Peertechz®

CLINICAL GROUP

GLOBAL JOURNAL OF
Infectious Diseases and Clinical Research

ISSN: 2455-5363 DOI: https://dx.doi.org/10.17352/gjidcr

Research Article

Pulmonary and meningeal tuberculosis patterns in children at King Abdul-Aziz university hospital in Jeddah, Saudi Arabia: A retrospective study

Nadia M Fida*, Mohammed Farouq, Razan Daghistani, Abeer Alnajar and Duha Alamawi

Department of Pediatrics, Faculty of Medicine, King Abdulaziz University, Jeddah, Saudi Arabia

Received: 27 April, 2020
Accepted: 04 June, 2020
Published: 05 June, 2020

***Corresponding author:** Nadia M Fida, MBBS, CABP, Professor of Pediatrics, Department of Pediatrics, Faculty of Medicine, King Abdulaziz University, P.O. box 80215, Jeddah 21589, Saudi Arabia, Tel: +966126952000 # 22279; E-mail: nadiafida@hotmail.com

Keywords: Children; Manifestations; Pulmonary tuberculosis; Tuberculous meningitis

https://www.peertechz.com

Abstract

Background: Paediatric Tuberculosis (TB) is a significant health problem worldwide, with the World Health Organization (WHO) reporting almost 550,000 children infected with TB yearly. Several factors have affected the TB infection rate in Saudi Arabia, including Hajj and Umrah (Islamic pilgrimages to Mecca), travel, global migration, indigence, inaccessible healthcare services and drug resistance.

Objectives: This retrospective study aimed to describe the patterns of pulmonary TB (PTB) and *tuberculous meningitis* (TBM) among children admitted to the Paediatric Department at King Abdul-Aziz University Hospital (KAUH) in Jeddah, Saudi Arabia, between January 2010 and May 2015.

Methods: The patients' clinical information was retrieved retrospectively from the hospital TB register and case notes, including the age, gender, clinical features, investigations, treatments and prognosis.

Results: The clinical presentation for PTB upon admission was primarily fever (75.0%), followed by cough (65.9%). For TBM, the clinical presentation was mainly convulsions (36.8%), followed by disturbed consciousness (21.1%). The diagnosis of PTB was most often made via TB culture (57.0%) and the Purified Protein Derivative (PPD) test (15.9%). There was a significantly higher number of PTB cases than TBM cases (71.0% versus 29.0%, P=0.0001).

Conclusions: Overall, the paediatric TB mortality and morbidity rates in this area were high. Moreover, the diagnostic tools currently being used need improvement.

Abbreviations

CSF: Cerebrospinal Fluid; CT: Computer Tomography; DOT: Directly Observed Therapy; EPTB: Extra Pulmonary Tuberculosis; ER: Emergency Room; HIV: Human Immunodeficiency Virus; ICP: Intracranial Pressure; LP: Lumber Puncture; NTP: National Tuberculosis Program; PTB: Pulmonary Tuberculosis; TB: Paediatric tuberculosis; TBM: Tuberculous Meningitis; TST: Tuberculin Skin Test; WBC: White Blood Cells; WHO: World Health Organization

Introduction

Paediatric tuberculosis (TB) is one of the main health problems worldwide. The World Health Organization (WHO) has reported that almost nine million people are infected with TB each year, and nearly 550,000 (6.5%) of these cases are children [1,2]. In the developed countries, 3-6% of the total number of TB cases involve children, while in developing countries the prevalence becomes higher, reaching 25% paediatric cases [1,3]. Due to the difficulties in isolating the

Citation: Fida NM, Farouq M, Daghistani R, Alnajar A, Alamawi D (2020) Pulmonary and Meningeal Tuberculosis Patterns in Children at King Abdul-Aziz University Hospital in Jeddah, Saudi Arabia: A Retrospective Study. Glob J Infect Dis Clin Res 6(1): 031-036. DOI: https://doi.org/10.17352/2455-5363.000032

mycobacterium responsible for TB infections in children, there has been a relative degree of negligence in the paediatric patient population [2,4,5].

