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Does Incremental Positioning (Weight Shifts) Reduce Pressure Injuries in Critical Care Patients?

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ABSTRACT

BACKGROUND: Incremental positioning or weight shifts are often suggested as an alternative to standard repositioning/turning in critical care patients deemed clinically unstable.

OBJECTIVE: This evidence-based report card reviews whether incremental positioning and/or weight shifts reduce hospital-acquired sacral/buttocks pressure injuries in critical care patients deemed too unstable to turn.

METHODS AND SEARCH STRATEGY: A scoping review of the literature was conducted for studies related to repositioning and hospital-acquired pressure injuries in high-risk, critical care patients. The databases searched were CINAHL, EMBASE, and PubMed. Key words used in the search were "intensive care," "critical care," "pressure ulcer(s)," "pressure injury(ies)," "pressure sore(s)," "turn(s)," "turning," "shift(s)," "shifting," "position(s)," OR "positioning, cardiopulmonary support." The search yielded 183 articles. The search was then narrowed to those published within the past 10 years, yielding 35 citations. Following title and abstract review, 5 studies were identified that met inclusion criteria; an additional 13 articles were found by ancestry and hand-searching.

FINDINGS: No evidence was identified that incremental positioning and/or weight shifts reduce hospital-acquired sacral/buttocks pressure injuries in critical care patients deemed too unstable to turn. In addition, no evidence was found that incremental positioning and/or weight shifts affect interface pressure on the sacrum/buttocks. However, there was evidence that incremental positioning and/or weight shifts do impact gravitational equilibrium.

CONCLUSION: Despite the paucity of evidence, incremental positioning and/or weight shifts are recommended as an intervention in critical care patients deemed too unstable to turn. Further research is needed to examine whether incremental positioning and/or weight shifts are effective in reducing pressure injuries in critical care patients.

KEY WORDS: Critical care, Evidence-based, Hospital-acquired pressure injuries, Incremental repositioning, Pressure injuries, Pressure ulcers, Weight shifts.

INTRODUCTION

Hospital-acquired pressure injuries (HAPIs) are a persistent and costly patient safety issue and despite the wide availability of clinical practice guidelines.[1,2] Critical care patients are at particular risk for development of HAPI due to their hemodynamic instability and vasopressor requirements. The prevalence rates of HAPIs in the critical care population are reported to be as high as 42%.[3] Additionally, optimal repositioning can be limited in this patient population for a variety of reasons, including delayed sternal closure, head-of-bed elevation for prevention of ventilator-associated pneumonia (VAP) or aspiration, continuous pulmonary toileting, and cardiac assist devices.[4-8]

While critical care patients are at the highest risk to develop HAPI on any location, the sacrum and buttocks are the most common and can often pose the biggest challenge for prevention.[3] Historically, repositioning and turning have been an important nursing intervention aimed at reducing interface pressures on the sacrum and buttocks. Nevertheless, repositioning and turning are only one piece of a broader pressure injury prevention program that includes the use of pressure redistributing surfaces, moisture management, and nutritional support.

Repositioning is typically defined as moving a patient into another position to relieve pressure off a particular part of the body or to redistribute pressure on a body part.[9,10] The 2-fold aim of repositioning is to reduce or relieve interface pressure between a bony prominence and the support surface and to limit the time the tissues are exposed to pressure. Optimal care includes regular repositioning of the patient in a 30° lateral recumbent position, with the head-of-bed elevation at less than 30°.[10] This position ideally minimizes interface pressures to all bony prominences, particularly the sacrum and trochanters, while also minimizing friction and shear forces. Clinical experience and anecdotal evidence suggest that this optimal bed position is not always possible in the nonambulatory, critical care population for a wide variety of clinical reasons.[7] When the complexity and instability of the patient limit repositioning, nurses are typically encouraged to "do the best that they can" with a challenging situation. Incremental positioning or weight shifts, commonly described as frequent small repositioning shifts of 15° to 20°, are suggested each time the nurse

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enters the room as an intervention to prevent pressure injury.[11] Patient assessment and routine nursing care require repositioning the patient with incremental positioning and weight shifts, even if only for a short period of time. This clinically relevant and common nursing practice demonstrates the need to identify evidence to support incremental positioning and/or weight shifts to prevent pressure injuries when caring for unstable critical care patients. The purpose of this article is to report the findings of our scoping review.

