Chapter 27. Prevention of Pressure Ulcers in Older Patients

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Background

Pressure ulcers, localized areas of tissue damage or necrosis that develop due to pressure over a bony prominence, are common causes of morbidity in older hospitalized and institutionalized persons. Other terms referring to the same phenomena are pressure sores, bedsores, and decubitus ulcers. Risk factors include immobility, friction, shear, incontinence, cognitive impairment and poor nutritional status.[1-3] Pressure ulcers are one indicator of quality of care measured by nursing homes as part of the mandatory Minimum Data Set (MDS), which is required for participation in Medicare and Medicaid. Part of the MDS evaluation includes the Resident Assessment Instrument, which serves as a guide to assess pressure ulcers and many other pertinent clinical problems.[4]

Risk assessment is an integral part of prevention efforts. The Norton scale[5] and the Braden scale[6] are widely used tools to identify at-risk patients. The Norton scale assesses five domains: activity, incontinence, mental status, mobility, and physical condition. The Braden scale assesses six domains: activity, dietary intake, friction, mobility, sensory perception, and skin moisture. Agreement between the scales is 0.73 using the kappa statistic.[7]

Different strategies have been used for primary prevention. Major clinical guidelines,[8] for pressure ulcer prevention are based primarily on published evidence, and in some areas, on professional judgment and face validity of practices. Turning and/or repositioning patients is a practice with high face validity, but there are no well-designed controlled trials that examine its effect in the absence of other interventions. Other practices include regular skin inspection and assessment, use of appropriate pressure-relief surfaces, improved mobility, adequate nutritional intake, and documentation of the skin examination. Additionally, the use of general educational interventions for hospital staff is supported by before-after study designs.[9, 10] Several reports suggest the value of using topical applications applied to intact skin in an attempt to prevent ulcers.[5, 11, 12] This chapter focuses on the use of pressure-relieving strategies that can be incorporated into hospital or nursing home practice and are based on evidence from controlled clinical trials.

Practice Description

The preventive practices that have received the most research attention are the use of specific beds or mattresses. Many studies have compared a specific mattress with either another high-technology mattress or with a “standard” hospital mattress. A standard mattress, which is not uniformly defined in the literature, may be described as a hospital-issue, usually foam-based mattress found in a typical hospital room. The lack of consensus as to what constitutes a standard hospital mattress presents an interpretative challenge to investigators and administrators hoping to extrapolate results of a published trial to another locale.

In 1991 Krasner reported that there were over 115 different pressure-relieving support surfaces on the market.[13] Sheepskin and other inexpensive pads (eg, “egg-crate” mattresses) are common pressure-reducing devices. Other static devices include pressure-relieving pads (eg,

fabricated from elastic polymers) such as those used to cover operating room tables. Constant, low-pressure supports maintain uniform pressure throughout. Examples include higher-grade foam, and gel-, air-, or water-filled supports. In contrast, dynamic or alternating air devices have a built-in pump that continually redistributes air pressure. Low air-loss beds, as their name implies, permit small amounts of air to escape through a network of pores, whereas high air-loss (or air-fluidized) beds purposefully pump air through ceramic-type beads. Finally, kinetic turning beds, which allow continual rotation, are used more commonly in critically ill patients.

Prevalence and Severity of the Target Safety Problem

In 1990 a large, prospective epidemiologic study reported the one-year incidence for pressure ulcer development in nursing homes to be 13.2%,[14] with prevalence reports ranging from 7% to 23% in a systematic review.[15] Risk-adjusted rates of new pressure ulcers have been reported to decrease by 25% from 1991 to 1996, based on a recent study using data from the Minimum Data Set.[16] In hospitalized patients, prevalence ranges from about 3% to 11%.[17] Meehan reported that the prevalence of pressure ulcers was 11.1% in 177 hospitals surveyed in 1993 and that 54% of the pressure ulcers occurred in patients 70 to 89 years old.[18] Eckman estimated that almost 1.7 million hospitalized patients had pressure ulcers.[19] Approimately 60% of pressure ulcers develop in these acute care settings. The National Health and Nutrition Examination Survey found that less than 20% of pressure ulcers arise in non-institutional environments.[20]

Pressure ulcers result in both increased length of hospital stay and hospital costs[21] and increased nursing care time, as demonstrated by a study of long-term care patients.[22] Cellulitis, osteomyelitis, and sepsis are morbid complications of untreated pressure ulcers. Increased mortality has also been associated with pressure ulcers.[17]

Opportunities for Impact

The passage of the Omnibus Budget Reconciliation Act of 1987 and subsequent implementation regulations provided a written mandate for hospitalized and institutionalized patients to receive regular assessment, preventive measures, and treatment of pressure ulcers. There are no specific data on the current utilization of preventive measures by hospitals. The pressure ulcer protocols often vary from institution to institution.

Study Designs

We identified a recent systematic review of pressure-relieving devices[23] that evaluated 37 randomized controlled trials (RCTs), 31 of which were focused on pressure ulcer prevention (Table 27.1). Seven trials compared standard foam mattresses with various “low-technology” supports. These low-technology supports were defined as beds with constant low-pressure supports, including bead-, water-, or gel-filled supports; static air-filled supports; or foam or Silicore-filled supports. Seven of the trials compared constant low-pressure devices with alternating pressure devices. Six studies limited enrollment to orthopedic patients, 5 to patients in intensive care units, and 3 to patients undergoing operations (ie, the study evaluated different operating table surfaces). We identified no further RCTs of pressure ulcer prevention published after the systematic review identified above.

