

Taking the pressure off in the Emergency Department: evaluation of the prophylactic application of a low shear, soft silicon sacral dressing on high risk medical patients

Katrina Cubit, Bernadette McNally, Violeta Lopez

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ABSTRACT

Pressure injuries are key clinical indicators of care standard. In Australia, pressure injuries increase length of hospital stay by 4.31 and cost \$285 million annually. This pilot study examined the effectiveness of sacral dressing in reducing the prevalence of pressure injuries in older, high-risk patients. A non randomised one-sample experimental design was used in this study comprising of four phases. Of the 51 patients recruited to the study, one patient developed a sacral pressure injury compared to six patients identified in a known group with similar demographics who were not approached to participate in the study. The results indicated that patients in the known group were 5.4 times more likely to develop a pressure injury than the intervention group. Findings suggest that applying a protective sacral dressing with a low shear backing as part of a simple standardised prevention injury prevention regime commencing in the Emergency Department was beneficial in the prevention of pressure injury in older 'at high risk' medical patients.

Key words: Older person • Pressure injury • Sacral

INTRODUCTION

The development of pressure injuries in hospitalised patients is a key clinical indicator of the standard and effectiveness of care (1). Pressure injuries represent a serious clinical and economic problem for a resource-constrained public hospital system and negatively affect patient

outcomes (2). In Australia, patients developing pressure injuries have an increased length of hospital stay of 4.31 days (2).

Pressure injuries can affect the patient's mobility, nutritional intake, psychological status and elimination can become problematic and prolong their length of hospital stay (3).

Authors: K Cubit, RN, BN (Hons), PhD, MRCNA, Learning and Development Unit, Calvary Health Care ACT, Bruce, Australia; B McNally, RN, Dip. HSc., BN, Grad Cert STN, Grad Dip Nsg (Community Nursing), MEd&Wk, MNurs (Adv Pract), Clinical Nurse Consultant, Wound Management and Quality Support, Calvary Health Care ACT, Bruce, Australia; V Lopez, RN, MNA, MPET, PhD, FRCNA, Research Centre for Nursing and Midwifery, Australian National University, Medical School, Woden, Australia

Address for correspondence: Dr K Cubit, RN, BN (Hons), PhD, MRCNA, Learning and Development Unit, Calvary Health Care ACT, Mary Potter Circuit, Bruce 2617, Australia

E-mail: katrina.cubit@utas.edu.au

Key Points

- pressure injury risk assessment is not routinely undertaken in the Emergency Department
- high-risk medical patients were 5.4 times more likely to sustain a sacral pressure injury than the intervention group
- the application of a low shear sacral dressing with a soft silicon contact layer in the ED may prevent sacral pressure injuries in high-risk medical patients
- the application of a low shear sacral dressing with a soft silicon contact layer should be considered as part of a pressure injury prevention strategy initiated in the ED
- Further study is required to determine the efficacy of the prophylactic dressing applications designed to reduce sheer, friction and excess moisture in other groups of high-risk patients. A RCT should be undertaken to explore associations between other variables including nutrition, continence, mobility and comorbidities.

Pressure injuries consume resources in the form of wound management, increased nursing care, physiotherapy, medications, nutritional support and other clinical services (4). Studies using multivariate methods on risk factors for pressure injuries indicated that increasing age increases the probability of developing a pressure injury adult patient with reduced mobility (5). Increasing age leads to a decrease in collagen in the soft tissue which is required for tissue strength: a decrease in elastin which assists the skin to stretch without breaking and a flattening out of the epidermal-dermal junction which leads to these layers of skin separating under minimal trauma.

Predictions are that the median of 95 695 pressure ulcers will occur annually in Australia, requiring a median of 398 432 extra bed days at a cost, on average, of \$285 million (2). These costs do not take into account the cost of managing patients once discharged into the community setting or the financial, physical and social costs to the individual.

