

# Exchange Transfusion in Hyperbilirubinemia: Experience in Tertiary Care Centre in Bihar

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## ABSTRACT

**Introduction:** Neonatal hyperbilirubinemia is commonly seen in neonates and is one of most easily treatable condition in neonates. Bilirubin is mainly classified as conjugated and unconjugated bilirubin. Unconjugated fraction of bilirubin causes mitochondrial enzyme inhibition, deranges cerebral glucose metabolism and leads to apoptosis in neurons leading to severe damage in developing brain. Among various methods available for treating neonatal hyperbilirubinemia exchange transfusion is most effective in decreasing bilirubin level in very short period of time and thus preventing likely brain damage. bilirubin level can be reduced to about 60% of pre exchange level after half hour of exchange transfusion

**Material and methods:** The following study was done in tertiary care NICU in a medical college in Bihar. Neonates who underwent exchange transfusion for hyperbilirubinemia were enrolled in this study. Period of study was one year. After enrolling the neonates in study their medical record and data were recorded for cause of hyperbilirubinemia, duration of exchange, any adverse effect during procedure, pre and post exchange bilirubin. Inclusion criteria was all neonates who had bilirubin levels enough for exchange transfusion according to AAP nomogram. Neonates who underwent exchange transfusion for other causes like sepsis, polycythemia were not included in study. Standard procedure was applied for exchange transfusion in all neonates. Isovolemic double volume transfusion was done. Whole blood was used at some times and reconstituted blood using PRBC and plasma was also used.

**Result:** During study period of one year 35 neonates underwent exchange transfusion for hyperbilirubinemia. Among the causes identified in this study ABO incompatibility was most common. It was found in 16 neonates (45.71%). Next cause was Rh incompatibility. It constituted about 25.71% of total study cases. In rest of 10 cases no specific cause could be identified. Mean post exchange Hb (13.48 g/dl) was greater than mean pre exchange Hb levels (11.77 g/dl). There was mean rise of 1.71 g/dl. In this study immediate complications occurred in 7 cases. Hypoglycaemia and electrolyte abnormalities (hypocalcaemia, hyperkalemia) were only abnormalities associated. None of them had catheter related complications or sepsis after procedure.

**Conclusion:** Neonatal hyperbilirubinemia is one of most commonly encountered problems in neonates. Rapidly increasing bilirubin levels in neonates is very harmful for neonates and may be life threatening if not treated promptly. ABO incompatibility and Rh incompatibility must be excluded in neonates presenting with alarming levels of bilirubin and early recognition of problem and early starting of treatment is key in changing the prognosis of this condition. Exchange transfusion is one of most effective and safe method of treating NNH in tertiary care centres where in cases come very late and after being referred from many primary centres.

**Keywords:** Exchange Transfusion, Hyperbilirubinemia

## INTRODUCTION

Neonatal hyperbilirubinemia is commonly seen in neonates and is one of most easily treatable condition in neonates. Among term babies 6 out of every 10 and among preterm babies 8 out of every 10 have hyperbilirubinemia. Physiological immaturity of hepatobiliary system and lack of balance between production and handling of bilirubin is one of most important cause of hyperbilirubinemia in this age group.

Bilirubin is mainly classified as conjugated and unconjugated bilirubin. Unconjugated fraction of bilirubin causes mitochondrial enzyme inhibition, deranges cerebral glucose metabolism<sup>1</sup> and leads to apoptosis in neurons<sup>7</sup> leading to severe damage in developing brain.

Among all the structures in brain most commonly and severely affected is basal ganglia, geniculate bodies, hippocampus and other brainstem nuclei like oculomotor, cochlear, vestibular. Cerebellum is also affected in many cases<sup>2</sup>.

Among various methods available for treating neonatal hyperbilirubinemia exchange transfusion is most effective in decreasing bilirubin level in very short period of time and thus preventing likely brain damage. bilirubin level can be reduced to about 60% of pre exchange level after half hour of exchange transfusion.

Now a day exchange transfusion is mainly started in neonatal hyperbilirubinemia if phototherapy fails to prevent increasing bilirubin levels and to remove antibodies and sensitized RBC thus to prevent further hemolysis in neonates.

