

Predictive validity of the EVARUCI scale for intensive care patients

Validade preditiva da escala de EVARUCI para pacientes de terapia intensiva

Validez predictiva de la escala EVARUCI para pacientes en cuidados intensivos

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Abstract

Objective: To evaluate the predictive validity of the EVARUCI scale for intensive care patients. **Methods:** This is a retrospective longitudinal study with secondary data carried out in a reference ICU in neurology and trauma-orthopedics. The study population consisted of all users who were admitted to the ICU between January and December 2020, excluding those with a length of stay of less than 48 hours, and those who died as an outcome. Data were collected regarding admission, the first 48 hours of hospitalization and discharge. **Results:** The profile found was of young men, victims of external causes. The incidence of PI was 18.9%, higher EVARUCI scores were recorded on admission. The sensitivity of the test was 90.9% and 72.73%, the specificity was 16.9% and 48.9%, the positive predictive validity was 20.27% and 24.74%, and the negative validity was 88.89% and 88.46% at admission and first 48 hours, respectively. **Conclusion:** The scale was unable to satisfactorily predict high risk. However, it was satisfactory to predict the low risk for PI, patients who scored less than 10 on the scale were less likely to develop the lesions.

Descriptors: Intensive Care Units; Predictive Value of Tests; Pressure Injury; Critical Care Critical Care Nursing.

Whats is already known on this?

The scales used to predict pressure injuries in the ICU are commonly generic and do not consider the clinical particularities of critically ill patients.

What this study adds?

The EVARUCI scale was satisfactory for predicting the low risk of pressure injuries.



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Resumo

Objetivo: Avaliar a validade preditiva da escala de EVARUCI para pacientes de terapia intensiva. **Métodos:** Estudo longitudinal retrospectivo, com dados secundários, realizado em UTI referência em neurologia e traumatologia. A população do estudo foi composta por todos os usuários que deram entrada na UTI entre janeiro e dezembro de 2020, sendo excluídos aqueles com tempo de internação menor que 48 horas e os que tiveram óbito como desfecho. Coletaram-se dados referentes à admissão, às primeiras 48 horas de internamento e à alta. **Resultados:** O perfil encontrado foi de homens jovens, vítimas de causas externas. A incidência de LPP foi de 18,9%, maiores scores da EVARUCI foram registrados na admissão. A sensibilidade do teste foi de 90,9% e 72,73%, a especificidade de 16,9% e 48,9%, a validade preditiva positiva de 20,27% e 24,74% e a negativa de 88,89% e 88,46% na admissão e primeiras 48 horas, respectivamente. **Conclusão:** A escala não conseguiu prever de forma satisfatória o alto risco. No entanto, apresentou-se satisfatória para prever o baixo risco para LPP. Os pacientes que apresentaram pontuação menor que 10 na escala apresentaram menor probabilidade de desenvolver as lesões.

Descritores: Unidades de Terapia Intensiva; Valor Preditivo dos Testes; Lesão por Pressão; Cuidados Críticos; Enfermagem de Cuidados Críticos.

Resumen

Objetivo: Evaluar la validez predictiva de la escala EVARUCI para pacientes en cuidados intensivos. **Métodos:** Estudio longitudinal retrospectivo, con datos secundarios, realizado en una UCI de referencia en neurología y traumatología. La población de estudio estuvo compuesta por todos los usuarios que ingresaron a la UCI entre enero y diciembre de 2020, excluyendo aquellos con estancia hospitalaria menor a 48 horas, y aquellos que tuvieron como resultado la muerte. Se recogieron datos sobre el ingreso, las primeras 48 horas de hospitalización y el alta. **Resultados:** El perfil encontrado fue el de hombres jóvenes, víctimas de causas externas. La incidencia de LPP fue del 18,9%, se registraron puntuaciones más altas de EVARUCI al ingreso. La sensibilidad de la prueba fue del 90,9% y 72,73%, la especificidad del 16,9% y 48,9%, la validez predictiva positiva del 20,27% y 24,74% y la negativa del 88,89% y 88,46% al ingreso y las primeras 48 horas, respectivamente. **Conclusión:** La escala no logró predecir satisfactoriamente el alto riesgo. Sin embargo, resultó satisfactoria para predecir un riesgo bajo de LPP: los pacientes que obtuvieron una puntuación inferior a 10 en la escala tenían menos probabilidades de desarrollar lesiones.

