Anatomical location of injury in Stage I and Stage II heel pressure injuries – a pilot study

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Abstract

Human feet, and heels in particular, are well adapted for movement but are at great risk of pressure injury when people are immobilised. Heels are the second most common anatomical location of pressure injuries. Whilst there are aids available to minimise potential for injury, these devices have been developed in the absence of precise knowledge of the exact location of pressure injury development in this highly specialised site.

The primary aim of this pilot study was to explore the anatomical locations of Stage I and Stage II pressure injury foci on the heels of adult inpatients. A secondary aim was to test data collection processes to inform development of a larger study. A prospective, descriptive design was utilised at a tertiary hospital with a convenience sample of inpatients with Stages I or II injury on either heel. A wound management system (VISITRAK™) was used to measure wound dimensions producing a visible record.

Seven patients were recruited with nine pressure injuries in total. When aggregated, the anatomical location of heel pressure injuries was primarily around the midline close to the junction of the calcaneus and sole of the foot. Aggregated data suggest that the left heel had a greater area of injury.

We have described the exact location of Stages I and II pressure injuries in a small sample of hospitalised patients for the first time. These findings should be replicated in other patient populations to facilitate development of better devices for prevention of pressure injuries at this vulnerable anatomical location.

What is already known about the topic: Pressure injuries are a preventable cause of patient morbidity. Heel pressure injuries are common and, despite extensive research, their prevention and management remains a major challenge in health care settings.

What this paper adds: This novel research reports a method to describe the exact anatomical location of heel pressure injuries and the natural fall of the foot in supine lying, described using the angle of the long axis of the foot from the vertical. It adds to existing knowledge to guide clinician decision-making in the prevention and management of pressure injuries.

Keywords: Pressure injury, pressure ulcer, heels, pathophysiology, prevention.

Introduction

Pressure injury remains a constant risk to patients requiring bed rest, causing destruction to underlying tissues and compromise of skin integrity[1]. Pressure injuries impact on the individual's health[2] as well as on health service infrastructure and resources[1]. Prevention and management of pressure injuries remains a challenge across all health care settings and indeed around the world. This is despite extensive research and the significant preventive efforts of many health care institutions[1]. Despite being a largely preventable health problem, pressure injuries remain prevalent and represent a serious clinical and economic problem and their prevention and appropriate management is necessary to improving both patient health outcomes and health budget efficiency[2].

It is beyond doubt that heel pressure injuries are common. Prevalence and incidence studies of pressure injury nationally and internationally have cited heels as the second most common location for pressure injury development after the sacrum[3]. The heel has been identified as accounting for up to 28% of all reported pressure injuries[4]. In Australia, one estimate of pressure injury prevalence in acute and subacute health care facilities ranged from 5.6% to 48.4% (mean 25.5%)[2] and estimates in acute care facilities range from 4.5% to 36.7%[2]. Hospital-acquired pressure injuries accounted for 67.6% of pressure injuries identified, with most pressure injuries being Stage I or II and located over the sacro-coccygeal region, heels, elbows or malleoli[2]. Another Australian study in 2005 reported a median of 95,695 cases of pressure injuries in

Australian public hospitals, with a median of 398,432 bed days lost. The median opportunity costs were A$285 million nationally with the greatest cost attributed to New South Wales and the lowest in the Australian Capital Territory[5].

Patients admitted to acute hospital settings have an immediate and often prolonged reduction in their mobility status. Care and management of these patients is primarily focused around the hospital bed and mattress on which they are placed. Despite the variety of positions in which adults lie on mattresses, in hospital traditionally people are nursed at a 30° angle at the head end and are supine: thus they face upwards lying on their back. Heels are predominately at risk due to their anatomical location and potentially their relative invisibility to the clinician.

In 2009 Cichowitz, Pan and Ashton dissected cadaver heels to analyse the anatomy and blood supply of the heel to better understand the development of pressure injury in general and tissue breakdown and necrosis in the heel specifically[6]. While no heel pressure injuries were present on the cadavers, the researchers found that the tissue in the heel with the most marginal vascular supply was the relatively avascular fat that was located in loculi or compartments between the fibrous septa beneath the calcaneus. The septa, to all intents and purposes, create isolated compartments[6]. The epidermis of the heel is relatively thick, but in the presence of pressure and shear forces, friction and maceration may contribute to the mechanical skin integrity damage[6]. Most importantly, they argue that the small surface contact area, limited subcutaneous tissue volume and prolonged perpendicular pressure forces exerted directly on bone are the suspected cause of the deep pressure injuries. The septa create relatively avascular compartments of fat that may result in a situation similar to compartment syndrome[6].

