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Clinical validation of the Neonatal Skin Condition Score with Portuguese newborns

Validação clínica da Neonatal Skin Condition Score com recém-nascidos portugueses

Validación clínica de la Neonatal Skin Condition Score con recién nacidos portugueses

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ABSTRACT

Objective: Clinically validate the Neonatal Skin Condition Score - Portuguese version with Portuguese newborns, verifying if the risk of skin injury in this population is influenced by their condition.

Method: Observational, cross-sectional and methodological study, conducted from 2018 to 2021. The Neonatal Skin Risk Assessment Scale - Portuguese version and Neonatal Skin Condition Score were used in data collection. Of the latter, content validation and sensitivity of the items were improved. MANOVA was used to evaluate whether the effect of independent variables (intrinsic and extrinsic factors) on dependent variables (score of both scales) was statistically significant. Non-random sampling (n=167).

Results: The items showed good sensitivity. MANOVA revealed that the factors had a significant effect on the scores of the two scales.

Conclusion: The comparison of the scales shows clinical validity, revealing that better skin condition corresponds to a lower risk of injury, and the two scales can be applied concomitantly.

Keywords: Infant, newborn. Neonatology. Skin. Validation study. Nursing.

RESUMO

Objetivo: Validar clinicamente a *Neonatal Skin Condition Score* - versão portuguesa com recém-nascidos portugueses, verificando se o risco de lesão da pele nessa população é influenciado pela sua condição.

Método: Estudo observacional, transversal e metodológico, realizado de 2018 a 2021. Na coleta de dados, utilizaram-se a *Neonatal Skin Risk Assessment Scale* - versão portuguesa e a *Neonatal Skin Condition Score*. Desta última, realizou-se a validação de conteúdo e a estimação da sensibilidade dos itens. Utilizou-se a MANOVA para avaliar se o efeito das variáveis independentes (fatores intrínsecos e extrínsecos) sobre as dependentes (escore das duas escalas) era estatisticamente significante. Amostragem não aleatória (n=167).

Resultados: Os itens apresentaram boa sensibilidade. A MANOVA revelou que os fatores tiveram efeito significante sobre os escores das duas escalas.

Conclusão: A comparação das escalas evidencia validade clínica, demonstrando que melhor condição da pele corresponde a menor risco de lesão, podendo as duas escalas ser aplicadas concomitantemente.

Palavras-chave: Recém-nascido. Neonatologia. Pele. Estudo de validação. Enfermagem.

RESUMEN

Objetivo: Validar clínicamente el *Neonatal Skin Condition Score* – versión portuguesa con recién nacidos portugueses, comprobando si el riesgo de lesión cutánea en esta población está influenciado por su condición.

Método: Estudio observacional, transversal y metodológico, realizado de 2018 a 2021. En la recolección de datos se utilizaron el *Neonatal Skin Condition Score* - versión portuguesa y el *Neonatal Skin Condition Score*. De estos últimos, se mejoró la validación del contenido y la sensibilidad de los ítems. La MANOVA se utilizó para evaluar si el efecto de variables independientes (factores intrínsecos y extrínsecos) sobre variables dependientes (puntuación de ambas escalas) fue estadísticamente significante. Muestreo no aleatorio (n=167).

Resultados: Los artículos mostraron buena sensibilidad. La MANOVA reveló que los factores tuvieron un efecto significante en las puntuaciones de las dos escalas.

Conclusión: La comparación de las escalas muestra validez clínica, revelando que una mejor condición de la piel corresponde a un menor riesgo de lesión, y las dos escalas se pueden aplicar concomitantemente.

Palabras clave: Recién nacido. Neonatología. Piel. Estudio de validación. Enfermería.

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INTRODUCTION

Technological advances and scientific innovation in the last ten years, in the field of health care for the neonatal population, have led to a significant improvement in the survival of newborns (NB) who need special care in Neonatal Intensive Care Units (NICUs) and, consequently, a considerable increase in iatrogenic events[1]. Hospitalization in these special units is associated to a greater risk of skin injuries in NB[1]. and significant rates of morbidity and mortality that can be attributed to practices that cause trauma to the skin or changes in its function[2]. Most of these injuries are due to the immaturity and vulnerability of the skin of newborns, as well as to the various diagnostic and therapeutic procedures to which this population is subject[1,3].

Newborn skin is particularly important after birth due to its multifunctionality. It intervenes in thermoregulation, in the prevention of transepidermal water loss (TEWL), acts as a barrier, providing protection against physical/mechanical injuries, chemical and biological threats[2,4,5], among others. It is an organ that works as an interface between the NB and the human and physical environment[2].

