Original Article

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Prevalence of Tuberculosis in Severe Acute Malnutrition: A Prospective Observational Study

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Abstract

Introduction: Tuberculosis (TB) and malnutrition are important causes of morbidity and mortality in children in the developing world. This study was done to determine the prevalence of tuberculosis in severe acute malnutrition (SAM) cases and to observe different presentations of SAM.

Method: This prospective observational study was carried out in the Department of Paediatrics and Adolescent Medicine at a tertiary care center in Nepal for a duration of one year from December 2018 to November 2019. All cases of SAM meeting the inclusion criteria were evaluated with Mantoux test, chest X-ray, gastric aspirate / sputum analysis and gene-Xpert for diagnosis of TB. Other relevant investigations for diagnosis of TB were also sent as per the clinical scenario. Data were entered and analyzed using Microsoft excel. Descriptive statistics was used for analysis of data.

Results: Total 107 SAM cases were analyzed. The hospital prevalence of wasting and severe wasting was 11.98% and 0.73% respectively. The prevalence of TB in SAM was 4.67%, commonest being pulmonary TB (60%). Among TB cases, 40% were without any systemic complaints. Only 19.6% cases presented with nutritional complaint.

Conclusions: This study found that a significant percentage of cases with SAM had TB and hence adds on the importance of screening for TB (Pulmonary TB) in every case of SAM, irrespective of symptoms.

Introduction

Tuberculosis (TB) and malnutrition are important causes of morbidity and mortality in children in the developing world.[1,2] The available literature suggests that the rate of infections are higher in malnourished children compared to well-nourished children.[3] In 2015, approximately one million children developed TB out of which 170,000 died.[2] Similarly, an estimated 50 million children suffered from severe wasting worldwide resulting in about one million deaths annually which occur mostly in Sub- Saharan Africa and Asia.[4,5]

Malnutrition and tuberculosis together go in a vicious cycle.[6,7] Severe malnutrition leads to an immunodeficiency state known as NAIDs (Nutritionally Acquired Immune

Deficiency).[8] Malnutrition mainly affects cell mediated immunity (CMI) which is the principal host defense against tuberculosis.[9] TB ranks as the second leading cause of death from infectious disease worldwide, after Human Immunodeficiency Virus (HIV) infection.[10] Children with SAM and TB are 40% more likely to die than children with SAM and without TB.[11] Further, children with SAM rarely come to health care settings with complaint of under nutrition, rather they present for some other illnesses, signifying unawareness regarding malnutrition among parents. This leads to the harboring of disease in uncomplicated SAM cases for long duration and presenting to hospital with complications increasing morbidity and mortality.

The United Nations had adopted Sustainable Development Goals (SDGs) in 2015 which aimed to end the global TB epidemic by 2030.[12] Globally, TB control program has given low priority to childhood TB.[13] Despite the strong epidemiological association between malnutrition and TB infection, the burden of TB among severely malnourished children is not well defined. Most of the studies pertaining to this are retrospective. So this study was done with the aim to determine the prevalence of TB in SAM cases and to observe various presentations of SAM.

Methods

This study was carried out in the Department of Paediatrics and Adolescent Medicine, BPKIHS, Dharan, Nepal for a period of one year from December 2018 to November 2019 after obtaining ethical approval from the Institutional Review Committee (IRC). All cases meeting the definition of SAM according to WHO 2013 updated guidelines were included in the study.[14] World Health Organization (WHO) has defined SAM as a child aged between six to 59 months who has any one of the following: 1. Weight for height / length < - 3 z score 2. Mid Upper Arm Circumference (MUAC) < 11.5 cm 3. Bilateral pitting edema of nutritional origin.[14] Parents not giving consent and patients who died / left hospital before work up of TB was complete were excluded. All children in the age group six to 59 months were evaluated with detail anthropometry (weight, height / length and MUAC). Weight was measured to the least count of 10 gram and height / length and MUAC was measured to the least count of 1 mm following standard methods.

