransfusion* is possible. Autotransfusion involves collecting the patient's own blood, called autologous blood, for reinfusion. It may involve collecting units of blood before surgery and storing them in the laboratory blood bank until they are needed, or it may involve using a recovery device during the procedure. There are a number of devices designed to collect suctioned or drained blood, separate it, and filter any contaminants mixed with the blood. Then, these autotransfusion devices usually add an anticoagulant and prepare the blood for reinfusion. They range from simple vacuum drainage collectors to expensive and sophisticated machines. Your primary role in assisting with these devices is setting them up and following local instructions or directions to care for and maintain them. It is critical you follow the exact procedures to ensure the blood is usable and its integrity is not compromised. If autotransfusion is not an option or if all the autologous blood has been used, blood that has been typed and crossed may be transfused.

Units of blood or blood components (platelets, fresh frozen plasma, etc.) should be typed and cross matched by the laboratory blood bank specifically for the individual patient. Type and cross match refer to ascertaining that the patient's blood group type and antibodies match those of the donated blood unit to reduce chances of a reaction. If a transfusion is anticipated prior to surgery, blood is typed and cross matched, reserved for the patient, and placed in refrigerated storage either in the surgical suite or in the hospital blood bank.

If no blood is available, the anesthetist draws tubes of blood from the patient to send to the lab for typing and cross matching. While the anesthetist draws the blood, you, the circulator, prepare labels with patient identification data for the blood tubes and initiate the paperwork. Blood is requested using SF 518, Medical Record—Blood or Blood Component Transfusion. You obtain and fill out the form; the anesthetist (or person who drew the blood samples) verifies the accuracy of the form and blood tube labels and then signs the SF 518. A member of the surgical team (not scrubbed in), who watched the anesthetist draw the blood, rechecks all information for accuracy and signs the form as a witness. The form and the labeled blood vials are then taken directly to the hospital blood bank for processing.

Even a stat type and cross may take over half an hour to complete. Sometimes, the blood may receive an abbreviated cross match in order to ensure the blood is available for immediate transfusion. In critical situations, noncross-matched blood compatible with the patient's blood group and Rh factor, or ABO/Rh compatible blood, is transfused. In a life-or-death circumstance, O-negative blood may be transfused along with other IV plasma expanders. O-negative blood is sometimes called the "universal donor" because it can be given to people with group A, B, AB, or O blood without causing agglutination or "clumping" of the recipient's blood.

Before administering any blood or blood component, the unit is carefully identified. All information contained on the blood unit label must exactly match the corresponding information on the SF 518 and the patient's identification information. A blood unit that has been typed and crossed contains a label indicating the patient's full name, the ABO group and Rh type of the donor blood, the date the blood was drawn, a blood bank assigned unit identification number, and the unit expiration date. Identical information must be listed on the SF 518.

NOTE: The information on the sf 518 and the blood unit label must match ***exactly*** before the blood can be transfused.

Patient identification is also verified, usually by comparing the information on the SF 518 and the blood unit to the information on the patient's ID band or bracelet. If any information does not match (even the patient's middle initial) the blood should not be used. This is extremely important—a mistake in the type or cross match of the patient or blood unit can prove fatal to the patient.

Before administering a transfusion, two people positively identify and match the patient to the blood unit about to be given. Whenever possible, both people verifying the identification should be professionally licensed, so usually the anesthesia provider and circulating nurse perform this function. The anesthetist and the other verifier sign the SF 518 in the pretransfusion data section; then, the anesthetist takes and records the patient's vital signs immediately before starting the transfusion.

Blood is usually transfused using a Y-type tubing administration set that allows two solutions to be administered simultaneously. Blood and blood products are usually administered with normal saline to reduce the blood viscosity and help maintain patency of the intravenous line. The blood administration set also contains a special fine-pore filter in the drip chamber that helps filter out fine blood clots and clumped blood cells; if massive transfusions are given, a special micropore filter is placed in-line between the blood unit and the drip chamber. This filter eliminates fibrin strands and smaller aggregates (such as leukocytes) that may cause complications.

NOTE: Filters are not used when administering platelets.

When rapid transfusion is required to keep up with a patient's acute blood loss, a blood pump may be used. A *pneumatic blood pump* is simply an inflatable bladder with a nylon mesh front. The unit of blood is sandwiched between the bladder and the mesh, then suspended from an IV pole. The pump bladder is inflated with a hand bulb just like a blood pressure cuff. The inflated bladder squeezes the unit of blood up against the mesh on the front side of the pump, and the pressure increases the rate of blood flow out of the bag. Mechanical transfusion devices are also available and used for rapid blood

administration; some of these devices also provide for collection and reinfusion of autologous blood as we discussed previously.

Since blood is refrigerated until used, it must be warmed before transfusion to avoid patient hypothermia. The most common blood warming devices used in the operating room use electrically heated metal plates to warm the blood. The blood is heated either in a bag or in a coil of tubing as it passes through the warming device. You must be thoroughly familiar with the type of blood warmer used in your facility, and always follow the manufacturer's directions and local policy when tasked to set up a blood warmer. As the blood is being transfused, you can help the anesthetist by paying close attention to the temperature gauge or digital readout on the warming unit. Blood is usually heated to approximately 37° C (89° F), and should never be heated to more than 40° C (104° F) because red blood cells are destroyed at high temperatures.

Blood not transfused must be immediately returned to the blood bank for storage along with the SF 518. If blood has been transfused, the person who administered the blood transfusion fills out and signs the "Record of Transfusion" section on the SF 518, and returns a copy of the SF 518 to the laboratory along with the empty blood bag. The completed original SF 518 is placed in the patient's chart.

If a patient has a transfusion reaction, the transfusion is immediately stopped, and the reaction is recorded on the SF 518. The completed form is returned to the laboratory with the unit and administration set. These are studied to determine the possible causes of reaction. In addition, samples of the patient's blood and urine may be required. All hospitals have written, detailed, procedures that must be followed in the event a transfusion reaction occurs.

Air embolism

Air embolism can be fatal. It is basically defined as the introduction of air into the vascular system. Air entering the *venous* system passes through the right side of the heart into the pulmonary circulation. This obstructs blood flow through the lungs and results in acute cor pulmonale, or loss of oxygenated blood returning to the left side of the heart and into the general circulation. Symptoms include hypotension, cardiac dysrhythmias, hypoxia, and even cardiac arrest. Air introduced into the *arterial* system is even more dangerous. It can block the flow of blood in the coronary arteries and produce dysrhythmias and cardiac arrest, or it may enter the cerebral (brain) circulation and result in a stroke.

Causes

Air embolism may occur during surgery involving any of the large veins in the body. The most common situation is during neurosurgical or craniofacial procedures when the patient is in the sitting position. Other ways air enters the circulatory system are through:

- Blood transfusion or intravenous solution administration apparatus. This is particularly important in children and infants, where small bubbles in the IV tubing can be hazardous.
- Open blood vessels or intravascular devices (i.e., cardiopulmonary bypass) during vascular or heart surgery.
- The venous system during large-vein catheterization.
- Open venous sinuses, as in the brain, spine, and uterus, during surgical procedures involving these areas. In addition, air embolism is more likely to occur when the surgical site is higher than or above the level of the heart.

Management

The anesthetist must immediately identify the source of air entry and stop it. If the source is the surgical site, the surgeon will close or compress the open vein, or flood the site with normal saline to stem the air entry. Next, to limit air entry into the heart, the patient is positioned so the heart is higher than the open vein. If the patient is symptomatic and massive air embolism is suspected, the patient is

usually placed in extreme Trendelenburg position with his or her right side up (left lateral decubitus). This maneuver traps the air bubble in the apex of the heart's right ventricle, keeping the air from traveling into the pulmonary circulation. The air is then aspirated out of the heart using a central venous line or CVP catheter. Further treatment includes administering 100 percent oxygen, discontinuing the anesthetic agents, and maintaining the cardiovascular system as is described for treatment of shock.

Cardiac dysrhythmias

Cardiac dysrhythmias are irregular heartbeats; they can decrease the blood flow from the heart, or cardiac output, resulting in reduced cellular perfusion, or shock, in the vital organs. Some dysrhythmias, if untreated, can progress to lethal dysrhythmias such as ventricular fibrillation or cardiac asystole.

Causes

There are multiple causes of cardiac dysrhythmias. Among these causes are hypoxia, severe hemorrhage or hypovolemia, pain, fever, heart disease, heart attack or myocardial ischemia (lack of oxygen to the heart muscle), drug overdose, toxic level of medications or anesthetic agents, and chemical or electrolyte imbalance in the body.

Types of dysrhythmias and corrective measures

There are many different types of dysrhythmias, but we discuss only the ones that cause most concern to anesthesia personnel. These include severe sinus bradycardia and high degrees of atrioventricular (A-V) block, supraventricular or sinus tachycardia, premature ventricular contractions, ventricular tachycardia, ventricular fibrillation, and cardiac asystole.

Sinus bradycardia and A-V block

Sinus bradycardia is an abnormally slow heart rate, usually less than 60 beats per minute. This often occurs naturally in young, healthy adults who are physically active. Some medications or anesthetic agents, such as medications used to treat heart disease or hypertension, or narcotics can be expected to cause this type of dysrhythmia. Sinus bradycardia becomes a major concern when it is caused by severe hypoxia.

A-V block occurs when nerve impulse conduction between the atria and ventricles is delayed or absent. Patients with this dysrhythmia usually have some type of heart disease that produced lesions in the conduction pathway. In advanced or high degree, A-V block results in bradycardia.

Bradycardia usually does not require treatment unless it is accompanied by a decrease in blood pressure that reduces blood flow to the vital organs. If treatment becomes necessary, it involves giving oxygen and intravenous administration of medications, such as atropine sulfate, ephedrine, or isoproterenol, to stimulate the heart and increase its rate. If bradycardia is persistent, a transvenous pacemaker may be inserted.

Supraventricular or sinus tachycardia

Tachycardia is an abnormally fast heart rate, usually over 100 beats per minute. Stress, as caused by anxiety or pain, is the number one cause of supraventricular or sinus tachycardia. Other causes include hypovolemia, dehydration, fever, hypoxia, and the physical intrusion and manipulation of surgery. Treatment usually involves simply removing or treating the cause of the tachycardia, but if cardiac output is adversely affected, digitalis based medications may be administered.

Premature ventricular contractions

A premature ventricular contraction (PVC) is simply contraction of the ventricles of the heart before they would normally do so during the atrioventricular contraction sequence (heartbeat). PVCs are common with chronic heart and lung disease; patients may refer to them as *palpitations.* PVCs are also caused by excessive smoking, caffeine, alcohol, stress, toxic levels of certain drugs, and chemical

or electrolyte imbalances in the body. The occasional PVC is commonplace in many patients and requires no treatment. In the surgical environment, if PVCs occur frequently (more than 6 per minute), or occur in groups of two (a couplet) or three (a salvo), they may lead to ventricular tachycardia or ventricular fibrillation. If several PVCs occur in a generally healthy patient, inadequate oxygenation is the first suspected cause. In pediatric patients, PVCs are often a sign of inadequate

general anesthesia. Treatment of PVCs begins with identifying and treating the cause and includes administration of 100 percent oxygen. If the patient does not show signs of bradycardia, IV lidocaine may be injected to control the PVCs.

Ventricular tachycardia

Ventricular tachycardia (V-tach) is very rapid contractions of the ventricles—more than 100 per minute—or basically, a rapid sequence of PVCs. The causes are generally the same as for PVCs, but at their extremes—acute myocardial infarction (heart attack), toxic reaction to drugs, or severe hypoxia. Ventricular tachycardia is life threatening. The incomplete and insufficient contractions of the ventricles reduce the pumping efficiency of the heart and decrease blood circulation. Treatment depends on the absence or presence of a pulse. If a pulse is absent, treatment is similar to that for ventricular fibrillation, discussed next. If a pulse is present, oxygen, IV lidocaine, and IV procainamide are administered. If the patient does not respond or is unstable, a *cardioversion,* or synchronized defibrillation, may be applied

Cardioversion uses a *defibrillator* to fire an electrical shock, synchronized with the exact peak of the PVC, across the heart. The goal is to briefly stop all heart rhythm and, hopefully, reset the heart's natural electrical system to resume the normal firing sequence. One defibrillator paddle is usually placed just below the clavicle and slightly to the right of the sternum; the other just under the left nipple. The paddle surfaces are covered with conductive gel and pressed firmly on the skin. The defibrillator is usually set to deliver an initial charge of 50 joules (watts per second); if the patient's rhythm does not convert, the charge is progressively increased to about 360 joules. Before firing the paddles, the operator must ensure everyone is away from and not touching the patient or any metal surfaces contacting the patient to avoid accidental electrical shock.

Ventricular fibrillation

Ventricular fibrillation (V-fib) is an irregular, rapid, uncoordinated quivering of the entire heart muscle that makes it incapable of pumping blood. This is considered a preliminary stage of cardiac arrest and brain damage or death results if it is not rapidly corrected. Patients with chronic heart disease, patients who have exhibited previous ventricular dysrhythmias, and patients in shock are most susceptible to ventricular fibrillation. The primary treatment is immediate defibrillation to attempt to restore the heart to a normal, or at least nonlethal, rhythm. Defibrillation procedure is the same as for cardioversion, but the defibrillator is not synchronized to fire at the peak of the ventricular contraction (because there is no contraction), and the initial shock setting is usually 200 joules. Medications such as epinephrine (Adrenaline) or lidocaine may be used intravenously in conjunction with defibrillation. Other treatments include cardiopulmonary resuscitation (CPR), oxygenation, and possible endotracheal intubation for airway management. If triggered by shock, fluid or blood volume restoration techniques are required.

Cardiac asystole

If efforts at reversing ventricular fibrillation fail, the rhythm will deteriorate to cardiac asystole. This occurs when there is no cardiac activity and the ECG rhythm is flatline. The patient is in complete cardiac arrest, and full resuscitative measures are employed. CPR, oxygenation and endotracheal intubation, and cardiac medications, such as IV epinephrine, IV atropine sulfate, and IV sodium bicarbonate, are usually required. Defibrillation is not usually indicated unless the patient converts to ventricular fibrillation.

419. Cardiac arrest in the operating room: roles and responsibilities

Fortunately, cardiac arrest in the operating room is a rare event. However, when it does occur, you'll not have time to look in a book for your role and responsibilities. It is imperative you learn exactly what is expected of you as a surgical team member.

Cardiac arrest

Cardiac arrest is the cessation of functional heart activity, thereby stopping circulation, as occurs in asystole or ventricular fibrillation. It may be caused by the body's response to anesthesia or surgery; in which case it is usually preceded by one or more of the complications we previously discussed. Cardiac arrest may also result from heart attack, asphyxiation, electrical shock, hypothermia, or toxic or allergic reactions.

Since you've received training in basic cardiac life support (BCLS) in technical school and will receive regular recertification, we don't discuss the specific techniques, but instead, we concentrate on the specific roles of various team members and the sequence of events that occur during a cardiopulmonary resuscitation effort in the operating room.

Responsibilities of the surgical team during a cardiac arrest

A disciplined, well-trained, and organized team can save lives in emergencies. An inefficient group can panic, cause confusion, and waste valuable time. Even the best team cannot ensure success in every emergency, but the patient's chance of survival greatly increases when each team member understands and fulfills his or her assigned role in an efficient and professional manner.

Anesthetist's role

Since the anesthetist constantly monitors the patient's vital signs, he or she usually identifies a cardiac arrest and is first to act. The anesthetist immediately alerts the surgical team and assumes the role of team leader during the resuscitation efforts using advanced cardiac life-support (ACLS) protocols. If no anesthetist is present, the surgeon or circulating nurse directs the team.

As soon as the cardiac arrest is recognized, the anesthetist verifies the absence of pulse or respirations using standard BCLS protocol. The anesthetist then secures the airway and provides positive pressure ventilation of 100 percent oxygen. If an endotracheal tube is present, its position and adequacy is verified. If the anesthetist cannot ventilate the patient due to an airway obstruction, emergency cricothyroidotomy or tracheostomy may be required.

The various intravenous medications discussed previously are administered to stimulate or control the patient's heart rhythm and maintain normal blood pressure. At this time, the anesthetist tries to determine the specific cause of the arrest and treat it accordingly. Treatment may include procedures such as decompression of a tension pneumothorax or correction of severe hypovolemia with fluids. As time permits, the anesthetist draws blood for blood gas sampling to monitor the body's acid-base and electrolyte balance and maintain them within acceptable limits. The anesthetist constantly monitors the patient's vital signs during the resuscitation efforts; it may become necessary to insert invasive monitoring devices such as arterial lines or central venous pressure lines. A chronological record of all resuscitative measures taken and drugs given must be maintained; this task may be delegated to the circulating nurse as the anesthetist is usually extremely busy.

Surgeon and assistant's role

Immediately upon notification of the cardiac arrest, the surgeon works closely with the anesthetist to administer BLS and ALS. While the anesthetist is maintaining or establishing the patient's airway and respiration, the surgeon or surgeon's assistant starts to provide artificial circulation using external or, if the chest is already open, internal cardiac compression. The chest may have to be "cracked" to start internal compression if external compression is ineffective. In addition, the surgeon may have to help start additional intravenous or arterial lines, especially those requiring a sterile cutdown procedure.

If defibrillation is indicated, the surgeon controls the paddles and determines the power setting. Defibrillation can be done externally, as described previously, or internally by "sandwiching" the heart between two specially designed (sterile) paddles. As previously mentioned, during defibrillation do not touch the patient or any metal item contacting the patient to avoid accidental electrical shock.

If cardiac arrest occurs in the middle of an operation, either the surgeon or first assistant will initiate compression while the person who is free works to control any bleeding at the site. The wound may be packed with moist laparotomy sponges and covered with a sterile drape or towel until the resuscitation is over, or it may be closed during the resuscitation effort. Whenever possible, the latter course of action is taken so that the patient can be transferred to the intensive care unit immediately after being resuscitated.

Circulator's role

Circulating nurses and technicians play key roles during a cardiac arrest. They must be intimately familiar with the location of all anesthesia and emergency resuscitation equipment, supplies, and drugs. They must also know how to operate the equipment and how to assist with preparing drugs and solutions. The following is a list of the major duties performed by the circulators during a cardiac arrest:

1. When the anesthetist announces the arrest, immediately record the time on the operation report and perioperative nursing record. If the operating room is so equipped, start the stopwatch or time clock to provide a visible guide to time elapsed and assist the anesthetist and surgeon when making decisions concerning the timing of medications, treatment, and viability of the patient.
2. Next, notify the other personnel in the surgical department. Most operating rooms have an emergency button that sounds an alarm to individuals or the departments designated to assist with resuscitation.
3. If the patient is not supine, assist with repositioning the patient as directed. If needed, get a stepstool for the person performing the external chest compression.
4. Retrieve the crash cart. This cart contains a defibrillator and other emergency equipment, and usually has supplies, medications, and forms used for managing arrests.
5. Control traffic. This seemingly minor detail is essential to maintaining an effective resuscitation effort. The senior ranking or most experienced circulating nurse should delegate tasks to capable assistants. A cardiac arrest usually brings a throng of people to the operating room. If too many people try to help, they get in the way and hinder the resuscitation. Never allow curious onlookers into the room, and do not let personnel just stand around. If they cannot help, get them out of the way!
6. Assist the anesthetist as needed; monitor intravenous lines, obtain extra supplies, assist with maintaining the patient's airway, help draw blood samples, complete laboratory and other test request forms, and help prepare and administer emergency drugs.
7. Provide necessary supplies to and conduct sponge, needle, and instrument counts with the scrub technician. Every effort should be made to preserve the sterile field.
8. The anesthetist may delegate the circulator to record the resuscitation events. This record includes the time of each action taken and the type, dosage, and time of administration of all drugs.

As you can see, the circulators will be very busy, and it is imperative that they really know their stuff. So, what is the scrub technician doing all this time?

Scrub's role

Your primary responsibility, as the scrub technician, during a cardiac arrest is to keep the sterile field from becoming contaminated—this can be nearly impossible if the room gets crowded with helpers.

If the arrest occurs in midoperation, assist with packing and covering the wound or with closure if the surgeon chooses to do so. As with any other surgical procedure, all sponges, needles, blades, and instruments must be counted. If the primary circulating nurse is busy, perform the count with another licensed provider. If the patient must be repositioned, maintain or reestablish the integrity of the sterile field, if possible. Assist with sterile procedures such as tracheostomy and vein or artery cutdown, as required. In a nutshell, you assist the surgeon so the circulator can concentrate on helping the anesthetist.

Knowing how to perform BCLS and what to do in an arrest situation is a must for all surgical personnel. You must be briefed and have a working knowledge of all local policies and procedures that address emergency situations.

In addition to respiratory and cardiovascular complications, there are a few other complications worthy of discussion. These are complications associated with the administration of local and regional anesthetics and a rare but serious condition, malignant hyperthermia.

420. Other complications of anesthesia

In addition to respiratory and cardiovascular complications, patients have numerous other reactions to administration of anesthesia.

Reactions to and side effects of local anesthetic agents

Reactions to local anesthetics are rare, but as with all anesthesia administration, the patient must be carefully observed and monitored for signs and symptoms. Regardless of the method chosen, local infiltration, topical administration, or major conduction block, each local anesthetic has inherent risks. Patient reactions to local anesthetics are generally related to either the toxicity of the agent, allergy, or individual patient idiosyncrasies. If a patient reacts to local anesthesia when the surgeon is administering the anesthetic, immediately notify the anesthesia staff to evaluate the patient and provide advanced treatment as required.

Toxic reaction

Each local anesthetic agent has an individual maximum dose and level of toxicity, and these may vary depending on the intended use and injection site. Toxicity depends on the area of injection, the dose injected, the level of agent in the blood, and whether epinephrine, which slows absorption, has been added to the agent. Anesthetic injected into highly vascular areas, such as the intercostal, caudal, or epidural regions, reaches toxic levels faster than if the same anesthetic is injected into subcutaneous tissue. Toxic reactions can occur if the maximum recommended dose is exceeded, or if the anesthetic is unintentionally injected directly into the bloodstream through a vessel.

Initial symptoms of toxic reaction include dizziness, metallic taste in the mouth, numbness around the lips or tongue, slurred speech, and ringing in the ears. As toxicity increases, seizure, hypotension, cardiac dysrhythmia, and cardiac arrest can occur. If the patient exhibits any symptom of a toxic reaction, immediately:

- Notify the surgeon or anesthetist so the anesthetic injection (if still in progress) can be stopped.
- Support the patient’s airway and administer oxygen.

Specific treatment includes IV barbiturates (Pentothal), benzodiazepines (Valium), and possibly a muscle relaxant to control the airway.

Allergic or anaphylactic reactions

As stated above, adverse reactions to local anesthetics are rare; true allergic reactions are rarer still. Less than 1 percent of all adverse reactions are due to true hypersensitivity or allergy. When one does occur, it is usually from the “ester type” of local anesthetic (procaine, chloroprocaine, tetracaine); the “amide type” local anesthetics (lidocaine, mepivacaine, bupivacaine) are virtually free from reactions.

Cross sensitivity is not usually a problem; if a patient is allergic to one type, the other can be used. If a patient reacts to the preservatives used in some solutions, preservative-free anesthetic agents are available.

Initial symptoms of allergic reaction include hives (urticaria), swelling, rashes, and wheezing. Untreated reactions may lead to respiratory distress, and/or cardiovascular collapse. Initial treatment is the same as for toxic reactions. Specific treatment may include administration of fluids, epinephrine, diphenhydramine (Benadryl), and possibly a systemic steroid such as methylprednisolone (Solu-Medrol).

Patient idiosyncrasies

Patients often believe they are having (or have had) an allergic reaction to a local anesthetic, when in fact they experience an expected (by the health care provider) result or sensation. The patient may feel his or her heart pounding (palpitations), feel flushed, develop tremors and dizziness, or even faint. Many times, these symptoms result from epinephrine added to the local anesthetic. Epinephrine causes blood pressure to rise and increases the patient's heart rate. This increase may also cause mild dysrhythmias. When cocaine is used as an anesthetic, it also may produce these symptoms.

Never dismiss or take these patients' complaints lightly. Reassure them and explain what is happening. Closely monitor them; they know how they normally feel and react, and are usually the first to know when something does not feel right.

Complications of major conduction blocks

In addition to local anesthetic reactions, during spinal, epidural, and other regional blocks, complications can occur. These include nerve or vascular damage, poorly controlled or uncontrolled blocks, and postspinal headaches. Most complications are temporary, but some can cause permanent damage.

Damage to nerve fibers or blood vessels can be caused by incorrect needle placement. The needle can puncture or tear the nerve or vessel. Injection of the agent directly into the nerve, rather than next to it, may distort or tear nerve fibers. Rupture of nearby small blood vessels can cause a hematoma and compress the nerve. A puncture or tear in a major artery or vessel can lead to extensive blood loss and require surgical repair. Nerve damage effects range from loss of sensation, through chronic pain, to total loss of function, and may be temporary or permanent, depending on the nerves involved and extent of damage. Fortunately, use of proper techniques makes any of these complications extremely rare.