In the neonatal period, the skin undergoes a substantial process of transformation and adaptation, triggered by birth. The transfer from an aquatic intrauterine environment to an aerobic environment stimulates and accelerates the maturation of its function[2,4,5]. Therefore, preserving the integrity of the skin is particularly relevant at this stage, facilitating and supporting NBs in the transition and adaptation to extrauterine life, especially in preterm newborns (PTNBs) [2,4,6].

Newborn skin care practices can have an impact for many years[5], and their careful evaluation provides health professionals with an overview of the newborn's health as well as any underlying pathology[7]. Thus, skin care should be tailored to the skin's characteristics and individual risk factors, and these aspects must be investigated through the use of measurement instruments, based on reliable research results[5]. Its implementation in the practice of care allows associating the general observation of the NB with a more objective observation[5], systematized and standardized, which guides care focused on the individuality and needs of the NB.

Currently, two instruments for assessing the risk of skin injuries in pediatrics have been validated and approved by the General Directorate of Health (DGS - Service of the Ministry of Health) in Portugal, as follows: the Observation Neonatal Skin Risk Assessment Scale (NSRAS), applied to the neonatal population from 0 to 21 days; and Braden Q scale, aimed at children aged between 21 days and 18 years old[8].

The NSRAS is a risk assessment scale for skin injuries in newborns, validated with Portuguese newborns. It has satisfactory psychometric quality, being suitable not only for risk observation, but also for research use. It consists of six items: general physical condition (gestational age), mental state, mobility, activity, nutrition and humidity. The lowest score indicates a low risk of skin damage; and the highest score, a high risk[8].

Parallel to the use of predictive scales for the risk of injury, it is necessary to objectify and systematize the assessment of the skin. It is essential to recognize that risk assessment is different from skin assessment, and careful observation and documentation of their condition are essential components of skin care for NBs hospitalized in NICUs[2].

The Neonatal Skin Condition Score (NSCS) is a skin condition assessment scale for NBs that can be applied without restrictions both to PTNBs with very low birth weight and to term NBs who are healthy[5,9]. It describes the global condition of the NB's skin, allowing its consistent assessment and the identification of NBs who need intervention[9], being the only instrument published internationally focused on the assessment of the skin condition[6]

In a neonatal context, due to its relevance in protecting the newborn's skin and promoting its health, this research article intends to clinically validate the Neonatal Skin Condition Score - Portuguese version (NSCS-PT) with Portuguese newborns, verifying whether the risk of skin injury is influenced by skin condition, through the evaluation of the effect of the independent variables (hospitalization time, corrected age, use of medical devices and application of adhesives) on the dependent variables (NSRAS and NSCS-PT scores). Thus, the following research questions were elaborated: Does the NSCS-PT have clinical validity for the observation of the skin condition of Portuguese NBs? Is the risk of skin damage in newborns influenced by their condition?

METHOD

Observational, cross-sectional and methodological study, with a quantitative approach. Non-random, accidental, casual or convenience[10] sampling was used. All NBs admitted to the NICU of Centro Hospitalar de Lisboa Oeste, were considered participants, excluding only those with diagnosed congenital dermatological diseases.

Data were collected in two different periods: the first, from January 8 to March 11, 2018, coinciding with the pre-test phase; and the second, from May 25 to June 3, 2021, to continue the validation study and increase the sample size. The collection ended with 167 observations (n=167).

Instrument

The NSRAS scales, validated for the Portuguese neonatal population[8] and NSCS-PT, were used in data collection.

The NSCS is an instrument composed of three items — dryness, erythema and skin rupture — common to the 3-point measurement scale (See Chart 1). Its data is obtained through direct observation of the NB and provide information on the state of integrity of their skin[5,9].

In 1997, in the United States, the Neonatal Skin Care Project was initiated by the Association of Women's Health, Obstetric and Neonatal Nurses (AWHONN) and the National Association of Neonatal Nurses (NANN), and at this time the NSCS[5,9,11] was validated. AWHONN holds the copyright of this instrument.

For the development of the present investigation study, the Portuguese translation (Portuguese of Portugal) of the 3rd edition of The Neonatal Skin Care: Evidence-based Clinical Practice Guideline[11], provided by AWHONN, with the indication that no change could be made to the existing translation of the NSCS-PT.