Although the need for accurate and standardised wound assessment and documentation has been identified, no research has been conducted to describe the specific anatomical location of pressure injuries on the heels. This is significant, considering that the heels are currently the second most frequently reported site of pressure injury and contribute to lengthened hospital stay, decrease quality of life and substantial additional costs to the health care sector worldwide. Heel pressure injury is rarely examined independently in research and falls under the collective "pressure injury" umbrella. This may be because the physiological characteristics of the heel are considered to be well understood and can be easily related to injury development and healing more broadly[7].

However, extensive review of published research literature demonstrated very limited data available plotting the anatomical location of heel pressure injuries. This pilot study, the first of its kind, explored the use of digital planimetry to obtain heel-tracing measurements and determine the anatomical locations of heel pressure injuries. The study also explored the natural fall of the foot when the patient was supine, described using an angular range of the foot from the vertical.

Aim and objectives

The aim was to conduct a pilot study exploring the anatomical locations of Stage I and Stage II pressure injuries on the heels of adult inpatients in an acute hospital. Stages I and II level injuries are deemed superficial and were most appropriate for the pilot study (see Table 1 for full staging criteria).

This study had three objectives as follows:

- To determine the range of anatomical locations of Stage I and Stage II heel pressure injuries.
- To determine the natural fall of the foot described as an angular range of the long axis of the foot from the vertical

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Table 1. Definition of Stages I and II pressure injuries.*

Stage	Definition
Stage I pressure injury: non-blanchable erythema	Intact skin with non-blanchable redness of a localised area usually over a bony prominence. Darkly pigmented skin may not have visible blanching; its colour may not have visible blanching; its colour may differ from the surrounding area. The area may be painful, firm, soft, warmer or cooler as compared to adjacent tissue. Stage I may be difficult to detect in individuals with dark skin tones. May indicate "at risk" persons
Stage II pressure injury: partial thickness	Partial thickness loss of dermis presenting as a shallow, open wound with a red-pink wound bed, without slough. May also present as an intact or open/ruptured, serum-filled blister. Presents as a shiny or dry shallow ulcer without slough or bruising (e.g. this may indicate deep tissue injury).This category should not be used to describe skin tears, tape burns, perineal dermatitis, maceration or excoriation.

*The classification of pressure injuries is based on the 2009 NPUAP/EPUAP classification system[11], which was the most recent at the time of the study.

- To confirm the applicability of the use of digitised contact tracing to describe heel pressure sites.

Method

Design and setting

This study utilised a prospective descriptive design with a convenience sample of inpatients from a major tertiary hospital with superficial heel pressure injuries.

Sample size and eligibility of participants

A formal sample size calculation was not undertaken because this was a pilot study and also because there were no data on which to base calculations. Advice was obtained from a biostatistician who recommended recruiting between five and 10 participants. Recruitment of seven participants was completed between September 2007 and October 2008 (delays were due to unrelated administrative problems). Participants were patients identified to have a pressure injury Stage I or Stage II on either heel. Following approval from the Human Research Ethics Committees, a total of seven patients from medical and surgical areas provided informed consent to participate in the study. The main inclusion criterion was presence of a Stage I or Stage II pressure injury. Patients who were less than 16 years of age; pregnant; distressed, restless, agitated, unable to provide consent due to physiological or psychological reasons; and those with a heel injury not caused by pressure were excluded from the study.

Data collection

Demographic data, clinical characteristics and pressure injury classification were combined into a single, paper-based survey instrument. Data were collected by one senior clinical nurse and obtained from three sources: the patient, investigator observation and patient's clinical record. Demographics included sex, age, weight and height. From the latter two factors the Body Mass Index (BMI) was calculated. Other patient characteristics collected included pain scale (reported using a visual analogue scale of 1–10), presence of pedal pulse (manually palpated by the research nurse), natural internal or external foot rotation using a bubble inclinometer, and self-reported shoe size. The Waterlow Risk Assessment Tool was used to identify the patient's level of risk for developing a pressure injury. It is a multivariable tool that assesses the patient according to predefined demographic, health and behavioural factors to determine a risk score[8,9]. The variables included were weight and build, continence, skin type, mobility, gender and age, and appetite and includes the consideration of special risk associated with tissue malnutrition, neurological deficits, surgery/trauma and special medications. These categories enable the scorer to complete a detailed clinical assessment of the patient.

