

Original Research Article

Clinico-epidemiological study of iatrogenic cutaneous manifestations in neonates in intensive care unit in a tertiary care hospital

E. S. Sushmitha¹, D. Manoj^{2*}, K. Ravindra¹, G. Guruprasad²

¹Department of Dermatology, ²Department of Neonatology, JJM Medical College, Davanagere, Karnataka, India

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***Correspondence:**

Dr. D. Manoj,

E-mail: siddhardha.rajahmundry@gmail.com

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ABSTRACT

Background: Neonatal dermatology, by definition, encompasses the spectrum of cutaneous disorders that arise during the first four weeks of life ranging from physiological and transient to grossly pathological lesions in the skin of a neonate. The aim and objectives of the study were to determine the quantum of iatrogenic problems which can be minimized and prevented.

Methods: A total of 1000 neonates admitted in the tertiary care NICU of JJM Medical College were examined and spectrums of pathological cutaneous lesions noted.

Results: Among 1000 neonates examined, 101 had iatrogenic cutaneous conditions which were commonly seen in day one of life in 48 neonates and least in newborns between 15-21 days. Skin lesions were commonly seen in full term neonates (59), followed by preterm (39) and post term (3) neonates. Among the iatrogenic injuries needle prick injury (83), thermal burns (12) and bronze baby syndrome (11) were most commonly noted in LBW and the normal for weight neonates. A variety of other conditions which could not be categorized into any of the above categories accounted for 5 cases. These included albinism, Waardenburg syndrome, TORCH complex and Down's syndrome and Goltz syndrome.

Conclusions: Iatrogenic cutaneous abnormalities among neonates are under reported, with no detailed studies on these variants. Genetic, neonatal, maternal, social and geographic factors seen to influence the patterns of neonatal dermatoses. Hence, it is important for a dermatologist and paediatrician to have a thorough knowledge and to distinguish various iatrogenic manifestations and to minimize the outcomes during their stay in NICU.

Keywords: Neonatal, Iatrogenic, NICU

INTRODUCTION

Neonatal dermatology, by definition, encompasses the spectrum of cutaneous disorders that arise during the first four weeks of life. A host of aberrations from physiological and transient to grossly pathological are observed in the skin of a neonate and require no therapy.

The skin of the neonates is different from that of an adult in that it is thinner, less heavier, has weaker intercellular attachments and produces lesser sweat and sebaceous

secretions. Also, neonatal skin is less effective in detoxifying and deactivating compounds applied on it. The function and efficacy of newborn skin are strongly related to the maturity of the infant. The full-term infant has well-developed epidermis and dermis, histologically similar to the skin of a child or adult. The barrier properties of the epidermis are excellent, so the infant is well equipped for the move from amniotic fluid to air. Dermal structures are well developed too although there may be a degree of functional immaturity. Preterm infants will have skin whose structure and functions,

particularly of the epidermal barrier, directly reflect their degree of prematurity. Those immature infants of 23-26 weeks gestation who are at the limits of viability have a poorly developed epidermal barrier, with important implications for illness and survival.¹

Majority of these are transient and physiological and disappear without any treatment while only few are pathological. Neonatal dermatoses can be classified as follows.²

- 1) Transient skin disorders.
- 2) Congenital disorders- birthmarks and genodermatoses.
- 3) Acquired skin disorders specific to the neonatal period.
- 4) Iatrogenic dermatologic complications.

A non-intentional harm to a patient arising out of some aspect of health care is considered as an iatrogenic injury.³ Iatrogenic skin disorders can occur before labour, during delivery or after birth.⁴ The major risk factors are low birth weight, gestational age, duration of stay, central venous line, mechanical ventilation and support with cutaneous positive airway pressure.⁵

Neonates are admitted to the neonatal intensive care unit for various conditions. Some may be dermatological conditions whereas some can develop various cutaneous manifestations during their stay in neonatal intensive care unit.

The life supporting equipments in neonatal intensive care unit (NICU) can cause significant skin lesions which include cutaneous puncture marks, scars or lacerations and complications due to phototherapy, fetal scalp electrodes, transcutaneous oxygen monitors, skin temperature monitoring probes, adhesive tapes and pulse oxymeters. Although their therapeutic procedure have reduced morbidity and mortality, they may pose significant risk for iatrogenic cutaneous complications. And hence, it is worthwhile to make an analysis of these. However, apart from iatrogenic cutaneous manifestations, recent advances in neonatal intensive care have greatly decreased the mortality and morbidity of the neonates.

