

Original Research Article

Sex-wise changes in haematological and biochemical parameters before and after exchange transfusion in neonatal hyperbilirubinemia

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ABSTRACT

Background: Exchange transfusion (ET) is required in hyperbilirubinemic hospitalized neonates.

Methods: The study center at SMS and associated hospitals. The blood bank is licensed and fully equipped. Fall in serum bilirubin minimum of 40 cases was required as the sample size of the present study.

Results: The Sex ratio in the neonates undergoing Exchange transfusion was 65% (26) Males and 35% (14) females. The mean values of Hb (g/dl), Hematocrit and Direct bilirubin (mg/dl) of male and female before and after exchange transfusion, were non-significant.

Conclusion: Exchange transfusion was required more commonly in male neonates. The mean values of change in Hb (g/dl), Hematocrit and Direct bilirubin (mg/dl) of males and females before and after exchange transfusion, were non-significant. The mean values of change in Indirect bilirubin (mg/dl) in both males and females before and after exchange transfusion was highly significant. The mean values of change in Total bilirubin (mg/dl) in males and in females were significant.

Keywords: Exchange transfusion, Haematocrit, Haemoglobin, Hyperbilirubinemia, Total, Direct and indirect bilirubin

INTRODUCTION

An exchange transfusion involves removing small aliquots of neonate's blood and replacing it with small aliquots of donor blood in order to remove abnormal blood components and circulating toxins whilst maintaining adequate circulating blood volume. It is primarily performed to remove antibodies and excess bilirubin in isoimmune disease, the incidence of exchange transfusion is decreasing secondary to the prevention and improved prenatal management of alloimmune hemolytic disease and improvements in the management of neonatal hyperbilirubinaemia.¹ Severe hyperbilirubinemia in relatively healthy term or preterm neonate's has continued

to carry the potential for complications from acute bilirubin encephalopathy and chronic sequelae. Neonatal hyperbilirubinemia with mild to moderate elevation of serum bilirubin levels were generally considered to be an innocuous state. However, if serum bilirubin levels exceed a dangerous limit, which varies with birth weight, gestational age, chronological age and internal milieu of the body, bilirubin may cross the blood-brain barrier and bilirubin encephalopathy results. Severe hyperbilirubinemia occurs when the total serum bilirubin (TSB) concentration is $>340 \mu\text{mol/L}$ (20mg/dl) at any time during the first 28 days of life and critical hyperbilirubinemia occurs when the TSB concentration is $>425 \mu\text{mol/L}$ (25 mg/dl) during the first 28 days of life. It

is estimated that 60% of the term newborns develop jaundice and 2 % reach a TSB concentration >340 $\mu\text{mol/L}$ (20mg / dl).²

These changes in global and national contexts have prompted this work. Therefore, there was a need for Clarification of probably related factors (s) like age and these objectives were arranged to some fulfilled the scanty information.

Research in basic emergency clinical subjects like Transfusion Medicine forms the foundation stone for further work in other disciplines. The present investigation has been planned to elucidate the Effect of age on various blood parameter before and after blood transfusion in neonatal hyperbilirubinemia.

The results of this study will be useful to clinician's pediatricians and para-clinicians for diagnosis and treatment of various ailments of neonatal hyperbilirubinemia and will also help the scientists involved in research on neonatal hyperbilirubinemia.

METHODS

The Interventional study without control. It was design Longitudinal study. The study was undertaken at SMS hospital, JK Lon Hospital and Mahila Chikitsalya, Jaipur. The tests were performed in the Department of Immunohematology and Transfusion Medicine and laboratories of SMS hospital, JK Lon Hospital and Mahila Chikitsalya, Jaipur, Rajasthan, India.

The sample size was calculated at a 95% confidence level assuming a standard deviation of 9.7% in fall of serum bilirubin as a preference study, at the precision of 3% fall in serum bilirubin minimum 40 cases were required as the sample size of the present study.

