Comparison of risk assessment scales for pressure ulcers in critically ill patients*

Comparação de escalas de avaliação de risco para úlcera por pressão em pacientes em estado crítico

Comparación de escalas de evaluación de riesgo para úlcera por presión en pacientes en estado crítico

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ABSTRACT

Objective: To compare the Norton, Braden and Waterlow scales of risk for pressure ulcer in critically ill patients. **Methods:** An exploratory and longitudinal study covering 42 patients who were evaluated for 15 days or at least 10 consecutive days, in three intensive care units within Fortaleza, Brazil, from March to July 2009. Each patient was evaluated, simultaneously, by three nurses, each of whom was responsible for the application of only one of the scales. **Results:** There was a 59.5% incidence of ulcers and an increase in score of Norton (p = 0.028) and Braden (p = 0.004) scales, between the 1st -15th day, and the Waterlow (p = 0.005) between the 1st -10th. When compared to Norton and Braden, the Waterlow scores steadily increased (p <0.001). Patients with high and very high risk, 2% and 92%, respectively, developed ulcers (p = 0.005). **Conclusion:** The Waterlow scale showed higher scores in the risk assessment for pressure ulcers in relation to the Norton and Braden scales.

Descriptors: Pressure ulcer; Risk assessment; Scales

RESUMO

Objetivo: Comparar as escalas de risco para úlcera por pressão de Norton, Braden e Waterlow entre pacientes em estado crítico. **Métodos:** Estudo exploratório e longitudial abrangendo 42 pacientesque foram avaliados, por 15 dias ou pelo menos 10 dias consecutivos, em três Unidades de Terapia Intensiva de Fortaleza-Brasil, no período de março a julho de 2009. Cada paciente foi avaliado, simultaneamente, por três enfermeiros, sendo cada um responsável pela aplicação de apenas uma das escalas. **Resultados:** Houve uma incidência de 59,5% de lesões e um aumento na pontuação das escalas de Norton (p=0,028) e Braden (p=0,004), entre os 1º-15º dias, e de Waterlow (p=0,005) entre os 1º-10º. Quando comparadas a Norton e Braden, os escores de Waterlow aumentaram constantemente (p<0,001). Os pacientes com alto e altíssimo risco, 2% e 92%, respectivamente, desenvolveram lesões (p=0,005). **Conclusão:** A escala de Waterlow apresentou maiores escores na avaliação do risco para úlcera por pressão em relação às escalas de Norton e Braden.

Descritores: Úlcera por pressão; Medição de risco; Escalas

RESUMEN

Objetivo: Comparar las escalas de riesgo para úlcera por presión de Norton, Braden y Waterlow entre pacientes en estado crítico. **Métodos:** Estudio exploratorio y longitudinal que abarcó a 42 pacientes que fueron evaluados, por 15 días o por lo menos 10 días consecutivos, en tres Unidades de Cuidados Intensivos de Fortaleza-Brasil, en el período de marzo a julio del 2009. Cada paciente fue evaluado, simultáneamente, por tres enfermeros, siendo cada uno responsable por la aplicación de apenas una de las escalas. **Resultados:** Hubo una incidencia del 59,5% de lesiones y un aumento en la puntuación de las escalas de Norton (p=0,028) y Braden (p=0,004), entre los 1º-15º días, y de Waterlow (p=0,005) entre los 1º-10º. Cuando fueron comparadas la Norton y Braden, los scores de Waterlow aumentaron constantemente (p<0,001). Los pacientes con alto y altísimo riesgo, 2% y 92%, respectivamente, desarrollaron lesiones (p=0,005). **Conclusión:** La escala de Waterlow presentó mayores scores en la evaluación del riesgo para úlcera por presión en relación a las escalas de Norton y Braden.

Descritores: Úlcera por pressión; Medición de riesgo; Escalas

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INTRODUCTION

Pressure ulcers (PU) are understood as skin lesions due to bony prominences compressions that are not relieved, with clinical, social and economic severe and expensive consequences. In the world, billions of dollars are spent on direct or/and indirect treatment of a totally preventable health problem. Easily identifiable, PU financial costs are constantly mentioned in publications which do not consider the social damages which are, most of the time, irreversible.

Even with the health care services modernization, PU prevalence remains as a problem to be solved, especially among inpatients, because it culminates in a longer hospitalization period, in the necessity of specialized professionals and products, and also in the increase of the infection risk[1-2].

