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Cateter central de inserção periférica em neonato: revisão integrativa da literatura

Central catheter of peripherally insertion in neonates: integrative literature review

Catéter central de inserción periférica en el neonato: revision integrativa de la literatura

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ABSTRACT

Objective: To evaluate the evidence published on the practices of the use of Peripheral Inserted Central Venous Catheter (PICC) in newborns. **Method:** Integrative review researching the databases LILACS, MEDLINE, and COCHRANE, from 2008 to 2012. **Results:** Forty one articles were selected and ranked by evidence level: 4.9% level one; 9.8% level two; 31.7% level three; 34.2% level four; 17% level five; and 2.4% level six. These articles were grouped into the categories: general complications; blood flow infection related to catheter; utilization description and insertion of practices and maintenance. **Conclusion:** The evidence highlighted the importance of the permanent education for the insertion, maintenance and application of new technologies, in order to

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minimize the unwanted effects of the use of PICC. It was noted that there is a lack of national production of studies that showed strong evidence levels.

Descriptors: Central Venous Catheterization, Newborn, Neonatal Intensive Care Unit, Neonatal Nursing.

RESUMO

Objetivo: Avaliar as evidências publicadas acerca das práticas no uso do Cateter Venoso Central de Inserção periférica (PICC) em Recém-Nascido. **Método:** Revisão integrativa que pesquisou as bases de dados LILACS, MEDLINE e COCHRANE nos anos de 2008 a 2012. **Resultados:** Selecionaram-se 41 artigos, os quais foram classificados, em nível de evidência, 4,9% nível um, 9,8% nível dois, 31,7% nível três, 34,2% nível quatro, 17% nível cinco, 2,4% nível seis. Foram agrupados nas categorias: complicações gerais, infecção de corrente sanguínea relacionada ao cateter, descrição da utilização e práticas de inserção e manutenção. **Conclusão:** As evidências ressaltaram a importância da educação permanente para inserção, manutenção e aplicação de novas tecnologias para minimizar os efeitos indesejados do uso do PICC. Observou-se escassez de produção nacional de estudos que retratem fortes níveis de evidências.

Descritores: Cateterismo venoso central, Recém-nascido, Unidades de Terapia Intensiva Neonatal, Enfermagem Neonatal.

RESÚMEN

Objetivo: Evaluar las evidencias publicadas acerca de las prácticas del uso del Catéter Venoso Central de Inserción Periférica (PICC) en Recién Nascidos. **Método:** Revisión integrativa que investigó las bases de datos LILACS, MEDLINE y COCHRANE en los años de 2008 a 2012. **Resultados:** Se seleccionaron 41 artículos, que fueran clasificados, en nivel de evidencia, 4.9% nivel uno, 9.8% nivel dos, 31.7% nivel tres, 34.2% nivel cuatro, 17% nivel cinco, y uno 2.4% nivel seis. Fueran agrupados en las categorías: complicaciones generales, infección de corriente sanguíneo relacionada al catéter, descripción de la utilización y de las prácticas de inserción y mantenimiento. **Conclusión:** Las evidencias resaltarán la importancia de la educación permanente para la inserción, mantenimiento y aplicación de nuevas tecnologías para minimizar los efectos indeseados del uso del PICC. Fue observado la escasez de producción nacional de estudios que retraten fuertes niveles de evidencias.

Descritores: Cateterismo venoso central, Recién Nacido, Unidades de Terapia Intensiva Neonatal, Enfermería Neonatal.

INTRODUCTION

Scientific and technological advances are increasing in the area of neonatology, as well as assistance in the Neonatal Intensive Care Unit (NICU), which contribute to a significant increase in the survival rate of newborn preterm and low-weight, changing the newborn mortality profile.¹

In nursing care of neonatology, they highlight the need for safe and durable venous access for administration of antibiotics, intravenous hydration, parenteral nutrition, vasoactive drugs and others.²⁻³

Currently an alternative widely used in a stable and effective venous access for newborns critically ill in NICUs is Central Catheter of Peripheral Insertion (PICC), so that the catheter is long and flexible, inserted through a peripheral vein, it progresses to the distal third of the cava vena – superior or inferior, thus gaining access for the central venous.⁴⁻⁷