QUESTION

Do incremental positioning and/or weight shifts reduce hospital-acquired sacral/buttocks pressure injuries in critical care patients deemed too unstable to turn?

METHODS

An experienced reference librarian searched 3 multidisciplinary medical databases in October 2016 to find literature related to hospital-acquired sacral pressure injuries in high-risk, critical care patients. The databases searched were CINAHL, EMBASE, and PubMed, which were selected for their robust, international scope of available literature. Key words used in the search included ("extracorporeal membrane oxygenation" OR "extracorporeal life support" OR "extracorporeal cardiopulmonary support" OR "intensive care" OR "critical care") AND ("pressure ulcer" OR "pressure ulcers" OR "pressure sore" OR "pressure sores" OR "pressure injury" OR "pressure injuries" OR decubitus OR bedsore OR "bed sore" OR "bed sores" OR bed-sore) AND (turn OR turns OR turning OR shift OR shifts OR shifting OR position OR positions OR positioning). Search filters for all databases were only English language; article types included were Academic Journals for CINAHL, and Articles, Articles in Press, and Reviews for EMBASE. PubMed was not limited by article type. The search was not limited by year, and the results spanned from 1992 to present. This extended time span was selected in order to capture any relevant evidence for this topic.

Following these limiters, 15 results were retrieved from PubMed and 20 results were found in CINAHL. EMBASE returned no results. Thirty-five citations were transferred to a proprietary management software program. After removing duplicate studies across databases, 22 citations remained for further review. An initial review of these abstracts removed 11 citations as nonrelevant to meet criteria. Inclusion criteria for the final review were original research studies that looked at weight shifts/incremental positioning/turning as prevention for hospital-acquired sacral pressure injuries in critical care patients. Of the remaining 11 studies, 5 were identified that met inclusion criteria and an additional 13 publications were found via ancestry or hand-searching (Figure 1).

FINDINGS

We originally identified 5 studies that met inclusion criteria (Table 1).[12-16] Three descriptive observational studies included a range of 15 to 23 participants.[13-15] A prospective design study enrolled 87 participants,[16] and a single, prospective, randomized crossover trial enrolled 20 participants.[12] Three of the studies involved healthy adult volunteers.[12-14] One study targeted bedridden patients,[15] and one evaluated critical care patients.[16] All 5 studies used a sensor pad or pressure mapping device to measure interface pressures over the sacrum and buttocks in a variety of bed positions. Interface pressure is defined as the pressure that occurs at the interface between the body and the support surface.[17]

Lippoldt and colleagues[12] reported findings from a prospective, randomized crossover trial of 20 healthy adult volunteers. They measured tissue interface pressures in the supine and reverse Trendelenburg positions during varying degrees of head-of-bed elevation. Peak interface pressures (PIPs) increased significantly at 45° backrest elevation. Reverse Trendelenburg positions in combination with backrest elevation led to lower PIPs for all positions, although the authors acknowledge that this position has the greatest risk of increasing friction/shear effects and affected the tilt of the hip.[12]

Peterson and colleagues[13] studied 15 healthy adults on a low air loss mattress and measured the effects of head-of-bed elevation on interface pressures. Interface pressures on the sacrum and buttocks were measured at 0°, 10°, 20°, 30°, 45°, 60°, and 75° head-of-bed elevations. Peak sacral interface pressures increased significantly at 30° and higher. Head-of-bed elevation at 45° or higher significantly increased the area of skin exposed to capillary closing pressure. At 60°, there was a slight decrease in the interface pressures over the sacrum but a corresponding increase in interface pressures over the buttocks, suggesting a shift in weight distributing and a change in pressure points.

In another study of 15 healthy adults placed on a low air loss mattress, Peterson's group[14] evaluated the effects of lateral turning on the skin-bed interface pressures. No instructions were given to the nurse other than to turn the participant in the same way a typical patient would be positioned. Peak interface pressures were not significantly impacted by lateral turning, but they increased significantly in response to head-of-bed elevation. Lateral turning did not effectively lower the effect of pressures created by head-of-bed elevation. They also reported that sacral interface pressures were higher when using wedges as compared to pillows.[14]

Peterson and colleagues[15] repeated their descriptive, observational study in 23 bedridden patients. Peak interface pressures, peak pressures over time, and at-risk areas did not differ significantly by position. Despite lateral turning, all 23 patients demonstrated skin surfaces measuring on average greater than 200 × 200 cm that were never offloaded. Bedridden, at-risk patients had substantial areas of skin that did not experience effective pressure redistribution despite repositioning by experienced nurses. A comparison of these data of at-risk bedridden patients to their similar study with healthy adults both showed that PIPs were higher with and without head-of-bed elevation. However, the area of at-risk skin was larger in bedridden patients when compared to healthy adults.

