

Recommended Practices for Positioning the Patient in the Perioperative Practice Setting

The following recommended practices for positioning the patient in the perioperative practice setting were developed by the AORN Recommended Practices Committee and have been approved by the AORN Board of Directors. They were presented as proposed recommendations for comments by members and others. They are effective January 1, 2008.

These recommended practices are intended as achievable recommendations representing what is believed to be an optimal level of practice. Policies and procedures will reflect variations in practice settings and/or clinical situations that determine the degree to which the recommended practices can be implemented.

AORN recognizes the various settings in which perioperative registered nurses practice. These recommended practices are intended as guidelines adaptable to various practice settings. These practice settings include traditional operating rooms, ambulatory surgery centers, physicians' offices, cardiac catheterization laboratories, endoscopy suites, radiology departments, and all other areas where surgery may be performed.

References to nursing interventions (I) used in the Perioperative Nursing Data Set (PNDS) are noted in parentheses when a recommended practice corresponds to a PNDS intervention.¹ The reader is referred to the PNDS for further explanation of nursing diagnoses, interventions, and outcomes.

Purpose

These recommended practices provide guidelines for positioning the patient in the perioperative setting. They are not intended to cover aspects of perioperative patient care addressed in other recommended practices. Prevention of positioning injury requires anticipation of the positioning equipment necessary based on the patient's identified needs and the planned operative or invasive procedure, application of the principles of body mechanics and ergonomics, ongoing assessment throughout the perioperative period, and coordination with the entire perioperative team.¹ Attention should be given to patient comfort and safety, as well as to assessing circulatory, respiratory, integumentary, musculoskeletal, and neurological structures. Working as a member of the team, the perioperative registered nurse can minimize the risk of perioperative complications related to positioning.

Recommendation I

Personnel who purchase positioning equipment should make decisions based on the health care organization's patient population, current research findings, and the equipment design safety features required to minimize risks to patients and personnel.

The technology used to create mattresses, padding, and other positioning equipment continues to evolve, and it is important for perioperative registered nurses to be aware of products and current research to support their product selection.

The primary safety feature consideration for positioning equipment is that it redistribute pressure, especially at bony prominences on the patient's body. The National Pressure Ulcer Advisory Panel Support Surface Standards Initiative defines a support surface as "a specialized device for pressure redistribution designed for management of tissue loads, micro-climate, and/or other therapeutic functions (ie, any mattresses, integrated bed system, mattress replacement, overlay, or seat cushion, or seat cushion overlay)."²

Although physiologic blood and lymphatic flow rates vary among individuals, capillary pressures may increase to as much as 150 mm Hg during prolonged, unrelieved pressure without position change.³

The traditional procedure bed mattress usually is constructed of one to two inches of foam covered with a vinyl or nylon fabric. Research studies have found that foam overlays or replacement pads, which represent most OR and procedure bed mattresses, do not have effective pressure-reduction capabilities.⁴ Studies comparing the pressure-reducing abilities of standard foam procedure bed mattresses to gel mattresses (ie, visco-elastic polymer) have found gel mattresses to be more effective.^{4,5} One research study reported that polyether mattresses generate a lower capillary interface pressure when the patient was in the supine position than gel mattresses or foam mattresses.⁶ Another study found that foam and gel mattresses are effective for preventing skin changes, but visco-elastic overlays are effective for preventing both skin changes and pressure sore formation.⁷

Clinical support surfaces (ie, padding) function differently for persons of different height and weight.⁸ A performance improvement study reported that supplemental padding on the procedure bed mattress or the use of other positioning

devices may not reduce capillary interface pressure for all body types or for all areas of bony prominences even in patients with the same body type.⁹

Postoperative use of alternating pressure mattresses has been found to minimize the incidence of pressure ulcers. Intraoperative use of this technology may be limited due to concerns about patient movement, electrical safety, and asepsis.³

There are studies reporting a reduction in the postoperative incidence of pressure ulcers when pressure-relieving overlays are used on procedure bed mattresses and in the postoperative period; however, use of mattress overlays intraoperatively may not minimize this risk.¹⁰ It is difficult, therefore, to draw firm conclusions about the most effective means of intraoperative pressure relief. Future studies of pressure-relieving surfaces are needed and must address methodological deficiencies associated with many of the available studies. Examples of current study limitations include the following:

- ◆ Trials that do not clearly reflect whether a reduction in risk for skin changes is due to intraoperative or postoperative pressure relief or whether application of the trial is necessary in both settings to achieve a risk reduction.¹⁰
- ◆ Studies that do not include information gathered on the postoperative skin care of the patient make it difficult to assess the clinical significance of the studies' findings.¹⁰
- ◆ Cross comparisons of study results often are not effective because of variations of selection criteria. In addition, limited sample sizes, interrater reliability, and contradictory findings further contribute to weak scientific support for recommendations on how to predict and prevent pressure ulcers resulting from intraoperative procedure bed mattresses.¹¹
- ◆ Studies that measure only interface pressure (ie, the pressure on different parts of the patient's body that are in contact with the support surface) have serious limitations. The process that leads to the development of a pressure ulcer involves the complex interplay of several factors.¹⁰

The most frequent predictors of perioperative pressure ulcers have been found to be

- ◆ increasing age of the patient,
- ◆ a patient diagnosed with diabetes or vascular disease, and
- ◆ vascular procedures.¹¹

I.a. Personnel selecting procedure bed mattresses and positioning equipment for purchase and use should make decisions based on criteria that include, but are not limited to,

- ability to hold the patient in the desired position;
- available in a variety of sizes and shapes;
- suitable for the patient population and anticipated position requirements;
- ability to support maximum weight requirements;
- durable material and design (eg, maintains resilience under constant use);
- evidence that it is able to disperse skin interface pressure;
- resistance to moisture;
- low risk for moisture retention;
- radiolucent, if necessary;
- fire retardant;
- nonallergenic;
- promotes air circulation;
- low risk of harboring bacteria (eg, replacements may be needed when soiled);
- easy to use and store; and
- cost effective.^{3,4,7,12}

One study found the viscoelastic mattress overlay appears to offer the most benefit for older patient populations; patients who have more serious or chronic health problems, where there is a prevalence of vascular disease; or in situations where surgical procedures extend beyond two-and-one-half hours.⁷

I.a.1. Positioning equipment for obese patients should include, but is not limited to,

- lateral transfer devices or patient lifts to move obese patients from stretcher procedure bed to the OR procedure bed;¹³ and
- stretchers and beds in the postanesthesia care unit (PACU) that are able to accommodate at least a 30-degree elevation of the patient's upper body and head to avoid respiratory distress.

Whether or not a facility has a bariatric surgery program, it is necessary to accommodate the unique needs of the obese patient population. Patient demographics, baseline utilization requirements, and peak census requirements may help to

determine whether caseloads justify purchasing rather than leasing special bariatric equipment. Upgrading existing equipment with bariatric accessories may be a viable option rather than replacing equipment in its entirety.¹⁴

- I.a.2. The manufacturer should be consulted for both weight capacity and articulation abilities of the procedure bed.

Many procedure beds are designed to safely support a 500-pound patient, but maximum weight for special functioning capabilities is an important consideration. Heavy-duty procedure beds are available that lift, articulate, and support patients weighing 800 to 1000 lbs.¹⁵

- I.b. Procedure bed mattresses and positioning equipment should be evaluated according AORN's "Recommended practices for product selection in the perioperative practice setting."¹⁶

Recommendation II

During the planning phase of patient care, the perioperative registered nurse should anticipate the positioning equipment needed for the specific operative or invasive procedure.

The patient's position should provide optimum exposure for the procedure while providing access to IV lines and monitoring devices. The nurse determines the equipment to be used based on the planned procedure, surgeon's preference, and patient condition. Assessment of surgical case characteristics (eg, procedure length, surgical approach, use of radiological equipment) helps determine positioning equipment and modifications in positioning needed to safely accommodate a patient's physical needs.

- II.a. The perioperative registered nurse should review the surgery schedule before the patient's arrival, preferably before the day of surgery, to identify potential conflicts in availability of positioning equipment. (PNDS: I85, I30, I138)

Compromises in patient safety may result when proper equipment is not available.

