Clinical pattern of tuberculosis in malnourished children in Kassala hospitals, Sudan: A hospital based study

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Abstract

Objective: To study the clinical pattern of tuberculosis in malnourished children below five years of age admitted as diagnosed cases of tuberculosis.

Materials and Methods: This is a cross sectional hospital based study done in Kassala Teaching Hospital and Kwaiti Paediatric Hospital during the period from January 2010 to December 2011. Data was collected through a questionnaire detailing full socio-demographic, nutritional and medical history. Examination, anthropometric measurements and investigations of the children included in the study.

Results: The mean (SD) age was 28.8 months in 84 children of almost equal gender distribution. Almost all were of low socio-economic class. 51(60.7%) were BCG vaccinated; the mean duration of symptoms was 46 days. The commonest symptoms were loss of weight in all patients, fever in 95.5% and cough in 79.8% of the study group. The cough had a significant statistical relation to the pulmonary disease (P>0.042). 82.1% of the children had a weight /height percentage of less than or equal to 70%. Chest signs were seen in 66 (87.6%) patients. Pulmonary disease was diagnosed in 72.6%, miliary in 8(9.5%) and meningitic TB in 4 (4.8%) of the children in the study group. The WHO score system was positive of ≥7 in 65 (78.6%) of the study group.

Conclusion and recommendation: The clinical diagnostic scores are sensitive but they use non-specific parameters. Screening of children with adult TB contact and sufficient rehabilitation of malnourished children before labelling them as tuberculous is recommended.

Key words: Tuberculosis, Malnutrition, Marasmus, Kwashiorkor

Abbreviations: TB=tuberculosis; WHO=World health organization, TSC=tuberculosis score chart, IUTLD=international union against tuberculosis and lung disease, BCG=Bacille- Calmette- Guerin vaccination, MOH=ministry of Health

Introduction

One third of the world's population (about 1.7 billion people) are thought to be infected with TB with 30 million active cases and 8 to 10 million new cases annually. 3 million people die of TB annually and TB probably causes about 6% of all deaths world wide(1,2).

In 1993 the WHO declared TB as a global emergency. The case fatality rate exceeded 50% in some African Countries with high HIV rate and 8% of incident TB cases have HIV infection(3,4).

95% of the cases and 98% of tuberculosis deaths occur in developing countries where about 0.2% to 1% of the population are infectious for TB. The estimated incidence in Africa is 272 cases per 100,000 population(5). In children it is estimated that 1.3 million children are infected annually and the annual deaths due to TB in children reaches 450,000 world wide(6). TB may be responsible for about 10% of hospital admissions of children in the developing countries and about 10% of hospital deaths(7). Tuberculosis in Sudan is one of the most important public health problems as it is a leading cause of health service utilization of ambulatory services (the fourth), a most frequent cause for hospital admissions and is the fourth commonest cause of hospital deaths constituting about 16% of all hospital deaths(8). Figures may change yearly but still they are high. The best indicator of the problem of tuberculosis in Sudan is the average Annual Risk of Infection (ARI) which is the proportion of population that is likely to be infected over a period of one year. This is estimated in Sudan to be 1.8% putting Sudan among countries of high prevalence for TB in the East Mediterranean region. The incidence of all forms of TB is therefore about 180 per 100,000 with a detection rate of only 43.6% in the beginning of this century. Prevalence of infection is between 35% and 40% with death rate of about 60 per 100,000 cases(8,9,10.11).

There is a strong link between malnutrition and increased susceptibility and or severity of tuberculosis. The nutrients that have been implicated in the immune response to tubercle bacilli include protein, zinc and vitamin D. Others also are vitamin A, vitamin C and iron Malnutrition exerts many detrimental effects on many aspects of host immune response against mycobacterial infection(12,13,14).

Studies were carried out to show the very important relationship of different nutritional elements and the depletion, especially significant changes in the cell mediated type of immunity against tuberculosis and in cytokine production in human and animal models. These include the studies of Barnes et al., Mcmurray et al Chan et al and other researchers(12,15,16,17,18,19).

