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ORIGINAL ARTICLE

Experiences and outcomes of peripherally inserted central venous catheters in complex surgical cases at a tertiary referral hospital in Peru

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ABSTRACT

Objective: To describe the experience of interventional procedures using peripherally inserted central venous catheters in pediatric patients at the Instituto Nacional de Salud del Niño San Borja (INSNSB).
Methodology: A retrospective cross-sectional descriptive study was conducted on 54 patients with central venous catheters inserted between January and December 2022. The study encompassed parameters such as age, sex, diagnosis, indications for catheter use, duration of the insertion procedure, catheter dwell time, complications, catheter diameter used, insertion site, catheter indication, and reasons for withdrawal.
Results: Out of the 54 patients with central venous catheters, 80.30 % were in the early childhood group, and 57.40 % were women. The majority of insertions occurred in the Pediatric Surgical Hospitalization Service (29.60 %). The most common diagnosis was digestive surgical diseases (27.78 %), and the main reason for catheter insertion was continuous treatment for more than 7 days (68.52 %). The basilic vein was most frequently used for insertion (48.15 %), with an average procedure time of 92.5 minutes. 72.20 % of patients were sedated during insertion, and 77.80 % experienced no complications during the procedure. However, 51.90 % developed subsequent complications, with the average catheter dwell time being 15 days. The primary reason for catheter withdrawal was complications (53.70 %), followed by medical discharge (22.20 %).
Conclusions: The study highlights the importance of maintaining peripherally inserted central venous catheters to extend their duration in pediatric patients at INSNSB. We recommend the implementation of more comprehensive epidemiological studies to identify associations and risk factors linked to the maintenance of PICCs in pediatric patients in Peru.

Keywords: Catheterization, Peripheral; Catheters; Nursing, Team; Pediatrics (Source: MeSH)

Experiencias y resultados de procedimientos de intervención en el uso del catéter venoso central de inserción periférica en un hospital terciario de cirugías complejas del Perú

RESUMEN

Objetivo: Describir las características de pacientes pediátricos sujetos a la colocación de catéter venoso central de inserción periférica en el Instituto Nacional de Salud del Niño San Borja (INSNSB).
Metodología: Se realizó un estudio descriptivo transversal retrospectivo, en 54 pacientes con catéter venoso central insertados, durante el periodo de enero a diciembre de 2022. Se incluyó edad, sexo, diagnóstico, indicaciones para el uso del catéter, la duración del procedimiento de inserción, el tiempo de permanencia del catéter, las complicaciones, el diámetro del catéter utilizado, el sitio de inserción, la indicación del catéter y el motivo de retiro.
Resultados: De 54 pacientes con catéter venoso central, se encontró que el 80.30 % pertenecían al grupo de primera infancia y el 57.40 % fueron mujeres. La mayoría de las inserciones ocurrieron en el Servicio de Hospitalización de Cirugía Pediátrica (29.60 %). El diagnóstico más común fue enfermedades quirúrgicas digestivas (27.78 %), y la principal razón para la inserción del catéter fue un tratamiento continuado de más de 7 días (68.52 %). La vena basílica fue la más utilizada para la inserción (48.15 %), con un

tiempo promedio de procedimiento de 92.5 minutos. El 72.20 % de los pacientes fueron sedados durante la inserción y el 77.80 % no presentó complicaciones durante el procedimiento (inmediatas). Sin embargo, el 51.90 % presentó complicaciones posteriores (tardías), y el tiempo promedio de permanencia del catéter fue de 15 días. El motivo principal de retiro fue por las complicaciones posteriores (53.70 %), seguido por alta médica (22.20 %).

Conclusiones: El estudio resalta la importancia del mantenimiento de catéteres venosos centrales de inserción periférica para prolongar su duración en pacientes pediátricos del INSNSB. Sugerimos el desarrollo de estudios con mayor robustez epidemiológica, que permitan determinar asociaciones y factores de riesgo asociados con el mantenimiento de PICC en pacientes pediátricos en el Perú.

Palabras claves: Cateterismo Periférico; Catéteres; Grupo de Enfermería; Pediatría (Fuente: DeCS)

INTRODUCTION

Peripherally inserted central venous catheters (PICC) are an important tool in administering prolonged intravenous therapies, especially in pediatric patients. When inserted peripherally with their distal end in the superior or inferior vena cava, these devices offer the advantage of remaining in place for extended periods, provided they receive adequate care and maintenance (1).

Worldwide, evidence supports the importance of establishing protocols for inserting and maintaining PICCs. The optimization of results, translated into improved technique and longer duration of safe venous access, has been an outstanding result of such protocols (2). However, research on using these catheters in pediatrics is still limited in Peru. A study at the Instituto Nacional de Salud del Niño-Breña during 2017-2021 reported a remarkable decrease in complications thanks to the care applied during the procedure and PICC maintenance (3). In addition, another study in a public hospital in Callao between 2010 and 2015 reported a low rate of complications during insertion and maintenance, highlighting the experience of the nursing team involved (4).

