

HIGH RISK NEWBORNS USING PERIPHERAL VENOUS CATHETERS*

Mitzy Tannia Reichembach Danski¹, Priscila Mingorance², Derald Athanasio Johann³,
Alessandra Amaral Schwanke⁴, Késia Angelina Souza Barros⁵

¹Registered Nurse. PhD in History. Professor of the Federal University of Paraná. Curitiba-PR-Brazil.

²Registered Nurse. MSc in Nursing. Municipal Health Secretariat of Colombo. Curitiba-PR-Brazil.

³Registered Nurse. PhD in Nursing. Federal Institute of Paraná. Curitiba-PR-Brazil.

⁴Registered Nurse. MSc candidate in Nursing. Federal University of Paraná. Curitiba-PR-Brazil.

⁵Professor of Nursing. Federal University of Paraná. Curitiba-PR-Brazil.

ABSTRACT: This observational, prospective study aimed to describe the profile of newborns that use peripheral venous catheters and present risk factors for the development of complications. The sample consisted of newborns that were hospitalized in the Neonatal Intensive Care Unit, from 01/02 to 30/06/2013. Among the 145 newborns that used 677 peripheral venous catheters, 95 presented complications. There was statistical significance for complications in newborns: who were premature, using central venous catheters and endotracheal intubation, had greater mean usage of catheters, lower mean birth weight and longer mean time of hospitalization. Using peripheral venous catheter exposes newborns to risks arising from their use, however, understanding the complications and triggering risk factors based on evidence qualifies the care.

KEYWORDS: Peripheral catheterization; Newborn; Complications.

NEONATOS DE ALTO RISCO EM USO DE CATETER INTRAVENOSO PERIFÉRICO

RESUMO: Estudo observacional, prospectivo com o objetivo de descrever o perfil de neonatos que utilizam cateter intravenoso periférico e apresentam os fatores de risco para desenvolvimento de complicações. A amostra compôs-se de neonatos que estavam internados em Unidade de Terapia Intensiva Neonatal, de 01/02 a 30/06/2013. Dentre os 145 neonatos que utilizaram 677 cateter intravenoso periférico 95 apresentaram complicações. Houve significância estatística para complicações em neonatos: prematuros em uso de cateter venoso central e intubação orotraqueal, uso médio de mais cateteres, peso médio ao nascer menor e tempo médio de internamento maior. Utilizar cateter intravenoso periférico expõe os neonatos a riscos decorrentes de seu uso, porém conhecer complicações e fatores de risco desencadeantes embasados em evidências qualifica o cuidado.

DESCRIPTORES: Cateterismo periférico; Recém-nascido; Complicações.

NEONATOS DE ALTO RIESGO EN USO DE CATÉTER INTRAVENOSO PERIFÉRICO

RESUMEN: Estudio observacional, prospectivo cuya finalidad fue describir el perfil de neonatos que utilizan catéter intravenoso periférico y presentan factores de riesgo para desarrollo de complicaciones. La muestra fue compuesta de neonatos que estaban internados en Unidad de Terapia Intensiva Neonatal, de 01/02 a 30/06/2013. Entre los 145 neonatos que utilizaron 677 catéteres intravenosos periférico, 95 presentaron complicaciones. Hubo significancia estadística para complicaciones en neonatos: prematuros en uso de catéter venoso central e intubación orotraqueal, uso medio de más catéteres, peso medio menor al nacer y tiempo medio de internamiento mayor. Utilizar catéter intravenoso periférico expone los neonatos a riesgos advenidos de su uso, pero conocer complicaciones y factores de riesgo desencadenantes basados en evidencias califica el cuidado.

DESCRIPTORES: Cateterismo periférico; Recien nacido; Complicaciones.

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Corresponding author:

Derald Athanasio Johann.

Universidade Federal do Paraná

Rua Rozália Goronkosky de Almeida, 126-83065-578-São José dos Pinhais-PR-Brazil.

E-mail: derald.johann@ifpr.edu.br

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INTRODUCTION

Neonatology is the area of knowledge dedicated to care of the child shortly after birth until the 28th day of life, during which the individual is called a newborn or newborn⁽¹⁾. The newborn is considered at high risk when one of the following signs are present: birth weight less than 2000g or greater than 4000g; gestational age <35 weeks; axillary temperature <36°C or >37,5°C; respiratory distress and/or respiratory rate >60rpm or <30rpm; maternal fever; premature rupture of membranes >12 hours before delivery; pallor; signs of intrauterine infection; major congenital anomalies; severe injuries due to the delivery; or the need for cardiopulmonary resuscitation⁽²⁾.

