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Braden scale (ALB) for assessing pressure ulcer risk in hospital patients: A validity and reliability study

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ABSTRACT

Purpose: The inter-rater reliability of Braden Scale is not so good. We modified the Braden(ALB) scale by defining nutrition subscale based on serum albumin, then assessed it's the validity and reliability in hospital patients.
Methods: We designed a retrospective study for validity analysis, and a prospective study for reliability analysis. Receiver operating curve (ROC) and area under the curve (AUC) were used to evaluate the predictive validity. Intra-class correlation coefficient (ICC) was used to investigate the inter-rater reliability.
Results: Two thousand five hundred twenty-five patients were included for validity analysis, 76 patients (3.0%) developed pressure ulcer. Positive correlation was found between serum albumin and nutrition score in Braden scale (Spearman's coefficient 0.2203, $P < 0.0001$). The AUCs for Braden scale and Braden(ALB) scale predicting pressure ulcer risk were 0.813 (95% CI 0.797–0.828; $P < 0.0001$), and 0.859 (95% CI 0.845–0.872; $P < 0.0001$), respectively. The Braden(ALB) scale was even more valid than the Braden scale ($z = 1.860$, $P = 0.0628$). In different age subgroups, the Braden(ALB) scale seems also more valid than the original Braden scale, but no statistically significant differences were found ($P > 0.05$). The inter-rater reliability study showed the ICC-value for nutrition increased 45.9%, and increased 4.3% for total score.
Conclusion: The Braden(ALB) scale has similar validity compared with the original Braden scale for in hospital patients. However, the inter-rater reliability was significantly increased.

1. Introduction

Although much progress has been made in recent years, the incidence of pressure ulcers is still high. In hospital, the incidence varied from 7.0 to 8.3 per 100,000 population (Scott, Gibran, Engrav, Mack, & Rivara, 2006); in nursing homes, the incidence ranged from 0.73% to 5.79% (Tippet, 2009). Pressure ulcers can lead to soft tissue infection (Mizokami, Furuta, & Isogai, 2014). About 75% pressure ulcers patients accompanied with pain (McGinnis et al., 2014). Among older patients, pressure ulcers are associated with high mortality rates (Khor, Tan, Poi, Tan, & Saedon, 2014). Pressure ulcers also can lead to increased medical costs, with cost ranged from £1214 (category 1) to £14,108 (category IV) (Dealey, Posnett, & Walker, 2012).

Assessment of development risk is an important procedure in the pressure ulcer prevention. The Braden Scale is the most widely used risk assessment scale in the world. The Braden scale is composed of six subscales: sensory perception, skin moisture, activity, mobility, nutrition, and friction and shear, and the Braden sum scores range from 6 to 23 (Bergstrom, Braden, Laguzza, & Holman, 1987a; Bergstrom, Demuth, & Braden, 1987b). Based on Braden sum scores, the pressure ulcer risk was divided into five categories: 6–9 was identified as very high risk, 10–12 as high risk, 13–14 as moderate risk, 15–18 as at risk, and 19–23 as no risk.

Some studies have confirmed the Braden Scale has good validity in predicting pressure ulcer risk. Pancorbo reviewed 35 published studies, found the Braden scale offers optimal validation and the best sensitivity/specificity balance (57.1%/67.5%, respectively) (Pancorbo-Hidalgo, Garcia-Fernandez, Lopez-Medina, & Alvarez-Nieto, 2006). In our clinical practice, we found the Braden scale does not have good inter-rater reliability. The Braden scale was often different assessed by different nurses in same patients, which will leads to different risk stratification. In the Braden scale, the subscales of sensory perception, skin moisture, activity, mobility, nutrition, and friction and shear were defined by different criterion. Previous study showed the intra-class correlation coefficients (ICC) for nutrition item in Braden scale was 0.683 (95% CI 0.529–0.824), which indicated low inter-rater reliability (Wang et al., 2014). Although some studies reported, Braden scale has highly satisfactory reliability when used by RNs, with r ranging from 0.83 to 0.99

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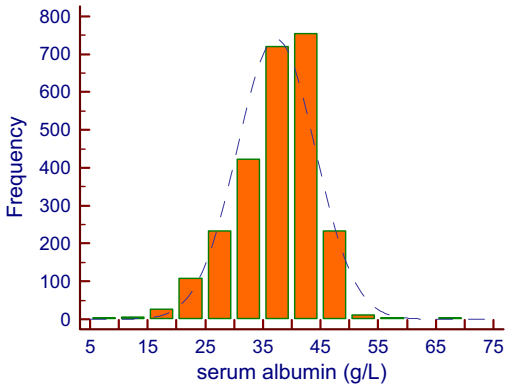

Fig. 1. The serum albumin value frequency of 2525 included patients.

(Bergstrom et al., 1987a; Bergstrom et al, 1987b). Use quantitative indicators to define the subscales must increase the inter-rater reliability.

