Skin tear risks associated with aged care residents: a cross-sectional study

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ABSTRACT

Background: To describe the profile of aged care residents and to examine those variables that were associated with skin tears.

Method: A representative sample of 200 elderly residents were recruited into this cross-sectional study, which was conducted between February and December 2014 from four aged care facilities in Western Australia. The resident's history of skin tears over the preceding 12-months was compared with their demographics (age, gender, place of birth) and a broad range of clinical characteristics including: body mass index, comorbidities, medications, smoking history, falls, and personal skin characteristics (purpura, ecchymosis, bruising uneven pigmentation, pseudoscars).

Results: A history of skin tears was documented for 101 (50.5%) residents during the preceding 12-months.

Residents with a skin tear history were significantly older, more likely to have a skin tear on initial assessment, had a lower Braden Scale score and a lower Braden sub-score for mobility, were at higher risk of falling, had osteoporosis, used a corticosteroid inhaler, and displayed both skin purpura (≤ 20 mm.) and ecchymosis (≥ 20 mm.).

Conclusions: Aged care residents are at substantial risk of skin tears. Identification of factors associated with skin tears aids better understanding of risk factors and enables more effective targeted preventive strategies.

Keywords: Skin tears, elderly, demographics, clinical, residential care.

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BACKGROUND

Skin tears are commonly reported wounds associated with ageing skin[1,2]. They are generally defined as a "traumatic wound occurring principally on the extremities of older adults, as a result of friction alone or shearing and friction forces which separate the epidermis from the dermis (partial-thickness wound) or which separates both the epidermis and the dermis from underlying structures (full-thickness wound)"[3,p.22].

The wide range of incidents and causes that are reported in the literature to be associated with skin tears are due in part to methodological differences and geographical diversity of the study populations[2,4-9]. Published global epidemiological data indicate that Australia (41–59%) has one of the highest prevalence rates of skin tears among aged care residents when compared to similar North America (14–22%) and Japanese (4–14%) populations[2,4-8]. Regardless of the geographical location of these studies, skin tears are reported to primarily occur on the upper extremities, followed by the lower extremities[5,10-12]. As Australia's population aged 65 years and older is projected to grow from 15% in 2015 to 22% in 2056[13,14], it is likely skin tear incidents will increase.

The early identification of older individuals at risk of skin tears will potentially permit timely and targeted implementation of preventive strategies to reduce these injuries, optimise quality of life and better utilise health care resources. While a number of studies have reported determinants of skin tears[4,15-17] in Australia there is a paucity of data that have explored the risk of skin tears over the extremities of aged care residents. Given the paucity of data, a cross-sectional study was undertaken to identify demographic, clinical and

skin characteristics associated with a documented history of skin tears in the preceding 12 months. This report presents the demographic and clinical profile of aged care residents who participated in that study.

METHODOLOGY

Study design, setting and sample

A cross-sectional study was conducted across four residential aged care facilities (two metropolitan and two regional) that were operated by a single service provider in Western Australia. Staffing ratios and care practices were standardised across the four residential facilities. A sample size of 200 residents was determined a priori from power analysis. Residents were invited to participate if they met the inclusion criteria, were aged over 65 years and had provided informed, written consent. Residents were excluded if consent was not obtained, a connective tissue disorder, were in pain, agitated or were receiving palliative services.

Data collection

A data collection form was devised to standardise the recording of demographic (age, sex, place of birth), clinical (skin type, history of smoking, body mass index [BMI], Braden Scale scores[18], falls history co-morbidities, medication, use of moisturiser) and skin characteristics (purpura, ecchymosis, bruising, uneven pigmentation, pseudoscars). Demographic data were sourced from the resident, their legal guardian or the medical records.

A review of the skin tear literature identified a lack of clarity about the definition and classification of skin characteristics[9]. To maintain consistency with the medical literature, precise definitions were based on the Medical Subject Heading (MeSH) controlled index terms that are listed in the US National Library of Medicine's (NLM) biomedical literature database and Medline[19]. Where terminologies were not available under the MeSH headings, additional medical literature resources were searched to clarify these definitions.

