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RESEARCH ARTICLE (ORIGINAL)

Assessment interval scale for peripheral intravenous catheters in pediatrics: A convergent care research study

Escala para determinar intervalo de avaliação dos acessos periféricos em pediatria: Estudo convergente assistencial

Escala para determinar el intervalo de evaluación del acceso periférico en pediatría: Estudio convergente assistencial

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Abstract

Background: According to the literature 58.7% to 86.7% of hospitalized patients have a peripheral venous catheter. However, the use of this device is not without complications. The management of these devices generates a significant demand for care by the nursing team.
Objective: Construct and validate a scale to determine the time interval for the evaluation of peripheral accesses using continuous infusion in pediatrics.
Methodology: Methodological, observational, prospective, quantitative and convergent assistential study.
Results: The scale was submitted to two phases for construct validation. The final sum of all scores had an agreement of 87.5%. The Linear Weighted Kappa Reliability Test showed almost perfect reliability 0.91, 0.87 and 0.88 for patient's clinical condition, vein characteristics and final score respectively. All indicators were statistically significant (p = 0.001).
Conclusion: The time interval for the evaluation of peripheral accesses in continuous infusion, considering the specificity of each patient, is possible using the Maia e Castro scale, which helps the practice of nursing care in pediatric patients.

Keywords: catheterization, peripheral; nursing care; Delphi technique; child

Resumo

Enquadramento: Segundo a literatura 58,7% a 86,7% dos pacientes hospitalizados têm um cateter venoso periférico. Contudo, a utilização desse dispositivo não é isenta de complicações. A gestão desses dispositivos gera uma necessidade significativa de cuidados pela equipa de enfermagem.
Objetivo: Construir e validar uma escala para determinar o intervalo tempo para a avaliação dos acessos periféricos em uso de infusão contínua em pediatria.
Metodologia: Estudo, metodológico, observacional, prospetivo, quantitativo e convergente assistencial.
Resultados: A escala foi submetida a duas fases para validação de constructo. A somatória final de todos os *scores* teve concordância de 87,5%. O Teste de confiabilidade de Kappa Ponderado Linear apontou confiabilidade quase perfeita 0,91, 0,87 e 0,88 para a "condição clínica do paciente", "características das veias" e a "pontuação final", respetivamente. Todos os indicadores foram estatisticamente significativos (p = 0,001).
Conclusão: O intervalo de tempo para avaliação dos acessos periféricos em infusão contínua considerando a especificidade de cada paciente é possível utilizando a Escala Maia e Castro que auxilia a prática da assistência do enfermeiro na população pediátrica.

Palavras-chave: cateterismo periférico; cuidados de enfermagem; técnica de Delfos; criança

Marco contextual: Según la bibliografía, entre el 58,7% y el 86,7% de los pacientes hospitalizados tienen un catéter venoso periférico. Sin embargo, el uso de este dispositivo no está exento de complicaciones. La gestión de estos dispositivos genera una importante necesidad de cuidados por parte del equipo de enfermería.
Objetivo: Construir y validar una escala para determinar el intervalo de tiempo para evaluar los accesos periféricos mediante infusión continua en pediatría.
Metodología: Estudio metodológico, observacional, prospectivo, cuantitativo y convergente asistencial.
Resultados: La escala se sometió a dos fases de validación de constructo. La suma final de todas las puntuaciones mostró una concordancia del 87,5%. La prueba de fiabilidad Kappa lineal ponderada indicó una fiabilidad casi perfecta de 0,91, 0,87 y 0,88 para el estado clínico del paciente, las características de las venas y la puntuación final, respectivamente. Todos los indicadores fueron estadísticamente significativos (p = 0,001).
Conclusión: El intervalo de tiempo para evaluar los accesos periféricos en infusión continua, teniendo en cuenta la especificidad de cada paciente, es posible utilizando la Escala de Maia y Castro, que ayuda a la práctica de los cuidados de enfermería en la población pediátrica.

