Prevalence of Tuberculosis among Children with Severe Acute Malnutrition at Ola During Children's Hospital in Freetown Sierra Leone

Abstract

Prevalence of Tuberculosis among Children with Severe Acute Malnutrition at Ola during Children's Hospital in Freetown Sierra Leone. Worldwide, pediatric tuberculosis account for about 1million cases, annually, accounting for 10-15% of all tuberculosis; with more than 100,000 estimated mortality annually, it is also one of the 10 most common causes of childhood mortality. Aim of this study was to determine the prevalence of tuberculosis among children with severe acute malnutrition at Ola During Children's Hospital in Freetown Sierra Leone. It was a descriptive cross-sectional study, carried out at the therapeutic feeding center (TFC) of Ola During Children's Hospital in 2018. An opportunistic sampling method in which every next patient whose mother gave consent was recruited until the number 74 was reached. Patients who met the World Health Organisation (WHO) criteria for diagnosis of severe acute malnutrition were admitted into the TFC and consecutively selected and interviewed using a structured questionnaire after obtaining written informed consent, from their mothers or caregivers. All the mothers approached during the study period consented for the study. Diagnosis of tuberculosis was both clinically and by laboratory investigations, 74 children whose mothers/caregivers consented for the study were recruited. Data was entered into an excel spread sheet and analyzed using Epi info version 7. There were 74 children with a median age of 11months ± 9.9SD. Forty (54.1%) Males and 34(45.9%) Females, with a M:F ratio of 1.18:1. Prevalence of tuberculosis was 20%. Diagnosis of Tuberculosis was based on clinical findings of extreme weight loss or failure to gain

weight, Chest x-ray findings of perihilar infiltrates. Gene Xpert MTB RIF results were all negative 0(0%). Most of the mothers 59 (79.7%) were aged between 20-29years, 45(60.9%) of them were petty traders, while 15(20.3%) had no formal education. The chi square was used to determine the statistical difference, there was no statistically significant difference between gender and TB, P= 0.3415, there is a statistically significant difference between no formal education and occurrence of tuberculosis in their children P= 0.0467.

CONCLUSIONS/RECOMMENDATIONS: Prevalence of Tuberculosis is still high among children with severe acute malnutrition. Gene Xpert MTB RIF was unable to make a bacteriological confirmation. There are difficulties with making bacteriological confirmation of tuberculosis in resource poor settings. Guidelines requiring mainly clinical parameters need to be developed for use in resource limited countries.

KEY WORDS: Prevalence, Tuberculosis, Severe acute malnutrition. Paediatrics.

1. INTRODUCTION

Ten to twenty percent of deaths in children under the age of 15years in tuberculosis (TB) endemic countries are alleged to be associated with tuberculosis. [1,2] The World health Organisation reported a total of 140,000 mortalities in Paediatric age in their 2015 global TB report from vital registration data. [3] In 2012, TB accounted for 2% of total deaths in children. [4] In Southeast Asia and Sub-Saharan Africa tuberculosis in children accounted for less than 4% among the notified new tuberculosis cases[4] Tuberculosis continues to be a major cause of morbidity and mortality in children

globally especially in those from resource limited settings.[5] Globally there are about 9million new TB cases each year and 11% of these occur in Paediatric patients.[5] Children living in areas where TB is endemic are also plagued with malnutrition and it accounts for 2.2million deaths in children less than 5years all over the world.[6] Malnutrition and poor infection control have blossomed in an environment of poverty, overcrowding, food insecurity, human immunodeficiency Virus [7] Malnutrition is deadly when coexisting with tuberculosis, social and economic factors that cause malnutrition to thrive such as poverty, illiteracy, ignorance, overcrowding and poor sanitation also contribute to the prevalence of tuberculosis.[8] Hence we tried to look at the prevalence of tuberculosis among children with severe acute malnutrition at Ola During Children's hospital in Freetown and some of its socioeconomic factors, since there has been no known study in this subject matter in Freetown.

2. Materials and Methods

a. Study Area

Therapeutic feeding center (TFC) of the Ola During children's hospital in Freetown, Sierra Leone. A place where children with severe acute malnutrition are admitted and managed. Ola During children's hospital is the only Paediatric tertiary hospital in Freetown Sierra Leone and as such receives referrals from all across the country.

b. Study Population

Under-five children admitted in to TFC during the period of the study whose parents or care giver consented for the study were recruited. The children were admitted in to TFC, if they met the WHO criteria for severe acute malnutrition. Severe acute malnutrition criteria was met as defined by WHO, if there was very low weight for height (Below -3zscores of the median

NCHS/WHO growth standards), or visible severe wasting, or presence of nutritional oedema. [9]

c. Selection and Inclusion criteria

i. Inclusion criteria

All children on admission at TFC ward during the period of the study whose parent or caregiver consented for the study.