Study Outcomes

All studies reported pressure ulcer development in both intervention and control groups. Pressure ulcer grading systems were used in most trials. Typically, a 4-level grading system was

employed, ranging from Grade 1 (discolored skin) to Grade 4 (full-thickness skin lesions with bone involvement).

Evidence for Effectiveness of the Practice

Many specialized beds appear to be effective in reducing the development of pressure ulcers when compared with standard mattresses. For example, in 4 studies[24-27] cited by the systematic review[23] that compared standard hospital foam mattresses to enhanced foam alternatives, a summary relative risk of 0.29 (95% CI: 0.19-0.43) was calculated, favoring the intervention group. Between-group comparisons of the previously defined low-technology constant low-pressure devices did not yield clear conclusions. Similarly, in 7 RCTs the comparison of alternating pressure devices with a variety of constant low-pressure devices (a water mattress, foam pad, static air mattress, and foam overlays) showed no significant difference in pressure ulcer development (summary RR 0.84, 95% CI: 0.57-1.23).[23] However, a study of alternating pressure supports compared with standard foam mattresses did demonstrate lower pressure ulcer development in the intervention group (RR 0.32; 95% CI 0.14-0.74).[28] Comparing pressure-reducing devices among themselves (versus against a standard mattress) yields no significant differences in the prevention of pressure ulcers. These trials have been summarized in a recent review.[29]

In addition, 2 published trials evaluating different operating table-like surfaces suggest reduction in pressure ulcer development with enhanced surfaces.[30, 31] In a well-designed RCT of 446 patients, Nixon and colleagues[31] showed that a dry gel-polymer pad placed on an operating table decreased the incidence of new pressure ulcers by almost half—11% for intervention patients vs. 20% for control patients placed on a standard operating table mattress (RR 0.46, 95% CI: 0.26-0.82).

Several caveats temper the interpretation of studies of specialized pressure-relieving surfaces. In general the studies had poor methodologic design, as the systematic review points out.[23] The trials were mostly small, true baseline comparability was hard to confirm, standardization of protocols was often unclear, and assessments were frequently unblinded. Patient selection across trials was not consistent, and differences in pressure ulcer risk at enrollment were difficult to compare across studies.

Potential for Harm

None reported.

Costs and Implementation

The costs of treating a pressure ulcer are estimated to range from $4000 to $40,000 for newly developed ulcers.[32] Indeed, both hospital costs and length of stay are significantly higher for patients who develop pressure ulcers during hospitalization, as noted earlier.[21] In the nursing home in particular, failure to prevent this adverse outcome carries increasing liability—the median settlement for pressure ulcer-related disputes was $250,000 between the years 1977 and 1987.[33] The cost of specialized beds and mattresses to prevent pressure ulcer development can be high, ranging from $40 to $85 per day for low air-loss beds.[34] Specialized beds and intensive nursing interventions all carry clear resource implications. Inman and colleagues[35] have demonstrated the cost-effectiveness of an air suspension bed compared to a standard intensive care unit bed. Yet cost-effectiveness studies of the many different pressure-relieving devices have not been formally completed.

In terms of the feasibility of implementing these specific devices and following guidelines for high-risk patients, both cost and time considerations must be examined.[36] Other considerations relate to the design and functionality of a particular bed or mattress—for example the ability of nursing staff to move and transfer patients placed on deeper or bulkier beds. Finally, difficulty in accurately assessing changes in the incidence and prevalence of pressure ulcers resulting from the institution of preventive measures is another barrier to documenting progress.[37]

Comment

Overall there is adequate evidence that specially designed surfaces effectively prevent the development of pressure ulcers in high-risk patients, but the definition of high risk varies across studies. The variety of pressure-relieving devices makes it difficult to recommend one over another because there are few direct comparisons among the many different types of surfaces. Of note, the treatment of established pressure ulcers is a separate topic, and the type of pressure-relieving surface that is effective in treatment may not prove best for prevention. Appropriate patient selection criteria need further development and refinement because the cost of many prevention interventions is high. The necessity for larger RCTs to assess both clinical and cost-effectiveness of these specially designed mattresses is clear. Better descriptions of what constitutes a "standard" bed or mattress, and improved reporting of baseline comparability between experimental and control groups are also necessary to adequately interpret existing studies. To better track progress in prevention, standardized strategies should be developed so that accurate prevalence estimates can be documented.

Table 27.1. Studies of pressure ulcer prevention*

Participants and Setting	Study Design, Outcomes	Relative Risk of Pressure Ulcer
Systematic review of 31 RCTs from the US, UK and elsewhere assessing pressure relieving interventions for prevention of pressure ulcers[23]	Level 1A, Level 1	Enhanced alternative foam mattresses vs. standard hospital mattresses: RR 0.29 (95% CI: 0.19-0.43) Alternating pressure vs. constant low pressure devices: RR 0.84 (95% CI: 0.57-1.23)

* CI indicates confidence interval; RCT, randomized controlled trial; and RR, relative risk.

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