

PERIOPERATIVE PATIENT POSITIONING

A Focus on Quality Improvement for Pediatric Patients

Elizabeth Norton and Mary Ann Young

Approximately 12% to 25% of patients with hospital acquired pressure ulcers develop them during surgical procedures.¹ Studies reveal that one in 12 patients undergoing surgical procedures lasting more than three hours will develop postoperative pressure ulcers within four days.² Not only do skin pressure ulcers produce needless pain and suffering for patients, but they also have a negative effect on a patient's quality of life, sometimes for months at a time. This complication represents a cost of nearly \$5 billion annually to the US health care system.³ Recent changes in practices and products, however, can help improve patient outcomes and decrease the incidence of skin integrity alterations during the perioperative course.

Positioning pediatric patients for lengthy surgical procedures can challenge perioperative nurses. While there is a great deal of research and many studies about skin pressure ulcers in the adult population, literature focused on the development of skin ulcers in pediatric patients is scarce. Most fundamental concepts of positioning to prevent ulcer formation in adults can be applied to pediatric patients as well, but pediatric nurses must base their planning and interventions on scientific theory, extrapolating information from the adult literature. This is a continuous work in progress with a focus on quality improvement. The delivery of safe, quality patient care in this era of cost containment can be challenging, but a patient-centered, cost-effective approach in the prevention of skin pressure ulcers must become the norm. This can be accomplished with theoretically based guidelines, appropriate positioning devices, and a planned strategy to educate perioperative nurses about proper positioning techniques.

ETIOLOGY AND PATHOPHYSIOLOGY

The etiology of pressure ulcer formation involves two synergistic factors: duration and intensity of pressure.

Long duration and high pressure, combined or alone, increase the risk for pressure ulcers. In the perioperative setting, additional risk factors include

- ▲ the absence of sensory perception due to general anesthesia,
- ▲ exposure to moisture from prep solutions,
- ▲ perspiration,
- ▲ decrease or absence of mobility,
- ▲ poor nutrition, and
- ▲ the presence of friction and shear.

While under anesthesia, patients experience a loss of muscle tone, which increases pressure on bony prominences. Any patient—adult or child—undergoing a procedure for two or more hours is at high risk for developing skin pressure ulcers. Patients with specific medical diagnoses (eg, diabetes, cerebral palsy, spina bifida) also are at high risk.

The term pressure gravity refers to the force of the patient against the OR bed and the compression of skin, muscle, and bone, which adversely affects capillary interface pressures. In 1930, it was found that the end arterial capillary pressure average was 32 mm Hg.⁴ Pressure that exceeds 32 mm Hg can

result in altered tissue perfusion, which causes ischemia—in which small vessels collapse and thrombose. This leads to occlusion of blood flow and oxygen, nutrients, and lymph circulation deprivation. This series of events produces toxic metabolites at the cellular level, causing tissue acidosis, as well as increased capillary permeability, edema, cell death, and potential pressure ulcer formation.

In pediatric patients, as in adults, pressure ulcers commonly occur at bony prominences. Reactive hyperemia (ie, blanchable erythema) can be caused by sustained pressure for even a short time, resulting in reddened skin, which develops after the blood supply to a body part is cut off and then restored. This response is seen frequently, and it must be differentiated from true alterations in skin integrity. There is a system for grading or staging skin pressure ulcers to classify the

IN BRIEF

△ Positioning pediatric patients for surgical procedures poses a challenge to perioperative nurses. Most patient positioning concepts for preventing pressure ulcers in adults can be applied to pediatric patients, but pediatric nurses must base their planning and interventions on scientific theory, extrapolating information from the adult literature.

△ Individualized planning, effective positioning devices, education, and acute assessment skills can help minimize the occurrence of pressure ulcers.

△ This article details how Children's Hospital, Boston, used new techniques and products to minimize pressure ulcers, maintain high patient care standards, and remain cost effective.

severity of tissue damage (Table 1).⁵ Reactive hyperemia is reversible with pressure relief. Stage I may be reversed with intervention. Stages II through IV, however, require aggressive treatment and long-term management. This staging system can be used to assess skin changes in both adults and children.