In the validation of NSCS-PT for the Portuguese population, the collaboration of a panel of 45 experts in the area of neonatology (25 nurses and 20 doctors) was obtained for the quantitative validation of the content of the NSCS-PT items, according to Lawshe's model[12]. Experts answered whether each of the items on the scale was "Not necessary to assess skin condition" (1); or "Useful, but not necessary for assessing skin condition" (2); or else was "Essential for skin condition assessment" (3). For the number of experts used, the content validity coefficient was always higher than the reference values (nurses, CVR > 0.37; and physicians, CVR > 0.37), and in the panel of physicians, only the item "dryness" had a lower but still very high CVR value (CVR=0.95), and all other values were CVR=0.99.

Data collection was carried out simultaneously by two observers, with previous training in the application of the instrument, and the coefficients of agreement between observers were evaluated for the NSCS-PT items, which showed high values[13] (dryness, Kappa = 0.704 ; erythema, Kappa = 0.803; and breakdown, Kappa = 0.725; and $p < 0.001$). Thus, an interobserver agreement was obtained between the substantive and almost perfect reference values (> 0.700 and > 0.800) [13].

Procedures

Due to the impossibility of statistical validation of the NSCS-PT, as its component items are independent and as such are not correlated, clinical validation was chosen, which is supported by comparison with the NSRAS[14].

In predicting the data analysis for the clinical validation of the NSCS-PT, descriptive statistics was used (asymmetry coefficients (g1) and flatness (g2)) with reference values $g1<|3|$ and $g2<|7|$ and critical ratios < 2.

To verify whether the risk of skin injuries in newborns is influenced by their condition (NSCS-PT score and NSRAS score and independent factors), MANOVA was used, after validation of the assumptions of multivariate normality and homogeneity of variances- covariance matrices.

Items	Descriptors of the items	Criteria for applying the NSCS scale – PT		
1	Dryness	1 = Normal, no sign of dry skin	2 = Dry skin, visible skin peeling	3 = Very dry skin, cracks/fissures
2	Erythema	1 = no sign of erythema	2 = Visible erythema, less than 50% of body surface	3 = Visible erythema, more than or equal to 50% of the body surface
3	Breakdowns	1 = No evident breakdown	2 = Small localized areas	3 = Extensive areas

Chart 1 - Descriptors and criteria for applying the NSCS-PT scale.
Source: Elaborated by the authors.

Four independent variables (factors) were selected, with the characterization of intrinsic factors performed by the "corrected age" of the NB (in age groups); and that of extrinsic factors, by the number of "days of hospitalization" (in classes), "medical devices" and "application of adhesives" (yes or no), variables that interfere with the condition of the skin and susceptibility to injury. A two-way multivariate analysis of variance (MANOVA) was performed to assess whether the effect of the above-mentioned independent variables on the dependent variables, NSRAS score and NSCS-PT score, was statistically significant. The assumption of multivariate normality was defined by the normal distribution trend of the dependent variables; and the homogeneity of variances-covariance matrices in each group was evaluated with Box's M test (M = 87.05; F (57, 2527, 20) = 1.198; p = 0.149). When statistically significant effects were detected by MANOVA, ANOVA was immediately performed for each of the dependent variables, followed by Tukey's post-hoc HSD test, considering a significance level of 5% (α = 0.05) and a power of test greater than 70%[10].

Clinical validation of the NSCS-PT scale for the Portuguese neonatal population was authorized by AWHONN, and data analysis was performed using the IBM SPSS® Statistics for Windows software, v.27 (IBM Corp., Armonk, N. Y., USA). The STROBE instrument was used, with the rules included in the International Guide for preparation of articles.

The study was approved by the Ethics Committee (RNEC no 20170700050) of the hospital involved and the Informed Consent of the parents of all the NBs was obtained, and acronyms were used in the observation record, in order to preserve the anonymity of the NBs. There was no conflict of interest on the part of the researchers.

RESULTS

Of the NBs observed at the NICU, 54.5% were male and 45.5% female; 15% were born by eutocic delivery and 85% by dystocic delivery (cesarean section, 79.6%; forceps, 4.2%; and ventouse suction cup, 1.2%). The birth weight of the NBs ranged between 3,810 g (maximum) and 625 g (minimum), with a mean birth weight of 1,427 g (M = 1,427.25 g) and a standard deviation of 768 g (SD = 768, 47g). Gestational age (GA) ranged between 171 and 287 days, with an average of 214 days (M = 216.92) and standard deviation of 30 days (SD=29.66).