Inclusion Criteria

- All neonates with Neonatal Hyperbilirubinemia requiring exchange transfusion and/or if requiring multiple exchange transfusions.³
- Those giving consent for participation in this study.

Exclusion Criteria

- Patients who may get benefit from phototherapy and blood transfusion and don't fall in the range of exchange transfusion criteria.
- Major congenital malformations.
- Those refusing consent for participating in this study.

This study was initiated after the approval of the research review board and fulfilled all requisite formalities. The selection of the study population was done as per the inclusion and exclusion criteria. The detailed personal

and medical history of the neonate was recorded as per the proposed Performa.

Information recorded were age, weight, and sex of the newborn baby and Volume of Blood Transfusion. Investigations conducted in all neonates requiring exchange were total serum bilirubin (TSB), conjugated and unconjugated fractions of TSB, ABO, and Rhesus blood group; direct Coombs test (DCT), reticulocyte count and peripheral blood smear examination. Glucose-6-phosphate dehydrogenase (G6PD) levels, thyroid profile and sepsis screen were done wherever indicated.

Traditional guidelines suggest exchange transfusion in the following circumstances:

Within 12 hours of birth if

- Cord blood bilirubin concentration exceeds 3 to 5 mg/dL for preterm infants, 5 to 7 mg/dL for term infants, or the rate of increase is >0.5 mg/dL/hour.
- Severe anemia: hemoglobin 10 g/dl combined with hyperbilirubinemia.

After 24 hours of birth if

- Total bilirubin concentration >20 mg/dL or a bilirubin increase of >0.5 mg/dL/hour or hemoglobin <10 g/dL combined with hyperbilirubinemia.

The study centre at SMS / JKLon hospital / Mahila Chikitsalya blood bank is licensed and fully equipped for component preparation with the facility of deep fridge centrifuge, laminar flow, plasma extractor, dielectric tube sealer, deep fridge of -40°C and -70°C, sterilized connecting device, cryo water bath etc. Whole Blood was supplied to neonatal hyperbilirubinemia cases requiring an exchange transfusion, hospitalized in the Newborn Care Unit attached with the present institute. All the cases of HDN were diagnosed by testing cord blood/neonate blood for ABO grouping and Rh typing (Tube technique), Direct Coomb's test (DCT) by Polyspecific AHG Column technique, total, direct and indirect serum bilirubin (Autoanalyser method) along with mother's sample for ABO grouping, RhD typing (Tube technique).

RESULTS

Sex ratio - The Sex ratio in these neonates requiring ET was 65% (26) Males and 35% (14) females. (Table 1)

Sex-wise changes in hematological and biochemical parameters before and after exchange transfusion (Table 2)

The mean value of Hb (g/dl) in male was 13.32 ± 0.62 and 13.74 ± 0.54 before and after exchange transfusion, respectively and P-value of mean difference was 0.477 which was non-significant whereas in female mean value

were 11.81±0.80 and 13.51±0.57, respectively and P-value of mean difference was 0.192 which was non-significant.

Table 1: Sex ratio.

| Sex | Numbers of Neonates | Percent |
|--------|---------------------|---------|
| Male | 26 | 65 |
| Female | 14 | 35 |

The mean value of Hematocrit in male was 36.74±1.90% and 40.34±1.52% before and after exchange transfusion, respectively and P-value of mean difference was 0.069 which was non-significant whereas in female mean value were 35.51±2.16 and 39.51±1.98, respectively and P-value of mean difference was 0.057 which was non-significant.

The mean value of Total bilirubin (mg/dl) in male was 20.89±1.71 and 11.60±0.95 before and after exchange

transfusion, respectively and P-value of mean difference was <0.001 which was highly significant whereas in female mean value were 22.58±2.09 and 10.40±1.11, respectively and P-value of mean difference was 0.001 which was highly significant.