Palabras clave: cateterismo periférico; cuidados de enfermería; técnica Delphi; niños

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Introduction

In order to enhance the quality of care and increase the chances of achieving the desired health outcomes, the Institute of Medicine in the United States recommends striving for the following patient-oriented goals: safety, efficiency, effectiveness, timeliness, equity, and patient-centeredness (Institute of Medicine, 2001; Shaller & Consulting, 2007). Nurses are expected to implement safety strategies to prevent adverse events in pediatric hospitalized patients with peripheral intravenous catheters (PIVCs) for continuous infusion of fluids with electrolytes, solutions, and/or medications. Therefore, it is crucial to assess these patients to avoid local complications, including phlebitis, thrombosis, infiltration, and extravasation of different degrees and severity (Corbett et al., 2018). Peripheral infiltration occurs when non-vesicant fluids or drugs are accidentally administered into surrounding tissues. Phlebitis is characterized by pain, erythema, heat, edema, induration, palpable vein cord, and purulent exudate. It can have a mechanical, chemical, or infectious etiology and is classified into four degrees of severity (Major & Huey, 2016; Odom et al., 2018). Extravasation is the accidental leakage of vesicant drugs into surrounding tissues. It can damage soft tissues, nerves, and tendons, causing severe inflammatory responses, edema, circulatory impairment, blistering, burning, pain, and possibly necrosis (Bitencourt et al., 2018; Braga et al., 2018). Extravasation can lead to wounds, functional impairment of limbs, and vascular damage to nerves and may require surgical intervention (Braga et al., 2018; Odom et al., 2018). The physiochemical characteristics of drugs, like their osmolarity, can increase the likelihood of local complications at the insertion site of PIVCs. Therefore, nurses must carefully select the appropriate gauge and flow rate of the PIVCs to mitigate such risks when administering solutions with a maximum osmolarity of 900 mOsm/L (Bitencourt et al., 2018; Braga et al., 2018). Modern drug infusion pumps are outfitted with pressure sensors that can detect and respond to flow blockages in PIVCs, thus limiting the amount of fluid that reaches the extravascular space (Giuliano et al., 2021; O'Grady et al., 2011). In pediatrics, PIVCs are maintained for an undetermined duration if there are no alterations at the insertion sites or signs of infection. Therefore, it is necessary to assess beforehand the characteristics of the fluid to be administered and to identify any possible local PIVC-associated complications early (Bitencourt et al., 2018; O'Grady et al., 2011). Based on the researchers' experience in healthcare units, extravasation is a cause of great concern due to the complications and difficulties associated with its treatment. Such adverse events can have physical and emotional consequences for the patient and cause distress for the family and the multidisciplinary health team. They can also have financial and legal implications and prolong hospital stays. Thus, considering the availability of validated scales for the prevention and management of PIVC-associated complications, such as phlebitis and infiltration (Gorski et al., 2021), an assessment interval scale for individual monitoring of PIVCs used for continuous infusion of drugs and/or solutions over periods greater than or equal to one hour would be of great relevance to help nurses prevent local complications such as infiltration, phlebitis, and extravasation in pediatric hospitalized patients. Hence, this study aimed to develop and validate a scale to determine the assessment intervals for pediatric patients' PIVC insertion sites during continuous infusion of drugs and/or solutions controlled by infusion pumps over periods longer than one hour to avoid local complications such as phlebitis, extravasation, and infiltration.