At the time of observation of the NBs through the NSCS-PT, the weight varied between 3,810 g and 625 g, with a mean of 1,590 g and standard deviation of 701 g; corrected age (CI) had a maximum value of 341 days and a minimum value of 179 days, with a mean of 233 days and a standard deviation of 26 days. These NBs had between 1 and 180 days of hospitalization, with an average of 17 days (M = 16.69) of hospitalization and standard deviation of 19 days (SD=18.99); and there was a prevalence rate of infection of 36% of NBs (35.9%).

All NSCS-PT items showed good sensitivity and asymmetry and kurtosis values were lower than the reference values, as well as the critical ratios for the three items[10] (See Table 1).

Regarding the relationship between the scores of the two scales, NSCS – PT and NSRAS, and the independent variables, the results of parametric MANOVA test showed that the factors "corrected age" of the NB (Pillai Trace = 0.178; F (6 , 303) = 5.008; p < 0.001, Eta_p2 =0.089; test power (π = 0.993)), "hospitalization days" (Pillai trace = 0.152; F (6.306) = 4.237; p < 0.001, Eta_p2 = 0.076 ; test power (π = 0.979)), "medical devices" (Pillai Trace=0.060; F(2, 163) = 0.212; p = 0.006, Etap2 = 0.060; test power (π = 0.825)) and " application of adhesives" (Pillai Trace = 0.065; F (2, 163) = 5.675; p=0.004, Eta_p2 = 0.065; test power (π = 0.857)) demonstrated a high-dimensional, statistically significant observed effect with high test powers.

After observation of the multivariate significance of the different factors, univariate ANOVA was performed for each of the dependent variables, the scores of the two scales (NSRAS and NSCS-PT) and the respective post-hoc Tukey HSD tests, which will be presented.

Table 1 - Medians (Me), shape measures, asymmetry (g1) and kurtosis (g2) with the respective critical ratios (g1 /SEg1; g2 /SEg2), SEg1 = 0.19, SEg2 = 0.37 for the three NSCS items -PT. Lisbon, 2018-2021

Items	Me	g_1	g_1/SE_{g1}	g_2	g_2/SE_{g2}	Min.	Max.
Dryness	2.00	0.14	0.70	-0.60	1.62	1	3
Erythema	2,00	0.04	0.21	-0.22	0.59	1	3
Breakdown	2,00	-0.18	0.95	0.34	0.92	1	3

Source: Elaborated by the authors.

As for the NSRAS, and after considering the "days of hospitalization" effect, we can state that the "corrected age" of the NB had a statistically significant and high-dimensional effect (F (3, 154) = 9.266; p< 0.001, Eta_p2 = 0.153; π = 0.996) on the total score of the NSRAS scale. The "corrected age" ≤ 196 days (M = 12.9 days; SD = 3.24; N = 134) class had the highest NSRAS score, followed by classes 197-224 days (M = 11, 8 days; SD = 3.41; N = 17), 225-258 days (M = 10.8 days; SD = 3.86; N = 4) and, finally, class ≥ 259 days (M=8 .9 days; SD = 2.11; N = 12). Tukey's post-hoc test revealed that the statistically significant differences for this factor were between corrected ages ≤ 196 days and ≥ 259 days (95% CI]6.44; 1.52[; p< 0.001) (See Figure 1).

Similarly, and after considering the effect of the "corrected age" of the NB, the "days of hospitalization" had a statistically significant and high dimension effect (F (3, 154) = 3.237; p = 0.024, Eta_p2 = 0.059 ; π = 0.735) on the total score of the NSCS-PT scale. Class 8-14 "hospitalization days" (M = 6.10 days; SD = 0.92; N = 40) had the highest NSCS score, while classes ≥ 15 days (M = 5.27 days; SD = 1.15; N = 67), 0-3 days (M=5.53 days; SD = 1.34; N = 40) and 4-7 days (M = 5.63 days; SD = 1.22; N = 30) had lower scores on the NSCS-PT scale.

As for the "application of adhesives", with regard to the NSRAS and after considering the effect of using "medical devices", we can state that the "application of adhesives" had a statistically significant and high-dimensional effect (F (1, 164) =11.415; p< 0.001, Etap2 = 0.065; π = 0.919) in the total score of the NSRAS scale.

It should be noted that, see figure 2, in the presence of devices (M = 12.37; SD = 3.29; N = 163), there was a lower NSRAS score than in the presence of adhesives (M = 16.0; SD = 4, 55; N=4).

Similarly, after considering the effect of "application of adhesives" on the newborn's skin, "medical devices" had a statistically significant and high-dimensional effect (F (1, 164) = 4.609; p = 0.033, Etap2 = 0.027; π = 0.669) on the total score of the NSCS-PT scale, although with a lower test power.