Studies in South Africa indicated that Tuberculosis can be found in 12 -30% of malnourished children and as a bidirectional relationship 66% of tuberculous children fail to gain weight or they show weight loss before tuberculosis become evident in them(20). There is good evidence that malnutrition increases the frequency of occurrence and exacerbates the clinical manifestations of TB. Our knowledge on the exact mechanism is limited. In the study of Mabebo et al. on clinical and radiological features of pulmonary TB in 329 adults of whom 78% were malnourished about 20% of severely malnourished patients presented more often with dyspnea, diarrhea, and night sweats and less often with hemoptysis and cavitation(21). In other studies malnutrition was significantly associated with smaller size of positive Mantoux test and with increased mortality(22,23).

Natural history of tuberculosis in children included three stages: exposure, infection and disease. Studies showed that without specific treatment, infection will proceed to disease in 43% of infants, in 24% of under five years and in 16% in children between 11 to 15 years. History of contact is usually found in up to 50% of cases and the disease is extrapulmonary in 25 to 35 % of cases in children including lymphadenitis, skeletal TB, abdominal TB and the less common serious forms of disseminated or miliary and meningitic TB and also other rarer types (24,25).

The objective of this study was to look at the clinical pattern of tuberculosis diagnosed in malnourished children attending Kassala hospitals in Eastern Sudan as an area of high prevalence of tuberculosis in Sudan.

Materials and Methods

Study design: This was a cross sectional hospital based study.

Study area: Kassala State in Kassala Teaching and Kuwaiti Pediatric hospitals and referred patients from peripheral refugee camps and rural hospitals.

Study Period: January 2010 to December 2011
Sample size: 84 patients

Inclusion criteria: All newly diagnosed children as cases of tuberculosis of age less than 60 months and were classified as malnutrition or underweight according to the clinical Welcome -Trust classification

Exclusion criteria: Neonates, age more than 60 months, parental or care giver refusal to enrol in the study, concomitant chronic medical disease.

Research tools and techniques
Ethical consideration: Ethical approval from the hospital authority was requested and obtained prior to the start of the study (dated on 15.11.2009).

A questionnaire was designed to contain full information about the nutritional social and medical history of the patient. Also examination finding,s anthropometric measurements and relevant investigation findings records for every patient were made. Anthropometric measurements done were the weight, height or length, and the head and mid-

upper arm circumference and these were plotted against the suitable centile charts and the results were recorded. Weight of every child unclothed was recorded in grams. Investigations included the Mantoux testing, radiology; chest x-ray, E.S.R .and hemoglobin, BCG test, ZN stain for gastric aspirate and some further investigations as relevant.

Informed consent was obtained for each patient from parents or guardian.

Direct interview for each patient was performed by the author to fill in the questionnaires. Data entry and statistics: data obtained was entered in a computer program (SPSS) and appropriate tests for significance levels were used.

Results

Socio-demographic characters: Eighty four tuberculous malnourished children were enrolled in the study. Ages of the study group ranged from 5 to 59 months the average with average age of 28.8 months of these children 13(15.5%) were less than one year. There were 53 children (63.1%) belonging to the original Eastern Sudan ethnic groups and 50 children (59.5%) living inside the city. Male to female ratio was almost equal (43:41). Almost all the group is of low socioeconomic background.

The most common presenting symptom were loss of weight (100%), anorexia (92.8%), mood changes and fever (90.5%) cough (79.8%) and sweating (61.9%) as shown in Figure 1. Fever most commonly was of continuous pattern.

History of close family member contact was detected in 25% of cases (Table 1). The mean duration of symptoms was 46 days with ranges from 10 days up to 6 months. Pulmonary TB was statistically significantly associated with presence of cough (p value of 0.042) but no significant association between pulmonary disease and fever was detected (p value > 0.6).

Difficult breathing at rest occurred in 23 (27.4%) of the children and the weight loss was severe in 50 (59.5%) of patients. Rarer symptoms were back deformity in 5 children and convulsions in six children. Convulsions have statistically significant correlation with severe types of TB (miliary or meningitic types) with p value of > 0.001 (Table 2).

Seventeen of the children were admitted twice or more to the hospital previously. There were 51 children who were BCG vaccinated but about half of the vaccinated children did not show a BCG scar. History of measles was not statistically associated with the presence of pulmonary disease nor with the presence of severe TB types nor with the type of malnutrition or Mantoux skin test size. In this study no significant correlation was found between previous BCG vaccination and presence of severe types of TB.

