The Prevalence of Pulmonary Tuberculosis among Severely Acute Malnourished Children – A Cross Sectional Study

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***Abstract*- Introduction:** Globally, about 1 million cases of pediatric tuberculosis are estimated to occur every year accounting for 10-15% of all tuberculosis; with more than 100,000 estimated deaths every year, it is one of the top 10 causes of childhood mortality.1 The source of infection to a child is usually an adult, often family member with sputum smear positive tuberculosis. The frequency of childhood tuberculosis in a given population depends on: (a) the number of infectious cases ;(b) closeness of contact with an infectious case; (c) the age of child when exposed to tuberculosis; and (d) the age structure of the population .2The objective of this study was to study the prevalence of Tuberculosis among severely acute malnourished children and socio-demographic factors associated with it.

Study methods: A retrospective cohort study was conducted in Nutritional Rehabilitation Centre of Molakalmuru, Chitradurga district. All the 13134 children (0-6years) in Molakalmuru block were screened by AWW for severely acute malnourished as per criteria laid down by Government of India.3Out of 386 identified severely acute malnourished children only 269 cases attended Nutritional Rehabilitation Centre. A detailed history, general physical examination, systemic examination and investigations were done. The findings were recorded in a predesigned pretested structured proforma. Screening for tuberculosis was done as per current RNTCP standards.4The data thus collected was compiled and analyzed by using Microsoft Excel software.

Results: The prevalence of pulmonary tuberculosis among severely acute malnourished children was 5.6%; out of them 86.6% were females. 92.3% of tuberculosis patient had history of contact in the house hold was more among females. 5.2% of the children were positive for sputum or gastric aspirate smear examination, 5.6% also had positive PPD test and chest X-ray was showing the evidence of tuberculosis making the prevalence to be 5.6%.A statistically significant association was found among sex, age and history of contact in the house hold.

***Index Terms*-** Severely malnourished children, Prevalence, Tuberculosis.

I. INTRODUCTION

From the oral tradition of medicine and public health, it is clear that malnutrition is an important risk factor for the development of tuberculosis. The available literature suggests that the rate of infections are higher in a malnourished children compared to well nourished children.[5] According to Government of India, severe acute malnutrition is defined as "very low weight for height /length (Z score below 3 SD of the median WHO child growth standards) or by visible severe wasting or by the presence of nutritional oedema".[3]Severe malnutrition leads to an immunodeficiency state known as NAIDs (Nutritionally Acquired Immune Deficiency).[6] Malnutrition mainly affects cell mediated immunity (CMI) and CMI is the principal host defense against tuberculosis.[7]

The global burden of childhood tuberculosis is not known, but it has been assumed that 10% of the actual total case load is found amongst children. According WHO Global tuberculosis report 2012, at least half million of children became ill with tuberculosis and an estimated 64000 children died of tuberculosis in 2011. It ranks as the second leading cause of death from an infectious disease worldwide, after HIV.[1] Tuberculosis infection among children can be used as a marker of recent ongoing transmission in the communities. Therefore information on prevalence of tuberculosis infection among children is important to evaluate tuberculosis transmission in community.

The commonest age for developing childhood tuberculosis is 1 to 4 years.[8] Children rarely have sputum smear-positive tuberculosis. Children under five years of age are more prone to develop (up to 20 %) the disease, mostly within 2 years following infection. Many studies have established that prevalence of tuberculosis is higher in household contacts, the highest being for those who are sharing activities and room air with sputum smear positive cases. Studies have also shown that the socio economic factors such as poor housing, crowded condition, poorly ventilated spaces, low income, lack of access to medical care, lack of knowledge of tuberculosis prevention are associated with tuberculosis infection.[8]

Globally, tuberculosis control program has given low priority to childhood Tuberculosis.[8]The reason for this may be diagnostic difficulties faced of pediatric tuberculosis, the limited resources available for tuberculosis control activities, a misplaced faith in BCG, a lack of data on treatment and the belief that tuberculosis in children is rarely infectious.[9] Additionally, contact tracing is rarely done in developing countries like India because of lack of resources and social stigma. Hence the study was carried out to know the prevalence of Pulmonary Tuberculosis among severely acute malnourished children and the socio-demographic factors associated with it.

II. METHODOLOGY

A retrospective cohort study was conducted in Nutritional Rehabilitation Centre of Molakalmuru block, Chitradurga district. All the 13134 children (0-6years) in Molakalmuru block were screened by AWW for severely acute malnourished as per criteria laid down by Government of India.[3]Out of 386 identified severely acute malnourished children only 269 cases attended Nutritional Rehabilitation Centre. A detailed history, examination and screening for tuberculosis was done as per current RNTCP standards.[4]The findings were recorded in a predesigned pretested structured proforma. The data thus collected was compiled and analyzed by using Microsoft Excel software.

