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Abstract

Introduction: The incidence and prevalence of sickle cell disease in India is high and they are major health problem in India. Neonatal detection and prophylactic management can reduce morbidity and mortality in childhood. A study is therefore planned for analyzing maternal solubility test and HPLC of newborn as effective and cost screening protocol. Material and Method: The infants born of solubility positive mothers were taken for Hb electrophoresis/ hemoglobin analysis using Biorad Hemoglobin variant by high performance liquid chromatography (HPLC) at birth and the test was repeated at six months of age. Data were analyzed using appropriate statistical method. Results: A total of 100 mothers were positive on solubility test, their infants underwent Hb analysis by high performance liquid chromatography. 74 infants shows normal hemoglobin variants while 19 were heterozygous for Hbs (sickle cell trait) and 7 babies were homozygous for HbS at birth. On follow up at 6 month of age cases were reanalyzed by HPLC, 12 cases were lost in follow up, 7 cases who were heterozygous for sickle cell turned out to be homozygous for sickle cell, and of those with normal reports 7 cases were homozygous. Conclusion: Maternal solubility test and HPLC of newborn at birth is good screening protocol for sickle cell anemia.

Keywords:

High Performance Liquid Chromatography, Sickle Cell Disease, Solubility Test

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Research Article

Maternal solubility test and high performance liquid chromatography of newborns in combination as a better neonatal screening protocol for sickle cell disease

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Abstract

Introduction: The incidence and prevalence of sickle cell disease in India is high and they are major health problem in India. Neonatal detection and prophylactic management can reduce morbidity and mortality in childhood. A study is therefore planned for analyzing maternal solubility test and HPLC of newborn as effective screening protocol. **Material and Method:** The infants born of solubility positive mothers were taken for hemoglobin analysis using Biorad Hemoglobin variant by high performance liquid chromatography (HPLC) at birth and the test was repeated at six months of age. Data were analyzed using appropriate statistical method. **Results:** A total of 100 mothers were positive on solubility test, their infants underwent Hb analysis by high performance liquid chromatography. 74 infants shows normal hemoglobin variants while 19 were heterozygous for Hbs (sickle cell trait) and 7 babies were homozygous for HbS at birth. On follow up at 6 month of age cases were reanalyzed by HPLC, 12 cases were lost in follow up, 7 cases who were heterozygous for sickle cell turned out to be homozygous for sickle cell, and of those with normal reports 7 cases were homozygous. **Conclusion:** Maternal solubility test and HPLC of newborn at birth is good screening protocol for sickle cell anemia

Keywords: High Performance Liquid Chromatography, Sickle Cell Disease, Solubility Test.

Introduction

Sickle cell disease is an autosomal recessive genetically transmitted hemoglobinopathy responsible for considerable morbidity and mortality [1]. This hereditary disorder is due to defective hemoglobin structure. Sickle cell disorder is caused by a point mutation at sixth position in beta globin chain, Valine substituting Glutamic acid, due to which in deoxygenated state the shape of erythrocytes change to sickle shape and also the fragility of cell membrane increases [2].

The very first description of sickle cell disease was provided by Dr. James Harrick in 1910 when he was studying blood cells under light microscopy of 20 yr old dental student who came with complaint of fever and anemia and he noted "large number of thin sickle-shaped and cresent shaped" red blood cells [3]. For many years, sickle cell gene has been considered as a disease confined to people of African ancestry although the gene was described in southern India in person with African origin as early as in 1952a [4]. In each year about approximately 300000 children are born with sickle cell anemia or of its variant and the worldwide affected birth prevalence is estimated at 2.55 per 1000 [5]. In recent years its incidence has increased dramatically also in Europe and north America because of high rate of migration of people from endemic area [6]. It represents one of the major health problems in Central India and constitutes the most common genetic disorder in some communities.

