Editorial

Explaining anthropometric variations in sickle cell disease requires a multidimensional approach

Malay B. Mukherjee, Kanjaksha Ghosh

National Institute of Immunohaematology (ICMR), KEM Hospital Campus, Parel, Mumbai, India

It has been more than a century, since the first description of sickle cell hemoglobin in an anemic patient was published.[1] Sickle cell hemoglobin is a β chain structural variant where valine is substituted for glutamic acid in the sixth amino acid position. A point mutation (A→T) in codon 6 of the β globin gene which is located on the short arm of chromosomes 11 is responsible for this abnormality. The β^S mutation is one of the most common single gene mutations in man and has a very widespread geographical distribution including most of the Africa, the Middle East, India, and parts of the Mediterranean. Approximately 2-18% of the global population carries the β^S gene.[2] Despite the fact that all sickle cell disease (SCD) patients have an identical single base change in their DNA, the severity in the clinical manifestations specially the morbidity and mortality varies between and within different population groups.[3] The diversity of the clinical course is believed to be due to some environmental as well as the interaction of various genetic factors (linked or unlinked).

An important clinical issue that needs to be further clarified is the effect of sickle cell hemoglobin on the growth and development of individuals either with sickle cell trait (SCT) or disease conditions. Earlier studies from United States, Jamaica, Italy, and Nigeria have shown that children and adolescents with SCD have impaired growth as compared to normal control. Growth delay starts in early childhood but becomes more apparent during adolescents when the growth spurt of normal children separates them from the patients with SCD. On the other hand, adults with SCD were found to be average or above average height, shorter in sitting height and thinner body than comparable controls.[4] This discrepancy between the children and adults has led to the investigation of a possible disease related patterning of growth in SCD children. Although the anthropometric data on SCT individuals are lacking, available data indicate that Jamaican adults with SCT had both normal heights and weights compared to normal controls.[5]

Sickle cell disease is a condition present in Indian populations and usually considered to be a clinically benign. However, there is evidence to indicate that the pathophysiology is variable, ranging from a benign to a relatively severe clinical manifestations.[6] Although it is generally believed that SCD had an adverse effect upon the physical growth and development, published data on this aspect from India are very limited.[7-9]

In the present issue, Nikhar *et al*.[10] have reported the anthropometric and hematological data of SCD children from rural and urban areas of Wardha district, Maharashtra. The authors have shown a significant difference of body weight and BMI index between the rural and urban areas which indicates that SCD children from rural areas are underweight and undernourished. The BMI index is the body mass per unit per area and a measure of adiposity of an individual and found to

Access this article online	
Quick Response Code:	Website: www.ijhg.com
	DOI: 10.4103/0971-6866.96632

Address for correspondence: Dr. Malay B. Mukherjee, National Institute of Immunohaematology (ICMR), 13th Floor, NMS Building, KEM Hospital campus, Parel, Mumbai – 400 012, India. E-mail: drmalaybm@yahoo.com

be a good indicator of nutritional status. However, it is difficult to find out whether the inadequacy of nutrients is due to inadequate diet or poor absorption or defective metabolic utilization by an individual. In a population like India where sickle cell anemia is common along with iron deficiency anemia,[11] there is a possibility that low BMI seen in these children with SCD could have nutritional deficiencies which might have occurred due to inadequate food intake because of poor appetite especially during the vasoocclusive crisis. Dietary intake can significantly influence body weight. A number of studies have indicated that reduced stress levels (pain can be considered a specific type of stressor) are associated with improved dietary choices and nutritional status. The evidence in support of nutritional deficiencies in individuals with SCD has been increasing. A range of micronutrient deficiencies has now been identified in SCD patients, some of which can be corrected by supplements.[12]

In the present study, anemia was found to be very common in SCD cases from rural and urban areas with a mean hemoglobin of 7.8 ± 0.2 g/dl and 9.1 ± 0.4 g/dl respectively. It is believed that anemia plays a role in the pathophysiology of SCD; however, it is not very clear whether anemia affects either specific organ function or over-all cellular metabolism sufficiently to result in growth retardation. Anemia can be corrected by giving multiple blood transfusions which will ultimately help to reduce the number of cells capable of sickling to clinically insignificant levels. It has been shown that intensive transfusion therapy could lead to a better health with a normal growth in β-thalassemia patients.[13] Similarly, normal growth of these SCD children could be maintained by giving repeated transfusions; however, they could develop transfusion reactions and hence this may not be a feasible therapeutic measure.

