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Analytical Review: Systematic

Prevention of Pressure Ulcers Among People With Spinal Cord Injury: A Systematic Review

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Abstract

Objectives: To evaluate the literature on the effectiveness of bed and wheelchair positioning and repositioning in the prevention of pressure ulcers (PUs) in both the spinal cord injury (SCI) and non-SCI populations.
Design: Systematic review.
Methods: PubMed, CINAHL, PsycINFO, and EMBASE were queried with the subject heading terms "pressure sore," "pressure ulcer," "position or turn in bed, wheelchair," "pressure relief," and "pressure release." All study design types that assessed the effectiveness of bed and wheelchair positioning and pressure relief maneuvers in any patient group and in any setting were sought. Three independent reviewers extracted and summarized details of eligible trials using a standardized method. Two independent reviewers assessed the methodological quality of each trial using the American Academy of Neurology guidelines. When reviewers were not able to reach consensus, a third independent reviewer served as tiebreaker.
Results: We identified 2820 publications, of which 49 met inclusion criteria. Of these publications, the subject population was 2834 (923 persons with SCI, 717 persons without SCI, and 1194 healthy control subjects). Among studies examining pressure related to position or repositioning in bed or sitting, procedures for measuring skin pressure and metabolism were highly variable by anatomic location, measurement technique, outcome measure, study site, participant characteristics, and description of position/turning for bed and seated interventions. Numerous factors can influence tissue interface pressures, and no prospective studies had been performed to determine a causal relationship between interface pressure and skin breakdown. Several studies suggest that skin response to pressure differs between subjects with and without SCI. Conflicting results and insufficient evidence for optimal bed and seated positioning and turning and pressure relief maneuvers to prevent PUs in both SCI and non-SCI populations were limiting factors.
Conclusions: Although there is no clear optimal positioning or turning frequency in bed, the evidence suggests avoiding the 90° lateral position because of high pressures and PU risk over the trochanters. During sitting, pressures are linearly redistributed from the sitting area during recline and tilt; however, reclining carries with it an increased risk of shear forces on this skin. The evidence does not support conclusive guidelines on positioning or repositioning techniques for PU prevention in bed or during sitting. We conclude that PU risk is highly individualized, with the SCI population at a higher risk, which demands *flexible* PU prevention strategies for bed/seated positioning and pressure relief maneuvers. Education has and will remain our most powerful ally to thwart this pervasive public health problem.

Introduction

The prevalence of pressure ulcers (PUs) in the U.S. general population is estimated at 14%-17% [1,2], and PU-related health care costs are estimated to be in excess of $3 billion annually [3], placing a significant burden on individuals and society. It is well known that people with a spinal cord injury (SCI) have a higher risk of PUs as a result of immobility, insensate skin, and varying degrees of incontinence. During initial acute medical and rehabilitation hospitalization, 27%-40% of persons with an SCI will experience a PU [4-6]. Data from the annual report of the National SCI Statistical Center indicate that 17.7% of persons with an SCI had been rehospitalized for a PU during their first year after rehabilitation and that by year 20, that number had increased to 37.4% [7-9]. If left untreated, PUs can lead to immobility, surgery, and in extreme cases, death [10].

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PU risk is multifactorial, with in excess of 200 risk factors described in the literature [11], and thus population-based evaluation of risk factor impact and the subsequent development of effective preventive strategies are extremely challenging. A recent prospective observational cohort study of 159 people with SCI in acute rehabilitation revealed only an existing PU and a Functional Independence Measure admission transfer score of <3.5 as predictive of developing a new PU during inpatient rehabilitation [12]. Gelis et al [13] conducted a review of PU risk factors in the acute setting after SCI. Among the 6 studies analyzed, 26 potential risk factors emerged and were classified as factors related to sociodemographics, neurologic, functional, clinical, and biological aspects, and medical care management. The evidence was largely insufficient to draw conclusions regarding the magnitude of any one risk factor or group of risk factors; however, risk factors associated with care management [13], such as time on a backboard, transport time to a hospital, and length of stay, were most relevant. Combined, these findings suggest the importance of prolonged pressure and repositioning in the development and prevention of PUs.

