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RESEARCH ARTICLE

PREVALENCE OF SICKLE CELL TRAIT IN FOUR TRIBAL COMMUNITIES OF VISAKHAPATNAM DISTRICT

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ABSTRACT

Sickle cell disease is a commonest single gene disorders and the clinical course is highly variable ranging from frequent severe pain crisis and life threatening complications that can result in early childhood death to infrequent pain and only mild temporary symptomology. It is prevalent in some of the communities in Africa, America, Middle East and East Asia and its distribution varies geographically and from community to community. In India the prevalence of sickle cell trait varies from 0.8-45% among many tribal populations from different states. A cohort of 628 randomly selected unrelated individuals aged between 16-71 years from four different tribal communities of Visakhapatnam District was studied to analyze the prevalence of sickle cell anemia. All the 628 individuals were tested for red blood cell indices, sodium meta-bisulphate slide test and cellulose acetate electrophoresis. The total prevalence of sickle cell gene has been found to be 9.71% among the studied sample. The individual community distribution is 1.69% among Konds, 14.36% among Bagatas, 7.8% among Konda Doras and 13.59% among Konda Kammaras.

INTRODUCTION

The inherited disorders of hemoglobin are the commonest single gene disorders in man which include mostly the thalassemias and sickle cell anemia. Sickle cell anemia is a widely distributed red blood cell disorder which is inherited autosomal recessively characterized by crescent moon or sickle shaped red blood cells. This is a result of point mutation in the beta globin chain of hemoglobin replacing Glutamic acid with Valine at the sixth position of the beta chain which causes high degree of hereditary hemolytic anemia, jaundice, joint pains, painful crisis, hepato-splenomegaly, growth retardation and affects the general health of an individual. It is prevalent in some of the communities in Africa, America, Middle East and East Asia and its distribution varies geographically and from community to community. Clinically severe HbS variant is seen in population from African ancestry, carried on chromosomes with Senegal, Benin or Bantou haplotypes which is high early mortality and continued attrition with age (Pagnier *et al*., 1984). In India and Arabic countries sickle cell anemia is linked to the Arab-Indian haplotype which shows mild clinical presentation. This has been attributed to high fetal hemoglobin levels and associated alpha thalassemia seen among these patients (Labie *et al*., 1989; Italia *et al*., 2009). Every year about 3,00,000 infants are born with a major hemoglobinopathies , which implies about 250 million people, i.e. 4.5% of the world population are carriers (Angastinitos *et al*., 1995).

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In India alone based on the prevalence rates of sickle cell hemoglobin, it was estimated that there were over 50,00,000 carriers and 2 lakh homozygous sickle cell disease cases among the tribal (Malhotra, 1993). The first case of sickle hemoglobin in India was reported by Dunlop & Mazumder in 1952 among tea garden labourers of Upper Assam and at the same time Lehmann and Cutbush reported the presence of sickle cell trait among the aboriginal (Pre-Dravidian) Tribe (Todo) of the Nilgiri Hills in Southern India (Dunlop and Mazumder 1952; Lehmann and Cutbush 1952). Since then many hospital based studies and epidemiological surveys in various ethnic groups were conducted to report the frequency distribution. In India the prevalence of sickle cell trait varies from 5-40% among many tribal populations from different states. The highest prevalence has been recorded in the state of Orissa (1-44.4%), followed by Madhya Pradesh (1-40%) including Chattisgarh, Tamil Nadu (1-40.0%), Andhra Pradesh (1-35.7%), Assam (1-35.5%), Maharastra (0.8-35%), Gujarat (1-31.4%), Kerala (1-30%), Uttar Pradesh (1.5-18.5%), Karnataka (1-8.0%), Rajasthan (1-5.7%), West Bengal (1-1.7%) and Bihar 0.8% including Jharkand. The gene frequency of HbS varies between 0.031-0.41. (Balgir 1988; 1996; 2004; Mohanty 2002)

MATERIALS AND METHODS

The present study was conducted to investigate the prevalence of sickle cell anemia among Kondh, Bagatha, Konda Dora and Konda Kammara tribes of Devarapalli, Sundruputtu, Ubbetiputtu, Kondamamidi, Gurraguava villages of Paderu,

Pedabayalu, Munchingput and G.Madugula mandals, agency areas of Visakkhapatnam District, Andhra Pradesh. Five ml of blood sample was collected by vein puncture method in EDTA coated tubes from 628 individuals i.e, 108 Kondhs (54 male & 64 female), 202 Bagathas (100 male &102 female), 205 Konda Doras (103 male &102 female) and 103 Konda Kammaras (50 male & 53 female) aged between 16-71 years with prior consent. A full blood count was performed on all samples by using an electronic red cell counter (Sysmex K100 Japan). Simple slide test using sodium meta-bisulphite (Dacie & Lewis 1977) was done to screen the individuals as a preliminary test and latter the zygosity was confirmed by carrying out Cellulose Acetate membrane electrophoresis (Dacie & Lewis 1991).