Supriadi and colleagues[16] reported results of a prospective study of 87 critical care patients in 2 intensive care units (ICUs) in Indonesia. Participants underwent a tilting intervention, and the relationships between PIP and peak pressure gradient (PPG) were used to predict the likelihood of pressure injury development. Participants were deemed at high risk for pressure injury development based on Braden Scale for Pressure Sore Risk scores of less than 12. These patients were also on air and foam pressure redistributing mattresses. Peak interface pressures of greater than 50.0 mm Hg and PPG of greater than 8.0 mm Hg were identified as predictors for pressure injury. The investigators also reported that tilting left and right is an effective intervention at reducing interface pressures on the sacrum.[16]

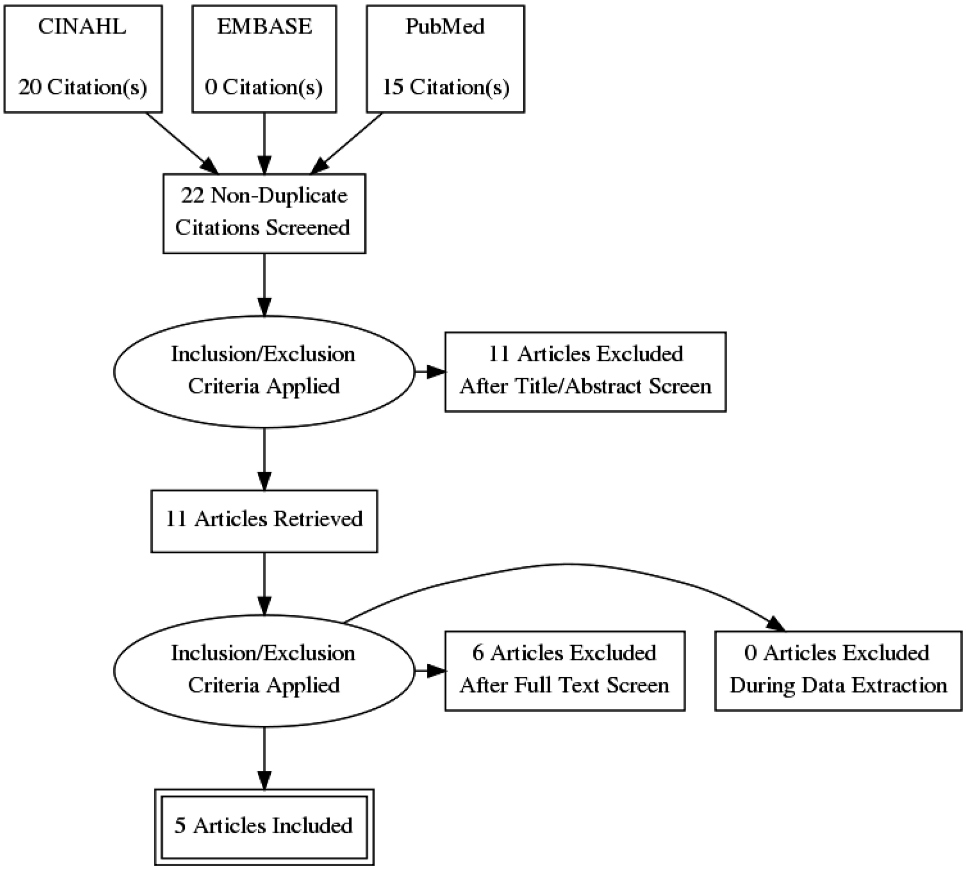

Figure 1. Search flowchart.