2.3.2 Exclusion criteria

All patients on admission in TFC during the period of the study whose parents or caregivers refused to consent for the study.

d. Sampling Method

This was a descriptive cross-sectional study. A non-probability sampling method (opportunistic sampling) was used, in which every next child admitted into TFC, whose parents and caregivers consented for the study was recruited into the study until we got 74 subjects. All parents or caregivers whose children were on admission at TFC during the period of the study, who were approached by the researcher consented for the study. The study was collected over a six months period in 2018. A structured questionnaire was used to collect data on parents or caregiver's biodata, child's biodata, clinical and laboratory results. All children were to have a chest X-ray and a gene X-pert MTB -RIF test done for the diagnosis of tuberculosis. Laboratory results were obtained from patient's case note by the researcher. But often

times the diagnosis of TB was made clinically as most times the chest X-ray machine was not working or the gene X-pert machine was not functioning. The diagnosis was most times based on failure of the child to gain weight despite appropriate feeding. On one occasion we had history of contact with mother who was on treatment for tuberculosis, as often times in paediatric, patients it is difficult to find history of contact. Rarely diagnosis was based on therapeutic trial on those with chronic cough and failure to gain weight despite appropriate feeding.

Data was entered into Microsoft excel spread sheet and analyzed using Epi-info version 7

3. Results and Discussions

There were 74subjects, 40(54.05%) Males and 34(45.95%) females giving a M:F ratio of 1.17:1. Their median age was 11months SD ± 9.9. 48(64.9%) were aged between 12-59months. The prevalence of tuberculosis was high 20(27%). Tuberculosis was highest in the age group 12-59months 14(70.0%) Diagnosis was mostly clinical and with chest X-ray 15(20.27%) as all the gene X-pert test done 13(17.57%) came out negative. The chest X-rays showed pulmonary infiltrates and perihilar opacities All 20(27%) of the children with TB had received BCG at birth. 59(79.7%) of the parents/caregivers were aged between 20-29years., they were mostly traders 45(60.9%) while 8(10.45) were unemployed, 15(20.3%) had no formal education. All the patients (100%) got well and were discharged home to the nearest moderate acute malnutrition (MAM) clinic to their home. The chi square was used to test for statistical significance.There was a statistically significant difference between no formal education in

parents/caregivers and occurrence of TB in their children P-value 0.046. There was no significant difference in sex P-value 0.341

Discussions

This study found a 20% prevalence of TB among patients with SAM. This in contrast to the finding of Munthali et al [10] working in Lusaka, Zambia who had a prevalence of 1.58% in Zambia among malnourished children. The number of patients (74) in this study was much smaller than the Zambian study that was reported among 9540, this may have accounted for the difference in the prevalence. [11] Christi et al in Bangladesh who reported a prevalence of 7% among children with SAM and signs of Pneumonia, and the work of Bhat et al in Karnataka, also in India who found a 4% prevalence among children with SAM following the diagnostic algorithm and a 0.3% prevalence among children with SAM who did not follow the diagnostic alogorithm. These three studies had similar values which are lower than what we found in this study. However, ours is comparable to the work of Veeraraja et al [8] in India who found a prevalence of tuberculosis of 22% among children with severe acute malnutrition. There was a 0 % bacteriological confirmation in this study which is also in contrast to the Zambian study that had a 25% bacteriological confirmation among the 151patients with tuberculosis in their study. Although the method of bacteriological confirmation employed in their study was a smear microscopy performed on gastric aspirates. This study used a more sensitive Xpert MTB/ RIF which gave a 0% yield, however, Christi et al [11] in Bangladesh reported that tuberculosis was microbiologically confirmed in 7% (27/396) of the children who provided sputum. Twenty-one was by Xpert MTB/RIF while 10 was by culture and 4 was by both methods. [11] Using more sensitive X pert MTB RIF was also of no additional value among severely malnourished children in Malawi [13] This however shows that there is a low yield of Mycobacterium tuberculosis. The

