

Pressure Ulcer Prevention

QUICK REFERENCE GUIDE



NATIONAL
PRESSURE
ULCER
ADVISORY
PANEL

DEVELOPED BY
EUROPEAN
PRESSURE ULCER
ADVISORY PANEL
(EPUAP)
AND
NATIONAL
PRESSURE ULCER
ADVISORY PANEL
(NPUAP)



epuap



Introduction

This *Quick Reference Guide* summarizes evidence-based guidelines on pressure ulcer prevention and treatment. It was developed as a 4-year collaborative effort between the European Pressure Ulcer Advisory Panel (EPUAP) and American National Pressure Ulcer Advisory Panel (NPUAP). The more comprehensive *Clinical Practice Guideline* version of the guideline provides a detailed analysis and discussion of available research, critical evaluations of the assumptions and knowledge of the field, a description of the methodology used to develop guideline, and acknowledgments of editors, authors, and other contributors. This *Quick Reference Guide* contains excerpts from the *Clinical Practice Guideline*, but users should not rely on these excerpts alone.

Printed copies of the English editions of both documents are available through the NPUAP website (www.npuap.org). The *Quick Reference Guide* has been translated into several languages; translations are available on the EPUAP website (www.epuap.org).

The goal of this international collaboration was to develop evidence-based recommendations for the prevention and treatment of pressure ulcers that could be used by health care professionals throughout the world. An explicit scientific methodology was used to identify and evaluate available research. In the absence of definitive evidence, expert opinion (often supported by indirect evidence and other guidelines) was used to make recommendations. Guideline recommendations were made available to 903 individuals and 146 societies/organizations registered as stakeholders in 63 countries on 6 continents. The final guideline is based on the available research and the accumulated wisdom of the EPUAP, NPUAP, and international stakeholders.

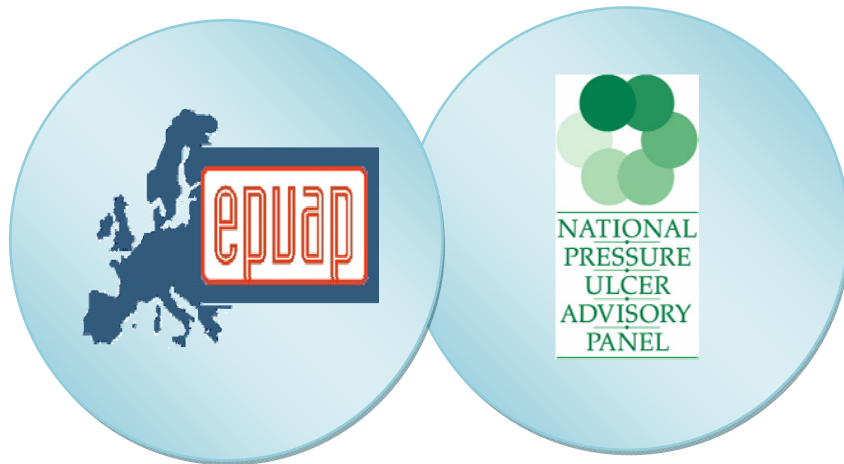
Suggested Citation

The EPUAP and NPUAP welcome the use and adaptation of the guidelines at a national and local level. However, we request citation as to the source, using the following format:

European Pressure Ulcer Advisory Panel and National Pressure Ulcer Advisory Panel. Prevention and treatment of pressure ulcers: quick reference guide. Washington DC: National Pressure Ulcer Advisory Panel; 2009.

International Guideline

**Prevention of Pressure Ulcers:
Quick Reference Guide**



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2009

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National Pressure Ulcer Advisory Panel
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Limitations and Appropriate Use of This Guideline

- Guidelines are systematically developed statements to assist practitioner and patient decisions about appropriate health care for specific clinical conditions. The recommendations may not be appropriate for use in all circumstances.
- The decision to adopt any particular recommendation must be made by the health care professional in light of available resources and circumstances presented by the individual patient. Nothing contained in this guideline is to be considered medical advice for specific cases.
- Because of the rigorous methodology used to develop this guideline, the NPUAP and EPUAP believe that the research supporting these recommendations is reliable and accurate. However, we do not guarantee the reliability and accuracy of individual studies referenced in this document.
- This guideline and any recommendations herein are intended for educational and informational purposes only.
- This guideline contains information that was accurate at the time of publication. Research and technology change rapidly and the recommendations contained in this guideline may be inconsistent with future advances. The health care professional is responsible for maintaining a working knowledge of the research and technological advances that may affect his/her practice decisions.
- Generic names of products are provided. Nothing in this guideline is intended as an endorsement of a specific product.
- Nothing in this guideline is intended as advice regarding coding standards or reimbursement regulations.