Mycobacterium tuberculosis is the primary human pathogen that causes TB [1]. This disease damages the lungs, central nervous system, lymphatic system and circulatory system [1]. However, many primary pulmonary TB (PTB) patients are asymptomatic. Hilar adenopathy is a common radiological finding, while pulmonary infiltrates in the mid and lower lung fields are rare [6,7]. Infrequently, a child presents with a high fever and cough, and symptoms similar to flu symptoms, which improve within approximately one week [8,9]. Pulmonary manifestations are common among most children with TB, with only 25-35% of children developing extra pulmonary (EPTB) manifestations. The first and most common presentation is lymphatic, which occurs in 66.7% of TB cases, while the second is meningeal, which occurs in 13% of the EPTB cases [10]. Tuberculous meningitis (TBM) is the most severe form, and carries a high mortality[11]. Approximately 1% of all TB cases develop central nervous system TB [12].

Although a TB infection can spread to any site, TBM is one of the most common results of PTB, developing 3–6 months after the primary infection [13]. The clinical signs of TBM begin with 2–3 weeks of prodromal malaise, headaches, a low-grade fever and personality changes. These are followed first by a meningitis phase that mimics bacterial meningitis (fever, nuchal rigidity and an altered mental status), and then by a paralytic phase characterized by the rapid progression to stupor, coma, seizures, paralysis and death [13]. In 50% of the TBM cases there is a risk of serious long term neurological consequences or death [14]. The previous literature has reported mortality rates ranging from 30% to 90% [14].

One situation that increases the risk of EPTB is an advanced case of Human Immunodeficiency Virus (HIV). The HIV pandemic, particularly in the advanced phases of this immune disease, has increased the overall burden of TBM [12], with high mortality rates reaching 67% (without HIV the mortality rate is 25%) [12,15].

The rates of TB vary across different regions of Saudi Arabia. For instance, compared to 32 cases per 100,000 in the capital, Riyadh, the infection rate has been found to be as high as 64 cases per 100,000 in Jeddah, which is a major hub of air and sea travel for pilgrimages to Mecca [16-18]. Two special factors may influence the infection rates in Saudi Arabia: the large number of emigrant workers who live in the country, and the many religious visitors who come to Mecca and Medina for Hajj and Umrah. Many of these labourers and visitors come from TB endemic countries, and previous research has found that more than 60% of the genotyped isolates come from imported strains [16-18]. In Saudi Arabia, few studies have highlighted children with delayed diagnoses presenting to the hospital as advanced cases of TB, obviously leading to poor and unsatisfactory outcomes.

This retrospective study aimed to describe patterns of PTB and TBM among children admitted to the Paediatric Department at King Abdul-Aziz University Hospital in Jeddah, Saudi Arabia, between January 2010 and May 2015.

Methods

This retrospective study described the patterns of PTB and TBM in children admitted to the emergency room (ER) and paediatric units at King Abdul-Aziz University Hospital, a large tertiary public hospital in Jeddah, Saudi Arabia, from January 2010 to May 2015. The patients included in the study were < 18 years old and treated for PTB and/or TBM. The patients' clinical information was retrieved from the hospital TB register and case notes. This information included the age, gender, hospitalization, clinical features, results of routine laboratory investigations, results of Cerebrospinal Fluid (CSF) analyses, chest radiographic findings, lymph node biopsy results, treatments received, duration and prognosis.