Clinical examination: Almost all of the children in the study group (98.8%) have weights that are below the third centiles for age and gender and 51(60.7%) have height or length below the third centile. There were 32 children (38.1%) of less than 60% and further 37 children (44%) of less than 70% regarding the Weight for height percent (severe wasting). The Welcome classification of malnutrition has no significant association statistically with the severe TB forms but the weight /height classification has a significant relation (p > 0.05).(Table 3).

Signs detected in the study group include severe pallor in 25 children (29.8%), edema in 22 (26.2%). Signs of vitamin A deficiency were in one third of the group, hepatomegaly alone in 38 patients (45.2%) and hepatosplenomegaly in 16 patients (19%). 39 children showed lymphadenopathy mostly of small size. Figure 2 shows the Welcome classification of malnutrition in the study group. Sixty-six children (77.4%) in the study group showed chest signs as demonstrated in Figure 3. The Mantoux test size was significantly related to the Welcome's classification of malnutrition (p> 0.001). The chest x-ray showed positive features in 72 patients (85.7%). The WHO clinical score chart was positive of ≥ in 66 patients (78.6%) and had statistical significance when compared with chest x-ray features and the duration of symptoms. The pattern of tuberculous disease seen in this series was pulmonary alone in 48 patients (57.1%), pulmonary with other extrapulmonary features in 13 patients (15.5%) miliary or disseminated in 8 patients (9.5%) nodal only in 6 patients (7.1%) meningitic in 4 patients (4.8%) 2 patients with Pott,s disease and 2 patients with other osteal disease. One patient had suspected abdominal TB. The pattern of tuberculous disease in this group is shown in Figure 4.

Figure 1: The main presenting symptoms in the study group (n = 84)

