

# Prevention of Pressure Ulcers in the Surgical Patient

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The development of pressure ulcers (PUs) is of enormous concern in all health care settings. A PU is any lesion (ie, localized area of tissue necrosis) caused by unrelieved pressure or pressure in combination with friction or shear that results in damage to the skin or underlying tissue.<sup>1,2</sup> An ulcer often develops when soft tissue is compressed between a bony prominence and an external surface for a prolonged period.<sup>2-4</sup>

Pressure ulcers can occur any time body tissue is compromised causing skin breakdown. Monitoring and maintaining skin integrity is an essential component of defining a patient's health status and evaluating the quality of nursing care.<sup>5</sup> It is incumbent upon all health care providers to work not only to decrease the incidence of PUs, but also to effectively

treat them when they occur. The Institute for Healthcare Improvement has initiated interventions to help hospitals reduce PUs through the use of evidence-based practices to improve patient care.<sup>6</sup>

According to Graves et al, any patient affected by PU development will require a longer hospital stay.<sup>7</sup> Brown's research indicates that there is a link between hospital-acquired PUs and mortality.<sup>8</sup> Reddy et al estimate that approximately 60,000 patients will die each year from hospital-acquired pressure ulcers and that the cost of treating these wounds is approximately \$11 billion per year.<sup>9</sup>

The Centers for Medicare and Medicaid Services will no longer reimburse health care facilities if a health care-associated PU develops or is not documented as present on the patient's admission to the facility.<sup>10</sup> Placing financial responsibility for PU development on the health care facility should intensify the focus on reducing PU incidence.

It is important to look at all areas within health care to decrease the possibilities of PU development whenever possible. There are many times during which patients are put at increased risk for developing PUs, including during surgery. Literature reviews reveal that PUs are discussed predominantly in regard to long-term care, intensive care,

## ABSTRACT


Pressure ulcers (PUs) are a serious health care problem, and it is crucial to assess how patients acquire pressure ulcers after admission to a health care facility. In the OR, factors related to positioning, anesthesia, and the duration of surgery, in addition to patient-related factors, all can affect PU development.

This article reviews current practices, including AORN recommended practices, regarding pressure ulcer prevention efforts for surgical patients.

All surgical patients should be considered at-risk for pressure ulcer development; therefore, perioperative departments should develop and implement strategic plans for pressure ulcer prevention.

**Key words:** *pressure ulcer, health care-acquired conditions, surgical patients, wound prevention. AORN J 89 (March 2009) 538-548. © AORN, Inc, 2009.*

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**TABLE 1**  
**Stages of Tissue Breakdown<sup>1,2</sup>**

<b>Type of injury</b>	<b>Length of pressure</b>	<b>Resolution</b>
Hyperemia	Occurs when pressure is applied for less than 30 minutes	Resolves within 1 hour
Ischemia	Occurs after 2 to 6 hours of unrelieved pressure	May require up to 36 hours to resolve
Necrosis	Develops after 6 hours of unrelieved pressure with microvasculature collapse and thrombosis	May require a vascular surgeon and/or wound care team consult
Ulceration	Occurs within 2 weeks of necrosis	May require a vascular surgeon and/or wound care team consult

1. Pressure ulcers. Landon Center on Aging. <http://www2.kumc.edu/coa/Education/AMED900/PressureUlc.htm>. Accessed December 28, 2008.

2. Pieper B. Mechanical forces: pressure, shear, and friction. In: Bryant R, Nix D, eds. Acute & Chronic Wounds: Current Management Concepts. 3rd ed. St Louis, MO: Mosby Elsevier; 2007:205-234.

and rehabilitation settings however, with little focus on acute care settings including the surgical environment.<sup>7,11-14</sup> Even though a large amount of information is available to educate health care providers and help them implement policies, procedures, protocols, and nursing care plans to decrease the number of health care-associated ulcers, the incidence of PUs continues to climb.<sup>3,7,12</sup> This article reviews the causes of and risk factors for PUs and intraoperative methods for pressure redistribution and prevention of ulcers that could occur during surgical procedures.

### **ETIOLOGY OF PRESSURE ULCERS**

An intraoperatively acquired PU may resemble, and is often documented as, a burn. According to AORN's "Recommended practices for positioning the patient in the perioperative setting," an intraoperatively acquired PU usually develops outward on the muscle of a bony prominence and has a purplish discoloration.<sup>15</sup> Depending on the patient's skin color, a purple or maroon localized area of discolored intact skin or blood-filled blister occurs as a result of damage to underlying soft tissue.<sup>2,4,16</sup> According to the National Pressure Ulcer Advisory Panel (NPUAP) and the Wound, Ostomy, and Continence Nurses Society (WOCN), PUs develop

based on three causes: pressure, extrinsic factors, and intrinsic factors.<sup>2,4</sup>

**PRESSURE.** Pressure can be defined by its intensity and its duration. Pressure ulcers are caused by compression of soft tissue between a bony prominence and an external surface such as a bed or chair. When the external pressure exceeds normal capillary filling pressure of approximately 32 mmHg, local blood flow is occluded, causing tissue ischemia and subsequent necrosis of skin and subcutaneous tissues. Muscle is more sensitive to pressure than skin; underlying tissue may become necrotic by the time a lesion presents on the skin surface.<sup>3,17</sup>