Poor control or no control of the block is a complication associated with spinal and epidural anesthesia. The level of anesthesia progresses towards the patient's head and enters the cervical nerves ("high spinal") and brainstem IF:

- too much local anesthetic is given,
- it is injected into the wrong area (epidural injection into the subarachnoid space), or
- the patient is improperly positioned after the injection.

Depending on the severity, this can cause significant decrease in blood pressure, slow the patient's heart rate, paralyze the patient's respiratory muscles, or cause unconsciousness ("total spinal"). Treatment ranges from medication for blood pressure and pulse control through intubation with mechanical ventilation. Total spinal block is an emergency situation; it is taken as seriously as cardiac arrest. Cardiac arrest can be a consequence if the agent is injected into an epidural vein.

When the dura in the spinal canal is punctured during a spinal anesthetic, a spinal tap, or (unintentionally) an epidural anesthetic, there is a risk of developing a "post-spinal headache" or a *postdural puncture headache (PDPHA).* This headache usually develops 24 to 48 hours after the puncture, and is caused by the cerebral spinal fluid (CSF) leaking through the puncture hole in the dura and decreasing the intracranial pressure. Young pregnant females are most susceptible; the

elderly are least susceptible. Symptoms are severe frontal or occipital pain, sometimes incapacitating, that increases in the sitting position. It is sometimes associated with double vision (diplopia), nausea, vomiting, ringing in the ears, and stiff neck. Prevention consists of using the smallest spinal needle possible (25- or 27-gauge), entry into the dura with the bevel parallel to the dural fibers (lateral approach), or the use of "pencil-point" needles such as the Sprotte or Whitacre. Treatment consists of using (1) analgesics, IV or oral hydration, and bed rest; (2) epidural blood patch; (3) oral or IV administration of caffeine.

Malignant hyperthermia

One of the most serious and potentially life-threatening anesthesia complications that can occur is malignant hyperthermia (MH). It is characterized by progressive elevation of a patient's body temperature to dangerously high levels. It occurs suddenly and without warning, and only the rapid response of the surgical team can save the patient.

Malignant hyperthermia is a rare, inherited disorder of the skeletal muscles. It has also been associated with other disorders such as muscular dystrophy. This syndrome is fairly unique to anesthetic practice; in other words, the disorder shows up only when the patient is administered certain medications or anesthetic drugs known as "triggering agents." MH is triggered by all volatile inhalation anesthetics and by succinylcholine (Anectine). This condition is thought to be due to an abnormally rapid rise in intracellular calcium, resulting in a rapidly accelerated metabolism.

Symptoms may include tachycardia, tachypnea (rapid respiratory rate), acidosis, cyanosis (blue skin color), rigidity (especially in the jaw muscles), and dangerously high fever. The high fever is usually a late sign and signifies a poor prognosis. Prompt recognition is the key to successful treatment. Most operating rooms have a plan of action to handle malignant hyperthermia. This plan may include a special "MH cart" or designated area in the surgical department where all necessary drugs and supplies to treat malignant hyperthermia are maintained.

The anesthetist will suspect MH if any of the previously mentioned symptoms occur. He or she will confirm the diagnosis by obtaining an arterial blood gas sample and electrolytes. These tests will show low oxygenation, severe respiratory and metabolic acidosis, and elevated potassium levels. In addition, the End-Tidal Carbon Dioxide Monitor may show elevated carbon dioxide. The usual treatment includes the following:

1. The anesthetist will stop anesthesia and the surgery will be canceled immediately.
2. The patient is hyperventilated with 100 percent oxygen, ideally with a source other than the anesthesia machine.
3. The patient is administered IV dantrolene (Dantrium), a drug specifically developed for the treatment of MH. This orange-colored, powdered drug comes in large vials, and must be reconstituted with sterile water. In addition, the patient receives large doses of IV sodium bicarbonate.
4. Cool down the body as quickly as possible. This includes the application of a cooling blanket and ice bags, infusion of a large amount of cold saline intravenously, and cold irrigation of the stomach, bladder, rectum, and open surgical wound, if applicable.
5. The anesthetist administers drugs, such as furosemide (Lasix) and mannitol, to maintain a urine output, and an insulin and glucose combination to control the elevated potassium and cardiac dysrhythmias.
6. To adequately monitor the patient, an arterial line and Foley catheter is inserted. Additional IV lines may be started. You may need to assist in obtaining the necessary supplies for these procedures. In addition, the anesthetist and surgeon obtain numerous stat blood tests, so a circulator may be assigned as a "runner" to and from the laboratory.

After studying this unit, you should have a better appreciation for the enormous responsibilities placed on the anesthetist's shoulders and some of the ways you can help anesthesia personnel, the

surgeon, and the OR nurses with recognizing and managing the more common anesthesia complications and emergency situations. But studying is not enough! To be a truly productive and respected member of the surgical team, be alert and know, not only what needs to be done, but how, why, and when it should be done. You must live and practice awareness whenever and wherever patients are. Developing into this type of surgical specialist doesn't come quickly, and it definitely isn't easy, but you'll be rewarded when you realize that you were part of a close-knit team that saved a patient's life—it's a feeling you don't forget!

Self-Test Questions

After you complete these questions, you may check your answers at the end of the unit.

417. Respiratory complications: causes and management

1. What is the most common and potentially fatal complication of anesthesia?

2. List four causes of respiratory obstruction.

3. Identify three methods an anesthetist can use to relieve an obstructed airway caused by relaxed throat muscles or the tongue blocking breathing passages.

4. What is laryngospasm? Bronchospasm?

5. What two conditions make patients highly susceptible to laryngospasm or bronchospasm?

6. List some of the actions the anesthetist can take to treat bronchospasms or laryngospasms?

7. What may happen if a patient aspirates highly acidic gastric contents?

8. Why does the presence of large amounts of gas in the patient's stomach concern the anesthetist?

9. List two conditions that can cause a buildup of gas in the patient's stomach.

10. What is the best preparation for preventing aspiration?

11. Briefly list five steps taken to treat a patient who has aspirated.

418. Cardiovascular complications: causes and management

1. Briefly define shock.

2. List five symptoms of shock.

3. List four situations that can cause a patient to go into shock.

4. What does basic treatment for shock include?

5. Cite four ways to control blood loss.

6. When are topical hemostatic agents most likely used to control hemorrhage?

7. What plasma volume expanders may be given instead of a blood transfusion?

8. What is autotransfusion?

9. Briefly describe the steps taken to order blood if a transfusion is needed and no blood has been reserved.

10. What type of blood or blood component may be ordered and transfused if there is no time to perform a type and cross match?

11. Information on what items must correctly match the information on the blood label to prevent the patient from receiving the wrong blood?

12. What must be done first if a patient has a transfusion reaction?

13. What are the symptoms of air embolism developing in a patient's venous system?

14. What may result if air enters the arterial system?

15. What position must the patient be put into immediately to prevent a venous air embolism from entering the pulmonary circulation?

16. List the causes of cardiac dysrhythmias.

17. What is a premature ventricular contraction?

18. What is first suspected if a generally healthy patient begins having multiple premature ventricular contractions?

19. What is V-tach? Why is it dangerous?

20. How are the defibrillator paddles usually placed?

21. What is ventricular fibrillation?

419. Cardiac arrest in the operating room: roles and responsibilities

1. Briefly define cardiac arrest.

2. Who usually identifies a cardiac arrest in the operating room?

3. Who takes charge of resuscitation efforts if no anesthetist is present?

4. What does the surgeon do while the anesthetist maintains the patient's airway and ventilates the lungs?

5. Who controls the defibrillator paddles and determines the proper defibrillator power setting?

6. List the circulator's duties during cardiac arrest.

7. What is the scrub's primary role during a cardiac arrest?

420. Other complications of anesthesia

1. What are the main factors that determine toxicity of local anesthetic agents?

2. List the initial symptoms of local anesthetic toxicity.

3. What steps should you immediately take if a patient exhibits symptoms of a toxic reaction?

4. What symptoms characterize a true allergic reaction to a local anesthetic agent?

5. During administration of spinal, epidural, and regional nerve blocks, how can nerves be damaged?

6. What four complications can result when the level of spinal or epidural anesthesia gets too high?

7. What is the key to effective treatment of malignant hyperthermia?

8. Describe treatment measures for malignant hyperthermia.

9. List four ways the surgical team can lower a patient's temperature when treating malignant hyperthermia.

Answers to Self-Test Questions

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1. Anesthesia is simply defined as insensibility or loss of sensation with or without loss of consciousness.
2. Amnesia, analgesia, hypnosis, and muscle relaxation.
3. Conduction anesthesia is the injection of an agent close to a nerve or nerves to provide analgesia to a specific area of the body without the loss of consciousness.
4. Any five of the following:
   (1) type of surgery.
   (2) surgical position.
   (3) degree of muscle relaxation required.
   (4) surgical technique.
   (5) urgency of the procedure.
   (6) operating environment.
   (7) skill and experience of the anesthetist.
5. Both codes help anesthesia personnel select the best anesthetic and communicate the patient's anesthesia risk to other providers.

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1. (1) Psychological premedication refers to drugs used to reduce a patient's anxiety, and (2) physiological premedication agents are used to affect one or more body system to help medically maintain the patient during the procedure.
2. (1) b.
   (2) a.
   (3) b.
   (4) c.
   (5) a.
   (6) d.
3. 45 to 60 minutes before surgery.
4. The desired effects of the drugs may not be present.
5. The elderly, extremely ill patients, patients with uncommon diseases, and (sometimes) ambulatory surgery patients.
6. The two schools of thought are not giving premedications because they may increase recovery time vs. using short-acting premedications for patient comfort.

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1. By concentrating in the blood supplying the brain and disrupting normal brain functions until the patient lapses into unconsciousness.
2. The type and amount of the anesthetic used and the individual patient.
3. Inhalation and intravenous methods.
4. Volatile liquid and compressed gas agents.
5. Potent, nonflammable, volatile liquid agents are changed from liquid to gas in closed containers called vaporizers. A selected mixture of gases is delivered into the vaporizer containing the liquid to produce a concentration of volatile agent and gas. The vapor and gas mixture is then delivered to the lungs via the anesthesia machine.
6. Any three of the following: isoflurane (Forane), enflurane (Ethrane), halothane (Fluothane), or desflurane (Suprane).
7. Nitrous oxide.
8. An endotracheal tube is inserted into the patient's mouth or nose and threaded through the trachea to a level just above the point where the bronchi branch off.

9. Helps hold the tube in place, prevents backflow of gases around the tube, and keeps the patient from aspirating secretions and emesis into the lungs.
10. Extubation.
11. Collects the patient's exhaled gas and helps the anesthetist to breathe for or *ventilate* the patient by squeezing the bag.
12. Collects the patient's exhaled gases and either actively suctions out or passively vents them out of the hospital to prevent surgical team members from inhaling potentially harmful gases.
13. In a closed system, the patient's exhaled air is filtered through canisters containing a chemical carbon dioxide (CO_2) absorber (usually soda lime), and then *all* anesthetic agents and gases are mixed with fresh oxygen and rebreathed. In a partial rebreathing system some of the patient's expired air and gas is filtered through the CO_2 absorber (semiclosed), or some is released through the pressure relief valve (semiopen), and the rest is rebreathed by the patient.
14. They are introduced into a peripheral arm vein through an intravenous catheter connected to flexible IV tubing. The agents may be injected directly into the vein through a stopcock on the IV tubing, or they may be mixed with the IV solution and dripped into the patient's bloodstream throughout the operation.
15. They must have time to leave the brain and other blood-rich organs, and then be metabolized by the liver or kidneys before leaving the body.
16. Because they do not provide muscle relaxation or analgesia, only hypnosis and amnesia.
17. Anesthetic agents alone may not relax the jaw and laryngeal muscles enough for intubation, or may not produce the muscle paralysis or relaxation the surgeon needs for exposure and wound closure.
18. Any three of the following: succinylcholine (Anectine), atracurium (Tracrium), vecuronium (Norcuron), mivacurium (Mivacron), pancuronium (Pavulon), pipecuronium (Arduan), doxacurium (Nuromax), tubocurarine, gallamine, or metocurine.
19. Dissociative anesthesia provides analgesia and amnesia; the patient appears awake but is actually unaware of or dissociated from his or her surroundings. Ketamine hydrochloride (Ketalar) is almost exclusively used to produce this effect; it works by selectively blocking sensory receptors in the brain without depressing the entire central nervous system.
20. A combination of several types of intravenous and inhalation anesthetic agents to produce a general anesthesia to meet the needs of the individual patient and procedure.

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1. By deadening the sensory nerves, or pain receptors, in a specific body area and blocking the conduction of sensory and motor impulses to the brain.
2. Local and regional.
3. Direct application of anesthetic agents on tissue surfaces.
4. Solutions, ointments, or gels containing cocaine, lidocaine, tetracaine, or benzocaine.
5. The injection of a conduction anesthetic agent beneath the skin or directly into the tissue at the operative site.
6. Any three of the following: lidocaine, procaine, tetracaine, mepivacaine, and bupivacaine.
7. To prolong the effect of the anesthetic's action, decrease the rate of absorption, and control bleeding by constricting small peripheral blood vessels.
8. The injection of anesthetic agent near a specific nerve or group of nerves to block receptors from the entire area. Regional nerve blocks produce a wider and more extensive area of anesthesia than local infiltration.
9. A field block numbs a body area by infiltrating large amounts of local anesthetic agent into the general operative area to numb the nerve branches and ends that serve the area; it can be compared to a large, local infiltration. A peripheral nerve block involves injection of the anesthetic next to the trunk of a major nerve to interrupt nerve function in all branches of this nerve (which may be some distance from the operative site) to block receptors from the entire area.
10. A regional nerve block that produces anesthesia by injecting a local anesthetic agent into the veins of a limb rendered bloodless by application of an Esmarch bandage and a tourniquet.
11. Pneumatic, double-bladder/double-cuffed.

12. To allow a gradual release of the anesthetic agent into the circulatory system and return of blood to the extremity. This reduces the possibility of a toxic reaction.
13. (1) b.
    (2) a.
    (3) c.
    (4) a, c.
    (5) a, b, e.
    (6) a.
    (7) b.
    (8) e.

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1. To supplement or to replace body fluids lost before, during, and after a surgical procedure.
2. Most commonly inserted in a distal vein (metacarpal vein) of the patient's nondominant hand.
3. Most IV solutions come in flexible plastic bags or plastic bottles; a few are in glass containers.
4. To prevent the air from entering the patient's venous system and causing *air emboli.*
5. The over-the-needle catheter is most commonly used for adult patients; while short, beveled needles with single or double plastic "butterfly" tabs are routinely used for pediatric patients.
6. If the vein diameter is larger than the catheter, insert the catheter needle with the bevel up (you can see the needle lumen).
7. Swelling or discoloration indicates the catheter may not be within the vessel and the IV solution is infiltrating the surrounding soft tissue.
8. Record the date and time the infusion was stopped and the total amount of fluid given. Also, list any reaction the patient had and the name or initials of the person discontinuing the IV.

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1. You may be required to change gas tanks, the chemical CO_2 absorbing compound (soda lime) canisters, or breathing circuits on the machine.
2. You must be trained and thoroughly familiar with them; observe all safety precautions, and follow any directions specific to the machine you are using. You also NEVER touch an anesthesia machine unless you know exactly what you are doing and have specific permission from the anesthesia staff to do so.
3. It is inserted to guide or stiffen the ET-tube if necessary.
4. The gel acts as a lubricant to help reduce laryngeal and tracheal irritation and reduce risk of laryngospasm.
5. A laryngotracheal anesthesia kit. It consists of a special disposable cartridge-type syringe with a long flexible plastic tip. The kit is used to spray the local anesthetic on the vocal cords or exactly where the anesthetist desires to further reduce the incidence of intubation-induced laryngospasm.

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1. (1) b.
   (2) c.
   (3) d.
   (4) c.
   (5) a.
   (6) b.
   (7) a.
2. Any four of the following:
   (1) Open and set up all instruments and supplies prior to anesthesia induction.
   (2) Suspend all nonessential activities.
   (3) Be especially careful not to drop items on the floor.
   (4) Avoid unnecessary conversation and movement.

(5) Keep overhead surgical lights off the patient's face and eyes.

(6) Stay close to and reassure the patient.

3. When the patient reaches stage III (surgical stage).
4. Approximately one finger width below the patient's Adam's apple.
5. Remove the mask from the anesthesia breathing circuit and pass the connector end of the circuit to the anesthetist.
6. Any four of the following:
   (1) Assist with patient positioning.
   (2) Assist with monitoring blood and body fluid loss.
   (3) Obtain additional anesthesia supplies as needed.
   (4) Retrieve blood or blood components and assist with administering transfusions.
   (5) Assist with starting and monitoring special intravenous or arterial pressure monitoring lines.
   (6) Assist with anesthetic emergencies by obtaining resuscitation equipment and supplies and remaining available to assist with resuscitation as directed.
7. When stage II is complete and the patient is breathing spontaneously (unassisted) and normal reflex activity returns.
8. Anesthetic agents may affect the patient's temperature-regulating mechanisms and cause the patient to become chilled very easily.
9. Empty all drainage containers, and measure the contents for the anesthetist.

415

1. The surgeon's preference card and the surgery scheduling form.
2. The expiration dates and additives such as epinephrine.
3. (1) Type of medication to be administered.
   (2) Volume of medication to be administered.
   (3) Degree of accuracy required in measuring the dosage of the medication.
   (4) The surgeon's preference based on experience and training.
4. The Luer-lock tip allows the surgeon to twist and lock the hub of the needle to the tip of the syringe.
5. The viscosity or thickness of the solution to be injected, volume of solution, the depth and extent if the injection site, and the discomfort the patient may experience when a particular needle is used.
6. Small diameter (25- to 30-gauge), short (1/2- to 1-inch) needles.
7. In a locked drug cabinet. Because cocaine is a federally controlled substance.
8. Amount dispensed, date, time, patient's hospital register number or social security number, patient's name, and pharmacy control or prescription number.
9. The unused portion is verified by the OR nurse or anesthetist, and the balance properly recorded on the AF Form 579, Controlled Substances Register.
10. Patients anesthetized via conduction anesthetics are often awake and aware of their surroundings. Many are apprehensive about what is happening to them and what they see and hear; some medications (such as ketamine) can intensify these effects.
11. (1) Provide a pillow for the head if the procedure allows.
    (2) Ensure potential pressure points are well padded, and rolled sheets or pillows support areas subject to muscle strain.
    (3) Fasten a privacy sheet between two IV poles at the head of the bed to screen the view of the operative site and prevent the patient from becoming embarrassed, as well as the surgical drapes from covering the patient's face.
    (4) Provide the patient with warm sheets or blankets.
12. Keep the patient informed about what is being done, how long it will take, and the sensations they may feel; use warm prep solutions; minimize body exposure; if possible, have a team member who is the same sex as the patient do the prep.

13. Every 5 to 15 minutes.
14. Patient's vital signs, type and amount of all drugs given, route and time of drug administration, remarks on the patient's condition and responses during the procedure, the operation performed, the operation start and finish times, and the name of the surgeon.
15. Any five of the following:
    (1) Take a last set of vital signs.
    (2) Record all IV fluids administered.
    (3) Remove monitoring equipment.
    (4) Cover the patient with a warm sheet or blanket.
    (5) Assist the patient in moving from the OR bed to the transport gurney.
    (6) Call the nursing unit and give a patient status report.
16. Some drugs may interact with the metal.
17. By pointing the tip toward the ceiling and pushing the plunger until the air is gone and a few drops of solution squirt out of the needle.
18. A hands-free method. If the surgeon requires you to pass the syringe, pass it in the position of use with the plunger facing the surgeon.
19. By adding the amounts left in the syringe and container on the sterile field and subtracting this amount from the amount of solution you received from the circulator.

416

1. Pad the tourniquet site with webril.
2. By elevating the limb, wrapping an Esmarch bandage from the distal end of the extremity towards the tourniquet, and then inflating the proximal tourniquet cuff.
3. For the sitting position administration of the spinal, epidural, or caudal blocks, the patient is seated with feet supported on a sitting stool padded with a sheet or blanket, with buttocks and back even with the edge of the OR bed closest to the anesthetist, and with the circulator supporting patient's upper body by facing him or her with hands on patient's shoulders. For the lateral recumbent position administration, the patient is placed on side with buttock and lower back even with side of bed closest to anesthetist; the circulator stands in front of patient and helps maintain tucked position by placing one arm behind patient's knees and the other arm or hand behind patient's neck.
4. Because a sudden flinch or twist can cause disruption of the position of the needle and injure a nerve or blood vessel.
5. (1) Place a pillow under the patient's head.
   (2) Position the arm boards so patient's arms are above the head of the bed, flexed at the elbows.
   (3) Place a warm blanket or sheet over the patient's back and shoulders.
   (4) Position safety straps as directed.

417

1. Loss of a patent airway.
2. Any four of the following:
   (1) Excessive relaxation and backward displacement of the jaw and tongue.
   (2) Inadequate relaxation or premature attempt at intubation.
   (3) Pre-existing physiological conditions or anatomical structure.
   (4) Vomitus or excessive secretions.
   (5) Hyperextension, hyperflexion, and anatomical pressure.
   (6) Accidental or premature extubation.
3. Any three of the following:
   (1) The head-tilt/chin-lift.
   (2) The head-tilt/jaw thrust.
   (3) An oral airway may be inserted.

(4) The patient may be intubated.

4. Laryngospasm is the involuntary contraction of the vocal cords. Bronchospasm is the contraction of the muscle layer of the bronchi.
5. Cigarette smoking and chronic bronchitis.
6. (1) Administer oxygen under gentle pressure using the rebreathing bag.
   (2) Administer additional medications or anesthetic agents.
   (3) Clear any irritant, using suction.
   (4) Perform emergency endotracheal intubation.
   (5) Perform a tracheotomy or cricothyroidotomy.
7. Chemical irritation and damage of lungs, possibly resulting in death.
8. The gas can cause pressure in the stomach and literally "blow" gastric contents into the esophagus; it can also impair respiration by causing excessive pressure on the diaphragm.
9. (1) It may be forced through the esophagus into the stomach during positive-pressure ventilation using a face mask.
   (2) Extended use of nitrous oxide may result in the gas diffusing through the gastrointestinal tissues and accumulating in the stomach and intestines.
10. Delaying surgery until the stomach has emptied.
11. (1) Place the OR bed in the Trendelenburg (head down) position and turn the patient's head to the side.
    (2) Suction the patient's oropharynx, trachea, and bronchial tree.
    (3) Set up and perform an emergency bronchoscopy if solid aspirate is obstructing the airway.
    (4) Provide continuous positive-pressure ventilation (of 100 percent oxygen) between suctioning.
    (5) Administer drugs and IV fluids to cause bronchial dilation (open constricted airways) and to maintain blood pressure.

418

1. The body's reaction to insufficient blood circulation or circulatory collapse. Shock is usually caused by a decrease in blood return to the heart, which naturally results in decreased blood flow from the heart.
2. Any five of the following:
   (1) Hypotension (low blood pressure).
   (2) Weak, rapid pulse.
   (3) Pale, clammy skin.
   (4) Shallow, irregular breathing.
   (5) Restlessness.
   (6) Confusion.
   (7) Weakness.
   (8) Decreased urine output.
3. (1) Overdose of anesthetic agents (stage IV) leading to cardiovascular collapse.
   (2) Aggravation of a preexisting condition, such as anemia, diabetes, cardiovascular or lung disease, or by the stress of the surgical procedure.
   (3) *Hypovolemia* (decreased volume of circulating blood and fluids) caused by severe hemorrhage or insensible losses.
   (4) Inadequate venous return to the heart causing *hypotension* (low blood pressure) due to poor positioning of the surgical patient.
4. Maintaining an open airway and providing oxygen, restoring the fluid balance using intravenous fluids or blood products, placing the patient in the supine position with feet elevated, keeping the patient warm and quiet, and controlling hemorrhage.
5. (1) Use of topical hemostatic agents.
   (2) Direct pressure over wound.
   (3) Pressure on pressure points.

(4) Application of a tourniquet.