Descriptores: Unidades de Cuidados Intensivos; Valor predictivo de las pruebas; Lesión por presión; Enfermería de cuidados crítico

INTRODUCTION

The Intensive Care Unit (ICU) is the hospital sector for critically ill patients who require continuous monitoring and intensive support. Due to the severity of their condition, many of these patients require mechanical ventilation, potent analgesics, continuous use of vasoactive and sedative drugs, in addition to presenting nutritional deficits. Such factors favor the decrease of physical mobility and, consequently, the development of pressure injuries (PI) (1).

Pressure injuries (PI) are defined, by the National Pressure Ulcer Advisory Panel (NPUAP), as localized damage to the skin or underlying soft tissue usually over bony or medical device-related prominences. Occur as a result of prolonged pressure or shear. Such lesions can be classified into: stage I (intact skin with non-bleachable erythema), stage II (loss of partial thickness of the skin with exposure of the dermis), stage III (total loss of skin thickness, with adipose tissue being visualized), stage IV (total loss of skin thickness and tissue loss, with fascia, muscle, tendon and bone being visualized) and non-static PI (loss of skin not visualized by devitalized tissue coverage) (2).

The development of PI during the hospitalization of the patients, especially in the ICU, is an adverse event, since it can be avoided by the preventive care provided by the team (3-4). Thus, it is taken as an indicator of the quality of the care provided. If it is frequently present, it indicates failure in the care provided by the multidisciplinary team, thus bringing suffering and greater risk of infection to the patients, in addition to higher hospital costs to the service (5).

In Pernambuco, according to the National Report of Incidents Related to Health Care, from January to December 2021, 225,650 adverse events were reported, of which 27.56% were PI. In addition to being preventable, the presence of these injuries in patients leads to worsening of the clinical condition, increased length of stay and expenditure on supplies, and decreased hospital quality indicators (6-7).

To assist professionals in identifying risk factors for the development of PI, scales were developed, the best known being those of Norton, Braden and Waterlow(8-9). However, these scales do not take into account the sector and the clinical particularities of the patients. Thus, more specific scales were developed, such as Sunderland, Cubbin-Jackson and the "Intensive Care Pressure Injury Risk Assessment Scale" (EVARUCI), which aims to predict the risk of PI specifically in patients admitted to the ICU (5).

The EVARUCI Scale was created in 2001, in an Intensive Care Unit and major burn people of the University Hospital of Getafe, Spain, by a group of specialists in PI. For its preparation, the most frequent risk factors in critically ill patients and expert opinions on these factors were considered. Thus, the EVARUCI Scale consists of four items (consciousness, hemodynamics, respiratory and mobility). In

addition to these aspects, the following are considered: presence of fever, hypotension, low oxygen saturation levels, skin status, prone position and length of ICU stay. Its score ranges from 4 to 23 points, and the higher the score, the greater the risk of developing PI (10). The scale was translated and validated in Brazil (11).

In the scenario experienced during the Intensive Care Nursing Residency, a generic scale is used to predict pressure injuries. Therefore, the interest in knowing and evaluating how much a specific scale such as EVARUCI is able to predict the PI of patients hospitalized in the field of practice aiming at improving the care provided in this context.

The present study aimed to evaluate the predictive validity of the EVARUCI scale for intensive care patients.

METHODS

This is a retrospective longitudinal study, carried out using secondary data from the medical records and printed matter of patients admitted to the ICU of the University Hospital of the Federal University of the São Francisco Valley (HU-UNIVASF). Data were collected regarding admission, first 48 hours and discharge. The recommendations of the Reporting of Observational Studies in Epidemiology (STROBE) were respected.

The study was carried out in the ICU of UNIVASF-HU, which is located in the municipality of Petrolina, in the State of Pernambuco. The ICU has 10 beds, which primarily serve patients with neurological disorders and orthopedic trauma.

Patients admitted to the UNIVASF ICU-HU during the period from January to December 2020, who had the nursing diagnosis of impaired bed mobility and who did not present PI at the time of admission, were included in the study. Those with hospitalization time less than 48 hours, those who had the outcome of death at the end of the period and those who had no data on PI were excluded.

The initial population consisted of 549 patients admitted in the aforementioned period. After excluding those who did not meet the criteria proposed by the authors, the study had 175 participants.

