Scholars Journal of Applied Medical Sciences
Abbreviated Key Title: Sch J App Med Sci
ISSN 2347-954X (Print) | ISSN 2320-6691 (Online)
Journal homepage: www.saspublishers.com

OPEN ACCESS

Physiology

An Identification of Treatment Option and Duration in Hospital Stay of G6PD Deficiency Neonates with Jaundice

Nilufa Akhter[1*], Noorzahan Begum[2], Sultana Ferdausi[3], Waqar Ahmed Khan[4]

[1]Associate Professor, Department of Physiology, Bangladesh institute of child health (BICH), Dhaka, Bangladesh
[2]Professor, Department of physiology, Bangabandhu Sheikh Mujib Medical University (BSMMU), Bangladesh
[3]Professor & Head, Department of physiology, Bangabandhu Sheikh Mujib Medical University (BSMMU), Bangladesh
[4]Professor, Department of Pathology, Bangladesh institute of child health (BICH), Dhaka, Bangladesh

***Corresponding author:** Nilufa Akhter
| **Received:** 16.03.2019 | **Accepted:** 27.03.2019 | **Published:** 30.04.2019
DOI: 10.36347/sjams.2019.v07i04.004

Abstract **Original Research Article**

Glucose-6-phosphate dehydrogenase deficiency is the most common clinically significant red blood cell enzyme defects in human biology. G6PD deficiency is an important risk factor for severe Neonatal hyperbilurubinamia NIH carries a substantial risk for harmful complications which include long-term neurologic impairments and death. In G6PD-deficent neonates, Proper management should be hastened to avoid irreversible neurological complications. This cross sectional study was carried out to observe the G6PD status in 90 male, term neonates with jaundice, age ranged from 3 to 12 days (Group B) in the Department of Physiology, Bangabandhu Sheikh Mujib Medical University from 1st July 2007 to 30th June 2008. Our aim was to assess the treatment duration of neonates who have G6PD deficiency with jaundice. On the basis of total serum bilirubin level, study group was further divided into three groups: Group B1 (TSB <15mg/dl), Group B2 (TSB 15-20mg/dl) and Group B3 (TSB>20mg/dl). For comparison, age and sex matched 30 apparently healthy neonates (Group A) were also studied. Study group was selected from in patient and control group from outpatient department of Dhaka Shishu Hospital. Based on the severity of G6PD level with neonatal jaundice, Study group are admitted and observed with all others parameters including types of therapy, treatment duration, Blood grouping etc. Standard treatment protocol was followed like Phototherapy (PT) and exchange transfusion (ET). Identification and discontinuation of the precipitating agent is critical to manage hemolysis in patients with G6PD deficiency. Study suggested that treatment duration were significantly taking higher hospital stay in severe ($p<0.01$) groups in comparison to those of control, mild& moderate group .Erythrocyte G6PD levels were significantly lower in moderate ($p<0.01$, $p<0.05$) and severe ($p<0.001$, $p<0.01$) hyperbilirubinemic group in comparison to those of control and mild group. Based on severity, exchange transfusion (ET) were significantly ($p<0.001$) higher in severe hyperbilirubinemic than those of control, mild and moderate group. From this study, it is revealed thatG6PD deficiency in neonates increased hospital stay and significant higher exchange transfusion in severe hyperbilirubinemic neonates.

Keywords: G6PD deficiency Treatment, Management, Duration.

INTRODUCTION

Glucose-6-phosphate dehydrogenase deficiency is the most common clinically significant red blood cell enzyme defects in human biology [1]. G6PD deficiency is an important risk factor for severe Neonatal hyperbilurubinamia [1]. Glucose-6-phosphate dehydrogenase deficiency is the most common clinically significant red blood cell enzyme defects in human biology.[i] G6PD deficiency is an important risk factor for severe Neonatal hyperbilurubinamia[2]. NIH carries a substantial risk for harmful complications which include long-term neurologic impairments and death. In G6PD-deficent neonates, Proper management should be hastened to avoid irreversible neurological complications. Neonatal Jaundice is a commonly encountered pediatric problem, usually visible in the first week of life. Approximately 60% of term infants usually develop jaundice at this period [2]. It has been reported that hyperbilirubinemia results from excessive destruction of red blood cells. In addition, they also reported that decreased conjugation and excretion of bilirubin by the liver had major contribution to the development of neonatal hyperbilirubiemia in G6PD deficient neonates[ii]. Infants with prolonged neonatal jaundice as a result of G6PD deficiency should receive phototherapy with a bili light. Exchange transfusion may be necessary in cases of severe neonatal jaundice or hemolytic anemia caused by favism. However,

