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ORIGINAL ARTICLE

Frequency of Glucose 6 Phosphate Dehydrogenase Deficiency in Neonates Presenting with Jaundice

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ABSTRACT

Objective: Frequency of Glucose – 6- Phosphate Dehydrogenase deficiency in neonates presenting with jaundice
Study design: A cross-sectional study
Place and Duration: Pediatric department, civil hospital Karachi from January to June 2019
Methodology: The study included all infants who were hospitalized in the neonatology unit with jaundice. At the beginning of the trial, the parents of each neonate gave their assent after being assured that there would be no monitoring burden placed on the parents for the examinations. When entering the hospital, the researcher himself completed a predesigned proforma that asked for specific details about the patient's age, sex, ethnicity, jaundice onset age, consanguinity, and family history of G6PD deficiency. Investigations on newborns included measuring serum bilirubin and looking for signs of G6PD deficiency. (Estimation of G6PD enzymes). Sigma Diagnostic G6PD Reagent was used to estimate the G6PD enzymes for the qualitative, visual, and calorimetric assessment of G6PD deficit in red blood cells. When the sample's deep blue colour changes
Results: 174 infants with jaundice in total were included during the study period. Participants in the study had an average age of 16.12 +/- 7.2 days. 95 (54.6%) of the 174 study participants were men, and the male-to-female ratio was 1.2:1. It started at an average age of 8.83.8 days. 79 (45.5%) out of a total of 117 (67.2%) participants are Pathans by consanguineous marriage. 23 (13.2%) of the 174 subjects were G6PD deficient. According to a stratified analysis, out of 23 G6PD-deficient newborns, 11 (47.8%) were between 1 and 11 days old, 19 (82.6%) were between 0 and 6 days old, and 14 (60.8%) had blood bilirubin levels below 15 mg/dl.
Conclusion: It was concluded that G6PD is a common cause of neonatal jaundice in our setup.
Keywords: Neonates, Jaundice, G6PD deficiency

INTRODUCTION

The pentose phosphate pathway, which uses the enzyme glucose 6 phosphate dehydrogenase to produce NADPH, helps protect red blood cells from oxidative damage by maintaining lowered glutathione levels. [1] The red corpuscles are more prone to hemolysis due to oxidative stress when G6PD is absent. Clinical, biochemical, and molecular variability are features of G6PD deficiency, and prevalence varies greatly. [2] Numerous studies have noted the prevalence of G6PD deficiency in jaundiced newborns, supporting reports from around the globe that G6PD deficiency is a common cause of neonatal hyperbilirubinemia. [3-5]

In boys who have the faulty gene and in homozygous females, neonatal hyperbilirubinemia is twice as common as in the general population. Rarely does it happen in heterozygous females. [6] Asians more frequently experience severe newborn hyperbilirubinemia than do white people.

The prevalence of deficit is 2.5% in males and 1.6 in females. The highest frequencies of G6PD deficiency have been recorded in Asian males (4.3%), African American males (12.2%), and African American females (4.1%). [7] The (G6PD) enzyme is the first one in the frequency of male hexose mutations in specific areas of China. Khan and Khawar (2002) indicate a 13% prevalence of G6PD deficiency in Pakistan, Imran et al. (1984) 12%, Parveen et al. (1986) 12.1%, Khattak et al. (2006) 12%, Alvi et al. (2006) 10%, and Rashid et al. (2005) reported a 06% prevalence. [8-11] The study's goal is to ascertain the frequency and age at which neonates with G6PD deficiency arrive with jaundice at the pediatric department of civil hospital Karachi

METHODOLOGY

This cross-sectional study was conducted at the Neonatology Unit Department of Pediatrics Civil Hospital Karachi from January to June 2019.

Sample Size is calculated with formula: $n=z2\ p\ (1-p)\ e^2$, Where p: prevalence of G6PD deficiency in neonates having Jaundice = 13%.[9] Z: significant value at 95%, Confidence interval = 1.96, e: margin of error = 5% hence n: sample size = 174

Neonates with jaundice of both sexes were included in this study. The following were excluded from this study: 1. Neonates with conjugated hyperbilirubinemia an admission (when the direct serum bilirubin level is more than 20% of the total serum bilirubin level). 2. Neonates who had already received a blood transfusion.

The study included all infants who were hospitalized in the neonatology unit with jaundice. At the beginning of the trial, the parents of each neonate gave their assent after being assured that there would be no monitoring burden placed on the parents for the examinations. When entering the hospital, the researcher himself completed a predesigned proforma that contained specific information about his age, sex, ethnicity, the age at which his jaundice first appeared, his consanguinity, and his family's history of G6PD deficiency.

Investigations on newborns included measuring serum bilirubin and looking for signs of G6PD deficiency. (Estimation of G6PD enzymes). Sigma Diagnostic G6PD Reagent was used to estimate the G6PD enzymes for the qualitative, visual, and calorimetric assessment of G6PD deficit in red blood cells. It is found that a sample is G6PD deficient when the transition from a deep blue to a maroon or reddish tint takes longer than 60 minutes. With the help of SPSS version 15.0, data was examined. Although this was a descriptive study, the majority of the data for qualitative variables including sex, ethnic origin, consanguinity, and G6PD deficiency were provided as frequency and percentages. For quantitative characteristics such as age, gender, ethnicity, age of onset of jaundice, and serum bilirubin level, the mean and standard deviation were calculated. To determine how these factors affected the result, stratification by age, the age at which jaundice first appeared, and serum bilirubin was performed.