Classification of iatrogenic injuries⁶

- Iatrogenic disorders of the newborn
 - Scars
 - Fetal wound healing
- Iatrogenic injury during pregnancy
 - Amniocentesis
 - Chronic villus sampling
 - Other antenatal procedures
- Iatrogenic injuries during labour
 - Fetal monitoring
 - Injuries acquired during normal or operative deliveries
 - Forceps deliveries

- Vacuum extractors
- Caesarean section.
- Iatrogenic skin disorders after birth
 - Damage produced in ensuring adequate respiratory function
 - Conditions related to arterial catheterization
 - Complications related to drugs and nutrients
 - Extravasation injuries
 - Problems related to intensive care monitoring
 - Transcutaneous monitoring
 - Adhesive tape damage
 - Needle marks
 - Heel prick marks
 - Surgical scars
 - Vaccination

Causes for iatrogenic injury⁷

- The newborn skin is sensitive, fragile with neutral pH on the surface, lower lipid content and a higher water content.
- The stratum corneum is thinner, as also the epidermis and dermis compared to adults.
- Because of these characteristics, newborn skin is vulnerable to injury and infection during routine procedures.
- The newborns who are nursed in the neonatal ICU are more vulnerable as they are subjected to more invasive techniques where the margin of safety between effective treatment and iatrogenic damage is narrow.
- The skin may be pierced, cut, stripped and burned thermally from outside or chemically from inside.
- Extremely low birth weight and very low birth weight babies are at the greatest risk because of the –
 - Size
 - Length of hospital stay and the need for sustained intensive care
 - May be subjected to multiple diagnostic and therapeutic manoeuvres
 - Repeated blood sampling
 - Parenteral nutrition.

No matter how simple and routine the delivery care may seem, between their admission and discharge, the neonates are submitted to a range of procedures, using life – support devices, which demand the application of care, including instalment of catheters; capillary, venous and arterial punctures; probes, placement of adhesive devices, use of sensors, placement of electrodes, body hygiene, dressing change, position change, among others. All these situations represent aggravation factors for the appearance of lesions, due to their repetitive frequency during the hospitalization.^{8,9}

Newborn skin lesions are quite common, both in healthy neonates, as well as in those needing hospitalization at neonatal intensive or semi-intensive care units, due to some disease. A good number of conditions are seen in

neonates, some of which are due to iatrogenic causes. Hence the objective of the study is to determine the quantum of iatrogenic problems. The identification of iatrogenic conditions can be very useful as many of them can be minimized and some of them can be prevented also. Hence it is worthwhile to update the knowledge of all the medical profession involved in care of the Neonates. The available literature on neonatal iatrogenic dermatoses in our country is limited. The present study was undertaken to make an analysis of these conditions to understand the multitude of skin disorders that affect the newborn especially in the neonatal intensive care unit.

METHODS

Study design

Hospital based, prospective study

Study place and Period

This study was conducted in JJM Medical College, Davanagere from November 2016 to October 2017

One thousand neonates admitted in the tertiary set up Neonatal Intensive Care Unit (NICU) of the Department of Paediatrics after being delivered in the labour room in Department of Obstetrics and Gynecology in Chigateri General hospital and Bapuji Hospital attached to J.J.M. Medical College, Davangere for a period of 1 year.

Inclusion criteria

Inclusion criteria were only neonates (first four weeks of life) admitted in neonatal intensive care unit; any skin manifestation present in admitted neonates or developed during the course of their stay in neonatal intensive care unit.

Exclusion criteria

Neonates/ infants not admitted in neonatal intensive care unit.

Procedure and statistical methods

All the newborns admitted in the NICU were examined for iatrogenic cutaneous lesions during their stay in NICU. After taking relevant maternal and neonatal history, entire skin surface, scalp, mucous membranes, genitalia, hair and nails were examined after thorough hand washing and sterilization measures.

The newborns were classified according to gestation as preterm, term and post-term. Birth weight and history of consanguinity were noted. The mode of delivery, reasons for NICU admission and associated systemic illness of the neonate and congenital malformations were also recorded. Parity of the mother and other significant maternal illnesses were noted.

Diagnosis was made on clinical features. No specific investigations or interventions were done/conducted on the babies. Only photographs of the newborns were taken.

Data was entered into Microsoft Excel (Windows 7; Version 2007) and analyses were done using the Statistical Package for Social Sciences (SPSS) for Windows software (version 20.0; SPSS Inc, Chicago). Microsoft word and excel have been used to generate graphs, tables etc.