Background

Recent research using data from Latin America indicates that 70% of all hospitalized patients require PIVCs for various clinical reasons (Walker et al., 2023). The Infusion Nurses Society also reports that an average of 330 million PIVCs are sold annually in the United States (Gorski et al., 2021). PIVCs are the most commonly used vascular access devices due to their ease of insertion into the patient and the fact that they are considered a simple procedure compared to peripherally inserted central catheters and/or central venous catheters. Despite the lack of robust data in adult and pediatric populations, the situation is similar in Brazil, where 90% of hospitalized patients require PIVCs, with their insertion considered one of the most common interventions nurses perform (Floriano et al., 2018). Considering that PIVCs are extensively used in Brazil, in 2022, the Brazilian Health Regulatory Agency (*Agência Nacional de Vigilância Sanitária* - ANVISA) issued recommendations on safe practices for the prevention of adverse events related to PIVCs in health services (ANVISA, 2022). The expertise of nurses in inserting, manipulating, and removing such devices can impact the incidence of complications (Gorski et al., 2021). Consequently, using validated scales for assessing patients with these devices who are at higher risk of developing complications will help nurses prescribe preventive care and ensure improvements in healthcare safety, quality, and efficiency (Gorski et al., 2021). Therefore, the implementation of instruments to avert PIVC-associated complications is of great importance for clinical practice. Currently, there are scales to assess patients with difficult venous access, indicate venous access, and identify and manage complications such as phlebitis, extravasation, and infiltration. However, this study did not find any scale in the literature to prevent complications related to the use of PIVCs. Small or intubated children cannot communicate the cause of their discomfort. Despite this, PIVCs are commonly used in pediatric medicine, inserted in areas proximal to the joint, such as the antecubital fossa or the forearm area near the wrist, to deliver the prescribed infusion therapy. Hence, a scale that allows nurses to monitor patients and determine the assessment interval of PIVC insertion sites to avoid complications represents a valuable contribution to health care.

Research question

What are the assessment intervals for pediatric patients' PIVC insertion sites during continuous infusion of fluids with electrolytes and/or drugs controlled by infusion pumps over periods longer than 1 hour?

Methodology

This prospective and quantitative study applied both observational and convergent care research methodologies. From January 2008 to December 2019, searches were conducted in the bibliographic databases of the National Library of Medicine Institute (PubMed) and the Virtual Health Library (VHL) to develop a scale to be validated in this study.

The content of the scale was submitted to experts to evaluate its theoretical content and clinical applicability. The data were gathered at the Child and Adolescent Institute of the *Hospital das Clínicas* at the Faculty of Medicine of the University of São Paulo, Brazil.

To evaluate the theoretical content of the proposed instrument, twelve nurse experts were selected via the Lattes Platform (the scientific and curricular information system maintained by the Brazilian National Council for Scientific and Technological Development - CNPq), using the following inclusion criteria: homogeneity, at least 3 years of experience in pediatrics, and the title of nurse specialist, master's degree, or doctoral degree.

Eight nurse experts with experience in pediatrics and at least 2 years of direct patient care experience administered the validated instrument to 80 hospitalized patients in person. Organized into four pairs, the nurses administered the scale to 80 hospitalized patients in the pediatric surgery department, pediatric department, emergency department, and intensive care unit using a blinded method to ascertain if the experts' validated instrument accurately measured the study's proposed objectives.

The inclusion criterion for patients was to have a PIVC used for continuous infusion of drugs and/or electrolyte solutions for more than one hour, whose infusion rate was controlled by an infusion pump at the moment the study was conducted.

The sample size (80/61.5%) was calculated based on the total number of 130 operational beds, with a 95% confidence interval and 5% margin of error.

Data collection was conducted in two phases between June 2019 and December 2021.

First, a questionnaire was sent via *Google Forms* to 10 experts willing to participate in the study. The questionnaire featured sociodemographic and professional information along with the proposed scale's content to enable the experts to express their opinions on the theoretical content using a Likert scale. The Likert scale consisted of five degrees of suitability: *optimal* (5 points) – for items considered correct, highly pertinent, and without the need for any further addition; *good* (4 points) - for items considered correct and pertinent but in need of some supplementation or modification; *regular* (3 points) - for items considered partially pertinent, but in need of reasonable correction or reformulation to improve understanding; *poor* (2 points) - for items that need to be almost completely redone; and *very poor* (1 point) - for items considered to be completely inappropriate or unsuitable and that need to be redone, suppressed or removed.

The experts were selected based on the inclusion criteria: having at least 2 years of professional nursing experience, holding the title of pediatric nurse specialist, and being an active health care provider. The selected experts were briefed on the content of the validated scale to be administered to hospitalized patients with PIVCs receiving solutions or drugs via continuous infusion.