However, the use of this device is associated with some complications that can occur during insertion, maintenance and removal, but often less frequent than other catheters of central location.⁸⁻¹⁰

Despite its benefits, the use of PICC is a complex process that requires technical and scientific knowledge specific to their insertion and maintenance, requiring skilled professionals and employing safe procedures and technologies to minimize side effects while using this device.¹¹⁻²

Professionals responsible for the appointment, insertion and maintenance of PICC must provide special care related to technical and technologies that promote success in catheter insertion, perform the appropriate management of pain control, use methods of visualization and optimal positioning of the catheter tip, take measures to avoid the main complications and prevention of infection related to catheter.¹³⁻⁵

To accompany these developments and encourage improvements in the quality of care provided to the differentiated clientele, it is important a reflective practice based on scientific knowledge, as evidence-based practice, which seeks to find in search results the main ideals and efficient conduct of a problem established through the organization of consistent and relevant evidence.¹⁶

Before the above, this review aims to assess the available evidence about the practices in the use of PICC in newborns and its implications, as the production of scientific knowledge about this practice can contribute to the development and incorporation of strategies for patient safety and quality of care to high-risk newborns that contribute to the reduction of neonatal mortality.

METHODS

This is an integrative review of the literature, considered as a research method that enables the search, critical evaluation and synthesis of the state of knowledge about a particular topic or issue in a systematic and orderly manner, and point to the implications in the professional practice and gaps in the scientific production that need to be filled with the realization of new studies.¹⁷

For the realization of this integrative review, the steps proposed by Ganong were as follows: (1) issue identification and selection guiding question; (2) literature search with the establishment of criteria for inclusion and exclusion of studies; (3) data collection with defining the information to be extracted from selected studies and categorization of studies; (4) Critical analysis of the included studies; (5)

interpretation and discussion of results and (6) presentation of the review/synthesis of knowledge.¹⁷

It was established the following question: what are the published evidence about the practices in the use of PICC in newborns and its implications?

A search of the scientific literature according to the following inclusion criteria was performed: productions in Portuguese, English or Spanish, included from January 2008 to December 2012, available in the databases Latin American and Caribbean Sciences Health (LILACS), Medical Literature Analysis and Retrieval System online (Medline) and Cochrane Library (Cochrane).

For electronic search, the following descriptors were used in Health Sciences (DeCS), "central venous catheterization," "peripheral catheterization" and "newborn".

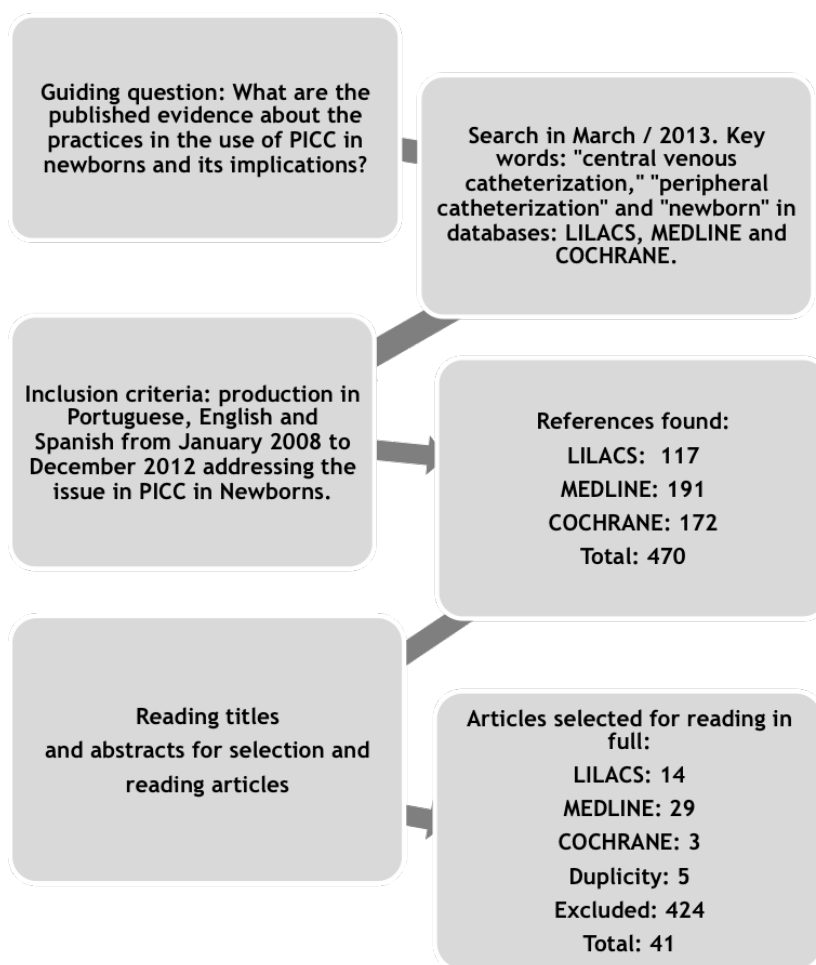
The data were organized as item identification, institution of study, type of publication, features and methodological rigor.

