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Research Article

Neonatal Hyperbilirubinemia Due to ABO Incompatibility

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Abstract

Background: Newborn infants with maternal-fetal ABO incompatibility face an increased risk of developing significant hyperbilirubinemia. Thiqs study aimed to investigate the clinical manifestations and outcome of treatment modalities.

Methods: It was a retrospective, descriptive and analytical study conducted in the neonatal unit of Mohamed V military Hospital of RABAT. A total of 75 neonates with blood group A or B born to mothers with blood group O; with jaundice and or anemia were enrolled during the period from January 2022 to December 2022. The various maternal and neonatal parameter and their association with development of jaundice and or anemia was studied. The outcome of treatment modalities was studied.

Results: Out of 75 ABO Incompatible neonates 40 (53%) were male and 35 (47%) were female. The percentage of O-A and O-B incompatible neonates were 45% (34) and 54% (41), respectively. Jaundice was detected within the first 24 hours in 13.3% and 20% neonates had anemia. The mean age of presentation was 2.5 ± 0.7 days. The various maternal and neonatal factors had no significant association with development of jaundice and or anemia due to ABO Incompatibility. The mean initial Indirect Bilirubin was 20.26 ± 3.97, initial hemoglobin was 13.3 ± 2.31 and the mean Reticulocyte count was 17.6 ± 4.3. Total 30 (40%) neonates had laboratory evidence of hemolysis (microspherocytosis). DCT was positive in 5 (6.66%) neonates. The main clinical manifestation was jaundice and was treated with phototherapy in 75 (100%) of the cases. The mean duration of phototherapy was 53.84 ± 9.82 hours. No one required exchange transfusion. The mean total duration of stay was 3.6 ± 1.2 days. There was no significant difference in the hemolytic disease of the new-born due to ABO incompatibility due to either O-A or O-B incompatibility.

Conclusions: Early identification of high-risk neonates with ABO incompatibility can significantly reduce morbidity and mortality associated with this condition.

Keywords: Hemolysis; New-born; Phototherapy; Blood group

Introduction

Hemolytic disease of newborn due to ABO-incompatibility is the most common cause of hemolytic diseases [1]. It's occurring exclusively in newborns of blood group A or B whose mothers have blood group O [2]. While it was first described by Morgagni in 1761, it wasn't until the last 35 years that its origin in blood group incompatibilities between the fetus and the mother became known [3].

The etiology of haemolytic disease of the newborn due to ABO incompatibility is a form of Isoimmune hemolytic disease resulting from ABO blood group incompatibility between the mother and the infant. In this condition, maternal anti-A or anti-B Immunoglobulin G (IgG) antibodies cross the placenta and attach to the corresponding antigens on the neonatal red blood cells. Resultant heme catabolism causes an increased indirect bilirubin production, leading to neonatal jaundice [4].

Jaundice in hemolytic disease of the newborn is more frequent and severe in ABO incompatible black compared to white newborns. Jaundice in ABO-incompatible babies tends to be more severe than that caused by other factors [5]. For reasons that are unclear B-O incompatibility (mother type O, Baby type B) seems to be in general more severe than A-O incompatibility [6].

While anemia is rare in this condition, the primary clinical problem is jaundice. Severe hemolysis and anaemia requiring exchange blood transfusion have however been reported [7]. Early detection and treatment of neonatal hyperbilirubinaemia are crucial in prevention of bilirubin-induced encephalopathy in the affected children [8].

This study aims to estimate the risk of ABO hemolytic disease of the newborn, assess clinical manifestations, and examine the outcomes of various treatment modalities.

Material and Methods

A retrospective, descriptive and analytical study was conducted at Mohammed V Military training hospital enrolled during the period from January 2022 to December 2022 in the Neonatal Medicine and Intensive Care Unit of the University Hospital Center of Rabat.

This center, located in the city of Rabat, capital of Morocco. He receives from all regions of the kingdom and whose annual number of deliveries is estimated at an average of 5000. He has a resuscitation unit and intensive care unit.

A sample size of 75 term neonates were included in the study with neonatal jaundice and or anemia due to ABO Incompatibility by purposive method.