Nutritional edema was determined by pressing on the dorsum of foot for 10 seconds. These anthropometric values were further interpreted for weight for height / length as per WHO growth chart. All cases meeting the inclusion criteria were evaluated for TB with Mantoux test, sputum / gastric aspirate smear and gene-Xpert, chest X-ray. Other tests to diagnose TB were sent as per the decision of treating physician based on clinical scenario like CSF analysis, CT / MRI, FNAC, fluid Adenosine deaminase (ADA). Mantoux test was done using 1 U of purified protein derivative (PPD) with an insulin syringe. PPD was injected intradermally on the ventral surface of forearm. The reading was done at 48 hours and induration greater than five mm was considered positive. If reading at 48 hours was negative, then reading was repeated at 72 hours. Two early morning samples of sputum / gastric aspirate taken 24 hours apart were sent for microscopic examination for Acid Fast Bacillus (AFB). Gene-Xpert was also performed from the sample. Sputum production was induced by nebulization with hypertonic saline (3% NaCl) for 15 minutes. Gastric aspiration was done after an overnight fasting of at least four hours. Chest x-ray was done and when required opinion from radiologist experienced in reading paediatric x-ray was taken.

Values of ADA > 60 IU / L for pleural fluid and > 10 IU / l for CSF was considered positive.[15] Cases were managed as per the WHO protocol for management of SAM[14] and other clinical condition were managed as per hospital protocol. Diagnosis of TB was categorized as bacteriologically confirmed if acid fast bacillus (AFB) was demonstrated or gene-Xpert was positive and clinically diagnosed based on overall clinical scenario, supportive investigations and response to standard treatment. Data was entered and analyzed using Microsoft excel. Descriptive statistics was used for representation of data.

Results

Total of 14,756 (Male:7976, female: 6780) children aged six to 59 months were evaluated with detailed anthropometry. Out of these 1768 had acute malnutrition (Wasting): 1659 (Male:487, Female:390) had moderate acute malnutrition (MAM) and 109 (M:67, F:42) had SAM, showing the hospital prevalence of MAM and SAM to be 11.98% and 0.73% respectively. Two cases of SAM died before TB work up and hence were excluded from the study. Finally, 107 samples were available for further analysis. Male to female ratio among 107 sample was 1.55. The median age was 22 months (IQR: 13 - 37 months). Average MUAC was 11.44 cm. Moderate and severe stunting was present in 19% and 25% of SAM cases respectively. Total five cases of tuberculosis were diagnosed, the prevalence being 4.67%. The characteristic of cases with TB has been described in table 1. Pulmonary TB was present in 60% cases. Among TB cases, 40% were bacteriologically confirmed. Male children comprised 80% of the TB cases. Miliary TB was diagnosed in one child with known case of HIV. Two cases (40% of TB cases) had no any pulmonary complaint but on work up were diagnosed to have pulmonary TB; out of these two cases, one case (Fourteen months female child) had contact history of TB.

Table 1. Characteristics of children with tuberculosis

Age (Months)	Sex	Type	Diagnosis	Presenting complaint
24	Male	Pulmonary	Clinical	Fever and cough
14	Female	Pulmonary	Bacteriological	Not gaining weight
49	Male	Pulmonary	Clinical	Not gaining weight
59	Male	Disseminated (pulmonary+ abdominal)	Clinical	Fever, cough and vomiting
24	Male	Miliary	Bacteriological	Fever and cough

Only 19.6% of cases presented with complaints related to nutrition and physical growth like not gaining weight. 80.4% presented with other complaints and not nutritional (34.6%: respiratory infection, 10.3%: gastroenteritis, 9.3%: neurological complaint, 6.5%: each for renal and cardiovascular related, 2.8%: blood related like anemia and 10.3%: other complaints). No mortality was recorded among enrolled cases during the hospital stay.