The importance of a nursing team trained in PICC insertion and maintenance has been reported, as they avoid complications during and after the procedure (5,6). Therefore, the study aimed to describe the intervention of the use of peripherally inserted central venous catheters by a nursing team at the Instituto Nacional de Salud del Niño - San Borja (INSNSB) from January to December 2022.

MATERIALS AND METHODS

Study design

This is a cross-sectional observational study with retrospective data collection. Data were collected from nursing records of the hospitalization areas of the Instituto Nacional de Salud del Niño de San Borja of patients attended between January and December 2022.

Population and sample

The study included 54 patients who were hospitalized at the Instituto Nacional de Salud del Niño San Borja and had records indicating the placement of one or more PICC lines using the modified Seldinger technique. As the study encompassed the entire population, there was no need to calculate the sample size.

Study variables

The study encompassed parameters such as age, sex, diagnosis, indications for catheter use, duration of the insertion procedure, catheter dwell time, complications, catheter diameter used, insertion site, catheter indication, and reasons for withdrawal. It is worth mentioning that all PICC line-related data were entered into the database in a timely manner while the patients were in the hospital. The time of the PICC insertion procedure was recorded from patient preparation in the procedure room (either in the patient's room or in a specialized unit) to catheter fixation.

Procedure

Data on patients with one or more PICC lines were collected from the services of the Instituto Nacional de Salud del Niño San Borja, a specialized high-complexity hospital center that provides care to patients referred from various areas of Peru. These services included Cardiology Hospitalization, Hematology Hospitalization, Pediatric Surgery Hospitalization, Neurosurgery Hospitalization, Pediatric Specialties Hospitalization, Surgical Specialties Hospitalization, Burn Hospitalization and Transplant Hospitalization.

Statistical analysis

For data analysis, univariate descriptive measures appropriate to the nature of the variables were used. In the case of quantitative variables, measures of central tendency and dispersion were applied, considering compliance with the assumptions about their distribution. For qualitative variables, tables were constructed to present absolute frequencies and relative frequencies in percentages. Data processing and analysis were carried out using the SPSS v25 statistical package.

RESULTS

This study analyzed data from 54 patients with one or more inserted venous catheters. It was observed that 80.30 % of these patients belonged to the early childhood age group (3 to 5 years old), followed by infancy (6 to 11 years old) and adolescence (12 to 18 years old). Additionally, 57.40 % were female and 42.60 % were male. Similarly, the highest number of insertions was performed in the pediatric surgery hospitalization service, accounting for 29.60 % (Table 1).

Regarding the initial assessment of the procedure, the most frequent diagnosis was related to digestive surgical diseases in 27.78 %. The main reason for catheter placement was the need for continuous treatment for more than seven days,

Table 1. Characteristics of hospitalized patients with peripherally inserted central venous catheters

Characteristics	n=54	%
Age		
Early childhood	45	83.3
Childhood	5	9.3
Adolescence	4	7.4
Sex		
Female	31	57.4
Male	23	42.6
Weight		
Median (IQR)	8	4.6–14.4
Service		
Pediatric Surgery	16	29.6
Neurosurgery	11	20.4
Pediatric Specialties	9	16.7
Burnt	5	9.3
Trasplant	5	9.3
Emergency	3	5.6
Cardiology	3	5.6
Surgical Specialties	1	1.9
Hematology	1	0.9

***IQR**: interquartile range*

Table 2. Initial assessment prior to placement of peripherally inserted central venous catheters

	n=54	%
Initial diagnosis		
Digestive surgical diseases	15	27.78
Infectious diseases	14	25.93
Neurological diseases	8	14.81
Neoplastic diseases	6	11.11
Malnutrition	6	11.11
Cardiovascular diseases	2	3.7
Respiratory diseases	2	3.7
Epidermolysis bullosa	1	1.85
PICC indication		
Treatment over 7 days	37	68.52
TPN	11	20.37
Palliative	4	7.41
DIVA	1	1.85
TPN and major treatment 7 days	1	1.85
Palliative		
Yes	4	7.4
No	50	92.6
PICC diameter		
Less or equal to 2	33	61.1
Greater than 2	21	38.9

***PICC**: : Peripherally inserted central venous catheters; **TPN**: Total parenteral nutrition; **DIVA**: Difficult venous access.*

comprising 68.52 % of the indications, followed by 20.37 % of the cases in which parenteral nutrition was required. It is important to note that 7.41 % of the patients required the catheter for palliative purposes. In most cases, a catheter with a diameter of 2 Fr was chosen, which represented 61.10 % of the choices (Table 2).

As for the insertion procedure, it was observed that the basilic vein was the most chosen, with 48.15 %, followed by 16.67 % in the middle vein and 14.81 % in the axillary vein. The interquartile range of the procedure time is 92.5 minutes. Of the catheters, 42.60 % were placed on the third venipuncture attempt, and 24.10 % were placed on the first venipuncture. The 72.20 % were sedated for the insertion; it is also detailed that 77.80 % did not present complications during the insertion of the catheter. However, 51.90 % did present complications after the procedure, being the interquartile range of the catheter permanence time of 15 days. Finally, the highest percentage of reasons for catheter removal was due to complications (53.70 %), followed by the patient's medical discharge conditions (22.20 %) (Table 3).

