Anthropometric Measurements of Sickle Cell Anemia
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Abstract
Objectives:- The sickle cell anaemia is genetically transmitted multisystem disease, which includes a group of disorders; that differ in severity of signs and symptoms, predominantly leading to retardation of growth. To evaluate appendicular skeleton of S. C. D. patients; compare it with normal individuals of same age, sex and previous data.
Methods:- Ten parameters of Appendicular skeleton including Height, Weight were studied in 286 S.C.D. males against 302 non S.C.D. males; 287 S. C. D. females against 308 non S. C. D. females of age-groups from 5 to 20 years. The duration lasted for project was 20 months.
Results:- S.C.D. patients showed lower values than normal individuals, higher values as compare to previous data.
Conclusion:- The present study definately shows raised values in all parameters of appendicular skeleton in S. C. D. patients compared to observations of previous workers. May be because of increased health awareness; availability of improved medical facilities.

Key Words: S. C. D. genetically transmitted; appendicular skeleton.

INTRODUCTION

The term Anthropometry was coined by J. S. Elsholtz [1], a german physician in 17th Century & refers to measures of human body and its various proportions. Anthropometry is a system of techniques. It is a systematized art of measuring and taking observations on man, his skeleton, brain or other organs by most reliable means and methods for scientific purposes (2).

Sickle cell anemia or sickle cell disease is a genetically transmitted, multi-system disease which includes a group of disorders that differ in severity of signs and symptoms. This is a hereditary blood disorder due to defective hemoglobin structure. It is well documented that gene for Sickle cell Hb is located on the short arm of chromosome 11 and has an autosomal recessive inheritance. In normal persons, Glutamic Acid is seen in Beta chain at 6th position, while in Sickle cell disease Glutamic Acid is replaced and substituted by Valine at the same position. The single amino acid substitution in Beta chain of HbS located on the surface of molecule has no significant effect on oxygen affinity or molecular stability. It causes a unique intermolecular reaction in which molecules of deoxygenated HbS align in spirally arranged polymers, forming insoluble fibres like structures which distort the R. B. Cs.; increase its rigidity and thereby cause the Sickling Deformation first described by J. B. Herrick 3 in the year 1910.

The normal adult haemoglobin pattern is 'AA'. In Sickle Cell Anaemia, an abnormal adult Hb designated as haemoglobin 'S' is present. The typical or homozygous sickle cell anaemia is designated as 'SS'. In deoxygenated state this HbS is relatively less soluble and forms needle like tactoids which destroy shape of erythrocyte producing characteristic sickle cell deformity. These sickled erythrocytes are mechanically more fragile and are phagocytosed readily; destroyed more rapidly in the circulation than normal R.B.Cs. This increased blood destruction is associated with jaundice (Haemolytic type) hyperplasia of
bone-marrow, reticulosis and formation of immature cells in the blood, destruction of which produces varying degree of anaemia and stunted growth.

Sickle Cell Disease has been known & studied for years by various scientists (3, 4, 5, 6). Sickle Cell Disease in India exists mainly in tribal population, scheduled castes, scheduled tribes and nomadic tribes. The disease is not seen uniformly everywhere, but it has some topographical distribution. In India, it is most prevalent in the State of Madhya Pradesh; Maharashtra; Tamil Nadu; Andhra Pradesh; Uttar Pradesh; Gujarat and Kerala. In Maharashtra, work evaluating the anthropometric measurements of Sickle Cell Disease patients was done by Dr. Iravati Karve (7) & Dr. V. M. Dandekar in 1951; by Dr. B. R. Kate (8) in 1977 and by Dr. M. P. Perchand (9) in 1986. They found that anthropometric criteria revealed a significant stunting of growth in affected persons as compared to unaffected normal identical persons of same age, sex, etc.

Hence, it was decided to conduct a study of anthropometric measurements in Sickle Cell Anaemic patients, attending Sickle Cell O. P. Ds. in (1) L.M.H. (2) G.M.C. (3) I.G.M.C. and at some private practitioner's clinics in Nagpur Urban Region.

**MATERIALS & METHODS**

The study of anthropometric measurements of Sickle Cell Anemia (S.S. Pattern) patients was carried out in the Department of Anatomy, N.K.P. S.I.M.S. and Research Centre, Digdoh Hills, Hingna Road, Nagpur.

The subjects were ranging from 5 years of age to 20 years of age of Sickle Cell Anemia patients with SS pattern. Screening of diseased state of patients was done by Solubility Test. Thereafter diagnosis of Sickle Cell Anemia and pattern of Haemoglobin S.S. was confirmed by

Electrophoresis.

The patients with Sickle Cell Disease (confirmed S.S. pattern) attending sickle cell O.P.D.s at (1) Lata Mangeshkar Hospital, (2) Government Medical College, (3) Indira Gandhi Government Medical College and clinics of some eminent doctors located in urban areas working for Sickle Cell Society Of India, were subjected to anthropometric measurements.

