Journal of Tissue Viability (2015) **24**, 102—113

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JOURNALOF tissueviability

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Review

Predictive validity of the Braden Scale for pressure ulcer risk in hospitalized patients

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KEYWORDS
Pressure sore;
Sensitivity;
Specificity;
Meta-analysis

Abstract *Purpose:* Although the Braden Scale has been used as a basic tool to assess pressure ulcer risk, the validity of its effectiveness and accuracy was insufficient. Therefore, this study developed the groundwork for the predictive validity of the Braden Scale through a meta-analysis of prospective diagnosis assessment research.
Methods: Articles published between 1966 and 2013 from periodicals indexed in the Ovid Medline, Embase, CINAHL, KoreaMed, NDSL and other databases were selected, using the keyword 'pressure ulcer'. QUADAS-II was applied to assess the internal validity of the diagnostic studies. Selected studies were analyzed using meta-analysis with MetaDiSc 1.4.
Results: Twenty-one diagnostic studies with high methodological quality, involving 6070 patients, were included. The meta-analysis revealed that the pooled sensitivity was 0.72 (95% CI 0.68, 0.75); pooled specificity was 0.81 (95% CI 0.80, 0.82), and the sROC AUC was 0.84 (SE = 0.02). A detail analysis confirmed that age and reference standards were the factors that affected the diagnostic accuracy of the Braden Scale.
Conclusion: The results suggest that the Braden Scale has a moderate predictive validity. This research also revealed the possibility that the predictive validity of the Braden Scale could be enhanced if it was applied differently according to the attributes of the study subjects.

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http://dx.doi.org/10.1016/j.jtv.2015.05.001

1. Introduction

Pressure ulcers can occur in any patient whose movement is limited, and once present, treatment is difficult. Therefore, it is of the utmost importance that all measures are taken to prevent it from occurring [1]. An ideal method for preventing pressure ulcers is possible by identifying the small group of patients at risk for pressure ulcers out of the entire patient group by utilizing a validated pressure ulcer risk assessment tool, and its effectiveness is maximized through systematic and focused training of patients and caregivers as well as proper nursing management [2].

The currently used pressure ulcer risk assessment tools include the Norton Scale, which was developed in 1962 in the U.K., the Gosnell Scale, which was developed in 1973, the Waterlow Scale, which was developed in 1985, the Cubbin and Jackson Scale, which was developed in 1991 for critical patients, and the Braden Scale which was developed in 1987 in the U.S.A. for seniors in long-term care facilities [3—5]. A pressure ulcer risk assessment tool needs to identify the occurrence of pressure ulcers when applied to patients; thus, the validity of the tool is very important, and it must be accompanied by a sufficient amount of research [6]. There have been some studies to assess the validity of pressure ulcer risk assessment tools; however, a solid conclusion has not been drawn that indicates which tool is the most appropriate. Additionally, the existing tools were not developed in the countries that intend to use the tools; thus, it can create issues regarding validity due to the differences in medical culture. According to the study of Zimmerman et al. [7], the predictive tools inevitably reflect the population characteristics and the medical culture of the country in which they were developed, it is essential to test the validity of the predictive assessment tools before applying to the certain patients. Therefore, the validity of the tool should be more widely reviewed in advance in order for these issues to be resolved.

Predictive validity is a criterion that is estimated based on the relationship between a score from a test or an evaluation tool and a result in the future. The evaluation tool for pressure ulcers is not a diagnostic test that confirms the occurrence of pressure ulcers. Rather, it is a screening test that predicts the risk of pressure ulcers. A screening test is implemented for general people who possess potential risk factors but do not have symptoms, and an easy, simple, and non-invasive tool is normally recommended. Ideally, a screening tool is good when the sensitivity, specificity, and positive and negative likelihoods are all high. However, this is not realistically feasible [8]. A screening test should be highly sensitive not to miss any potential risk from a disease, and it is necessary to prove its benefits against its harms before conducting the test in order not to burden patients with the test results [9].

The Braden Scale has been recommended as the most basic tool because it incorporates fewer questions and is easier to use than that of other tools [10,11]. However, during the process in which the Braden Scale was re-verified by other researchers, the sensitivity and specificity showed a wide range of differences from 50 to 100% depending on the research subjects or conditions [12], and the cut-off point differed as well [13]. Additionally, some studies revealed that using the Braden Scale as a standard, daily tool in clinical practices is inefficient, and there has been consistent assertion that pressure an ulcer risk assessment tool should be accurately verified based on prospectively collected materials [6,10,14—16].

Therefore, this study focused on confirming the predictive validity of the Braden Scale, the most widely used pressure ulcer risk assessment tool, by conducting a meta-analysis based on prospective diagnostic assessment research in order to confirm its ability to determine the occurrence of pressure ulcers. In addition, factors that affect it's the predictive power were analyzed in order to propose a scientific evidence for its usefulness as a screening tool of pressure ulcer risk assessment.

2. Methods

2.1. Criteria for considering studies for this review

(1) Type of participants: Studies involving adult patients over 18 years of age without pressure ulcers at the time of hospitalization were eligible for inclusion.
(2) Types of Index test: Studies that were reported prospective diagnostic test accuracy using the Braden Scale for pressure ulcer risk assessment were eligible for inclusion in this review.
(3) Reference standards: Evaluation standards of skin condition for defining pressure ulcers and stages of pressure ulcers were extracted from each study and listed as the National Pressure Ulcer Advisory Panel (NPUAP), Agency for Health Care Policy and Research (AHCPR), and others.