The nurses received training on the use of the scale, which includes data on patient identification, diagnosis, age, clinical aspects, PIVC information, medication specifications, and complications observed or identified at the PIVC insertion sites.

Despite evaluating the same patient, the pairs of nurses administering the instrument were instructed not to contact each other. To ensure a blind assessment, the nurses administered the instrument in the presence of one of the researchers. Once one of the nurses administered the scale, it was given to the researcher. Then, the other nurse assessed the same patient, accompanied by the same researcher, who was instructed not to answer any of the nurses' questions while the scale was being administered. All doubts were resolved after the data were statistically analyzed.

Data analysis

The acquired data was inputted into an Excel® file and uploaded, processed, and analyzed using IBM SPSS Statistics software, version 27.0, 2017. A 5% significance level was considered.

Absolute (no.) and relative (%) frequencies were used to describe the qualitative and quantitative variables. The Content Validity Index (CVI) was used to evaluate the theoretical content, measuring the proportion or percentage of agreement regarding specific aspects of the instrument and its items (Yusoff et al., 2019). A criterion of ≥ 80% was used. Additionally, the weighted Cohen's kappa test (Kottner et al., 2011) was used to assess the inter-rater reliability between the pairs of experts who administered the instrument directly to hospitalized patients. This test is used to evaluate ordinal categorical variables. According to it, agreement values from 0.81 to 1.00 are considered "almost perfect," from 0.61 to 0.80 are considered "substantial," from 0.40 to 0.60 are considered "moderate," from 0.21 to 0.40 are considered "fair," from 0 to 0.20 are considered as "none to slight," and < 0 are considered as having "no agreement" (Landis & Koch, 1977).

The study was submitted to the Ethics Committee for the Analysis of Research Projects of the institution where it was conducted and received approval under opinion number 3311.262 on February 20th, 2019. The study only commenced after receiving approval.

Results

A four-indicator scale was developed with score items to assist in selecting adequate assessment intervals for individual monitoring of PIVC insertion sites.

The instrument includes the following indicators:

1- Age: with intervals grouped every three years, it is the indicator with the most significant weight, comprising six interval variations: 1.1 Patients ≤ 3 years and older than 28 days (worth 6 points); 1.2 ≤ 6 years (worth 5 points); 1.3 ≤ 9 years (worth 4 points); 1.4 ≤ 12 years (worth 3 points); 1.5 ≤ 15 years (worth 2 points); 1.6 ≤ 18 years (worth 1 point).

2 – The Patient's Clinical Condition (acute or chronic) – including three items: 2.1 Sedated patients, invasive or non-invasive mechanical ventilation, neurological diseases, and/or cognitive and motor deficits (worth 3 points); 2.2 Inability to express pain, inability to express discomfort, reduced sensitivity in any part of the body (worth 2 points); 2.3 Alert, expresses pain, expresses discomfort, without motor, cognitive or neurological function impairment (worth 1 point).

3- Solutions and Medications – including three items: 3.1 administered via continuous infusion pump and/or concentration ≤10%, Partial Parenteral Nutrition with osmolarity ≤ 600mOsm/L, pH ≤5 or ≥9 (worth 3 points); 3.2 Solutions; medications; irritant chemotherapy; administration of electrolytes via infusion pump with administration time ≥ 1 hour; pH between 6 – 8 (worth 2 points); 3.3 Solutions; medications via continuous infusion pump; concentration ≤5%; pH between 6 - 7 (worth 1 point);

4- Characteristics of Peripheral Veins – including three items: 4.1 Small gauge; difficult to puncture; difficult to see; non-palpable vein; close to the joint; mobile (worth 3 points). 4.2 Medium gauge; easy to puncture; palpable; difficult to see; distant from the joint; mobile (worth 2 points). 4.3 Large gauge; easy to puncture; palpable; visible; distant from the joint; not mobile (worth 1 point).

