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# Incidence of skin tears in the extremities among elderly patients at a long-term medical facility in Japan: A prospective cohort study

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**Aim:** There is a lack of data from cohort studies for the incidence of skin tears among an elderly population in an Asian country. We estimated the cumulative incidence of skin tear, and identify its risk factor.

**Methods:** The present prospective cohort study was carried out at a long-term medical facility in Japan. Participants included patients ($n$ = 368) aged 65 years or older receiving hospital care. The 3-month cumulative incidence of skin tears was estimated by identifying them using direct inspection of the extremities. In order to find the risk factors for the skin tear incidence, odds ratios and their 95% confidence intervals of skin tear development in association with the factors were estimated using logistic regression analyses.

**Results:** A total of 14 patients developed skin tears, and their cumulative incidence was 3.8%. No patients with skin tears developed multiple wounds on their extremities. Half of the skin tears occurred on the outside of the right forearm, and just three skin tears were found in the lower legs. Multiple logistic analyses showed that pre-existing skin tears (odds ratio 15.42, 95% confidence interval 3.53–67.43, $P < 0.001$) and a 6-point decrease in the total score of the Braden Scale (odds ratio 0.10, 95% confidence interval 0.01–0.83, $P < 0.033$) were significantly associated with skin tear development.

**Conclusions:** Patients with pre-existing skin tears and a low score of the Braden Scale have a higher risk of skin tear development during 3 months. These factors could be used to identify patients requiring prevention care for skin tears. **Geriatr Gerontol Int 2015; 15: 1058–1063.**

**Keywords:** epidemiology, dermatology, nursing care, preventive medicine, skin tears.

## Introduction

A skin tear is a wound caused by shear, friction and/or blunt force that results in separation of skin layers, and it commonly occurs in the extremities in elderly people.[1] Skin tears have been attracting attention from clinicians, especially in the geriatric field, because they are common, often preventable, and cause severe pain and additional costs.[2] Because of the nature of the appearance of skin tears, some cases might be doubted as a result of physical abuse by clinicians or their family in their home, care facilities, or hospitals, although no previous report has supported a relationship between skin tears and physical abuse.[1] To resolve this uncomfortable situation, an effective strategy should be established for the prevention of skin tears. One prospective pre-post intervention study investigated the cost effectiveness of a nutrient-based skin care regimen for skin tear prevention among institutionalized elderly residents in an extended care facility.[3] Another pre-post intervention study showed a possible prevention strategy for skin tears, including staff education, skin sleeves, padded side rails, gentle skin cleansers and lotion use among elderly patients.[4] These studies clearly showed promising preventive care regimens. However, there are still many cases of skin tears unless there is installation of preventive practice. Therefore, the incidence of skin

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tears needs to be described, and risk factors should be examined for their development in elderly people in whom existing preventative measures are ineffective to facilitate establishment of a more effective strategy.

Identifying risk factors would facilitate an effective strategy specific for skin tear prevention. However, only a few studies on skin tears have been published, and unfortunately, they were mostly based on medical reports, which have a significant potential to overlook wounds. Malone *et al*. estimated that the overall incidence of skin tears was 0.92 per patient per year in long-term care facility residents, of whom data were extracted from incident reports.[5] Another promising study reported a 2-year incidence of skin tears of 2.1% in men and 4.6% in women, but these data were restricted to pretibial skin tears.[6] Another issue of previously published data is the population differences among studies. Skin tears occur more frequently among people in critical care units or pediatric care settings than in long-term care settings. Therefore, risk factors need to be explored in an aging-specific manner.[7,8] Furthermore, differences in race/ethnicity should be accounted for in managing the risk of skin tears, because skin properties may vary among different ethnic groups.[9,10] Because of the growing elderly Asian population, the rate of incidence and risk factors for skin tears, such as age, sex, underlying diseases and limited activity of daily living, need to be examined in an Asian country to provide better understanding of the risk of skin tears.[11,12]

The purpose of the present study was to determine the cumulative incidence of skin tears among elderly patients at a long-term medical facility in Japan, and to examine possible risk factors.