To determine the level of evidence, the following hierarchy proposal of evidence was used:¹⁸

- Level 1: evidence from meta-analysis of multiple controlled and randomized clinical trials;
- Level 2: evidence from individual studies with experimental design;
- Level 3: evidence of quasi-experimental studies, such as studies without randomization with one group pre and post-test, time series or case control;
- Level 4: evidence from descriptive studies (non-experimental) or qualitative approach;
- Level 5: evidence from case reports or experience;
- Level 6: evidence based on expert opinions.

The figure 1 shows the flowchart of the sample selection of the studies included in the integrative review.

Figure 1 - Flowchart of the sample selection of the studies included in the Integrative Review - March/2013 (RANGEL, CASTRO, PRIMO, 2013)



RESULTS AND DISCUSSION

They found 470 articles (117 LILACS 191 MEDLINE and COCHRANE 172), being excluded 424 which did not meet the inclusion criteria and included 46 articles. From these, 5 had up in duplicate, for a total of 41 final sample articles.

After exhaustive reading of the 41 items selected in the final sample, we elaborated the themes: insertion practices and maintenance of PICC (18 articles), description of the use of PICC (07 articles), general complications of PICC (09 articles) and bloodstream infection related to catheter (07 articles).

We conducted a synthesis of articles about the category, authorship, journal, country, language, year and level of evidence, presented in Figure 2.

Among the articles selected, 29.3% were published in Brazilian journals in Portuguese, 24.4% in US journals in English, 46.3% in international journals of different countries, as Turkey, India, England, Taiwan, Japan, the Netherlands, and all in English. There was 20% publications in 2012; 22.5% in 2011; 27.3% in 2010; 7.7% in 2009; and 22.5% in 2008.

As for the level of evidence, 4.9% had level one, level two 9.8%, 31.7% level three, level four 34.2%, 17% level five, and 2.4% level six. The highlight was the strongest level of evidence (1, 2 and 3) in international studies, still incipient in national, which were predominantly descriptive.

Considering the importance of strong evidence for the practice, there was the synthesis of evidence items 1, 2 and 3, which are shown in Figures 3, 4 and 5, respectively, as written, study type, action, outcomes, and conclusions.

Figure 2 - Summary of articles about the category (Cat), authorship, journal, country, language, year and level of evidence (LE). USA: The United States of America. Vitória 2013 (RANGEL, CASTRO, PRIMO, AMORIM, CHRISTOFFEL, ZANDONADE, 2013)

