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PREVALENCE OF PULMONARY TUBERCULOSIS IN SEVERE ACUTE MALNOURISHED CHILDREN WITH ACUTE PNEUMONIA

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Abstract

Background: The most severe type of malnutrition that affects children under five is called severe acute malnutrition (SAM), and it is linked to a number of infectious illnesses, including tuberculosis (TB). Although it is crucial for managing pneumonia in children residing in areas where tuberculosis is extremely common, the presentation of pulmonary tuberculosis (PTB) as pneumonia in severely malnourished children has not received much attention.

Objective: To investigate the prevalence of acute pneumonia and severe acute malnutrition in children with pulmonary tuberculosis.

Materials And Methods: Prospective hospital based observational study done in children admitted to NRC, Pediatric Department, Hubballi from January 2015 to December 2015 with diagnosis of severe acute malnutrition with pneumonia.

Results: A total of 29 children were enrolled in the study; their male to female ratio was 0.9:1, and their mean age was 14.29±9.63 months. 10.34% (3/29) of SAM patients with acute pneumonia had pulmonary tuberculosis. Two of the three cases involved younger than twelve months old, and they were all male. Clinical symptoms/signs in order of frequency were fever (100%), respiratory distress (100%), and cough (66.66%). Possession of a contact history (66.66% (2/3) and a positive Mantoux test (66.66% (2/3) were risk factors for TB development. Though tuberculosis was greater in children with absence BCG scar yet it was statistically not significant (2/3). While the smear for AFB was positive in only one child, the Xpert MTB/RIF assay was positive in all three cases. In our

investigation, the Mantoux test's sensitivity and specificity for TB diagnosis were 66.6% and 96%, respectively.

Conclusion: Consideration should be given to pulmonary tuberculosis in children who have pneumonia and severe acute malnutrition. When it came to isolating TB bacilli, Xpert MTB/RIF was found to be more effective than smear for AFB.

Key Words: SAM, Xpert MTB/RIF Assay, Pneumonia, and Tuberculosis.

INTRODUCTION

In 2015, there were 9.6 million cases of Tuberculosis worldwide, of which 2.2 million were in India.[1] This country is classified as having a high prevalence of tuberculosis.[2] It has the greatest rate of undernourished children outside of Africa. Combining malnutrition with tuberculosis can be fatal.[3] One of the main causes of sickness and mortality among children worldwide is malnutrition. Malnutrition is linked to almost 33% of fatalities in children under the age of five in India.[4]

Both innate and learned host defense mechanisms are impacted by SAM.[5,6] The bacterial infections that cause pneumonia in children who are extremely malnourished sometimes differ from those that cause the illness in children who are better-nourished.[7,8,9,10] In chronically malnourished children, the clinical signs of pneumonia frequently stay mild.[8,11] The duration of symptoms, which include cough, fever, anorexia, and failure to thrive, in PTB presenting as pneumonia is frequently less than two weeks, particularly in children with severe malnutrition.[12]

Apart from the typical respiratory bacterial cause of community-acquired pneumonia in undernourished children, tuberculosis (TB) is more frequent than is typically thought.[8,12,13] Pneumonia in children with SAM is thought to be primarily caused by Mycobacterium tuberculi.[8,13,14,15,16]

According to clinical postmortem investigations conducted in areas with high child mortality, TB was frequently discovered in children who were dying from pneumonia in a research by McNally LM et al.[16,17,18,19,20]

Although it is crucial to the management of pneumonia in children residing in areas where tuberculosis is extremely common, the presentation of pulmonary tuberculosis (PTB) as pneumonia in severely malnourished children has not received much attention.[13] Children who present with severe acute malnutrition and acute pneumonia have a higher mortality rate from PTB.[7] Thus, this study was conducted to determine the prevalence of pulmonary tuberculosis in severely acutely malnourished children who had acute pneumonia.

MATERIAL AND METHODS

Hospital based observational study conducted at NRC, Dept of Paediatrics, KIMS, Hubballi, between January 2015 to December 2015. The study was approved by institutional ethics committee.

Inclusion Criteria: Severe acute malnutrition in children aged one month to five years, with or without HIV infection, accompanied by pneumonia.

Exclusion Criteria: Youngsters on ATT who have been diagnosed with tuberculosis in any form and who are suffering from severe acute malnutrition.