## Methods

### *Study design*

The present prospective cohort study was carried out during August to November 2012 at a long-term medical facility (500 beds) in which patients with a stable medical condition received daily living care and nursing along with medical care, in Japan. All patients, or their proxies, were informed of the procedure and provided written consent. This study was approved by the Ethical Committee of the Graduate School of Medicine, The University of Tokyo, Tokyo, Japan.

### *Participants*

A total of 488 patients in this hospital who were hospitalized during August 2012 were assessed for eligibility regardless of the presence or absence of skin tears. Of these, 12 patients were in a critically ill condition and 66 patients had no consent obtained from patients or by proxy. Therefore, 410 patients participated in the first skin assessment. A total of 42 patients were lost to follow up (deceased, $n = 31$; refused, $n = 6$; and unspecified reasons, $n = 5$). Therefore, a total of 368 patients were re-assessed for the presence of skin tears in November 2012. Because the mean healing time (standard deviation [SD]) was reported as $37 \pm 26$ days, we anticipated 3 months (average plus two SD) for the interval between the first and second skin assessment to avoid duplication of a case, which lasts from the first assessment to the second assessment.[6] Using this fixed cohort, we observed patients' skin twice in August and November in 2012. Follow up was terminated when patients developed a skin tear or when they received the second skin assessment.

### *Confirmation of skin tears*

A skin tear is 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 separate both the epidermis and the dermis from underlying structures (full thickness wound)".[13] Because it is difficult to diagnose wounds as skin tears, two researchers carried out a direct inspection to obtain the most accurate incidence of skin tears.[14] For this reason, we focused on the incidence of skin tears within the extremities, which are the most prone anatomical location of this type of wound, and have less possibility for misdiagnosis. One of the researchers, a fully trained research nurse from the Department of Wound Care Management, directly inspected each patient's extremities, and recorded and photographed the findings. To avoid including prevalent skin tears that were present at the baseline skin tear assessment, the location and shape of skin tears were recorded, and whether a skin tear was newly formed was investigated. The researcher collected information on the process of skin tear development by ward nurse staff when detecting any skin lesions suspected as skin tears during a skin inspection. A wound, ostomy, and continence nurse and another researcher confirmed the final assessment of skin tears using all photographs, and determined them as a skin tear. Each skin tear was classified according to the Skin Tear Audit Research Classification system, which is a method used to classify skin tears in clinical practice.[15]

Because we set the observation window for 3 months, and the mean healing time (standard deviation) for skin tears was reported as 37 days (26 days), there might be a case of skin tear that developed during the study period and healed before the second assessment.[6] To exclude such cases in order to guarantee the strict analysis for exploring risk factors for skin tear incidence, we recorded the presence of scar formation in the extremities.

### *Baseline characteristics*

The following data were collected and examined at baseline for their possible associations with an increased risk for developing skin tears: pre-existing skin tear at the start of the present study, age, sex, length of hospitalization, Braden Scale scores,[16] body mass index, immobility, paralysis, articular contracture, medication, comorbidity and nutritional routes. These data were obtained from medical and nursing records. The Braden Scale is a prediction scale of pressure ulcers, which has a range of 6–23, where 6 indicates a high risk and 23 indicates no risk.

### *Analysis*

We used cumulative incidence estimates to assess the absolute risk of skin tears. The 3-month cumulative incidence (%) was calculated by dividing the number of patients with skin tears by the total number of patients at baseline ($n$ = 368) multiplied by 100.

Descriptive data are expressed as the median (interquartile range) for continuous variables, or as $n$ (%) for categorical variables. For examining risk factors, the end-point of subsequent analyses was restricted to skin tear cases without a scar. The Wilcoxon rank sum test or Fisher's exact probability test was used to evaluate the potential risk factors related to skin tear development between patients with and those without skin tears.

Odds ratios and their 95% confidence intervals of skin tear development in association with the factors investigated in the present study were estimated using logistic regression analyses. Variables were subjected to multiple logistic regression analyses when the $P$-values were less than 0.10 between the groups with and without skin tear in univariate analyses. Before multiple logistic regression, relationships among candidates were assessed using the Wilcoxon rank sum test or $\chi^2$-test to confirm if there was multicollinearity. Two types of models were developed in multiple logistic regression analyses related to the development of skin tears (crude model) and the adjusted model (adjusted model), where age and sex were entered. For descriptive data, univariate analyses and multivariate analyses, results are shown for participants with no missing data for each independent variable.