IN THE BEGINNING

In 1994, the perioperative risk management committee at Children's Hospital, Boston, identified an area of concern related to alterations in skin integrity. Committee members recognized that this realm of practice warranted attention. By summarizing in-house data gathered from current and past reports, the committee identified areas of practice unique to the perioperative arena that needed improvement.

The data revealed no consistent trends, but a significant number of isolated incidents were identified that required further evaluation. At the same time, pediatric patients with skin pressure ulcers that had been acquired in the home or a chronic care facility were admitted to the hospital. These patients required skin grafts or flaps to treat their grade IV ulcers, along with a costly pressure reduction bed postoperatively. The hospital's clinical nurse specialist responsible for skin, wounds, ostomy, and incontinence management relayed information about these patients to the perioperative nurses. She soon became a valuable colleague and consultant, providing literature for staff members and sharing knowledge about pressure ulcers and skin care.

We learned that this was an issue of hospital-wide concern and that a skin care committee was addressing a number of areas (eg, pressure ulcer prevention and management, ostomy care, the implementation of specialty beds). This committee's responsibilities included identifying areas for improvement and implementing changes on inpatient units. Our skin care clinical specialist verified the problem with alterations in skin integrity and the need for follow-up. We recognized that there was a lack of communication between the perioperative phase and the postoperative phase. We also identified the need for prompt intervention. As perioperative nurses, we needed to be more aware of postoperative complications. This was a crucial area that required conscientious follow-up to measure patient outcomes.

REVIEWING PRODUCT CHOICES

Product research was an integral component of improving patient outcomes. Finding cost-effective, high-quality, pressure-reducing products that fit the needs of the pediatric and adult patient population was a priority. A myriad of positioning products are available, most characterized as either static or dynamic. Static devices provide dry flotation and generally are preferred for perioperative procedures because they keep the patient immobile. Dynamic devices involve a pump or motor. These provide continuous alternating pressure points under the patient.

A gel-based positioning device was introduced to the OR, and research indicated that it was more effective in preventing skin changes than the standard foam mattress (Table 2).⁶ Foam positioning devices are primarily provided for comfort and may have a tendency to bottom out. For long-term use or lengthy surgical procedure, these devices could contribute to pressure ulcer formation. Gel-based products are shaped in different sizes to accommodate any position and any size patient. Further research of positioning devices indicated that such items as sheepskin and egg crate mattresses offer

TABLE 1: STAGES OF PRESSURE ULCER FORMATION¹

Stage I	Intact skin is reddened and does not blanch to fingertip pressure. This lesion signifies the beginning of pressure injury. This is the only stage that is potentially reversible with intervention.
Stage II	Skin is abraded, blistered or has shallow craters. Partial thickness and skin loss involving the epidermis and dermis characterize this stage.
Stage III	Deep craters are present with or without undermining deep sinus tracts in tissues. Full thickness skin loss occurs that may extend down to but not through underlying fascia.
Stage IV	Extensive damage to muscle, bone, and supporting structures develops, and undermining deep sinus tracts may be present.

1. Agency for Health Care Policy and Research, *Pressure Ulcers in Adults: Prediction and Prevention, Clinical Practice Guideline Number 3*, pub no 92-0047 (Washington, DD: US Department of Health and Human Services, May 1992); "Dermal wounds: Pressure ulcers," *Standards of Care/Guidelines for Management* (Laguna Beach, Calif:Wound, Ostomy and continence Nurses Society, 1992).

TABLE 2: GEL PRODUCT CHARACTERISTICS

- ▲ Tissue-like in composition.
- ▲ Prevents skin from shearing.
- ▲ Supports weight without bottoming out.
- ▲ Self healing if punctured.
- ▲ Latex-free.
- ▲ Reusable.
- ▲ Will not absorb body fluid or odors.
- ▲ Easily cleaned with disinfectants.
- ▲ Does not support microbiological growth.
- ▲ Radiotranslucent.
- ▲ Supports thermoregulation by dissipating heat.

minimal, if any, pressure-relieving qualities.

In response to these findings, our clinical nurse specialist in wound care helped initiate a hospital-wide change to a new and improved pressure reduction mattress (ie, mattress replacement system). This virtually eliminated the need for egg crate mattresses. In addition, we streamlined products, which benefited the hospital and patients by offering

- ▲ better positioning devices for patients,
- ▲ a higher quality mattress for patients,
- ▲ long-term cost savings,
- ▲ elimination of the specialty equipment storage space problem,
- ▲ simplification and reduction in product ordering or rental, and
- ▲ a standardized approach in patient care delivery.

