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Original article

Predictors of pressure ulcer risk in adult intensive care patients: A retrospective case-control study

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ABSTRACT

Objectives: To evaluate the predictive power of risk factors for pressure ulcers in adult intensive care patients.

Method: A retrospective case-control study was performed utilising a heterogeneous sample group allocated into a case group with pressure ulcers (n = 90) and a control group without pressure ulcers (n = 90). The analysis explored the predictive power of risk factors for pressure ulcers using a hierarchical logistic regression model.

Results: The risk factors that predicted pressure ulcers were friction (OR = 5.97), previous history of pressure ulcers (OR = 5.43), prolonged intensive care unit stay (OR = 3.92), dehydration (OR = 3.18), elevated skin temperature by 1-2 °C (OR = 3.12) and treatment of other comorbidities (OR = 2.79).

Conclusion: Adult intensive care patients have an increased risk of developing a pressure ulcer. These risk factors are regarded as strong predictors for pressure ulceration. This study advances nursing knowledge in that it investigates additional risk factors for the development of pressure ulcers and it identifies a set of factors that best predict their occurrence, which may contribute to the nurses' diagnostic reasoning in the intensive care unit.

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Implications for clinical practice

- The identification of risk factors for pressure ulcers in critically ill patients may offer strategies to promote safe care and reduce the risk of morbidity and mortality in these patients.
- The set of factors that increase pressure ulcer risk in adult intensive care patients identified in this study may contribute to better diagnostic reasoning by nurses.
- Knowledge about risk factors for the development of pressure ulcers may lead to good nursing practice and promote excellent prevention in adult intensive care patients.

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Introduction

Patient safety is part of the central axis of care and quality management in health services. It involves environmental safety and risk management, including infection control, safe use of medicines, equipment safety, safe clinical practice and a safe environment of care (WHO, 2002).

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A.B. de Almeida Medeiros et al. / Intensive and Critical Care Nursing xxx (2017) xxx-xxx

In the 1990s, the report "To err is human: building a safer health system" was published by the Institute of Medicine in the United States of America. The high incidence of adverse events in hospital institutions, usually caused by human error, presented by the report, stimulated public debate about patient safety worldwide (WHO, 2002).

The World Health Organisation (WHO) estimates that one in 10 patients are victims of adverse events in health care and approximately 43 million patient safety incidences occur every year.

The intensive care unit (ICU) is the sector that has the greatest chance of occurrence of adverse events due to the clinical instability of patients and the high number of interventions. Pressure ulcers (PUs) are common adverse events with high prevalence and incidence in the ICU (Boyle et al., 2006).

PUs cause great physical and emotional suffering to the patient, compromise the rehabilitation process, prolong hospitalisation, increase the risk of other diseases, decrease quality of life and increase financial costs for healthcare organisations (Carson et al., 2012). Worldwide, costs for the treatment of pressure ulcers and their complications are estimated at \$11 billion annually (AHRQ, 2014).

In the United States, 2.5 million hospitalised patients develop pressure ulcers each year, with a prevalence of 22%, and approximately 60,000 patients died from injury-related complications (AHRQ, 2014; Van gilder et al., 2009; Still et al., 2013). The presence of PUs was significantly associated with mortality at 21 days in patients with severe traumatic brain injury (Dhandapani et al., 2014).

Pressure ulcer prevention is a strategy directly related to patient safety and should be a priority of health professionals, especially nurses (Santos et al., 2016). The recognition of risk factors for PUs and the use of prevention measures are recommended practices that can reduce the incidence of cases and improve nursing care for patients admitted to the ICU (Duncan, 2007; Stechmiller et al., 2008).

The literature identifies evidence concerning evaluation and identification of PU risk factors, especially in ICU, such as age, comorbidity, treatment, extremes of weight, prolonged ICU stay, inadequate nutrition, decreased mobility, incontinence, anaemia, lymphopenia, medicines, hypoalbuminemia, friction, skin moisture, oedema, elevated skin temperature, sedation and limitations of sensory perception (Alderden et al., 2011, 2017; Nijs et al., 2008; Frankel et al., 2007; Kaitani et al., 2010). However, other factors may be included, such as: previous history of pressure ulcer, smoking, insufficient caregiver knowledge of pressure ulcer prevention, dry skin, tissue hypoperfusion, dehydration, thin skin, pressure, shearing forces and scaly skin. In this context, it is necessary to identify a set of risk factors that best predict the risk for developing a pressure ulcer in ICU.

Risks associated with pressure ulcers are often unrecognised. A prevalence study of pressure ulcers performed in Norway showed poor knowledge among the nursing team regarding the classification of pressure ulcers and risk assessment of PUs (Bjøro and Ribu, 2009).

In this context, knowledge of nurses in the assessment of the predictive accuracy of PU risk factors is considered relevant and could promote a positive impact on patient safety with excellence in the care of the critically ill patient.

This study advances nursing knowledge in that it investigates additional risk factors for the development of pressure ulcers (Alderden et al., 2011, 2017; Nijs et al., 2008; Frankel et al., 2007; Kaitani et al., 2010) and it identifies a set of factors that best predict the occurrence of pressure ulcers in intensive care unit patients.

This study aimed to answer the following question: What are the risk factors that increase the chances of development of pressure ulcers in intensive care unit patients? To answer this question, we aimed to evaluate the predictive power of risk factors for pressure ulcers in adult intensive care patients.

Method

Design and setting

This was a retrospective case-control study, conducted in the first semester of 2016 in a general ICU of a large university hospital in northeast Brazil. This is a reference unit for quality in the care of critically ill patients.

Sample

The study population included patients admitted to the ICU of the hospital. The following parameters were used in the sample calculations: 95% confidence level (Z1- α /2 = 1.96), 80% power (Z1- β = 0.84), odds ratio of developing ulcers due to a pressure of greater than 2.5 (OR = 2.5), and ratio between the number of controls and cases equal to 1 (r = 1). Assuming equal numbers of cases and controls, the sample size was 90 in each group (90 cases and 90 controls), for a total of 180 patients. No losses occurred during the data collection process.

Cases included patients with pressure ulcers at the time of data collection, the control group included patients without pressure ulcers. This classification was performed by the researcher through evaluation of the patient at the time of a bath and/or by checking the nursing records in the information system of the hospital.

The eligibility criterion for the case and control groups was age equal to or greater than 18 years. For the case group, the presence of at least one pressure ulcer from "stage I" was required. Sampling was done consecutively.

Instrument

A data collection form was specifically designed by the researchers for this study. The instrument included items regarding social and clinical data and pressure ulcer risk factors. It was validated by seven teacher nurses with experience in nursing diagnoses and pressure ulcers. Modifications to the organisation of the questions were suggested to clarify the measurement. The suggestions made by the experts were applied to the final version of the form.

Procedure

The data were obtained by a primary source through direct interaction with the patient and through a physical examination. Secondary source included the clinical records. To perform the data collection, the researcher classified the patient as case or control group and delegated the data collection function to another researcher.

Data analysis

The data were organised by means of a spreadsheet built in Microsoft Excel and were analysed using the statistical package R, version 3.0.2 (R Core Team, 2015).

Continuous data (age, length of hospital stay, length of ICU stay) were presented by means of measures of central tendency and dispersion. The Kolmogorov-Smirnov test was applied to check the normality of the data (p < 0.05). Categorical data were dichotomized and presented as percentages and frequencies (gender, comorbidities). Patient characteristics were compared between cases and controls using the Mann–Whitney *U* test.

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2

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