Prophylactic dressing use to prevent heel ulceration in post-epidural orthopaedic patients

KEY WORDS
- Friction
- Heel pressure ulceration
- Insensate movement
- Prophylactic pressure ulcer prevention

The absence of pressure injury remains a key indicator of care; as with many disease processes, prevention is better than management. In recent years, the concept of prophylactic pressure ulcer prevention using dressings has gained traction. This article reports a small quality assurance study undertaken on an orthopaedic ward, where dressings were used prophylactically on the heels of patients who had undergone surgery under spinal anaesthesia. Results showed that in the study group (n=87), no tissue damage occurred during the wear time or whilst in hospital, whereas in the comparator group, 12 patients (18.75%) went on to develop category 2 heel pressure ulcers during the same period.

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A review of death and severe harm incidents from the 2011/2012 National Reporting and Learning System, found pressure ulcer reports represented the largest proportion of patient safety incidents (19%) (National Institute for Health and Care Excellence [NICE], 2015). Accordingly, efforts have been made to prevent their development through quality standards; for example, pressure ulcer prevalence is a common harm recorded on the NHS Safety Thermometer (Clinical Audit and Registries Management Service, 2017).

However, debate continues as to whether pressure ulcers are avoidable or not. The National Patient Safety Agency (NPSA, 2010) definitions of avoidable and unavoidable pressure ulceration are:

"Avoidable means that the person [...] developed a pressure ulcer and care provider did not do one of the following: evaluate the person's clinical condition and pressure ulcer risk factors; plan and implement interventions that are consistent with the person's needs and goals, and recognised standards of practice; monitor and evaluate the impact of the interventions; or revise the interventions as appropriate" (NPSA, 2010).

"Unavoidable means that the person [...] developed a pressure ulcer even though care provider had evaluated the person's clinical condition and pressure ulcer risk factors; planned and implemented interventions that are consistent with the persons needs and goals; and recognised standards of practice; monitored and evaluated the impact of the interventions; and revised the approaches as appropriate; or the individual person refused to adhere to prevention strategies in spite of education of the consequences of non-adherence" (NPSA, 2010).

Heels are the second most common site for pressure injury (Moore and Cowman, 2012; Leijon et al, 2013). Evidence has shown that adult patients of all ages undergoing epidural or spinal anaesthesia are at greater risk of developing heel ulcers (Punt et al, 1991; Angel et al, 2004; Edwards et al, 2006). Shah (2000) reports the development of heel pressure ulcers post-epidural anaesthesia in patients not deemed to be at risk, although these patients had the epidural in situ for 2–3 days. In a 2001 study, Duncan (2001) reported a 23% incidence of heel ulcers in a population who had received an epidural post-operatively for pain relief, and Jury (2001) reported that over a 12-month period, nine healthy women who had an epidural during labour post-epidural during labour developed a sacral pressure ulcer.

THE ISSUE

The authors' organisation has a robust pressure ulcer prevention and management policy supported by staff education and training. In accordance with this guidance, all in-patient beds have

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pressure reducing foam and dynamic bed frames as standard, and a Waterlow risk assessment (Waterlow, 1985) is undertaken within 6 hours of admission to hospital. Patients admitted with category 3 or 4 pressure ulcers (National Pressure Ulcer Advisory Panel (NPUAP), European Pressure Ulcer Advisory Panel (EPUAP) and Pan Pacific Pressure Injury Alliance (PPPIA; 2014), or those identified as 'very high risk' (Waterlow, 1985), or those predominantly at risk of heel ulceration, are placed on a dynamic mattress.

As a result of this policy, hospital-acquired heel ulcers incidence is low; 0.01% at the time of writing. Therefore, when over a 6-month period, 24 patients developed a category 2 heel ulcer (NPUAP/EPUAP/PPPIA, 2014) within the orthopaedic unit despite risk assessment and standard interventions being implemented, the ward staff and tissue viability (TV) team began a process of identifying probable causes. All 24 pressure ulcers were deemed unavoidable as it was confirmed that local prevention guidance was being adhered to.