bacteriological isolation of mycobacterium tuberculosis in children is said to be very difficult due to the pauci bacillary nature of childhood tuberculosis [8] This study found a median of age of 11±9.9months this is in keeping with the finding of other workings with a peak incidence of pulmonary tuberculosis among malnourished children of 1-3years [8,11,14,15] However Veeraraja et al [8] found incidence of pulmonary tuberculosis at a younger age of 6-12months in severely malnourished children. While Munthali et al had a higher median age of 16months. However, they are all among preschool children. Just like other workers [8,14,15] this study did not find any sex predilection. No child in this study had the severe forms of tuberculosis such as disseminated TB and neuro tuberculosis. as they were all vaccinated with BCG. This is not surprising as BCG is known to protect from the very severe forms of tuberculosis such as disseminated TB and neuro tuberculosis [15] 20.27% of the parents in this study had no formal education, 10% were unemployed and 79.7% of them were young adults. These features conform to the description of poverty, illiteracy, ignorance that constitute risk factors for the formation of tuberculosis [6] There was an epileptic functioning of the chest x-ray machine and the Gene Xpert machine this made making a diagnosis of tuberculosis very difficult and making a diagnosis had to be done clinically, following failure of the patients to gain weight despite adequate therapeutic feeding and therapeutic trials. For some other patients a history of contact with a confirmed case was used among other criteria. This is no different from what is obtained in other resource limited countries like India. Bhat et al [12] reported that full current electricity required for the x-ray machine was only available for 3hours during working hours resulting in long waiting hours for patients and as such not all patients could have the X-ray done for their diagnosis. The diagnostic algorithm in their protocol places importance in detecting AFB in the sputum, broncho-alveolar specimen or

gastric lavage but it was difficult to carry out on all patients in their setting. This also made bacteriological confirmation difficult in their setting like we had in this study. All the children in this study recovered and were discharged home to be followed up at the moderate acute malnutrition centers closest to them. similar to the work of Christi et al [11]in Bangladesh where the patients where discharged and followed up for six months in case of tuberculosis. While Bhat et al [12] had patients, who may have died who they were unable to account for in Karma kata.

Conclusion

The prevalence of tuberculosis is high among children with severe acute malnutrition. One interesting thing that was found in this study is the fact that although X pert MTB/ RIF is said to be highly sensitive in diagnosis of mycobacterium tuberculosis there was a zero percent yield with it in this study. T he high technology machines used in more advanced countries were not very helpful in diagnosis of TB in this setting because of its repeated break down and lack of uninterrupted power supply. Clinical guidelines for diagnosis of tuberculosis, which do not require such high technology machines should be developed for resource poor countries. They should be used to compliment this high technology machines.

Limitations

This was a hospital-based study and so needs to be replicated in a rural community. Also, the Xpert MTB /RIF test should be done in a community-based study as it was epileptic in its function during the period of this study and the

results obtained in this study need to be validated in a larger sample in the community.

4. Tables and Figures

Table. 1 Socio-demographic information of children

Age-Groups (months)	Frequency (n = 74)	Percent (%)
1 – 11	26	35.1
12 – 59	48	64.9
Median ±SD	**11.0 ±9.9**	
Gender		
Male	40	54.1
Female	34	45.9

Table 2. Cross-Tabulation of TB with age groups

Age-Groups (months)	TB positive	TB Negative	Chi-square (p-value)
1 – 11	6 (30.0)	20 (37.04)	0.31 (0.5733)**
12 – 59	14 (70.0)	34 (62.96)	
Total	**20 (100.0)**	**54 (100.0)**	

Figure 1.

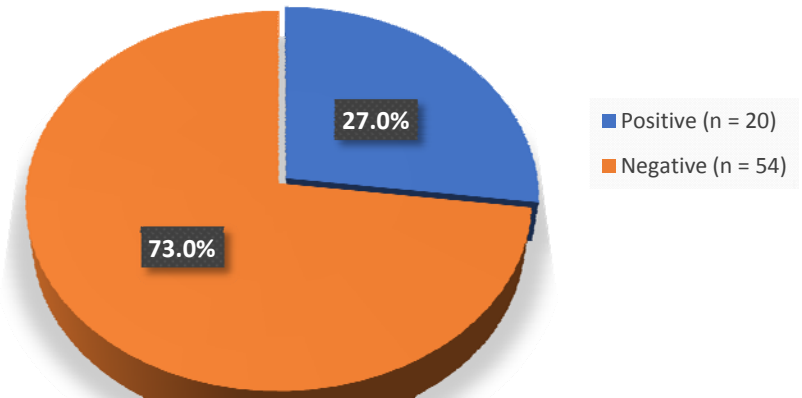

Table 3. Distribution of Nutritional Status of Patients

Nutritional Status Of Patients	Frequency (%)
Marasmus	65 (87.80)
Kwashiokor	9(12.20)
Total	74(100)

Table 4. Chest X-ray and GeneXpert MTB RIF

	CXR (%)	GeneXpert MTB RIF (%)
Test Done	15 (20.27)	13 (17.57)
Not Done	59(79.73)	61 (82.43)
Total	**74 (100.0)**	**74 (100.0)**

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229 **Table 5. Socio-demographic information of parents**