Written consent was taken. In case of minor subjects consent was given by the parents or the responsible relative who was attending the patient. The duration of this study was from November 2004 to July 2006. A group of age and sex matched normal individuals i.e. non-sicklers (AA Hb) were matched for the same parameters. This group was selected from various areas of Nagpur City, from different organisations, private schools and colleges like Bal Jagat, Ramdapeth Gruhini Samaj Primary school, schools run by Vidya Shikshan Prasarak Mandal and from Pracharya Arunrao Kalode Vidyalaya and Junior College, Khamla, Nagpur. Comparative study was done in between two groups. In all 1183 cases were examined, out of which 573 were Sickle Cell Anaemia patients with S.S. Hb and 610 were normal individuals with AA Hb. All the Sickle Cell Disease patients and normal individuals were asked about the date of birth and the exact date of birth was noted. Accordingly age was calculated. In some patients and individuals where the exact date of birth/year was not known then month & year was noted and accordingly the age was calculated. In remaining patients and individuals where the month was not known then with the help of related season/festivals the month was determined and accordingly age was calculated.

Parameters studied were weight, height, upper limb length, arm length, forearm length, hand length, lower limb length, thigh length, leg length, foot length.
Instruments used were weighing machine, height rod, spreading Caliper or Pelvimeter, Vernier's Callipers and measuring tape. Patients less than 5 years & more than 20 years, having sickle cell trait & other haemoglobinopathies were excluded from the study.

The mean value was calculated for each parameter of S.C.D. & control group graphs were plotted. Significantly lower values were observed in all S.C.D. groups.

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**OBSERVATIONS**

1. **Arm length**
   Comparison between normal & SCD males & females for mean arm length

   ![Graph Showing Comparison between Normal and SCD Male for Mean Arm Length](image1)
   ![Graph Showing Comparison between Normal and SCD Female for Mean Arm Length](image2)

   Significantly low values in males in age groups of 5-6, and 16-17 years and females in age groups of 6-7 and 13-14 years were observed.

2. **Forearm length**
   Comparison between normal & SCD males & females for mean forearm length

   ![Graph Showing Comparison between Normal and SCD Male for Mean Forearm Length](image3)
   ![Graph Showing Comparison between Normal and SCD Female for Mean Forearm Length](image4)

   Significantly low values in males in age groups of 12-13 and 15-20 years and females in age groups of 6-8, 13-14 and 15-18 years were observed.
3. **Hand length**
   Comparison between normal & SCD males & females for mean hand length
   
   ![Graph Showing Comparison between Normal and SCD Male for Mean Handlength](image1)
   ![Graph Showing Comparison between Normal & SCD Female for Mean Handlength](image2)
   
   Significantly low values in males in age groups of 7-8, 13-16 and 17-20 years and females in age groups of 6-7, 12-13 and 14-17 years were observed.

4. **Thigh length**
   Comparison between normal & SCD males & females for mean thigh length
   
   ![Graph Showing Comparison between Normal and SCD Male for Mean Thighlength](image3)
   ![Graph Showing Comparison between Normal & SCD Female for Mean Thighlength](image4)
   
   Significantly low values in males in age groups of 5-6 and 16-17 years and females in age groups of 5-7, 14-16 and 17-19 years were observed.
5. Leg length
Comparison between normal & SCD males & females for mean leg length

Significantly low values in males in age groups of 11-12 and 14-20 years and females in age groups of 14-15 and 16-19 years were observed.

6. Foot length
Comparison between normal & SCD males & females for mean foot length

Significantly low values in males in age groups of 5-6, 8-9, 11-12 and 15-16, 18-19 years and females in age groups of 5-8, 11-12 and 14-17 years were observed.
RESULT AND DISCUSSION

The total number of S.C.D. males examined was 286 against normal 302 individuals and S.C.D. females examined was 287 against the normal individuals 308 for the age groups ranging from 5 years to 20 years respectively.

The height and weight showed lower values in all age groups of both sexes in S.C.D. patients. When the mean weight was compared (in between normal & SCD males & females), significantly low values were found in SCD males in age groups of 5-6, 8-10 and 14-20 years & in SCD females of 5-10, 13-16 and 19-20 years when compared with normal controls.

Also significantly low values in weight were found in SCD males of age groups of 6-10, 12-17 & 18-19 years & SCD females in age groups of 7-15 & 19-20 years when compared with normal controls.

Upper limb length was significantly low in SCD males in group of 5-6, 8-9 & 13-20 years & SCD females of 5-7 & 8-18 years when compared with normal controls.

Mean lower limb length was significantly low in SCD males in 5-8, 11-13 & 14-20 years of age and SCD females in 5-7, & 14-18 years of age when compared with normal control group. Forearm length and hand length in females suffering from Sickle Cell Disease showed lower values. Comparing the parameters studied for upper limb viz. upper limb length, arm length, values in all age groups were lower, except forearm length which showed higher values than normal individuals in age from 18 to 20 years. In S.C.D. males all parameters showed decreased value in all age groups.

The parameters studied for lower limb viz. lower limb length, thigh length, leg length, foot length, Inter-trochanteric distance, and Inter-spinous distance showed decreased values in both S.C.D. males and females in age groups ranging from 5 to 20 years as compared to matched age groups of normal individuals.

In a nutshell it can be stated that, all measurements in Sickle Cell Disease patients show lower values than normal individuals. But due to increased health awareness amongst people, improved socio-economic status and food habits, more number of facilities available for early detection of ailments, counseling of patients and parents, morbidity and mortality has been reduced in Sickle Cell Disease patients.

Overall higher values are observed in present study as compared to previous data available in literature may be because of increased health awareness, improved socioeconomic status, better food habits, early diagnosis and treatment, counseling of patients and parents, better health support.

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