A category 2 pressure ulcer is defined as "... partial-thickness skin loss involving the epidermis, dermis or both. The ulcer is superficial and presents clinically as an abrasion or blister..." (NPUAP/EPUAP/PPPIA, 2014; Eastburn et al, 2016) suggest that blisters may 'significantly impinge' upon the rehabilitation of post-operative patients. The category 2 ulcers that developed in our organisation took on average, between 3 and 16 weeks to heal, with an approximate treatment cost of £144,000 (lower range £116,000; upper range £174,000), using the Department of Health (DH) productivity calculator (DH, 2010).

Identifying the causative factors

While these ulcers had been deemed unavoidable, both the ward team and the TV team wanted to determine whether or not a factor out-with the criteria for unavoidable harm was contributing to the ulceration.

Following an investigation, it was identified that:

- The heel ulcers occurred in patients whose ages ranged from 45–65 years old who had undergone repair of fractured neck of femur or hip replacement surgery with spinal or epidural anaesthesia
- Both elective admission and emergency admission patients were affected
- Tissue damage occurred within 24 hours post-operatively on the affected side
- None of the patients who developed pressure injury were identified as high risk, none had risk-factor co-morbidities, and none had a history of previous pressure area damage.

The teams concluded that the most likely cause was friction. Other possible causative factors were discounted on the basis that all of the affected patients were adults who had previously been independent in their own activities of daily living, all had undergone surgery under spinal/epidural anaesthesia, all were pain free, and all felt well immediately post-operatively. In addition, an anaesthetist explained that after epidural or spinal anaesthetic, motor sensation normally returns before full sensory; insensate movement on a high specification pressure reducing foam mattress could lead to 'dragging' of the limb and associated friction on the heel.

The team then needed to ascertain whether friction alone could cause a heel blister in an otherwise healthy individual and what could be done to prevent this continuing. In order to do this, they explored a number of options which are outlined below.

PREVENTION OPTIONS

Off-loading

Initially, heel off-loading using lower limb splints until the immediate insensate period was completed was considered. However, it was agreed that as patients had decreased sensory perception, they would not necessarily be aware if the boot slipped or was not in the correct place, so this approach was deemed unfeasible.

Use of dynamic mattresses

Another option was to use a dynamic mattress, although this was discounted as it would increase cleaning and maintenance costs and limit the availability of the beds for patients who required them according to our pressure injury management and prevention policy.

Use of slide sheets

A third consideration was the use of slide sheets during the post-operative phase. This option was

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dismissed due to the potential for mal-alignment of the limb should the limb slide while the patient still had sensory impairment and be unaware of it occurring.

Prophylactic dressing use

The team were aware of the recent raft of evidence for the prophylactic use of a soft-silicone dressing in the prevention of sacral and heel pressure ulcers (Brindle, 2010; Chaiken et al, 2012, Levy et al, 2015; Santamaria et al 2015a; Gefen, 2015), and the 2015 International Consensus on the use of the use of prophylactic dressings for pressure ulcer prevention, which recommends that consideration should be given to applying foam dressings to bony prominences (in conjunction with other prevention measures) to prevent pressure ulceration in anatomical areas that are frequently subjected to friction and shear (Black et al, 2015). The dressing provides protection as it minimises shear and friction, balances the wound micro-climate, provides a barrier between the bed and the skin, and its atraumatic material prevents the mechanical stripping of the skin on removal (Gefen, 2015). The mechanisms by which dressings prevent pressure ulcer development is thought to relate to the redistribution of shear and friction forces, the distribution of pressure and the regulation of the microclimate at the wound/dressing interface (Call et al, 2013).

In relation to the prophylactic prevention of heel pressure ulcers, Levy et al (2015) used finite element modelling to evaluate the biomechanical performance of a multi-layered heel dressing (Mepilex Border Heel) to demonstrate that the multi-layer dressing dissipated heel pressure (load). Other studies both randomised and uncontrolled, have demonstrated the effectiveness of using dressings prophylactically to prevent heel injury (Santamaria et al, 2015a; Qiuli and Qiongyu, 2010; Haisley et al, 2015; Edwards and Lynch, 2014).

It was therefore decided to undertake a small study to establish whether or not using a 5-layer soft silicone dressing on the heel of patients undergoing hip repair under spinal/epidural anaesthesia, would prevent the development of heel pressure ulcers.

