Nursing Practices in Intravenous Therapy in Newborns: an Integrative Review

Cíntia Lira Borges1, Saul Filipe Pedrosa Leite2, Renata Kelly Lopes de Alcântara3, Maria Lígia Silva Nunes Cavalcante1, Vanelly de Almeida Rocha1, Mardênia Gomes Ferreira Vasconcelos1, Edna Maria Camelo Chaves1

1 State University of Ceará. Fortaleza, CE, Brazil
2 City Hall of Fortaleza. Fortaleza, CE, Brasil.
3 Faculty Mauricio de Nassau. Fortaleza, CE, Brasil.

Abstract

Objective: To identify the evidence on nursing practices in intravenous therapy in newborns.

Method: Integrative review in the PubMed, Scopus and SciELO databases. A total of 150 articles were selected, and after thorough reading, eight studies remained.

Results: Most of the studies were descriptive and cross-sectional (50%), using peripheral venous catheter (62.5%). The years varied between 2006 and 2014. Brazilian studies corresponded to 37.5%.

Conclusion: The main nursing practices were: use of saline solution for catheter clearing; use of larger caliber catheters; use of splints to support the limbs; adequate positioning of the upper limb during radiography for correct confirmation of the positioning of the tip of the peripherally inserted central catheter; management of pain with pharmacological and non-pharmacological actions.

Introduction

Numerous technologies in the field of neonatology have been produced to improve the care of newborns, optimizing the chances of survival in the first days of life, as many procedures are necessary for the reestablishment of their physiological functions. Intravenous...
therapy stands out among these practices, and represents an essential technology for the survival of newborns [1].

Nurses responsible for intravenous therapy need to have technical-scientific knowledge to maintain catheters, avoiding possible complications and risk factors that may affect the venous circulation, especially in the first 48 hours of life [2]. The devices commonly used in the newborn are peripheral venous catheters, umbilical catheters, peripherally inserted central catheters, and non-tunneled central venous catheters.

The procedure for performing intravenous therapy requires attention and care. Obtaining and maintaining a safe access is one of the greatest challenges for the nursing team, which must select the best device and the best venipuncture site. The intention is to avoid risks and damages, guaranteeing the safety of intravenous therapy and contributing to minimize the neonate's stress, since the hospital environment by itself already causes discomfort and suffering.

We believe that this study may contribute to the improvement of techniques and procedures applied during nursing care to neonates who require intravenous therapy. Thus, the study aims to identify the evidence on nursing practices in intravenous therapy in newborns.

Method

This is an integrative review that consists of collecting previous studies to obtain conclusions about common knowledge, being an important instrument of Evidence-Based Practice [3]. Six phases were used to construct the integrative review: elaboration of the guiding question, searching or sampling in the literature, data collection, critical analysis of the included studies, discussion of results and presentation of the integrative review [4].

The guiding question was: "What are the nursing practices used in the intravenous therapy in newborns?" The articles were selected in the PubMed, Scopus and SciELO databases, using the controlled descriptors: catheterization peripheral, infant newborn, nursing care, defined through HSCDs (Health Sciences Descriptors) and MeSH (Medical Subject Heading Term). Collection occurred between February and March 2016.

The inclusion criteria set for the search of articles were: articles published in Portuguese, English and Spanish; full-length articles portrayed the topic of nursing practices in venous therapy in newborns; and articles published and indexed in the above-mentioned databases in the last ten years, from 2005 to 2015. Theses or dissertations, review articles, case studies, reflections and experiences were excluded; researches performed with nurses on the care provided in intravenous therapy in newborns (Table 1). The time delimitation was 10 years, with a view to giving visibility to recent and still usable technologies.

We searched the three descriptors together: catheterization peripheral AND nursing care; and infant newborn AND nursing care. Ninety one articles were found in the PubMed and 57 in the Scopus. No results were obtained in SciELO with the three conjugated descriptors. Therefore, the search was first performed with catheterization peripheral AND nursing care, and after that, infant newborn AND nursing care, obtaining one article in each search (Table 1).