The total score was based on the following parameters: Scores between 12 and 15 points indicate a very high risk of complications - nurses should assess the PIVC every half an hour and label it with the color red; Scores between 9 and 11 points indicate a high risk of complications - nurses should assess the PIVC every hour and label it with the color orange; Scores between 6 and 8 points indicate a medium risk of complications - nurses should assess the PIVC every three hours and label it with the color yellow; Score ≤ 5 points indicate a low risk of complications - nurses should assess the PIVC every four hours and label it with the color green.

It is worth noting that the level of agreement regarding the percentages of "optimal" and "good" scores was determined by the confidence interval ≥ 80%, without the need to restructure the item but with the analysis of the experts' suggestions. The data underwent a preliminary Delphi phase from June 2019 to February 2020. The instrument was evaluated by eight experts: seven women (87.5%) and one man (12.5%), four (50%) between 40 - 50 years old, two (25%) between 50 - 60 years old, and two (25%) between 30 - 40 years old. Seven experts (87.5%) worked in public institutions, and one (12.5%) in a private institution. Their qualifications were as follows: two had the title of nurse specialist (25%), four had a master's degree (50%), and two had a doctoral degree (25%). Five had graduated 11 - 20 years ago (62.5%), two had graduated 21 - 30 years ago (25%), and one nurse had graduated 1 - 10 years ago (12.5%). Six experts had professional experience in intensive care (75%), one had professional experience in the emergency department (12.5%), and one had professional experience in continuing education (12.5%). As such, they were considered to be nurses with extensive experience and knowledge in pediatric care and the training and updating of health professionals working in the field. All had experience in pediatric nursing.

The "Age" of the patients, being the first indicator, carried the most weight on the scale. It was divided into six intervals and achieved a 100% level of agreement on all items. The second indicator, concerning "The Patient's Clinical Condition," showed that item 2.1 was considered *optimal* by all eight experts, with no suggestions. As for item 2.2, 62.5% (5) of the experts rated it as *optimal*, while the remaining 37.5% (3) rated it as *good*. The experts suggested substituting "express" for "verbalize" and adding the phrase "inconsolable crying," both of which were accepted and integrated into the scale.

Item 2.3 received an *optimal* rating from 75% (6) of the experts and a *good* rating from 25% (2). These items achieved a 100% level of agreement and thus required no restructuring. In the third indicator, "Solutions and Medications," item 3.1 was rated *optimal* by 50% (4) of the experts, *good* by 12.5% (1), *regular* by 25% (2), and *very poor* by 12.5% (1). This item achieved 62.5% of the experts' agreement and had to be restructured to reach a minimum of 80% agreement. The recommendations included adding vesicant chemotherapy, blood components, vasoactive drugs, replacing osmolarity of ≥ 900 mOsm/L with osmolarity of ≥ 600 mOsm/L, and changing the pH value from ≤ 4 to ≤ 5. Out of the experts, 62.5% (5) rated item 3.2 as *optimal*, while 12.5% (1) rated it as *good*, 12.5% (1) rated it as *regular*, and 12.5% (1) rated it as *very poor*. Consequently, this item achieved a 73% level of agreement from the experts but had to be restructured to reach an 80% level of agreement. The experts suggested changing the fluid and solution concentration from ≥ 12.5% to ≤ 10% and giving it a score of 3 (the highest), equal to the score of "Partial Parenteral Nutrition." Item 3.3 received an "optimal" rating from 62.5% (5) of the experts and a "good" rating from 37.5% (3), resulting in a 100% level of agreement without requiring any restructuring.

Suggestions were made to remove partial parenteral nutrition from score 2 and leave it only in score 3, which were accepted after the researchers' analysis.

Regarding the "Characteristics of Peripheral Veins" indicator, item 4.1 received an *optimal* rating from 62.5% (5) of the experts, *good* from 25% (2), and *very poor* from 12.5% (1). This item received a favorable rating of 87.5% (7), indicating that no restructuring was required. The

experts made no recommendations. Item 4.2 received an *optimal* rating from 75% (6) of the experts, a *good* rating from 12.5% (1), and a *very poor* rating from 12.5% (1). Item 4.3 received an *optimal* rating from 87.5% (7) of the experts, indicating a good level of agreement, with only one expert rating it as *very poor* (12.5%). In addition, no suggestions were provided for this item.