- II.a.1. When a procedure is scheduled, the availability of special equipment should be verified.

- II.b. The perioperative registered nurse should confirm that the room is set up appropriately for the planned procedure before the patient arrives. (PNDS: I85, I30, I138)

Compromises in patient safety may result when the room arrangement is not specific to the planned procedure and its laterality.¹⁷

- II.b.1. The correct patient position and related equipment should be verified during the time out period.¹⁸

Recommendation III

Positioning and transporting equipment should be periodically inspected and maintained in properly functioning condition.

Properly functioning equipment contributes to patient safety and assists in providing adequate exposure of the surgical site. Patients and health care workers are at risk for injury if equipment is not used according to manufacturers' specifications.

- III.a. Scheduled preventive maintenance and repair should be performed on all equipment used for patient transport. (PNDS: I138)

Preventive maintenance and repair promote proper functioning and decrease the risk for injury to patients and personnel.

- III.b. Surfaces of positioning and transporting equipment should be smooth and intact. (PNDS: I122, I138)

Loss of equipment surface integrity can result in bacterial growth. Surfaces that hold moisture or wrinkle contribute to skin breakdown.

- III.c. Proper working condition of positioning and transporting equipment should be verified before use. (PNDS: I122, I138)

Creating a culture of safety includes designing a work environment that minimizes factors that contribute to errors or injuries.¹⁹

- III.d. Potential hazards associated with the use of positioning and transporting equipment should be identified, and safe practices

should be established in accordance with AORN's "Recommended practices for a safe environment of care."²⁰ (PNDS: I122, I138)

Recommendation IV

During the preoperative assessment, the perioperative registered nurse should identify unique patient considerations that require additional precautions for procedure-specific positioning.

Assessing patients for pressure ulcer development risk factors serves as a key step to preventing them. Patients who are immobile, as is required during operative procedures, are at increased risk.³

Additional precautions may be necessary when positioning special patient populations (eg, neonatal, elderly, malnourished, morbidly obese patients; patients with chronic diseases; patients with existing pressure ulcers) to reduce the risk for integumentary, respiratory, or cardiovascular compromises, and nerve impairment.^{12,21} For example:

- ◆ Obesity adversely affects most body systems.²² Routine skin condition assessments may be difficult because of the patient's size, lack of landmarks, and chronic conditions.²³ Traditional foam positioning products may prove ineffective, due to compression resulting from the patient's weight.^{15,23}
- ◆ Patients with vascular disease may have existing tissue ischemia and often have additional risk factors (eg, age, nutritional deficits, obesity, diabetes). Patients with vascular disease who are hypertensive may react unexpectedly to a reduction in blood pressure that is considered normotensive for many patients, but which results in loss of blood flow through stenotic vessels.²⁴
- ◆ Patients who smoke often experience vasoconstriction, another mechanism that contributes to pressure ulcer formation.²⁴

IV.a. Patient needs should be assessed by a registered nurse before transport to determine the required equipment and the skill level and number of transport personnel needed. (PNDS: I64)

Advance preparation for transport may be required for obese patients or other patients with special needs.²¹

IV.b. The preoperative nursing assessment should include questions to determine patient tolerance to the planned operative position. (PNDS: I15, I60, I64, I66, I127, I144, I148)

IV.b.1. The perioperative registered nurse should take additional precautions to decrease the risk for pressure ulcers in patients who

- are more than 70 years of age;
- require vascular procedures or any procedure lasting longer than four hours;
- are thin, small in stature, or who have poor preoperative nutritional status;
- are diabetic or have vascular disease; and
- have a preoperative Braden Scale score that is less than 20.¹¹

Studies report that the duration of a procedure is a significant predictor of pressure ulcer development. One study reported that intraoperative pressure ulcers increased when the procedure time extended beyond three hours. Cardiac, general, thoracic, orthopedic, and vascular procedures were reported to be the most common types of procedures associated with pressure ulcer formation.²⁵

IV.b.2. Preoperative assessment should include evaluation of both patient and intraoperative factors.

- Patient assessment should include, but is not limited to,
 - age;
 - height;
 - weight;
 - body mass index (BMI);
 - skin condition;
 - presence of jewelry;
 - nutritional status;
 - allergies (eg, latex);
 - preexisting conditions (eg, vascular, respiratory, circulatory, neurological, immune system suppression);
 - laboratory results;
 - physical or mobility limitation (eg, range of motion);
 - presence of prosthetics or corrective devices;

- presence of implanted devices (eg, pacemakers, orthopedic implants);
- presence of external devices (eg, catheters, drains, orthopedic immobilizers);
- presence of peripheral pulses;
- perception of pain;
- level of consciousness; and
- psychosocial and cultural considerations.^{1,12}
- Intraoperative assessment factors should include, but are not limited to,
 - anesthesia care provider's access to patient;
 - estimated length of procedure; and
 - desired procedural position.

IV.c. Special procedure beds and accessories designed to meet unique patient needs should be used. (PNDS: I30, I64, I122)

When assessing a patient's body weight and condition it is important to assess more than just their BMI. Patients of the same BMI (a relative ratio of height and weight) can have significantly different body composition that affects positioning needs and their risk for pressure ulcer development; therefore, procedure bed and positioning device requirements may be quite different.

The perioperative nursing assessment should include the length and weight capacity of the procedure bed.

IV.d. Perioperative registered nurses should participate in their health care organization's fall-reduction program by including an assessment of the patient's risk for falling. (PNDS: I64)

Patients may be prone to falls before they enter the operating room, during transfer to the procedure bed, and when attempting to sit up or transfer to a recliner in the PACU.²⁶ Patients may be at a higher risk for falling if the following conditions are present:

- history of a fall during the past three months;
- use of certain medications (eg, psychotropics, antidepressants, benzodiazepines, cardiovascular agents, antihypertensives, diuretics, anticoagulants, antihistamines,

bowel preparation medications, medications related to treating nocturia);²⁷

- confusion or depression;
- function or mobility problems (ie, gait),
- age, and
- dizziness.^{27,28}

The top three risk factors for predicting falls include a previous fall, medications used, and gait.²⁷ Age ranks fourth as a risk factor, however, it is not a good predictor of falls because studies show a wide range of age groups experience falls. One study reported a high percentage of injuries due to falls occurring in the 20- to 24-year-old age group.²⁸

IV.d.1. Regardless of age, patients who have poor vision, postural hypotension, or an altered mental status should be considered to be at a high risk for falling.²⁷

Recommendation V

Perioperative personnel should use proper body mechanics when transporting, moving, lifting, or positioning patients.

The incidence of work-related back injuries in nursing is among the highest of any profession worldwide.²⁹ Manual lifting and other patient-handling tasks are high-risk activities that can result in musculoskeletal disorders.¹³ Most injuries are due to overexertion when lifting patients; tasks that require staff members to twist or bend forward; and high-risk tasks performed on a horizontal plane (eg, lateral transfer from bed to stretcher, repositioning patient in bed).^{29,30}

Biomechanical studies have demonstrated that health care personnel are at risk for injury, despite the use of proper body mechanics, if patient-handling tasks are beyond reasonable limits and the caregiver's capabilities.²⁹ The combination of frequency, duration, and the stress of performing high-risk tasks that push the limits of human capabilities (eg, heavy loads; sustained, awkward positions; bending and twisting; reaching fatigue or stress; force; standing for long periods of time) predisposes nurses to musculoskeletal disorders.¹³

V.a. An adequate number of personnel should be available to ensure patient and personnel safety when transporting the patient. (PNDS: I30, I77)

Procedure beds can be very heavy and difficult to move, even without the presence of a patient. When a procedure bed is moved with a patient on it, the risk of injury is increased for both the worker and the patient.¹³

- V.b. The perioperative registered nurse should identify high-risk tasks and implement ergonomic solutions to eliminate or reduce occupational risks for injury.