<table>
<thead>
<tr>
<th>Table 1. Identification of the articles selected in the databases. Fortaleza. Ceará. 2016.</th>
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<tr>
<td><strong>Databases</strong></td>
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<tr>
<td>Inclusion and exclusion criteria</td>
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<tr>
<td>Productions found</td>
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<tr>
<td>Last 10 years</td>
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<tr>
<td>Other languages</td>
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<tr>
<td>Non-original articles</td>
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<tr>
<td>Articles not available in full-length</td>
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<tr>
<td>Other age groups</td>
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<tr>
<td>Did not perform direct care or did not classify care</td>
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<tr>
<td>Repeated on PUBMED</td>
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<td>Total</td>
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Table 2. Identification of studies included in the integrative review according to title, database/authors, objectives, type of study, device used, level of evidence, year (2006 to 2011) and country. Fortaleza. Ceará. Brazil. 2016.

<table>
<thead>
<tr>
<th>Title</th>
<th>Database</th>
<th>Authors</th>
<th>Objectives</th>
<th>Type of study</th>
<th>Device used</th>
<th>Level of evidence</th>
<th>Year</th>
<th>Country</th>
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<tbody>
<tr>
<td>Peripheral vascular access in intensive care to neonates: experience of a public hospital</td>
<td>SciELO</td>
<td>Barría, Santander</td>
<td>To compare the venipuncture facility, the type and incidence of complications of venipuncture methods in neonatal intensive care</td>
<td>Prospective study</td>
<td>Peripheral venous catheter</td>
<td>IV</td>
<td>2006</td>
<td>Venezuela</td>
</tr>
<tr>
<td>Peripheral IVs: factors affecting complications and patency: a randomized controlled trial</td>
<td>PubMed</td>
<td>Tripathi, Skaushik, Singh</td>
<td>To analyze the factors that affect the permeability of peripheral venous accesses and their complications</td>
<td>Controlled randomized clinical trial</td>
<td>Peripheral venous catheter</td>
<td>II</td>
<td>2008</td>
<td>Índia</td>
</tr>
<tr>
<td>Heparinized saline vs normal saline for maintenance of intravenous access in neonates: an evidence-based practice change</td>
<td>PubMed</td>
<td>Cook, Bellini, Cusson</td>
<td>To evaluate and implement the results of a change of practice, based on evidence about the use of heparin in intravenous infusions</td>
<td>Descriptive study</td>
<td>Peripheral venous catheter</td>
<td>VI</td>
<td>2011</td>
<td>United States</td>
</tr>
<tr>
<td>Assessment of phlebitis, infiltration and extravasation events in neonates submitted to intravenous therapy</td>
<td>SciELO</td>
<td>Gomes</td>
<td>To describe the occurrence of phlebitis, infiltration and extravasation in the neonatal intensive care unit of a public maternity hospital in Rio de Janeiro</td>
<td>Descriptive study</td>
<td>Peripheral venous catheter</td>
<td>VI</td>
<td>2011</td>
<td>Brasil</td>
</tr>
<tr>
<td>Effectiveness of heparin solution versus normal saline in maintaining patency of intravenous locks in neonates: a double blind randomized controlled study</td>
<td>PubMed</td>
<td>Arnts</td>
<td>To evaluate the effect of heparin versus saline solution for the clearance of peripheral intravenous blockade in newborns and to investigate variables that influence the longevity of venous access.</td>
<td>Controlled randomized clinical trial</td>
<td>Peripheral venous catheter</td>
<td>II</td>
<td>2011</td>
<td>Netherlands</td>
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</table>

Table 3. Identification of the studies included in the integrative review according to title, database/authors, objectives, type of study, device used, level of evidence, year (from 2013 to 2014) and country. Fortaleza. Ceará. Brazil. 2016.

