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Serum Biochemical Alterations in Sickle Cell Anemic Subjects from Gadchiroli District, Maharashtra. (India)

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Abstract
Next to Thalassemia, Sickle cell anaemia is second common major hereditary hemoglobinopathy caused due to the mutation in HBB gene. It is common autosomal recessive disorder due to single nucleotide substitution (GTG-GAG). A study was conducted in Gadchiroli district, of Maharashtra to determine the serum Biochemical values of sickle cell subjects from April 2010 to April 2012. 27 carrier subjects (heterozygous Hb-AS) and 24 sufferers (homozygous -HB-SS) were studied. Our reports revealed, high level of serum Alkaline Phosphatase. For Hb-AS it was 120 ± 36.93 and in Hb-SS it was 148 ± 26.08, p<0.0001, SGOT was 39.67 ± 14.62 in Hb-AS subjects and 50.46 ± 23.65 IU/L in Hb-SS subjects. SGPT in Hb-AS subjects was 32.81 ± 13.98 and in Hb-SS subjects was 44.33 ± 19.39. Total serum Protein, in Hb-AS was 6.493 ± 0.693 and in Hb-SS it was 8.183 ± 0.772 gm/dl. Total Bilirubin level in Hb-AS subjects was 0.8204 ± 0.4880 and in Hb-SS Subjects it was 2.5513 ± 0.7827 mGs/dl. All these alteration leads to disease symptoms.The results are discussed.
Key words: *Sickle cell anemia, Biochemical analysis, Gadchiroli District, Jaundice.*

Introduction

Sickle cell anaemia is known to the medical world since the discovery of this entity by **Dr. James Herrick, (1910)** a Chicago cardiologist. Sickle cell disease is caused by Mutations in the HBB gene. Hemoglobin consists of four protein subunits, typically, two subunits called alpha-globin and two subunits called beta-globin. The instruction for making beta-globin gene is provided by HBB gene. Variants of beta-globin result from different mutations in the HBB gene**.** One particular HBB mutation produces an abnormal version of beta-globin known as hemoglobin S (Hb-S). **Herrick, (1910)** first time, reported that the blood smear of a sickle cell anemic patient, contains pear shaped and elongated forms which led not only to the recognition of hundreds of abnormalities of hemoglobin synthesis but, also to a series of remarkable scientific advances involving protein Chemistry, Cell Biology, Physiology, and Genetics. The discovery of hemoglobin- S (Hb-S) by **Linus Pauling** and colleagues in 1949 was the first demonstration that the production of an abnormal protein could be the cause of a hereditary disorder **(Pauling *et al.*, 1949).** In India it is the second most dominated haemoglobinopathy after Thalassemia, it is most common in central and southern part of India. In this, autosomal recessive disorder there is substitution of valine for glutamic acid at position 6 in the β-Globin chain (Hb-S). This results in a solubility problem in deoxygenated state causing affected biconcave discoid cell RBCs to become crescent or sickle shaped cell **(Evans and Mohandas, 1987).** This major haemoglobinopathy occurs in both homozygous and heterozygous state, red cell contain both normal adult hemoglobin (Hb-A) and the variant, because they rarely have phenotypic expression of clinical significance, heterozygous is said to have the trait for that abnormality, e,g. sickle cell trait. In the homozygous state, Hb-A is totally lacking, and clinical manifestation is of variable severity; individuals so have the anemia called sickle cell anemia. Gadchiroli is a newly carved district in Vidarbha region, of Maharashtra having major tribal population of Gond and Madia. Being backward and Naxlite hit, this district lag behind in healthcare facility from rest of the region. Though various aspects of SCA are studied aspects with reference to subjects from Gadchiroli district of Maharashtra, are scare, hence we conducted the present study to investigate some of the biochemical aspects of sickle cell anemic subjects from Gadchiroli district.

Material and Method

The study conducted in Gadchiroli district, of Maharashtra with the help of local public health centers. The district is having 45 PHC's, Gadchiroli-3, Korchi-2, Kurkheda-3, Wadsa- 3, Armori-4, Dhanora-5, Chamorshi-6, Etapalli-3, Mulchera-3, Bhamragarh-3, Aheri-5, and Sironcha-5. Fifty one SCA subjects visiting different PHCs of district during April 2010 to April 2012 were studied. 27 carrier subjects (heterozygous – Hb-AS) and 24 sufferer subjects (homozygous – Hb-SS) considered for the Biochemical analysis.

With due permission and with the help of concerned PHC staff about 3-5 ml of blood sample from both heterozygous and homozygous subjects was sampled and , Biochemical analysis is done with reference to, Alkaline Phosphatase : Schlevusch *et al.,* (1974) and Rathman *et al.,* (1986), Serum Glutamate Oxaloacetate Transaminase (SGOT) (Bergmeyer. *et al.,* 1985), Serum Glutamate Pyruvate Transaminase (SGPT): (Bergmeyer. *et al.,* 1985), Determination of total Protein: Total protein was determined by Autozyme total protein Biuret (Henri *et al.,* 1974), Determination of Bilirubin: By Dimethyl Sulphoxide (DMSO) Manual kit (Walter *et al*., 1970).