Researchers found that in neonates with idiopathic hyperbilirubinemia, transfusion with G6PD-deficient blood was significantly less effective than transfusion with G6PD-normal blood[iii]. Some researchers reported that most of these enzyme deficient neonates developed exaggerated jaundice without hemolysis same as non-deficient neonates[iv]. In addition .Hematological parameters including, hemoglobin concentration, hematocrit value, total count of red blood cells, reticulocyte count and different features of peripheral blood film in neonate's with G6PD deficiency also influence on Blood group, treatment duration [v]. Since the last two decades a good number of studies were undertaken to investigate the role of G6PD deficiency in neonatal jaundice and it was reported that G6PD deficiency is the second common cause of hyperbilirubinemia in neonates.

Objectives

General Objective

To assess the treatment response for the management of Neonatal jaundice with G6PD deficiency.

Specific Objective

To identify treatment option and duration in hospital stay of G6PD deficiency neonates with jaundice.

MATERIALS AND METHODS

This was a Cross sectional study. Study was placed in Department of Physiology, Bangabandhu Sheikh Mujib Medical University (BSMMU), and Dhaka, Bangladesh from July 2007 to June 2008. Ninety (90) Male term neonates aged 3-12 days who were hospitalized in inpatient department of Dhaka shishu hospital with jaundice are the study subject group and 30 healthy male term neonates without jaundice from outpatient department of DSH was the control group. Total numbers of 120 male, term neonates are the sample population. Sample population is divided into 2 groups: Group A and Group B. Group a (Control) Consisted of 30 apparently healthy male, term neonates without jaundice. Group B (Study group) was consisted of 90 male, term neonates with jaundice. On the basis of total serum bilirubin level (TSB), Group B was further divided into three subgroups: Group B1 (with TSB <15mg/dl.), Group B2 (TSB from 15 to 20 mg/dl) and Group B-3(with TSB >20mg/dl.). For Better understanding and study defined group B1 designated as mild, group B2 as moderate and group B3 as severe hyperbilirubinemia. Protocol approved by the Ethical Committee of the Department of Physiology, BSMMU and Ethical Committee of BICH DSH, Dhaka. After selection of the subjects, aims, objectives and detail procedure of the study and the benefit of the child, out of the study were explained to the parents or legal guardians by the investigator herself. The legal guardians/parents were encouraged for voluntary participation & they have allowed freedom to withdraw from the study even after participation whenever they feel like. Then written informed consents were taken from parents or legal guardians in a prescribed form. The cases of jaundice were diagnosed by clinical examination and were confirmed by increased total serum bilirubin level corresponding to gestational age & body weight. Legal guardians/parents were interviewed for detail about gestational, delivery, medical and family history. Data were expressed as mean and standard deviation. Statistical analysis was performed by using SPSS (Statistical package of social service) for windows version-17. Anova test, Independent sample t test, Chi-Square test and Pearson's correlations coefficient test were performed as applicable. P value <0.05 was accepted as significant.

Inclusion criteria (for both groups)

Age 3-12 days, Sex-Male, Gestational age-more than 37 weeks of gestation are enrolled in both group but for control: Neonates without jaundice having bilirubin level <5mg/dl and for study group: Neonates with jaundice having serum bilirubin level >10mg/dl (Vitros 250 model Biochemistry auto analyzer).

Exclusion criteria (for both groups)

Age not between 3 and 12 days, Sex –female, Gestational age- less than 37 weeks of gestation, Rh incompatibility, Sepsis, Cephalohematoma

RESULTS

Data analysis from the study clearly identified that 5.83% of the G6PD deficiency neonates have average 8.86 days hospital stay where 71.4 % (5 out of 7) severe group needed Exchange transfusion. Moreover, the age at onset of jaundice is 4.42 days. Based on severity of G6PD level, average hospital stay is significantly higher in G6PD deficient neonates than other G6PD groups. Even, Study suggested in the observation, G6PD deficiency increases exchange transfusion (ET) than phototherapy (PT) in severe group. G6PD 5% (6 subject population had the lowest Erythrocyte G6PD level) study subject have ErythrocytesG6PD deficiency included in Group B3 (Table 1). Exchange transfusion became the second-line treatment when phototherapy failed to control serum bilirubin levels [3]. Table 2 data revealed that Severe Group (B3) had mostly G6PD deficiency whose serum bilirubin (with TSB >20mg/dl) needed more than 20% exchange transfusion (ET) for the recovery which also significant than mild & moderate group.