POLICY, PROCEDURE, AND EDUCATION

From the outset, we knew that we needed new guidelines and education to improve the quality of care for our pediatric patients. As a first step toward providing guidelines, the perioperative nursing policy and procedure was revised to include theoretically based information and practical innovations specific to each patient position. We used a multidisciplinary approach to develop a comprehensive policy that included all aspects of the perioperative phase, and consulted representatives from surgery and anesthesia, as well as nursing experts from each service, about positioning recommendations. We extrapolated data from the available pediatric and adult literature and applied the scientific principles. We also added data from our own experiences with the pediatric patient population. General information in the policy included theory, guidelines for skin assessment, documentation, and follow-up.

A series of educational in-service sessions were held for perioperative nursing staff members. During the first session, a company sales representative presented information about the benefits and use of gel-based products and the theory and fundamentals of positioning. Next, our clinical nurse specialist gave a presentation on skin pressure ulcer formation, skin assessment, and the key points of documentation. In this session, she used case studies to demonstrate her own experiences, and she discussed prevention methods and ways to apply this knowledge to perioperative practice. She emphasized the importance of using acute assessment skills during the perioperative phase to assess patients' skin conditions.

The revised policy and procedure for positioning patients was presented to perioperative nursing staff members. An anesthesia department representative and the clinical nurse specialist were present to offer input and support changes in products and practice. Theoretical basics of positioning were reviewed and included hands-on demonstrations of specific examples of positions. After this presentation, staff members were eager to put the theory into practice. In addition, anesthesia staff members attended an in-service session on key components of the positioning policy and procedure. This facilitated a collaborative team effort for more positive patient outcomes in skin integrity changes. Branching out to educate other departments within the hospital was crucial if

we hoped to provide a universally improved approach to patient positioning.

ASSESSMENT, DOCUMENTATION, AND FOLLOW-UP

Assessing patients for their risk of developing pressure ulcers preoperatively is an integral part of the nursing process. A systematic, comprehensive, routine skin inspection helps when designing patient positioning interventions and deciding which devices will be used. Noting the skin integrity over bony prominences on high-risk patients with impaired sensory motor conditions or other high-risk diagnoses is crucial in the assessment process. Identifying risk factors according to the Braden Scale is helpful when determining a patient's propensity for developing skin ulcers.⁷ (Table 3.) This scale can be used for adult and pediatric patients alike, but it has been modified for pediatric patients as the Modified Braden Q Scale.⁸

The intraoperative record should have detailed documentation about preoperative skin integrity, as well as patient positioning, for all surgical procedures. Positioning devices, padding, protection, and body alignment should be described in intraoperative nursing notes.

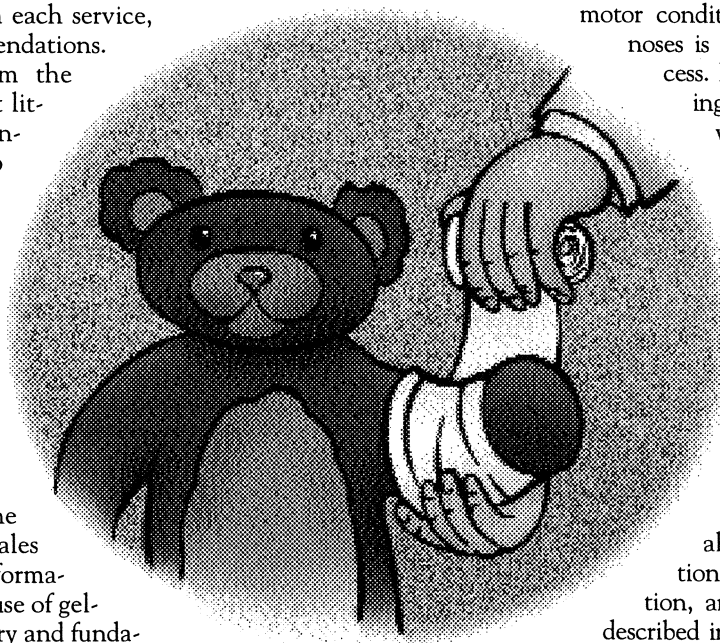
This documentation becomes crucial for follow-up if an alteration in skin integrity does occur.