Heel skin type was assessed by the research nurse and recorded using skin type descriptors taken from the Waterlow Risk Assessment Tool "skin type" component. Non-blanching erythema in Stage I pressure injury was assessed using the transparent disk method reported by Vanderwee *et al.* in 2006. In this method, a transparent plastic disk is used to press on the erythema. If the skin under the disk does not blanch, it is regarded as non-blanching erythema[10]. The National Pressure Ulcer Advisory Panel (NPUAP) classification was used to determine pressure injury staging (Table 1[11]). After determining the pressure injury stage, an acetate-tracing tool (VISITRAK™ Grid, see below) was placed on the heel and the wound edge traced with an alcohol-based pen. Tracings were retraced on the VISITRAK™ System with the attached pen, which automates wound surface area calculation.

Presence of comorbidities was extracted from the clinical record and the Charlson Comorbidity Index (CCI) was used to calculate a level of comorbidity. This index provides a simple, readily applicable and valid method of estimating risk of death from comorbid disease[12]. The CCI contains 19 conditions, each of which is given a severity weighting of 1–6. Severity weights are based on the adjusted relative risks from the Cox proportional hazard regression model used in the development of the index. The CCI score consists of the sum of the weighted items[13].

Study equipment

VISITRAK™ System

The VISITRAK™ wound management tool, hereafter referred to as the VISITRAK™ System, comprises three components: a digital measuring tablet with stylus (VISITRAK™ Digital Unit), a three-layer tracking grid and acetate tracing tool that includes a single use cover (VISITRAK™ Grid) and a depth indicator (not used in this study). This technology enables measurement of wound dimensions (areas, length, width, and depth) producing a visible record. The reliability, validity and convenience of this wound area measurement system have been demonstrated for pressure injuries by Sugama *et al.*[14]. The VISITRAK™ reliability results from this study showed high test retest (0.99) intraclass correlation coefficient values with similar findings for validity when compared to digital planimetry[14]. For the purposes of this project, only the digital measuring tablet and tracking grid were used. The VISITRAK™ Digital Unit is a small, portable device weighing only 688 grams (height 35.1 mm, length 300.7 mm and width 207.1 mm). The VISITRAK™ Grid is a transparent, square, plastic grid separated into four quarters; each quarter represents a surface area of 49 cm^2. The transparent, plastic grid is premarked with vertical and horizontal lines, representing 1 cm^2. The depth indicator component was not used as the skin was either intact (Stage I pressure injury) or with minimal tissue loss (Stage II pressure injury).

Other systems are available including non-contact imaging systems with automated calculation of depth, area and volume. However, these systems were prohibitively expensive for a pilot study. In addition, they usually require complex software which introduces compatibility issues for a larger study across several jurisdictions with different software.

Once consent had been obtained from the patient, the existing dressing covering the pressure injury was removed and discarded. The pressure injury site was cleaned with saline and excessive moisture gently dried with gauze. With the patient in a supine position with the head of the bed elevated at a 30–60° angle, the white backing layer of the VISITRAK™ Grid was removed. A single, two-layer tracing grid was applied over the surface of the pressure injury, positioned with the top of the VISITRAK™ Grid in the direction of the patient's head. The VISITRAK™ Grid central axis was placed in the midline at the base of the calcaneus, anatomically posterior to the sole of the foot of each patient. The upper half of the grid was placed at the inferior end of the calcaneus 90° to the sole of the foot. In this position, the two upper quadrants and two lower quadrants of the grid were above and below the heel respectively. While maintaining its central orientation on the heel, the grid was wrapped around the ankle.

Bubble inclinometer

The "Baseline Bubble Inclinometer" is a simple device which allows the resting angle of the foot to be measured relative to the vertical. It was aligned with the long axis of the foot at the base of the 5th metatarsal, with the foot in its natural resting position. The heel was resting on the end of the bed surface. The reliability of this device as a measure of angular position has been described previously[15].

Monofilament #14 (5.07)

Reduced or absent skin sensation increases the risk of injury. A commonly used tool in the recording and testing of sensation in peripheral neuropathy was used (the Monofilament #14, 5.07). The monofilament, a thickness of 5.07 mm of nylon, is pressed against the skin surface until the monofilament bends. If the patient cannot identify that pressure is being exerted, then the protective sensation is said to be lost. The tip of the monofilament was placed perpendicular to the skin surface, for approximately 1.5 seconds, allowing for a gentle bend in the monofilament. Patients were asked to respond yes or no to a question asking whether they could feel it touching the skin surface. The areas tested were six areas on the posterior of the foot surface, three toes (great, third and fifth) and one area on the upper surface of the foot. If the monofilament was not felt at more than four out of 10 sites, that patient was reported as abnormal and the site(s) was recorded[16].