In India, the carrier rate of HbS mutation varies among states, communities and ethnic groups with an average

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Results

This study is on newborn screening for sickle cell disease by high performance liquid chromatography done from period of 1st February 2014 to 30th of September 2015 in Pt. Jawaharlal Nehru Memorial Medical College and Dr. B. R. Ambedkar Memorial Hospital Raipur. Our study started with sample size of 100 solubility positive mothers, newborns of these mothers were screened by high performance liquid chromatography at birth and these results were confirmed by repeat HPLC at 6 month. Out of 100 newborns screened 59 were males and 41 were females, 7 were less than 2kg and 93 were between 2 to 2.5 kg.

Table 1: Results of high performance liquid chromatography at birth.

Hb phenotype at birth	No of newborns	Percent
FA	74	74.0
FAS	19	19.0
FS	7	7.0
Total	**100**	**100.0**

74 out of 100 newborns shows normal hemoglobin variant, 19 shows sickle cell trait (FAS) and 7 shows sickle cell disease (FS).

Table 2: Results of high performance liquid chromatography at 6 month.

Hb phenotype - 6 m	No of newborns	Percent
AA	57	57.0
AS	10	10.0
SS	21	21.0
Lost	12	12.0
Total	100	100.0

Out of 100 infants 57 shows normal hemoglobin variant; 10 sickle cell trait (AS); 21 have sickle cell disease (SS) and 12 cases lost during follow up .

Table-3: Correlation of HPLC results at birth and at 6 month.

Hb phenotype at birth	Hb phenotype - 6 m				Total
	AA	AS	SS	Lost	
FA	57	0	7	10	74
FAS	0	10	7	2	19
FS	0	0	7	0	7
Total	57	10	21	12	100

At birth 74 newborns had normal hemoglobin variant (FA) out of which at 6 month only 57 came out to be normal, 7 [illegible] shows (SS) sickle cell disease pattern and 10 lost in follow up. At birth 19 cases showed (FAS) hemoglobin variant out of [illegible] which at 6 month only 10 cases came out to be (AS) sickle cell trait positive 2 cases lost in follow up and 7 cases turned out to be SS positive. At birth 7 cases had (FS) hemoglobin variant that remain to be SS (sickle cell disease) positive at 6 month.

Table 4: Community distribution of sickle cell newborns

Communities	Sickle cell disease				Total
	Absent	%	Present	%	
SC	19	65.5	10	34.5	29
ST	20	83.3	4	16.7	24
OBC	14	45.2	17	54.8	31
OTHERS	4	100.0	0	0.0	4
Total	**57**	**64.8**	**31**	**35.2**	**88**

Other Backward Classes with highest incidence from Sahu, Kurmi community, 10% Scheduled Caste and 4% to Scheduled Tribe. P.K. Patra et al 2010 [16] found although prevalence is high for Scheduled Caste and Scheduled Tribe community it is highest for Kurmi (55%) and Teli (53%) caste which belong to Other Backward Class. D.L Jain et al 2012 [10] found prevalence of sickle cell gene is highest in mothers belonging to Scheduled Caste 22.5% followed by Other Backward Class 22% although prevalence of sickle cell carrier is similar in Scheduled Caste and Other Backward Class.

Our study able to screen 19 % of sickle cell trait and 7% of sickle cell disease newborns at birth by HPLC, so total 26% of sickle cell anemic infants are screened by our study at birth as compared to study done by Panigrahi et al 2012 [12] which found 5.8% sickle cell trait and 0.2 % sickle cell disease newborns at birth.

This shows yield of our study is higher than this study, this is because of our specific screening which taken into account mother sickling status.

Sensitivity of present neonatal screening protocol for sickle cell anemia is 77%, specificity and positive predictive value is 100% with negative predictive value is 89%. This shows present neonatal screening protocol is better for screening of sickle cell anemia.

Conclusion

The prevalence of sickle cell anemia in Chhattisgarh is 10%, hence there is need to implement neonatal screening program for sickle cell disease in Chhattisgarh. Specificity of HPLC as a newborn screening test is good, this fact was previously known but when we add solubility test of parents, yield of screening tool become better. So, we recommend this approach until universal neonatal screening programs are implemented over large scale.

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