6. When a relatively large area is oozing blood, and the bleeding cannot be controlled by clamping, ligation, or cauterization.
7. Dextran, human albumin, or plasma protein fraction.
8. Autotransfusion involves collecting the patient's own blood, called autologous blood, for reinfusion.
9. The anesthetist draws tubes of blood from the patient. While the anesthetist draws the blood, the circulator initiates the paperwork. The anesthetist (or person who drew the blood samples) then verifies the accuracy of the form and blood tube labels and signs the SF 518. A member of the surgical team (not scrubbed in), who witnessed the blood drawing, rechecks all information for accuracy and signs the form. The form and the labeled blood vials are taken directly to the hospital blood bank for processing.
10. ABO/Rh compatible blood (preferably) or O negative blood along with other IV plasma expanders.
11. All information contained on the blood unit label must exactly match the corresponding information on the request form and the patient's identification.
12. Stop the transfusion immediately and record the reaction on the SF 518.
13. Hypotension, cardiac dysrhythmias, hypoxia, and possible cardiac arrest.
14. Air embolism blocks the flow of blood in the coronary arteries and produces dysrhythmias and cardiac arrest, or it may enter the cerebral (brain) circulation and result in a stroke.
15. Extreme Trendelenburg with the patient's right side up.
16. Hypoxia, severe hemorrhage, hypovolemia, pain, fever, heart disease, heart attack, myocardial ischemia, drug overdose, toxic levels of anesthetic agents, and chemical or electrolyte imbalances in the body.
17. A contraction of the heart ventricles before the normal contraction sequence.
18. Inadequate oxygenation.
19. Ventricular tachycardia. Very rapid contractions of the ventricles—more than 100 per minute—basically a rapid sequence of PVCs. The incomplete and insufficient contractions of the ventricles reduce the pumping efficiency of the heart and decrease blood circulation.
20. One defibrillator paddle is usually placed just below the clavicle and slightly to the right of the sternum; the other just under the left nipple.
21. Rapid, irregular, uncoordinated quivering of the entire heart muscle that makes it incapable of pumping blood.

419

1. Cardiac arrest is the cessation of functional heart activity, thereby stopping circulation, as occurs in asystole or ventricular fibrillation.
2. The anesthetist.
3. The surgeon or circulating nurse directs the team.
4. Provides artificial circulation using external or, if the chest is already open, internal cardiac compression.
5. The surgeon.
6. (1) Immediately record the time on the operation report and perioperative nursing record. Start the time clock.
   (2) Notify the other personnel in the surgical department.
   (3) Assist with repositioning the patient as directed.
   (4) Retrieve the crash cart.
   (5) CONTROL TRAFFIC.
   (6) Assist the anesthetist as needed.
   (7) Provide necessary supplies to and conduct sponge, needle, and instrument counts with the scrub technician.
   (8) Record the resuscitation events if delegated.
7. Maintain sterility of sterile field.

420

1. Area of injection, the dose injected, the level of agent in the blood, and whether epinephrine, which slows absorption, has been added to the local anesthetic agent.
2. Dizziness, metallic taste in the mouth, numbness around the lips and tongue, slurred speech, and ringing in the ears.
3. Notify the surgeon or anesthetist and help support the patient's airway and administer oxygen.
4. Initial symptoms of allergic reaction include hives (urticaria), swelling, rashes, and wheezing.
5. (1) Incorrect needle placement can puncture or tear the nerve.
   (2) Injection may distort or tear nerve.
   (3) Rupture of nearby small blood vessels can cause a hematoma and compress the nerve.
6. (1) Significant decrease in blood pressure.
   (2) Slowing of the patient's heart rate.
   (3) Paralysis of the patient's respiratory muscles, or
   (4) Unconsciousness ("total spinal").
7. Prompt recognition.
8. (1) Stop anesthesia and cancel the surgery immediately.
   (2) Hyperventilate the patient with 100 percent oxygen, ideally with a source other than the anesthesia machine.
   (3) Administer IV dantrolene (Dantrium).
   (4) Cool down the body as quickly as possible.
   (5) Administer drugs, such as furosemide (Lasix) and mannitol, to maintain a urine output, and an insulin and glucose combination to control the elevated potassium and cardiac dysrhythmias.
   (6) Monitor the patient adequately by inserting an arterial line, Foley catheter, and, possibly, also additional IV lines.
9. (1) Application of a cooling blanket.
   (2) Application of ice bags.
   (3) Administering of cold IV solutions.
   (4) Cold irrigations of the stomach, bladder, rectum, and the open surgical wound with sterile saline, if applicable.

Do the unit review exercises before going to the next unit.

Unit Review Exercises

Note to Student: Consider all choices carefully, select the *best* answer to each question, and *circle* the corresponding letter.

Do not return your answer sheet to AFCDA.

22. (408) What is a simple definition of anesthesia?
    a. Lessening of, or insensibility to pain.
    b. Loss of control over voluntary reflexes.
    c. Insensibility or loss of sensation, with or without loss of consciousness.
    d. Loss of consciousness, with or without loss of sensation or insensibility.

23. (408) Which of the following is *not* a factor an anesthetist usually considers when selecting the type of anesthesia best suited for a particular patient?
    a. Patient's personal preference.
    b. Type of surgery to be performed.
    c. Type of surgical position required.
    d. Skill and experience of surgical assistants.

24. (409) What are the two basic reasons a patient is given preoperative medication?
    a. Psychological and physiological.
    b. Physiological and psychosocial.
    c. Psychomatic and hypochondric.
    d. Psychosocial and psychomatic.

25. (409) Anticholinergic agents are administered preoperatively to
    a. provide local analgesia and reverse the effects of narcotics.
    b. dry up mucous secretions in the oral and respiratory tract.
    c. depress respiration and dilate peripheral blood vessels.
    d. help the patient sleep and reduce pre-op "jitters".

26. (410) What is probably the *most* commonly used anesthetic gas?
    a. Nitrous oxide.
    b. Cyclopropane.
    c. Ethylene oxide.
    d. Methoxyflurane.

27. (410) When thiopental sodium (Sodium Pentothal) is used for rapid induction of anesthesia, it *must* be supplemented because it does *not* provide
    a. analgesia or hypnosis.
    b. hypnosis and amnesia.
    c. amnesia or muscle relaxation.
    d. muscle relaxation or analgesia.

28. (410) What drug is primarily used to produce dissociative anesthesia?
    a. Narcan.
    b. Innovar.
    c. Fentanyl.
    d. Ketamine hydrochloride (Ketalar).

29. (411) What are the two main categories of conduction anesthesia?
    a. Local and regional.
    b. General and hypnotic.
    c. Inhalation and Intravenous.
    d. Hypotension and hypothermia.

30. (411) The injection of a local anesthetic into the vein of an exsanguinated extremity produces a type of regional anesthesia known as a
    a. hypobaric block.
    b. saddle block.
    c. field block.
    d. Bier block.

31. (411) Which regional nerve block *normally* requires the *greatest* amount of local anesthetic?
    a. Spinal.
    b. Caudal.
    c. Epidural.
    d. Subarachnoid.

32. (412) What action *should* be taken before connecting the IV administration tubing to the solution bag or bottle?
    a. Flush the tubing to remove all the air.
    b. Check the solution for discoloration and sediments.
    c. Invert the solution bag or bottle and hang it from the IV pole.
    d. Connect the tubing to the IV catheter to avoid wasting solution.

33. (412) If the catheter package label is *not* used, what information is typically written on the tape securing the IV catheter?
    a. Type of catheter inserted, name of the vein it was inserted into, and initials of the inserter.
    b. Patient's hospital registry number, date and time of insertion, and type of catheter used.
    c. The size administration tubing used, solution being infused, and date IV was started.
    d. The size and type of catheter, date and time of insertion, and initials of inserter.

34. (413) What is the purpose of the soda lime canister used in the anesthesia machine?
    a. Absorb excess carbon dioxide.
    b. Absorb excess anesthetic gases.
    c. Regulate the humidity of insufflated agents.
    d. Regulate the rate of compressed gas flow.

35. (413) When is it permissible for a surgical technician to touch the anesthesia machine?
    a. Only after a surgical procedure is done and the patient has left the room.
    b. Only when a member of the anesthesia staff directs you to do so.
    c. Only when changing compressed gas tanks and soda lime.
    d. Only during an anesthetic emergency.

36. (413) What is the purpose of the laryngo-tracheal anesthetic (LTA) kit?
    a. Numb the vocal cords before intubation to reduce chances of spasm.
    b. Insert a large bore catheter or tube into the trachea to maintain the airway.
    c. Insert a small bore catheter or needle into the trachea to restore the airway.
    d. Apply topical anesthetic to the cricoid pressure area and reduce chances of aspiration.

37. (414) During which stage of anesthesia are *most* patients intubated?
    a. Danger.
    b. Induction.
    c. Relaxation.
    d. Excitement.

38. (414) If the anesthetist asks a circulator to apply cricoid cartilage pressure during endotracheal intubation, where should the pressure be applied?
    a. On the trachea, directly over the patient's thyroid gland.
    b. In the area of the neck just above the suprasternal notch.
    c. In the middle of the neck just above the patient's "Adam's apple."
    d. On the trachea, approximately one finger-width below the "Adam's apple."

39. (414) After a surgical procedure, when should you disconnect the anesthetist's suction apparatus?
    a. Never, it is the anesthetist's responsibility.
    b. Immediately after the patient is extubated.
    c. After the patient leaves the operating room.
    d. When the scrub technician needs it for case breakdown.

40. (415) Following an ear, nose, and throat (ENT) procedure, you find a medicine glass containing a small amount of cocaine solution. What should you do?
    a. Return the solution to the drug cabinet key monitor.
    b. Notify the Operating Room Supervisor or anesthesia staff.
    c. Dump the solution in a hopper and thoroughly rinse the medicine glass.
    d. Pour the solution into an empty bottle and leave it in the operating room for future use.

41. (415) What is the best way for a scrub technician to estimate the amount of local anesthetic a surgeon has used if he or she loses track of the amount injected?
    a. Mark the syringe with a sterile marking pen before and after each injection of the anesthetic agent.
    b. Ask the circulator to keep track of the amount of solution transferred to the sterile field and the amount the surgeon injects.
    c. Add the amount left in the syringe to the amount left in the medicine glass and subtract the total from the amount received from the circulator.
    d. Request additional syringes from the circulator so that all the medication transferred to the sterile field can be drawn out of unmarked containers.

42. (416) When a Bier block is used for regional anesthesia, what should a circulator do before wrapping the tourniquet cuff around the extremity?
    a. Connect the cuff to the pneumatic tourniquet.
    b. Wrap webril around the extremity where the cuff will be placed.
    c. Elevate the patient's extremity to facilitate gravity drainage of blood from the veins.
    d. Wrap an Esmarch bandage around the extremity above the tourniquet application site.

43. (416) Why should the patient be cautioned not to move during the insertion of a spinal or epidural needle?
    a. To prevent the patient from falling off the operating room bed.
    b. To prevent the patient from passing out as a result of sudden exertion.
    c. Because a sudden flinch can disrupt the position of the needle and injure nerves or blood vessels.
    d. To prevent alteration of the level of anesthesia that results from the patient's muscular movement.

44. (416) To administer a caudal anesthetic, the patient is *usually* placed in the
    a. prone position.
    b. lateral position.
    c. supine position.
    d. lithotomy position.

45. (417) The *most* common and potentially fatal anesthetic complication is
    a. aspiration of regurgitated gastric contents.
    b. bronchospasm induced by extubation.
    c. a venous air embolism.
    d. an obstructed airway.

46. (417) Bronchospasm may occur anytime, but is *most likely* to occur during
    a. stage III insufflation of volatile anesthetic agents.
    b. emergence from general anesthesia.
    c. the excitement stage of anesthesia.
    d. general anesthesia induction.

47. (417) If a bronchospasm occurs during surgery, what is the *first* step to take?
    a. Perform a tracheotomy.
    b. Use suction apparatus to clear the irritant.
    c. Administer oxygen by manually squeezing the rebreathing bag.
    d. Administer additional anesthetic agents to deepen the anesthesia.

48. (417) For a patient aspirating, after placing the operating room bed in the Trendelenburg position, what is done next?
    a. Perform an emergency endotracheal intubation.
    b. Suction the oropharynx, trachea, and bronchial tree.
    c. Administer drugs and IV fluids to cause bronchial dilation.
    d. Provide continuous positive-pressure ventilation of 100 percent oxygen.

49. (417) Which of the following patients is *least* susceptible to aspiration?
    a. A pregnant female.
    b. A morbidly obese male.
    c. An infant with pyloric stenosis.
    d. An infant who was fed formula shortly after midnight.

50. (418) What is the *first* action taken if the patient starts to complain of back pains, chest pains, or chills during a blood transfusion?
    a. The surgeon prepares to open the chest and begin internal compressions.
    b. The patient is placed on a hyperthermia blanket and given analgesics.
    c. The transfusion is stopped and the blood bank is notified.
    d. The anesthetist records the reaction on the SF 518.

51. (418) What cardiac dysrhythmia is characterized by a heart rate of less than 60 beats per minute?
    a. Sinus bradycardia.
    b. Ventricular tachycardia.
    c. Sinus tachycardia.
    d. Ventricular fibrillation.

52. (419) When a patient is having a cardiac arrest, the circulator records the time and starts the time clock. What does the circulator do next?
    a. Obtain the cardiac arrest cart.
    b. Assist with repositioning the patient.
    c. Use the emergency button to notify other personnel.
    d. Provide the necessary supplies to the scrub technician.

53. (419) During cardiac arrest, if the circulating nurse is busy, how does the scrub technician perform sponge, needle, and other counts?
    a. The scrub counts all items, writes the total using a sterile skin marker, and reports results to the circulator after the arrest.
    b. The scrub covers all items with sheets, then the conducts the counts with the circulator after the arrest.
    c. Counts are not required as this is an emergency situation.
    d. The count is performed with another licensed provider.

54. (420) Which is an initial symptom of a toxic reaction to a local anesthetic agent?
    a. Slurred speech.
    b. Spinal headache.
    c. Cardiac asystole.
    d. Ventricular tachycardia.

55. (420) An anesthetic complication characterized by progressive elevation of a patient's body temperature to dangerously high levels is called malignant
    a. hypothermia.
    b. hypervolemia.
    c. hyperesthesia.
    d. hyperthermia.

Please read the unit menu for unit 3 and continue ➔

Student Notes

Unit 3. Postoperative Patient Care

SUCCESSFUL RECOVERY OF A SURGICAL PATIENT depends a great deal on the quality of the immediate postoperative care he or she receives. Several years ago patients returned directly to the nursing units after completion of their operations. Although nursing units made special preparations, the mortality rates following surgery were much higher than they are today. The key difference between the postoperative care of the past and today is that we now routinely observe and treat patients in centralized special care units during the critical period immediately following an operation. These special postanesthesia care units (PACU), commonly called recovery rooms, or postanesthesia recovery rooms (PAR), are staffed by specially trained personnel and equipped with sophisticated monitoring and patient treatment devices. Postoperative patients admitted to the PACU are closely observed and given special care until their overall physical condition is stable enough to ensure they can return to their nursing units or be discharged from the medical facility with minimal risk.

Although most immediate postanesthesia care is provided by nurses and the anesthesia staff, you may have to help them, especially now that the majority of your cases may be same day surgery. You, as a surgical technician, must be familiar with the PACU environment—equipment, supplies, and procedures used to assist the patients with immediate postoperative recovery.

This unit covers the physical and environmental features of the PACU and some important aspects of postanesthesia care. The discussion begins with how the PACU is arranged, equipped, and staffed. Then, we discuss how patients are admitted to the PACU and what is done to assess their condition. Next, we look at some essential information on general nursing care of the postoperative patient, including how we help a patient "wake up," how we maintain his or her airway and administer oxygen, and how we detect and treat some postoperative complications. The final section of this unit looks at safety, patient comfort measures, infection control, and PACU discharge procedures.

NOTE: As in the previous unit, the word anesthetist is used as a generic term to describe the anesthesia provider, regardless of whether it is an anesthesiologist or certified registered nurse anesthetist (CRNA). Also PACU is used interchangeably with the Same Day Surgery Center (SDSC) in regard to recovering patients from anesthesia after a surgical procedure. When the missions of the two diverge, they will be explained for each area.

3–1. Postanesthesia Care Unit

The primary purpose of the Postanesthesia Care Unit (PACU) is to provide a controlled environment where postoperative patients are directly observed and evaluated during emergence from general or conduction anesthesia. During this crucial period the PACU staff constantly monitors the patient's vital signs and neurological status. They also perform a variety of nursing care procedures that often involve life-support measures. To accomplish this intensive postoperative patient care in an effective, efficient, and safe manner, the PACU is specially designed and furnished.

421. Physical characteristics and environmental features

Most postoperative patients are virtually helpless until their physiological body functions stabilize, so they are totally dependent on the PACU staff. During this critical transition period, a number of things can go wrong. The PACU should be located and designed to allow staff members to closely observe and monitor the patient, prevent or treat postanesthesia complications, and have rapid access to emergency resuscitative equipment and supplies. It must also provide a safe, comfortable environment for the patient. The PACU should be as self-sufficient as possible and should have all the supplies and equipment needed to provide both routine postoperative nursing care and emergency treatment.

Location and size

The PACU must be located as close as possible to the operating rooms and should be centrally located to other specialty units such as the intensive care unit (ICU), critical care unit (CCU), and ambulatory surgery unit (ASU). This allows for rapid transfer of patients to specialty care and ensures that surgeons, anesthetists, nurses, and specialty technicians are immediately available to lend emergency assistance. This arrangement also saves money by allowing the units to share special equipment without sacrificing availability. By consolidating and sharing these physical and personnel resources, the hospital provides improved quality care and reduces operating costs.

The size (number of beds or patient capacity) of the PACU is primarily based on the number of operating rooms in the surgical suite; ideally, there are two beds for every operating room. The PACU is usually an open-bay design, divided into patient-care areas or cubicles that can be isolated with curtains or folding doors. Cubicle space is very limited and may be conserved by using built-in furniture and devices such as wall-mounted shelving, cabinets, oxygen supply lines, wall-suction equipment, and ceiling-mounted intravenous (IV) hooks.

The PACU should also be large enough to accommodate areas for supply and equipment storage. Space between these areas should be small enough to allow rapid access to a patient, but large enough to turn a recovery bed in a complete circle (360 degrees) without interference. These areas should not block or crowd the patient-care cubicles.

Floor plan

The floor plan of each PACU varies with the available floor space, location of specialty units and support services (laboratory, blood bank, X-ray department, etc.), overall design of the medical facility, budget constraints, and the number and types of operations normally performed. There are a few considerations usually taken into account when designing a PACU.

First of all, the floor plan must allow for easy transfer of postoperative patients from the operating room to the PACU and, in turn, from the PACU to the nursing units. This makes the location of entry and exit doors very important. To provide efficient traffic flow, anesthetized patients are usually brought into the PACU through a door as close as possible to or adjoining the surgical suite, and leave the PACU by a separate door leading to a corridor in the hospital.

Second, the design of the PACU must permit observation of all patient cubicles simultaneously from the nursing station. An open floor plan is generally preferred over individual rooms, so all patients can be observed continually and simultaneously by a minimum staff. When needed, privacy is

provided by washable, movable curtains attached to ceiling mounted rails or by movable partitions separating each patient-care area. Some PACUs have glass walls or partitions to separate the cubicles into rooms, and some have isolation rooms to reduce chances of cross-contamination or to provide increased privacy for patients with special needs. A PACU with more than one room requires more staff than a single room with an open floor plan does.

Structural design and features

Because of the flow of activity between the surgical suite and PACU, structural features and environmental conditions are very similar.

Physical structure

As in the surgical suite, doors in the PACU should be high and wide enough to allow free passage of a full size patient bed and all attachments (such as orthopedic traction bars), as well as any accompanying equipment (such as a respirator). Also, walls, floors, and ceilings are normally constructed of the same types of smooth, durable, materials as those used in the surgical suite. This helps provide optimal sanitation and allow extension of the aseptic environment to reduce postoperative infections.

Air-conditioning

Ventilation systems for the surgical suite and PACU should be separate, but have similar capabilities. Just like in the operating room, separate and accurate temperature and humidity controls are necessary to ensure patient comfort and welfare, provide a comfortable working environment for the staff, and ensure electronic equipment functions properly. The air-conditioning system in the PACU should provide 12 to 15 complete air changes per hour to keep the air fresh and reduce the level of airborne contaminants. The temperature should be maintained at approximately 75°F. This temperature is slightly higher than recommended for most operating rooms but provides greater patient comfort while still low enough to help reduce the rate of bacterial growth. Like the surgical suite, the humidity should be around 50 to 60 percent. Controls for the air system should be located in, or close to, the nurses' station so environmental conditions can be adjusted to suit individual patients.

Lighting

Adequate lighting is also essential. PACU procedures may involve observing patients' skin color, checking dressings, starting and maintaining IVs, or inserting various types of catheters. When possible, ceiling mounted, high-intensity lights should be available in each patient cubicle to provide sufficient lighting for performing these condition checks and minor procedures. Also, an emergency lighting system that automatically comes on when the main electrical power supply is disrupted is absolutely essential.

Electrical power

The use of state-of-the-art electrical monitoring devices and patient support equipment is constantly increasing. Numerous electrical power outlets should be located on each side of the patient cubicle near each patient bed. This provides easy access and permits the use of several pieces of electrical equipment at one time. At least two outlets in each cubicle should be connected to the hospital's emergency power system. There should also be at least one, 220-volt electrical outlet in the PACU to supply power to portable X-ray devices.

Plumbing

At least one "clean" sink with foot, leg, or arm controls should be available for personnel handwashing. In addition, there should be a separate "dirty" utility room or area with facilities for disposal of drainage and waste fluids. The utility area should also have large sinks for cleaning equipment and reusable supplies. Whenever possible, a staff toilet should be located close to the PACU to reduce time nursing personnel must spend away from their patients.

Other features

Numerous other features are routinely found in the PACU. Some of these items are built into the walls or ceiling, and some are free-standing. Each cubicle usually has at least two vacuum outlets in the wall or in a ceiling pillar to provide multiple and separate suction capability. One is reserved for airway maintenance; any others may be used for gastrointestinal tube evacuation, chest tubes, or wound drainage. Near the vacuum outlets is at least one oxygen outlet with attached administration devices—regulator, flow gauge, and humidifier. Some PACUs have outlets for compressed air and nitrous oxide; others can fully support an anesthesia machine.

Most cubicles have one or more tracks or mounting devices attached to the ceiling. These tracks hold the privacy curtains discussed previously, hold suspended IV poles, or have specially designed hangers for equipment such as patient monitors. These built-in features allow immediate access to equipment and supplies without sacrificing large areas of floor space, interfering with traffic flow (you might have to watch your head), or restricting access to the patient.

At least one large, easy-to- read clock with a second hand should be visible from each patient cubicle. A time clock is needed for cardiopulmonary resuscitation monitoring. Finally, there should be some type of alarm system that can be quickly activated to alert and summon personnel from designated areas in the event of an emergency.

422. Equipment, furniture, supplies, and staffing

Every PACU has basic equipment, supplies, and personnel to support the patient and to treat postoperative complications.

Equipment and furniture

Each patient cubicle should have a fully adjustable, well-padded recovery bed. A good one has safety features such as mechanisms to rapidly elevate the head or feet, a device to “lock” the bed to the floor, swivel locks on all four wheels, side rails, patient restraint straps, and removable head and foot boards. Some recovery beds have a fifth wheel or other device to help control steering during transport; some have attachments to hold drainage bags, portable oxygen tanks, patient charts, extra IV poles, and other patient-care items.

Other furniture in the patient cubicles helps to improve the quality of postoperative care. Small cabinets or shelves for convenient storage and rapid access of bedside supplies may be mounted on the wall near the head of the recovery bed. If there are no wall-mounted shelves or cabinets in the cubicles, a small bedside utility stand should be available. Each cubicle should also have some type of trash receptacle and a sharps’ disposal container.

In the PACU, but outside the cubicles, additional furniture and equipment are needed—cabinets and shelves for storing linen, IV and irrigation solutions, oxygen administration tubing, dressing materials, and other bulky supplies. A lockable cabinet for storing narcotics and other controlled drugs is a must. A refrigerator for cold storage of many hormones and drugs should be close by. In larger PACUs, you may also find special blood coolers for storage of whole blood and blood components. At least one large X-ray illuminating device should be easily accessible for viewing postoperative X-rays.

The nurses’ station has a desk or writing table that faces the patient cubicles and at least one chair. It should not be separated from the patient cubicles by a partition or any other structure that blocks direct vision of the patients. Also, it must have a telephone and any other central communicating device used in the hospital, such as an intercom system. Most PACU nurses’ stations have some type of computer terminal and printer linked to other areas of the hospital to facilitate communication, record keeping, and retrieval of laboratory and other test results.