The mean value of Direct bilirubin (mg/dl) in male was 3.99±1.31 and 1.16±0.18 before and after exchange transfusion, respectively and P-value of mean difference was 0.029 which was significant whereas in female mean value were 3.55±2.41 and 0.74±0.07, respectively and P-value of mean difference was 0.271 which was non-significant.

The mean value of Indirect bilirubin (mg/dl) in male was 20.89±1.21 and 10.47±0.91 before and after exchange transfusion, respectively and P-value of mean difference was <0.001 which was highly significant whereas in female mean value were 22.28±1.51 and 9.67±1.10, respectively and P-value of mean difference was <0.001 which was highly significant.

Table 2: Sex-wise changes in Hematological and biochemical parameters before and after exchange transfusion.

| Variable | Sex | Before transfusion | After transfusion | P-value |
|----------------------------|--------|--------------------|-------------------|---------|
| Hb (g/dl) | Male | 13.32±0.62 | 13.74±0.54 | 0.477 |
| | Female | 11.81±0.80 | 13.51±0.57 | 0.192 |
| Hematocrit (%) | Male | 36.74±1.90 | 40.34±1.52 | 0.069 |
| | Female | 35.51±2.16 | 39.51±1.98 | 0.057 |
| Total bilirubin (mg/dl) | Male | 20.89±1.71 | 11.60±0.95* | <0.001 |
| | Female | 22.58±2.09 | 10.40±1.11* | <0.001 |
| Direct bilirubin (mg/dl) | Male | 3.99±1.31 | 1.16±0.18* | 0.029 |
| | Female | 3.55±2.41 | 0.74±0.07 | 0.271 |
| Indirect bilirubin (mg/dl) | Male | 20.89±1.21 | 10.47±0.91* | <0.001 |
| | Female | 22.28±1.51 | 9.67±1.10* | <0.001 |

*—Denotes significance difference in the table.

DISCUSSION

The Sex ratio in these neonates was 65% (26) Males and 35% (14) females percentage of male neonates among those requiring exchange were 55% and female neonates were 44% with a male-to-female ratio of 1.2:1 by Singla, et al (2017).⁴ Eghbalian (2007) who evaluated 120 neonates, 64 neonates (53.3%) were boys and 56 cases (46.7%) were girls Heydarian and Majdi (2010) evaluated 118 patients of which 75 (63.6%) were male and 43 patients (36.4%) were female.^{5,6} Bujandric and Gruji (2016) correlative study mentioned that a total of 468 double volume ET were performed 221 male and 177 female infants, with a sex ratio of 1.25:1.⁷ Das et al (2017) noted that out of the 1970 cases of unconjugated hyperbilirubinemia 18 (0.913%) required an exchange transfusion. Overall male preponderance was noted in 55.55% of cases. Satyasree (2017) found in their study that there were 61.1% males and 38.8% females who had

neonatal jaundice.⁹ The present study is antithetical to the findings of Sabzehei et al (2015)¹⁰ who found that among 148 neonates, 80 (54.9%) were female Rahman et al. (2015) found 16 (41%) cases were male and 23 (59%).¹¹

Sex-wise changes in hematological and biochemical parameters before and after exchange transfusion in males and females:

The mean values of change in Hb (g/dl), Hematocrit and Direct bilirubin (mg/dl) of males and females before and after exchange transfusion, were non-significant.

The mean value of change in Indirect bilirubin (mg/dl) in males and females before and after exchange transfusion, which was highly significant.

The mean values of change in Total bilirubin (mg/dl) in males and in females were significant. Similar to the

present study, Kale et al (2016) also found higher values of serum bilirubin in the female babies and this difference was also statistically significant.¹²

CONCLUSION

Exchange transfusion was required more commonly in male neonates. The mean values of change in Hb (g/dl), Hematocrit and Direct bilirubin (mg/dl) of males and females before and after exchange transfusion, were non-significant.

The mean values of change in Indirect bilirubin (mg/dl) in both males and females before and after exchange transfusion was highly significant. The mean values of change in Total bilirubin (mg/dl) in males and in females were significant.

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