The Neonatal Intensive Care Unit (NICU) is for the hospitalization of serious and potentially serious newborns^(1,3) and aims to achieve greater survival of extremely premature and high risk newborns, with consequent improvement in their clinical condition.

Prolonged stays in this unit may cause complications in the short, medium and long term, as well as compromise the quality of life of the child⁽³⁾. Peripheral venous catheterization (PVC) is widely used in the neonatal population, however, it is related to the occurrence of complications. Local complications in the peripheral intravenous therapy, occurring as adverse events around the puncture site, are likely to be observed, with these being: infiltration, extravasation, thrombosis, phlebitis, thrombophlebitis, hematoma and local infection⁽⁴⁾.

The low durability of peripheral venous catheters is an important factor, however, the frequent occurrence of complications stands out. A study conducted in an NICU showed that 34,77% of the catheters are removed due to extravasation, 12,67% due to phlebitis, 11,32% due to accidental withdrawal, 15,36% due to the end of therapy and 10,51% due to expiry of the vein (permanence time greater than 72 hours)⁽⁵⁾.

Although peripheral catheterization has the advantage of a lower risk of systemic complications when compared to central catheterization, it also has disadvantages, such as difficulty in maintenance for a prolonged period, with the consequent need for successive punctures, painful

stimulation and local complications. Therefore, this study was developed in order to answer the following question: What is the profile of the newborn using PVC and what are the risk factors arising from this use?

The results originating from the development of this study seek to support the clinical practice of the NICU nursing professionals. Therefore, the study aimed to describe the profile of newborns using PVC and to present the risk factors related to this clientele that increase the likelihood of developing complication in the PVC.

METHOD

The study met all ethical precepts, with CAAE registration number 04956212,0,0000,0102 and authorization of the Research Ethics Committee and Co-participant Institution nº 165,675. It was a prospective observational cohort study, which was performed in the Neonatal Intensive Care Unit (NICU) of a teaching hospital in Curitiba - Paraná state. Data were collected from February 1 to June 30, 2013.

The sample consisted of all newborns admitted to the NICU during the data collection period that used peripheral intravenous access (n=145), followed from admission until outcome of their hospitalization in the NICU (discharge, transfer or death). Those newborns with fragility of the venous network that prevented the PVC puncture, diagnosed by the treating physician, were excluded.

The data collection instrument included the following variables: sociodemographic (identification, registration, gender, date of birth, type of delivery, birth data and reason for hospitalization); clinical (Parkin score, Apgar score, pre-existing infection), and catheter data. The adequacy of the data collection instrument was based on a pilot test and the training of the research team (composed of one doctoral student, one master's student and five nursing students) was previously conducted through meetings and side by side training.

Data collection occurred daily, uninterrupted, through reading of the information contained in the medical records of the newborn and direct observation of the puncture device, location and ostium of insertion and possible local complications.

The puncture and handling of the devices were carried out by the nursing staff of the unit.

Data were entered into Microsoft Excel® spreadsheets and analyzed using the Bioestat® program. For the descriptive analysis, absolute and relative frequencies and measures of central tendency and dispersion were determined. In the analysis of factors that could affect with the response variable, the Chi-square test and the Williams G-test were used for categorical explanatory variables and the Mann-Whitney U test for quantitative explanatory variables. The Relative Risk (RR) and confidence intervals (CI) were used to estimate the strength of association between the variables and outcomes. In all tests, a 5% significance level was considered.

RESULTS

The results were organized in order to meet the research objectives, that is, firstly the profile of the population of newborns who used PVC during hospitalization was described and secondly the risk factors related to this profile were noted. A total of 145 newborns were included in the study, who used 677 PVCs. The inserted catheters were gauge number 24, made of polyurethane, with passive safety device and needed a polyvinyl extender for administering drugs and solutions.

Regarding the gender of the newborns, similarity was obtained, i.e., 73 (50,34%) male and 72 (49,66%) female. There was predominance of surgical birth through transverse caesarean section (TCS), this totaling 105 (72,41%) of the births. In the first minute of life 60 newborns (41,38%) presented an Apgar score greater than or equal to seven, in the fifth minute this figure rose to 128 (88,28%). The high number of newborns, 90 (62,07%), with Parkin scores indicative of less than 37 weeks of gestation was evident (Table 1).