Results and discussion:

Table.1 and Table.2 depicted the results we reported for Serum analysis on 27 Hb-AS and 24 Hb-SS subjects. A higher level of serum alkaline phosphatase was reported in both Hb-AS and Hb-SS which was 120 ± 36.93 and 148 ± 26.08 respectively. High levels of serum alkaline phosphatase enzyme apparently arise from the continuous destruction of erythrocytes, leukocytes and other cells. Measurement of these non functional enzymes provides more important diagnostic and prognostic information to clinician. Broady *et al.,* (1975) observed Sickle cell anaemia related elevation in serum Alkaline Phosphatase. Omange *et al.,* (1998) Kotila *et al.,* (2005) and Pandey *et al.,* (2011) too suggested increased levels of Alkaline Phosphatase, and supports to our results.

SGPT and SGOT play important role in pathophysiology of sickle cell disease. Presences of elevated level of serum glutamate Oxaloacetate Transaminase i.e., 39.67 ± 14.62 in Hb-AS subjects and 50.46 ± 23.65 IU/L in Hb-SS subjects, above normal level suggest an increased level of tissue destruction. We also reported Elevation in Glutamate Pyruvate Transaminase in Hb-AS subjects as 32.81 ± 13.98 and in Hb-SS, 44.33 ± 19.39 IU/L which leads to symptom of diseased Condition. Brody *et al.,* (1975) found elevation in Alanine Transaminase which reflects hepatic injury in sickle cell patients Kotila *et al.,* (2005), Ajayi *et al.,*(2006) and Kehinde *et al.,* (2010) discussed correlation between sickle cell anaemia and SGOT and SGPT. Tripathi *et al.,* (2011), suggested that elevated levels of SGPT, which suggest necrosis of hepatocytes or myocardial cells or erythrocytes or skeletal muscle cells.

Protein of serum is a mixture of not only simple protein but also conjugated proteins. This Protein, too reported to be altered, as Hb-AS subjects showed 6.493 ± 0.693 and Hb-SS , 8.183 ± 0.772 gm/dl. Concentration of total protein in human is approximately 6-8 gm %. Isichei *et al.,* (1979) and Tete-Benissan *et al.,* (2000) showed the sicklers have higher total protein, which is might be due to oxidative modification of glycoprotein carbohydrate moieties as reported in the present study.

Total Bilirubin level in Hb-AS patients it was 0.8204 ± 0.4880 and in Hb-SS patients it was 2.5513 ± 0.7827 mGs/dl, which is too an elevated condition, called as hyper-bilirubinemia Caused due to production of more Bilirubin in the blood than normal liver can excrete. This bilirubin accumulates in the blood and when it reaches a certain concentration, it diffuses into the tissues which then become yellow. Hemolysis of RBC's results in Bilirubin, which occurs in spleen, bone marrow and liver reticuloendethelial cells. In accordance to our study, Hargrove, (1970) found elevated level of Bilirubin in six studied patients with sickle cell anaemia. Johnson *et al.,* (1985) found elevation in Bilirubin without any clinical or laboratory evidences of liver disease, Lang *et al.,* (1995) and Nkuda, (1995) Kaur *et al.,* (1997), Omange *et al.,* (1998), Kotila *et al.,* (2005) Ajayi *et al.,* 2006, and Makani *et al.,* 2011 reported high Bilirubin in homozygous Hb-SS sickle cell anemic subjects. Changes in both Bilirubin and proteins, suggests that under stress of sickle cell anemia hepatic impairment occurs, and thus sickling may cause hepatic damage in population. Isichei *et al.,* (1979) and Tete-Benissan *et al.,* (2000) also reported that Bilirubin is a metabolic by-product of haemoglobin and serum total bilirubin is increased in hepatocellular damage (toxic hepatopathy, neoplasm), intra and extra hepatic biliary tract obstructions, intravascular and extra vascular hemolysis etc. Disproportionate elevation of direct bilirubin is seen in cholestasis and late in the course of chronic liver disease. Along with these changes in bilirubin clinical and biochemical jaundice was also seen in subjects with sickle cell disease

Conclusion:

Our study conclude, thatAlkaline Phosphatase, Serum Glutamate Oxaloacetate Transaminase (SGOT), Serum Glutamate Pyruvate Transaminase (SGPT), found elevated. Total Protein and Bilirubin level observed high in Hb-SS Subjects as compared to Hb-AS showing the symptoms of jaundice and anemia.Our study would make expertinvolved in inspecting sickle cell anaemia subjects tobecome more knowledgeable and help them in their skill to manage this geneticmenace in the Naxlite hit tribal region.

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Table: 1. Biochemical Profile of Hb-AS Subjects (Carrier, N =27)

Sr.No.	Parameters	Mean	S.D.	SEM
1	Alkaline Phosphatase	120.37	± 36.93	7.11
2	SGOT	39.67	± 14.62	2.81
3	SGPT	32.81	± 13.98	2.69
4	Total Protein	6.493	± 0.693	0.133
5	Bilirubin	0.8204	±0.4880	0.0939

Table: 2. Biochemical Profile of Hb-SS Subjects (Diseased, N =24)

Sr.No.	Parameters	Mean	S.D.	SEM
1	Alkaline Phosphatase	148.17	± 26.08	5.32
2	SGOT	50.46	± 23.65	4.83
3	SGPT	44.33	± 19.39	3.96
4	Total Protein	8.183	± 0.772	0.158
5	Bilirubin	2.5513	± 0.7827	0.1598

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