Data analysis

All quantitative data were analysed using the IBM SPSS version 19 statistical package. Descriptive analysis was undertaken for the main demographic and clinical characteristics of the sample. Given the small number of participants, no percentages were calculated. For the pressure injuries, surface area values were generated by the VISITRAK™ Digital unit; a value of 1.0, for example, indicating that the whole area covered by a square in the grid was affected by the pressure injury. The surface areas corresponding to each pressure injury for each patient were transcribed from each completed

Table 2. Characteristics of the subjects recruited to the study.

Variable	Result
Median age in years [range]	83 (51–89)
Male: female	4:3
Primary diagnosis	
Major gastrointestinal surgery	2
Chronic subdural haematoma	1
Diabetes, visual problems	1
Fractured femur	1
Below knee amputation	1
Motor vehicle accident	1
Median weight in kg (range), n=5	80 (58–90)
Median Charlson Comorbidity Index (range)	2 (0–7)
Median Pain Score (range)	7 (0–10)
Self reported shoe size, n=6 median values	8.45 (8–12)
Foot length in cm, n=7	26 (20.5–30)
Pressure injury risk assessment score (WRAT)†	
Number of patients "at risk"	2
Number of patients "high risk"	4
Number of patients "very high risk"	1
Number of pressure injuries per patient	
1	5
2	2
Pressure stockings present "Yes"	1

†Waterlow Pressure Ulcer Risk Assessment Tool

VISITRAK™ Grid and plotted separately for the right and left heel of each patient using Excel spreadsheets. These grids were then combined to provide a simple calculation of total squares of the grid for each heel affected by pressure injury to demonstrate the locations most affected in this sample. This was achieved by cumulative addition of each corresponding square on the patients' grids. This procedure was done for the left and right heels separately to obtain the total surface area of each heel affected by the pressure injury for all patients.

Results

A total of seven patients were recruited to this study. Of these, three patients had pressure injuries only on their left heel, two had pressure injuries only on their right heel and two had pressure injuries on both their right and left heels. The seven participants presented with a combination of Stage I and II pressure ulcers; two with Stage I and five with Stage II pressure ulcers. Table 2 summarises the main demographic and clinical characteristics of the sample.

Table 3 represents the pedal pulse assessment. Six patients had a pedal pulse present on the right and five had a pedal pulse present on the left (note that one patient had a left below-knee amputation, so there were only six left heels included). Four participants had pedal pulses present on both feet.

The resting angle of the foot was measured for five patients, with only one patient having the same fall (outward) and angle (40°) for both feet. Table 4 illustrates the presence or absence of peripheral neuropathy in the feet of all participants as measured using a monofilament. Four patients had 100% sensation in the right foot, two had 80% and one had 10%. In comparison, for the left foot the results were the same excluding one patient with a left below-knee amputation. The dimensions of the pressure injury for each participant were measured (Table 5) with a maximum length and width of 7.6 cm and 7.7 cm respectively. The largest pressure injury measured had a total area of 34.4 cm^2.

Figure 1 displays the total area of injury on the left heel aggregated for five patients (ID 1, 3, 4, 5, 6). The vertical axis

Table 3. Presence or absence of palpable pedal pulse.

Patient ID	Pedal pulse present (right foot)	Pedal pulse present (left foot)	Primary diagnosis
1	No	Yes	Chronic subdural haematoma
2	Yes	Yes	Fractured femur
3	Yes	Yes	Major gastrointestinal surgery
4	Yes	Yes	Major gastrointestinal surgery
5	Yes	No	Diabetic, visual problems
6	Yes	Yes	Motor vehicle accident
7	Yes	No (BKA)*	Below-knee amputation
Total	6/7	5/6	

*BKA: below-knee amputation

Table 4. Presence or absence of peripheral neuropathy as measured by monofilament.

