Available online at **www.ijmrhs.com**

ISSN No: 2319-5886

International Journal of Medical Research & Health Sciences, 2019, 8(8): 9-13

Frequency of Exchange Transfusion in Newborns with Neonatal Hyperbilirubinemia

Miami K. Yousif[1]*, Mariam Dawood[2], Nabaa Yasien[2] and Wid Zaki[2]

[1] College of Medicine, University of Basrah, Basrah, Iraq

[2] Basra Teaching Hospital, Basrah, Iraq

**Corresponding e-mail: miamiyousif@yahoo.com*

ABSTRACT

Background: *Almost all newborn infants develop some degree of hyperbilirubinemia as a normal transition in physiology. High levels of unbound unconjugated bilirubin can cross the blood-brain barrier and cause neurological symptoms.* ***Objectives:*** *To determine the frequency of exchange transfusion in neonates with hyperbilirubinemia and to describe the characteristics of neonates with hyperbilirubinemia including those who underwent exchange transfusion.* ***Methods:*** *A retrospective study was conducted to know the frequency of exchange transfusion in neonates admitted to hospital with hyperbilirubinemia and to study selected characteristics of these babies including; sex, gestational age, body weight, type of feeding, and mode of delivery, and to identify the causes of hyperbilirubinemia.* ***Results:*** *A total of 120 neonates were enrolled in the study, 70 males and 50 females. Most of them (67%) were full-term, weighing more than 2.5 kg. The majority (77%) was delivered vaginally, and mixed feeding with breast and artificial milk formula was the main source of feeding. The mean value of serum bilirubin at time of admission was 14.7 mg/dl and for those underwent exchange transfusion was 22 mg/dl at the time of exchange. In 92 babies (77%), the cause of hyperbilirubinemia was unknown. Hemolytic anemia due to Rh and ABO incompatibility was identified in 16% of babies, and G6PD deficiency was identified in 7%. Exchange transfusion was performed in 16.6% of patients.* ***Conclusion:*** *Although neonatal jaundice is a benign condition in most cases, pathologic harmful hyperbilirubinemia can occur, and despite the benefits of phototherapy, exchange transfusion is still performed and kernicterus is still occurring.* ***Recommendation:*** *Newborn babies should be screened for hyperbilirubinemia and correctly managed to reduce the frequency of exchange transfusion which carries many risks for newborns, and to prevent kernicterus.*

Keywords: Neonatal jaundice, Exchange transfusion, Kernicterus

INTRODUCTION

For centuries, neonatal jaundice (icterus neonatorum) has been observed in newborns [1]. Jaundice is a yellow discoloration of the skin and eyes caused by hyperbilirubinemia (elevated serum bilirubin concentration). The serum bilirubin level required to cause jaundice varies with skin tone and body region, but jaundice usually becomes visible on the sclera at a level of 2-3 mg/dL (34-51 µmol/L) and on the face at about 4-5 mg/dL (68-86 µmol/L). With increasing bilirubin levels, jaundice seems to advance in a head-to-foot direction, appearing at the umbilicus at about 15 mg/dL (258 µmol/L) and at the feet at about 20 mg/dL (340 µmol/L) [2].

Almost all newborn infants develop some degree of hyperbilirubinemia as a normal transition in physiology. High levels of unbound unconjugated bilirubin can cross the blood-brain barrier and cause neurological symptoms [3]. Pathologic hyperbilirubinemia in term infants is diagnosed if:

- Jaundice appears in the first 24 h, after the first week of life, or lasts >2 weeks
- Total serum bilirubin (TSB) rises by >5 mg/dL/day
- TSB is >18 mg/dL
- Infant shows symptoms or signs of a serious illness

Some of the most common pathologic causes are immune and non-immune hemolytic anemia, G6PD deficiency, hematoma resorption, sepsis and hypothyroidism [2].