PU epidemiological prospect in developed countries is not different from developing ones. In the United States of America, for example, it presents a prevalence of 15% and increasing costs of 50% due to patients' hospitalization extension[3]. In Brazil, some publications have detected prevalence that ranges from 27% to 39.4% among patients hospitalized for this problem[4-5]. In Europe, countries like England, Germany, Sweden, Italy and the Netherlands the percentages are of 7.9%, 8.3%, 20%, 23% and 24.2%, respectively. In other countries, like Portugal, there are serious problems reporting PU cases[6]. In Asia, in nations like South Korea, PU prevalence ranges from 10.5% to 45.5%[7].

An early and regular stratification of the risk of developing a PU is essential to adopt adequate preventive measures on an appropriate therapeutic strategy implementation. It includes methods to reduce predisposing factors and to optimize the patients' general health. But, in most cases, the therapeutic strategy still depends on the health care professionals and on costly inputs provision. Thus, it's notorious the necessity of studies which evaluate instruments, techniques and products used to prevent PU, which can be adapted to several health service scenarios. In this regard, it is remarkable the use of indirect methods like risk assessment scales for PU, because if they present reliable psychometric indices, they will be economical, practical and effective[1-8].

Nowadays, there is an average of 40 risk assessment scales for PU. And studies about them, on most literature review, have considered experts beliefs or existing instruments adaptations. However, they don't report the value assigned to the risk factors neither the use of adequate statistics techniques[2]. In this regard, authors have created assessment instruments capable of predicting the PU occurrence. Among these instruments, the best known are Norton, Waterlow and Braden scales[11]. These scales have already been evaluated separately[4, 12-13], in pairs[14] and together[8, 15-18]. Only five papers were found in which these scales were analyzed together: two which were developed in Great Britain and the others in Germany, the Netherlands and China.

In the bibliographical research carried out until this manuscript's preparation, it was not identified a publication which compares Norton, Braden and Waterlow scales among Brazilian studies.

Due to space limitations on health publications or yet the execution time of several nursing care activities at Intensive Care Units (ICU), it is important to guarantee the nurse access to practical instruments that are capable to predict the risks of developing PU in critically ill patients. Thus, this paper objective is to compare the Norton and Waterlow scales for evaluating PU development risks in Brazilian critically ill patients.

METHODS

This exploratory and longitudinal research was carried out at three Intensive Care Units of a Heath Institute that is a reference on urgency and emergence care in Brazilian Northwest, which is located in Fortaleza City, in Brazil. The study was carried out from March to June in 2009, with all the patients accepted during this time at the three adult Intensive Care Units of the Institution. Criteria for selecting the study subjects were as follows: being at least 18 years old; not presenting a PU at the admission moment; being at the ICU for at most 48 hours before data collection. On the other hand, the criteria for excluding subjects from the study were as follow: being a hemodynamically instable patient; having a brain death diagnosis; and having a prognosis of ICU discharge in less than 15 days.

At the researched institution, there are 31 ICU beds, from which eight are for pediatric patients. So, only 23 beds were eligible to compose the study sample. According to the Institutional Nucleus of Epidemiological Surveillance, in 2008, 432 adult patients were accounted at these three ICU. Thus, to calculate the sample extent, it was chosen the "PU incidence at ICU" as an outcome. The adopted value was 25.6%, according to a study carried out with ICU patients in São Paulo – Brazil[19]. On the sample calculus, the statistical formula for longitudinal studies was used before and after a 95% confidence interval. After the calculus process, it was identified a sample of 42 patients to compose the study population.

During the four months of research, there were 83 inpatients. Among them 11 were accepted with PU; 02 were younger than 18 years old; 10 died; and 18 were removed before being there for 10 follow-up days.

During data collection, four instruments were used: the first one was a questionnaire consisting of social, demographic and clinical data; the three others referred to the translated and adapted versions of Norton, Braden and Waterlow assessment scales for PU risk.

The Norton scale assesses five parameters for PU risk: physical condition; level of consciousness; activity; mobility; incontinence. Each parameter was scored from 1 to 4. The four parameters sum resulted in a score which varied from 5 to 20 points, understood like this: ≤14 (risk); and < 12 (high risk). Moreover, the smaller the

final sum is, higher is the risk of developing PU[20].

The Braden Scale assesses the sensorial perception, humidity, activity, mobility, nutrition, friction and shear. The maximum score is 23 points; and the smaller the score is, higher will be the PU risk. To the analyses, the Braden scores were dichotomized into two categories: low risk (score < 16) and high risk (score ≤16)[21].