The NBs who did not have medical devices (M = 7.00 days; SD = 1.16; N = 4) had lower NSCS - PT scores compared to those who had the devices applied (M = 12 .59; SD = 3.28; N = 163).

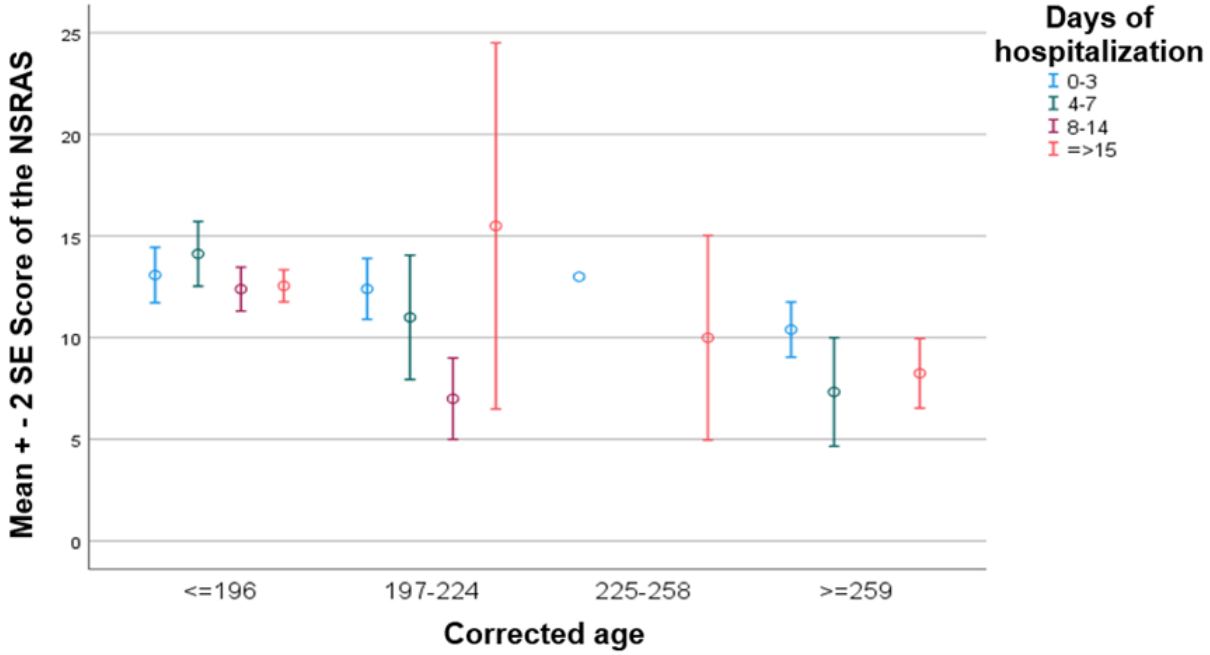

Figure 1 - NSRAS score of the NBs and respective days of hospitalization.
Source: Elaborated by the authors.