Ecchymosis is a general term referring to the extravasation of blood into skin[20,21]. These lesions are benign, non-palpable, non-blanching and have a purplish/brown colour[19,22]. Purpura referred to the isolated demarcated ecchymotic lesions that occurred in the dermal layer of the skin and range in size between 2 and 20 mm. Senile purpura (also known as ecchymosis, actinic purpura, Bateman's purpura, traumatic purpura or corticosteroid purpura) also occurred in the dermal layer skin but present as a more extensive (greater than 20 mm) and demarcated lesion[23,24]. The presence of purpura and ecchymosis in this study were the result of age-related skin changes and not from any underlying medical conditions.

The use of the word 'bruise' within the skin tear literature appears to be synonymous with the term ecchymosis[17,25-29]. Caution is nevertheless needed when using these terms interchangeably, as *Stedman's Medical Dictionary* (2016) advises against associating the term 'bruise' with any haemorrhagic lesion other than that which arises from a blunt force injury. For the purpose of this study, a bruise or contusion referred to the extravasation of blood in the subcutaneous layer that resulted from a non-penetrating blunt force or crush injury[30,31]. These lesions have an indistinct edge and undergo characteristic discolouration until they progressively disappear. Colour changes range from red, blue and purple in the first 5 days; green after 5–7 days; and yellow about 1–2 weeks later[22,32].

The extremities of aged residents were visually assessed, inspected and gently palpated to evaluate skin characteristics. All residents were assessed by a single investigator within the privacy of their own room under standardised temperature (20–22 ± 1°C) and relative humidity (40–60%) testing conditions. All skin tears in the centralised database were classified according to the validated Skin Tear Audit Research (STAR) Classification System and recorded by the service provider in an integrated database[33]. The STAR Classification accounts for ecchymotic skin colour changes associated with the skin tear injury such as 'dusky, darkened'.

ANALYSIS

Categorical data was represented by frequency (percentage) and mean ± standard deviation and median (interquartile range) for continuous variables. Chi-squared tests were conducted to evaluate the frequency data for categorical variables and the preceding 12 months' documented history of skin tears. Independent sample t-tests were used to compare continuous data between residents with and without a history of skin tears. All tests were two-sided with a p-value less than 0.05 considered significant. The skin tears classification was obtained from the service providers integrated database to avoid removing any dressing found to be in situ on assessment. Data was analysed using the Statistical Package for the Social Sciences (SPSS® version 22)[34].

ETHICAL APPROVAL

Ethics approval for this study was obtained from Curtin University Research and Development Human Research Ethics Committee (RD-23-13) and The Bethanie Group Inc. Governance Committee. The study protocol conformed to the ethical guidelines of the 1975 Declaration of Helsinki and the Australian Code for the Responsible Conduct of research[35,36].

RESULTS

In total, 200 aged care residents participated in this study, which was conducted over an 11-month period between February 2014 and December 2014. Among the study population, 101 residents had a documented history of skin tears during the 12 months preceding recruitment and 99 had no recorded skin tear incident. The demographic, clinical and skin characteristics of the 200 residents are presented in Table 1: Comparison between residents with and without a documented history of skin tears.

Table 1: Comparison between residents with and without a documented history of skin tears

	Total	Residents with a history of skin tears (n = 101) n (%)	Residents without a history of skin tears (n = 99) n (%)	*p*-value
Demographics				
Age: Mean (SD)	87.4	88.4 (6.8)	86.4 (7.4)	0.038
Sex				
Males	56	31 (55.4)	25 (44.6)	0.392
Females	144	70 (48.6)	74 (51.4)	
Place of birth				
Oceanian	133	74 (55.6)	59 (44.4)	0.109
North-West European	46	17 (37.0)	29 (63.0)	
Southern/Eastern European	11	3 (27.3)	8 (72.7)	
North African & Middle East	1	0 (0.0)	1 (100.0)	
South-East Asian	2	1 (50.0)	1 (50.0)	
North-East Asian	1	1 (100.0)	0 (0.0)	
Southern & Central Asian	1	1 (100.0)	0 (0.0)	
Central Americans	3	3 (100.0)	0 (0.0)	
Sub-Saharan African	1	1 (50.0)	1 (50.0)	
Clinical characteristics				
Fitzpatrick skin type				
Type 1	11	5 (45.5)	6 (54.5)	0.264
Type 2	64	33 (51.6)	31 (48.4)	
Type 3	83	47 (56.6)	36 (43.4)	
Type 4	42	16 (38.1)	26 (61.9)	
Body mass index	25.4	24.7 (5.1)	26.1 (5.5)	0.068
History of smoking				
Lifelong non-smoker	105	49 (46.7)	56 (53.3)	0.314
Ex-smoker	80	42 (52.5)	38 (47.5)	
Unknown	15	10 (66.7)	5 (33.3)	
Skin tear at time of assessment				
No	177	79 (44.6)	98 (55.4)	<0.001
Yes	23	22 (95.7)	1 (4.3)	
Braden Scale score	17.9	17.3 (3.5)	18.5 (4.0)	0.023
Braden sub-scores				
Sensory perception	3.1	3.0 (0.6)	3.2 (.7)	0.078
Moisture	3.3	3.2 (1.0)	3.3 (0.9)	0.252
Activity	3.2	3.0 (0.9)	3.3 (1.0)	0.133
Mobility	3.0	2.8 (0.8)	3.1 (0.9)	0.023
Nutrition	3.4	3.2 (0.9)	3.5 (0.6)	0.015
Friction	2.2	2.1 (0.7)	2.3 (0.8)	0.093