Cat	Author	Journal	Country	Country	Year	LE
PRACTICES OF INSERTION AND MAINTENANCE	Sartoli et al ¹⁹	Nursing (São Paulo)	Brazil	Brazil	2012	4
	Jain et al ²⁰	Am J Perinatol	USA	USA	2012	3
	Johann et al ²¹	Rev Esc Enferm USP	Brazil	Brazil	2012	5
	Marcatto et al ²²	Arch Dis Child Fetal Neonatal	Brazil	Brazil	2011	2
	Taylor et al ²³	Adv Neonatal Care	USA	USA	2011	3
	Fidler et al ²⁴	Adv Neonatal Care	USA	USA	2011	1
	Uygun et al ²⁵	Acta Cir. Bras	Turkey	Turkey	2011	3
	Uslu et al ²⁶	J Perinatol	Turkey	Turkey	2010	2
	Johann et al ²⁷	REME rev. min.	Brazil	Brazil	2010	4
	Sharpe et al ²⁸	Adv Neonatal Care	USA	USA	2010	5
	Corzine et al ²⁹	Neonatal Netw	USA	USA	2010	5
	Monskly et al ³⁰	J Vasc Access	USA	USA	2010	4
	Sneath et al ³¹	Neonatal Netw	USA	USA	2010	5
	Ragavan et al ⁷	Indian J Pediatr	India	India	2010	3
	Smirk et al ³²	Arch Dis Child Fetal Neonatal	Australia	Australia	2009	2
Lago et al ³³	Paediatr Anaesth	Italy	Italy	2008	2	
Shah et al ³⁴	Cochrane Database Syst Rev	Canada	Canada	2008	1	
Chaves et al ³⁵	Nursing (São Paulo);	Brazil	Brazil	2008	6	
GENERAL COMPLICATIONS	Costa et al ¹²	Rev. Gaúcha Enferm	Brazil	Brazil	2012	4
	Kalkra et al ³⁶	J Vasc Access	England	England	2012	5
	Tosello et al ³⁷	J Pediatr Surg	France	France	2011	5
	Tsai et al ³⁸	Infect Control Hosp Epidemiol	Taiwan	Taiwan	2011	3
	Bulbul et al ³⁹	J Matern Fetal Neonatal	Turkey	Turkey	2010	4
	Wolfe et al ⁴⁰	Adv Neonatal Care	USA	USA	2010	5
	Francheschi et al ¹¹	Rev Lat Am Enfermagem	Brazil	Brazil	2010	4
	Liu et al ⁴¹	J Infus Nurs	China	China	2009	3
Ohki et al ⁵	Pediatr Int	Japan	Japan	2008	3	

(To be continued...)

(Continuation)

Cat	Author	Journal	Country	Country	Year	LE
INFECTION	Ponnusamy ⁴²	Arch Dis Child Fetal	England	England	2012	3
	Tsai et al ⁴³	Am J Infect Control.	Taiwan	Taiwan	2012	3
	Njere et al ⁴⁴	J Pediatr Surg	England	England	2011	3
	Hsu et al ⁴⁵	Pediatr Neonatol	Taiwan	Taiwan	2010	3
	Van den Hoogen et al ⁴⁶	Acta Paediatr	Netherlands	Netherlands	2008	3
	Garland et al ⁴⁷	Infect Control Hosp Epidemiol	USA	USA	2008	3
	Hoang et al ⁴⁸	Pediatrics	USA	USA	2008	4
DESCRIPTION OF USE	Ishida et al ⁴⁹	Nursing (São Paulo)	Brazil	Brazil	2012	4
	Dórea et al ⁵⁰	Rev Bras Enferm	Brazil	Brazil	2011	4
	Reis et al ¹⁰	Rev Bras Enferm	Brazil	Brazil	2011	4
	Baggio et al ¹⁴	Rev Gaucha Enferm	Brazil	Brazil	2009	4
	Freitas et al ⁵¹	REME rev. min. enferm	Brazil	Brazil	2009	4
	Camargo et al ⁶	Rev Esc Enferm USP	Brazil	Brazil	2008	4
	Bueno et al ⁴	J Perinatol	Spain	Spain	2008	4

Figura 3 - Summary of evidence of articles Level 1 as the authorship, study type, intervention, results and conclusions. PICC: Central Catheter of Peripherally Insertion; NB: Newborn (RANGEL, CASTRO, PRIMO, AMORIM, CHRISTOFFEL, ZANDONADE, 2013)

Author/Type of study	Intervention	Results and conclusion
Fidler <i>et al.</i> ²⁴ Meta-analysis	Use of bedside ultrasound during insertion and placement of the PICC.	It has been associated with: increased success rate on the first try; declines in thrombosis rates; increased number of options veins; ability to put large-caliber catheter; ability to view and prevent arterial puncture; decreased tissue trauma; affordable equipment; experienced professional requirement
Shah <i>et al.</i> ³⁴ Meta-analysis	Use of prophylactic heparin.	It reduces occlusion and enables greater number of patients completing the therapy desired. It supports the prophylactic use of heparin for PICC in newborns, at a dose of 0.5 IU/kg/h. None of these studies was designed to evaluate the rate of adverse events.