Tissue breakdown occurs in stages (Table 1). Tissue damage may become apparent within several hours after surgery or may not appear for up to three days. Therefore, a PU that results from surgery may not be noticed until the patient's recovery period.<sup>3,18</sup> An inverse relationship may exist between the duration and intensity of pressure. Low-intensity pressure over a long period can initiate the tissue breakdown process, as can high-intensity pressure for a short period of time.<sup>3,17</sup>

Tissue tolerance is the condition or integrity of the skin and supporting structures that influences the skin's ability to tolerate pressure.<sup>3</sup> Pressure risk factors for skin damage include

immobility, sensory deficit, mental status changes, and "bottoming out."<sup>2,19</sup> Immobility is the limitation of the patient's ability to reposition. Sensory deficit is the patient's limited ability to sense the need to reposition. This could be caused by neuropathies, spinal cord lesions, stroke, coma, or chemical restraints. Mental and cognitive changes may prevent pressure sensitivity. Patients may not be able to move promptly or may be too confused to follow common movement patterns. Bates-Jensen defines bottoming out as when the pressure-relieving device no longer prevents direct pressure on the surface from which the patient needs to be protected.<sup>19</sup> This can be evaluated by sliding a hand between the pressure-redistribution device and the prominence exposed to the pressure.<sup>19</sup>

**EXTRINSIC FACTORS.** Extrinsic factors include shear, friction, and moisture. Shear is defined as the applied force that can cause an opposite, parallel sliding motion in the planes of an object. Shear is affected by the amount of pressure that is exerted.<sup>3,16</sup> This tends to occur in larger occluded areas of vascular supply. An example is pulling skin in one direction and the bone in another. Friction is defined as a superficial, mechanical force directed against the epidermis, resulting in increased susceptibility to ulceration.<sup>3</sup> For example, this can occur when a patient is dragged across a sheet during repositioning or when a patient self-repositions. Another extrinsic factor occurs when the layer of skin (eg, stratum corneum) becomes overhydrated, causing weakness of the collagen or elasticity of the skin. This leads to maceration of the skin, resulting in tissue damage. All of these extrinsic factors can cause tissue damage, especially in older adult patients, patients with spastic movements, and patients who use braces or appliances that can rub against the skin.

**INTRINSIC FACTORS.** Many patients undergoing surgery, especially older adults, have numerous risk factors that can result in PUs. Intrinsic risk factors causing skin damage affect the ability of the skin and supporting structures to respond to pressure and shear forces. Intrinsic factors include advanced age, anaerobic waste products, nutritional deficiencies, and steroid administration that affect collagen synthesis and degradation. Other factors that

affect tissue perfusion include

- certain medications (eg, steroids, vasoactive medications);<sup>3,20</sup>
- presence of comorbid diseases (eg, cancer, cardiovascular and peripheral vascular deficiencies, diabetes mellitus, neurological or respiratory disease);<sup>3,20</sup>
- extracorporeal circulation;<sup>21</sup>
- impaired regulation in body temperature;<sup>3,20</sup>
- fractures;<sup>3</sup>
- low hemoglobin and hematocrit levels;<sup>3,20</sup>
- nutritional deficiencies;<sup>3,11</sup>
- obesity;<sup>22</sup>
- low serum protein (ie, prealbumin or total albumin plus globulin);<sup>3</sup>
- smoking;<sup>3,20</sup> and
- low systemic blood pressure.<sup>3,20</sup>

### POSITIONING

Positioning is a crucial component of surgical care. Positioning for a surgical procedure depends on the surgeon's preference, the anesthesia care provider's needs, the procedure being performed, the need for exposure of the surgical site, and the patient's predisposing conditions.<sup>5,15,23</sup>

Positioning is recognized as a balance between the position a patient can physically assume and those that are physiologically tolerated. A patient's body must be positioned adequately on an OR bed and proper body alignment must be maintained to lessen the potential risk of skin injuries. Factors to be taken into account during the preoperative interview before sedation and positioning occur include

- preexisting conditions;<sup>24</sup>
- decreased ranges of motion;<sup>24</sup>
- previous surgical procedures;<sup>24</sup>
- presence of joint prostheses;<sup>24</sup>
- fractures;<sup>24</sup> and
- the patient's age, height, and weight.<sup>23,24</sup>

A surgical patient should be positioned properly during the intraoperative phase of surgery to lessen possible injuries. Physiological injuries that are short-term (ie, resolving in 24 to 48 hours) or long-term can occur during surgery. Some injuries are modifiable and others are not.<sup>25</sup> The incidence of modifiable injuries can be decreased by proper positioning during surgery to lessen the probability of adverse physiological

responses, while providing access to the surgical site, the patient's airway, IV sites, and monitoring devices.<sup>23,24</sup> Maintaining optimal physiological conditions lessens the risk for complications both intraoperatively and postoperatively.

