Ten top tips: preventing pressure ulcers in the surgical patient

Pressure ulcers attributable to the operating room (OR) are not uncommon; they account for up to 45% of all hospital-acquired pressure ulcers. The incidence of pressure ulcers occurring during surgery was addressed in international pressure ulcer guidelines in 2014, reflecting the research and work that has been done in this area. Prevention begins before surgery, continues in the OR and is imperative during recovery from anaesthesia and the operation. These top tips cover each of these stages of the surgical journey and the considerations required to prevent pressure ulcers in the surgical patient.

1. Understand the epidemiology and presentation of pressure ulcer development in the operating room

Pressure ulcers in the OR usually develop as a result of improper body positioning, increased time on the OR bed, inadequate padding of bony prominences and also possibly from incorrect use of positioning devices. Other factors that may contribute to a pressure ulcer in the OR include heat, shear forces, skin moisture and friction. The patient’s absolute immobility and anaesthetised state during surgery create a unique timeframe of very high risk. However, pressure ulcers can often be incorrectly diagnosed as a burn or attributed to the postoperative period.

Many pressure ulcers that develop in the OR follow a pattern of evolution, so recognising the classic presentation associated with pressure damage acquired during surgery helps to identify their origin. Deep tissue injury appears purple or maroon in colour at approximately 48 hours after the pressure episode. Blisters develop 24–48 hours later (Black, unpublished data). Therefore, if purple tissue is present two days after surgery, this may be a key indication that the ulcer started during surgery.

In addition, the location of the ulcer should be examined to determine if it correlates to the position the patient was in during surgery. For example, if the patient was supine, and of normal body weight, ulcers tend to develop on the soft tissue of the buttocks rather than the sacrum and coccyx. Pressure ulcers can also develop on the heels. In a study by Schoonhoven, 37% of patients developed heel ulcers during cardiac surgery. Therefore identifying the timing of the first appearance of deep tissue injury and the anatomical location of the pressure ulcer can alert staff to pressure damage caused in the OR.

The duration of surgery is a major risk factor. Studies have shown that operations over 3 hours are associated with a higher risk of pressure ulcers, with Tschanen finding that the risk rises for every hour of additional time in the OR. Schoonhoven et al. found that for every 30 minutes of anaesthesia after 4 hours, the risk of pressure ulcer development increased by 33%. Shaw et al. reported that the odds of developing pressure ulcers during general anesthesia is 4.8 times greater than under local anesthesia.

2. Identify patients at high risk of pressure ulcer development

Assessing for risk of pressure ulcers before surgery is an important first step. When patients are identified as at risk, additional interventions can be put into place to reduce pressure ulcer risk. Although there is not a validated pressure ulcer risk assessment tool specific to surgical patients, the use of a screening tool in conjunction with use of the Braden Scale for Predicting Pressure Sore Risk may reduce pressure ulcer incidence. In a study of 7000 surgical patients, the incidence rate of hospital-acquired pressure ulcers dropped from 3.37% to 0.89% (p=0.0004) over an 18-month period following implementation of a screening tool in combination with the Braden Score (Scott, unpublished data). Risk factors before, during and after surgery are outlined in Box 1.

3. Assess the patient’s skin before surgery

The condition of the skin before any procedure should be known in order to plan for special pressure redistribution during the operation. Any skin injury on body areas that will be subjected to pressure during the operation should be noted. Assessment should be done...
before surgery, while the patient is conscious (if possible) so that any complaints of pain can be ascertained. Findings of abnormal skin or high-risk areas, such as previously healed pressure ulcers, should be communicated to the staff in the OR\(^{12}\).

4 Consider preoperative use of additional protection on high-risk body areas

Once high-risk areas are identified, foam and gel cushions or multi-layer soft silicone foam dressings should be applied pre-operatively to protect these areas\(^{7,13}\). Protection of the sacrum or buttocks when a patient will be in a supine position for operative cases of 2 hours or more should be considered before surgery. In addition, special consideration of the need for localised protection of the head, clavicles, ribs and iliac crest for such cases is also recommended\(^{7,15}\). Research on the use of multi-layer soft silicone foam dressings, such as Mepilex\textsuperscript{®} Border sacral dressings (Mölnlycke Health Care), placed in vulnerable anatomical locations before surgery has shown a reduction in the number of OR-acquired pressure ulcers\(^{13-14}\). When selecting pads and positioning devices before surgery, the intended use and the manufacturer's instructions for use must be adhered to.

5 Use appropriate operating room table padding and equipment

Several studies\(^{4,15-16}\) have indicated that the standard operating room table pad (2-inch-thick elastic foam covered with black conductive laminated vinyl fabric) may contribute to pressure ulcer development during surgery. Using high-specification OR table pads in every room is one strategy to reduce risk of ulceration. These pads may include multi-layering foams of various grades and types. The design considers indentation load deflection, density of foam, depth, and a mattress cover that allows for immersion while providing infection control features such as ease of cleaning, waterproofing and/or welded seams, and fire retardant properties. There is limited research on active support surfaces in the OR; however, a laser Doppler study confirmed reduced capillary occlusion with fluid immersion therapy when compared to non-powered foam and gel devices\(^{17}\).

