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Dry skin and pressure ulcer risk: A multi-center cross-sectional prevalence study in German hospitals and nursing homes

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ABSTRACT

Background: Pressure ulcers are a serious health problem in medical and nursing care. Therefore, effective prevention is crucial. Major pressure ulcer risk factors have been identified but the particular role of dry skin (xerosis cutis) is unclear.
Objectives: To investigate possible associations between dry skin and pressure ulcers focusing on the sacrum/trochanter and at heel/ankle skin areas.
Design: Two multicenter cross-sectional studies.
Settings/participants: In 2014 and 2015 thirty nursing homes and thirteen hospitals in Germany participated. In total 3837 participants were included. Mean age was 76.1 (SD 15.5) years.
Methods: Skin assessments and data collection were performed by trained nurses based on a standardized data collection form. Descriptive comparisons and multilevel logistic regressions predicting pressure ulcers at sacrum/trochanter and ankle/heel were conducted.
Results: The prevalence of skin dryness at the trunk was significantly higher for subjects with pressure ulcers category 2+ at the sacral area compared to without (39.0% vs. 24.4%, $p = 0.010$). Adjusted to demographic variables, mobility and type of institution dry skin at the trunk was no longer associated with pressure ulceration (OR 1.11 (95% CI 0.62–2.00)). 71.9% of patients with heel/ankle pressure ulcers category 2+ were affected by dry skin at legs or feet, compared to 42.8% of subjects without pressure ulcers ($p < 0.001$). In the adjusted analysis the OR was 1.85 (95% CI 0.83–4.14).
Conclusions: Study results indicate that dry skin at the feet may be considered as a risk factor for heel pressure ulcer development. Skin dryness may be less important for sacral pressure ulcers. Therefore, the variable skin status should be better defined in future studies and pressure ulcer risk models. Results further support differences in pressure ulcer aetiologies between anatomical locations.

What is already known about the topic?

- Skin status is regarded as an important risk factor in pressure ulcer development.
- The particular impact of dry skin on pressure ulcer development at pressure ulcer predilection areas has not been investigated so far.

What this paper adds

- Dry skin at feet seems to be a relevant risk factor for pressure ulcer development at heel/ankle
- Skin dryness at the sacral skin does not seem to increase pressure ulcer risk.
- There seem to be differences in sacral and heel pressure ulcer development.

1. Introduction

Worldwide, pressure ulcers are a serious health problem in all healthcare settings. The reported prevalence of category 1 to 4 pressure ulcers ranges from 1.6% in China (Jiang et al., 2014) to 18.2% in Norway (Bredesen et al., 2015). Individuals with impaired mobility are at particular high risk for developing pressure ulcers due to prolonged loading and mechanical deformation of soft tissues at pressure ulcer

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predilection areas (Coleman et al., 2014). The process of tissue breakdown is not yet completely understood, but empirical evidence supports two main pathological pathways: (1) Prolonged mechanical loading leads to direct deformation damage in soft vulnerable tissues (e.g. muscle tissue); (2) Prolonged loading causes occlusion of blood and lymph vessels leading to ischemia and triggering inflammation, which results in cellular necrosis (National Pressure Ulcer Advisory Panel et al., 2014; Berlowitz and Brienza, 2007; Kottner et al., 2009a).

Pressure ulcers are painful and therapy is expensive (Demarré et al., 2015). Thus, effective prevention of pressure ulcers is crucial. It includes an accurate individual risk assessment and the application of preventive measures based on the assumed pressure ulcer risk level. For this purpose it is essential to consider and to assess all relevant risk factors (Kottner et al., 2011; National Pressure Ulcer Advisory Panel et al., 2014).

In 2014 an updated pressure ulcer conceptual framework was introduced (Coleman et al., 2014). It was based on the results of a systematic review (Coleman et al., 2013) and the discussions of an expert panel. In this framework direct and indirect causal factors for developing pressure ulcers and the interrelationships between these are proposed (Coleman et al., 2014). Beside immobility, poor perfusion and skin/pressure ulcer status are also listed as direct causal factors (Coleman et al., 2014). The concept of skin status is considered to affect tissue tolerance (Coleman et al., 2013). Skin status emerges in several multivariable models as a significant risk factor (National Pressure Ulcer Advisory Panel et al., 2014). However, the concept of skin status is broad and it covers a wide range of meanings from increased skin surface moisture to dry skin (Kottner and Surber, 2016).