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Purpose and Scope

The overall purpose of this international collaboration was to develop evidence-based recommendations for the prevention and treatment of pressure ulcers that could be used by health care professionals throughout the world. A joint Guideline Development Group with representatives from both the NPUAP and EPUAP planned the guideline development process and reviewed all the documentation. However to simplify logistics, the EPUAP took the lead on the pressure ulcer prevention recommendations and NPUAP on the pressure ulcer treatment recommendations.

The purpose of the prevention recommendations is to guide evidence-based care to prevent the development of pressure ulcers. The prevention recommendations will apply to all vulnerable individuals of all age groups. The guideline is intended for the use of health care professionals who are involved in the care of patients and vulnerable people who are at risk of developing pressure ulcers, whether they are in a hospital, long-term care, assisted living at home or any other setting, and regardless of their diagnosis or health care needs. It will also help to guide patients and carers on the range of prevention strategies that are available.

Methods

A rigorous and explicit methodology was used in the development of these guidelines. (See the *Clinical Practice Guidelines* for a more detailed description.) All evidence was reviewed for quality. Individual studies were classified by design and quality (see Table 1). The cumulative body of evidence supporting each recommendation was examined; a “Strength of Evidence” rating was assigned using the criteria in Table 2.

Table 1. Level of Evidence for Individual Studies

Level	
1	Large randomized trial(s) with clear-cut results (and low risk of error)
2	Small randomized trial(s) with uncertain results (and moderate to high risk of error)
3	Non randomized trial(s) with concurrent or contemporaneous controls
4	Non randomized trial(s) with historical controls
5	Case Series with no controls. Specify number of subjects.

Adapted from Sackett, 1989. See the *Clinical Practice Guideline* for a discussion of the guideline development methodology.

Table 2. Strength of Evidence Rating for Each Recommendation

Strength of Evidence	
A	The recommendation is supported by direct scientific evidence from properly designed and implemented controlled trials on pressure ulcers in humans (or humans at-risk for pressure ulcers), providing statistical results that consistently support the guideline statement (Level 1 studies required).
B	The recommendation is supported by direct scientific evidence from properly designed and implemented clinical series on pressure ulcers in humans (or humans at-risk for pressure ulcers), providing statistical results that consistently support the recommendation. (Level 2, 3, 4, 5 studies)
C	The recommendation is supported by indirect evidence (e.g., studies in normal human subjects, humans with other types of chronic wounds, animal models) and/or expert opinion.

This clinical practice guideline is based on the current research and will need revision in the future as new evidence is published. Future research should focus on the areas where evidence is absent or weak.

International NPUAP-EPUAP Pressure Ulcer Definition

A pressure ulcer is localized injury to the skin and/or underlying tissue usually over a bony prominence, as a result of pressure, or pressure in combination with shear. A number of contributing or confounding factors are also associated with pressure ulcers; the significance of these factors is yet to be elucidated.

NPUAP / EPUAP Pressure Ulcer Classification System**Category I: Non-blanchable erythema**

Intact skin with non-blanchable redness of a localized area usually over a bony prominence. . Darkly pigmented skin may not have visible blanching; its color may differ from the surrounding area. The area may be painful, firm, soft, warmer or cooler as compared to adjacent tissue. Category I may be difficult to detect in individuals with dark skin tones. May indicate “at risk” persons.

Category II: Partial thickness

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 or sero-sanguinous filled blister. Presents as a shiny or dry shallow ulcer without slough or bruising*. This category should not be used to describe skin tears, tape burns, incontinence associated dermatitis, maceration or excoriation.

*Bruising indicates deep tissue injury.

