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Original Article

Prevalence of omphalitis in newborns admitted to a Neonatal Intensive Care Unit

Prevalência de onfalite em recém-nascidos internados em Unidade de Terapia Intensiva Neonatal

Prevalencia de onfalitis en recién nacidos ingresados a una Unidad de Cuidados Intensivos Neonatales

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ABSTRACT

Objective: To determine the prevalence of omphalitis in newborns admitted to a Neonatal Intensive Care Unit at a charitable hospital between 2011 and 2020. **Methodology:** A documentary, observational and descriptive study using a secondary database. The population consisted of newborns admitted and hospitalized between 2011 and 2020 in the Neonatal ICU of a philanthropic hospital from the municipality of Cornélio Procópio, Paraná. The information was extracted directly from the spreadsheets available in the sector in question. The variables studied were as follows: clinical diagnosis and clinical outcome. The project was approved by the Ethics and Research Committee of *Universidade Estadual do Norte do Paraná*. **Results:** A total of 1,131 newborns were admitted during the study period, of which 7.25% were diagnosed with omphalitis. As a clinical outcome, it is noted that 97.56% of the newborns were discharged from the hospital and that 2.43% died. **Conclusion:** There is high prevalence of newborns hospitalized due to omphalitis. In addition, the data reinforce the importance of the care provided by health professionals, especially in relation to the assistance offered to newborns in a Neonatal ICU.

DESCRIPTORS:

Newborn; Umbilical Cord; Intensive Care Units.

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RESUMO

Objetivo: Determinar a prevalência de onfalite em recém-nascidos internados em Unidade de Terapia Intensiva Neonatal de um hospital filantrópico entre os anos de 2011 a 2020. **Metodologia:** Trata-se de um estudo documental, observacional e descritivo com o uso de uma base de dados secundária. A população foi composta por recém-nascidos admitidos e internados na Terapia Intensiva Neonatal de um hospital filantrópico no município de Cornélio Procópio, Paraná, entre os anos de 2011 e 2020. As informações foram extraídas diretamente das planilhas disponíveis no setor responsável. As variáveis estudadas foram: diagnóstico clínico e desfecho clínico. O projeto foi aprovado pelo Comitê de Ética e Pesquisa da Universidade Estadual do Norte do Paraná. **Resultados:** Foram internados 1.131 recém-nascidos no período de estudo, sendo que 7,25% foram diagnosticados com onfalite. Como desfecho clínico, nota-se que 97,56% dos recém-nascidos receberam alta hospitalar e 2,43% evoluíram para óbito. **Conclusão:** Constata-se uma alta prevalência de recém-nascidos internados por onfalite. Além disso, os dados reforçam a notoriedade da assistência prestada pelos profissionais de saúde, principalmente em relação aos cuidados com os recém-nascidos em uma Unidade de Terapia Intensiva Neonatal.

DESCRITORES:

Recém-Nascido; Cordão Umbilical; Unidades de Terapia Intensiva Neonatal.

RESUMEN

Objetivo: Determinar la prevalencia de onfalitis en recién nacidos ingresados a una Unidad de Cuidados Intensivos Neonatales de un hospital filantrópico entre los años 2011 y 2020. **Metodología:** Estudio documental, observacional y descriptivo en el que se usó una base de datos secundaria. La población estuvo compuesta por recién nacidos ingresados y hospitalizados entre 2011 y 2020 en la UCI neonatal de un hospital filantrópico en el municipio de Cornélio Procópio, Paraná. La información se extrajo directamente de las hojas de cálculo disponibles en el sector responsable. Las variables estudiadas fueron las siguientes: diagnóstico clínico y resultado clínico. El proyecto fue aprobado por el Comité de Ética e Investigación de la *Universidade Estadual do Norte do Paraná*. **Resultados:** Ingresaron 1131 neonatos durante el período de estudio, de los cuales el 7,25 % fueron diagnosticados con onfalitis. Como resultado clínico, se observa que el 97,56 % de los recién nacidos fueron dados de alta y que el 2,43 % falleció. **Conclusión:** Se observa alta prevalencia de recién nacidos hospitalizados por onfalitis. Además, los datos refuerzan la notoriedad de la asistencia prestada por los profesionales de la salud, principalmente en relación con los cuidados de recién nacidos en una Unidad de Cuidados Intensivos Neonatales.