When a patient has inadequate arterial blood flow, improper positioning can cause complications with blood pressure, decrease tissue perfusion and venous return, and cause thrombus formation. The patient's skin is at increased risk of tissue damage when the patient's body weight is not distributed evenly on the OR bed or if poor tissue perfusion is present.<sup>23,24</sup>

Safety is the primary concern when determining a patient's position for a procedure. The number of personnel and devices must be ade-

quate to safely transfer or position the patient preoperatively or intraoperatively. Transferring is accomplished with a lateral transfer device (eg, slide boards, air-assisted transfer devices) that reduces friction and shear. Perioperative team members should place proper padding around the patient's body to help prevent skin breakdown, especially on high-risk areas, depending on the position (Tables 2, 3, 4, 5, and 6).

Pressure-relieving devices should be used to decrease possible ischemic changes as a result of pressure when a patient must remain in a position for several hours. Rolled sheets and towels are not to be used beneath overlays. This decreases the effectiveness of the overlay and causes pressure. It is important to monitor the

**TABLE 2**  
**Common Surgical Positions—Supine<sup>1</sup>**

### Description

- Patient lies on back with face toward the ceiling.
- Ankles are uncrossed.
- Arms are padded at sides in neutral position or on padded arm boards at less than a 90-degree angle with palms up.
- Head and upper body are in alignment with hips.
- Legs are parallel.
- If patient is pregnant, a wedge should be placed under patient's right side to shift the uterus to the left and relieve compression on the aorta and vena cava.

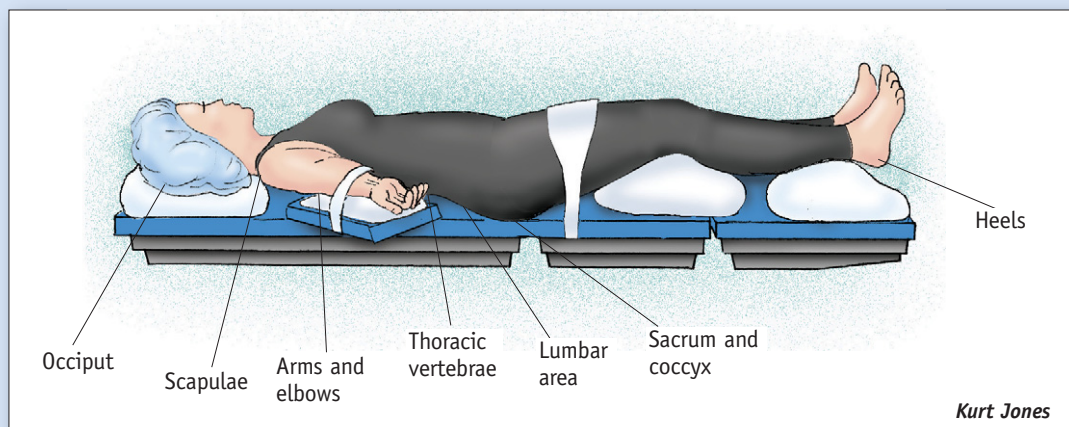
### Applicable procedures

- Anterior chest (eg, open heart)
- Abdomen
- Pelvis
- Face, neck, and mouth
- Extremities

### Vulnerable anatomy

- Occiput
- Scapulae
- Arms
- Elbows
- Thoracic vertebrae
- Lumbar area
- Sacrum and coccyx
- Heels

1. Recommended practices for positioning the patient in the perioperative setting. In: Perioperative Standards and Recommended Practices. Denver, CO: AORN, Inc; 2008:497-520.



quantity of pads, blankets, and warming blankets placed on top of or beneath a patient. Use of too many pads or blankets can cause the capillary pressure to rise over 32 mmHg, which increases the risk for poor tissue perfusion at that area of pressure, causing the patient to be at risk for PU development.<sup>15</sup>

Patients should be repositioned during surgery if they are at high risk for skin breakdown. For example, a patient in the lithotomy position may have to be repositioned after prolonged surgery. AORN's "Recommended practices for positioning the patient in the perioperative setting" suggests that a patient should be repositioned every two hours to prevent continuous pressure on pressure

points and assist in decreasing the risk of adverse physiological responses.<sup>15</sup>

### ANESTHESIA

Together, positioning and anesthesia put the patient in a compromised state. Anesthesia affects how the patient is positioned. It also blocks a patient's sensitivity to pain and pressure, causing tissue damage vulnerability. All agents used in anesthesia can depress the autonomic nervous system, causing some degree of vasodilatation that is reflected in a lowering of blood pressure that causes a decrease in tissue perfusion. The compounded effect of anesthesia and the cold OR bed causes decreased perfusion.<sup>23,24</sup> According to a study performed by

**TABLE 3**  
**Common Surgical Positions—Prone<sup>1</sup>**

**Description**

- Begins in the supine position.
- After induction of anesthesia, patient is log-rolled into the prone position (ie, face down).
- Patient may be placed on a positioning device.
- Head is placed on a padded headrest.
- Head and cervical alignment is maintained.
- Arms are at the patient's sides or on padded arm boards at less than a 90-degree angle.
- Chest rolls may be used to accommodate chest movement and lower abdominal pressure.
- Protection is provided for patient's forehead, eyes, chin, breasts, genitalia, knees, and shins.
- Toes are allowed to extend over the end of the bed or are raised off the bed with padding under the shins.