The mean weight of the newborns was 2277,88g (+932,11g), with a minimum of 525g and a maximum of 4315g. When grouped into categories, 64 (44,14%) weighed more than 2500g and 34 (23,45%) weighed less than 1500 g (Table 1).

It was observed that, among the reasons for hospitalization, prematurity occurred in 67 (46,21%) newborns. It should be noted that prematurity could be present in isolation and/or associated with other clinical conditions.

Tabela 1 – Distribuição dos neonatos internados em UTIN de hospital de ensino, segundo o perfil. Curitiba-PR-Brasil, 2013

Categorias	(n=145)	%
Sexo		
Feminino	72	49,66
Masculino	73	50,34
Tipo de parto		
CST	105	72,41
PV	40	27,59
Apgar 1'		
< 7	85	58,62
> 7	60	41,38
Apgar 5'		
< 7	11	7,59
> 7	128	88,28
Não informado	6	4,14
Parkin		
< 37	90	62,07
> 37	52	35,86
Não informado	3	2,07
Peso ao nascer (g)		
< 1500	34	23,45
1500 a 2500	45	31,03
> 2500	64	44,14
Não informado	2	1,38
Motivo da internação		
Prematuridade	67	46,21
Outros	78	53,79
Uso de CVC		
Não	85	58,62
Sim	60	41,38
Uso de CVD		
Não	137	94,48
Sim	8	5,52
Submetido à IOT		
Não	95	65,52
Sim	50	34,48
Submetido à cirurgia		
Não	141	97,24
Sim	4	2,76
Desfecho do internamento		
Alta	95	65,52
Óbito	11	7,59
Ainda internado	16	11,03
Transferência	23	15,86

Legenda: Cesareana segmentar transversa (CST); Parto vaginal (PV); Cateter venoso central (CVC); Cateterismo vesical de demora (CVD); Intubação orotraqueal (IOT).

During the hospitalization period the newborns underwent other invasive procedures, among which: 60 (41,38%) used central venous catheters (CVCs); and 50 (34,48%) required orotracheal intubation (OTI).

Regarding the outcome of the hospitalization, 95 (65,52%) newborns were discharged from the NICU, 23 (15,86%) were transferred, 11 (7,59%) died, and 16 (11,03 %) remained hospitalized at the end of the data collection period (Table 1). The length of stay of the newborns monitored until the outcome varied from one to 96 days, with a mean of 19,96 days (+21,62).

The number of catheters per newborn ranged from 01 to 28, with a mean of 4,67 (+5,08). Regarding the 145 newborns evaluated, 95 (65,52%) presented PVC related complications and 50 (34,48%) did not present complications.

Considering the risk factors related to the characteristics of the newborns, there was increased likelihood of developing complication in the PVC, explained below, which responds to the second aim of the study.

The following variables showed statistical significance regarding the development of complications: prematurity as a reason for hospitalization increased the risk of developing complications in the PVC 1,29 times ($p=0,0324$; $RR=1,29$); use of CVC during hospitalization increased the risk of developing complications 1,39 times ($p=0,0064$, $RR=1,39$); and undergoing OTI increased the risk of developing complications 1,38 times ($p=0,0078$; $RR=1,38$) (Table 2).

It was also observed that in the newborns that developed complications the mean for use of catheters was higher ($p<0,0001$); the median of the Parkin score was lower ($p=0,0166$); the mean birth weight was lower ($p=0,0049$); and the mean time of hospitalization was higher ($p<0,0001$) (Table 2).

DISCUSSION

The profile of the newborns studied showed parity between the female and male newborns. However, the literature indicates a predominance of males, with 55,6%⁽⁶⁾. It can be seen that high-risk newborns admitted to the NICU are predominantly born by TCS delivery, according to the data found in this study and in the literature (66,7%)

⁽⁶⁾. Currently this type of delivery is becoming increasingly common in Brazil, considering the social, demographic, cultural and economic factors of the pregnant women and the families⁽⁷⁾. The NICU studied is a public service of reference in caring for high-risk pregnancies, therefore the clinical factors that determined the choice of surgical birth may have been related to the pathological conditions of maternal and fetal health.

Several factors related to the clinical condition of the newborn are analyzed after the birth, with the aim of early detection of possible complications that cause the morbidity and mortality, including: Apgar score, Parkin score and weight.