III. RESULTS

There were a total of 13134 children aged between 0-6 years in Molakalmuru taluk out of which 8717(66.4%) were well nourished, 4031(30.7%) were moderately nourished and 386(2.9%) were severely malnourished. Among the 386 severely malnourished children, 269(69.7%) attended the NRC, out of which 162 were in the age group of 0-3 years and 107 in the age group of 3-6 years (Table 1). The dropout rate was 30.3%.

All the severely acute malnourished children belonged to below poverty line family and were immunized with BCG. Almost of all the parents were illiterates or educated up to primary school level. More than 70% of severely acute malnourished children belonged to SC/ST category. Majority of severely acute malnourished children were from rural area (80%).

Out of 7972 children in the age group of 0-3 years, 222(2.1%) were severely acute malnourished. Among 4910 children in the age group of 3-6 years, 164 (2.3%) were severely acute malnourished. (Table 1)

Among 8717 well nourished children, 4288 (49.19%) were males. Among 386 severely acute mal- nourished children, 219 (56.73%) were females. There was statistically significant association between the sex of the children and nutritional status. (Table2)

In this study the prevalence of pulmonary tuberculosis among severely acute malnourished children was more among those aged between 3-6 years (6.5%), in females (8.17%) and in urban (11.11%) and those with history of contact. (Table 3) Statistically significant association was found between the tuberculosis and age as well as sex of the severely acute malnourished children. However there was no statistically significant association between the location of the severely acute malnourished children. (Table 3)

In present study 5.2% of the children were positive for sputum or gastric aspirate smear examination, 5.6% also had positive PPD test and chest X-ray was showing the evidence of tuberculosis making the prevalence to be 5.6%.

Among 15 diagnosed tuberculosis severely acute malnourished children 86.6 % of the females had tuberculosis as compared to 13.4% in male children. There is a significant association between sex of child & tuberculosis. It is evident that the prevalence of tuberculosis was high in rural children compared to urban children. Statistical significant association between location & tuberculosis was not found.

Among the 15 identified severely acute malnourished children with tuberculosis there was a history of contact in the household for 13 children, out of which 12(92.3%) were female and 1 (7.7%) was male. (Table 4)

IV. DISCUSSION

In present study, prevalence of severely acute malnourished children aged between 1 to 6 years in Molakalmuru block was found to be 2.9%. According to NFHS-III survey, 6.8% of children below 60 months of age were found to be suffering from acute variety of severe under-nutrition.[10] Out of 386 severely acute malnourished children 269 were reported to NRC. The drop out was found that 30.3% which may be due to migratory population. Molakalmuru is a backward taluk of Chitradurga, where most of the people are laborers and engaged in mining. Poverty, illiteracy, ignorance, lack of knowledge are the factors associated.

Among 269 severely acute malnourished children who attended NRC, 66.22% were < 3years. Mean age was 32.7 months. Similar findings were found in study conducted by Md. Iqbal Hossain[5] et al in Bangladesh. It was found that 66% of the severely acute malnourished children belonged to age group of less than 2 years. In another study conducted by Sunguya Bruno[7] et al showed that more than75% of all severe protein energy malnutrition children were below 2 years of age. Prevalence of Severe malnutrition increases with age up to the maximum at the age of 1 to 2years and there after it decreases. The reason may be because of the weaning and other eating habits of the children which make them more prone to infections such as diarrhea, measles, tuberculosis etc.

Out of total 269 severely acute malnourished children 59.1% were females. The male: female ratio was 0.69. The study conducted by Mittal et al[11] in Punjab & Dwivedi et al. [12] showed that malnutrition is more common in females. Our study also shows similar findings.

The percentage of severely acute malnourished children was more in rural area than in urban area. Similar findings were concluded by severely acute malnourishedi-ul-haq[13] in which 61.5% of the cases were from rural area. More than 70% of severely acute malnourished children belonged to SC/ST caste. In less developed countries, place of residence usually determines people's life-styles, their economic, social and cultural activities, and, most importantly, their health conditions .[14] One of the reasons forwarded to explain the urban health advantage has been that unlike villages, cities generally have an important modern health care system which facilitates public health interventions. Some studies point out that even when health facilities are available in rural areas, they are often ill-suited to deliver the primary health services needed by the rural populations, and that people have to travel a greater distance to obtain care than the urban dwellers .[15] Most of the parents (58%) were illiterates. A study conducted by severely acute malnourished-ul-haq# showed the similar results in which 51.5% was illiterate.[13]

Out of 269 severely acute malnourished children 15(5.6%) were suffering from pulmonary tuberculosis. A study conducted

by Md. Iqbal Hossain[5] et al in Bangladesh showed that 9% of severely acute malnourished children were suffering from pulmonary tuberculosis. A prospective observational study conducted in tertiary hospital; Delhi by Praveen Kumar et al[16] found that the prevalence of pediatrics tuberculosis among severely acute malnourished children was 9.3% which is similar to our study.