Patient number	Sensation in right foot present											Sensation in left foot present										
	U1*	L1**	L2	L3	L4	L5	L6	L7	L8	L9	%	U1	L1	L2	L3	L4	L5	L6	L7	L8	L9	%
1	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	100	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	100
2	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	100	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	100
3	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	100	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	100
4	Yes	No	No	No	No	No	No	No	No	No	10	Yes	No	No	No	No	No	No	No	No	No	10
5	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	No	80	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	No	80
6	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	100	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	100
7	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	80	BKA	BKA	BKA	BKA	BKA	BKA	BKA	BKA	BKA	BKA	0
Total	5/6	5/7	5/5	5/5	6/7	5/7	6/7	5/6	5/6	5/7		6/6	5/6	3/4	3/4	5/5	3/5	4/4	4/5	5/6	4/6	

*U=upper, **L=lower

is labelled A to M with point A closest to patient's head. The horizontal axis is numbered from 1 to 15. Each square on the grid represents the area of injury and the colour codes represent the different sizes. The most medial square in the upper inner quadrant shows a total area of 3.4 cm^2, which is the anatomical site on the left heel for all five patients where the injury is most marked. As shown on Figure 1, the further away from the midline axis of the grid, the smaller the area (in cm^2) covered by the injury.

Figure 2 represents the total area on the right heel aggregated for four patients (ID 2, 3, 4, 7). The most medial square in the lower inner quadrant shows a total area of 3.0 cm^2, which is the anatomical site on the right heel for all four patients

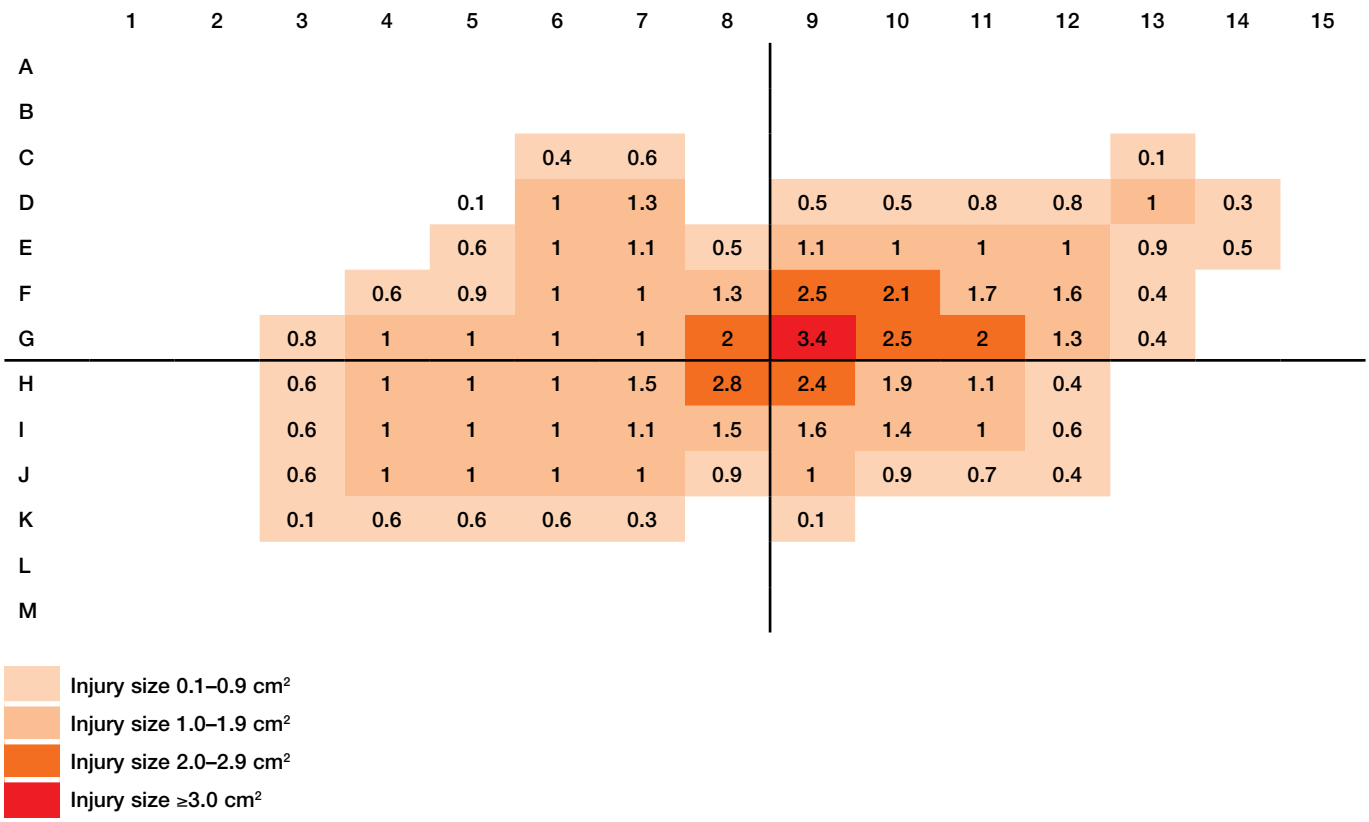

Figure 1. Left heel. The numbers in each square on the grid represent the total injury area measured in cm^2 for the left heel of five patients. The colour codes indicate the different sizes ranging from 0.1 to ≥ 3.0 cm^2.

where injury is most marked. It can also be observed that the further away from the midline axis of the grid, the smaller the area (in cm^2) covered by injury.