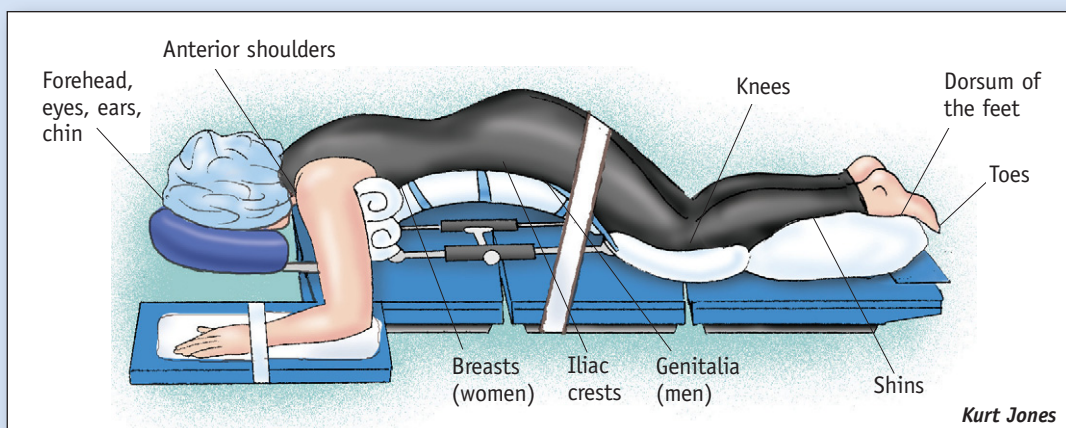
**Applicable procedures**

- Back and spine
- Posterior legs

**Vulnerable anatomy**

- Forehead, eyes, ears, and chin
- Anterior shoulders
- Breasts
- Iliac crests
- Genitalia
- Knees
- Shins
- Dorsum of the feet
- Toes

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Lindgren et al,<sup>26</sup> patients having epidural or spinal anesthesia were more likely to develop pressure ulcers than patients having general anesthesia. Other contributing factors in the study were low body mass, poor nutritional status, low albumin levels, and decreased blood pressure. Changing the position of a patient undergoing anesthesia, regardless of what vasoactive medications are used, can decrease blood pressure, putting skin integrity at risk.

### SURGERY DURATION

Most tissue can only withstand excessive pressure for brief periods. Prolonged exposure to pressure can initiate events resulting in tissue ischemia, which may lead to tissue anoxia and

necrosis. In acute and chronic settings, it is suggested that patients who are immobile be turned at least every two hours.<sup>3,15,18</sup> The duration of the surgical procedure is a significant indicator in the risk of tissue damage. Repositioning a surgical patient, except for the heels, arms, and head, is rarely possible intraoperatively.<sup>14</sup> O'Connell<sup>24</sup> demonstrated that procedures lasting longer than four hours triple the risk of tissue damage. Even the healthiest patient can be at risk for tissue damage if a surgical procedure lasts longer than four hours.

Length of a surgical procedure is not always the primary predictor of PU development. Other factors could complicate or influence the course of the procedure, resulting in

**TABLE 4**  
**Common Surgical Positions—Kraske/Jackknife<sup>1</sup>**

#### Description

- Begins in the supine position.
- After induction of anesthesia, patient is log-rolled into the prone position.
- OR bed is then flexed to a 90-degree angle.
- Head and cervical alignment is maintained.
- A padded headrest and chest rolls are used.
- Arms are at sides of bed or on arm boards at less than a 90-degree angle.
- Toes are allowed to extend over the end of the bed or are raised off the bed with padding under the shins.

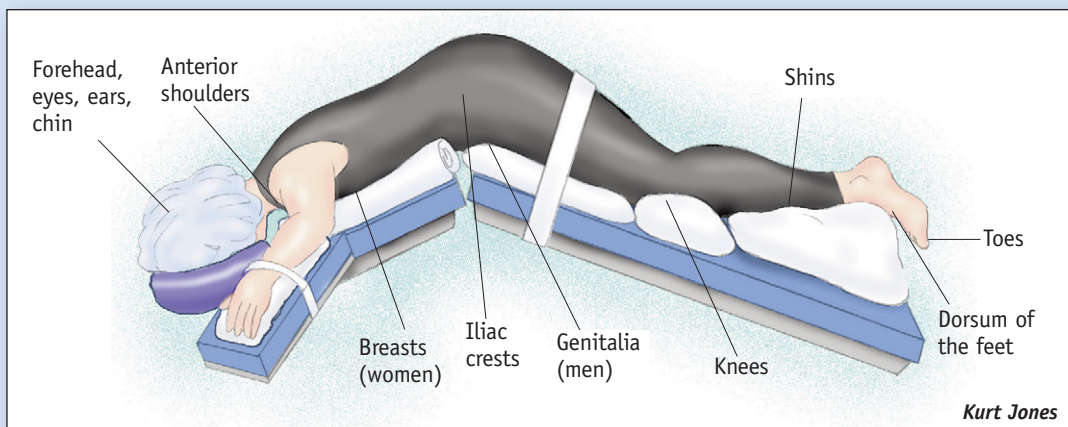
#### Applicable procedures

- Rectum
- Anus

#### Vulnerable anatomy

- Forehead, eyes, ears, and chin
- Anterior shoulders
- Breasts
- Iliac crests
- Genitalia
- Knees
- Shins
- Dorsum of the feet
- Toes

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longer time spent on the OR bed. Perioperative nurses and surgeons must address immobility if the patient will remain in one position for several hours.

