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Skin lesions of newborns in a neonatal unit: descriptive study

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ABSTRACT
Aim: Identify the incidence and prevalence of skin lesions in hospitalized neonates and characterize the identified lesions.
Method: Longitudinal, observational and quantitative. Daily studies on 40 newborns in a neonatal unit, during the physical examination, during September and October 2011. Data analyzed through descriptive and inferential statistics.
Results and Discussion: The study identified 195 lesions with an average of five lesions per newborn; incidence was 16%; prevalence was 58% and; average hospitalization period was 37.2 days. Diaper-caused dermatitis was the most common lesion, which progressed to moniliasis complications at a lower rate than previously found in other studies. The findings show statistical significance between the use of anti-fungals for diaper-caused dermatitis and treatment time.
Conclusion: The need for preventive lesion treatment, which can improve the quality of life and growth for newborns.
Keywords: integumentary system; skin; infant, newborn; nursing care

INTRODUCTION

Skin lesions are common amongst premature newborns in a hospital environment and, by the first month in hospital, 80% of these infants will have suffered from some kind of lesion. Consequently, the body's protection mechanism is compromised and the lesion becomes a gateway for germs, resulting in 25% of premature and underweight newborns contracting sepsis by the third day after birth[1].

Skin is a sensory organ that performs numerous functions vital for survival. The epidermis is the outermost layer responsible for liquid homeostasis and protecting the body against infection, germs and toxins. Above the epidermis is the stratum corneum that consists of a bilaminar layer of hydrophobic lipids that enable the regulation *protection function* of the epidermis. In the process of embryogenesis, its formation is usually complete after the twenty-fourth week of pregnancy, with a small number of embryonic layers, and its functional activity reaches maturity close to birth. Thus, prematurity along with the appearance of coetaneous lesions damages tegumentary functions by increasing permeability and causing trans-epidermal loss. This may result in excessive weight loss, hypotension, hydro-electrolyte imbalance and infections. In the case of premature birth, the skin has contact with an extrauterine environment, which is drier than an intrauterine environment and this change stimulates its growth, which can occur between the first two to four weeks or even be extended to eight weeks, as in the most extreme cases of prematurity[2].

Since is it extremely thin, the skin of preterm neonates can be frequently injured during hospitalization procedures. Considering the immunological immaturity of preterm neonates, these skin lesions cause damage to the coetaneous barrier, consequently permitting the entrance of pathogens that cause infection. A descriptive study undertaken in a general hospital identified 768 different types of infections, with 485 (63.2%) classified as hospital-acquired infections and, of these, 79 (16.3%) occurred in the neonatal intensive care unit (NICU). This high rate of infection is due to the fact that

hospitalized individuals, mainly in the NICU, are more susceptible to infection because of their exposure to a large variety of pathogenic micro-organisms, in addition to the numerous invasive procedures required for their survival[3].

Skin lesions can cause hostile feelings in parents, as they represent the pain and suffering their child undergoes during hospitalization and can even hinder bonding between parents and newborns. Thus, the proper treatment and prevention of skin lesions implies humane medical assistance and it is the responsibility of nursing professionals to invest in this type of assistance, since the lack of it implies professional negligence.

The lack of knowledge about the incidence and characteristics of skin lesions hinders the standardization of methods for its treatment and prevention, especially when there is no protocol for treatment. It is the responsibility of the hospital staff, mainly the nursing staff, to do their best to prevent any damage to the skin integrity of preterm neonates during handling and treatment.

In this context, this research aims to identify the incidence and prevalence of skin lesions and characterize those that are most common amongst neonates admitted to the neonatal unit of a university hospital.

METHOD

What follows is a descriptive and observational study with a quantitative approach that studied skin lesions in newborns admitted to a Semi-Intensive Care Unit (SICU) and NICU of a university hospital. A pilot test was carried out in August 2011 to fit the instrument and training of the professionals for collecting data. Between September and October 2011, the unit nurses collected data daily during physical examinations. Two forms were used. The first registered the number of skin lesions per patient and classified them as hematoma, ecchymosis, infiltration, phlebitis, necrosis, nasal injuries, adhesive lesions, pressure ulcers, umbilical granuloma, dermatitis in the diaper area and

dermatitis from skin contact. This data was then used to fill out a second form, which registered the number of patients treated that day, the number of patients with lesions, the number of new lesions identified per day and the average number of nursing staff present during all three shifts that day.