Both figures show that the anatomical location of heel pressure injuries in this sample appears to be primarily around the midline region close to the junction of the calcaneus and the sole of the foot. The aggregated left heel grid also has a larger area of injury compared to the right. The data gathered from the left and right heels of all seven participants was combined and the same results were observed with the wound area most marked at the midline if all heel data are aggregated (Figure 3).

Discussion

This study has enabled mapping of common locations of heel pressure injuries in hospitalised patients and, to our knowledge, is the first published study to achieve this. The anatomical location of heel pressure injuries in this sample appears to be primarily around the midline region close to the junction of the heel bone and the sole of the foot. This location corresponds at least in part to the area identified by Cichowitz *et al.*[6] with the most marginal vascular supply. As indicated in the literature review, this is an area of fat located in loculi between fibrous septa. Cichowitz *et al.* liken this area to a discrete compartment and argue that it may be "especially vulnerable to ischaemia because the fibrous septa essentially form sealed compartments that inhibit the dissipation of external pressure and create a situation analogous to compartment syndrome"[6]. A vicious cycle of pressure build-up, inflammation, oedema and further ischaemia leads to tissue breakdown. They also point out the small subcutaneous tissue volume at this site, resulting in pressure being directly exerted onto the bone. Finally, they argue that the structures deteriorate with increasing age, making the elderly particularly vulnerable. All these factors go some way to explaining the often rapid development of higher staged pressure injuries in the heels of immobilised patients and the difficulties encountered when trying to promote healing in this area.

The findings from this study are significant. They have the potential to inform the development of new products. In particular, the range of dressing sizes needs to allow for coverage of areas most affected by the injury. The characteristics of dressings, including size, will have an

Table 5. Presence or absence of pressure injuries and their size in cm.

Patient ID	Position of injury	Pressure injury staging	Length Injury length in cm (longest distance along vertical axis)	Width Injury width in cm (longest distance along horizontal axis)	Total Injury area* in cm^2
1	left	Stage II	5.2	5.6	20
2	right	Stage I	2.5	2.1	4.1
3	left right	Stage II Stage II	Left 7.6 Right 5.3	Left 7.5 Right 7.7	Left 34.4 Right 29.7
4	left right	Stage II Stage II	Left 2.1 Right 3.7	Left 3.7 Right 2.8	Left 4.5 Right 7.0
5	left	Stage II	3.8	6.0	16.5
6	left	Stage II	2.1	1.8	2.3
7	right	Stage I	1.2	1.5	1.4
Totals	5 left 4 right 9 in total	Stage I: 2 Stage II: 7			

