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HYPERBILIRUBINEMIA FOLLOWING EXCHANGE TRANSFUSION WITH G-6-PD DEFICIENT DONOR BLOOD

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ABSTRACT

Background: The incidence of glucose-6-phosphate dehydrogenase (G-6-PD) deficiency in Iran is estimated at 10-14.9%. The donor blood in blood banks is not screened routinely for this enzyme deficiency and such blood may be used for neonatal exchange transfusion.

Objective: To study the effect of G-6-PD deficient blood in neonatal exchange blood transfusion.

Methods: In a prospective study, serum bilirubin was checked before and 6 hours after exchange transfusion in three hundred and fifty consecutive neonates who were admitted to Nemazee Hospital, Neonatal Ward. Hemoglobin, direct Coomb's test, direct bilirubin, reticulocyte count, blood group of neonates and mothers, G-6-PD of neonates and the blood used for exchange transfusion were also checked. For analysis of the data, 102 neonates who weighed more than 2500 gr and with no evidence of hemolysis, liver disease or sepsis were divided into three groups; Group I: patients in this group were exchanged with G-6-PD deficient blood. Group IIa: patients in this group were exchanged with normal blood. Group IIb: the neonates from Group IIa who needed a repeat exchange transfusion. Group III: G-6-PD deficient patients who were exchanged with normal blood.

Results: Group I neonates had a small drop in bilirubin 6 hours post-exchange transfusion in contrast to groups II and III ($P<0.05$). Exchange transfusion with G-6-PD deficient donor blood led to repeat exchange transfusion due to insufficient fall in bilirubin level in Group I neonates.

Conclusion: It is recommended that in areas endemic for G-6-PD deficiency, the donor blood be screened before exchange transfusion.

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Key Words • Hyperbilirubinemia • glucosephosphate dehydrogenase deficiency • hemolysis • exchange transfusion

Introduction

Exchange transfusion is often the most effective treatment for immediate reduction of serum bilirubin and prevention of central nervous system (CNS) damage, however, it is not without risk.[1,2]

Recently, most Iranian blood banks routinely screen donors for hepatitis B surface antigen (HBs Ag), cytomegalovirus (CMV) and human immunodeficiency virus (HIV).[2]

The overall incidence of G-6-PD deficiency in Iran according to a WHO report is 10-14.9%[3] and in Fars Province the incidence is about 12 % in males and 0.9% in females.[4]

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Table1: The mean reduction of bilirubin 6 hours after exchange transfusion and the mean duration of phototherapy after the last exchange in each group

Group	Number of cases	The mean reduction of bilirubin 6 hr post exchange transfusion (mg/dl ± SD)	The mean duration of phototherapy (Days ± SD)
I	3	1.53 ± 0.51	3.5 ± 1
IIa	63	7.67 ± 4.52	3.12 ± 2.97
IIb	9	5.70 ± 2.93	3.66 ± 0.66
III	36	6.28 ± 2.77	3.17 ± 1.19

The following study was undertaken to evaluate the outcome of exchange transfusion where G-6-PD donors blood is used.

Materials and Methods

From April 2000 to April 2001, all neonates (#350) with high levels of bilirubin admitted to Nemazee Hospital Neonatal Ward for exchange transfusion were enrolled in this study. The patients were checked for bilirubin before and 6 hours after exchange transfusion. Hemoglobin, direct Coomb's test, direct bilirubin, reticulocyte count, blood group of neonates and mothers, G-6-PD of neonates and the bags of blood used for exchange transfusion were also checked. The duration of phototherapy needed after the last exchange transfusion was recorded.

G-6-PD determination on blood samples taken from each bag of transfused blood was done by Fluorescent Spot test.[5,6] For analysis of the data, 102 neonates who weighed more than 2500gr and had no evidence of hemolysis, liver disease or sepsis were divided into three groups: Group I; included 3 neonates, who were exchanged with G-6-PD deficient blood. They were not G-6-PD deficient and had no evidence of hemolytic disease, liver disease or sepsis at birth. Group IIa: including 63 neonates, exchanged with normal blood. Group IIb comprised 9 neonates from group IIa who needed repeat exchange transfusion. Group III: including 36 neonates who were G-6-PD deficient and exchanged with normal blood.

All neonates(#248) who weighed less than 2500gr or received transfusions due to hemolytic disease, liver disease or sepsis were excluded from the study.

Differences in variables were analyzed by Mann-Whitney U test, P values of less than 0.05 were considered significant.

Results

From 350 transfused blood bags, 3 were G-6-PD deficient. In neonates who were exchanged with this blood (Group I) the mean reduction in bilirubin before and 6 hours after exchange transfusion was 1.53 ± 0.51 mg/dl. All these neonates required a repeat exchange transfusion and the mean duration of phototherapy after the last exchange in this group was 3.5 ± 1 days.

As shown in Table 1, the mean reduction of bilirubin 6 hours after exchange transfusion and the mean duration of phototherapy after the last exchange transfusion is quite similar in Groups II and III without a statistically significant difference ($p > 0.05$). There is a statistically significant difference between Group I and other groups as to the mean reduction of bilirubin, 6 hours after exchange transfusion ($p < 0.05$) although this difference was not noted in regard to the duration of phototherapy after the last exchange transfusion between Group I and others ($p > 0.05$).

Discussion

One-volume blood exchange transfusion results in the removal of 70% to 75% of neonate's red blood cells (RBC) and two-volume exchange transfusion replaces about 90% of RBCs.[7]

The amount of bilirubin removed by exchange transfusion varies according to its serum concentration and the rate of exchange.[5,7] A double volume exchange transfusion should eliminate more than half of the intravascular bilirubin but there is a rebound hyperbilirubinemia 2-6 hours after exchange transfusion due to the entrance of bilirubin from the tissues into the circulation.[7,8]

As illustrated by this study, exchange transfusion with G-6-PD deficient blood may result in prolonged hyperbilirubinemia and at times even necessitate additional exchange transfusions. In this study, Group I had a small drop in bilirubin 6 hours post exchange transfusion in contrast to Groups II and III ($p < 0.05$). Exchange transfusion with G-6-PD deficient donor blood did not reduce bilirubin levels significantly and a repeat exchange transfusion was necessary in these neonates.

In all one hundred and two cases included in this study, no evidence of hemolysis was found although jaundice caused by breast feeding and exaggerated physiologic jaundice due to high altitude should be kept in mind.[9-12]

The duration of phototherapy after the last exchange transfusion in Group I was not significantly different from other groups ($P > 0.05$).

It is therefore concluded that since G-6-PD deficiency is a common cause of jaundice, attempts should be made to screen donors' blood routinely for G-6-PD deficiency in areas endemic for this enzyme deficiency. Babies showing a blunted post exchange fall in bilirubin and requiring repeated exchange transfusion without an obvious cause to account for the hyperbilirubinemia, should also be investigated along these lines.[12]

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