Discussion

We found that 11.98% and 0.73% of children between six to 59 months had MAM and SAM respectively. Out of 107 SAM cases 4.67% had TB, pulmonary TB being the most common (60%). Two cases (40% of TB cases) had no any pulmonary complaint but on work up were diagnosed to have pulmonary TB and over 80% of SAM cases presented with other complaints but not nutritional. This shows that under nutrition is still prevalent in low income countries and TB is quite prevalent in severely malnourished children. These children are harboring TB without obvious signs and symptoms except for under nutrition. Further, parents are not considering under nutrition as a serious problem and present to hospital for other complaints but not nutritional.

In a retrospective study done by Munthali T et al in Zambia over a period of four years among 9540 under-five children with SAM, the prevalence of TB was 1.58% of which 25% were bacteriologically confirmed cases.[11] Our study was prospective study with relatively small sample size but the findings were similar: prevalence of TB being 4.67% of which 40% were bacteriologically confirmed. Similarly, in a retrospective cohort study involving 269 (Age: 0-6 years) severely malnourished children by Payghan BS et al in India, the prevalence of pulmonary tuberculosis was 5.6% and out of the TB cases 86.6% were - females and only 5.2% of total TB cases were bacteriologically confirmed.[16] The prevalence of TB was similar to our study. Male preponderance for TB in our study could be because of increased proportion of male in our study compared to the above study where female was the predominant gender. The difference in bacteriologically confirmed cases could be because of difference in obtaining sample which has not been explained in the compared study and because of small size of TB cases in both study. In an observational pilot study conducted in a tertiary hospital at Delhi, India by Kumar P et al, the prevalence of tuberculosis among 76 children with SAM was 9.3% with pulmonary tuberculosis (57%) being the predominant one, which is similar to our study.[17] Similarly, a review by Chisti MJ et al, quoted three studies from Gambia, Ethiopia and Thailand showing the overall prevalence of bacteriologically confirmed TB in children with SAM to be 21%.[18] The low prevalence of both TB and bacteriologically confirmed TB in our study could be because of the difference in type of sample (Lung aspirate and induced sputum in compared study vs gastric aspirate and induced sputum in ours).

In a prospective study done by Jena P et al among 190 SAM patients, fever (71%), vomiting (51%), loose stool (46.8%), cough (46.3%) were the common presenting complaints signifying respiratory and gastroenteritis as common presenting complaint similar to our study.[19] The same study found that poor appetite / weight loss was the presenting complaint only in 31% of SAM cases similar to our study (19.6%). In a retrospective study done by Derseh B et al[20] among 413 children, common comorbidities reported were pneumonia (54.8%), gastroenteritis (41.8%) and in a descriptive study by Baskaran VM et al[21] among 200 SAM cases, the common comorbidities were acute gastroenteritis (57.5%), pneumonia (44.5%) and anemia (27%). These findings were similar to our study. Our study had various limitations like relatively small sample size, bronchoalveolar lavage was not performed which is better for diagnosing TB than gastric aspirate and other modalities to diagnose TB like mycobacterium growth indicator tube (MGIT), culture were not performed because of unavailability.

Conclusions

TB is common among children with SAM. These children might not have typical manifestations of TB except for under nutrition. So screening for TB should be made compulsory in every case of SAM irrespective of symptoms. Further, children usually don't come to hospital for under nutrition rather they remain in the community till they have other comorbidity, so it would be prudent to search for TB among cases of SAM at community level as well. Screening for TB among cases of SAM especially becomes important in this COVID world where malnutrition is on the rise.

References

1. Jenkins HE. Global burden of childhood tuberculosis. Pneumonia. 2016;8(1):24. DOI: 10.1186/s41479-016-0018-6

2. WHO. Global tuberculosis report. Geneva: World Health Organisation Press; 2016.

3. Sunguya BF, Koola JI, Atkinson S. Infection associated with severe malnutrition among hospitalised children in East Africa. Tanzan Health Res Bull. 2006;8(3). DOI:10.4314/thrb.v8i3.45120.