Category III: Full thickness skin loss

Full thickness tissue loss. Subcutaneous fat may be visible but bone, tendon or muscle are *not* exposed. Slough may be present but does not obscure the depth of tissue loss. *May* include undermining and tunneling. The depth of a Category/Stage III pressure ulcer varies by anatomical location. The bridge of the nose, ear, occiput and malleolus do not have (adipose) subcutaneous tissue and Category/Stage III ulcers can be shallow. In contrast, areas of significant

adiposity can develop extremely deep Category/Stage III pressure ulcers. Bone/tendon is not visible or directly palpable.

Category IV: Full thickness tissue loss

Full thickness tissue loss with exposed bone, tendon or muscle. Slough or eschar may be present. Often includes undermining and tunneling. The depth of a Category/Stage IV pressure ulcer varies by anatomical location. The bridge of the nose, ear, occiput and malleolus do not have (adipose) subcutaneous tissue and these ulcers can be shallow. Category/Stage IV ulcers can extend into muscle and/or supporting structures (e.g., fascia, tendon or joint capsule) making osteomyelitis or osteitis likely to occur. Exposed bone/muscle is visible or directly palpable.

Additional Categories for the USA

Unstageable/ Unclassified: Full thickness skin or tissue loss – depth unknown

Full thickness tissue loss in which actual depth of the ulcer is completely obscured by slough (yellow, tan, gray, green or brown) and/or eschar (tan, brown or black) in the wound bed. Until enough slough and/or eschar are removed to expose the base of the wound, the true depth cannot be determined; but it will be either a Category/Stage III or IV. Stable (dry, adherent, intact without erythema or fluctuance) eschar on the heels serves as “the body’s natural (biological) cover” and should not be removed.

Suspected Deep Tissue Injury – depth unknown

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. Deep tissue injury may be difficult to detect in individuals with dark skin tones. Evolution 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.

Risk Assessment

Epidemiological research has increased considerably in recent years, allowing for a better understanding of risk factors important in the development of pressure ulcers. This literature should underpin risk assessment practice. However, one must be careful in interpreting the results of these epidemiological research studies, as the results may depend on which risk factors are included in a multivariable model.

Risk Assessment Policy

1. Establish a risk assessment policy in all health care settings. (Strength of Evidence = C)

Each health care setting should have a policy in place that includes clear recommendations for: a structured approach to risk assessment relevant to that health care setting; clinical areas to be targeted; the timing of risk assessment and reassessment; documentation of risk assessment; and communication of that information to the wider health care team.

2. Educate health care professionals on how to achieve an accurate and reliable risk assessment. (Strength of Evidence = B)

3. Document all risk assessments. (Strength of Evidence = C)

Documentation of risk assessments ensures communication within the multidisciplinary team, provides evidence that care planning is appropriate, and serves as a benchmark for monitoring the individual's progress.

Risk Assessment Practice

4. Use a structured approach to risk assessment to identify individuals at risk of developing pressure ulcers. (Strength of Evidence = C)

A structured approach may be achieved through the use of a risk assessment scale in combination with a comprehensive skin assessment and clinical judgment. Evidence suggests that the introduction of those elements, in conjunction with the establishment of skin-care teams, education programs, and care protocols, can reduce the incidence of pressure ulcers.

5. Use a structured approach to risk assessment that includes assessment of activity and mobility. (Strength of Evidence = C)

5.1. Consider individuals who are bedfast and/or chairfast to be at risk of pressure ulcer development.

- 6. Use a structured approach to risk assessment that includes a comprehensive skin assessment to evaluate any alterations to intact skin. (Strength of Evidence = C)**

- 6.1. Consider individuals with alterations to intact skin to be at risk of pressure ulcer development.**

Alteration in skin condition may include dry skin, erythema, and other alterations. The presence of non-blanching erythema also increases the risk of further pressure ulcer development.

- 7. Use a structured approach to risk assessment that is refined through the use of clinical judgment informed by knowledge of key risk factors. (Strength of Evidence = C)**

- 8. Consider the impact of the following factors on an individual's risk of pressure ulcer development:**

- a) Nutritional indicators**

Nutritional indicators include anemia, hemoglobin and serum albumin levels, measures of nutritional intake, and weight.

- b) Factors affecting perfusion and oxygenation**

Factors affecting perfusion include diabetes, cardiovascular instability/norepinephrine use, low blood pressure, ankle brachial index, and oxygen use.

- c) Skin moisture**

Both dry skin and excessive skin moisture are risk factors (see Skin Assessment).