METHOD

In order to undertake the study, it was agreed that all patients admitted to the ward would be part of the study group, given standard pressure ulcer intervention according to the Trust policy, and a number offered prophylactic dressing application in addition to standard care. As this was a small-scale quality assurance study, randomisation was not necessary. Ethics committee permission was not required as this intervention was complementary to the usual prevention regimen and was not invasive.

Two members of the ward team were trained to apply the dressing and collect the data. The patients in the comparator group were allocated to other staff members for care.

RESULTS

Over the 4-month study period, 151 patients admitted to the orthopaedic unit were included in the study; no patients refused to be included. All participants had a routine full skin assessment on admission using the Waterlow risk assessment scale (Waterlow, 1985); scores ranged between 8 and 19, indicating low to medium risk. None had any pre-existing open pressure ulcers.

Eighty-seven were included in the study group, of which 46 were female, 41 were male, and whose ages ranged between 49 years and 86 years old. In the comparator group, 64 (30 male, 34 female) patients received the same anaesthesia and standard pressure ulcer prevention interventions as the study group, minus the application of the heel dressing.

In the study group (n=87), no tissue damage occurred during the wear time or whilst in hospital, whereas in the comparator group, 12 patients (18.75%) went on to develop a category 2 heel blister during the same period. In a small number of patients (n≤6, 7%) the dressing 'wrinkled' within 12 hours post operatively due to patient movement. This was addressed by reapplying the dressing and covering with a tubular stocking. None of the patients in the study group required the dressing to be kept in situ for longer than 48 hours

In the comparator group, 12 patients (18.75%) went on to develop a category 2 heel blister during the same period.

DISCUSSION

While the aetiology of pressure ulceration is incompletely understood, is widely reported to be a combination of sustained mechanical load applied to tissues (either high load for a short period of

time or a low load for a prolonged period of time) (NPUAP, 2014), non-uniform distribution of load (Linder-Ganz et al, 2007), ischaemia, reperfusion injury, and sustained cell deformation.

Over recent years, studies have indicated that the use of a soft-silicone 5-layer dressing can ameliorate these effects. A systematic review of 21 papers (one high quality randomised controlled trial, cohort studies, case series and weaker RCTs), undertaken by Clark et al (2014), found using a dressing as part of a prevention regimen may help PU reduction. In another review of a prospective randomised control trial, three cohort studies and two case series, the authors concluded adequate evidence exists to recommend the use of five-layer silicone bordered dressings (Mepilex® Border Sacrum and three-layer Mepilex® Heel dressings [Mölnlycke Health Care]) for PU prevention in the sacral, buttock and heel regions. A recent review of the clinical and scientific data relating to the use of multi-layer foam dressings with Safetac in the prevention of pressure ulceration was undertaken by Davies (2016). The result of this review of three randomised controlled trials, six non-randomised trials with concurrent or contemporaneous controls, 17 non-randomised trials with historical controls, four case series with no controls and 10 review articles. In addition, 10 evidence pieces referring to reductions in the occurrence of PUs following the introduction of new prevention regimens, one component of which was the use of multi-layer foam dressings with Safetac were reviewed, along with two articles exploring relevant economic studies and three research articles describing relevant pre-clinical data.

COST EFFECTIVENESS

From their study, Santamaria et al (2015b) concluded that the use of multi-layer foam dressings with Safetac for the prevention of sacral and heel PUs in critically ill patients results in cost savings in the acute-care setting. In another study, Santamaria and Santamaria (2014) concluded that using dressings prophylactically could save AUS$35 million per annum. The recent NICE Medtech Innovation Briefing (MIB) (NICE, 2017) on the use of Mepilex Border dressings as an adjunct to pressure ulcer prevention strategies, suggests that while using Mepilex Border dressings would represent an additional cost to standard care, this cost could be offset if using the dressings reduced the severity or incidence of pressure ulcers.

In this study, the cost of treating the 12 category 2 ulcers which occurred in the comparator group was approximately £72,000 (DH, 2010). The individual dressing cost is approximately £7.00; when compared to a potential cost of £6,000 for the management of one category 2 pressure ulcer, plus quality of life issues including increased pain, swelling of the lower limb, prolonged post operative rehabilitation time, and potentially prolonged hospital stay, prophylaxis can only be of benefit. The sensible course of action going forward would be to embrace the emerging evidence and prevent tissue damage occurring at minimal cost.

