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Maternal and Neonatal Risk Factors of Hyperbilirubinemia among Term and Preterm Newborns - A Comparative Study

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ABSTRACT

Jaundice in newborns is a prevalent ailment which often manifests during the first week following birth. The prime reason of jaundice is an imbalance between bilirubin conjugation and production, which raises bilirubin levels. The rapid disintegration of red blood cells and the underdeveloped liver, which may be induced by a number of circumstances, are the leading causes of this imbalance. Around the world, 60% of term and 80 percent of its total of preterm newborns suffer from this preventable illness. The goal of the study was to assess the neonatal and maternal risk factors for hyperbilirubinemia among term and preterm newborns admitted to Saveetha Medical College and Hospital. A quantitative approach with a non-experimental research design was adopted for the present study with 60 samples that were designated by using the purposive sampling technique. A self-structured questionnaire method was used to collect both demographic data and clinical variables of the maternal and neonatal risk factors of hyperbilirubinemia among term and preterm newborn babies. Among 60 participants 30 were in-term babies and 30 were preterm babies. The study shows that there was a significant difference in the type of birth injury between the preterm and term babies which was found to be statistically significant at a $p < 0.05$ level. The study also predicts that there was a significant difference in the blood group between the preterm and term babies which was found to be statistically significant at a $p<0.05$ level.

KEYWORDS: *Neonatal jaundice, risk factors, maternal risk factors, term, and preterm newborn babies*

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INTRODUCTION

Jaundice in newborns, which occurs during the period of adjustment after birth, is a prevalent ailment. Around the world, 60% of term and 80% of preterm newborns struggle from this preventable illness. One of the most probable causes for neonatal readmission to the hospital is jaundice. Without therapy, it typically commences on the second days following birth and requires two to three days to return to normal bilirubin levels. The neonate population, on the other hand, is more likely to develop severe jaundice or jaundice that progresses to acute bilirubin encephalopathy or kernicterus. The primary reason hyperbilirubinemia is significant is that an increase in unconjugated bilirubin levels is closely related to neurotoxic consequences that might result in long-term issues such cerebral palsy, kernicterus, including deafness. A diverse range of factors, such as hereditary and/or geographical instances, can avert the onset of severe jaundice, which is a critical challenge that can be fatal. [1]

The prime reason of jaundice is an imbalance between bilirubin conjugation and production, which raises bilirubin levels. The rapid disintegration of red blood cells and the underdeveloped liver, which may be triggered by a lot of circumstances, are the leading causes of this imbalance. On the third day, the indirect bilirubin value in term neonates with physiologic jaundice does not surpass 12 mg/dL, while on the first day in preterm infants, this maximum increase reaches 15 mg/dL [2] Despite the simple fact that jaundice is a condition, babies should be examined to stop it from deteriorating and progressing into acute encephalopathy and severe

hyperbilirubinemia. A temporary or permanent brain damage could arise from bilirubin condensation in the brain. A rare but significant side effect of hyperbilirubinemia is kernicterus. Therefore, it is crucial to detect jaundice as soon as possible.[3]

Hyperbilirubinemia is one of the most frequent clinical conditions. A frequent clinical issue throughout the neonatal era, particularly during the first week of life, is neonatal hyperbilirubinemia. Between 8% and 11% of newborns experience hyperbilirubinemia. During the first week of birth, hyperbilirubinemia is defined as the total serum bilirubin (TSB) above the 95th percentile for age (high-risk zone). [4] A buildup of bilirubin in the skin and mucous membrane causes jaundice, which manifests as a yellowish coloring of the skin and sclera. As the most common cause of neonatal re-confirmation and neonatal mortality, it necessitates careful study, examination, and treatment. It defines the excessive deposition of bilirubin that gives the skin a yellow-orange color. Neonatal hyperbilirubinemia, according to Stevenson et al., emerges when there is an imbalance between bilirubin synthesis and removal. Elevations of unconjugated bilirubin have the potential to be neurotoxic, despite the fact that it may have a physiological role as an antioxidant. In our standard obstetric and pediatric practice, infants who are close to term are functionally regarded as full-term. However, continuing to practise in this manner might not be acceptable. Despite being equal in size and apparent functional maturity to term infants, near-term infants have a higher risk of difficulties including neonatal hyperbilirubinemia, feeding issues, etc. than term infants. As a result, the complications necessitate a lengthy hospital stay, which drives up the cost even more. As a result, these babies represent an unidentified at-risk neonatal population.[5]

