UNIT 3 Perioperative Concepts and Nursing Management

Case Study

MAINTAINING A CULTURE OF SAFETY USING THE SURGICAL SAFETY CHECKLIST

A 32-year-old woman is admitted to the hospital with nausea, vomiting, and right upper quadrant pain. She is diagnosed with acute cholecystitis and is scheduled for a laparoscopic procedure to remove her gallbladder. After completing the preoperative procedures and preprocedure verification, the patient is brought to the operating room (OR) where you work. The surgical safety checklist involves members of the team including the surgeon, anesthesia provider, circulating nurse, and OR technician. Prior to induction of anesthesia the team confirms the patient's identity, procedure, and consent. In addition, the incision site is marked, the anesthesia machine and medication check is completed, and the pulse oximeter is placed on the patient and is confirmed to be working. The team also checks if the patient has a known allergy, if there are any airway or aspiration risks, and whether there is risk of a >500 mL blood loss.

QSEN Competency Focus: Safety

The complexities inherent in today's health care system challenge nurses to demonstrate integration of specific interdisciplinary core competencies. These competencies are aimed at ensuring the delivery of safe, quality patient care (Institute of Medicine, 2003). The Quality and Safety Education for Nurses project (Cronenwett, Sherwood, Barnsteiner, et al., 2007; QSEN, 2020) provides a framework for the knowledge, skills, and attitudes (KSAs) required for nurses to demonstrate competency in these key areas, which include ***patient-centered care***, ***interdisciplinary teamwork and collaboration***, ***evidence-based practice***, ***quality improvement***, ***safety***, and ***informatics.***

Safety Definition: Minimizes risk of harm to patients and providers through both system effectiveness and individual performance.

SELECT PRE-LICENSURE KSAs	APPLICATION AND REFLECTION
Knowledge	
Describe factors that create a culture of safety (such as, open communication strategies and organizational error reporting systems)	Describe your role in participating in a surgical safety checklist. Identify the additional checks that need to be conducted before the surgical skin incision is made and further safety measures that must be addressed before the patient leaves the OR to help facilitate a culture of safety.
Skills	
Communicate observations or concerns related to hazards and errors to patients, families, and the health care team	Identify your role in communicating to the members of the OR team important assessments, potential hazards, and errors that may occur because of surgery.
Attitudes	
Value relationship between national safety campaigns and implementation in local practices and practice settings	A goal of the Joint Commission is to ensure the safety of patients by eliminating potential errors. The surgical safety checklist is supported by accrediting bodies such as the Joint Commission and the World Health Organization. What other practices can you implement to ensure safety in the OR setting?

Cronenwett, L., Sherwood, G., Barnsteiner, J., et al. (2007). Quality and safety education for nurses. *Nursing Outlook*, *55*(3), 122–131; Institute of Medicine. (2003). *Health professions education: A bridge to quality*. Washington, DC: National Academies Press; QSEN Institute. (2020). *QSEN competencies: Definitions and pre-licensure KSAs; Safety*. Retrieved on 8/15/2020 at: qsen.org/competencies/pre-licensure-ksas/#safety

14 Preoperative Nursing Management

LEARNING OUTCOMES

On completion of this chapter, the learner will be able to:

1. Define the phases of perioperative patient care.
2. Perform a comprehensive preoperative assessment to identify pertinent health and surgical risk factors.
3. Describe considerations related to preoperative nursing care of older adult patients, patients with obesity, and patients with disability.
4. Identify the regulatory documents that are required prior to a patient entering surgery.
5. Initiate the immediate preoperative preparation and education of the patient.

NURSING CONCEPTS

Communication
Managing Care
Mobility

GLOSSARY

ambulatory surgery: includes outpatient, same-day, or short-stay surgery that does not require an overnight hospital stay

bariatrics: having to do with patients with obesity

history and physical: mandatory form completed by the surgeon that gives a comprehensive overview of the patient's history, current physical status, and plan of care

informed consent: the patient's autonomous decision about whether to undergo a surgical procedure, based on the nature of the condition, the treatment options, and the risks and benefits involved

intraoperative phase: period of time that begins with transfer of the patient to the operating room area and continues until the patient is admitted to the postanesthesia care unit

minimally invasive surgery: surgical procedures that use specialized instruments inserted into the body either through natural orifices or through small incisions

perioperative phase: period of time that constitutes the surgical experience; includes the preoperative, intraoperative, and postoperative phases of nursing care

postoperative phase: period of time that begins with the admission of the patient to the postanesthesia care unit and ends after follow-up evaluation in the clinical setting or home

preadmission testing: diagnostic testing performed before admission to the hospital

preoperative phase: period of time from when the decision for surgical intervention is made to when the patient is transferred to the operating room table

As techniques to perform surgery have evolved with improved technology and expertise, surgery has become less invasive and less debilitating. The increased use of **minimally invasive surgery** (procedures that use specialized instruments inserted into the body either through natural orifices or through small incisions) enables many procedures to be performed on an outpatient basis. Surgery remains a complex, stressful experience, whether minimally invasive, elective, or emergent. Even healthy patients having elective outpatient surgery may experience unanticipated complications during otherwise benign procedures. Many patients enter the hospital 90 minutes prior to surgery and have necessary medical assessments and analyses preceding the surgical intervention. The surgery is followed by a recovery period in the postanesthesia care unit (PACU). Later that day the patient goes home. When comorbidities exist or procedures are more complex, the patient may have laboratory studies completed prior to admission, and may be admitted to the hospital for postoperative recovery.

Traumatic and emergency surgery most often results in prolonged hospital stays. Patients who are acutely ill or undergoing major surgery and patients with concurrent medical disorders may require supportive supplementary care from other medical disciplines, which can be coordinated more easily within the hospital setting. The high acuity level of surgical inpatients and the greater complexity of procedures have placed greater demands on the practice of nursing in this setting.

Although each setting (ambulatory, outpatient, or inpatient) offers its own unique advantages for the delivery of patient care, all patients require a comprehensive preoperative nursing assessment, patient education, and nursing interventions to prepare for surgery.

Perioperative Nursing

Communication, teamwork, and patient assessment are crucial to ensure good patient outcomes in the perioperative setting. Professional perioperative and perianesthesia nursing standards encompass the domains of behavioral response, physiologic response, and patient safety and are used as guides toward development of nursing diagnoses, interventions, and plans. Perioperative nursing, which spans the entire surgical experience, consists of three phases that begin and end at particular points in the sequence of surgical experience events. The **preoperative phase** begins when the decision to proceed with surgical intervention is made and ends with the transfer of the patient onto the operating room (OR) bed. The **intraoperative phase** begins when the patient is transferred onto the OR bed and ends with admission to the PACU. Intraoperative nursing responsibilities involve acting as scrub nurse, circulating nurse, or registered nurse first assistant (see Chapter 15 for the description of these roles). The **postoperative phase** begins with the admission of the patient to the PACU and ends with a follow-up evaluation in the clinical setting or home (see Chapter 16).

Each **perioperative phase** includes the many diverse activities a nurse performs, using the nursing process, and is based on the recommended practice standards of the Association of periOperative Registered Nurses (AORN), formerly known as the Association of Operating Room Nurses (AORN, 2019) and the American Society of PeriAnesthesia Nurses (ASPAN, 2019). Chart 14-1 presents examples of nursing activities characteristic of the three perioperative phases of care. The phases of the surgical experience are reviewed in more detail in this chapter and in the other chapters in this unit.

A conceptual model of patient care, published by AORN, helps delineate the relationships between various components of nursing practice and patient outcomes into four domains: safety, physiologic responses, behavioral responses, and health care systems. The first three domains reflect phenomena

of concern to perioperative nurses and are composed of nursing diagnoses, interventions, and outcomes. The fourth domain—the health care system—consists of structural data elements and focuses on clinical processes and outcomes. The model is used to depict the relationship of nursing process components to the achievement of optimal patient outcomes (Rothrock, 2019).

Advances in Surgical and Anesthesia Approaches

Technologic advancements continue to lead health care industry providers toward performing more complex procedures that are less invasive, and therefore cause less morbidity during the recovery phase of surgery (Rothrock, 2019). Minimally invasive and robotic surgeries are continuing to replace traditional surgical procedures. Advancements in surgical technology allow for shorter hospital stays and promote patient comfort (Sadler, 2017).

The fastest growing trend in recent years is the use of robotic surgery (see Fig. 14-1). Robotic surgery offers many advantages over laparoscopic surgery including more precise accuracy for dissecting and suturing, better range of motion of the instruments, enhanced ability to access deep structures, and attain three-dimensional visual feedback (Rothrock, 2019). Robotic surgery is used in a wide variety of surgical specialties such as cardiac; gastrointestinal; urologic; gynecologic; ear, nose, and throat (ENT); thoracic; and orthopedic.

Enhanced anesthesia methodology complements advances in surgical technology. Modern methods of achieving airway patency, sophisticated monitoring devices, and new pharmacologic agents, such as short-acting anesthetics, have created a safer atmosphere in which to operate. Effective antiemetics have reduced postoperative nausea and vomiting (PONV). Improved postoperative pain management and shortened procedure and recovery times have improved the operative experience for surgical patients.

Surgical Classifications

The decision to perform surgery may be based on facilitating a diagnosis (a diagnostic procedure such as biopsy, exploratory laparotomy, or laparoscopy), a cure (e.g., excision of a tumor or an inflamed appendix), or repair (e.g., multiple wound repair). It may be reconstructive or cosmetic (such as mammoplasty or a facelift) or palliative (to relieve pain or correct a problem—such as debulking a tumor to achieve comfort, or removal of a dysfunctional gallbladder). In addition, surgery might be rehabilitative (e.g., total joint replacement surgery to correct crippling pain or progression of degenerative osteoarthritis). Surgery can also be classified based upon the degree of urgency involved: emergent, urgent, required, elective, and optional (see Table 14-1).

Preadmission Testing

Concurrent with the increase in **ambulatory surgeries** (surgery that does not require an overnight hospital stay) have been changes in the delivery of and payment for health care. Incentives to reduce hospital stays and contain costs have resulted in diagnostic **preadmission testing** (PAT) and preoperative preparation prior to admission. Many facilities have a presurgical services department to facilitate PAT and to initiate the nursing assessment process, which focuses on admission data such as patient demographics, health history, and other information pertinent to the surgical procedure (i.e., appropriate consent forms, diagnostic and laboratory tests) (Rothrock, 2019). During the PAT visit, patients learn what to expect on the day of surgery and receive answers to questions they may have. Nurses in the PAT department are responsible for communicating information related to the surgical procedure and the effect that the surgical procedure and anesthetic may have on the patient's health status, functional status, and family dynamics (Malley, Kenner, Kim, et al., 2015).

Chart 14-1

Examples of Nursing Activities in the Perioperative Phases of Care

Preoperative Phase

Preadmission Testing

1. Performs initial preoperative assessment
2. Initiates education appropriate to patient's needs
3. Involves family in interview
4. Verifies completion of preoperative diagnostic testing according to patient's needs
5. Confirms understanding of surgeon-specific preoperative prescribed therapies (e.g., bowel preparation, preoperative shower)
6. Discusses and reviews advance directive document
7. Begins discharge planning by assessing patient's need for postoperative transportation and care

Admission to Surgical Center

1. Completes preoperative assessment
2. Assesses for risks for postoperative complications
3. Reports unexpected findings or any deviations from normal
4. Verifies that operative consent has been signed
5. Coordinates patient education and plan of care with nursing staff and other health team members
6. Reinforces previous education
7. Explains phases in perioperative period and expectations
8. Answers patient's and family's questions

In the Preoperative Area

1. Identifies patient
2. Assesses patient's physical and emotional status, baseline pain, and nutritional status
3. Reviews medical record
4. Verifies surgical site and that it has been marked per institutional policy
5. Establishes IV line
6. Administers medications if prescribed
7. Takes measures to ensure patient's comfort
8. Provides psychological support
9. Communicates patient and family's needs to other appropriate members of the health care team

Intraoperative Phase

Maintenance of Safety

1. Maintains aseptic, controlled environment

2. Effectively manages human resources, equipment, and supplies for individualized patient care
3. Transfers patient to operating room bed or table
4. Positions patient based on functional alignment and exposure of surgical site
5. Applies grounding device to patient
6. Ensures that the sponge, needle, and instrument counts are correct
7. Completes intraoperative documentation

Physiologic Monitoring

1. Communicates amount of fluid instillation and blood loss
2. Distinguishes normal from abnormal cardiovascular data
3. Reports changes in patient's vital signs
4. Institutes measures to promote normothermia

Psychological Support (Before Induction and When Patient is Conscious)

1. Provides emotional support to patient
2. Stands near or touches patient during procedures and induction
3. Continues to assess patient's emotional status
4. Notifies the patient's family or significant others of updates throughout the procedure

Postoperative Phase

Transfer of Patient to Postanesthesia Care Unit

1. Communicates intraoperative information:
   a. Identifies patient by name
   b. States type of surgery performed
   c. Identifies type and amounts of anesthetic and analgesic agents used
   d. Reports patient's vital signs and response to surgical procedure and anesthesia
   e. Describes intraoperative factors (e.g., insertion of drains or catheters, administration of blood, medications during surgery, or occurrence of unexpected events)
   f. Describes physical limitations
   g. Reports patient's preoperative level of consciousness
   h. Communicates necessary equipment needs
   i. Communicates presence of family or significant others

Postoperative Assessment Recovery Area

1. Determines patient's immediate response to surgical intervention
2. Monitors patient's vital signs and physiologic status
3. Assesses patient's pain level and administers appropriate pain-relief measures
4. Maintains patient's safety (airway, circulation, prevention of injury)

5. Administers medications, fluid, and blood component therapy, if prescribed
6. Provides oral fluids if prescribed for ambulatory surgery patient
7. Assesses patient's readiness for transfer to inhospital unit or for discharge home based on institutional policy (e.g., Aldrete score, see Chapter 16)

Surgical Nursing Unit

1. Continues close monitoring of patient's physical and psychological response to surgical intervention
2. Assesses patient's pain level and administers appropriate pain-relief measures
3. Provides education to patient during immediate recovery period
4. Assists patient in recovery and preparation for discharge home
5. Determines patient's psychological status
6. Assists with discharge planning

Home or Clinic

1. Provides follow-up care during office or clinic visit or by telephone contact
2. Reinforces previous education and answers patient's and family's questions about surgery and follow-up care
3. Assesses patient's response to surgery and anesthesia and their effects on body image and function
4. Determines family's perception of surgery and its outcome

Figure 14-1 • The daVinci surgical system. Reprinted with permission from ©2022 Intuitive Surgical, Inc.

Special Considerations during the Perioperative Period

In an effort to reduce surgical complications, The Joint Commission and the Centers for Medicare and Medicaid Services (CMS) developed National Patient Safety Goals. The goals are updated yearly and identify performance measures aimed at preventing surgical complications, including venous thromboembolism (VTE), surgical site infections (SSIs), and wrong-site surgery related to positive patient identification (Joint Commission, 2019). On the day of surgery, the preoperative nurse should verify the list of home medications with the patient and, if applicable, confirm which medications the patient discontinued and when they were last taken. This information assists providers in understanding the patient's medical conditions and helps to avoid medication interactions between what patients take at home and what is administered to them during surgery (Ubaldi, 2019). For example, particular beta-blockers taken within 24 hours of surgery are associated with improved perioperative cardiovascular outcomes. If the patient has not taken the usual dosage of this medication, the anesthesiologist or certified registered nurse anesthetist (CRNA) must evaluate whether or not it should be administered prior to surgery or during the perioperative period. The nurse in the perioperative area needs to be alert for appropriate preoperative prescriptions aimed at preventing VTE and SSIs. If these prescriptions are not present, they should be requested so that appropriate treatment begins before the start of surgery.

TABLE 14-1 Categories of Surgery Based on Urgency

Classification	Indications for Surgery	Examples
I. Emergent—Patient requires immediate attention; disorder may be life-threatening	Without delay	Severe bleeding Bladder or intestinal obstruction Fractured skull Gunshot or stab wounds Extensive burns
II. Urgent—Patient requires prompt attention	Within 24–30 h	Closed fractures Infected wound exploration/irrigation
III. Required—Patient needs to have surgery	Plan within a few weeks or months	Prostatic hyperplasia Thyroid disorders Cataracts
IV. Elective—Patient should have surgery	Failure to have surgery not catastrophic	Repair of scars Simple hernia Vaginal repair
V. Optional—Decision rests with patient	Personal preference	Cosmetic surgery

Gerontologic Considerations

The hazards of surgery for older adults are proportional to the number and severity of comorbidities and the nature and duration of the operative procedure. Anesthesia associated with these surgeries can precipitate the dysregulation of older adult physiology. Identification of at-risk older adult patients is important in determining the appropriate operative risk and management (Vernon, Rice, Titch, et al., 2019). Cardiac reserves are lower, renal and hepatic functions are depressed, and gastrointestinal activity is likely to be reduced. Therefore, a comprehensive assessment that focuses on the cardiovascular, respiratory, and renal systems may help improve immediate perioperative outcomes (Odom-Forren, 2018). See Chapter 8, Table 8-1 for additional age-related changes.

In the preoperative period, the nurse pays careful attention to the integumentary system of the patient as it can reveal pertinent data about the patient's health status. Assessment includes the overall condition of the skin, and determination of any bruises, abrasions, and discolorations (Phillips, 2017). Precautions are taken when moving an older adult. Decreased subcutaneous fat makes older adults more susceptible to temperature changes. A lightweight cotton blanket is an appropriate cover when an older patient is moved to and from the OR but never replaces asking patients if they feel sufficiently warm and attending to their needs.

The older adult is at a higher risk of cardiovascular complications. Of all the body systems, the cardiovascular system exerts the most influence on anesthesia. The older adult patient usually has decreased or slow circulation to the rest of the body. A preoperative assessment, including blood tests, blood pressure, and EKG, can identify potential risks including anemia, hypertension, and arrhythmias (Phillips, 2017).

In addition to physical risks, the older adult should be assessed for poor memory and cognition. When older adults are in a vulnerable and stressful state, such as preparing for surgery, they may show poor concentration, confusion, and disorganized thought patterns (Odom-Forren, 2018). Nurses must educate patients and caregivers about appropriate pain management and encourage good communication to obtain greater postoperative pain relief. Older adults may need multiple education formats (verbal and print) along with extra time in order to understand and retain what is communicated (see Providing Patient Education section).

Bariatric Patients

Bariatrics is a specialty that revolves around diagnosing, treating, and managing patients with obesity. The prevalence of obesity is approximately

39.8% and affects about 93.3 million adults in the United States (Centers for Disease Control and Prevention [CDC], 2018). Obesity increases the risk and severity of complications associated with surgery. Preoperative assessment of the patient with obesity should pay careful attention to pulmonary, cardiovascular, psychological, and integumentary systems.

Patients with obesity have more subcutaneous fat. The increase in adipose tissue can result in difficult intravenous (IV) access and delayed wound healing at the incision site (Odom-Forren, 2018). Obesity is also associated with increased SSIs and joint replacement failure. Patients with a body mass index (BMI) of greater than 45 are at a significantly increased risk for total joint replacement failure and postoperative infection (Boudreaux & Simmons, 2019).

The patient with obesity tends to have shallow respirations when supine, increasing the risk of hypoventilation and postoperative pulmonary complications. Additionally, diagnosed and undiagnosed obstructive sleep apnea (OSA) is common among patients with obesity. Since these apnea and hypopnea events occur during sleep, most patients with OSA may not be aware that they have the condition. It has been estimated that up to 80% of individuals with moderate to severe OSA may remain undiagnosed and untreated (Chung, Abdullah, & Liao, 2016). Positive identification of OSA and OSA risks can dramatically reduce intubation and postoperative complications (see Chapter 18).

Patients with Disability

Special considerations for patients with mental or physical disability include the need for appropriate assistive devices, modifications in preoperative education, and additional assistance with and attention to positioning or transferring. Assistive devices include hearing aids, eyeglasses, braces, prostheses, and other devices. People who are hearing impaired may need and are entitled by law to a sign interpreter or some alternative communication system perioperatively. If the patient relies on signing or speech (lip) reading and their eyeglasses or contact lenses are removed or the health care staff wears surgical masks, an alternative method of communication will be needed. These needs must be identified in the preoperative evaluation and clearly communicated to personnel. Specific strategies for accommodating the patient's needs must be identified in advance. Ensuring the security of assistive devices is important, because these devices are expensive and require time to replace if lost.

Nurses in the preoperative area report that patients with mobility limitations have difficulty transferring from a standing position to the transport gurney and then, once on the gurney, to reposition themselves (Link, 2018). Therefore, the surgical team should incorporate a plan of care that ensures safe patient

movement and handling. The patient with a disability that affects body position (e.g., cerebral palsy, postpolio syndrome, and other neuromuscular disorders) may need special positioning during surgery to prevent pain and injury. Patients with disability may be unable to sense painful positioning if their extremities are incorrectly adjusted, or they may be unable to communicate their discomfort. A comprehensive care plan should be developed preoperatively addressing the type of disability and patient specific needs.

Patients with respiratory problems related to a disability (e.g., multiple sclerosis, muscular dystrophy) may experience difficulties unless the problems are made known to the anesthesiologist or CRNA and adjustments are made (Barash, Cullen, Stoelting, et al., 2017). These factors need to be clearly identified in the preoperative period and communicated to the appropriate personnel.

Patients Undergoing Ambulatory Surgery

Ambulatory surgery includes outpatient, same-day, or short-stay surgery not requiring admission for an overnight hospital stay but may entail observation in a hospital setting for 23 hours or less. During the brief time the patient and family spend in the ambulatory setting, the nurse must quickly and comprehensively assess and anticipate the needs of the patient and at the same time begin planning for discharge and follow-up home care.

The nurse needs to be sure that the patient and family understand that the patient will first go to the preoperative area before going to the OR for the surgical procedure and then will spend some time in the PACU before being discharged home with the family member later that day. Other preoperative education content should also be verified and reinforced as needed (see later discussion). The nurse should ensure that any plans for follow-up home care or new assistive devices are in place if needed.

Patients Undergoing Emergency Surgery

Emergency surgeries are unplanned and occur with little time for preparation of the patient or the perioperative team. The unpredictable nature of trauma and emergency surgery poses unique challenges throughout the perioperative period. It is important for the nurse to communicate with the patient and team members as calmly and effectively as possible in these situations. (See Chapter 15 for the duties of the members of the perioperative team.)

Factors that affect patients preparing to undergo surgery also apply to patients undergoing emergency surgery, although usually in a very condensed time frame. The only opportunity for preoperative assessment may take place at the same time as resuscitation in the emergency department. A quick visual

survey of the patient is essential to identify all sites of injury if the emergency surgery is due to trauma (see Chapter 67 for more information). The patient, who may have undergone a traumatic experience, may need extra support and explanation of the surgery. For the patient who is unconscious, essential information, such as pertinent past medical history and allergies, need to be obtained from a family member, if one is available.

Required Preoperative Documents

Informed consent is the patient's autonomous decision about whether to undergo a surgical procedure. Voluntary and written informed consent from the patient is necessary before nonemergent surgery can be performed to protect the patient from unsanctioned surgery and protect the surgeon from claims of an unauthorized operation or battery. Consent is a legal mandate, but it also helps the patient to prepare psychologically, because it helps to ensure that the patient understands the surgery to be performed (Rothrock, 2019).

It is the surgeon's and the anesthesiologist's responsibility to provide a clear and simple explanation of what the surgery will entail prior to the patient giving consent. The surgeon must also inform the patient of the benefits, alternatives, possible risks, complications, disfigurement, disability, and removal of body parts as well as what to expect in the early and late postoperative periods. The nurse clarifies the information provided, verifies the presence of the patient's or designee's signature, and may be asked to sign as a witness. If at any point the patient requests additional information, or if the nurse feels that the patient may not understand, the nurse notifies the physician. The nurse ascertains that the consent form has been signed before administering psychoactive premedication, because consent is not valid if it is obtained while the patient is under the influence of medications that can affect judgment and decision making capacity.

Quality and Safety Nursing Alert

Any signed form required for surgery is placed in a prominent place on the patient's medical record and accompanies the patient to the OR.

Many ethical principles are integral to informed consent. Informed consent is necessary in the following circumstances:

- Invasive procedures, such as a surgical incision, a biopsy, a cystoscopy, or paracentesis

- Procedures requiring sedation or anesthesia (see Chapter 15 for a discussion of anesthesia)
- A nonsurgical procedure, such as an arteriography, that carries more than a slight risk to the patient
- Procedures involving radiation
- Blood product administration

The patient personally signs the consent if of legal age and mentally capable. Permission is otherwise obtained from a surrogate, who most often is a responsible family member (preferably next of kin) or legal guardian (see Chart 14-2 for criteria for valid informed consent). State regulations and agency policy must be followed. In an emergency, it may be necessary for the surgeon to operate as a lifesaving measure without the patient's informed consent. However, every effort must be made to contact the patient's family. In such a situation, contact can be made by telephone, fax, or other electronic means and consent obtained.

Chart 14-2

Valid Informed Consent

Voluntary Consent

Valid consent must be freely given, without coercion. Patient must be at least 18 years of age (unless an emancipated minor), a physician must obtain consent, and a professional staff member must witness patient's signature.

Patient Who Is Incompetent

Legal definition: individual who is *not* autonomous and cannot give or withhold consent (e.g., individuals who are cognitively impaired, mentally ill, or neurologically incapacitated).

Informed Subject

Informed consent should be in writing. It should contain the following:

- Explanation of procedure and its risks
- Description of benefits and alternatives
- An offer to answer questions about procedure
- Instructions that the patient may withdraw consent
- A statement informing the patient if the protocol differs from customary procedure

Patient Able to Comprehend

If the patient is non-English speaking, it is necessary to provide consent (written and verbal) in a language that is understandable to the patient. A trained medical interpreter may be consulted. Alternative formats of communication (e.g., Braille, large print, sign interpreter) may be needed if the patient has a disability that affects vision or hearing. Questions must be answered to facilitate comprehension if material is confusing.

If the patient has doubts and has not had the opportunity to investigate alternative treatments, a second opinion may be requested. No patient should be urged or coerced to give informed consent. Refusing to undergo a surgical procedure is a person's legal right and privilege. Such information must be documented and relayed to the surgeon so that other arrangements can be made. Additional explanations may be provided to the patient and family, or the surgery may be rescheduled. Consents for specific procedures such as sterilization, therapeutic abortion, disposal of severed body parts, organ donation, and blood product administration provide additional protection for the patient (Rothrock, 2019). States and regions may vary in their mandates.

Discussion with patients and their family members may be supplemented with audiovisual materials. Consent forms should be written in easily understandable words and concepts to facilitate the consent process and should use other strategies and resources as needed to help the patient understand the

content (see Chart 14-2). Asking patients to describe in their own words the surgery they are about to have promotes nurses' understanding of patients' comprehension.

A completed, updated and signed **History and Physical** must be present prior to the patient entering the OR. Not more than 30 days before the date of the scheduled surgery, each patient must have a comprehensive medical history and physical assessment. The primary provider is required to update the form within 24 hours of scheduled surgery on all non-inpatient clients (Joint Commission, 2019). The History and Physical consists of the history of present illness; surgical, medical, social, and family histories; allergies; current medications; and plan of care. It is the surgical team's responsibility to make sure the presence of these forms and all other supporting documentation (medication reconciliation, Power of Attorney form, etc.) are current and accurate in the preoperative area.

Preoperative Assessment

The goal in the preoperative period is for the patient to be as healthy as possible. Every attempt is made to assess for and address risk factors that may contribute to postoperative complications and delay recovery (see Chart 14-3). The preoperative assessment provides information regarding underlying conditions that may affect the patient's response to surgery techniques and anesthesia (AORN, 2019). During the physical examination, many factors that have the potential to affect the patient undergoing surgery are considered, such as joint mobility. Genetic considerations are also taken into account during assessment to prevent complications with anesthesia (see Chart 14-4).

Chart 14-3 SELECT RISK FACTORS

Surgical Complications

- Arthritis
- Cardiovascular disease:
  - Coronary artery disease or previous myocardial infarction
  - Cardiac failure
  - Cerebrovascular disease
  - Arrhythmias
  - Hemorrhagic disorders
  - Hypertension
  - Prosthetic heart valve
  - Venous thromboembolism (VTE)
- Dehydration or electrolyte imbalance
- Endocrine dysfunction:
  - Adrenal disorders
  - Diabetes
  - Thyroid malfunction
- Extremes of age (very young, very old)
- Extremes of weight (underweight, obese)
- Hepatic disease:
  - Cirrhosis
  - Hepatitis
- Hypovolemia
- Immunologic abnormalities
- Infection and sepsis
- Low socioeconomic status
- Medications
- Nicotine use
- Nutritional deficits
- Pregnancy:
  - Diminished maternal physiologic reserve
- Preexisting cognitive, developmental, intellectual, physical, or sensory disability
- Pulmonary disease:
  - Obstructive disease
  - Restrictive disorder
  - Respiratory infection
- Renal or urinary tract disease:
  - Decreased kidney function
  - Urinary tract infection
  - Obstruction
  - Toxic conditions

Asking the patient about use of prescription and over-the-counter (OTC) medications, including herbal and other supplements, provides useful information. Activity and functional levels should be determined, including that involving regular aerobic exercise. Known allergies and sensitivities to drugs, foods, adhesives, and latex could avert an anaphylactic response (Barash et al., 2017). Patients may have early manifestations of a latex allergy and be unaware of this. If a patient states that he or she is allergic to kiwi, avocado, or banana, or cannot blow up balloons, there may be an association with an allergy to latex.

The patient should be assessed for latex allergy and sensitivities. Latex is found in some food (such as bananas and kiwi) as well as in some hospital materials and equipment. Most hospital products today are latex-free, especially in ORs; however, special precautions are still taken to eliminate the risk of exposure to the patient. These precautions include thorough cleaning of the surgical areas between cases, awareness of allergy among surgical team members, ensuring the materials used are latex-free, and eliminating the use of latex powdered gloves during the case (Mendez, Martinez, Lopez, et al., 2018).

Quality and Safety Nursing Alert

A latex allergy can manifest as a rash, asthma, or anaphylactic shock.

The preoperative assessment should pay attention to the possible presence of undiagnosed OSA. The STOP-Bang is one assessment that may be performed (*S*noring, *T*ired, *O*bserved, *P*ressure, *B*MI, *A*ge, *N*eck, *G*ender) to assess for the presence of OSA (Chung et al., 2016).

Health care providers also should be alert for signs of interpersonal violence, including intimate partner violence, which can occur at any age, in either sex, and in any socioeconomic, ethnic, and cultural group. Findings need to be reported accordingly (see Chapter 4 for further discussion of signs of interpersonal violence). Laboratory tests and other diagnostic tests are prescribed when indicated by information obtained from the history and physical examination. Autologous blood donation or patient self-donation is discussed as needed for the type of surgical procedure planned. See Chapter 28 for further discussion of autologous blood donation.

Nutritional and Fluid Status

Optimal nutrition is an essential factor in promoting healing and resisting infection and other surgical complications. Assessment of a patient's nutritional status identifies factors that can affect the patient's surgical course, such as obesity, weight loss, malnutrition, deficiencies in specific nutrients, metabolic abnormalities, and the effects of medications on nutrition. Nutritional needs may be determined by measurement of BMI and waist circumference. (See Chapter 4 for further discussion of nutritional assessment.)

Any nutritional deficiency should be corrected before surgery to provide adequate protein for tissue repair. The nutrients needed for wound healing are summarized in Table 14-2.

Assessment of a patient's hydration status is also essential. The patient's NPO (Nothing by Mouth or *nil per os*) status should be confirmed preoperatively. Preoperative fasting helps prevent the risk of aspiration but it also induces stress on the body, including the loss of glycogen stores, and the body sacrifices lean muscle to meet the energy needs of the surgery. This may lead to dehydration, which may be exhibited day of surgery by low blood pressure or blood tests revealing fluid and electrolyte imbalances. The depletion of fluids and electrolytes following bowel preparation, especially when combined with prolonged fasting, can result in dehydration and chemical imbalances, even among healthy surgical patients.

Chart 14-4  **GENETICS IN NURSING PRACTICE**

Genetics Concepts and Perioperative Nursing

Nurses who are caring for patients undergoing surgery need to take various genetic considerations into account when assessing patients throughout the operative experience. Genetic disorders can impact pre-, intra-, and postoperative surgical outcomes. In particular, consideration must be given to genetic disorders associated with the delivery of anesthesia as well as other genetic disorders that may increase the risk of postoperative complications. Examples of genetic conditions that may cause complications with anesthesia include the following:

Autosomal Dominant

- Central core disease
- Hyperkalemic periodic paralysis
- Malignant hyperthermia

Examples of other genetic conditions that must be evaluated and are associated with perioperative risks include the following:

- Cystic fibrosis (autosomal recessive)
- Duchenne muscular dystrophy (X-linked recessive)
- Ehlers–Danlos syndrome
- Factor V Leiden (autosomal dominant)
- Hemophilia (X-linked)
- Scleroderma

Nursing Assessments

Refer to Chapter 4, Chart 4-2: Genetics in Nursing Practice: Genetic Aspects of Health Assessment

Family History Assessment Specific to Genetics and Perioperative Nursing

- Obtain a thorough assessment of personal and family history for three generations, inquiring about prior problems with surgery or anesthesia with specific attention to complications, such as fever, rigidity, dark urine, and unexpected reactions.
- Inquire about any history of musculoskeletal complaints, history of heat intolerance, fevers of unknown origin, or unusual drug reactions.
- Assess for family history of any sudden or unexplained death, especially during participation in athletic events.
- Assess whether any family members have been diagnosed with King–Denborough syndrome, as this is a form of congenital myopathy that places the patient at risk for malignant hyperthermia.

Patient Assessment Specific to Genetics and Perioperative Nursing

- Identify the presence of other inherited genetic disorders that may impact surgical outcomes (e.g., inherited connective tissue, metabolic, bleeding, or neurologic disorders).

- Assess for subclinical muscle weakness.
- Assess for other physical features suggestive of an underlying genetic condition, such as contractures, kyphoscoliosis, and pterygium with progressive weakness.

Management Issues Specific to Genetics and Perioperative Nursing

- Inquire as to whether DNA mutation or other genetic testing has been performed on an affected family member.
- If indicated, refer for further genetic counseling and evaluation so that family members can discuss inheritance, risk to other family members, and availability of diagnostic/genetic testing.
- Provide support to families of patients with newly diagnosed malignant hyperthermia.
- Participate in management and coordination of care of patients with genetic conditions and individuals predisposed to develop or pass on a genetic condition.

Genetics Resources

Malignant Hyperthermia Association, www.mhaus.org

See Chapter 6, Chart 6-7: Components of Genetic Counseling for genetics resources.

Dentition

The condition of the mouth is an important health factor to assess. Dental caries, dentures, and partial plates are particularly significant to the anesthesiologist or CRNA, because decayed teeth or dental prostheses may become dislodged during intubation and occlude the airway. This is especially important for older patients as well as those who may not have regular dental care. The condition of the mouth is also important because any bodily infection, even in the mouth, can be a source of postoperative infection.

Drug or Alcohol Use

Excessive alcohol consumption can cause arrhythmias, infections, and withdrawal. These factors can lead to extended hospital stays and increased complications. Identifying patients who have excessive alcohol use presurgically and implementing interventions can reduce the incidence of complications by about 50% (Cuomo, Abate, Springer, et al., 2018). In addition, the use of illicit drugs and alcohol may impede the effectiveness of some medications. Because acutely intoxicated people are susceptible to injury, surgery is postponed if possible. If surgery is required, local, spinal, or regional block anesthesia is used for minor surgery (Norris, 2019). In an

emergency, to prevent vomiting and potential aspiration, a nasogastric tube is inserted before general anesthesia is given.

The person with a history of alcohol abuse often suffers from malnutrition and other systemic problems or metabolic imbalances that increase surgical risk. People who have a substance abuse problem may deny or attempt to hide it. In such situations, the nurse who is obtaining the patient's health history needs to ask frank questions with patience, care, and a nonjudgmental attitude. Such questions should include asking whether the patient has had two drinks per day or more on a regular basis in the 2 weeks prior to surgery (see Chapter 4 for an assessment of alcohol and drug use).

TABLE 14-2 Nutrients Important for Wound Healing

Nutrient	Rationale for Increased Need	Possible Deficiency Outcome
Protein	Allows collagen deposition and wound healing to occur	Collagen deposition leading to impaired/delayed wound healing Decreased skin and wound strength Increased wound infection rates
Arginine (amino acid)	Provides necessary substrate for collagen synthesis and nitric oxide (crucial for wound healing) at wound site Increases wound strength and collagen deposition Stimulates T-cell response Associated with various essential reactions of intermediary metabolism	Impaired wound healing
Carbohydrates and fats	Primary source of energy in the body and consequently in the wound-healing process Meets demand for increased essential fatty acids needed for cellular function after an injury Spares protein Restores normal weight	Signs and symptoms of protein deficiency due to the use of protein to meet energy requirements Extensive weight loss
Water	Replaces fluid lost through vomiting, hemorrhage, exudates, fever, drainage, diuresis Helps maintain homeostasis	Signs, symptoms, and complications of dehydration, such as poor skin turgor, dry mucous membranes, oliguria, anuria, weight loss, increased pulse rate, decreased central venous pressure
Vitamin C	Important for capillary formation, tissue synthesis, and wound healing through collagen formation Needed for antibody formation	Impaired/delayed wound healing related to impaired collagen formation and increased capillary fragility and permeability Increased risk for infection related to decreased antibodies
Vitamin B complex	Indirect role in wound healing through their influence on host resistance	Decreased enzymes available for energy metabolism

Vitamin A	Increases inflammatory response in wounds, reduces anti-inflammatory effects of corticosteroids on wound healing	Impaired/delayed wound healing related to decreased collagen synthesis; impaired immune function Increased risk for infection
Vitamin K	Important for normal blood clotting Impaired intestinal synthesis associated with the use of antibiotics	Prolonged prothrombin time Hematomas contributing to impaired healing and predisposition to wound infections
Magnesium	Essential cofactor for many enzymes that are involved in the process of protein synthesis and wound repair	Impaired/delayed wound healing (impaired collagen production)
Copper	Required cofactor in the development of connective tissue	Impaired wound healing
Zinc	Involved in DNA synthesis, protein synthesis, cellular proliferation needed for wound healing Essential to immune function	Impaired immune response

DNA, deoxyribonucleic acid.