IMPLICATIONS FOR PRACTICE

The results of this study prompted the addition of the 5-layer dressing with Safetac technology into the organisations' pressure ulcer and management policy. A dressing is routinely applied to the heels of all patients who are to undergo surgery with a spinal or epidural anaesthesia, with monthly checks of our PU status carried out across the organisation.

A review of the period from June to August 2017 showed that the 43 patients were admitted and all had the dressing applied prophylactically; no patient developed blistering or pressure injury. Indeed, since the regimen was introduced, no hospital-acquired heel ulcers have been noted, and in the last 12 months, no avoidable hospital-acquired pressure ulcers have occurred within the acute areas.

CONCLUSION

As a result of this study, the 5-layer soft silicone foam dressing is used prophylactically on patients undergoing spinal anaesthesia and has proven to be an invaluable addition to the organisation's pressure injury prevention strategy. No avoidable pressure injuries have been seen in our organisation in the past 12 months. Only one avoidable pressure injury within the last 18-months was noted; this is one too many for the TV team and extensive work is on-going to ensure that it returns at zero.

The transferable value of this study lead to discussions within the organisation about the use of prophylactic dressings for pressure ulcer

prevention in elderly dementia patients, stroke patients with vertebral irritation, and neurological deficit patients who have sensory loss. The application is potentially widespread with the gold standard of zero hospital acquired pressure ulceration now a distinct possibility. WUK

REFERENCES

Angel D, Sieunarine K, Hunduma N et al (2004) Postoperative pressure ulcers in vascular patients after epidural analgesia: case reports. *Primary Intention* 12(1): 35–8

Black J, Clark M, Dealey C et al (2015) Dressings as an adjunct to pressure ulcer prevention: consensus panel recommendations. *Int Wound J* 12(4): 484–8

Brindle CT (2010) Outliers to the Braden Scale: Identifying high-risk ICU patients and the results of a prophylactic dressing use. *WCET J* 30(1): 11–8

Call E, Perdersen J, Bill B et al (2013) Enhancing pressure ulcer prevention using wound dressings: what are the modes of action? *Int Wound J* 12(4): 408–13

Chaiken N (2012) Reduction of sacral pressure ulcers in the intensive care unit using a silicone border foam dressing. *J Wound Ostomy Continence Nurs* 39(2):143–5

Clark M, Black J, Alves P et al (2014) Systematic review of the use of prophylactic dressings in the prevention of pressure ulcers. *Int Wound J* 11(5):460–471

Clinical Audit and Registries Management Service (2017) *NHS Safety Thermometer: Patient Harms and Harm Free Care. NHS Digital. Health and Social Care Information Centre.* Available at: https://digital.nhs.uk/catalogue/PUB23160 (accessed 14.2.2014)

Davies P (2016) Role of multi-layer foam dressings with Safetac in the prevention of pressure ulcers: a review of the clinical and scientific data. *J Wound Care* 25(1): S1–S24

Department of Health (2010) *Pressure Ulcers: Productivity Calculator.* Available at: https://www.gov.uk/government/publications/pressure-ulcers-productivity-calculator (accessed 14.2.2014)

Duncan FM (2001) Anaesthetists and their teams should examine heels of patients. *BMJ* 322(7288): 732

Eastburn S, Ousey K, Rippon MG (2016) A review of blisters caused by wound dressing components: can they impede post-operative rehabilitation and discharge? *Int J Orthop Trauma Nurs* (21): 3–10

Edwards JL, Pandit H, Popat MT (2006) Perioperative analgesia: a factor in the development of heel pressure ulcers? *British Journal of Nursing (Tissue Viability Supplement)* 15(6): S20–S25

Edwards MB, Lynch JH (2014) *Head Over Heels for Prevention: Use of a Silicone Bordered Foam Heel Dressing in the Prevention of Pressure Ulcers.* Poster presented at the Symposium on Advanced Wound Care Fall, Las Vegas, Nevada, United States of America