Data were collected on age, sex, days of ICU stay, medical diagnosis, preventive measures related to PI used, EVARUCI Scale related to admission and after 48 hours of hospitalization. In addition to data related to the appearance of PI in the period, length of hospitalization and outcome of the case.

Quantitative variables (age, length of stay in days, EVARUCI at admission and EVARUCI after 48 hours) were presented as medians since they did not present normal distribution (Kolmogorov-Smirnov test $p > 0.05$).

The EVARUCI scale score ranges from 4 to 23 points. The higher the score, the greater the risk of developing PI (10). The EVARUCI variable was categorized as greater than or equal to 10 points and less than 10 points (8,10) to calculate the relative risk (RR) of developing PI during the study period.

Predictive validity was analyzed for data regarding ICU admission and the first 48 hours through sensitivity tests (proportion of people who had PI and EVARUCI ≥ 10 points), specificity (proportion of people who did not have PI and EVARUCI < 10 points), positive prediction value (probability of PI in people with EVARUCI ≥ 10 points) and negative prediction value (probability of PI in people with EVARUCI < 10), and the cutoff point was to reach 10 or more points (box 1).

Box 1. Formulas used to calculate sensitivity, specificity, and positive and negative predictive values. Petrolina, PE - Brazil.

| |
|---|
| Sensitivity |
| $\frac{\text{People with PI EVARUCI} \geq 10 \text{ points}}{\text{Total people with PI}} \times 100$ |
| Specificity |
| $\frac{\text{People without PI EVARUCI} < 10 \text{ points}}{\text{Total people with PI}} \times 100$ |
| Positive Predictive Value |
| $\frac{\text{People with PI EVARUCI} \geq 10 \text{ points}}{\text{Total people with EVARUCI} \geq 10 \text{ points}} \times 100$ |
| Negative Predictive Value |
| $\frac{\text{People with EVARUCI PI} < 10 \text{ points}}{\text{Total people with EVARUCI} < 10 \text{ points}} \times 100$ |

Source: Research authors, 2023.

The area under the Receiver Operator Characteristic (ROC) curve was used to represent the relationship between sensitivity and specificity. The values of the area under the curve are between 0 and 1, with 1 being the value for an ideal test (12). Values above 0.7 are considered satisfactory (13).

The data were tabulated using spreadsheets in the Microsoft Office Excel 2016 software and the analyses were performed using the SPSS software.

The research was approved by the Research Ethics Committee of the Sertão Integration College under opinion number 4,841,836.

RESULTS

Five hundred and forty-nine (549) patients were admitted to the ICU during the study period, of which 277 were excluded for having spent less than 48 hours in the sector, of the remaining 272 were excluded from the sample 75 for having died and 22 for not having a record of PI in the medical record.

The final sample consisted of 175 participants, 78.9% male. Of these patients, 56.4% had diagnoses related to external causes. Among them, severe traumatic brain injury secondary to motorcycle accidents prevailed (49.5%). The median length of stay was seven days.

During the study period, 33 patients developed pressure injuries, with an incidence of 18.9%. Of these, 42.42% (n=14) occurred in the calcaneal region, 36.36% (n=12) in the sacral region. Lesions were also scored in the occipital (n=3), malleolar (n=2), mental (n=1) and auricular (n=1) regions. A median of 6 days was observed for the development of lesions.

The median age of patients who presented PI was 40 years and they remained on mean 15 days in the ICU; among those who did not present PI the median age was 38.5 years and the stay was five days.

In the group that developed PI, the median EVARUCI score was 13 points at admission and 11.20 points after 48 hours. Among those who did not develop PI, the median was 12 points at admission, and 10 points after 48 hours.

Table 1 shows the distribution of patients who developed or did not develop PI according to the EVARUCI scores (greater or less than ten points). In both evaluations, patients with EVARUCI scores greater than or equal to 10 points had a higher risk of developing PI during the hospitalization period (RR 1.82 and 2.14).

Table 1. Distribution of patients with and without PI according to EVARUCI scores during ICU admission and after 48 hours of hospitalization. Petrolina, PE - Brazil.

| | With PI | Without PI | Total | RR* |
|----------------------------------|-----------|------------|------------|------|
| EVARUCI during admission | | | | |
| EVARUCI ≥ 10 admission | 30 | 118 | 148 | 1.82 |
| EVARUCI < 10 admission | 3 | 24 | 27 | |
| Total | 33 | 142 | 175 | |
| EVARUCI after 48 hours | | | | |
| EVARUCI ≥ 10 AFTER 48 hours | 24 | 73 | 97 | 2.14 |
| EVARUCI < 10 after 48h | 9 | 69 | 78 | |
| Total | 33 | 142 | 175 | |

*Relative Risk

Source: Research authors, 2023.