Figura 4 - Summary of evidence of articles Level 2 as the authorship, study type, intervention, results and conclusions. EMLA: eutectic mixture of lidocaine and prilocaine; PICC: Central Catheter Peripherally Insertion; NB: Newborn (RANGEL, CASTRO, PRIMO, AMORIM, CHRISTOFFEL, ZANDONADE, 2013)

Author/Type of study	Intervention	Results and conclusions
Marcatto <i>et al.</i> ²² Randomized clinical trial	Use of oral glucose 25% or EMLA cream in pain management in preterm infants undergoing insertion of PICC.	There were no statistically significant differences between the groups for the primary outcome. Other strategies should be considered to control pain during this procedure.
Uslu <i>et al.</i> ²⁶ Clinical, prospective, randomized, controlled, double-blind	Use of heparin in a low dose on permeability and occlusion of the PICC in newborns.	In the group of heparin continuous infusion of low dose heparin (0,5 IU kg ⁻¹ h ⁻¹) the duration of catheter patency was higher and catheter occlusion rate was smaller and allowed the completion of therapy without increasing adverse effects.
Smirk <i>et al.</i> ³² 2009 Randomized clinical trial	Pressure changes in neonatal PICC under different laboratory conditions and the risk of rupture in the clinical practice.	The polyurethane PICC has tolerance of pressure higher than the silicone catheters and is less likely to break under experimental conditions. Silicone Catheters clogged easily break when they receive flush.
Lago <i>et al.</i> ³⁵ Randomized clinical trial	Infusion of low dose of remifentanil during PICC in premature infants.	Validated pain scales, cardiovascular movements, respiratory response and body during insertion of PICC suggest control of pain and discomfort with remifentanil, but the time to complete the insertion and the number of attempts required remained the same.

Figura 5 - Summary of evidence of articles Level 3 as the authorship, study type, intervention, results and conclusions. CRBSI: bloodstream infection related to catheter; PICC: Central Catheter

Author/Type of study	Intervention	Results and conclusions
Ponnusamy <i>et al.</i> ⁴² Observational	Culture of the middle and proximal segments of the catheter beyond the tip.	The culture of the middle, proximal and tip segments did not improve the diagnosis of CRBSI in relation to only tip culture.
Jain <i>et al.</i> ²⁰ Comparative	Using x-rays to determine PICC tip position compared with the use of echocardiography in the NICU.	Echocardiography is useful tool for tip position identification, making manipulation in real time, and minimizing the exposure of new X-rays.
Tsai <i>et al.</i> ⁴³ Retrospective cohort study	It assesses removal of the PICC in newborns with CRBSI, and examines the risk factor for infectious complications.	The retention of the catheter for more than 3 days in NB with CRBSI is associated with a delay resolution and a higher incidence of recurrence within one month.
Njere <i>et al.</i> ⁴⁴ Retrospective cohort study	It identifies the rates of complications and possible predictors of infection related to the PICC in a NICU	The PICC infection rate was 17/1000 catheter-days. OR = 3,1 catheter in situ for 9 days or more. Negative coagulase staphylococcus was isolated in 89% blood cultures.
Taylor <i>et al.</i> ²³ Retrospective control case	Establishment of a team dedicated to PICC and CRBSI.	The CRBSI was reduced by almost half after the creation of a team dedicated to PICC.
Tsai <i>et al.</i> ³⁸ Retrospective cohort study	Insertion time and PICC permanence over the complications.	Insertion with more than 60 minutes and length of stay for more than 30 days is associated with higher rates of complications related to the catheter.
Uygun <i>et al.</i> ²⁵ Retrospective cohort study	Insertion time and PICC permanence over the complications.	95% of the PICC have been successfully inserted. Major complications were observed. The new insertion technique can be a safe and easy procedure.
Liu <i>et al.</i> ⁴⁰ Retrospective, comparative descriptive	It analyzes complication rates with PICC in a NICU and study the risk factors associated with non-elective catheter removal.	The complication rate was 31.73%, with most of phlebitis. The NB of elective removal group had position in the vena cava. Mechanical complications are the most common reasons for removal of catheters.
Ohki <i>et al.</i> ⁵ National questionnaire to NICU in Japan	Institutional policies regarding the use of PICC and also the frequency of complications.	Tip positions of the catheter out of the heart were preferred. The frequency of pericardial effusion and cardiac tamponade were 0.07 to 0.11%.
Garland <i>et al.</i> ⁴⁷ Retrospective cohort study	It defines the pathogenesis of CRBSI in NB with PICC.	Most CRBSI was caused by coagulase-negative staphylococci and derive from intraluminal contamination (67%).
Hsu <i>et al.</i> ⁴⁵ Descriptivo comparativo	It assesses the risk of infection and other complications associated with PICC in newborns with very low weight.	Significant risk factors of CRBSI include catheters inserted in the femoral sites and a longer duration of placement of PICC.
Ragavan <i>et al.</i> ⁷ Comparative descriptive	It compares complication rates of surgical central venous catheters (CL) and PICC.	The rates of all complications were significantly lower in the PICC group. The removal before the completion of therapy was in 11.5% (PICC) and 37.5% (CL).
Van den Hoogen <i>et al.</i> ⁴⁶ Comparative descriptive	It assesses effect of antibiotic administration at the time of removal of the PICC	The administration of antibiotics at the time of catheter removal reduced significantly the incidence of sepsis.