Adapted from Norris, T. L. (2019). *Porth's pathophysiology: Concepts of altered health states* (10th ed.). Philadelphia, PA: Wolters Kluwer.

Respiratory Status

The patient is educated about breathing exercises and the use of an incentive spirometer, if indicated, to achieve optimal respiratory function prior to surgery. The potential compromise of ventilation during all phases of surgical treatment necessitates a proactive response to respiratory infections. Surgery is usually postponed for elective cases if the patient has a respiratory infection. Patients with underlying respiratory disease (e.g., asthma, chronic obstructive pulmonary disease) are assessed carefully for current threats to their pulmonary status.

Preoperative smoking cessation interventions can be effective in changing smoking behavior and reducing the incidence of postoperative complications. Patients who smoke are more likely to experience poor wound healing, a higher incidence of SSI, and complications that include VTE and pneumonia.

During the preoperative assessment, patients should be asked about current and previous tobacco use. The PAT visit is an optimal time to advocate for smoking cessation (Cuomo et al., 2018). Patients undergoing elective cases may have their surgery delayed or cancelled due to the potential complications associated with smoking. Those at highest risk of complications are patients scheduled to receive artificial implants such as grafts, total joint replacements, or breast enhancements (Devlin & Smeltzer, 2017).

Cardiovascular Status

Patient preparation for surgical intervention includes ensuring that the cardiovascular system can support the oxygen, fluid, and nutritional needs of the perioperative period. Patients are assessed for cardiac comorbidities including congestive heart failure, shortness of breath upon movement, and arrhythmias (Clifford, 2018). Preoperatively, patients may receive a chest x-ray and electrocardiogram (ECG) to rule out any undiagnosed cardiac condition. Before surgery, the patient's baseline vital signs and blood pressure are taken. In elective situations, surgery may be postponed if there is evidence of cardiac decomposition or unexplained elevated blood pressure (Phillips, 2017).

Hepatic and Renal Function

The presurgical goal is optimal function of the liver and urinary systems so that medications, anesthetic agents, body wastes, and toxins are adequately metabolized and removed from the body. The liver, lungs, and kidneys are the routes for elimination of drugs and toxins.

The liver is important in the biotransformation of anesthetic compounds. Disorders of the liver may substantially affect how anesthetic agents are metabolized. Acute liver disease is associated with high surgical mortality; preoperative improvement in liver function is a goal. Careful assessment may include various liver function tests (see Chapter 43).

The kidneys are involved in excreting anesthetic medications and their metabolites; therefore, surgery is contraindicated if a patient has acute nephritis, acute renal insufficiency with oliguria or anuria, or other acute renal problems (see Chapter 48). Exceptions include surgeries performed as lifesaving measures, surgery to enable easier access for dialysis, or those necessary to improve urinary function (e.g., obstructive uropathy or hydronephrosis).

Endocrine Function

Dysfunction of the endocrine system is associated with overproduction or underproduction of a hormone or hormones. This dysfunction may be the primary reason for surgery or it may coexist in patients who need surgery on other organ systems (Odom-Forren, 2018). Patients who have received corticosteroids are at risk for adrenal insufficiency. The use of corticosteroids for any purpose during the preceding year must be reported to the anesthesiologist or CRNA and surgeon. The patient is monitored for signs of adrenal insufficiency (see Chapter 45).

Patients with uncontrolled thyroid disorders are at risk for thyrotoxicosis (with hyperthyroid disorders) or respiratory failure (with hypothyroid disorders). The patient with an associated history of a thyroid disorder is assessed preoperatively (see Chapter 45).

The patient with diabetes who is undergoing surgery is at risk for both hypoglycemia and hyperglycemia. Hypoglycemia may develop during anesthesia or postoperatively from inadequate carbohydrates or excessive administration of insulin. Hyperglycemia, which can increase the risk of SSI, may result from the stress of surgery, which can trigger increased levels of catecholamine. Other risks are acidosis and glucosuria. Although the surgical risk in the patient with controlled diabetes is no greater than in the patient without diabetes, strict glycemic control leads to better outcomes (ASPAN, 2019). Frequent monitoring of blood glucose levels is important before, during, and after surgery. (See Chapter 46 for a discussion of the patient with diabetes.)

Immune Function

An important function of the preoperative assessment is to determine the presence of infection or allergies. Routine laboratory tests used to detect infection include the white blood cell (WBC) and the urinalysis. Surgery may be postponed in the presence of infection or elevated temperature.

It is important to identify and document any sensitivity to medications, solutions, adhesives, and past adverse reactions (ASPAN, 2019). The patient is asked to identify any substances that precipitated previous allergic reactions, including medications, blood transfusions, contrast agents, latex, and food products, and to describe the signs and symptoms produced by these substances. A sample latex allergy screening questionnaire is shown in Figure 14-2.

Latex Allergy Assessment

Ask the patient the following questions. Check "Yes" or "No" in the box.	YES	NO
1. Has a doctor ever told you that you are allergic to latex?		
2. Do you have on-the-job exposure to latex?		
3. Were you born with problems involving your spinal cord?		
4. Have you ever had allergies, asthma, hay fever, eczema, or problems with rashes?		
5. Have you ever had respiratory distress, rapid heart rate, or swelling?		
6. Have you ever had swelling, itching, hives, or other symptoms after contact with a balloon?		
7. Have you ever had swelling, itching, hives, or other symptoms after a dental examination or procedure?		
8. Have you ever had swelling, itching, hives, or other symptoms following a vaginal or rectal examination or after contact with a diaphragm or condom?		
9. Have you ever had swelling, itching, hives, or other symptoms during or within 1 hour after wearing rubber gloves?		
10. Have you ever had a rash on your hands that lasted longer than 1 week?		
11. Have you ever had swelling, itching, hives, runny nose, eye irritation, wheezing, or asthma after contact with any latex or rubber product?		
12. Have you ever had swelling, itching, hives, or other symptoms after being examined by someone wearing rubber or latex gloves?		
13. Are you allergic to bananas, avocados, kiwi, or chestnuts?		
14. Have you ever had an unexplained anaphylactic episode?		

Preop RN Signature: _____

Patient Name: _____

Procedure: _____

Scheduled Date / Time: _____

Surgeon: _____

Figure 14-2 • Example of a latex allergy assessment form. Courtesy of Inova Fair Oaks Hospital, Fairfax, VA.

TABLE 14-3 Examples of Medications with the Potential to Affect the Surgical Experience

Agent	Effect of Interaction with Anesthetics
Corticosteroids	
Dexamethasone	Cardiovascular collapse can occur if discontinued suddenly. Therefore, a bolus of corticosteroids may be administered IV immediately before and after surgery.
Diuretics	
Hydrochlorothiazide	During anesthesia, may cause excessive respiratory depression resulting from an associated electrolyte imbalance.
Phenothiazines	
Chlorpromazine hydrochloride	May increase the hypotensive action of anesthetics.
Tranquilizers	
Diazepam	May cause anxiety, tension, and even seizures if withdrawn suddenly.
Insulins	
Insulin	Interaction between anesthetics and insulin must be considered when a patient with diabetes is undergoing surgery. IV insulin may need to be given to keep the blood glucose within the normal range.
Anticoagulants	
Warfarin	Can increase the risk of bleeding during the intraoperative and postoperative periods; should be discontinued in anticipation of elective surgery. The surgeon will determine how long before the elective surgery the patient should stop taking an anticoagulant, depending on the type of planned procedure and the medical condition of the patient.
Anticonvulsant Medications	
Carbamazepine	IV administration of medication may be needed to keep the patient seizure-free in the intraoperative and postoperative periods.
Thyroid Hormone	
Levothyroxine sodium	IV administration may be needed during the postoperative period to maintain thyroid levels.
Opioids	
Morphine sulfate	Long-term use of opioids for chronic pain (≥6 mo) in the preoperative period may alter the patient's response to analgesic agents.

IV, intravenous.

Adapted from Comerford, K. C., & Durkin, M. T. (2020). *Nursing 2020 drug handbook*. Philadelphia, PA: Wolters Kluwer.

Immunosuppression is common with corticosteroid therapy, organ transplantation, radiation therapy, chemotherapy, and disorders affecting the immune system, such as acquired immunodeficiency syndrome and leukemia. The mildest symptoms or slightest temperature elevation must be investigated.

Previous Medication Use

A medication history is obtained because of the possible interactions with medications that might be given during surgery and the effects of any of these medications on the patient's perioperative course. Any medications the patient is using or has used in the past are documented, including OTC preparations and herbal agents, as well as the frequency with which they are used. Many medications have an effect on physiologic functions; interactions of such medications with anesthetic agents can cause serious problems, such as hypotension and circulatory collapse. Medications that cause particular concern are listed in Table 14-3.

Aspirin, clopidogrel, and other medications that inhibit platelet aggregation should be prudently discontinued 7 to 10 days before surgery; otherwise, the patient may be at increased risk for bleeding (Rothrock, 2019). Any use of aspirin or other OTC medications is noted in the patient's medical record and conveyed to the intraoperative team. The anesthesia provider evaluates the potential effects of prior medication therapy, considering the length of time the patient has used the medication, the physical condition of the patient, and the nature of the proposed surgery.

Quality and Safety Nursing Alert

The possible adverse interactions of some medications require the nurse to assess and document the patient's use of prescription medications, OTC medications (especially aspirin), herbal agents, and the frequency with which medications are used. The nurse must clearly communicate this information to the intraoperative team.

Preprocedure evaluation needs to include dietary and herbal supplements that may increase surgical risks (Odom-Forren, 2018). Commonly used herbal medications and supplements along with their indications for use and possible surgical risks can be found in Table 14-4. Additional herbal medications may include echinacea and licorice extract (*Glycyrrhizic acid*). Many patients fail to report the use of herbal medicines to health care service providers; therefore, the nurse must ask surgical patients specifically about the use of these agents. The American Society of Anesthesiologists (ASA) issued a statement cautioning patients who take herbal products to refrain from taking them for at

least 2 weeks before surgery (American Society of Anesthesiologists [ASA], 2017).

TABLE 14-4 Herbs or Supplements and Possible Surgical Risks

Herb or Supplement	Indication for Use	Possible Surgical Risk
Ephedra (Ma-Huang)	Appetite suppressant	May interact with medications to cause increased BP and HR
Garlic (*Allium sativum*)	Reported to lower BP and cholesterol levels	Can increase bleeding
Ginkgo biloba	Used to improve memory	Can increase bleeding
Ginseng	Used to increase concentration	Can increase HR and risk of bleeding
Kava kava (*Piper methysticum*)	Used to decrease anxiety	Can increase the effect of anesthesia
St. John's wort (*Hypericum perforatum*)	Used to decrease anxiety, help with depression and sleep problems	May prolong the effects of anesthesia
Valerian (*Valeriana officinalis*)	Used as a sleep aid	May prolong the effects of some types of anesthesia
Vitamin E	Thought to slow the aging process	Can increase bleeding and may cause BP problems

BP, blood pressure; HR, heart rate.

Adapted from American Society of Anesthesiologists. (2017). Herbal and dietary supplements and anesthesia. Retrieved on 6/3/2019 at: www.asahq.org/whensecondscount/wp-content/uploads/2017/10/asa_supplements-anesthesia_final.pdf.

Psychosocial Factors

The nurse anticipates that most patients have emotional reactions prior to surgery—obvious or veiled, normal or abnormal. Fear may be related to the unknown, lack of control, or of death and may be influenced by anesthesia, pain, complications, cancer, or prior surgical experience. Preoperative anxiety can be a preemptive response to a threat to the patient's role in life, a permanent incapacity or body integrity, increased responsibilities or burden on family members, or life itself. Less obvious concerns may occur because of previous experiences with the health care system and people the patient has known with the same condition. Psychological distress directly influences body functioning. Identification of anxiety by the health care team using

supportive guidance at every juncture of the perioperative process helps to ease anxiety. Research suggests that negative postoperative outcomes can result from fear and anxiety preoperatively. Anxiety triggers a physical response, stimulating the release of epinephrine and norepinephrine, which in turn raises blood pressure and increases heart rate, cardiac output, and blood glucose levels. Therefore, overall healing may be impaired while pain and risk of infection may increase postoperatively (Bagheri, Ebrahimi, Abbasi, et al., 2019).

People express fear in different ways. Some patients may ask repeated questions, regardless of information already shared with them. Others may withdraw, deliberately avoiding communication by reading, watching television, or talking about trivialities. Consequently, the nurse must be empathetic, listen well, and provide information that helps alleviate concerns.

An important outcome of the psychosocial assessment is the determination of the extent and role of the patient's support network. The value and reliability of available support systems are assessed. Other information, such as knowledge of the usual level of functioning and typical daily activities, may assist in the patient's care and recovery. Assessing the patient's readiness to learn and determining the best approach to maximize comprehension provide the basis for preoperative patient education. This is of particular importance in patients who are developmentally delayed and those who are cognitively impaired, where the approach to patient education and consent will include the legal guardian.

Spiritual and Cultural Beliefs

Showing respect for a patient's cultural values and beliefs facilitates rapport and trust. Assessment includes identifying the ethnic group to which the patient relates and the customs and beliefs the patient holds about illness and health care providers. Knowledge of the patient's physiologic, psychosocial, cultural, spiritual, and educational needs allows the perioperative nurse to provide a holistic approach to care. A holistic picture of the patient allows the perioperative nurse the opportunity to identify patient care issues that extend beyond the medical diagnosis and planned surgical procedure and choose a nursing diagnosis based on key elements of the patient's needs and goals. The nurse advocates for the patient and develops a holistic care plan that is communicated to members of the intraoperative and postoperative team. Perioperative patient advocacy entails paying respect to other human beings, preserving the patient's expressed values, and treating all patients equally (Sundqvist, Holmefur, Nilsson, et al., 2016).

Certain ethnic groups are unaccustomed to expressing feelings openly with strangers, and nurses need to consider this pattern of communication when assessing pain. In some cultural groups, it is seen as impolite to make direct

eye contact with others and doing so is seen as disrespectful. The nurse should know that this lack of eye contact is not avoidance nor does it reflect a lack of interest. Other ethnicities view the top of the head as sacred; therefore, a nurse would not put the surgical cap on the patient but would ask the patient to don the cap.

Perhaps the most valuable skill at the nurse's disposal is listening carefully to the patient and observing body language, especially when obtaining the history. Invaluable information and insights may be gained through effective communication and interviewing skills. An unhurried, understanding, and caring nurse promotes confidence on the part of the patient.

Preoperative Nursing Interventions

A wide range of interventions are used to prepare the patient physically and psychologically and to maintain safety. Beginning with the nursing history and physical examination, listing of medications taken routinely, history of allergies, and surgical and anesthetic histories, the patient's overall health status and level of experience and understanding may be established.

Providing Patient Education

Nurses have long recognized the value of preoperative education (Rothrock, 2019). Each patient's education is individualized, with consideration for any unique concerns or learning needs. Multiple education strategies should be used (e.g., verbal, written, return demonstration), depending on the patient's needs and abilities.

Preoperative education is initiated as soon as possible, beginning in the physician's office, in the clinic, or at the time of PAT when diagnostic tests are performed. During PAT, the nurse or health care provider makes resources available related to patient education, such as written instructions (designed to be copied and given to patients), audiovisual and online resources, and telephone numbers, to ensure that education continues until the patient arrives for the surgical intervention. When possible, education is spaced over a period of time to allow the patient to assimilate information and ask questions as they arise.

Frequently, education sessions are combined with various preparation procedures to allow for an easy and timely flow of information. The nurse should guide the patient through the experience and allow ample time for questions. Education should go beyond descriptions of the procedure and should include explanations of the sensations the patient will experience. Telling the patient that a preoperative medication will cause relaxation before

the operation is not as effective as also noting that a medication will act quickly and may result in lightheadedness, dizziness, and drowsiness. Knowing what to expect will help the patient anticipate these reactions and attain a superior degree of relaxation. Overly detailed descriptions may increase anxiety in some patients; therefore, the nurse should be sensitive to this, by watching and listening, and provide less detail based on the individual patient's needs.

Unfolding Patient Stories: Vernon Watkins • Part 1

Vernon Watkins, a 69-year-old male, came to the emergency department with severe abdominal pain, and a bowel perforation was diagnosed. He is being prepared for surgery. Significant medical history includes controlled hypertension and smoking for 50 years. What preoperative education should the nurse discuss with Mr. Watkins prior to his emergent surgery? (Vernon Watkins' story continues in Chapter 58.)

Care for Vernon and other patients in a realistic virtual environment: *vSim* (**thepoint.lww.com/vSimMedicalSurgical**). Practice documenting these patients' care in DocuCare (**thepoint.lww.com/DocuCareEHR**).

Deep Breathing, Coughing, and Incentive Spirometry

One goal of preoperative nursing care is to educate the patient how to promote optimal lung expansion and resulting blood oxygenation after anesthesia. The patient assumes a sitting position to enhance lung expansion. The nurse then demonstrates how to take a deep, slow breath and how to exhale slowly. After practicing deep breathing several times, the patient is instructed to breathe deeply, exhale through the mouth, take a short breath, and cough deeply in the lungs (see Chart 14-5). The nurse or respiratory therapist also demonstrates how to use an incentive spirometer, a device that provides measurement and feedback related to breathing effectiveness (see Chapter 19). In addition to enhancing respiration, these exercises may help the patient relax.

If a thoracic or abdominal incision is anticipated, the nurse demonstrates how to splint the incision to minimize pressure and control pain. The patient should put the palms of both hands together, interlacing the fingers snugly. Splinting or placing the hands across the incision site acts as an effective support when coughing. The patient is informed that medications are available to relieve pain and should be taken regularly for pain relief so that effective deep-breathing and coughing exercises can be performed comfortably. The goal in promoting coughing is to mobilize secretions so that they can be

removed. Deep breathing before coughing stimulates the cough reflex. If the patient does not cough effectively, atelectasis (collapse of the alveoli), pneumonia, or other lung complications may occur.

Mobility and Active Body Movement

The goals of promoting mobility postoperatively are to improve circulation, prevent venous stasis, and promote optimal respiratory function. The patient should be taught that early and frequent ambulation postoperatively, as tolerated, will help prevent complications.

The nurse explains the rationale for frequent position changes after surgery and then shows the patient how to turn from side to side and how to assume the lateral position without causing pain or disrupting IV lines, drainage tubes, or other equipment. Any special position the patient needs to maintain after surgery (e.g., adduction or elevation of an extremity) is discussed, as is the importance of maintaining as much mobility as possible despite restrictions. Reviewing the process before surgery is helpful, because the patient may be too uncomfortable or drowsy after surgery to absorb new information.

Exercise of the extremities includes extension and flexion of the knee and hip joints (similar to bicycle riding while lying on the side) unless contraindicated by type of surgical procedure (e.g., hip replacement). The great toe is pointed and rotated as though tracing a large circle (see Chart 14-5). The elbow and shoulder are also put through their range of motion. At first, the patient is assisted and reminded to perform these exercises. Later, the patient is encouraged to do them independently. Muscle tone is maintained so that ambulation will be easier. The nurse should remember to use proper body mechanics and to instruct the patient to do the same. Whenever the patient is positioned, their body needs to be properly aligned.

Chart 14-5 PATIENT EDUCATION

Diaphragmatic Breathing

Diaphragmatic breathing refers to a flattening of the dome of the diaphragm during inspiration, with resultant enlargement of the upper abdomen as air rushes in. During expiration, the abdominal muscles contract.

1. Practice in the same position you would assume in bed after surgery: a semi-Fowler position, propped in bed with the back and shoulders well supported with pillows.
2. Feel the movement with your hands resting lightly on the front of the lower ribs and fingertips against the lower chest.

Diaphragmatic breathing

3. Breathe out gently and fully as the ribs sink down and inward toward midline.
4. Then take a deep breath through your nose and mouth, letting the abdomen rise as the lungs fill with air.
5. Hold this breath for a count of five.
6. Exhale and let out *all* the air through your nose and mouth.
7. Repeat this exercise 15 times with a short rest after each group of five.
8. Practice this twice a day preoperatively.

Coughing

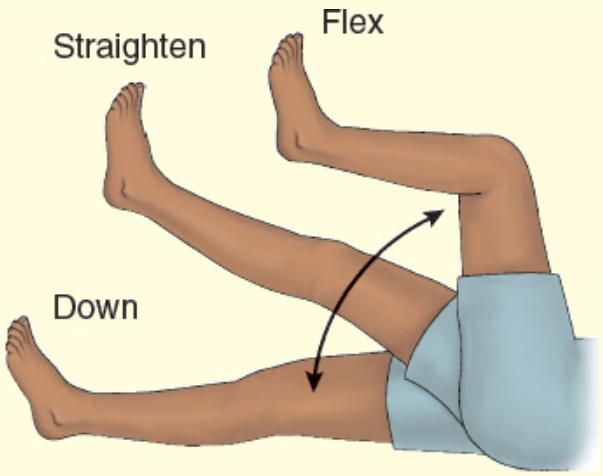
1. Lean forward slightly from a sitting position in bed, interlace your fingers together, and place your hands across the incision site to act as a splint for support when coughing.

Splinting of chest when coughing

2. Breathe with the diaphragm as described under “Diaphragmatic Breathing.”
3. With your mouth slightly open, breathe in fully.
4. “Hack” out sharply for three short breaths.
5. Then, keeping your mouth open, take in a quick deep breath and immediately give a strong cough once or twice. This helps clear secretions from your chest. It may cause some discomfort but will not harm your incision.

Leg Exercises

1. Lie in a semi-Fowler position and perform the following simple exercises to improve circulation.
2. Bend your knee and raise your foot—hold it a few seconds, then extend the leg and lower it to the bed.

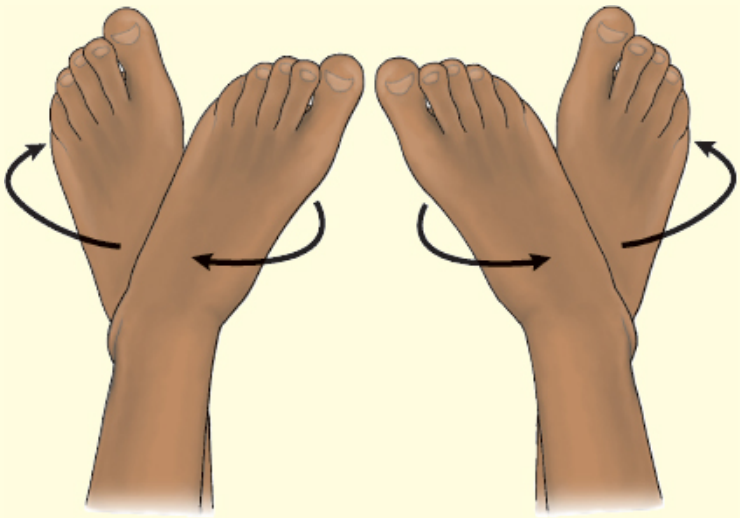


Leg exercises

3. Do this five times with one leg and then repeat with the other leg.
4. Then trace circles with the feet by bending them down, in toward each other, up, and then out.
5. Repeat these movements five times.

Turning to the Side

1. Turn on your side with the uppermost leg flexed most and supported on a pillow.
2. Grasp the side rail as an aid to maneuver to the side.
3. Practice diaphragmatic breathing and coughing while on your side.



Foot exercises

Getting Out of Bed

1. Turn on your side.
2. Push yourself up with one hand as you swing your legs out of bed.

Pain Management

A pain assessment should include differentiation between acute and chronic pain. A pain intensity scale should be introduced and explained to the patient to promote more effective postoperative pain management. (See Chapter 9 for examples of pain scales.) Preoperative patient education also needs to include the difference between acute and chronic pain so that the patient is prepared to differentiate acute postoperative pain from a chronic condition such as back pain. Preoperative pain assessment and education for the older patient may require additional attention (see Chart 14-6).

Chart 14-6

Preoperative Assessment and Education for Older Adults

Assessment

- Assess for allergies and medical comorbidities.
- Assess the patient's cognitive and sensory function before the surgeon begins the informed consent process.
- Perform a Fall Risk Assessment including the following factors:
  - History of previous falls
  - Medication use (e.g., preoperative sedatives)
  - Level of consciousness (e.g., alert, lethargic)
  - Ability to follow directions (e.g., cognitive impairment, language barrier)
  - Sensory impairments (e.g., vision, hearing)
  - Level of coordination or balance
  - Toileting needs (e.g., incontinence, frequency, need for assistance)
  - Presence of external devices (e.g., catheters, drains)
- Determine the need for a designated support person or power of attorney to complete the informed consent process.
- Review medications to identify potential polypharmaceutical risks to include the following:
  - Multiple medications
  - Multiple prescribers
  - Several filling pharmacies
  - Too many forms of medications
  - Over-the-counter medications
  - Multiple dosing schedules
- Document baseline physical assessment parameters, including pain, cardiac rhythm, and oxygen saturation level.
- Document a detailed skin assessment with notation of areas of dryness, lesions, or bruising.
- Document preoperative fasting status and assess for dehydration, malnutrition, and hypoglycemia.
- Perform a psychosocial assessment that addresses fears, anxiety, and feelings of loneliness.
- Identify social support to determine whether the patient has home assistance to complete ADLs.

Education

- Discuss advanced directives and code status to identify the patient's wishes.
- Educate the patient about the benefits of controlling pain.
- Be prepared to spend additional time, increase the amount of therapeutic touch utilized, and encourage family members to be present to decrease anxiety.

ADLs, activities of daily living.

Adapted from Ogg, M. (2018). Clinical issues. *AORN Journal, 108*(2), 195–203; Phillips, N. (2017). *Berry and Kohn's operating room technique*. St. Louis, MO: Elsevier.

Postoperatively, medications are given to relieve pain and maintain comfort without suppressing respiratory function. The patient is instructed to take the medication as frequently as prescribed during the initial postoperative period for pain relief. Anticipated methods of administration of analgesic agents for inpatients include patient-controlled analgesia (PCA), epidural catheter bolus or infusion, or patient-controlled epidural analgesia (PCEA; see Chapter 9 for discussion of PCA and PCEA). A patient who is expected to go home will likely receive oral analgesic agents. These methods are discussed with the patient before surgery, and the patient's interest and willingness to use them are assessed.

Cognitive Coping Strategies

Although some anxiety is common in the surgical setting, untreated or undertreated high preoperative anxiety can lead to complications. Tachycardia, arrhythmias, hypertension, and increased levels of pain have been reported postoperatively in patients with increased preoperative anxiety (Jaruzel, Gregoski, Mueller, et al., 2019). Cognitive strategies may be useful for relieving tension, overcoming anxiety, decreasing fear, and achieving relaxation. Examples of general strategies include:

- *Guided Imagery:* The patient concentrates on a pleasant experience or restful scene.
- *Distraction:* The patient thinks of an enjoyable story or recites a favorite poem or song.
- *Optimistic Self-Recitation:* The patient recites optimistic thoughts ("I know all will go well").
- *Music Therapy:* The patient listens to soothing music (an easy-to-administer, inexpensive, noninvasive intervention).
- *Aromatherapy:* The patient inhales aromatic oils to trigger emotional and physical relaxation responses through the olfactory system and brain.
- *Reiki:* The practitioner places hands over the patient to (theoretically) transfer energy to promote healing and relaxation.

Alternative interventions may include acupuncture, yoga therapy, muscle relaxation, and therapeutic touch.

Education for Patients Undergoing Ambulatory Surgery

Preoperative education for the same-day or ambulatory surgical patient comprises all previously discussed patient education as well as collaborative planning with the patient and family for discharge and follow-up home care. The major difference in outpatient preoperative education is the environment.

Preoperative education content may be presented in a group class, in a media presentation, at PAT, or by telephone in conjunction with the preoperative interview. In addition to answering questions and describing what to expect, the nurse tells the patient when and where to report, what to bring (insurance card, list of medications and allergies), what to leave at home (jewelry, watch, medications, contact lenses), and what to wear (loose-fitting, comfortable clothes; flat shoes). The nurse in the surgeon's office may initiate education before the perioperative telephone contact.

During the final preoperative telephone call, education is completed or reinforced as needed and last-minute instructions are given. The patient is reminded not to eat or drink for a specified period of time and about skin cleansing techniques prior to surgery (see later section on preparing the skin).

Providing Psychosocial Interventions

The nurse assesses for and provides interventions to enhance coping mechanisms to deal effectively with anxiety and fears, and thus provide emotional comfort (Phillips, 2017). Preoperatively, the nurse assesses any patient specific needs that may affect the emotional, psychosocial, or physical surgical experience.

Reducing Anxiety and Decreasing Fear

Perioperative nurses in the preoperative department have a limited amount of time to acquire information and establish trust. Nurses must introduce themselves, giving their title and a brief synopsis of their professional role and background. Each preoperative patient should be acknowledged as an individual, and each patient's needs and desires must be assessed. The patient should be thanked for choosing that particular hospital or surgical center. These methods facilitate establishing a positive nurse–patient relationship. Discussion of the surgical experience, its length, and explanation of what will happen may diminish the patient's anxiety.

During the preoperative assessment of psychological factors and spiritual and cultural beliefs, the nurse assists the patient to identify coping strategies that he or she has previously used to decrease fear. Discussions with the patient to help determine the source of fears can help with expression of concerns. The patient benefits from knowing when family and friends will be able to visit after surgery and that a spiritual advisor will be available if desired. Knowing ahead of time about the possible need for a ventilator, drainage tubes, or other types of equipment helps decrease anxiety related to the postoperative period.

Careful attention should be placed on patients who experience a delay in surgery as prolonged wait times in the preoperative area can lead to increased fear and anxiety.

Respecting Cultural, Spiritual, and Religious Beliefs

The nurse assesses for any patient specific needs that may affect the spiritual, emotional, or physical surgical experience. In some cultures, for example, people are stoic in regard to pain, whereas in others they are more expressive. These responses should be recognized as normal for those patients and families and should be respected by perioperative personnel. If patients decline blood transfusions for religious reasons (Jehovah's Witnesses), this information needs to be clearly identified in the preoperative period, documented, and communicated to the appropriate personnel. Although minimally invasive surgery has significantly lowered blood loss, any surgical procedure has the potential for hemorrhage.

Maintaining Patient Safety

Protecting patients from injury is one of the major roles of the perioperative nurse. Adherence to AORN-recommended practices and The Joint Commission's National Patient Safety Goals (see Chart 14-7) are crucial (Rothrock, 2019). These apply to hospitals as well as to ambulatory surgery centers and office-based surgery facilities (Joint Commission, 2019).

Chart 14-7

Summary of the 2019 National Patient Safety Goals

- Identify patients correctly
- Improve staff communication
- Use medicines safely
- Use alarms safely
- Prevent infection
- Identify patient safety risks
- Prevent mistakes in surgery

Adapted from Joint Commission (2019). 2019 National Patient Safety Goals. Retrieved on 5/22/19 at: www.jointcommission.org/assets/1/6/2019_HAP_NPSGs_final2.pdf

Managing Nutrition and Fluids

The purpose of withholding food and fluid before surgery is to prevent aspiration. Specific recommendations for restrictions depend on the age of the patient and the type of food eaten. For example, adults may be advised to fast for 8 hours after eating fatty food and 6 hours after ingesting milk products. Healthy patients are allowed clear liquids up to 2 hours before an elective procedure. New methods of "carbohydrate loading" have been implemented preoperatively in surgeries that do not involve the gastrointestinal system (i.e., thoracic, urologic, obstetric, orthopedic). A carbohydrate-rich drink has been used as a safe fasting process before surgery. It has been reported that these solutions do not pose a risk for aspiration and decrease insulin resistance when the duration of gastric emptying and the amount of liquid intake are controlled (Cakar, Yilmaz, Cakar, et al., 2017). Preoperative carbohydrate loading in patients undergoing surgery as part of an enhanced recovery after surgery protocol has demonstrated positive outcomes including decreased LOS, decreased incidence of PONV, and decreased pain (Pachella, Mehran, Curtin, et al., 2019).

Preparing the Bowel

Enemas are not commonly prescribed preoperatively unless the patient is undergoing abdominal or pelvic surgery. In this case, a cleansing enema or laxative may be prescribed the evening before surgery and may be repeated the morning of surgery. The goals of this preparation are to allow satisfactory visualization of the surgical site and to prevent trauma to the intestine or contamination of the peritoneum by fecal material. Unless the condition of the patient presents some contraindication, the toilet or bedside commode, rather than the bedpan, is used for evacuating the enema if the patient is hospitalized during this time. In addition, antibiotics may be prescribed to reduce intestinal flora.

Preparing the Skin

The goal of preoperative skin preparation is to decrease bacteria without injuring the skin. If the surgery is not performed as an emergency, most health care facilities and ambulatory surgical centers have implemented preoperative antiseptic skin cleansing protocols. At a minimum, preoperative bathing should consist of a full-body wash using antimicrobial soap the night before the planned surgery (Berríos-Torres, Umscheid, Bratzler, et al., 2018). Additional body cleansing with chlorhexidine wipes may occur in the preoperative area via the nurse or by the patient under the direction of the nurse. Surgical site hair removal should occur in the preoperative area. Electric clippers, not skin razors, are the preferred method for hair removal. Special consideration is given to those undergoing gynecologic, urologic, and cranial

surgeries. To ensure the correct site, the surgical site is typically marked by the patient and the surgeon prior to the procedure.

Immediate Preoperative Nursing Interventions

The nurse confirms the patient identity upon entry and dons "alert" bracelets on the patient when applicable: medication allergies, fall risk, extremity precautions (for needle sticks and blood pressures), and code status. The patient changes into a hospital gown, covers the head with a disposable bouffant, and nail polish is removed (if present) as it may interfere with hemodynamic monitoring. The mouth is inspected, and dentures or plates are removed. If left in the mouth, these items could easily fall to the back of the throat during induction of anesthesia and cause respiratory obstruction.

Jewelry is not worn to the OR; wedding rings and jewelry or body piercings should be removed to prevent injury. If a patient objects to removing jewelry, the patient must be notified of the risks associated with it. All articles of value, including assistive devices, dentures, glasses, and prosthetic devices, are given to family members or are labeled clearly with the patient's name and stored in a safe and secure place according to the institution's policy.

Preoperative Checklist

1. Patient's name: _____ Date: _____ Height: _____ Weight: _____
   Identification band present: _____
2. Informed consent signed: _____ Special permits signed: _____
3. Surgical site: _____ (Ex: Sterilization)
4. History & physical examination report present: _____ Date: _____
5. Laboratory records present: _____
   CBC: _____ Hgb: _____ Urinalysis: _____ Hct: _____
6. Traveled Outside of the United States in the last 14 days: Yes/No
7. NPO Status: Date/Time last liquid: _____ Date/Time last solid: _____
8.

Item	Present	Removed
a. Natural teeth		
Dentures; upper, lower, partial		
Bridge, fixed; crown		
b. Contact lenses		
c. Other prostheses—type: _____		
d. Jewelry:		
Wedding band (taped/tied)		
Rings		
Earrings: pierced, clip-on		
Neck chains		
Any other body piercings		
e. Make-up		
Nail polish		
9. Clothing		
a. Clean patient gown		
b. Cap		
c. Sanitary pad, etc.		

10. Family instructed where to wait? _____
11. Valuables secured? _____
12. Blood available? _____ Ordered? _____ Where? _____
13. Preanesthetic medication given: _____
    Type: _____ Time: _____
14. Voided: _____ Amount: _____ Time: _____ Catheter: _____
    Mouth care given: _____
15. Vital signs: Temperature: _____ Pulse: _____ Resp: _____ Blood Pressure: _____
16. Special problems/precautions: (Allergies, deafness, etc.): _____
17. Area of skin preparation: _____
18. _____ Date: _____ Time: _____
    Signature: Nurse releasing patient

Figure 14-3 • Example of a preoperative checklist.

All patients (except those with urologic disorders) should void immediately before going to the OR. This is particularly important in promoting visibility of anatomy and continence during low abdominal surgery. Urinary catheterization is performed in the OR only as necessary.

Administering Medication

The use of preanesthetic medication is minimal with ambulatory or outpatient surgery but may be used to help some patients remain calm and comfortable (Phillips, 2017). If a preanesthetic medication is given, the patient is kept in bed with the side rails raised, because the medication can cause lightheadedness or drowsiness. During this time, the nurse observes the patient for any untoward reaction to the medications.

Antibiotics are given preoperatively, as needed, to help reduce the risk of SSIs. The antibiotic is typically prescribed prior to the patient arriving and is prepared by the pharmacy so that it can be administered in a timely fashion

prior to surgery. Administration of the appropriate antibiotic should occur so that the peak efficacy of the medication is in the patient's tissues and bloodstream immediately before incision (Bashaw & Keister, 2018).