**VULNERABLE SURGICAL PATIENTS**

Patients who are 65 years of age or older experience the highest incidence of PU development. The incidence of PUs in surgical patients can be as high as 45%.<sup>2,3</sup> In older adult patients, there is a greater incidence of preoperative variables (ie, extrinsic and intrinsic factors) occurring that result in physiological changes to the skin and ultimately, PU development.<sup>2,3</sup> During the intraoperative phase of surgery, which includes the time on the OR

bed, hypotension and the type of procedure increase the patient’s susceptibility to PU development.<sup>3,18</sup> The skin of the older adult is most likely to sustain tissue injury because it is less elastic with a thinner dermis and has less collagen, muscle, and adipose tissue. These characteristics make older patients not just susceptible to pressure problems with the skin, but also to increased bruising, skin tears, infection, impaired thermoregulation, and slow healing.<sup>24</sup>

**SURGICAL PRESSURE REDISTRIBUTION**

Rather than focusing on pressure reduction and pressure relief, support surfaces redistribute pressure.<sup>16</sup> These devices are designed to

**TABLE 5**  
**Common Surgical Positions—Lithotomy<sup>1</sup>**

**Description**

- Patient begins in the supine position then legs are slowly and simultaneously raised and placed in stirrups or leg holders that are at an even height. Legs are not in contact with the stirrup posts.
- Patient’s buttocks are at the break in the procedure bed.
- Arms are on arm boards at less than a 90-degree angle with the palms up. Arms are tucked at sides only if this is surgically necessary.
- Heels are in the lowest possible position.
- After surgery, the patient’s legs are lowered slowly and simultaneously.

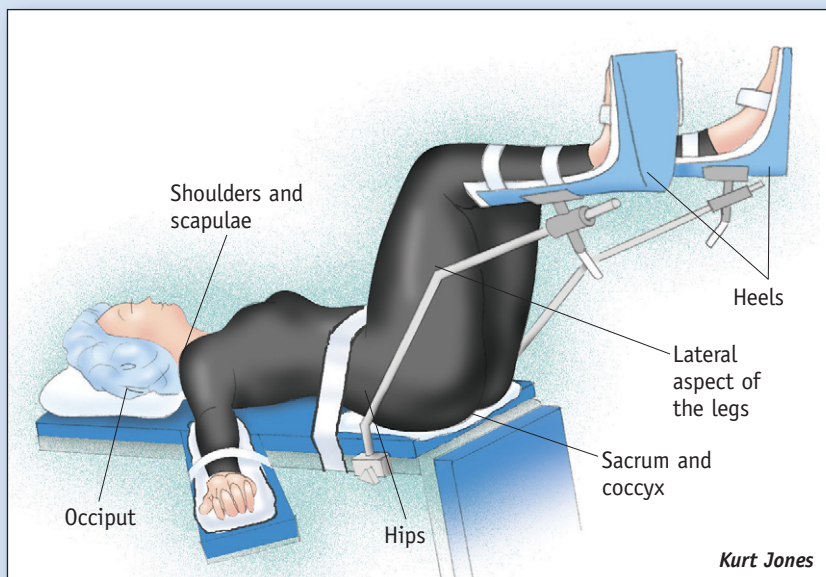
**Applicable procedures**

- Obstetrics and gynecological procedures
- Genitourinary procedures

**Vulnerable anatomy**

- Occiput
- Shoulders
- Scapulae
- Hips
- Sacrum/coccyx
- Lateral aspect of the legs
- Heels

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prevent PUs or to promote reduction of interface tissue pressure.

Several types of pressure redistribution support surfaces are available. One type is an overlay, which is placed directly on the mattress or on the bed frame as a replacement for the standard foam OR mattress. Foam, static air, gel, and dynamic air are common types of overlays, and all are latex free. Foam overlays are available in a variety of sizes, depths, densities, and construction. Static-air overlays allow air to exchange through multiple chambers when a patient lies on the overlay. This type of overlay must be reinflated periodically.

Gel overlays (ie, visco-elastic polymer) prevent shearing, support weight, and prevent

bottoming out. If punctured, gel overlays are capable of self-repair. One study found that gel overlays helped to prevent both skin changes and PU development in the older adult population, including those with chronic health comorbidities or vascular disease and those experiencing extended surgical times (ie, longer than two hours).<sup>27</sup>

Dynamic-air overlays have a mechanical pump alternating inflation and deflation. These types of overlays include alternating pressure mattresses, low-air-loss beds, and air-fluidized mattresses. Alternating-pressure mattresses produce alternating high and low pressures between the patient and the mattress with diminishing periods of high pressure.