The independent variables studied were the following: weight; corrected age; chronological age; sector and time when admitted to unit; systemic medication used (antibiotics and antifungal drugs); lesion development; treatment chosen and; duration of diagnosis until recovery.

The lesions were classified according to the literature:

Ecchymosis: a macular lesion with a round or irregular shape larger than 3mm. The initial color is blue-red, which turns to blue-green, then yellow and golden brown. This lesion appears as a secondary manifestation of blood extravasation trapped in tissue after trauma[4].

Hematoma: an accumulation of blood located outside the vessels, forming clots in tissue. It is usually trapped in tissue, which gives it a round shape and is a result of trauma[4].

Extravasation or Infiltration: the escape or discharge of blood from a vessel into tissue, characterized by edema and hyperemia. Skin lesions may be a resulting complication when the infused volume is cytotoxic[6].

Phlebitis: an inflammatory process that results in fibrous cords, the stiffening of the vein wall perceptible to palpation and is caused by mechanical, bacterial or chemical action. It is accompanied by pain, a burning sensation and flushing.

Tissue Necrosis: an irreversible lesion in cell membranes due to vascular impairment in the area, which causes lack of blood supply and cell death[5].

Nasal Lesions: caused by the use of nasal prongs that may appear in three stages: mild with hyperemia, moderate with bleeding and severe with necrosis and partial or total destruction of the nasal septum[6].

Adhesive Label Lesions: characterized by skin abrasion, erythema and even ulcerations, caused by friction during adhesive label removal[5].

Pressure Ulcers: Lesion caused by soft tissue ischemia due to compression and shearing of bone prominences. As a result, blood flow is damaged and local ischemia occurs decreasing the supply of nutrition and oxygen, causing cell death[5].

Umbilical Granuloma: an infection from *Staphylococcus* may occur during the process of mummification of the umbilical cord stump. It is characterized by erythema and hardening around the stump and may or may not contain a secretion that is clear, serous, bloody or purulent with a fetid odor. This infection favors the formation of granulation tissue with secretion or only local humidity[7].

Dermatitis in the Diaper area: The most prevalent coetaneous disease. It is characterized by an initially glossy erythemia and then evolves to 'parched' skin. There may be erythematous papules linked to edema and skin exfoliation. It appears mainly on the buttocks, thighs, lower abdomen, pubis, labia majora and scrotum with the **preservation** of skin folds[8].

Contact Dermatitis: Inflammatory coetaneous reaction, caused by external factors, with the forming of eczema that is characterized by erythema, blisters, exudation, scaling and lichenification, frequently similar to burns[9].

The risk factors associated with the incidence of skin lesions of this population were: decreased time in hospital, 15 days or less; lower weight, equal to or below 1500g and; gestational age at birth (GAB) equal to 31 weeks and six days or 32 weeks or more.

The association of the time period of perineal dermatitis considered the following factors: weight at the time of the smaller lesion diagnosis, equal to or above 1500g; type of treatment chosen; corrected gestational age (CGA) of less than 32 weeks, between 32 weeks and 37 weeks and six days and 38 weeks or more. These factors were determined by the observation of the nursing assistance provided and a review of the literature.

The study included all the infants that required medical assistance in a neonatal unit after birth and had skin lesions during the data-collecting period. Patients that were discharged from the unit after 24 hours were not included in the study.

To calculate the incidence and prevalence of skin lesions, the research used a measurement unit for the assistance provided: day-patient which included, for calculating morbidity, the patients that required nursing assistance for 24 hours, excluding the day of discharge or death. The discharge day was only considered when it coincided with the day the infant was admitted, amounting to one day. In this study, however, a discharge on the same day of internment was a criterion for exclusion[10].
The following formula was used to calculate prevalence:

$$\frac{\text{Amount of patients affected by skin lesions during the period X 100}}{\text{Amount of day-patients with risks of skin lesions}}$$

To calculate incidence:

$$\frac{\text{Amount of patients with new skin lesions during the period X 100}}{\text{Amount of day-patients with risks of skin lesions}}$$

The data was inserted into *Microsoft Office Excel® 2007* and the *Statistic Package for Social Science-SPSS® version 15.0* was used to apply the Chi-squared statistic test. The patients were monitored from the moment they were admitted until discharge and each lesion was classified and described chronologically from appearance until remission. The treatment for each diagnosed lesion was organized according to the facility schedule.
After diagnosing a lesion and classifying it, the researchers contacted the parents and asked for authorization to include their child in the research. The parents were told about the research objectives, their right to anonymity and their right to end participation whenever requested. After their approval, the parents signed an Informed Consent Form. The research project also received approval from the Research Ethics Committee at the State University of Londrina (Number 246/10).