DESCRIPTORES:

Recién Nacido; Cordón Umbilical; Unidades de Cuidados Intensivos Neonatales.

INTRODUCTION

Omphalitis is classified as a bacterial infection that surrounds a newborn's umbilical stump during the neonatal period; in turn, it can devitalize the skin leading to late stump separation, in addition to creating an opening for bacteria to enter the body, thus easing their dissemination through the bloodstream and reducing the immune system action, with the possibility of triggering a systemic infection (sepsis) and evolving to neonatal death[1-2].

On average, the signs start to appear on newborns' 5th day of life, presenting erythema (redness) around the navel, as well as edemas that can be associated with purulent secretions and with increased skin sensitivity in the region. In turn, the presence of systemic signs such

as fever, irritability and appetite loss or food intolerance are suggestive of severe complications or infections[3].

In cases where the disease progresses, it can be extended through the abdominal wall leading to cellulitis, necrotizing fasciitis and other intra-abdominal complications up to systemic infection (sepsis). In these cases, the umbilical stump necrotic and thrombosed vessels are the gateway to a child's bloodstream[4]. In turn, this infection presents itself as polymicrobial; in other words, it is triggered by various species found in the environment and in mothers' genital tract, with the following as the most frequent ones: *Staphylococcus aureus, Streptococcus pyogenes* (Gram-positive bacteria) and *Escherichia coli, Klebsiella pneumoniae, Pseudomonas aeruginosa* and *Proteus mirabilis* (Gram-negative bacteria)[2,5].

The treatment is applied by means of antibiotic therapy and skin care, using antiseptic topical solutions such as alcohol chlorhexidine 2%, iodopovidone and alcohol 70%. Although they may prolong the umbilical stump separation time, these solutions do not impose any harms on newborns[3,6].

In 2011, the World Health Organization (WHO) estimated that one-fourth of all neonatal deaths in the world are due to infections, with 75% of them originating in devitalized umbilical cord tissues, even during the first week of life; especially omphalitis, with a mortality rate estimated at between 7% and 15%[7]. In turn, epidemiological studies focused on neonatal diseases reveal high prevalence of pathologies related to the pre-natal period. However, infections are more frequent in developing countries than in developed ones[4,8].

The literature describes the incidence of omphalitis in relation to various traditional ways and customs, with the possibility of being related to the emergence of microorganisms in the umbilical region. The prevalence of methods based on applying herbs, cinders, oils and cloth strips raise the risk of bacterial growth[9].

The state of Paraná recorded 146,296 live births in 2020 but presents a rate of 10.3 deaths out of every 1,000 live births. In addition to that, 25 fetal and infant death cases due to omphalitis were recorded in Brazil: 5 in the South region, with 4 of them reported in the state of Paraná alone[10]. At the national level, Brazil presents morbidity and mortality rates still considered high when compared to international standards. Recent data indicate that the infant mortality rate in 2023 was approximately 12.5 deaths out of every 1,000 live births, with important regional inequalities varying from nearly 10.0 out of 1,000 in the South region to 15.9 out of 1,000 in the North one[10].

Despite significant progress in the last decades (with an infant mortality reduction of over 60% since 2000 and an expressive drop in the number of avoidable deaths), the country still faces structural challenges related to access to maternal-child care and to its quality[11]. In this context, although services like Neonatal intensive Care Units (NICUs) have contributed to reducing these indicators,

Brazil has not yet fully attained the targets established in the Sustainable Development Goals (SDGs) for 2030, which foresee reducing neonatal mortality to levels close to 5 deaths out of every 1,000 live births nationwide, evidencing the need to intensify public policies and to qualify neonatal assistance[11].

As years went by, NICUs became increasingly equipped (both technologically and professionally) to admit newborns and ensure their favorable evolution. Given the importance of analyzing these data, it becomes fundamental to devise targets and strategies that not only optimize treatments but which also implement health education policies and active searches for pregnant women to enable proper pre-natal follow-up[11-12].