Nurses should conduct a postoperative assessment of all skin areas, particularly over bony prominences. Some alterations in skin may not appear until several days after surgery.⁹ Keep this in mind when assessing patients for potential skin alterations. To assess any reddened areas, use fingertip pressure to check for skin blanching. This assessment differentiates between reactive hyperemia and actual tissue trauma. If an alteration in skin integrity does occur, documentation in the nurses' notes and an incident report are required.

When describing stage I through IV skin injury, documentation should include

- ▲ the exact location of the injury,
- ▲ its size in centimeters,
- ▲ its color,
- ▲ whether it is draining, and
- ▲ capillary refill response to fingertip pressure.

Interventions to provide pressure relief, as well as treatment of the area, may be necessary. Communication with postoperative caregivers is essential to ensure proper care, monitoring, and documentation.



All skin-related incident reports should be followed up within 48 hours of filing. If it is possible, the perioperative nurse involved should make a follow-up telephone call to the inpatient unit. If this is not possible, the risk management committee assumes responsibility. The follow-up telephone call is documented on the incident report form, and any skin alteration requiring further intervention or consultation can be arranged through the risk management committee.

For significant alterations in skin integrity, a postoperative visit to the patient by the perioperative nurse or a member of the risk management committee is warranted. If the patient is no longer in the hospital, one of the surgical team members (eg, perioperative nurse, surgeon, anesthesiologist) or a member of the risk management committee calls the patient. These individuals also may follow up during the postoperative surgical visit. If necessary, a visiting nurse is arranged by the surgical office through discharge planning. Because some pressure ulcers are not evident until one to four days postoperatively, they are underreported. Accurate documentation is imperative for follow-up when determining the origin of skin pressure ulcers.

PRACTICAL INNOVATIONS

As a result of a literature review and consultations with the skin care clinical nurse specialist, we incorporated some practical innovations into our daily practice to improve patient outcomes. The skin care nurse specialist identified an in-house trend for heel pressure ulcers among the patient population receiving epidural anesthesia, including the pediatric patients. Most of these patients wore sheepskin booties, which was part of the protocol for those with an epidural catheter. She had us convert from sheepskin booties to a simple elevation of heels. Sheepskin is used purely for comfort and possesses no actual pressure-relieving qualities. Because patients with an epidural do not move their lower extremities independently and have no sensory perception in their legs, they are at high risk for heel pressure ulcer formation.

As well as being a bony prominence, the heel also is a small body surface area with high interface pressures. To redistribute pressure from under the heels to a larger body surface area, it is necessary to elevate or suspend the heels by placing a pillow or other appropriately sized positioning devices under the full length of the lower legs. Since we began using this intervention, we have had no incidents of heel pressure ulcers in patients who receive epidural anesthesia. This practice not only has been of benefit to the patients with epidurals, but also has been implemented among all our perioperative patients with great success. It is a simple innovation that is valuable and cost-effective because it is accomplished with the use of readily available pillows or bath blankets. This also is a procedure that can easily be adjusted to the various body sizes of a pediatric patient population.

We also learned that donut-shaped positioning devices may cause circumferential venous congestion and edema.¹⁰ In some circumstances there is no acceptable alternative; therefore,

efforts must be made to elevate or change the patient's head position at least every two hours. Newer devices—alternatives to donut-shaped products—have a gel base with a gradual concave shape. These products minimize circumferential venous congestion, especially when used while lifting the head at least every two hours intraoperatively. Current guidelines discourage the use of donut-shaped devices anywhere on the body. In fact, we have had several reported incidents of temporary alopecia directly attributed to the use of donut-shaped positioning and inadequate head lifts during surgical procedures. When at all possible, alternate gel headrests and frequent position changes or head lifts should be a standard to decrease the risk of venous congestion and accompanying alopecia.

Another effective intervention adopted by the perioperative nurses was the use of a transparent dressing over bony prominences to help further protect areas at risk for breakdown.¹¹ Because this product decreases friction and shearing of the skin, we find it especially useful over hips, knees, elbows, and the coccyx. The dressing mimics an extra layer of skin to protect the patient. We have had positive results with patients undergoing posterior spine fusion who lie in the prone position; they have experienced a significant decrease in skin alteration over their anterior hips.