The Waterlow scale assesses seven main topics: weight/height relation (BMI), visual evaluation risk skin areas, gender/age, continence, mobility, appetite, and medications. Besides these four items that score special risk factors, there are: undernourished tissue, neurologic deficit, surgery time over two hours and trauma below the lumbar spine. In this case, a high score indicates a high risk of developing PU. Patients in study were divided into three groups, according to their evaluations: at risk (score from 10 to 14); high risk (score from 15 to 19) and very high risk of developing PU (score > 20)[4].

Each patient was assessed once a day for 15 days or for at least 10 successive days, by three nurses at the same time. During the assessment, each one of these professionals was responsible for only one scale of assessing PU risk. Evaluations were done only once a day, always during the morning, during the patients' bath or dressing treatment.

The data collecting period was based on a previous study which informed that the critical period for developing PU injuries occurs until 14 days after the patient's hospital admission[18]. In the cases that was impossible to conclude 15 visits to the patients because he/she died or was removed, this individual only composed the research sample when it was possible to visit him/her at least 10 times.

It was recorded the day on which the PU appeared in those patients who have developed this injury, as well as, the ulcer stage and location. These patients still being assessed until the 15th day in order to identify any new injury and to keep up with his/her inpatient time until the end (discharge, death or hospital transference) for statistics aims. PU stage was classified according to the *European Pressure Ulcer Advisor Panel* prevention and treatments guidelines[22]. It's worth saying that during this data collection, beyond the physical test, the patient's medical records has been checked and that some information has been gotten from the patient's family.

Data was entered twice and it was storage on an Excel program data basis. SPSS 13.0 software was used to formulate the percentage and absolute frequency, in addition to the measures of central tendency. Kolmogorov-Sminorv test was used for data homogeneity assessment and a 95% trust level was applied. Within each scale group and also among the scales, all the values were compared, for the 15 assessments, using the Friedman non-parametric test, aiming to found statistics differences between the scores of patients with and without injuries over time; multiple comparisons using the Conover test were also carried out over the research period. The correlation analysis

of the three scales averages was accomplished using the Pearson correlation coefficient.

After the Institutional Ethics Committee approval, the study was carried out according to protocol number 86145/08. To unconscious patients, the permission was given by their family or guardians.

RESULTS

Patients were assessed using the three scales of assessing PU risks, daily, for 15 or, at least, 10 days. The follow-up days average was 14.2 (SD±3,6). During the data collection 32 (76.2%) patients were observed for 15 days; 07 (16.7%) for 10 days; 02 (4.7%) 13 days; and only 01 (2.4%) for 11 days.

The investigated sample consisted of 34 young men (81%), as follows: 31% aged from 18 to 25 years old, and 26.2% aged from 36 to 46 years old. The age average and median were 35.3 and 33.3 years old, respectively.

A substantial proportion of patients admitted at the ICU who were included on this study have come from the anesthetic recovery room, and from the Emergency Unit, 25 (59.5%) and 14 patients (33.3%), respectively. During the admission process, the following clinical situations were verified as the most common ones: neurological dysfunction, with traumatic brain injury prevalence (61.9%), followed by surgeries (26.2%), mostly exploratory laparotomies and neurosurgeries. On the other patients, it was detected the use of mechanical ventilation (78.6%), vasoactive drugs (31%) and drugs for sedation (69%). Most patients (85.7%) did not present any pre-existing diseases and among those who presented comorbidity, there was a prevalence of arterial hypertension and diabetes mellitus.

Out of the 42 assessed patients, 25 developed PU evidencing an incidence of 59.5%. PU were detected in the patients between the 2nd and the 14th follow-up days, with a time of PU appearance average of 9.6 (SD± 3.3) after the hospitalization.

From the total of 47 injuries identified, 23 (48.9%) were stage-I pressure ulcers and 24 (51.1%), stage-II. The number of injuries per patients states as follows: 06 patients with 01 PU; 16 with 02 PU; and 3 with 03 PU. Among those patients who developed two PU, four injuries were sacral and heel; nine were sacral and occipital; and three were heel and occipital pressure ulcers. Altogether, patients have had 47 PU at different locations and stages, with an average of 1.88 PU (SD±0.7) for patient. In regards to pressure ulcers staging, 23 (48.9%) stage-I and 24 (51.1%) stage-II pressure ulcers were observed.

Patients assessed with the Norton scale presented a daily average score that varied from 8.8 to 9.1 (SD±6.7), showing a discrete increasing, but statistically insignificant during the 1st – 15th hospitalization days (p=0.028) (Table 1). These patients' assessment detected a moderate risk in two patients (4.8%) and a high risk in 40 patients (95.2%). Among those who did not presented risk, it was not detected the PU presence, but in those with a

high UP risk, 62.5% developed injuries, nevertheless there was not statistical significance on this relation (p=0.099).