Each PACU develops its own inventory of required equipment based on local needs and established standards of care, but most have as a minimum the following common equipment items:

Common PACU Equipment	
Equipment	**Description**
Cardiac monitors	A cardiac monitor should be available in each patient cubicle to provide continuous monitoring of patients. Routine use of cardiac monitors has become the accepted standard of practice in recent years, especially during recovery of general anesthesia patients. Ideally, the monitors are connected to a central control and monitoring panel at the nurse's station that allows the PACU staff to monitor all patients simultaneously. Most cardiac monitors are capable of printing a paper strip or other record of the patient's cardiac activity during the recovery period. The best monitors are multifunctional; they can monitor arterial pressure and body temperature using catheters and probes. In addition to the bedside cardiac monitors, there should also be a 12-lead EKG machine available for special-needs situations.
Emergency "crash" cart	This special cart containing a variety of emergency resuscitation equipment, supplies, and drugs should always be maintained in the PACU. Usually included are a defibrillator, backboard, endotracheal intubation supplies, tracheostomy instrument trays, IV cut-down trays, manual ventilation (ambu) bags, oxygen, emergency drugs, and IV supplies.
Respiratory monitoring and support equipment	This equipment includes pulse oximeters, respiration monitors, automatic ventilators, oxygen administration devices, and nebulizers. These are used to monitor or assist the patient's breathing and provide saturated oxygen during the recovery period.
Hyper- and hypothermia machines, commonly called warming blankets	These machines are used primarily to rewarm the patient after extensive surgery. They work by either circulating a solution of the desired temperature through channels in a rubber or plastic pad, or by "bathing" the patient with a warm airflow. **NOTE:** When using hyperthermia blankets or pads, always cover the patient with a sheet or blanket first to prevent burns.
Blanket and fluid warmer cabinets	The PACU should have its own warming cabinet to prevent staff from leaving patients to obtain warming blankets and solutions.
Heat lamps	These heat lamps are used in place of, or in conjunction with, the hyperthermia unit.
Ice machine	Ideally, the PACU should have its own ice machine so ice is available for spot application of cold packs. This machine may also be close to the operating room for when large quantities of ice are needed to treat malignant hyperthermia (as discussed in the previous unit).
Malignant hyperthermia cart	Some local policies require a specific cart or area in the PACU be available for treatment of this rare but serious condition.

Drugs and supplies

The drugs, solutions, and supplies maintained in the PACU depend on local policy. Emergency drugs are always maintained, and small quantities of these drugs are usually in the crash cart with backup supplies stored in the nursing station drug cabinet. Also, the PACU has a supply of the most commonly administered analgesics, antibiotic drugs, and medications to reverse the effects of various anesthetic agents and muscle relaxants.

Normally, all intravenous solutions routinely used and maintained by anesthesia staff and administration tubing sets and IV catheters are also kept in the PACU central storage areas. Different sizes of syringes and hypodermic needles are stored for preparing and administering medications and drawing blood samples. Other supplies stocked in the PACU include drainage tubes, collection bags, sterile irrigation kits, disposable scalpels, a small assortment of suture material, and a variety of dressing materials identical to those stocked in the surgical suite.

Some basic supplies are maintained in patient cubicles. These include such things as:

Basic Supplies in Patient Cubicles	
Supply item	**Uses**
Stethoscope	To monitor breathing, heartbeat, and blood pressure readings.
Large (Kelly) hemostats or tubing clamps	To occlude drainage tubes and catheters.
Bandage scissors	For preparing dressing materials and cutting tubing.
Disposable oxygen administration tubing, masks, and nasal prongs	To administer oxygen.
Assorted sterile suction catheters, disposable connective tubing, and tonsil suction tips	For suctioning blood and mucus secretions from the patient's nose, mouth, and throat to prevent airway obstruction.
Assorted tubing connectors (both sterile and unsterile)	To connect different diameter suction and drainage tubes.
Various sizes of oral and nasal airways	To maintain airway patency.
Tongue blades	To hold the tongue down while inserting oral airways and examining the throat and mouth. A tongue blade with a heavily taped end may be kept near the bedside to prevent patient from biting tongue if he or she suddenly has a seizure.
Sterile gloves	To be worn anytime you may come in contact with blood or body fluids. Also needed for dressing changes, suctioning, and emergency invasive procedures.
Alcohol swabs	For antisepsis of the skin prior to administering an injection or starting an IV. Also, to disinfect injection ports on IV infusion tubing and solution bags or bottles and connecting ports on wound drainage reservoirs.
Bed protective pads or Chux	To prevent the linen on the recovery bed from becoming exceedingly soiled by secretions or drainage. Also, to place under the head of nauseated patient to absorb any vomitus.
Cloth or disposable towels	For cleaning.
Sterile plain sponges, usually 2×2 or 4×4 inches	For dressings, applying pressure when discontinuing an IV, and moistening a patient's mouth.
An assortment of tape—cloth, paper, nylon, and plastic	To secure dressings, catheters, drainage tubing, and just about anything else you can think of!
Safety pins	For a variety of purposes, such as pinning drainage tubes to a patient's hospital gown or securing dressings.
Tissues	For removing secretions and ointments and for a tearful patient.
Disposable plastic emesis basins	(Use your imagination on this one!)
Sterile lubricants, such as K-Y jelly or Surgi-lube	To reduce tissue irritation and trauma from catheters, drainage tubes, and endoscopy instruments.
Ammonia inhalant capsules	To help arouse a patient, family member, or staff member who faints. They are not used routinely to help arouse sleeping patients.
Glycerin swabs (supposedly lemon flavored)	To moisten a patient's lips and mouth. General anesthesia patients usually have "cotton-mouth" and greatly appreciate these swabs.

These are only some of the items used for routine patient care. Each PACU is different and maintains its own inventory of supplies. Ensure you follow local guidelines when stocking or ordering supplies.

Staffing

The PACU is supervised and directed by the anesthesia department but is usually staffed by registered nurses (RN) with critical care nursing experience. Surgical technicians (4N1X1), medical technicians (4N0X1), licensed practical nurses (LPN) or licensed vocational nurses (LVN) may be designated to assist with PACU care ONLY with direct supervision by a registered nurse or anesthetist.

Most surgical suites and PACUs are operated as separate departments, so normally you'll not be expected to remain with a patient after you have assisted with an operation. Usually, the circulating nurse transfers a patient to the PACU; however, you may help anesthesia personnel with this transfer and then, normally return to the operating room to prepare for the next procedure or assist with end-of-day cleaning activities.

You may, however, be assigned to assist in the PACU, so it's important you learn the special needs of the postoperative patient and the basic nursing care procedures involved. In the next section we discuss postoperative patient care; but first, make sure you understand the basics of the PACU by answering the following questions.

Self-Test Questions

After you complete these questions, you may check your answers at the end of the unit.

421. Physical characteristics and environmental features

1. Where should the PACU be located? Why?

2. What determines the size or patient capacity of the PACU?

3. Cite the considerations normally taken into account when the floor plan of a PACU is developed.

4. The PACU ventilation system should provide how many air exchanges per hour? At what temperature and humidity is the PACU maintained?

5. Why is it important to have good lighting in the PACU?

6. How many electrical outlets in each PACU patient cubicle should be connected to the hospital's emergency power supply system?

7. How many vacuum outlets are normally built into the walls of each patient cubicle in the PACU? Explain the use of the outlets.

422. Equipment, furniture, supplies, and staffing

1. List the 10 desired features of a recovery room bed.

2. List the nine most common equipment items maintained in the PACU.

3. List at least ten routine supply items kept in the recovery room.

4. Care of patients in the PACU is under the direction of what department?

5. What types of medical personnel may be assigned to work in the PACU?

3–2. Initial Assessment and Monitoring of the Postanesthesia Patient

The immediate postoperative period can be extremely critical for patients; they have increased risk of respiratory obstruction, hemorrhage, shock, and cardiorespiratory problems. Those who care for patients during this time must know and recognize the signs and symptoms indicating complications. They should also be familiar with the procedures for admitting patients to the PACU, monitoring basic vital functions, and documenting the observations and care provided.

This section discusses activities carried out when a patient first arrives in the PACU, including the initial assessment of the patient's condition. Accurate monitoring of vital signs is a major part of assessing a patient's condition, so we cover the procedures and reasons for taking and recording a patient's pulse, respirations, blood pressure, and temperature.

423. Initiating postanesthesia patient care

When the patient arrives in the PACU, there is a flurry of activity. It is here that the nurse or tech will make comprehensive and detailed assessments of the patient's condition. The effects of anesthesia and the physiologic stressors imposed by surgery place the patient at risk for a variety of physiologic alterations. It is also important for the nurse to facilitate communication among all members of the health care team, the patient, and the patient's family.

Patient admission and initial report

When the patient arrives in the PACU, there is a flurry of activity. The patient on the recovery bed is placed in an unoccupied cubicle and immediate resuscitative care is started. Patency of the airway is verified, oxygen is administered, pulse and respirations are taken, cardiac monitors and pulse oximeters are connected, and blood pressure is taken.

The anesthetist takes (and records on the anesthesia record) the patient's vital signs to determine if the transfer from surgery has had any adverse effects. Next, a member of the PACU staff takes the vital signs and records them on the PACU record. These two sets of vital signs are taken back to back to verify the readings are consistent. Inconsistent readings may result from defective equipment, improper monitor connections, or human error. Corrective measures are applied until the anesthetist and PACU providers are satisfied vital signs are consistent.

Next, the anesthetist tells the PACU nurse about the patient's surgery and general condition. This report normally includes:

- A brief description of the operation performed, including the name of the operating surgeon, the type and location of wound dressings, and the type and number of drains, tubes, or catheters (if any) in the patient.
- The type and dose of anesthetic agents and supplemental drugs administered during surgery.
- A description of the patient's reactions and vital signs monitored during surgery (including the final set taken just before transfer to the PACU).
- Fluid intake and output during surgery, including estimated blood loss (EBL), amount and type of wound drainage, amount of emesis or gastric secretions (if any), amount and color of urinary drainage, and the volume and type of IV solutions (including blood and blood products) administered.
- Relevant medical history, including allergies, maintenance medications needed, known physical problems—especially those that affect the heart and lungs, and previous illnesses and hospitalizations.
- Complications that occurred during surgery or anesthesia administration and any problems that may be anticipated due to the patient's physical condition, the surgery performed, or the anesthetic agents and drugs that were administered.

Postanesthesia care record

The PACU nurse records pertinent information on the postanesthesia care or recovery room record as the anesthetist is giving the report. This record provides a graphic representation of the patient's vital signs, and a written record of observations and care performed by the nursing staff during the recovery period. Some of the first entries on this form are the time the patient was admitted to the PACU and the patient's preanesthetic vital signs. These are obtained from the anesthesia record or by looking at the preoperative checklist on the cover of the patient's chart.

Initial assessment

The admission activities described previously are part of the PACU personnel's initial observation and assessment of the patient's overall condition. Particular attention is paid to the status of the patient's life-sustaining cardiac and respiratory systems, but this assessment is for adequacy of vital functions, not an in-depth examination. The airway is checked to ensure that it is unobstructed. The chest is observed and breath sounds are monitored to determine if the lungs are inflating properly or if the patient is having difficulty breathing. The color and condition of the patient's skin, lips, and nail beds are also observed and recorded on the PACU record. This is done to help determine how well blood is circulating to the extremities and whether or not the patient is getting enough oxygen. Generally, if the patient's cardiovascular status is good, the skin color and tone will be normal, and the lips and nail beds will be pink. Skin that appears pale, blotchy, yellow (jaundiced), or blue (cyanotic) indicates a problem has developed. Circulation to the extremities is also assessed by pinching the nails and seeing how long it takes the blood to refill the nail beds. (This action is sometimes called *blanching* because it temporarily pushes the blood out of the tissue, making the nail bed appear white.) Respiratory problems in dark-skinned people are suspected immediately if the nail beds appear bluish-colored.

Assess neurological status by the patient's voluntary or involuntary (reflex) responses to stimuli. Check the unconscious patient for equal pupil dilation in response to light, or brush the eyelashes lightly to see if they are aware enough to blink. A reflex action, such as spitting out an oral airway also indicates the patient is beginning to awaken. In the conscious or semiconscious patient, check the level of consciousness (awareness) and muscular control by responses to questions, commands, or noises. Ask or tell the patient to move the extremities, lift the head, open the eyes, squeeze a hand, or stick out the tongue to determine awareness.

If the patient was anesthetized by regional block, determine reflex response and return of sensation in the affected areas by pricking the skin with a small needle or other sharp object and noting where the patient can feel it. Reflex return can also be tested by using a battery-powered nerve stimulator to send a low-voltage current through two separate points on the skin to see if the muscles respond automatically. Return of sensation can also be determined by the patient's ability to feel the temperature of an object, such as a wet towel or sponge.

During this initial assessment, the recovery nurse or technician also checks the security of the dressing and estimates the amount and type of drainage it contains. One way the amount of drainage on the dressing can be monitored is by circling the drainage-stained area on the outside of the dressing with a pen or marker. If the drainage increases, the stain spreads outside the limits of the marked area. A dramatic increase over a short period of time may indicate the patient is hemorrhaging or the wound has reopened.

Drainage tubes and catheters are inspected for patency and security, and the type and amount of drainage noted. All intravenous lines are checked to make sure the flow rate is properly adjusted and the solution is not infiltrating into the tissues around the vein. The type and volume of IV solution administered during surgery is determined and recorded on the recovery record. The patient's position is evaluated for its effect on body parts. Finally, the patient's chart is checked for any surgeon's orders to ensure any immediate postoperative orders for such things as ice applications, drug administration, and wound care, are carried out.

Observations made during this initial assessment are recorded on the PACU record in the designated blocks and remarks section. The initial vital signs are plotted on the special graph using the appropriate symbols (see the legend on the particular form you use). Accurate and complete documentation of admission observations and vital signs is essential to establish a baseline for comparing patient conditions or reactions during the recovery period.

424. Monitoring the patient's vital signs

A variety of signs are used to assess a patient's condition. These signs are referred to as diagnostic signs, vital signs, or physical findings. This lesson's discussion is limited to the vital signs you learned in technical school—pulse, blood pressure, temperature, and respiration. Here is a brief review of what they are and how they relate to the patient in the PACU.

Pulse

The pulse is defined as the regular throbbing of the arteries caused by the contractions or "beat" of the heart. It is caused by the momentary expansion of the artery as a wave of blood passes through it after leaving the heart. A pulse can be felt every time the heart beats. You can monitor the pulse from a number of sites. The most commonly used sites are the radial pulse in the wrist, carotid pulse in the neck, and apical pulse over the heart—we cover these three sites in depth. Other sites used include the temporal pulse in the head, brachial pulse under the upper arm, femoral pulse in the upper leg, popliteal pulse behind the knee, posterior tibial pulse in the lower leg, and pedal pulse in the foot. The temporal, carotid, brachial, radial, femoral, popliteal, posterior tibial, and pedal sites are all considered peripheral sites because they are away from the central source—the heart. They are also bilateral; the pulse can be taken on either the left or right side of the body. The apical pulse is the only pulse you need any equipment for; you must listen for it with a stethoscope placed over the apex, bottom tapered portion, of the heart.

Characteristics of a pulse

All pulses exhibit three basic characteristics—rate, rhythm, and force. When you check for pulse, first ensure a pulse exists and, then, determine its rate, rhythm, and force. The pulse rate is the number of heartbeats or pulses felt per minute. The rate is influenced by a number of factors including—but not limited to—fever, stress, exercise, fear, anger, anxiety, excitement, heat, position, pain, and effects of

medication. These factors may cause the heart to beat faster or slower. The pulse rate also varies with age; averages for different age groups are:

- Infants—100 to 140 beats per minute (bpm).
- Children—80 to 100 bpm.
- Adults—60 to 80 bpm.

NOTE: In an adult patient, a pulse rate less than 60 (bradycardia) or greater than 100 (tachycardia) is considered abnormal. ABNORMAL RATES ARE REPORTED IMMEDIATELY.

Another characteristic of the pulse you must pay attention to is the pulse rhythm. The pulse should have a regular pattern, with the same interval occurring between beats. In an irregular pulse, beats are unevenly spaced or beats are skipped. These skips in the pulse are caused by the various cardiac arrhythmias we discussed in the previous unit. An irregular rhythm can be a warning sign that the patient is developing a serious problem; immediately report it to the nurse or anesthetist.

The force of the pulse is its strength. A forceful pulse is easy to feel, or palpate, and is described as strong, full, or bounding. A hard to feel pulse is described as weak, thready, or feeble.

Postoperative patients are usually monitored by electronic blood pressure equipment that displays the pulse along with the blood pressure. Depending on the type of monitor, it may display only the rate or the rate and rhythm; some monitors use an ultrasonic Doppler device to monitor the pulse force. If the monitor does not display or record all three characteristics, manually palpate the pulse to determine the rhythm or force.

Procedure for taking a radial pulse

The radial pulse site is the most commonly used site when checking vital signs in the PACU. To locate the radial artery, place the tips of your first three fingers on the center of the palm side of the patient's wrist, about two inches from the base of the hand. Slide your fingertips toward the thumb side of the wrist while lightly pressing inward until you feel the pulse of the radial artery.

NOTE: Do not use your thumb to palpate a pulse! Your thumb has a pulse of its own and can cause you to take an inaccurate reading.

When you feel the pulse, determine the rate by one of these methods:

- Counting the beats for 15 seconds and multiplying by 4.
- Counting for 30 seconds and multiplying by 2.
- Counting for a full minute.

NOTE: If the pulse is irregular, you *must* use the full minute method.

Procedure for taking the carotid pulse

As you learned in basic cardiac life support (BCLS), you take the carotid pulse during emergency situations such as cardiac arrests. The carotid pulse is easily accessible, very strong, and, since the carotid arteries supply the brain, persists even when reduced blood flow from the heart makes other peripheral pulses undetectable. To palpate the carotid pulse, place your index and middle fingers on the patient's Adam's apple and gently slide them laterally into the groove between the trachea and the sternocleidomastoid muscle (the cord-like muscle) on the near side of the neck. Then, count the beats for 15, 30, or 60 seconds. Do not let your hand straddle the trachea. You may obstruct the patient's airway, or the patient may feel as if you are trying to "choke" him or her.

Procedure for taking an apical pulse

As we mentioned earlier, take the apical pulse with a stethoscope. Use this method for infants and small children (usually under three), and for adults who have weak or nonpalpable peripheral pulse due to coronary or vascular disease. Sometimes, patients recovering from general anesthesia or

vascular surgery also have faint peripheral pulse. The apical pulse is located by placing a stethoscope on the left side of the chest slightly below the breast (where the apex or point of the heart is located). Move the diaphragm until you hear the "lub-dub" of the heartbeat, and count each "lub-dub" as one beat. Do not count the "lub" as one beat and the "dub" as another! The apical pulse is counted for 1 full minute.

Since taking an apical pulse and blood pressure reading requires the use of a stethoscope, you need to know how to properly use this simple monitoring instrument. The stethoscope is simply a hollow tube with ear pieces at one end and a bell-shaped head or head containing a flat plastic diaphragm at the other end. The basic steps to use one are:

1. Inspect the stethoscope tubing and ear pieces for splits or cracks, and the diaphragm for visible damage.
2. Wash your hands, then wipe the ear pieces and diaphragm with alcohol swabs. Pay close attention to the holes in the ear pieces and ensure they are clear.
3. Press the diaphragm against the palm of your hand to warm it.
4. Insert the ear pieces in your ears with the bend of the tips pointing forward.
5. Lightly tap the diaphragm with your finger. If the stethoscope is working, the tapping sound is amplified. If the stethoscope has a double head—flat and bell-shaped—the "tap test" also tells you which head is active. Most double-headed stethoscopes have a selection lever or control that allows you to switch from one side of the head to the other. When taking blood pressure, use the flat head with the plastic diaphragm instead of the bell-shaped head.
6. Place the diaphragm over the area to be monitored—chest, heart, artery, etc.—and LISTEN while holding it in place using two fingers.
7. Do not allow anything to touch the tubing. If you do, the sounds you hear will be greatly distorted.
8. Ask the patient to remain silent during the procedure. If you explained the procedure to the patient at the start, this should not be a problem.
9. After you are finished using the stethoscope, clean the ear pieces and diaphragm with separate alcohol swabs, and return the stethoscope to its proper place.

Now that you know how to use a stethoscope and take a pulse, let's look at how to record your findings.

Recording the pulse

After you obtain the pulse and determine its characteristics, document your findings on the PACU record. When you document the pulse, describe all its characteristics. For example, instead of writing or graphically plotting, "pulse rate 80," write, "pulse rate 80, strong and regular." This provides a clearer picture of the patient's condition. Take and record the pulse, and other vital signs, frequently, at least every 15 minutes, and document the results each time you do so. Check the record for changes in the pulse indicating a change in the patient's condition. The pulse rate is usually slightly faster immediately after surgery than before, but be aware of irregularities or changes in the rate that may be symptoms of cardiac arrhythmias, especially tachycardia. If you find any abnormalities in the pulse, notify the PACU nurse immediately! If the pulse is within acceptable limits, continue checking the cardiovascular vital signs by taking the patient's blood pressure.

Blood pressure

The blood pressure (BP) reading is another critical indicator of a patient's condition. A blood pressure reading can tell you if blood is flowing through the vessels with enough force to reach all areas of the body. *Blood pressure* is the force that the circulating blood exerts against the walls of the arteries. It is normally measured and recorded at systolic and diastolic levels. *Systolic pressure* is the highest pressure in the arteries, the pressure during contraction of the left ventricle, the heart's main pumping

chamber. *Diastolic pressure* is the minimum pressure in the arteries, the pressure during relaxation of the heart when the atria are contracting and the ventricles are filling up with blood. We measure blood pressure in millimeters of mercury (mm Hg). In adults, the normal range of systolic pressure is between 90 and 140mm Hg; diastolic pressures range between 60 and 90mm Hg. We refer to the blood pressure as the systolic over diastolic readings. For example, if the systolic measurement is 122mm Hg and the diastolic measurement is 88mm Hg, we say the patient's BP is one-twenty-two over eighty-eight, written as 122/88.

Blood pressure readings vary with the age, sex, and genetic makeup of individual patients. A normal blood pressure for one patient may indicate a problem in another. Check the preanesthetic blood pressure on the patient's chart to determine the normal reading, and compare the readings you obtain during the recovery period. A change in blood pressure can be caused by, among other things, anesthetic agents or drugs, low blood volume (hypovolemia), or inadequate pumping of the heart (cardiac insufficiency or heart failure).

A sudden blood pressure drop in a postoperative patient is cause for concern. Some of the problems this may indicate are:

- Cardiovascular depression from drugs or anesthetic agents.
- Internal bleeding from a vessel severed during surgery.
- Wound hemorrhage or disruption from the stress of moving and transporting the patient.
- Dehydration due to inadequate fluid replacement during surgery.
- Shock.

As you take blood pressures, be alert for abnormally high or low pressures and especially for sudden changes. Report suspected problems to the PACU nurse or anesthetist immediately.

Blood pressure monitoring devices

In the modern PACU, blood pressure is routinely monitored using sophisticated electronic devices that automatically check blood pressure, pulse, and other vital signs. These monitors are not foolproof and not always available due to power failure, damage, or other problems. They probably will not be available in a contingency situation, such as war or natural disaster, especially under field conditions. The ability to manually check and monitor blood pressure is a fundamental skill of patient care, and a skill you must possess.

Blood pressure is measured manually with a sphygmomanometer and stethoscope. A sphygmomanometer consists of an inflatable blood-pressure cuff (BP cuff) with an inflating bulb and pressure release valve, and a pressure measuring device or manometer.

BP cuffs are available in various types and sizes. The cuffs are usually secured around a limb by means of hook and loop (Velcro) fasteners. Some cuffs have a specific area or range that must be placed over the artery you are measuring, and some have a built-in stethoscope diaphragm. Some cuffs have no attached inflating bulb or manometer, just two or three tubes sticking out of the side; you connect one tube to the manometer, one to an inflating device, and the third (if present) to a "headless" stethoscope. Electronic monitors have cuffs specifically designed for the particular monitor; ensure you use the proper cuff for automatic inflation/deflation and accuracy. Be familiar with the types of BP cuffs in your facility and follow directions for applying, connecting, and inflating them.

The two types of manometers used to manually measure blood pressure are mercury-gravity and aneroid. Mercury sphygmomanometers use a column of mercury within a calibrated clear tube. As air pressure increases, the column rises within the tube; as it is released, the column drops. This system does not require calibration, but it must be in the upright position to function properly; the mercury must also be read at eye level. Mercury-gravity sphygmomanometers are not routinely used and have virtually disappeared from the PACU because of the toxicity of mercury.

An aneroid sphygmomanometer is a dial-type device containing a metal bellows attached to a needle. As the air pressure in the dial increases, the bellows expands and moves the needle around the dial. When the pressure is released, the needle returns to its original position. The aneroid sphygmomanometer must be calibrated at regular intervals (usually annually), but is very reliable and is the safest, most commonly used device for manually measuring blood pressure.