When verifying the Apgar score variable it can be observed that high-risk infants tend to be born clinically unstable, with further improvement in the condition, rising to acceptable levels. This study demonstrated a high percentage of newborns with Apgar scores below seven shortly after birth, data that differ from a study that showed the majority (69,4%) of the population with a higher index than this value⁽⁶⁾. In the fifth minute of life the values observed in this study corroborate the literature, which shows 86,1% of newborns with an index higher than or equal to seven⁽⁶⁾; 20,3% of the newborns that obtained an Apgar score less than seven in the fifth minute evaluation presented a 5,33 times greater risk of death⁽⁸⁾.

The risk of neonatal death is highlighted when the infant presents factors such as a Parkin score of less than 38 weeks gestation, weighing less than 2500 grams and born by surgical delivery⁽⁹⁾.

The Parkin score is a variable that determines gestational age, through the physical characteristics of the newborn at birth, In this study values of less than 37 weeks were predominant, similar to the literature, which shows a percentage of 61,19% of newborns with less than 37 weeks gestation⁽⁵⁾.

Birth weight is an important characteristic of this population, since it is a risk factor related to neonatal morbidity and mortality. In this study, the weight showed great variability, with a mean value below satisfactory (less than 2500g)(1-2), characterizing the majority of the newborns as low birth weight. Conversely, one study presented data showing higher weights, ranging from 3375g to 3435g⁽¹⁰⁾.

When comparing the results of this study with those of the literature, with regard to the classification of weight of 1500g to 2500g and

Tabela 2 – Variáveis dos neonatos associadas à ocorrência de complicações e fatores de risco pelo uso do cateter intravenoso periférico (n=145). Curitiba-PR-Brasil, 2013

Variável	Complicação				p-valor	RR	IC [95%]
	Sim		Não				
	n	%	n	%			
Neonatos com complicação	95	65,52	50	34,48	-	-	-
Sexo	n = 95		n = 50				
Feminino	42	44,21	30	60	0,07071	0,8	[0,63;1,02]
Masculino	53	55,79	20	40		1	
Tipo de parto	n = 95		n = 50				
CST	66	69,47	39	78	0,2749 ¹	0,87	[0,68;1,10]
PV	29	30,53	11	22		1	
Motivo de internação	n = 95		n = 50				
Prematuridade	50	52,63	17	34	0,0324 ¹	1,29	[1,02;1,64]
Outros	45	47,37	33	66		1	
Apgar 1'	n = 90		n = 48				
< 7	36	40	12	25	0,07811	1,25	[0,99;1,58]
> 7	54	60	36	75		1	
Apgar 5'	n = 91		n = 48				
< 7	9	9,89	2	4,17	0,2236 ²	1,28	[0,94;1,74]
> 7	82	90,11	46	95,83		1	
Uso de CVC	n = 95		n = 50				
Não	48	50,53	37	74	0,0064 ¹	1	
Sim	47	49,47	13	26		1,39	[1,10;1,74]
Uso de CVD	n = 95		n = 50				
Não	88	92,63	49	98	0,1595 ²	1	
Sim	7	7,37	1	2		1,36	[1,02;1,82]
Submetido à IOT	n = 95		n = 50				
Não	55	57,89	40	80	0,0078 ¹	1	
Sim	40	42,11	10	20		1,38	[1,11;1,72]
Submetido à cirurgia	n = 95		n = 50				
Não	92	96,84	49	98	0,6977 ²	1	
Sim	3	3,16	1	2		1,15	[0,64;2,05]
Nº cateter*	95	6,22 ± 5,64	50	1,72 ± 1,16	< 0,00013	-	-
Parkin**	94	34 ± 7,75	48	36 ± 4	0,01663	-	-
Peso ao nascer*	94	2133,35 ± 927,98	49	2555,14 ± 884,59	0,00493	-	-
Tempo internamento*	82	26,62 ± 24,35	47	10,28 ± 9,14	<0,001 ³	-	-

LEGENDA: ¹ Teste Qui-Quadrado; ² Teste G de Williams; ³ Teste U de Mann-Whitney; RR - Risco relativo; IC [95%] - Intervalo com 95% de confiança; * média ± desvio padrão; ** mediana ± desvio interquartilico.

over 2500g, the findings demonstrate superiority in relation to the study (27,8% and 22,2% respectively)⁽⁶⁾. It was observed that 23,45% of the newborns studied presented very low birth weight (<1500g), which differs from a study, conducted in 2011, in which 50% presented this weight range⁽⁶⁾; another study, conducted with 2126 very low birth weight newborns, presented a mean weight of 1075g⁽¹¹⁾.