Putting simple interventions into practice resulted in positive patient outcomes for both pediatric and adult patients. Ideas based on scientific theory and translated into our perioperative nursing care plan improve and maintain our high standards. Some of the practical innovations we use in our everyday practice include

TABLE 3: THE BRADEN SCALE FOR PREDICTING PRESSURE ULCER RISK¹

The Braden scale is used to determine the level of risk for pressure ulcer formation by the use of the following scoring system.

Sensory perception:	The ability to respond meaningfully to pressure-related discomfort
Moisture:	The degree to which skin is exposed to moisture
Activity:	The ability to change and control body position
Nutrition:	The usual food intake pattern
Friction and shear:	Amount of body shift against a stationary surface

1. Agency for Health Care Policy and Research, *Pressure Ulcers in Adults: Prediction and Prevention, Clinical Practice Guideline Number 3*, pub no 92-0047 (Washington, DD: US Department of Health and Human Services, May 1992).

- ▲ padding the OR bed with gel for cases that last more than two hours or for patients at high risk for skin breakdown;
- ▲ maintaining patient body alignment;
- ▲ protecting the skin from wrinkled clothing, bedding, and devices (eg, tubing, cords);
- ▲ lifting patients to avoid friction and shearing;
- ▲ positioning armboards at less than a 90-degree angle;
- ▲ elevating heels;
- ▲ elevating the head at least every two hours;
- ▲ protecting eyes, ears, breasts, and genitals from pressure;
- ▲ using gel rolls for prone and lateral positions;
- ▲ using clear, transparent dressings on bony prominences when needed;
- ▲ protecting bony prominences from direct contact with each other (eg, knees in lateral position);
- ▲ raising and lowering legs simultaneously (eg, for lithotomy position);
- ▲ minimizing external rotation of hips, as well as hyperflexion;
- ▲ avoiding nerve injury by alleviating pressure to nerves—commonly the brachial, ulnar, and peroneal;
- ▲ avoiding donut-shaped positioning devices; and
- ▲ developing consistencies in positioning for routine cases (eg, posterior spine fusion patients are always positioned prone on a spine frame using the same positioning devices).

THE FINANCIAL IMPACT

When new products are necessary to implement improvements in practice, cost is always a factor. The long-term benefits and advantages of preventive practice have to be considered when researching new products. In a study conducted at Children's Hospital Medical Center, Akron, Ohio, 994 of 4,533 hospital days could be attributed to loss of skin integrity.¹² For inpatient pediatric patients with a primary diagnosis of skin-related alterations, the average cost per day was approximately \$1,375, with a total cost of approximately \$1.4 million during a four-year period for skin integrity problems alone.¹³ In the adult population, another study showed that pressure ulcer treatment costs range from \$10,000 to \$60,000 per skin pressure ulcer.¹⁴ Preventive measures seem to be the only common sense approach to this problem.

Certain cost-saving strategies evolved within our own institution. For example, synthetic sheepskin was eliminated from every OR bed when we learned that the product was ineffective and did not meet fire safety requirements. This saved an estimated \$20,000 annually. The new pressure reduction mattresses replaced egg crate mattresses throughout the hospital. These mattresses range in price from \$207 to \$288 and resulted in an average cost saving of \$11,000 per year. The discontinuance of air fluidized therapy beds brought savings of \$80 per day over a six-week inpatient stay. This bed was replaced with pressure relief overlay mattresses with 18 alternating air sacs for pressure reduction, at a cost of \$16 per day. Patients use this mattress for an average of four inpatient days, and, when discharged, are able to use the mattress at home for six weeks. This represents a significant savings from the \$80 to \$130 per day spent on air fluidized therapy beds.

The average cost of gel-based positioning products was significant during the initial conversion phase. Because this product is reusable, however, the current cost to maintain our stock is approximately \$5,000 per year. There are many quality products available, and the initial cost must be weighed against the long-term benefits. It is prudent to continuously evaluate positioning products in use and monitor their effectiveness in promoting positive patient outcomes.