The mainstay of PU prevention is widely considered to be pressure-relieving maneuvers in bed and while sitting [14]. The 2009 National Pressure Ulcer Advisory Panel and European Pressure Ulcer Advisory Panel Clinical Practice Guidelines state that repositioning frequency should be determined by the individual's tissue tolerance, activity level, general medical condition, observed skin condition, and support surface used. Whereas significant supporting evidence exists for repositioning by support surface (strength of evidence: A), repositioning frequency lacks a strong evidence base (strength of evidence: C, supported only by indirect evidence) [15]. Hence, the current standard of care for repositioning patients in bed has remained a turn or position shift every 2 hours [16-18], although little to no substantiating evidence exists to support this standard of care [19]. For example, Breuls et al [20] demonstrated that tissue damage occurs within 1-2 hours in the clinical setting. Further, other than visual examination of the skin, clinicians have no feedback as to whether turning frequency is adequate for a given patient [21].

Likewise, no consensus exists regarding the frequency, duration, or type of seated pressure relief maneuvers. The Paralyzed Veterans of America Consortium Guideline for PU prevention states that "…a weight shift every 15-30 minutes is recommended to allow the skin to be replenished with oxygen-…and…weight shift every 15 minutes for 15 seconds if [the] SCI is at T1 or lower" [14]. For people who cannot shift their own weight, the recommendation is "…for independent pressure relief every 30 minutes for 30 seconds" [14,22]. This recommendation is based on a 1992 study [23] and a book chapter [24] representing a level of evidence of only V (the lowest level of evidence for a case series with no control subjects) and grade of recommendation of C, yet the importance of the recommendation was reflected in a "strong" opinion of the Paralyzed Veterans of America expert panel.

Repositioning with the goal of pressure relief and redistribution is a mainstay of PU prevention. However, despite best efforts, the prevalence of PUs has been stubbornly persistent, and our preventive efforts have done little to effect a positive change. In this study we aim to determine whether evidence supports specific recommendations for the type and frequency of bed repositioning and seated pressure relief maneuvers to prevent PUs among people with SCI.

Methods

Search Criteria

The criteria used to search for published studies for this systematic review included peer-reviewed studies (1) of adults affected or at risk for PUs; (2) investigating positioning for pressure release to prevent PUs; (3) published since 1960; and (4) written in English. The search was not restricted to subjects with SCI because it was concluded that evidence from non-SCI populations could be extrapolated with a second-stage stratification of populations with SCI. For the initial database search, all study types such as review papers and meta-analyses were included.

Searches were conducted in PubMed, CINAHL, PsycINFO, and EMBASE. Search terms used for each database included (a) "pressure sore or pressure ulcer"; (b) "position or turn in bed, wheelchair"; (c) "pressure relief"; and (d) "pressure release." This comprehensive search located 2820 articles.

Criteria and Methods for Inclusion

Once the search for published articles was complete, more specific inclusion criteria were created to find the most relevant of the 2820 articles. These criteria identified experimental and observational research studies in which positioning for pressure release to prevent PUs was either a primary or secondary outcome. Positioning for pressure release included positioning in a wheelchair, bed, or other furniture. The criteria also included any persons affected by PUs such as those in wheelchairs, those who are bedridden, or those with limited movement.

Using these criteria, abstracts from the 2820 articles were reviewed by 2 trained reviewers at the University of Washington Model Systems Knowledge Translation Center (MSKTC). Discrepancies were resolved by consensus of the reviewers. Author and journal names were not masked from the reviewers. If reviewers were unable to determine if the article met the criteria from the abstract, the full article was reviewed. If a study did