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Neonatal Hyperbilirubinemia: Causes, Symptoms, and Management in the Context of Research on Newborns

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

Hyperbilirubinemia is a medical disorder characterized by elevated blood levels of bilirubin, which can cause jaundice, or a yellowing of the skin, sclera, and nails. A condition known as hyperbilirubinemia frequently affects babies. Neonatal hyperbilirubinemia patients are managed with exchange transfusion and phototherapy. This study aimed to determine the neonatal hyperbilirubinemia therapies at the one private hospital in Azerbaijan. In 2023, data on the condition of hyperbilirubinemia and the kind of therapies received were gathered from medical records. Samples for this study were chosen based on inclusion criteria. Phototherapy was used to treat all 41 neonates with hyperbilirubinemia; 29.26 % of the patients received treatment for less than 24 hours, and 70.73 % received treatment for longer than 24 hours. 100% of patients recovered after treatment. After treatment, 100% patients cured. Hyperbilirubinemia neonates in this hospital were treated with phototherapy and the treatment was successful.

Keywords: Hyperbilirubinemia; conjugated bilirubin; unconjugated bilirubin; phototherapy.

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1. INTRODUCTION

Hyperbilirubinemia is a medical condition marked by heightened concentrations of bilirubin in the bloodstream. Bilirubin, a yellow pigment, is a derivative produced during the degradation of hemoglobin in red blood cells. This essential physiological process facilitates the recycling of aging or impaired red blood cells [1]. Typically, the liver processes bilirubin, which is then excreted in the bile. Increased bilirubin levels can arise from diverse underlying factors, culminating in jaundice, a discoloration of the skin and eyes.

Neonatal hyperbilirubinemia, commonly referred to as jaundice in newborns, is a prevalent condition marked by the yellowing of a baby's skin and eyes, resulting from heightened levels of bilirubin in the bloodstream. Jaundice typically appears a few days after birth, with Physiological Jaundice becoming apparent after the initial 24 hours of life and reaching its peak around the third to fourth day. This condition is linked to an increased breakdown of fetal red blood cells and the immature function of the liver.

Bilirubin exists in two primary forms: direct (conjugated) and indirect (unconjugated), and the total bilirubin level is the combined sum of these two forms. Direct Bilirubin (Conjugated Bilirubin) is water-soluble and has undergone conjugation with glucuronic acid in the liver, making it ready for excretion in the bile. Elevated levels of direct bilirubin may indicate issues with the liver or bile ducts. In contrast, Indirect Bilirubin (Unconjugated Bilirubin) is not water-soluble and has not undergone conjugation in the liver (Fig. 1). It is transported to the liver bound to albumin, where it is subsequently conjugated to become direct bilirubin. Increased levels of indirect bilirubin may suggest heightened breakdown of red blood cells or impaired liver function. In newborns, elevated bilirubin levels can lead to neonatal jaundice, generally a harmless condition but one that may require medical attention if levels become excessively high. Mild jaundice is common in healthy term infants during the first few days of life, often termed physiological jaundice, and is typically due to the newborn's liver immaturity. Premature infants may experience higher levels of indirect bilirubin due to less developed livers and a higher rate of red blood cell breakdown.

2. MATERIALS AND METHODS

The medical records of newborn infants with hyperbilirubinemia who were admitted to the one private hospital in Azerbaijan in 2010 served as secondary data for this descriptive analysis. The information included information on sex, birth weight, status at birth, total bilirubin levels, phototherapy treatment, and phototherapy treatment outcome. 41 samples met the inclusion requirements for this investigation. We used DCA (Dichloroaniline) method to measure total bilirubin levels. A non-probability/consecutive sampling technique was used to collect the samples. The collected data were manually tallied, then descriptive statistics were used for analysis.