Another important factor to be investigated is socioeconomic status of the patients which has a direct implication on growth and nutrition and may be more prominent in the presence of chronic disease such as SCD. Poor socioeconomic status is known to have an adverse effect on the nutritional status and hemoglobin levels of SCD patients. The steady-state hemoglobin level may have a potential impact on growth of the patients because of its direct relationship with oxygen delivery to the tissues.[14] Therefore, this study, once again, highlights the need of a multidimensional approach for understanding the anthropometric variations seen among the Indian SCD patients.

References

1. Herrick JB. Peculiar elongated and sickle-shaped red blood corpuscles in a case of severe anemia. Arch Intern Med 1910;6:517.
2. Piel FB, Patil AP, Howes RE, Nyangiri OA, Gething PW, Williams TN, *et al*. Global distribution of the sickle cell gene and geographical confirmation of the malaria hypothesis. Nat Commun 2010;1:104.
3. Mukherjee MB, Lu CY, Ducrocq R, Gangakhedkar RR, Colah RB, Kadam MD, *et al*. Effect of α-thalassemia on sickle cell anemia linked to the Arab-Indian haplotype in India. Am J Hematol 1997;55:104-9.
4. Ohene-Frempong K, Steinberg MH. Clinical aspects of sickle cell anemia in adults and children. In: Steinberg MH, Forget BG, Higgs DR, Nagel RL, editors. Disorders of Hemoglobin. 1st ed. USA: Cambridge University Press; 2001.
5. Ashcroft MT, Miall WE, Milner P. A comparison between the characteristics of Jamaican adults with normal hemoglobin and those with sickle cell trait. Am J Epidemiol 1969;90:236-43.
6. Mohanty D, Mukherjee MB. Sickle cell disease in India. Curr Opin Hematol 2002;9:117.
7. Balgir RS. The body mass index in sickle cell hemoglobinopathy. J Indian Anthropol Soc 1993;28:147-50.
8. Mukherjee MB, Gangakhedkar RR. Physical growth of children with sickle cell disease. Indian J Hum Genet 2004;10:70-2.
9. Qamra S, Roy J, Srivastav P. Impact of sickle cell trait on physical growth in tribal children of Mandla district Madhya Pradesh, India. Ann Hum Biol 2011;38:385-90.
10. Nikhar HS, Meshram SU, Shinde GB. An anthropometric and hematological comparison of sickle cell disease children from rural and urban areas. Indian J Hum Genet 2012;18:33-5.
11. Mohanty D, Mukherjee MB, Colah RB, Wadia M, Ghosh K, Chottray GP, *et al*. Iron deficiency anemia in sickle cell disorders in India. Indian J Med Res 2008;127:371-4.
12. Hyacinth HI, Gee BE, Hibbert JM. The role of nutrition in sickle cell disease. Nutr Metab Insights 2010;3:57-67.
13. Kattamis C, Touliatos N, Haidas S, Matsaniotis N. Growth of children with thalassemia: Effect of different transfusion regimens. Arch Dis Child 1970;45:502-5.
14. Animasahun BA, Temiye EO, Ogunkunle OO, Izuora AN, Njokanma OF. The influence of socio economic status on the hemoglobin level and anthropometry on sickle cell anemia patients in steady state at the Lagos University Teaching Hospital. Niger J Clin Pract 2011;14:422-7.