* Depth superficial for all injuries

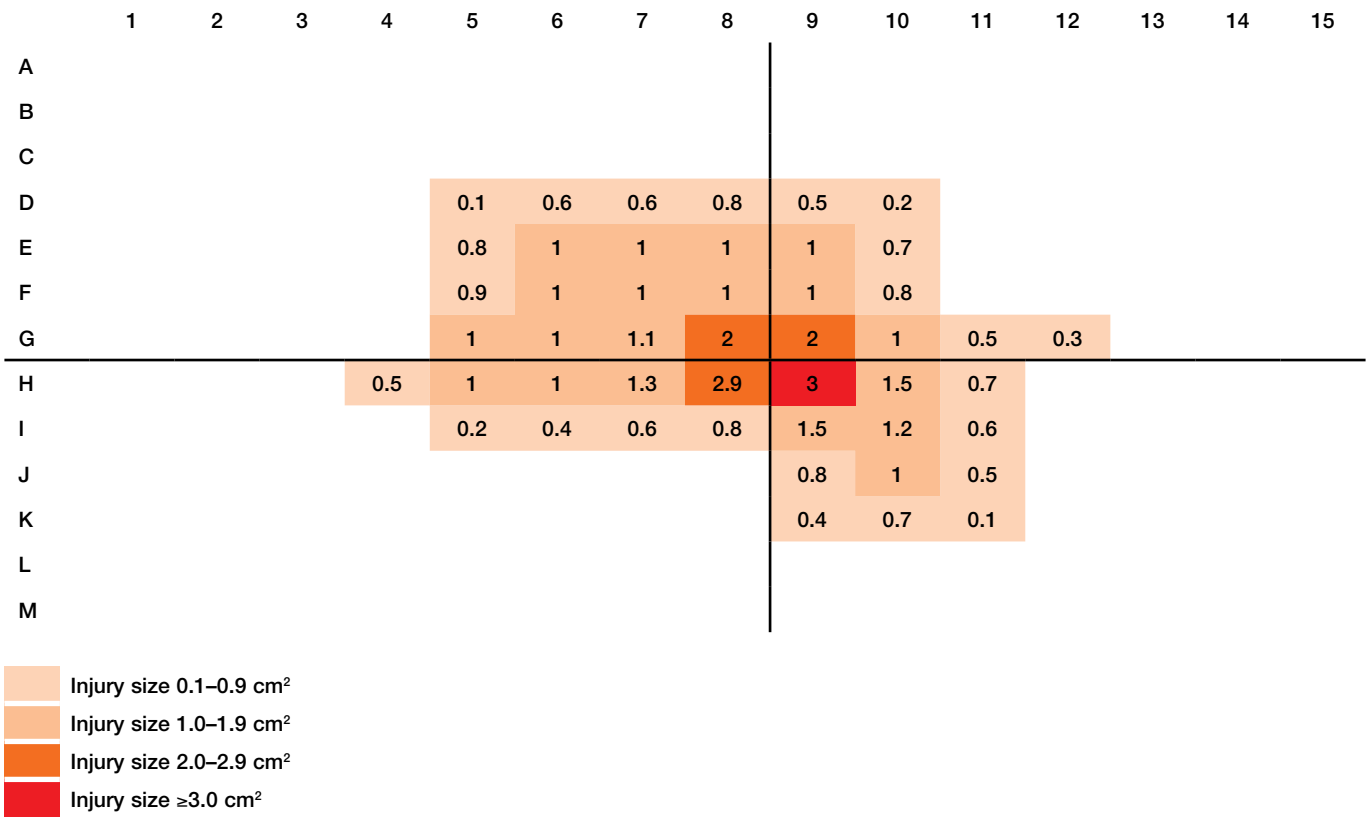

Figure 2. Right heel. The numbers in each square on the grid represent the total injury area measured in cm^2 for the right heel of four patients. The colour codes indicate the different sizes ranging from 0.1 to ≥ 3.0 cm^2.

impact on the ability of a dressing to provide a protective effect on the at-risk tissue[17]. In the management of pressure injuries the current heel dressings available are limited in size and shape, often not meeting the requirements of coverage for the pressure injury presented. Studies have also demonstrated that shear and ulceration can be significantly reduced by the application of an appropriate dressing[18]. The findings from this study need to be tested more widely.

One unexpected and potentially interesting finding from our pilot study was that the mapping showed the left heel had a larger area of injury compared to the right. Whilst this may be explained by the greater number of patients with pressure injuries on the left heel in our small sample, it also raised debate about the potential for right or left leg dominance being a contributing factor to heel pressure injury development. We did not collect data about left or right dominance, but recommend that this is included in future studies, which will need to be adequately powered to explore the potential for statistically and clinically significant differences. Given the link between immobility and pressure injury development, it may be that this factor affects mobility in the less dominant leg. If this proposition is confirmed, then this factor would be an important consideration for pressure injury preventative strategies.

Limitations

This is a pilot study which utilised a convenience sample of patients, hence findings can only be generalised to a similar population and compared to other samples. However, the findings have been sufficient to test suitability of equipment and to provide preliminary description of the exact location of heel pressure injuries in a small sample of patients admitted to an acute tertiary hospital.

Some limitations of the VISITRAK™ System were identified. The VISITRAK™ Grid has the potential of risk for wound contamination, cross-infection and discomfort for the patient with painful wounds. We excluded patients with deeper pressure injuries, thus minimising risk of pain. Best practice infection prevention and control principles were observed and the risks of cross-infection and contamination minimised by using a new grid for each injury, but it must be noted that these grids are not sterile. While there are different techniques and tools with varying degrees of reliability, validity and clinical practicality in tracing wounds[19], in this study the