According to the evolution and incidence of complications due to bacterial growth in newborns, the need for care measures and other treatment modalities increases, such as controlled use of broad-spectrum antibiotics. Considering the aforementioned, the NICU's broad and modern structure is useful to assist in this service, providing the assistance required by newborns[6,13]. However, the ways to prevent bacterial growth in the umbilical stump area involve ensuring that aseptic techniques are applied during delivery, such as using sterilized blades or scissors when cutting the cord or training the team to preserve the filed sterile, as well as providing guidance to the parents to properly care for the umbilical region after birth[2].

One of the ways to clean the umbilical stump is using alcohol 70% and chlorhexidine 2%, in addition to dry cord care, a method indicated by the WHO that consists in always keeping the navel clean and dry, preventing it from entering into contact with the diaper so that the area remains ventilated[8,14-15]. Therefore, the reason underlying this study is to provide new scientific knowledge on the theme addressed, with the intention of improving Nursing services and practices, as well as enhancing what is known about the epidemiology of newborns in order to contribute to reducing the hospitalization rates in Neonatal Intensive Care Units.

OBJECTIVE

To determine the prevalence of omphalitis in newborns hospitalized between 2011 and 2020 at the Neonatal Intensive Care Unit of a philanthropic hospital.

METHODOLOGY

Design

A documentary, observational and descriptive study using a secondary database was conducted.

Study *locus* and period

The research was developed in the Neonatal Intensive Care Unit of a philanthropic hospital from the municipality of Cornélio Procópio-PR. The town is part of Health Regional Office 18 and a

reference in high maternal-child risk for the municipalities attached to it. Health Regional Office 18 is located in the inland of the state of Paraná and offers services to 21 municipalities with an estimated population of 225,992 inhabitants[16].

Cornélio Procópio is located in northern Paraná and had an estimated population of 47,842 inhabitants in 2020. The mean infant mortality rate in the city is 11.63 out of every 1,000 live births. A total of 5,234 live births were recorded between 2011 and 2020[16-17].

Inclusion and exclusion criteria

The population was comprised by newborns admitted and hospitalized between 2011 and 2020 in the Neonatal ICU of a philanthropic hospital from the municipality of Cornélio Procópio.

All the newborns (N=1,131) admitted and hospitalized between 2011 and 2020 in the Neonatal ICU of this philanthropic hospital from the municipality of Cornélio Procópio were included. The neonates excluded were those with no clinical omphalitis diagnoses during the study period (N=1,049), resulting in a sample of 82 newborns (7.24%).

Study protocol

The necessary information to conduct this research was obtained from the administration sector responsible for the hospital unit under study. The sector provided the data referring to the newborns' admission and hospitalization in spreadsheets. The data were collected by means of a form developed by the researchers themselves. This tool included all the variables available in the spreadsheets provided by the service under study and was applied in-person once a week from February to May 2025.

The study variables were as follows: municipality of origin, clinical diagnosis, ventilatory support and clinical outcomes.

Analysis of the results and statistics

The data were tabulated and grouped in an Excel® 2016 spreadsheet and converted to figures and tables. The statistical analysis was performed by means of absolute and relative frequencies regarding the study variables.

Ethical aspects

The project was approved by the Ethics and Research Committee of *Universidade Estadual do Norte do Paraná* (UENP) under No. 4,766,395/2021.

RESULTS

In all, 82 newborns were diagnosed with omphalitis between 2011 and 2020 in the Neonatal Intensive Care Unit of a philanthropic hospital from the municipality of Cornélio Procópio. Among those

diagnosed, 18.30% presented the disease as an isolated diagnosis and the others correlated it with other complications and pathologies (Table 1).

Table 1. Clinical diagnoses and other complications correlated to hospitalizations due to omphalitis in newborns hospitalized between 2011 and 2020 at the Neonatal Intensive Care Unit. Cornélio Procópio-PR, 2025.