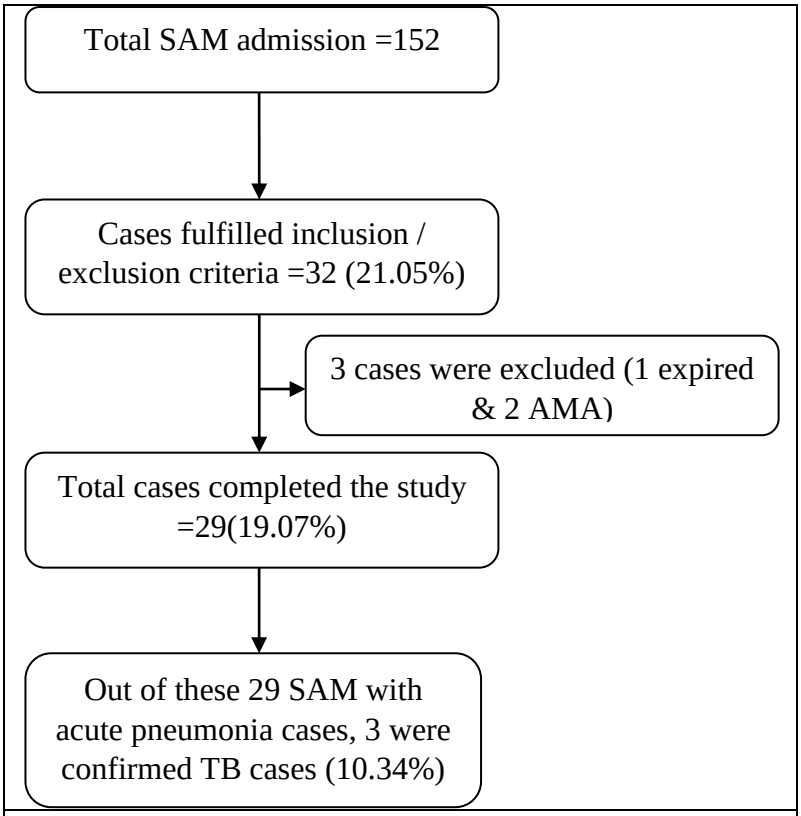
A thorough history and physical examination of every kid enrolled was recorded on a pre-made proforma, and all cases included investigations like as stomach lavage, Xpert MTB/RIF, Mantoux test,[21] and chest Xray.

Every child who met the study's inclusion and exclusion requirements was enrolled. Every enrolled child's complete medical history and examination were recorded on a proforma that was pre-made. The following tests were performed on every kid who was enrolled: Mantoux test, Xpert MTB/RIF,[22] complete hemogram with ESR, chest x-ray, gastric lavage for AFB, and sputum for

AFB. According to RNTCP standards, tuberculosis was diagnosed by sputum/gastric lavage for AFB by smear or by XpertMTB/RIF. The WHO SAM criteria[23] were used to define severe acute malnutrition. According to the WHO criteria of acute respiratory infection, pneumonia was defined as the radiological evidence of lobar or patchy consolidation or the clinical evidence of pneumonia, severe pneumonia, or very severe pneumonia.[24] Mantoux test: 48–72 hours following intradermal injection of 2TU units of PPD RT 23 in the middle third of the flexor aspect of the left forearm, the test was assessed.

Analysing data: Preformed proformas were used for data collection, and IBM SPSS Statistics 22.0 (Statistical Presentation System Software, IBM, New York) was used for statistical analysis. The mean and standard deviation (SD) of quantitative data were computed. A statistical test such as the Fisher exact test was employed to compare the variations amongst categorical variables. A significant threshold of p-value < 0.05 at 95% confidence range was used to interpret the data.

RESULTS



Flow chart showing the enrolled cases

A total of 29 children, whose male to female ratio was 0.9:1, and whose mean age was 14.29±9.63 months, met the inclusion/exclusion criteria. 10.34% (3/29) of SAM patients with pneumonia had pulmonary tuberculosis.

Age	< 12 months	13
	13-60 months	16
Sex	Male	14
	Female	15
Residence	Urban	7
	Rural	22
Socio economic status	Lower	15
	Upper lower	7
	Lower middle	6

	Upper middle	1
Contact with TB	Present	2
	Absent	27
Immunization	Fully immunized	17
	Partially immunized	7
	Unimmunized	5
Clinical s/o	Fever	28
	Cough	27
Chest x ray	Consolidation	10
	Collapse with consolidation	2
	Perihilar prominance	1
	Normal	16
Table 1: *Baseline characteristics of malnourished children (n=29)*		

Characteristics	**Case 1**	**Case 2**	**Case 3**
Age	19 months	5 months	1.5 months
Sex	Male	Male	Male
Residence	Rural	Urban	Rural
SES	Lower SES	Upper lower SES	Lower SES
Fever	20 days	15 days	12days
Contact TB history	Present	Absent	Present
Immunization	Fully immunized	Not immunized	Not immunized
HIV	Negative	Negative	Negative
Mantoux	15mm induration	14 mm induration	Negative
CXR	Rt mid and lower zone consolidation	B/L hilar prominence with increased density L>R	B/L perihilar haziness f/s/o bronchopneumonia
Smear for AFB	Negative	Negative	Positive
Gene Xpert	Positive	Positive	Positive
Table 2: *Baseline characteristics of confirmed TB cases (n=3)*			

Two of the three cases involved younger than twelve months old, and they were all male. The following were the most common clinical symptoms/signs: fever (100%), respiratory distress (100%), and cough (66.66%). Possession of a contact history (66.66% (2/3) and a positive Mantoux test (66.66% (2/3) were risk factors for TB development. There was a higher incidence of tuberculosis in children without a BCG scar, however it was not statistically significant. While the smear for AFB was positive in only one child, the Xpert MTB/RIF assay was positive in all three cases. In our investigation, the Mantoux test had a 66.6% sensitivity and a 96% specificity for TB diagnosis.