Transferring, lifting, and handling patients have been identified as the most frequent precipitating trigger of back and shoulder problems for nurses.¹³ Nurses are often required to use the weaker muscles of the arms and shoulders as the primary lifting muscles, rather than the stronger muscles of the legs, because lifting, turning, or repositioning patients is often performed on a horizontal plane, such as a bed or stretcher.²⁹

Experts do not always agree on the safest methods for lifting or assisting dependent patients. One research center recommends the use of a roller or mechanical lifting equipment to reduce the risk of strain when moving a patient who is unable to move independently. The same center studied nurses' behaviors regarding use of lifting equipment and identified the following reasons for continued manual lifting:

- devices were purchased in insufficient quantities,
- lifts were stored in inconvenient locations, and
- equipment was not maintained adequately.²⁹

- V.c. All perioperative personnel should be educated in the principles of body mechanics and ergonomics.

The majority of musculoskeletal disorders reported by nurses working in the private sector are back injuries that require time away from work. Several studies report that nurses complain of chronic back pain, are unable to do their work because of injuries to shoulder and neck, or are planning to leave the profession because of their concern for personal safety in the health care environment.¹³

Recommendation VI

Potential hazards associated with patient transport and transfer activities should be identified, and safe practices should be established.

Preoperative patient observation and assessment by a perioperative registered nurse allows for identification of potential problems during transport and transfer activities that can be prevented by the implementation of appropriate precautions.

- VI.a. When selecting the appropriate transport vehicle, design features to be considered should include, but are not limited to,
- locking devices on wheels;
 - protective devices (eg, safety straps, side rails, cribs rails high enough to prevent a standing child from falling out);
 - stable, adjustable IV poles or stands;
 - holding devices for oxygen tanks;
 - positioning capabilities;
 - controls that are easy to operate and within reach of the operator;
 - maneuverability;
 - sufficient size;
 - removable head and foot boards;
 - mattress-stabilizing devices;
 - easily cleanable surfaces; and
 - a rack or shelf to hold monitoring equipment. (PNDS: I138)

Equipment safety design features help reduce the risk of injury to patients and personnel during transport.

- VI.b. The patient should be attended during transport and transfer by personnel deemed appropriate by the perioperative registered nurse or as determined by the anesthesia care provider or surgeon. (PNDS: I138)

- VI.c. Safety measures to be implemented during transport and transfer activities should include, but are not limited to,
- presence of locking wheels on the transport vehicle and the patient's bed during transfer activities;
 - side rails that can be elevated;
 - use of safety straps;
 - hanging and securing IV containers away from the patient's head;

- ensuring that the patient's head, arms, and legs are protected;
- ensuring that one staff member remains at the head of the patient transport vehicle;
- pushing the transport vehicle with the patient's feet first and avoiding rapid movement through hallways or when turning corners;
- maintaining the integrity and function of IV infusions, indwelling catheters, tubes, drainage systems, and monitoring equipment; and
- obtaining appropriately skilled assistance personnel and specific instructions for the patient with special needs. (PNDS: I138)

Locking wheels, raising side rails, and securing safety straps reduce the risk of patient falls. Maintaining proximity to the patient's head provides access to the patient's airway in the event of respiratory distress or vomiting. Rapid movements can cause patient disorientation, nausea and vomiting, and dizziness.

Recommendation VII

Positioning equipment should be used in a safe manner and according to manufacturers' written instructions.

To reduce the risk of injury, it is important to follow manufacturers' written instructions regarding weight limits in flat, articulated, and reverse orientation positions for each type of procedure bed. One researcher reviewed 16 perioperative incident reports and found that 63% involved patients who were above the specified weight limit for the positioning equipment used for back surgery. In all of the reports, it was noted that a staff member notified the surgeon of the problem before the beginning of the surgery, but the equipment was used anyway because alternative equipment was not available.³¹

VII.a. The perioperative registered nurse should verify that the positioning equipment to be used has been designed specifically for surgical procedure positioning. (PNDS: I122)

The goal of using positioning equipment is to use equipment that is designed to redistribute pressure and that decreases the risk for positioning injuries.

The number of pads, blankets, and warming blankets beneath the patient has been implicated as a risk factor for pressure ulcer development.^{4,11,26,32,33}

- Foam pads may not be effective as padding devices because they quickly compress under heavy body areas.³³⁻³⁵ In some situations, however, foam can be an effective pressure-reducing material equal to that of gel or visco-elastic.
- Convuluted foam mattress overlays (eg, egg crate mattresses) may be more effective in redistributing pressure if they are made of thick, dense foam that resists compression. The effectiveness of this type of mattress overlay depends on the weight of the patient and may not provide adequate pressure reduction in obese patients.
- Pillows, blankets, and molded-foam devices may produce only a minimum amount of pressure redistribution and are less effective during long procedures.
- Towels and sheet rolls do not reduce pressure and may contribute to friction injuries.³

VII.b. The perioperative registered nurse should select a surface that is able to reduce excessive pressure on the patient's bony prominences. (PNDS: I11, I122)

Pressure against the skin above 32 mm Hg interferes with tissue perfusion.^{36,37} Firm, stable devices may help hold the patient in position but may not help redistribute pressure. If care is not taken to minimize pressure points caused by positioning equipment, the positioning equipment may not adequately decrease the potential for injury and may actually increase the potential for pressure injury.

VII.b.1. Rolled sheets and towels should not be used beneath the procedure bed mattress or an overlay. When using positioning equipment such as a uterine displacing wedge or chest rolls, the positioning devices should be placed underneath the patient and not beneath the mattress or overlay.

When rolled towels, sheets, or other positioning equipment are placed beneath the mattress or the overlay,

they may negate the pressure-reducing effect of the mattress or overlay.¹¹

- VII.c. Patients should not be transported in procedure beds unless the manufacturer's written instructions state that the bed is safe to use as a transportation device. (PNDS: I122)

Procedure bed designs vary. Unlocking the bed may make it unstable. Moving an occupied procedure bed is not recommended because the risk of injury increases for both the worker and the patient.¹³ There are some procedure beds, however, that are designed for patient transport. It is important to consult the manufacturers' written instructions to determine if unlocking and moving a patient-occupied procedure bed is recommended.

Recommendation VIII

The perioperative registered nurse should actively participate in safely positioning the patient under the direction of and in collaboration with the surgeon and anesthesia provider.

The physiologic effects of anesthesia increase the patient's vulnerability to the effects of pressure. Patients may have preexisting conditions that limit the positions they can assume and may influence the positions they can tolerate.³⁷

- VIII.a. The perioperative registered nurse should provide for patient dignity and privacy during transport, transfer, and positioning. (PNDS: I100, I102, I150)

Maintaining patient privacy is essential to preserving the trust developed in the nurse-patient relationship. The perioperative registered nurse is responsible for developing a caring environment that promotes the well-being of patients. Perioperative registered nurses should provide care that recognizes the importance of each patient's values, beliefs, and health practices and is culturally relevant to a diverse patient population.³⁸

- VIII.a.1. The perioperative registered nurse should implement actions that include, but are not limited to, the following:
- Restrict OR patient care area access to designated authorized personnel only.

- Keep doors to patient care areas closed.
- Limit traffic coming into OR procedure rooms.
- Expose only the areas of the patient's body needed to provide care or access to the surgical site during the planned procedure.
- Provide auditory privacy for patient and staff member conversations during transport and transfer.
- Provide care without prejudicial behavior.³⁸

- VIII.b. Patient jewelry and body piercing accessories should be removed before positioning or transferring to the procedure bed if it will cause potential injury or interfere with the surgical site. (PNDS: I138)

Patients positioned on jewelry may be subject to pressure injuries.³⁹ Patient jewelry can become entangled in bedding or caught on equipment while moving the patient and cause injuries due to accidental removal.

- VIII.c. Movement or positioning of the patient should be coordinated with the surgical team. (PNDS: I96, I77)

Sliding or pulling the patient can result in shearing forces and/or friction on the patient's skin. Shearing can occur when the patient's skin remains stationary and underlying tissues shift or move, as might occur when the patient is pulled or dragged without support to the skeletal system or while using a draw sheet. Friction occurs when skin surfaces rub over a rough stationary surface.^{3,40}

- VIII.c.1. Specific patient needs should be communicated to the perioperative team before initiating transfer or positioning the patient.
- VIII.c.2. Attention should be given to protecting the patient's airway at all times during patient transfer and positioning.
- VIII.c.3. Before and during transfer or positioning, perioperative team members should communicate with each other regarding securing tubes, drains, and catheters; take actions to support these devices and prevent dislodging; and confirm that the

devices have maintained patency after transfer, positioning, or repositioning.