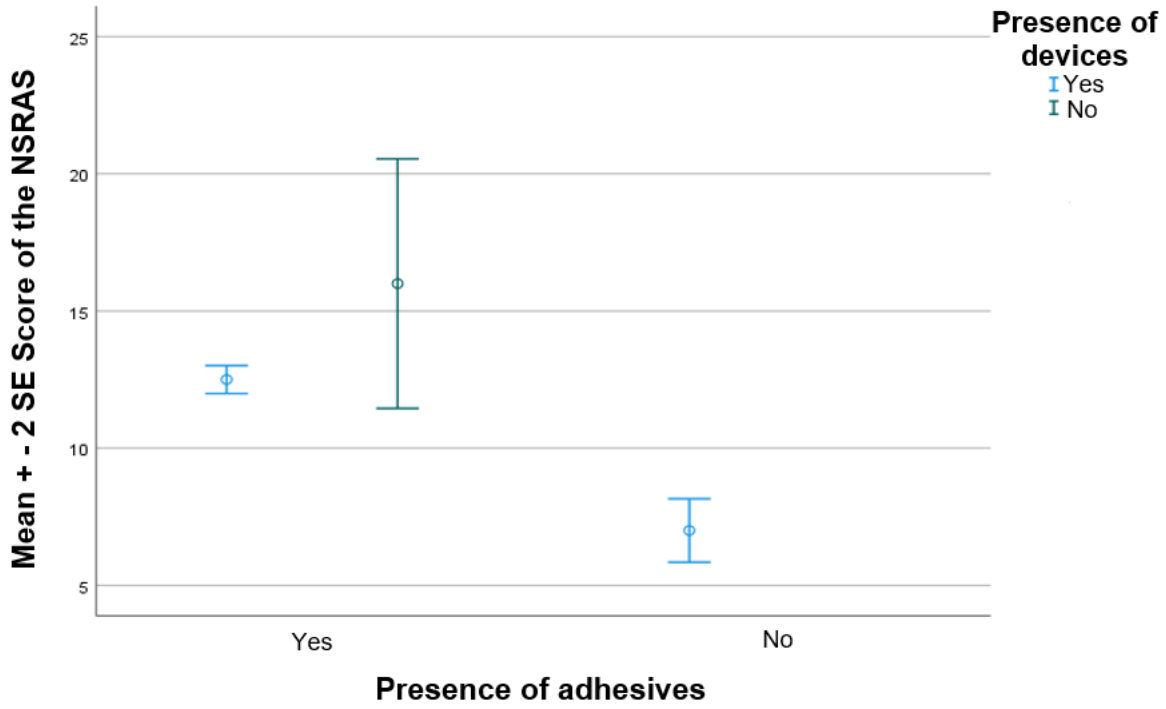

Figure 2 - NSRAS score of RNs and presence of devices
Source: Elaborated by the authors.

DISCUSSION

During the first days and months of life, neonatal skin care is centered on protecting its integrity and function, both for healthy and sick NBs, with a focus on preventing skin disorders. Maintaining the NB's skin integrity is one of the main indicators of the quality of nursing care, which makes it possible to prevent skin injuries and significantly reduce the rate of infection and other serious complications, such as the negative impact on neurodevelopment[5,15].

For PTNB, in particular, care practices that pose a greater risk to their fragile and underdeveloped skin are an ongoing concern for all caregivers. Assessment of the newborn's skin can be very complex, due to the different clinical manifestations of the developing neonatal skin injuries. In PTNBs, the skin may appear gelatinous and transparent, and the injuries tend to appear more superficial and discreet, especially when the NB is plethoric. Thus, given these and other particularities, the need for skin assessment skills and abilities, through the use of validated instruments and forms of documentation that support health professionals in the practice of care, is emphasized[16]. Parallel to the systematic and structured observation and assessment of the skin, other qualified nursing care is essential to maintain its integrity, including actions aimed at preventing complications associated with the present risk factors, such as prematurity and anatomical and physiological immaturity of the NB. These nursing interventions include hygiene, hydration with emollients, changing body position every two hours and more care with phototherapy, invasive procedures and fixation and removal of equipment using adhesives, with the use of a product that provides a barrier between the skin and the adhesive[15].

Therefore, frequent skin assessment is essential to prevent and treat breakdown of the structure and maintain its function. The lack of skin assessment, characterized by the absence of a detailed physical examination, and an inadequate recording of its alterations stand out as aggravating factors for the occurrence of skin injuries in the NICU[15]. On the other hand, detailed documentation of the skin assessment and adequate records provide continuous care, as well as the perception of the evolution of the results of this assessment[17]. Therefore, the preliminary technique of observation is a direct ally in the search for signs and symptoms in the skin, allowing the recognition of situations that may pose a risk to the maintenance of its integrity[17].

Thus, the nursing team must know the particularities of the NB's skin, carefully evaluate it based on its physiology, GA and days of life, in order to reduce the risk of iatrogenic

injuries during hospitalization in the NICU[,15]. Therefore, statistically and clinically validated instruments are needed to target and guide the nursing intervention. The clinical validation of the NSCS-PT, therefore, is an added value for the assessment of the skin condition[5,9,18] of the NB, proving to be an important assessment instrument for measuring the result of the interventions carried out[5,15].

The clinical validity of the scale was inferred by comparing the agreement between the total scores of the NSRAS and the NSCS-PT, when related to the same independent variables. Statistical tests showed a significant relationship between the four variables (factors) investigated and the score value of both scales, with a high test power. This corroborates the fact that a NB with more fragile or immature skin are expected to be at greater risk of skin damage, with these conditions being influenced by the factors "corrected age", "days of hospitalization", "medical devices" and " application of adhesives".

Analysis of the "corrected age" of the NB (in age groups) and its influence on the risk of skin damage (NSRAS), considering the days of hospitalization, showed that it had a statistically significant effect. This result corroborates what is mentioned in the literature: it is considered that the integrity of the skin is strongly influenced by the GA/CA, as its vulnerability increases at younger ages[5,15]. Also, higher injury risk scores were detected at earlier ages; and full-term newborns have lower scores, since birth marks the starting point for skin maturation in the extrauterine environment and maturation will be faster the higher the GA[18].