<table>
<thead>
<tr>
<th>Title</th>
<th>Database</th>
<th>Authors</th>
<th>Objectives</th>
<th>Type Of Study</th>
<th>Device Used</th>
<th>Degree of Evidence</th>
<th>Year</th>
<th>Country</th>
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<tbody>
<tr>
<td>Incidence of nonelective removal of percutaneously inserted central catheters according to tip position in neonates</td>
<td>PubMed</td>
<td>Costa</td>
<td>To evaluate the incidence of non-elective removal of percutaneous central catheters according to the position of the catheter tip in newborns</td>
<td>Prospective cohort study</td>
<td>Peripherally inserted central catheter</td>
<td>IV</td>
<td>2013</td>
<td>Brazil</td>
</tr>
<tr>
<td>Analgesia and sedation during the installation of the central peripheral insertion catheter in neonates</td>
<td>Scopus</td>
<td>Costa</td>
<td>To characterize the strategies of analgesia and sedation in neonates submitted to the installation of the peripherally inserted central catheter.</td>
<td>Descriptive study</td>
<td>Peripherally inserted central catheter</td>
<td>VI</td>
<td>2013</td>
<td>Brazil</td>
</tr>
<tr>
<td>Evaluation of neonatal peripherally inserted central catheter tip movement in a consistent upper extremity position</td>
<td>PubMed/ Scopus</td>
<td>Newberry</td>
<td>To compare the effect of the standard upper position extremity with respect to different insertion positions of the percutaneous central catheter in neonates.</td>
<td>Descriptive study</td>
<td>Peripherally inserted central catheter</td>
<td>VI</td>
<td>2014</td>
<td>United States</td>
</tr>
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The abstracts of the articles found were read and those that approached the studied theme were separated for reading and critical analysis of the results. Subsequently, the selected articles were classified using a pre-established form surveying information on database, name of the authors, title of the article, year of publication, objective, type of study, level of evidence, device used, specific care and procedures for intravenous therapy. Tables were used to organize the characteristics (Table 2, 3) and a map of main themes (Figure 1).

To classify the level of evidence, we adopted the following division [5]: Level 1 (I): systematic review and meta-analysis of all relevant randomized controlled clinical trials; Level 2 (II): at least one randomized controlled clinical trial; Level 3 (III): well-designed clinical trial without randomization; Level 4 (IV): well-designed cohort and case-control study; Level 5 (V): reviews of descriptive and qualitative studies; Level 6 (VI): descriptive or qualitative study; Level 7 (VII): opinion of authorities and/or report of expert committees.

Results

Eight studies from PubMed, Scopus and SciELO databases were included and are specified in Table 1. Most articles were descriptive (level of evidence VI) and cross-sectional (50%), published in PubMed (62.5%), and using peripheral venous catheter device (66.6%). The years of publication varied between 2006 and 2014. International surveys prevailed, being 37.5% Brazilian. All the studies had nurses as processors or collaborators (Table 2, 3).

The following topics stood out: use of heparin and saline solution; sites of venipuncture; use of splints; puncture site monitoring; size and type of catheters; radiography to confirm the catheter positioning; pharmacological and non-pharmacological therapies for pain before, during and after the catheter introduction procedure (Figure 1).

Discussion

The present review is limited by the small number of randomized clinical trials found. It is known that clinical studies are less frequently carried out due to the high cost and the long time for their implementation; however, they are the ones that have greater level of evidence.

Currently, there is a great concern related to the health needs, well-being, quality of life, comfort and patient safety. Increasingly, the health area has been focusing on safe practices that prioritize the quality of health services. In this context, nursing is ahead in the studies related to patient safety, specialized nursing technologies and care derived from evidence-based practice.

Regarding the care and procedures implemented in the articles, the use of heparin versus saline solution for unblocking the access is a controversial issue. Cannulas used in newborns are easily obstructed compared to those used in adults because they are smaller. In some cases, heparin is effective in clearing lower lumen catheters [6], which are easier to occlude when compared to larger catheters,
especially if there is an infusion of medications [7]. Many studies cite the use of saline solution in place of heparin to unblock catheters due to the potential for adverse reactions of the second substance [6, 8-9].