Table 1 (continued): Comparison between residents with and without a documented history of skin tears

	Total	Residents with a history of skin tears (n = 101)	Residents without a history of skin tears (n = 99)	*p*-value
		n (%)	n (%)	
Falls risk category				
Medium (11–20)	93	31 (33.3)	62 (66.7)	<0.001
High (21–39)	107	70 (65.4)	37 (34.6)	
Contractures				
No	189	97 (51.3)	92 (48.7)	0.335
Yes	11	4 (36.4)	7 (63.6)	
Paralysis				
No	193	100 (51.8)	93 (48.2)	0.051
Yes	7	1 (14.3)	6 (85.7)	
Dementia				
No	85	43 (50.6)	42 (49.4)	0.983
Yes	115	58 (50.4)	57 (49.6)	
Heart disease				
No	113	57 (50.4)	56 (49.6)	0.985
Yes	87	44 (50.6)	43 (49.4)	
Respiratory disease				
No	173	83 (48.0)	90 (52.0)	0.071
Yes	27	18 (66.7)	9 (33.3)	
Renal disease				
No	181	89 (49.2)	92 (50.8)	0.246
Yes	19	12 (63.2)	7 (36.8)	
Parkinson's disease				
No	183	91 (49.7)	92 (50.3)	0.473
Yes	17	10 (58.8)	7 (41.2)	
Osteoporosis				
No	95	47 (49.6)	48 (50.5)	0.782
Yes	105	54 (51.4)	51 (48.6)	
Osteoarthritis				
No	106	46 (43.4)	60 (56.6)	0.033
Yes	94	55 (58.5)	39 (41.5)	
Total number of medications: Mean (SD)	6.9	6.8 (3.2)	7.0 (3.8)	0.128
Anticoagulants				
No	188	96 (51.1)	92 (48.9)	0.528
Yes	12	5 (41.7)	7 (58.3)	
Antiplatelets				
No	118	61 (51.7)	57 (48.3)	0.685
Yes	82	40 (48.8)	42 (51.2)	

Table 1 (continued): Comparison between residents with and without a documented history of skin tears

	Total	Residents with a history of skin tears (n = 101)	Residents without a history of skin tears (n = 99)	
		n (%)	n (%)	*p*-value
Oral corticosteroids				
No	187	94 (50.3)	93 (49.7)	0.803
Yes	13	7 (53.8)	6 (46.2)	
Topical corticosteroids				
No	154	77 (50.3)	76 (49.7)	0.930
Yes	47	24 (51.1)	23 48.9)	
Inhalation corticosteroids				
No	18.3	88 (48.1)	95 (51.9)	0.025
Yes	17	13 (76.5)	4 (23.5)	
Sedative				
No	167	81 (48.5)	86 (51.5)	0.204
Yes	33	20 (60.6)	13 (39.4)	
Opioids				
No	148	72 (48.6)	76 (51.4)	0.377
Yes	52	29 (55.8)	23 (44.2)	
Moisturiser used				
No	61	33 (54.1)	28 (45.9)	0.500
Yes	139	68 (48.9)	71 (51.1)	
Skin characteristics				
Purpura ≤ 20 mm				
No	77	16 (20.8)	61 (79.2)	<0.001
Yes	123	85 (69.1)	38 (30.9)	
Ecchymosis ≥ 20 mm				
No	149	66 (44.3)	83 (55.7)	0.003
Yes	51	35 (68.6)	16 (31.4)	
Bruising				
No	19.3	100 (51.8)	93 (48.2)	0.051
Yes	7	1 (14.3)	6 (85.7)	
Uneven skin pigmentation				
No	76	33 (16.5)	43 (21.5)	0.117
Yes	124	68 (34.0)	56 (28.0)	
Pseudoscars				
No	187	92 (49.2)	95 (50.8)	0.162
Yes	13	9 (69.2)	4 (30.8)	

Note: n = number; % = percentages; SD = standard deviation, *p*-value from chi-square test for categorical variables or *t*-test for continuous variables.