Due to a decrease in hepatic bilirubin conjugation capability and a drop in the activity of the uridine diphosphate glucuronyltransferase (UDPGT) enzyme as gestational age (GA) lowers, late preterm newborns are more susceptible to developing severe hyperbilirubinemia than term infants. However, despite the well-known substantial negative link between GA and the risk for major hyperbilirubinemia, near-term newborns are still treated the same as term babies in current studies that examine neonatal hyperbilirubinemia.[6]

Unconjugated (indirect) hyperbilirubinemia in newborns is a common and generally benign illness that causes jaundice (icterus neonatorum), a yellow colouring of the skin, sclera, and mucous membranes, in the first few days of life. A metabolic imbalance that favours bilirubin synthesis over hepatic-enteric bilirubin clearance is responsible for the disease. Additionally proven to be the most effective superoxide with peroxyl radical scavenging action is serum bilirubin. Hyperbilirubinemia, on the other hand, can reach neurotoxic quantities and have potentially fatal effects if it is unchecked or increases quickly. In order to ensure the welfare of newborns with jaundice, it is necessary to strike a balance between the protective effects of serum bilirubin and the risk of bilirubin neurotoxicity.[7] By 3 to 5 days of birth, this level typically rises in full-term neonates to a peak of 6 to 8 mg/dl before falling. The physiologic range is at 12 mg/dl an increase of 33. On the fifth day of life, the peak in premature newborns may be between 10 and 12 mg/dl, and it may even rise to 15 mg/dl without any obvious abnormalities in bilirubin metabolism. Increased bilirubin synthesis, increased enterohepatic circulation, poor conjugation, and reduced hepatic elimination of bilirubin are the causes of this physiologic jaundice.[8]

The lysis of RBC, release of haemoglobin, and catabolism of biliverdin, which is regulated by the enzyme heme oxygenase, all result in the production of bilirubin. Bilirubin was excreted after being taken up by the hepatocyte and converted there into conjugated bilirubin. The intestine and bile are cleared of newly produced conjugated bilirubin by the stool and urine. Infants' digestive flow goes through a three-step process. The conjugated bilirubin is changed into its unconjugated form, reabsorbed, and then sent through a port flow pathway into the hepatic bilirubin pool for outflow. The equilibrium in the metabolic pathways affects TSB stabling. An imbalance in the production and excretion of bilirubin leads to hyperbilirubinemia. The eyes are where hyperbilirubinemia initially manifests, followed by the face, chest, belly, and legs. Due to conditions including kernicterus, surfactant blockage, and enhanced hemolysis, it is very crucial. [9] Jaundice is referred to as protracted neonatal jaundice if it persists for more than 14 days. The primary cause of jaundice is an imbalance between bilirubin conjugation and production, which raises bilirubin levels. The primary reasons of this imbalance are the young liver and red blood cell rapid decomposition, which can be brought on by a variety of conditions. Jaundice is referred to as protracted neonatal jaundice if it persists for more than 14 days. The primary cause of jaundice is an imbalance between bilirubin conjugation and production, which raises bilirubin levels. The rapid disintegration of red blood cells and the young liver, which may be caused by a number of circumstances, are the main causes of this imbalance.[10]

Objective:

The purposes of the study are 1. To assess the maternal and neonatal risk factors of hyperbilirubinemia among term and preterm newborn babies. 2. To compare the maternal and neonatal risk factors with hyperbilirubinemia among term and preterm newborn babies. 3. To associate maternal and neonatal risk factors with selected socio-demographic variables.

Methods and Materials:

A Quantitative research approach with a non-experimental research design was used to conduct the study at neonatal ICU, Saveetha Medical College & Hospital with a sample size of 60 to assess the maternal and neonatal risk factors of hyperbilirubinemia among term and preterm newborn babies who were selected by purposive sampling technique. The inclusion criteria were neonates' Bilirubinemia level above 4 mg/dl, both pathological and physiological jaundice, and both sex. and the exclusion criteria were who are not willing to participate in the study. The data was collected with prior permission from the HOD the of Neonatology Department and ethical clearance was obtained from the institution. The purpose of the study was explained to the mothers of the neonates and written informed consent was obtained from them. Foremost All the term and preterm newborn babies with neonatal jaundice were tested with Bilirubinometer. A self-structured questionnaire method was used to collect both demographic data and clinical variables. The demographical variables include Maternal age, Educational qualification & Mother occupation of the mother, the clinical variables include Newborn's age, the Birth weight of the newborn, Maturity, Place of delivery, Apgar score, Feeding type, Any injury at birth, Type of birth injury to newborn's, History of the previous child with hyperbilirubinemia/Phototherapy, Gestational Age, Parity, Multiple Pregnancy, Maternal illness during pregnancy, Maternal blood group, Rh factor, Oxytocin Induction labor Mode of delivery, Duration of labor, Premature rupture of membrane, & Time of initiation of breastfeeding. That was collected were analyzed using descriptive and inferential statistics.