Another important factor when analyzing the profile of this clientele is the reason for hospitalization in the NICU, of which there were many. The prevalence of prematurity was observed in this study, which included just under half of the newborns studied (46,21%), these data are lower than those found in a study performed in 2011, which highlighted prematurity as the most prevalent reason for hospitalization, between 61% and 72%⁽¹²⁾. Prematurity stands out as a biological risk factor that can trigger future neuropsychomotor impairments in these children, with adequate care being important soon after birth in order to prevent later damage.

Due to the complexity of newborns admitted to the NICU, they are subjected to various invasive procedures directed toward the improvement of health. In this study, in addition to the peripheral venous puncture, central venous and arterial punctures, OTI, the performance of surgery and the use of UC were observed. National⁽¹³⁻¹⁴⁾ and international studies⁽¹⁵⁻¹⁶⁾ have reported the use of central venous catheters in the neonatal clientele, and studies of peripheral intravenous therapy have cited central catheter use⁽⁶⁾. Related to the other procedures, the OTI is addressed⁽¹⁷⁻¹⁸⁾, however the use of UC and the performance of surgical procedures are not often mentioned.

Regarding the number of catheters used for each newborn great variability and a high mean were observed, higher than data found in the literature, which ranged from 1,4 to 3,82 catheters per newborn^(5-6,10). Intravenous therapy is required for hemodynamic and clinical recovery of newborns, with the peripheral puncture highlighted due to the ease of access and lower risk of systemic complications, which cause injury to newborns⁽⁴⁾.

Considering the hospitalization outcomes, the majority of these were hospital discharge, with few deaths being observed, It should be noted that this population is hospitalized in the NICU due

to hemodynamic and clinical instability and only discharged when a stable condition is maintained, with their improvement being attributable to the care of the multidisciplinary team and use of the technologies available in these units.

When considering the survival of the newborns of this study, the data found was similar to the literature, which ranged between 91,7% and 94%⁽¹⁸⁾. Among the infants who developed complications in any of the PVCs the fact that the majority were discharged is highlighted, showing that the use of PVC helps the clinical recovery of the newborn.

Concerning the risk factors for the development or not of complications in the PVC, variables were observed that were related to the physiology of the newborn, undergoing other invasive procedures and the length of hospitalization. In relation to the physiology, it was observed that premature newborns, those with lower Parkin scores and those with lower birth weight are more likely to develop complications when using PVC. These variables are biological risk factors for complications, considering the clinical fragility of this population.

Regarding the invasive procedures that newborns are subjected to while hospitalized in the NICU, it was observed that the use of CVC and undergoing OTI during the hospitalization increase the risk for developing complications in the PVC. Thus, it should be noted that the presence of CVC and OTI at some point in the hospitalization of this population increase susceptibility for the development of complications when using PVC.

Newborns that developed complications related to the use of PVC used a higher mean number of catheters and had longer mean periods of hospitalization in the NICU. It can be perceived that the time of exposure to the unhealthy environment of the NICU reflects in an increase in complications. However, most newborns hospitalized for prolonged periods gradually improved their physiology and immune response, with consequent advances in their overall clinical conditions. When this does not occur, the treatment is prolonged, resulting in the need for further PVC punctures. The clinical and epidemiological variables related to the newborn, such as: gender, type of delivery, Apgar score in first and fifth minutes, use of CVD and performance of surgical procedures did not

present as risk factors for the development of complications in the PVC.

CONCLUSION

The clinical profile of the newborns was characterized by: similar ratio of genders, premature births, predominantly TCS delivery, improvement in the Apgar score when considering the first and fifth minutes of life, and variability in birth weight, number of PVCs used and length of hospitalization. The greater incidence of complications related to the catheter occurred in newborns with a higher mean number of catheters, greater length of hospitalization, lower median Parkin score or lower mean weight at birth.

Given the results, a large number of unpublished results can be observed - results with statistical significance for the risk factors - in relation to the profile of newborns and to the PVC complications related to risk factors, a fact that provides the scientific basis for new studies on the subject and generates evidence to be implemented in the professional practice.

It is known that newborns in the NICU present physical frailty and require specialized care, therefore, to outline the profile of newborns enables the nursing staff to perform the care associated with the best available technology. The use of PVC in at risk newborns is necessary and inevitable for pharmacological treatment and recuperation from the changes related to prematurity. Therefore, understanding the complications and triggering risk factors, based on evidence, underlies the care plan and the consequent reduction of risks for this clientele.

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