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The Relationship between Neonatal Jaundice and Maternal and Neonatal Factors in Zakho City

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ABSTRACT

Background: Neonatal jaundice, which affects 60% of full-term and 80% of preterm infants globally, is a common physiological problem in neonates**.** It was linked to various factors like gestational age, male sex, birth weight, labor duration, multiple pregnancies, teenage pregnancy, diabetes, Rh and ABO incompatibility, breast-feeding, and vacuum extraction.

The current study was designed and carried out to examine the effects of the factors mentioned above, on neonatal jaundice in light of the disparity between the findings regarding factors influencing jaundice in newborns (such as mode of delivery and anesthesia) and the continuously increasing prevalence of cesarean sections.

Methodology: Cross-sectional research was carried out on 205 children hospitalized at Iraq's Zakho General Hospital**,** analyzing data from peripheral venous blood samples. The study involved hematological investigations, cell indices assessment, and a hybrid test. The ethics committee gave its approval to the study, and participants completed informed consent forms. SPSS vs. 26 was used for statistical analysis, with frequencies and percentages employed for descriptive statistics. A Chi-Square and t-test test were used to investigate the relationship between essential demographic characteristics factors and jaundice. A p-value of 0.05 or less was considered statistically significant.

Results: A study found 205 newborns with jaundice, with 110 boys and 95 girls. Most were breast-feeding. The majority of mothers were between 20 and 29. The study found 122 cesarean births and 83 vaginal deliveries. Oxytocin was required in 47 cases of spontaneous births. The study found a significant difference in jaundice severity between children born by oxytocin induction and those born spontaneously. The severity of jaundice did not differ significantly between anesthesia techniques.

Conclusion: Neonatal jaundice is a leading cause of morbidity and mortality, with male children and oxytocin infusion being the main predictors. However, a causal link between feeding style and high bilirubin levels is not established.

Keywords: Cesarian section, Maternal, Neonatal Jaundice, Newborn, Oxytocin.

1. Introduction

Neonatal jaundice is one of the most common physiologic disorders requiring medical attention in newborns[1]. It is distinguished by a yellow coloration of the mucosa, sclera, and skin caused by an excess of bilirubin in the tissue and plasma[2]. Hyperbilirubinemia is defined as a blood total bilirubin level in a newborn of more than 5 mg/dl (86 mol/L)[3]. The majority of these appear within the first week after birth. It is seen in around 60% of full-term neonates and more than 80% of preterm infants all over the world[4-5]. Neonatal jaundice is the most prevalent reason infants are readmitted throughout their newborn period. It is responsible for 70% and 10% of neonatal morbidity and mortality worldwide, respectively[6].

The transport mechanisms controlling bilirubin metabolism and the equilibrium of bilirubin in serum remain controversial after a century of research. Bilirubin is the byproduct of hemoprotein heme moiety breakdown[7, 8]. The mechanism of baby jaundice is an imbalance in bilirubin production and excretion, resulting in elevated bilirubin levels. The neonate's immature liver and the fast breakdown of red blood cells are the primary causes of this imbalance, which may be complex[9]. Based on total serum bilirubin levels, there are two categories of hyperbilirubinemia: physiologic and pathologic hyperbilirubinemia[10].

Neonatal jaundice was significantly associated with several maternal, obstetric, and gestational factors, including male sex, birth weight, primiparity, prolonged labor, normal and oxytocin-

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assisted delivery, multiple pregnancies, teenage pregnancy, diabetes mellitus, Rh incompatibility, ABO incompatibility, breast-feeding, and vacuum extraction[6], [11].

Visual evaluation of jaundice is used to diagnose hyperbilirubinemia in the first instance, followed by selective total serum bilirubin (TSB) measurement[12]. For newborn hyperbilirubinemia, several therapeutic options have been outlined, including phototherapy, improved feeding, intravenous immunoglobulin, and neonatal exchange transfusion[13]. If left untreated, it can result in neurological abnormalities, cerebral palsy, damage to the auditory nerve, chorea, and bilirubin encephalopathy, among other severe and perhaps lifelong issues[14]. In the long term, the patient may present with anemia, Anaemic individuals, significantly children, have decreased immunity against infections, reduced appetite, and an inability to maintain body temperature in severe anemia may also be seen [15].

Even though jaundice has become more common in recent years, no studies have been done to determine the elements that contribute to this condition. The **current study was designed** and carried out to examine the effects of the factors above on neonatal jaundice in light of the disparity between the findings regarding factors influencing jaundice in newborns (such as mode of delivery and anesthesia) and the continuously increasing prevalence of cesarean sections.

2. Methodology

2.1 Selection of subjects

A cross-sectional research study was used to examine data from a sample of 205 children, 110 of whom were male and 95 of whom were female, and who were admitted to the Neonatal Unit at Zakho General Hospital in Zakho City, in the Kurdistan region of Iraq. The sample was collected between October 1st, 2022, and April 1st, 2023.

2.2 The criteria of the study sample

Inclusion criteria: Neonates must be term, icteric, and between the ages of 2 and 28 days old with birth weights of more than 2500 grams.