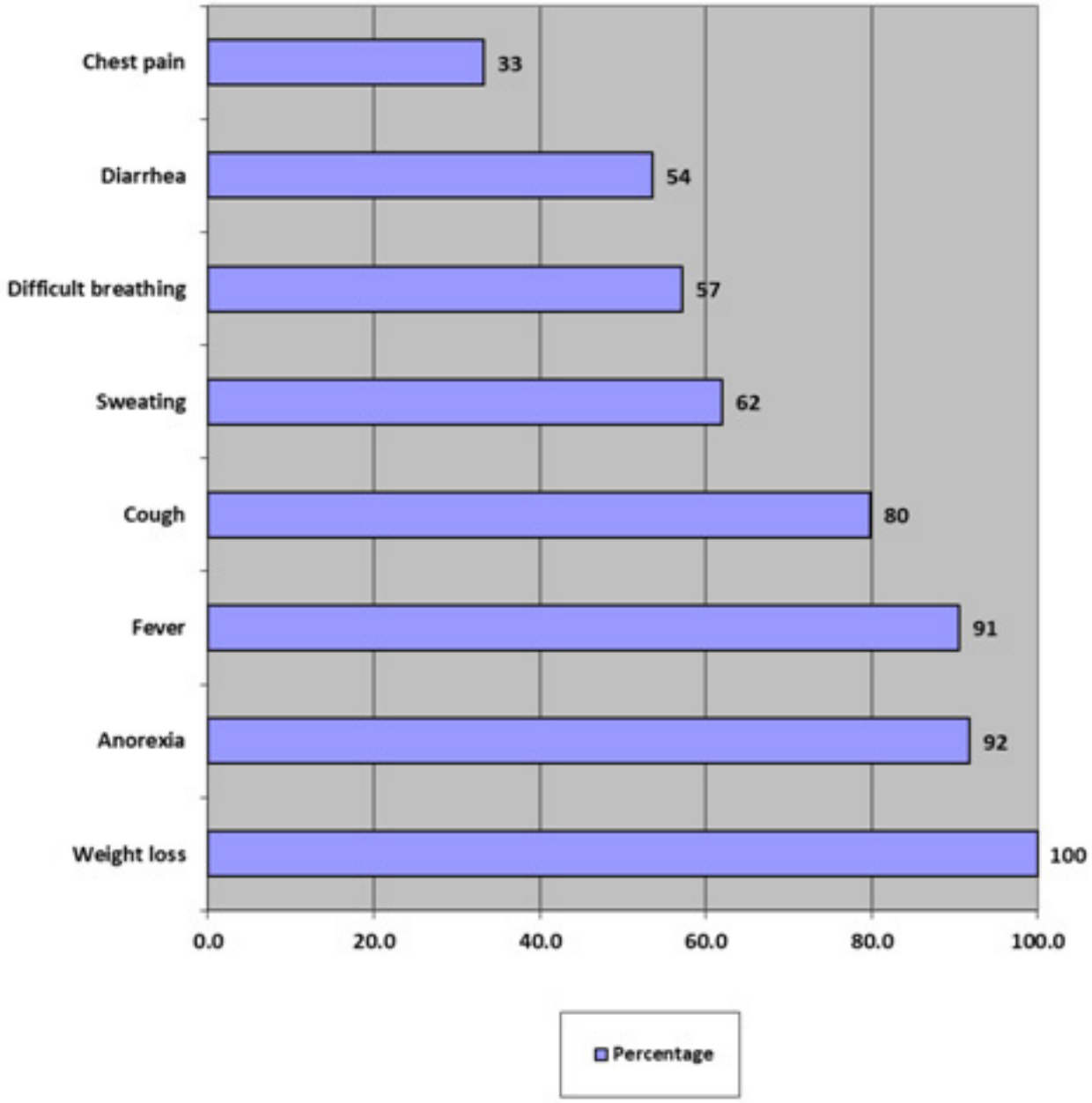


Table 1: History of contact with adult TB cases in the study group (n=84)

History of contact	Frequency	Percentage
No contact	47	56.0
House hold contact	21	25.0
Neighbour contact	14	16.6
School contact	01	1.2
Visitor contact	01	1.2
Total	***84***	***100.0***

Table 2: Comparison of pulmonary and non pulmonary TB with presence of cough in the study group (n=84)

Disease	Cough					
	No		Yes		Total	
	No.	%	No.	%	No.	%
Pulmonary	9	10.7	52	61.9	61	72.6
Non-Pulmonary	8	9.5	15	17.9	23	27.4
Total	17	20.2	67	79.8	84	100.0

$X^2 = 4.1$ P<0.0.042

Table 3: Comparison of severe TB and non -severe TB with presence of convulsions in the study group (n=84)

Disease	Convulsion					
	No		Yes		Total	
	No.	%	No.	%	No.	%
Severe TB	7	8.3	5	6.0	12	72.6
Non- severe TB	71	84.5	1	1.2	72	27.4
Total	17	20.2	6	7.2	84.0	100.0

$X^2 = 24.86$ P<0.0.01

Figure 2: The Welcome's classification of malnutrition in the study group (n = 84)