Table-I: Distribution of the study participants based on G6PD Deficiency (n=120)

	Total Frequency	Total Percentage	Group A	Group B1	Group B2	Group B3
G6PD Deficiency (<245 mU/10^9 erythrocytes)	7	5.83	0.00	0.00	0.83	5.00
Normal G6PD (245-299 mU/109 erythrocytes)	93	77.50	18.33	17.50	22.50	19.17
G6PD Deficiency >300 mU/109 erythrocytes)	20	16.67	6.67	7.50	1.67	0.83

Table-II: Study group were divided based on TSB level (n=90)

	n	Mean Age
Group-B1	30	7.33 days
Group-B2	30	7.40 days
Group-B3	30	7.30 days

Table-III: Distribution of Age and Weight of the study (study group) participants (n=90)

	n	Mean Age	Mean Weight
Group-B1	30	7.33 days	2.34 kg
Group-B2	30	7.40 days	2.36 kg
Group-B3	30	7.30 days	2.34 kg

Table-IV: Erythrocyte G6PD level in the study groups (n=90)

Groups	n	Mean ± SD	Range
Group-B1	30	280.90± 29.01	245-344
Group-B2	30	263.77± 30.64	137-311
Group-B3	30	232.77± 77.58	49-304

Table-V: Distribution of Phototherapy (PT) and exchange transfusion (ET) of the study participants (n=90)

	Group B1	Group B2	Group B3	Total
PT	30	30	24	84
ET	0	0	6	6

Table-V: Duration of therapy among the study groups ((n=90)

Indicator	Group B1	Group B2	Group B3
Age	7.33 +/-2.106	7.4+/-2.151	7.3 +/-2.193
The age at onset of Jaundice	3.27 +/-1.468	2.9 +/-1.472	3.3 +/-1.473
Duration of therapy	2.53 +/-1.934	2.9 +/- 1.93	5.7 +/-1.94

Table-6: Shown the treatment duration compared with three different situation (n=90)

Hospital Stay (Mean)	Group B1	Group B2	Group B3	Total
G6PD Deficiency (<245 mu/dl)	0	7	9.17	8.08
Normal G6PD (245-299 my/dl)	2.71	3.63	4.83	3.72
G6PD over >300 mu/dl)	2.11	3.5	5	3.53

The differences of these values among the groups were statistically significant (p<0.01)

Average hospital stay specially G6PD deficiency (considered based on the amount of G6PD enzyme), delayed response for the treatment management and increases patient to stay in hospital more days. Differences of these values among the groups were statistically significant (p<0.01. It clearly indicated that G6PD deficient neonates needed more hospital stay than others neonates.

DISCUSSION

Based on Study population, table 1 considers G6PD deficiency on the study Population. Study identified that in controlled group there had no neonates who have erythrocytes G6PD deficiency. But in Study group, 7 subject population identified deficiency where 1 subject from Moderate group and 6 from Group 3 (Severe hyperbilirubinemia). Near 6% babies observed lo G6PD deficiency, which have low G6PD enzyme activity. Based on Table 2 and table 3, all the values especially each group has average 30 neonates and their mean age and weight are not statistically significant. Therefore, all the groups are matched for age. For the management, it considers Phototherapy, intravenous immune globulin (IVIG), and exchange transfusion are the most widely used therapeutic modalities in infants

with neonatal jaundice. Although medications that impact bilirubin metabolism have been used in studies, drugs are not ordinarily used in unconjugated neonatal hyperbilirubinemia [5]. Exchange transfusion became the second-line treatment when phototherapy failed to control serum bilirubin levels [6]. Table 4 shows the higher demand (20%) for exchange transfusion (ET) of G6PD deficient neonates compare than any other group. Moreover, the meanerythrocyte G6PD level of the subjects were 280.90± 29.01, 263.77± 30.64 and 232.77± 77.58 mU/109 erythrocyte in Group-B1, Group-2, and Group-3 respectively. Mean erythrocyte G6PD levels were lower in Group B3in comparison to Group B1 and Group B2. All these values were within normal range except Group B3, which was below this range. However, the mean age, the age at onset of jaundice, duration of therapy compare with the group B1, GroupB2 & Group B3 where age and the age at onset of jaundice was similar and not significant whereas duration of therapy is significant in group B3 (5.7 +/-1.94) than Group B1(2.53 +/-1.934) and group B2 (2.9 +/- 1.93). Based on G6PD deficiency, the mean hospital stay for the patients who have G6PD Deficiency (<245 mu/dl) is 8.08 days which is longer than who have normal G6PD (245-299 my/dl) and G6PD over >300 mu/dl) respectively 3.72 days and 3.53 days. It is significant in G6PD deficient neonates (P<.001) than compare to others group. Even, Based on TSB level in the patients who have <245 mu/dl, those patient has also considered more significant in group B2 and Group B3 respectively average 7 days and 9.13 days which is more significant than others.