Procedure for manually measuring blood pressure

The method you most commonly use to manually measure blood pressure is called the auscultatory method, because you listen through the stethoscope to determine the pressure. The most common site for measuring the blood pressure is the brachial artery on the upper arm. Normally, you can use either arm, but avoid using an arm with an IV in place or the side where a patient has had breast, arm, or hand surgery. If using an arm is not feasible, use the appropriate cuff to measure the BP at the popliteal artery or posterior tibial artery. The steps to take the pressure at the brachial artery are:

1. Select the appropriate BP cuff.
2. Ensure the patient is as comfortable as possible, either sitting up or lying down, with the forearm supported at about the level of the heart and palm facing up.
3. Locate the brachial pulse on the inner portion of the upper arm by palpating the groove under the biceps.
4. Wrap the cuff snugly around the upper arm with the lower edge one to two inches above the elbow and the inflatable bladder (or cuff range) centered over the brachial artery. Apply it tightly enough to prevent it from sliding up or down or rotating freely on the arm, but not tight enough to restrict circulation; you should be able to easily slide two fingers under it.
5. Place the ear pieces of the stethoscope in your ears, hold the inflating bulb in the palm of your hand, and close the pressure release valve.
6. Palpate the brachial pulse in the antecubital fossa (inner elbow), or palpate the radial pulse using the fingertips of your free hand.
7. Continue to palpate the pulse as you inflate the cuff. Inflate the cuff to a point 30 mm Hg higher than the point where you feel the pulse disappear. (An alternative to inflating the cuff to 30mm Hg beyond the disappearance of the pulse is to inflate the cuff to 200mm Hg. However, this technique is not recommended because it can result in error, especially when taking the blood pressure of hypertensive patients.)
8. Place the stethoscope diaphragm (if the cuff does not have a self-contained stethoscope diaphragm) over the brachial artery in the antecubital fossa using as little pressure as possible. Make sure the head of the stethoscope does not touch the bottom of the cuff or any clothing.
9. While listening closely, open the screw valve slightly, gradually deflating the cuff at a rate of two to three mm Hg per second. Watch the manometer. The point where you hear the first of two consecutive heartbeats is the systolic pressure.
10. Continue deflating the cuff slowly and evenly. The point where you no longer hear the pulse or it becomes muffled is the diastolic pressure. The point where the pulse becomes muffled is recorded as the diastolic pressure in children. The point where the sound completely disappears is recorded as the diastolic pressure in adults. (The pulse sounds you hear through the stethoscope are called Korotkoff's sounds.)
11. After you hear the last Korotkoff sound, continue to monitor and slowly release cuff pressure another 30 mm Hg, and then, release all remaining pressure in the cuff by fully opening the valve.

NOTE: If you get an abnormal reading, have trouble hearing the sounds, or make a mistake, allow at least 20 to 30 seconds for the patient's circulation to return to normal, then retake the pressure. If you still do not get a good reading after the second time, retry using a different extremity. Taking the BP

several times in succession on the same limb can cause the patient severe discomfort and may damage underlying tissues.

12. Document the results on the PACU record according to local policy. You may write it as a fraction, with the value for the systolic pressure over the value for the diastolic pressure (120/80, 160/90, etc.), or plot the values on the vital signs graph. Also, document, in the remarks section of the record, the extremity used and any out-of-the-ordinary procedures used.

NOTE: In some PACUs, you may be required to document all three stages of the pulse sounds. In other words, you may have to record the systolic pressure, the point where the sounds change from a sharp thumping or rapping to a distinctly muffled tone, and point where all sounds disappear. This results in a three-figure, blood pressure reading such as 130/112/70.

An alternative method for measuring the systolic blood pressure only is the palpation method. This method is not as accurate as auscultation, but we cover it because it is useful in contingency situations or in very loud environments. To check the blood pressure by palpation, follow the same steps for placing and inflating the cuff, but do not use the stethoscope. Instead, continue to palpate the brachial or radial pulse and watch the manometer. The reading when you first feel the pulse return is the patient's systolic pressure.

NOTE: Diastolic pressure cannot be measured by the palpation method. When you use the palpation method, write "palpation" next to the reading when you document the results.

Blood pressure monitoring is an extremely important part of the assessment process. You measure blood pressure at least every 15 minutes while the patient remains in the PACU, unless otherwise directed. Always document your results carefully and report any abnormal readings. Be aware of errors that can cause inaccurate blood pressure reading so you can avoid them.

Inaccurate Blood Pressure Readings	
Error	**Causes**
Using the wrong size cuff	It is essential to use the proper size BP cuff to ensure an accurate reading. If the cuff is too big, the reading may be low; if too small, the reading is high. Narrow, short cuffs are used on pediatric patients, and extra-wide, long cuffs are used for obese patients or for measuring the pressure on a patient's thigh.
Improper positioning of the cuff	If the cuff is positioned too low (the edge lies just above the elbow instead of 2 inches above it), the head of the stethoscope may touch the cuff and cause sounds misinterpreted as Korotkoff's sounds. If applied over a shirt or gown sleeve, or with the inflatable bladder not over the brachial artery, you may not hear any sound at all.
Improper positioning of the stethoscope	If you do not palpate the brachial pulse before positioning the stethoscope, the BP sounds may be faint or indistinguishable from background noise. Every patient is different, and anatomy may vary—his or her arteries may not be exactly where you expect them, so do not automatically assume you will find the brachial pulse in the center of the inside of the elbow.
Deflating the cuff too quickly	This makes it nearly impossible to accurately determine the reading on the manometer when the sounds are first heard or when they become muffled.
Deflating the cuff too slowly	This not only causes patient discomfort, but also prolongs pressure on the artery and distorts the reading.

Inaccurate Blood Pressure Readings	
Error	**Causes**
Auscultatory gap	The auscultatory gap occurs when Korotkoff's sounds suddenly disappear and then reappear at a lower cuff pressure. In simpler terms, it's a silent gap between the systolic and diastolic pressure readings that can make you think the systolic pressure is lower or the diastolic pressure is higher than it actually is. During this gap, the pulse is still palpable, so it is important to palpate the pulse while inflating the cuff and to continue to increase pressure by 30mm Hg after the pulse cannot be felt. It is also why you continue to monitor the pressure for 30mm Hg after the sounds stop. If you detect an auscultatory gap, wait a few minutes and retake the blood pressure.

Now that you can monitor the circulatory system, we discuss the other vital signs monitored in the PACU—respiration and body temperature.

Respiration

Respiration or breathing is the act of inhaling oxygen and exhaling carbon dioxide. A postoperative patient's respiratory systems may be compromised for several reasons, including the use of anesthetic agents and narcotics that can depress the central nervous system; use of muscle relaxants that may affect the diaphragm and accessory muscles of respiration; pain and physical limitations that may result from the surgical procedure and pre-existing diseases (tuberculosis or emphysema); or other conditions (smoking and airway obstruction caused by secretions, posture, or trauma) that may reduce efficiency of the cardiorespiratory system. Pay close attention to your patient's breathing to ensure he or she is getting enough oxygen into the lungs and effectively eliminating waste carbon dioxide.

Respiratory function is evaluated by observing the rate and character of respiration, the patient's skin (or nail bed) coloration, and the oxygen saturation level as monitored by a pulse oximeter.

Respiratory characteristics

Like the pulse, respiration has certain characteristics that can help you detect problems—quality, rate, depth, and pattern.

Quality

Respiration quality refers to the effort or pain the patient experiences, the type of noises made by the patient, and how equal or evenly the lungs expand while breathing.

Normal breathing is effortless, automatic, and relaxed. Breathing is abnormal if it is labored (difficult) or painful; this condition is called *dyspnea*. To detect dyspnea, observe the way the patient breathes, his or her facial expressions, behavior, and breathing sounds. Patients who have difficulty breathing usually appear tired, restless, confused, or anxious because they are struggling to get oxygen into their bodies. Their lips, nail beds, and mucous membranes may develop a blue-gray tinge, or cyanotic coloring, and their nostrils may flare in an effort to draw in more air. They may gasp for breath or make severe wheezing, crowing, or gurgling sounds. Two other signs of distress are retraction, drawing back, of the intercostal muscles and belly breathing (overuse of abdominal muscles during breathing, which causes the belly to rise and fall instead of the rib cage expanding).

Normal breathing is also symmetrical. Both sides of the chest rise and fall at the same time as a person breathes in and out. Nonsymmetrical breathing can indicate pneumothorax (air in the pleural cavity that prevents a lung from expanding), consolidation (fluid buildup in the lungs that limits their ability to expand), or splinting (muscles becoming rigid due to pain caused by movement). These conditions require rapid treatment; report them immediately. As you evaluate the quality of respiration, also determine how fast the patient is breathing.

Rate

A single respiration consists of one inspiration (inhalation) and one expiration (exhalation). Adults normally breathe at a rate of 12 to 20 times per minute, depending on emotional activity, physical activity, and physical condition of the individual. Respiratory rates increase during periods of stress or physical activity. Age also may affect the respiratory rate; children and infants tend to breathe faster than adults.

Abnormal rates are either too fast or too slow. A respiratory rate over 20 breaths per minute is called *tachypnea*; it may be caused by conditions such as fever, fear, and hypoxia. A rate less than 12 breaths per minute is called *bradypnea*; it is caused by depression of the respiratory system from anesthesia, narcotic overdose, or brain tumors. When respirations stop completely, the condition is referred to as *apnea*.

Depth

The depth of respiration is the volume of air moving in and out with each respiratory cycle (inspiration and expiration). Depth is also known as tidal volume. The average adult exchange is about 500 ml and is accurately measured by a device known as a spirometer. Most patients in the PACU are not monitored with a spirometer; you assess the respiratory depth by observing the chest expansion and by feeling exhaled air against the back of your hand. If the patient is breathing normally, you see the chest rise about an inch, and feel a steady airflow against the back of your hand.

Pattern

The pattern is actually a combination of the rate, volume, and regularity of the respirations. A normal breathing pattern consists of an inspiration followed by a pause, then a longer expiration, and a second pause. This sequence occurs at a steady rate with a normal volume exchange. If you note an abnormal pattern, report it to the nurse.

It is sometimes difficult to accurately assess a conscious patient's respiration. Fear, pain, and excitement often cause mild tachypnea. It is even more difficult if the patient knows you are watching him or her breathe; respiration is under some degree of voluntary control, and the patient may unconsciously alter the results by controlling respiratory effort. One of the ways to avoid this problem is to assess the respiration either just before or after you take the pulse (more on this later). For infants and shallow breathers, you may have to use a stethoscope to obtain an accurate count of respirations. The key to obtaining an accurate assessment of respirations is to be subtle, so the patient is not aware of what you are doing. This is one time you do not explain the procedure to the patient before you actually perform it.

While you are checking the respiration, assess the patient's ability to cough or speak. As you should know from your basic cardiac life-support training, the inability to speak or cough is one of the classic signs of airway obstruction.

Manually assessing respiration

Counting respirations can be a bit tricky and may require some acting on your part so the patient does not know that you are watching his or her chest rise and fall. To ensure you get the most accurate respiratory assessment, use the following procedure:

Begin counting respirations immediately before or after assessing the pulse. While you count respirations, keep your fingers in position to palpate the pulse; if you take an apical pulse, keep the stethoscope in contact with the chest. In most cases, the patient thinks you are counting the pulse, so he or she remains quiet and does not change the breathing pattern.

1. Do *not* tell the patient you are counting respirations.
2. Begin counting when you see the chest rise. Count each rise and fall of the chest as one respiration.

3. Observe if respirations are regular and both sides rise equally. Also, note the depth of respirations and if the patient has any pain or difficulty in breathing.
4. Count the respirations for one full minute if you notice an irregular pattern.
5. Report any abnormalities in quality, rate, depth, and pattern.
6. Record observations in the proper place on the PACU record. Usually, this involves plotting the respiratory rate on the vital signs graph and making comments about other respiratory characteristics in the remarks or nursing notes section of the form.

Pulse oximetry

To help monitor the quality of a patient's respiration and circulation, most PACUs routinely use a pulse oximeter. The pulse oximeter is a noninvasive method for continually measuring the oxygenation of a patient's arterial blood. It uses a sensor connected to the patient's finger, earlobe, or other relatively thin, vascular area; one side of the sensor emits red light and the other is an infrared sensor. After the lights pass through the arterial blood, a microprocessor determines how much of the light was absorbed and translates these values into the percentage of oxygen in the hemoglobin. The result is reported as a percentage of oxygen saturation. In the PACU, the goal is to maintain the patient's oxygen saturation as closely as possible to 100 percent. If the percentage drops below 90 percent, you must immediately initiate treatment for *hypoxia*.

The immediate postoperative recovery period is a critical time for your patients. It is essential the vital signs you obtain in the PACU are accurate. All vital signs are interrelated, and close monitoring helps to ensure any problems with circulation are detected early and treated quickly. For instance, if the blood pressure is low because the body is trying to compensate for reduced blood volume, the heart beats faster and the pulse rate increases. If the blood volume is low enough, the force of the pulse decreases and results in a thready pulse. The reduced flow causes poor oxygen exchange, so the respiratory rate increases to compensate.

The care given to patients in the PACU is designed to protect them and prevent complications. You and other members of the PACU nursing staff are constantly checking for signs you hope do not appear, but, as you well know, unexpected physiological reactions do occur following surgery and anesthesia. The best you can do is detect any problem before it has a chance to become serious or life-threatening. Learn and practice taking vital signs. The knowledge and skills you develop will ensure the surgeons and anesthesia staff always have accurate data on which to base treatment of postanesthesia patients. Now, test yourself to see if you are ready to assess the postoperative patient.

Self-Test Questions

After you complete these questions, you may check your answers at the end of the unit.

423. Initiating postanesthesia patient care

1. When a patient is admitted to the PACU, why are two complete sets of vital signs taken back to back, first by the anesthetist and then by the PACU nurse?

2. What information does the anesthetist tell the PACU nurse during the admission report?

3. Where do you find a record of the patient's preanesthetic vital signs?

4. What is the purpose for assessing the color and condition of the patient's skin, lips, and nail beds?

5. How is neurological status assessed in an unconscious patient?

424. Monitoring the patient's vital signs

1. Define pulse.

2. Which pulse sites are considered peripheral and bilateral?

3. Cite three characteristics a human pulse exhibits.

4. What are the average pulse ranges for the following groups of people?

   a. Infants.

   b. Children.

   c. Adults.

5. What body site is most often used to monitor the pulse in the PACU?

6. Why do you never use your thumb to palpate a pulse?

7. In what specific instance must you count the pulse for a *full minute*?

8. Why is monitoring the carotid pulse preferred during emergency situations, such as cardiac arrest?

9. Specify three instances when it may be necessary to take an apical pulse.

10. Briefly define:

    a. Blood pressure.

    b. Systolic pressure.

    c. Diastolic pressure.

11. What is the normal range of the systolic and diastolic blood pressure values in the adult patient?

12. What may a sudden drop in blood pressure indicate?

13. Match the descriptive statements in column A to the appropriate type of sphygmomanometer in column B. Column B items can be used once or more than once.

Column A	*Column B*
____1. Does not require calibration.	a. Mercury.
____2. Uses a metal bellows and needle gauge.	b. Aneroid.
____3. Must be read at eye level.	
____4. Requires periodic calibration.	
____5. Uses a cuff with an inflatable bladder.	

14. What is the most common site on the body for measuring the blood pressure?

15. Specify two methods for measuring a blood pressure, and indicate which one is most often used.

16. When taking a blood pressure, how fast is the pressure in the inflated cuff released?

17. Briefly describe how you document a blood pressure.

18. Cite four errors commonly made when measuring blood pressures.

19. List four reasons a patient's respiratory system may be compromised.

20. What are the four characteristics of respiration?

21. Define the following:

    a. Tachypnea.

    b. Bradypnea.

    c. Apnea.

22. If a pulse oximeter indicates a saturated oxygen level below 90 percent, what must you do?

3–3. Basic Postanesthesia Nursing Care

By now you should be fairly familiar with the PACU environment, the basic supplies and equipment needed for postoperative nursing care, and the personnel who provide this care. You should also know what to do when patients arrive in the PACU and how to assess their overall condition. Now let's look at the nursing care procedures you'll use or assist with during the immediate postoperative recovery period.

425. Patient comfort and continuous assessment of the PACU patient

One of the most important aspects of PACU care is continuously assessing the patient for changes in condition. In addition to monitoring vital signs and making the patient comfortable, you assess his or her awareness, sensation, and control of muscular reflexes. Some recovery rooms use procedures, sometimes known as a "stir-up routine," to help patients wake up, help you assess them, and reduce postoperative complications such as atelectasis and venous stasis (blood pooling from poor circulation). Although some of the procedures described sound harmless or simple, always check with the PACU nurse to ensure they are not contraindicated by the surgery or other condition.

Patient comfort measures

Keeping the postanesthesia patient clean, dry, and comfortable is an integral part of total perioperative nursing care that must not be overlooked. In the flurry of activity that goes on throughout a typical day in the PACU, we sometimes forget to apply the "human touch" to our patients. Satisfying the postoperative patient's needs and desires and helping allay his or her fears is as important after surgery as it is before surgery.

After the patient has been admitted to the PACU and the initial assessment is complete, begin to make your patient as comfortable as possible. Clean the patient's skin by removing all unnecessary electrode patches, paste, and skin preparation solutions such as povidone-iodine paint. Besides making the patient feel more comfortable, this cleaning lets you examine the skin more closely and better assess his or her condition. A patient who complains about being stiff and sore should be encouraged to change position or flex the extremities; you may be able to help ease the discomfort with a back-rub or by massaging the legs and arms.

"Cotton mouth" can be relieved by using moistened sponges and/or lemon-glycerin swabs. Remember, most of your postoperative patients have gone hours without food or water. Many were given drugs that turned their mouths into the Sahara desert, and they had various tubes stuck in their mouths and throats. They definitely appreciate any moisture they get. Use lemon glycerin swabs or wet 4×4 gauze sponges to moisten the lips, and allow the patient to suck the end of the swab or sponge. After the patient is fully conscious and regains the laryngeal (gag) reflex, he or she may be allowed to rinse the mouth with mouthwash or water.

One of the most common complaints of postanesthesia patients is they are cold. Mild hypothermia is commonly seen in an estimated 60 to 90 percent of PACU patients. The surgical patient is prone to heat loss from contact with cool surfaces (conduction) such as the OR bed or prep solutions, and from nondraped body areas being exposed to cool temperatures (radiation) and airflow (convection). The patient also loses body heat from evaporation, either through the wound and viscera, or through anesthesia machine ventilation (warm, moist, breath replaced with cool, dry, anesthetic gases). Sometimes patient hypothermia is produced intentionally. As you should recall from the lesson on anesthesia, induced hypothermia is used in cardiac surgery to lower the body's metabolic rate and decrease the demand for oxygen. In the PACU, you try to rewarm the patient. Warm cotton blankets are applied to the patient as soon as possible, and exchanged as often as necessary. These blankets are never placed where they hide intravenous lines and monitoring leads from the nursing staff's view. In some cases, special warming lamps are used. When these lights are used, skin temperature is constantly monitored to ensure the patient does not become overheated.

In addition to providing physical comfort, the PACU staff also attempts to provide psychological comfort and support. Helping patients get quickly reoriented as to time and place is an important step in helping them feel more secure. Constant reassurance that all is well also helps patients relax and feel more comfortable. By staying close, touching, and talking to your patients, you show them you care, satisfy their need for safety and belonging, and make the recovery experience much less traumatic.

Frequency of monitoring

As stated previously, vital signs are taken immediately upon admission to the PACU. After this initial check, PACU staff take and record vital signs at least every 15 minutes until the patient is discharged from the PACU. The vital signs checked include pulse, blood pressure, and respiration. In many hospitals, it is policy to take the patient's vital signs every 5 minutes for the first 15 minutes or until the patient stabilizes, and then every 15 minutes thereafter.

Can the patient breathe deeply?

A major cause of postoperative respiratory complications is decreased lung volume. The effects of general anesthesia, narcotics, and postoperative pain can depress the respiratory system, causing the patient to take shallow, monotonous, ineffective breaths. The lungs never fully inflate; this causes the tiny air sacs in the lungs (alveoli) to collapse and eventually leads to a collapsed lung. The poor exchange of air may also result in prolonged effects of anesthetic agents.

After you record the vital signs, ask the patient to inhale deeply through the nose until the chest is fully expanded and, then, exhale forcefully through the mouth. This is known as *diaphragmatic breathing* and prevents a patient from relying too heavily on accessory muscles of respiration, and particularly the abdominal muscles.

Can the patient cough to clear the airway?

When secretions are thick or threaten to cause airway obstruction, the best way to remove them is to have the patient cough. If a patient cannot cough effectively, mucus secretions may have to be suctioned out of the airway (we discuss how later). Some patients recovering from general anesthesia are encouraged to perform *cascade cough*—the patient takes a deep breath and then coughs at successive levels as he or she exhales. This "stair-step" can help dislodge mucous plugs in the alveoli

and bronchioles of some patients. Coughing is most effective in a sitting or lateral position, but if the patient must be supine, bending his or her knees may help decrease tension on abdominal muscles and allows the diaphragm to move more freely.

A patient recovering from chest or abdominal surgery may have severe pain when attempting to cough. To help decrease the pain and prevent possible wound disruption, you can help support the area over or near the incision site. The palms of your hands, a pillow, rolled towel, or folded sheet may be used to support the wound over the dressing by applying steady gentle pressure. This support is known as a splinting maneuver, but do not confuse it with the respiratory complication splinting discussed previously.

Can the patient change position as necessary for safety and comfort?

Whenever possible, general anesthesia patients are transported to the PACU in (and are kept in) a modified lateral position until they can move themselves. In this position, the patient's head is turned to the side with the neck straight or slightly extended, both arms are flexed at the elbows in front of the chest, the top leg is flexed at the hip and knee, and the lower leg is straight. The modified lateral position maintains an open airway, helps to prevent aspiration, and permits good ventilation of the lowest lobes in the lungs. During extended recovery periods, the unconscious or semiconscious patient should be repositioned frequently (at least once each hour) to improve venous circulation to the extremities and prevent atelectasis and hypostatic pneumonia. Hypostatic pneumonia is an inflammation and fluid buildup in the lower lobes of the lungs, caused by lying in a lateral position for long periods of time. It most often occurs in elderly or very weak patients who are immobilized and cannot move themselves. Whenever changing patient position, ensure all drainage catheters and IV lines stay in place, are not overly stressed, and remain open.

To prevent blood from pooling in the extremities, conscious patients are encouraged to move their arms and legs. Movement and muscle contractions aid venous return to the heart, cause deeper breathing, and improve cardiac function by stimulating the heart to beat harder and faster.

Some patients are discouraged from position changes. Spinal anesthesia patients usually stay supine. After delicate operations such as eye surgery, a patient may be supine (on his or her side) with the unaffected eye down to prevent pressure on the operative eye. Thoracic surgery patients with chest tubes are usually supine with the head of the bed slightly elevated. If special postoperative positioning is required, the anesthetist or anesthesiologist normally informs the PACU nurse during the admission report. The surgeon's postoperative written orders are also checked when the patient is admitted to determine any positioning requirements or restrictions during the immediate postoperative period.

426. Administering oxygen

We've discussed the safety precautions for using oxygen in Volume 1. Now, this lesson focuses on the various methods of oxygen administration most commonly used in the PACU.

Purpose of oxygen administration

The goal of administering oxygen to patients is to prevent or eliminate hypoxia by saturating the red blood cells with oxygen to ensure maximum oxygen reaches all cells and tissues in the body. We provide low-flow oxygen to virtually all patients in the PACU to counter the respiratory interference caused by most anesthetic agents, and particularly for patients administered a general anesthetic. As stated in the previous unit, hypoxia may result from preoperative medications, anesthetic agents, pulmonary complications, pain, hemorrhage, shock, or airway obstruction. Because complications may occur at any time, oxygen must be available for every patient in the PACU.

One important fact to remember—and often overlooked—is medical grade oxygen used in the hospital is a drug, and like any drug, oxygen can cause complications. Some of these complications are respiratory depression, collapsed lung (atelectasis), chest pain (sometimes with splinting), and

oxygen toxicity. Because of the potential hazards involved with its use, you never administer oxygen unless it is specifically ordered by a licensed provider.

Basic considerations and conditions

Certain conditions must exist and factors must be considered for effective oxygen administration, or oxygen therapy. First, the patient's airway must be patent because air and oxygen must be able to get into the lungs to do any good. Second, the patient must be breathing on his or her own, or must be mechanically ventilated. Third, 100 percent medical-grade oxygen, and devices to administer it, must be available. Room air contains about 21 percent oxygen; for effective therapy, inspired air must be increased to between 30 and 50 percent oxygen. Fourth, once initiated, oxygen therapy is continued until all signs of hypoxia disappear (unless oxygen-related complications arise); discontinuing treatment too soon can result in the return of hypoxia. Fifth, the patient must be observed and monitored for effects.

Methods of oxygen administration

Oxygen is delivered from the source through moisture-adding and regulating devices, such as nebulizers or humidifiers, via administration tubing and devices, such as nasal catheters, nasal cannulas, face tents, face masks, oxygen tents, and automatic ventilators. This lesson only covers the administering devices usually used in the PACU—nasal cannulas, face tents, and face masks. Nasal catheters, oxygen tents, and ventilators are most often used only in long-term care areas such as ICU or other nursing units.

Humidification devices

Because surgery and anesthetic agents often prevent the nasal passages from naturally adding moisture to inspired air, moisture is added to the oxygen administered in the PACU. This moisture helps prevent the mucous membranes in the respiratory tract from drying out and becoming irritated. It also prevents mucous secretions from thickening and blocking the airway and keeps the cilia lining the bronchial tree actively removing secretions and inhaled debris. There are numerous devices designed to moisturize or humidify the air the patient breathes, but the ones most commonly used in the PACU are divided into two basic types—humidifiers and nebulizers.