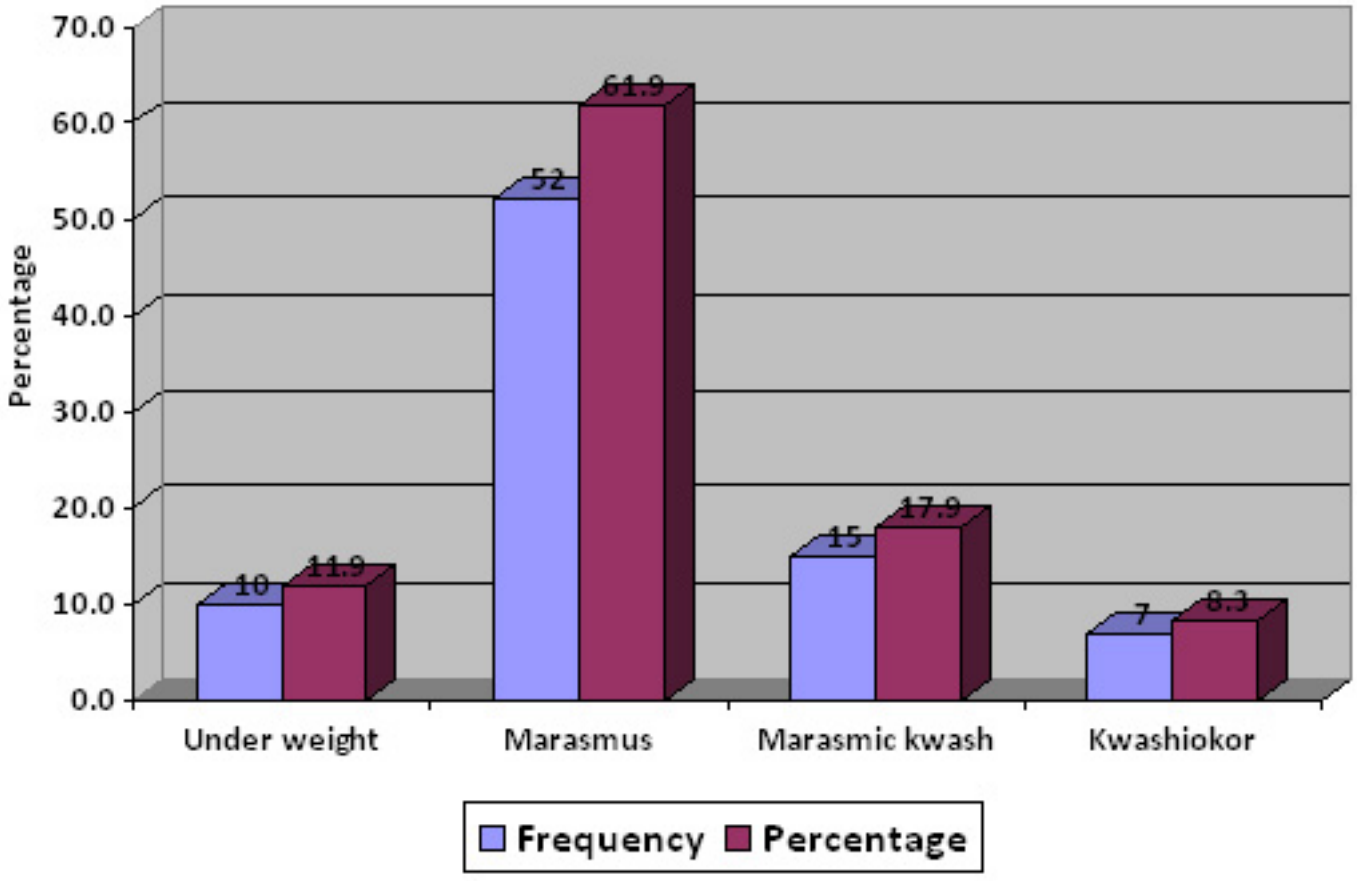


Figure 3: The chest signs seen in the children of the study group (n = 84)