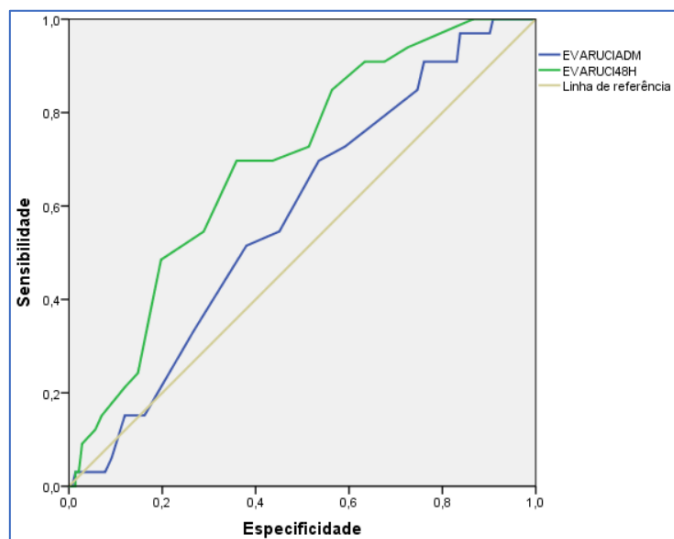
Sensitivity, specificity, positive and negative prediction value tests were performed in order to evaluate the score (less than or greater than ten points) scored on the EVARUCI scale at admission and after 48 hours of hospitalization (table 2).

Table 2. Results of the predictive validity test applied to the cutoff point 10 points of the EVARUCI Scale at ICU admission and first 48 hours of hospitalization. Petrolina, PE - Brazil.

| | Sensitivity | Specificity | Positive prediction | Negative prediction |
|-------------------|-------------|-------------|---------------------|---------------------|
| EVARUCI admission | 90.9 | 16.9 | 20.27 | 88.89 |
| EVARUCI after 48h | 72.73 | 48.59 | 24.74 | 88.46 |

Source: Research authors, 2023.

The area under the ROC curve was 0.580 for admission and 0.694 after 48 hours (Figure 1).

Figure 1. ROC curve of the EVARUCI scale applied during admission and 48 hours after hospitalization. Petrolina, PE - Brazil.

Source: Research authors, 2023.

Patients who were excluded from the sample due to death were mostly male (73.43%), median age of 42 years with EVARUCI of 13 points both at admission and in the first 48 hours. The incidence of PI was 17.74% and the median hospitalization was seven days.

DISCUSSION

The profile of patients treated in the study ICU were young men, victims of external causes, especially motorcycle accidents, which culminated in traumatic brain injury, corroborating studies carried out in ICUs of general hospitals (14,15).

External causes are a relevant factor of morbidity and mortality among men, young, economically active, black or brown, with emphasis on the high incidence of motorcycle accidents that has been increasing over the years ⁽¹⁶⁻¹⁹⁾.

Most patients in the sample presented traumatic brain injury, this aggravation when moderate or severe is associated with neurological conditions and functional deficiencies ⁽¹⁸⁾. Such situations predispose to longer hospitalization, more interventions, use of medications, loss of mobility and consequently to greater risk for the development of PI ^(19,20).

In the scenario studied, the incidence of PI was 18.9%, being considered low when related to other studies available in the literature, with a patient profile similar to that of the present study. These studies show higher incidences, reaching 69% of patients with the outcome ⁽²⁰⁻²³⁾. Therefore, this difference can be justified by the quality of care provided by the health team, since these injuries are directly related to the level of care offered to the patients, so their presence or absence are considered as indicators of the quality of care ⁽³⁻⁵⁾.

However, it is important to consider the high turnover of the sector. Patients spend a mean of seven days in the ICU, however, those who develop PI have a median of 15 days of hospitalization. Thus, length of stay is a risk factor for the development of PI and is interconnected with greater use of sedation, vasoactive drugs, immobility, humidity, among other risk factors ⁽²⁴⁾.