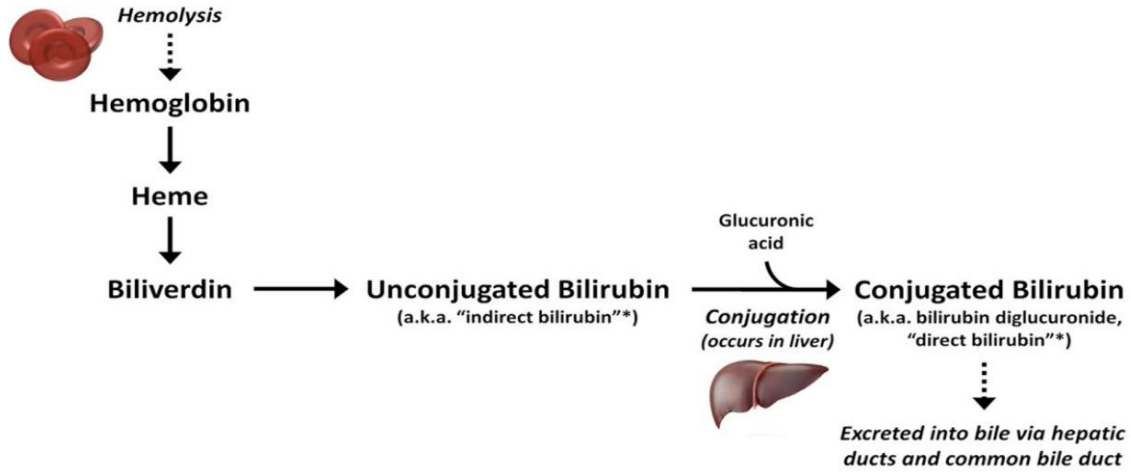

Fig. 1. Metabolism of bilirubin

3. RESULTS AND DISCUSSION

In this research we studied hyperbilirubinemia in 41 newborns. Different parameters are given below in the Table 1.

Monitoring and managing bilirubin levels in newborns are usually conducted in clinical settings by healthcare professionals. Interventions such as phototherapy may be employed if bilirubin levels reach concerning levels. It is crucial to note that these are general trends, and individual cases can vary. Healthcare providers should be consulted for personalized advice and guidance on specific concerns regarding bilirubin levels in newborns. Normal bilirubin levels can vary, and reference ranges may differ slightly between laboratories and healthcare institutions. Additionally, total bilirubin levels, encompassing both indirect and direct bilirubin, are often reported.

Management typically involves spontaneous resolution without treatment; severe cases may require phototherapy. Pathological Jaundice, presenting within the first 24 hours or persisting beyond the first week, signals potential underlying issues like hemolytic disease, ABO or Rh incompatibility, G6PD deficiency, or metabolic disorders. Identifying and addressing the root cause may involve interventions such as phototherapy, exchange transfusions, or medications. If a baby's bilirubin levels surpass recommended thresholds for phototherapy or if concerns about the underlying cause arise, further medical evaluation and intervention may be necessary. In our study also used phototherapy for treatment.

Prevalence and Severity: Mild hyperbilirubinemia is common and often benign, but severe cases, especially in newborns, pose serious health risks. Neonatal jaundice, reflecting elevated bilirubin levels, affects up to 60% of term newborns and 80% of preterm newborns [2].

Hyperbilirubinemia stems from various factors: increased red blood cell breakdown, impaired liver function, reduced liver processing of bilirubin, or bile duct obstruction. Risk factors include prematurity, ABO or Rh incompatibility, delivery-related bruising or bleeding, and exclusive breastfeeding in the initial days of life. East Asian or Mediterranean ethnicity may be associated with glucose-6-phosphate dehydrogenase (G6PD) deficiency.

Table 1. Baseline characteristic of study sample (n=41)

Charasteristics	n	%
Gender		
male	27	65.85
female	14	34.14
Birth status		
premature	26	63.41
normal	15	36.58
Birth weight		
<1000	0	0
1000-1500	1	2.43
1500-2000	5	12.19
2000-2500	13	31.70
>2500	22	53.65
Total bilirubin levels		
5-10 mg/dl	6	14.63
10-15 mg/dl	24	58.53
15-20 mg/dl	9	21.95
>20 mg/dl	2	4.87
Treatment		
Phototherapy given < 24 h	12	29.26
Phototherapy given > 24 h	29	70.73
Outcome		
Cured	41	100
Complication	0	0
Dead	0	0

The causes of hyperbilirubinemia are multifactorial and can be categorized by mechanisms: Increased Bilirubin Production, such as hemolysis leading to premature red blood cell breakdown [3]; prehepatic (hemolytic) hyperbilirubinemia, impaired liver function causing hepatic (hepatocellular) hyperbilirubinemia, and obstruction of the bile ducts resulting in posthepatic (obstructive) hyperbilirubinemia.

In impaired Bilirubin Conjugation, the liver's role in conjugating bilirubin to make it water-soluble is crucial. Conditions affecting this process, like Gilbert's syndrome, can elevate levels of unconjugated bilirubin [4].