The primary concern with respect to exaggerated hyperbilirubinemia is the potential for neurotoxic effects. The concentration of bilirubin in the brain and the duration of exposure to bilirubin are important determinants of the neurotoxic effects of bilirubin [4]. Kernicterus is the German term for jaundice of the basal ganglia of the brain and is sometimes seen in infants dying with extreme jaundice. This complication was primarily seen in infants with severe hyperbilirubinemia accentuated by hemolysis as in Rhesus-negative immunization. However, kernicterus has also been described in the absence of hemolysis. Afflicted infants often died during the acute phase, and a neurological condition with choreoathetosis, gaze paresis, sensorineural deafness, and occasional mental retardation was observed in survivors [5].

Jaundice may be inadequately or ineffectively monitored, with disastrous results of continued mortality and morbidity of a small but very important number of otherwise healthy and precious infants [6]. Measuring the free bilirubin in addition to the hour-specific total bilirubin and estimating bilirubin production using CO measurements can be helpful in understanding the risk faced by some babies because they have a large bilirubin load distributed in part outside the circulation [7].

The American Academy of Pediatrics recommends universal screening with TSB or transcutaneous bilirubin (TcB) levels or targeted screening based on risk factors. Universal TSB/TcB screening can accurately identify infants whose TSB level is likely to exceed the 95th percentile for age. Some studies have found that the use of risk scores is as accurate as universal screening for predicting hyperbilirubinemia. A combination of universal screening and risk factor scoring seems to be the most effective method for identifying infants at risk of hyperbilirubinemia [8].

Intensive phototherapy is recommended for those with severe hyperbilirubinemia, or at high risk from developing severe hyperbilirubinemia. Conventional phototherapy may also be considered for those with a moderate risk of severe hyperbilirubinemia [9]. Exchange transfusion (ET) has been universally established as an efficacious and reliable treatment for Severe neonatal hyperbilirubinemia (SNH) and the prevention of bilirubin-induced neonatal mortality and long-term morbidity.

For total serum bilirubin concentrations of between 375 μmol/L and 425 μmol/L (21.9 mg/dL and 24.8 mg/dL), exchange transfusion should be considered to lower the concentration. Exchange transfusion should also be immediately carried out in those with clinical signs of bilirubin encephalopathy [9].

This study was conducted to determine the frequency of exchange transfusion in newborns with hyperbilirubinemia, to study selected characteristics of these babies including sex distribution, gestational age, birth weight, type of feeding, and mode of delivery and to identify the causes of hyperbilirubinemia in these babies.

MATERIALS AND METHODS

A retrospective study was conducted to know the frequency of exchange transfusion in babies admitted to the neonatal intensive care unit in Basra Maternity and Children Hospital and Al-Mawani Hospital with the diagnosis of neonatal hyperbilirubinemia for the period from January 2016 to June 2016. A special form to collect data was prepared for the purpose of the study which includes age, sex, gestational age, birth weight, mode of delivery, type of feeding, level of serum bilirubin and causes of hyperbilirubinemia like blood group incompatibility (ABO and Rh), glucose 6 phosphate dehydrogenase (G6PD) deficiency, sepsis, and others. Data were analyzed and expressed in number and percentage.

RESULTS

The total study population was 120 neonates aged 1-10 days, 70 (58%) males and 50 (42%) females. Table 1 demonstrated the characteristics of neonates with hyperbilirubinemia and shows the distribution of the studied population according to sex, gestational age, body weight, feeding and mode of delivery.

Table 1 Selected characteristic of the neonates with hyperbilirubinemia

Variables	N	%
Sex		
Male	70	58%
Female	50	42%
Gestational Age		
Term	80	67%
Pre-term	40	33%
Body Weight (Kg)		
>2.5	92	77%
<2.5	28	23%
Feeding		
Breast	70	58%
Milk formula	34	28%
Mixed	16	13%
Mode of Delivery		
Vaginal	80	77%
Cesarean section	28	23%

Neonates with Hyperbilirubinemia and Exchange Transfusion

Among 120 patients with hyperbilirubinemia, 20 underwent exchange transfusion (16.6%). Table 2 shows the distribution of the neonates who underwent exchange transfusion according to sex, gestational age, body weight, feeding, mode of delivery, treatment by phototherapy and outcome.