4. Ahmed T, Hossain M, Sanin KI. Global burden of maternal and child undernutrition and micronutrient deficiencies. Ann Nutr Metab. 2012;61(Suppl 1):8–17. DOI: https://doi.org/10.1159/000345165

5. Levels and trends in child malnutrition: UNICEF/WHO/ World-Bank joint child malnutrition estimates—Key findings of the 2016 edition. (http://www.who.int/nutgrowthdb/ jme_brochure2016.pdf).

6. WHO. Guideline: nutritional care and support for patients with tuberculosis. Geneva: World Health Organisation; 2013.

7. Nelson LJ, Wells CD. Global epidemiology of childhood tuberculosis. Int J Tuberc Lung Dis. 2004;8(5):636–47. PMID: 15137548

8. Sunguya B. Effects of infections on severely malnourished children in Kilifi-Mombasa and Dar es Salaam: a comparative study. DMSJ. 2006;14(1):27-35. DOI: 10.4314/dmsj.v14i1.51189.

9. Berkowitz FE. Bacteremia in hospitalized black South African children, a one year study emphasizing nosocomial bacteremia and bacteremia in severely malnourished children. Am J Dis Child. 1984; 138:551-556. PMID: 6372439

10. Annual status report, Tuberculosis India 2012 Revised National TUBERCULOSIS Control Programme, pp 51.

11. Munthali T, Chabala C, Chama E, Mugode R, Kapata N, Musonda P, et al. Tuberculosis caseload in children with severe acute malnutrition related with high hospital based mortality in Lusaka, Zambia. BMC research notes. 2017 Dec;10(1):1-6. DOI: 10.1186/s13104-017-2529-5.

12. Uprety S, Lamichhane B. Global Attention on Tuberculosis: Summary of Global TB Report 2016; Health Research and Social Development Forum (HERD);

13. Quynh Nga DT. Risk factors for tuberculosis infection among child contacts of pulmonary tuberculosis cases [Dissertation], (Oslo), University of Oslo, May 2009.

14. Guidelines: Updates on the Management of Severe Acute Malnutrition in Infants and Children, WHO 2013.

15. Kumar A, Gupta D, Nagaraja SB, Singh V, Sethi GR, Prasad J. Updated National Guideline for Pediatric Tuberculosis in India, 2012. Indian Pediatr 2013;50: 301-306. DOI: https://doi.org/10.1007/s13312-013-0085-1

16. Payghan BS, Kadan SS, Kotresh M. The Prevalence of Pulmonary Tuberculosis among Severely Acute Malnourished Children—A Cross Sectional Study. IJSRP. 2013;3(7):1-5.

17. Kumar P, Mishra K, Singh P, Rai K. Should we screen children with severe acute malnutrition for celiac disease. Indian Pediatr. 2012 Apr 1;49(4):330-1. PMID: 22565083.

18. Chisti MJ, Ahmed T, Pietroni MA, Faruque AS, Ashraf H, Bardhan PK, et al. Pulmonary tuberculosis in severely-malnourished or HIV-infected children with pneumonia: a review. J Health Popul Nutr. 2013 Sep;31(3):308. DOI: 10.3329/jhpn.v31i3.16516 .

19. Jena P, Rath S, Nayak MK, Satapathy D, Das P. Clinical manifestations, comorbidities and causative organisms of infections in children aged 6 months to 59 months with Severe Acute Malnutrition. JMSCR. 2018;6:1114-20. DOI:10.18535/jmscr/v6i10.185

20. Derseh B, Mruts K, Demie T, Gebremariam T. Co-morbidity, treatment outcomes and factors affecting the recovery rate of under-five children with severe acute malnutrition admitted in selected hospitals from Ethiopia: retrospective follow up study. Nutrition Journal BMC. 2018 Dec 1;17(1):116. DOI: https://doi.org/10.1186/s12937-018-0423-1.

21. Baskaran VM, Naaraayan SA, Priyadharishini D. Comorbidities in children hospitalized with severe acute malnutrition. IJCH. 2018:530-2. DOI: https://doi.org/10.32677/IJCH.2018.v05.i08.005