Clinical diagnoses	N	%
Omphalitis	15	18.30
Omphalitis + PTNB	4	4.88
Omphalitis + SGA	2	2.44
Omphalitis + Jaundice	7	8.54
Omphalitis + TTNB	6	7.33
Omphalitis + UTI	3	3.66
Omphalitis + Hypoglycemia	4	4.88
Omphalitis + Respiratory Distress	1	1.21
Omphalitis + Sepsis	2	2.44
Omphalitis + Maternal *Streptococcus*	1	1.21
Omphalitis + NEC in Tx	1	1.21
Omphalitis + Hemorrhagic Syndrome	1	1.21
Omphalitis + Malnutrition	1	1.21
Omphalitis + Clavicular Fracture	1	1.21
Omphalitis + Two associated complications	18	21.97
Omphalitis + Three associated complications	15	18.30
Total	82	100.00

PTNB: Pre-Term Newborn; SMA: Small for Gestational Age; TTNB: Transient Tachypnea of the Newborn; UTI: Urinary Tract Infection; NEC in Tx: Syndrome characterized by ischemic inflammation and necrosis of the gastrointestinal tract.

Such being the case, the Pre-Term Newborn (PTNB) cases and the incidence of Transient Tachypnea of the Newborn (TTNB) stood out, accounting for 46.34% and 23.17% of the analyses, respectively. However, specific care measured offered in the NICU were required in some cases due to complications, namely: resorting to respiratory support with mechanical ventilators and with Continuous Positive Airway Pressure (nasal CPAP), both presented in Table 2.

Table 2. Number of newborns hospitalized due to omphalitis and other secondary diseases, who had to be subjected to respiratory support between 2011 and 2020 in the Neonatal Intensive Care Unit. Cornélio Procópio-PR, 2025

Year	Mechanical ventilation		Nasal CPAP		No device		Newborns with Omphalitis	
	N	%	N	%	N	%	N	%
2011	-	-	1	6.67	14	93.33	15	18.30
2012	2	20.00	-	-	8	80.00	10	12.20
2013	-	-	-	-	13	100.00	13	15.85
2014	3	15.00	-	-	17	85.00	20	24.40
2015	-	-	-	-	4	100.00	4	4.87
2016	3	27.28	-	-	8	72.72	11	13.41
2017	-	-	-	-	3	100.00	3	3.65
2018	-	-	-	-	6	100.00	6	7.32
Total	8	9.76	1	1.22	73	89.02	82	100.00

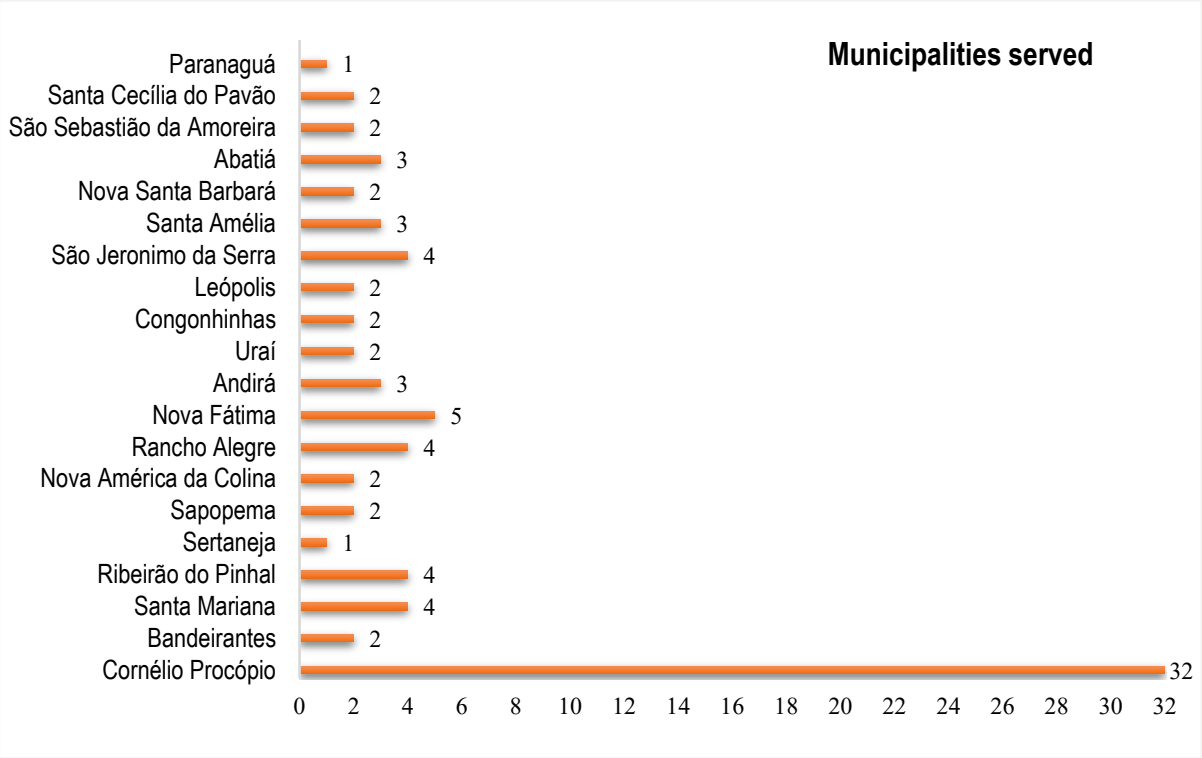
In turn, the clinical outcomes were as follows: 97.56% were discharged from the hospital and 2.43% evolved to death (Table 3).