The statistical significance level was set at $P = 0.05$. All analyses were carried out using Statistical Analysis System software version 9.3 (SAS Institute, Cary, NC, USA).

## Results

### *Incidence of skin tear and its location*

Of 368 patients, 274 patients were women (74.5%) and 94 were men (25.5%). The median age of the patients was 87 years (interquartile range 81–92 years). A total of 14 patients developed skin tears, and their cumulative incidence was 3.8%. No patients with skin tears developed multiple wounds on their extremities. The frequency of skin tears at each anatomical location is shown in Table 1. Half of the skin tears occurred outside of the right forearm, and just three skin tears were found in the lower legs. The Skin Tear Audit Research Classification of skin tears of 1b (i.e. a skin tear with a pale, dusky or darkened flap) was dominant (57.1%). No skin tears were found on the patients' palm or plantar skin.

**Table 1** Frequency of skin tears at each anatomical location

| Anatomical location | | | Frequency of skin tears | STAR classification | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | 1a | 1b | 2a | 2b | 3 |
| Forearm | Posterior | Right | 7 (50.0) | | 5 (71.4) | | 2 (28.6) | |
| | | Left | 2 (14.3) | | 1 (50.0) | | 1 (50.0) | |
| Hand | Dorsum | Left | 2 (14.3) | | 1 (50.0) | | | 1 (50.0) |
| Lower leg | Anterior | Right | 1 (7.1) | | 1 (100.0) | | | |
| | | Left | 1 (7.1) | | | | | 1 (100.0) |
| | Posterior | Left | 1 (7.1) | | | | | 1 (100.0) |
| Total | | | 14 (100.0) | 0 | 8 (57.1) | 0 | 3 (21.4) | 3 (21.4) |

Data presented as $n$ (%). Category 1a: A skin tear where the edges can be realigned to the normal anatomical position (without undue stretching), and the skin or flap color is not pale, dusky or darkened. Category 1b: A skin tear where the edges can be realigned to the normal anatomical position (without undue stretching), and the skin or flap color is pale, dusky or darkened. Category 2a: A skin tear where the edges cannot be realigned to the normal anatomical position, and the skin or flap color is not pale, dusky or darkened. Category 2b: A skin tear where the edges cannot be realigned to the normal anatomical position, and the skin or flap color is pale, dusky or darkened. Category 3: A skin tear where the skin flap is completely absent. STAR, Skin Tear Audit Research Classification for skin tears.

### *Risk factors for development of skin tears*

We compared baseline characteristics between patients with and those without skin tears. The frequency of the presence of pre-existing skin tears was significantly higher in patients with skin tears than in those without skin tears ($P < 0.001$, Table 2). All patients with skin tears were suffering from arm and leg contractures ($P = 0.006$ and $P = 0.026$, respectively). The use of steroids tended to be more frequent in patients with skin tears than in those without skin tears ($P = 0.063$). The total score of the Braden Scale tended to be lower in skin tear patients than in those without skin tears ($P = 0.067$). Because the frequency of arm and leg contractures was 100% in skin tear patients, and highly related to a lower score of the Braden Scale, these two factors were not entered into multiple logistic analysis. Significant risk factors for the development of skin tears are shown in Table 3. Multiple logistic analyses showed that pre-existing skin tears, use of steroids and a 6-point decrease in the total score of the Braden Scale, which corresponds to a 1-point decrease in each subscale, were significantly associated with development of skin tears in the unadjusted model (crude model). All of the risk factors in the crude model, except for steroid use, remained significant after adjusting for age and sex (adjusted model). The use of steroids tended to be associated with skin tears, but did not reach statistical