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RESULTS

Of the 52 newborns admitted to these units during the data-collecting period, 12 were not included in the study since were discharged before 24 hours or simply did not have any skin lesions. The sample was taken from 42 newborns, of which 55% were male, weighing between 535g and 3440g and gestational age at birth was between 23 weeks and three days and 41 weeks and three days. Of the lesions found, 51.8% were in ICU patients and 61.2% were in heated incubators.

The length of stay varied from two to 135 days, with an average of 37.2 days and a mode of 15 days. The longest periods were those of extremely premature newborns that required intensive and extensive support and who were later discharged to the ICU. In total, the newborns had 195 lesions. The amount of lesions per newborn varied from two to 13, with an average of five and a mode of four lesions, as Table 1 shows.

Table 1 - Characterization of newborns observed in the neonatal unit of a university hospital, based on gender, weight and gestational age at birth, length of stay and number of lesions (Londrina – PR, 2011)

Variable	N	%
Gender		
Female	19	47.5
Male	21	52.5
Birth weight		
> 1500g	18	45.0
≤1500g	22	55.0
Gestational age at birth		
> 32 weeks	18	45.0
≤ 32 weeks	22	55.0
Length of stay in unit		
> 15 days	8	20.0
≤ 15 days	32	80.0
Total amount of lesions		
> 5 lesions	26	65.0
< 5 lesions	14	35.0

The incidence of skin lesions varied from zero to 56%, with an average of 16% of new lesions; that is, for every 17 infants admitted to this unit, three presented a new skin lesion. Prevalence varied between 30% and 91%, with an average of 58%, which means for every 17 infants admitted, 10 presented some kind of skin lesion.

Table 2 shows the type of lesion and its average duration in days. Even though the newborns were evaluated according to the appearance of pressure ulcers, none were affected by this type of lesion during the study.

Table 2 - Characterization of skin lesions based on type and duration for newborns admitted to the neonatal unit of a university hospital (Londrina-PR, 2011)

Type of lesion	N	%	Duration (in days)
Dermatitis from diapers	58	29.7	5.8
Hematoma and ecchymosis	48	24.7	9.9
Lesion from labels	19	9.8	4.7
Infiltration	18	9.2	2.2
Phlebitis	11	5.6	5.1
Nasal lesion	10	5.1	4.6
Umbilical Granuloma	10	5.1	4.6
Surgical incision	10	5.2	10.6
Necrosis	9	4.6	9.0
Contact Dermatitis	2	1.0	2.0

As the researcher diagnosed each new lesion, he/she would apply the treatment according to the hospital schedule (Table 3). Antifungal medication was prescribed for perineal dermatitis that had evolved into fungal infections, which accounted for 8.7% of the total lesions.

Table 3 - Therapy chosen for treating the diagnosed lesions of newborns admitted to a neonatal unit at a university hospital (Londrina-PR, 2011)

Treatment	Type of lesion	N	%
None	Hematoma and ecchymosis	75	5.1
Essential Fatty Acids (EFA)	Lesion from labels, nasal lesions, perineal dermatitis, continual lesions and fissure	52	26.6
Antifungal med.	Perineal dermatitis infected by fungi	17	8.7
Hydrocolloid	Necrosis, lesion prevention in nasal septum, lesions from labels	17	8.7
Heat/sunlight	Phlebitis, perineal dermatitis	14	7.2
Silver Nitrate	Umbilical Granuloma	10	3.1
Agarol®	Used empirically for extensive infiltration	6	38.5
Barrier cream	For the prevention of extensive perineal dermatitis	4	2.1
Total		**195**	**100**

Table 4 shows the characterization of neonates that had a number of lesions above the study average, which was five. The results of the Chi-squared test for studying the association between prematurity and the length of stay in the unit (p=0.412), weight (p=0.212) and gestational age at birth (p=0.0446) were not of any statistical significance.