Humidifiers

Humidifiers bubble oxygen through sterile, distilled water to convert water to a gaseous state, usually with the help of a heating element in the water container. When heated humidifiers are used, care must be taken to ensure the water vapor reaching the patient is not too hot (usually not above normal body temperature), in order to prevent burns of the face and upper respiratory passages. Prefilled, single-patient-use, disposable humidifiers are most commonly used in PACUs, but you may see refillable humidifiers still used in some places.

Nebulizers

Nebulizers turn the water into a fine mist or spray that mixes with the oxygen flow and is delivered to the patient. This is done by forcing the oxygen through a very small nozzle to create a jet and, then, passing this oxygen jet across the top of a tube immersed in sterile distilled water. The jet draws water up the tube by capillary action, where it is blown into baffles that create water droplets. The finest of the droplets mix with the oxygen flow and are delivered to the patient. Some nebulizers also contain heating elements to increase the humidity of the oxygen. Also, nebulizers provide a method of delivering liquid drugs or agents, such as asthma medications, to the patient. The medication is added to the reservoir and delivered to the patient with the humidified oxygen.

Administration devices

Administration devices are used to get the oxygen from the source and humidifier to the patient.

Nasal cannulas

Nasal cannulas, or nasal prongs, are made of flexible plastic tubing, usually tinted green to signify use with oxygen, with two hollow prongs, about 1/2-inch long, that are inserted into the patient's nostrils. The cannulas are held in place by an adjustable elastic band placed around the back of the patient's head and connected to the humidifier or nebulizer by a long, thin piece of tubing about 1/4-inch diameter. They are disposable, easy to use, inexpensive, and comfortable for the patient. Cannulas are primarily used for routine oxygen administration in patients with mild respiratory dysfunction because they provide relatively low concentrations of oxygen. When nasal cannulas are used, the flow rate is set between 6 and 8 liters per minute (L/min) to deliver an oxygen concentration of between 30 and 40 percent.

Face tents

Face tents or half masks (open-top) are commonly used to administer oxygen to postanesthesia patients. They resemble upside-down plastic ice scoops placed under the chin enclosing it and over the lower third of the patient's face to direct airflow upwards. The upper end closest to the eyes is open. Like the nasal prongs, face tents are held in place with an adjustable elastic band. Face tents are connected to a humidifier with large diameter, disposable tubing that is about the same as a breathing circuit. They are very comfortable for the patient, easily applied, and deliver extra humidity to the mucosa. When face tents are used, set the flow rate between 4 and 8 L/min to deliver an oxygen concentration between 30 and 55 percent.

Face masks

When patients need higher concentrations of oxygen than can be provided by nasal cannulas or face tents, a variety of soft plastic, disposable masks are used to administer oxygen. Unlike the masks commonly used to administer inhalation anesthetics and oxygen in the operating room, these masks are held in place by elastic headbands, and are made of clear (usually green) plastic that allows visualization of the patient's nose and mouth.

Face masks are usually not tolerated very well. They tend to slip out of position, create pressure on the face, and make the patient's face very wet under the rim of the mask. Another disadvantage is that at low flow rates, a patient may rebreathe significant amounts of carbon dioxide (CO_2). When a face mask is used, periodically remove it to relieve the pressure and wash and dry the patient's face.

Simple masks completely cover a patient's nose and mouth, and may fit under or over the chin. They usually have metal strips or clips to seal around the bridge of the nose, and are flexible enough to conform to the contours of the face. Simple face masks have holes in the sides to allow patients to exhale CO_2, and also to let them inhale room air when their inspiration volume exceeds the oxygen flow rate. They do not have valves or reservoir bags. Simple masks may be connected to a nebulizer by small diameter tubing, like nasal cannulas, for low-flow of 6–8 L/min, or to a humidifier for high-flow of 10–12 L/min. The percentage of oxygen delivered at these flow rates varies between 35 to 60 percent.

Partial rebreathing masks are simple masks with one-way valves (instead of holes) on the sides and a bag attached to the bottom. As the patient exhales, part of his or her CO_2 escapes through the valves, and part enters the "rebreathing bag." The air in the bag is then mixed with fresh oxygen from the humidifier or nebulizer and rebreathed. This allows higher oxygen concentrations than a simple mask when oxygen flow is high, but significant rebreathing of CO_2 is possible when the oxygen flow rate is low.

427. Preventing airway obstruction

As you know, general anesthesia can not only cause relaxation of respiratory muscles—diaphragm, intercostals, and abdominal—it can also affect the muscles that control the jaws. When these muscles relax, the lower jaw drops and the tongue falls back in the throat and obstructs the airway. To prevent this, anesthetists may insert an oral or nasal airway after extubation. Relaxation of the patient's neck

muscles can also cause airway obstruction if proper neck alignment is not maintained during the immediate postoperative period. How do you tell if a patient's airway is obstructed or partially obstructed? Follow the guidelines we discussed above. Look for the rhythmic, symmetrical rise and fall of the chest, listen for unusual breathing sounds, such as gurgling, wheezing, or high-pitched crowing, and feel for exhaled breaths by placing a hand in front of the patient's mouth and nose.

Airway obstruction by the tongue, mucous secretions, or posture causes most of the respiratory problems encountered in the PACU. The simplest way to prevent this is by turning the patient's head to the side and hyperextending the chin. This not only keeps the tongue and jaw from falling back, but also reduces chances of aspiration of mucus and vomitus into the trachea and lungs. Two other techniques used in critical instances of airway obstruction are the ones you learned in BCLS—the head tilt/chin lift or the head tilt/jaw thrust. Preventing postural obstruction usually involves a simple adjustment of the patient's neck alignment, so the head and neck are in a straight line with the spine. Special attention must be given to the neck alignment of unconscious infants and small children because their tracheas are softer than adults and more susceptible to collapse when their heads are hyperextended or hyperflexed.

Another measure that helps prevent possible airway obstruction is to leave an oral or nasal airway in position until the patient regains sufficient reflex responses to spit or pull the airway out. If you see a patient gagging, choking, or trying to push the airway out with the tongue, remove it. Do not let the patient continue to gag on an oral airway; otherwise, they may suddenly vomit and aspirate the emesis. Then you'll have a major respiratory complication on your hands! For more in-depth discussion of possible respiratory complications and your role in managing them, refer to the section on anesthesia complications in Unit 2.

One action frequently required to maintain an open airway in the postanesthesia patient is suctioning of the nose, mouth, and trachea.

Suctioning procedures

Suction is used to remove any mucous, blood, or other secretions from a patient's nose, mouth, throat, and trachea before they are aspirated into the deeper breathing passages. Proper technique is essential to effectively remove secretions, prevent harm to the patient, and minimize risk of infection.

Oropharyngeal and nasopharyngeal suctioning

Suctioning the mouth, nose, and throat are relatively simple procedures, but you still need preparation and training to perform them safely. Since you will most often be required to suction out a patient's mouth and throat (oropharynx), we'll cover this technique first. The steps for oropharyngeal suctioning are:

Oropharyngeal Suctioning
(Also to be used with nasopharyngeal suctioning.)

Steps	Explanations
Assemble all equipment and supplies	PACUs have wall-mounted suction; make sure the device is properly assembled and working. Ensure the connecting tubing between the suction apparatus and suction tip is long enough and all connections are tight. Gather a basin of sterile saline, surgical or examination gloves, and a variety of suction catheters. Use a size 14, 16, or 18 French (Fr.) catheter to suction adults and an 8 Fr. for infants or small children.
Wash your hands thoroughly, dry them, and don gloves	The gloves do not have to be sterile since oropharyngeal suctioning is considered a clean procedure rather than a sterile one.

Oropharyngeal Suctioning (Also to be used with nasopharyngeal suctioning.)	
Steps	**Explanations**
Place the patient in a semisitting position whenever possible	This makes it easier for the patient to breath and cough, and also allows gravity to help with the catheter insertion. In an emergency, if large amounts of vomit, blood, or secretions totally fill the patient's mouth and throat, immediately turn the patient's head to the side and have someone help you lower the head of the bed. Quick action is needed in this situation to ensure the majority of the fluid drains out of the patient's mouth by gravity and is not aspirated into the lungs. Keep the patient in this position while you suction out the mouth and nose.
Explain the procedure to the patient, even if he or she appears unconscious	This reduces the patient's apprehension and helps gain his or her cooperation during the procedure. (Just think how you would feel if someone tried to stick a long skinny tube in your mouth without telling you why!)
Turn on and regulate the suction device	Block (occlude) the tubing to obtain maximum vacuum, then regulate the pressure to 60 to 100mm Hg for infants or 100 to 120 mm Hg for children. Higher levels may be used for adults.
Suck a small amount of saline out of the basin	This ensures the suction device is functioning properly and lubricates the inside and outside of the catheter. Lubricating the outside prevents the catheter from sticking to the membranes in the mouth and throat; wetting the inside reduces the chances of secretions clogging it.
Gently insert the catheter into the patient's mouth, threading it along the roof of the mouth towards the trachea	Do NOT apply suction as you are threading the catheter into the patient's mouth. Applying suction as the catheter is introduced would remove oxygen and could cause trauma to the mucosal tissues. If the patient gags, back the catheter out slightly.
Block the catheter's suction control port with your finger and apply suction as you slowly and gently withdraw the catheter using a twisting motion	Rotating the catheter as it's withdrawn, helps clean secretions in a complete circle around the catheter tip. Do not apply suction for more than 10 to 15 seconds at a time as you will reduce oxygen to the patient's lungs and trachea.
Listen to chest and breathing sounds	Determine the effectiveness of suctioning; use a stethoscope if necessary.
Repeat as necessary to clear the airway	Allow the patient to rest and breathe humidified oxygen for two to three minutes between applications. Aspirate a small amount of saline through the catheter before each suctioning.
Assess respiration after suctioning	Document on the PACU record, the time, nature, and amount of secretions removed by suctioning.
Offer the patient a damp sponge or lemon-glycerin swab	Assist in cleaning the patient's lips and mouth after and between suctioning.

The preparation and technique required for nasopharyngeal suctioning are the same as those for oropharyngeal suctioning, except:

Nasopharyngeal Suctioning (Use these steps in addition to the ones above.)	
Steps	**Explanations**
Position the patient's head	He or she should be looking straight ahead and the tip of the nose should be slightly elevated.
Measure the catheter length required for insertion	Estimate how much of the catheter needs to be inserted to reach the pharynx by holding the catheter next to the patient's face and noting the distance between the tip of the nose and the external ear opening.

Nasopharyngeal Suctioning (Use these steps in addition to the ones above.)	
Steps	**Explanations**
Insert the catheter along the floor of the nostril—either one	If you meet resistance, do not force the catheter. Back it off and try inserting it at another angle or in the other nostril. Suction the nasopharynx using the techniques previously described. If both nostrils are open with no obstructions, alternate nostrils between suctioning. Administer oxygen between and after suctioning.

Sometimes it may be necessary to perform intratracheal suctioning to remove deeper secretions.

Intratracheal suctioning

This type of suctioning is tricky and requires strict aseptic technique to prevent introduction of potential pathogens deep into the patient's respiratory passages. Usually, only the PACU nurse or anesthetist performs this type of suctioning, but you should learn the technique in case of emergency. Never attempt tracheal suctioning unless you have been properly trained and certified to do it. The steps are as follows:

Intratracheal Suctioning	
Steps	**Explanations**
Prepare supplies and equipment	This time, obtain a *sterile* basin for holding the sterile saline solution. Select a catheter that will not occlude the trachea, endotracheal tube, or tracheostomy tube, usually a 14 or 16 Fr. suction catheter. Leave the suction catheter in the peel-back wrapper to preserve sterility; open it just enough to connect it.
Talk to the patient	Inform the patient of the procedure about to take place to reduce his or her apprehension.
Ensure the patient has been properly ventilated before suctioning	Deep suctioning removes much of the oxygen from the patient's lungs and can lead to cardiac arrhythmias. If the patient is conscious, ask him or her to take four or five deep breaths while breathing humidified oxygen. If the patient is unconscious, hyperventilate with an Ambu bag. If the patient has an endotracheal tube in place, ensure the lungs are fully inflated with the Ambu bag or other mechanical respiratory assistance device several times prior to suctioning.
Don sterile gloves using the open glove method	Do not touch anything other than the sterile catheter.
Unwrap catheter	Remove the catheter from the wrapper using aseptic technique.
Insert the catheter	Insert the catheter through the endotracheal tube or tracheostomy tube, if in place, or insert it along the roof of the mouth or floor of a nostril until it reaches the larynx. Gently grasp and retract the patient's tongue with a sponge to make the glottis open and move in line with the trachea (if the patient is conscious, say "stick out your tongue!"). Monitor breath sounds and air movement through the suction port on the connector as you slowly advance the catheter. When you reach the front of the larynx, breath sound loudness will increase and you will feel more air movement through the suction port. If breath sounds decrease or the patient starts to gag, the catheter is probably touching the lower part of the pharynx (hypopharynx) near the esophagus; draw the catheter back and retry. When the tip of the catheter enters the larynx, the patient usually coughs suddenly. When this occurs, wait for the patient's next breath, and advance the catheter during the breath.

Intratracheal Suctioning	
Steps	**Explanations**
Apply intermittent suction	Once the catheter is in the trachea, apply intermittent suction by alternately opening and closing the suction control port on the catheter connector with your thumb.
Remove the catheter	Slowly remove the catheter using the same technique we described before.
Resuction as needed	If resuctioning is necessary, make sure the patient is hyperventilated before inserting the catheter. Also, make sure you don a new set of sterile gloves and use a new sterile catheter.
Assess respiration after suctioning	Document the procedure as previously described.

Anytime suctioning is performed, closely monitor the patient's vital signs. Whenever possible, take a complete set of vital signs immediately before and after each suctioning procedure to make sure the patient is stable.

Self-Test Questions

After you complete these questions, you may check your answers at the end of the unit.

425. Patient comfort measures and continuous assessment of the PACU patient

1. What are two reasons for cleaning the patient's skin in the PACU?

2. What can you use to help relieve the patient's dry mouth before he or she is fully awake?

3. List four ways surgical patients are susceptible to heat loss.

4. After the initial check, how often does the PACU staff take and record vital signs?

5. Briefly describe how general anesthesia can result in decreased lung volume.

6. Describe diaphragmatic breathing. What is its primary benefit?

7. Describe the cascade cough. What is its primary benefit?

8. How often should an unconscious patient be repositioned? Why?

9. List three categories of patients who may be discouraged from moving.

426. Administering oxygen

1. What is the goal of oxygen administration?

2. List five conditions or factors for effective oxygen administration.

3. Give four reasons moisture is added to the oxygen administered in the PACU?

4. Describe the difference between a humidifier and a nebulizer.

5. Describe nasal cannulas.

6. List five disadvantages to oxygen administration using a face mask?

7. What two ways do partial rebreathing masks differ from simple face masks?

427. Preventing airway obstruction

1. What are the three main causes of airway obstruction in the PACU?

2. How long is an oral airway left in a patient’s mouth following surgery?

3. What size suction catheters are normally used on adult patients?

4. Why do you aspirate a small amount of saline into a suction catheter before and between uses?

5. Why is it important to avoid applying suction to a suction catheter during insertion?

6. When performing oropharyngeal suctioning, what is the *maximum* length of time you apply suction?

7. Before performing nasopharyngeal suctioning, how can you approximate the length of catheter that needs to be inserted in order to reach the pharynx?

8. Why is strict aseptic technique required for intratracheal suctioning?

9. What do you do to ensure a conscious patient is well ventilated prior to suctioning out the trachea?

10. When performing intratracheal suctioning, how can you determine when the catheter is properly positioned in front of the larynx?

3–4. Postoperative Complications, Discharge Procedures, and Safety

As in all areas of patient care, complications may arise in the PACU. Therefore, this section covers some of the more likely problems you may encounter. It then moves to the criteria patients must meet before they can be safely discharged from either the PACU or Same Day Surgery Center (SDSC). Finally, it discusses some of the infection control procedures that apply specifically to the PACU.

428. Helping detect and manage postoperative complications

Many of the complications that can occur in the postanesthesia patients are the same as the ones that can occur during anesthesia administration in the operating room. For instance, the patient may hemorrhage and go into hypovolemic shock, a respiratory obstruction can occur for a number of reasons, or the patient may have an allergic reaction to one of the anesthetic agents or adjunct drugs administered before, during, or after the operation. In addition, cardiac arrhythmias can develop unexpectedly and lead to a cardiorespiratory arrest, and the patient can have a transfusion reaction when an attempt is made to infuse whole blood. We've covered many of these complications in the previous unit, so we now confine our discussion to some that normally only occur postoperatively. The first problem is inherent to surgery—postoperative pain.

Pain management

Pain relief is an important part of quality postoperative care. Not only is pain uncomfortable, but it can cause respiratory problems, cardiovascular problems, nausea and vomiting, patient agitation or delirium, and other conditions that can interfere with postoperative recovery. When patients tell you they are in pain—they ARE in pain! Pain is personal and subjective; no matter how minor an operation or how small an incision, different patients experience and tolerate varying degrees of pain. Pain management must be tailored to fit the individual reactions and needs of each patient. Typical areas and causes of postoperative pain include:

- Skin and subcutaneous pain from the incision.
- Deeper tissue pain from manipulation, retraction, electrocautery, etc.

- Airway/respiratory tract pain from drying agents, endotracheal tubes, nasogastric tubes, oral or nasal airways, and mask pressure.
- Localized pain and stiffness from pressure or immobilization resulting from the surgical position.
- IV site pain from the needle or catheter insertion, infiltration, or internal pressure.

Pain management sometimes begins before the patient enters the PACU. When patients have upper abdominal or thoracic surgery, surgeons may administer a field block by injecting a long-duration local anesthetic agent (such as Marcaine) in the tissue surrounding the incision. This blocks incisional pain during the first few hours after surgery, and allows the patients to stabilize and recover from the effects of the general anesthetic before having to cope with the postoperative pain. Patients having extensive knee or hip surgery may have a continuous epidural catheter placed for postoperative administration of local anesthetics or narcotics.

Narcotics, such as morphine or fentanyl, are sometimes prescribed as analgesics during the immediate postoperative period if the patient's pain is severe. Narcotics are carefully controlled and effects are monitored because they can depress the respiratory system. If narcotics are ordered, they are usually injected intramuscularly or intravenously; sometimes they are "piggy-backed" or spliced into the IV. Conscious patients may be given oral, nonnarcotic analgesics, such as aspirin, acetaminophen, or ibuprofen, for pain relief. Drugs are always administered by a licensed practitioner.

Actions you can take to help prevent or reduce a patient's pain include:

- Ease patient's fears and anxieties by keeping him or her informed of progress, causes of different sensations, what you are doing, and why you are doing it. Provide as much reassurance as possible during the recovery period.
- Ensure patient is positioned as comfortably as possible without putting stress or pressure on the incision or compromising respiration.
- "Splinting" incision sites as the patient takes deep breaths or coughs.
- Assisting with application of transcutaneous electrical nerve stimulation (TENS) devices to help relieve acute incisional pain. These battery-operated devices send a mild electrical current through electrodes placed on the skin near the incision site. The current is adjusted until the patient feels a mild tingling or vibrating sensation over the area of application. Transcutaneous nerve stimulators are usually used in conjunction with analgesics and can significantly reduce the dosages of the drugs required to effectively relieve pain.

In addition to managing the patient's pain, the PACU staff must constantly be aware of and ready to treat other postoperative complications. One of these is emergence delirium.

Emergence delirium

Most general anesthesia patients have a calm, placid recovery, but some emerge in an agitated or excited state. They can be extremely restless, cry or moan incessantly, babble incoherently, and be extremely disoriented. In extreme cases, patients may scream, shout, or thrash violently as if in a rage. This extreme irrational behavior is known as emergence delirium.

Emergence delirium occurs most often in healthy patients, and frequently in children. Some of the factors or causes that can contribute to emergence delirium are:

- Hypoxemia is the number one cause and is the first suspect when patients show signs of postoperative excitement or delirium.
- Drugs, especially barbiturates and scopolamine, may contribute, particularly when coupled with fear.
- Patients who are afraid of cancer, disfigurement, or are claustrophobic preoperatively should be watched closely.

Other conditions that can contribute to the development of emergence delirium include:

- Poorly managed postoperative pain
- Cramping of muscles and joints after immobilization during long surgical procedures, or
- Full bladder causing discomfort or pain.

When a patient shows signs of delirium, the first thing PACU personnel do is check the airway and administer oxygen to treat hypoxia and, then, ensure patient and staff safety by using restraining devices and side rails. In some cases, the patient's arms and legs must be restrained to prevent injury and prevent dislodging of catheters, drains, or IV lines. Blood oxygen levels should be checked by a pulse oximeter or with arterial blood gas samples to confirm or rule out hypoxia. If hypoxia is ruled out, the delirium is treated by relieving the source if possible. Changing the patient's position is sometimes all it takes to quiet him or her. Children may be calmed by being held by their parents. Drugs such as physostigmine may be given to reverse the effects of scopolamine, a catheter may be inserted to drain the bladder, or tranquilizers such as diazepam may be injected to calm patient fears. If all else fails, administration of a narcotic agent, such as morphine, may settle the patient down. Narcotics are almost never used on children, and PACU staff must watch very closely for signs of respiratory depression and hypotension when they are used. Narcotics can also cause postanesthesia complications such as those discussed next—nausea and vomiting.

Nausea and vomiting

Postoperative nausea and vomiting can greatly increase recovery time and create serious problems for the patient. Vomiting increases the risk of airway obstruction and aspiration. The violent retching and muscle spasms associated with vomiting can cause abdominal muscle cramps and lead to wound disruption. Extended nausea or vomiting can lead to dehydration and electrolyte imbalance.

Nausea and vomiting are caused by stimulation of the vomiting center in the medulla of the brain, frequently triggered by foreign materials such as gas, blood, or mucus in the stomach or other portions of the gastrointestinal tract. Narcotics can directly stimulate the vomiting center. It may be influenced by certain anesthetic agents that sensitize the balance control center and cause dizziness. Severe postoperative pain has also been linked to nausea and vomiting. Rough handling of the patient during transportation and frequent position changes in the PACU are two main causes of nausea and vomiting in the surgical patient.

Women are historically more prone to nausea and vomiting than men. Drugs, such as meperidine (Demerol) used for premedication, and inhalation anesthetic agents also increase the risk. "Masked" patients are more susceptible to nausea than those who are intubated, probably because of higher levels of gases having inadvertently been pumped into the stomach during positive-pressure ventilation. Other groups of patients who are likely to vomit include patients who become hypotensive during surgery, undergo major abdominal surgery, have a history of motion sickness, and have been given large dosages of a reversing agent such as naloxone (Narcan).

One of the easiest and most effective treatments for the postoperative patient who is nauseous is to have him or her breathe deeply and cough and then administer oxygen. Another simple treatment that often helps reduce nausea is to place a cool, wet washcloth or hand towel on the patient's forehead and reassure him or her. Because a nauseated patient may vomit, always remain close by. If severe nausea persists, the surgeon or anesthetist may order an antinausea drug.

If the patient vomits, immediately turn his or her head to one side and lower the head of the bed to reduce chances of aspiration. If the patient cannot clear the vomitus, oral suctioning is indicated. As soon as the vomiting episode is over, administer oxygen and evaluate breath sounds with the stethoscope.

If aspiration is suspected, immediately notify the surgeon and anesthetist. If the airway is obstructed by aspiration, lower the head of the bed, turn the patient's head to the side, try to remove the obstruction by finger sweep or oropharyngeal suctioning, and send someone for a doctor or

anesthetist. Ideally, a professional staff is available to take immediate charge of this emergency situation.

Just as anesthesia administration can affect the vomiting center of the brain, it can also affect the brain's body temperature regulating area.

Extreme body temperature fluctuation

The systems that normally regulate the body's temperature are impaired during the anesthesia administration, and the patient's temperature may be lowered (hypothermia) or raised (hyperthermia) significantly.

The patient's core body temperature may drop 10°F (6°C) or more, especially if the surrounding room temperature is low and the patient is an infant, small child, or elderly patient. This hypothermia can be compounded by infusion of cold IV solutions and the use of insufficiently warmed, wound irrigation. The lowered body temperature intensifies the depressant effects of the anesthetic agents—slowing respiration and causing the patient to shiver uncontrollably. This is a double insult to the respiratory system. Not only is the patient's breathing slowed, which lowers his or her intake of oxygen, but the muscle activity caused by the shivering may quadruple oxygen use. This combination significantly lowers the amount of oxygen in the blood, and can result in hypoxia and, eventually, cardiorespiratory failure.

Treatment includes gradual rewarming of the patient, using the methods we discussed previously, and avoiding sudden movement to prevent large volumes of cool blood in the extremities (particularly the legs) from returning suddenly to the heart. Oxygen is administered to increase the oxygen levels in the blood, sedatives can be administered to reduce shivering, and small doses of methylphenidate (Ritalin) can be administered to stimulate the respiratory centers in the brain.