Maintaining the Preoperative Record

Preoperative checklists contain critical elements that must be checked and verified before the procedure (Rothrock, 2019). The nurse completes a preoperative checklist (see Fig. 14-3). The completed medical record (with the preoperative checklist and verification form) accompanies the patient to the OR with the surgical consent form attached, along with all laboratory reports and nurses' records. These documents may also be found in the patient's electronic health record; however, they must be easily accessed and verified by the surgical team. Any patient alerts (allergies, safety precautions) and individual needs are "flagged" on either the paper or electronic record.

Chart 14-8  **NURSING RESEARCH PROFILE**

The Efficacy of Prewarming in the Preoperative Setting

Rosenkilde, C., Vamosi, M., Lauridsen, J. T., et al. (2017). Efficacy of prewarming with a self-warming blanket for the prevention of unintended perioperative hypothermia in patients undergoing hip or knee arthroplasty. *Journal of PeriAnesthesia Nursing, 32*(5), 419–428.

Purpose

Unintended perioperative hypothermia (UPH) is defined as a core temperature of less than 36°C (96.8°F) in patients in the surgical setting when cooling is not associated with the procedure. Many risks are associated with UPH including increased wound infections, pain, coagulation disorders, and cardiac complications. The purpose of this study was to evaluate UPH rates when a self-warming blanket was utilized by patients undergoing hip or knee joint replacement surgeries.

Design

This was a secondary analysis of two cross-sectional studies. A control group of patients did not receive any warming methods, and another group of patients received a prewarming intervention. Core temperatures of both groups were taken preoperatively, every 30 minutes throughout the procedure, and postoperatively.

Findings

Sixty patients were included in the study, 30 in each group. The incidence of UPH was identified in 13% of the patients in the prewarmed group and 43% of the patients in the control group. Mean core temperature in the prewarmed group was significantly higher and remained above 36°C in the perioperative period.

Nursing Implications

Careful attention needs to be paid to maintaining normothermia in the patient throughout the entire perioperative phase of care. The findings of this study showed a reduction in UPH rates when patients were prewarmed with a self-warming blanket. Nurses at both outpatient and inpatient surgical settings could use this study to help develop interdisciplinary prewarming techniques and protocols.

Preoperative Patient Warming

Preoperative patient warming for a period of at least 30 minutes can be beneficial to prevent hypothermia development after anesthesia induction. Various techniques include warm blankets, forced air warming, and warmed IV fluid administration. Unintended hypothermia is associated with increased adverse patient outcomes, including bleeding, delayed surgical wound healing,

increased length of stay (LOS) in the PACU, cardiac dysfunction, and longer inpatient hospital stay (Williams, 2018). Patients should be educated about the purpose of the warming intervention and should be assessed for abnormal temperatures, profuse sweating, and discomfort (Williams, 2018). Research suggests that nurses play a crucial part in the reduction of unintended hypothermia, below 36°C (96.8°F), by applying prewarming techniques in the preoperative area (Rosenkilde, Vamosi, Lauridsen, et al., 2017). See the Nursing Research Profile in Chart 14-8.

The patient is taken to the preoperative area, greeted by name, and positioned comfortably on the stretcher or bed. The surrounding area should be kept quiet if the preoperative medication is to have maximal effect. Unpleasant sounds or conversation should be avoided, because a patient who is sedated may misinterpret them.

Attending to Family Needs

Most hospitals and ambulatory surgery centers have a waiting room where family members and significant others can wait while the patient is undergoing surgery. This room may be equipped with comfortable chairs, televisions, telephones, and light refreshments. Volunteers may remain with the family, offer them coffee, and keep them informed of the patient's progress. After surgery, the surgeon may meet the family in the waiting room and discuss the outcome.

The family and significant others should never judge the seriousness of an operation by the length of time the patient is in the OR. A patient may be in the OR much longer than the actual operating time for several reasons:

- Patients are routinely transported well in advance of the actual operating time.
- The anesthesiologist or CRNA often makes additional preparations that may take 30 to 60 minutes.
- The preceding case may take longer than expected, which delays the start of the next surgical procedure.

After surgery, the patient is taken to the PACU to ensure safe emergence from anesthesia. Family members and significant others waiting to see the patient after surgery should be informed that the patient may have certain equipment or devices (e.g., IV lines, indwelling urinary catheter, nasogastric tube, oxygen lines, monitoring equipment, blood transfusion lines) in place when he or she returns from surgery. When the patient returns to the room, the nurse provides explanations regarding the frequent postoperative observations that will be made. However, it is the responsibility of the surgeon, not the nurse, to relay the surgical findings and the prognosis, even when the findings are favorable.

Expected Patient Outcomes

Expected patient activities to decrease anxiety and fear, as well as increase knowledge in the preoperative phase of care are summarized in Chart 14-9. Nurse-sensitive outcomes often include central line–associated bloodstream infections (CLABSI), catheter-associated urinary tract infections (CAUTI), hospital-acquired pressure ulcers and unit-acquired pressure ulcers.

Chart 14-9

Expected Patient Activities in the Preoperative Phase of Care

Relief of anxiety, evidenced when the patient:

- Discusses with the anesthesiologist or CRNA concerns related to types of anesthesia and induction
- Verbalizes an understanding of the preanesthetic medication and general anesthesia
- Discusses last-minute concerns with the nurse or physician
- Discusses financial concerns with the social worker, when appropriate
- Requests visit with spiritual advisor, when appropriate
- Appears relaxed when visited by health care team members

Decreased fear, evidenced when the patient:

- Discusses fears with health care professionals or a spiritual advisor, or both
- Verbalizes an understanding of any expected bodily changes, including expected duration of bodily changes

Understanding of the surgical intervention, evidenced when the patient:

- Participates in preoperative preparation as appropriate (e.g., bowel preparation, shower)
- Demonstrates and describes exercises that he or she is expected to perform postoperatively
- Reviews information about postoperative care
- Accepts preanesthetic medication, if prescribed
- Remains in bed once premedicated
- Relaxes during transportation to the operating room or unit
- States rationale for use of side rails
- Discusses postoperative expectations

CRNA, certified registered nurse anesthetist.

CRITICAL THINKING EXERCISES

1 pq A 55-year-old man who is a patient on the surgical unit where you work is scheduled for a prostatectomy; he is showing signs of increased anxiety, fear, and insomnia. What are the priorities of the perioperative nurse? What further assessments are priorities? What are your priorities for nursing intervention?

2 ebp A 60-year-old woman with obesity has been admitted for a minimally invasive hysterectomy. She was diagnosed during her PAT visit with severe OSA. What resources would you use to identify evidence-based practices for prevention of complications during the perioperative period? Identify the evidence, as well as the criteria used to evaluate the strength of the evidence, for the practices identified.

3 ipc A 38-year-old man is admitted for knee surgery following a horse riding accident. He is in good physical condition but reports a family history of "problems with anesthesia." What are your immediate preoperative assessments? What should you include in the interprofessional handoff to the surgical team?

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*Asterisk indicates nursing research.

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American Association of Gynecologic Laparoscopy (AAGL), www.aagl.org
American Society for Metabolic and Bariatric Surgery (ASMBS), asmbs.org
American Society of Anesthesiologists (ASA), www.asahq.org
American Society of PeriAnesthesia Nurses (ASPAN), www.aspan.org
Association of periOperative Registered Nurses (AORN), www.aorn.org
Joint Commission, www.jointcommission.org

15 Intraoperative Nursing Management

LEARNING OUTCOMES

On completion of this chapter, the learner will be able to:

1. Describe the roles of the surgical team members during the intraoperative phase of care.
2. Identify adverse effects of surgery and anesthesia.
3. Describe ways to decrease the risk of surgical site infections.
4. Compare types of anesthesia with regard to uses, advantages, disadvantages, and nursing responsibilities.
5. Use the nursing process to optimize patient outcomes during the intraoperative period.

NURSING CONCEPTS

Assessment
Comfort
Managing Care
Safety

GLOSSARY

anesthesia: a state of narcosis or severe central nervous system depression produced by pharmacologic agents

anesthesiologist: physician trained to deliver anesthesia and to monitor the patient's condition during surgery

anesthetic agent: the substance, such as a chemical or gas, used to induce anesthesia

certified registered nurse anesthetist (CRNA): advanced practice registered nurse who delivers anesthesia care under the direction of an anesthesiologist

circulating nurse : registered nurse who coordinates and documents patient care in the operating room (*synonym*: circulator)

laparoscope: a thin endoscope inserted through a small incision into a cavity or joint using fiber-optic technology to project live images of structures onto a video monitor; other small incisions allow additional instruments to be inserted to facilitate laparoscopic surgery

malignant hyperthermia: a rare life-threatening condition triggered by exposure to most anesthetic agents inducing a drastic and uncontrolled increase in skeletal muscle oxidative metabolism that can overwhelm the body's capacity to supply oxygen, remove carbon dioxide, and regulate body temperature, eventually leading to circulatory collapse and death if untreated; often inherited as an autosomal dominant disorder

moderate sedation: previously referred to as conscious sedation, involves the use of sedation to depress the level of consciousness without altering the patient's ability to maintain a patent airway and to respond to physical stimuli and verbal commands

monitored anesthesia care: moderate sedation given by an anesthesiologist or CRNA

multimodal anesthesia: the intentional practice of using a combination of nonopioid pharmaceuticals and regional anesthesia techniques

registered nurse first assistant: a member of the operating room team whose responsibilities may include handling tissue, providing exposure at the operative field, suturing, and maintaining hemostasis

restricted zone: area in the operating room where scrub attire and surgical masks are required; includes operating room and sterile core areas

scrub role: registered nurse, licensed practical nurse, or surgical technologist who scrubs and dons sterile surgical attire, prepares instruments and supplies, and hands instruments to the surgeon during the procedure

semirestricted zone: area in the operating room where scrub attire is required; may include areas where surgical instruments are processed

sterile technique: measures taken to maintain an area free from living microorganisms, including all spores

surgical asepsis: absence of microorganisms in the surgical environment to reduce the risk of infection

unrestricted zone: area in the operating room that interfaces with other departments; includes patient reception area and holding area

The intraoperative experience has undergone many changes and advances that make it safer and less disturbing to patients. Even with these advances, anesthesia and surgery still place the patient at risk for several complications or adverse events. Consciousness or full awareness, mobility, protective biologic functions, and personal control are totally or partially relinquished by the patient when entering the operating room (OR). Staff from the departments of anesthesia, nursing, and surgery work collaboratively to implement professional standards of care, to control iatrogenic and individual risks, to prevent complications, and to promote high-quality patient outcomes.

The Surgical Team

The surgical team consists of the patient, the anesthesiologist (physician) or certified registered nurse anesthetist (CRNA), the surgeon, nurses, surgical technicians, and registered nurse first assistants (RNFAs) or certified surgical technologists (assistants). The anesthesiologist or CRNA administers the **anesthetic agent** (substance used to induce anesthesia) and monitors the patient's physical status throughout the surgery. The surgeon, nurses, technicians, and assistants scrub and perform the surgery. The person in the scrub role, either a nurse or a surgical technician, provides sterile instruments and supplies to the surgeon during the procedure by anticipating the surgical needs as the surgical case progresses. The circulating nurse coordinates the care of the patient in the OR. Care provided by the circulating nurse includes planning for and assisting with patient positioning, preparing the site for surgery, managing surgical specimens, anticipating the needs of the surgical team, documenting intraoperative events, and updating the plan of care. Collaboration of the core surgical team using evidence-based practices tailored to the specific case results in optimum patient care and improved outcomes (see Chart 15-1).

Chart 15-1 ETHICAL DILEMMA

Can Lack of Civility in the OR Threaten Patient Safety?

Case Scenario

You are a registered nurse who has worked in the operating room (OR) for the past five years. You have enjoyed an ancillary role precepting students for the past two years. Recently, you volunteered to serve as a preceptor for a nurse who is transferring to the OR after working as a registered nurse on a general medical-surgical unit for the past two years since graduating from nursing school. The new nurse was accepted into the hospital's onsite perioperative nursing internship program three months ago and has completed most of the classroom portion of the program, reportedly receiving excellent test scores. Today, she is assigned to the role of scrub nurse. A staff nurse with 20 years of experience in the OR is the circulating nurse assigned to the OR suite where the new nurse is assigned. As you are preparing to enter the OR suite to check on the new nurse and to verify that she has setup the instruments properly, the circulating nurse storms angrily out of the room, rolls her eyes and tells you "that newbie badly bungled" and did not set up instruments correctly for the case. You immediately walk into the OR suite to investigate and find the surgeon and the CRNA are there, as well as the new nurse, who is blinking back tears. The new nurse tells you that the circulating nurse "chewed me out in front of everyone." The surgeon requests to have a different nurse assigned to be the scrub nurse.

Discussion

In the *Code of Ethics for Nurses*, the American Nurses Association (ANA; 2015) stresses that it is the responsibility of the nurse to treat colleagues with civility, dignity, and respect and that doing so creates an ethical work environment. By contrast, incivility, which can be evidenced by harassment, intimidation, and bullying, is considered morally unacceptable behaviors for the nurse to exhibit. Clark and Kenski (2017) take these tenets further, and note that incivility, which can consist of both overt behaviors (e.g., yelling, making disparaging remarks) as well as covert behaviors (e.g., eye rolling, withholding communication) can disrupt important professional transactions and communication, which may then threaten patient safety. They assert that "nurses have an ethical responsibility to foster healthy work environments in which conflict is managed in a respectful way and communication is clear, direct, and concise." (p. 62).

Analysis

- Identify the ethical principles that are in conflict in this case (see Chapter 1, Chart 1-7). Who are the stakeholders who might have been adversely affected by this event? Do nurses have a moral obligation to foster beneficent relationships? Can incivility threaten nonmaleficence?
- Describe how you would proceed and what you would say to the nurse you are precepting. Would your communication with her be different if you were to find that she had set up the instruments correctly or

incorrectly? Would you honor the surgeon's request and ask the charge nurse to change the new nurse's assignment?
- What resources might be of help to you so that a civil work environment may be cultivated? Should the nurse manager or other administrators be consulted to help resolve this conflict?

References

American Nurses Association (ANA). (2015). *Code of ethics for nurses with interpretive statements*. Silver Spring, MD: Author.

Clark, C. M. & Kenski, D. (2017). Promoting civility in the OR: An ethical imperative. *AORN Journal*, *105*(1), 60–66.

Resources

See Chapter 1, Chart 1-10 for Steps of an Ethical Analysis and Ethics Resources.

The Patient

As the patient enters the OR, they may feel either relaxed and prepared or fearful and highly stressed. These feelings depend to a large extent on the amount and timing of preoperative sedation, preoperative education, and the individual patient. Fears about loss of control, the unknown, pain, death, changes in body structure, appearance, or function, and disruption of lifestyle all contribute to anxiety. These fears can increase the amount of anesthetic medication needed, the level of postoperative pain, and overall recovery time (see Chapter 5 for more information on stress).

The patient is subject to several risks. Infection, failure of the surgery to relieve symptoms or correct a deformity, temporary or permanent complications related to the procedure or the anesthetic agent, and death are uncommon but potential outcomes of the surgical experience (see Chart 15-2). In addition to fears and risks, the patient undergoing sedation and anesthesia temporarily loses both cognitive function and biologic self-protective mechanisms. Loss of the sense of pain, reflexes, and the ability to communicate subjects the intraoperative patient to possible injury. The OR nurse is the patient's advocate while surgery proceeds.

Chart 15-2

Potential Adverse Effects of Surgery and Anesthesia

Anesthesia and surgery disrupt all major body systems. Although most patients can compensate for surgical trauma and the effects of anesthesia, all patients are at risk during the operative procedure. These risks include the following:

- Agitation or disorientation, especially in older adult patients
- Allergic reactions
- Anesthesia awareness
- Bleeding
- Cardiac arrhythmia from electrolyte imbalance or adverse effect of anesthetic agents
- Central nervous system agitation, seizures, and respiratory arrest
- Drug toxicity, faulty equipment, and other types of human error
- Electrical shock or burns
- Hypotension from blood loss or adverse effect of anesthesia
- Hypothermia from cool operating room temperatures, exposure of body cavities, and impaired thermoregulation secondary to anesthetic agents
- Hypoxemia or hypercarbia from hypoventilation and inadequate respiratory support during anesthesia
- Infection
- Laryngeal trauma, oral trauma, and broken teeth from difficult intubation
- Laser burns
- Malignant hyperthermia secondary to adverse effect of anesthesia
- Myocardial depression, bradycardia, and circulatory collapse
- Nerve damage and skin breakdown from prolonged or inappropriate positioning
- Oversedation or undersedation
- Retained foreign body or object
- Thrombosis from compression of blood vessels or stasis

Adapted from Association of PeriOperative Registered Nurses (AORN). (2019a). *Association of PeriOperative Registered Nurses (AORN) standards, recommended practice, and guidelines.* Denver, CO: Author.

Gerontologic Considerations

One in 10 patients undergoing surgery is age 65 or older (American Society of Anesthesiologists [ASA], 2019). Older adult patients are at higher risk for complications from anesthesia and surgery compared with younger adult patients due to several factors (Rothrock, 2019). One factor is age-related decline in physiologic reserve that weakens the normal response to stressors, acute illness, anesthesia, and surgery (Vernon, Rice, Titch, et al., 2019). Risks include delirium, hypothermia, positioning injury, deep vein thrombosis (DVT) formation, electrolyte imbalance, and circulatory compromise. Further discussion of age-related physiologic changes can be found in Chapter 8.

Biologic variations of particular importance include age-related cardiovascular and pulmonary changes. The aging heart and blood vessels have decreased ability to respond to stress. Cardiac output and pulmonary capacity diminish with age, with a decline in maximal oxygen uptake. Slow circulation and hypotension predispose the patient to thrombus formation and emboli (Phillips, 2017). Excessive or rapid administration of intravenous (IV) solutions can cause pulmonary edema. A sudden or prolonged decline in blood pressure may lead to cerebral ischemia, thrombosis, embolism, infarction, and anoxia. Reduced gas exchange can result in cerebral hypoxia.

Lower doses of anesthetic agents are required in older adults due to decreased tissue elasticity (lung and cardiovascular systems) and reduced lean tissue mass. Older patients often experience an increase in the duration of clinical effects of medications. With decreased plasma proteins, more of the anesthetic agent remains free or unbound, and the result is more potent action (Barash, Cullen, Stoelting, et al., 2017).

In addition, body tissues of the older adult are made up predominantly of water, and those tissues with a rich blood supply, such as skeletal muscle, liver, and kidneys, shrink as the body ages. Reduced liver size decreases the rate at which the liver can inactivate many anesthetic agents, and decreased kidney function slows the elimination of waste products and anesthetic agents. Nursing management for the older surgical patient in the intraoperative period includes the following (Phillips, 2017):

- Application of intraoperative warming techniques to reduce unintentional hypothermia
- Careful transfer and positioning on the OR bed. Protect pressure points and bony prominences with extra padding. Support the back and neck to prevent stiffness while maintaining respiratory and circulatory support
- Use of antiembolic stockings or a sequential compression device to prevent VTE formation
- Careful fluid and electrolyte monitoring via accurate blood loss measurement, urinary output, and blood gases

Nursing Care

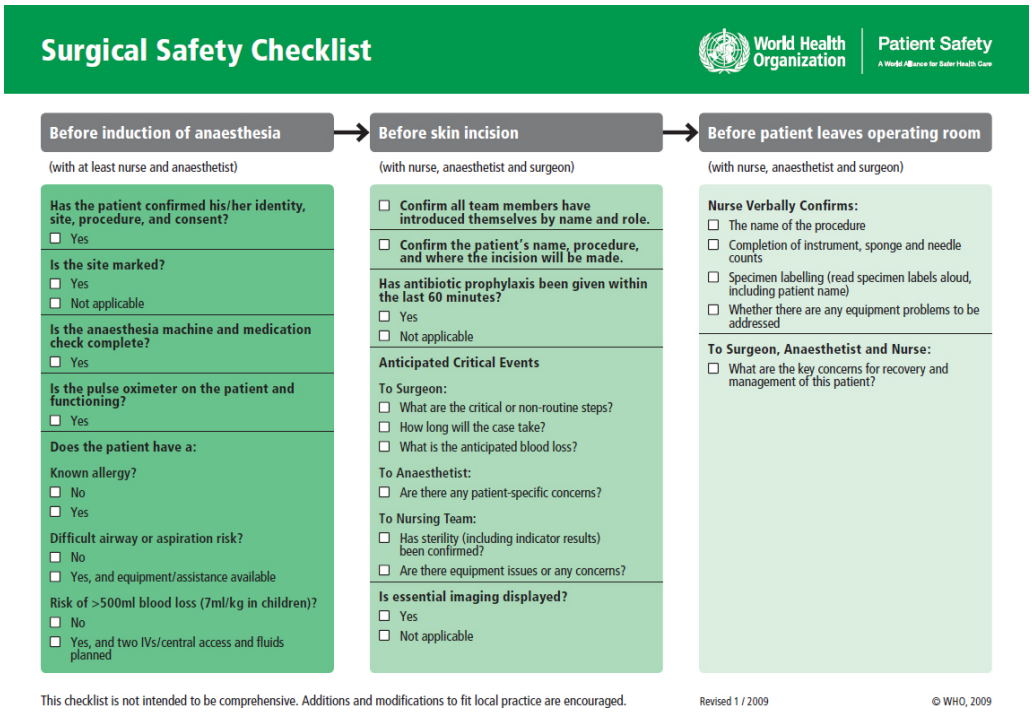
Throughout surgery, nursing responsibilities include providing for the safety and well-being of the patient, coordinating the OR personnel, and performing scrub and circulating activities. Because the patient's emotional state remains a concern, the intraoperative nursing staff provides the patient with information and reassurance, continuing the care initiated by preoperative nurses. The nurse supports coping strategies and reinforces the patient's ability to influence outcomes by encouraging active participation in the plan of care, incorporating cultural, ethnic, and religious considerations as appropriate. The establishment of an environment of trust and relaxation through visualization techniques is

another method of patient reassurance that can be used as the patient is anesthetically induced.

As patient advocates, intraoperative nurses monitor factors that have the potential to cause injury, such as patient position, equipment malfunction, and environmental hazards. Nurses also protect the patient's dignity and interests while the patient is under anesthesia. Additional nursing responsibilities include maintaining surgical standards of care, identifying risks, and minimizing complications.

Cultural Diversity

Cultural, ethnic, and religious diversities are important considerations for all health care professionals. Nurses in the perioperative area should be aware of medications that may be prohibited by certain groups (e.g., Muslims and those of the Jewish faith may not wish to use porcine-based products [heparin (porcine or bovine)]; Buddhists may choose not to use bovine products). In certain cultures, the head is a sacred area, and staff should allow patients to apply their own surgical cap in this case. When English is the second language of the patient having surgery under local anesthesia, certified medical translators can be provided to maintain understanding and comprehension by the patient. Translator devices are also available at most hospitals. Family members may have the ability to translate but should not be used as medical translators, as they may wish to save the patient anxiety and not provide an accurate translation, resulting in the patient not receiving complete information.



Surgical Safety Checklist

World Health Organization | Patient Safety
A World Alliance for Safer Health Care

Before induction of anaesthesia → **Before skin incision** → **Before patient leaves operating room**

(with at least nurse and anaesthetist)

Has the patient confirmed his/her identity, site, procedure, and consent?
- ☐ Yes

Is the site marked?
- ☐ Yes
- ☐ Not applicable

Is the anaesthesia machine and medication check complete?
- ☐ Yes

Is the pulse oximeter on the patient and functioning?
- ☐ Yes

Does the patient have a:

Known allergy?
- ☐ No
- ☐ Yes

Difficult airway or aspiration risk?
- ☐ No
- ☐ Yes, and equipment/assistance available

Risk of >500ml blood loss (7ml/kg in children)?
- ☐ No
- ☐ Yes, and two IVs/central access and fluids planned

(with nurse, anaesthetist and surgeon)

- ☐ **Confirm all team members have introduced themselves by name and role.**
- ☐ **Confirm the patient's name, procedure, and where the incision will be made.**

Has antibiotic prophylaxis been given within the last 60 minutes?
- ☐ Yes
- ☐ Not applicable

Anticipated Critical Events

To Surgeon:
- ☐ What are the critical or non-routine steps?
- ☐ How long will the case take?
- ☐ What is the anticipated blood loss?

To Anaesthetist:
- ☐ Are there any patient-specific concerns?

To Nursing Team:
- ☐ Has sterility (including indicator results) been confirmed?
- ☐ Are there equipment issues or any concerns?

Is essential imaging displayed?
- ☐ Yes
- ☐ Not applicable

(with nurse, anaesthetist and surgeon)

Nurse Verbally Confirms:
- ☐ The name of the procedure
- ☐ Completion of instrument, sponge and needle counts
- ☐ Specimen labelling (read specimen labels aloud, including patient name)
- ☐ Whether there are any equipment problems to be addressed

To Surgeon, Anaesthetist and Nurse:
- ☐ What are the key concerns for recovery and management of this patient?

This checklist is not intended to be comprehensive. Additions and modifications to fit local practice are encouraged.

Revised 1 / 2009

Figure 15-1 • Surgical safety checklist. Reproduced with permission from the World Health Organization. WHO Bulletin, 86[7]. New checklist to help make surgery safer, 496–576. © 2015. Retrieved on 5/22/19 at: whqlibdoc.who.int/publications/2009/9789241598590_eng_Checklist.pdf

The Circulating Nurse

The **circulating nurse (or circulator)**, a qualified registered nurse, works in collaboration with surgeons, anesthesia providers, and other health care providers to plan the best course of action for each patient (Rothrock, 2019). In this leadership role, the circulating nurse manages the OR and protects the patient's safety and health by monitoring the activities of the surgical team, checking the OR conditions, and continually assessing the patient for signs of injury and implementing appropriate interventions. A foremost responsibility includes verifying consent; if not obtained, surgery may not commence. The team is coordinated by the circulating nurse, who ensures cleanliness, proper temperature, humidity, appropriate lighting, safe function of equipment, and the availability of supplies and materials.

The circulating nurse monitors aseptic practices to avoid breaks in technique while coordinating the movement of related personnel (medical, x-ray, and laboratory), as well as implementing fire safety precautions. The circulating nurse also monitors the patient and documents specific activities throughout the operation to ensure the patient's safety and well-being.

In addition, the circulating nurse is responsible for ensuring that the second verification of the surgical procedure and site takes place and is documented (see Fig. 15-1). In some institutions, this is referred to as a time-out, surgical pause, or universal protocol that takes place among the surgical team prior to induction of anesthesia with a briefing about anticipated problems, potential complications, allergies, and comorbidities. Every member of the surgical team verifies the patient's name, procedure, and surgical site using objective documentation and data before beginning the surgery. Identifying patients correctly is a 2019 National Patient Safety Goal (see Chapter 14, Chart 14-7). The Surgical Safety Checklist (SSC) (see Fig. 15-1) has been adopted in ORs worldwide to reduce medical errors, increase patient safety, and improve interprofessional communication (Ziman, Espin, Grant, et al., 2018). A team debriefing session, led by the circulating nurse, often follows the completion of surgery to identify potential problems with the postsurgical care of the patient and potential areas for improvement (American Society of PeriAnesthesia Nurses [ASPAN], 2019).

Quality and Safety Nursing Alert

It is imperative that the correct patient identity, surgical procedure, and surgical site be verified prior to surgery. The surgical site should be marked by the physician and confirmed by the patient prior to coming to the OR suite during the consent process. The marking should be visible after the sterile drapes are applied and verified by the surgical team members during the time-out.

The Scrub Role

The registered nurse, licensed practical nurse, or surgical technologist (or assistant) performs the activities of the **scrub role**, including performing hand hygiene; setting up the sterile equipment, tables, and sterile field; preparing sutures, ligatures, and special equipment (e.g., a **laparoscope**, which is a thin endoscope inserted through a small incision into a cavity or joint using fiber-optic technology to project live images of structures onto a video monitor); and assisting the surgeon and the surgical assistants during the procedure by anticipating the instruments and supplies that will be required, such as sponges, drains, and other equipment. As the surgical incision is closed, the scrub person and the circulating nurse count all needles, sponges, and instruments to be sure that they are accounted for and not retained as a foreign body in the patient (Association of PeriOperative Registered Nurses [AORN], 2019a; Rothrock, 2019). Standards call for all sponges used in surgery to be visible on x-ray and for sponge counts to take place at the beginning of surgery and twice at the end (when wound closure begins and again as the skin is being closed). Tissue specimens obtained during surgery are labeled by the person in the scrub role

and sent to the laboratory by the circulating nurse. Medications and solutions are transferred to the sterile table by the circulating nurse and the name, strength, dosage, and expiration date are labeled by the person in the scrub role. Implants are handled in a similar fashion whereby the name, type, size, expiration date, and sterility are verified prior to handoff to the person in the scrub role.

The Surgeon

The surgeon performs the surgical procedure, heads the surgical team, and is a licensed physician (MD or DO), oral surgeon (DDS or DMD), or podiatrist (DPM) who is specially trained and qualified. Qualifications and training must adhere to The Joint Commission standards, hospital standards, and local and state admitting practices and procedures (Rothrock, 2019).

The Registered Nurse First Assistant

The **registered nurse first assistant (RNFA)** is another member of the OR team. Although the scope of practice of the RNFA depends on each state's nurse practice act, the RNFA practices under the direct supervision of the surgeon. RNFA responsibilities may include handling tissue, providing exposure at the operative field, suturing, and maintaining hemostasis (Rothrock, 2019). The role requires a thorough understanding of anatomy and physiology, tissue handling, and the principles of surgical asepsis. The RNFA must be aware of the objectives of the surgery, must have the knowledge and ability to anticipate needs and to work as a skilled member of a team, and must be able to handle any emergency situation in the OR.

The Anesthesiologist and CRNA

An **anesthesiologis**t is a physician specifically trained in the art and science of anesthesiology. A **certified registered nurse anesthetist (CRNA)** is a qualified and specifically trained health care professional who administers anesthetic agents, has graduated from an accredited nurse anesthesia program, and has passed examinations sponsored by the American Association of Nurse Anesthetists. The anesthesiologist or CRNA assesses the patient before surgery, selects the anesthesia, administers it, intubates the patient if necessary, manages any technical problems related to the administration of the anesthetic agent, and supervises the patient's condition throughout the surgical procedure. Before the patient enters the OR, often at preadmission testing, the anesthesiologist or CRNA visits the patient to perform an assessment, supply information, and answer questions. The type of anesthetic agent to be given, previous reactions to anesthetic medications, and known anatomic abnormalities that would make airway management difficult are among topics addressed.

The anesthesiologist or CRNA uses the American Society of Anesthesiologists (ASA) Physical Classification System to determine the patient's status. A patient who is classified as P2, P3, or P4 has a systemic disease that may or may not be related to the cause of surgery. If a patient with a classification of P1, P2, P3, P4, or P5 requires emergency surgery, an E is added to the physical status designation (e.g., P1E, P2E). P6 refers to a patient who is brain dead and is undergoing surgery as an organ donor. The abbreviations ASA1 through ASA6 are often used interchangeably with P1 to P6 to designate physical status (Rothrock, 2019).

When the patient arrives in the OR, the anesthesiologist or CRNA reassesses the patient's physical condition immediately prior to initiating anesthesia. The anesthetic agent is given, and the patient's airway is maintained through an intranasal intubation (if the surgeon is using an oral approach to surgery), intubation with an endotracheal tube (ET), or a laryngeal mask airway (LMA). During surgery, the anesthesiologist or CRNA monitors the patient's blood pressure, pulse, and respirations, as well as the electrocardiogram (ECG), blood oxygen saturation level, tidal volume, blood gas levels, blood pH, alveolar gas concentrations, and body temperature. End tidal CO_2 monitoring by electroencephalography (EEG) is sometimes required. Levels of anesthetic medications in the body can also be determined; a mass spectrometer can provide instant readouts of critical concentration levels on display terminals. This information is used to assess the patient's ability to breathe unassisted or the need for mechanical assistance if ventilation is poor and the patient is not breathing well independently.

Safety and Infection Prevention

Within the OR, many factors prevent the spread of microorganisms that may cause surgical site infections (SSIs). These factors involve a combination of facility structure and personnel practices, which are regulated by professional guidelines and overseen by facility members.

The Surgical Environment

The surgical suite is behind double doors, and access is limited to authorized, appropriately clad personnel. The OR is considered a restricted area where careful attention to infection prevention is at the highest standard. In the OR environment, microbial contamination can occur through an airborne or contact route; as a result, the OR has special air filtration devices to screen out contaminating particles, dust, and pollutants. ORs are designed with laminar flow ventilation to circulate particles away from the patient and surgical field. Personnel also follow strict aseptic practices, including hand scrubbing, machine and room cleaning, sterile supply and instrumentation use, and limited

movement. Reducing traffic and door openings has been linked to maintaining optimal airflow with minimal circulating particles and contaminants (Armellino, 2017). Policies governing this environment address such issues as the health of the staff; the cleanliness of the rooms; the sterility of equipment and surfaces; processes for scrubbing, gowning, and gloving; and OR attire (AORN, 2019a).

The surgical environment is known for its stark appearance and cool temperature. Therefore, it is important to maintain patient normothermia. Research supports warming the patient starting in the preoperative area, and throughout all perioperative phases of care. Examples of intraoperative warming techniques are raising room temperature, using forced-air warming blankets, and administering warmed irrigation and IV solutions (Phillips, 2017; Williams, 2018).

To provide the best possible conditions for surgery, the OR is situated in a location that is central to all supporting services (e.g., pathology, x-ray, and laboratory).

Many National Patient Safety Goals pertain to the perioperative areas (see Chapter 14, Chart 14-7); however, the one with the most direct relevance to the OR is to identify patient safety risks. A unique risk is the risk of fire in the OR due to three factors: a source of fuel, an oxygen source, and a mechanism to ignite a fire (AORN, 2019b; ASPAN, 2019).

Prevention of OR Fires

AORN recommends the use of the Fire Risk Assessment Tool to assess the dangers of fires for each surgical case (see Fig. 15-2). The fire risk is discussed during the surgical time-out, and an indication of whether or not the patient has a fire risk is placed on the team communication board in the OR. A regulatory requirement endorsed by The Joint Commission is that every OR perform an annual fire drill to ensure staff familiarity with evacuation plans and to test facility safeguards in the event of a fire (Joint Commission, 2019). To further improve safety, electrical hazards, emergency exit clearances, and storage of equipment and anesthetic gases are monitored periodically by official agencies, such as the respective state Department of Health and The Joint Commission.

Surgical Attire

To help decrease microbes, the surgical area is divided into three zones: the **unrestricted zone**, where street clothes are allowed; the **semirestricted zone**, where attire consists of scrub clothes and caps; and the **restricted zone**, where scrub clothes, shoe covers, caps, and masks are worn. The surgeons and other surgical team members wear additional sterile clothing and protective devices during surgery.

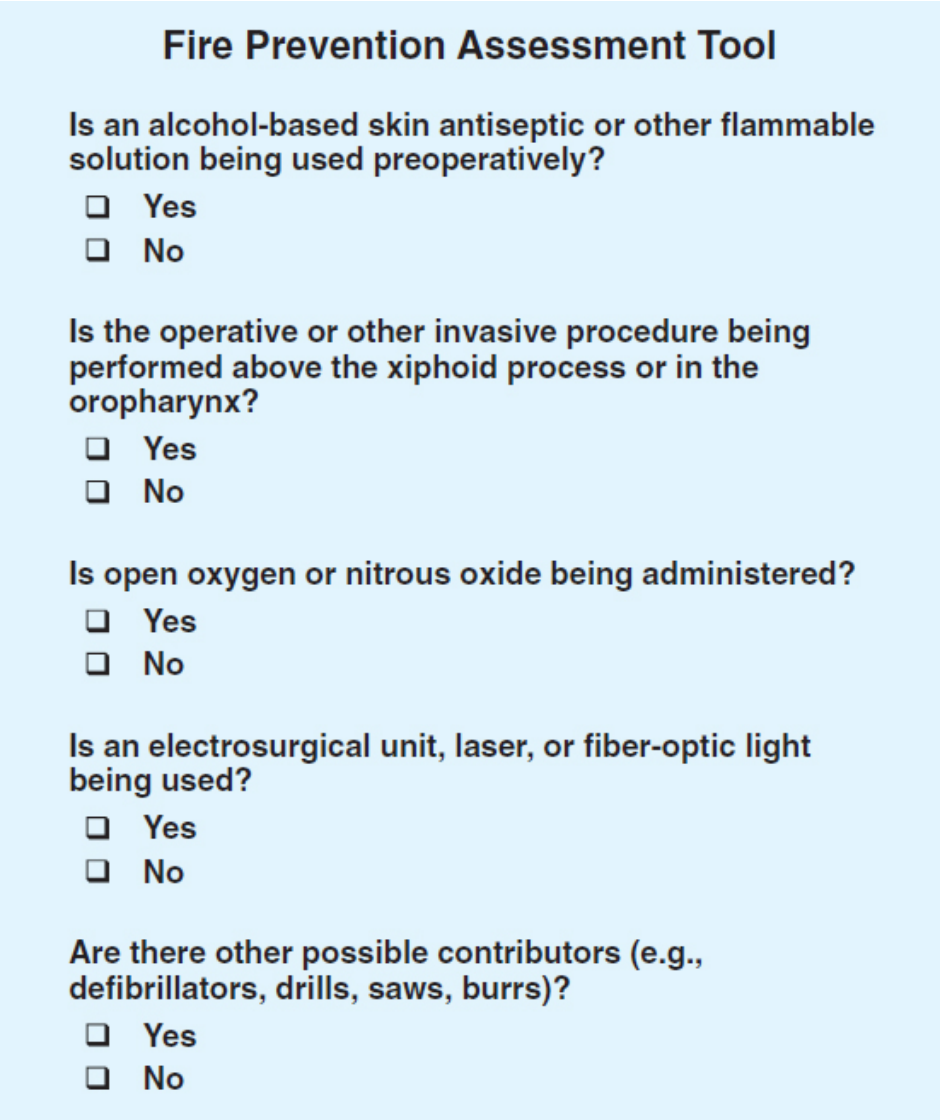


Figure 15-2 • AORN fire risk assessment tool. Reprinted with permission from Association of PeriOperative Registered Nurses (AORN). (2019b). Fire safety tool kit: Fire prevention assessment tool. Retrieved on 5/29/19 at: www.aorn.org/guidelines/clinical-resources/tool-kits/fire-safety-tool-kit

The AORN recommends specific practices for personnel wearing surgical attire to promote a high level of cleanliness in a particular practice setting (AORN, 2019a). OR attire includes close-fitting cotton scrub shirts and pants, gowns, and jackets. Knitted cuffs on sleeves prevent organisms from shedding and being released into the immediate surroundings. Shirts and waist drawstrings should be tucked inside the pants to prevent accidental contact with sterile areas and to contain skin shedding. Wet or soiled garments should be changed.