There has been little focus to date on initiating pressure injury prevention measures when a patient first presents to the Emergency Department (ED). However, two recent studies from the USA have reported on pressure injury prevention in the ED. The first was a cross-sectional study of 792 patients aged 65 years or older admitted via the ED to a medical ward. Findings from the study indicated that the use of preventative devices and documentation is suboptimal even among patients at high risk (6). The second study undertaken by Denby and Rowland (7) was a descriptive analysis of retrospective patient admission data from 2006. This study reported that of the 125 patients who developed hospital-acquired pressure injuries (99.2%) had an ED length of stay >2 hours. This study recommended that early nursing interventions in the ED are needed to prevent hospital-acquired pressure injury (7). Pressure injury risk assessment and prevention regimes must be introduced as a priority in the patient's admission process as evidence has shown that these regimes can reduce the incidence of pressure injuries by as much as 60% (8). The National Safety and Quality Health Service Standards released by the Australian Commission on Safety and Quality in Healthcare in 2011 (9) advises that patients are to be screened for the risk of pressure injury on presentation to a health

facility and prevention strategies are to be implemented when clinically indicated. These Standards must be adhered to by all health service facilities in Australia. As the majority of patients present to this health facility via the ED, simple and effective strategies for pressure injury prevention and management need to be developed and implemented.

Pressure injuries occur as a result of tissue ischaemia caused by prolonged reduction or cessation of soft tissue perfusion (10). It is widely accepted that irreversible tissue damage from unrelieved pressure can develop in a vulnerable patient in as little as 2 hours in patients with poor mobility (11). Patients in the ED can wait immobile on trolleys or in chairs for long periods of time prior to their admission and transfer to a general ward. In October 2009, the average length of stay in the study hospital ED for patients aged 75 years and over, prior to admission to a medical ward was 7.5 hours. In 2009, the length of stay for patients on the medical wards ranged from 7 to 18 days. The risk for older medical patients developing pressure injuries is considerably increased due to restricted mobility and pre-existing comorbidities that predispose them to decreased tissue integrity and greater risk of pressure injury development.

At the study hospital, 20% of ED presentations are aged 60 years and over. The majority of medical patients were admitted via the ED. In the Australian Capital Territory Health Annual Pressure Injury Prevalence Survey (12), the two areas with the highest prevalence of pressure injuries were the sacrum and heels. The survey also reported that, between 2008 and 2009, the number of stage II pressure injuries had doubled. The financial cost of managing pressure injuries combined with an increasing prevalence in stage II pressure injuries prompted a study to improve current practice.

According to the Australian Wound Management Association (AWMA) Clinical Practice Guidelines for the Prediction and Prevention of Pressure Ulcers (13), stage I pressure injuries are 'observable pressure-related alteration(s) of intact skin ... the ulcer appears as a defined area of persistent redness in lightly pigmented skin, whereas in darker skin tones, the ulcer may appear with persistent red, blue or purple hues' (p. 6) and stage II pressure injury is defined as partial-thickness

skin loss involving the epidermis and/or dermis. Stage II pressure injuries in particular are often related to issues of shearing, friction and changes in microclimate.

The term 'shear' is often used to describe both shear stress and shear force (14). A shear force is a force that acts parallel or tangential to the surface while the base remains stationary that leads to a change in shape of the cell in soft tissue and possible cell damage (15). It also causes small blood vessels to tear and leads to disruption of the local blood supply resulting in ischaemia (16). Gerhardt *et al.* (17) commented that it occurs particularly when pressure and shear are combined. Shear forces often occur when a patient cannot support their own body weight, maintain postural alignment or move independently (13). Studies have shown that shearing forces lead to more rapid tissue damage at lower normal forces than just pressure (18). Bill *et al.* (19) hypothesised that shearing may occur in five ways: (1) displacement of adhered skin, (2) cross-sectional bulk shearing, (3) rolling shear displacement, (4) shear of dressing layers and (5) elastomeric shear. Mimura *et al.*'s (20) study showed that both the position of the patient in bed, the position of the patient's knees and the patient's body type impacted on the amount of shear force applied in five different areas of the body. While lowering bed heads and elevating the foot of the bed can assist in reducing shearing, some patients, particularly those with respiratory conditions, find these positions uncomfortable or intolerable.

Friction is defined as the force that resists the relative motion of two objects that are touching (14). Friction injuries are often not noticed until an injury to the epidermis occurs (21). Friction may occur if patients are not sufficiently lifted when being repositioned and skin is dragged along rough bed linen (13).