Postoperative hyperthermia, or fever, can be caused by many factors including infection, drug reactions, preexisting diseases, and malignant hyperthermia. Unless hyperthermia is extremely severe, treatment is not usually initiated in the PACU. The main treatment for excessively high body temperatures is rapid cooling of the body. This can be done by wiping or wrapping the skin with towels saturated in cold sterile saline, internal irrigation of body cavities and orifices with cold saline, packing the body in ice, or placing the patient on a cooling blanket. For a more in-depth description of the causes and treatment of malignant hyperthermia, refer to Unit 2, Anesthesia.

Fluid and electrolyte imbalances

Patients most vulnerable to problems associated with fluid and electrolyte imbalances include infants, elderly patients, and patients with severe chronic diseases such as diabetes mellitus or heart disease. Surgical patients who have received large amounts of mannitol (an osmotic diuretic) and patients with severe hypertension who take diuretics to lower blood pressure are also very susceptible to fluid and electrolyte imbalances.

Most of the problems result from excessive fluid loss from the body, especially for patients who receive diuretics. Dehydration can be accelerated and compounded by hemorrhaging during surgery. When severe dehydration occurs, the patient's blood pressure falls and the heart rate increases (tachycardia). If left untreated, seizures, coma, and death follow. The basic treatment for severe dehydration is massive infusion of IV fluids and close monitoring of serum electrolytes.

Sometimes patients are given too much fluid intravenously. This can result in a fluid overload characterized by a frothy, pink sputum, obvious respiratory distress (due to the fluid buildup in the lungs), elevated central venous pressures (CVP), and a "fluffy" looking chest X-ray. If left untreated, this condition can result in congestive heart failure. Treatment for fluid overload involves intubating the patient and providing positive-pressure ventilation while administrating a diuretic such as furosemide (Lasix), and opiods such as morphine.

Other complications

Other postoperative complications include shock, hemorrhage, hypoxia, and problems associated with particular surgical procedures. Continuously observe, monitor, and report any abnormal signs or symptoms, regardless of how minor they appear. Some of the common conditions and symptoms are listed in the following table. This is only a partial list, and symptoms listed in a regional area may pertain to other areas as well.

Postoperative Complications	
Complication	**Description**
Shock	Low blood pressure (systolic below 90); cold, moist skin; ashen, pale skin; rapid, thready pulse; rapid, shallow respiration; cyanosis of lips; subnormal temperature.
Hemorrhage	Bleeding; rapid pulse; increasing pulse rate with falling pulse pressure; rapid, deep sighing respirations; cold, moist, pale skin; restlessness; apprehension; low blood pressure; pallor of lips and mucous membranes; thirst.
Hypoxia	Rapid, difficult respiration; restlessness; marked air hunger; rapid, thready, pulse; apprehension; cyanosis; yawning; blurring vision.
Abdominal surgery	Distention; tenderness; bleeding or excessive drainage; bright red blood in drainage; vomiting; continued hiccups; cramping abdominal pain; blood-tinged urine; patient complaint, “Something let go.”
Neurological surgery	Weak, spontaneous movements; weakness or paralysis of side or extremity; unequal pupils or a fixed pupil; convulsions; rapid rise in blood pressure with decrease in pulse rate and respiration; labored respiration; restlessness; headache; edema; pallor; drowsiness after patient reaction; difficult speech; lessened reaction to stimuli (such as pin prick); agitation; personality change.
Thoracic or cardiac surgery	Rapid respiration; tachycardia; cyanosis; restlessness; distended neck veins; low blood pressure; subcutaneous emphysema (escape of air from pleural space into tissues); crepitus (crackling or grating sound when touching swollen tissue); abnormal movement of chest wall; splinting of chest; sudden increase in volume of drainage; difficult respiration; swelling; bloody drainage in chest evacuation container; patient apprehension.
Orthopedic surgery	Pain in casted extremity; difficult respiration due to tight body cast; excessive bleeding; extremity swelling, coldness, paleness, blanching, cyanosis, tingling, or numbness; localized burning pain; loss of sensation; sudden severe chest pain; reddened skin areas; inability to extend fingers accompanied with pain.
Urological surgery	Excessive bleeding or drainage; bright red drainage or clots; sudden drop in blood pressure; spasms of bladder; extreme desire to urinate; overly distended bladder; inability to void; nausea and vomiting; lethargy; abdominal distention; oliguria (reduced urine output); edema; hematoma.
Eye surgery	Nausea; vomiting; restlessness; disorientation; apprehension; bleeding or excessive discharge; persistent or increasingly severe pain.

Postoperative Complications	
Complication	**Description**
Ear surgery	Facial paralysis; impairment or loss of hearing; elevated temperature; headache; stiff neck; dizziness; vomiting.
Nose surgery	Respiratory distress; restlessness; sudden elevation of temperature; excessive or projectile vomiting; headache; stiff neck; edema; bleeding; hematoma; severe pain; subcutaneous emphysema; frequent swallowing and belching.
Throat or neck surgery	Bleeding; difficult, sighing, or noisy respiration; repeated swallowing; edema; nausea and vomiting; increasing restlessness; emphysema; patient complains of tightness or pressure of operative site; muscular twitching; spasms of hands and feet; tachycardia; high temperature; loss of voice.

Never ignore a patient's complaint, no matter how insignificant it appears. Small problems can grow into very big problems when left unattended. There are numerous other complications and symptoms that occur in postanesthesia patients. We do not expect you to memorize all of them or know how to treat each one—that's the doctor's job. Your main job is to learn enough to help detect a postoperative problem before it mushrooms into a life-threatening situation. To do this, you must master the techniques used for taking and recording vital signs and be able to readily identify abnormal reactions and vital sign fluctuations.

429. Discharging patients from the PACU and SDSC

The PACU is a short-term care unit for inpatient surgery. After patients have recovered from the immediate effects of the anesthetic, they are discharged to another unit in the medical facility for further assessment and care. The SDSC is a short-term care unit for stage 1 and stage 2 recovery from surgery. Stage 1 recovery is the immediate period following a surgery where the patient is recovering from the effects of anesthesia (usually around 30–45 minutes) and monitored very closely. Stage 2 recovery is the process of preparing the patient for discharge to home. Both units care for the patients in the same way during the recovery period. The difference is that patients released from the PACU are sent to a nursing unit and the patients released from the SDSC are sent home.

Patient recovery scoring systems

Many hospitals use a postanesthesia recovery scoring system (PARS) to determine a patient's general condition and readiness to be released from the PACU/SDSC. As patients progress through various stages of the recovery period, physical signs are observed and evaluated. These signs are given a numerical value, totaled to obtain a score, and recorded on the PACU/SDSC record. The patient's score is normally recorded on admission to the PACU/SDSC and at 15 to 30 minute intervals through the stage 1 recovery period.

Most scoring systems used today are modifications of the Apgar scoring system used to express the condition of newborn infants. One popular scoring system used in the PACU/SDSC is the Aldrete system, which uses five categories to evaluate a patient's overall condition. The patient is assessed, and a numerical value ranging from 0 to 2 is assigned to each of the five evaluation categories; then the score is totaled. If this total score is 8 or above, the patient usually can be discharged unless a condition not scored, such as extreme nausea or vomiting, indicates otherwise. The following table lists the categories and values scored under a typical postanesthesia scoring system.

Postanesthesia Recovery Scoring System			
	0	**1**	**2**
Activity	Unable to move.	Can lift head and move two extremities on command.	Can lift head and move all extremities on command.
Respiration	Apnea. Requires ventilator or other assisted breathing.	Dyspnea—labored or limited breathing. Breathes on own. May have oral airway.	Normal respiration. Can take deep breath and cough.
Circulation	Blood pressure 50 percent of preanesthetic level.	Blood pressure 20 to 50 percent of preanesthetic level.	Blood pressure 20 percent of preanesthetic level.
Consciousness	Unresponsive.	Responds when called. Very drowsy & drifts back to sleep easily.	Fully awake— knows date, time place, etc.
Color	Blue-gray (cyanotic).	Pale, blotchy, dusky, yellow (jaundiced).	Normal skin tone.

Using a scoring system helps PACU/SDSC personnel provide an objective evaluation of the patient's condition because the criteria for assessment are established and standardized. This helps ensure all patients are evaluated thoroughly and equally, and helps PACU/SDSC staff to limit written remarks to those required to clarify a particular score or explain an unusual occurrence or activity.

HOWEVER, scoring systems are not perfect. Some facilities discount the score for color because it is subjective; in this case the safe discharge score is eight. It is also possible for patients to be assessed and attain a perfect score (2 in all categories), but still have conditions preventing them from being discharged from the PACU/SDSC. Some complications that may outweigh the score include severe vomiting, cardiac arrhythmias that do not affect blood pressure, and lack of urine output. Remember, patients are people! Always evaluate and consider the patient's individual and specific needs. Once a patient is ready to be released from the SDSC they are allowed to go home. For patients to be discharged from the PACU a different process is involved.

Discharge procedures for inpatients

Normally, a patient is not discharged from the PACU until his or her postanesthesia score is 10, vital signs are stable, no indication of any postoperative complications exists, and his or her recovery from most of the effects of the anesthetic has been reached. The patient is conscious and reoriented enough to recognize the need for and can call for assistance and give you his or her full name, social security number, date, current location, and why he or she is in the PACU. Before leaving the PACU, the patient should also be clean, dry, and dressed in a fresh hospital gown or pajama top. All dressings must be dry and intact, all drainage collection containers emptied, and the drainage amount collected recorded on the PACU record.

A patient administered a narcotic in the PACU is not discharged for at least 30 minutes to allow close observation for complications and ensure vital signs restabilize. A 30-minute holding period is also normally required after discontinuing oxygen administration.

A summary discharge note is annotated on the PACU record indicating the time of transfer and the patient's overall condition. The PACU nurse calls the patient-care unit to notify the staff of the patient transfer and of any special requirements or equipment needed by the patient. At this time, a full report can be given over the phone to a nurse on the patient-care unit. However, the report can also be given in person by the PACU staff member who helps transfer the patient back to the patient-care unit.

In most hospitals before the patient is officially discharged from the PACU, a member of the anesthesia staff reviews the recovery record to ensure documentation is complete and there are no unusual observations or fluctuations in the patient's vital signs needing closer assessment. After this review, the anesthesia staff member signs the discharge permission block on the form. In many hospitals, all PACU discharges have to be signed by an anesthesiologist. The patient is normally transported back to the patient-care unit on the recovery bed. All safety procedures outlined in volume 1 apply when returning a patient to the nursing care unit.

Whenever possible, a nurse or senior medical technician meets the patient on arrival to the patient-care unit and directs the transfer to the bed. The patient and all attached apparatus are carefully transferred. Drainage tubes and collection reservoirs are checked and connected as ordered by the surgeon. The patient's call button is clipped to the bed sheets or pillow within easy reach. Other items that the patient will frequently use are also positioned within easy reach. The intravenous flow rate is checked and readjusted, as necessary, and a complete set of vital signs is taken by nursing unit personnel. The bed side rails are raised as soon as the vital signs are completed. If a patient status report was not given to the nurse over the phone, it can be given at this time. Information normally provided in this report includes:

- The operative procedure performed.
- The type of anesthesia used.
- The patient's general condition and discharge postanesthesia recovery score.
- The location and type of incision, type of dressing, and location and type of any drains or catheters.
- A summary of the patient's fluid intake and output during the recovery period, including a description of the types and amounts of fluids administered and lost.
- A summary of any medications administered in the PACU with special note of any narcotics.

This verbal report, combined with the written record of perioperative care found in the patient's chart, provides the nurse on the patient-care unit a clearer picture of what to expect and how to plan for the patient's general postoperative nursing care.

Intensive care unit

Sometimes, patients are taken to the intensive care unit (ICU) or other special care unit instead of the PACU. This is usually the case for the following reasons:

- Critically ill patients who require 24-hour or long-term care and monitoring.
- The PACU is closed. The PACU is usually staffed only when surgery is scheduled. Emergency patients may be recovered in ICU as it is staffed around the clock.
- A patient may have a disease or be near death and require continuous monitoring and attention.
- The patient may have a disease or condition that requires isolation to reduce chances of cross-contamination. The ICU generally has specially designed isolation rooms; the PACU is usually one large, open area.
- The patient is still deeply anesthetized or will not be extubated after surgery. Patients who remain intubated following surgery are generally taken directly to ICU rather than the PACU.
- The PACU may be filled to capacity. If all cubicles in the PACU are full, but patients are expected to be discharged shortly, the anesthetist may begin the recovery process in the operating room. If the PACU is likely to be full for an extended period, a patient may be transferred to the ICU.

Normally, if a patient is transferred to the ICU, a special bed from the unit is prepared and brought to the surgical suite. There the patient is placed on the ICU bed with any required life-support equipment (e.g., portable oxygen tanks, hand ventilators, monitors, heart pumps, etc.) for transport immediately

following the operation. This prevents moving the patient twice and reduces the chance of additional patient trauma or disturbing support devices.

430. Maintaining a safe and sanitary recovery environment

As in all aspects of patient care, safety and sanitation must be maintained at all times. It does no good to help Mrs. Miller recover from anesthesia if you let her fall from the bed, or if she gets an infection because you forgot to clean a piece of equipment used on her.

Safety measures

All safety measures cited throughout this course must be observed in the PACU/SDSC. This is particularly true when it comes to protecting patients from falls or other injuries. Patients recovering from anesthesia may be extremely disoriented and usually have great difficulty controlling movement of arms and legs due to the effects of anesthesia and muscle relaxants. It is essential to raise the side rails on the bed to prevent the patient from falling before leaving his or her side. Also, secure uncontrolled or anesthetized extremities by tucking them under a safety strap or other suitable restraining device. Just like on the OR bed, secure the wheel or floor locks on the recovery bed at all times until the patient is ready to be moved.

Many patients admitted to the PACU/SDSC are unconscious or semiconscious due to the effects of general anesthetics or sedatives. These patients are never left alone. When possible, at least two members of the PACU/SDSC staff should be available at all times. Never neglect or reduce your vigilance of conduction-anesthesia patients. Although they may appear to be wide awake, alert, and in control of their reflexes, you never know when they may have an allergic reaction to one of the medications or when their vital signs will suddenly deteriorate. This is especially true for patients who have been given regional anesthesia, such as a Bier block or spinal block. These patients usually stay in the PACU/SDSC until sensation returns to the anesthetized area, and their vital signs are stable; this may take a few hours.

The precautions normally used in the presence of compressed gas cylinders containing oxygen and for piped-in gases must also be observed in the PACU/SDSC. Signs indicating “oxygen in use” must be conspicuously displayed at each entrance. Open flames are not allowed in the area where oxygen is being administered. Since the Air Force has a no-smoking policy in every hospital, open flames as a source of ignition should not be a problem. Know the fire procedures and evacuation plans for the PACU/SDSC, including proper procedures for reporting a fire, location of all compressed gas and vacuum line shutoff valves that supply the PACU/SDSC, location and use of fire extinguishers, and routes of evacuation.

Always test all electrical and mechanical equipment before use. If a piece of equipment malfunctions, remove it and notify your supervisor or NCOIC, and find a replacement. Know the location of the electrical circuit breakers that control the PACU/SDSC power so you can turn the “juice” off if someone is shocked. Avoid the use of extension cords, do not overload circuits, and avoid stringing electrical power cords and suction tubing across open traffic lanes in the PACU/SDSC.

Clean all spills immediately so staff members do not trip and fall. Avoid stacking equipment and supplies in precarious locations or on high shelves. Dispose of all needles and blades according to local policies established by your infection control committee. Wear gloves and protective eyewear when handling cleaning solutions and caustic chemical disinfectants. Also, know the location of emergency eyewash stations and how to use them.

When X-rays are taken in the PACU/SDSC, ensure nonessential staff members leave the immediate area. Those who must stay should be protected by lead shields, vests, or aprons. To reduce radiation exposure, cover areas of the patient’s body not being x-rayed, particularly the genital area. Other sources of radiation are the radioisotopes sometimes implanted into cancer patients to kill growing cancer cells. These isotopes emit harmful radiation that can destroy healthy tissue. All personnel

should wear protective lead vests or aprons when caring for these patients, and these patients should be isolated from other patients.

Obviously, you must be thoroughly familiar with basic cardiac life support (BCLS). If you discover a patient's vital signs have disappeared, immediately call for help or activate the cardiac arrest alarm and begin BCLS procedures. When the doctors and nurses arrive, stand by to assist them with resuscitation efforts the same way you do as a circulator in the operating room. To assist with patient resuscitation, you must know the location, preparation, and use of the PACU crash cart; intubation materials; emergency drugs; intravenous solutions and tubing sets; tracheostomy trays; defibrillators; cardiac monitors; pacemakers; and other emergency supplies. (Refer to Unit 2 for refresher information on cardiac arrest procedures.)

Infection control

Controlling the spread of infection in the PACU/SDSC is essential because the patient's "armor"—the skin—has usually been cut and other body defenses are weakened. To prevent the spread of infection, three major routes of microbial transmission must be blocked—air, inanimate objects used for patient care, and human carriers. When a patient is received in the PACU/SDSC with a condition such as tuberculosis that allows air to act as a vector for the spread of infectious agents, the patient must be isolated in a single room. Strict isolation techniques are carried out in accordance with nationally accepted standards and local policies. When possible, the patient is recovered in an isolation room with glass partitions separating a patient with "dirty" wounds or a highly contagious disease from the other patients. Glass partitions are necessary to allow constant observation of the patient. A patient in isolation who cannot be observed from a central area in the PACU/SDSC is attended constantly during the entire recovery period. In hospitals that do not have isolation rooms in the PACU/SDSC, such a patient is usually recovered in the operating room or sent directly to a room on the patient care unit for isolation. He or she may also be sent to a special isolation room in the intensive care unit.

Thorough hand washing before and after each patient contact is a must. This policy must be strictly followed, except in extreme emergencies. Hand-washing facilities and antiseptic detergent agents must be available in the PACU/SDSC. Also, personal protective gear for prevention and control of bloodborne pathogens is worn.

To the greatest extent possible, disposable patient-care items are used in the PACU/SDSC. One of the biggest aids to preventing the spread of respiratory pathogens was the development of prefilled disposable humidifiers and other respiratory care supplies. Now, instead of having to be cleaned and disinfected, humidifiers and various types of oxygen administration tubes and masks can be disposed of after each patient use. All reusable patient-care items, particularly instruments, are terminally sterilized and reprocessed before they can contact another patient.

As in the operating room, all PACU/SDSC personnel must maintain the highest standards of personal hygiene, cleanliness, and health. Anyone who has open sores or an infectious disease, especially one involving the respiratory system, is never allowed to perform direct care in the PACU/SDSC. Although not absolutely necessary, wearing surgical attire in the PACU/SDSC is a good idea because it allows personnel to change contaminated clothing frequently, keeps contaminated clothing confined to an isolated area of the hospital, and prevents staff members' uniforms from becoming grossly soiled and contaminated.

The PACU/SDSC is cleaned just like the operating rooms at the start and end of each duty day by use of a detergent germicide solution on floors, equipment, and other environmental surfaces. Prior to the start of each duty day, flat surfaces are damp dusted with a germicidal agent and the floors wet vacuumed. After each patient use, recovery beds are thoroughly disinfected with a detergent germicide solution. Other cleaning activities are performed in accordance with local infection control guidelines.

Self-Test Questions

After you complete these questions, you may check your answers at the end of the unit.

428. Helping detect and manage postoperative complications

1. Besides being uncomfortable, pain causes other problems. List three.

2. Cite three areas that typically cause postoperative pain.

3. List three ways immediate postoperative pain is managed with medication.

4. What is emergence delirium?

5. Cite five factors or causes that can contribute to emergence delirium.

6. List at least four actions PACU personnel can take when a patient exhibits signs of emergence delirium?

7. Specify five side effects of a patient vomiting.

8. What are two *main* causes of nausea and vomiting in the surgical patient?

9. What is one of the easiest and most effective treatments for a patient experiencing nausea?

10. List the five steps you take if a patient vomits in the PACU.

11. Briefly describe the effects hypothermia can have on a patient.

12. What is the main treatment for excessively high body temperatures?

13. Briefly describe the effects severe dehydration can have on the body?

14. What is the basic treatment for severe dehydration?

15. What signs can a patient with extreme fluid overload exhibit?

16. What measures are included in the treatment for fluid overload?

429. Discharging patients from the PACU

1. Briefly describe how most postanesthesia recovery scoring systems work.

2. What are the five categories used in the Aldrete recovery scoring system to evaluate a postanesthesia patient's overall condition?

3. Cite three advantages of using a patient recovery scoring system.

4. List four criteria most PACUs require before discharging the patient.

5. What information is normally included in the discharge report PACU personnel give to nursing unit personnel.

6. When and why may patients bypass the PACU and go directly to the intensive care unit?

430. Maintaining a safe and sanitary PACU/SDSC environment

1. Why are postanesthesia patients at higher risk of falling out of bed during their postoperative recovery?

2. How many nursing personnel should be available in the PACU/SDSC at all times?

3. How long do patients who were administered regional anesthesia usually stay in the PACU/SDSC?

4. Cite the four aspects of PACU/SDSC fire procedures you need to know?

5. What two precautions should PACU/SDSC personnel take when caring for patients with radioisotopes inserted in their bodies to treat cancer.

6. What actions do you take if you suddenly discover that a postanesthesia patient's vital signs have disappeared?

7. Why is controlling the spread of infection in the PACU/SDSC an essential process?

8. What is done with a postanesthesia patient who requires isolation if the PACU/SDSC does not have a separate room designated for isolation use?

9. What type of patient-care items are used in the PACU/SDSC as much as possible?

10. Cite three reasons why wearing surgical attire in the PACU/SDSC is a good idea.

11. How often are PACU/SDSC beds disinfected with a germicidal solution?

Answers to Self-Test Questions

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1. As close as possible to the operating rooms and centrally located to other specialty units, such as the intensive care unit (ICU), critical care unit (CCU), or ambulatory surgery unit (ASU). This allows for rapid transfer of patients to specialty care, and ensures surgeons, anesthetists, nurses, and specialty technicians are immediately available to lend emergency assistance.
2. The number of operating rooms in the surgical suite.
3. (1) Available floor space.
   (2) Location of specialty units and support services (laboratory, blood bank, X-ray department, etc.).
   (3) Overall design of the medical facility.
   (4) Budget constraints.
   (5) The number and types of operations normally performed.
   (6) Design that allows for easy transfer of postoperative patients to the PACU and from the PACU to the nursing units.
   (7) Design that permits observation of all patient cubicles simultaneously from the nursing station.
4. The air-conditioning system in the PACU should provide 12 to 15 complete air changes per hour, and the temperature should be maintained at approximately 75°F. The humidity should be around 50 to 60 percent.
5. Adequate lighting is required because PACU procedures may involve observing patients' skin color, checking dressings, starting and maintaining IVs, and inserting various types of catheters.
6. At least two.
7. Each cubicle usually has at least two vacuum outlets in the wall or ceiling pillar. One is reserved for airway maintenance; any others may be used for gastrointestinal tube evacuation, chest tubes, or wound drainage.

422

1. (1) Fully adjustable.
   (2) Well-padded.
   (3) Mechanisms to rapidly elevate the head or feet.
   (4) A device to "lock" the bed to the floor.
   (5) Swivel locks on all four wheels.
   (6) Side rails.
   (7) Patient restraint straps.
   (8) Removable head and foot boards.
   (9) Fifth wheel or other device to help control steering.
   (10) Attachments to hold drainage bags, portable oxygen tanks, patient charts, extra IV poles, and other patient-care items.
2. (1) Cardiac monitors.
   (2) A 12-lead EKG machine.
   (3) Emergency "crash" cart.
   (4) Respiratory monitoring and support equipment.
   (5) Hyper and hypothermia machines.
   (6) Blanket and fluid warmers.
   (7) Heat lamps.
   (8) Ice machine.
   (9) Malignant hyperthermia cart.
3. Any ten of the following:
   (1) A stethoscope.
   (2) Large (Kelly) hemostats or tubing clamps.

(3) Bandage scissors.
(4) Disposable oxygen administration tubing, masks, and nasal prongs.
(5) Suction supplies.
(6) Oral and nasal airways.
(7) Tongue blades.
(8) Tubing connectors.
(9) Sterile gloves.
(10) Alcohol swabs.
(11) Bed protective pads.
(12) Cloth or disposable towels.
(13) Sterile plain sponges.
(14) Tape.
(15) Safety pins.
(16) Tissues.
(17) Emesis basins.
(18) Antibiotic or other ointments.
(19) Sterile lubricants.
(20) Ammonia inhalant capsules.
(21) Glycerin swabs.

4. Anesthesia.
5. Usually registered nurses (RN) with critical care nursing experience. Surgical technicians (4N1X1), medical technicians (4N0X1), licensed practical nurses (LPN) or licensed vocational nurses (LVN) may be designated to assist with PACU care under the direct supervision of a registered nurse or anesthetist.