Table 3. Clinical outcomes corresponding to the newborns hospitalized due to omphalitis between 2011 and 2020 in the Neonatal Intensive Care Unit, according to hospital discharge and death. Cornélio Procópio-PR, 2025

Clinical outcomes	Hospital discharge		Death		Hospitalized	
	N	**%**	**N**	**%**	**N**	**%**
2011	14	93.33	1	6.66	15	18.30
2012	9	90.00	1	10.00	10	12.20
2013	13	100.00	-	-	13	15.85
2014	20	100.00	-	-	20	24.40
2015	4	100.00	-	-	4	4.87
2016	11	100.00	-	-	11	13.41
2017	3	100.00	-	-	3	3.65
2018	6	100.00	-	-	6	7.32
Total	80	97.56	2	2.43	82	100.00

As the NICU from the city of Cornélio Procópio is a reference in the region, other municipalities occasionally ended up transferring their patients. In this case, the hospital provided assistance to 20 municipalities from the state, with 32 hospitalization (39.02%) corresponding to the Cornélio Procópio community itself and another 5 (6.09%) to Nova Fátima, both cities standing out for the number of cases served (Figure 1).

Figure 1. Municipalities of origin corresponding to the newborns hospitalized due to omphalitis between 2011 and 2020 in a philanthropic hospital from the municipality of Cornélio Procópio. Cornélio Procópio-PR, 2025



DISCUSSION

After birth, the umbilical stump (the part remaining from the mother-newborn separation after cutting the umbilical cord) becomes a region vulnerable to exogenous bacterial infections due to the time it is exposed to the environment and to not using aseptic techniques during the assistance provided. This contamination results in late stump separation, happening on the 7th day of life on average and, consequently, in developing omphalitis[4].

Some factors predispose to developing this bacterial infection, such as low birth weight, using umbilical catheters, and maternal infections. Situations referring to delivery itself also stand out, such as home births, increased labor times and membrane ruptures, in addition to non-hygienic conditions[15]. Such findings are in line with the current study, which presented a high percentage for the incidence of PTNBs and SMAs[18].

In addition to that, the incidence of secondary opportunistic infections such as necrotizing enterocolitis and systemic infection (sepsis) are the main cases of omphalitis progression and consequences, both detected in this research. As reported in other studies, skin openings, bacterial dissemination through the bloodstream and low immunity levels in newborns contribute to developing other pathologies[2].

This imbalance in the immune system also contributes to irregularities as for the functions and deficits in leukocyte adherence, as well as to low mobility of neutrophils, reduced number of natural killer cells and low interferon production[19]. However, due to their fast and safe intervention, developed countries present low neonatal mortality rates when compared to underdeveloped nations. This is due to the support provided by health services and to the population socioeconomic level. On the other hand, maternal characteristics such as low schooling, age and precarious hygiene habits (such as not performing hand hygiene techniques) can be responsible for the increased incidence of omphalitis[15].

A number of researchers evidence that pregnant/puerperal women and family members present many uncertainties in relation to newborns' hygiene and to cleaning the umbilical stump, highlighting that many controversies and popular customs lead these care measures[20]. Other research studies developed in inland São Paulo, Bahia and Maranhão highlight cultural wisdom in relation to care, namely: herbs (chamomile, calendula, dry cotton leaves), smoke powder, coffee powder, chicken feathers and using strips and coins to avoid umbilical hernias; these are the main non-sterile products that favor the development of opportunistic infections, leading to consequences in newborns[8].