Insertion And Maintenance Practices Category

The articles in this category discuss about technology, techniques and care used in the practice of inserting and maintaining the PICC.

The insertion of the catheter in newborns is a very delicate procedure, because of the fragility of this patient, small veins and need thin catheters.⁴⁶

In studies with purposes of analyzing new insertion techniques they presented in the insertion a success rate of 95%, without observing significant complications, demonstrating that are safe and easy procedure that can be used as an alternative for insertion of the PICC.^{4,46}

Also as a facilitator for successful integration, the use of ultrasound (US) of the head during insertion and placement of the PICC was described in meta-analysis associated with: increased success rate in the first attempt; increased number of options veins; ability to put large-caliber catheter; ability to view and prevent arterial puncture; decreased tissue trauma; and more affordable equipment. However, this requires experienced professional with training and eye-hand coordination.²⁴

Regarding pain control in insertion procedure, the remifentanyl in low dose has measurable and synergistic analgesic effect in combination with 12% sucrose and non-nutritive sucking, but it makes the insertion of PICC be easier or more fast.³³ The suction with glucose at 25% and EMLA cream alone were not sufficient strategies to control pain.²²

The position of the tip of the catheter to its proper position is essential to prevent complications. This should be located in the superior vena cava or inferior vena cava near the junction with the right atrium, 0.5 to 1 cm out of the heart chamber of NB.^{20,28,31}

It is not clear what the best viewing method of literature review localization.^{20,31} A research states that fluoroscopy is ideal, but cannot be performed at the bedside and has a high cost, and the supine chest radiograph is more convenient and more used.³¹

However, a comparative study concluded that the use of echocardiography has increased accuracy and minimizes exposure to x-rays, and also claims that the arm position is very important in performing radiography because their movement can cause catheter migration.²⁰ The movements of arm can even be used in non-invasive techniques to reposition the tip.²⁸

In relation to care for maintaining the catheter they emphasized the use of heparin to prevent obstruction, aseptic dressing technique and the pressure applied to the catheter and prevent disruption.^{19,21,26,29,34}

The continuous infusion of low dose of heparin (0.5 IU/kg/h) into the fluids is an effective measure to reduce the occlusion of the catheter, allowing the completion of therapy without observing adverse effects.^{26,34}

The healing practice is essential in maintaining the PICC because it covers and prevents local trauma and contamination, and respect the aseptic technique and

the evidence as to the material used and the frequency of change.²¹ In reporting experience with 491 catheters that evaluates technique of dressing with a protective base layer they concluded that catheter complication rates were low, and that dressing changes catheters wereminimized.³⁷