About 86.66% of the females had tuberculosis compared to 13.34% in male children. A study conducted by VK Arora et al. [17] showed that female children were more susceptible to tuberculosis. This is because the privileged and male dominated society usually delays the medical treatment for girls. Females are ignored in a society like India especially in rural areas which thus leads to malnutrition and various infections like tuberculosis.

The younger the age of involvement, the greater will be the morbidity & mortality in children. In our study 53.3% of children had tuberculosis between the age group 0 to 3 years. A study by Chakravorty et al.[18] reported pediatric tuberculosis in 54.3% cases and another study by Narain et al. [19] reported 38.98% in children below 4 yrs of age. Though the children can present tuberculosis at any age, majority of cases present between 1 to 4 years. Disease usually present within 1 year of infection and dissemination will be more in younger age group who present disease with earlier. In children with pulmonary tuberculosis usually sputum smear negative and pulmonary tuberculosis to extra pulmonary tuberculosis ratio is around 3:1. Prevalence of pulmonary tuberculosis usually low between 5 to 12 years of age and increases with advancing age.[20]

Overall the risk of disease highest among infants and in late teens, with the lowest risk between 5 and 10 years - the so-called "safe school years" .Thus because disease in young children reflects recent infection, rather than secondary reactivation, the pediatric disease burden potentially provides a useful measure of current transmission within a community, including Multi-drug resistant (MDR) and extensively drug resistant (XDR) strains.[21]

In present study 86.7% severely acute malnourished children had Tuberculosis with house hold contact with Tuberculosis. A study from Pakistan by Emad uddin Siddiqui et al.[22] found that 66% had Tuberculosis with house hold contact with Tuberculosis. Tuberculosis in children is mainly due to failure of tuberculosis control in adults. The risk of infection to a child depends on extent of exposure infectious droplet nuclei. An infant whose mother has sputum smear positive pulmonary tuberculosis has a high chance of becoming infected. The chance of developing the disease is greatest shortly after infection, and steadily decreases as the times go by.

V. CONCLUSION

Our findings suggest that prevalence of tuberculosis among severely acute malnourished children is higher than the general population and risk is significantly increased with malnutrition, but is significant for house hold contact of sputum positive persons, significant association between sex of child & tuberculosis and significant association between the tuberculosis and age. Severe malnutrition, younger age, illiteracy and lower socioeconomic status are significant risk factors for prevalence of tuberculosis.

VI. RECOMMONDATIONS

More robust regional data on the epidemiology of childhood tuberculosis are urgently needed to define the true burden of disease, and to characterize current transmission rates and circulating strains. Recent WHO guidance recommending reporting of all cases of childhood tuberculosis (smear positive, smear negative and extra pulmonary) in two age bands (0-4 and 5-14 years) takes an important step in this direction.[23] More detailed study is needed to evaluate the prevalence tuberculosis among severely acute malnourished children. This study argues strongly in favor of routine screening of all children who were suffering from malnutrition and identifies the group of children at higher risk who should be screened on a priority basis if there are constraints of resources and time.

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TABLES:

Table-1: Distribution of children as per age nutritional status

Age	**0-3(years) N=7972**	**3-6(years) N=4910**	**Total N=12992**
Well nourished babies n (%)	5466 (62.7)	3251(37.29)	8717
Moderately Malnourished n (%)	2344(60.27)	1545(39.72)	3889
Severely acute Mal- nourished babies' n (%)	222 (57.51)	164 (42.48)	386

Table-2: The relationship between Nutritional status of children and sex of children.

Nutritional status of children	**Male N=4455**	**Female N=4648**	**Total N=9103**
Well nourished Children N (%)	4288 (49.19)	4429(50.80)	8717
Severely acute Mal- nourished Children N (%)	167 (43.23)	219 (56.73)	386

Chi-Square- 7.19 *p* value <0.05

Table-3: Association between TUBERCULOSIS and socio demographic factors of SEVERELY ACUTE MALNOURISHED children

Particulars		**TUBERCULOSIS Present**	**TUBERCULOSIS Absent**	**Prevalence of TUBERCULOSIS**	**P value**
Age group	**0-3 years**	8	154	4.9	240.67 *p<0.05
	3-6 years	7	100	6.5	
Sex	**Male**	2	108	1.8	4.99

	Female	13	146	8.17	*p<0.05
Location	**Urban**	3	24	11.11	1.75 p>0.05
	Rural	12	230	4.9	
History of contact	**Male**	1	109	0.9	6.33288 *p<0.05
	Female	12	145	7.6	

Table 4: Distribution of SEVERELY ACUTE MALNOURISHED as per history of contact with tuberculosis patients

Particulars		**Tuberculosis absent**	**Tuberculosis present**
History of contact	**Yes**	25	13
	No	229	2
Total		254	15