RESULT AND DISCUSSION:

SECTION A: DESCRIPTION OF THE VARIABLES OF PRETERM AND TERM BABIES.

The result shows that among mothers of preterm babies, 13(46.4%) were aged between 26 – 30 years, 12(42.9%) were graduates and above, 18(64.3%) were housewives, 16(57.1%) were primipara mothers, 14(50%) were direct breastfeeding and paladai respectively and 15(53.6%) were primigravida mothers.

The above result also shows that among mothers of term babies, 17(53.1%) were aged 21 – 25 years, 12(37.5%) had higher secondary education, 21(65.6%) were housewives, 23(71.9%) were primipara mothers, 18(56.2%) were feeding through paladai and 23(71.9%) were primigravida mothers.

SECTION B: ASSESSMENT OF NEWBORN FACTORS AMONG PRETERM AND TERM BABIES.

Table 1: Frequency and percentage distribution of newborn factors among preterm and term babies.

N = 60(28+32)

Newborn Factors	Preterm Babies		Term Babies		Chi-Square & p-value
	F	%	F	%	
Newborn age (in days)					χ^2=5.290 d.f=2 p=0.071 N.S
At birth	6	21.4	12	37.5	
1 – 3 days	13	46.4	17	53.1	
4 – 6 days	9	32.1	3	9.4	
≥7 days	-	-	-	-	
Birth weight of newborn					χ^2=7.790 d.f=3 p=0.051 N.S
≤1.5 kg	5	17.9	8	25.0	
1.6 – 2.4 kg	14	50.0	6	18.8	
2.5 – 3.5 kg	7	25.0	10	31.2	
≥3.6 kg	2	7.1	8	25.0	
Place of delivery					-
Home	-	-	-	-	
Health care centres	-	-	-	-	
Hospital	28	100.0	32	100.0	
Others	-	-	-	-	

Apgar scoring					χ^2=1.429 d.f=1 p=0.232 N.S
0 – 3 scores	-	-	-	-	
4 – 6 scores	5	17.9	10	31.2	
7 – 10 scores	23	82.1	22	68.8	
Total serum bilirubin (TSB) level of newborn a birth					χ^2=1.908 d.f=2 p=0.385 N.S
≤5 mg/dl	-	-	-	-	
6 – 10 mg/dl	0	0	2	6.2	
11 – 15 mg/dl	11	39.3	13	40.6	
≥16 mg/dl	17	60.7	17	53.1	
Any injury at birth					-
Yes	28	100.0	32	100.0	
No	-	-	-	-	
Type of birth injury to newborns					**χ^2=6.934 d.f=2 p=0.031 S***
Caput succedaneum	0	0	2	6.2	
Cephal – hematoma	0	0	5	15.6	
Skin lacerations	28	100.0	25	78.1	

*p<0.05, S – Significant, N.S – Not Significant

Table 1 shows that most of the newborn preterm babies, 13(46.4%) were aged 1 – 3 days, 14(50%) were weighing 1.6 – 2.5 kg, 28(100%) were born in a hospital, 23(82.1%) had Apgar score of 7 – 10, 17(60.7%) had total bilirubin level of ≥16 mg/dl, 28(100%) had an injury at birth and they had skin lacerations as birth injury. The data shows that most of the newborn term babies, 17(37.5%) were at birth, 10(31.2%) were weighing 2.5 – 3.5 kg, 32(100%) were born in a hospital, 22(68.8%) had Apgar score of 7 – 10, 17(60.7%) had total bilirubin level of ≥16 mg/dl, 32(100%) head injury at birth and 25(78.1%) had skin lacerations as birth injury. The table shows that there was a significant difference in the type of birth injury between the preterm and term babies which was evident from the calculated chi-square **(χ^2=6.934, p=0.031)** value which was found to be statistically significant at p<0.05 level.

A Cross-Sectional Study on Risk Factors Associated with Neonatal Jaundice was examined by **Mojtahedi SY, et al. in 2018**. The data showed that a mother's WBC, Hb, PLT, and gestational age were related to jaundice. (P < 0.05). The prevention of susceptible predisposing variables in babies and high-risk moms can therefore be successful through the identification of factors impacting the prevalence of jaundice. [11]

SECTION C: ASSESSMENT OF MATERNAL FACTORS AMONG PRETERM AND TERM BABIES.

Table 2: Frequency and percentage distribution of maternal factors among preterm and term babies.