As for the pressure applied to the catheter and the risk of rupture, only one study addressed the issue.³² A randomized clinical trial examined the pressure changes in neonatal PICC in different laboratory conditions and found that the polyurethane have tolerance of pressure greater than the silicone catheters and they are less likely to break under experimental conditions. The silicone catheters clogged are broken easily when they receive flush even with syringe in a greater caliber.³²

Faced with various evidence and conduct the insertion and maintenance of the PICC, the standardization of everyday practice in the care of newborns is critical. An experience report presented a form to unify the practices related to the PICC in a NICU, which has been a supporting tool for early detection of alterations that result in risk of complications for newborns, contributing to a qualified care.⁴²

In addition to standardizing the behavior, the establishment of a team dedicated to PICC also improves the quality of care, reaching to reduce by almost half the CRBSI in infants with extremely low birth weight requiring venous access in a long term.²⁹

In conclusion, this category emphasizes the importance of skills training for insertion and maintenance as well as the need to implement new technologies to minimize the undesirable effects in the use of PICC.

General surgery category

it highlights studies that provide information about the complications associated with the use of PICC in newborns.

Prevalence of complications has been described in different studies, ranging from 30.7% to 50.7% (30,7%⁴⁸, 31,7%⁴⁰, 39,3%¹², 45,9%³⁹, 47,6%¹¹, 50,7%³⁸). Despite the differences between these values and the reality of each search location, it can be seen that the prevalence show an average of 41.1% of complications.

The most common complications were reported in studies:

- Obstruction (6,9%⁴⁸; 12,7%³⁹; 13,1%¹²; 16,6%³⁸; 19,4%¹¹);
- Disruption (7,1%³⁸; 8,8%¹¹; 9,5%¹²; 11,2%²⁶; 15,4%⁵⁰)
- Phlebitis (5,6%⁴⁸; 10,8 %³⁸; 22,1%⁴⁰)
- Limb edema (7,1%¹²)
- Infection related to PICC (2,3%¹¹; 6%¹²; 11,1 %⁴⁸; 36,4%³⁸)
- Extravasation (1,2%¹²; 4,3%³⁸; 5,8%⁴⁸);
- Accidental Attraction (1,2%¹²; 2,3%¹¹)

Regarding the outcome, complications often lead to non-elective removal of PICC.^{12,40} On the other hand, they have also been reported some rare complications such as

diaphragmatic paralysis, oliguria with the presumed etiology of tip catheter misplaced which blocks renal vein and hypertonic solution and parenteral nutrition administration directly into the renal vein, the disruption and migration of the catheter to the pulmonary artery, pericardial effusion, cardiac tamponade, pleural effusion, ascites and difficulty of removal.^{5,12,29,37,39,41}

Some authors concluded that most of the complications were related to care, requiring qualification of professionals to better care related to insertion technique, maintenance and management of catheter.^{11-2,36}

It also stands out in this category more evidence from international research indicating the need for national studies that address the theme and have a strong level of evidence.

Whereas the infection was a major complication of the use of PICC and showed up seven articles dealing exclusively with this question, so we constituted a new topic category: infection.

Infection category

the infection category contains seven articles that have as main theme the bloodstream infection related to catheter (CRBSI) in newborns.

Regarding the definition of CRBSI studies we used similar concepts, being defined as: positive culture of at least one blood sample obtained from a peripheral vein, clinical signs of infection, no other site of infection and PICC insertion at least 5 days.⁴²⁻⁷

The CRBSI can be confirmed through the tip culture catheter. Thus, prospective observational study in England with 189 catheters in 143 newborns, 47 with suspected CRBSI, concluded that the culture of the middle segments, proximal and the tip catheter has not improved the diagnosis of infection in relation to only tip culture.⁴²

The principal pathogen related to CRBSI found in blood cultures, this was the negative-coagulase staphylococci (CNS), as noted in a prospective cohort study of 218 newborns and 294 catheters, conducted in England, in which isolated the ECN from the 89% of 62 blood cultures, followed by *Klebsiella* (3.2%), *Escherichia coli*, *Candida*, *Enterococcus* and *Staphylococcus aureus* (1.6% each).⁴⁴