**Table 2** Univariate analysis of factors in relation to skin tear development

| Baseline characteristics | Patients with skin tear development ($n = 14$) | Patients without skin tear† ($n = 312$) | *P*-value |
|---|---|---|---|
| Pre-existing skin tears | 4 (28.6) | 8 (2.6) | <0.001 |
| Age | 87 (84–92) | 87 (81–92) | 0.520 |
| Sex | | | 0.370 |
| Male | 5 (35.7) | 80 (25.6) | |
| Female | 9 (64.3) | 232 (74.4) | |
| Length of hospitalization (years) | 3 (1–4) | 2 (0–4) | 0.426 |
| Braden Scale score | | | |
| Total (range 6–23) | 11 (10–12) | 12 (11–13) | 0.067 |
| Sensory Perception (range 1–4) | 3 (2–3) | 3 (2–3) | 0.106 |
| Moisture (range 1–4) | 2 (2–3) | 2 (2–3) | 0.868 |
| Activity (range 1–4) | 1 (1–1) | 1 (1–2) | 0.148 |
| Mobility (range 1–4) | 2 (1–2) | 2 (1–2) | 0.277 |
| Nutrition (range 1–4) | 3 (2–3) | 3 (3–3) | 0.231 |
| Friction and Shear (range 1–3) | 1 (1–1) | 1 (1–1) | 0.427 |
| Body mass index (kg/m$^2$) | 17.0 (12.7–19.4) | 17.6 (15.4–19.7) | 0.279 |
| Immobility | 13 (92.9) | 266 (85.3) | 0.702 |
| Paralysis | 4 (28.6) | 81 (26.0) | 0.764 |
| Contracture: arm | 14 (100.0) | 209 (67.0) | 0.006 |
| Contracture: leg | 14 (100.0) | 232 (74.4) | 0.026 |
| Steroid use | 2 (14.3) | 8 (2.6) | 0.063 |
| Anticoagulant use | 1 (7.1) | 83 (26.6) | 0.127 |
| Polypharmacy (>5) | 6 (42.9) | 143 (45.8) | 1.000 |
| No. drugs used | 4 (1–6) | 4 (2–6) | 0.997 |
| Underlying diseases | | | 0.941 |
| Stroke | 12 (85.7) | 228 (73.1) | |
| Dementia | 1 (7.1) | 23 (7.4) | |
| Cardiac disease | 0 (0.0) | 21 (6.7) | |
| Parkinson's disease | 0 (0.0) | 11 (3.5) | |
| Disuse syndrome | 0 (0.0) | 8 (2.6) | |
| Cancer | 0 (0.0) | 6 (1.9) | |
| Nutritional route ($n = 308$ for patients without skin tear) | | | 0.377 |
| Enteral | 6 (42.9) | 161 (52.3) | |
| Parenteral | 7 (50.0) | 93 (30.2) | |
| Oral | 1 (7.1) | 52 (16.9) | |
| Parenteral and enteral | 0 (0.0) | 2 (0.7) | |

†Patients with scars but without skin tears were excluded from the comparison.

**Table 3** Crude and multivariate adjusted odds ratios and 95% confidence intervals for potential risk factors in relation to skin tear development among elderly patients

| Risk factors | Crude OR (95% CI) $n = 326$ | *P*-value | Adjusted OR (95% CI) $n = 326$ | *P*-value |
|---|---|---|---|---|
| Pre-existing skin tear(s) (ref: no) | 15.91 (3.76–67.31) | <0.001 | 15.42 (3.53–67.43) | <0.001 |
| Use of steroids (ref: no) | 6.87 (1.05–44.77) | 0.044 | 6.31 (0.90–44.18) | 0.064 |
| Braden Score (unit = 6)* | 0.12 (0.01–0.97) | 0.047 | 0.10 (0.01–0.83) | 0.033 |
| Age (unit = 1) | | | 1.04 (0.96–1.12) | 0.354 |
| Sex (ref: female) | | | 2.21 (0.60–8.18) | 0.237 |

*A 6-point increase in the total score of Braden Scale. Multiple logistic analysis. Patients with scars but without skin tears were excluded from this analysis. Hosmer–Lemeshow goodness-of-fit test: $P = 0.792$. CI, confidence interval; OR, odds ratio.

significance. The Hosmer–Lemeshow goodness-of-fit was 0.792.