Similar results were found in studies conducted in Africa and Asia. In this case, they reported using a mix of oils from different sources and herbs (commonly used in the region), raising the risk of infections mainly by the *Clostridium tetani* bacterium[9]. Consequently and considering the uncertainties inherent to post-natal care, the WHO recommends using antiseptics such as chlorhexidine 2% in underdeveloped and developing countries. This is justified by the fact that most births are home-based, with few resources and not applying aseptic techniques. Although it increases the stump separation time, such practice does not pose any risks to newborns[21-22].

However, the WHO recommends dry cord care in developed countries[8]. In consonance, the *National Institute of Health Care and Excellence* guidelines add that keeping the cord clean is the most practical and effective method, thus avoiding proliferation of microorganisms[23]. This dry care consists in cleaning with warm water and neutral soap; however, it is of utmost importance that the umbilical stump region always remains dry, with the possibility of being kept outside the diaper, exposed to the environment or covered with sterilized gauze, if necessary[4]. In turn, another study made an association between using cotton garments and hindering bacterial growth[15]. The literature describes that the umbilical stump separation time is related to the frequency with which it is moistened and that it is determined that, the longer it remains dry, the shorter the interval for its separation from the abdominal skin[24].

According to a previous study, some researchers evidenced that newborns who were subjected to late breastfeeding initiation had a higher omphalitis risk when compared to neonates that incorporated breastfeeding early in time, taking into account that introducing milk in the diet provides

newborns with antibodies that assist in their bacterial defenses[5]. Given the problems and consequences that omphalitis can cause, NICUs are a hospitalization service responsible for providing comprehensive care to severely or potentially severely ill newborns, as they have assistance structures with proper technical conditions and specialized care[25].

Consequently, given the conditions offered by the unit, some of the research patients required respiratory support (nasal CPAP, for example); these patients were pre-term newborns and had been diagnosed with transient tachypnea In addition to that, antibiotics are administered as treatment; however, toxicity of the drugs and sensitivity of the newborns' bodies need to be considered[6].

Therefore, health professionals (especially nurses) are of utmost importance in the assistance provided to these newborns, not only during the follow-up process but also in the role of health educators, providing all necessary explanations and solving the doubts presented by puerperal women and family members during the entire process[8].

Study limitations

For being a research study conducted in a secondary database, it did present limitations. Absence or incomplete filling-in of some records resulted in gaps as for interpretation and analysis of the information, reinforcing the importance of data reliability in health services.

Contributions for the Nursing, Health or Public Policy areas

The study reinforces the importance of training health professionals, especially Primary Health Care nurses. For being in direct contact with pregnant and puerperal women, they can lead counseling and guidance during the pre-natal period and the childcare appointments. The need for ongoing updates in health services based on national and international guidelines is also noted. Consequently, the data from this research were shared with the Nursing coordination office of the sector in question and will serve as the basis for ongoing omphalitis education actions targeted at the Neonatal ICU team.

In addition to the aforementioned, this research contributes to conducting future studies, favoring the acquisition of scientific knowledge on the theme addressed with the intention of optimizing Nursing services and practices, as well as enhancing what is known about the epidemiology of newborns in order to contribute to reducing the hospitalization rates in Neonatal Intensive Care Units.

CONCLUSION

It was concluded that the prevalence of omphalitis in hospitalized newborns was high, a population mostly comprised by pre-term neonates that presented transient tachypnea. The issues raised and all the information presented in this research reinforce the notoriety of the assistance provided by health professionals, mainly in relation to care measures in Neonatal Intensive Care Units,

where dynamic and comprehensive clinical reasoning and management are required due to the specificity inherent to the cases served.

The data also highlight the importance of good communication between professionals and family members, taking into account the guidelines that need to be provided mainly in relation to the influencing beliefs and customs that can pose risks to health. In addition to that, the need for simple and low-cost interventions in terms of umbilical stump care for this population segment is emphasized, by means of hand hygiene techniques and, if possible, by using cotton garments.

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