423

1. To determine if the readings obtained by anesthesia personnel are consistent with those obtained by PACU personnel.
2. (1) A brief description of the operation performed.
(2) The type and dose of anesthetic agents and supplemental drugs.
(3) A description of the patient's reactions and vital signs during surgery.
(4) Fluid intake and output during surgery.
(5) Relevant medical history.
(6) Complications that occurred during surgery or anesthesia administration.
3. On the anesthesia record or preoperative surgical checklist on the cover of the patient's chart.
4. To help determine the patient's cardiovascular status.
5. Check for equal pupil dilation in response to light, or brush the eyelashes lightly to see if they are aware enough to blink.

424

1. The regular throbbing of the arteries caused by the contractions or "beat" of the heart.
2. The temporal, carotid, brachial, radial, femoral, popliteal, posterior tibial and the pedal sites.
3. Rate, rhythm, and force.
4. (1) 100 to 140 bpm.
(2) 80 to 100 bpm.
(3) 60 to 80 bpm.
5. The radial artery.
6. Your thumb has a pulse of its own and can cause you to take an inaccurate reading.
7. When the pulse is irregular.

8. The carotid pulse is easily accessible, very strong, and, since the carotid arteries supply the brain, persists even when reduced blood flow from the heart makes other peripheral pulses undetectable.
9. (l) On infants and small children (usually under 3).
   (2) For adults who have weak or nonpalpable peripheral pulse due to coronary or vascular disease.
   (3) Sometimes, on patients recovering from general anesthesia or vascular surgery who have faint peripheral pulse.
10. a. Blood pressure—force the circulating blood exerts against the walls of the arteries.

    b. Systolic pressure—level of pressure in the arteries during contraction of the heart's left ventricle; represents the highest level of pressure in the arteries.

    c. Diastolic pressure—level of pressure in the arteries during relaxation of the heart; represents the minimum level of pressure in the arteries.
11. Normal systolic pressure is between 90 and 140 mm Hg; normal diastolic pressures ranges between 60 and 90 mm Hg.
12. (1) Cardiovascular depression from drugs or anesthetic agents.
    (2) Internal bleeding from a vessel severed during surgery.
    (3) Wound hemorrhage or disruption from the stress of moving and transporting the patient.
    (4) Dehydration due to inadequate fluid replacement during surgery.
    (5) Shock.
13. (1) a.
    (2) b.
    (3) a.
    (4) b.
    (5) a, b.
14. The most common site for measuring the blood pressure is the *brachial artery* on the upper arm.
15. (1) Auscultation—most often used.
16. Palpation.
17. 2 to 3 mm Hg per second.
18. Written as a fraction, with the value for the systolic pressure over the value for the diastolic pressure (120/80, 160/90, etc.), or plot the values on the vital signs graph. Also, document in the remarks section of the record, the extremity used and any out-of-the-ordinary procedures used.
19. (1) Using the wrong size cuff.
    (2) Improper positioning of the cuff.
    (3) Improper positioning of the stethoscope.
    (4) Deflating the cuff too quickly.
    (5) Deflating the cuff too slowly.
    (6) Auscultatory gap.
19. (1) Anesthetic agents and narcotics can depress the central nervous system.
    (2) Muscle relaxants may affect the diaphragm and accessory muscles of respiration.
    (3) Pain and/or physical limitations may result from the surgical procedure.
    (4) Pre-existing diseases (tuberculosis or emphysema) or other conditions (smoking and airway obstruction caused by secretions, posture, or trauma) may reduce efficiency of the cardiorespiratory system.
20. Quality, rate, depth, and pattern.
21. a. Tachypnea is a respiratory rate over 20 breaths per minute.

    b. Bradypnea is a rate less than 12 breaths per minute.

    c. Apnea is the condition when respirations stop completely.
22. Immediately initiate treatment for hypoxia.

425

1. To make the patient feel more comfortable and allow you to examine the skin closely to help assess the patient's condition.
2. Lemon-glycerin swabs or moistened gauze sponges.
3. (1) Contact with cool surfaces (conduction).
   (2) Nondraped body areas being exposed to cool temperatures (radiation) and airflow (convection).
   (3) Evaporation, either through the wound and viscera, or through anesthesia machine ventilation (warm, moist breath replaced with cool, dry anesthetic gasses).
   (4) Intentionally produced patient hypothermia.
4. At least every 15 minutes until the patient is discharged. In many hospitals , vital signs are taken every 5 minutes for the first 15 minutes or until the patient stabilizes and then every 15 minutes thereafter.
5. General anesthesia agents, narcotics, and postoperative pain can depress the respiratory system, causing the patient to take shallow, monotonous, ineffective breaths. The lungs never fully inflate; this causes the tiny air sacs in the lungs (alveoli) to collapse, and eventually leads to a collapsed lung.
6. The patient inhales deeply, through the nose, until the chest is fully expanded and, then, exhales forcefully through the mouth. This prevents a patient from relying too heavily on accessory muscles of respiration, particularly the abdominal muscles.
7. The patient takes a deep breath and then coughs at successive levels as he or she exhales. This "stair-step" can help dislodge mucous plugs in the alveoli and bronchioles of some patients.
8. At least once each hour. To improve venous circulation to the extremities and prevent atelectasis and hypostatic pneumonia.
9. (1) Spinal anesthesia patients usually stay supine.
   (2) After delicate operations such as eye surgery, a patient may be supine or on his or her side with the unaffected eye down to prevent pressure on the operative eye.
   (3) Thoracic surgery patients with chest tubes are usually supine with the head of the bed slightly elevated.

426

1. To prevent or eliminate hypoxia by saturating the red blood cells with oxygen to ensure maximum oxygen reaches all cells and tissues in the body.
2. (1) The patient's airway must be patent.
   (2) The patient must be breathing on his or her own, or must be mechanically ventilated.
   (3) 100 percent medical grade oxygen and devices to administer it must be available.
   (4) Once initiated, oxygen therapy is continued until all signs of hypoxia disappear (unless oxygen-related complications arise).
   (5) The patient must be observed and monitored for effects.
3. (1) Surgery and anesthetic agents often prevent the nasal passages from naturally adding moisture to inspired air.
   (2) Moisture helps prevent the mucous membranes in the respiratory tract from drying out and becoming irritated.
   (3) It prevents mucous secretions from thickening and blocking the airway.
   (4) It keeps the cilia lining the bronchial tree actively removing secretions and inhaled debris.
4. Humidifiers bubble oxygen through sterile distilled water to convert water to a gaseous state, usually with the help of a heating element in the water container. Nebulizers turn the water into a fine mist or spray by forcing the oxygen through a very small nozzle to create a jet, then passing this oxygen jet across the top of a tube immersed in sterile distilled water. The jet draws water up the tube by capillary action, where it is blown into baffles that create water droplets.
5. Nasal cannulas, sometimes called nasal prongs, are made of flexible plastic tubing, usually tinted green to signify use with oxygen, with two hollow prongs, about 1/2 inch long, that are inserted into the patient's nostrils. The cannulas are held in place by an adjustable elastic band placed around the back of the patient's head and connected to the humidifier or nebulizer by a long, thin piece of tubing about 1/4-inch diameter.

6. (1) Are usually not tolerated very well.
   (2) Tend to slip out of position.
   (3) Create pressure on the face.
   (4) Make the patient's face very wet under the rim.
   (5) May cause rebreathing of significant amounts of carbon dioxide at low flow rates.
7. (1) Partial rebreathing masks are simple masks with one-way valves (instead of holes) on the sides and a bag attached to the bottom.

   (2) Allows higher oxygen concentrations than a simple mask when oxygen flow is high, but significant rebreathing of CO_2 is possible when the oxygen flow rate is low.

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1. (1) The tongue.
   (2) Mucous secretions.
   (3) By posture.
2. Until the patient reacts and regains sufficient reflex responses to spit or pull the airway out. If he or she is choking on it, then, you remove it to prevent vomiting.
3. 14, 16, and 18 Fr.
4. To ensure that the suction device is working properly, and to lubricate the inside and outside of the catheter.
5. To prevent the removal of oxygen from the patient's respiratory tract and to prevent the catheter from causing trauma to delicate tissues.
6. 15 seconds.
7. By holding the catheter alongside the patient's face and measuring the distance between the tip of the nose and the external ear opening.
8. To prevent introduction of potential pathogens deep into the patient's respiratory tract.
9. Ask the patient to take four or five deep breaths while breathing humidified oxygen.
10. By listening for an increased loudness of breath sounds, and by feeling more air coming from the open suction port at the base of the catheter.

428

1. Any three of the following:
   (1) Respiratory problems.
   (2) Cardiovascular problems.
   (3) Nausea and vomiting.
   (4) Patient agitation or delirium.
2. Any three of the following:
   (1) Skin and subcutaneous pain from the incision.
   (2) Deeper tissue pain from manipulation, retraction, electrocautery, etc.
   (3) Airway/respiratory tract pain from drying agents, endotracheal tubes, nasogastric tubes, oral or nasal airways, and mask pressure.
   (4) Localized pain from pressure or immobilization resulting from the surgical position.
   (5) IV site pain from the needle or catheter insertion, infiltration, or internal pressure.
3. Any three of the following:
   (1) By injecting a long-duration, local anesthetic agent into the tissue surrounding the incision just before wound closure.
   (2) Using a continuous epidural catheter placed for postoperative administration of local anesthetics or narcotics.
   (3) Injecting narcotics intramuscularly or intravenously.
   (4) Giving patients nonnarcotic analgesics such as aspirin, ibuprofen, or acetaminophen.

4. A form of extreme irrational behavior exhibited by a patient emerging from a general anesthetic, characterized by screaming, shouting, and violent thrashing as if in a rage.
5. (1) Hypoximia.
   (2) Administration of drugs, especially barbiturates and scopolamine.
   (3) Fear of cancer.
   (4) Fear of disfigurement.
   (5) Preoperative claustrophobia.
   (6) Poorly managed postoperative pain.
   (7) Cramping of muscles and joints caused by extended immobilization.
   (8) A full bladder.
6. Any four of the following:
   (l) Check the airway and administer oxygen to treat hypoxia.
   (2) Ensure patient and staff safety by using restraining devices and side rails.
   (3) Check blood oxygen levels with a pulse oximeter or with arterial blood gas samples to confirm or rule out hypoxia.
   (4) Change the patient's position.
   (5) Children may be calmed by being held by their parents.
   (6) Drugs such as physostigmine may be given to reverse the effects of scopolamine.
   (7) Catheter may be inserted to drain the bladder.
   (8) Tranquilizers such as diazepam may be injected to calm patient fears.
   (9) Narcotic agent such as morphine may settle the patient down.
7. Any five of the following:
   (l) Increases recovery time.
   (2) Increases the risk of airway obstruction.
   (3) Increases risk of aspiration.
   (4) Causes abdominal muscle cramps.
   (5) May lead to wound disruption.
   (6) Extended nausea or vomiting may lead to dehydration and electrolyte imbalance.
8. Rough handling of the patient during transportation and frequent position changes in the PACU.
9. Have the patient breathe deeply and cough, and then administer oxygen.
10. (1) Immediately turn the patient's head to one side.
    (2) Lower the head of the bed.
    (3) Suction vomitus out of the mouth if the patient cannot clear it.
    (4) Administer oxygen.
    (5) Auscultate the patient's breath sounds on both sides of the chest.
11. It may intensify the depressant effects of anesthetic agents, slowing respiration and causing the patient to shiver uncontrollably making him or her use oxygen more rapidly. The net result is a significant lowering of the amount of oxygen in the blood.
12. Rapid cooling of the body, both internally and externally.
13. The patient's blood pressure falls; the heart rate increases; the patient eventually lapses into a coma and dies.
14. Massive infusion of intravenous fluids and close monitoring of electrolytes.
15. Frothy, pink sputum; obvious respiratory distress; elevated central venous pressure; and a fluffy- looking X-ray.
16. Intubating the patient; positive-pressure ventilation; administration of a diuretic; and administration of furosemide and opiods.

429

1. System uses five categories to evaluate a patient's overall condition. The patient is assessed, and a numerical value ranging between 0 to 2 is assigned to each of the five evaluation categories; then the score is totaled. If this total score is 8 or above, the patient usually can be discharged unless a condition not scored (such as extreme nausea or vomiting) indicates otherwise.
2. (1) Activity.
   (2) Respiration.
   (3) Circulation.
   (4) Consciousness.
   (5) Color.
3. (1) Helps PACU personnel provide an objective evaluation of the patient's condition because the criteria for assessment are established and standardized.
   (2) Helps ensure all patients are evaluated thoroughly and equally.
   (3) Helps PACU staff to limit written remarks to those required to clarify a particular score or explain an unusual occurrence or activity.
4. Any four of the following:
   (1) Their postanesthesia score is usually 10.
   (2) Their vital signs are stable.
   (3) There is no indication of any postoperative complications.
   (4) They have recovered from most of the effects of the anesthetic.
   (5) The patients are conscious and reoriented enough to recognize the need for and call for assistance.
   (6) The patients can tell you their full names, social security numbers, date, current location, and why they are in the PACU.
   (7) The patients should also be clean, dry, and dressed in a fresh hospital gown or pajama top.
   (8) All dressings must be dry and intact, and all drainage collection containers are emptied.
5. (1) The operative procedure performed.
   (2) The type of anesthesia used.
   (3) The patient's general condition and discharge postanesthesia recovery score.
   (4) The location and type of incision, type of dressing, and location and type of any drains or catheters.
   (5) A summary of the patient's fluid intake and output during the recovery period, including a description of the types and amounts of fluids administered and fluids lost.
   (6) A summary of any medications administered in the PACU with special note of any narcotics.
6. (1) Critically ill patients may require 24-hour or long term care and monitoring.
   (2) The PACU is closed.
   (3) A patient may have a disease or be near death and require continuous monitoring and attention.
   (4) The patient may have a disease or condition that requires isolation to reduce chances of cross-contamination.
   (5) The patient is still deeply anesthetized or will not be extubated after surgery.
   (6) The PACU may be filled to capacity.

430

1. Patients recovering from anesthesia usually have great difficulty controlling movement of arms and legs due to the effects of anesthesia and muscle relaxants, and may be extremely disoriented.
2. At least two.
3. Until sensation returns to the anesthetized area and their vital signs are stable.
4. (1) Proper fire reporting procedures.
   (2) Location of all compressed gas and vacuum line shut-off valves.
   (3) Location and use of fire extinguishers.

(4) Routes of evacuation.

5. Wear protective lead aprons or vests and ensure the patient is isolated from other patients.
6. Immediately call for help, or activate the cardiac arrest alarm, and begin BCLS procedures.
7. Because the patient's skin, or armor, has usually been cut and his or her body defenses are weakened.
8. The patient is usually recovered in the operating room and sent directly back to his or her room on the patient-care unit for isolation. He or she may also be sent to a special isolation room in the intensive care unit.
9. Disposable.
10. (1) Allows personnel to change contaminated clothing frequently.
    (2) Confines contaminated clothing to one area of the hospital.
    (3) Prevents staff members' uniforms from becoming grossly soiled.
11. After each patient use.

Unit Review Exercises

Note to Student: Consider all choices carefully, select the *best* answer to each question, and *circle* the corresponding letter. When you have completed all unit review exercises, transfer your answers to the Field Scoring Answer Sheet.

Do not return your answer sheet to AFCDA.

56. (421) The patient capacity of the postanesthesia care unit (PACU) or recovery room is based *primarily* on the number of
    a. assigned surgeons.
    b. assigned anesthesia personnel.
    c. inpatient clinics in the hospital.
    d. operating rooms in the surgical suite.

57. (421) Open floor plans are generally preferred in the postanesthesia care unit (PACU) over individual rooms because they
    a. allow greater privacy for all patients recovering from general anesthesia.
    b. allow all recovering patients to be observed continuously and simultaneously by minimum staff.
    c. reduce the overall level of noise that patients are subjected to during their postoperative recovery.
    d. reduce the risk of cross-contamination between patients with known infections and those without infections.

58. (422) Why should you cover a patient with a sheet or blanket before using hypo/hyper thermia blankets or pads to warm him or her?
    a. To increase conduction warmth to the patient.
    b. The blanket should never be covered.
    c. To prevent puncturing the blanket.
    d. To prevent burning the patient.

59. (422) Ammonia inhalant capsules maintained in the postanesthesia care unit (PACU) *may* be used to
    a. routinely help arouse sleeping patients.
    b. test the level of major conduction nerve blocks.
    c. arouse an expectant father or other family member who faints.
    d. clean oxygen administration equipment such as masks and nebulizers.

60. (423) The patient admission report that anesthesia personnel give to the recovery room nurse normally includes all of the following information *except*
    a. the type of anesthetic agents administered.
    b. the type of materials used to close the wound.
    c. the patient's fluid intake and output during surgery.
    d. a history of the patient's allergies and known medical problems.

61. (423) What does the term "blanching" refer to in the postanesthesia care unit (PACU)?
    a. The patient turning pale due to nausea.
    b. The color of the patient's lips due to cyanosis.
    c. Pinching the patient's fingernails to determine circulation.
    d. Inflating the blood pressure cuff until the patient's forearm turns dark red.

62. (423) After surgery, what is the last thing checked by the recovery nurse or technician?
    a. The color and condition of the patient's skin.
    b. If there are any postoperative orders from the surgeon.
    c. The security of the patient's dressing and type of drainage.
    d. The patient's voluntary or involuntary responses to stimuli.

63. (424) What is the first thing you should do when using a stethoscope?
    a. Inspect it for splits, cracks and visible damage.
    b. Wipe the ear pieces and diaphragm with alcohol swabs.
    c. Press the diaphragm against the palm of your hand to warm it.
    d. Lightly tap the diaphragm with your fingers to insure it is working.

64. (424) When measuring blood pressure at the brachial artery, what should you do after putting on the appropriate cuff and have started palpating the pulse?
    a. Inflate the cuff to 200 mm Hg.
    b. Place the stethoscope diaphragm on the brachial artery.
    c. Deflate the cuff at the rate of two to three mm Hg per second.
    d. Inflate the cuff to 30 mm Hg above the point where the pulse disappears.

65. (424) What describes the correct procedure for palpating a carotid pulse?
    a. Place a stethoscope on the left side of the chest slightly below the breast, directly over the "point" of the heart. Move the diaphragm until you hear the "lub-dub" of the heartbeat; count each "lub-dub" as one beat.
    b. Place your index and middle fingers on the patient's "Adam's apple" and gently slide them laterally into the groove between the trachea and the cord-like muscle on the near side of the neck.
    c. Place your thumb in the notch at the base of the trachea and apply gentle pressure. Count the beats for 15 seconds and multiply by four.
    d. Straddle the trachea with your hand, then gently press down and in towards the throat with the finger tips until you feel the rhythm.

66. (424) What is dyspnea?
    a. Painful or labored breathing.
    b. Abnormally rapid breathing.
    c. Abnormally slow breathing.
    d. Absence of respirations.

67. (424) What is pulse oximetry?
    a. An invasive procedure designed to measure the amount of carbon dioxide dissolved in a patient's arterial blood.
    b. A noninvasive method for continually measuring the oxygenation of a patient's arterial blood.
    c. An invasive procedure used to determine the rate and pressure of blood flow to the lungs.
    d. A noninvasive technique used to determine a postoperative patient's tidal volume.

68. (425) After initial assessment, the postanesthesia care unit (PACU) patient's vital signs are taken *at least* every
    a. 5 minutes until discharge.
    b. 10 minutes until stable.
    c. 15 minutes until discharge.
    d. 30 minutes until stable.

69. (425) After delicate operations such as eye surgery, patients may be positioned supine (on their side) with the unaffected eye down to
    a. allow the postanesthesia care unit (PACU) staff to monitor the dressing.
    b. reduce incidence of post-dural puncture headache.
    c. prevent pressure on the operative eye.
    d. prevent hypostatic pneumonia.

70. (426) The *main* goal of administering oxygen to any patient is to
    a. loosen up thick mucous secretions in the trachea and bronchi.
    b. eliminate hypoxia by making maximum use of the oxygen-carrying capacity of the red blood cells.
    c. fully expand the alveoli in the lungs to prevent atelectasis and hypostatic pneumonia from developing.
    d. prevent a spontaneous pneumothorax from developing by providing positive-pressure ventilation of the lungs.

71. (426) Which device may cause the patient to rebreathe a significant amount of CO_2?
    a. Nasal cannulas.
    b. Nasal catheters.
    c. Face masks.
    d. Face tents.

72. (427) When doing *oropharyngeal suctioning*, what should you do after you have turned on and regulated the suction device?
    a. Explain the procedure to the patient.
    b. Suck a small amount of saline out of the basin.
    c. Gently insert the catheter into the patient's mouth.
    d. Use a stethoscope to listen to the chest and breathing sounds.

73. (427) When doing *intratracheal suctioning*, what should you do before starting to suction?
    a. Test the operation of the suction control port.
    b. Suck a small amount of saline out of the basin.
    c. Ensure the patient has been properly ventilated.
    d. Use a stethoscope to listen to the chest and breathing sounds.

74. (427) The type of suctioning (if any) that requires strict aseptic technique is
    a. intratracheal.
    b. oropharyngeal.
    c. nasopharyngeal.
    d. none. Suctioning is a non-sterile procedure.

75. (428) Emergence delirium occurs most often
    a. in patients who are generally healthy.
    b. in patients with chronic lung disease.
    c. after regional anesthetics.
    d. after local anesthetics.

76. (428) One of the *main* causes of nausea and vomiting in the surgical patient is
    a. electrolyte imbalance.
    b. mild to intermediate postoperative pain.
    c. rough handling of the patient during transportation.
    d. interruption of blood flow to the vomiting center in the brain.

77. (428) What does frothy, pink sputum, obvious distress, elevated central venous pressures (CVP), and a “fluffy” looking chest x-ray indicate?
    a. Transfusion reaction.
    b. Fluid overload.
    c. Dehydration.
    d. Hypoxia.

78. (428) What is the key thing to remember when assessing a postoperative patient’s condition and detecting potential problems?
    a. Always ignore the patient’s complaints when the problem seems insignificant.
    b. Always report any deviation from normal, no matter how slight it appears to be.
    c. Only report abnormal conditions that may cause a major postoperative complication.
    d. Don’t worry about detecting problems because that is the postanesthesia care unit (PACU) nurses’ job.

79. (429) In most hospitals, who must review the recovery-room record before a patient can be released?
    a. The chief of surgery.
    b. The operating room supervisor.
    c. A recovery room nurse.
    d. A member of the anesthesia staff.

80. (429) How long are patients normally kept in the postanesthesia care unit (PACU) after administration of a narcotic?
    a. 15 minutes.
    b. 30 minutes.
    c. 60 minutes.
    d. 90 minutes.

81. (430) Whenever possible, how many members of the recovery room staff have to be available in the recovery room at any given moment?
    a. Only one.
    b. At least two.
    c. At least three.
    d. At least four.

82. (430) Postoperative patients who have had regional anesthesia remain in the recovery room until
    a. they feel well enough to be moved.
    b. they are examined by their surgeon and cleared for discharge.
    c. they are alert enough to identify themselves and recite the date.
    d. sensation returns to the anesthetized area and their vital signs are stable.

Student Notes

Glossary

Abbreviations and Acronyms

A&D	admissions and dispositions
ABO	A, B, or O blood group
ACLS	advanced cardiac life support
ASU	ambulatory surgical unit
BCLS	basic cardiac life support
BP	blood pressure
CAT	computerized axial tomography
CBC	complete blood count
CCU	critical care unit
CO_2	carbon dioxide
CRNA	certified registered nurse anesthetist
CSF	cerebrospinal fluid
CT	computerized tomography
CVP	central venous pressure
ECG (EKG)	electrocardiogram
EEG	electroencephalogram
ENT	ear, nose, throat
ET	endotracheal
H&H	hemoglobin and hematocrit
hCG	human chorionic gonadtropin
Hct	hematocrit
Hgb	hemoglobin
ICU	intensive care unit
IV	intravenous
LPN	licensed practical nurse
LTA	laryngotracheal anesthesia
LVN	licensed vocational nurse
MAC	monitored anesthesia care or minimum alveolar concentration
MEB	Medical evaluation board
MH	malignant hyperthermia
MRI	magnetic resonance imaging
NKDA/NKA	no known drug allergies/ no known allergies

NPO	nothing by mouth
OR	operating room
P	pulse
PACU	postanesthesia care unit
PAR	postanesthesia recovery room
PARS	postanesthesia recovery scoring
PDPHA	postdural puncture headache
PRBC	packed red blood cells
PT	prothrombin time
PTT	partial thromboplastin time
PVC	premature ventricular contraction
R	respirations
RBC	red blood cells
RN	registered nurse
SCU	special care unit
SDSC	same day surgical care
T	temperature
WBC	white blood cells
WBC Diff	differential white cell count
WT	weight

Student Notes

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