The TB diagnosis protocol in our hospital is as follows: a standard Tuberculin Skin Test (TST) (5 TU in 0.1ml; Radiant Parenterals, Ltd., Vaghodia, India) administered during the initial visit and read at 48–72 hours; a result of ≥ 5mm induration was considered positive for TB [3]. Gastric aspirates (up to three consecutive samples), a lymph node biopsy, CSF analysis and culture, and pleural fluid analysis and culture were obtained for the mycobacterial culture to confirm the diagnosis. A diagnosis of PTB and/or TBM should be considered when a patient with the clinical symptoms or when the laboratory and radiological findings lead to the suspicion of PTB with meningeal involvement. These clinical symptoms include fever, headaches, seizures and, upon examination, focal signs, neck stiffness and/or altered mentation. There should be evidence of space occupying lesions and/or signs of a raised Intracranial Pressure (ICP) before performing a Lumbar Puncture (LP) for a CSF analysis. TBM was suspected when the CSF showed high protein levels, low glucose levels, a high White Blood Cell (WBC) count, the absence of *Cryptococcus* spp. (India ink staining), and the absence of bacteria that commonly cause meningitis (gram staining) or their antigens (*Streptococcus pneumonia*, *Neisseria meningitis*, *Haemophilus influenzae*). TBM was confirmed when *M. tuberculosis* was found in the CSF analysis. PTB was suspected in those cases with a history of fever and cough. The chest X-rays and chest Computed Tomography (CT) scans were reviewed for suspicious lesions (PTB), and three consecutive sputum samples were collected on different days for examination via Ziehl-Neelsen staining. Individuals were included in this study if sufficient information was available to make a firm diagnosis, and were treated for PTB and/or TBM.

Statistical analysis

The collected data were analysed using the SPSS statistical software package, version 20. The parametric data were expressed as the mean and standard deviation (minimum and maximum), and the non-parametric data were expressed as numbers (percentages). The PTB and TBM comparisons were made using an unpaired Student's t test for the parametric parameters and a chi squared test for the non-parametric parameters. A cross tabulation between the PTB and TBM cases was conducted, and a P value < 0.05 was considered to be statistically significant.

Citation: Fida NM, Farouq M, Daghistani R, Alnajar A, Alamawi D (2020) Pulmonary and Meningeal Tuberculosis Patterns in Children at King Abdul-Aziz University Hospital in Jeddah, Saudi Arabia: A Retrospective Study. Glob J Infect Dis Clin Res 6(1): 031-036. DOI: https://doi.org/10.17352/2455-5363.000032

Results

Sixty-three TB patients were enrolled in this study: 31 (49.2%) females, 32 (50.8%) males, 47 (74.4%) Africans, 11 (17.5%) Caucasians and 5 (7.9%) Asians. There were more cases of PTB than TBM (71.0% versus 29.0%, *P*=0.0001) (Tables 1,2). The most common clinical presentation for PTB upon admission was fever (75.0%), followed by cough (65.9%), chest infection (9.1%) and haemoptysis (6.8%), while the most common presentation for TBM was fever (89.5%), followed by convulsions (36.8%), disturbed consciousness (21.1%), neck stiffness (5.3%) and headaches (5.3%). The PTB diagnosis was detected most often by a positive AFB culture (54.5%), followed by PPD (15.9%), while TBM diagnosis was positive AFB culture (52.6%). Erythrocyte Sedimentation Rate (ESR) and C-Reactive Protein (CRP) levels were higher in PTB than TBM. The mean CSF cell count and proteins were higher while, CSF glucose was lower in TBM than PTB. With respect to the chest imaging in the PTB patients, a chest X-ray was performed in 97.7% of the cases, chest CT in 59.1%, brain CT in 22.7% and brain MRI in 2.3%. In the TBM patients, a chest X-ray was performed in 100% of the cases, chest CT in 5.3%, brain CT in 94.7% and a brain MRI in 42.1% (Table 2).

With regard to the drug administration, rifampin was given to 98.0% of the patients, isoniazid to 100.0%, pyrazinamide to 95.2%, ethambutol to 63.50%, streptomycin to 22.2% and dexamethasone to 23.8%. The duration of each antibiotic followed the international guidelines. In the treatment regimen, the number of patients given dexamethasone and streptomycin was significantly lower in the PTB versus TBM patients (9.10% versus 57.90% and 6.80% versus 57.90%, *P*=0.0001 for both). Moreover, there were insignificant differences between the numbers of patients with PTB and TBM treated with rifampin (97.7% versus 100.0%, *P*=0.587), isoniazid (100.0% versus 100.0%, *P*=1.000), pyrazinamide (95.5% versus 94.7%, *P*=0.112) and ethambutol (65.9% versus 57.9%, *P*=0.295) (Table 3). The mortality rate at the time of the study was lower in the PTB patients than in the TBM patients, with insignificant difference (20.5% versus 26.3%, *P*=0.743) (Table 3).

