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ORIGINAL ARTICLE

ASSOCIATION OF TUBERCULOSIS WITH SEVERE ACUTE MALNUTRITION

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ABSTRACT: BACKGROUND: India houses highest number of malnourished children next to African countries. Malnutrition is lethal in combination with Tuberculosis. Efficacy of BCG vaccination, a part of Universal Immunization Programme in preventing TB infection and utility of TST in detection of TB infection in malnourished children needs to be studied. **OBJECTIVE:** 1. To obtain the morbidity pattern of tuberculosis. 2. To study the role of BCG vaccination and reliability of TST in under five children with severe acute malnutrition. **MATERIAL AND METHODS: DESIGN:** A prospective study. **SETTING:** Severe malnutrition unit in a tertiary level referral hospital in central India. **PARTICIPANTS:** Under five children with severe acute malnutrition in SMTU. **OUTCOME MEASURES:** 1. Presence of tuberculosis in SAM children. 2. Morbidity pattern of tuberculosis in SAM children. 3. Presence of BCG scar in diseased children. 4. Reactivity status of TST in diseased children. **RESULTS:** Tuberculosis was diagnosed in 22% of severe acute malnutrition cases. Seventy eight percent (78.50%) of the pulmonary tuberculosis cases were younger than 1 year. In children of 13-26 months of age, 50% of cases were pulmonary tuberculosis while neuro-tuberculosis and disseminated tuberculosis contributed 25% each. BCG scar was present in 86.6% of malnourished children with pulmonary tuberculosis while only 28.4% of extra pulmonary seriously ill cases had BCG scar. Positive tuberculin reaction was seen in only 8.0% children, 50% of them had 10-15mm induration. **CONCLUSION:** Tuberculosis is one of the treatable causes of malnutrition and there is high prevalence of tuberculosis infection among SAM children. Identifying adult cases and giving proper treatment as well as screening their malnourished children will help in early identification and preventing spread of pulmonary TB among children.

KEYWORDS: Tuberculosis, Severe acute malnutrition, Tuberculin skin sensitivity testing.

INTRODUCTION: The current estimated total population of India is 1.27 billion and it is expected that amongst the 120 million under-five children about 6.4% (7.6million) are likely to be suffering from severe acute malnutrition[1]. Malnutrition is lethal in combination with Tuberculosis. Socio economic risk factors of malnutrition like poverty, illiteracy, ignorance, overcrowding and poor sanitation do play significant role in tuberculosis also. Effect of BCG vaccination and utility of tuberculin skin testing (TST) in severely malnourished children with tuberculosis remain a subject of interest. The present study was carried out in light of above facts, with the aim to obtain the morbidity pattern of tuberculosis, role of BCG vaccination and reliability of TST in under five children with severe acute malnutrition.

METHODS: Design and Setting: This prospective cohort study has been carried out in Severe Malnutrition Treatment Unit (SMTU), Department of Pediatrics, Gandhi Memorial Hospital, Rewa over a period of 1 year from August 2011 to September 2012. The hospital caters the needs of huge population of underprivileged section of Vindhyanchal region of India, which is one of the endemic regions for malnutrition.

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Study Population: Participants - Children between 6 to 60 months of age admitted in the Severe Malnutrition Treatment Unit in our hospital. Severe acute malnutrition was defined by the presence of any one of following WHO criteria, very low weight for height (Below −3z scores of the median NCHS/WHO growth standards), or visible severe wasting, or presence of nutritional edema[2]. Sample size is calculated to 100 and 108 children were selected by random number generation. Two patients left the hospital against advice and no reliable attendants were available in two cases and finally 104 cases were enrolled.

Data Collection: Details were collected by investigator and entered in proforma. History of fever and/or cough of more than 2 weeks duration, failure to gain weight, loss of appetite, decline in weight and symptoms of extra-pulmonary tuberculosis such as lymphadenopathy, seizure, abdominal pain and history of contact with an open case of tuberculosis (Current and past) were recorded. Ability to adhere to anti-tuberculosis treatment (ATT) in the past was also sought. Nutritional status was assessed by various anthropometric measurements of weight, height or length, weight for height, left upper- mid arm circumference. Osborne diagnostic Criteria[3] was used for diagnosis of pulmonary tuberculosis and Modified Ahuja criteria[4] was used for diagnosing tuberculosis meningitis.

Tuberculin Skin Testing: Resident doctor posted in the malnutrition unit performed TST on each enrolled child using five tuberculin unit (5TU) of Purified Protein Derivative (PPD) RT23 with tween 80 (Prepared by Statens Serum Institute, Denmark (SSI) from Mycobacterium tuberculosis). Subjects received an intradermal injection of 0.1 ml of PPD-tuberculin in the volar aspect of the forearm. The TST result was read at 48–72 h by measuring the transverse axis of the induration at the site of PPD application and exact size of the induration was measured and recorded in millimeters.

Data Analysis: The data was analyzed using Statistical Package for Social Scientists, SPSS-X (SPSS Inc., Chicago, Illinios, USA).

Ethical Issues: A written, informed consent from parents was obtained at the time of admission to mal nutrition ward. As there was no institutional ethical committee was present at the time of initiation of study, clearance from departmental ethics committee was taken.