Exclusion criteria: Age less than two days; parents who refused to participate in the trial; insufficient knowledge of pregnancy or delivery; preterm and term neonates with low birth weights, less than 2500 grams; and TSB greater than 15 mg/dl.

2.3 Patient information

Parents of the patients were requested to complete a questionnaire containing demographic, neonatal, and maternal data after giving their agreement to participate in the study. Age, gender, weight, maturity, location of residence, feeding method, birth method, and family history of NNJ were all included in the neonatal data. We also checked their PCV and TSB levels. In addition, details on the mother, such as her age, status of education, place of employment, history with drugs and health conditions, usage of oxytocin or spinal anesthetic, and parity, are all noted.

2.4 Blood Sample Collection

4 milliliters of peripheral venous blood were drawn from each patient and divided into two sterile (K2-EDTA anticoagulated) tubes with 2 milliliters each and four plain tubes with 2 milliliters. After allowing the 2 ml in the plain tube to clot, the serum was extracted and centrifuged at 3000 rpm for 20 minutes to estimate the total serum bilirubin. Hematological investigations, such as complete blood counts and morphology, were conducted using the additional 2 ml in an EDTA tube.

2.5 Laboratory procedures

The cell indices of well-mixed EDTA blood samples were assessed using an electronic hematological analyzer (Beckman-Coulter counter, USA) that was calibrated each day using quality control reagents supplied by the manufacturer [4°C]. Two ml of reagent (R2) was pipetted, and one ml was into two cuvettes (one for calibration and one for testing) at 37°C, then 50 l of reagent (R3) was added to the test cuvette, mixed, and incubated for 5 minutes at the same temperature. 100 l of serum was added to the calibration and test cuvettes, respectively, and absorbance at 550 nm was recorded after 3 minutes.

2.6 Ethical Approval

The study proposal was approved by the ethics committee at the University of Zakho's College of Medicine, located in the Kurdistan Region of Iraq. Before collecting samples, parents of children were contacted for permission to participate in the study, and informed written agreements were obtained from all participants.

2.6 Statistical Analysis

SPSS vs. 26 was used to do statistical analysis. The participant's descriptive data were described using percentages and frequencies. Chi-square and t-tests were used to examine the relationship between jaundice and fundamental demographic factors. For statistical significance, a p-value of less than 0.05 was considered.

3. Results

There were 205 newborns with jaundice, with 110 boys (53.7%) and 95 girls (46.3%). Males outnumber females. The average weight of a newborn was 3192 ± 423 grams; most of them are in the breast-feeding group and have no family history of neonatal jaundice, as shown in table 1.

Based on Table 2, the majority of mothers are between the ages of 20 and 29, followed by 30-39, with 11 cases of mothers under the age of 20, and the P value for the relationship between maternal age and newborn jaundice is 0.211.

In order to deliver newborns, 122 (59.5%) instances of cesarean births and 83 (40.5%) cases of vaginal deliveries were employed, according to the findings. In the cesarean section group, spinal and general anesthesia were used in 103 (50.2%) and 19 (9.3%) cases, respectively, as shown in Table 3.

Table 1: Participants' sociodemographic features.

Parameter	**Cases**	
Age of neonate (days)	5.440	± 2.705
Age of mother (years)	27.74	± 5.927
Weight in Kg	3.192	± 0.423
Sex of neonate		
Male	110	53.7%
Female	95	46.3 %
Feeding		
Breast-feeding	90	43.9%
Formula feeding	43	21%
Both milk	72	35.1%
Family history of neonatal jaundice		
Yes	67	32.7%
No	138	67.3%
Residence		
Urban	155	75.6%
Rural	30	14.6%
Camps	20	9.8%
Mother's employment		
Housewife	177	86.3%
Employer	28	13.7%
Mother Education level		
Illiterate	26	12.7%
Primary school	43	21%
Secondary school	91	44.4%
College and above	45	22%

Table 2: The correlation between the mother's age and her newborn's total serum bilirubin level.

Variable	**Num.**	**Percentages**	**P value**
Less than 20 years	11	5.4%	0.211
20-29 years	125	61%	
30-39 years	61	29.8%	
40 years and more	8	3.9%	
Total	205	100%	

Table 3: Shows the difference between types of anesthesia.

Types of anesthesia	**Spinal**	**General**	**No anesthesia was used**	**P value**
	103 (50.2%)	19 (9.3%)	83 (40.5%)	0.175

Furthermore, oxytocin was required in 47 cases (56.6%) of spontaneous births to initiate or enhance the labor process. Most patients (37.1%) had a primiparous birth, and 43.9% were breast-fed. However, the t-test analysis indicated a statistically significant difference between children born by oxytocin induction (14.58 ± 3.48) and those born spontaneously (8.57 ± 2.26); t-test = 0.037, as in Table 4.

Additionally, compared to male neonates (13.52 ± 3.79), female babies' mean total bilirubin levels (12.50 ± 3.72) were considerably higher (t-test = 0.534). as in Table 4.