Clinical information was taken including age, sex, gestational age, birth weight, previous family history of neonatal jaundice, the onset of the jaundice, gestational hypertension, mode of delivery and use of drugs during pregnancy.

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Thorough clinical examination of the baby was done to identify the presence of pallor, jaundice, hepatosplenomegaly and any neurological signs like opisthotonos.

Blood sample was taken for all the babies and send for blood group and Rh, complete blood picture including reticulocyte count, total serum bilirubin and direct Coomb's test.

Blood sample was taken from their mothers and send for identification of blood group and Rh factor, and indirect Coomb's test. The following investigations were done from babies for identification blood group and Rh factor, direct Coomb's test, serum Bilirubin and Complete blood count of baby including hemoglobin, total count, differential count, band cells, peripheral smear examination and reticulocyte count. All the babies were treated by phototherapy and/or exchange transfusion and most of them did well and discharged in good condition.

Statistical analyses were performed using SPSS version. The $\chi 2$ test was used for the comparison of the proportions. $P<0.05$ was considered statistically significant.

Results

A total of 75 patients with ABO incompatibility admitted to hospital and included in this study. Forty patients (53%) were male and 35 patients (47%) were female. The mean birth weight was 3200 ± 442 (1950-4400) grams. 34 infants (45%) had blood group A, while 41 infants (55%) had blood group B. Mean age on the day of admission to hospital was 4.5 ± 2.5 (0-10) days. Mean initial IB was 20.26 ± 3.97 mg/dl.

Ten infants (13.3%) developed jaundice in the first 24 hours of life and 15 infants (20%) had anemia in the first complete blood count examination. Mean initial hemoglobin was 13.3 ± 2.31 g/dl. DCT was positive in 5 (6.66%) neonates. No one received exchange transfusion and 15 (20%) received IVIG.

In the present study, blood group A and B had similar demographic parameters such as birth weight, gender and day of admission. Similarly, there were no statistically significant differences in hematological parameters such as initial hemoglobin levels, initial indirect bilirubin levels, frequency of positive direct Coombs test and hemolytic findings in peripheral blood smear, duration of phototherapy, and IVIG therapy ($p>0.05$) (Table 1).

Direct Coombs Test (DCT) was performed in all newborns. Five newborns had a positive ADT while 70 had a negative ADD. The characteristics are summarized in the Table 2.

In the DCT (+) subgroup, jaundice was intense in 02 newborns, (40%), and moderate in 3 newborns, (60%); while in the newborns of the DCT (-) subgroup, jaundice was intense in 42 newborns (60%) and moderate in 28 newborns (40%) ($p=0.001$).

Discussion

Hemolytic diseases of the fetus and newborn with an immune origin result from the transplacental passage of maternal IgG antibodies into the fetal circulation, responsible for fetal and neonatal erythrocyte lysis. The most well-known form of this condition was historically associated with feto-maternal incompatibility in the rhesus D system, but prevention has allowed a clear reduction in the incidence of hemolytic diseases of the fetus and newborn due to feto-maternal incompatibility in this system [9,10]. In recent years, ABO incompatibility has emerged as the most common cause of isoimmune hemolytic disease of the newborn [11].

In this study, we did not observe a significant correlation between the blood type of the newborn and the severity of jaundice. Our findings revealed no significant differences between the two groups regarding the levels of indirect bilirubin upon admission to the hospital, the duration of phototherapy, or the hemoglobin levels at admission. Kumar et al. Akgul, Shah and Preethi et al. reported that gender, race, birth weight, and blood type of the infant showed no significant relationship with clinical outcome [12,13].

In general, hemolysis resulting from ABO incompatibility is typically minimal, and the clinical course tends to be relatively benign. This is attributed to the relatively lower number of group A or B antigenic sites on neonatal red blood cells. However, it's worth noting that severe cases characterized by aggressive hemolysis and even hydrops fetalis have been reported [14]. Although our findings indicate no significant correlation between the blood type of the newborn and the severity of hemolysis, an analysis of the existing literature reveals that in certain ethnic groups, neonates with blood group type B are more frequently affected [15]. Furthermore, hemolysis continues with the risk of significant anemia during the first month of life, and blood transfusion may sometimes be necessary secondarily [16].