- d) Advanced age**

- 9. Consider the potential impact of the following factors on an individual's risk of pressure ulcer development:**

- a) Friction and shear (Subscale Braden Scale)**

- b) Sensory perception (Subscale Braden Scale)**

- c) General health status**

- d) Body temperature**

- 10. Conduct a structured risk assessment on admission, and repeat as regularly and as frequently as required by the individual's condition.**

Reassessment should also be undertaken if there is any change in patient condition. (Strength of Evidence = C)

- 11. Develop and implement a prevention plan when individuals have been identified as being at risk of developing pressure ulcers. (Strength of Evidence = C)**

Risk factors identified in a risk assessment should lead to an individualized plan of care to minimize the impact of those variables.

Skin Assessment

Skin Assessment

- 1. Ensure that a complete skin assessment is part of the risk assessment screening policy in place in all health care settings. (Strength of Evidence = C)**

Each health care setting should have a policy in place that includes recommendations for a structured approach to skin assessment relevant to the setting, as well as for clinical areas to be targeted and the timing of assessment/reassessment. It should make clear recommendations for documenting skin assessment and communicating information to the wider health care team.

- 2. Educate professionals on how to undertake a comprehensive skin assessment that includes the techniques for identifying blanching response, localized heat, edema, and induration (hardness). (Strength of Evidence = B)**

These additional assessment techniques can be used in caring for all individuals. However, there is evidence that Category I pressure ulcers are under-detected in individuals with darkly pigmented skin because areas of redness are not as easily seen.

- 3. Inspect skin regularly for signs of redness in individuals identified as being at risk of pressure ulceration. The frequency of inspection may need to be increased in response to any deterioration in overall condition. (Strength of Evidence = B)**

Ongoing assessment of the skin is necessary to detect early signs of pressure damage.

- 4. Skin inspection should include assessment for localized heat, edema, or induration (hardness), especially in individuals with darkly pigmented skin. (Strength of Evidence = C)**

Localized heat, edema, and induration have all been identified as warning signs for pressure ulcer development. As it is not always possible to see signs of redness on darkly pigmented skin, these additional signs should be considered in assessment.

- 5. Ask individuals to identify any areas of discomfort or pain that could be attributed to pressure damage. (Strength of Evidence = C)**

A number of studies have identified pain as a major factor for individuals with pressure ulcers. Several studies also offer some indication that pain over the site was a precursor to tissue breakdown.

- 6. Observe the skin for pressure damage caused by medical devices. (Strength of Evidence = C)**

Many different types of medical devices have been reported as having caused pressure damage (e.g., catheters, oxygen tubing, ventilator tubing, semirigid cervical collars, etc.).

- 7. Document all skin assessments, noting details of any pain possibly related to pressure damage. (Strength of Evidence = C)**

Accurate documentation is essential for monitoring the progress of the individual and to aiding communication between professionals.

Skin Care

- 8. Whenever possible, do not turn the individual onto a body surface that is still reddened from a previous episode of pressure loading. (Strength of Evidence = C)**

Redness indicates that the body has not recovered from the previous loading and requires further respite from repeated loading (see Etiology).

- 9. Do not use massage for pressure ulcer prevention (Strength of Evidence = B)**

Massage is contraindicated in the presence of acute inflammation and where there is the possibility of damaged blood vessels or fragile skin. Massage cannot be recommended as a strategy for pressure ulcer prevention.

10. Do not vigorously rub skin that is at risk for pressure ulceration. (Strength of Evidence = C)

As well as being painful, rubbing the skin can also cause mild tissue destruction or provoke an inflammatory reaction, particularly in the frail elderly.

11. Use skin emollients to hydrate dry skin in order to reduce risk of skin damage. (Strength of Evidence = B)

Dry skin seems to be a significant and independent risk factor for pressure ulcer development.

12. Protect the skin from exposure to excessive moisture with a barrier product in order to reduce the risk of pressure damage. (Strength of Evidence = C)

The mechanical properties of the stratum corneum are changed by the presence of moisture and as a function of temperature.

Nutrition for Pressure Ulcer Prevention

GENERAL RECOMMENDATIONS

1. Screen and assess the nutritional status of every individual at risk of pressure ulcers in each health care setting.

Since undernutrition is a reversible risk factor for pressure ulcer development, early identification and management of undernutrition is very important. Individuals at risk of pressure ulcer development may also be at risk of undernutrition, and so should be screened for nutritional status.