**TABLE 6**  
**Common Surgical Positions—Lateral<sup>1</sup>**

### Description

- Patient begins in the supine position and is log-rolled onto the nonoperative side with assistance of positioning devices.
- Solid positioning devices (eg, bean bags) should be avoided as they compromise circulation and increase risk of ulceration.
- Patient's dependent leg is flexed and the top leg is straight with padding (eg, a pillow) between the legs.
- Spinal alignment is maintained.
- A headrest or pillow is used for the patient's head.
- The dependent arm is on a padded arm board. The upper arm is on a padded arm board or is supported with padding and a pillow is placed between the arms.

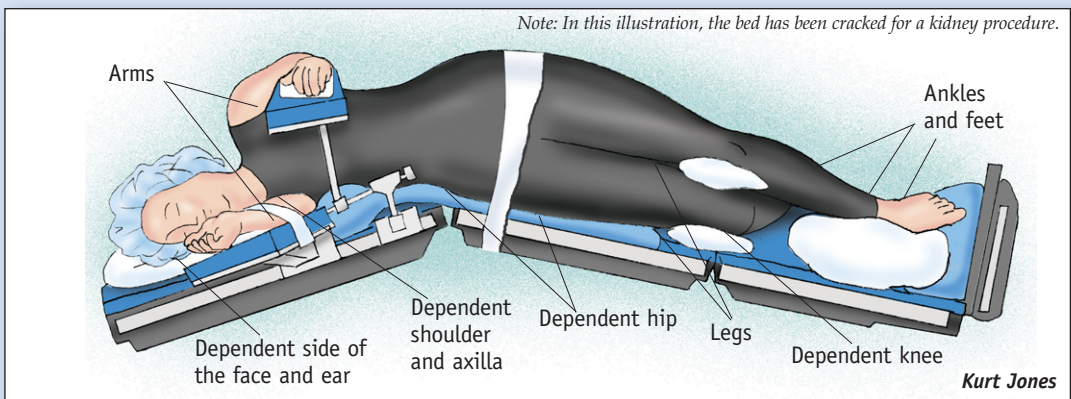
### Applicable procedures

- Chest
- Lung
- Kidney
- Hip

### Vulnerable anatomy

- Dependent side of face and ear
- Dependent shoulder
- Arms
- Dependent axilla
- Dependent hip
- Legs
- Dependent knee
- Ankles
- Feet

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Low-air-loss mattresses are air sacs through which warm air passes. Air-fluidized mattresses contain small silicone-coated beads; warm air under pressure sets the beads in motion to stimulate circulation and evenly distribute weight.<sup>7</sup> Dynamic-air overlays are not often used intraoperatively because of the possibility of body movement, electrical problems, and asepsis.<sup>15</sup>

Mackey<sup>28</sup> reviewed three OR trials that indicated that the use of air and gel pressure overlays on the OR bed might be beneficial in reducing the incidence of PU for high-risk surgical patients.<sup>28</sup> Reddy et al<sup>9</sup> reviewed 59 randomized controlled trials that addressed impairment of mobility, skin integrity, and nutrition in relation to PU development. Strategies to address mobility impairment included the use of a support surface, mattress overlays on the OR bed, and specialized foam and specialized sheepskin overlays. Reddy's review reaffirmed that mattress overlays on the OR bed may decrease the incidence of postoperative PUs along with adequate nutrition, moistening the skin, and repositioning.<sup>9</sup> More current and unbiased research is needed to address the effectiveness and deficiencies of surgical pressure redistribution support surfaces.

### **SURGICAL CONSIDERATIONS AND RECOMMENDATIONS**

All surgical patients should be considered at risk for PU development because of the uncontrollable length of surgery and the effects of anesthesia on the patient's hemodynamic state along with the use of vasoactive medications during surgery. Classifying all surgical patients as "at risk" for PU development is an appropriate preoperative intervention to successfully help reduce the incidence of possible PU development. The preoperative assessment should include details of the patient's skin status along with a risk assessment noting whether the patient is a high-risk candidate for PU development based on the proposed procedure and intrinsic and extrinsic factors. Perioperative nurses should develop nursing guidelines and protocols and individualized nursing care plans based on the patient's condition, the type and length of the surgical procedure, the required surgical posi-

tioning devices, and risk factors (Table 7).

**SKIN ASSESSMENT.** The perioperative nurse should perform a thorough skin assessment of each surgical patient. This establishes a preoperative baseline to compare with the patient's postoperative status. The preoperative nurse should check thoroughly for any skin complications (eg, rash, maceration, infection, breakdown, dermatitis, incontinence, lymphedema) and look for signs of venous insufficiency<sup>21</sup> (eg, aching, cramps, pain, tiredness, paresthesia in the legs that worsens with standing or walking and is relieved by rest and elevation). A Braden or Norton Scale can be used to validate the patient's skin integrity and provide a comparison of preoperative and postoperative skin status. These scales can determine preoperatively whether the patient is at high risk for PU development, depending on the parameters being assessed. These assessments can provide evidence that would suggest the need to take more proactive steps before surgery to help prevent possible tissue damage and PU development.

