SPECTRUM OF INFECTION IN SICKLE CELL DISEASE (SCD) CHILDREN

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ABSTRACT

BACKGROUND

Although, Sickle Cell Disease (SCD) children are highly susceptible to infections. There is a dreadful lack of data related to the burden and spectrum of infections in Odisha, especially southern Odisha, which is the belt for SCD. This study aimed to determine the burden and spectrum of infection among SCD children hospitalised in a Paediatric Department of MKCG Medical College and Hospital.

MATERIALS AND METHODS

The prospective hospital-based study was conducted from 2015-2016 in the Department of Paediatrics, MKCG Medical College and Hospital. We enrolled all known SCD children aged 14 years or less, hospitalised with evidence of infection.

RESULTS

The incidence of infection was high among 6-10 years of children. There was a male predominance with male:female ratio 3:2. High incidence of infection was found in homozygous HbS mutant (46%). Maximum infections were observed in low SES. Most common infection in children with SCD was found to be malaria (36%). The incidence of infection was found to be high in unimmunised children as compared to partially and routinely immunised children and a less incidence of infection was detected among children who were routinely immunised along with special category vaccines. 62.5% children with pneumonia did not develop any complications, but 25% developed empyema thoracis and 12.5% developed pneumothorax. Blood culture was positive in 75% of the cases, out of which, pneumococci was isolated in 50% and influenza in 25% of the children. The incidence of mortality was 10% and found high among the age groups 0-5 years. The mortality due to malaria was 8% followed by pneumonia 4% and meningitis 2%. However, with early diagnosis and proper management, 90% of children got cured of infection.

CONCLUSION

Male children, homozygous SCD in age group of 6-10 years and belonging to low SES contribute maximum number of infections in SCD. Contrary to previous beliefs that heterozygotes in SCD resist infections like malaria, malaria seems to be the common infection in children with SCD, which is also the leading cause of death followed by pneumonia.

KEYWORDS

Sickle Cell Disease, Children, Infection, Odisha.

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BACKGROUND

Sickle Cell Disease (SCD) is one of the most common monogenic disorders globally with an autosomal recessive inheritance. James Herrick, a physician first described the characteristic sickle-shaped red cells in a medical student from Grenada in 1910. It is an inherited blood condition, which is most common among people of African, Arabian and Indian origin. SCD is particularly disastrous, mainly due to its acute and chronic complications, including painful vaso-occlusive events, cerebral vasculopathy, priapism, chronic kidney disease, acute chest syndrome, pulmonary hypertension and infections among others. Indeed, infections are one of the prevailing complications of SCD and can occur either as an acute or a chronic condition. Sickle disease predominantly exists among the tribal communities and certain other distinct groups in different states of the country. However, as per studies, not only is the highest frequency of sickle cell gene in India reported from Odisha, but even the average load of sickle cell disease in the state is almost double the national average. Hence, this study will help in early suspicion and its rational management, which in turn will minimise morbidity and mortality due to SCD.

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MATERIALS AND METHODS

Study design- The prospective hospital-based study was conducted from 2015-2016 in the Department of Paediatrics, MKCG Medical College and Hospital.

Inclusion Criteria

- We enrolled all known SCD children aged 14 years or less, hospitalised with evidence of infection.

Exclusion Criteria

- Children with SCD with no evidence of infection.

Method- During the study period, 50 children were included in study group. After thorough history taking and clinical examination, the different investigations were carried out for evidence of infection. Each case was recorded with the consent in a Performa and analysed.

RESULTS

The incidence of infection was high among 6-10 years of children (Table 1). There was a male predominance with male:female ratio 3:2 (Table 2). High incidence of infection was found in homozygous HbSS mutant 46%, HbAS 36%, HbS with thalassaemia 18% (Table 3). Maximum infections were observed in low SES 54%, middle 32% and upper 14%. Most common infection in children with SCD was found to be malaria 36%, pneumonia 16%, Upper Respiratory Tract Infection (URTI) 10%, enteric fever 8%, pyomyositis 8%, occult bacteraemia 8%, UTI 4%, meningitis 4%, osteomyelitis 2%, TB 2% and hepatitis 2% (Table 4). The incidence of pneumonia was found to be high in unimmunised children 40% as compared to partially immunised 25% and routinely immunised 16% children and no incidence of pneumonia was detected among children who were routinely immunised along with special category vaccines (Table 5). 50% of the malaria cases were due to plasmodium falciparum, 22% due to vivax and 28% due to mixed infections (Table 6). Incidence of thrombocytopenia in malaria was 78.5%. 62.5% children with pneumonia did not develop any complications, but 25% developed empyema thoracis and 12.5% developed pneumothorax (Table 7). Blood culture was positive in 75% of the cases, out of which, pneumococci was isolated in 50% and H. influenza in 25% of the children. The incidence of mortality was 10% and found high among the age groups 0-5 years. The mortality due to malaria was 57%, followed by pneumonia 28.5% and meningitis 14.5% (Table 8). However, with early diagnosis and proper management, 90% of children got cured of infection.