1.1 Use a valid, reliable and practical tool for nutritional screening that is quick and easy to use and acceptable to both the individual and health care worker.

1.2 Have a nutritional screening policy in place in all health care settings, along with recommended frequency of screening for implementation.

- 2. Refer each individual with nutritional risk and pressure ulcer risk to a registered dietitian and also, if needed, to a multidisciplinary nutritional team that includes a registered dietitian, a nurse specializing in nutrition, a physician, a speech and language therapist, an occupational therapist, and when necessary a dentist.**

If the nutritional screening identifies individuals as being prone to develop pressure ulcers or to be malnourished or at nutritional risk, then a more comprehensive nutritional assessment should be undertaken by a registered dietitian or a multidisciplinary nutritional team. Nutritional support should be offered to each individual with nutritional risk and pressure ulcer risk.

- 2.1. Provide nutritional support to each individual with nutritional risk and pressure ulcer risk, following the nutritional cycle. This should include:**
 - **Nutritional assessment**
 - **Estimation of nutritional requirements**
 - **Comparison of nutrient intake with estimated requirements**
 - **Provide appropriate nutrition intervention, based on appropriate feeding route**
 - **Monitoring and evaluation of nutritional outcome, with reassessment of nutritional status at frequent intervals while an individual is at risk.****(Strength of Evidence = C)**

Individuals may need different forms of nutritional management during the course of their illness.

- 2.2. Follow relevant and evidence based guidelines on enteral nutrition and hydration for individuals at risk of pressure ulcers, who show nutritional risks or nutritional problems.**

SPECIFIC RECOMMENDATIONS

- 1. Offer high-protein mixed oral nutritional supplements and/or tube feeding, in addition to the usual diet, to individuals with nutritional risk and pressure ulcer risk because of acute or chronic diseases, or following a surgical intervention. (Strength of Evidence = A)**

Oral nutrition (via normal feeding and/or with additional sip feeding) is the preferred route for nutrition, and should be supported whenever possible.

Oral nutritional supplements are of value because many pressure-ulcer-prone patients often cannot meet their nutritional requirements via normal oral food intake. Moreover, oral nutritional supplementation seems to be associated with a significant reduction in pressure ulcer development, compared to routine care.

Enteral (tube feeding) and parenteral (delivered outside the alimentary tract) nutrition may be necessary when oral nutrition is inadequate or not possible, based on the individual's condition and goals.

- 1.1. Administer oral nutritional supplements (ONS) and/or tube feeding (TF) in between the regular meals to avoid reduction of normal food and fluid intake during regular mealtimes. (Strength of Evidence = C)**

Repositioning for the Prevention of Pressure Ulcers

Repositioning

- 1. The use of repositioning should be considered in all at-risk individuals.**
 - 1.1. Repositioning should be undertaken to reduce the duration and magnitude of pressure over vulnerable areas of the body. (Strength of Evidence = A)**

High pressures over bony prominences, for a short period of time, and low pressures over bony prominences, for a long period of time, are equally damaging. In order to lessen the individual's risk of pressure ulcer development, it is important to reduce the time and the amount of pressure she/he is exposed to.
 - 1.2. The use of repositioning as a prevention strategy must take into consideration the condition of the patient and the support surface in use. (Strength of Evidence = C)**

Repositioning Frequency

- 2. Frequency of repositioning will be influenced by variables concerning the individual (Strength of Evidence = C) and the support surface in use. (Strength of Evidence = A)**

- 2.1. Repositioning frequency will be determined by the individual's tissue tolerance, his/her level of activity and mobility, his/her general medical condition, the overall treatment objectives, and assessments of the individual's skin condition. (Strength of Evidence = C)**
- 2.2. Assess the individual's skin condition and general comfort. If the individual is not responding as expected to the repositioning regime, reconsider the frequency and method of repositioning. (Strength of Evidence = C)**
- 2.3. Repositioning frequency should be influenced by the support surface used. (Strength of Evidence = A)**

An individual should be repositioned with greater frequency on a non-pressure-redistributing mattress than on a viscoelastic foam mattress. The repositioning frequency should depend on the pressure-redistributing qualities of the support surface.