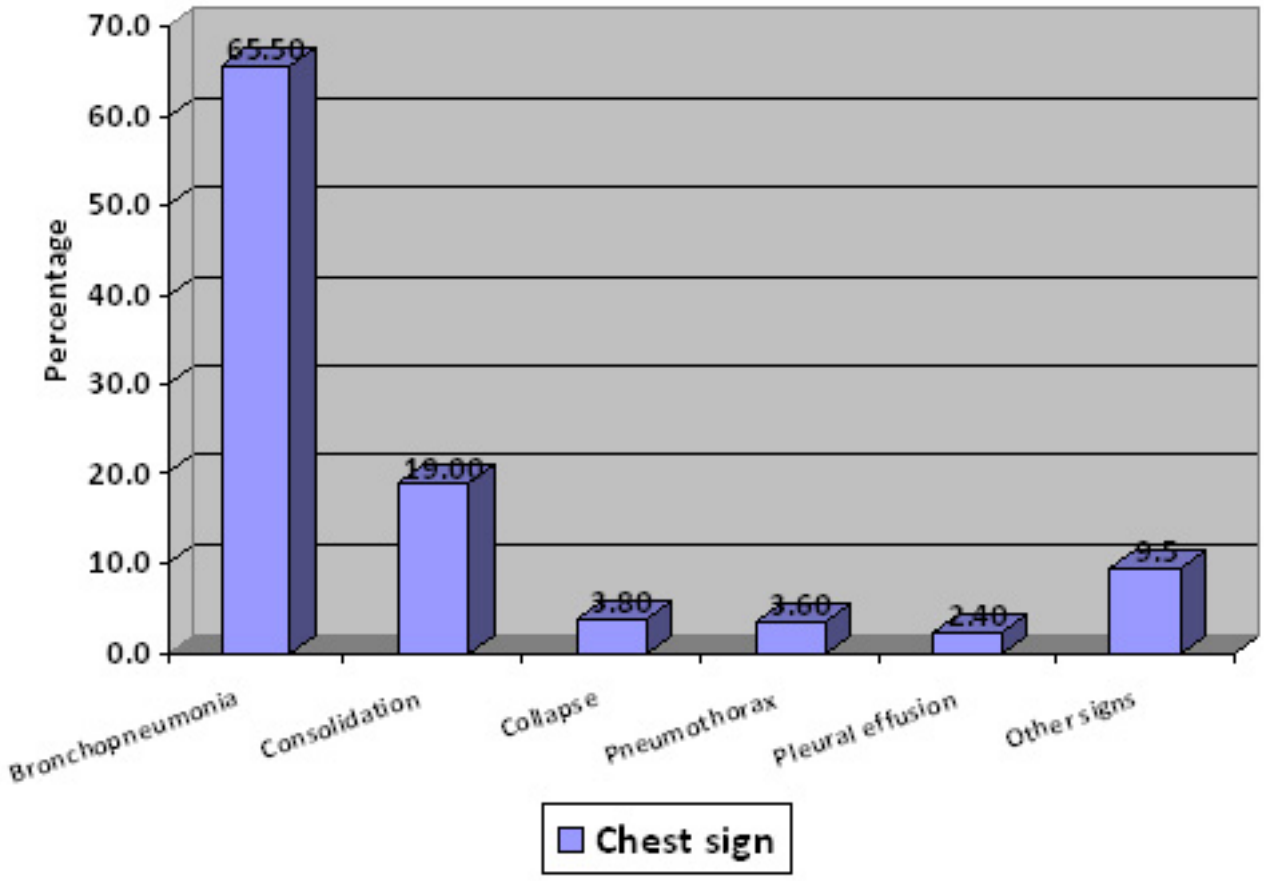
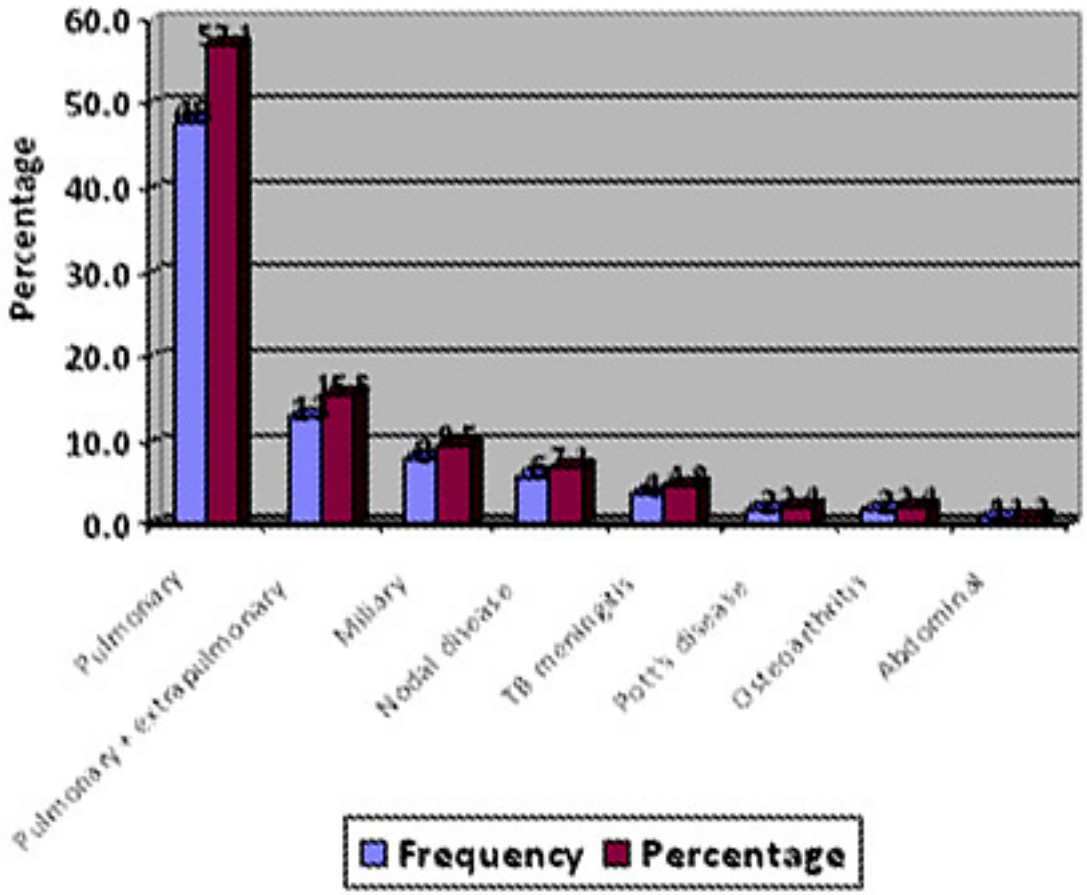