RESULTS

Participants in the study had an average age of 16.12 ± 7.2 days. A total of 95 (54.6%) of the 174 study participants were males, and the male-to-female ratio was 1.2:1. It started at an average age of

8.8±3.8 days. Overall 79 (45.5%) of the participants are Pathans, while 117 (67.2%) are the offspring of consanguineous marriages. (As shown in Table 1) A total of 23 (13.2%) of the 174 subjects were G6PD deficient. The stratified analysis revealed that, of the 23 G6PD-deficient newborns, 11 (47.8%) were aged 1 to 11 days, 19 (82.6%) were aged 1 to 6 days, and 14 (60.8%) had blood bilirubin levels below 15 mg/dl. (As shown in Table 3-5)

Table 1: Demographic data of enrolled neonates (n=174)

Age groups (Days)	Number	Percentage
1-11	44	25.3
12-17	48	27.6
18-22	45	25.9
23-28	37	21.3
Gender		
Male	95	54.6
Female	79	45.4
Ethnicity		45.4
Pathans	79	
Urdu Speaking	53	30.5
Baloch	42	24.1
Consanguity		
Yes	117	67.2
No	57	32.8
G6PD deficiency		
Yes	23	13.2
No	151	86.8

Table 2: Age of onset of jaundice among enrolled neonates (n=174)

Age of onset (Days)	Frequency	Percentage
1-6	53	30.5
7-9	41	23.6
10-11	37	21.3
12-17	43	24.7

Table 3: Stratification of G6PD deficiency by age (n=23)

G6PD deficiency	Age group (Days)				Total
	1-11	12-17	18-22	23-28	
Yes	11 (47.8%)	5 (21.7%)	3 (13%)	4 (17.3%)	23
No	33 (21.8%)	43 (28.4%)	42 (27.8%)	33 (21.8%)	151
Total	44	48	45	37	174

Table 4: Stratification of G6PD deficiency by age of onset (n=23)

G6PD deficiency	Age of onset (Days)				Total
	1-6	7-9	10-11	12-17	
Yes	19 (82.6%)	4 (21.7%)	0	0	23
No	34 (21.8%)	37 (22.5%)	37 (24.5%)	43 (28.4%)	151
Total	53	41	37	43	174

Table 5: Stratification of G6PD deficiency by serum bilirubin level (n=23)

G6PD deficiency	Serum bilirubin level (mg/dl)				Total
	12-14	14.1-16	16.1-17	17.1-18	
Yes	9(39.1%)	5 (21.7%)	4 (17.4%)	5 (21.7%)	23
No	46 (30.4%)	56 (37%)	25 (16.2%)	24 (15.8%)	151
Total	55	61	29	29	174

DISCUSSION

The study's goal was to ascertain the frequency and age at which neonates with G6PD deficiency arrive with jaundice at the pediatric department of civil hospital Karachi. Participants in the study had an average age of 16.12 ± 7.2 days. A total of 95 (54.6%) of the 174 study participants were males, and the male-to-female ratio was 1.2:1. It started at an average age of 8.8±3.8 days. Overall 79 (45.5%) of the participants are Pathans, while 117 (67.2%) are the offspring of consanguineous marriages. A total of 23 (13.2%) of the 174 subjects were G6PD deficient. The stratified analysis revealed that, of the 23 G6PD-deficient newborns, 11 (47.8%) were aged 1 to 11 days, 19 (82.6%) were aged 1 to 6 days, and 14 (60.8%) had blood bilirubin levels below 15 mg/dl.

Hasan M. Isa concluded that 1,129 of the 1,159 NIH patients admitted were included, and 646 (57%) of them were males. There were 442 (42%) G6PD defective patients out of 1,046 tested patients, 49 (4%) needed exchange transfusion, and 11 (1%) had probable Kernicterus. [12]

Overall 202 infants in total were enrolled in Egyptian research. Male infants outnumbered female babies by a margin of 71.3% to 28.7%. The babies in the study had a mean age of 3.75 ± 2.5 days. There were 18 male infants (8.9%) with G6PD deficiency. In one instance, both RH incompatibility and G6PD deficiency were present. In patients with G6PD deficiency, the mean serum total bilirubin was 17.2 4.4. In cases where G6PD was insufficient, there was a strong positive association between the number of days from the onset of jaundice and G6PD levels. [13] In a study by Zeinab A Kasemy et al 10.10% of neonates have G6PD deficiencies. Serum bilirubin levels were greater in neonates with G6PD deficiencies (p 0.001). Risk factors for G6PD deficiency included male gender, family history of G6PD deficiency, and consanguinity. [14] Rahul Sinha found that a total of 10 (2.5%) newborns with indirect hyperbilirubinemia were G6PD impaired, according to the results of the research. Given that G6PD affects only men, there was a statistically significant difference between the G6PD deficient and non-G6PD deficient groups in terms of indirect bilirubin levels, phototherapy duration, and gender. However, there were no differences in the ages of the neonates, their gestational ages, or their reticulocyte counts. [15] In a local study, 6% of 100 neonates had a G6PD deficiency, and most of them started to exhibit jaundice on the third day. When compared to G6PD-normal newborns, the maternal age for neonates with G6PD deficiency was shown to be greater. [16]

In another local study, newborns' mean age plus standard deviation was 10.63 + 3.48 days, with 68% of them being male. The majority of neonates ie 87.5% presented after their fifth day of life. 8.3% of the newborns with indirect hyperbilirubinemia had G6PD deficiency. Over 50% of the newborns who presented with neonatal jaundice had consanguinity. [17]

CONCLUSION

It was concluded that G6PD is a common cause of neonatal jaundice in our setup.

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