Repositioning Technique

- 3. Repositioning contributes to the individual's comfort, dignity, and functional ability. (Strength of Evidence = C)**
 - 3.1. Reposition the individual in such a way that pressure is relieved or redistributed. (Strength of Evidence = C)**
 - 3.2. Avoid subjecting the skin to pressure and shear forces. (Strength of Evidence = C)**
 - 3.3. Use transfer aids to reduce friction and shear. Lift — don't drag — the individual while repositioning. (Strength of Evidence = C)**
 - 3.4. Avoid positioning the individual directly onto medical devices, such as tubes or drainage systems. (Strength of Evidence = C)**
 - 3.5. Avoid positioning the individual on bony prominences with existing non-blanchable erythema. (Strength of Evidence = C)**
 - 3.6. Repositioning should be undertaken using the 30-degree tilted side-lying position (alternately, right side, back, left side) or the prone position if the individual can tolerate this and her/his medical condition allows. Avoid postures that increase pressure, such as the 90-degree side-lying position, or the semi-recumbent position. (Strength of Evidence = C)**

- 3.7. If sitting in bed is necessary, avoid head-of-bed elevation and a slouched position that places pressure and shear on the sacrum and coccyx. (Strength of Evidence = C)**

Repositioning the Seated Individual

- 4. Position the individual so as to maintain his/her full range of activities. (Strength of Evidence = C)**

This may be a complex process — for example, in an armchair that tilts back, the use of a footrest with the heels offloaded may be a suitable position in terms of pressure redistribution, but may impede transfer to and from the chair.

- 4.1. Select a posture that is acceptable for the individual and minimizes the pressures and shear exerted on the skin and soft tissues. (Strength of Evidence = C)**

- 4.2. Place the feet of the individual on a footstool or footrest when the feet do not reach the floor. (Strength of Evidence = C)**

When the feet do not rest on the floor, the body slides forward out of the chair. Footrest height should be adjusted so as to slightly flex the pelvis forward by positioning the thighs slightly lower than horizontally.

- 4.3. Limit the time an individual spends seated in a chair without pressure relief. (Strength of Evidence = B)**

When an individual is seated in a chair, the weight of the body causes the greatest exposure to pressure to occur over the ischial tuberosities. As the loaded area in such cases is relatively small, the pressure will be high; therefore, without pressure relief, a pressure ulcer will occur very quickly.

Repositioning Documentation

- 5. Record repositioning regimes, specifying frequency and position adopted, and include an evaluation of the outcome of the repositioning regime. (Strength of Evidence = C)**

Repositioning Education and Training

- 6. Education about the role of repositioning in pressure ulcer prevention should be offered to all persons involved in the care of individuals at risk of pressure ulcer development, including the individual and significant others (where possible). (Strength of Evidence = C)**

- 6.1. Training in the correct methods of repositioning and use of equipment should be offered to all persons involved in the care of individuals at risk of pressure ulcer development, including the individual and significant others (where possible and appropriate). (Strength of Evidence = C)**

Support Surfaces

1. General Statements

- 1.1. Prevention in individuals at risk should be provided on a continuous basis during the time that they are at risk. (Strength of Evidence = C)**
- 1.2. Do not base the selection of a support surface solely on the perceived level of risk for pressure ulcer development or the category/stage of any existing pressure ulcers. (Strength of Evidence = C)**

Selection of an appropriate support surface should take into consideration factors such as the individual's level of mobility within the bed, his/her comfort, the need for microclimate control, and the place and circumstances of care provision.

- 1.3. Choose a support surface that is compatible with the care setting. (Strength of Evidence = C)**

Not all support surfaces are compatible with every care setting. Support surface use in a home setting requires consideration of the weight of the bed, the structure of the home, the width of doors, the availability of uninterrupted electrical power, and the ability to promote ventilation of heat from the motor.

- 1.4. Examine the appropriateness and functionality of the support surfaces on every encounter with the individual. (Strength of Evidence = C)**
- 1.5. Verify that the support surface is being used within its functional life span, as indicated by the specific manufacturer's recommended test method (or other industry-recognized test method) before use of the support surface. (Strength of Evidence = C)**

2. Mattress and Bed Use in Pressure Ulcer Prevention

2.1. Use higher-specification foam mattresses rather than standard hospital foam mattresses for all individuals assessed as being at risk for pressure ulcer development. (Strength of Evidence = A)

Higher-specification foam mattresses seem to be more effective in preventing pressure ulcers than standard hospital foam mattresses.