Maintaining the patient's skin integrity is vital in any prevention regime. For the skin to maintain optimal health, it should have a pH of 4–6.8. Urinary and faecal incontinence can lead to excess moisture on the skin, as can excessive perspiration. This in turn can lead to a change in the skin pH and an increased risk of tissue breakdown (3).

Dressings with a low friction or low shear backing have been considered in previous studies as a way to reduce pressure injuries caused

by shearing and friction. Gerhardt *et al.*'s (17) study suggested that the type of fabric next to the skin has an impact on the amount of shearing and friction and therefore tissue damage. Schafer *et al.* (22) noted that prophylactic dressings could cause overhydration of skin, leading to tissue breakdown and recommended that a preventive dressing should have an absorbent structure. Nakagami *et al.*'s (23) study found that a dressing reduced the incidence of persistent erythema and improved skin hydration. Ohura *et al.* (24) demonstrated that an adhesive dressing material could prevent the transmission of force to the underlying skin, and in 2008, Ohura *et al.* tested several dressings which all reduced both the shear force and the pressure applied to both the skin and subcutaneous layers (25). Brindle's (26) study on the use of a sacral dressings as part of a pressure injury prevention strategy resulted in no patients in an intensive care unit developing a pressure injury while using the dressing.

Therefore, the aim of this pilot study was to examine the effectiveness of using a low-shear, silicon-coated, sacral dressing to reduce the prevalence of sacral pressure injuries caused by friction, shearing and changes to the microclimate in older, high-risk patients admitted via the ED with a medical condition.

METHODS

Design

A non randomised one-sample experimental design was used in this study. The project comprised four phases: staff education, patient recruitment, data collection and an audit of inpatient medical records. To facilitate comparison of patient outcomes, a retrospective quality medical records audit was undertaken on all patients admitted to a medical ward who met the inclusion criteria but who were not approached to participate in the study. Because they were selected on the basis of our inclusion criteria and that routine skin assessment is a routine practice in this clinical setting, we considered this as the 'known group' for data comparison purposes. The retrospective audit was conducted to include only those patients admitted during the same period of our evaluation study. An ethics approval was obtained to review the medical records.

Dressing product information

The dressing chosen to support this project was Mölnlycke's Mepilex Border Sacrum dressing. Due to its soft silicon coating, this shaped dressing is easy to apply and remove, reducing the potential for pain and trauma. The soft silicon moulds to the uneven skin surface, leading to overall soft adhesion to the skin. The low-shear outer layer reduces the friction and shearing forces on the sacral area.

Sample and setting

Intervention group

Consecutive patients admitted to the medical ward via the ED were recruited to the study as the trial group. The inclusion criteria were male and female patients who were admitted via the ED during March and April 2010 who were aged 65 years and over and presented with a medical condition, assessed to be 'at high risk' or 'very high risk' for developing a pressure injury based on the Waterlow Pressure Ulcer Risk Assessment Tool and did not have an existing sacral pressure injury. Those who consented to participate had a prevention plan documented in the patient notes. The plan included documentation of risk factors, details of pressure relieving devices and written schedules for frequency of repositioning based on the patient's level of risk. In addition, the participants had a low-shear, silicon-coated sacral dressing applied as per the manufacturers' guidelines. Patients who presented to the ED with a sacral pressure injury were excluded from the study and their pressure injury managed as per the hospital's procedures and guidelines.

The study was conducted at a 334-bed medium-sized metropolitan public district teaching hospital in the ACT, Australia. The project was undertaken in the ED and on three medical wards during the months January to May 2010.

Known group

In order to compare the effectiveness of the sacral dressing with the intervention group, we reviewed the medical records of all patients admitted in the medical wards via the ED during the same period as the intervention group who were not approached to participate in the study during their admission. We purposely included a matched sample of 58

patients to be the known group. Patients who were admitted with a pressure injury were excluded from the study. In auditing the medical records, we extracted data including risk, presence and stage of pressure injury and management plan. Presence of pressure injury was validated with the online incident reports from the RiskMan™ Instant Reporting System used in this hospital.