The problem with the use of heparin comes from its allergic reactions and events such as infiltration, extravasation [8] and thrombocytopenia or haemorrhages [6]. Furthermore, because heparin is incompatible with many drugs, it needs to be infused with saline solution before its use, which can lead to cardiac overload and death of many babies, especially premature infants [6,8]. Heparin use is cited as restricted in most of the studies found in this review except for one of the randomized controlled clinical trials that found statistically significant longer catheter use with heparin, although associated with increased phlebitis [7].

Using saline solution instead of heparin is much more sustainable. This means that the purchase of heparin by the service is more expensive. It also means longer time of preparation by the nursing staff, because for each application of heparin, it is necessary to infuse saline solution. Moreover, the adverse events caused by this medication are responsible for longer hospitalization, and higher hospital and professional expenses [8]. Access durability with heparin is around 41 [8] and 56 hours [6]. In contrast, saline solution lasts on average 54 [8] and 61 hours [6]. Thus, reducing venous access results in less frequent use of catheters and less time spent by nursing on it.

The choice and installation of venipuncture devices are often determined by the practitioner’s practice. The proper choice of the device can be decisive for the duration and maintenance of the access. The more days of hospitalization and the more procedures are done, the worse the access routes and the more difficult puncturing become.

A study included in this review compared the use of needle catheters and needle-mounted catheters. One finding was that needle catheters had a 17.6 higher risk of causing tissue necrosis compared to needle-mounted catheters [10]. This same study calculated the increased risk of phlebitis (6.3 greater) in neonates in whom the cannula remained for more than 72 hours, with a higher frequency of phlebitis in the scalp and antecubital fossa [10]. The nursing care indicated by the article is to avoid needle catheters, except in the cases of puncture in the scalp, where it showed greater durability [10].

Another study included in the review agrees with the incidence of infiltration (58%) and phlebitis (53%) mainly in catheters that remain for more than 96 hours [7]. Phlebitis can be identified by the presence of pain, erythema and induration; and infiltration by skin whitening and edema [7].

An important detail during nursing care is the choice for larger gauge cannulas to prevent phlebitis and increase permeability [7], as well as continuous monitoring of the insertion site [11]. It has been shown that puncture sites with less durability and permeability are the scalp, wrist veins and nearby sites of joints [7]. Based on their skills and abilities, nurses should avoid repeated punctures in their clinical practice, contributing to reduce the pain of the newborn and the child, suffering of the family and the number of materials used [7].

To avoid loss of access, an option is the continuous use of splints that provide support and less mobility for the infant and child’s arm, being able to maintain therapy for longer times [7]. Therapy should be based on guidelines and protocols that establish the best type of access, intravascular devices and venous system assessment, acting in an integrated manner and in a team work, in order to safeguard the patient’s safety [11].

Care in necessary with the introduction of drugs that can be toxic and vesicant into the vessel. The application of different drugs irritates the vascular endothelium and contributes to exhaustion of the venous system of the newborn and multiple punctures during hospitalization [11]. The use of aminoglycosides and anti-inflammatory steroids,
for example, may compromise access permeability [7]. Errors in the administration of vasoactive drugs, electrolytes, glucose and antimicrobials may lead to hypotension, hydroelectrolytic disturbances, hypoglycemia and risk of infections [11]. Therefore, nurses should be aware of the characteristics and compatibility of drugs in order to optimize their work and reduce complications [11]. Fortunately, the preparation of medications only by specialist nurses able to perform such a function, helping to reduce errors in medication handling and administration, is a common practice in many services in Brazil today.

Undesirable events from intravenous therapy can easily lead to skin lesions that cause infections, longer hospitalization and death. In order to identify phlebitis, infiltration and extravasation, nurses may use scales or instruments for classification, and to detect or prevent the appearance of wounds and other harmful lesions to the life of these patients [11]. Some interventions directed to wounds refer to the use of hydrocolloid plaques and/or mechanical debridement [11].