Table 4 - Characterization of newborns that had over five lesions in the neonatal unit of a university hospital, based on length of stay, weight and gestational age at birth (IGN) (Londrina-PR, 2011)

Variables		Five or more lesions			
		Yes	%	No	%
Length of stay	< 15 days	2	25.0	6	75.0
	≥ 15 days	12	37.5	20	62.5
Weight	< 1500g	8	44.4	10	55.6
	≥ 1500g	6	27.2	16	72.8
IGN	< 32 weeks	7	38.8	11	61.2
	> 32 weeks	7	31.8	15	68.2

The most common lesion that required the most attention from the nursing team was dermatitis in the diaper area. To understand this condition more clearly, the Chi-squared statistic test was used to find a link between the lesion duration and the chosen treatment. The results showed the statistical significance (p=0.012) of the analyzed variables. Dermatitis treated with EFA lasted for a shorter period when compared to dermatitis infections that were treated with the topic antifungal. The results of the Chi-squared test, which was completed during the duration of the diaper area dermatitis and the newborn weight variables (p=0.100) and the corrected age at the moment of diagnosis (p=0.666) were not statistically significant.

The main causes for the appearance of skin lesions in newborns found in this study were related to, firstly, medical agents, such as puncturing and intravenous therapy (n=82 lesions; 42.1 %) and, secondly, non-medical agents, such as the use of adhesive labels directly on the skin, nasal prongs for ventilatory support, surgical procedures and oxymeter sensor monitoring, which accounted for 36 lesions (18.4%). In 77 lesions (39.5%), however, it was impossible to identify a possible cause due to lack of information in the nursing records.

DISCUSSION

During this study, 195 lesions were diagnosed over a two-month period for a group of 40 newborns. Some of the lesions were not immediately evaluated and were later diagnosed between 24 and 48 hours after appearance, due to the difficulty of maintaining researchers working around the clock. This made it impossible to identify the type of lesion precisely, as the skin of a premature newborn is extremely fragile and lesions evolve to necrosis quite quickly.

In a study involving 121 neonates, 230 lesions were identified during approximately five months, with an average of 1.9 lesions per patient[9]. Another study identified 55 lesions over approximately three months in a sample of 36 newborns, with an average of 1.5 lesions per patient[11]. Both studies showed an average of lesions per patient that was

lower than the average of this study (five lesions) even though the data was collected over a longer period of time.

The neonates studied in the research mentioned were those admitted to the ICU, which suggests they were at a high-risk of skin problems and in need of specialized treatment. This information confirms the need for the development of a nurse training program, with the aim of training the whole nursing team to deal with skin treatment and improve nursing assistance[11]. The indicators of the present study show high incidence and prevalence of skin lesions in this population and demonstrate the need for specialized skin treatment. This can be achieved by creating protocols for the standardization of work practices and the implementation of safeguards through the training of nursing staff.

During the observation period for data collecting for the present study, the researchers sought to identify the lesion's causative agent, which was found to be most frequently medical agents (42.1%), followed by non-medical agents, such as adhesive labels, nose prongs and surgical procedures (18.4%). Both showed a higher incidence rate in comparison with the rates from previous studies[9, 11].

This study did not find classified lesions such as pressure ulcers, possibly because of the dynamics of the treatment work process that strictly determines changing position every two hours during the vital signs check. Even though the oximeter sensor was considered a causative agent, this research did not identify any lesion resulting from its improper use, probably because of the strict rotation of its monitoring point every two hours and its proper use. This is corroborated by Nepuceno and Kurckant[9], who also consider the pulse oximeter a risk factor for lesions but did not find any related to its improper use.

The main risk factors they identified were intravenous therapy (80.4%), which requires puncturing, volume infusion and causes lesions such as ecchymosis, hematoma, infiltration, erosion and coetaneous eruptions in the diaper area, possibly caused by the application of antibiotic treatment and adhesive labels (1.7%), as they damage skin due to the strong adhesiveness and their difficult removal due to skin fragility[11].

Fontanele and Cardoso[11], in turn, considered hematoma the most incidental lesion (46.0%) but did not report any case of dermatitis in the diaper region, as opposed to this study, which identified that lesion as the most frequent (n=58; 29.7%). In second place were hematomas/ecchymoses with 45 reported cases (24.7%) and in third, lesions from adhesive labels characterized by hyperemia, with 19 reported cases (9.8%). Nepuceno and Kurcgant[9] identified eccyhmosis as the most frequent lesion (n=117 cases; 50.9%), followed by perineal erythemia (n=66; 28.7%) and moniliasis (n=19; 8.3%). This study found a lower incidence rate for dermatitis from diapers but a higher rate of eventual complications than the study by Nepuceno and Kurcgant[9].