The aim of treatment is to mitigate the risk of neurological toxicity relating to bilirubin concentrations. Consequently, any therapeutic decision should be based on the measurement of total bilirubin levels [17]. In cases of feto-maternal incompatibility in the ABO system, the majority can typically be managed effectively with phototherapy alone, while only a small number of cases may necessitate additional therapeutic interventions [18-20].

Intensive phototherapy plays a crucial and effective role in the treatment of hyperbilirubinemia resulting from feto-maternal incompatibility in the ABO system. It is particularly valuable because

Table 1: Comparison of demographic and clinical characteristics of newborn with blood group A or B.

	Blood group A (n=34)	Blood group B (n=41)	P
Birth weight (g)	2.8 ± 0.40	3.75 ± 0.8	
Gender (M/F)	25/18	15/17	
Day of hospitalization (day)	3.16 ± 1.7	2.18 ± 0.95	0.4
Initial hemoglobin (g/dl)	14.7 ± 2.20	12.45 ± 2.40	0.2
Initial indirect bilirubin (mg/dl)	20.6 ± 3.2	21.79 ± 2.7	0.3
Positive direct coombs test, n	2	3	0.5
Anemia (Hb <13 g/dl), n	7	8	
Presence of hemolysis, n	13	17	1
Jaundice in the first 24 hours, n	7	3	0
Duration of phototherapy (hr)	46.6 ± 21.2	45.6 ± 15.9	0.3
Need for IVIG therapy, n	10	5	0.5

Table 2: Comparison of demographic and clinical characteristics of newborn with direct coombs test.

	direct coombs test (+) (n=5)	direct coombs test (-) (n=70)	P
Birth weight (g)	2.75 ± 0.35	3.0 ± 0.7	0.25
Gender			
Male	2	25	0.3
Female	3	45	
Initial hemoglobin (g/dl)	12.7 ± 1.20	12.15 ± 2.40	0.45
Initial indirect bilirubin (mg/dl)	18.6.6 ± 2	185 ± 2.7	0.83
Anemia (Hb <13 g/dl)	2	3	0.1
Blood group			
A	4	30	0.75
B	1	40	
intensity of jaundice			
Moderate	3	28	0
Intense	2	42	
Duration of phototherapy (hr)	2,88 ± 1,553	1,74 ± 0,919	0.02

it frequently enables the postponement of exchange transfusion. The specific indications for intensive phototherapy are determined based on the bilirubin levels, taking into consideration postnatal age in hours, gestational age, and the presence of aggravating factors related to bilirubin-induced neurological toxicity, as outlined in the AAP curves [21].

Intravenous immunoglobulins are considered as therapeutic adjuncts in cases of hemolysis due to feto-maternal incompatibility in the ABO system. They are employed to mitigate hemolysis. However, it's essential to limit the use of immunoglobulins and reserve them for cases characterized by severe hyperbilirubinemia [22]. As per AAP guidelines, a recommended dose of 0.5 g/kg to 1 g/kg should be administered over 2 hours, with the option to repeat if necessary. This treatment should be initiated promptly when indicated, especially in cases of immune hemolytic jaundice in the ABO system with a positive direct Coombs test [23,24].

Conclusion

Neonatal jaundice due to feto-maternal incompatibility in the ABO system remains a frequent pathology, it is the most common cause of incompatibilities neonatal erythrocytes. It is a benign pathology more often, which exposes newborns to the risk of severe hyperbilirubinemia with its complications; the most fearsome is hyperbilirubinemic encephalopathy. Early identification of high-risk neonates with ABO incompatibility might reduce the morbidity and mortality due to jaundice and or anemia.

All babies born to O positive mother with A or B or AB father should be evaluated for blood group as soon as possible to identify the high-risk neonates developing jaundice and or anemia due to ABO incompatibility.

Consent

Written informed consent was obtained from the patient for publication of this case report.

Disclosure

This clinical case was written based on clinical observation without any funding.

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