Pressure ulcer development does not necessarily start in the OR. Many factors that can contribute to tissue fragility begin before surgery. It would be appropriate, therefore, to thoroughly assess the patient's skin when performing the preoperative physical examination (eg, nutrition, hydration) and laboratory tests (eg, hemoglobin, total albumin, prealbumin), all of which are important in evaluating skin integrity. For example, if a patient has been immobile or unable to react to ischemic pain before surgery, the patient is at increased risk for skin breakdown. Perioperative nurses should emphasize evaluating skin integrity before surgery. More research needs to be performed to help support the preoperative and postoperative use and effectiveness of a skin assessment for surgical patients.

**CONSIDERATIONS FOR SUPPORT SURFACES.** Pressure redistribution devices should be used for all surgical patients. The use of pressure redistribution support surfaces has been proven to be effective in decreasing PU formation, especially among high-risk populations.<sup>9,14,27,28</sup> For surgery, research supports the use of a static-air mattress in the OR. Gel overlays have been shown

**TABLE 7**  
**Nursing Care Plan to Prevent the Development of**  
**Intraoperatively Acquired Pressure Ulcers [PNDS code]**

<b>Diagnosis</b>	<b>Nursing interventions</b>	<b>Outcome indicator</b>	<b>Outcome statement</b>
Risk for injury [X29]	<ul style="list-style-type: none"> <li>● Verifies the patient's identity, allergies, NPO status, informed consent, and laterality [I26, I123, I124, I143].</li> <li>● Identifies physiological status (eg, skin integrity, sensory impairments, musculoskeletal status) [I66, I90].</li> <li>● Implements protective measures to prevent injury (eg, appropriate positioning, adequate padding of pressure points, safety devices) [I11, I72-I78, I90].</li> <li>● Evaluates for injury [I136-I143, I152].</li> </ul>	The patient's skin remains intact, nonreddened, and free of blistering; motion, sensation, and circulation are maintained or improved during the perioperative period.	The patient is free from signs and symptoms of physical injury acquired during the perioperative period [O1].
Ineffective tissue perfusion [X61]	<ul style="list-style-type: none"> <li>● Identifies baseline tissue perfusion [I60].</li> <li>● Identifies risk factors for ineffective tissue perfusion (eg, venous stasis) [I15].</li> <li>● Maximizes mechanical prophylaxis by               <ul style="list-style-type: none"> <li>● assisting the patient in donning thromboembolic disease (TED) stockings properly,</li> <li>● educating the patient about the importance of wearing them as prescribed, and</li> <li>● suggesting that the patient use stockinettes or socks under foot pumps for comfort.</li> </ul> </li> <li>● Administers pharmacologic agents as ordered.</li> <li>● Maintains continuous surveillance [I128].</li> <li>● Evaluates postoperative tissue perfusion [I46] and response to venous stasis prophylaxis.</li> </ul>	The patient does not exhibit signs or symptoms of venous stasis.	The patient has wound/tissue perfusion consistent with or improved from baseline levels established preoperatively [O11].

to provide a reduction in pressure but not as effectively as air mattresses. More research needs to be done to help identify preventative techniques, supplies, and equipment.

Nurse managers should assess the support surfaces used throughout the hospital, including in the emergency department (ED). Many patients are transported to the ED in ambulances on hard surfaces. Patients then are transferred onto stretcher mattresses that do not provide the pressure redistribution needed to help prevent PU development. Often, patients in the ED are left on that surface waiting for admission for many hours. Patients may already have adversely affected tissue because of this extensive and long-term pressure.

More research is needed to address the prevention of PUs in surgical patients. The re-

search then should be translated into better education to improve the competency of perioperative team members and to help develop and implement policies and procedures, where needed, to decrease the vulnerability for PU development. More evidence-based research in this area will encourage practice changes that will in turn help decrease PU development, improve patient comfort, decrease patient mortality, and lower health care costs. — **AORN** —

***Acknowledgment:** The author acknowledges Michelle M. Byrne, PhD, RN, CNOR, associate professor of nursing and coordinator of the MS Nursing Education Program, North Georgia College and State University, Dahlonega, GA, for her support and mentorship during the development of this manuscript.*

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## Prevention of Pressure Ulcers in the Surgical Patient

### PURPOSE/GOAL

To educate perioperative nurses about prevention of intraoperatively acquired pressure ulcers (PUs).

### BEHAVIORAL OBJECTIVES

After reading and studying the article on preventing PUs in surgical patients, nurses will be able to

1. discuss the etiology of PU development,
2. describe factors that contribute to the development of intraoperatively acquired PUs,
3. identify surgical patient populations that may have an increased risk of developing PUs, and
4. describe methods available to help prevent PUs in surgical patients.

### QUESTIONS

1. Local blood flow is occluded when the external pressure exceeds normal capillary filling pressure of approximately
  - a. 32 mmHg.
  - b. 64 mmHg.
  - c. 86 mmHg.
  - d. 92 mmHg.
2. Underlying tissue may become necrotic by the time a lesion presents on the skin surface because
  - a. muscle rests directly on bone.
  - b. muscles have less vascular supply than skin.
  - c. muscle is more sensitive to pressure than skin.
  - d. muscles have more vascular supply than skin.
3. Necrosis occurs when unrelieved pressure is applied for
  - a. less than 30 minutes.
  - b. two to four hours.
  - c. four hours or more.
  - d. six hours or more.
4. Extrinsic risk factors for tissue damage include
  1. comorbid diseases.
  2. friction.
  3. overhydration of tissue.
  4. shear.
5. When a patient has inadequate arterial blood flow, improper positioning can
  1. cause blood pressure complications.
  2. decrease tissue perfusion.
  3. decrease venous return.
  4. result in thrombus formation.
6. According to AORN's "Recommended practices for positioning the patient in the perioperative setting," the OR team should reposition the patient every \_\_\_\_\_ to prevent continuous pressure on pressure points.
  - a. 30 minutes
  - b. hour
  - c. two hours
  - d. three hours