Moniliasis is caused by the fungus *Candida albicans,* which is found in intestinal tract microbiota in the mouth, skin and vagina of healthy persons[12]. This perineal region infection has red spots, unlike dermatitis from diapers and the professional in charge should suspect and evaluate if there is an associated oral infection[13]. It can be treated with nystatin cream during every diaper change, after washing the affected area with water and neutral soap. In the case of dermatitis without infection, sunlight and the use of corn starch is recommended[14]. Skin exposure to sunlight is recommended because the ultraviolet rays heal the lesion and eliminate any pathogen microorganisms[13]. Amongst the cases of diaper-caused dermatitis diagnosed in this study, 29.3% evolved to a fungal infection and were treated with nystatin.

A premature newborn can acquire *Cândida albicans* during the intrauterine period, through ascending infection or passage through the birth canal, which may cause a mucocotaneous infection. Contamination via the hematogenous route is rare and the high incidence rates of the fungus may have been caused by catheters and invasive procedures during treatment[12]. Healthy infants with unbroken skin rarely acquire this fungal infection. On the other hand, infants with dermatitis in the diaper region are 40 to 50% more susceptible to acquiring this fungal infection, precisely because of this tegumentary dysfunction[15].

Premature newborns during hospitalization frequently need antibiotic therapy, which favors perineal moniliasis, as it inhibits the normal growth of microbiotic bacteria on the

skin. Additionally, the prolonged use of corticosteroids may be required, which damages the body's defense mechanism and consequently favors fungal proliferation[11].

This study discovered that dermatitis treatment with the topic anti-fungal was not as efficient as dermatitis treatment (without signs of infection) with EFA, since as it was seen in the first case, the lesion remission period was longer. This can be partly explained by the fact that remission is more likely to occur before fungal contamination, which points to the importance of preventive treatment of a local infection.

The treatment most frequently used in this study was EFA (26.6%), used for 52 lesions or a fourth of the total identified. EFA becomes part of the stratum corneum of the epidermis and decreases trans-epidermis water loss, which promotes elasticity and protects skin integrity. Essential fatty acids are also vital for cell functions since they are precursors for the synthesis of long chain polyunsaturated fatty acids and promote cell membrane fluidity, membrane enzyme activity and the synthesis of eicosanoids, such as prostaglandins, thromboxanes and leucotrienes. These three substances are capable of modifying inflammatory and immunological reactions, altering leukocyte functions and accelerating the process of tissue granulation, in addition to promoting chemotaxis, leukocyte attraction, angiogenesis and favoring humidity, which accelerates the healing process. Linoleic acid is a vital component of EFA for transporting fat, maintaining cell membrane integrity and functions and acting as a local immunogen. It is also found in sunflower seed oil, which can be used for skin healing[16].

Silver nitrate was used for the treatment of umbilical granuloma and is a standard staff procedure for treating this lesion. It helps control local infection by its bactericide effect on gram-positive bacteria such as *Stafilococcus aureus.* The literature recommends caution and awareness for signs of hyper-sensibility, such as itching, hyperemia, pain and overheating that may result from silver nitrate use. The National Agency for Sanitary Inspection (ANVISA) set specific criteria for its commercialization, as seen in RDC 199/ 2006[17].

In a study with newborns weighing less than 2000g, who were admitted to a neonatal unit and randomly placed in two groups, micropore and a hydrocolloid were both used for

placing sensors to prevent lesions, since there is less friction on removal. Both caused lesions but the hydrocolloid lesion was less frequent and less intense according to statistics ($p<0.05$), mainly in premature newborns below 1kg with very thin and gelatinous skin[16].

CONCLUSION

With this study, it became possible to describe the main lesions that affect newborns during hospitalization and made it possible to evaluate these lesions in providing data and insights concerning the skin care of premature infants. It is the responsibility of the nurse to plan the assistance to be provided and give the nursing team theoretical and practical training to perform interventions more adequately whilst caring for the skin of premature newborns.

It is clear to see that this research has had a positive impact on the service environment observed, since during the data-collecting period no serious lesions were found on neonates in treatment. This may be a result of establishing dynamics for lesion diagnosis and the early start of preventive treatment.

With these findings, we notice the need for preventive lesion care (avoiding pain and infections) which can greatly favor the quality of life of neonates and their growth. This research also highlights the need for more specific research that can improve and instruct the evaluation processes for skin care, techniques and products available on the market.

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