Preparation of staff

Education was provided to nursing staff in both the ED and on the medical wards by the researchers and Mölnlycke Health Care product experts in the 2 weeks preceding the data collection period (January to February 2010) to familiarise staff with the product and the upcoming project/evaluation. The education covered aspects of pressure injury risk assessment, prevention and management strategies and documentation using the RiskMan incident online reporting tool and dressing product knowledge. Pressure injuries were graded using the four-stage system approved by the Australian Wound Management Association (13). Education also included encouraging nursing staff to complete the Victorian Quality Council e-Learning pressure injury prevention package

Ethical considerations

Approval to conduct this study was obtained from the hospital's Human Research Ethics Committee (HREC). Additionally, at the conclusion of the study, the researchers gained approval from the HREC to conduct a retrospective quality audit of patients admitted to the medical wards via the ED and who met the study inclusion criteria, but who were not approached to participate in the study. These people had not declined to participate in the study. This process created a known patient group for the purpose of analysis and comparison to the intervention group. This final stage of the study was approved by the HREC under Section 95A of the Privacy Act 1988 (Cth).

Data collection

Nursing staff undertook sacral skin integrity checks on the participating patients three times every 24 hours by lifting a portion of the sacral dressing away from the intact skin. A key feature of the dressing is the soft silicon

adhesive which reduced potential for pain and skin trauma when the dressing was lifted. According to the study by Waring *et al.* (27), lifting and reapplying the sacral dressing used in this study did not cause skin stripping and impairment of the skin's barrier function. The dressing was reapplied on completion of assessment. The dressing was changed every 3 days or when soiled. All observations were documented in the patients' notes and on the data collection form developed for the project. The development of any pressure injury was documented and reported in the RiskMan™ online incident reporting tool. Any change in the patient's skin integrity was reviewed by the Wound Management Clinical Nurse Consultant and an appropriate management plan was implemented and recorded in the nursing care and data collection form.

Outcome measure

The data collection tool was developed by the researchers specifically for the study. The tool was a four-page bifold document. The front page contained the selection criteria and instructions for the nurses undertaking the initial assessment and recruiting the patients into the study in the ED, together with an outline of the role of the nurses caring for the patients on the medical wards. The second page contained the Waterlow Pressure Ulcer Risk Assessment Tool. Written approval was received from the tool developer, Judy Waterlow, prior to inclusion. The third and fourth pages were identical and were developed to record the eight hourly skin checks. This section required date and time of assessment and prompted nursing staff to document whether the dressing was completely sealed, whether the sacral skin was intact or not, and the presence of erythema, blanching erythema or stage 1 or stage 2 pressure injuries. This section also prompted nurses to report any pressure injury in the RiskMan Incident Reporting Tool.

The Waterlow Pressure Ulcer Risk Assessment Tool reviews gender, age, body mass index, special risks, mobility, continence, neurological deficit, medication, skin type and surgery in the past 48 hours and includes the Malnutrition Screening Tool. A review by Pancorbo-Hidalgo *et al.* (28) showed that the Waterlow Pressure Ulcer Risk Assessment Tool has a high sensitivity score (82.4%), but low specificity (27.4) with a good risk prediction

score (odds ratio = 2.05, 95% CI = 1.11–3.76). While there is much discussion as to the relevance of this tool in the acute care setting (29), this tool is presently part of the required documentation for admission risk screening at study hospital.

Data analysis

Data were analysed by the research team with assistance from the hospital's Casemix and Performance Unit. Descriptive statistics were used to describe and summarise data. The Chi-square test was used to compare the intervention and the known group results.

RESULTS

Education

Thirty-three nursing staffs in the ED attended education session, 41 from the medical wards, 7 from the intensive care unit and 10 from other areas.

During the 61-day recruitment period, 186 patients aged over 65 years were admitted via the ED. A total of 77 patients were excluded from the project either because they did not meet the project criteria or consent was not obtained. Of the possible 109 remaining patients, 51 were recruited to the study. A retrospective quality medical records audit was undertaken on the records of the 58 patients who met the inclusion criteria and have completed skin assessment recorded in the nursing care plan but who were not approached to participate in the study during their admission.

Demographic data – intervention group and known group

A total of 51 patients met the inclusion criteria and consented to participate in this study. There were 19 male and 32 female patients with an age range of 65–96 years with a mean age of 82.0 years (SD = 8.3). Patients' length of stay ranged from 1 to 68 days with a mean of 15.2 days (SD = 16.1). Eighteen (35%) of the patients admitted to the ED had respiratory conditions (Table 1).