The mean CSF cell count was 35.0±24.0 (5.0–66.0). The mortality rate at the time of the study was lower in the PTB patients than in the TBM patients, with a significant difference (15.0% versus 37.0%, *P*=0.05) (Tables 2,3). With respect to the chest imaging in the PTB patients, a chest X-ray was performed

Table 1: Demographic data of patients diagnosed with tuberculosis (n = 63).

Variables	Number (%)
Gender	
Male	32 (50.80%)
Female	31 (49.20%)
Ethnicity	
African	47 (74.6%)
Caucasian	11(17.5%)
Asian	5 (7.9%)

Data were expressed as number (%).

Table 2: Clinical presentation and investigation findings among patients with TB (n = 63).

Variables	PTB (n=44)	TBM (n=19)
Clinical presentation		
Fever	33 (75.0%)	17 (89.5%)
Cough	29 (65.90%)	10 (52.6%)
Hemoptysis	3 (6.8%)	-----
Chest infection	4 (9.10%)	2 (10.5%)
Convulsions	-----	7 (36.8%)
Disturbed consciousness	2 (4.5%)	4 (21.1%)
Neck stiffness	1 (2.3%)	1 (5.3%)
Headache	-----	1 (5.3%)
Diagnosis		
Positive AFB culture	24 (54.5%)	10 (52.6%)
PPD skin test	7 (15.9%)	-----
CSF finding		
CSF cells (cells/ul)	6.00 [1.00] (5.00 -7.00)	48.5[23.41] (12.00 -84.00)
CSF protein (mg/dl)	0.42 [0.24] (0.20 -0.80)	1.36 [1.08] (0.12 – 3.90)
CSF glucose (mmol/L)	2.92 [1.19] (1.00 -3.90)	2.73 [1.58] (0.40 - 7.40)
CSF culture	------	------
Radiology finding		
Chest X-ray	43 (97.7%)	19 (100.0%)
HRCT chest	26 (59.1%)	1 (5.3%)
HRCT brain	10 (22.7%)	18 (94.7%)
MRI brain	1 (2.3%)	8 (42.1%)
Laboratory finding		
Hemoglobin)g/dl)	9.7 [1.9] (6.1-14.1)	10.10 [1.50] (7.1-13.1)
White blood cells (K/uL)	12.76 [7.93] (4.60 -47.10)	12.51 [6.70] (1.00 -32.10)
ESR (mm/hr)	46.77 [29.40] (6.00 -104.00)	41.79 [23.61] (5.00 -91.00)
CRP (mg/L)	68.21 [54.23] (3.00 -212.00)	61.50 [64.23] (3.30 -235.00)

Data were expressed as mean [SD] (minimum – maximum) or number (%) as appropriate. CSF: cerebrospinal fluid; HRCT: high resolution computer tomography; ESR: erythrocytic sedimentation rate; CRP: C= reactive protein; AFB: acid fast bacilli; PPD: purified protein derivative skin test.

Table 3: Comparison of treatment and mortality rate between pulmonary tuberculosis (PTB) and tuberculosis meningitis (TBM).

Variable	PTB (n =44)	TBM (n= 19)	P- value
Management plan			
Dexamethasone	0.10 [0.00] (0.10 – 0.10) 4 (9.10%)	0.10 [0.00] (0.10 – 0.10) 11 (57.90%)	1.000 0.0001
Rifampicin	7.51 [6.27] (0.10 – 25.00) 43 (97.7%)	8.31 [6.81] (0.20 – 26.30) 19 (100.00%)	0.654 0.587
Isoniazid	7.36 [6.19] (0.10 – 25.20) 44(100.00%)	8.36 [6.53] (0.10 -26.80) 19 (100.00%)	0.565 1.000
Pyrazinamide	5.25 [5.25] (0.10 – 25.20) 42 (95.50%)	4.62 [3.19] (0.10 – 14.20) 18 (94.70%)	0.638 0.112
Ethambutol	4.39 [5.08] (0.10 – 25.00) 29 (65.90%)	1.22 [4.75] (0.10- 8.80) 11 (57.90%)	0.392 0.295
Streptomycin	1.08 [1.52] (0.10 – 2.83) 3 (6.80%)	2.30 [1.91] (0.10 – 7.00) 11 (57.90%)	0.335 0.0001
Mortality	9 (20.5%)	5 (26.3%)	0.743