Masks are worn at all times in the restricted zone of the OR. High-filtration masks decrease the risk of postoperative wound infection by containing and

filtering microorganisms from the oropharynx and nasopharynx. Masks should fit tightly; should cover the nose and mouth completely; and should not interfere with breathing, speech, or vision. Masks must be adjusted to prevent venting from the sides. Disposable masks have a filtration efficiency exceeding 95%. Masks are changed between patients and should not be worn outside the surgical department. The mask must be either on or off; it must not be allowed to hang around the neck.

Headgear should completely cover the hair (head and neckline, including beard) so that hair, bobby pins, clips, and particles of dandruff or dust do not fall on the sterile field.

Shoes designated for use inside the OR (not worn home) should be comfortable and supportive. Shoe covers are used when spills or splashes are anticipated. If worn, the covers should be changed whenever they become wet, torn, or soiled (AORN 2019a; Rothrock, 2019).

Barriers such as scrub attire and masks do not entirely protect the patient from microorganisms. Upper respiratory tract infections, sore throats, and skin infections in staff and patients are sources of pathogens and must be reported.

Because artificial fingernails harbor microorganisms and can cause nosocomial infections, a ban on artificial nails by OR personnel is supported by the Centers for Disease Control and Prevention (CDC), AORN, and the Association for Professionals in Infection Control and Epidemiology (APIC). Research provides support for policies prohibiting artificial nails for health care workers (AORN, 2019a). Short, natural fingernails are encouraged.

Principles of Surgical Asepsis and Sterile Technique

Surgical asepsis prevents the contamination of surgical wounds. **Sterile technique** implies that the area is free of living microorganisms. The patient's natural skin flora or a previously existing infection may cause postoperative SSI. Rigorous adherence to the principles of sterility by OR personnel is basic to preventing SSIs.

All surgical supplies, instruments, needles, sutures, dressings, gloves, covers, and solutions that may come in contact with the surgical wound or exposed tissues must be sterilized before use (Rothrock, 2019). The surgeon, surgical assistants, scrub personnel, and nurses prepare themselves by scrubbing their hands and arms with antiseptic soap and water or alcohol-based (waterless) product. OR personnel must follow the product manufacturer's recommendations in order to achieve hand antisepsis (AORN, 2019a).

The skin of patients, OR team members, and visitors constitutes a microbiologic hazard. In an average individual, an estimated 4000 to 10,000 viable contaminated particles are shed by the skin each minute. *Staphylococcus aureus*, a bacterium, is the most common type of particle on dispersed skin cells (Phillips, 2017). Surgical team members wear long-sleeved, sterile gowns and gloves. Head and hair are covered with a cap, and a mask is worn over the nose

and mouth to minimize the possibility that bacteria from the upper respiratory tract will enter the wound. During surgery, only personnel who have scrubbed, gloved, and gowned touch sterilized objects. Nonscrubbed personnel refrain from touching or contaminating anything sterile.

An area of the patient's skin larger than that requiring exposure during the surgery is meticulously cleansed, and an antiseptic solution is applied (Rothrock, 2019). Close attention is paid to the application dry time of the agent, in particular chlorhexidine and other alcohol-based products. If hair removal needs to take place and this was unable to be performed before the patient arrived in the OR suite, this is done immediately before the procedure with electric clippers (not shaved) to minimize the risk of infection (AORN, 2019a). The remainder of the patient's body is covered with sterile drapes.

Environmental Controls

In addition to the protocols described previously, surgical asepsis requires meticulous cleaning and maintenance of the OR environment. Floors and horizontal surfaces are cleaned between cases with detergent, soap, and water or a detergent germicide. Sterilized equipment is inspected regularly to ensure optimal operation and performance.

All equipment that comes into direct contact with the patient must be sterile. Sterilized linens, drapes, and solutions are used. Instruments are cleaned and sterilized in a unit near the OR. Individually wrapped sterile items are used when additional individual items are needed.

Airborne bacteria are a concern. To decrease the amount of bacteria in the air, standard OR ventilation provides 15 air exchanges per hour, at least three of which are fresh air (AORN, 2019a; Rothrock, 2019). A room temperature of 20° to 24°C (68° to 73°F), humidity between 30% and 60%, and positive pressure relative to adjacent areas are maintained. With the standard air exchanges, air counts of bacteria are reduced to 50 to 150 colony-forming units (CFUs) per cubic foot per minute. Systems with high-efficiency particulate air (HEPA) filters are needed to remove particles larger than 0.3 μm (Rothrock, 2019). Unnecessary personnel and physical movement may be restricted to minimize bacteria in the air and achieve an OR infection rate no greater than 3% to 5% in clean, infection-prone surgery.

Some ORs have laminar airflow units. These units provide 400 to 500 air exchanges per hour (Rothrock, 2019). When used appropriately, laminar airflow units result in fewer than 10 CFUs per cubic foot per minute during surgery. The goal for a laminar airflow–equipped OR is an infection rate of less than 1%. An OR equipped with a laminar airflow unit is frequently used for total joint replacement or organ transplant surgery.

Even using all precautions, wound contamination may inadvertently occur. Constant surveillance and conscientious technique in carrying out aseptic practices are necessary to reduce the risk of contamination and infection.

Basic Guidelines for Maintaining Surgical Asepsis

All practitioners involved in the intraoperative phase have a responsibility to provide and maintain a safe environment. Adherence to aseptic practice is part of this responsibility. The basic principles of aseptic technique follow (AORN, 2019a):

- All materials in contact with the surgical wound or used within the sterile field must be sterile. Sterile surfaces or articles may touch other sterile surfaces or articles and remain sterile; contact with unsterile objects at any point renders a sterile area contaminated.
- Gowns of the surgical team are considered sterile in front from the chest to the level of the sterile field. The sleeves are also considered sterile from 2 inches above the elbow to the stockinette cuff.
- Sterile drapes are used to create a sterile field (see Fig. 15-3). Only the top surface of a draped table is considered sterile. During draping of a table or patient, the sterile drape is held well above the surface to be covered and is positioned from front to back.
- Items are dispensed to a sterile field by methods that preserve the sterility of the items and the integrity of the sterile field. After a sterile package is opened, the edges are considered unsterile. Sterile supplies, including solutions, are delivered to a sterile field or handed to a scrubbed person in such a way that the sterility of the object or fluid remains intact.

Figure 15-3 • Proper draping exposes only the surgical site, which decreases the risk of infection.

- The movements of the surgical team are from sterile to sterile areas and from unsterile to unsterile areas. Scrubbed people and sterile items contact only sterile areas; circulating nurses and unsterile items contact only unsterile areas.
- Movement around a sterile field must not cause contamination of the field. Sterile areas must be kept in view during movement around the area. At least a 1-ft distance from the sterile field must be maintained to prevent inadvertent contamination.
- Whenever a sterile barrier is breached, the area must be considered contaminated. A tear or puncture of the drape permitting access to an unsterile surface underneath renders the area unsterile. Such a drape must be replaced.
- Every sterile field is constantly monitored and maintained. Items of doubtful sterility are considered unsterile. Sterile fields are prepared as close as possible to the time of use.
- The routine administration of hyperoxia (high levels of oxygen) is *not* recommended to reduce SSIs.

Health Hazards Associated with the Surgical Environment

Faulty equipment, improper use of equipment, exposure to toxic substances, surgical plume (smoke generated by electrosurgical cautery), as well as infectious waste, cuts, needlestick injuries, and lasers are some of the associated hazards in the surgical environment (Rothrock, 2019). Internal monitoring of the OR includes the analysis of surface swipe samples and air samples for infectious and toxic agents. In addition, policies and procedures for minimizing exposure to body fluids and reducing the dangers associated with lasers and radiation are identified in AORN standards (AORN, 2019a).

Regardless of the size or location of an incision, unintentional retention of an object (e.g., sponge, instrument) can occur. A retained object can cause wound infection or disruption, an abscess can form, and fistulas may develop between organs (Rothrock, 2019). Safety measures should be in place to reduce the risk of a retained object. Best practices include minimized distractions during the counting process, radiofrequency (RF) technology, and clear communication that includes the willingness to raise concerns among the surgical team members. RF technology acts as a "back-up method" for sponge counting using low-frequency RF chips inside sponges that can be detected via a wand or other scanning detection device. The technology is used in many institutions and can increase patient safety by detecting retained sponges before the surgeon closes the incision (Steelman, Schaapveld, Storm, et al., 2019).

Laser Risks

The AORN has recommended practices for laser safety (AORN, 2019a). When lasers are in use, warning signs must be posted on the doors and safety goggles must be available for staff to don prior to room entry. Personnel must also wear a protective mask to prevent inhalation of the plume emitted from the laser. The type of laser in use and the safety precautions in place are verified by all team members during the time-out (Burlingame, 2017). Several types of lasers are available for clinical use; perioperative personnel should be familiar with the unique features, specific operation, and safety measures for each type of laser used in the practice setting and wear appropriate laser goggles for the type of laser beam in use. Registered nurses trained and certified in laser safety maintain the established standards in the OR (AORN, 2019a).

Surgical Smoke

Approximately 500,000 health care workers are exposed to surgical smoke each year. This smoke is created from thermal destruction of tissue. Smoke plumes may contain toxic gases and vapors such as benzene, hydrogen cyanide, formaldehyde, bioaerosols, dead and live cellular material, and viruses. It is estimated that in an average day, the effect of breathing surgical smoke could be comparable to smoking 30 unfiltered cigarettes. Perioperative nurses are twice as likely as the general population to report experiencing respiratory problems (Davis, 2018; US Department of Labor, Occupational Safety and Health Administration, 2018).

Smoke evacuators are used in some procedures to remove the plume from the operative field. If a smoke evacuator is not available, surgical team members should don an N95 respirator mask rather than a surgical mask, which does not prevent smoke from entering the airway orifices. In recent years, this technology has been extended to all surgical cases to protect the surgical team from the potential hazards associated with the generalized smoke plume generated by standard electric cautery units. Evacuating surgical smoke not only protects the perioperative team, but also patients (Spruce, 2018).

Exposure to Blood and Body Fluids

Basic scrub attire worn by sterile “scrubbed-in” OR personnel include double sterile gloves, eye protection, surgical mask, a sterile gown, and shoe covers. These help to protect against splashing, drilling, and blood loss exposure. In hospitals where numerous total joint procedures are performed, a complete bubble mask may be used. This mask provides full-barrier protection from bone fragments and splashes. Ventilation is accomplished through an accompanying hood with a separate air filtration system.

An estimated 380,000 sharps injuries occur in health care per year, and roughly one third of these occur in the OR setting. Interventions such as using sharps with safety engineered devices, passing sharps using a “neutral zone” or “safe zone,” and placing used sharps in puncture-resistant containers can help to reduce these incidents (Davis, 2018). The “neutral zone” or “safe zone”

techniques are designated spaces established for sharps to be put down and picked up (AORN, 2019).

Robotics

Several types of surgical robots are used to facilitate the performance of minimally invasive procedures. These techniques were first introduced in the 1980s in an effort to overcome the disadvantages of traditional laparoscopic surgery, such as limited arm movement and view (Carlos & Saulan, 2018). Many surgical specialties have the ability to use robotic technology for surgical cases, particularly those in the cardiac, urologic, thoracic, and gynecologic specialties. Several types of robotic-driven tools assist in making surgery more precise and less invasive for patients. Technologic advancements of the robot include 3D high-definition imaging and better motion control of instrumentation. The articulated arms offer a 360-degree wristlike movement for precision grasping, manipulation, dissection, and suturing of tissue (Phillips, 2017).

The Surgical Experience

During the surgical procedure, the patient will need sedation, anesthesia, or some combination of these. There are many low-risk anesthesia agents to choose from.

Types of Anesthesia and Sedation

Research estimates anesthesia-related death rates in the United States to be less than 1 per 10,000 surgeries (Barash et al., 2017). For the patient, the anesthesia experience consists of having an IV line inserted, if it was not inserted earlier; receiving a sedating agent prior to induction with an anesthetic agent; losing consciousness; being intubated, if indicated; and then receiving a combination of anesthetic agents. Typically, the experience is a smooth one, and the patient has no recall of the events. The main types of anesthesia are general anesthesia (inhalation, IV), regional anesthesia (epidural, spinal, and local conduction blocks), moderate sedation (monitored anesthesia care [MAC]), and local anesthesia.

General Anesthesia

Anesthesia is a state of narcosis (severe central nervous system depression produced by pharmacologic agents), analgesia, relaxation, and reflex loss. Patients under general anesthesia are not arousable, not even to painful stimuli. They lose the ability to maintain ventilatory function and require assistance in maintaining a patent airway. Cardiovascular function may be impaired as well.

General anesthesia consists of four stages, each associated with specific clinical manifestations (Rothrock, 2019). Understanding of these stages is necessary for nurses because of the emotional support that the patient might need as anesthesia progresses. These stages occur in reverse as the patient wakes up at the end of surgery, so the nurse must be aware of the need for appropriate patient support.

- *Stage I: beginning anesthesia.* Dizziness and a feeling of detachment may be experienced during induction. The patient may have a ringing, roaring, or buzzing in the ears and, although still conscious, may sense an inability to move the extremities easily. These sensations can result in agitation. During this stage, noises are exaggerated; even low voices or minor sounds seem loud and unreal. For these reasons, unnecessary noises and motions are avoided when anesthesia begins.
- *Stage II: excitement.* The excitement stage, characterized variously by struggling, shouting, talking, singing, laughing, or crying, is often avoided if IV anesthetic agents are given smoothly and quickly. The pupils dilate, but they constrict if exposed to light; the pulse rate is rapid; and respirations may be irregular. Because of the possibility of uncontrolled movements of the patient during this stage, the anesthesiologist or CRNA must always be assisted by someone ready to help restrain the patient or to apply cricoid pressure in the case of vomiting to prevent aspiration. Manipulation increases circulation to the operative site and thereby increases the potential for bleeding.
- *Stage III: surgical anesthesia.* Surgical anesthesia is reached by administration of anesthetic vapor or gas and supported by IV agents as necessary. The patient is unconscious and lies quietly on the table. The pupils are small but constrict when exposed to light. Respirations are regular, the pulse rate and volume are normal, and the skin is pink or slightly flushed. With proper administration of the anesthetic agent, this stage may be maintained for hours in one of several planes, ranging from light (1) to deep (4), depending on the depth of anesthesia needed.
- *Stage IV: medullary depression.* This stage is reached if too much anesthesia has been given. Respirations become shallow, the pulse is weak and thready, and the pupils become widely dilated and no longer constrict when exposed to light. Cyanosis develops and, without prompt intervention, death rapidly follows. If this stage develops, the anesthetic agent is discontinued immediately and respiratory and circulatory support is initiated to prevent death. Stimulants, although rarely used, may be given; narcotic antagonists can be used if the overdose is due to opioids. It is not a planned stage of surgical anesthesia.

When opioid agents (narcotics) and neuromuscular blockers (relaxants) are given, several of the stages are absent. During smooth administration of an

anesthetic agent, there is no sharp division between stages. The patient passes gradually from one stage to another, and it is through close observation of the signs exhibited by the patient that an anesthesiologist or CRNA controls the situation. The responses of the pupils, the blood pressure, and the respiratory and cardiac rates are among the most reliable guides to the patient's condition.

Anesthetic medications produce anesthesia because they are delivered to the brain at a high partial pressure that enables them to cross the blood–brain barrier. Relatively large amounts of anesthetic medication must be given during induction and the early maintenance phases because the anesthetic agent is recirculated and deposited in body tissues. As these sites become saturated, smaller amounts of the anesthetic agent are required to maintain anesthesia because equilibrium or near-equilibrium has been achieved between brain, blood, and other tissues. When possible, the anesthesia induction (initiation) begins with IV anesthesia and is then maintained at the desired stage by inhalation methods, achieving a smooth transition and eliminating the obvious stages of anesthesia (see Table 15-1). All are given in combination with oxygen and usually nitrous oxide as well.

TABLE 15-1 Inhalation Anesthetic Agents

Agent	Administration	Advantages	Disadvantages	Implications/Considerations
Volatile Liquids				
Halothane	Inhalation; special vaporizer	Not explosive or flammable Induction rapid and smooth Useful in almost every type of surgery Low incidence of postoperative nausea and vomiting	Requires skillful administration to prevent overdose May cause liver damage May produce hypotension Requires special vaporizer for administration	In addition to observation of pulse and respiration postoperatively, blood pressure must be monitored frequently
Enflurane	Inhalation	Rapid induction and recovery Potent analgesic agent Not explosive or flammable	Respiratory depression may develop rapidly, along with electrocardiogram abnormalities Not compatible with epinephrine	Observe for possible respiratory depression. Administration with epinephrine may cause ventricular fibrillation
Isoflurane	Inhalation	Rapid induction and recovery Muscle relaxants are markedly potentiated	A profound respiratory depressant	Monitor respirations closely, support when necessary, and monitor for malignant hyperthermia
Sevoflurane[a]	Inhalation	Rapid induction and excretion; minimal side effects	Coughing and laryngospasm; trigger for malignant hyperthermia	Monitor for malignant hyperthermia
Desflurane	Inhalation	Rapid induction and emergence; rare organ toxicity	Respiratory irritation; trigger for malignant hyperthermia	Monitor for malignant hyperthermia and arrhythmias
Gases				
Nitrous oxide (N_2O)	Inhalation (semiclosed method)	Induction and recovery rapid Nonflammable Useful with oxygen for short procedures Useful with other agents for all types of surgery	Poor relaxant Weak anesthetic May produce hypoxia	Most useful in conjunction with other agents with longer action Monitor for chest pain, nausea and vomiting, hypertension, and stroke
Oxygen (O_2)	Inhalation	Can increase O_2 available to tissues	High concentrations are hazardous	Increased fire risk when used with lasers

[a]Currently most popular choice.
Adapted from Association of PeriOperative Registered Nurses (AORN). (2019a). *Association of PeriOperative Registered Nurses (AORN) standards, recommended practice, and guidelines*. Denver, CO: Author.

Any condition that diminishes peripheral blood flow, such as vasoconstriction or shock, may reduce the amount of anesthetic medication required. Conversely, when peripheral blood flow is unusually high, as in a muscularly active or apprehensive patient, induction is slower, and greater quantities of anesthetic agents are required because the brain receives a smaller quantity of anesthetic agent.

Inhalation

Inhaled anesthetic agents include volatile liquid agents and gases. Volatile liquid anesthetic agents produce anesthesia when their vapors are inhaled. Some commonly used inhalation agents are included in Table 15-1. All are given in combination with oxygen and usually nitrous oxide as well.

Gas anesthetic agents are given by inhalation and are always combined with oxygen. Nitrous oxide, sevoflurane, and desflurane are the most commonly used gas anesthetic agents. When inhaled, the anesthetic agents enter the blood through the pulmonary capillaries and act on cerebral centers to produce loss of consciousness and sensation. When anesthetic administration is discontinued, the vapor or gas is eliminated through the lungs.

The vapor from inhalation anesthetic agents can be given to the patient by several methods. The inhalation anesthetic agent may be given through an LMA—a flexible tube with an inflatable silicone ring and cuff that can be inserted into the larynx (see Fig. 15-4A). The endotracheal technique for administering anesthetic medications consists of introducing a soft rubber or plastic ET into the trachea, usually by means of a laryngoscope. The ET may be inserted through either the nose (see Fig. 15-4B) or mouth (see Fig. 15-4C). When in place, the tube seals off the lungs from the esophagus so that if the patient vomits, stomach contents do not enter the lungs.

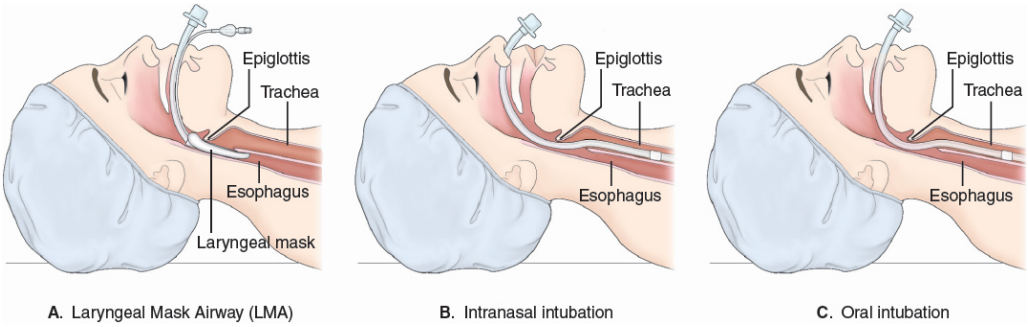


Figure 15-4 • Anesthetic delivery methods. **A.** Laryngeal mask airway (LMA). **B.** Nasal endotracheal catheter used when oral access will be required by the surgeon (in position with cuff inflated). **C.** Oral endotracheal intubation (tube is in position with cuff inflated).

Intravenous Administration

General anesthesia can also be produced by the IV administration of various anesthetic and analgesic agents, such as barbiturates, benzodiazepines, nonbarbiturate hypnotics, dissociative agents, and opioid agents. Table 15-2 lists commonly used IV anesthetic and analgesic agents, including IV medications used as muscle relaxants in the intraoperative period. These medications may be given to induce or maintain anesthesia. Although they are often used in combination with inhalation anesthetic agents, they may be used alone. They may also be used to produce moderate sedation, as discussed later in this chapter.

TABLE 15-2 Commonly Used Intravenous Medications

Medication	Common Usage	Advantages	Disadvantages	Comments
Opioid Analgesic Agents				
Alfentanil	Surgical analgesia in ambulatory patients	Ultra–short-acting (5–10 min) analgesic agent; duration of action 0.5 h; bolus or infusion	—	Potency: 750 µg; half-life 1.6 h
Fentanyl	Surgical analgesia: epidural infusion for postoperative analgesia; add to SAB	Good cardiovascular stability; duration of action 0.5 h	May cause muscle or chest wall rigidity	Most commonly used opioid; potency: 100 µg = 10 mg morphine sulfate; elimination half-life 3.6 h
Morphine sulfate	Preoperative pain; premedication; postoperative pain	Inexpensive; duration of action 4–5 h; euphoria; good cardiovascular stability	Nausea and vomiting; histamine release; postural ↓ BP and ↓ SVR	Epidural and intrathecal administration for postoperative pain; elimination half-life 3 h
Remifentanil	IV infusion for surgical analgesia; small boluses for brief, intense pain	Easily titrated; very short duration; good cardiovascular stability. Ultiva is rapidly metabolized by hydrolysis of the propanoic acid–methyl ester linkage by nonspecific blood and tissue esterases	Expensive; requires mixing; may cause muscle rigidity	Potency: 25 µg = 10 mg morphine sulfate; 20–30 times potency of alfentanil; elimination half-life 3–10 min
Sufentanil	Surgical analgesia	Duration of action 0.5 h; prolonged analgesia exceptionally potent (5–10 times more than fentanyl); provides good stability in cardiovascular surgery	Prolonged respiratory depression	Potency: 15 µg = 10 mg morphine sulfate; elimination half-life 2.7 h
Depolarizing Muscle Relaxants				
Succinylcholine	Relax skeletal muscles for surgery and orthopedic manipulations; short procedures; intubation	Short duration; rapid onset	No known effect on consciousness, pain threshold, or cerebration; fasciculations, postoperative myalgias, arrhythmias; raises serum K^+ in tissue trauma, muscular disease, paralysis, burns; histamine release is slight; requires refrigeration	Prolonged muscle relaxation with serum cholinesterase deficiency and some antibiotics; may trigger malignant hyperthermia
Nondepolarizing Muscle Relaxants—Intermediate Onset and Duration				
Atracurium besylate	Intubation; maintenance of skeletal muscle relaxation	No significant cardiovascular or cumulative effects; good with kidney injury	Requires refrigeration; slight histamine release; pregnancy risk category C; do not mix with lactated Ringer's solution or alkaline solutions such as barbiturates	Rapid IV bolus; use cautiously with older adult patients and those who are debilitated
Cisatracurium besylate	Intubation; maintenance of skeletal muscle relaxation	Similar to atracurium	No histamine release	Similar to atracurium
Mivacurium	Intubation; maintenance of skeletal muscle relaxation	Short acting; rapid metabolism by plasma cholinesterase; used as bolus or infusion	Expensive in longer cases	Competes with acetylcholine for receptor sites at the motor end plate, blocking neuromuscular transmission; new; rarely need to reverse; prolonged effect with plasma cholinesterase deficiency
Rocuronium	Intubation; maintenance of relaxation	Rapid onset (dose dependent); elimination via kidney and liver	No known effect on consciousness, pain threshold, or cerebration; vagolytic; may ↑ HR	Duration similar to atracurium and vecuronium
Vecuronium	Intubation; maintenance of relaxation	No significant cardiovascular or cumulative effects; no histamine release	Requires mixing	Mostly eliminated in bile, some in urine

Nondepolarizing Muscle Relaxants—Longer Onset and Duration				
d-Tubocurarine	Adjunct to anesthesia; maintenance of relaxation	—	No known effect on consciousness, pain threshold, or cerebration; might cause histamine release and transient ganglionic blockade	Mostly used for pretreatment with succinylcholine
Metocurine	Maintenance of relaxation	Good cardiovascular stability	Slight histamine release	Most commonly used opioid; potency: 100 μg = 10 mg morphine sulfate; elimination half-life 3.6 h
Pancuronium	Maintenance of relaxation	—	May cause ↑ HR and ↑ BP	Used intrathecally and epidurally for postoperative pain; elimination half-life 3 h
Intravenous Anesthetic Agents				
Diazepam	Amnesia; hypnotic; relieves anxiety; preoperative	Good sedation	Long acting	Residual effects for 20–90 h; increased effect with alcohol
Etomidate	Induction of general anesthesia; indicated to supplement low-potency anesthetic agents	Short-acting hypnotic; good cardiovascular stability; fast, smooth induction and recovery	May cause brief period of apnea; pain with injection and myotonic movements	—
Ketamine	Induction; occasional maintenance (IV or IM)	Short acting; profound analgesia; patient maintains airway; good in small children and burn patients	Large doses may cause hallucinations and respiratory depression; chest wall rigidity; laryngeal spasm	Need darkened, quiet room for recovery; often used in trauma cases
Midazolam	Hypnotic; anxiolytic; sedation; often used as adjunct to induction	Excellent amnesia; water soluble (no pain with IV injection); short acting	Slower induction than thiopental	Often used for amnesia with insertion of invasive monitors or regional anesthesia; depresses all levels of CNS, including limbic and reticular formation, probably through increased action of GABA, which is major inhibitory neurotransmitter in brain
Propofol	Induction and maintenance; sedation with regional anesthesia or MAC	Rapid onset; awakening in 4–8 min; produces sedation/hypnosis rapidly (within 40 s) and smoothly with minimal excitation; decreases intraocular pressure and systemic vascular resistance; rarely is associated with malignant hyperthermia and histamine release	May cause pain when injected; suppresses cardiac output and respiratory drive	Short elimination half-life (34–64 min)
Methohexital sodium	Induction; methohexital slows the activity of brain and nervous system	Ultra–short-acting barbiturate	May cause hiccups	Can be given rectally
Thiopental sodium	Induction; stops seizures	—	May cause laryngospasm	Large doses may cause apnea and cardiovascular depression; can be given rectally

BP, blood pressure; CNS, central nervous system; GABA, gamma-aminobutyric acid; HR, heart rate; IM, intramuscular; IV, intravenous; K^+, potassium; MAC, monitored anesthesia care; SAB, subarachnoid block; SVR, stroke volume ratio.

Adapted from Association of PeriOperative Registered Nurses (AORN). (2019a). *Association of PeriOperative Registered Nurses (AORN) standards, recommended practice, and guidelines*. Denver, CO: Author.

An advantage of IV anesthesia is that the onset of anesthesia is pleasant; there is none of the buzzing, roaring, or dizziness known to follow administration of an inhalation anesthetic agent. The duration of action is brief, and the patient awakens with little nausea or vomiting.

The IV anesthetic agents are nonexplosive, require little equipment, and are easy to administer. The low incidence of postoperative nausea and vomiting (PONV) makes the method useful in eye surgery, because in this setting vomiting would increase intraocular pressure and endanger vision in the operated eye. IV anesthesia is useful for short procedures but is used less often for the longer procedures of abdominal surgery. It is not indicated for those who require intubation because of their susceptibility to respiratory obstruction. The combination of IV and inhaled anesthetic agents produces an effective and smooth experience for the patient, with a controlled emergence following surgery.

IV neuromuscular blockers (muscle relaxants) block the transmission of nerve impulses at the neuromuscular junction of skeletal muscles. Muscle relaxants are used to relax muscles in abdominal and thoracic surgery, relax eye muscles in

certain types of eye surgery, facilitate endotracheal intubation, treat laryngospasm, and assist in mechanical ventilation.

Multimodal Anesthesia

Multimodal analgesia regimens in surgical patients often use a combination of scheduled, nonopioid analgesic agents and regional anesthesia techniques (Wolfe, 2018). Multimodal analgesia aims to reduce opioid requirements and associated risks such as sedation, respiratory depression, nausea, vomiting, and potential of overuse of opioids. Multimodal anesthesia is a growing trend in the enhanced recovery after surgery (ERAS) pathways, as it decreases the risks of general anesthesia and aids in opioid reduction strategies. Analysis of opioid-naive surgical patients and opioid-naive nonsurgical patients found that those undergoing surgery had an increased risk of chronic opioid use during the first year after surgery (Sun, Darnall, Baker, et al., 2016). ERAS pathways are evidence based and facility specific; the patient follows these pathways from pre-, intra-, postoperative, and home phases of care. ERAS pathways are developed by multidisciplinary teams to optimize the recovery from surgery by reducing the patient's stress response. Instead of general anesthesia, regional/local anesthesia (LA) (discussed below) is administered. Nonopioid medications such as acetaminophen and nonsteroidal anti-inflammatory drugs (NSAIDs), ketamine, and gabapentinoids are preferred pain control methods in ERAS pathways (American Association of Nurse Anesthetists [AANA], 2019b).

Regional Anesthesia

In regional anesthesia, an anesthetic agent is injected around nerves so that the region supplied by these nerves is anesthetized. The effect depends on the type of nerve involved. Motor fibers are the largest fibers and have the thickest myelin sheath. Sympathetic fibers are the smallest and have a minimal covering. Sensory fibers are intermediate. A local anesthetic agent blocks motor nerves least readily and sympathetic nerves most readily. An anesthetic agent is not considered metabolized until all three systems (motor, sensory, and autonomic) are no longer affected.

The patient receiving regional anesthesia is awake and aware of their surroundings unless medications are given to produce mild sedation or to relieve anxiety. The health care team must avoid careless conversation, unnecessary noise, and unpleasant odors; these may be noticed by the patient in the OR and may contribute to a negative response to the surgical experience. A quiet environment is therapeutic. The diagnosis must not be stated aloud if the patient is not to know it at this time.

Epidural Anesthesia

Epidural anesthesia is achieved by injecting a local anesthetic agent into the epidural space that surrounds the dura mater of the spinal cord (see Fig. 15-5).

The given medication diffuses across the layers of the spinal cord to provide anesthesia and pain relief (AORN, 2019; ASPAN, 2019). In contrast, spinal anesthesia involves injection through the dura mater into the subarachnoid space surrounding the spinal cord. Epidural anesthesia blocks sensory, motor, and autonomic functions; it differs from spinal anesthesia by the site of the injection and the amount of anesthetic agent used. Epidural doses are much higher because the epidural anesthetic agent does not make direct contact with the spinal cord or nerve roots (AORN, 2019a; ASPAN, 2019).

An advantage of epidural anesthesia is the absence of headache that can result from spinal anesthesia. A disadvantage is the greater technical challenge of introducing the anesthetic agent into the epidural space rather than the subarachnoid space. If inadvertent puncture of the dura occurs during epidural anesthesia and the anesthetic agent travels toward the head, high spinal anesthesia can result; this can produce severe hypotension and respiratory depression and arrest. Treatment of these complications includes airway support, IV fluids, and the use of vasopressors.

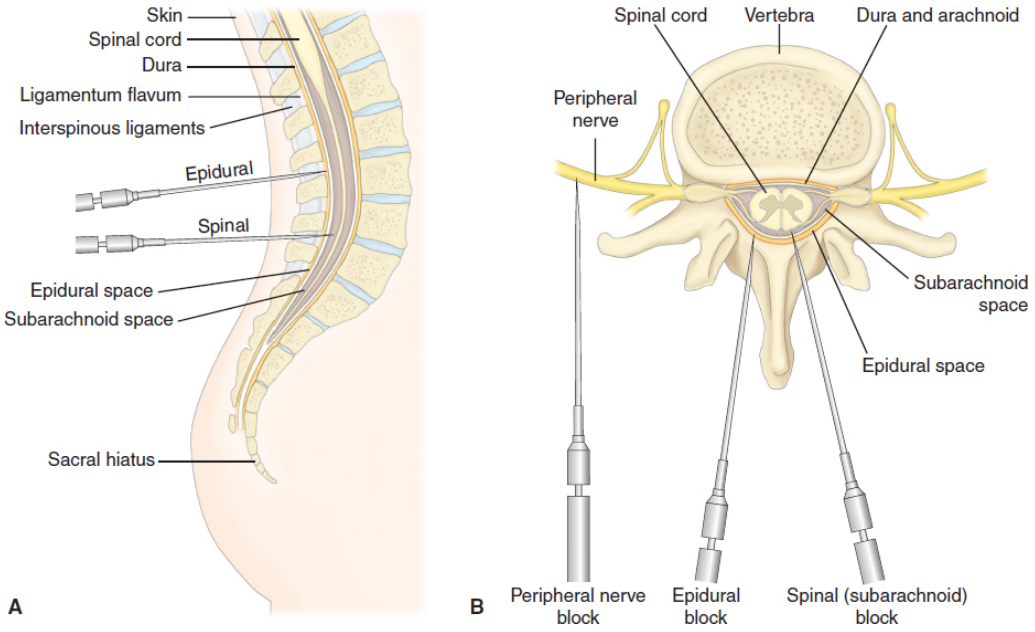


Figure 15-5 • **A.** Injection sites for spinal and epidural anesthesia. **B.** Cross-section of injection sites for peripheral nerve, epidural, and spinal blocks.

TABLE 15-3 Select Regional and Local Anesthetic Agents

Age	Administration	Advantages	Disadvantages	Implications/Considerations
Lidocaine	Epidural, spinal, peripheral IV anesthesia, and local infiltration	Rapid Longer duration of action (compared with procaine) Free of local irritative effect	Occasional allergic reaction	Useful topically for cystoscopy Observe for untoward reactions—drowsiness, depressed respiration, seizures
Bupivacaine	Epidural, spinal, peripheral IV anesthesia, and local infiltration	Duration is 2–3 times longer than lidocaine	Use cautiously in patients with known drug allergies or sensitivities	A period of analgesia persists after return of sensation; therefore, the need for strong analgesic agents is reduced Greater potency and longer action than lidocaine
Tetracaine	Topical, infiltration, and nerve block	Long acting, produces good relaxation	Occasional allergic reaction	>10 times as potent as procaine
Procaine	Local infiltration	—	Occasional allergic reaction	Commonly used in oral or dental surgery

IV, intravenous.

Spinal Anesthesia

Spinal anesthesia is an extensive conduction nerve block that is produced when a local anesthetic agent is introduced into the subarachnoid space at the lumbar level, usually between L4 and L5 (see Fig. 15-5). It produces anesthesia of the lower extremities, perineum, and lower abdomen. For the lumbar puncture procedure, the patient usually lies on the side in a knee–chest position. Sterile technique is used as a spinal puncture is made and the medication is injected through the needle. As soon as the injection has been made, the patient is positioned on their back. If a relatively high level of block is sought, the head and shoulders are lowered.

The spread of the anesthetic agent and the level of anesthesia depend on the amount of agent injected, the speed with which it is injected, the positioning of the patient after the injection, and the specific gravity of the agent. If the specific gravity is greater than that of cerebrospinal fluid (CSF), the agent moves to the dependent position of the subarachnoid space. If the specific gravity is less than that of CSF, the anesthetic agent moves away from the dependent position. The anesthesiologist or CRNA controls the administration of the agent. Table 15-3 presents select regional anesthesia agents.