RESULTS

Among 1000 neonates admitted in NICU, 101 babies had iatrogenic cutaneous lesions, of these 51 were males and 50 were females. Iatrogenic cutaneous lesions were seen in 48 neonates in 1 day of life, between 2-7 days in 40, between 8-14 days in 8, between 22-28 days in 4 and between 15-21 days in 1. Preterm babies accounted to 39, 59 were term and 3 were post-term.

History of consanguinity was present in 40 cases. Normal vaginal delivery accounted to 89 neonates, 10 by caesarean section and 2 by forceps assisted delivery. Multiparity was seen in 31 mothers and 70 were uniparous (Table 1).

Table 1: Types of iatrogenic lesions.

	No. of cases
Types	
Needle prick mark	83
Bronze baby syndrome	11
Phototherapy induced rash/ Thermal burns	12
Gangrene	4
Adhesive tape injury	1
Other associated conditions	
TORCH Complex	1
Albinism	1
Wandunberg syndrome	1
Down's syndrome	1

Most of the iatrogenic cutaneous lesions were seen in neonates aged day 1 of life (which accounts to 48) term babies (59) and newborns weighing between 2.4-4.5 kgs (Table 2).

Most couples 61 (60.40%) were non-consanguineously married and 70 (69.31%) mothers were uniparous and 89 (88.12%) delivered by normal vaginal route (Table 3).

Of the 101 neonates, 60 (59.41%) had a single condition followed by 21 (20.79%) with 2 conditions and 20 (19.80%) with 3 conditions (Table 4).

Out of the total cases observed, a variety of other conditions which could not be categorized into any of the above categories accounted for 5 cases. These included albinism, Waardenburg syndrome, TORCH complex and Down's syndrome and Goltz syndrome (Table 5).

Table 2: Relationship of skin lesions with neonatal factors.

	No. of cases	Percentage (%)
Age (in days)		
1	48	47.52
2-7	40	39.60
8-14	8	7.92
15-21	1	0.99
22-28	4	3.96
Sex		
Male	51	50
Female	50	50
Birth weight (kg)		
<1.0 (ELBW)	0	0
1.0–1.49 (VLBW)	11	10.89
1.50–2.49 (LBW)	47	46.53
2.5–4.5 (Normal)	43	42.57
Maturity		
PT	39	38.61
T	59	58.42
PsT	3	2.97

Table 3: Relationship of skin lesions with maternal factors.

Maternal factors - consanguinity	No. of cases	Percentage (%)
Consanguineous (C)	40	39.60
Non-consanguineous (NC)	61	60.40
Parity		
Uniparous	70	69.31
Multiparous	31	30.69
Mode of delivery		
Normal	89	88.12
LSCS	10	9.90
Forceps	2	1.98

Table 4: Distribution of number of cutaneous manifestations.

Number of cutaneous manifestation	No. of cases	Percentage (%)
One type of lesion	60	59.41
Two types of lesions	21	20.79
Three and more lesions	20	19.80
Total	101	100

Table 5: Distribution of various iatrogenic cutaneous conditions recorded in NICU.

	No. of cases	Percentage (%)
Iatrogenic cutaneous injuries		
a) Needle prick mark	83	70.34
b) Adhesive tape damage	1	0.85
c) Heel prick marks	2	1.69
d) Gangrene 2° to probe	4	3.39
e) Thermal burns/ Phototherapy induced rash	12	10.17
f) Bronze baby syndrome	11	9.32
Associated conditions		
a) Albinism	1	0.85
b) Waardenburg syndrome	1	0.85
c) TORCH complex	1	0.85
d) Down's syndrome	1	0.85
e) Goltz syndrome	1	0.85

DISCUSSION

Cutaneous lesions are not uncommon among neonates admitted in the NICU. The incidence of pattern of findings may depend on various factors. Although cutaneous disorders were not a significant cause for NICU admission, non-negligible morbidity and mortality due to them in neonates in the intensive care.