The weight of the patient must always be considered; as most foam pads have a weight limit of 115 kg. However, some viscoelastic foam mattresses can support up to 315 kg. Staff must be mindful of the fact that the number of pads, sheets, blankets and warming/cooling blankets placed between the patient and the procedure bed mattress interferes with the pressure

\textbf{Box 1. Pressure ulcer risk factors in the surgical patient}

\begin{itemize}
  \item Risk factors before surgery:
    \begin{itemize}
      \item Operation planned for 3 hours or more\(^{10,24}\)
      \item Age > 62 years
      \item Albumin <3.5g/dl
      \item American Society of Anaesthesiologists score >3
      \item Cardiopulmonary bypass
      \item Operations requiring prone positioning
      \item Diabetes\(^{22}\)
      \item Trauma, orthopaedic, vascular, transplant or bariatric procedures\(^{26}\)
      \item Body mass index <19 or >40
    \end{itemize}
  \item Risk factors during surgery include:
    \begin{itemize}
      \item Increased hypotensive episodes during surgery
      \item Low core temperature during surgery
      \item Use of vasopressors\(^ {26}\)
    \end{itemize}
  \item Risk factors after surgery include:
    \begin{itemize}
      \item Reduced mobility on first postoperative day
      \item Use of vasopressors\(^ {21}\)
    \end{itemize}
\end{itemize}
During surgery, the use of towels, sheet rolls, IV fluid bags and blankets for padding must be avoided, as they do not reduce pressure. Appropriate padding should be placed between the patient and surgical devices such as stirrups and extremity holders. Pillows and molded-foam devices may produce only a minimum amount of pressure redistribution and are less effective during long procedures.

Practice safe patient handling during transfers and positioning
Correct patient positioning and transfer is critical in pressure ulcer prevention, and requires a team effort. Team members must understand the positional needs of the operation, and have knowledge of the positional devices, pressure-reducing surfaces, and the correct equipment available to protect the patient. Staff should complete training and competency validation to ensure this.

Lateral transfer devices such as friction-reducing sheets, slider boards and air-assisted transfer devices, should be used for supine-to-supine patient transfer. Soft tissue can be distorted from pressure, shear, and friction, so adequate personnel to move the patient while positioning are required to prevent shear and friction. Incorrect body alignment can also cause decreased blood flow to areas affected and increase the potential for pressure ulcers.

Know how to protect the occiput and heels from pressure damage during surgery
The occiput may ulcerate during long procedures and this can be prevented by use of a gel pad under the occiput, by lifting the occiput from the operating table or by repositioning the head, if possible, during surgery. Heels also require particular prevention strategies; staff should ensure that the heels are free of the operating table surface. For those patients who will not likely need heel-offloading devices after surgery, a foam dressing to the heel prior to the operation should be considered. For those requiring heel-offloading devices, these should be used in the OR. Schoonhoven found the highest incidence of OR-acquired ulcers on the heels.

Heel off-loading devices, such as Prevalon® Boot (Sage Products) and the HeelLift® (DM Systems) are preferable for immobilised individuals since they reduce interface pressure and can provide distribution of the weight of the leg along the calf while floating the heels. Most operating tables alone are not adequate to reduce interface pressure at the heel. Hyperextension of the knee must be avoided as it can obstruct the popliteal vein and predispose an individual to deep vein thrombosis. Therefore positioning the knees in slight flexion when off-loading the heels is advised.

Use careful positioning of operating room equipment
After positioning the patient, the perioperative team should monitor the patient to ensure that there is no pressure occurring from equipment used during surgery, which can have serious consequences. As the patient is positioned and draped, the scrub team will move the back tables and instrument tray — or mayo stand — into position. Care must be taken to ensure that the mayo stand does not lie on the toes or legs. During the course of surgery the surgeon may raise the bed for better visualisation or better access. As the bed is raised the mayo stand should also be raised so that it does not rest on toes or legs, which would cause an increase in pressure from above. All potential points of pressure should be monitored when repositioning the patient during surgery. It should be noted here that pressure can also occur from scrub team members leaning on the patient, which increases the risk of tissue and nerve damage in the surgical patient.

Continue pressure ulcer prevention after surgery, and include skin status and risk factors for pressure ulcers in patient transfer communication
Pressure ulcer prevention must continue after surgery, especially while the patient is sedate or medicated for pain. Team members must collaborate to ensure that risk factors related to pressure injuries are conveyed efficiently and correctly to staff looking after the patient postoperatively, to create a proactive approach to prevention. Handover communication should...
The **only dressings** supported by results of randomised controlled trials\(^1,2\)

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Substantial **cost savings**\(^4,6,*\)

Combats **4 extrinsic causes** of pressure ulcers\(^7,8,9,*\)

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**References:**

1. Kalowes P. et al. Use of a soft silicone, self-adherent, bordered foam dressing to reduce pressure ulcer formation in high risk patients: a randomized clinical trial. Poster presentation at Symposium on Advanced Wound Care Fall, Baltimore, Maryland, United States of America. 2012.


9. *In addition to current prevention protocols.*

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10 Conduct patient safety investigations such as root cause analysis to improve outcomes

Pressure ulcer development in surgical patients should be investigated using a systems approach. This should involve the interprofessional team and appropriate stakeholders, such as wound care, ostomy and continence nurses, operating room nurses, post-anaesthesia care unit staff, anaesthesiology staff, surgeons and postoperative nursing staff. The causes and contributing factors may be multifactorial involving assessment, processes, competency, people, environment of care and availability of equipment/devices. A detailed analysis of the perioperative process is essential in developing meaningful improvement strategies\(^{18}\). Policies, procedures and education should be developed and reviewed annually.

**Conclusion**

Research is needed to determine the history of pressure ulcers that begin in the OR. Many of these ulcers are deep tissue injuries, which can deteriorate rapidly. Refinement of a risk assessment for surgical patients that goes beyond the usual risk assessments would aid those patients at risk. Intervention programmes for various types of surgery position, such as prone and lithotomy positions, would also be helpful to reduce pressure ulcer incidence.

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**References**


4. Stewart TP, Magnano SJ. Burns or pressure ulcers in surgical patients. Decubitus 1988; 1: 36–42