A few minutes after induction of a spinal anesthetic agent, anesthesia and paralysis affect the toes and perineum and then gradually the legs and abdomen.

Headache may be an aftereffect of spinal anesthesia. Several factors are related to the incidence of headache: the size of the spinal needle used, the leakage of fluid from the subarachnoid space through the puncture site, and the patient's hydration status. Measures that increase cerebrospinal pressure are helpful in relieving headache. These include maintaining a quiet environment, keeping the patient lying flat, and keeping the patient well hydrated.

In continuous spinal anesthesia, the tip of a plastic catheter remains in the subarachnoid space during the surgical procedure so that more anesthetic medication may be injected as needed. This technique allows greater control of the dosage; however, there is greater potential for postanesthetic headache because of the large-gauge needle used.

Peripheral Nerve Blocks

Peripheral nerve blocks (PNBs) are used in conjunction with general or MAC anesthesia, or as a stand-alone method. Instead of a single nerve being targeted, a bundle of nerves is located via ultrasound and injected with an anesthetic, opioid, or steroid. Traditionally, anesthesia would place the block in the OR setting. However, current research and best practices indicate that placing regional blocks in the preoperative department has greater efficacy. Patients emerge from anesthesia with less pain, decreasing the need for opioids. Research also suggests that patients spend less time in the postanesthesia care unit (PACU) and inpatients are discharged earlier (Gutierrez, Biehn, Eluna, et al., 2018).

Examples of common local conduction blocks include:

- Brachial plexus block, which produces anesthesia of the arm
- Paravertebral anesthesia, which produces anesthesia of the nerves supplying the chest, abdominal wall, and extremities
- Transsacral (caudal) block, which produces anesthesia of the perineum and, occasionally, the lower abdomen

Moderate Sedation

Moderate sedation, previously referred to as conscious sedation, is a form of anesthesia that involves the IV administration of sedatives or analgesic medications to reduce patient anxiety and control pain during diagnostic or therapeutic procedures. It is commonly used for many short-term surgical procedures in hospitals and ambulatory care centers (Rothrock, 2019). The goal is to depress a patient's level of consciousness to a moderate level to enable surgical, diagnostic, or therapeutic procedures to be performed while ensuring the patient's comfort during and cooperation with the procedures. With moderate sedation, the patient is able to maintain a patent airway, retain protective airway reflexes, and respond to verbal and physical stimuli.

Moderate sedation can be given by an anesthesiologist, CRNA, or other specially trained and credentialed physician or nurse. The practitioner who administers the sedation must be trained in resuscitative efforts as these patients are at risk for slipping into a deeper level of sedation (AORN, 2017). The continual assessment of the patient's vital signs, level of consciousness, and cardiac and respiratory function is an essential component of moderate sedation. Pulse oximetry, a continuous ECG monitor, and frequent measurement of vital signs are used to monitor the patient. Regulations for the use and administration of moderate sedation differ from state to state, and its administration is governed by standards issued by The Joint Commission and by institutional policies and nursing specialty organizations (AORN, 2017; ASPAN, 2018).

Monitored Anesthesia Care

Monitored anesthesia care (MAC), also referred to as monitored sedation, is moderate sedation given by an anesthesiologist or CRNA who must be prepared

and qualified to convert to general anesthesia if necessary. The skills of an anesthesiologist or CRNA may be necessary to manage the effects of a level of deeper sedation to return the patient to the appropriate level of sedation (Barash et al., 2017). MAC may be used for healthy patients undergoing relatively minor surgical procedures and for some critically ill patients who may be unable to tolerate anesthesia without extensive invasive monitoring and pharmacologic support (Rothrock, 2019).

Local Anesthesia

LA is the injection of a solution containing the anesthetic agent into the tissues at the planned incision site. Often it is combined with a local regional block by injecting around the nerves immediately supplying the area. A monitoring nurse (in addition to a circulating nurse) must be present during these cases. The monitoring nurse is responsible for documenting the patient's condition, pain level, level of consciousness, and vital signs throughout the procedure (AORN, 2019a). Advantages of LA are as follows:

- It is simple, economical, and nonexplosive.
- Equipment needed is minimal.
- Postoperative recovery is brief.
- Undesirable effects of general anesthesia are avoided.
- It is ideal for short and minor surgical procedures.

LA is often given in combination with epinephrine. Epinephrine constricts blood vessels, which prevents rapid absorption of the anesthetic agent and thus prolongs its local action and prevents seizures. Select local anesthetic agents are listed in Table 15-3; some of the same agents used in regional anesthesia are used as local anesthetic agents.

The skin is prepared as for any surgical procedure, and a small-gauge needle is used to inject a modest amount of the anesthetic medication into the skin layers. This produces blanching or a wheal. Additional anesthetic medication is then injected into the skin until an area surrounding the proposed incision is anesthetized. A larger, longer needle then is used to infiltrate deeper tissues with the anesthetic agent. The action of the agent is almost immediate, so surgery may begin shortly after the injection is complete. The anesthetic may be mixed with a fast-acting analgesic of short duration to circumvent the burning felt when the longer-acting anesthetics are injected.

Local Anesthetic Systemic Toxicity

Local Anesthetic Systemic Toxicity (LAST) is a potentially life-threatening event. LAST occurs when a bolus of LA is inadvertently injected into peripheral tissue or venous or arterial circulation during a PNB or spinal nerve block procedure and is rapidly absorbed into systemic circulation, resulting in cardiovascular or neurologic collapse (Ferguson, Coogle, Leppert, et al., 2019).

Signs and symptoms of LAST are:

- Metallic taste
- Oral numbness
- Auditory changes
- Slurred speech
- Arrhythmias
- Seizure
- Respiratory arrest

LAST is a rare event that occurs in approximately 1 of every 1000 patients (Wadlund, 2017). Early detection and treatment may prevent symptom progression and can lead to a better outcome for the patient. Initial treatment of LAST should focus on airway management. Hypoxemia and acidosis intensify the effects of LAST. The nurse calls for help and maintains the patient's airway while administering 100% oxygen and confirming IV access. Additional resources include members of the anesthesia team and critical-care nurses in the event that CPR or airway interventions take place. An IV infusion of lipid emulsions (an emulsion of soybean oil, egg phospholipids, and glycerin) can reverse the effects of LAST on the heart and central nervous system (AORN, 2019a; Wadlund, 2017).

Potential Intraoperative Complications

The surgical patient is subject to several risks. The major potential intraoperative complications include anesthesia awareness, nausea and vomiting, anaphylaxis, hypoxia, hypothermia, and malignant hyperthermia (MH). Targeted areas include SSIs as well as cardiac, respiratory, and venous thromboembolic complications (Joint Commission, 2019).

Anesthesia Awareness

It is important to discuss concerns about intraoperative awareness with patients preoperatively so that they realize that only general anesthesia is meant to create a state of oblivion. All other forms of anesthesia will eliminate pain, but sensation of pushing and pulling tissues may still be recognized and they may hear conversations among the operative team. In many cases, patients may be able to respond to questions and involve themselves in the discussion. This is normal and is not what is referred to as anesthesia awareness.

Unintended intraoperative awareness refers to a patient becoming cognizant of surgical interventions while under general anesthesia and then recalling the incident. Neuromuscular blocks, sometimes required for surgical muscle relaxation, intensify the fear of the patient experiencing awareness because they are then unable to communicate during the episode. Patients may or may not feel pain, and some patients experience a feeling of pressure. It has been estimated

that roughly 1 patient per 1000 receiving general anesthesia experiences some level of awareness that is most commonly fleeting (AANA, 2019a).

Indications of the occurrence of anesthesia awareness include an increase in the blood pressure, rapid heart rate, and patient movement. However, hemodynamic changes can be masked by paralytic medication, beta-blockers, and calcium channel blockers, thus the awareness may remain undetected. Premedication with amnesic agents and avoidance of muscle paralytics except when essential help to preclude its occurrence.

Nausea and Vomiting

Nausea and vomiting, or regurgitation, may affect patients during the intraoperative period. The patient should be assessed preoperatively for risk factors of PONV so that the surgical team can formulate a plan for intraoperative prevention. Risk factors include female gender, age less than 50 years, history of PONV, and opioid administration (Finch, Parkosewich, Perrone, et al., 2019).

If gagging occurs, the patient is turned to the side, the head of the table is lowered, and a basin is provided to collect the vomitus. Suction is used to remove saliva and vomited gastric contents. In some cases, the anesthesiologist or CRNA administers antiemetics preoperatively or intraoperatively to counteract possible aspiration. If the patient aspirates vomitus, an attack with severe bronchial spasms and wheezing is triggered. Pneumonitis and pulmonary edema can subsequently develop, leading to extreme hypoxia. Increasing medical attention is being paid to silent regurgitation of gastric contents (not related to preoperative fasting times), which occurs more frequently than previously realized. The volume and acidity of the aspirate determine the extent of damage to the lungs. Patients may be given citric acid and sodium citrate, a clear, nonparticulate antacid to increase gastric fluid pH or a histamine-2 (H_2) receptor antagonist such as cimetidine, or famotidine to decrease gastric acid production (Rothrock, 2019).

Anaphylaxis

Any time the patient comes into contact with a foreign substance, there is potential for an anaphylactic reaction. An anaphylactic reaction can occur in response to many medications, latex, or other substances. The reaction may be immediate or delayed. Anaphylaxis can be a life-threatening reaction.

Latex allergy—the sensitivity to natural rubber latex products—has become more prevalent, creating the need for alert responsiveness among health care professionals. If patients state that they have allergies to latex, even if they are wearing latex in their clothing, treatment must be latex free. In the OR, many products are latex free with the notable exception of softer latex catheters. Surgical cases should use latex-free gloves in anticipation of a possible allergy, and if no allergy is present, then personnel can switch to other gloves after the case starts if desired.

Fibrin sealants are used in various surgical procedures, and cyanoacrylate tissue adhesives are used to close wounds without the use of sutures. These sealants have been implicated in allergic reactions and anaphylaxis (Rothrock, 2019). Although these reactions are rare, the nurse must be alert to the possibility and observe the patient for changes in vital signs and symptoms of anaphylaxis when these products are used. In the OR, the team should remove potential causative agents promptly—within 3 minutes or less—of becoming aware of an anaphylactic reaction. The surgical team should be aware of the importance of prompt intervention to prevent cardiovascular and respiratory collapse (Seifert, 2017). (Chapters 11 and 33 provide more details about the signs, symptoms, and treatment of anaphylaxis and anaphylactic shock.)

Hypoxia and Other Respiratory Complications

Inadequate ventilation, occlusion of the airway, inadvertent intubation of the esophagus, and hypoxia are significant potential complications associated with general anesthesia. Many factors can contribute to inadequate ventilation. Respiratory depression caused by anesthetic agents, aspiration of respiratory tract secretions or vomitus, and the patient's position on the operating table can compromise the exchange of gases. Anatomic variation can make the trachea difficult to visualize and result in insertion of the artificial airway into the esophagus rather than into the trachea. In addition to these dangers, asphyxia caused by foreign bodies in the mouth; spasm of the vocal cords; relaxation of the tongue; or aspiration of vomitus, saliva, or blood can occur. Brain damage from hypoxia occurs within minutes; therefore, vigilant monitoring of the patient's oxygenation status is a primary function of the anesthesiologist or CRNA and the circulating nurse. Peripheral perfusion is checked frequently, and capnography readings are monitored continuously. Capnography provides instantaneous information about carbon dioxide production, pulmonary perfusion, and respiratory patterns that detect hypoventilation and apnea (Odom-Forren, 2018).

Hypothermia

During anesthesia, the patient's temperature may fall. Glucose metabolism is reduced, and as a result, metabolic acidosis may develop. This condition is called *hypothermia* and is indicated by a core body temperature that is lower than normal (36.6°C [98°F] or less). Risks of intraoperative hypothermia include cardiovascular events, SSIs, bleeding, and delayed arousal from anesthesia (Williams, 2018). Unintended hypothermia may occur as a result of a low temperature in the OR, infusion of cold fluids, inhalation of cold gases, open body wounds or cavities, decreased muscle activity, advanced age, or the pharmaceutical agents used (e.g., vasodilators, phenothiazines, general anesthetic medications). Hypothermia can depress neuronal activity and decrease cellular oxygen requirements below the minimum levels normally required for

continued cell viability. As a result, it is used to protect function during some surgical procedures (e.g., carotid endarterectomy, cardiopulmonary bypass) (Barash et al., 2017).

Unintended hypothermia needs to be avoided. If it occurs, it must be minimized or reversed. If hypothermia is intentional, the goal is safe return to normal body temperature. Environmental temperature in the OR can temporarily be set at 25° to 26.6°C (78° to 80°F). IV and irrigating fluids are warmed to 37°C (98.6°F). Wet gowns and drapes are removed promptly and replaced with dry materials, because wet materials promote heat loss. Warm air blankets and thermal blankets can also be used on the areas not exposed for surgery, and minimizing the area of the patient that is exposed will help maintain core temperature. Whatever methods are used to rewarm the patient, warming must be accomplished gradually, not rapidly. Conscientious monitoring of core temperature, urinary output, ECG, blood pressure, arterial blood gas levels, and serum electrolyte levels is required.

Malignant Hyperthermia

Malignant hyperthermia is a rare inherited muscle disorder that is chemically induced by anesthetic agents (Rothrock, 2019). This disorder can be triggered by myopathies, emotional stress, heatstroke, neuroleptic malignant syndrome, strenuous exercise exertion, and trauma. The incidence rate is 1 in every 170,698 general anesthetic cases (Phi, Carvalho, Sun, et al., 2018). MH occurs because of a genetic autosomal dominant disorder involving a mutation on the ryanodine receptor that causes an atypical increase in release of calcium in muscle cells (Mullins, 2018). Susceptible people include those with strong and bulky muscles, a history of muscle cramps or muscle weakness and unexplained temperature elevation, and an unexplained death of a family member during surgery that was accompanied by a febrile response (Ho, Carvalho, Sun, et al., 2018).

Pathophysiology

During anesthesia, potent agents such as inhalation anesthetic agents (i.e., halothane, enflurane, isoflurane) and muscle relaxants (succinylcholine) may trigger the symptoms of malignant hyperthermia (Rothrock, 2019). Stress and some medications, such as sympathomimetics (epinephrine), theophylline, aminophylline, anticholinergics (atropine), and cardiac glycosides (digitalis), can induce or intensify a reaction.

The pathophysiology of MH is related to a hypermetabolic condition that involves altered mechanisms of calcium function in skeletal muscle cells. This disruption of calcium causes clinical symptoms of hypermetabolism, which in turn increases muscle contraction (rigidity) and causes hyperthermia and subsequent damage to the central nervous system.

Clinical Manifestations

The initial symptoms of MH are often cardiovascular, respiratory, and abnormal musculoskeletal activity. Tachycardia (heart rate greater than 150 bpm) may be an early sign. Sympathetic nervous stimulation also leads to ventricular arrhythmia, hypotension, decreased cardiac output, oliguria, and, later, cardiac arrest. Hypercapnia, an increase in carbon dioxide (CO_2), may be an early respiratory sign. With the abnormal transport of calcium, rigidity or tetanuslike movements occur, often in the jaw. Generalized muscle rigidity is one of the earliest signs. The rise in temperature is actually a late sign that develops rapidly; body temperature can increase 1° to 2°C (2° to 4°F) every 5 minutes, and core body temperature can exceed 42°C (107°F) (Rothrock, 2019).

Medical Management

Goals of treatment are to decrease metabolism, reverse metabolic and respiratory acidosis, correct arrhythmias, decrease body temperature, provide oxygen and nutrition to tissues, and correct electrolyte imbalance. The treatment for MH is well known. Use of dantrolene has lowered mortality rates to 10% in current practice (Ho et al., 2018). The Malignant Hyperthermia Association of the United States (MHAUS) publishes a treatment protocol that should be posted in the OR and be readily available on a MH cart (see Resources section).

Anesthesia and surgery should be postponed. However, if end-tidal CO_2 monitoring and dantrolene sodium are available and the anesthesiologist is experienced in managing MH, the surgery may continue using a different anesthetic agent (Barash et al., 2017). Although MH usually manifests about 10 to 20 minutes after induction of anesthesia, it can also occur during the first 24 hours after surgery.

Nursing Management

Although MH is uncommon, the nurse must identify patients at risk, recognize the signs and symptoms, have the appropriate medication and equipment available, and be knowledgeable about the protocol to follow. Preparation and early intervention may be lifesaving for the patient.

NURSING PROCESS

The Patient during Surgery

Intraoperative nurses focus on nursing diagnoses, interventions, and outcomes that surgical patients and their families experience. Additional priorities include collaborative problems and expected goals.

Assessment

Nursing assessment of the intraoperative patient involves obtaining data from the patient and the patient's medical record to identify factors that can affect care. These serve as guidelines for an individualized plan of patient care. The intraoperative nurse uses the focused preoperative nursing assessment documented on the patient record. This includes assessment of physiologic status (e.g., health–illness level, level of consciousness), psychosocial status (e.g., anxiety level, verbal communication problems, coping mechanisms), physical status (e.g., surgical site, skin condition, and effectiveness of preparation; mobility of joints), and ethical concerns.

Diagnosis

NURSING DIAGNOSES

Based on the assessment data, major nursing diagnoses may include the following:

- Anxiety associated with surgical or environmental concerns
- Risk for latex allergy
- Risk for perioperative positioning injury associated with positioning in the OR
- Risk for injury associated with anesthesia and surgical procedure
- Risk for compromised dignity associated with general anesthesia or sedation

COLLABORATIVE PROBLEMS/POTENTIAL COMPLICATIONS

Based on the assessment data, potential complications may include the following:

- Anesthesia awareness
- Nausea and vomiting
- Anaphylaxis
- Hypoxia
- Unintentional hypothermia
- Malignant hyperthermia
- Infection

Planning and Goals

The major goals for care of the patient during surgery include reduced anxiety, absence of latex exposure, absence of positioning injuries, freedom

from injury, maintenance of the patient's dignity, and absence of complications.

Nursing Interventions

Reducing Anxiety

Preoperatively, the intraoperative nurse visiting the patient can help decrease anxiety and promote a relationship of communication and trust. The effect of familiarizing patients revealed significant decreased preoperative and postoperative anxiety (Bagheri, Ebrahimi, Abbasi, et al., 2019). The patient should be notified of what to expect when entering the operating room, and the nurse should inquire about any patient-specific relaxation preferences. The OR environment can seem cold, stark, and frightening to the patient, who may be feeling isolated and apprehensive. Introducing yourself, addressing the patient by name warmly and frequently, verifying details, providing explanations, and encouraging and answering questions provide a sense of professionalism and friendliness that can help the patient feel safe and secure. When discussing what the patient can expect in surgery, the nurse uses basic communication skills, such as touch and eye contact, to reduce anxiety. Attention to physical comfort (warm blankets, padding, position changes) helps the patient feel more comfortable. Telling the patient who else will be present in the OR, how long the procedure is expected to take, and other details helps the patient prepare for the experience and gain a sense of control.

The circulating nurse may assist to decrease anxiety during induction by using techniques such as guided imagery, decreasing room stimuli by dimming the lights, having the patient's favorite music playing, or by talking in a soft voice and using eye contact, if culturally appropriate.

Reducing Latex Exposure

Patients with latex allergies require early identification and communication to all personnel about the presence of the allergy according to standards of care for patients with latex allergy (AORN, 2019a). In most ORs, there are few latex items currently in use, but because there still remain some instances of latex use, maintenance of latex allergy precautions throughout the perioperative period must be observed. For safety, manufacturers and hospital materials managers need to take responsibility for identifying the latex content in items used by patients and health care personnel. (See Chapters 14 and 33 for assessment for latex allergy.)

Quality and Safety Nursing Alert

It is the responsibility of all nurses, and particularly perianesthesia and perioperative nurses, to be aware of latex allergies, necessary precautions, and products that are latex free. Hospital staff are also at risk for development of a latex allergy secondary to repeated exposure to latex products.

Preventing Perioperative Positioning Injury

The patient's position on the operating table depends on the surgical procedure to be performed as well as the patient's physical condition (see Fig. 15-6). One type of injury, peripheral nerve injury, is defined as the interruption of electrical activity that affects either the sensory, motor, or both nerve functions resulting in a deficit. Studies suggest a correlation between total OR time and tissue breakdown (Grap, Schubert, Munro, et al., 2019). See Chart 15-3 for a Nursing Research Profile that investigated these occurrences. The potential for transient discomfort or permanent injury is present because many surgical procedures require awkward anatomical positions. Hyperextending joints, compressing arteries, or pressing on nerves and bony prominences usually results in discomfort simply because the position must be sustained for a long period of time (Rothrock, 2019). Factors to consider include the following:

Chart 15-3 NURSING RESEARCH PROFILE

Sacral Tissue Pressure Injury Prevalence in Surgical Patients

Grap, M. J., Schubert, C., Munro, C. L., et al. (2019). OR time and sacral pressure injuries in critically ill surgical patients. *AORN Journal, 109*(2), 229–239.

Purpose

The ability to identify early changes associated with pressure injury and OR time may enhance pressure injury prevention strategies. The purpose of this study was to explore the relationship between OR time and sacral pressure injuries in critically ill patients using high-frequency ultrasound (HFU) to identify early tissue changes.

Design

A secondary analysis was used to evaluate the effect of backrest elevation on 150 ventilated patients in the ICU post surgery. All of the patients had recorded OR time and the Braden Score was collected to identify patients at risk for surgical pressure injury.

Findings

One hundred and fifty participants were enrolled and 132 had skin evaluations. The majority of participants were middle-aged White males (58%), overweight, and had a Braden Scale score showing moderate risk for pressure injury. Total OR time ranged from just under 1 hour to more than 13 hours, with an average time of more than 4 hours. For those participants who developed pressure injuries, time between the OR and injury observed was approximately 2 to 3 days on average. Approximately 63% of participants did not have sacral pressure injuries at any point during the observation period. Using multivariable models, the model containing OR bed time, BMI, and Braden Scale score produced the best prediction of pressure injury. A higher BMI, shorter OR bed time, and lower Braden Scale score were associated with a greater chance of pressure injury.

Nursing Implications

Preventing pressure injuries are a priority for nurses in all setting and is particularly challenging for critical-care patients. These preliminary results demonstrate that the use of HFU may help nurses identify the development of tissue changes before observable skin changes, leading to earlier pressure injury prevention strategies.

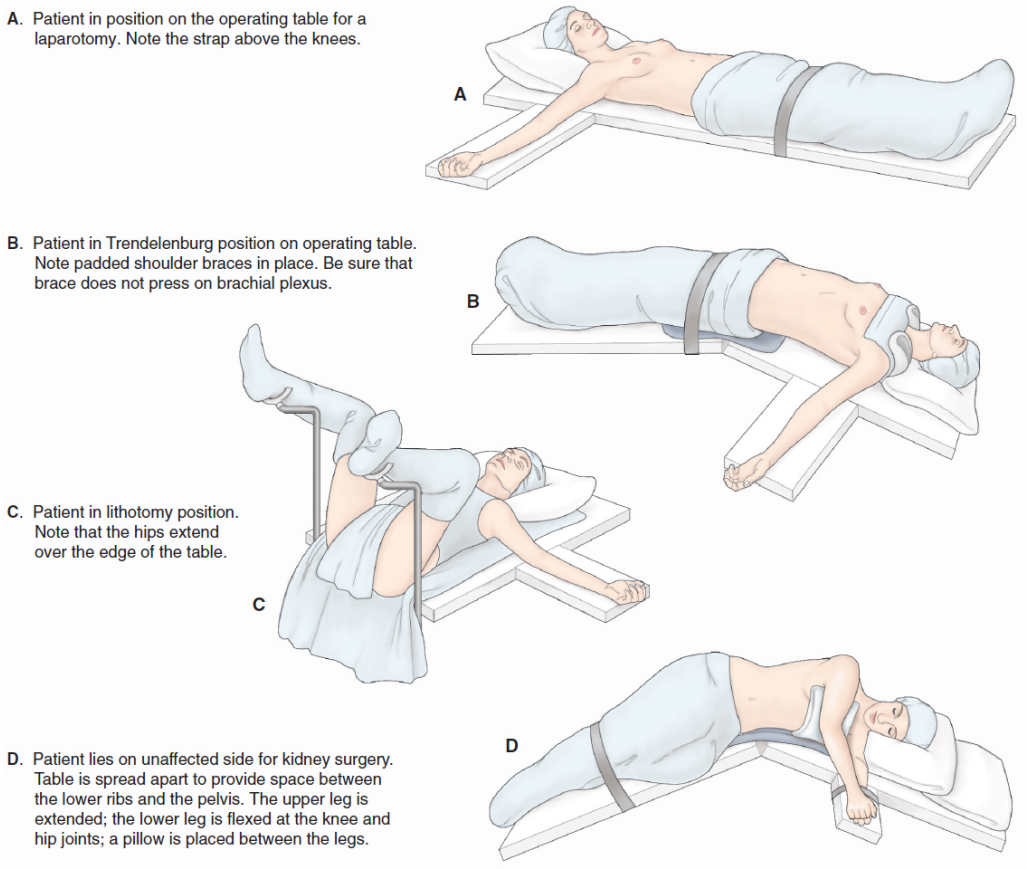


Figure 15-6 • Patient positions on the operating table. Captions call attention to safety and comfort features. All surgical patients wear caps to cover the hair completely.

- The patient should be in as comfortable a position as possible, whether conscious or unconscious.
- The operative field must be adequately exposed.
- An awkward anatomical position, undue pressure on a body part, or the use of stirrups or traction should not obstruct the vascular supply.
- Respiration should not be impeded by pressure of arms on the chest or by a gown that constricts the neck or chest.
- Nerves must be protected from undue pressure. Improper positioning of the arms, hands, legs, or feet can cause serious injury or paralysis. Shoulder braces must be well padded to prevent irreparable nerve injury, especially when the Trendelenburg position is necessary.
- Precautions for patient safety must be observed, particularly with older adults, patients who are thin or obese, and those with a physical deformity.
- The patient may need light restraint before induction in case of excitement.

The usual position for surgery, called the *dorsal recumbent position,* is flat on the back. Both arms are positioned at the side of the table: one with the hand placed palm down and the other carefully positioned on an armboard to facilitate IV infusion of fluids, blood, or medications. This position is used for most abdominal surgeries, except for surgery of the gallbladder or pelvis (see Fig. 15-6A).

The Trendelenburg position usually is used for surgery on the lower abdomen and pelvis to obtain good exposure by displacing the intestines into the upper abdomen. In this position, the head and body are lowered. The patient is supported in position by padded shoulder braces (see Fig. 15-6B), bean bags, and foam padding. Reverse Trendelenburg position provides the space to operate on the upper abdomen by shifting the intestines into the pelvis. A padded footboard and other supportive cushioning preserve a safe environment for the patient.

The lithotomy position is used for nearly all perineal, rectal, and vaginal surgical procedures (see Fig. 15-6C). The patient is positioned on the back with the legs and thighs flexed. The position is maintained by placing the feet in stirrups.

The Sims or lateral position is used for renal surgery. The patient is placed on the nonoperative side with an air pillow 12.5 to 15 cm (5 to 6 inches) thick under the loin, or on a table with a kidney or back lift (see Fig. 15-6D).

Protecting the Patient from Injury

Various activities are used to address the diverse patient safety issues that arise in the OR. The nurse protects the patient from injury by providing a safe environment. Verifying information, checking the medical record for completeness, and maintaining surgical asepsis and an optimal environment are critical nursing responsibilities. Verification that all the required documentation is completed is an important function of the intraoperative nurse. A surgical checklist is used prior to induction of anesthesia, before the skin incision is made, and before the patient leaves the OR (see Fig. 15-1). It is important to review the patient's record for the following:

- Allergies (including latex)
- Correct informed surgical consent, with patient's signature
- Completed records for health history and physical examination
- Results of diagnostic studies

In addition to checking that all necessary patient data are complete, the perioperative nurse obtains the necessary equipment specific to the procedure. The need for nonroutine medications, blood components, instruments, and other equipment and supplies is assessed, and the readiness of the room, completeness of physical setup, and completeness of instrument, suture, and dressing setups are determined. Any aspects of the OR environment that may negatively affect the patient are identified. These include physical features, such as room temperature and humidity; electrical

hazards; potential contaminants (dust, blood, and discharge on floor or surfaces; uncovered hair; nonsterile attire of personnel; jewelry worn by personnel; chipped or artificial fingernails); and unnecessary traffic. The circulating nurse also sets up and maintains suction equipment in working order, initiates appropriate physical comfort measures for the patient, and prepares any potential implantable devices and medications used at the surgical field.

Preventing physical injury includes using safety straps and side rails and not leaving the sedated patient unattended. Transferring the patient from the stretcher to the OR table requires safe transferring practices. Other safety measures include properly positioning a grounding pad under the patient to prevent electrical burns and shock, removing excess antiseptic solution from the patient's skin, and promptly and completely draping exposed areas after the sterile field has been created to decrease the risk of hypothermia.

Nursing measures to prevent injury from excessive blood loss include blood conservation using equipment such as a cell saver (a device for recirculating the patient's own blood cells) and administration of blood products (Rothrock, 2019). Fewer patients undergoing an elective procedure require blood transfusion, but those undergoing high-risk procedures (such as orthopedic or cardiac surgeries) may require an intraoperative transfusion. The circulating nurse anticipates this need, checks that blood has been cross-matched and held in reserve, and is prepared to administer blood.

Serving as Patient Advocate

The patient undergoing general anesthesia or moderate sedation experiences temporary sensory or perceptual alteration or loss, and has an increased need for protection and advocacy. Patient advocacy in the OR entails maintaining the patient's physical and emotional comfort, privacy, rights, and dignity. Patients, whether conscious or unconscious, should not be subjected to excess noise, inappropriate conversation, or, most of all, derogatory comments. Other advocacy activities include minimizing the clinical, dehumanizing aspects of being a surgical patient by making sure that the patient is treated as a person, respecting cultural and spiritual values, providing physical privacy, maintaining confidentiality, and contacting approved family or support personnel about updates throughout the procedure.

Preventing Retained Surgical Items

It is the entire surgical team's responsibility to provide vigilance and communication regarding items entering and leaving the surgical site. As part of their responsibilities, the circulating nurse and scrub personnel must account for items introduced to the sterile field. This includes sponges, needles, instruments, and access devices. Some of these items are radiopaque (visible under x-ray), others are not. All items must be accounted for at the beginning of surgery, prior to wound closure, and again at skin closure. The nurse serves as a patient advocate to alert the team of any missing items.

Technology can assist in surgical item identification; however, it should not be used as the primary source for counting.

Monitoring and Managing Potential Complications

It is the responsibility of the surgeon and the anesthesiologist or CRNA to monitor and manage complications. However, intraoperative nurses also play an important role. Being alert to and reporting changes in vital signs, cardiac arrhythmias, symptoms of nausea and vomiting, anaphylaxis, hypoxia, hypothermia, and MH and assisting with their management are important nursing functions. Each of these complications was discussed earlier. Maintaining asepsis and preventing infection are responsibilities of all members of the surgical team (Rothrock, 2019). Evidence-based interventions to decrease SSIs include appropriate skin preparation and antibiotic administration. These interventions are discussed by the surgical team and documented by the nurse in the intraoperative record.

Evaluation

Expected patient outcomes may include:

1. Exhibits low level of anxiety while awake during the intraoperative phase of care
2. Has no symptoms of latex allergy
3. Remains free of perioperative positioning injury
4. Experiences no unexpected threats to safety
5. Has dignity preserved throughout OR experience
6. Is free of complications (e.g., cardiac arrhythmias, nausea and vomiting, anaphylaxis, hypoxia, hypothermia, or MH or experiences successful management of adverse effects of surgery and anesthesia should they occur)

CRITICAL THINKING EXERCISES

1 ebp A 48-year-old man is scheduled to have robotic-assisted abdominal surgery. What is the best evidence for how his vital signs should be monitored? As the OR nurse, what best practices should you implement to support the patient and OR team during this minimally invasive surgery?

2 ipc A 66-year-old woman with chronic obstructive pulmonary disease (COPD) is scheduled for an elective procedure to remove a lipoma on her chest. She is having problems breathing, is agitated, and cannot lie flat on the surgical bed. How will you, as the circulating nurse, facilitate an interprofessional discussion to improve the patient's breathing and relieve her agitation? Which members of the surgical team are essential to include?

3 pq Identify the priorities, assessments, and nursing interventions you would implement for a 76-year-old female patient who is hard of hearing and is having spinal anesthesia for total knee replacement surgery. How would your priorities, approach, and techniques differ if the patient is having general anesthesia? What other risks should be considered based on this patient's age?

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Centers for Disease Control and Prevention, Injury and Violence Prevention and Control, www.cdc.gov/injury
Joint Commission, www.jointcommission.org
Malignant Hyperthermia Association of the United States (MHAUS), www.mhaus.org
World Health Organization (WHO), www.who.int/en/

16 Postoperative Nursing Management

LEARNING OUTCOMES

On completion of this chapter, the learner will be able to:

1. Describe the responsibilities of the postanesthesia care nurse in the prevention of immediate postoperative complications.
2. Identify common postoperative problems and their management.
3. Explain variables that affect wound healing and surgical site infections.
4. Implement nursing care to enhance recovery in the postoperative phase.
5. Use the nursing process as a framework for care of the hospitalized patient recovering from surgery.

NURSING CONCEPTS

Assessment
Infection
Managing Care

GLOSSARY

dehiscence: partial or complete separation of wound edges

evisceration: protrusion of organs through the surgical incision

first-intention healing: method of healing in which wound edges are surgically approximated and integumentary continuity is restored without granulation

phase I PACU: area designated for care of surgical patients immediately after surgery and for patients whose condition warrants close monitoring

phase II PACU: area designated for care of surgical patients who have been transferred from a phase I PACU because their condition no longer requires the close monitoring provided in a phase I PACU. The patient is prepared for transfer to an inpatient unit or for discharge from the facility

postanesthesia care unit (PACU): area where postoperative patients are monitored as they recover from anesthesia

second-intention healing: method of healing in which wound edges are not surgically approximated and integumentary continuity is restored by the process known as granulation

The postoperative period extends from the time the patient leaves the operating room (OR) until the last follow-up visit with the surgeon. This may be as short as a day or two or as long as several months. During the postoperative period, nursing care focuses on reestablishing the patient's physiologic equilibrium, alleviating pain, preventing complications, and educating the patient about self-care. Careful assessment and immediate intervention assist the patient in returning to optimal function quickly, safely, and as comfortable as possible. Ongoing care in the community through home care, clinic visits, office visits, or telephone follow-up facilitates an uncomplicated recovery.

Care of the Patient in the Postanesthesia Care Unit

The **postanesthesia care unit** (PACU) is located adjacent to the OR suite. Patients still under anesthesia or recovering from anesthesia are placed in this unit for easy access to experienced, highly skilled nurses, anesthesia providers, surgeons, advanced hemodynamic and pulmonary monitoring and support, special equipment, and medications.

Phases of Postanesthesia Care

In some hospitals and ambulatory surgical centers, postanesthesia care is divided into two phases (Rothrock, 2019). In the **phase I PACU**, used during

the immediate recovery phase, intensive nursing care is provided. After this phase, the patient transitions to the next phase of care as either an inpatient to a nursing unit or phase II PACU. In the **phase II PACU**, the patient is prepared for transfer to an inpatient nursing unit, an extended care setting, or discharge. Recliners rather than stretchers or beds are standard in many phase II units, which may also be referred to as step-down, sit-up, or progressive care units. Patients remain in PACU until they have met predetermined discharge criteria, depending on the type of surgery and any preexisting conditions or comorbidities. In facilities without separate phase I and II units, the patient remains in the PACU and may be discharged home directly from this unit.

Admitting the Patient to the Postanesthesia Care Unit

Transferring the postoperative patient from the OR to the PACU is the responsibility of the anesthesiologist or certified registered nurse anesthetist (CRNA) and other licensed members of the OR team. During transport from the OR to the PACU, the anesthesia provider remains at the head of the stretcher (to maintain the airway), and a surgical team member remains at the opposite end. Transporting the patient involves special consideration of the incision site, potential vascular changes, and exposure. The surgical incision is considered every time the postoperative patient is moved; many wounds are closed under considerable tension, and every effort is made to prevent further strain on the incision. The patient is positioned so that they are not lying on and obstructing drains or drainage tubes. Orthostatic hypotension may occur when a patient is moved too quickly from one position to another (e.g., from a lithotomy position to a horizontal position or from a lateral to a supine position), so the patient must be moved slowly and carefully. As soon as the patient is placed on the stretcher or bed, the soiled gown is removed and replaced with a dry gown. The patient is covered with lightweight blanket or a forced air warming blanket.

The nurse who admits the patient to the PACU reviews essential information with the anesthesiologist or CRNA (see Chart 16-1) and the circulating nurse. Oxygen is applied, monitoring equipment is attached, and an immediate physiologic assessment is conducted.