The development of the skin's barrier function begins in the uterus and is completed at the 34th week of pregnancy[4]; and its development is intrinsically linked to the GA: the higher the GA, the more developed and effective the said function will be. This strong influence of GA on the skin's barrier function is associated with the stage of maturation of the stratum corneum[18]. With a decrease in GA and a structural deficit in this layer, it is known that PTNBs have a significant increase in TEWL, which can lead to considerable problems such as dehydration, thermal instability, electrolyte imbalances, greater vulnerability to trauma and maturation delay[2,18].

Two to three weeks after birth, the epidermis of preterm newborns is histologically similar to that of full-term newborns. However, in extremely preterm infants, this time becomes longer, and may exceed four weeks. In these cases, the dermis is also deficient in structural proteins, the mechanical properties are weak, and the skin is easily damaged[4,5,18]. Also, the skin barrier properties of PTNBs, even if full term age is adjusted, differ from full term NBs, suggesting that their development depends not only on GA, but also on the elapsed lifetime, reinforcing the idea that that, even after seven to eight weeks, skin integrity is worse in PTNB[18].

Regarding the number of "hospitalization days" (in classes), the 8-14 days class had a higher NSCS-PT score, probably explained by the fact that, after birth, the skin condition undergoes a progressive transformation, related to the contact with the external, drier environment, stimulating and accelerating its maturation[18]. However, the permanence of NB in the NICU, especially PTNB, makes the skin highly vulnerable to several adverse reactions, compromising its integrity and leading to an increased risk of infection[19]. In these NBs, the greater the immaturity of the skin, the greater the TEWL, which impairs enzymatic functions necessary for the normal desquamation process, resulting in visibly dry and scaly skin[4,18]. Thus, in the second week of hospitalization the most marked effects of the change from the uterine to the extrauterine environment can already been seen, combined with the skin immaturity of newborns and the procedures they undergo on a daily basis.

The importance of new techniques used in NB care is recognized, which led to a significant reduction in neonatal mortality, particularly in PTNBs, namely diagnostic and therapeutic procedures[3]. However, the prevention of iatrogenic damage, trauma and injuries related to this type of care represents a daily challenge in intensive care, and it is essential to assess the skin of newborns on a daily basis using an objective and validated assessment instrument [3,5,16]. These tools contribute to the construction of relevant care plans that prevent or reduce the risk of developing injuries [16]. A complete and detailed observation of the skin surface, using the NSCS, will provide a greater understanding of their condition in critically ill or premature NBs[2,9], allowing greater attention to the first signs of skin changes (such as erythema, abrasions or excoriations) and, therefore, a timely intervention, preventing the increase in the severity of the injury[2,18,19].

Hospitalized NBs are at risk of numerous skin injuries, either due to skin immaturity or their associated health problems, such as inadequate perfusion, reduced mobility, neuromuscular disorders, water imbalances, dehydration and inadequate nutrition[19]. Furthermore, the use of equipment and interventional care plays a relevant role in the incidence of skin injuries, in addition to the neonatal condition itself[19].

One of the findings of the original NSCS validation study was that NBs with longer hospitalization times had higher skin condition scores[9], which also occurred in the present study. These findings are in line with the recent investigation, in which it is reiterated that prolonged hospitalization increases the probability of developing iatrogenic injuries, due to the numerous diagnostic or therapeutic interventions[15], which necessarily interfere with the skin condition. Once again, the importance of evaluating the skin of NBs hospitalized in the NICU is reinforced, daily, in a consistent and structured way, which can prevent the occurrence or worsening of the degree of skin injury[19].

When the study of the consequence of "medical devices" and "application of adhesives" takes into consideration the skin condition and risk of injury scores, a statistically significant effect is observed, although the presence of devices does not seem as aggressive as that of adhesives for risk assessment, but is relevant for the worsening of skin condition. In contrast, the literature considers the use of medical devices to be the main risk factor for neonatal skin damage, considering newborns younger than 27 weeks at greater risk[5]. According to this line of thought, the present investigation shows that care related to medical devices are essential elements of nursing care, little explored or even absent in injury risk assessment scales. Thus, it is reinforced that the evaluation of the skin should diagnose hyperemic regions, risk or formation of injuries caused by medical devices, existing injuries, quality of wound healing and the evolution of the skin condition after the start of preventive interventions [16].