Reduced Bilirubin Elimination involves obstruction or dysfunction of the bile ducts, seen in conditions such as biliary atresia, hindering bilirubin elimination and contributing to its accumulation in the blood [5].

The principal manifestation of hyperbilirubinemia is jaundice, characterized by the yellowing of the skin and eyes. Additional indications may comprise dark urine, pale stools, weariness, and abdominal discomfort. Jaundice, identified by the yellowing of the skin and eyes due to bilirubin deposition, emerges as a prominent symptom of hyperbilirubinemia [6].

Increased bilirubin levels can impact stool color, resulting in pale or clay-colored stools, and urine color, leading to dark-colored urine [7]. The systemic effects of hyperbilirubinemia may involve fatigue, weakness, and, in severe instances, neurological symptoms [8].

Blood examinations are utilized to gauge bilirubin levels. The clinical evaluation of jaundice includes an assessment of the degree of yellowing in the baby's skin and eyes. Diagnosis incorporates a comprehensive approach, encompassing a thorough medical history, physical examination, and diverse blood tests to measure bilirubin levels and evaluate liver function. Blood tests distinguish between unconjugated and conjugated bilirubin by quantifying total and direct bilirubin levels. Imaging procedures, such as ultrasound or MRI, may be employed to identify any underlying liver or bile duct irregularities [9].

We studied hyperbilirubinemia in 41 patients. 27 of them were male and 14 were female. All studied patients were newborns born in 2023. 26 of the babies were born prematurely and 15 normally. The conjugated bilirubin varies between 0.54 mg/dl to 1.78 mg/dl in premature babies, and between 0.6 mg/dl to 3.4 mg/dl in normal babies. Unconjugated bilirubin in premature babies varies from 9.3 mg/dl to 21.09 mg/dl. In normal births, it varies between 2.89 mg/dl to 12.6 mg/dl. The total bilirubin in premature births generally range from 10.7 to 22, and normal births range from 4.03 to 14.

Strategies for treating hyperbilirubinemia differ depending on the underlying cause and its severity. Effective management relies on addressing the specific cause. For example, addressing the underlying cause of increased red blood cell breakdown may alleviate hemolytic jaundice. Managing liver diseases may be imperative for hepatocellular jaundice, while procedures such as surgery or endoscopy may be necessary to eliminate obstructions in cases of obstructive jaundice [10]. Various approaches are utilized for treating hyperbilirubinemia. In the studes also discovered that over the same time frame, there was an increase in neonatal jaundice (NNJ) admissions for infants 1-3 months old. This implies that prolonged jaundice in the breast milk could be an unintentional result of effective breastfeeding promotion. To optimize the advantages of breastfeeding promotion, the authors advise enhancing breastfeeding assistance and improving NNJ management [11]. Phototherapy, commonly applied in neonatal cases, entails exposing the infant's skin to specific light wavelengths, promoting the conversion of unconjugated bilirubin into a more easily excretable form [12,13]. In instances of severe hyperbilirubinemia, particularly in newborns with critically high bilirubin levels, exchange transfusion may be considered. This involves replacing the infant's blood with donor blood, effectively reducing the bilirubin load [14]. Additionally, ensuring adequate fluids and nutrition is crucial, contributing to the infant's hydration and nutritional needs.

The identification and treatment of the root cause of hyperbilirubinemia are paramount. This may encompass addressing hemolytic disorders, managing liver diseases, or correcting bile duct obstructions through surgical interventions [15].

Significant or prolonged hyperbilirubinemia has the potential to result in complications, such as brain damage in newborns, a condition known as kernicterus, as well as complications linked to the root cause of jaundice [16]. It has not been

demonstrated that hyperbilirubinemia, as the only risk factor, has an impact on neurodevelopment in the preterm population. The population of full-term neonates with hyperbilirubinemia showed abnormalities in their neurological, motor, and auditory development, which were more pronounced in the first year of life [17,18].

4. CONCLUSION

hyperbilirubinemia, although frequently harmless, demands meticulous assessment and handling, especially among susceptible groups like newborns. Timely identification, vigilant monitoring, and suitable interventions are imperative to avert complications and guarantee favorable health outcomes. In our research the treatment administered to patients with neonatal hyperbilirubinemia was phototherapy >24 hours in 29 patients (70.73%) and phototherapy of <24 hours in 12 patients (29.26%). All neonates with hyperbilirubinemia receiving treatment phototherapy healed.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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