Chart 16-1

Anesthesia Provider-to-Nurse Report and Nurse-to-Nurse Report: Information to Convey

- Patient name, gender, age
- Allergies
- Surgical procedure
- Position during the procedure
- Length of time in the operating room
- Anesthetic agents and reversal agents used
- Estimated blood loss/fluid loss
- Fluid/blood replacement
- Last set of vital signs and any problems during the procedure (e.g., nausea and/or vomiting)
- Any complications encountered (anesthetic or surgical)
- Medical comorbidities (e.g., diabetes, hypertension)
- List of allergies and medications taken at home (including pain medications, antihypertensives, and anticoagulants)
- Considerations for immediate postoperative period (pain management, reversals, ventilator settings)
- Language barrier
- Location of patient's family
- Ideally, the anesthesia provider should not leave the patient until the nurse is satisfied with the patient's airway and immediate condition.

Nursing Management in the Postanesthesia Care Unit

The nursing management objectives for the patient in the PACU are to provide care until the patient has recovered from the effects of anesthesia. PACU nurses have unique competencies as they care for patients who have undergone a wide range of surgical procedures. Recovery criteria include a return to baseline cognitive function, the airway is clear, nausea and vomiting is controlled, and vital signs are stabilized. The nurse in the PACU uses critical care skills and training to detect early subtle changes that could lead to complications (i.e., hemorrhage or respiratory distress) without intervention (American Society of PeriAnesthesia Nurses [ASPAN], 2019; Odom-Forren, 2018).

Some patients, particularly those who have had extensive or lengthy surgical procedures, may be transferred from the OR directly to the intensive care unit (ICU) or from the PACU to the ICU while still intubated and receiving mechanical ventilation. In most facilities, the patient is awakened and extubated in the OR (except in cases of trauma or critical illness) and arrives in the PACU breathing without ventilatory support.

Assessing the Patient

The nurse performs frequent, basic assessments of every postoperative patient. These assessments include airway, level of consciousness, cardiac, respiratory, wound, and pain. The patient's comorbidities and type of procedure will dictate additional assessments such as peripheral pulses, hemodynamics, and surgical drain placements (Odom-Forren, 2018). A baseline of any postanesthesia assessment scoring tool, such as the Aldrete score, is performed at this time as well (Aldrete & Wright, 1992). See discussion of this score later in this chapter.

The nurse performs and documents a baseline assessment, checks all drainage tubes, and verifies that monitoring lines are connected and functioning. IV fluids and medications currently infusing are checked, and the nurse verifies that they are infusing at the correct dosage and rate. Vital signs are assessed at time of arrival to PACU and repeated at intervals (i.e., every 5 or 15 minutes) per institutional protocol. The nurse must be aware of any pertinent information from the patient's history that may be significant (e.g., patient is deaf or hard of hearing, has a history of seizures, has diabetes, or is allergic to certain medications or to latex).

Concept Mastery Alert

Following surgery, patients who had ketamine as anesthesia must be placed in a quiet, darkened area of the PACU. See Chapter 15, Table 15-2 for more information about anesthetic agents.

Maintaining a Patent Airway

The primary objective in the immediate postoperative period is to maintain ventilation and thus prevent hypoxemia (reduced oxygen in the blood) and hypercapnia (excess carbon dioxide in the blood). Both can occur if the airway is obstructed and ventilation is reduced (hypoventilation). Besides administering supplemental oxygen as prescribed, the nurse assesses respiratory rate and depth, ease of respirations, oxygen saturation, and breath sounds.

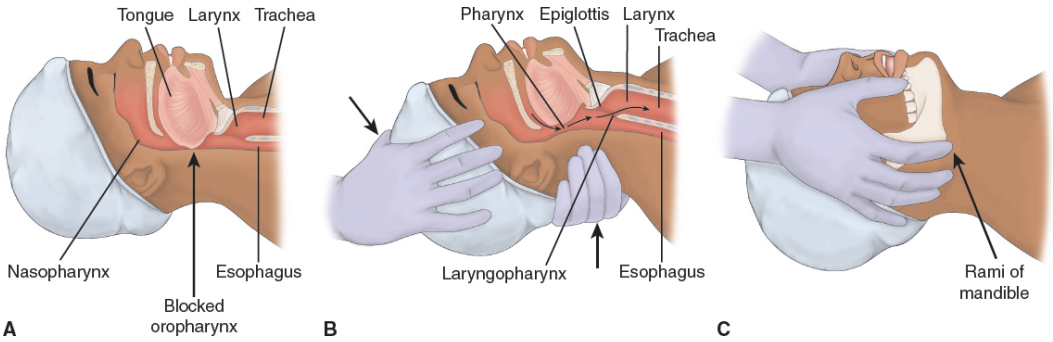


Figure 16-1 • A. A hypopharyngeal obstruction occurs when neck flexion permits the chin to drop toward the chest; obstruction almost always occurs when the head is in the midposition. **B.** Tilting the head back to stretch the anterior neck structure lifts the base of the tongue off the posterior pharyngeal wall. The direction of the *arrows* indicates the pressure of the hands. **C.** Opening the mouth is necessary to correct a valvelike obstruction of the nasal passage during expiration, which occurs in about 30% of unconscious patients. Open the patient's mouth (separate lips and teeth) and move the lower jaw forward so that the lower teeth are in front of the upper teeth. To regain backward tilt of the neck, lift with both hands at the ascending rami of the mandible.

Patients who have experienced prolonged anesthesia usually are unconscious, with all muscles relaxed. This relaxation extends to the muscles of the pharynx. When the patient lies on the back, the lower jaw and the tongue fall backward and the air passages become obstructed (Fig. 16-1A). This is called *hypopharyngeal obstruction.* Signs of occlusion include choking; noisy and irregular respirations; decreased oxygen saturation scores; and, within minutes, a blue, dusky color (cyanosis) of the skin. Because movement of the thorax and the diaphragm does not necessarily indicate that the patient is breathing, the nurse needs to place the palm of the hand at the patient's nose and mouth to feel the exhaled breath.

Quality and Safety Nursing Alert

The treatment of hypopharyngeal obstruction involves tilting the head back and pushing forward on the angle of the lower jaw, as if to push the lower teeth in front of the upper teeth (see Fig. 16-1B,C). This maneuver pulls the tongue forward and opens the air passages.

The anesthesiologist or CRNA may place a temporary, hard rubber or plastic airway in the patient's mouth to maintain a patent airway (see Fig. 16-2). Such a device should not be removed until signs such as gagging indicate

that reflex action is returning. Alternatively, the patient may enter the PACU with an endotracheal tube still in place and may require continued mechanical ventilation. The nurse assists in initiating the use of the ventilator as well as the weaning and extubation processes.

If the teeth are clenched, the mouth may be opened manually but cautiously with a padded tongue depressor. The head of the bed is elevated 15 to 30 degrees unless contraindicated, and the patient is closely monitored to maintain the airway as well as to minimize the risk of aspiration. If vomiting occurs, the patient is turned to the side to prevent aspiration and the vomitus is collected in the emesis basin. Mucus or vomitus obstructing the pharynx or the trachea is suctioned with a pharyngeal suction tip or a nasal catheter introduced into the nasopharynx or oropharynx to a distance of 15 to 20 cm (6 to 8 inch). Caution is necessary in suctioning the throat of a patient who has had a tonsillectomy or other oral or laryngeal surgery because of the risk of bleeding and discomfort.

Maintaining Cardiovascular Stability

To monitor cardiovascular stability, the nurse assesses the patient's level of consciousness; vital signs; cardiac rhythm; skin temperature, color, and moisture; and urine output. The nurse also assesses the patency of all IV lines. The primary cardiovascular complications seen in the PACU include hypotension and shock, hemorrhage, hypertension, and arrhythmias.

In patients who are critically ill, have significant comorbidity, or have undergone riskier procedures, additional monitoring may have been done in the OR and will continue in the PACU. These may include central venous pressure, pulmonary artery pressure, pulmonary artery wedge pressure, and cardiac output.

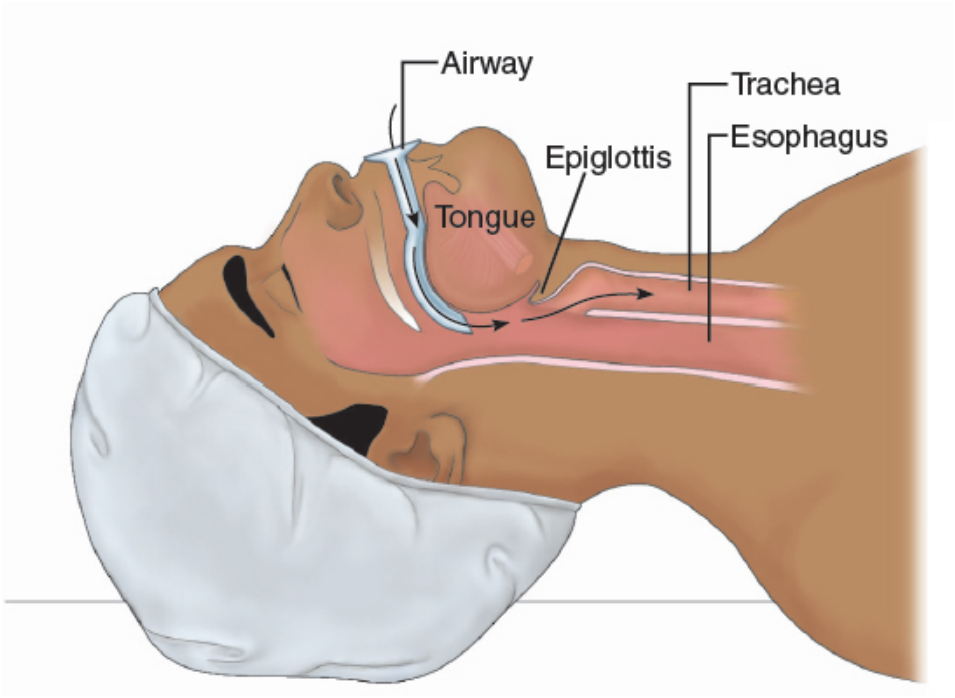


Figure 16-2 • The use of an airway to maintain a patent airway after anesthesia. The airway passes over the base of the tongue and permits air to pass into the pharynx in the region of the epiglottis. Patients often leave the operating room with an airway in place. The airway should remain in place until the patient recovers sufficiently to breathe normally. As the patient regains consciousness, the airway usually causes irritation and should be removed.

Hypotension and Shock

Hypotension can result from blood loss, hypoventilation, position changes, pooling of blood in the extremities, or side effects of medications and anesthetics. The most common cause is loss of circulating volume through blood and plasma loss. If the amount of blood loss exceeds 500 mL (especially if the loss is rapid), replacement may be considered.

Quality and Safety Nursing Alert

A systolic blood pressure of less than 90 mm Hg is usually considered immediately reportable. However, the patient's preoperative or baseline blood pressure is used to make informed postoperative comparisons. A previously stable blood pressure that shows a downward trend of 5 mm Hg at each 15-minute reading should also be reported.

Types of shock are classified as hypovolemic, cardiogenic, neurogenic, anaphylactic, and septic. The most common type of shock in the postoperative setting is hypovolemic and is associated with hemorrhage from the surgical site (Odom-Forren, 2018). The classic signs of hypovolemic shock are pallor; cool, moist skin; rapid breathing; cyanosis of the lips, gums, and tongue; rapid, weak, thready pulse; narrowing pulse pressure; low blood pressure; and concentrated urine (see Chapter 11 for a detailed discussion of shock).

Hypovolemic shock can be avoided largely by the timely administration of IV fluids, blood, blood products, and medications that elevate blood pressure. The primary intervention for hypovolemic shock is volume replacement, with an infusion of lactated Ringer solution, 0.9% sodium chloride solution, colloids, or blood component therapy (see Chapter 11, Table 11-3). Oxygen is given by nasal cannula, facemask, or mechanical ventilation. If fluid administration fails to reverse hypovolemic shock, then various cardiac, vasodilator, and corticosteroid medications may be prescribed to improve cardiac function and reduce peripheral vascular resistance.

The PACU bed can readily be positioned to facilitate the use of measures to counteract shock. The patient is placed flat with the legs elevated, usually with a pillow. Respiratory rate, pulse rate, blood pressure, blood oxygen concentration, urinary output, and level of consciousness are monitored to provide information on the patient's respiratory and cardiovascular status. Vital signs are monitored continuously until the patient's condition has stabilized.

Other factors can contribute to hemodynamic instability, such as body temperature and pain. The PACU nurse implements measures to manage these factors. The nurse keeps the patient warm (while avoiding overheating to prevent cutaneous vessels from dilating and depriving vital organs of blood), avoids exposure, and maintains normothermia (to prevent vasodilation). Pain control measures are implemented, as discussed later in this chapter.

Hemorrhage

Hemorrhage is an uncommon yet serious complication of surgery that can result in hypovolemic shock and death. It can present insidiously or emergently at any time in the immediate postoperative period or up to several days after surgery (see Table 16-1). The patient presents with hypotension; rapid, thready pulse; disorientation; restlessness; oliguria; and cold, pale skin. The early phase of shock will manifest in feelings of apprehension, decreased cardiac output, and vascular resistance. Breathing becomes labored, and "air hunger" will be exhibited; the patient will feel cold (hypothermia) and may experience tinnitus. Laboratory values may show a sharp drop in hemoglobin and hematocrit levels. If shock symptoms are left untreated, the patient will continually grow weaker but can remain conscious until near death (Rothrock, 2019).

TABLE 16-1 Types of Hemorrhage

Classification	Defining Characteristic
Time Frame	
Primary	Hemorrhage occurs at the time of surgery.
Intermediary	Hemorrhage occurs during the first few hours after surgery when the rise of blood pressure to its normal level dislodges insecure clots from nonanastomosed vessels.
Secondary	Hemorrhage may occur sometime after surgery if a suture slips because a blood vessel was not securely anastomosed, became infected, or was eroded by a drainage tube.
Type of Vessel	
Capillary	Hemorrhage is characterized by slow, general ooze.
Venous	Darkly colored blood flows quickly.
Arterial	Blood is bright red and appears in spurts with each heartbeat.
Visibility	
Evident	Hemorrhage is on the surface and can be seen.
Concealed	Hemorrhage is in a body cavity and cannot be seen.

Determining the cause of hemorrhage includes assessing the surgical site and incision for bleeding. If bleeding is evident, a sterile gauze pad and a pressure dressing are applied, and the site of the bleeding is elevated to heart level if possible. The patient is placed in the shock position (flat on back; legs elevated at a 20-degree angle; knees kept straight). Severe bleeding requires immediate action by the nurse. The surgeon is called and preparations are made to return the patient to the OR for ligation of bleeding veins and arteries, hematoma evacuation, or other necessary surgical interventions to stop the bleeding (Odom-Forren, 2018).

If hemorrhage is suspected, the nurse should be aware of any special considerations related to blood loss replacement. The treatment of hemorrhage is infusion of crystalloid and possibly blood product. Patients with blood loss of over 1500 mL should be considered for blood administration (Henry, 2018). Nurses in the PACU should be aware that patients may decline blood transfusions for religious or cultural reasons and may identify this request on their advance directives or living will.

Hypertension and Arrhythmias

Hypertension is common in the immediate postoperative period secondary to sympathetic nervous system stimulation from pain, hypoxia, or bladder distention. Arrhythmias are associated with electrolyte imbalance, altered respiratory function, pain, hypothermia, stress, and anesthetic agents. Both hypertension and arrhythmias are managed by treating the underlying causes.

Relieving Pain and Anxiety

The nurse in the PACU monitors the patient's physiologic status, manages pain, and provides psychological support in an effort to relieve the patient's fears and concerns. The nurse checks the electronic health record (EHR) for special needs and concerns of the patient. Opioid analgesic medications are given mostly by IV in the PACU (Rothrock, 2019). IV opioids provide immediate pain relief and are short acting, thus minimizing the potential for drug interactions or prolonged respiratory depression while anesthetics are still active in the patient's system (Barash, Cullen, Stoelting, et al., 2017). (See Chapter 9 for more information about pain management.) When the patient's condition permits, a close member of the family may visit in the PACU to decrease the family's anxiety and make the patient feel more secure. The nurse should consider providing nonpharmacologic, emotional, and psychological support to the patient. These include massage, acupuncture, heat or cold packs, relaxation and breathing techniques, guided imagery, and soothing music (Odom-Forren, 2018).

Controlling Nausea and Vomiting

Postoperative nausea and vomiting (PONV) occurs in about 30% to 50% of surgical patients (Thomas, Maple, Williams, et al., 2019). The nurse should intervene at the patient's first report of nausea to control the problem rather than wait for it to progress to vomiting.

Quality and Safety Nursing Alert

At the slightest indication of nausea, the patient is turned completely to one side to promote mouth drainage and prevent aspiration of vomitus, which can cause pneumonia, asphyxiation, and death.

PONV is controlled via medication administered intraoperatively and postoperatively. Table 16-2 contains select medications prescribed to control PONV. Studies suggest that nonpharmacologic measures, such as aromatherapy, may be effective for PONV prevention and treatment (Asay, Olson, Donnelly, et al., 2019). Aromatherapy inhalers with ginger, lavender, spearmint, and peppermint are a complementary, homeopathic, and a nonpharmacologic option (de la Vega, Gilliand, Martinez, et al., 2019).

Risk factors for PONV are female gender, age less than 50 years, history of nausea or vomiting after previous anesthesia, and opioid administration (Finch, Parkosewich, Perrone, et al., 2019). Surgical risks are increased with PONV due to an increase in intra-abdominal pressure, elevated central venous pressure, the potential for aspiration, increased heart rate, and systemic blood pressure, which increase the risk of myocardial ischemia and arrhythmias.

Aside from PONV as an unpleasant and uncomfortable experience, it may lead to dehydration, electrolyte imbalances, airway compromise, stress on suture lines or incision dehiscence, esophageal tears, hypotension, and increased length of stay in the recovery room (Asay et al., 2019). Chart 16-2 contains a Nursing Research Profile about PONV.

Gerontologic Considerations

The older patient, like all patients, is transferred from the OR table to the bed or stretcher slowly and gently. The effects of this action on blood pressure and ventilation are monitored. Special attention is given to keeping the patient warm, because older adults are more susceptible to hypothermia. The patient's position is changed frequently to stimulate respirations as well as promote circulation and comfort.

TABLE 16-2 Select Medications Used to Control Postoperative Nausea and Vomiting

Drug Classes	Name	Nursing Implications
GI stimulant	Metoclopramide	Acts by stimulating gastric emptying and increasing GI transit time. Administration recommended at the end of procedure. Available in oral, IM, and IV forms.
Phenothiazine antiemetic	Prochlorperazine	Indicated for control of severe nausea and vomiting. Available in oral, SR, rectal, IM, and IV forms.
Phenothiazine antiemetic antimotion sickness	Promethazine	Recommended every 4–6 h for nausea and vomiting associated with anesthesia and surgery. Available in oral, IM, and IV forms.
Antimotion sickness	Dimenhydrinate	Indicated for prevention of nausea, vomiting, or vertigo of motion sickness. Available in oral, IM, and IV forms.
Antiemetic	Hydroxyzine	Control of nausea and vomiting and as adjunct to analgesia preoperatively and postoperatively to allow decreased opioid dosage. Available in oral and IM forms.
Antiemetic antimotion sickness	Scopolamine	Used to prevent and control of nausea and vomiting associated with motion sickness and recovery from surgery. Available in oral, transdermal SC, and IM forms.
Antiemetic	Ondansetron	Prevention of postoperative nausea and vomiting. Available in oral, IM, and IV forms. With few side effects, frequently the drug of choice.

GI, gastrointestinal; IM, intramuscular; IV, intravenous; SR, sustained release; SC, subcutaneous.

Adapted from Comerford, K. C., & Durkin, M. T. (2020). *Nursing 2020 drug handbook*. Philadelphia, PA: Wolters Kluwer.

Chart 16-2 NURSING RESEARCH PROFILE

An Investigation of PONV in Ambulatory Surgery

Finch, C., Parkosewich, J. A., Perrone, D., et al. (2019). Incidence, timing, and factors associated with postoperative nausea and vomiting in the ambulatory surgery setting. *Journal of PeriAnesthesia Nursing, 34*(6), 1146–1155.

Purpose

Postoperative nausea and vomiting (PONV) is a major concern for patients having surgery under general anesthesia. The purpose of this study was to investigate the incidence, timing, and factors associated with PONV in an ambulatory surgery PACU.

Design

The study used a prospective descriptive correlational, cross-sectional design. A random sample of 139 patients admitted to a 10-bed ambulatory PACU participated.

Findings

The mean age of participants was 50 years and 70% were female. Only 3 participants had nausea upon arrival to the PACU, but this number increased to 10 by 90 minutes in the PACU, and then went back down to 3 at 150 minutes in the PACU. A total of 4 participants vomited after reporting nausea. Participants with nausea had more hydration and longer PACU stays. Younger age and the presence of gastroesophageal reflux disease (GERD) were significantly associated with nausea.

Nursing Implications

Nurses working with postoperative patients should be aware that PONV can and does occur in both ambulatory and inpatient surgery settings. Nurses should take the age of patients into consideration with anticipating PONV. This study provides evidence that a history of GERD may be a risk factor and thus should be included in preoperative assessment.

Immediate postoperative care for the older adult is the same as for any surgical patient; however, additional support is given if cardiovascular, pulmonary, or renal function is impaired. With careful monitoring, it is possible to detect cardiopulmonary deficits before signs and symptoms are apparent. Changes associated with the aging process, the prevalence of chronic diseases, alteration in fluid and nutrition status, and the increased use of medications result in the need for postoperative vigilance. Nurses should keep in mind that older adults may have slower recovery from anesthesia due to the prolonged time it takes to eliminate sedatives and anesthetic agents. Thermoregulation is important to maintain immune function, adequate pain relief, and tissue oxygenation. Special care to maintain normothermia can

minimize the risk of postoperative ischemia and angina in older patients (Odom-Forren, 2018).

Postoperative confusion and delirium may occur in up to half of all older adult patients. Signs and symptoms include cognitive deficits, hallucinations, and fluctuating state of consciousness. It is important for the nurse to verify the preoperative psychological assessment as it can help differentiate between postoperative cognitive dysfunction (POCD) and postoperative delirium. With both conditions, patients exhibit signs of cognitive impairment; however, POCD is of sudden onset in the postsurgical period and is associated with the use of several anesthetic agents (Alalawi & Yasmeen, 2018). Providing adequate hydration, reorienting to the environment, and reassessing the doses of sedative, anesthetic, and analgesic agents may reduce the risk of confusion. Hypoxia can present as confusion and restlessness, as can blood loss and electrolyte imbalances. Exclusion of all other causes of confusion must precede the assumption that confusion is related to age, circumstances, and medications.

Maintaining a safe environment for older adults requires alertness and planning. Arthritis is a common condition among older patients, and it affects mobility, creating difficulty turning from one side to the other or ambulating without discomfort. The nurse provides mobility support and is vigilant for patients with an increased risk for falls. Fall prevention methods include using a fall risk identification method, providing assistance with ambulation, and allowing legs to dangle off of the stretcher prior to standing (DeSilva, Seabra, Thomas, et al., 2019).

Bariatric Considerations

Patients with obesity are seen in the PACU for a wide variety of conditions, including bariatric and nonbariatric procedures (Tjeertes, Hoeks, Beks, et al., 2015). Properly sized blood pressure cuffs, gowns, transfer devices, and wheelchairs may be needed for the recovery and transitioning care of these patients. Patients with obesity have unique postoperative risks including an increased risk of venous thromboembolism (VTE), deep vein thrombosis (DVT), and pulmonary embolus (PE).

Patients with obesity are at particular risk for obstructive sleep apnea (OSA) in the postoperative period. A direct correlation exists between the incidence of pulmonary complications and the degree of obesity. The mortality rate after upper abdominal operations in patients with severe obesity is 2.5 times that of their normal weight counterparts (Odom-Forren, 2018). As discussed in Chapter 14, careful preoperative assessment for OSA should occur in patients with obesity in order to detect and manage the manifestations that may occur during the surgical stay. A combination of pulse oximetry and capnography should be utilized when patients are on supplemental oxygen therapy as

respiratory depression may be masked when measured only by pulse oximetry (Jungquist, Card, Charchaflieh, et al., 2018). Research suggests that the combination of continuous monitoring tools alerts PACU nurses to respiratory changes allowing for timely interventions (Wortham, Rice, Gupta, et al., 2019). Patients with OSA, many of whom also have obesity, are prone to hypoventilation and airway obstruction (ASPAN, 2019).

Determining Readiness for Postanesthesia Care Unit Discharge

A patient remains in the PACU until fully recovered from the anesthetic agent. Indicators of recovery include stable blood pressure, adequate respiratory function, and adequate oxygen saturation level compared with baseline.

The Aldrete score is used to determine the patient's general condition and readiness for transfer from the PACU (Aldrete & Wright, 1992). Throughout the recovery period, the patient's physical signs are observed and evaluated by means of a scoring system based on a set of objective criteria. This evaluation guide allows an objective assessment of the patient's condition in the PACU (see Fig. 16-3). The patient is assessed at regular intervals, and a total score is calculated and recorded on the assessment record. The Aldrete score is usually between 7 and 10 before discharge from the PACU. The unit policy and the established PACU discharge criteria determine appropriate postanesthesia recovery score parameters. Scores or conditions lower than the preestablished level necessitate evaluation by the anesthesia provider or surgeon and can result in an extension of the PACU stay or possible disposition to a special care or critical care unit (Odom-Forren, 2018).

Post Anesthesia Care Unit

MODIFIED ALDRETE SCORE

Patient: _____ Final score: _____

Room: _____ Surgeon: _____

Date: _____ PACU nurse: _____

Area of Assessment	Point Score	Upon Admission	After			
			15 min	30 min	45 min	60 min
Activity						
(Able to move spontaneously or on command)						
• Ability to move all extremities	2					
• Ability to move 2 extremities	1					
• Unable to control any extremity	0					
Respiration						
• Ability to breathe deeply and cough	2					
• Limited respiratory effort (dyspnea or splinting)	1					
• No spontaneous effort	0					
Circulation						
• BP 20% of preanesthetic level	2					
• BP 20% –49% of preanesthetic level	1					
• BP 50% of preanesthetic level	0					
Consciousness						
• Fully awake	2					
• Arousable on calling	1					
• Not responding	0					
O_2 Saturation						
• Able to maintain O_2 sat >92% on room air	2					
• Needs O_2 inhalation to maintain O_2 sat >90%	1					
• O_2 sat <90% even with O_2 supplement	0					
Totals:						

Required for discharge from Post Anesthesia Care Unit: 7–8 points

Time of release

Signature of nurse

Figure 16-3 • Postanesthesia care unit record; modified Aldrete score. O_2 sat, oxygen saturation; BP, blood pressure. Adapted from Aldrete, A., & Wright, A. (1992). Revised Aldrete score for discharge. *Anesthesiology News, 18*(1), 17.

The patient is discharged from the phase I PACU by the anesthesiologist or CRNA to the critical care unit, the medical-surgical unit, or the phase II PACU.

Preparing the Postoperative Patient for Direct Discharge

Ambulatory surgical centers frequently have a step-down PACU similar to a phase II PACU. Patients seen in this type of unit are usually healthy, and the plan is to discharge them directly to home. Prior to discharge, the patient will require verbal and written instructions and information about follow-up care.

Promoting Home, Community-Based, and Transitional Care

To ensure patient safety and recovery, expert patient education and discharge planning are necessary when a patient undergoes same-day or ambulatory surgery (Association of PeriOperative Registered Nurses [AORN], 2019; ASPAN, 2019). Because anesthetics cloud memory for concurrent events, verbal and written instructions should be given to both the patient and the adult who will be accompanying the patient home. Alternative formats (e.g., large print, Braille) of instructions or the use of a sign language interpreter may be required to ensure patient and family understanding. A translator may be required if the patient and family members do not understand English.

Discharge Preparation

The patient and caregiver (e.g., family member, friend) are informed about expected outcomes and immediate postoperative changes anticipated (AORN, 2019; ASPAN, 2019). Chart 16-3 identifies important educational points; before discharging the patient, the nurse provides written instructions covering each of those points. Prescriptions are given to the patient. Contact information for the hospital and surgeon's office are provided, and the patient and caregiver are encouraged to call with questions and to schedule follow-up appointments. A list of possible complications and how to manage them (e.g., call the surgeon's office, report to the emergency department [ED]), including elevated temperature, bleeding, and wound care instructions, are key focal points during discharge education.

Although recovery time varies depending on the type and extent of surgery and the patient's overall condition, instructions usually advise limited activity for 24 to 48 hours. During this time, the patient should not drive a vehicle, drink alcoholic beverages, or perform tasks that require high levels of energy or skill. Fluids may be consumed as desired and smaller than normal amounts may be eaten at mealtime. Patients are cautioned not to make important decisions at this time because the medications, anesthesia, and surgery may affect their decision-making ability. Follow-up phone calls from the nurse are also used to assess the patient's progress and to answer any questions.

Chart 16-3  **HOME CARE CHECKLIST**

Discharge After Surgery

At the completion of education, the patient and/or caregiver will be able to:

- Name the procedure that was performed and identify any permanent changes in anatomic structure or function as well as changes in ADLs, IADLs, roles, relationships, and spirituality.
- Identify interventions and strategies (e.g., durable medical equipment, adaptive equipment) used in adapting to any permanent change in structure or function.
- Describe ongoing postoperative therapeutic regimen, including diet and activities to perform (e.g., walking and breathing exercises) and to limit or avoid (e.g., lifting weights, driving a car, contact sports).
- State the name, dose, side effects, frequency, and schedule for all medications.
- State how to obtain medical supplies and carry out dressing changes, wound care, and other prescribed regimens.
- Describe signs and symptoms of complications.
- State time and date of follow-up appointments.
- Relate how to reach health care provider with questions or complications.
- State understanding of community resources and referrals (if any).

Identify the need for health promotion (e.g., weight reduction, smoking cessation, stress management), disease prevention, and screening activities. ADLs, activities of daily living; IADLs, instrumental activities of daily living.

Continuing and Transitional Care

Although most patients who undergo ambulatory surgery recover quickly and without complications, some patients require referral for some type of continuing or transitional care. These may be older or frail patients, those who live alone, and patients with other health care problems or disabilities that might interfere with self-care or resumption of usual activities. The home, community, or transitional care nurse assesses the patient's physical status (e.g., respiratory and cardiovascular status, adequacy of pain management, the surgical incision, surgical complications) and the patient's and family's ability to adhere to the recommendations given at the time of discharge. Previous education is reinforced as needed. Nursing interventions may include changing surgical dressings, monitoring the patency of a drainage system, or

administering medications. The patient and family are reminded about the importance of keeping follow-up appointments with the surgeon.

Care of the Hospitalized Postoperative Patient

The majority of surgical patients who require hospital stays are trauma patients, acutely ill patients, patients undergoing major surgery, patients who require emergency surgery, and patients with a concurrent medical disorder. Seriously ill patients and those who have undergone major cardiovascular, pulmonary, or neurologic surgery may be admitted to specialized ICUs for close monitoring and advanced interventions and support. The care required by these patients in the immediate postoperative period is discussed in specific chapters of this book.

Patients admitted to the clinical unit for postoperative care have multiple needs and require frequent assessment and care interventions by nursing staff. Postoperative care for those surgical patients returning to the general medical-surgical unit is discussed later in this chapter.

Receiving the Patient in the Clinical Unit

The patient's room is readied by assembling the necessary equipment and supplies: IV pumps, drainage receptacle holder, suction equipment, oxygen, emesis basin, tissues, disposable pads, blankets, and postoperative documentation forms. When the call comes to the unit about the patient's transfer from the PACU, the need for any additional items is communicated. The PACU nurse reports relevant data about the patient to the receiving nurse (see Chart 16-1).

Usually, the surgeon speaks to the family after surgery and relates the general condition of the patient. The receiving nurse gets a report about the patient's condition, reviews the postoperative orders, admits the patient to the unit, performs an initial assessment, and attends to the patient's immediate needs (see Chart 16-4).

Nursing Management After Surgery

During the first 24 hours after surgery, nursing care of the hospitalized patient on the medical-surgical unit involves continuing to help the patient recover from the effects of anesthesia (Barash et al., 2017), frequently assessing the patient's physiologic status, monitoring for complications, managing pain, and implementing measures designed to achieve the long-range goals of independence with self-care, successful management of the therapeutic regimen, discharge to home, and full recovery. In the initial hours after

admission to the clinical unit, adequate ventilation, hemodynamic stability, incisional pain, surgical site integrity, nausea and vomiting, neurologic status, and spontaneous voiding are primary concerns. The pulse rate, blood pressure, and respiration rate are assessed at intervals determined by the institution.

Patients usually begin to return to their usual state of health several hours after surgery or after awaking the next morning. Although pain may still be intense, many patients feel more alert, less nauseous, and less anxious. They have begun their breathing and leg exercises as appropriate for the type of surgery, and most will have dangled their legs over the edge of the bed, stood, and ambulated a few feet or been assisted out of bed to the chair at least once. Many will have tolerated a light meal and had IV fluids discontinued. The focus of care shifts from intense physiologic management and symptomatic relief of the adverse effects of anesthesia to regaining independence with self-care and preparing for discharge.

Chart 16-4

Immediate Postoperative Nursing Interventions

Nursing Interventions	Rationale
1. Assess breathing and administer supplemental oxygen, if prescribed.	**1.** Assessment provides a baseline and helps identify signs and symptoms of respiratory distress early.
2. Monitor vital signs and note skin warmth, moisture, and color.	**2.** A careful baseline assessment helps identify signs and symptoms of shock early.
3. Assess the surgical site and wound drainage systems. Connect all drainage tubes to gravity or suction as indicated and monitor closed drainage systems.	**3.** Assessment provides a baseline and helps identify signs and symptoms of hemorrhage early.
4. Assess level of consciousness, orientation, and ability to move extremities.	**4.** These parameters provide a baseline and help identify signs and symptoms of neurologic complications.
5. Assess pain level; pain characteristics (location, quality); and timing, type, and route of administration of the last dose of analgesic.	**5.** Assessment provides a baseline of current pain level and assesses effectiveness of pain management strategies.
6. Administer analgesic medications as prescribed and assess their effectiveness in relieving pain.	**6.** Administration of analgesic agents helps decrease pain.
7. Place the call light, emesis basin, ice chips (if allowed), and bedpan or urinal within reach.	**7.** Attending to these needs provides for comfort and safety.
8. Position the patient to enhance comfort, safety, and lung expansion.	**8.** This promotes safety and reduces risk of postoperative complications.
9. Assess IV sites for patency and infusions for correct rate and solution.	**9.** Assessing IV sites and infusions helps detect phlebitis and prevents errors in rate and solution type.
10. Assess urine output in closed drainage system or use bladder scanner to detect distention.	**10.** Assessment provides a baseline and helps identify signs of urinary retention.
11. Reinforce the need to begin deep breathing and leg exercises.	**11.** These activities help prevent complications related to immobility (e.g., atelectasis, VTE).
12. Provide information to the patient and family.	**12.** Patient education helps decrease the patient's and family's anxiety.

VTE, venous thromboembolism.

Adapted from Association of PeriOperative Registered Nurses (AORN). (2019). *Association of PeriOperative Registered Nurses (AORN) standards, recommended practice, and guidelines*. Denver, CO: Author.

NURSING PROCESS

The Hospitalized Patient Recovering from Surgery

Nursing care of the hospitalized patient recovering from surgery takes place in a compressed time frame, with much of the healing and recovery occurring after the patient is discharged to home or to a rehabilitation center.

Assessment

Assessment of the hospitalized postoperative patient includes monitoring vital signs and completing a review of systems upon the patient's arrival to the clinical unit (see Chart 16-4) and at regular intervals thereafter.

Respiratory status is important because pulmonary complications are among the most frequent and serious problems encountered by the surgical patient. The nurse monitors for airway patency and any signs of laryngeal edema. The quality of respirations, including depth, rate, and sound, is assessed regularly. Chest auscultation verifies that breath sounds are normal (or abnormal) bilaterally, and the findings are documented as a baseline for later comparisons. Often, because of the effects of analgesic and anesthetic medications, respirations are slow. Shallow and rapid respirations may be caused by pain, constricting dressings, gastric dilation, abdominal distention, or obesity. Noisy breathing may be due to obstruction by secretions or the tongue. Another possible complication is flash pulmonary edema that occurs when protein and fluid accumulate in the alveoli unrelated to elevated pulmonary artery occlusive pressure. Signs and symptoms include agitation; tachypnea; tachycardia; decreased pulse oximetry readings; frothy, pink sputum; and crackles on auscultation.

The nurse assesses the patient's pain level using a verbal or visual analog scale and assesses the characteristics of the pain. The patient's appearance, pulse, respirations, blood pressure, skin color (adequate or cyanotic), and skin temperature (cold and clammy, warm and moist, or warm and dry) are clues to cardiovascular function. When the patient arrives in the clinical unit, the surgical site is assessed for bleeding, type and integrity of dressings, and drains.

The nurse also assesses the patient's mental status and level of consciousness, speech, and orientation and compares them with the preoperative baseline. Although a change in mental status or postoperative restlessness may be related to anxiety, pain, or medications, it may also be a symptom of oxygen deficit or hemorrhage. These serious causes must be investigated and excluded before other causes are pursued.

General discomfort that results from lying in one position on the operating table, the handling of tissues by the surgical team, the body's

reaction to anesthesia, and anxiety are also common causes of restlessness. These discomforts may be relieved by administering the prescribed analgesic medication, changing the patient's position frequently, and assessing and alleviating the cause of anxiety. If tight, drainage-soaked bandages are causing discomfort, reinforcing or changing the dressing completely as prescribed by the provider may make the patient more comfortable. The bladder is assessed for distention (usually with a bladder scanner) because urinary retention can also cause restlessness and change in mental status (AORN, 2019).