7. All agents used in anesthesia can
1. cause a decrease in tissue perfusion.
  2. cause some degree of vasodilatation.
  3. depress the autonomic nervous system.
  4. lower blood pressure to some degree.
- a. 1 and 3  
b. 2 and 4  
c. 1, 2, and 3  
d. 1, 2, 3, and 4
8. Anatomical sites that are vulnerable to pressure ulcer development when a patient is in the jackknife position include
1. dorsum of the feet.
  2. eyes, ears, and forehead.
  3. genitalia and breasts.
  4. knees.
  5. occiput.
  6. sacrum.
- a. 1 and 5  
b. 1, 2, 3, and 4  
c. 2, 3, 4, 5, and 6  
d. 1, 2, 3, 4, 5, and 6
9. The highest incidence of PU development occurs in patients who are
- a. younger than 10 years of age.  
b. 50 years of age or older.  
c. 65 years of age or older.
10. Gel overlays (ie, visco-elastic polymer)
1. allow gel to exchange through multiple chambers.
  2. are capable of self-repair.
  3. prevent bottoming out.
  4. prevent shearing.
  5. support the patient's weight.
- a. 2 and 3  
b. 1, 4, and 5  
c. 2, 3, 4, and 5  
d. 1, 2, 3, 4, and 5

*The behavioral objectives and examination for this program were prepared by Rebecca Holm, RN, MSN, CNOR, clinical editor, with consultation from Susan Bakewell, RN, MS, BC, director, Center for Perioperative Education. Ms Holm and Ms Bakewell have no declared affiliations that could be perceived as potential conflicts of interest in publishing this article.*

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## Prevention of Pressure Ulcers in the Surgical Patient

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| 3 | A | B | C | D | E | 8  | A | B | C | D | E |
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| 5 | A | B | C | D | E | 10 | A | B | C | D | E |

## Prevention of Pressure Ulcers in the Surgical Patient

**T**HIS EVALUATION is used to determine the extent to which this continuing education program met your learning needs. Rate these items on a scale of 1 to 5.

### PURPOSE/GOAL

To educate perioperative nurses about prevention of intraoperatively acquired pressure ulcers (PUs).

### OBJECTIVES

To what extent were the following objectives of this continuing education program achieved?

1. Discuss the etiology of PU development.
2. Describe factors that contribute to the development of intraoperatively acquired PUs.
3. Identify surgical patient populations that may have an increased risk of developing PUs.
4. Describe methods available to help prevent PUs in surgical patients.

### CONTENT

To what extent

5. did this article increase your knowledge of the subject matter?
6. was the content clear and organized?
7. did this article facilitate learning?
8. were your individual objectives met?
9. did the objectives relate to the overall purpose/goal?

### TEST QUESTIONS/ANSWERS

To what extent

10. were they reflective of the content?
11. were they easy to understand?
12. did they address important points?

### LEARNER INPUT

13. Will you be able to use the information from this article in your work setting?
  - a. yes
  - b. no
14. I learned of this article via
  - a. the *AORN Journal* I receive as an AORN member.

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	1	2	3	4	5	6	7	8	9	0
	1	2	3	4	5	6	7	8	9	0
	1	2	3	4	5	6	7	8	9	0
	1	2	3	4	5	6	7	8	9	0

(Low) (High) (Low) (High)

<b>1</b>	1	2	3	4	5	<b>11</b>	1	2	3	4	5
<b>2</b>	1	2	3	4	5	<b>12</b>	1	2	3	4	5
<b>3</b>	1	2	3	4	5	<b>13</b>	1	2	3	4	5
<b>4</b>	1	2	3	4	5	<b>14</b>	1	2	3	4	5
<b>5</b>	1	2	3	4	5	<b>15</b>	1	2	3	4	5
<b>6</b>	1	2	3	4	5	<b>16</b>	1	2	3	4	5
<b>7</b>	1	2	3	4	5	<b>17</b>	1	2	3	4	5
<b>8</b>	1	2	3	4	5	<b>18</b>	1	2	3	4	5
<b>9</b>	1	2	3	4	5	<b>19</b>	1	2	3	4	5
<b>10</b>	1	2	3	4	5	<b>20</b>	1	2	3	4	5

- b. an *AORN Journal* I obtained elsewhere.
- c. the *AORN Journal* web site.

15. What factor most affects whether you take an *AORN Journal* continuing education examination?
  - a. need for continuing education contact hours
  - b. price
  - c. subject matter relevant to current position
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What other topics would you like to see addressed in a future continuing education article? Would you be interested or do you know someone who would be interested in writing an article on this topic?

Topic(s): \_\_\_\_\_

Author names and addresses: \_\_\_\_\_