CONCLUSION

To pioneer this endeavor required the support of staff members and nurse directors. This project was solely for the benefit of our pediatric patients, but by researching alternative products, cost savings were recognized as well. We took a proactive approach in the prevention of skin breakdown, decreasing the financial burden on the health care system caused by such injuries. Most importantly, our patients are the recipients of quality nursing care based on knowledge, experience, and a learning continuum as we strive to maintain clinical excellence in the perioperative setting. Δ

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Pressure Ulcers

A Preventable Tragedy

George T. Rodeheaver

Thousands of patients annually develop pressure ulcers in the OR, at a huge cost to the health care system. The tragedy is that most, if not all, of these pressure ulcers could have been prevented with simple, cost-effective interventions. The most cost-effective intervention is by increasing awareness that prolonged immobility can result in pressure ulcer formation.

PRESSURE ULCERS

A pressure ulcer is an area of localized tissue destruction caused by the compression of skin over bony prominences between bones and support surfaces. Pressure ulcers are not just a problem for immobile geriatric patients. They can occur in neonates who are immobilized by severe conditions; they can occur in healthy teenagers who are involved in car accidents and immobilized on backboards for hours waiting for neurosurgical repair or release; and they can occur in middle-aged adults who require prolonged procedures for bypass surgery.

Pressure ulcers occurring in the OR have only been recognized in the past decade.¹ Previously, when discolored areas were present on the posterior skin, they were ascribed to cautery pad burns. This was especially true in those situations in which the darkened area broke down to a full thickness wound within hours of the patient leaving the OR. No one suspected that pressure could cause such a horrific wound in such a short period of time—it had to have been an electrical injury. Operating room personnel must make every effort to minimize the duration and extent of tissue ischemia. The susceptibility of tissue to ischemic damage is directly related to its viability. Healthy, vital tissue is much more resistant to damage than tissue that has already been devitalized by other factors (eg, malnutrition, dehydration, poor circulation, age). Thus, all patients must be assessed for their total risk for pressure ulcers.

The prevalence of pressure ulcers in acute care hospitals has remained steady at approximately 10% for the past decade.² Though some patients are admitted with existing pressure ulcers, the majority of patients develop them during their hospital stay. For many surgical patients, their preoperative, intraoperative, and postoperative care results in tissue

damage. At-risk patients must be identified upon admission to health care facilities, and care plans that relieve pressure and prevent ulcers must be in place during all phases of their care. These care plans should include, at a minimum, pressure relief, nutritional support, maintaining clean skin, and educating patients, their families, and care providers about the etiology and prevention of pressure ulcers.

GUIDELINES

In 1992, the Agency for Health Care Policy and Research (AHCPR) published a clinical practice guideline entitled, *Pressure Ulcers in Adults: Prediction and Prevention*.³ The consensus was that patients who had impaired ability to reposition themselves were at risk for developing pressure ulcers. The guideline states that any additional risk factors should be assessed and documented using a validated risk assessment tool.

The guideline also states that “any individual who is assessed to be at-risk for developing pressure ulcers should be repositioned at least every two hours.”⁴ What can be done for accident victims on backboards, patients undergoing prolonged surgical procedures, patients in traction, or patients in intensive care units (ICU) who cannot be repositioned? These individuals must be

placed on effective pressure relieving surfaces that prevent tissue from being compressed to the point of vessel closure, which results in tissue ischemia. Special pads can be used on backboards and OR tables, and special beds can be used in ICUs. Pressure ulcers are everyone’s responsibility, and, though some providers may never see a pressure ulcer, they must be aware that how they manage patients can determine whether they develop pressure ulcers.

THE AT-RISK SURGICAL PATIENT

Trauma patients and patients undergoing lengthy elective procedures are susceptible to pressure ulcers. In a recent study, researchers reported that the incidence of pressure ulcers in surgical patients ranged from 19% to 66%.⁵ In another study, 104 hospitals monitored for a one-week period patients who underwent surgeries lasting three or more hours.⁶ Of 1,128 patients monitored, 8.1% developed pressure

IN BRIEF

△ Pressure ulcers that occur in the OR increase patient morbidity and hospital expense.

△ Identifying at-risk patients and implementing effective prevention measures can help prevent pressure ulcers.

ulcers. The incidence rate was correlated with the length of surgery: 5.8% for surgeries lasting three to four hours, 13.2% for surgeries of more than seven hours.