Indwelling catheters, tubes, or canulas may be dislodged without proper support.

- VIII.c.4. The perioperative registered nurse should actively participate in monitoring the patient's body alignment and confirming that the patient's legs are not crossed during transfer and positioning.

Maintaining the patient's correct body alignment and supporting his or her extremities and joints decreases the potential for injury during transfer and positioning.¹²

- VIII.c.5. When on the procedure bed, the patient should be attended by surgical team members at all times.

A lack of clear communication about who should be watching the patient after the safety straps are removed or before the patient is transferred has been reported as a contributing factor for patient falls in the operating room.²⁸

- VIII.d. The number of personnel and required equipment should be adequate to safely position the patient. (PNDS: I64, I138)

Inadequate numbers of personnel and/or equipment can result in patient or personnel injury.

- VIII.e. The perioperative registered nurse should actively participate in monitoring the patient's tissue integrity based on sound physiologic principles. (PNDS: I15, I42, I64, I96, I145)

- VIII.f. The perioperative registered nurse should implement general positioning safety measures including, but not limited to, the following:

- Positioning equipment should be used to protect, support, and maintain the patient's position.
- Padding should be used to protect the patient's bony prominences.
- The patient's arms should be positioned to protect them from nerve injury.^{37,41}
- The location of the patient's fingers should be confirmed to ensure they are in a position that is clear of procedure bed breaks or other hazards.

- Safety restraints should be applied carefully to avoid nerve compression injury and compromised blood flow.⁴²
- The patient's body should be protected from coming in contact with metal portions of the procedure bed.
- The patient's heels should be elevated off the underlying surface when possible.⁴³
- The patient's head and upper body should be in alignment with the hips. The patient's legs should be parallel and the ankles uncrossed to reduce pressure to occiput, scapulae, thoracic vertebrae, olecranon processes (ie, elbows), sacrum/coccyx, calcaneae (ie, heel),^{12,44} and ischial tuberosities.^{9,45}
- The patient's head should be in a neutral position and placed on a headrest.
- A pillow may be placed under the back of the patient's knees to relieve pressure on the lower back.¹²
- If the patient is pregnant, a wedge should be inserted under the patient's right side to displace the uterus to the left and prevent supine hypotensive syndrome, caused by the gravid uterus compressing the aorta and vena cava.⁴⁶
- If patient is attached to a robot, caution should be used before moving either the patient or the robot. (PNDS: I77, I92, I96, I139)

- VIII.f.1. Unless necessary for surgical reasons, the patient's arms should not be tucked at his or her sides when in the supine position. If there are surgical reasons to secure the patient's arms at his or her side with the use of a draw sheet, the draw sheet should extend above the elbows and should be tucked between the patient and the procedure bed's mattress.^{37,44}

When a patient's arms are tucked tightly at his or her side with sheets, it may add unnecessary pressure on the tucked arms and may lead to tissue injury and ischemia. It may also cause interference with physiologic monitoring (eg, blood pressure monitoring, arterial catheter monitoring) and result in an inability to resuscitate during an emergency due to unrecognized IV

infiltration in the tucked arm. There is also an increased risk for the patient to develop compartment syndrome in the upper extremity.⁴⁷

- VIII.f.2. Direct pressure on the eye should be avoided to reduce the risk of central retinal artery occlusion and other ocular damage, including corneal abrasion.

Patients who are at increased risk for development of postoperative visual loss are those that are undergoing procedures that are prolonged (ie, > 6.5 hrs), have substantial blood loss (ie, > 44.7% of estimated blood volume), or who are in a prone position.⁴⁸

- Patients at risk for ocular injury should be positioned so that their heads are level with or higher than their hearts, when possible. In addition, their heads should be maintained in a neutral forward position without significant neck flexion, extension, lateral flexion, or rotation, when possible. The use of a horseshoe headrest may increase the risk of ocular compression.
- The eyes of patients in the prone position should be assessed regularly.
- The surgeon may consider using a series of staged spine procedures for high-risk patients.

- VIII.g. Perioperative team members should implement measures to reduce the risk of nerve injuries when positioning the patient's extremities. (PNDS: I38, I144)

- Patients who undergo general anesthesia are at an increased risk for nerve injury resulting from patient positioning.⁴²
- Trauma may result from compression or stretching of nerves, with the most frequent injuries involving the ulnar nerve and brachial plexus. Why some of these injuries occur is unknown.^{12,41,42,49,50,51}
- The saphenous, sciatic, and peroneal nerves are vulnerable when the patient is in the lithotomy position. The peroneal nerve is also at risk with the patient in the lateral position.⁵⁰
- Injury to the pudendal nerve may result from inadequate padding or incorrect

placement of the positioning post, when using a fracture table.^{37,52,53}

- VIII.g.1. To minimize the risk of nerve injury, safety measures should include, but are not limited to, the following:

- Padded arm boards should be attached to the procedure bed at less than a 90-degree angle for supine patients.^{37,41,44,50}
- The patient's palms should be facing up and the fingers should be extended when his or her arms are placed on arm boards.^{37,41,50}
- When the patient's arms are placed at the side of the body, they should be in a neutral position (ie, elbows slightly flexed, wrist in neutral position, palms facing inward).^{37,41,50}
- Patient shoulder abduction and lateral rotation should kept be to a minimum.⁴²
- Patient extremities should be prevented from dropping below procedure bed level.
- The patient's head should be placed in a neutral position, if not contraindicated by the surgical procedure or the patient's physical limitations.⁵⁰
- Adequate padding is required for the saphenous, sciatic, and peroneal nerves, especially when the patient is in a lithotomy or lateral position.⁵⁰
- A well-padded perineal post should be placed against the perineum between the genitalia and the uninjured leg when a patient is positioned on a fracture table.^{37,52,53}

- VIII.h. Perioperative team members should implement measures to reduce the risk of injuries when positioning the patient in the supine position. (PNDS: I3, I11, I77, I96, I122)

The supine position may be modified into a sitting or semi-sitting position for access to the shoulder, posterior cervical spine, or posterior or lateral head. While there is better lung excursion and diaphragmatic activity in these positions, there is increased risk for poor venous return from the lower extremities and pooling of blood in the patient's pelvis.¹²

- When using only a draw sheet without a lateral transfer device for a lateral patient

transfer in the supine position, the care provider exerts a pull force up to 72.6% of the patient's weight.⁵⁴

- When one care provider (eg, anesthesia care provider) supports the patient's head and neck, the remaining mass of the patient's body equals 91.6% of his or her total body mass.⁵⁵ To accommodate this body mass, each caregiver can safely contribute a pull force required to transfer up to 48 lbs.¹³

- When moving the patient into and out of a sitting or modified sitting position, the mass of a patient's body from the waist up, including the head, neck, and upper extremities, equals almost 69% of the patient's total body weight.⁵⁵

VIII.h.1. A lateral transfer device (eg, friction-reducing sheets, slider board, air-assisted transfer device) should be used for supine-to-supine patient transfer. One caregiver and one anesthesia care provider (who is managing the airway, head, and neck) should be assigned to safely transfer a patient who weighs 52 lbs. Two caregivers plus the anesthesia care provider should be assigned to safely transfer a patient up to 104 lbs. Three caregivers plus the anesthesia care provider should be assigned to safely transfer a patient up to 157 lbs. For patients who weigh more than 157 lbs, an appropriate mechanical lifting device (ie, mechanical lift with supine sling, mechanical lateral transfer device, or air-assisted lateral transfer device) should be used and a minimum of three to four caregivers should be assigned.¹³

VIII.h.2. When moving the patient into and out of a sitting or modified sitting position, three caregivers should be assigned to work together to lift up to 67 lbs (30 kg). It is preferable to use mechanical devices and a minimum of three caregivers if the patient weighs more than 68 lbs.¹³

VIII.i. The perioperative team should implement measures to reduce the risk of injuries when

positioning the patient in the prone position. (PNDS: I3, I11, I77, I96, I122)

The prone position may be modified into the jackknife position to provide exposure to sacral, rectal, and perineal areas, or modified into the knee-chest position to provide exposure for spinal procedures.^{11,36}

Respiratory function may be affected by the ultimate positioning of the patient and is mitigated by many factors, including the angle of incline, external pressure on the rib cage, and whether the diaphragm is free to move.