During the second round of the Delphi study, the eight experts were informed about the changes made to the instrument. Data collection occurred between July 2020 and September 2021. The terms *acute* and *chronic* were removed from the "The Patient's Clinical Condition" indicator as they were deemed unnecessary when evaluating the PIVC insertion sites. Item 2.1 received an *optimal* score from 62.5% (5) of the experts and a *good* score from 37.5% (3), resulting in a 100% level of agreement. Item 2.2 was rated as *optimal* by 87.5% (7) of the experts and *good* by 12.5% (1), achieving 100% level of agreement. Item 2.3 was rated *optimal* by 75% (6) of the experts and *good* by 25% (2), also resulting in a 100% level of agreement. The "Solutions and Medications" indicator achieved a 100% level of agreement on items 3.1 and 3.2, as they were both rated *optimal* by 87.5% (7) of the experts and *good* by 12.5% (1). Item 3.3 received an *optimal* rating from 75% (6) of experts, while 12.5% (1) rated it *good* and another 12.5% (1) rated it as "regular." The "Characteristics of Peripheral Veins" indicator received an *optimal* rating from 75% (6) of the experts and a *good* rating from 25% (2). Furthermore, items 4.1, 4.2, and 4.3 reached a 100% level of agreement among the experts.

The experts' proposals to modify the scale's Final Score, which is the sum of all items in the indicators, and to determine the degree of risk of complications at the PIVC insertion sites were accepted.

The assessment intervals are determined by the Final Score, with an assessment every four hours if the sum of the points is ≤ 5 (low risk), an assessment every three hours if the score is between 6 and 8 points (medium risk), an assessment every hour if the score is between 9 and 11 points (high risk), and an assessment every thirty minutes if the score is between 12 and 15 points (very high risk).

The proposed instrument's theoretical content achieved a level of agreement of over 80% on all items. Thus, the Delphi phases regarding the agreement on the theoretical content of the proposed instrument for assessing PIVC insertion sites were completed.

The team decided to use color-coded labels to indicate the degree of risk of complications at the PIVC insertion sites. The assigned colors are green for low risk, yellow for medium risk, orange for high risk, and red for very high risk. Identifying patients with color labels after assessing them with the scale will assist the health team in monitoring patients and providing better care. The four pairs of nurse experts administered the validated scale from September 2021 to July 2022. After receiving the appropriate training, the experts administered the scale to 80 hospitalized pediatric patients with PIVCs for continuous infusion of solutions and/or medications. The results are presented in Table 1.

Table 1

Inter-rater reliability, confidence interval, agreement, and p-value for the indicators The Patient's Clinical Condition, Solutions and Medications, Characteristics of Peripheral Veins, and Final Score

Indicators	Weighted Cohen's Kappa	95% CI	Agreement	*p*-value
The Patient's Clinical Condition	0.917	0.842 e 0.992	87%	$p < 0.001$
Solutions and Medication	0.605	0.322 e 0.887	92%	$p < 0.001$
Characteristics of Peripheral Veins	0.879	0.797 e 0.960	90%	$p < 0.001$
Final Score	0.889	0.822 e 0.957	87.5%	$p < 0.001$

Note. M = Mean; *SD* = Standard Deviation. CI = Confidence Interval.

After being assessed by experts, the scale (Figure 1) was validated regarding its theoretical content and clinical applicability.

Designated as the Maia and Castro Scale, the present study developed this instrument to determine the assessment intervals for pediatric patients' PIVC insertion sites during continuous infusion of fluids with electrolytes and/or drugs controlled by infusion pumps over periods longer than 1 hour.