Threshold level of bilirubin for starting exchange transfusion is debatable among many treating neonatologists and paediatricians. This holds significance more now a days as phototherapy is now widely available and newer generation phototherapy devices are quite effective in rapidly reducing bilirubin levels if started on time and thus saves time and undue intervention of exchange transfusion.

## MATERIAL AND METHODS

The following study was done in tertiary care NICU in a

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medical college in Bihar. Neonates who underwent exchange transfusion for hyperbilirubinemia were enrolled in this study. Period of study was one year. After enrolling the neonates in study their medical record and data were recorded for cause of hyperbilirubinemia, duration of exchange, any adverse effect during procedure, pre and post exchange bilirubin. Inclusion criteria was all neonates who had bilirubin levels enough for exchange transfusion according to AAP nomogram. Neonates who underwent exchange transfusion for other causes like sepsis, polycythemia were not included in study.

Standard procedure was applied for exchange transfusion in all neonates. Isovolemic double volume transfusion was done. Whole blood was used at some times and reconstituted blood using PRBC and plasma was also used. Exchange was done with neonate under radiant warmer and cardiac and BP monitoring in place. Umbilical vein catheterisation was done under aseptic conditions. Exchange was done with push pull technique. Removal and infusion of blood was done according to standard published guidelines with intermittent infusion of calcium. CBC, serum bilirubin levels, electrolytes, glucose were measured after exchange. Exchange related complications were defined as complications not present before exchange, which occurred within three days of exchange. Exchange related mortality was defined as death within three days of exchange directly attributing to the procedure.

#### Definitions

- **Hypocalcaemia:-** defined as total serum calcium level of  $<7$  mg/dl in preterm infants and  $<8$  mg/dl in term infants.
- **Hypoglycaemia:-** defined as blood glucose level  $< 40$  mg/dl.
- **Hyperkalemia:-** defined as serum potassium level  $> 5.5$  meq/l

#### Laboratory investigations

Following lab investigation were done for study:-

- 1) Blood grouping of mother and child
- 2) Pre and post exchange serum bilirubin (total, direct and indirect)
- 3) SGPT, SGOT
- 4) Pre and post exchange serum electrolytes ( $\text{Na}^+$ ,  $\text{K}^+$ ,  $\text{Ca}^{2+}$ )
- 5) Pre and post exchange RBS
- 6) CBC
- 7) Direct Coomb's test
- 8) Septic screen
- 9) BERA
- 10) PBS & Reticulocyte count

#### RESULTS

During study period of one year 35 neonates underwent exchange transfusion for hyperbilirubinemia. Among these cases male:female ratio was 1: 1.05. ( $n=18$ ,  $n=17$ ). Preterm neonates were only 20% of total cases ( $n=7$ ). Among the causes identified in this study ABO incompatibility was most common. It was found in 16 neonates (45.71%). Next cause

was Rh incompatibility. It constituted about 25.71% of total study cases. In rest of 10 cases no specific cause could be identified. Mean pre exchange bilirubin level among study group was  $24.53 \pm 4.34$  mg/dl. Mean Post exchange level observed was  $13.68 \pm 3.44$  mg/dl. No neonate included in this study had to undergo for repeat transfusion.

Mean post exchange Hb (13.48 g/dl) was greater than mean pre exchange Hb levels (11.77 g/dl). There was mean rise of 1.71 g/dl. Subtle fall in calcium level was found in most of cases after exchange transfusion. Mean pre exchange serum calcium was 8.74 mg/dl and post exchange value was  $8.61 \pm 0.5$  mg/dl. Hypocalcaemia was documented in two cases (7.6 and 7.8 mg/dl respectively). Mean fall in serum calcium was 0.13 mg/dl. Hyperkalemia was documented in 3 cases. Pre exchange RBS values ranged from 59 mg/dl to 133 mg/dl, with a mean value of 98.68 mg/dl. Post exchange value ranged from 36 mg/dl to 127 mg/dl with mean value of 92.4 mg/dl. Mean decrease in RBS was 6.28 mg/dl. Hypoglycaemia was documented in 3 cases. In this study immediate complications occurred in 7 cases. Hypoglycaemia and electrolyte abnormalities (hypocalcaemia, hyperkalemia) were only abnormalities associated. None of them had catheter related complications or sepsis after procedure.