Also, it is relevant to consider that during the study 22 medical records were excluded because they did not contain any information about PI, configuring underreporting, which may influence the low incidence found.

The risk of developing PI is higher in patients with EVARUCI greater than or equal to 10 points. In this study, most patients who were admitted to the ICU had EVARUCI greater than 10 points, but this incidence fell after the first 48 hours. Of these patients, the majority who underwent the PI outcome had parameters for high-risk classification in EVARUCI, thus translating into high sensitivity (90.9 at admission and 72.73 after 48 hours). However, high-risk stratification was also found in patients who did not present the outcome, making the specificity low (16.9 at admission and 48.59 after 48 hours).

The sensitivity, specificity and prediction values found in this study for EVARUCI do not differ much from those reported in the literature for the Braden scale, widely used in health services, with sensitivity from 71.4% to 95%, specificity from 45% to 83%, positive prediction value from 13 to 52% and negative prediction value from 94% to 96% ⁽⁵⁾.

Therefore, the high turnover and low incidence end up reflecting on the inability of the scale to predict the development of PI (positive predictive validity), as many patients enter at high risk, but do not develop the lesion at the end. However, the negative predictive validity is satisfactory, as the patient classified as low risk in the EVARUCI will actually have a low probability of developing PI.

For this purpose, EVARUCI must be carefully performed in person at the patient's bedside. Thus, it is possible to translate better reliability to the collected data. In addition, it is suggested to monitor these patients throughout their hospitalization ⁽¹⁰⁾. However, this study had as a limiting factor the realization of the scale through secondary data, due to the difficulty found in accessing legal guardians for such patients, due to restricted access to the hospital during the period of greater social isolation due to the COVID-19 pandemic.

Given these findings, it was noticed that, in the scenario studied, the performance of EVARUCI at the time of admission was not satisfactory, as demonstrated in the value under the area of the ROC curve (0.580). These findings may be related to the profile of patients on admission to the ICU, who are severe and who, through care provided by the team, they recover quickly. Thus, the length of hospital stay becomes reduced, which is a crucial factor for the non-development of injuries. Thus, even with high scores at admission, the outcome is not reproduced by the rapid clinical improvement.

After 48 hours of admission, the care provided in the ICU is reflected. Thus, it is possible to determine whether those patients have a higher risk of developing PI. Once the patients have shown significant improvement, their length of stay is shorter and the chance of developing these lesions decreases.

Therefore, in the reality studied, most patients showed significant improvement in the first 48 hours, which were translated into: decreased use of vasoactive drugs, sedation, controlled modes in mechanical ventilation and improved patient mobility. Therefore, the length of stay was reduced and the scores after 48 hours of hospitalization were lower. In addition, it can also be observed that patients who

had higher scores after 48 hours of hospitalization had longer hospitalization times and, consequently, a greater chance of developing PI.

However, despite this limitation, the study showed good sensitivity and negative prediction value at admission. It was well balanced in relation to sensitivity, specificity and positive and negative prediction values after 48 hours. The area under the ROC curve was not satisfactory (greater than 0.7), but for the application of the scale 48 hours after hospitalization, the value close to satisfactory (0.694) may indicate that under ideal application conditions (at the bedside) the scale will perform better.

The study had as limitations the use of secondary data, as they were taken from the evolution of physicians, nurses and physical therapists, nursing technicians, in addition to the use of the instruments of the unit itself, which were completed by the nurses of the ICU in question. Thus, these data tend to present the individualized view of each professional. In addition, the completion of the form related to the type of lesion that the patient had developed relied on the degree of knowledge of the nurse who performed it.

Given the limitations found, the authors suggest conducting the study through primary data, especially in the follow-up of the patients during the period of their hospitalization at the bedside.

CONCLUSION

The results presented demonstrate that the EVARUCI scale is a good instrument to predict low risk for PI. In view of the high risk, preventive measures must be adopted so that PI does not develop. Study with primary data should bring more robust and satisfactory results. However, despite the limitations found, the use of a specific instrument for intensive care, which considers the particularities of these critical patients, may bring benefits to clinical practice.

CONTRIBUTIONS

Study conception or design: Gomes LMC, Siqueira VB. Data collection: Gomes LMC. Data analysis and interpretation: Gomes LMC, Siqueira VB. Writing the article or critical review: Gomes LMC, Siqueira VB. Final approval of the version to be published: Siqueira VB.

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