A total of 58 patients medical records were reviewed, comprising 27 male and 31 female patients. Ages ranged from 65 to 95 years with a mean age of 82.0 years (SD = 7.2). Patients' length of stay ranged from 1 to 82 days with

Table 1 Admission demographics for intervention group versus known group

	Intervention (n = 51)	Known group (n = 58)
Gender		
Male	19 (37.3%)	27 (46.5%)
Female	32 (62.7%)	31 (53.5%)
Age		
Mean (SD)	82 (8.3)	82 (7.2)
Range	65–96 years	65–95 years
LOS		
Mean (SD)	15.2 (16.1)	12.8 (15.1)
Range	1–68 days	1–82 days
Admission Hx*		
Respiratory	35%	34%
Coronary disease	14%	16%
Falls	12%	10%
Infections	10%	12%
GI	7%	10%

Ca, cancer; GI, gastrointestinal; LOS, length of stay.

*Some patients have more than one admission history.

a mean of 12.8 days (SD = 15.1). Fourteen (34%) of the patients audited had an admission diagnosis of respiratory problems (Table 1).

Pressure injury development

Of the 51 patients in the intervention group, only one developed a stage II sacral pressure injury while in the known group, 6 of the 58 patients developed a sacral pressure injury (stage I or stage II). Both groups did not develop deep tissue injury. This indicated that the known group was 5.4 times more likely to sustain a pressure injury than the intervention group. Although presence and stage of pressure injury in the intervention group was through actual skin assessment on the patient, while pressure injury in the known group was recorded from the medical record and RiskMan™, we were confident that the data obtained were accurate because all nurses received mandatory training for pressure ulcer risk assessment and how to assess the stage of pressure injury. In addition, we conduct annual pressure injury prevalence survey across all hospitals and community health centres in our region in Australia which requires training of nurses in data collection.

Using a contingency table, the results showed that the application of the sacral dressing had an effect on the prevention of a sacral pressure injury [$\chi^2(1, n = 109) = 3.26, P \leq 0.08$]; however, these results were not

statistically significant due to the small size for this pilot intervention study but could be accepted as clinically significant.

DISCUSSION

Pressure injury prevention is an immense concern for health care organisations and every effort to prevent pressure injury is critical. This pilot study presents the preliminary findings of an effort to prevent pressure injuries in patients admitted to the ED by applying a simple sacral dressing to those assessed as being at risk. According to Butcher (30), although many different approaches have been adopted to prevent the development of pressure injury, one approach that has been overlooked was the potential benefit of wound dressings. The results of this study indicated that a low shear sacral dressing with a soft silicon contact layer could prevent pressure injury development. However, further physiological studies need to be conducted to evaluate its mechanical effect.

This study had a number of limitations. The results cannot be generalised due to the small sample size recruited from one ED and limited only to those patients aged 65 years and over. A quality audit was undertaken to compare the effectiveness of the low shear sacral dressing to a known group based on the inclusion criteria. However, there was no documentation whether any pressure injury prevention was given to these patients as routine assessments for risk of pressure injury were also noted. It is therefore recommended that further studies need to be conducted to include all patients admitted to ED and waiting for a hospital bed for >2 hours.

A randomised controlled trial (RCT) with to achieve medium effect size and power of 80 at $\alpha 0.05$ would require a minimum of 64 subjects per group (31) would be beneficial to further identify the effectiveness of a low-shear, soft silicon adhesive dressing in preventing pressure injuries. The study should explore associations between other variables including nutrition, continence, mobility and comorbidities.

CONCLUSION

Early risk assessment and intervention including the application of a low shear sacral dressing as part of a pressure injury prevention

strategy may be effective when applied to older 'at high risk' medical patients on admission when used in conjunction with best practice pressure injury prevention guidelines and procedures. Early pressure injury risk assessment and preventative strategies, which can include application of a prophylactic sacral dressing on older, 'high risk' medical patients must occur early during the hospital admission and preferably in the ED. Building capacity in the ED is imperative to encourage and support nursing staff to engage in risk assessment practices early in the patient journey which will prevent costly and painful pressure injuries in older medical patients.

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