Gefen A (2015) *Pressure Ulcer Prevention: Pressure Alone is Not a Sufficient Measure of Possible Tissue Damage.* Available at: http://www.molnlycke.co.uk/blog/pressure-ulcer-prevention-pressure-alone-is-not-a-sufficient-measure-of-possible-tissue-damage/ (accessed 14.2.2014)

Haisley V, Potter K, Wallace J et al (2015) *An Ounce Of Prevention: The Use Of An Absorbent Soft Silicone Self-Adherent Bordered Foam Heel Dressing To Decrease The Incidence Of Hospital-Acquired Heel Pressure Ulcers In An Acute Care Setting.* Poster presented at Wound, Ostomy and Continence Nurses Society conference, San Antonio, Texas, United States of America (accessed 14.2.2014)

Jury JS (2001) Staff needs to recognise patients are at risk. *BMJ* 322(7288): 732–3

Leijon S, Bergh I, Terstappen K (2013) Pressure ulcer prevalence, use of preventive measures, and mortality risk in an acute care population: a quality improvement project. *J Wound Ostomy Continence Nurs*. 40(5): 469–474

Levy A, Frank MB, Gefen A (2015) The biomechanical efficacy of dressings in preventing heel ulcers. *J Tissue Viability* 24(1): 1–11 doi: 10.1016/j.jtv.2015.01.001

Linder-Ganz E, Gefen A (2007) The effects of pressure and shear on capillary closure in the microstructure of skeletal muscles. *Ann Biomed Eng* 35(12): 2095–107

Moore Z, Cowman S (2012) Pressure ulcer prevalence and prevention practices in care of the older person in the Republic of Ireland. *J Clin Nurs* 21(3–4): 362–71

National Institute for Health and Clinical Excellence (2015) Quality standard [QS89] Pressure ulcers. https://www.nice.org.uk/guidance/qs89

National Institute for Health and Clinical Excellence (2017) Mepilex Border Dressings For Preventing Pressure Ulcers. Medtech Innovation Briefing. Available at: nice.org.uk/guidance/mib124 (accessed 14.2.2014)

National Patient Safety Agency (2010) *Defining Avoidable and Unavoidable Pressure Ulcers.* Available at: http://www.patientsafetyfirst.nhs.uk/ashx/Asset.ashx?path=/PressureUlcers/Defining%20avoidable%20and%20unavoidable%20pressure%20ulcers.pdf (accessed 14.2.2014)

National Pressure Ulcer Advisory Panel, European Pressure Ulcer Advisory Panel and Pan Pacific Pressure Injury Alliance (2014) *Prevention and Treatment of Pressure Ulcers: Quick Reference Guide National Pressure Ulcer Advisory Panel.* Available at: http://www.epuap.org/wp-content/uploads/2016/10/quick-reference-guide-digital-npuap-epuap-pppia-jan2016.pdf (accessed 14.2.2016)

Punt CD, van Neer PAFA, de Lange S (1991) Pressure sores as a possible complication of epidural analgesia. *Anesthesia and Analgesia* 73(5): 657–59

Qiuli B, Qiongyu J (2010) *Observation on effect of Mepilex on the prevention and treatment of pressure sores.* Department of Neurosurgery, The Second Affiliated Hospital of Harbin Medical University

Santamaria N, Santamaria H (2014) An estimate of the potential budget impact of using prophylactic dressings to prevent hospital-acquired PUs in Australia. *J Wound Care* 23(11): 583–4

Santamaria N, Gerdtz M, Liu W, et al. (2015a) Clinical effectiveness of a silicone foam dressing for the prevention of heel pressure ulcers in critically ill patients: Border II Trial. *J Wound Care* 24(8):340–5

Santamaria N, Liu W, Gerdtz M (2015b) The cost-benefit of using soft silicone multi-layered foam dressings to prevent sacral and heel pressure ulcers in trauma and critically ill patients: a within-trial analysis of the Border Trial. *Int Wound J* 12(3): 344–50

Shah JL (2000) Lesson of the week. Postoperative pressure sores after epidural anaesthesia. *BMJ* 321: 941–2

Waterlow J (1985) Pressure sores: a risk assessment card. *Nurs Times* 81(48): 50–5