Data were expressed as mean [SD] (minimum – maximum) or number (%) as appropriate. Significance was made between two groups using unpaired student "t" test.

Citation: Fida NM, Farouq M, Daghistani R, Alnajar A, Alamawi D (2020) Pulmonary and Meningeal Tuberculosis Patterns in Children at King Abdul-Aziz University Hospital in Jeddah, Saudi Arabia: A Retrospective Study. Glob J Infect Dis Clin Res 6(1): 031-036. DOI: https://doi.org/10.17352/2455-5363.000032

in 98.0% of the cases and a chest CT was performed in 39.0%. In the TBM patients, a chest X-ray was performed in 100% of the cases, a brain CT was performed in 96.0% and a brain MRI was performed in 86.0% (Table 3).

With regard to the drug administration, rifampin was given to 98.0% of the patients, isoniazid to 100.0%, pyrazinamide to 95.2%, ethambutol to 63.50%, streptomycin to 22.2% and dexamethasone to 23.8%. The duration of each antibiotic followed the international guidelines. In the treatment regimen, the number of patients given dexamethasone and streptomycin was significantly lower in the PTB versus TBM patients (10.0% versus 50.0% and 5.0% versus 55.0%, P=0.0001 for both). Moreover, there were insignificant differences between the numbers of patients with PTB and TBM treated with rifampin (98.0% versus 100.0%, P=0.587), isoniazid (100.0% versus 100.0%, P=1.000), pyrazinamide (96.0% versus 95.0%, P=0.112) and ethambutol (68.0% versus 46.0%, P=0.295) (Table 2).

The following two cases are examples of the presentations and investigations involved in this study

Case 1 (TBM): A 9-month-old unvaccinated Somali girl presented with fever and convulsions. Upon examination, she was hypertensive. The CSF lab results showed high protein (3.91 g/l), 100 cells (78% lymphocytes) and a negative culture. The staining and culture of the Acid-Fast Bacilli (AFB) were negative. The chest CT findings showed upper lobar pneumonia associated with multiple mediastinal and right hilar lymphadenopathies. The brain CT showed acute communicating hydrocephalus. The brain MRI demonstrated diffuse leptomeningeal enhancement and thickening representing meningitis, with a distribution suggestive of TB.

Case 2 (PTB): A seven-year-old Chadian girl presented with a history of fever over the previous 2 months, associated with night sweating and chills, weight loss, dry cough and a positive history of haemoptysis. The AFB sputum culture was positive. Her chest CT showed multiloculated patchy consolidations, one of which filled the entire upper right lobe showing multiple air bronchograms with multiple cavitations.

Discussion

In this study, the mean age of the patients was 6.28 years old, with a range of 0.1–14.0 years, which was consistent with previous studies indicating that age and immunity are the two major risk factors in the development of TB [7,9,19,20]. Fourteen out of 63 of these patients (22.0%) were exposed to TB over the previous two years. In this respect, it has been reported that TB is transferred from an infected person to a child via airborne particles that remain in the air for several hours [1,19,21].

In this retrospective study, the clinical presentation upon admission consisted most often of a fever (75.0%) followed by coughing (65.9%) in the PTB patients, and a fever (89.5%) followed by neurological disorders as convulsions (36.8%), disturbed consciousness (21.1%), neck stiffness (5.3%), and headache (5.3%) in the TBM patients. Previous studies have reported that a non-productive cough and mild dyspnoea are the most frequent symptoms in paediatric TB patients. In addition, systemic complaints, such as anorexia, fever and night sweats, were less commonly reported. Respiratory symptoms were found to be more common in infants and young children [1,22].