Serum albumin level is the most widely used diagnostic and follow-up marker of malnutrition (Don & Kaysen, 2004; Aussel & Cynober, 2013). Serum albumin level is a routine examination in hospital patients. In this paper, we modified the Braden(ALB) scale by defining nutrition subscale based on serum albumin, then assessed it's the validity and reliability in hospital patients.

2. Methods

2.1. Design

2.1.1. Setting

This study was conducted in a 1000-bed, teaching hospital in Eastern China.

We performed a retrospective analysis to investigate the validity of the Braden(ALB) scale. Inclusion criteria were: ① the consecutive patients with pressure ulcer risk between January 2013 and December 2013; ② Braden scores and its items, can be collected; ③ serum albumin values can be collected. Exclusion criteria were: ① patients with age < 18; ② patients with pressure ulcers on admission; ③ patients died before pressure ulcer developed. We also performed a prospective cohort to investigate the inter-rater reliability the Braden(ALB) scale.

The study was approved by the medical ethics committee of our hospital.

2.2. Construct the model

The Braden scale is composed of six subscales: sensory perception, skin moisture, activity, mobility, nutrition, and friction and shear. In our model, we defined the nutrition subscale by serum albumin: >35 g/L as adequate nutrition (4), 30–35 g/L as probably malnutrition (3), 25–30 g/L as poor nutrition (2) and <25 g/L as very poor nutrition (1). The rest of the five subscales were not changed. The sum scores still range from 6 to 23. Because this model was changed by serum albumin, we called this model as Braden(ALB) scale. The Braden(ALB) scale was listed in the Appendix A.

2.3. Retrospective data collection

We retrospective reviewed the medical records to obtain data for validity analysis. The collected data included three parts: ① demographic characteristics, which included patients' age, gender, weight, and disease category; ② Braden scores and its subscales scores, if there is more than one Braden score, we chose the lowest score, or the nearest score before pressure ulcer development; ③ serum albumin values, if there is more than one test values, we chose the lowest one; ④ pressure ulcer information, which included pressure ulcer occurrence (yes or no), the severity of ulcers according to NPUAP-EPUAP-PPPIA classification system (NPUAP-EPUAP-PPPIA, 2014), the number of the ulcers, the anatomical location, and outcomes.

2.4. Prospective inter-rater reliability study

Four experienced nurses were included in this prospective cohort. They were asked to do the risk assessment for one participating patient who was at pressure ulcer risk. They were informed about the aim of the study before the study begins. Four nurses conducted the Braden scale and the Braden(ALB) scale for every included patient. They assessed alone and independently from each other. All scale items were scored on written data collection forms.

2.5. Statistical analysis

In the validity study, we first investigated the correlation between the Braden subscale score for nutrition and serum albumin values by Spearman's rho test. Then, we investigated the predictive validity of two Braden scales by Receiver operating curve (ROC). The area under the curve (AUC) of 0.97–1.00 are identified as excellent accuracy; 0.93 to 0.96 as very good; 0.75 to 0.92 as good; but an AUC < 0.75 has obvious deficiencies, and AUC of 0.5 indicates that the test has no predictive ability (Swets, 1988; Jones & Athanasiou, 2005). Sensitivity, specificity, positive predictive value, negative predictive value and Youden index (Sensitivity + Specificity − 1) were also used to evaluate the validity. The validity comparison between two Braden scales was tested by DeLong's test (DeLong, DeLong, & Clarke-Pearson, 1988). We also did subgroup analyzes by patients age category.

In the inter-rater reliability study, we used intra-class correlation coefficient (ICC) to investigate the reliability of two Braden scales. This ICC is based on a 2-way random effects model with rater variance included in the ICC denominator. ICC of 0.00–0.10 are identified as virtually no inter-rater reliability, 0.11–0.40 as slight, 0.41–0.60 as fair, 0.61–0.80 as moderate, and 0.81–1.00 as substantial (Shrout, 1998).

$P < 0.05$ was considered statistically significant. Statistical analyses were performed using MedCalc Statistical Software version 13.0 (MedCalc Software bvba, Ostend, Belgium; http://www.medcalc.org; 2014).

3. Results

3.1. Patient characteristics and pressure ulcer incidence

We collected the data form 2582 patients form medical records. Fifty-seven patients missed the data of serum albumin values or nutrition scores in the Braden scale. At last, 2525 patients included in the study. The patients' ages ranged from 18 to 98 year, and the mean age

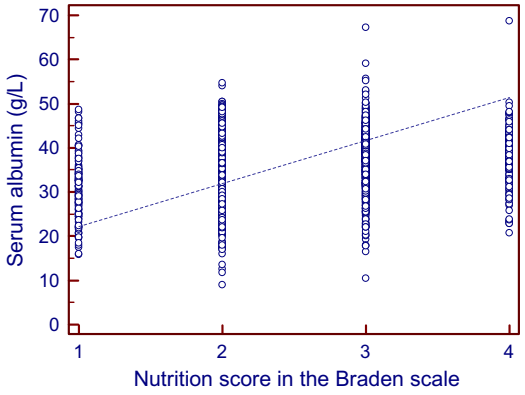

Fig. 2. Scatter diagram between nutrition score in the Braden scale and serum albumin value.