2.2. There is no evidence of the superiority of one higher-specification foam mattress over alternative higher-specification foam mattresses. (Strength of Evidence = A)

There seems to be no clear difference in the effectiveness of high-specification foam mattresses.

2.3. Use an active support surface (overlay or mattress) for patients at higher risk of pressure ulcer development where frequent manual repositioning is not possible. (Strength of Evidence = B)

When high-risk patients cannot be repositioned manually, active support surfaces are needed, as they can change their load-distribution properties.

2.4. Alternating-pressure active support overlays and replacement mattresses have a similar efficacy in terms of pressure ulcer incidence. (Strength of Evidence = A)

2.5. Do not use small-cell alternating-pressure air mattresses or overlays. (Strength of Evidence = C)

Alternating-pressure air mattresses with small air cells (diameter <10 cm) cannot be sufficiently inflated to ensure pressure relief over the deflated air cells. Internal sensors are being utilised in models currently under development that may resolve this problem.

2.6. Continue to turn and reposition, where possible, all individuals at risk of developing pressure ulcers. (Strength of Evidence = C)

3. The use of support surfaces to prevent heel pressure ulcers

3.1. Ensure that the heels are free of the surface of the bed. (Strength of Evidence = C)

3.2. Heel-protection devices should elevate the heel completely (offload them) in such a way as to distribute the weight of the leg along the

calf without putting pressure on the Achilles tendon. The knee should be in slight flexion. (Strength of Evidence = C)

Hyperextension of the knee may cause obstruction of the popliteal vein, and this could predispose an individual to deep vein thrombosis.

3.3. Use a pillow under the calves so that heels are elevated (i.e., “floating”). (Strength of Evidence = B)

Using a pillow under the calves elevates the heels from the mattress.

3.4. Inspect the skin of the heels regularly. (Strength of Evidence = C)

4. Use of support surfaces to prevent pressure ulcers while seated

4.1. Use a pressure-redistributing seat cushion for individuals sitting in a chair whose mobility is reduced and who are thus at risk of pressure ulcer development. (Strength of Evidence = B)

Different studies show that the use of a pressure-redistributing seat cushion prevents the development of pressure ulcers.

4.2. Limit the time an individual spends seated in a chair without pressure relief. (Strength of Evidence = B)

4.3. Give special attention to individuals with spinal cord injury. (Strength of Evidence = C)

5. The use of other support surfaces in pressure ulcer prevention

5.1. Avoid use of synthetic sheepskin pads; cutout, ring, or donut-type devices; and water-filled gloves. (Strength of Evidence = C)

5.2. Natural sheepskin pads might assist in preventing pressure ulcers. (Strength of Evidence = B)

Some studies show that the use of natural sheepskin on top of mattresses might help in the prevention of pressure ulcers.

Special Population: Patients in the Operating Room

1. **Refine risk assessment of individuals undergoing surgery by examining other factors that are likely to occur and will increase risk of pressure ulcer development, including:**
 - a) **Length of the operation**
 - b) **Increased hypotensive episodes intraoperatively**
 - c) **Low core temperature during surgery**
 - d) **Reduced mobility on day one postoperatively**

2. **Use a pressure-redistributing mattress on the operating table for all individuals identified as being at risk of pressure ulcer development. (Strength of Evidence = B)**

Several operating-room support surfaces that encourage pressure redistribution have been developed.

3. **Position the patient in such a way as to reduce the risk of pressure ulcer development during surgery. (Strength of Evidence = C)**
4. **Elevate the heels completely (offload them) in such a way as to distribute the weight of the leg along the calf without putting all the pressure on the Achilles tendon. The knee should be in slight flexion. (Strength of Evidence = C)**

Hyperextension of the knee may cause obstruction of the popliteal vein, and this could predispose the individual to deep vein thrombosis.

5. **Pay attention to pressure redistribution prior to and after surgery. (Strength of Evidence = C)**
 - a) **Place the individual on a pressure-redistributing mattress both prior to and after surgery. (Strength of Evidence = C)**
 - b) **Position the individual in a different posture preoperatively and postoperatively than the posture adopted during surgery. (Strength of Evidence = C)**

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