Table 2 Selected characteristics of the neonates with exchange transfusion

Variables	N	%
Sex		
Male	14	70%
Female	6	30%
Gestational Age		
Term	16	80%
Pre-term	4	20%
Body Weight (Kg)		
>2.5	16	80%
<2.5	4	20%
Feeding		
Breast	8	40%
Milk formula	2	10%
Mixed	10	50%
Mode of Delivery		
Vaginal	16	80%
Cesarean section	4	20%
Received Phototherapy		
Yes	14	70%
No	6	30%
Outcome		
Discharged	16	80%
Died	4	20%

Table 3 shows the presence of signs of kernicterus in babies who underwent exchange transfusion before the procedure.

Table 3 Signs of kernicterus

Sign	N
Lethargy	16

Poor feeding	16
Hypertonia	6
High pitch cry	4
Seizure	0
Apnea	2

Table 4 shows the causes of hyperbilirubinemia in the study population.

Table 4 Causes of hyperbilirubinemia

Cause	No. of neonates	%
Rh incompatibility	10	8%
ABO incompatibility	10	8%
G6PD deficiency	8	7%
Unidentifiable cause	92	77%
Total	120	100%

DISCUSSION

Neonatal jaundice is predominantly a benign condition that affects 60-80% of newborns worldwide but progresses to potentially harmful severe hyperbilirubinemia in some. Despite the proven therapeutic benefits of phototherapy for preventing extreme hyperbilirubinemia, acute bilirubin encephalopathy or kernicterus, several Low-income and middle-income countries (LMIC) continue to report high rates of avoidable exchange transfusions, as well as bilirubin-induced mortality and neurodevelopmental disorders [10,11]. The proper management of neonatal jaundice is the most frequent challenge faced daily by pediatricians [12].

According to the present study, it is worrying to note that 16.6% of those babies admitted with hyperbilirubinemia underwent exchange transfusion, carrying the risk and complication of this procedure. This is similar to the finding presented in a study done in Abakaliki, South Eastern Nigeria (16.9%), and according to their study, the mean serum bilirubin at which exchange transfusion was done was 28.3 mg/dl in comparison with the current study (22 mg/dl) [13].

In this study, males with hyperbilirubinemia out-numbered females (70, 50 respectively) with a sex ratio 1.4:1 and this is in approximation to a finding in a study done in Serbia 1.25:1 [14]. For those underwent exchange transfusion, male to female ratio was 2.3:1. Majority of them were term, vaginally delivered, breastfed, with normal weight. The study showed that many of neonates underwent exchange transfusion had one or more sign of kernicterus prior to exchange, this is related to the delay in seeking medical advice (Table 3).

There was no identifiable cause for a high level of serum bilirubin in 77% of the study population as shown in Table 4. Isoimmune hemolysis due to Rh incompatibility was found in 10 patients (8%) as compared to the study done in Serbia (38%) and ABO incompatibility was found in other 10 patients (8%) as compared to (38%) in the same study of Serbia [14], these babies should have been closely monitored after birth. Hemolytic anemia due to G6PD deficiency was detected in 8 patients (7%), parents of these babies should be informed and educated to avoid precipitating factors that may induce subsequent hemolysis including drugs like aspirin and non-steroidal anti-inflammatory and specific foods like beans and pea.

CONCLUSION

Although neonatal jaundice is a benign condition in most cases, pathologic harmful hyperbilirubinemia can occur, and despite the benefits of phototherapy, exchange transfusion still performed and kernicterus still occurring.