The severity of jaundice did not differ significantly between anesthesia techniques. However, the spinal anesthesia group's mean total bilirubin level was more incredible than usually delivered instances (11.97 ± 3.96) despite the difference being statistically insignificant (P = 0.403).

Table 4: Shows a comparison of the mean total bilirubin levels between groups of newborns who underwent oxytocin induction and those who did not, and between males and females.

	Mean	±SD	t-test
Oxytocin used	14.58	±3.48	0.037
Oxytocin without	8.57	±2.26	
Male	13.52	± 3.79	0.534
Female	12.50	± 3.72	

The difference between cases born through cesarean section (13.79 ± 3.48 mg/dl) and regularly delivered neonates (11.97 ± 3.97 mg/dl) was not statistically significant (t-test = 0.130), according to chi-square analysis as in Table 5.

Tabel 5: Compares the average total bilirubin levels in newborns with types of deliveries.

Variable	Mean total serum bilirubin
Normal vaginal delivery	11.97 ±3.96
Cesarean section	13.79±3.48
t-test	0.130

4. Discussion

Severe hyperbilirubinemia can lead to potential side effects like kernicterus and acute bilirubin encephalopathy[16]. The Academy of Pediatrics (2004) recommends identifying causes of newborn jaundice before discharge and examining newborns on days 3-5 to prevent jaundice-related issues[17].

According to the study, male neonates are more likely than female newborns to experience neonatal jaundice, with a total of 110 cases (53.7%). This finding is consistent with previous research in Nigeria and Rwanda, where male neonates presented with jaundice at higher rates (67.4% and 60.5%, respectively). Nonetheless, Ibadan research discovered that a more significant percentage (53.9%) was displayed by female newborns[18-20].

The Iranian study found a significant difference in newborn birth weight, but our finding did not find a significant link between birth weight and jaundice prevalence[16].

The research found that the mothers' mean age in patients was 27.74 years, but maternal age was not statistically significant; however, younger mothers' neonates had higher blood bilirubin levels, according to Tavakolizadeh et al.[21]. Another previous study revealed that newborns may be at a higher risk when their mothers are over 30 years old[22]. Another study found that mothers aged 41-50 had a threefold increased possibility of increasing newborn jaundice prevalence compared to those under 20[23].

The study suggests that a higher bilirubin level in children delivered via oxytocin infusion may be due to labor inducement, aligning with Abdelgader and Yazdiha's findings. Additionally, the use of oxytocin and suction was found to increase the risk of jaundice in normal-born newborns [24-25]. Additionally, the use of oxytocin and suction was found to increase the risk of jaundice in normal-born newborns[26].

Oxytocin, a bilirubin-metabolizing hormone, has been related to an increased incidence of infant jaundice. Inducing labor with oxytocin may cause hypoosmotic and lytic effects, potentially leading to hyperbilirubinemia[21].

The study found no significant difference between breast-fed and artificially fed infants, despite nursing and breast milk being known risk factors for NNJ, which agrees with Chiu YW[27]. The study found that the ratio of breast-fed to artificially fed newborns in both groups is nearly equal; hence, this non-significant difference might be referred to as a fact, that body weight and gestational age are similar in similar groups[24]. However, studies by Seyedi and Soldi A. disagreed with the findings[17,28].

Overall, according to TSB findings, there was no statistically significant difference (P = 0.130) between normal birth and cesarean delivery. In 2010, Alkan et al. found no significant difference in jaundice prevalence between cesarean and standard delivery, with total bilirubin levels not influenced by delivery mode, as per a study comparing 68 newborns born through cesarean section versus 155 delivered naturally[29]. According to Agarwal et al.'s study, infant jaundice is not influenced by the way a baby is delivered. The study by El-Sayed et al. discovered a statistically significant difference between cesarean and normal births, with 17.4% of neonatal jaundice cases in cesarean sections and 10.2% in regular deliveries, indicating no connection between delivery methods and newborn jaundice[30-34].

Eskicioglu et al. demonstrated that newborn jaundice is unaffected by the kind of anesthetic procedure, which is similar to the current study[35].

Conclusion

Neonatal morbidity and death were frequently brought on by neonatal jaundice. The male child and oxytocin infusion were the main predictors of newborn jaundice in this research. However, this study cannot demonstrate a causal link between the style of feeding or delivery and high bilirubin levels.

Recommendation

The American Academy of Pediatrics states that before the discharge of a newborn, predisposing factors must be recognized and addressed. Newborns should be monitored during the first three to five days following delivery when jaundice is most common. Furthermore, promoting natural delivery and minimizing needless interventions during childbirth may help lower the frequency and intensity of jaundice in newborns. A more significant of studies is required. Before establishing a link between risk factors and an elevated newborn bilirubin level, a more thorough evaluation of liver cells and red blood cell activity must be gathered.

Conflict of interests

None

Authors' contribution

The authors contributed equally to this work, from the implementation and design of the research to the analysis of the results and the writing of the manuscript.

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