DISCUSSION

The insertion of PICCs in pediatric patients represents a crucial aspect of pediatric nursing, especially in hospital settings such as INSNSB. These devices offer a safe and effective route for administering vesicant and irritant drugs, which is essential to understanding and improving insertion and handling procedures (1,2). The study described in detail the intervention of PICC use performed by an INSNSB nursing team, which is essential to understanding current practices and improving the quality of care for pediatric patients. A total of 54 patients hospitalized at the INSN-SB were evaluated, of which the female sex predominated over the male. The main reason for the placement of a PICC line was the need for treatments lasting more than seven days, followed by the need for total parenteral nutrition (TPN) and palliative patients. Regarding the choice of vein for PICC insertion, the basilic was the most selected, with a median insertion time of 92.5 minutes. Our results are similar to the study by Fajuri *et al. (1)*, where prolonged antibiotic therapy was the main indication for PICC installation and the most frequently used venous access was in the upper extremities with 52.2 %.

The results obtained in our study align with those reported by Rossi *et al.* (2), who found that protocolizing the PICC line insertion procedure resulted in longer catheter duration during the post-protocolization period compared to the pre-protocolization period. Additionally, they noted a rise in the rate of catheter removal due to treatment completion in the post-protocolization period, indicating an enhancement in catheter management (7). Conversely, Yu *et al.*'s study identified younger age and smaller PICC line diameter as risk factors for complications, underscoring the significance of age and catheter size considerations in PICC insertion planning (8).

Table 3. Distribution of data on insertion, maintenance and removal of inserted catheters

Characteristics	n=54	%
Chosen vein		
Basilic vein	26	48.15
Middle vein	9	16.67
Axillary vein	8	14.81
Cephalic vein	4	7.41
Jugular Vein	3	5.56
Saphenous vein	2	3.7
Dorsum of the hand veins	1	1.85
Pericranial veins	1	1.85
Procedure time		
Median (IQR)	92.5	80.0 -120.0
Number of venipunctures		
1	13	24.1
2	18	33.3
3	23	42.6
Sedation		
Yes	39	72.2
No	15	27.8
Complications during the procedure		
Yes	12	22.2
No	42	77.8
Length of permanence PICC		
Median (IQR)	15	7.0-21.0
Complications after the procedure		
Yes	29	53.7
No	25	46.3
Reason for withdrawal		
Discharge	12	22.2
End of treatment	8	14.8
Complications	29	53.7
Death	5	9.3

***n** (%); **Median**; **Interquartile Range** (IQR)*

Source: Own elaboration

Our study also underscores the importance of sedation and the comprehensive management of pharmacological and non-pharmacological pain and distress in pediatric patients undergoing painful procedures. Accordingly, 72.20 % of our study population required pharmacological sedation, in contrast to the approach taken by Trottier *et al.* (9), who utilized topical agents such as EMLA and aerosols like nitrous oxide, achieving effective pain management results. Our study's median catheter dwell time aligns with expectations and common clinical practice. This is similar to the study of Badheka *et al.* (10) where they had a median dwell time of 17.7 days. However, the reasons for removal due to complications were high with 53.70 % mainly due to occlusion and accidental removal, which highlights the importance of care and management to improve the duration of the device in patients. Occlusion is a frequent problem associated with withdrawal, although infections have also been reported relatively frequently (1). Likewise, the study by Rossi *et al.* (2) shows that the implementation of adequate protocols significantly reduces the occurrence of these complications.

The study contributes to the knowledge of PICC insertion in pediatric patients. Maintenance is a critical factor that impacts the duration of these devices, so nursing care is extremely important in their maintenance (7,8,11). Despite the relevance of the results, we suggest developing studies with greater epidemiological robustness to determine associations and risk factors associated with PICC maintenance in pediatric patients in Peru.

Authors' contribution

Conceptualization: MCM; data collection, management and curation: LMC, ELB, JCG, YLG, LAG, YRB, RBC, TAL, GVY; data analysis: MCM, LMC, ELB, JCG, YLG, LAG; drafting of original version: MCM, LMC, JCG; interpretation of results: ELB, JCG, YLG, LAG, YRB, RBC, TAL, GVY; drafting and revising of final version: MCM, LMC.

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Ethical Aspects

The study was approved by the Institutional Research Ethics Committee (CIEI) of the INSN-SB. Information retrieved from databases stored in the hospitalization area's repositories was utilized; therefore, informed consent and/or assent were not deemed necessary. The data collected for this study were stored in the REDCap Institutional Data Repository, employing specific codes generated for this project, which were not linked to patient identification.

Conflicts of interest

The authors have no conflicts of interest associated with the material presented in the manuscript.

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