Recommendation

- It is important to measure total serum bilirubin when the baby is jaundiced and not rely on the color of skin
- Screening and correct management of babies with severe hyperbilirubinemia to prevent the occurrence of kernicterus
- It is especially important to identify babies with the risk of isoimmune hemolysis
- Educating mothers and their families at antenatal clinic, how to detect jaundice, and to seek medical advice if their baby is jaundiced

- Follow-up of new-born babies discharged on the day of birth, who have risk factors for developing jaundice
- Early discharge after birth should be discouraged

DECLARATIONS

Conflict of Interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

REFERENCES

[1] Bryon J. Lauer, MD, Nancy D. Spector, MD. Hyperbilirubinemia in the newborn. *Pediatrics in Review*, Vol. 32, No. 8, 2011.

[2] Kevin C. Dysart. Neonatal hyperbilirubinemia. 2018, http://www.merckmanuals.com/professional/pediatrics/metabolic,-electrolyte,-and-toxic-disorders-in-neonates/neonatal-hyperbilirubinemia.

[3] Ballot, Daynia E., and Gilbert Rugamba. "Exchange transfusion for neonatal hyperbilirubinemia in Johannesburg, South Africa, from 2006 to 2011." *International Scholarly Research Notices,* 2016.

[4] Dennery, Phyllis A., Daniel S. Seidman, and David K. Stevenson. "Neonatal hyperbilirubinemia." *New England Journal of Medicine,* Vol. 344, No. 8, 2001, pp. 581-90.

[5] Hansen, Thor Willy Ruud. "Pioneers in the scientific study of neonatal jaundice and kernicterus." *Pediatrics,* Vol. 106, No. 2, 2000, p. 15.

[6] Lois Johnson, Vinod K. Bhutani. Management of neonatal hyperbilirubinemia. 2005, http://acutecaretesting.org/en/articles/management-of-neonatal-hyperbilirubinemia.

[7] Wong, Ronald J., et al. "Neonatal jaundice: bilirubin physiology and clinical chemistry." *NeoReviews,* Vol. 8, No. 2, 2007, pp. 58-67.

[8] Muchowski, K. Evaluation, and treatment of treatment of neonatal hyperbiliremia. *American Family Physician*, Vol. 89, No. 11, 2014, pp. 873-78.

[9] Fetus and Newborn Committee. "Canadian Paediatric Society. Guidelines for detection, management, and prevention of hyperbilirubinemia in term and late preterm newborn infants (35 or more weeks' gestation)-summary." *Paediatrics Child Health,* Vol. 12, No. 5, 2007, pp. 401-18.

[10] Olusanya, Bolajoko O., et al. "Revisiting the criteria for exchange transfusion for severe neonatal hyperbilirubinemia in resource-limited settings." *Neonatology,* Vol. 109, No. 2, 2016, pp. 97-104.

[11] Olusanya, Bolajoko O., Tinuade A. Ogunlesi, and Tina M. Slusher. "Why is kernicterus still a major cause of death and disability in low-income and middle-income countries?" *Archives of Disease in Childhood,* Vol. 99, No. 12, 2014, pp. 1117-21.

[12] Martinez, Jorge Cesar. "Argentinean perspective of the 2004 AAP Hyperbilirubinemia Guidelines." *NeoReviews,* Vol. 7, No. 1, 2006, pp. 4-6.

[13] Ibekwe, Roland C., MaryAnn U. Ibekwe, and Vivian U. Muoneke. "Outcome of exchange blood transfusions done for neonatal jaundice in abakaliki, Southeastern Nigeria." *Journal of Clinical Neonatology,* Vol. 1, No. 1, 2012, p. 34.

[14] Bujandric, Nevenka, and Jasmina Grujic. "Exchange transfusion for severe neonatal hyperbilirubinemia: 17 years' experience from Vojvodina, Serbia." *Indian Journal of Hematology and Blood Transfusion,* Vol. 32, No. 2, 2016, pp. 208-14.