Patients assessed with Braden scale presented an average score that varied from 11.6 to 12.5 (SD±6.7), showing a significant statistical increase between the 1st-15th and the 5th-15th assessment days (p=0.004) (Table 1). Based on this table, the subject's pressure ulcers risk was discriminated as follows: low (01 patient), moderate (34 patients) and high (07 patients). Among the patients who showed moderate and high risks, 76% and 20% developed during the study period, although there was not a statistic significance on this relation (p=0.070).

Patients assessed with the Waterlow scale obtained an average score which varied from 22.9 to 24.8 (SD± 16.1), with a significant statistical increase between the 1st - 10th days (p=0.003) (Table 1). Based on this framework, the subjects were discriminated as follows: at risk (3), at high risk (7) and at very high risk (32). Differently from Norton and Braden scales, among patients at high risk and at very high risk of developing pressure ulcers, according to Waterlow, 2% and 92%, respectively, developed PU during the study (p=0.005).

During the patient's monitoring, it was found an increase on Norton and Braden scores until the 10th assessment with a discrete decline on the 15th day (p<0.001) over the Waterlow average which increased continuously among the analyzed patients (Table 2).

After performing the average correlation tests for the three scales, simultaneously, it was observed between Norton and Braden (r=0.711, p<0.001); Norton and Waterlow (r=-0.535, p<0.001), Braden and Waterlow (r=-0.426, p=0.005) statistically significant correlations. The *r* and *p* values presented above has evidenced that Norton scale is directly proportional to the Waterlow scale; and that, in the other hand, the Braden scale is inversely proportional to the Waterlow scale.

DISCUSSION

In the current paper, the sample was composed, mostly, by male adults. These patients' profiles were different from those in large part of other analyzed studies, which have applied the same assessment scales for pressure ulcer risk in countries like German, the Netherlands, Turkey and Brazil, where patients' profile include elderly female patients who were in bed and presented association of chronic degenerative diseases[12, 23-25].

The fact that our study was carried out at a specialized service of emergency care on traumatology and neurology, which is normally associated to traffic accidents involving young male individuals, has perhaps determined such difference. Even though, nurses at these institutions need to identify and understand each medical specialty and the PU risk correlations, in order to act on the intrinsic and extrinsic factors related to PU.

In this research, the average of the monitoring days was 14.2 (SD± 3.6). And most of the studied population has developed PU, and 64% presented two injuries. In regards to detected PU incidence (59.5%) in Brazil, the problem's estimative at chronic care units was diversified, but some identified publications has shown a lower incidence in comparison to what was found during this research, like 5.9%; 39.7%; 26.8% and 11.8%, respectively[25-28]. Thereby, it is urgent and necessary that preventive care attitudes can be performed; even in order to reverse other morbidities that have probably been caused by these injuries.

In regards to the chronological aspects, it is known that PU do not develop in a precise time, due to each patient clinical conditions specificities; however, the literature points out that it can appear after 24 hours of hospitalization, or 10 – 15 days after the patients admission, depending on the given inputs and aids[29].

Table 1 - Norton, Braden and Waterlow scales score average comparison according to the PU risk assessment days. Fortaleza – Brazil, March to June, 2009.

Scales	1st – 5th	1st – 10th	1st – 15th	5th — 10th	5th — 15th	10th -15th
Norton	p= 0,426 (8,6-8,8)	p= 0,192 (8,8-9,1)	p= 0,028 (8,6-8,8)	p= 0,608 (8,8-9,1)	p= 0,156 (8,8-8,8)	p= 0,363 (9,1-8,8)
Braden	p= 0,955 (11,6-12,1)	p= 0,096 (11,6-12,5)	p= 0,004 (11,6-12,3)	p= 0,108 (12,1-12,5)	p= 0,004 (12,1-12,3)	p= 0,201 (12,5-12,3)
Waterlow	p= 0,086 (22,9-23,2)	p= 0,003 (22,9-23,6)	p= 0,054 (22,9-24,8)	p= 0,191 (23,2-23,6)	p= 0,834 (23,2-24,8)	p= 0,272 (23,2-24,8)

Table 2 - Norton, Braden and Waterlow scales score average comparison for PU risk assessment on the 1st, 5th, 10th and 15th assessment days. Fortaleza – Brazil, March to June, 2009.

