

Efficacy of Double Volume Exchange Transfusion in Term Neonates with Hyperbilirubinemia Due to Abo Incompatibility

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ABSTRACT

Objectives: To determine the efficacy of double volume exchange transfusion in term neonates with hyperbilirubinemia due to ABO incompatibility.

Materials and Methods: This was a descriptive case series study conducted in the Neonatal Unit, Department of Pediatrics, Sheikh Zayed Hospital, Rahim Yar Khan from 30-09-2016 to 29-12-2017.

Results: Total cases were 87, out of which 47 (54.02%) were males with a mean age of 4.32 ± 1.51 days. The efficacy of double exchange transfusion was seen in 28 (32.18%) cases.

Conclusion: The efficacy of double volume exchange is seen in 28 (32.18%) out of 87 cases and it is significantly high in cases when the exchange is done within the first 3 days of birth ($p = 0.01$).

Keywords: ABO incompatibility, hyperbilirubinemia, double volume exchange transfusion.

INTRODUCTION

Extreme hyperbilirubinemia is considered when the total serum bilirubin level is ≥ 25 mg/dl.¹ The incidence of extreme neonatal hyperbilirubinemia is estimated to be 9.4/100 000 live births. There are different causes of neonatal hyperbilirubinemia including physiological and pathological. In a study conducted in Australia, the main pathological causes include ABO incompatibility, Rh incompatibility, and G6PD deficiency.² Treatment depends on the total serum bilirubin level. Treatment includes IVIG, Phototherapy, and Exchange transfusion.

ABO incompatibility is the most common cause of hemolytic anemic in newborns. Most of the cases are mild and treatable with conservative management like phototherapy, Albumin transfusion, and IVIG, etc, but sometimes the cases are severe and babies develop extreme hyperbilirubinemia that may need exchange transfusion.³

Exchange transfusion is indicated in neonatal jaundice to avoid neurotoxicity when other treatment modalities are failed or not available. Exchange transfusion not only removes the serum bilirubin but also removes the anti-body coated RBCs. Other treatment modalities can reduce the serum bilirubin but can't remove the anti-body coated RBCs, so it is an extra benefit of choosing exchange transfusion in hemolytic anemia.⁴

Pakistan is a country with limited health care resources, poverty, and low literacy levels. So sometimes the expensive treatment modalities like albumin and IVIG are not available and the only treatment options left are phototherapy or exchange transfusion. Another dilemma is that many times patients present late and there is impending kernicterus, and an urgent intervention is needed. The rationale of this study is that if double volume exchange transfusion is proved efficacious, it will be of great help in managing extreme cases of hyperbilirubinemia when other modalities failed or are not available in a resource-poor country like Pakistan.

Objective: To determine the efficacy of double volume exchange transfusion in term neonates with hyperbilirubinemia due to ABO incompatibility.

Operational definitions:

- **ABO incompatibility:** labeled yes when the mother has blood group of O and the neonate has the blood group either A, B, or AB.
- **Double volume exchange transfusion:** It means to exchange the blood of neonate with the double volume of blood (160ml/kg).

- **Hyperbilirubinemia:** Serum bilirubin above 25 mg/dl.
- **Efficacy:** labeled as yes when there is more than 20% change in serum bilirubin after double volume exchange transfusion.
- **Percentage change in bilirubin levels:** calculated as follows;

MATERIALS AND METHODS

Descriptive, case series study conducted in Neonatal Unit, Department of Pediatrics, Sheikh Zayed Hospital, Rahim Yar Khan. From 30-09-2016 to 29-12-2017. Total 89 patients were enrolled by Non-probability consecutive sampling according to inclusion and exclusion criteria. Term neonates (gestational age 37-41 weeks) with weight more than 2.5 kg with hyperbilirubinemia having ABO incompatibility requiring exchange transfusion of either gender were included in the study. The neonates whose parent/guardian did not give consent or having any dismorphism were excluded from the study.

Informed consent was obtained from their parents. Sociodemographic data and pre-exchange transfusion bilirubin levels were taken just before the exchange transfusion and then the cases underwent double volume exchange transfusion (160ml/kg) as per operational definition. Post-exchange transfusion bilirubin level was taken 4 hours after exchange transfusion. The efficacy was labeled as yes if there was a change of more than 20% bilirubin level. Data was entered in predesigned Performa analyzed in SPSS version 20

RESULTS

In this study, there was a total of 87 cases out of which 47 (54.02%) were males and 40 (45.98%) females. The mean age at presentation was 4.32 ± 1.51 days and the mean weight at birth was 2.95 ± 0.36 kg. Mean bilirubin at presentation was 30.08 ± 2.67 mg/dl while mean percent change after double exchange transfusion was 31.97 ± 9.78 . There were 53 (60.92%) cases that had age more than 3 days and 59 (67.82%) cases had birth weight less than 3 kg. Sixty-one (70.11%) cases had gestational age of 37 to 39 weeks at birth and 55 (63.22%) were delivered by trans vaginal route. There were 66 (75.86%) mothers that had blood group O – ve while the rest had O +ve while among fetuses the most common group was B +ve comprising 39(44.83%) cases. The efficacy of double exchange transfusion was seen in 28 (32.18%) cases. Out of 47 males 19 (40.43%), and 40 females, 9 (22.5%) have shown efficacy with a p-value of 0.07. There was significantly

better efficacy in cases that had age less than 3 days, seen in 16 (47.06%) out of 34 cases as compared to 12 (22.64%) out of 53 cases ($p=0.01$). However, there was almost equal efficacy in cases with a birth weight of less or more than 3 kg with $p=0.99$. Efficacy in cases with the gestational age of 40-41 at birth was observed in 11 (42.31%) out of 26 cases as compared to 17 (27.81%) out of 61 cases as in table 6 ($p=0.21$). There was no significant difference in terms of mode of delivery regarding the efficacy with $p=0.81$.