Table 2: Number of skin tears at time of assessment and the proportion of residents

Number of skin tears	Residents n (%)	Total number of skin tears equals number of residents by number of skin tears
1	19 (82.6)	19 (70.4)
2	4 (17.4)	8 (29.6)
Total	23 residents	27 skin tears

Note: Values are number of residents (%).

Residents with a documented history of a skin tear in the preceding 12 months were significantly older than residents without skin tears and were more likely to have a skin tear and a lower Braden Scale score at time of the assessment. Further examination of the six Braden Scale sub-scores (sensory perception, moisture, activity, mobility, nutrition and friction) showed only mobility had a statistically significant effect. Residents with a history of skin tears were significantly less mobile than residents without a history of skin tears.

Residents with a documented history of skin tears were also significantly more likely to have osteoarthritis, be in a higher falls risk category, take inhalation corticosteroids, and display skin manifestations of purpura and ecchymosis.

Table 2 presents the number and relative proportion of residents with a skin tear at time of assessment.

At the time of the assessment, 23 of the 200 residents were recorded to have a total of 27 skin tears. In total, 82.6% of residents had a single skin tear and 17.4% of residents had two skin tears. The anatomical location and the total number of skin tears at time of the assessment by gender is presented in Table 3.

Skin tears were present at time of assessment in 12.5% of all males and 11.1% of all females. Of these skin tears, 51.9% occurred on the upper extremity, 44.4% on the lower extremities and 3.7% on the face.

According to the STAR Classification System, 40.7% of skin tears present at time of the assessment were classified as category 1a, 33.3% as 1b, 22.2% as 2b, and 3.7% as 3 (Table 4).

DISCUSSION

This cross-sectional study presents the demographic, clinical profile and skin characteristics of 200 aged care residents, which were found to be significantly associated with a preceding 12 months' documented history of skin tears. The study population comprised 144 females and 56 males with a total mean age of 87.4 (range 65–107) years. In terms of a preceding 12-month documented history of skin tears in this sample, skin tears occurred in 50.5% of residents, while 49.5% of residents did not have a reported injury.

There were significant differences in demographic and clinical profile between residents with a documented history of skin tears and residents without a reported history. Residents with a history of skin tears were precisely two years older than residents without a history of skin tears. This result is consistent with findings from other studies reporting age is associated with the risk of skin tears[11,16,17,37].

Table 3: General location of total number of skin tears at time of assessment by gender

Location	Location of skin tears at time of assessment by gender (n = 23) and number of skin tears (n = 27)		
	Males (n = 7)	Females (n = 16)	Total
Right arm	1 (25.0)	3 (75.0)	4
Left arm	2 (40.0)	3 (60.0)	5
Right leg	2 (40.0)	3 (60.0)	5
Left leg	1 (16.7)	5 (83.3)	6
Hand	1 (20.0)	4 (80.0)	5
Face	1 (100.0)	0 (0.0)	1
Foot	0 (0.0)	1 (100.0)	1

Note: Values are number of patients (%).

Table 4: Number and percentage of skin tears by the STAR Classification System

Location	STAR Classification					
	1a	**1b**	**2a**	**2b**	**3**	**Total**
Right arm	1 (25.0)	2 (50.0)		1 (25.0)		4 (14.8)
Left arm	3 (60.0)	1 (20.0)		1 (20.0)		5 (18.5)
Right leg	2 (40.0)	3 (60.0)				5 (18.5)
Left leg	1 (16.7)	1 (16.7)		3 (50.0)	1 (16.7)	6 (22.2)
Hand	4 (80.0)	1 (20.0)				5 (18.5)
Face		1 (100.0)				1 (3.7)
Foot				1 (100.0)		1 (3.7)
Total	11 (40.7)	9 (33.3)		6 (22.2)	1 (3.7)	27 (100.0)

Note: Values are number of patients (%).