Respiratory function may be decreased as a result of mechanical restriction of the rib cage and diaphragm when the patient is in a prone position.^{12,37}

Ophthalmic complications, including vision loss, have been reported in association with patients undergoing spinal surgery in a prone position.⁵⁶ There is an increased risk for direct compression to the orbit and corneal abrasion when the patient is in a prone position. During spinal surgeries, the patient may be turned to a prone position using a frame that causes the head to be lower than the rest of the body. This cerebral-dependent position may lead to a decreased venous return from the head, which can lead to capillary bed stasis and decreased perfusion to the optic nerve and result in blindness.⁵⁷

When transferring a patient from a supine position to a prone position, the most common physiologic changes are related to hypotension.³⁷

VIII.i.1. General safety considerations for the prone position should include, but are not limited to, the following.

- The patient's cervical neck alignment should be maintained.
- Protection for the patient's forehead, eyes, and chin should be provided.
- A padded headrest should be used to provide airway access.
- Chest rolls (ie, from clavicle to iliac crest) should be used to allow chest movement and decrease abdominal pressure.

- Breasts and male genitalia should be positioned in a way that frees them from torsion or pressure.
- The patient's toes should be positioned to allow them to hang over the end of the bed or to be elevated off the bed by placing padding under the patient's shins so the shins are high enough to avoid pressure on the tips of the toes.¹¹

VIII.i.2. When in the prone position, direct pressure on the patient's eyes and face should be avoided.⁵⁸

Although ocular injuries have been reported with and without the use of a headrest (eg, the head held with pins), the use of a horseshoe headrest may increase the risk of ocular compression and perioperative central retinal artery occlusion.⁵⁷

VIII.i.3. Ideally, the patient's arms should be placed down by his or her sides in the prone position. If this is not possible, each arm should be placed on an arm board with the arms abducted to less than 90 degrees, the elbows flexed, and the palms facing downwards. To safely secure the patient's arms at his or her sides, the palms of the hands should be facing in toward the thighs, the elbows and hands should be protected with padding, and the hands and wrists should be kept in anatomical alignment.³⁷

Positioning the arms above the patient's head can cause a stretch injury to the lower trunks of the brachial plexus.⁵⁰

VIII.i.4. Four caregivers should be available for a supine-to-prone patient transfer. One anesthesia care provider should maintain the airway and support the patient's head, while other members of the team are responsible for the patient's trunk and extremities.

Two caregivers, plus the anesthesia care provider, can safely transfer a patient weighing up to 48.5 lbs (22.0 kg) from the supine to the prone position. Three

caregivers, plus an anesthesia care provider, can safely transfer a patient weighing up to 72.7 lbs (33.0 kg). If the patient's weight is greater than 73 lbs, it is necessary to use assistive technology and a minimum of three to four caregivers.¹³

VIII.j. The perioperative team should implement measures to reduce the risk of injuries when positioning the patient in the Trendelenburg's and reverse Trendelenburg's positions. (PNDS: I3, I11, I77, I96, I122)

When the patient is in Trendelenburg's position, excessive pressure on the clavicle can compress the brachial plexus as it exits the thorax between the clavicle and the first rib. Morrell closed claims files revealed that brachial plexus injuries were related to the use of shoulder braces and the head-down position.⁵¹

Positioning a patient with a history of heart failure secondary to increased venous return and increased pulmonary blood flow in a steep, head-down tilt may adversely affect heart function. Trendelenburg's position causes redistribution of the blood supply due to increased venous return from the lower extremities. To ventilate the patient's lungs while in this position, the diaphragm must push against the displaced abdominal contents, which increases the risk for the alveoli to collapse resulting in atelectasis.^{12,44}

Circulatory response changes can be rapid and dramatic when moving the patient into or out of Trendelenburg's position. During surgery, there is gravitational flow of blood away from the surgical field, which can mask significant blood loss. The patient may be hypotensive as a result of hypovolemia when returned from Trendelenburg's position to the supine position. Cerebral blood flow may fall as venous and intracranial pressure rises; therefore, patients with known or suspected intracranial pathology should not be placed in Trendelenburg's position if it can be avoided.^{12,44} Trendelenburg's position can lead to visual loss related to decreased venous return from the head.⁵⁷

VIII.j.1. Measures should be taken to prevent patient from sliding on the procedure bed.

Risk for shear injuries increase when changing the patient's position from supine to Trendelenburg's or reverse Trendelenburg's.⁵⁹

- VIII.j.2. To prevent injury to the shoulders, brachial plexus, or feet in Trendelenburg's or reverse Trendelenburg's positions,^{41,42,49,60}
- shoulder braces should be avoided, and
 - a padded footboard should be used for reverse Trendelenburg's position.

VIII.k. The perioperative team should implement measures to reduce the risk of injury to patients and caregivers associated with the lithotomy position. (PNDS: I3, I11, I77, I96, I122)

- Some type of leg holder is used in all lithotomy positions. Modifications of the position include low, standard, high, and exaggerated positions depending on how high the legs and pelvis need to be elevated for the procedure.^{37,61}
- The length of time that a patient may remain in the lithotomy position without risk of injury is unknown and is related to patient condition.
- In the lithotomy position the patient's heels are at risk for pressure ulcers at the heel support sites, particularly when the legs are supported by the heel in the standard, high, or exaggerated lithotomy position for prolonged procedures.⁶¹
- Injury to the peroneal nerve on the lateral aspect of the knee is common and results from the fibular neck resting against the vertical post of the stirrup when the patient is in the lithotomy position. This injury can result in foot drop and lateral, lower-extremity paresthesia.^{12,37,50,60}
- Compartment syndrome, although infrequent, has been reported as a complication of surgical positioning, especially the lithotomy position.^{37,62-64}

There is increased risk for poor venous return from the lower extremities and pooling of blood in the patient's pelvis when the patient is in a lithotomy position. At the end of the procedure, the patient's overall circulating blood volume may be depleted when

the patient's legs are lowered to the procedure bed due to the blood returning quickly into the patient's peripheral circulation. Respiratory compromises may occur due to pulmonary congestion. There is increased risk for deep vein thrombus formation due to the increased risk of blood pooling in the calf muscles.¹²

When positioning the patient into and out of the lithotomy position, the maximum load for a two-handed lift is 22.2 lbs (10.1 kg). Each complete lower patient extremity (including thigh, calf, and foot) weighs almost 16% of the patient's total body mass.¹³

VIII.k.1. General positioning considerations for patients in the lithotomy position include, but are not limited to, the following:

- Stirrups should be placed at an even height.
- The patient's buttocks should be even with the lower break of the procedure bed and positioned in a manner that securely supports the sacrum on the bed surface. Confirm proper positioning of the patient buttocks before surgery is initiated.¹²
- The patient's legs should be moved slowly and simultaneously into the leg holders to prevent lumbosacral strain.
- The patient's legs should be removed from stirrups slowly and brought together simultaneously before lowering the legs to the bed surface when removing the patient from leg holders, to prevent lumbosacral strain. To maintain the patient's hemodynamic status, his or her legs should be slowly returned to the bed, one at a time if possible.³⁷
- The patient's arms should be placed on padded arm boards, extended less than 90 degrees from the long axis of the procedure bed, with the patient's palms up and gently secured.^{37,60} The arms should be tucked at the patient's sides only if surgically necessary. When it is necessary to tuck the arms at the patient's side, the elbows should be padded and the palms

should be facing in toward the patient's body. The hands should be enclosed and secured within a foam protector.³⁷

- The patient's fingers should be protected from injury when the foot of the procedure bed is repositioned.³⁷
- The patient's heels should be placed in the lowest position possible.⁶¹
- Support should be provided over the largest surface area of the leg possible.⁶¹
- The patient's legs should not rest against the stirrup posts.⁶⁰
- Scrubbed personnel should not lean against the patient's thighs.^{60,62}
- The patient should be in the lithotomy position for the shortest time possible.⁶¹
- Care should be exercised to avoid shearing when moving the patient to the break in the procedure bed during repositioning.