Figure 1

Maia and Castro Scale. To determine the frequency of evaluation of peripheral vascular accesses in pediatrics using continuous infusion and administration of drugs and/or solutions ≥ 1h in Pediatrics

Score one of the following items		
Age	≤ 3 years and older than 28 days	6
	≤ 6 years	5
	≤ 9 years	4
	≤ 12 years	3
	≤ 15 years	2
	≤ 18 years	1
Score one of the following items		
The Patient's Clinical conditions	Sedated patients; invasive or non-invasive mechanical ventilation; neurological diseases and/or cognitive and motor deficits	3
	Inability to verbalize pain; inability to verbalize discomfort; reduced sensitivity in any part of the body; inconsolable crying	2
	Alert; verbalizes pain; verbalizes discomfort; without motor, cognitive or neurological function impairment	1
Score one of the following items.		
Solutions and Medications	Medications; vesicant chemotherapy; blood component; vasoactive medications; Partial Parenteral Nutrition; concentration ≤ 10%; osmolarity ≤ 600 mOsm/L, pH ≤ 5 and/or ≥ 9	3
	Solutions; medications; irritant chemotherapy; administration of electrolytes via infusion pump with administration time ≥ 1 hour; pH between 6 - 8	2
	Solutions; medications via continuous infusion pump; concentration ≤5%; pH between 6 - 7	1
Score one of the following items.		
Characteristics of Peripheral Veins	Small gauge; difficult to puncture; difficult to see; non-palpable vein; close to the joint; mobile	3
	Medium gauge; easy to puncture; palpable; difficult to see; distant from the joint; mobile	2
	Large gauge; easy to puncture; palpable; visible; distant from the joint; not mobile	1
Score		
12 - 15 Assess every 30 min. **Very high risk**	9 - 11 Assess every 1 hour. **High risk**	6 - 8 Assess every 3 hours. **Medium risk**	≤5 Assess every 4 hours. **Low risk**
🔴	🟡	🟡	🟢
Identify the venous access with the color of the assessment interval score		

Discussion

Health professionals in hospital settings are becoming increasingly aware that PIVCs are more than a simple device for providing therapy to vulnerable patients who require intravenous medication. There are risks associated with their use, and proper management of these devices is crucial to prevent harm and ensure the safety of healthcare services for pediatric patients. Preventing complications associated with PIVCs for continuous infusion is essential for the safety of hospitalized pediatric patients (ANVISA, 2022). According to guidelines established by the Brazilian Health Regulatory Agency, patients of any age under intensive care, sedated, or suffering from cognitive impairment should be assessed every hour or every two hours. In pediatric patients, this assessment should occur at least twice per shift and once per shift in hospitalized patients.

This scale provides guidelines for nurses' assessment intervals of PIVC insertion sites used for continuous infusion and/or the administration of solutions controlled by infusion pumps for periods exceeding one hour in order to prevent complications associated with the use of these devices, such as infiltration, extravasation, and phlebitis. The National Health Service (NHS) in the United Kingdom reported 444 claims for injuries resulting from ex-

travasation between 2011 and 2021, amounting to a cost of approximately £15.6 million. Pediatrics and oncology accounted for over half of the claims, with 23% and 19%, respectively (Suarez, 2023). Thus, as the Maia and Castro Scale is designed to prevent complications resulting from intravenous therapy, it will contribute to enhancing patient safety and care experience in Brazilian institutions. Furthermore, it will also have an indirect impact on healthcare costs.

A limitation of this study was the nurses' availability for data collection. Each nurse expert required more time than expected to return the questionnaire with their suggestions, which delayed the completion of the study. Additionally, the study had to wait for patients who met the inclusion criteria to administer the instrument.

Conclusion

The Maia and Castro Scale can be used to customize the assessment intervals of PIVCs for continuous infusion, considering the individual characteristics of each patient. This includes age, clinical condition, medications, and veins. By identifying the risk of complications such as phlebitis, infiltration, and extravasation, this validated scale is particularly useful in identifying the risk of PIVC-associated complications in children. Improving the care quality and safety of pediatric patients with PIVCs is highly significant, given the impact PIVC-associated complications can have on the lives of children and their families.

Author contributions

Conceptualization: Castro, A. R., Costa, A. A.
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