Diagnosis

Nursing Diagnoses

Based on the assessment data, major nursing diagnoses may include the following:

- Impaired airway clearance associated with to depressed respiratory function, pain, and bed rest
- Acute pain associated with surgical incision
- Impaired cardiac output associated with shock or hemorrhage
- Risk for activity intolerance associated with generalized weakness secondary to surgery
- Impaired skin integrity associated with surgical incision and drains
- Impaired thermoregulation associated with surgical environment and anesthetic agents
- Risk for impaired nutritional status associated with decreased intake and increased need for nutrients secondary to surgery
- Risk for constipation associated with effects of medications, surgery, dietary change, and immobility
- Impaired urinary system function associated with anesthetic agents
- Risk for injury associated with surgical procedure/positioning or anesthetic agents
- Anxiety associated with surgical procedure
- Lack of knowledge associated with wound care, dietary restrictions, activity recommendations, medications, follow-up care, or signs and symptoms of complications in preparation for discharge

Collaborative Problems or Potential Complications

Based on the assessment data, potential complications may include the following:

- Pulmonary infection/hypoxia
- Venous thromboembolism (VTE) (e.g., deep vein thrombosis [DVT], pulmonary embolism [PE])
- Hematoma or hemorrhage

- Infection
- Wound dehiscence or evisceration

Planning and Goals

The major goals for the patient include optimal respiratory function, relief of pain, optimal cardiovascular function, increased activity tolerance, unimpaired wound healing, maintenance of body temperature, and maintenance of nutritional balance (Dudek, 2017). Further goals include resumption of usual pattern of bowel and bladder elimination, identification of any perioperative positioning injury, acquisition of sufficient knowledge to manage self-care after discharge, and absence of complications.

Nursing Interventions

Preventing Respiratory Complications

Respiratory depressive effects of opioid medications, decreased lung expansion secondary to opioid pain medication, and decreased mobility combine to put the patient at risk for respiratory complications, particularly atelectasis (alveolar collapse; incomplete expansion of the lung), pneumonia, and hypoxemia (Rothrock, 2019). Atelectasis remains a risk for the patient who is not moving well or ambulating or who is not performing deep-breathing and coughing exercises or using an incentive spirometer. Signs and symptoms include decreased breath sounds over the affected area, crackles, and cough. Pneumonia is characterized by chills and fever, tachycardia, and tachypnea. Cough may or may not be present and may or may not be productive. Pulmonary congestion may occur if secretions are not cleared from the airway. The symptoms are often vague, with perhaps a slight elevation of temperature, pulse, and respiratory rate as well as a cough. Physical examination reveals dullness and crackles at the base of the lungs. If the condition progresses, the outcome may be fatal.

The types of hypoxemia that can affect postoperative patients are subacute and episodic. Subacute hypoxemia is a constant low level of oxygen saturation when breathing appears normal. Episodic hypoxemia develops suddenly, and the patient may be at risk for cerebral dysfunction, myocardial ischemia, and cardiac arrest. Risk for hypoxemia is increased in patients who have undergone major surgery (particularly abdominal), have obesity, or have preexisting pulmonary problems. Unidentified hypoxemia in the postanesthesia patient is not common since the advent of noninvasive oxygen saturation monitoring with pulse oximetry (Odom-Forren, 2018). Factors that may affect the accuracy of pulse oximetry readings include cold extremities, tremors, atrial fibrillation, acrylic nails, and nail polish.

Preventive measures and timely recognition of signs and symptoms help avert pulmonary complications. Crackles indicate static pulmonary secretions that need to be mobilized by coughing and deep-breathing

exercises. When a mucus plug obstructs one of the bronchi entirely, the pulmonary tissue beyond the plug collapses, resulting in atelectasis.

To clear secretions and prevent pneumonia, the nurse encourages the patient to turn frequently, take deep breaths, cough, and use the incentive spirometer at least every 2 hours. These pulmonary exercises should begin as soon as the patient arrives on the clinical unit and continue until the patient is discharged. Even if they are not fully awake from anesthesia, the patient can be asked to take several deep breaths. This helps expel residual anesthetic agents, mobilize secretions, and prevent atelectasis. Careful splinting of abdominal or thoracic incision sites helps the patient overcome the fear that the exertion of coughing might open the incision (see Chapter 14, Chart 14-5). Analgesic agents are given to permit more effective coughing, and oxygen is given as prescribed to prevent or relieve hypoxia. To encourage lung expansion, the patient is encouraged to yawn or take sustained maximal inspirations to create a negative intrathoracic pressure of −40 mm Hg and expand lung volume to total capacity. Chest physical therapy may be prescribed if indicated (see Chapter 19).

Coughing is contraindicated in patients who have head injuries or have undergone intracranial surgery (because of the risk for increasing intracranial pressure), as well as in patients who have undergone eye surgery (because of the risk for increasing intraocular pressure) or plastic surgery (because of the risk for increasing tension on delicate tissues).

Early ambulation increases metabolism and pulmonary aeration and, in general, improves all body functions. Assessment for readiness to ambulate as soon as the patient arrives in the PACU provides consistency and increased patient safety (Persico, Miller, Way, et al., 2019). Ambulation occurs as soon as the patient returns to a safe physical state and level of consciousness.

Relieving Pain

Most patients experience some pain after a surgical procedure. Complete absence of pain in the area of the surgical incision may not occur for a few weeks, depending on the site and nature of the surgery, but the intensity of postoperative pain gradually subsides on subsequent days. A comprehensive pain assessment provides the foundation of good pain control and includes obtaining information regarding the location, intensity, and quality (e.g., sharp, shooting) (Odom-Forren, 2018). Many patients are unable to accurately report their level of pain in the postoperative setting due to sedatives and other medications given during surgery. Nurses must be able to accurately assess other indicators such as behavior, vital signs, level of consciousness, and preoperative baseline pain report (see Chapter 9).

The degree and severity of postoperative pain and the patient's tolerance for pain depend on the incision site, the nature of the surgical procedure,

the extent of surgical trauma, the type of anesthesia, and the route of administration.

Intense pain stimulates the stress response, which adversely affects the cardiac and immune systems. When pain impulses are transmitted, both muscle tension and local vasoconstriction increase, further stimulating pain receptors. This increases myocardial demand and oxygen consumption. The hypothalamic stress response also results in an increase in blood viscosity and platelet aggregation, increasing the risk of thrombosis and PE.

In some states, providers may prescribe different medications or dosages to cover various levels of pain. After the medication is delivered, the nurse should periodically assess the patient's level of pain using a validated pain scale.

Opioid Analgesic Medications. Opioid analgesic agents are commonly prescribed for pain and immediate postoperative restlessness. A realistic goal for postoperative pain management is toleration rather than the elimination of pain. A preventive approach, rather than an "as needed" (PRN) approach, is more effective in relieving pain. With a preventive approach, the medication is given at prescribed intervals rather than when the pain becomes severe or unbearable. In the postoperative setting, intravenous (IV) route is the first-line route of administration for analgesia delivery (Odom-Forren, 2018).

Prior to opioid delivery, the nurse should assess the patient's level of sedation. Sedation assessment tools, such as the POSS (Pasero Opioid-Induced Sedation Scale), are used by the nurse to assess sedation level at frequent intervals to safely care for patients in the PACU. The POSS is a tool developed to identify advancing sedation before it is compounded by continued opioid administration and results in clinically significant respiratory depression or apnea. The POSS indicates the nurse may administer opioids to a patient at sedation level S (*sleep, easy to arouse*) if it has been determined that the patient's respiratory status (rate, depth, regularity, and airway patency) is optimal. Patients assigned a sedation level of 1 or 2 may receive opioid administration; however, beginning at sedation level 3, the recommendation is that the nurse should provide nonopioid therapies to treat pain because the patient is becoming too sedated. Other sedation scales commonly used in the PACU are the RASS (Richmond Agitation–Sedation Scale), Aldrete Scale (see Fig. 16-3), and Glasgow Coma Scale (Hall & Stanley, 2019).

Patient-Controlled Analgesia. The goal is pain prevention rather than sporadic pain control. Patients recover more quickly when adequate pain relief measures are used, and patient-controlled analgesia (PCA) permits patients to administer their own pain medication when needed. Most patients are candidates for PCA. The two requirements for PCA are an understanding of the need to self-dose and the physical ability to self-dose.

The amount of medication delivered by the IV or epidural route and the time span during which the opioid medication is released are controlled by the PCA device. PCA promotes patient participation in care; eliminates delayed administration of analgesic medications; maintains a therapeutic drug level; and enables the patient to move, turn, cough, and take deep breaths with less pain, thus reducing postoperative pulmonary complications (Rothrock, 2019).

Multimodal Analgesia. The use of more than one method of analgesia, referred to as multimodal analgesia, is a growing trend to manage postoperative pain. Some of these methods are started in the preoperative area; however, the effects are seen in the postoperative area. The most common analgesics used for postoperative pain are a mixture of opioid and nonopioid analgesics (i.e., acetaminophen and NSAIDs) and local anesthetics. A multimodal approach may combine agents in any of the analgesic groups to provide effective pain relief and minimize adverse effects (Odom-Forren, 2018). A balanced, multimodal approach to pain management within the larger framework of an Enhanced Recovery After Surgery (ERAS) pathway has become standard at many institutions for perioperative care, to control postsurgical pain, reduce opioid-related adverse events, hasten postsurgical recovery, and shorten length of hospital stay (Montgomery & McNamara, 2016). ERAS is an evidence-based, multimodal care model resulting in substantial improvements in clinical outcomes and cost savings (Ljungqvist, Scott, & Fearon, 2017).

Epidural Infusions and Intrapleural Anesthesia. Epidural analgesia involves a continuous infusion of local anesthetics through a catheter and is the most widely used neuraxial technique for acute postoperative pain (Wolfe, 2018). A local opioid or a combination anesthetic (opioid plus local anesthetic agent) is used in the epidural infusion. Epidural infusions are used with caution in chest procedures because the analgesic may ascend along the spinal cord and affect respiration. Intrapleural anesthesia involves the administration of a local anesthetic by a catheter between the parietal and visceral pleura. It provides sensory anesthesia without affecting motor function to the intercostal muscles. This anesthesia allows more effective coughing and deep breathing in conditions such as cholecystectomy, renal surgery, and rib fractures, in which pain in the thoracic region would interfere with these exercises.

Postoperative nurses may also care for patients who received a preoperative local anesthetic block. The intended effects of pain relief may last for hours or up to days, depending on the method used. Nurses should include the location of the block, when it was administered, current pain level, and insertion site assessment when providing report to the inpatient nursing unit. Patient discharge instructions include information about when

to expect the return of sensation, mobility precautions with decreased sensation, and care of the dressing at the insertion site.

Other Pain Relief Measures. For pain that is difficult to control, a subcutaneous pain management system may be used. In this system, a nylon catheter is inserted at the site of the affected area. The catheter is attached to a pump that delivers a continuous amount of local anesthetic at a specific amount determined and prescribed by the primary provider (see Fig. 16-4).

Nonpharmacologic pain management approaches may be used as components of multimodal pain management plans of care. Effective methods include music therapy, guided imagery, Reiki, and therapeutic massage (Poulson, Coto, & Cooney, 2019). Changing the patient's position, using distraction, applying cool washcloths to the face, and providing back massage may be useful in relieving general discomfort temporarily, promoting relaxation, and rendering medication more effective when it is given.

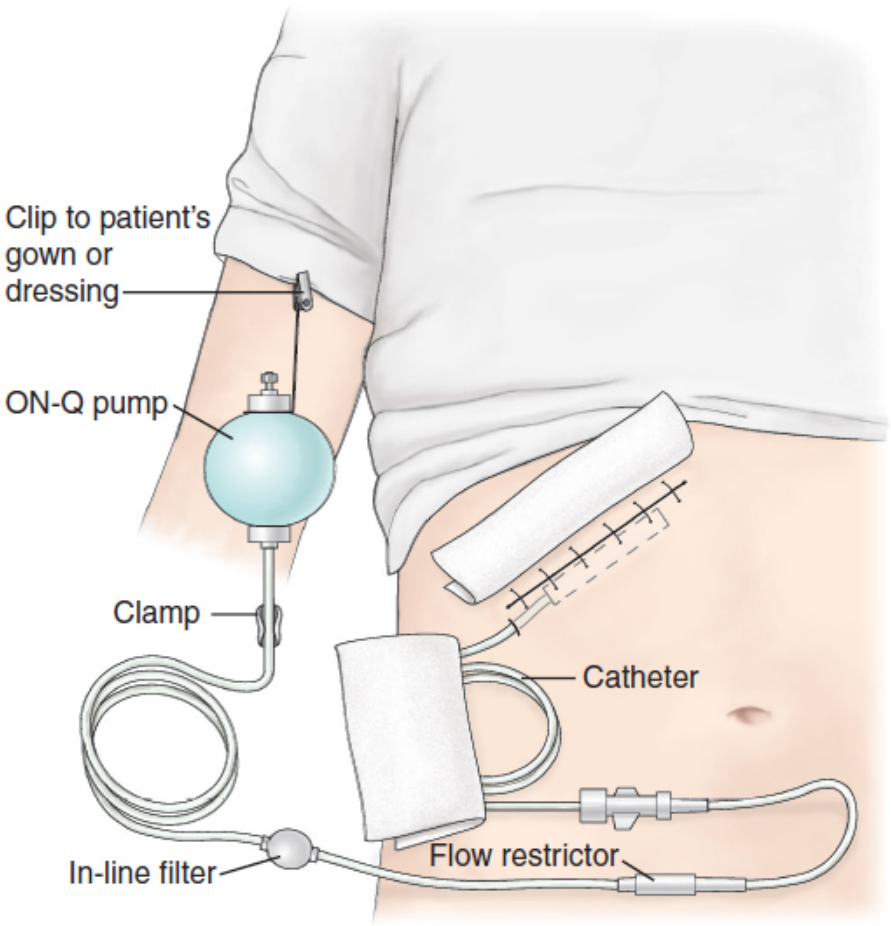


Figure 16-4 • Subcutaneous pain management system consists of a pump, filter, and catheter that delivers a specific amount of prescribed local anesthetic at the rate determined by the physician. Redrawn with permission from Kimberly-Clark Corporation, Neenah, WI.

Promoting Cardiac Output

If signs and symptoms of shock or hemorrhage occur, treatment and nursing care are implemented as described in the discussion of care in the PACU and in Chapter 11.

Although most patients do not hemorrhage or go into shock, changes in circulating volume, the stress of surgery, and the effects of medications and preoperative preparations all affect cardiovascular function. Volume status assessment in the PACU can be difficult because vasoconstriction from surgical stress and hypothermia can compensate for hypovolemia (Odom-Forren, 2018). Close monitoring is indicated to detect and correct conditions such as fluid volume deficit, altered tissue perfusion, and decreased cardiac output, all of which can increase the patient's discomfort, place him or her at risk of complications, and prolong the hospital stay. Consequently, fluid replacement must be carefully managed, and intake and

output records must be accurate. IV fluid replacement may be prescribed for up to 24 hours after surgery or until the patient is stable and tolerating oral fluids.

Nursing management includes assessing the patency of the IV lines and ensuring that the correct fluids are given at the prescribed rate. Intake and output, including emesis and output from wound drainage systems, are recorded separately and totaled to determine fluid balance. If the patient has an indwelling urinary catheter, hourly outputs are monitored and should not be less than 0.5 mL/kg/h or 25 mL/h; oliguria is reported immediately (Odom-Forren, 2018). Electrolyte levels and hemoglobin and hematocrit levels are monitored. Decreased hemoglobin and hematocrit levels can indicate blood loss or dilution of circulating volume by IV fluids. If dilution is contributing to the decreased levels, the hemoglobin and hematocrit will rise as the stress response abates and fluids are mobilized and excreted.

Venous stasis from dehydration, immobility, and pressure on leg veins during surgery put the patient at risk for VTE. Leg exercises and frequent position changes are initiated early in the postoperative period to stimulate circulation. Patients should avoid positions that compromise venous return, such as raising the bed's knee gatch, placing a pillow under the knees, sitting for long periods, and dangling the legs with pressure at the back of the knees. Venous return is promoted by antiembolism stockings and early ambulation.

Encouraging Activity

Early ambulation has a significant effect on recovery and the prevention of complications (e.g., atelectasis, hypostatic pneumonia, gastrointestinal [GI] discomfort, circulatory problems) (Rothrock, 2019). Postoperative activity orders are checked before the patient is assisted to get out of bed, in many instances, on the evening following surgery. Sitting up at the edge of the bed for a few minutes may be all that the patient who has undergone a major surgical procedure can tolerate at first.

Ambulation reduces postoperative abdominal distention by increasing GI tract and abdominal wall tone and stimulating peristalsis. Early ambulation prevents stasis of blood, and thromboembolic events occur less frequently. Pain is often decreased when early ambulation is possible, and the hospital stay is shorter and less costly.

Despite the advantages of early ambulation, patients may be reluctant to get out of bed on the evening of surgery. Reminding them of the importance of early mobility in preventing complications may help patients overcome their fears. When a patient gets out of bed for the first time, orthostatic hypotension, also called *postural hypotension,* is a concern. Orthostatic hypotension is an abnormal drop in blood pressure that occurs as the patient changes from a supine to a standing position. It is common after surgery because of changes in circulating blood volume and bed rest. Signs and

symptoms include a decrease of 20 mm Hg in systolic blood pressure or 10 mm Hg in diastolic blood pressure, weakness, dizziness, and fainting (Weber & Kelley, 2018). Patients may report a sense of dizziness or fainting, along with a marked drop in blood pressure. Older adults are at increased risk for orthostatic hypotension secondary to age-related changes in vascular tone. To detect orthostatic hypotension, the nurse assesses the patient's blood pressure first in the supine position, after the patient sits up, again after the patient stands, and 2 to 3 minutes later. Gradual position change gives the circulatory system time to adjust. If the patient becomes dizzy, they are returned to the supine position, and ambulation is delayed for several hours.

To assist the postoperative patient in getting out of bed for the first time after surgery, the nurse:

- Helps the patient move gradually from the lying position to the sitting position by raising the head of the bed and encourages the patient to splint the incision when applicable.
- Positions the patient completely upright (sitting) and turned so that both legs are hanging over the edge of the bed.
- Helps the patient stand beside the bed.

After becoming accustomed to the upright position, the patient may start to walk. The nurse should be at the patient's side to give physical support and encouragement. Care must be taken not to tire the patient; the extent of the first few periods of ambulation varies with the type of surgical procedure and the patient's physical condition and age.

Whether or not the patient can ambulate early in the postoperative period, bed exercises are encouraged to improve circulation. Bed exercises consist of the following:

- Arm exercises (full range of motion, with specific attention to abduction and external rotation of the shoulder)
- Hand and finger exercises
- Foot exercises to prevent VTE, footdrop, and toe deformities and to aid in maintaining good circulation
- Leg flexion and leg-lifting exercises to prepare the patient for ambulation
- Abdominal and gluteal contraction exercises

Hampered by pain, dressings, IV lines, or drains, many patients cannot engage in activity without assistance. Helping the patient increase the activity level on the first postoperative day is important to prevent complications related to prolonged inactivity. One way to increase the patient's activity is to have the patient perform as much routine hygiene care as possible. Setting up the patient to bathe with a bedside wash basin or, if possible, assisting the patient to the bathroom to sit in a chair at the

sink not only gets the patient moving but helps restore a sense of self-control and prepares the patient for discharge.

For a safe discharge to home, patients need to be able to ambulate a functional distance (e.g., length of the house or apartment), get in and out of bed unassisted, and be independent with toileting. Patients can be asked to perform as much as they can and then to call for assistance. The patient and the nurse can collaborate on a schedule for progressive activity that includes ambulating in the room and hallway and sitting out of bed in a chair. Assessing the patient's vital signs before, during, and after a scheduled activity helps the nurse and patient determine the rate of progression. By providing physical support, the nurse maintains the patient's safety; by communicating a positive attitude about the patient's ability to perform the activity, the nurse promotes the patient's confidence. The nurse encourages the patient to continue to perform bed exercises, wear pneumatic compression or prescribed antiembolism stockings when in bed, and rest as needed. If the patient has had orthopedic surgery of the lower extremities or will require a mobility aid (i.e., walker, crutches) at home, a physical therapist may be involved the first time the patient gets out of bed to educate him or her to ambulate safely or to use the mobility aid correctly.

Caring for Wounds

Wound Healing. Wounds heal by different mechanisms, depending on the condition of the wound.

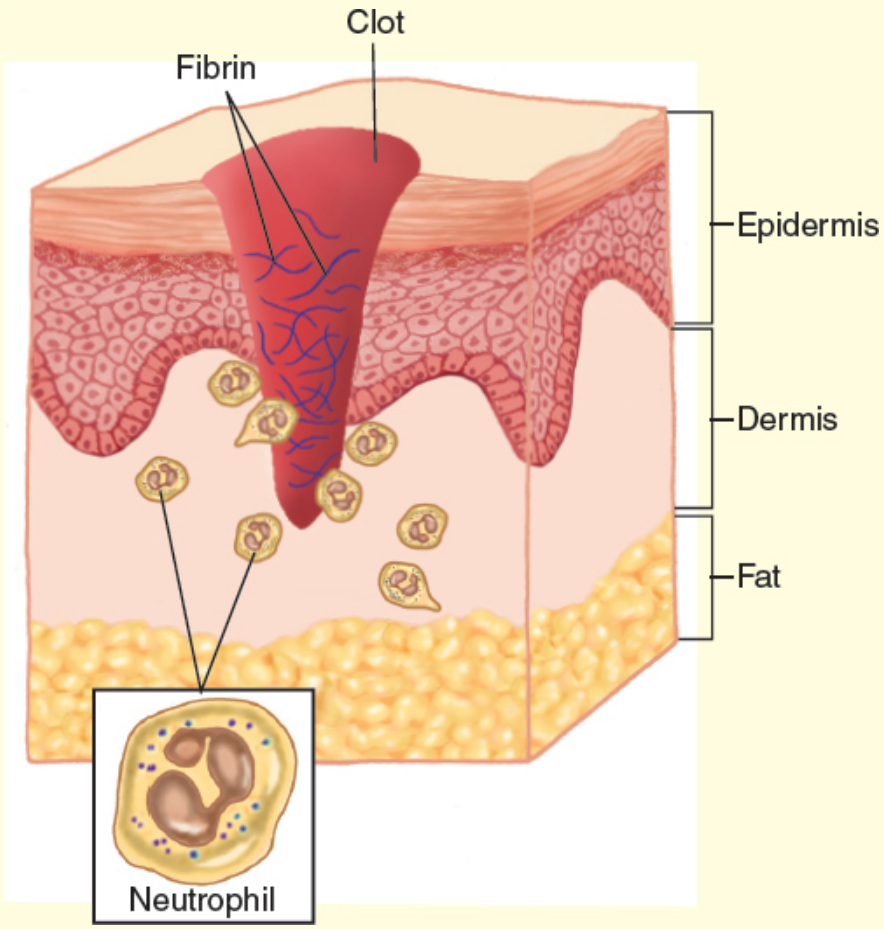
The healing of skin wounds follows three general phases, the inflammatory phase, the proliferative phase, and then wound contraction and remodeling phase. Each of these phases is mediated through cytokines and growth factors (Norris, 2019). See **Chart 16-5** for explanations and illustrations of these three phases.

Surgical wound healing occurs in two ways, by **first-intention or second-intention wound healing** (Norris, 2019). A sutured surgical incision is an example of first-intention healing. A larger wound, such as a burn heals by secondary intention.

Chart 16-5

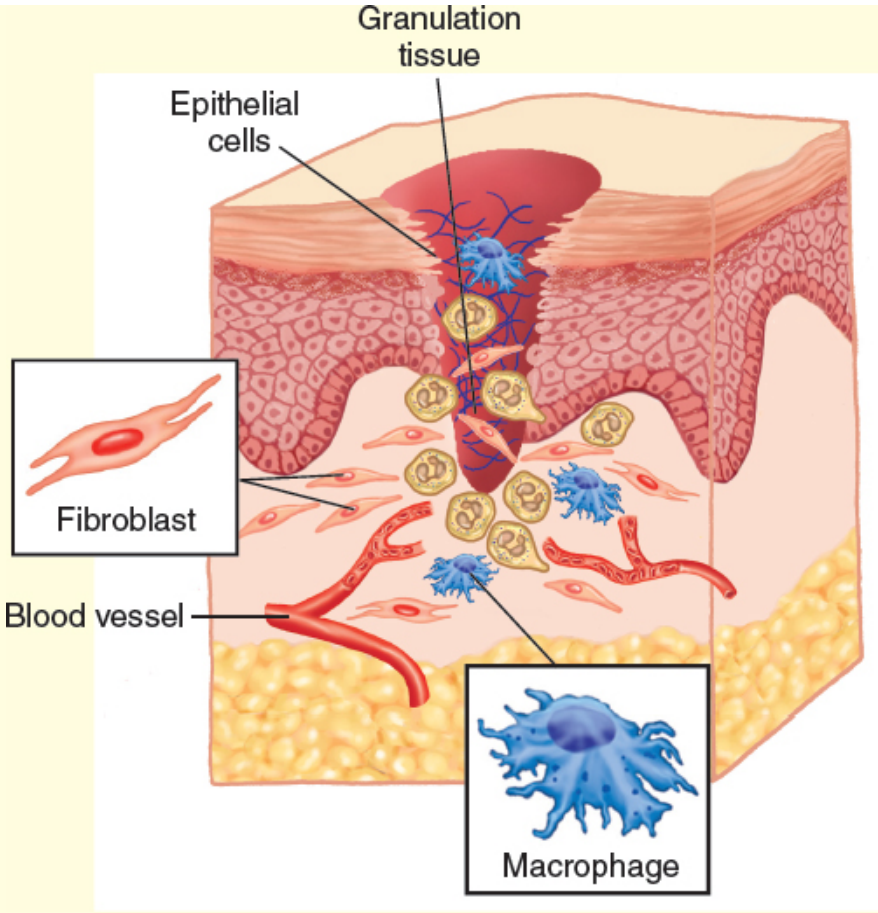
Three Phases of Wound Healing

Inflammatory Phase



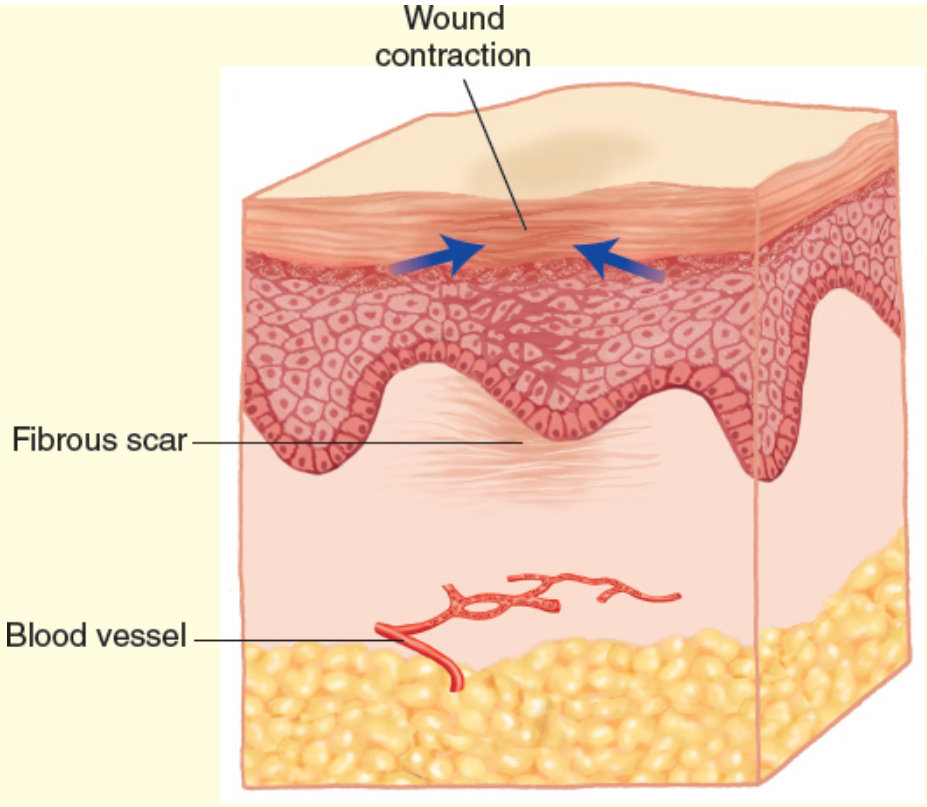
The inflammatory phase begins at the time of injury with the formation of a blood clot and the migration of phagocytic white blood cells into the wound site. The first cells to arrive, the neutrophils, ingest and remove bacteria and cellular debris. After 24 hours, the neutrophils are joined by macrophages, which continue to ingest cellular debris and play an essential role in the production of growth factors for the proliferative phase.

Proliferative Phase



The primary processes during this phase focus on the building of new tissue to fill the wound space. The key cell during this phase is the *fibroblast*, a connective tissue cell that synthesizes and secretes the collagen, proteoglycans, and glycoproteins needed for wound healing. Fibroblasts also produce a family of growth factors that induce angiogenesis (growth of new blood vessels) and endothelial cell proliferation and migration. The final component of the proliferative phase is epithelialization, during which epithelial cells at the wound edges proliferate to form a new surface layer that is similar to that which was destroyed by the injury.

Wound Contraction and Remodeling Phase



This phase begins approximately 3 weeks after injury with the development of the fibrous scar and can continue for 6 months or longer, depending on the extent of the wound. During this phase, there is a decrease in vascularity and continued remodeling of scar tissue by simultaneous synthesis of collagen by fibroblasts and lysis by collagenase enzymes. As a result of these two processes, the architecture of the scar is capable of increasing its tensile strength, and the scar shrinks so it is less visible.

Reprinted with permission from Norris, T. L. (2018). *Porth's pathophysiology: Concepts of altered health states* (10th ed.). Philadelphia, PA: Wolters Kluwer.

With shorter hospital stays, much of the healing takes place at home, and both the hospital and the transitional or home health nurse needs to be well versed in the principles of wound healing.

Ongoing assessment of the surgical site involves inspection for approximation of wound edges, integrity of sutures or staples, redness, discoloration, warmth, swelling, unusual tenderness, or drainage. The area around the wound should also be inspected for a reaction to tape or trauma from tight bandages. Risk factors for altered wound healing include poor nutrition, smoking, diabetes, and poor hygiene (Nasser, Kosty, Shah, et al., 2018; Norris, 2019). Specific nursing assessments and interventions that

address these factors and help promote wound healing are presented in Table 16-3.

TABLE 16-3 Factors Affecting Wound Healing

Factors	Rationale	Nursing Interventions
Age of patient	The older the patient, the less resilient the tissues.	Handle all tissues gently.
Bathing protocol	Use of chlorhexidine gluconate shower and preoperative wipes as a means for antimicrobial skin antisepsis.	Educate patient regarding use and importance. Confirm use with patient in preoperative area.
Hemorrhage	Accumulation of blood creates dead spaces as well as dead cells that must be removed. The area becomes a growth medium for organisms.	Monitor vital signs. Observe incision site for evidence of bleeding and infection.
Hypovolemia	Insufficient blood volume leads to vasoconstriction and reduced oxygen and nutrients available for wound healing.	Monitor for volume deficit (circulatory impairment). Correct by fluid replacement as prescribed.
Temperature Management	Hypothermia causes poor tissue oxygenation and thus poor perfusion needed for wound healing.	Assess the patient's temperature pre-, intra-, and postoperatively. Implement warm blanket or forced air warming measures.
Local Factors		
Edema	Reduces blood supply by exerting increased interstitial pressure on vessels.	Elevate part; apply cool compresses.
Inadequate dressing technique:		
Too small	Permits bacterial invasion and contamination.	Follow guidelines for proper dressing technique.
Too tight	Reduces blood supply carrying nutrients and oxygen.	
Nutritional deficits	Protein–calorie depletion may occur.	Correct deficits; this may require parenteral nutritional therapy.
	Insulin secretion may be inhibited, causing blood glucose to rise.	Monitor blood glucose levels.
		Administer vitamin supplements as prescribed.
Foreign bodies	Foreign bodies retard healing.	Keep wounds free of dressing threads, ensure sterility of implanted items.
Oxygen deficit	Insufficient oxygen may be due to	Encourage deep

(tissue oxygenation insufficient)	inadequate lung and cardiovascular function as well as localized vasoconstriction.	breathing, turning, and controlled coughing.
Drainage accumulation	Accumulated secretions hamper healing process.	Monitor closed drainage systems for proper functioning. Institute measures to remove accumulated secretions.
Medications		
Corticosteroids	May mask presence of infection by impairing normal inflammatory response.	Be aware of action and effect of medications patient is receiving.
Anticoagulants	May cause hemorrhage.	
Broad-spectrum and specific antibiotics	Effective if given immediately before surgery for specific pathology or bacterial contamination. Ineffective if given after wound is closed due to intravascular coagulation at the periphery of the surgical site.	
Patient overactivity	Prevents approximation of wound edges. Resting favors healing.	Use measures to keep wound edges approximated: taping, bandaging, splints. Encourage rest.
Systemic Disorders		
Hemorrhagic shock Acidosis Hypoxia Kidney injury Hepatic disease Sepsis	These depress cell functions that directly affect wound healing.	Be familiar with the nature of the specific disorder. Administer prescribed treatment. Cultures may be indicated to determine appropriate antibiotic.
Immunosuppressed state	Patient is more vulnerable to bacterial and viral invasion; defense mechanisms are impaired.	Provide maximum protection to prevent infection. Restrict visitors with colds; institute mandatory hand hygiene by all staff.
Wound Stressors		
Vomiting Valsalva maneuver Heavy coughing Straining	Produce tension on wounds, particularly of the torso.	Encourage frequent turning and ambulation, and administer antiemetic

	medications as prescribed. Assist patient in splinting incision.

Adapted from Padgette, P., & Wood, B. (2018). Conducting a surgical site infection prevention tracer. *AORN Journal*, *107*(5), 580–590.

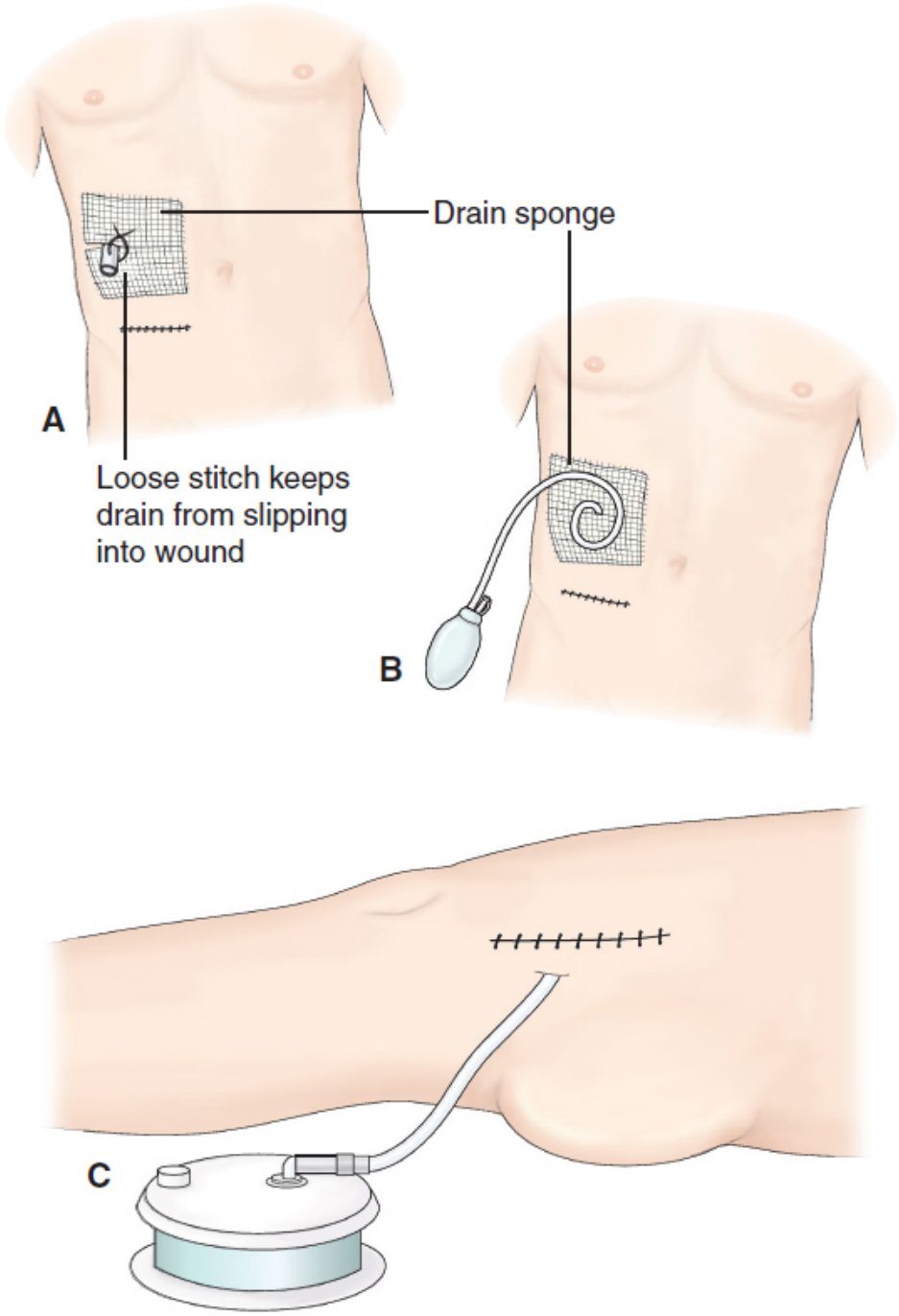


Figure 16-5 • Types of surgical drains: **A.** Penrose. **B.** Jackson–Pratt. **C.** Hemovac.