Variables	Frequency (n = 74)	Percent (%)
Age Groups (years)		
20 - 29	59	79.7
30 - 39	11	14.9
≥ 40	4	5.4
Mother's Occupation		
Unemployed	8	10.80
Trader	45	60.80
Student	13	17.60
Teacher	1	1.35
Tailor	1	1.35
Electrician	1	1.35
Hair dressing	3	4.05
Driver	1	1.35
Caterer	1	1.35
Education		
No Formal Education	15	20.27
Primary	5	6.76
Secondary	50	67.57
Tertiary	4	5.4

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231 **Table 6. Cross tabulation of Mother's education and TB Prevalence**

Education	TB Positive	TB Negative	Chi-square (p-value)
No Formal Education	1 (5.0)	14 (25.9)	3.95 (0.0467)*
Primary	2 (10.0)	3 (5.6)	0.45 (0.4987)**
Secondary	15 (75.0)	35 (64.8)	0.85 (0.3559)**

Tertiary	2 (10.0)	2 (3.7)	1.13 (0.2874)**
Total	**20 (100.0)**	**54 (100.0)**	

Table 7. Cross tabulation of Gender and TB among children

Gender	TB Positive	TB Negative	Chi-square (p-value)
Male	9 (45.0)	31 (57.4)	0.90 (0.3415)**
Female	11 (55.0)	23 (42.6)	
Total	**20 (100.0)**	**54 (100.0)**	

**Difference between both groups is not statistically significant (p > 0.05)

Table 8. BCG Vaccination Status of Patients

Vaccine	TB POSITIVE (%)	TB NEGATIVE (%)	TOTAL (%)
BCG	20(27.0)	54(73.0)	74(100)

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Competing Interest There was no competing interest in this study

Consent. Written informed consent was obtained from participants

Ethical Approval. There no ethical Issues in this study, given that it was a descriptive cohort study, WHO exempts it from ethical approval.

References

[1] Marais BJ, Schaaf HS. Childhood tuberculosis an emerging and previously neglected problem. Infect Dis Clin North. Am 2010 :24;727-49.

[2] Winston CA Menzies HJ, Pediatric and Adolescent tuberculosis in United States, 2008-2010. Pediatrics 2012; 130: e1425-32

[3] Global tuberculosis Report Geneva Switzerland: World Health Organization. 2015. In 2012,

[4] Graham SM, Sismanidis C, Menzies HI, Marais BJ, Derjen AK, Black RE. Importance of tuberculosis control to address child survival. Lancet. 2014:383: 1607-08

5] World health Organisation (WHO) Guidance for national tuberculosis programmes on the management of tuberculosis in children. Geneva: World Health Organisation. 2006

6] Black RE, Allen IH, Bhutta ZA et al Maternal and Child Undernutrition: global and regional exposures and health consequences. Lancet. 2008; 371: 243-60

7] Walker VP, Mindin RL.The Vitamin D concentration to Pediatric infections and immune function. Pediatr Res 2009;65: 106R-113R

[8] Veeraraja B, Sathenahalli, Naikey M, Vinod G, Rakesh K, Karan J et al Association of tuberculosis with severe acute Malnutrition.2015;4(68):11865-70

[9] WHO Child Growth Standards and the identification of severe Acute Malnutrition in infants and Children. A Joint Statement by the World Health Organisation and the United Nations Children's Fund, 2009

[10] 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 Res Notes 2017; 10:206

[11] Chisti MJ, Graham SM, Duke T, Ahmed T, Ashraf H, Faruque ASG, et al. A Prospective Study of the Prevalence of Tuberculosis and Bacteraemia in Bangladeshi Children with Severe Malnutrition and Pneumonia Including an Evaluation of Xpert MTB/RIF Assay. PLoS ONE; 2014 9(4): e93776.

[12] Bhat PG, Kumar AMV, Naik B, Satyanarayana S, KG D, Nair SA, et al. (2013) Intensified Tuberculosis Case Finding among Malnourished Children in Nutritional Rehabilitation Centres of Karnataka, India: Missed Opportunities. PLoS ONE. 2013 8(12): e84255. https://doi.org/10.1371/journal.pone.0084255

[13] LaCourse SM, Chester FM, Preidis G, McCrary LM, Arscott-Mills T ,Maliwichi M, Use of Xpert for the diagnosis of pulmonary tuberculosis in severely malnourished hospitalized Malawian children. Pediatr Infect Dis J 2014;33(11):1200-02

[14] Singh M, Mynak ML, Kumar L, Mathew L, Jindal SK. Prevalence and Risk factors for transmission of infection among children in household contact with adults having pulmonary TB Arch Dis Child 2005;90:624-28

[15] Dahiwale N, Rao S, Singh I, Rawat AK. Significance of Family Survey of Index case for Detection of Tuberculosis. Indian Pediatr 2011; 48:387-89