#### DISCUSSION

This study was done with aim to highlight and observe the causes of neonatal hyperbilirubinemia, gestational profile of neonates undergoing exchange transfusion, mean bilirubin levels of neonates undergoing exchange transfusion in our facility and effect and complications attributed to procedure.

Sample size of 35 was taken which is comparable to many studies carried by earlier researchers like Salas AA<sup>10</sup> et al, Spada A<sup>1</sup> et al.

In this study amongst 35 cases 18 (51.4%) were male and 17 (48.6%) were female. Outcome was compared between two groups and data was analysed using Chi square test ( $p$  value  $>0.1$ ). It was concluded that sex of patient is not related to outcome. In study done by Lo YS<sup>4</sup> et al, out of 194 cases 127 (65.46%) were male and 67(34.53%) were female. Rijal P<sup>12</sup> et al studied 86 cases of hyperbilirubinemia out of which male ( $n=51$ ) were 59.3% and female ( $n=35$ ) were 40.69%. Weisz B<sup>5</sup> et al studied complications of exchange transfusion on 143 infants, out of these male ( $n=81$ ) and female ( $n=62$ ) constituted 56.64% and 43.36% respectively

Majority (80%) of babies in this study were term ( $n=28$ ), preterm ( $n=7$ ) constituted only 20% of total cases. Mean pre exchange bilirubin in preterm was 23.14 mg/dl while in term babies it was 24.87 mg/dl. Dikshit SK<sup>3</sup> et al studied 335 babies. Out of these term ( $n=225$ ) were 67.16% as compared to preterm ( $n= 110$ ) which were 32.84%. Abu-Ekteish F<sup>6</sup> et al in similar study found that out of 336 neonates 25 (7.6%) were pre term and remaining were term

Out of 35 exchange transfusion most (65.71%) were done between 4<sup>th</sup>- 6<sup>th</sup> day of life ( $n=23$ ). Out of remaining 12 cases 6 (17.14%) were done between 0-3 days and remaining 6 (17.14%) were done between 7-9 days. Lo YS<sup>4</sup> et al studied

194 neonates suffering from hyperbilirubinemia treated with exchange transfusion. Mean age of exchange ranged from 13 hours to 16 days. Most of the neonates received BET at the 4th day of birth (23.2%), but there were still 30 cases (15.5%) that received BET after 1 week of age.

ABO incompatibility was most common cause of NNH in our study followed by Rh incompatibility. In 10 cases no specific cause for NNH could be identified. This may be due to minor blood group incompatibility, work up for which could not be done in our resource limited setting. Study conducted by Hosseinpour Sakh<sup>11</sup> and Badiie Z<sup>9</sup> respectively also found ABO incompatibility as most common cause for NNH. Mean pre exchange value in our study was about 25mg/dl and post exchange value was 13 mg/dl. Study conducted by Salas AA<sup>10</sup> had higher pre exchange bilirubin levels which also correlates with higher incidence of encephalopathy in his study.

Immediate complications in form of dyselectrolytemia and hypoglycaemia were seen in 7 out of 35 cases. No mortality occurred in our study. None of the enrolled neonate had to undergo repeat exchange transfusion. It is comparable to study conducted by Sanpavat S<sup>8</sup> where morbidity was noted in 15.3% of cases. Badiie Z<sup>9</sup> also found complication in 14 neonates (20.9%) in his study. Patra K<sup>7</sup> et al showed higher incidence (74%) of associated abnormalities, commonest being thrombocytopenia (44%) followed by hypocalcemia (29%).

## CONCLUSION

Neonatal hyperbilirubinemia is one of most commonly encountered problems in neonates. Most of the times it is well within physiological limits. In such conditions cautious counselling of attendants suffices but having said that it should also be kept in mind that rapidly increasing bilirubin levels in neonates is very harmful for neonates and may be life threatening if not treated promptly. ABO incompatibility and Rh incompatibility must be excluded in neonates presenting with alarming levels of bilirubin and early recognition of problem and early starting of treatment is key in changing the prognosis of this condition. Exchange transfusion is one of most effective and safe method of treating NNH in tertiary care centres where in cases come very late and after being referred from many primary centres.

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