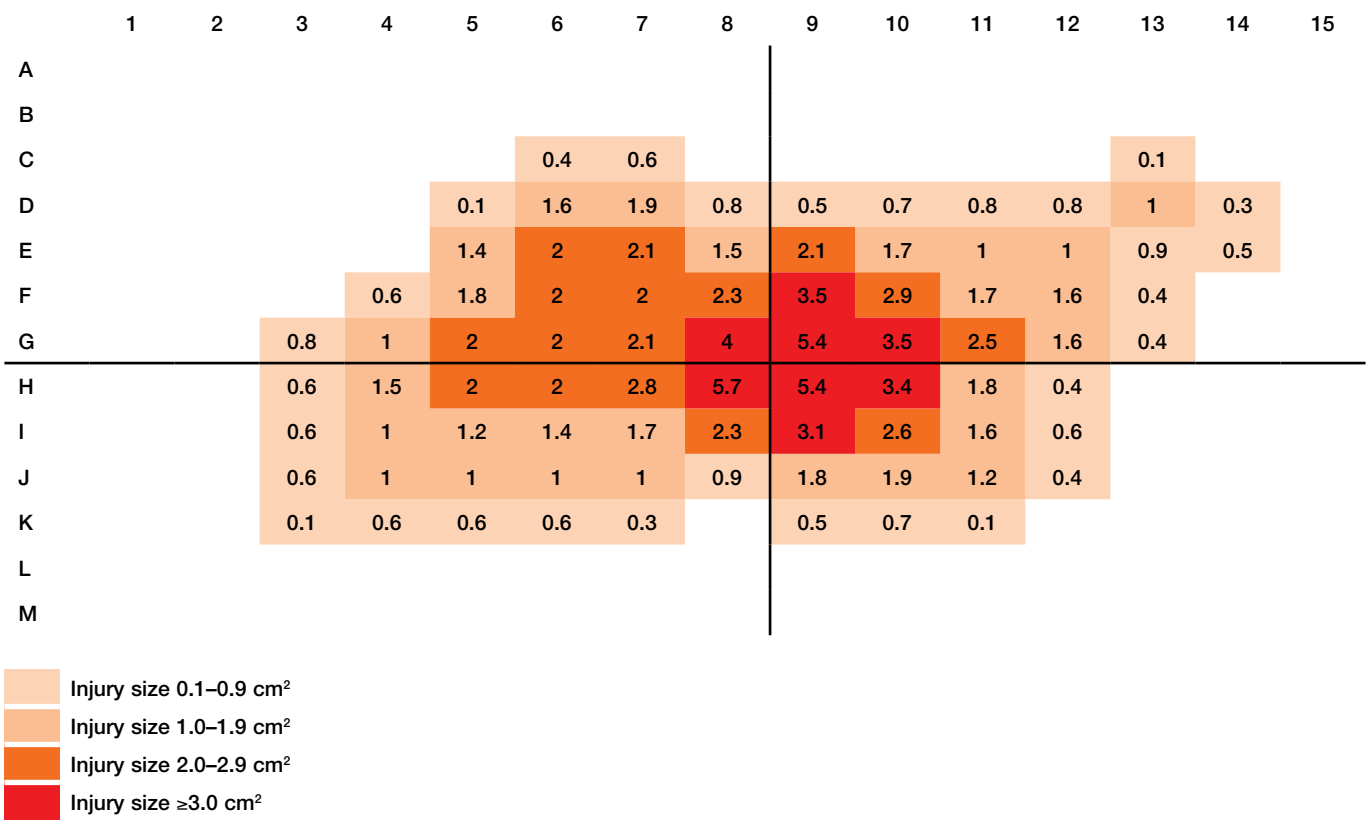

Figure 3. Left and right heels. The numbers in each square on the grid represent the total injury area measured in cm² for the right and left heels of all seven patients. The colour codes indicate the different sizes ranging from 0.1 to ≥ 3.0 cm².

VISITRAK™ System facilitated measurement of wound area, location and circumference. The system was cost-effective, easy to use and light to transport. The main difficulty encountered was the need to manually transcribe the tracings into an Excel spreadsheet. While manual transcription was manageable for a pilot study of seven patients, an electronic transfer of data would be needed to enable the use of the VISITRAK™ System in a larger study. The authors are in consultation with software experts to develop such a process.

Conclusion

The findings of this pilot study have demonstrated that, by mapping heel pressure injuries, it may be possible to guide clinician decision-making about the most appropriate preventative measures and treatment modalities available. The findings also have the potential to inform the development of new products and assessment tools. Finally, this successful pilot study demonstrates the need for further research and will be used to inform a major multi-site study that will conclusively map the location, circumference and depth of heel pressure injuries.

Acknowledgements

Thanks to Ms Lynne Millar for assistance with data analysis and to Mrs Oyebola Fasugba for assistance with data analysis and development of the manuscript.

Conflict of interest

No conflict of interest has been declared by the authors.

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