Three recent studies, which were undertaken in long-term, elderly Japanese residents, did not find any significantly difference in age between residents with and without skin tears[7,8,12]. It is likely that the skin of residents in this Australian study population were also subjected to substantial extrinsic ageing, which would also contribute to a progressive decline in the skin's structural integrity.

In residents with a documented history of skin tears, 21.8% had a skin tear incident at time of the assessment. Four previous studies also reported skin tears were associated with a history of skin tears[5,10,37,38]. This suggests that there may be yet unknown skin property changes that leave some older individuals more susceptible to repeated skin tear injuries.

Residents with a history of a skin tear were more likely to have a lower Braden Scale score and lower Braden mobility sub-score than residents without a history of skin tears. Despite the fact that residents with a history of skin tears had a lower Braden Scale score as compared to residents without a history of skin tears, the relative prediction risk of a pressure injury was mild for both populations. Three other studies, which reported using the Braden Scale to assess mobility did not find any significant difference between the mobility score between residents with and without skin tears[7,8,12]. A dated study by McGough-Csarny and Kopac[37] (1991), which did not use the Braden Scale, reported limited mobility to be a risk factor of skin tears. Recent research into the validity of the Braden Scale in assessing pressure injuries in long-term care facilities and in individuals aged over 80 years has questioned the use of this tool due to its low reliability in this population cohort[39,40]. As the relevance of the Braden Scale for use in the context of skin tears in older adults has never been validated, it is debatable whether it is the most appropriate tool to discriminate mobility, particularly in individuals aged over 80 years. Nevertheless, reduced mobility may be a marker for the risk of falling which in some older individuals can lead to skin trauma.

In this study, residents with a history of skin tears were nearly twice as likely to be documented as having a high falls risk than residents without a history of skin tears. This result is supported by a number of previous studies showing falls increase the risk of skin tears[41,42]. While there are numerous factors that contribute to the risk of older individuals falling[43], more extensive skin changes may predispose some individuals to recurrent disruption of their skin integrity.

Residents with a history of skin tears were 1.4 times more likely to have osteoarthritis. While osteoarthritis has not previously been reported to be associated with skin tears it inhibits stability and mobility and is a common falls risk factor[44,45]. Older adults with osteoarthritis of the hips and knee compensate to reduce the amount of pressure on the affected joints by adopting biomechanical changes when walking[46]. The pelvis slopes downwards to the opposing side during the stance phase of the gait, which results in the centre of gravity moving away from the stance leg, leading to instability and an increased risk of falling[46].

Likewise, residents with a documented history of skin tears were three times more likely to be taking corticosteroids in an inhaler form than residents without a history of skin tears. While the inhaled mode of steroid delivery has not previously been reported in the skin tear literature, research on the cutaneous effects of inhaled corticosteroids indicate that atrophic skin changes are similar to those that result from topical and oral corticosteroids use[47]. Atrophic effects of steroids includes epidermal thinning and decreased collagen synthesis of the dermal layer, which can lead to loss of skin integrity[48].

Two clinical skin manifestations were identified to be significantly associated with a history of skin tears in this study. Residents with a documented history of skin tears were more than twice as likely to have clinical skin purpura and ecchymosis than residents without a documented

history. These skin manifestations were consistent with other authors' findings in the skin tear literature[6,10,37]. The aetiology of purpura and ecchymosis is reported to arise from increased fragility of blood vessels and a decline in dermal structural collagen associated with age-related skin changes, which impact on the mechanical integrity of skin[22,49].

A strength of this cross-sectional descriptive study was the multi-site research settings from which participants were recruited. The study design included a representative sample of older adults in Western Australian aged care facilities with equal representation of residents with or without a history of skin tears. Thus, the findings could be considered to be relevant to a broader residential aged care population. Potential limitations to this cross-sectional study is the temporal association between a documented history of skin tears and identified risk factors.

CONCLUSION

This study identified the demographic, clinical and skin characteristics of a representative sample of 200 aged care residents, identifying factors which were found to be significantly associated with a documented history of skin tears. These associations identify variables that should be assessed among aged care residents on a routine basis, to better understand risk factors and plausibly quantify future risk of skin tears. This, in turn, will allow health care professionals to more effectively apply targeted preventive strategies to reduce the incidence of skin tears in aged care residential facilities. Reduction in skin tears will lead to improved quality of life among residents, and aged care providers can anticipate a reduction in wound care time and costs.

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CONFLICT OF INTEREST

The authors declare no conflicts of interest.

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