Though the exact risk factors have not been fully documented, there is strong evidence that prolonged surgery, increased patient age, use of extracorporeal circulation, low hematocrit, and diabetes may increase patients' risk of developing pressure ulcers. Another factor includes the use of heating blankets to prevent hypothermia. These blankets should be applied over patients, not under. Because of the increased metabolic demand of warmer tissue, if the tissue on which patients are lying has been warmed, the damage caused by ischemia is significantly enhanced. One study reported that 75% of the study's surgical patients who developed pressure ulcers had been lying on a warming blanket.⁷

PATIENT POSITIONING. Patient positioning also is a major concern. In our OR, we observed that, after patients were placed on the bed and the bed was elevated, tilted, or repositioned, patients were not lifted to release their skin. If patients

are not lifted after the bed has been repositioned, their skin stays in its original position while their body mass has been shifted. In this situation, the skin is subjected to shear forces that significantly exacerbate the tissue damage caused by pressure. Shear is a major factor in pressure ulcers. Lifting patients after positioning beds can minimize these forces.

Preliminary studies suggest that OR pads with alternating air technology may be more effective in preventing pressure ulcers than standard OR pads. In one study, 195 patients scheduled for cardiothoracic surgery were given either a standard OR pad or an alternating air pad.⁸ Patient characteristics were similar in both groups. The incidence of pressure ulcers was 1% in the alternating air group and 7% in the standard pad group. Similar results were obtained in an identical study of 217 patients.⁹

COSTS

One recent study determined whether the development of a stage II or greater pressure ulcer (Table 1) is associated with increased hospital costs and length of stay.¹⁰ Researchers studied 286 patients who were 55 years old or older and were confined to beds or chairs with hip fractures. During the study, 37 patients (12.9%) developed a stage II or greater pressure ulcer. After adjusting for other conditions and complications, the mean hospital costs for patients who developed pressure ulcers was \$15,229 higher than those who did not develop ulcers, and the mean length of stay was 8.2 days longer.

A detailed prospective study of the costs associated with pressure ulcers in the OR has not been done. However, researchers have made an attempt to estimate these costs. Their calculations suggest that 375,000 surgical patients develop pressure ulcers annually, at a cost to the health care system of up to \$1.5 billion.¹¹

PREVENTION IS COST-EFFECTIVE

Education and commitment can prevent pressure ulcers. After the release of the AHCPR guidelines, several hospitals initiated education programs and patient care plans that focused on identifying at-risk patients and implementing procedures to prevent pressure ulcers. These programs have been successful and their projected cost savings are substantial. The AHCPR recently reported that two hospitals reported significant success in implementing the pressure ulcer prevention guidelines.¹² Intermountain Health Care, Salt Lake City, tested the guideline in one of its hospitals for six months and found that it reduced the incidence of pressure ulcers significantly, saving the system \$240,000. Abbot-Northwestern Healthcare System, Minneapolis, estimated it would save \$288,000 annually by using the guideline. After implementing the guideline at the University of Texas Medical Branch, Galveston, Tex., the incidence rate of pressure ulcers dropped from 11% to 4%, with estimated savings of \$3,458,000.¹³

CONCLUSIONS

Patients undergoing surgical procedures of three hours or more are at risk for pressure ulcers. These patients should

TABLE 1: PRESSURE ULCER STAGES

Pressure ulcers are classified by the depth of tissue involved.¹

Stage I—the earliest stage. A stage I pressure ulcer is defined as an area of nonblanchable erythema of intact skin over a bony prominence. Many times, these reddened areas on the buttocks of patients undergoing long surgical procedures are stage I pressure ulcers and not just hyperemic areas that will quickly resolve. These areas have to be monitored postoperatively and pressure relieving protocols instituted. If the patient cannot be turned, a pressure relieving bed has to be used.

Stage II—involves partial thickness skin loss and may present as an abrasion, blister, or shallow crater.

Stage III—involves full thickness loss of skin and may extend down, but not through, the underlying fascia.

Stage IV—involves full thickness loss of skin with extensive damage to underlying muscle, bone, and supporting structures.

For surgical patients, the majority of pressure ulcers can be restricted to stage I or II if identified and treated properly. The majority of these ulcers occur on the sacrum and heels.

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be put on effective pressure relieving surfaces during surgical procedures and their postoperative stay. Preventing pressure ulcers by education and implementing simple guidelines can save hospitals thousands of dollars and keep patients healthier. Δ

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