N = 60(28+32)

Newborn Factors	Preterm Babies		Term Babies		Chi-Square & p-value
	F	%	F	%	
Mode of delivery					χ^2=3.128 d.f=1 p=0.077 N.S
NSVD	12	42.9	21	65.6	
Forceps delivery	-	-	-	-	
Ventous delivery	-	-	-	-	
LSCS	16	57.1	11	34.4	
Duration of labor					-
0 – 6 hours	28	100.0	32	100.0	
7 – 12 hours	-	-	-	-	
13 – 18 hours	-	-	-	-	
19 – 24 hours	-	-	-	-	
Any toxicants intake					χ^2=2.763 d.f=1 p=0.096 N.S
Yes	0	0	3	9.4	
No	28	100.0	29	90.6	

Time of initiation of breastfeeding					χ^2=0.837 d.f=1 p=0.360 N.S
Within ½ hour	11	39.3	9	28.1	
Within 1 – 2 hours	17	60.7	23	71.9	
Within 3 – 4 hours	-	-	-	-	
≥4 hours	-	-	-	-	
Maternal illness during pregnancy					-
Yes	28	100.0	32	100.0	
No	-	-	-	-	
Maternal blood group					**χ^2=9.541 d.f=3 p=0.023 S***
"A" blood group	5	17.9	9	28.1	
"B" blood group	10	35.7	8	25.0	
"AB" blood group	12	42.9	6	18.8	
"O" blood group	1	3.6	9	28.1	
Rh factor					χ^2=2.763 d.f=1 p=0.096 N.S
Positive	28	100.0	29	90.6	
Negative	0	0	3	9.4	

*p<0.05, S – Significant, N.S – Not Significant

Table 2 shows that most of the newborn preterm babies, 16(57.1%) were delivered by LSCS, 28(100%) had a duration of labor of 0 – 6 hours and had not taken any toxicants, 17(60.7%) were initiated with breastfeeding within 1 – 2 hours, 28(100%) ha maternal illness during pregnancy, 12(43.9%) belonged to "AB" blood group and 28(100%) had positive Rh factor. The data also shows that most of the newborn term babies, 21(65.6%) were delivered by NSVD, 32(100%) had a duration of labor of 0 – 6 hours, 29(90.6%) had not taken any toxicants, 23(71.9%) were initiated with breastfeeding within 1 – 2 hours, 32(100%) ha maternal illness during pregnancy, 9(28.1%) belonged to "O" blood group and 29(90.6%) had positive Rh factor. The association shows that there was a significant difference in the blood group between the preterm and term babies which was evident from the calculated chi-square **(χ^2=9.541, p=0.023)** value which was found to be statistically significant at p<0.05 level.

SECTION D: ASSOCIATION OF NEWBORN AND MATERNAL FACTORS WITH SELECTED DEMOGRAPHIC VARIABLES.

The result shows that the demographic variable mother occupation **(χ^2=14.000, p=0.030)** had shown statistically significant association with newborn factor birth weight of preterm babies at p<0.05 level and the other demographic variables had not shown statistically significant association with a birth weight of the preterm babies. The result shows that the demographic variable educational qualification **(χ^2=9.820, p=0.020)** had shown statistically significant association with newborn factor Apgar score of preterm babies at p<0.05 level and the other demographic variables had not shown statistically significant association with Apgar score of the preterm babies.

The results showed that the mean total bilirubin level was significantly higher in newborns delivered vaginally (17.33.5 mg/dl) compared to cases born by caesarean section (16.13.9 mg/dl) (P=0.02). **Garosi, E., et. al. (2016)** conducted a study to evaluate the relationship between Neonatal Jaundice and Maternal and Neonatal Factors. Continuous monitoring of infants after birth could help with early diagnosis, enhance illness management, and lessen the difficulties that follow because factors including style of delivery, oxytocin induction, and neonate's gender could contribute to jaundice. [12]

CONCLUSION:

The study's outcomes are in accordance with the research findings and have substantial support from several evidence gathered both abroad and in India. Neonatal jaundice development is also influenced by socio-demographic factors such the mother's age, education, occupation, place of residence, parity and gravida, family income, and the sex of the neonates. Risky pregnant women should receive timely therapeutic intervention as well as closer monitoring. It is suggested that the bilirubin level of all babies be checked with a non-invasive bilirubin check should be done before discharge from the hospital or maternity unit as well as during the first clinic visit on the third day after birth because neonatal jaundice in darker pigmented babies can be challenging to clinically diagnose. First and foremost, enhancing maternal and public health education can be used to

prevent the risk associated with maternal factors or identify neonates who have these risk factors, which is crucial for optimal newborn treatment.

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