The increasing use of adhesives and devices poses a clear threat to skin integrity. These adhesives and devices, skin immaturity, and the impact of duration and severity of critical illness combined are risk factors for skin injury, particularly pressure ulcers (PU) [5,19,20]. It is critical to recognize that adhesives impact the barrier function of the skin and have the potential to cause tissue trauma, including epidermal skin stripping resulting in skin tears, and contact dermatitis[5]. Therefore, scientific evidence highlights the importance of preventing or minimizing the risk of skin damage through frequent assessment of the skin under and around devices. This premise is particularly true when we refer specifically to the risk of PU, which requires a structured approach, combining an adequate risk assessment instrument and a complete and rigorous skin assessment, the frequency of which is determined by the degree of risk [20].

Such evidence is consistent with the findings of our study, which confirm the importance of combining the assessment of the condition of neonatal skin with the assessment of the risk of injury during hospitalization in the NICU, in order to complement nursing care for NBs and, thus, improve its quality.

CONCLUSION

Clinical validation of the NSCS-PT was achieved, as its component items showed good sensitivity to assess skin condition. The use of the NSRAS scale, as a comparative support, also revealed that the scores of the two scales reflect a statistically significant and high dimension effect regarding the independent variables. Thus, a better skin condition is associated with a lower risk of injury, and these scores were strongly influenced by factors corrected age, days of hospitalization, medical devices and application of adhesives.

The NSCS-PT is an instrument that can be used in all NICUs in Portugal, aiming to promote the skin integrity of NBs during their hospitalization, with a particular focus on the observation and assessment of the skin condition. Through the NSCS-PT, health professionals can assess needs and adapt their practices to NBs on an individual basis. Thus, effective and equitable health care is promoted, with an efficient mobilization of resources and greater satisfaction for both the health professionals involved and the users.

As for the contributions of the present validation study, the use of the NSCS-PT scale provides longitudinal monitoring of the skin of NBs and the practices used. The instrument also makes it possible to compare different services and contexts, allowing the analysis of data resulting from direct observation of the NB, the mobilization of knowledge and the consequent adoption of evidence-based practices. Benchmarking between NICUs is favored by the use of NSCS-PT, either by comparing total scores, taking into account the characteristics of the NBs, or by comparing items.

It is essential to use the NSCS-PT as a knowledge tool about the skin profile of NBs admitted to the NICU, as this allows the standardization of care, its optimization and, consequently, the increase of its quality. Considering the skin fragility and the intensity of the procedures associated with the health-disease condition of the newborns, standardized care should be promoted, but with concern for their individuality. All this can lead to changes in NICU routines and

the implementation of targeted training programs, as well as new practices and/or their reorganization.

This assessment tool, if concisely applied by different nurses in numerous differentiated NICUs, promotes a more specific understanding of neonatal skin care from different perspectives of care. It also allows for the sharing of experiences and practices related to the NB, contexts and similar situations, which may lead to the dissemination of good practices that contribute to the improvement of nursing care. The mobilization of the NSCS-PT, in the context of care, requires knowledge and training of the entire nursing team. Therefore, establishing clear criteria for completion, to ensure a correct clinical judgment and interventions targeted to the identified needs, promoting the standardization of patients' records and greater speed in their completion, is essential.

In addition to these applications and through the use of software in a clinical context, the detailed physical examination and the consequent recording of disorders in skin assessment, with the use of a structured and validated instrument, contribute to increasing the quality of care for the NB's skin. Thus, technologies are applied to ensure adequate information and to assist in the decision-making process, which must be based on scientific knowledge and reliable and easily applicable evaluation elements.

In view of the above, some limitations found in this validation study are the reduced number of assessment items and the fact that each item has only 3 points on the measurement scale. Therefore, the need for the scale to offer greater assessment variability was perceived, which would allow individualizing and a more accurate characterization of each NB. To increase the sample size and, consequently, its quality, the study should cover a greater number of NICUs. It is also recognized that there may be some bias in the interpretation of the scale assessment chart by each participant observer, influenced by the degree of knowledge and experience of each observer. This issue was minimized by the interobserver assessment, and a small team was used. Even the terminology of the concepts used in the instrument can generate varied interpretations and different results.

In the future, it is essential to invest in the production of a single assessment instrument that addresses injury risk factors, based on existing risk scales, and the aspects that describe the skin assessment (a more comprehensive characterization of the condition of the neonatal skin should take into account its specificities and the continuous transformation observed as the NB grows). This instrument should also include data about the NB's health condition, as well as the products, devices and equipment present and the most frequent procedures that can have negative consequences on the integrity of the entire integumentary system.

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