Scales	1st day	5th day	10th day	15th day	Average
Norton – Braden	p< 0,001 (8,6-11,6)	p< 0,001 (8,8-12,1)	p< 0,001 (9,1-12,5)	p< 0,05 (8,8-12,3)	p< 0,001 (8,8-12,1)
Norton – Waterlow	p< 0,001 (8,6-22,9)	p< 0,001 (8,8-23,2)	p< 0,001 (9,1-23,6)	p< 0,05 (8,8-24,8)	p< 0,001 (8,8-23,6)
Braden – Waterlow	p< 0,001 (11,6-22,9)	p< 0,001 (8,8-23,2)	p< 0,001 (9,1-23,6)	p< 0,05 (12,3-24,8)	p< 0,001 (12,1-23,6)

In other publications about chronic patients the PU incidence happened in 8, 4 and 10 days, respectively[30-31]. So, since the patient admission, the nursing care is an important predictive factor to the PU outcome, because the concern in examining the patient's skin, giving the preventive inputs and monitoring them with instruments which show effective preventive potential, both negative and positive, can be the guarantee of PU absence during the hospitalization.

Risk assessment scales are important tools to nurses, because they indicate vulnerable points, reinforce the constant assessment necessity and stimulate prevention. However, it is necessary, beyond the nurse abilities, the adoption of various efficient instruments to this work environment.

In this manuscript, both the Norton and the Braden scales showed a significant statistical increase in their scores until the 10th hospitalization day. A similar fact has happened with the Waterlow scale, but this proceeded during all the research time. However, Norton and Braden are negative scales and Waterlow is a positive one, in other words, the detected points increase indicates a reduction in the subjects' vulnerability to PU, according to Norton and Braden; and an increase in PU risk, according to the Waterlow scale. Besides, it was found that Norton scale is directly proportional to the Braden one; and that Braden scale is inversely proportional to the Waterlow one. In fact, in the research sequence, the Waterlow scale, perhaps because of the increased score, evidenced more statistically significant PU cases than the other two instruments. The interference of this in other health service which adopted only Norton and Braden scales might result in underestimate cases of vulnerable subjects to PU development.

There are several criticisms concerned to the Norton, Braden, Waterlow and Gosnell risk scales, because some of them underestimate and other overestimate the assessment of at-risk patients. One of these several criticism lies on the fact that these scales present inverse score order (ascending and descending) or yet have different cut-off point for the PU risk assessment. This fact makes it more difficult to compare the results of researches which assess the use of these instruments[7, 9].

The directly correlation detected between Norton and Braden scales was a discovery confirmed by a systematic bibliographic revision that, beyond this, evidenced that Braden scale presents better specificity and sensibility balance to prevent and predict injuries. On the other hand, this publication's authors point out that Waterlow scale is a great instrument for sensibility (50.6%) and specificity (60.1%). In the end, the authors' critical judgment has showed Braden and Norton scales as presenting better results, fact that is different from what was found out in our study[32].

Another foreign publication has identified the Waterlow scales as the one with better sensibility when compared to Braden and Norton scales, and the best specificity was given to Norton scale[16]. Some researches that point out some problems on the predictable factors of these scales were also identified. They question whether these instruments provide an accurate assessment and if they really help on the clinical practice[8, 14, 33]. For example, a research carried out in Great Britain with 110 nurses has identified a percentage of 72.6% of wrong classification of the PU risk development when using Waterlow scale. Besides, only 12% of the nurses made a precise score for patients using this method[34]. Thus, beyond the use of these instruments, the heath care professional must rely on his/her clinical experience and knowledge to attribute or not a subject's vulnerability to develop PU.

CONCLUSION

The current paper presents some limitations. One of them is due to the fact that heel injuries have not been divided into left and right heels. The established time to the patients monitoring on 10-15 days made it impossible to follow-up the injuries outcome, as well as the patients healing or the enlargement of their hospitalization period. In addition, despite of conducting a sample calculation on which the number was achieved, when compared to other papers, the sample was small. Even though, the study found out important facts like a better performance of the Waterlow scale assessing the PU risks if compared to Norton and Braden scales in a population composed mainly by young male. In addition, the results reinforced the existing direct correlation between Braden and Norton scales, highlighted by other publications.

Scales score comparison carried out separately and in group showed that even with a score increase many patients developed PU, even knowing that these increase indicates a vulnerability reduction, detected during the assessing period when using Norton and Braden scales.

So, in spite of being valid, practical and efficient instruments, it is necessary to base the subjects' assessment mainly on the health professional clinical knowledge and experience. Mainly because these instruments were made for populations that are different from the Brazilian ones and it is always possible that their limitations are noticed in the hospital everyday life. Thus, it is suggested that some new researches are carried out with better delimitation and a more representative sample, in order to clarify these instruments validity in other scenarios like nursing homes, medical wards and Brazilian homes to determine the better choice for the health professionals to predict injuries risks.

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