DISCUSSION

Our search of the literature identified 5 studies that evaluated interface pressures, reporting on the effects of lateral turning on the skin-bed interface pressures, over the sacrum in a variety of patient positions in bed.[17] While the etiology and progression of pressure injury are not fully understood, it is believed that the intensity and duration of pressure are important factors.[18] Shear forces can be an equally important risk factor, particularly in the critical care population where head-of-bed elevation is used for the prevention of VAP and aspiration.[18]

Two of the studies examined interface pressures and head-of-bed elevation.[12,13] Peak sacral interface pressures increased significantly when the head of bed was elevated 30° or higher.[13] Head-of-bed elevation to 45° or higher significantly increased the interface pressures to the sacrum and buttocks and increased the area of skin exposed to capillary closing pressure. At 60°, there was a slight decrease in the interface pressures over the sacrum but a corresponding increase in interface pressures over the buttocks, suggesting a shift in weight distribution.[13] Clinical practice guidelines for VAP and aspiration prevention recommend that the majority of critical care patients require head-of-bed elevation higher than 30° and that backrest elevation higher than 45° renders effective lateral repositioning difficult.[19] Lippoldt and colleagues[12] reported they were able to achieve significantly lower interface pressures when they combined head-of-bed elevation with reverse Trendelenburg positioning. They were able to achieve the equivalent of 45° head-of-bed elevation by utilizing 20° head-of-bed elevation in combination with a 10° reverse Trendelenburg position. This approach may be an effective method of VAP and aspiration prevention while maintaining head-of-bed elevation less than 30°, a situation that facilitates lateral positioning desirable for pressure injury prevention. However, Lippoldt and colleagues[12] further observed that shearing forces could occur or could even be intensified with this approach in certain patients.

Because we found no articles that described a direct link between incremental positioning and/or weight shifts and HAPI, we expanded our search to explore progressive mobility or early mobilization in the critical care population to gain another perspective. Progressive mobility may indirectly affect prevention of HAPI. Jankowski[20] states that the goals and techniques of progressive mobility are aligned with the goals and techniques for the prevention of pressure injuries. We also searched for studies employing positioning devices for evidence linking incremental positioning and/or weight shifts to pressure injury prevention. We found a number of quality improvement projects that advocated slow incremental positioning and weight shifts as a preventive intervention in patients deemed too unstable to turn.[21,22]

In several clinical practice reviews, Vollman[4,23,24] described the effects of prolonged bed rest on the cardiovascular system, namely, orthostatic tolerance called gravitational equilibrium. When patients move too fast from a supine position into a side-lying or sitting position, the normal vestibular adjustment can be mislabeled as hemodynamic instability. Moving the patient more slowly allows the baroreceptor mechanism to better respond to the position change. In the patient deemed too unstable to turn, she suggests continuous

TABLE 1.
Study Summary

Study Author and (Year)	Aim/Design/Subjects	Methods	Outcome Measures	Findings
Peterson and colleagues[13] (2008)	Descriptive, observational study included a range of 15 participants; healthy volunteers	Measured the effects of head-of-bed elevation with a sensor pad or pressure mapping device to measure interface pressures over the sacrum and buttocks on a low air loss mattress	Interface pressures on the sacrum and buttocks were measured at head-of-bed elevations of 0°, 10°, 20°, 30°, 45°, 60°, and 75°	Peak sacral interface pressures increased significantly at 30° and higher. Head-of-bed elevation at 45° or higher significantly increased the area of skin exposed to capillary closing pressure. At 60°, there was a slight decrease in the interface pressures over the sacrum but a corresponding increase in interface pressures over the buttocks, suggesting a shift in weight distribution and a change in pressure points
Peterson and colleagues[14] (2010)	Descriptive, observational study included a range of 15 healthy adult volunteers	Measured the effects of lateral turning on the skin-bed interface pressures with a sensor pad or pressure mapping device over the sacrum and buttocks on a low air loss mattress	Interface pressures	Despite lateral turning, the presacral area experienced significant levels of interface pressure and remained at risk. The pressure was never relieved by turning as intended. The sacral interface pressures were higher when using wedges compared to pillows
Peterson and colleagues[14] (2013)	Descriptive, observational study included a range of 23 bedridden patients and effects of lateral turning on the skin-bed interface pressures	A sensor pad or pressure mapping device measured interface pressures over the sacrum and buttocks in a variety of bed positions	Interface pressures, peak pressures over time	Bedridden, at-risk patients had substantial areas of skin that did not get relieved despite repositioning by experienced nurses. A comparison of their data of at-risk bedridden patients to their similar study with healthy adults showed that peak interface pressures were higher for the at-risk patients with and without head-of-bed elevation. The area of at-risk skin was also larger in the bedridden patient population compared to the healthy adult participants.
Lippoldt and colleagues[12] (2014)	Prospective, randomized crossover trial of 20 healthy volunteers	A sensor pad or pressure mapping device used to measure interface pressures over the sacrum and buttocks in a variety of bed positions	Interface pressures	Reverse Trendelenburg positions in combination with backrest elevation led to lower peak interface pressures of all positions. This position also posed the greatest risk of increasing friction/shear effects and affected the tilt of the hip
Supriadi and colleagues (2014)	Prospective design study involving 87 critical care patients with Braden Scale scores of <12 in 2 Indonesian hospital intensive care units	A sensor pad or pressure mapping device used to measure interface pressures over the sacrum and buttocks in a variety of bed positions; relationships between peak interface pressure and peak pressure gradient were used to predict pressure injury development	Interface pressures	Concluded that tilting left and right is an effective intervention at reducing interface pressures on the sacrum