RESULTS AND DISCUSSION

Sickle cell gene was observed in all the four scheduled tribe populations that were screened. It is considered to note that, the relative deficiency of the SS phenotype compared with the frequency of sickle cell trait (HbAS) indicates that some cases failed to enter the screened tribal population either as a result of early death or failing to be available on the day of screening. Among the four tribal groups the highest frequency of sickle cell trait occurred among Bagathas with 14.36%, followed by Konda Kammaras with 13.5%, followed by Konda Doras with 7.8% and Kondhs with 1.69%, however not even a single case with "homozygous S" condition has been identified. Table 1 shows the sex-wise distribution of sickle cell trait among the four tribal groups screened. No much difference in the distribution of sickle cell trait with reference to sex has been observed, except in Konda Doras where HbAS is 3.92% in females while it is 11.65% in males. The HbS allelic frequency among Kondhs is 0.008, in Bagathas it is 0.072, in Konda Dora 0.04 and in Konda Kammara it is 0.068.

Table 1. Sex wise distribution of Sickle cell trait among the four tribal groups

Population Screened	Normal HbA		Sickle cell trait HbAS		Sickle cell anemiaHbS	
	Male	Female	Male	Female	Male	Female
Kondh	53	63	1	1	0	0
Bagatha	86	87	14	15	0	0
Konda Dora	91	98	12	4	0	0
Konda Kammara	44	45	6	8	0	0

Table 2. Phenotype and allele frequencies of hemoglobin among the four tribal Groups

	Kondh	Bagatha	Konda Dora	Konda Kammara
Phenotype				
HbA	116	173	189	89
HbAS	2	29	16	14
HbS	0	0	0	0
Alleles				
$Hb^{*}A$	0.9915	0.928	0.96	0.932
$Hb^{*}S$	0.0085	0.072	0.04	0.068
χ^2	0.008	1.199	0.3321	0.54
	p=0.92	p=0.2	p=0.5	p=0.4

Chi-square test for homogeneity is statistically not significant in all the four tribal groups screened. However, the inter group test between the four population groups showed statistically significant values. (χ^2 =18.548; d=6; p=0.013). Saha and Banerjee (1973), Goud and Rao (1975) while reviewing the incidence of sickle cell trait in Indian populations concluded that the HbS gene is mostly present in scheduled tribes and scheduled caste and very rarely in caste groups. The frequency distribution of HbS allele among various Indian populations groups has been reviewed and summarized by Bhasin *et al*., 2001. The tribes inhabiting the North-West and eastern parts of Andhra Pradesh have shown high fquencies of sickle cell trait. The frequency of sickle cell trait ranges from 0.50% in Chenchu (Ramesh *et al*., 1980) to about 43.71% in Pardhans (Rao & Goud 1979) of Andhra Pradesh, while some such as Raj Gond (Blake *et al*., 1981) Yanadi (Reddy *et al*., 1982) and Naikpod (Muralidhar *et al*,. 1989) living in plains of this region showed total absence of sickle cell trait. Earlier studies from Visakhapatnam district showed a sickling percentage 12.37% among Bagatha community and 11.89% in Konda Dora community (Babu *et al*., 1980; Devi & Naidu1986). The present study reveals 14.36% sicklers in Bagathas and 7.8% in Konda Doras. Jai Kishan *et al*., 1982 reported 30% of sicklers among Konda Kammara tribe of East Godavari district whereas the Konda Kammara from the present study showed 13.59%.

Conclusion

During this study, out of 628 subjects 61 individuals were found to be sickle cell carriers. Thus the total prevalence of sickle cell gene has been found to be 9.71% among the studied sample. The individual community distribution of sickling is 1.69% among Konds, 14.36% among Bagatas, 7.8% among Konda Doras and 13.59% among Konda Kammaras.

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