Caring for Surgical Drains. Nursing interventions to promote wound healing also include management of surgical drains. Drains are tubes that exit the peri-incisional area, either into a portable wound suction device (closed) or into the dressings (open). The principle involved is to allow the escape of fluids that could otherwise serve as a culture medium for bacteria. In portable wound suction, the use of gentle, constant suction enhances drainage of these fluids and collapses the skin flaps against the underlying tissue, thus removing "dead space." Types of wound drains include the Penrose, Jackson-Pratt, and Hemovac drains (see Fig. 16-5). Output (drainage) from wound systems is recorded.

Wound vacuum-assisted closure (VAC) devices are used on open wounds allowed to heal on their own. The wound VAC is a foam dressing that uses negative pressure suction at the wound surface. The vacuum removes debris while promoting granulation tissue growth and blood flow. Wound VACs are placed intraoperatively and the foam dressing is changed periodically as the wound shrinks in size (see Fig. 16-6). The amount, pressure, and color of drainage should be assessed and recorded. Patients should be assessed for pain as nerve endings may grow into the sponge as tissue regrows.

The amount of bloody drainage on the surgical dressing is assessed frequently. Spots of drainage on the dressings are outlined with a pen, and the date and time of the outline are recorded on the dressing so that increased drainage can be easily seen. A certain amount of bloody drainage in a wound drainage system or on the dressing is expected, but excessive amounts should be reported to the surgeon. Increasing amounts of fresh blood on the dressing should be reported immediately. Some wounds are irrigated heavily before closure in the OR, and open drains exiting the wound may be embedded in the dressings. These wounds may drain large amounts of blood-tinged fluid that saturate the dressing. The dressing can be reinforced with sterile gauze bandages; the time at which they were reinforced should be documented. If drainage continues, the surgeon should be notified so that the dressing can be changed. Multiple similar drains are numbered or otherwise labeled (e.g., left lower quadrant, left upper quadrant) so that output measurements can be reliably and consistently recorded.

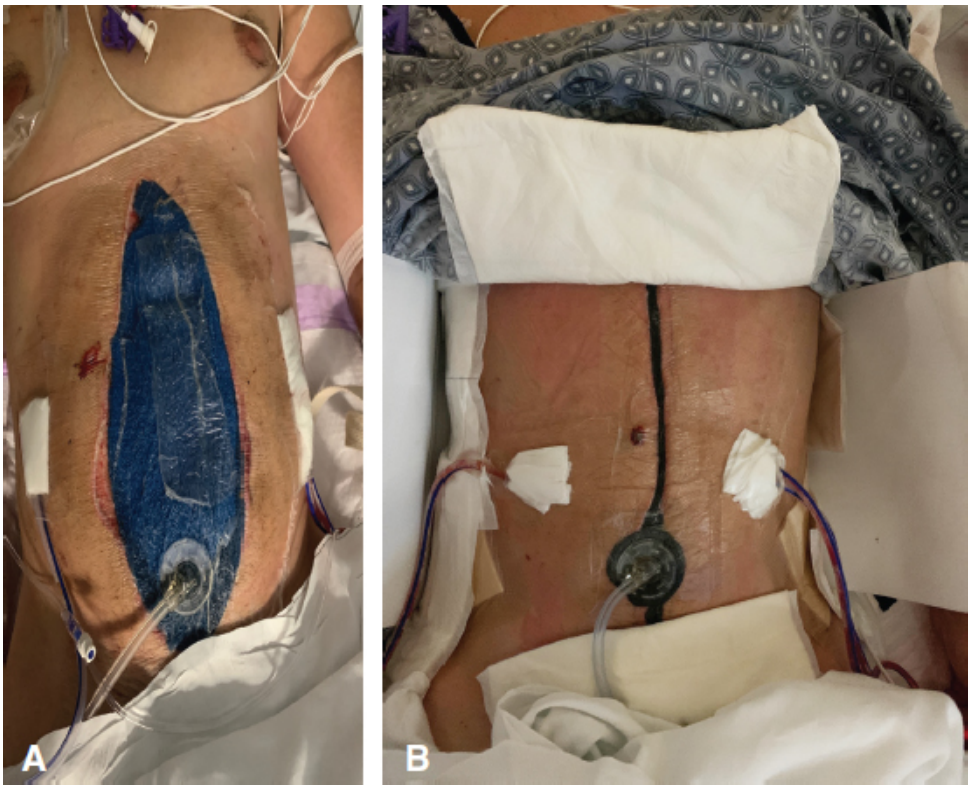


Figure 16-6 • Example of an abdominal wound with a vacuum-assisted closure (VAC). **A.** Abdominal gunshot wound showing VAC following initial laparotomy that allows for swelling. **B.** Abdominal gunshot wound showing VAC following partial closure 3 days later. Photos courtesy of Blaine Thomas.

Changing the Dressing

The surgical dressing is placed in the operating suite by a member of the surgical team. Dressing changes (if needed) in the immediate postoperative period are performed by the nurse. A dressing is applied to a wound for one or more of the following reasons: (1) to provide a proper environment for wound healing; (2) to absorb drainage; (3) to splint or immobilize the wound; (4) to protect the wound and new epithelial tissue from mechanical injury; (5) to protect the wound from bacterial contamination and from soiling by feces, vomitus, and urine; (6) to promote hemostasis, as in a pressure dressing; and (7) to provide mental and physical comfort for the patient.

The patient is told that the dressing is to be changed and that changing the dressing is a simple procedure associated with little discomfort. The dressing change is performed at a suitable time (e.g., not at mealtimes or when visitors are present). Privacy is provided, and the patient is not unduly exposed. Assurance is given that the incision will shrink as it heals and that the redness will fade.

The nurse performs hand hygiene before and after the dressing change and wears disposable gloves (sterile or clean as needed) for the dressing change itself. Most dressing changes following surgery are sterile. In accordance with standard precautions, dressings are never touched by ungloved hands because of the danger of transmitting pathogenic organisms. The tape or adhesive portion of the dressing is removed by pulling it parallel with the skin surface and in the direction of hair growth rather than at right angles. Alcohol wipes or nonirritating solvents aid in removing adhesive painlessly and quickly. The soiled dressing is removed and deposited in a container designated for disposal of biomedical waste.

Gloves are changed, and a new dressing is applied. If the patient is sensitive to adhesive tape, the dressing may be held in place with hypoallergenic tape. Many tapes are porous to prevent skin maceration. Some wounds become edematous after having been dressed, causing considerable tension on the tape. If the tape is not flexible, the stretching bandage will also cause a shear injury to the skin. This can result in denuded areas or large blisters and should be avoided. An elastic adhesive bandage (Elastoplast, 3M Microfoam) may be used to hold dressings in place over mobile areas, such as the neck or the extremities, or where pressure is required.

While changing the dressing, the nurse has an opportunity to educate the patient on how to care for the incision and change the dressings at home. The nurse observes for indicators of the patient's readiness to learn, such as looking at the incision, expressing interest, or assisting in the dressing change. Information on self-care activities and possible signs of infection is summarized in **Chart 16-6.**

Maintaining Normal Body Temperature

The patient is still at risk for malignant hyperthermia and hypothermia in the postoperative period. Efforts are made to identify malignant hyperthermia and to treat it early and promptly (Rothrock, 2019).

Patients who have received anesthesia are susceptible to chills and drafts. Interventions to avoid hypothermia, temperatures below 36°C (98.6°F), begin in the preoperative area (see Chapter 14) and continue throughout the intraoperative period (see Chapter 15). Low body temperature is reported to the primary provider. The room is maintained at a comfortable temperature, and blankets are provided to prevent chilling. Treatment includes oxygen administration, adequate hydration, and proper nutrition including glycemic control. The patient is also monitored for cardiac arrhythmias. The risk of hypothermia is greater in older adults and in patients who were in the cool OR environment for a prolonged period.

Managing Gastrointestinal Function and Resuming Nutrition

Discomfort of the GI tract (nausea, vomiting, and hiccups) and resumption of oral intake are issues for the patient and affect their outcome following surgery. (See the earlier discussion of PONV in the PACU.)

If the risk of vomiting is high due to the nature of surgery, a nasogastric tube is inserted preoperatively and remains in place throughout the surgery and the immediate postoperative period. A nasogastric tube also may be inserted before surgery if postoperative distention is anticipated. In addition, a nasogastric tube may be inserted if a patient who has food in the stomach requires emergency surgery.

Hiccups, produced by intermittent spasms of the diaphragm secondary to irritation of the phrenic nerve, can occur after surgery. The irritation may be direct, such as from stimulation of the nerve by a distended stomach, subdiaphragmatic abscess, or abdominal distention; indirect, such as from toxemia or uremia that stimulates the nerve; or reflexive, such as from irritation from a drainage tube or obstruction of the intestines. These occurrences usually are mild, transitory attacks that cease spontaneously. If hiccups persist, they may produce considerable distress and serious effects, such as vomiting, exhaustion, and wound dehiscence. Chlorpromazine (a phenothiazine) is the only drug approved to treat intractable hiccups (Aroke & Hicks, 2019).

Chart 16-6 PATIENT EDUCATION

Wound Care Instructions

Until Sutures Are Removed

1. Keep the wound dry and clean.
   - If there is no dressing, ask your nurse or physician if you can bathe or shower.
   - If a dressing or splint is in place, do not remove it unless it is wet or soiled.
   - If wet or soiled, change dressing yourself if you have been taught to do so; otherwise, call your nurse or physician for guidance.
   - If you have been taught, instruction might be as follows:
   - Cleanse area *gently* with sterile normal saline once or twice daily.
   - Cover with a sterile Telfa pad™ or gauze square large enough to cover wound.
   - Apply hypoallergenic tape (Dermicel™ or paper). Adhesive is not recommended because it is difficult to remove without possible injury to the incisional site.
2. Immediately report any of these signs of infection:
   - Redness, marked swelling exceeding 0.5 inch (2.5 cm) from incision site; tenderness; or increased warmth around wound
   - Red streaks in skin near wound
   - Pus or discharge, foul odor
   - Chills or temperature higher than 37.7°C (100°F)
3. If soreness or pain causes discomfort, apply a dry cool pack (containing ice or cold water) or take prescribed acetaminophen tablets every 4 to 6 hours. Avoid using aspirin without direction or instruction because bleeding can occur with its use.
4. Swelling after surgery is common. To help reduce swelling, elevate the affected part to the level of the heart.
   - Hand or arm:
   - Sleep—elevate arm on pillow at side
   - Sitting—place arm on pillow on adjacent table
   - Standing—rest affected hand on opposite shoulder; support elbow with unaffected hand
   - Leg or foot:
   - Sitting—place a pillow on a facing chair; provide support underneath the knee
   - Lying—place a pillow under affected leg

After Sutures Are Removed

Although the wound appears to be healed when sutures are removed, it is still tender and will continue to heal and strengthen for several weeks.

- Follow recommendations of physician or nurse regarding extent of activity.
- Keep suture line clean; do not rub vigorously; pat dry. Wound edges may look red and may be slightly raised. This is normal.
- If the site continues to be red, thick, and painful to pressure after 8 weeks, consult the health care provider. (This may be due to excessive collagen formation and should be checked.)

Adapted from American Society of PeriAnesthesia Nurses (ASPAN). (2019). *Perianesthesia nursing standards, practice recommendations and interpretive statements*. Cherry Hill, NJ: Author.

Association of PeriOperative Registered Nurses (AORN). (2019). *Association of PeriOperative Registered Nurses (AORN) standards, recommended practice, and guidelines*. Denver, CO: Author.

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Any condition that is persistent or considered intractable, such as hiccups, should be reported to the primary provider so that appropriate measures can be implemented.

Once PONV has subsided and the patient is fully awake and alert, the sooner they can tolerate a usual diet, the more quickly normal GI function will resume. Taking food by mouth stimulates digestive juices and promotes gastric function and intestinal peristalsis. The return to normal dietary intake should proceed at a pace set by the patient. The nature of the surgery and the type of anesthesia directly affect the rate at which normal gastric activity resumes. Enhanced recovery programs encourage early nutrition as a way to maintain fluid balance, prevent postoperative ileus, and decrease overall length of stay (Persico et al., 2019).

Clear liquids are typically the first substances desired and tolerated by the patient after surgery. Water, juice, and tea may be given in increasing amounts. Cool fluids are tolerated more easily than those that are ice cold or hot. Soft foods (gelatin, custard, milk, and creamed soups) are added gradually after clear fluids have been tolerated. As soon as the patient tolerates soft foods well, solid food may be given.

Assessment and management of GI function are important after surgery because the GI tract is subject to uncomfortable or potentially life-threatening complications. Any postoperative patient may suffer from distention. Postoperative distention of the abdomen results from the accumulation of gas in the intestinal tract. Manipulation of the abdominal

organs during surgery may produce a loss of normal peristalsis for 24 to 48 hours, depending on the type and extent of surgery. Even though nothing is given by mouth, swallowed air and GI tract secretions enter the stomach and intestines; if not propelled by peristalsis, they collect in the intestines, producing distention and causing the patient to complain of fullness or pain in the abdomen. Most often, the gas collects in the colon. Abdominal distention is further increased by immobility, anesthetic agents, and the use of opioid medications.

After major abdominal surgery, distention may be avoided by having the patient turn frequently, exercise, and ambulate as early as possible. This also alleviates distention produced by swallowing air, which is common in anxious patients. A nasogastric tube inserted before surgery may remain in place until full peristaltic activity (indicated by the passage of flatus) has resumed. The nurse detects bowel sounds by listening to the abdomen with a stethoscope. Bowel sounds are documented so that diet progression can occur.

Paralytic ileus and intestinal obstruction are potential postoperative complications that occur more frequently in patients undergoing intestinal or abdominal surgery (see Chapter 41).

Promoting Bowel Function

Constipation can occur after surgery as a minor or a serious complication. Decreased mobility, decreased oral intake, and opioid analgesic medications can contribute to difficulty having a bowel movement. In addition, irritation and trauma to the bowel during surgery may inhibit intestinal movement for several days. The combined effect of early ambulation, improved dietary intake, and a stool softener (if prescribed) promotes bowel elimination. Multimodal analgesia regimens in surgical patients minimize opioid-related adverse effects such as nausea, vomiting, and reduced gastric motility (Wolfe, 2018). The nurse should assess the abdomen for distention and the presence and frequency of bowel sounds. If the patient does not have a bowel movement by the second or third postoperative day, the primary provider should be notified and a laxative or other test or intervention may be needed.

Managing Voiding

The type of procedure, length of case, and patient position may have warranted a catheter being placed in the patient's urinary tract in the OR. In the postoperative period, any urine that was collected using a catheter (indwelling or straight) during the operative procedure should be noted. This information will assist the nurse to anticipate the patient's voiding needs.

Urinary retention after surgery can occur for various reasons. Anesthetics, anticholinergic agents, and opioids interfere with the

perception of bladder fullness and the urge to void and inhibit the ability to initiate voiding and completely empty the bladder. Abdominal, pelvic, and hip surgery may increase the likelihood of retention secondary to pain. In addition, some patients find it difficult to use the bedpan or urinal in the recumbent position.

Bladder distention and the urge to void should be assessed at the time of the patient's arrival at the unit and frequently thereafter. The patient is expected to void within 8 hours after surgery (this includes time spent in the PACU). If the patient has an urge to void and cannot, or if the bladder is distended and no urge is felt or the patient cannot void, catheterization is not delayed solely on the basis of the 8-hour time frame. All methods to encourage the patient to void should be tried (e.g., letting water run, applying heat to the perineum). The bedpan should be warm; a cold bedpan causes discomfort and automatic tightening of muscles (including the urethral sphincter). If the patient cannot void on a bedpan, it may be possible to use a commode or a toilet (if there is one in the PACU). Male patients are often permitted to sit up or stand beside the bed to use the urinal; however, safeguards should be taken to prevent the patient from falling or fainting due to loss of coordination from medications or orthostatic hypotension. If the patient has not voided within the specified time frame, a portable bladder ultrasound is performed to check for urinary retention (see Chapter 47, Fig. 47-8). The patient is catheterized, and the catheter is removed after the bladder has emptied. Straight intermittent catheterization is preferred over indwelling catheterization because the risk of infection is increased with an indwelling catheter.

Even if the patient voids, the bladder may not empty. The nurse notes the amount of urine voided and palpates the suprapubic area for distention or tenderness. Postvoid residual urine may be assessed by using either straight catheterization or a portable bladder ultrasound scanner and is considered diagnostic of urinary retention. Bladder scanning is an effective way to detect urinary retention in patients who have had general and regional anesthesia. Research suggests that frequent bladder scanning decreases incontinence as retention is detected early and treated before an incontinent episode (Wishart, 2019).

Maintaining a Safe Environment

During the immediate postoperative period, the patient recovering from anesthesia should have two side rails up, and the bed should be in the low position. The nurse assesses the patient's level of consciousness and orientation and determines whether the patient can resume wearing assistive devices as needed (e.g., eyeglasses, hearing aid). Impaired vision, inability to hear postoperative instructions, or inability to communicate verbally places the patient at risk for injury. All objects the patient may need should be within reach, especially the call light. Any immediate

postoperative prescribed therapies concerning special positioning, equipment, or interventions should be implemented as soon as possible. The patient is instructed to ask for assistance with any activity. Although restraints are occasionally necessary for a patient who is disoriented, they should be avoided if at all possible (see Chapter 1 for further discussion on use of restraints). Agency policy on the use of restraints must be consulted and followed.

Any surgical procedure has the potential for injury due to disrupted neurovascular integrity resulting from prolonged awkward positioning in the OR, manipulation of tissues, inadvertent severing of nerves or blood vessels, or tight bandages. Any orthopedic or neurologic surgery or surgery involving the extremities carries a risk of peripheral nerve damage. Vascular surgeries, such as replacement of sections of diseased peripheral arteries or insertion of an arteriovenous graft, put the patient at risk for thrombus formation at the surgical site and subsequent ischemia of tissues distal to the thrombus. Assessment includes having the patient move the hand or foot distal to the surgical site through a full range of motion, assessing all surfaces for intact sensation, and assessing peripheral pulses (Rothrock, 2019).

Providing Emotional Support to the Patient and Family

Although patients and families are undoubtedly relieved that surgery is over, stress and anxiety levels may remain high in the immediate postoperative period. Many factors contribute to this stress and anxiety, including pain, being in an unfamiliar environment, inability to control one's circumstances or care for oneself, fear of the long-term effects of surgery, fear of complications, fatigue, spiritual distress, altered role responsibilities, ineffective coping, and altered body image, and all are potential reactions to the surgical experience. The nurse helps the patient and family work through their stress and anxieties by providing reassurance and information and by spending time listening to and addressing their concerns. The nurse describes hospital routines and what to expect in the time until discharge and explains the purpose of nursing assessments and interventions. Informing patients when they will be able to drink fluids or eat, when they will be getting out of bed, and when tubes and drains will be removed helps them gain a sense of control and participation in recovery and engages them in the plan of care. Acknowledging family members' concerns and accepting and encouraging their participation in the patient's care assist them in feeling that they are helping their loved one. The nurse can modify the environment to enhance rest and relaxation by providing privacy, reducing noise, adjusting lighting, providing enough seating for family members, and encouraging a supportive atmosphere.

TABLE 16-4 Select Postoperative Complications

Body System/Type	Complications
Respiratory	Atelectasis, pneumonia, pulmonary embolism, aspiration
Cardiovascular	Shock, thrombophlebitis, DVT, pulmonary embolism
Neurologic	Delirium, stroke
Skin/Wound	Breakdown, infection, dehiscence, evisceration, delayed healing, hemorrhage, hematoma
Gastrointestinal	Constipation, paralytic ileus, bowel obstruction
Urinary	Acute urine retention, urinary tract infection
Functional	Weakness, fatigue, functional decline

DVT, deep vein thrombosis.

Managing Potential Complications

The postoperative patient is at risk for complications as outlined next and summarized in Table 16-4.

Venous Thromboembolism. Serious potential VTE complications of surgery include DVT and PE (Rothrock, 2019).

Prevention of DVT and PE development includes pharmacologic prophylaxis (e.g., subcutaneous heparin) (Odom-Forren, 2018). External pneumatic compression and antiembolism stockings can be used alone or in combination with low-dose heparin. The stress response that is initiated by surgery inhibits the thrombolytic (fibrinolytic) system, resulting in blood hypercoagulability. Dehydration, low cardiac output, blood pooling in the extremities, and bed rest add to the risk of thrombosis formation. Although all postoperative patients are at some risk, factors such as a history of thrombosis, malignancy, trauma, obesity, indwelling venous catheters, and hormone use (e.g., estrogen) increase the risk. The first symptom of DVT may be a pain or cramp in the calf, although many patients are asymptomatic. Other signs and symptoms include tachypnea, chest pain, hemoptysis, shortness of breath, and a sense of impending doom (Odom-Forren, 2018).

The benefits of early ambulation and leg exercises in preventing DVT cannot be overemphasized, and these activities are recommended for all patients, regardless of their risk. It is important to avoid the use of blanket rolls, pillow rolls, or any form of elevation that can constrict vessels under the knees. Even prolonged "dangling" (having the patient sit on the edge of the bed with legs hanging over the side) can be dangerous and is not recommended in susceptible patients because pressure under the knees can impede circulation. Adequate hydration is also encouraged; the patient can be offered juices and water throughout the day to avoid dehydration. (Refer to Chapter 26 for discussion of DVT and PE.)

Hematoma. At times, concealed bleeding occurs beneath the skin at the surgical site. This hemorrhage usually stops spontaneously but results in clot (hematoma) formation within the wound. If the clot is small, it will be absorbed and need not be treated. If the clot is large, the wound usually bulges somewhat, and healing will be delayed unless the clot is removed. Evacuation of the clot requires surgery where several sutures are removed by the surgeon, the clot is evacuated, and the wound is packed lightly with gauze. Healing occurs usually by granulation, or a secondary closure may be performed.

Infection (Wound Sepsis). The creation of a surgical wound disrupts the integrity of the skin, bypassing the body's primary defense and protection against infection. Exposure of deep body tissues to pathogens in the environment places the patient at risk for infection of the surgical site, and a potentially life-threatening complication such as infection can increase the length of hospital stay, costs of care, and risk of further complications.

Joint Commission–approved hospitals measure surgical site infections (SSIs) for the first 30 or 90 days following surgical procedures based on national standards. Reduction of SSIs remains an important National Patient Safety Goal (see Chapter 14, Chart 14-7) (Joint Commission, 2019).

Multiple factors, including the type of wound, place the patient at potential risk for infection. Surgical wounds are classified according to the degree of contamination. Table 16-5 defines the classification of surgical wounds and SSI rates per category. Patient-related factors include age, nutritional status, diabetes, smoking, obesity, remote infections, endogenous mucosal microorganisms, altered immune response, length of preoperative stay, and severity of illness (Rothrock, 2019). Factors related to the surgical procedure are proper ventilation in the surgical space, aseptic technique of personnel, sterile instrument use, and overall room cleanliness (Armellino, 2017). The focus of infection prevention has transitioned from controlling infections to preventing their occurrence. Prevention efforts include skin antisepsis, preoperative bathing, hair removal, antimicrobial prophylaxis, and patient temperature management (Padgette & Wood, 2018). (Preoperative and intraoperative risks and interventions are discussed in Chapters 14 and 15.) Postoperative care of the wound centers on assessing the wound, preventing contamination and infection before wound edges have sealed, and enhancing healing.

Signs and symptoms of wound infection include increased pulse rate and temperature; an elevated white blood cell count; wound swelling, warmth, tenderness, or discharge; and increased incisional pain. Local signs may be absent if the infection is deep. *Staphylococcus aureus* accounts for many postoperative wound infections. Other infections may result from *Escherichia coli, Proteus vulgaris, Aerobacter aerogenes, Pseudomonas aeruginosa,* and other organisms. Although they are rare, beta-hemolytic

streptococcal or clostridial infections can be rapid and deadly and need strict infection control practices to prevent the spread of infection to others. Intensive medical and nursing care is essential if the patient is to survive (Ackley & Ladwig, 2017).

When a wound infection is diagnosed in a surgical incision, the surgeon may remove one or more sutures or staples and, using aseptic precautions, separate the wound edges with a pair of blunt scissors or a hemostat. Once the incision is opened, a drain may be inserted. If the infection is deep, an incision and drainage procedure may be necessary. Antimicrobial therapy and a wound care regimen are also initiated.

Wound Dehiscence and Evisceration. Wound **dehiscence** (disruption of surgical incision or wound) and **evisceration** (protrusion of wound contents) are serious surgical complications (see Fig. 16-7). Dehiscence and evisceration are especially serious when they involve abdominal incisions or wounds. These complications result from sutures giving way, from infection, or, more frequently, from marked distention or strenuous cough. They may also occur because of increasing age, anemia, poor nutritional status, obesity, malignancy, diabetes, the use of steroids, and other factors in patients undergoing abdominal surgery.

TABLE 16-5 Wound Classification and Associated Surgical Site Infection Risk

Surgical Category	Determinants of Category	Expected Risk of Postsurgical Infection (%)
Clean	Nontraumatic site Uninfected site No inflammation No break in aseptic technique No entry into respiratory, alimentary, genitourinary, or oropharyngeal tracts	1–3
Clean contaminated	Entry into respiratory, alimentary, genitourinary, or oropharyngeal tracts without unusual contamination Appendectomy Minor break in aseptic technique Mechanical drainage	3–7
Contaminated	Open, newly experienced traumatic wounds Gross spillage from gastrointestinal tract Major break in aseptic technique Entry into genitourinary or biliary tract when urine or bile is infected	7–16
Dirty	Traumatic wound with delayed repair, devitalized tissue, foreign bodies, or fecal contamination Acute inflammation and purulent drainage encountered during procedure	16–29

Adapted from Edmiston, C. E., Jr., & Spencer, M. (2014). Patient care interventions to help reduce the risk of surgical site infections. *AORN Journal*, *100*(6), 590–602.

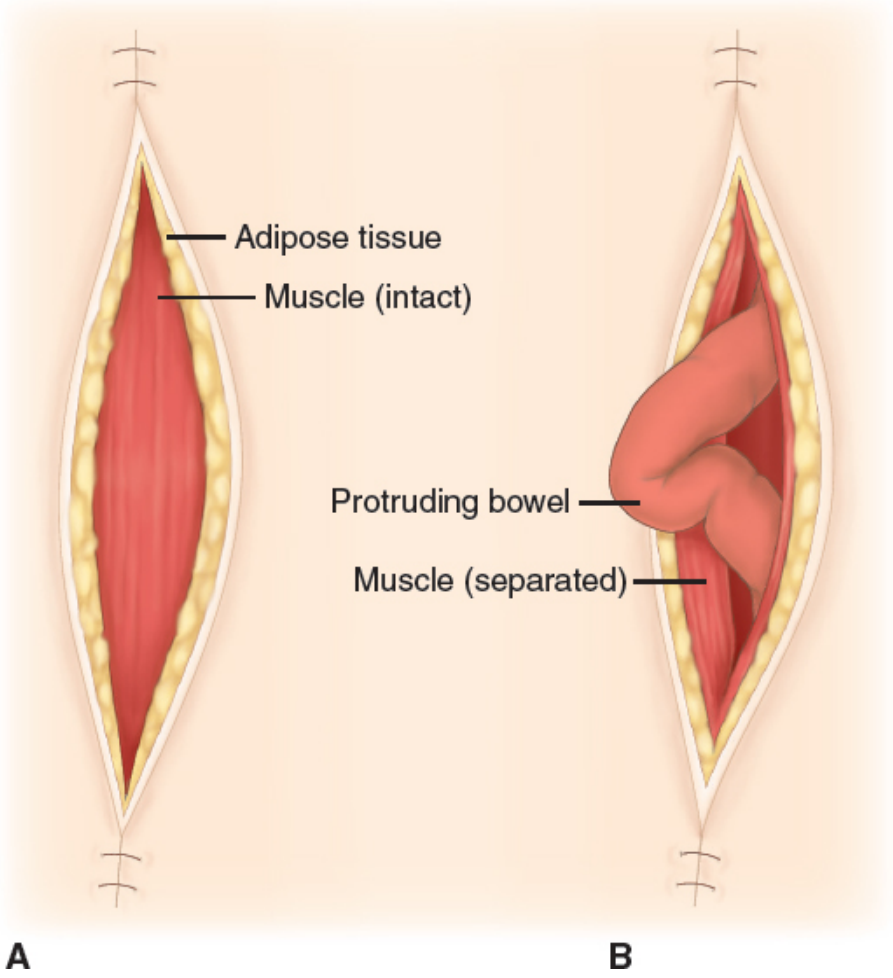

Figure 16-7 • **A.** Wound dehiscence. **B.** Wound evisceration.

When the wound edges separate slowly, the intestines may protrude gradually or not at all, and the earliest sign may be a gush of bloody (serosanguineous) peritoneal fluid from the wound. When a wound ruptures suddenly, coils of intestine may push out of the abdomen. The patient may report that "something gave way." The evisceration causes pain and may be associated with vomiting.

Quality and Safety Nursing Alert

If disruption of a wound occurs, the patient is placed in the low Fowler position and instructed to lie as still as possible. These actions minimize protrusion of body tissues. The protruding coils of intestine are covered with sterile dressings moistened with sterile saline solution, and the surgeon is notified at once.

An abdominal binder can provide support and guard against dehiscence and may be used along with the primary dressing, especially in patients with weak or pendulous abdominal walls or when rupture of a wound has occurred.

Gerontologic Considerations. Older patients recover more slowly, have longer hospital stays, and are at greater risk for development of postoperative complications. Cardiovascular, respiratory, renal, hepatic, thermoregulatory, sensory, and cognition problems unique to the older adult can cause complications throughout the recovery phase (Odom-Forren, 2018). Expert nursing care can help the older adult avoid these complications or minimize their effects (Rothrock, 2019).

Potential causes of postoperative delirium are multifactorial (see Chart 16-7). Skilled and frequent assessment of mental status and of all physiologic factors helps the nurse plan care because delirium may be the initial or only indicator of infection, fluid and electrolyte imbalance, or deterioration of respiratory or hemodynamic status in the older adult patient. Factors that determine whether a patient is at risk for delirium include age, history of alcohol abuse, preoperative cognitive function, physical function, serum chemistries, and type of surgery.

Chart 16-7

Potential Causes of Postoperative Delirium

- Acid–base disturbances
- Acute myocardial infarction
- Age >80 years
- Alcohol withdrawal
- Blood loss
- Cerebral hypoxia
- Decreased cardiac output
- Dehydration
- Emergent surgery
- Fecal impaction
- Fluid and electrolyte imbalance
- Heart failure
- High stress or anxiety levels
- History of dementia like symptoms
- Hypercarbia
- Hypothermia or hyperthermia
- Hypoxia
- Infection (urinary tract, wound, respiratory)
- Medications (anticholinergics, benzodiazepines, central nervous system depressants)
- Polypharmacy
- Presence of multiple diseases
- Sensory impairments
- Unfamiliar surroundings and sensory deprivation
- Unrelieved pain
- Urinary retention

Recognizing postoperative delirium and identifying and treating its underlying cause are the goals of care. Postoperative delirium is sometimes mistaken for preexisting dementia or is attributed to age. In addition to monitoring and managing identifiable causes, the nurse implements supportive interventions. Keeping the patient in a well-lit room and in close proximity to staff can reduce sensory deprivation. At the same time, distracting and unfamiliar noises should be minimized. Because pain can contribute to postoperative delirium, adequate pain control without oversedation is essential (Rothrock, 2019).

The patient is reoriented as often as necessary, and staff should introduce themselves each time they come in contact with the patient. Engaging the patient in conversation and care activities and placing a clock and calendar nearby may improve cognitive function. Physical activity should not be

neglected while the patient is confused because physical deterioration can worsen delirium and place the patient at increased risk for other complications. Restraints should be avoided because they can worsen confusion. A staff member is asked to stay with the patient instead. Medications may be given during episodes of acute confusion but should be discontinued as soon as possible to avoid side effects.

Other problems confronting the older postoperative patient, such as pneumonia, altered bowel function, DVT, weakness, and functional decline, often can be prevented by early and progressive ambulation. Prolonged sitting positions are avoided as they promote venous stasis in the lower extremities. A physical therapy referral may be indicated to promote safe, regular exercise for the older adult.

Urinary incontinence can be prevented by providing easy access to the call bell and the commode and by prompting voiding. Early ambulation and familiarity with the room help the patient become self-sufficient sooner.

Optimal nutrition can help promote wound healing and anesthesia recovery. The nurse and patient can consult with the dietitian to plan appealing, high-protein meals that provide sufficient fiber, calories, and vitamins. Nutritional supplements, such as Ensure™ or Sustacal™, may be recommended. Multivitamins, iron, and vitamin C supplements may be prescribed to aid in tissue healing, formation of new red blood cells, and overall nutritional status.

In addition to monitoring and managing physiologic recovery of the older adult, the nurse identifies and addresses psychosocial needs. The older adult may require much encouragement and support to resume activities, and the pace may be slow. Sensory deficits may require frequent repetition of instructions, and decreased physiologic reserve may necessitate frequent rest periods. The older adult may require extensive discharge planning to coordinate both professional and family care providers, and the nurse, social worker, or case management resource may institute the plan for continuing and transitional care.

Promoting Home, Community-Based, and Transitional Care

Educating Patients About Self-Care. Patient education is critical during postoperative care and includes what can be expected at every stage of the surgical process, including after discharge. It is important for nurses to assess patients preoperatively, especially outpatients, to determine their ability to manage at home and begin educating them about managing any postoperative wound care, drains, or other daily care needs (Lahr & Elliot, 2018). Although needs are specific to individual patients and the procedures they have undergone, general patient education needs prior to discharge have been identified (see Chart 16-3).

Continuing and Transitional Care. Community-based and transitional care services are frequently necessary after surgery. Older patients, patients who live alone, patients without family support, and patients with preexisting chronic illness or disabilities are often in greatest need. Planning for discharge involves arranging for necessary services early in the acute care hospitalization for wound care, drain management, catheter care, infusion therapy, and physical or occupational therapy. The home, community-based, or transitional care nurse coordinates these activities and services.

During home visits, the nurse assesses the patient for postoperative complications by assessment of the surgical incision, respiratory and cardiovascular status, adequacy of pain management, fluid and nutritional status, and the patient's progress in returning to preoperative status. The nurse evaluates the patient's ability to administer prescribed medications, manage dressing changes, drainage systems and other devices. The nurse may change dressings or catheters if needed. The nurse identifies any additional services that are needed and assists the patient and family to arrange for them. Previous education is reinforced, and the patient is reminded to keep follow-up appointments. The patient and family are educated about signs and symptoms to be reported to the surgeon. In addition, the nurse provides information about how to obtain needed supplies and suggests resources or support groups.

Evaluation

Expected patient outcomes may include the following:

1. Maintains optimal respiratory function
    a. Performs deep-breathing exercises
    b. Displays clear breath sounds
    c. Uses incentive spirometer as prescribed
    d. Splints incisional site when coughing to reduce pain
2. Indicates that pain is decreased in intensity
3. Increases activity as prescribed
    a. Alternates periods of rest and activity
    b. Progressively increases ambulation
    c. Resumes normal activities within the prescribed time frame
    d. Performs activities related to self-care
4. Wound heals without complication
5. Maintains body temperature within normal limits
6. Resumes oral intake
    a. Reports absence of nausea and vomiting
    b. Eats at least 75% of usual diet

c. Is free of abdominal distress and gas pains
d. Exhibits normal bowel sounds

7. Reports resumption of usual bowel elimination pattern
8. Resumes usual voiding pattern
9. Is free of injury
10. Exhibits decreased anxiety
11. Acquires knowledge and skills necessary to manage regimen after discharge
12. Experiences no complications

CRITICAL THINKING EXERCISES

1 ipc A 38-year-old woman is admitted to the PACU following open abdominal surgery for excision of a benign tumor and lysis of adhesions. The patient has been a smoker for many years and begins coughing as soon as she is transferred from the OR stretcher to the bed in PACU. How will you, as the nurse receiving this patient, facilitate an interprofessional discussion to improve her care and increase her chance of a good surgical outcome? What information is essential to obtain from the OR team during handoff report?

2 pq A 60-year-old man with obesity and a history of diabetes is admitted to the PACU following a right shoulder repair. He received multimodal analgesia, including a peripheral nerve block, and is scheduled to be discharged home. Identify the essential information you would need reported from the OR team. What are your immediate priorities in delivering care to this patient? He is transferred to Phase II PACU. What are your priorities for discharge instructions and education for this patient?

3 ebp An 80-year-old man has had a right total knee replacement. The anesthesia given was a spinal anesthetic. What signs and symptoms might he exhibit as he awakens from the surgery? As the PACU nurse, what complications should you observe for as he recovers? Describe an evidence-based nursing care plan for the patient during his hospital stay.

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*Asterisk indicates nursing research.
**Double asterisk indicates classic reference.

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Resources

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American Society of PeriAnesthesia Nurses (ASPAN), www.aspan.org
Association of PeriOperative Registered Nurses (AORN), www.aorn.org
Malignant Hyperthermia Association of the United States (MHAUS), www.mhaus.org