lateral rotation therapy (CLRT) as one strategy to gradually retrain patients to tolerate turning. Also, patients may tolerate turning better in the right lateral position rather than the left lateral position due to the chest compression of structures in the thoracic cavity.[23] Winkelman[25] reports that orthostatic intolerance is a common consequence of bed rest exacerbated by antihypertensive and β-blocker medications common to the ICU population.

Brindle and colleagues[7] used Vollman's work as the basis of a consensus process focused on defining the essential characteristics of hemodynamic instability in critical care patients, the physiologic responses to repositioning and the effect of pressure and shear forces on the sacral/buttock skin. Incremental "mini-turns" of 15° for 15 seconds as well as CLRT are recommended as useful in preparing a hemodynamically unstable patient for turning.

Positioning devices are often used to facilitate repositioning in critical care. In many facilities, pillows are typically propped behind the patient to help maintain the lateral recumbent position. However, pillows come in various sizes, shapes, and densities, with various moisture-proof coverings. Pillows tend to flatten when used repeatedly over time. Powers[26] examined 60 participants and demonstrated that a 20° turn was achieved when pillows were used, but this angle declined to an average of 15° when reassessed after 1 hour. Powers did not specifically measure interface pressures, and it is unknown if effective sacral offloading occurred with only a 15° to 20° tilt. Thirty-degree wedges are also used to facilitate repositioning, and Powers did demonstrate that a 30° turn was consistently achieved and maintained for 1 hour when a wedge was employed. This finding differs from that of Peterson and colleagues,[14] who reported that sacral and buttock interface pressures were actually increased in area and degree with the use of a wedge. This finding supports the importance of proper wedge placement. Brennan and colleagues[27] reported outcomes of a quality improvement project that evaluated the use of a fluidized positioning device instead of pillows; this change resulted in a decrease in HAPI occurrences.[27] However, they did not specifically measure the angle of lateral turn achieved with the device. Clements and colleagues[8] found that a gel positioning device was desirable in offloading critically ill patients who had poor physiological tolerance to turning.[8] Various positioning devices, such as foam wedges and fluidized positioning devices, offer various features and benefits; clinical experience and sparse reach suggest that no one positioning device is likely to be effective for all patients.

CLINICAL RECOMMENDATIONS

Despite the limited evidence demonstrating that incremental positioning and/or weight shifts reduce HAPI in the critical care patient, we recommend incremental positioning and/or weight shifts for those patients too unstable to turn. None of the 5 studies found that incremental positioning and/or weight shifts harmed patients. We found limited evidence that incremental positioning may have a positive impact on minimizing gravitational equilibrium and can be a positive step toward acclimating the patient for turning and mobilization. In the critically ill patient deemed too unstable to turn, incremental positioning and/or weight shifts should be employed with the goal of achieving a safe 30° lateral turn. Various positioning devices, such as foam wedges and fluidized positioning devices, offer various features and benefits that may aid in positioning but that the use of positioning devices may need to be individualized to meet the patient's condition and need.

CONCLUSIONS

We found insufficient evidence to conclude that incremental positioning and/or weight shifts are effective in reducing HAPI of the sacral/buttocks area in critical care patients deemed unstable to turn. Further research is needed to examine whether incremental positioning and/or weight shifts are effective in reducing pressure injuries in critical care patients.

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