RESULTS: Out of 8419 patients admitted in the department of pediatrics, during the period of one year from August 2011 to September 2012, 276 patients fulfilled the criteria of SAM, (Prevalence of SAM was 12%). One hundred and four SAM cases were selected finally and out of these 50(48.7%) were male and 54(51.9%) were female. HIV status of the subjects was tested and 3 cases testes positive. None of them had tuberculosis. Sixty percentages of participants were in age group 6 to 12 months. Tuberculosis was diagnosed in 22% of severe acute malnutrition cases, 56% (13) were males and 43.5% (10) were females. Seventy eight percent (78.50%) of the pulmonary tuberculosis cases were younger than 1 year. In children 13-26 months of age, 50% of cases were pulmonary tuberculosis while neuro-tuberculosis and disseminated tuberculosis contributed 25% each. Prevalence of pulmonary tuberculosis and disseminated tuberculosis were equal in 24- 60 months of age group. Fever was present in 82.6% of the children. Cough and weight loss were present in 26% each. Pallor was present in 73.9% of cases, followed by skin lesion and oropharyngeal candidiasis in 34.0% cases each.

Hepatomegaly, clubbing, ear discharge, lymphadenopathy, isolated splenomegaly and ascites were seen in 8.7% cases each. Mild and moderate anemia were seen in SAM with tuberculosis cases in equal proportion 25% and 25.8% respectively, whereas severe anemia was observed in 19% children.

BCG scar was present in 66 cases (63.5%) and absent in 38 cases (36.5%). There were no significant relation between tuberculin skin test positivity and presence of BCG scar ($P< 0.05$). Positive tuberculin reaction was seen in only 8.0% children, 50% of them had 10-15mm induration. History of contact with an adult tuberculosis case was present in 25 out of 104 (24.0%) cases, of which 16.0% had TST positive.

DISCUSSION: The diagnosis of tuberculosis in children rests largely on the result of relevant history, clinical examination, tuberculin test, radiological examination and history of contact. The isolation of bacteria is difficult in children due to pauci bacillary nature of childhood tuberculosis and diagnosis is consequently more difficult than in adults. Peak incidence of severe malnutrition in children is between 6-12 months. Though many studies showed a peak incidence of tuberculosis in 1 to 3 year old malnourished children, we found a greater incidence of pulmonary tuberculosis at a younger age of 6-12 months in severely malnourished children. In conformity with previous studies, we could not find a sex predilection for tuberculosis in malnourished children.[5,6] The high incidence of anemia in these children could be due to nutritional as well as incident helminth infections.[7]

The protective effect of BCG vaccine in neuro tuberculosis and in disseminated tuberculosis has been reinstated by our study as 80% of neurotuberculosis cases and 100% disseminated tuberculosis cases had no evidence of BCG vaccination. This finding was in conformity with a previous report.[6] We could not derive any protective effect of BCG vaccination in pulmonary tuberculosis. Association between TST positivity and BCG vaccination is a topic of serious research. Though there was conflicting opinion, we could not find any association between TST positivity and BCG vaccination in past[8]. This findings were in accord with many studies.[9] Relatively low percentage (63.5%) of scar positivity in this study is a matter of concern. 86% to 96.4% scar positivity has been reported by many authors.[10]

Tuberculin skin test (TST) helps to determine tuberculosis infection prevalence rate and is regularly done to identify individuals infected with Mycobacterium tuberculosis.[11] Anthropometric evidence of lower body protein reserves and reduced TST positivity is well defined.[12] The lower incidence (8%) of TST positivity in our study could be substantiated by this fact that ability to produce a delayed hypersensitivity reaction to tuberculin protein needs a strong immunological response of the host and hence the chance of getting a positive result in severely malnourished children is meager.[13] There were variable reports about prevalence of tuberculin positivity in endemic areas.[4,14]

Though Udani described 50% TST positivity among children suffering from malnutrition and tuberculosis, only 35% TST positivity was obtained among similar populations in this study.[15] Significantly high percentage of TST positivity was seen in children with a history of contact with adult tuberculosis cases. Previous reports have also shown that children exposed to a smear-positive adult were more likely to have a positive skin test, irrespective of BCG vaccination status.[14] Even among household contacts of smear-positive pulmonary TB patients, there were major differences in the proximity and duration of contact which were strongly associated with differences in the prevalence of positive tuberculin reactions.[13]

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Tuberculosis is one of the treatable causes of malnutrition and there is high prevalence of tuberculosis infection among SAM children. Identifying adult cases and giving proper treatment as well as screening their malnourished children will help in early identification and preventing spread of pulmonary TB among children.

What This Study Adds: Prevalence of tuberculosis in severe acute malnutrition children is 22%. Infancy and contact with adult cases are major risk factors.

Type of Disease	No. of Cases	BCG Scar			
		Present	%	Absent	%
Pulmonary tuberculosis	15	13	86.6	2	28.5
TBM+DTB	8	1	13.4	7	71.5
Total	23	14		9	

Table 1: Distribution of Cases According to Presence of BCG Scar

$\chi 2=8.96$; $p<0.001$ (PTB v/s TB m+ DTB)

H/o Contact	No. of SAM		TST Positive		CXR s/o TB		Both TST and CXR Positive	
Present	25	24.03	4	64%	6	24%	2	12
Absent	79	75.96	4	5%	9	11.3%	2	2.5
Total	104	100	8	6.7	15	14.4%	4	3.8

Table 2: Distribution of SAM with tuberculin reaction and chest x-ray positivity according to History of Contact

Tuberculin Reaction	No. of SAM	Percentage (%)	TB CASE	Percentage (%)
Negative (1-5mm)	95	95%	14	61%
Positive (+) (6-15mm)	5	5	5	21%
Positive (++) (16-20mm)	2	2	2	9%
Positive (+++) (>20mm)	2	2	2	9%
Total	**104**		**23**	

Table 3: Distribution of SAM case according to degree of tuberculin reactivity

$\chi 2=30.52$; $p<0.0001$

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