A successful way of providing long-term intravenous and nutritional therapy is the insertion of peripherally inserted central catheters with attention to the location of the catheter tip in order to avoid complications, such as leakage of fluid to the pleural and peritoneal region [12-13]. Studies suggest that the tip of the catheter should not be positioned in the right atrium in newborns because of the numerous negative clinical outcomes and cardiac problems [12-13]. For this purpose a proper position would be one centimeter outside the heart in the case of preterm infants and two centimeters in the case of full term infants, so that the tip remain at the junction at the right atrium and superior vena cava, or in the superior vena cava. The literature suggests yet that, during radiography, the upper extremity should ideally be maintained in adduction with elbow flexion to correctly confirm the location of the tip of the peripherally inserted central catheter [12-13].

An article in the present review reported that bad positioning of this type of catheter can cause occlusion or thrombosis in 36.4% of the cases, and catheter rupture or leakage in 18.2% of the cases [12]. The study also found that insertion into basilic and axillary veins resulted in displacement of the catheter out of the heart, and of cephalic veins into the heart [12]. It is suggested that axillary puncture may have facilitated mobility out of the heart since this is located near the shoulder and because of the smaller total internal length of the catheter [12]. It should be noted that peripherally inserted central catheters can be placed in non-central regions, such as subclavian, saphenous and jugular veins, but there is a higher incidence of urgency of removal due to extravasation [13].

Nursing care should be cautious during the radiographic evaluation for proper positioning of the catheter tip and maintenance of the access route. In neonatal nursing, the relationship between the position of the catheter tip and the high incidence of emergency and accidental removal of peripherally inserted central catheters is a complex issue that needs more evidence to aid nursing practice [13].

The installation of vascular devices and the need for a safe venous access shows the need for changes in nursing practice to reduce stress and pain [15]. In this context, non-pharmacological therapies focused on maternal and family support [16] stand out, as well as comfort of the newborn with the use of breast milk, warmth, aromas, soft music, sucrose and non-nutritive suction [15-16]. These care, unfortunately, are limited in the case of intubated and/or orally restricted neonates [15].

Similarly, attention needs to be drawn to the pharmacological practices of analgesia and sedation that in a Brazilian study occurred only in 34.6% of the neonates, with the most prevalent drugs being midazolam (18.5%) and fentanyl (7.3%) [15]. In general, opioids, as a potent analgesic, and EMLA (an eutectic mixture of prilocaine and lidocaine 5%) in the form of cream, 45 minutes before the pro-
procedure, are effective options for the treatment of pain and for the reducing discomfort [15]. There is a need to encourage professionals to know the signs of pain in the newborn, to use protocols and guidelines for proper management and to carry out more studies and strategies for the correct use of sedatives and analgesics.

The contributions of this study to nursing can make the difference by reducing the suffering of the neonate and of the family and the days of hospitalization. As this is a review, it is indicated mainly for nurses in the practice, since they integrate a vast knowledge that, often, cannot be acquired by the limited time for research and the difficulty for reading the analytical and statistical jargons of some articles. In a simplified way, through a review, it is possible to understand the essential role of nurses in the prevention of complications from the patient, from the device used and/or from the care provided [2].

Conclusion
We conclude that although there is little evidence of direct care and studies using randomized controlled clinical trials on intravenous therapy in newborns, there are several interventions and nursing strategies to reduce the innumerable undesirable effects of the therapy. There is a need for protocols and guidelines linking all these procedures, and that services put them into practice for quality and safe care.

The main nursing practices found were: use of saline solution to clear catheters; use of larger caliber catheters; use of splints for limb support; adequate positioning of the upper limb during the radiography for correct confirmation of the tip location of the peripherally inserted central catheter; management of pain with pharmacological and non-pharmacological actions.

We emphasize the need for articles that may expand the theme to systematic reviews and meta-analyses in order to increase the objectivity and validity of the findings.

Collaborations
The author Borges CL contributed to the design of the project. All authors contributed to data analysis and interpretation, article writing and final approval of the version to be published.

References