- VIII.k.2. In prolonged procedures (ie, longer than four hours), the perioperative team should consider repositioning the patient in the lithotomy position as a strategy to reduce the risk of pressure injury (eg, skin damage, nerve injury, compartment syndrome).^{60,62}

One research review suggests that perioperative team members remove the patient's legs from support structures every two hours, if the procedure is anticipated to last four hours or more.⁶³ Research does not identify how long the patient's legs should be out of the stirrups before repositioning.

- VIII.k.3. The perioperative registered nurse should monitor the patient at all times, especially when the safety strap is removed.

Proper placement of the safety strap is difficult in the lithotomy position. The perioperative registered nurse may not be able to place the safety strap low across the patient's pelvis without restricting access to the surgical site. Use of a safety strap that is placed high or too tight across the abdomen increases the

risk of restricting respiration or causing pressure injuries. The patient's legs may seem to be secure in leg holders with his or her arms tucked at the side. It is important to remember that there is still a risk for the patient to shift on the procedure bed, especially when moving into or out of Trendelenburg's position, which is often used in conjunction with the lithotomy position.

- VIII.k.4. When positioning the patient into and out of the lithotomy position, a minimum of two caregivers is needed to lift the legs. Mechanical devices such as support slings can be used to lift the legs to and from the lithotomy position.¹³

- VIII.l. The perioperative team should implement measures to reduce the risk of injury to patient and caregivers associated with the lateral position. (PNDS: I3, I11, I77, I96, I122)

The patient in the lateral position is at risk of injury due to spinal misalignment and vulnerable pressure points on the dependent side, specifically the ear, acromion process, iliac crest, greater trochanter, lateral knee, and malleolus.⁹

In a lateral position, the patient is positioned on the nonoperative side. This dependent side is the reference point for documentation. For example, when documenting a right lateral position, the patient is lying on his or her right side. This position provides exposure for a left-sided procedure (eg, upper chest or kidney procedure). When documenting the left lateral position, the patient is lying on the left side. The left lateral position provides exposure for a surgical or invasive procedure on the patient's right side.

One research study on interface pressures found that the highest pressures occurred in the lateral position and that there was an increased risk for the procedure bed mattress to become fully compressed under the weight of the patient's body and cause a "bottoming out" effect.⁶ Another study found an increased risk for ulceration when a solid object or positioning device (eg, "bean bag" product) is used to maintain patients in a specific position. The firm pressure of the positioning

device may compromise the circulatory system due to the tight restraint and because of the overall effect of gravity on the horizontal body posture.²⁵

The lateral position increases the risk of damage to the common peroneal nerve if there is not padding to protect the nerve on the dependent leg from being compressed between the fibula and the procedure bed.⁵⁰

VIII.I.1. Safety considerations for the lateral position should include, but are not limited to, the following:

- The patient's spinal alignment should be maintained during turning.
- The patient's dependent leg should be flexed for support.³⁷
- The patient's straight upper leg should be padded and supported with pillows between the legs.
- Padding should be used under the patient's dependent knee, ankle, and foot.
- A headrest or pillow should be placed under the patient's head to keep the cervical and thoracic vertebrae aligned.
- The patient's dependent ear should be assessed to ensure that it is not folded, and the ear should be well padded.³⁷
- The patient's arm should be secured to prevent movement during the procedure.

VIII.I.2. To safely position a patient weighing up to 76 lb (ie, 34.5 kg) into and out of the lateral position, three caregivers should be assigned; one caregiver (eg, the anesthesia care provider) should be assigned specifically to support the patient's head and neck and maintain the patient's airway during the lateral transfer.

When positioning or repositioning the anesthetized patient into and out of the lateral position, pushing and pulling forces can occur rather than lifting forces. Three caregivers plus an anesthesia care provider can safely position a patient weighing up to 115 lbs (ie, 52.2 kg). If the patient's weight exceeds 115

lbs (ie, 52.2 kg), it is important to use lateral positioning devices.¹³

VIII.m. The perioperative team members should implement measures to reduce the risk of injury to patient and caregivers associated with the morbidly obese patient. (PNDS: I3, III, I64, I77, I96, I122)

Morbid obesity is associated with patients who have a BMI of greater than 40 or who weigh 100 lbs or more over their recommended weight. Patients who are morbidly obese tend to have other health conditions, such as type II diabetes, hypertension, atherosclerosis, arthritis of weight bearing joints, sleep apnea, alveolar hypoventilation, urinary stress incontinence, and gastroesophageal reflux disease. Morbidly obese patients are at increased risk for stroke and sudden death.⁶⁵

It is essential for perioperative team members to understand the pathophysiology of obesity and the effects that various positions have on the obese patient's cardiopulmonary function.⁶⁶

- Respiratory issues include
 - airway compromise due to a patient's short, thick neck;
 - risk of difficult intubation;
 - increased risk for hypoxia;
 - increased risk for intra-abdominal pressure on diaphragm; and
 - increased risk of aspiration.
- Circulatory issues include
 - increased cardiac output,
 - increased pulmonary artery pressure, and
 - risk of inferior vena cava compression.

VIII.m.1. Safety considerations for positioning the morbidly obese patient should include, but are not limited to, the following:

- The procedure bed should be capable of articulating and supporting patients weighing 800 to 1000 lbs (363.2 kg to 454 kg).¹⁵ Specialized hydraulics should be capable of lifting patients weighing 800 to 1000 lbs (363.2 kg to 454 kg).⁶⁷
- Mattresses should provide sufficient support and padding and should not "bottom out."⁷³

- The width of the patient's legs determines whether the lower legs will remain on the procedure bed or must be supported by stirrups. Side attachments may be available on more recent procedure bed models.
- The patient's size may cause difficulty in determining if arms are positioned at less than a 90-degree angle. Padded sleds/toboggans may be used to contain the patient's arms at the side of the body if necessary, provided they can be used without causing excessive pressure on the arms.
- An extra wide, extra long safety strap should be used for patients who exceed the length limits for a regular size safety strap. Sheets should not be substituted for inadequately-sized safety straps. Two separate safety straps may be necessary to decrease the risk for the patient falling off the procedure bed due to instability and weight load shifts. One safety strap should be placed across the patient's thighs and one over the patient's lower legs.²²
- When in the supine position, a roll or wedge should be placed under the patient's right flank to relieve compression of vena cava.
- Patients may not be able to tolerate the supine position due to respiratory or circulatory compromises; it may be necessary to reposition the patient into a sitting or lateral position.⁶⁶
- When in the prone position, the patient's upper chest and pelvis should be adequately supported to free the abdominal viscera to reduce pressure on the diaphragm and inferior vena cava.⁶⁶
- Trendelenburg's position should be avoided because the added weight of the abdominal contents press against the diaphragm causing respiratory compromise, and the increased blood flowing from the lower extremities into central and pulmonary circulation causes vascular congestion.
- In reverse Trendelenburg's position, care should be taken when placing the patient's feet against a padded footboard to ensure that his or her feet are aligned and flat against the board. This prevents rotation and increased pressure on the ankle.
- The lithotomy position should be avoided, if possible, due to the weight of the patient's thighs pressing on his or her abdomen and raising intra-abdominal pressure, thus increasing the risk of circulatory complications.
- If the patient is placed in the lithotomy position, heavy-duty stirrups should be used, and the perioperative nurse should be aware of and institute measures to reduce risks for respiratory, circulatory, and neurological complications.
- The lateral position may be preferred over the prone position as the bulk of the patient's panniculus can be displaced off the abdomen. The perioperative nurse should be aware, however, that a shift of the patient's panniculus may increase the risk of falling or other injury due to unintentional change in position.¹⁵

Recommendation IX

After positioning the patient, the perioperative registered nurse should assess the patient's body alignment, tissue perfusion, and skin integrity.