Age in Years	No. of Children	Percentage
0-5	19	38
6-10	20	40
>10	11	22

Table 1. Incidence of Infection in Different Age Groups

Sex	No. of Children	Percentage
Male	30	60
Female	20	40

Table 2. Sex Related Incidence of Infection

Hb Pattern	No. of Children	Percentage
HbSS	23	46
HbAS	18	36
HbS with thalassaemia	9	18

Table 3. Variants of SCD Taken in the Study

Type of Infection	Malaria	Pneumonia	URTI	Enteric Fever	Pyomyositis	Occult Bacteraemia	UTI	Meningitis	Osteomyelitis	TB	Hepatitis
No. of cases	18	8	5	4	4	4	2	2	1	1	1
Percentage	36	16	10	8	8	8	4	4	2	2	2

Table 4. Spectrum of Infection in SCD

Immunisation Status	No. of Children	Pneumonia	Percentage
Unimmunised	5	2	40
Partly immunised	8	2	25
Routine immunised	25	4	16
Routine with special immunised	12	0	0

Table 5. Incidence of Pneumonia as Per Immunisation Status

Types of Malaria	No. of Children	Percentage
Pl. falciparum	9	50
Pl. vivax	4	22
Mixed	5	28

Table 6. Spectrum of Malaria with SCD

Incidence	No. of Cases	Percentage
Uncomplicated pneumonia	5	62.5
Empyema thoracis	2	25
Pneumothorax	1	12.5
Total	**8/50**	**16**

Table 7. Incidence of Pneumonia with Complications

Type of Infection	No. of Death	Percentage
Malaria	4	8
Pneumonia	2	4
Meningitis	1	2

Table 8. Mortality Related to Various Infections

DISCUSSION

Patients with Sickle Cell Disease (SCD) have an increased susceptibility to bacterial infections and die more frequently from infection than any other cause. Their sera do not promote the phagocytosis of pneumococci normally, apparently because of an inability to utilise the alternate pathway for C3 fixation as a means of opsonisation. The splenic dysfunction, which exists in SCD may result in depressed synthesis of alternate pathway factor (s), as well as in decreased phagocytic clearance of bacteria.[1] Silvestroni and Bianco[2] were the first to describe the compound heterozygosity (β^s/β^{thal}) for the sickle gene and a β-thalassaemia gene in 1944. β-thalassaemia is also prevalent in some tribal populations with the frequencies being as high as 6 to 14 percent in some tribes from Gujarat and Odisha.[3,4,5] Red cells from people with sickle cell disease do

not sickle to any significant degree at normal venous oxygen tension. Very low oxygen tension will cause cell to sickle.[6] Contrary to our findings, there are studied, which show concomitant presentation of sickle cell disease with malaria is very rare. This maybe because red cells in person of sickle cell disease infected with P. falciparum deforms, because parasite causes low oxygen tension in red cells. These abnormal cells become vulnerable for phagocytosis.[7] Experiments carried out in vitro with sickle cell, the red cell infected with falciparum sickle more readily than uninfected cell.[8] Selective sickling of infected cells reduces parasite burden. In other experiment, P. falciparum parasite cultured in red cells of sickle patient died when the cells were incubated at low oxygen tension.[9] Ultrastructural study show extensive vacuole formation in P. falciparum parasite in habitating sickle cell trait and causes damage of parasite.[10] Other study suggests oxygen radicle formation in sickle cell disease, retardation of growth and damage of parasite.[11] Homozygous HbS red cells produce hemin.[12] Infected cell might generate enough hemin, which damages parasite.[13]

CONCLUSION

Male children, homozygous SCD in age group of 6-10 years and belonging to low SES contribute maximum number of infections in SCD. Contrary to previous beliefs that heterozygotes in SCD resist infections like malaria. Malaria seems to be the common infection in children with SCD, which is also the leading cause of death followed by pneumonia. Thus, screening for sickle cell disorders should be done regularly especially in Odisha to avoid morbidity and mortality. Although, there is a screening program in Odisha.[14,15] Most of the population is ignorant. At least, screening should be done in all children born out of SCD parents and also those having history of SCD in their family.

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