## Discussion

A growing population of older people challenges healthcare providers facing an increasing risk of wounds. Skin tear is one of the major types of wounds, which often occurs in the extremely higher aged population. However, skin tear has not been well estimated, prevented or treated compared with other types of skin lesions, such as pressure ulcers, diabetic foot ulcers or venous and arterial ulcers. This is partly because of the nature of onset of skin tear, which is a type of accident resulting from shear, friction and/or blunt force. Therefore, the precise prediction of skin tears is a challenging issue. Many studies have investigated skin tear risk factors in various races/ethnicities in which the degree of age-related skin fragility varies. Asians have a higher ability to tolerate sun exposure than Caucasians do, which can explain the lower incidence of skin tears among Asians.[17] Because the Asian older population is increasing, our findings would be informative for establishing an effective prevention protocol in many different countries.

In the present study, we found a 3-month cumulative incidence of skin tears of 3.8%. Although a precise comparison with previously reported figures is not possible because of differences in methodologies, our 3-month cumulative incidence seems to be low. This low incidence can be explained by several reasons, including differences in skin properties, such as dermal thickness or tolerance against ultraviolet exposure, differences in care settings investigated or seasonal differences. The reason for such low incidence would be further analyzed to offer better understanding of the pathophysiology of skin tear development.

The factors significantly associated with the incidence of skin tears included contracture of the arms/legs, a lower Braden Scale score and pre-existing skin tears. Contracture of the arms/legs was excluded from multivariate analysis, because it was present in all of the patients with skin tears. Besides the difference in the absolute number of the incidence of skin tears, the tendency for the anatomical site of skin tears was similar to that reported in the literature in which many skin tears were reported to occur on their upper extremities.[5] Arms are the most prone to development of skin tear during moving or transferring across a bed or into a chair, which easily generate causative shear and friction.[12] Protective measures, such as wearing long sleeves, would be beneficial for this population.

Notably, we found that the Braden Scale was significantly associated with the incidence of skin tears. This assessment scale is widely accepted in the clinical setting for predicting the incidence of pressure ulcers. Interestingly, the present findings showed that scores in each subscale were not associated with the outcome, but the total score was associated with the outcome. This cannot be explained by a specific deficiency in the patient's ability to avoid pressure and tissue tolerance, but by a global decrease in their activity instead, which might reflect skin frailty in the elderly. Additionally, the total score of the Braden Scale was significantly lower in patients with contracture in the arms or legs than in those without contracture, which also supports this relationship. More specific scales for this domain, such as the Barthel Index or Functional Independence

 

Measure, are promising tools for predicting development of skin tears.[18,19]

Although the present study did not show a significant relationship between steroid use and the incidence of skin tears in the extremities, this type of medication allows the patient to be prone to the onset of skin tears by inhibiting collagen synthesis, and reducing the strength and elasticity of the skin.[8]

To investigate the possibility of bias, we examined variables between patients who were followed up and those who were lost to follow up. Only one variable for nutrition, a subscale of the Braden Scale, was significantly lower in patients who were lost to follow up compared with those who were not ($P < 0.001$). Because the main reason for being lost to follow up was death, such a population is likely to be undernourished and might be prone to death. No relationship was found regarding pre-existing skin tears.

The present study was carried out in a single hospital in Japan with a limited number of patients. In particular, because the nursing care level directly affects the incidence of skin tears, generalization of our results to Asian people in other countries requires caution. However, we surveyed the entire amount of patients eligible for this study to reduce the risk of bias. Two-point surveillance allowed us to estimate the 3-month cumulative incidence of skin tears, but not to estimate the incidence rate of skin tears. This was because of the difficulty in assessing the patients' extremities to determine if they had developed skin tears in a shorter time period. Despite these limitations, our findings provide a better understanding of prediction and prevention of skin tears in long-term care units, especially for the Asian aged population.

Our prospective cohort study investigating the 3-month incidence of skin tears in Asian elderly people's extremities showed a cumulative incidence of 3.8%. The most prevalent anatomical site was the posterior side of the right forearm, and the most frequent severity was 1b in the Skin Tear Audit Research Classification system. Pre-existing skin tears and a lower score of the Braden Scale were significantly associated with development of skin tears. The present study results could improve identification of the high-risk population for skin tears in Asian elderly people to facilitate a preventive strategy for skin tears.

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