In the present study, 101 of 1000 neonates in NICU had iatrogenic cutaneous findings with a hospital based incidence. Most of the neonates had single cutaneous iatrogenic condition, while the rest had more than one iatrogenic cutaneous finding. Even with progress in medical knowledge and technology, iatrogenic injuries have not yet been completely eliminated, but their nature and causes have changed. Based on the few data available in literature, the incidence of IE in neonates ranges from 1.2 to 3.2 per 100 hospitalization days.¹⁰

The reasons for NICU admissions in our neonates were prematurity, respiratory distress syndrome, asphyxia, neonatal icterus, pulmonary infection, cardiac abnormalities, meconium aspiration syndrome, neonatal convulsions, neonatal hyperbilirubinemia, vitamin K dependent bleeding disorder, hypoglycaemia for evaluation and late onset sepsis. This is comparable to a study conducted by Ligi et al.¹⁰ This stresses the need for better care of the neonates in the NICU and better understanding of the dermatological conditions by both paediatricians and the dermatologists.

The various iatrogenic conditions seen in the neonates are as follows

Iatrogenic injuries were noted in 101 of newborns admitted in NICU.

The most commonly noted injury was needle prick injuries in 83 of 101 neonates with iatrogenic injuries followed by thermal burns (phototherapy induced rash) in 12 and bronze baby syndrome in 11 neonates, gangrene secondary to probe in 4 neonates adhesive tape injuries in 1, heel prick mark in 2.

Other associated conditions which were noted during the study were albinism in 1, Down's syndrome 1, TORCH complex 1 and Waardenburg syndrome 1 and Goltz syndrome.

This is in concurrence with observations by Lencia, who studied among 27 preterm infants and observed/noticed that there were 12 bruising (31%), 4 abrasions (10%), 9 (diaper dermatitis 22%), 5 hyperemias and 1 pusutule, 1 cellulite and 1 hemangioma.¹¹

This category is a completely new entity and to the best of one knowledge, there are no other Indian studies or studies done abroad with which we could correlate our results.

We also observed that iatrogenic injuries were more commonly seen in low birth weight (47) and normal (43) followed by very low birth weight neonates.¹¹ This is in concurrence with a study by Basu et al which states that premature neonates, particularly the tiny ones are more prone to injuries because of their very delicate constitution, prolonged stay in nursery and exposure to manipulation with sophisticated instrumentation.³

This study also showed that Iatrogenic skin disorders can occur any time in the perinatal periods and are most commonly caused by skin injury, which may lead to infection and scarring. This is in concurrence with a study by Maalouf et al which states that Iatrogenic skin disorders can occur before labour, during delivery, or after birth.⁶ They are most commonly caused by skin injury, which may lead to infection and scarring.

Most commonly reported cutaneous iatrogenic injuries are due to IV access with an incidence of around 71%. This is in contrast to the study done by Franck et al whose study showed an incidence of 23-70% of all admitted newborns.¹²

CONCLUSION

The subject of neonatal dermatology is indeed an ideal subject for study from many points of view, such as the clinical importance, ubiquitousness and protean manifestations. However, a close liaison between the paediatrician and dermatologist is of utmost importance to allow early diagnosis and treatment and allay the anxiety of the parents.

In the present study, our main aim was to assess the frequency of iatrogenic conditions in newborns admitted

in a tertiary setup NICU and to focus on the preventive measures.

The appreciation of normal phenomena and their differentiation from more significant cutaneous disorders is critical to avoid unnecessary treatment on the tender newborn skin, while prompt diagnosis and treatment of significant disorders and genetic counselling of parents in cases of congenital malformations and genodermatoses play an extremely important role.

A variety of iatrogenic injuries which occur in newborns admitted to NICU can also harm the neonate's skin. In view of the paucity of the studies, the familiarity of these conditions among the obstetricians, paediatricians, dermatologists and nursing staff is relatively less. Hence it is worthwhile to update the knowledge of all the medical profession involved in care of infants.

Out of one thousand neonates admitted in NICU 101 (about 10%) had iatrogenic lesions which are significant and Needle prick marks constituted more than half the cases, which stresses the need for care during the procedure involving the needles. Almost half the patients had the lesions on the first day of life. Hence a meticulous cutaneous examination can help in detection of these lesions which helps in reducing the morbidity. The iatrogenic lesions were most common in low birth weight baby which suggests careful handling of these neonates, in view of the nature of skin. More than 10% of babies had thermal burns which necessitate the need of meticulous care when the infants are receiving phototherapy which can reduce the occurrence of these lesions which are preventable. Iatrogenic cutaneous abnormalities among neonates are under reported, with no detailed studies on these variants. It is thus important for a dermatologist and paediatrician to have a thorough knowledge of various iatrogenic manifestations and put an effort to minimize them during their stay in NICU in order to ensure a better outcome.

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