Similarly, another study had ECN isolated in 40.1% of 67 positive blood cultures, followed by *Staphylococcus aureus* (16.4%), *Enterococcus* and *Klebsiella* (13.4%).⁴⁵ Another study also showed the presence of ECN in 78% of the positive blood cultures and 92% had a positive culture of the catheter segments that corroborate with similar results of other authors.^{42,46-7}

Regarding the PICC infection rate, there are two articles, one obtained rate of 8.3 per 1000 catheter days, while the other obtained rate of 17 per 1000 catheter in a day.⁴³⁻⁴

In relation to the insertion site, a study found in a sample of 396 infants and 477 catheters (370 upper limb and 107 lower) a CRBSI rate of 11.6% for the superior and 9.3% in

catheters in inferior limbs.⁵ Another survey, with a sample of 292 infants and 412 catheters, found rates of 12.4% for non-femoral site and 21.6% for femoral site (increased risk of CRBSI compared with non-femoral catheters of 1,76).⁴⁵ More studies are needed to clarify the relationship of the insertion site with CRBSI in newborns.

Besides the insertion site, another predictor of infection that stood out was the duration time of catheter. Research has found an odds ratio of 3.1 and $P < 0.01$ for an infection by PICC if the catheter was in situ for 9 days or more.⁴⁴

Regarding the pathogenesis of CRBSI of PICC, only one study evaluated the derivation of contamination and concluded that most have intraluminal contamination source. Prospective cohort study nested with 82 neonates identified 15 CRBSI, 67% acquired through intra luminal, 20% extra luminal and 13% undetermined. To this predominant mechanism of infection, strategies for prevention are more likely to be effective.⁴⁷

With regard to indication to remove or not the catheter of RN who requires venous access in term of diagnosis of CRBSI, we concluded that the PICC should be removed, because the retention of PICC for more than three days is associated with delayed of resolution of clinical sepsis and increased incidence of recurrence within a month.⁴³

Also regarding the removal, it was observed that the administration of antibiotics for the PICC removal, there were significant results in reducing incidence of sepsis after removal of catheter;⁴⁶ however prospective studies are needed to confirm this observation.

Despite various evidence presented in this category, the study highlights the need for further studies to confirm the existing results and clarify the questions and controversies still unanswered.

For this category we observed national studies. Thus, the scientific production on this theme is a challenge to Brazilian researchers.

Description picc use category

this category includes articles describing the use of the PICC, providing knowledge on the device's use of reality and the people who received it.

The characterization of population studies show that the majority are preterm infants, with low birth weight, male, appropriate for gestational age, primary diagnosis of respiratory disease, especially respiratory distress syndrome (RDS) due to prematurity.^{14, 49-51}

The most used type of silicone catheter was mono lumen.^{10,14,49,51} Most punctured venous catheters were located in upper limbs, especially the basilic vein, and then the cephalic.^{4,6,10,14, 49}

The positioning of the catheter tip, visualized by radiography, predominated in central location, especially in the superior vena cava.^{10,14,49,51} With respect to the PICC

residence time, the average of studies varied between 7.7 to 14, 5 days (7.7⁴⁹, 9.4⁵⁰, 10.5⁵¹, 13.5⁴, 14.5²⁹).

The predominant removal reason was the completion of the proposed therapy for the indication of PICC, followed by events and complications.^{4,6,14,47,49}

It was concluded that the evidence found on the characteristics of the use of PICC presents homogeneity despite being studies of different institutions and realities.

CONCLUSIONS

This integrative review of the published evidence about the use of practices of PICC in infants involved 41 articles which have the following levels of evidence: 4.9% level one, level two 9.8%, 31.7% level three, 34.2% level four, 17% level five, and 2.4% level six. The considered strong evidence (level 1, 2 and 3) amounted to 46.3%.

There was national production shortage of studies that portray strong levels of evidence with experimental design, considered the “gold standard” in evidence-based practice.

Most publications analyzed are international, available in English, which is a challenge to be overcome by the professionals involved with care, so the understanding and application of research results to understand the English language becomes crucial.

Other research on the use of PICC in newborns are needed to help with the decision-making to disputes as the best end of the display method, the use of antibiotics at the time of catheter removal; and support the implementation of new technologies, such as ultrasound and its practical applicability, contributing to patient safety and quality of care.

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