Respiratory function may be compromised after positioning the surgical patient depending on individual factors and patient position.^{12,37}

Circulatory function is influenced by anesthetic agents and surgical techniques that may result in vasodilatation, hypertension, decreased cardiac output, and inhibition of normal compensatory mechanisms.³⁷

Intraoperative skin injury occurs because of a combination of events:

- ♦ unrelieved pressure,
- ♦ duration of the pressure, and
- ♦ the individual patient's ability to withstand the insult.

Several studies indicate that procedures over two-and-one-half to three hours significantly increase the patient's risk for pressure ulcer formation.^{37,68} External skin pressure exceeding normal capillary interface pressure (ie, 23 to 32 mm Hg) can cause capillary occlusion that will restrict or block blood flow. The resulting tissue ischemia leads to tissue breakdown. Both high pressure for a short duration and low pressure for extended duration are pressure injury risk factors. Other extrinsic factors for skin injury include shear forces and friction.^{3,4,7,34,64,68}

IX.a. After the desired patient position is attained, the perioperative registered nurse should reassess the patient to include, but not be limited to, the following systems:

- respiratory,
- circulatory,
- neurological, and
- musculoskeletal/integumentary.^{1,11} (PNDS: 138, 187, 196, 1128)

Positions such as lithotomy and Trendelenburg's can cause redistribution and congestion of the patient's blood supply.^{12,43}

Circulatory responses to certain positions or position changes can be rapid and dramatic.^{12,43}

IX.b. The perioperative registered nurse should monitor the patient for external pressure from surgical team members leaning against the patient's body. (PNDS: 177, 1128)

Retractors, equipment, or instruments resting on the patient and members of the perioperative team resting or leaning on the patient add to the risk of pressure injuries that cause nerve or tissue damage.^{37,60}

IX.b.1. The perioperative registered nurse should communicate with the surgical team about the position of surgical instruments, retractor frames, Mayo stands, or other items placed on or over the patient throughout the procedure.^{12,60}

IX.c. The perioperative registered nurse should reassess the patient's body alignment, placement of the safety strap, and the placement of all padding after repositioning or any movement of the patient, procedure bed, or any equipment that attaches to the procedure bed.¹² (PNDS: 111; 1128)

Changing the patient's position may expose or damage otherwise protected body tissue. The safety strap may shift and apply increased pressure when repositioning the patient or adding extra padding.

Patient repositioning may increase the risk of pressure ulcer development due to shearing of tissue.^{24,40}

An injury may result from adding or deleting positioning equipment, adjusting the procedure bed, or moving the patient on the procedure bed.¹²

In nonsurgical settings, patients who are identified as being at risk for developing pressure injuries are turned or repositioned at least once every two hours. If a patient is chair-bound preoperatively, it is optimal to reposition the patient once every hour.³ When patients receive anesthesia, they are even more vulnerable to the effects of pressure due to physiological changes.⁶⁷ One study found that the incidence of occipital alopecia was significantly reduced when the patient's head was repositioned at regular intervals during prolonged procedures (ie, longer than four hours).⁶⁹

When a prolonged surgical procedure is expected, a patient who is in the lithotomy position may need to be repositioned every two hours to reduce the risk of pressure injury and compartment syndrome.^{60,62,63}

Patients who have a radial intra-arterial catheter in place throughout the procedure may have their wrists in a hyperextended position for the duration of the surgical procedure. One study suggests that patients' wrists should be returned to the neutral position following arterial catheter placement as a strategy to decrease the risk of injury to the median nerve.⁷⁰

Literature searches demonstrate that it is difficult to determine the effect of patient repositioning during a surgical procedure because, while position changes are documented, these changes are not normally identified as a strategy to prevent pressure injuries.^{71,72}

IX.c.1. The perioperative registered nurse should communicate with anesthesia personnel and the surgeon when assessing the need for repositioning the patient every two hours for prolonged procedures.

Table 1

PRESSURE ULCER STAGES	
<p>Suspected deep tissue injury</p> <p>Purple or maroon localized area of discolored intact skin or blood-filled blister due to damage of underlying soft tissue from pressure and/or shear. The area may be preceded by tissue that is painful, firm, mushy, boggy, warmer, or cooler as compared to adjacent tissue.</p> <p>Further description: Deep tissue injury may be difficult to detect in individuals with dark skin tones. Evolution of the injury may include a thin blister over a dark wound bed. The wound may further evolve and become covered by thin eschar. Evolution may be rapid, exposing additional layers of tissue even with optimal treatment.</p>	<p>Stage III</p> <p>Full-thickness tissue loss. Subcutaneous fat may be visible, but bone, tendon, or muscles are not exposed. Slough may be present but does not obscure the depth of tissue loss. May include undermining and tunneling.</p> <p>Further description: The depth of a stage III pressure ulcer varies by anatomical location. The bridge of the nose, ear, occiput, and malleolus do not have subcutaneous tissue, and stage III ulcers can be shallow. In contrast, areas of significant adiposity can develop extremely deep stage III pressure ulcers. Bone/tendon is not visible or directly palpable.</p>
<p>Stage I</p> <p>Intact skin with nonblanchable redness of a localized area usually over a bony prominence. Darkly pigmented skin may not have a visible blanching; its color may differ from the surrounding area.</p> <p>Further description: The area may be painful, firm, or soft, and warmer or cooler than adjacent tissue. Stage I may be difficult to detect in individuals with dark skin tones.</p>	<p>Stage IV</p> <p>Full-thickness tissue loss with exposed bone, tendon, or muscle. Slough or eschar may be present on some parts of the wound bed. Often include undermining and tunneling.</p> <p>Further description: The depth of a stage IV pressure ulcer varies by anatomical location. The bridge of the nose, ear, occiput, and malleolus do not have subcutaneous tissue, and these ulcers can be shallow. Stage IV ulcers can extend into muscle and/or supporting structures (eg, fascia, tendon, joint capsule), making osteomyelitis possible. Exposed bone/tendons are visible or directly palpable.</p>
<p>Stage II</p> <p>Partial-thickness loss of dermis presenting as a shallow, open ulcer with a red-pink wound bed, without slough. May also present as an intact or open/ruptured serum-filled blister.</p> <p>Further description: Presents as a shiny or dry shallow ulcer without slough or bruising.* This stage should not be used to describe skin tears, tape burns, perineal dermatitis, maceration, or excoriation.</p> <p><i>*Bruising indicates suspected deep tissue injury.</i></p> <p><i>Adapted with permission from The National Pressure Ulcer Advisory Panel, Washington, DC.</i></p>	<p>Unstageable</p> <p>Full-thickness tissue loss in which the base of the ulcer is covered by a yellow, tan, gray, green, or brown slough and/or tan, brown, or black eschar in the wound bed.</p> <p>Further description: Until enough slough and/or eschar are removed to expose the base of the wound, the true depth, and therefore stage, cannot be determined. Stable wounds are dry, adherent, and intact without erythema or fluctuance. Eschar on the heels serves as "the body's natural (ie, biological) cover" and should not be removed.</p>

IX.c.2. The perioperative registered nurse should place his or her hand between the safety strap and the patient to ensure the strap is not applying excessive pressure to the patient's tissue.¹²

IX.c.3. The perioperative registered nurse should assess the patient for adequate padding by positioning a hand, palm up, below the part of the body at risk to be sure there is more than an inch of support material between the body part and any hard surface.³

IX.c.4. The perioperative registered nurse should confirm that prep solutions have not pooled beneath the patient and check for excessive moisture (eg, urine from incontinence) between the patient and positioning devices before the start of the surgical procedure.

A patient's skin may be more susceptible to pressure and friction due to prep solutions that change the pH of the skin and remove protective oils. When prep solutions pool beneath a patient, there is increased risk for skin maceration.^{4,24}

Recommendation X

The perioperative registered nurse should collaborate with the postoperative patient caregiver to identify patient injury due to intraoperative positioning.

The incidence of pressure ulcers occurring as a result of surgery may be as high as 66%. Pressure ulcers that originate in surgery may be assessed and documented as burns and may not appear until one to four days postoperatively. Operating room-acquired pressure injuries have a unique purple appearance initially. They tend to progress outwardly with origination at the muscle overlying bony prominences, which explains why they may not be detected when the initial skin assessment is done in the operating room. Pressure injuries in nonsurgical patients progress inward, getting deeper as the tissue injury advances³ (Table 1).