		Family History of Contact with TB		
		Yes	**No**	**Total**
SAM with Pneumonia	TB Positive	**2**	**1**	**3**
	TB Negative	**0**	**26**	**26**
	Total	**2**	**27**	**29**
Table 3: *Comparison of Contact history and Tuberculosis cases (n=3)*				
Fisher exact test p value is 0.007389 i,e <0.05, p value is significant				

		Tuberculosis		
		Positive	**Negative**	
Mantoux Test	Positive	2	1	3
	Negative	1	25	26
		3	26	29
Table 4: Comparison Mantoux positivity and Tuberculosis cases (n=3)				
Fisher exact test p value is 0.02162 which is significant				

DISCUSSION

Malnutrition is known to increase the risk of pneumonia and death in children, and pneumonia is the primary cause of mortality in children worldwide.[25] Gram negative bacteria are the most common cause of pneumonia in children with severe malnutrition, although other bacterial pathogens that cause pneumonia in children who eat well are different.[8] Although there is little information, mycobacterium tuberculosis is also thought to play a significant role in pneumonia among children who are extremely malnourished.[8,14] There are numerous reasons why tuberculosis in children with SAM goes undiagnosed. Some of the more significant ones are the disease's paucibacillary nature, the challenge of obtaining high-quality specimens, the rise in extrapulmonary illness, and the absence of a uniform case definition.

Prevalance

The frequency of tuberculosis (TB) among SAM children who had pneumonia was 10.3% in our study, which was in line with other findings from studies.[12,10,26] Nonetheless, a research by Veeraraja B et al found that 22% of SAM children had PTB, regardless of presentation. Younger age groups are generally affected more frequently, especially infancy. Reduced monocyte recruitment at the infection site, decreased microbial death, less effective major antigen presentation cells (APC), and poor naïve T cell response are likely the causes of the higher number of infections during infancy.[27,28] The three TB-affected children in our study were all male and from low-socioeconomic backgrounds. The most likely causes are that lower SES households tend to have more children, live in congested locations more often, practice poor hygiene, have a higher percentage of illiteracy, are unemployed, and seek medical attention less frequently.[29]

Clinical Features

All 3 individuals showed respiratory discomfort and a protracted fever lasting more than twelve days. Only two of the three individuals had a cough, and all three had bilateral crepitations and ronchi. Their chest x-ray revealed consolidation features that were comparable to those found in Chisti M. J. et al.[30]

Risk Factors

In our investigation, a positive Mantoux test result and a family history of tuberculosis contact were important risk factors. There was a higher incidence of tuberculosis in children without a BCG scar, although it was not statistically significant. Comparable results were observed.[10,30]

Smear vs Xpert MTB/RIF

The gastric lavage of all 29 children was sent for Xpert MTB/RIF as well as smear. Only one child with a smear and three with Xpert MTB/RIF had AFB identified. Chisti MJ et al.[12] noted similar findings.

Our study's limitations were a smaller sample size and the absence of the gold standard TB test, which is the culture of M. tuberculi.

In conclusion, children who have pneumonia and severe acute malnutrition should be evaluated for pulmonary tuberculosis. When it came to isolating TB bacilli, Xpert MTB/RIF was found to be more effective than smear for AFB.

CONCLUSION

In our region, severe acute malnutrition is a major issue; in 2015, 152 cases of SAM were hospitalised to our KIMS Hubballi, NRC. It contributes significantly to both morbidity and mortality. Comparably, pulmonary tuberculosis (TB) is a serious issue, particularly in children under five.

Together, SAM and TB create a vicious cycle in kids, especially those under five. Pulmonary TB diagnosis in SAM is challenging for a number of reasons, including the disease's paucibacillary

character the difficulty of obtaining high-quality specimens, the rise of extrapulmonary illness, and the absence of a defined case definition.
In our study, we employed CB NAT, a diagnostic technique that the WHO now recommends be utilized as the first line of inquiry for diagnosing pulmonary tuberculosis. In the diagnosis of paediatric TB cases, it was found to be more accurate than smear for AFB.

Salient Findings of Our Study

10.34% (3/29) of severely acutely malnourished children with pneumonia had pulmonary tuberculosis.
TB was more common in age group < 12 months with 3 all being males.
Though there was no statistical significance, increased incidence of TB was observed in those children in whom BCG scar was absent.
The significant risk factors for development of TB in SAM with pneumonia noticed in our study were,

A) History of contact with open TB cases
B) Mantoux positivity

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