More than 20 years ago dry skin was reported to be a risk factor for pressure ulcer development (Guralnik et al., 1988; Allman et al., 1995). A more recent study by Baumgarten et al. (2006) also showed that pressure ulcer incidence was associated with dry skin in aged hospital patients (odds ratio of 1.53, $p = 0.035$) in a multivariable model. These seem to be the only studies investigating this possible relationship. However, precise definitions and operationalizations of dry skin are lacking in these studies. Dry skin does not usually affect the whole body. Skin dryness is a local phenomenon that may be present at certain parts of the body (Lichterfeld et al., 2016; Kottner and Surber, 2016). The nature of skin dryness must be taken into account when considering its possible relationship to pressure ulcer development. Therefore, the aim of this study was to investigate the association between dry skin and pressure ulcers paying particular attention to the two most vulnerable body areas for pressure ulcer development sacrum/trochanter and heel/ankle.

2. Methods

2.1. Study design and setting

The data used in this study is based on two multicenter descriptive cross-sectional prevalence studies in 2014 and 2015, which have been performed annually by the Department of Nursing Science at the Charité – Universitätsmedizin Berlin (Lahmann et al., 2005) since 2001. The study design is based on a similar study conducted in The Netherlands since 1999 (Bours et al., 1999) and methods have been previously described (Kottner et al., 2009b; Lahmann et al., 2005). In brief, all hospitals and nursing homes in Germany were invited to participate. In participating sites data collection was performed by nurses using standardized data collection forms.

2.2. Participants

For participation a minimum age of 16 years was determined. Only patients and residents who gave their informed consent, personally or by a legal representative, were included. Approval by the ethics commission of the Medical Association of Berlin has been obtained.

2.3. Measures

For this study the following variables were relevant: demographic data including gender, age, weight, height, body mass index (BMI) and main medical diagnoses. Residents and patients with a BMI below 18.5 kg/m^2 were regarded as having 'underweight' (WHO, 1999).

The occurrence and severity of dry skin was assessed for four separate skin areas face, trunk, hands and arms, and feet and legs. The severity of dry skin was measured using the Overall Dry Skin Score according to the European Group on Efficacy Measurement of Cosmetics and other Topical Products for dry skin assessment (Serup, 1995), which was recently validated (Kang et al., 2014). The Overall Dry Skin Score categorizes clinical signs of dryness from 0 (=absent) to 4 (=large scales, roughness, redness, cracks/fissures). In this study the variable "dry skin overall" was defined as having dry skin (category 1+) at the trunk and/or hands and arms and/or feet and legs.

The presence of pressure ulcers was assessed in two localizations sacrum/trochanter and heel/ankle. Pressure ulcers were classified according to the NPUAP/EPUAP system (National Pressure Ulcer Advisory Panel et al., 2014) into following categories: category 1 was non-blanchable redness of a localized area, category 2 was partial thickness loss of epidermis, dermis or both. In the case of full thickness skin loss the pressure ulcer was referred to category 3. Subcutaneous fat may be visible here but bone, tendon or muscle are not exposed. Category 4 was extensive tissue destruction with exposed bone, tendon or muscle. Deep Tissue Injury (DTI) refers to purple or maroon discolored localized area with intact skin or blood-filled blister. This discoloring is due to damage of underlying soft tissue (National Pressure Ulcer Advisory Panel et al., 2014). Due to reliability and validity problems category 1 pressure ulcers were excluded from the main analyses (Kottner et al., 2009a).

The variable mobility was classified from 0 (=complete dependent) to 5 (=complete independent) according to the Care Dependency Scale (Dijkstra et al., 2000). Skin care independency was defined as the subject's ability to wash, shower, bath or cream the own body independently. Taking four or more drugs orally was determined as multi-medication (Patterson et al., 2012). The support surfaces were classified into alternating pressure, soft positioning, and no special support surface.

2.4. Data collection

Participating nursing homes and hospitals had a named a qualified study coordinator, who was responsible for data collection and who trained the involved nurse raters. The nurses were given detailed instructions and explanations about completion of the forms and the performance of assessments. The data collection manual included images of different pressure ulcers classes and explanations of diagnostic scores. On a specific day the data was collected by two trained nurses, who examined, interviewed and assessed the participating residents and patients. The completed data forms were sent to the Department for Nursing Science where they were analysed (Kottner et al., 2009b).

2.5. Bias

A high degree of standardization and the appropriate training of the data collectors were regarded as important measures to support internal validity. To enhance external validity a high number of institutions was invited to participate. Previous empirical evidence suggests that the sample characteristics seem to be generalizable to the German hospital and nursing home populations, and that pressure ulcer diagnoses, pressure ulcer classifications and assessment of mobility are accurate (Kottner et al., 2009b; Lahmann et al., 2015). These variables are relevant for the current study as well.