Epithelialization may be delayed in patients who are obese, which may cause poor postoperative wound healing and increased risk of infection.²¹

X.a. Perioperative registered nurses should evaluate the patient for signs and symptoms of physical injury related to intraoperative positioning. (PNDS: I44, I45, I46, I146; I152)

Pressure ulcers are staged according to the degree of tissue damage.^{4,73,74} Refer to Table 1 for assessment descriptors.

X.a.1. Perioperative registered nurses should identify patients who are high risk for postoperative injuries due to positioning and communicate areas of concern with postoperative care provider. (PNDS: I64)

X.a.2. When the patient has been in the lateral position for an extended amount of time in the OR, the perioperative nurse should alert the nurses caring for the patient postoperatively to carefully inspect the areas that are at high risk for pressure injuries. It is important to change the patient's positions postoperatively to avoid recurring pressure on those high risk areas.⁶

X.a.3. Patients who have been identified to be at-risk for development of postoperative vision loss should be assessed when the patient becomes alert postoperatively.

The patient who has anemia preoperatively, who undergoes a prolonged procedure, and who experiences substantial blood loss is identified as a high-risk patient for perioperative vision loss. Patient assessment, position modification, and staged procedures are strategies identified to minimize the risk of this rare complication.^{56,58}

The incidence of postoperative eye injury in nonocular surgery is relatively uncommon, but the risk may be greater in patients whose surgery involves the face, head, or neck, and in patients whose surgery requires use of the lateral position. The patient's age and length of procedure are also factors for ocular injury.⁷⁵

X.b. Perioperative registered nurses should establish open communications with postoperative care providers to obtain feedback about postoperative injuries due to positioning. (PNDS: I38, I42)

X.b.1. When patients are discharged the same day as the surgery, perioperative registered nurses should include an evaluation for signs and symptoms of injury due to positioning in the postoperative phone call.

Recommendation XI

Competency

Perioperative personnel should receive initial education, competency validation, and updated information on patient positioning, new positioning equipment and procedures, and ergonomic safety.

Competency verification serves as an indicator that personnel have a basic understanding of patient positioning, the risks of injury to patient and to staff members, and understand what may be implemented as appropriate corrective action when a process failure occurs.

XI.a. The perioperative registered nurse should be educated in, and demonstrate knowledge about, the physiologic effects and implications of positioning in relation to the patient's assessed status and limitations.^{3,12}

Knowledge of anatomy and physiology enhances the perioperative registered nurse's appreciation of injury mechanisms associated with common intraoperative patient positions.¹²

- XI.b. Perioperative personnel should be familiar with the proper function and use of positioning equipment.

Ongoing education of perioperative personnel will assist them in developing skills that will decrease the risk of patient injury due to positioning.

- XI.c. Perioperative personnel should receive education and competency validation in new positioning equipment as they are introduced into the perioperative setting.
- XI.d. Members of the perioperative team who transport patients should demonstrate competency in operating transport equipment.
- XI.e. Administrative personnel should periodically assess and document the competency of personnel in safe patient positioning and use of positioning equipment according to facility and department policy. (PNDS: 11)

Recommendation XII

Documentation

Patient care and use of positioning devices should be documented on the intraoperative record by the registered nurse circulator.

Documenting nursing activities provides a description of the perioperative nursing care administered, status of patient outcomes upon transfer, and provides information for continuity of patient care.⁷⁶

- XII.a. Documentation should include, but not be limited to,
- preoperative assessment including a description of the patient's overall skin condition on arrival and discharge from the perioperative suite;
 - type and location of positioning equipment;
 - name and titles of persons participating in positioning the patient;
 - patient position and new position, if repositioning becomes necessary; and
 - postoperative assessment for injury related to position.^{1,76}

- XII.b. Photography used to document injuries due to positioning should be consistent with health care organization's policies regarding medical photography and videotaping.

Although the American Medical Directors Association's guidelines for pressure-ulcer prevention and treatment suggest photographs as a means to monitor the progress of wound care, risk management experts and health care attorneys may advise against photographs being included in the patient's chart. If photography is used, high-definition grid film may be recommended for accuracy. Digital images can be modified, resulting in questions about the accuracy and integrity of the image.³

Recommendation XIII

Policies and Procedures

Policies and procedures related to positioning should be developed, reviewed annually, revised as necessary, and readily available in the practice setting.

Policies and procedures establish authority, responsibility, and accountability. Policies also assist in the development of performance improvement activities. These recommended practices should be used to guide the development of policies and procedures within the individual perioperative practice setting.

- XIII.a. Policies and procedures for positioning should include, but not be limited to,
- assessment and evaluation criteria,
 - required documentation,
 - safety interventions,
 - positioning equipment care and maintenance, and
 - ergonomic safety.
- XIII.b. Perioperative policies on positioning should be consistent with the health care organization's risk-control plan for pressure ulcer prevention and management

Recommendation XIV

Quality

A quality management program should be in place to evaluate the outcomes of patient positioning practices and to improve patient safety.

To evaluate the quality of patient care and formulate plans for corrective action, it is necessary to maintain a system of evaluation.^{77,78}

XIV.a. Perioperative administration members should participate in developing and monitoring an organization-wide risk control plan for pressure ulcer prevention and management.

XIV.a.1. Pressure ulcer prevention and management risk-control plans should include, but not be limited to, the following:

- a method for identifying patients at risk for pressure ulcers;
- a documentation system to follow the progress of a wound;
- prevention protocols that protect the patient's skin integrity; and
- education programs for caregivers, patients, and family members.^{3,79}

XIV.b. Information about adverse patient outcomes and "near-miss incidents" associated with positioning should be collected, analyzed, and used for performance improvement as part of the institution-wide performance improvement program.

To demonstrate that all reasonable efforts were made to protect the patient's safety, it is considered a sound professional practice to document information according to organizational policy when an event occurs.⁸⁰

XIV.b.1. Following organizational policy, documentation of an event related to positioning should include, but not be limited to,

- a description of what happened,
- the date and time of the incident,
- location of the incident,
- witnesses,
- corrective action to be implemented, and
- communications made regarding the outcome.

XIV.b.2. Data on health care personnel injuries related to positioning activities should be collected, analyzed, and used for performance improvement.

Glossary

Body mass index (BMI): The measure of a person's body fat based on height and weight that applies to both adult men and women.

Braden scale: A widely used assessment tool for predicting the development of pressure sores.

Capillary interface pressure: The amount of pressure placed on the skin's resting surface over a bony prominence.

Compartment syndrome: A pathologic condition caused by the progressive development of arterial compression and consequent reduction of blood supply. Clinical manifestations include swelling, restriction of movement, vascular compromise, and severe pain or lack of sensation.

Ergonomics: The science of fitting the demands of work to the anatomical, physiological, and psychological capabilities of the worker to enhance efficiency and well-being.

Friction: The act of rubbing one object (or tissue surface) against another.

Morbid obesity: A person whose body mass index (BMI) is more than 40.

Procedure bed: A type of bed used in ORs or procedure rooms that allow the surgical team access to the patient and the ability to position the patient for a surgical procedure through the use of the bed, its positions, and its attachments.

Positioning equipment/devices: Any device or piece of equipment used for positioning the patient and/or providing maximum anatomic exposure.

Devices include, but are not limited to,

- ◆ support devices for head, arms, chest, iliac crests, and lumbar areas;
- ◆ pads in a variety of sizes and shapes for pressure points (eg, head, elbows, knees, ankles, heels, sacral areas);
- ◆ securing devices (eg, safety belts, tapes, kidney rests, vacuum-pack positioning devices);
- ◆ procedure beds equipment (eg, headrest/holders, overhead arm supports, stirrups, footboard); and
- ◆ specialty surgical beds (eg, fracture table, ophthalmology carts/stretchers, chairs).¹⁶

Shearing: A sliding movement of skin and subcutaneous tissue that leaves the underlying muscle stationary.

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