DISCUSSION

Exchange blood transfusion is considered the gold standard for effective treatment of neonatal hyper-bilirubinemia. It can be carried out in the form of single and double volume exchange transfusion with different degrees of success and failure rates. Although the use of exchange transfusion rate was progressively decreased over the last few years, it is still required in up to 7% of neonates admitted to nurseries. In 44 (33.33%) cases the cause of hyper-bilirubinemia was hemolysis with ABO incompatibility being the most common.⁵ This is similar to the results of similar studies where hemolysis due to the ABO incompatibility was seen in 22-35% of the cases. And the studies have shown even up to 50% of the cases with ABO incompatibility. The mechanism of efficacy behind the exchange transfusion is the removal of the hemolyzed red blood cells along with the responsible antibodies present over them.⁶

In this study, the mean bilirubin at presentation was 30.08 ± 2.67 mg/dl. This was also similar to the studies were done in India and Turkey where it was seen with values of 33.5 mg/dl and 29.5 mg/dl respectively.^{7, 8} While studies conducted in the United States and Thailand described the prevalence as 25 mg/dl and 26 mg/dl respectively.^{9, 10, 11} This reinforces the pathophysiology that the bilirubin production due to ABO incompatibility in a specific region falls almost in the similar range of bilirubin. In contrast to this relatively lower results are seen by studies globally especially in developed countries like the United States. Hence it is thought that there might be some other factors responsible for this along with the sole ABO incompatibility or the earlier interventions done or steps taken at prenatal period can be a cause of relatively lower serum bilirubin level.

There were 53 (60.92%) cases that had aged more than 3 days at presentation when this procedure was carried out. Although there were no cut-off values used by other studies in this context but the mean age at which exchange transfusion was done was 4.97 days to 6.25 days in different studies.^{12, 13} The occurrence of this procedure in almost the same age groups indicates the mechanism of injury due to incompatible blood groups and accumulation of bilirubin, leading to the spectrum of the clinical picture in almost the same age groups when the exchange transfusion is required.

The mean percent change after double exchange transfusion was 31.97 ± 9.78 . The criteria to label the cases with efficacious outcomes in this study was devised when the percentage changes were more than 20% after double volume exchange; hence the efficacy in this study was seen in 28 (32.18%) cases. The studies did not use any specific values in the past to label as efficacious or not. In contrast to this, they compared the percentage changes in their patients, and that mainly relied upon the percentage changes in the individual cases. Regarding this parameter the results in our study were comparatively on the lower side as compared to the other studies in Iran and Nepal, accounting for 58% and 60.4% respectively.^{10, 14} While studies conducted in Brazil and Iraq had efficacy in terms of percent change in bilirubin of 30-40%.^{14, 16} The difference in percent change can be due to difference in inclusion criteria or there might be some other factors affecting like technique or procedure failure.

Out of 47 males 19 (40.43%), and 40 females, 9 (22.5%) have shown efficacy with a p -value of 0.07. This difference was not statistically significant and it was similar to a study done in Nepal

where the efficacy was also seen better in males as it was seen in 31 (64.6%) as compared to females where it was seen in 17 (35%) of cases with a p -value of 0.30.¹⁷ The reason of higher efficacy in male gender in contrast to females is not known.

There was significantly better efficacy in cases that had age less than 3 days, seen in 16 (47.06%) out of 34 cases as compared to 12 (22.64%) out of 53 cases ($p=0.01$). There were no studies to look for such age ranges regarding these age limits. One study from Iraq revealed that the cases with age up to 2 days had 20.8% change in their bilirubin level, while with 3-4 days it was 33.3%, with age 5-6, 38.3% and age 7 days or more it was 56.2%.¹⁶ The reason for higher success rates in the higher age groups can be due to the use of other treatment options as well before exchange transfusion like phototherapy, intravenous immunoglobulins, etc. Early presentation and intervention leading to improvement in bilirubin level can be another cause of it. Moreover, another factor that can affect it can be the mortality rate in other studies, which was not assessed in our study. The cases with higher bilirubin levels that presented earlier ended up in death while those that survived a few days longer, expressed better outcomes.

There was no significant difference in terms of mode of delivery regarding the efficacy with $p=0.81$. Similar was observed by the other studies as well. However, the incidence of the ABO incompatibility was higher in 55 (63.22%) were delivered by trans vaginal route.^{18, 19} The reason for higher cases of ABO incompatibility in trans vaginal delivery as compared to the cases that were delivered in the C section can be due to higher chances of mixing of maternal and fetal blood while passing through the birth canal.

There were a few limitations of this study, as this study did not study the other minor blood group antigens. This study did not mention that these cases were either treated with any other regimen like phototherapy or immunoglobulin administration etc. This study also did not compare with other modalities of the treatment.

There were many strengthening points in this study as well, as this study was conducted for the management of one of the most dreadful diseases. It thoroughly evaluated the data of different confounders.

CONCLUSION

The efficacy of double volume exchange transfusion is seen in every 3rd case and it is significantly high in cases when undergone within the first 3 days of birth.

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