Figure 4: The pattern of tuberculous disease in the study group (n = 84)



Discussion

In Kassala in 2003 severely malnourished children of under 5 years age were estimated to be about 1,124. The majority of malnutrition cases in Sudan occur in the age groups of 6 to 24 months(26,27). Infants constitute 15.5% in this group of patients they are prone to severe forms of the disease as shown in previous studies(28). A large Turkish study on 2,205 children with tuberculous was comparable to my study in showing no gender difference(29). In a large community based Indian study on childhood tuberculosis the number of infected children was significantly higher in urban compared to rural areas. This may be attributed partially to the higher prevalence of malnutrition in city slums(30). The common low Socioeconomic origin and parental illiteracy were also seen in other comparable Sudanese studies on both Tuberculosis and malnutrition(26,27.31.32).

Most of the refugees in the Sudan are in Kassala State (82%). Studies on Sudanese children showed similar symptomatology as seen in this study(32). Most of the symptoms were not specific and may denote other associated infections in a malnourished child as shown by Adil study that 50% of malnourished children had pneumonia 25% pyuria and 8% had gastroenteritis(27). In this study more than 60% of the children were BCG vaccinated but meta-analysis studies have shown that BCG vaccination gives only about 50% protection against all forms of TB and more than 70% protection against severe forms of TB(33).

Duration of symptoms and the over-all percentage of history of contact were more or less similar to previous studies in Sudanese children(32.35.36).

In this study 82.1% of the children had weight for height or length ratio below 70% (severe wasting). The predominant type of malnutrition was marasmus and seen in more than half of the patients (52.9%). Features of scattered chest signs of tuberculous bronchopneumonia was the commonest chest sign followed by features of localized consolidation in 19% of the cases. In contrast to a study done on well nourished and older Sudanese tuberculous children in whom localized consolidation was predominant(32).

Extra pulmonary TB was seen in 27.3% of cases which is comparable to previous studies on TB in well nourished children previously.(32,34).

The WHO TSC score of ≥7 was found in 78.6% and the IUATLD score of ≥ 5 was about 90%. Assuming correct clinical labelling the sensitivity of both tests is high. Specificity evaluation needs further sophisticated diagnostic methods.

Conclusion and Recommendations

From the prevalent socio-demographic characteristics in the study group it could be concluded that TB and malnutrition were associated with low socio-economic conditions, parental illiteracy, poor housing and nutritional support. The duration of symptoms was usually prolonged, of more than one month before the child's diagnosis was considered by the medical personnel .

malnourished predominantly marasmic or marasmic–kwashiorkor. This may be due to the double effect of both conditions as debilitating childhood health problems.

Almost two thirds of the patients showed clinical chest signs and most of the patients showed suggestive chest x-ray features so that pulmonary disease was the prevalent form of TB in this group . Severe forms of TB were also seen in a considerable number of these patients most likely due to the immunosuppressing effect of malnutrition against TB infection. The clinical diagnostic scores were sensitive, but they use non-specific parameters and need further evaluation.

The following were recommended:
Community and governmental efforts urgently needed to address the risk factors and attitude towards vaccination; Screening for all children with adult contact for TB; Sufficient nutritional rehabilitation of malnourished children before labelling them as TB patients and provision of the ideal under -5 years health care programmes will prevent or decrease occurrence of TB in this group substantially.

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