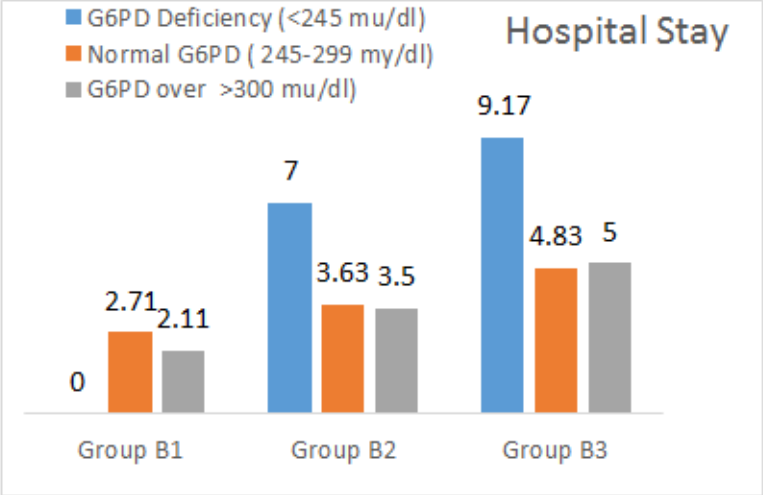

Fig-I: Hospital stay based on the amount of G6PD enzyme (n=90)

Limitation of the Study

We conducted an observational study in one Centre with limited sample size. So, study result can't reflect the scenarios of the whole country. Case-control study can identify the risk factors more accurately.

Conclusion and recommendations

In the present study, maximum numbers of G6PD deficient neonates with severe hyperbilirubinemia were compelled to stay more days in hospital compare to other groups. Even, it is identified that exchange transfusion is largely necessity for them. Again, significantly higher serum bilirubin, ALT levels and their negative correlations with G6PD levels suggests that this hyperbilirubinemia may be related to hepatic dysfunction in this deficient group of neonates. Therefore, from this study it can be concluded that G6PD deficiency in neonates has delayed the recovery from neonatal jaundice and also considered more exchange transfusion than phototherapy. Therefore, early detection of this enzymopathy and close surveillance of the affected neonates may be important in reducing the complications of severe hyperbilirubinemia.

Acknowledgment

We wish to appreciate financial support to this study by the Bangabondhu Sheikh Medical University and Dhaka Shishu Hospital.

Conflict of interest: The Authors have no conflict of interest

REFERENCES

1. Journal of Pediatric Hematology Oncology. 3(2).
2. Weng YH, Chiu YW. Clinical characteristics of G6PD deficiency in infants with marked hyperbilirubinemia. Journal of pediatric hematology/oncology. 2010 Jan 1;32(1):11-4.
3. Journal of Pediatric Hematology Oncology. 3(2).
4. Weng YH, Chiu YW. Clinical characteristics of G6PD deficiency in infants with marked hyperbilirubinemia. Journal of pediatric hematology/oncology. 2010 Jan 1;32(1):11-4.
5. Nelson Textbook of Pediatrics18th Edition

6. Oluboyeda. 1979; Beutler 1995; Kaplan. 1996; Mehta. 2000.
7. Samanta S, Kumar P, Kishore SS, Garewal G, Narang A. Donor blood glucose 6-phosphate dehydrogenase deficiency reduces the efficacy of exchange transfusion in neonatal hyperbilirubinemia. *Pediatrics*. 2009 Jan. 123(1):e96-e100
8. Chan.1996
9. Hafez 1986; Arif and Bhutta 1998; Kaplan. 2000; Dhillon. 2003; Mritunjay. 2005.
10. Huizing K, Roislien J, Hansen T. Intravenous immune globulin reduces the need for exchange transfusions in Rhesus and AB0 incompatibility. *Acta Paediatr*. 2008 Oct. 97(10):1362-5
11. Ogunfowora OB, Daniel OJ. Neonatal jaundice and its management: knowledge, attitude and practice of community health workers in Nigeria. BMC Public Health. 2006 Dec;6(1):19.
12. Huizing K, Roislien J, Hansen T. Intravenous immune globulin reduces the need for exchange transfusions in Rhesus and AB0 incompatibility. *Acta Paediatr*. 2008 Oct. 97(10):1362-5