A major challenge of paediatric TB is providing an accurate diagnosis. For this research, TB was most often diagnosed via a positive TB culture, followed by a positive PPD. Additionally, it has been reported that less than 15.0% of children with TB had positive sputum smears, with mycobacterial cultures detecting the bacilli in 30–40% of the cases [1,23]. All of the guidelines agree that the isolation of the *M. tuberculosis* complex from different specimens is the gold standard for the diagnosis of TB [3]. However, in those cases with no bacteriological confirmation, a childhood diagnosis in TB endemic countries should be based on a positive family history of TB, a positive tuberculin skin test, the presence of physical signs and symptoms and/or abnormal findings on the chest X-ray [7,23,24].

There is a general consensus that chest radiography is essential for the diagnosis of TB, and should be done for any child with suspicious symptoms [3]. Meanwhile, disagreement in chest radiographies findings for TB screening in children had been reported previously [25,26] In this study, active PTB was diagnosed on the basis of a combination of epidemiological (e.g., exposure, travel to or residence in a high prevalence area, previous TB), clinical (e.g., cough lasting longer than 2-3 weeks, fever, night sweats and weight loss), radiographic (e.g., infiltrates, fibrosis and cavitation), microbiological (e.g., positive sputum smear or culture) and histopathological (e.g., caseation granuloma) features. Those patients in whom the clinical suspicion of TB is strong on the basis of clinical criteria should undergo chest radiography [6,27, 28].

The diagnosis of TBM demands a high level of suspicion, and the CSF analysis should show mononuclear pleocytosis, increasing protein levels (100-150 mg/dl), an increasing WBC count (100-150 cells/µl) and decreasing glucose levels (<45 mg/dl) [7]. An exact diagnosis can be made via direct Ziehl-Neelsen staining (with low sensitivity) or CSF culture (too slow), which could delay the treatment decisions [12,29]. In the current study, the mean values were 1.36±1.08 (mg/dl) for the protein level, 2.73±1.58 (mmol/L) for the glucose level and 48.5±23.41 (cells/ul) for the cell count, which were consistent with those of other studies. An acid fast bacillus culture is routine practice, and should be done in suspicious cases of TB. However, due to logistic reasons and the long time period before the results become available, the majority of the diagnoses are based on either clinical suspicion associated with improvement due to empirical treatment, and indirect clinical, laboratory (specially CSF analysis) and radiological findings that provide a level of suspicion of TBM [12,30]. In the study by Luma, et al. [12], headaches and fevers were the most common symptoms, involving 74.1% and 59.3% of the patients, respectively. We, therefore, suspected TBM in the presence of central nervous system (CNS) disease symptoms/signs, and the diagnosis relied almost entirely on the CSF findings of high proteins levels, low glucose levels and leucocyte pleocytosis, especially where there was mononuclear cell predominance [13].

Citation: Fida NM, Farouq M, Daghistani R, Alnajar A, Alamawi D (2020) Pulmonary and Meningeal Tuberculosis Patterns in Children at King Abdul-Aziz University Hospital in Jeddah, Saudi Arabia: A Retrospective Study. Glob J Infect Dis Clin Res 6(1): 031-036. DOI: https://doi.org/10.17352/2455-5363.000032

In this study, the TBM mortality rate was 26.3% because the delays in the diagnoses greatly increased the number of patients that died. Similar results were found in a Johannesburg study in which the authors reported an increasing in mortality rate (from 56.0% to 90.5%) when the treatment was delayed for longer than 24 hours [12,13,31]. Obviously, there is a need to find ways to help provide an early diagnosis, especially in indigent settings [12]. The key strategy for reducing and preventing TB is the immediate and rapid recognition and remediation of TB patients, as well as patient education and vaccination [31].

TB treatment consists of two steps: an intensive step using a combination of antibiotics to kill the quickly growing bacilli, and a continuation step using less drugs to excise the slower growing incessant bacilli [19]. For TBM, there are two standard treatment plans: 1) two months of an *isoniazid*, rifampin, p*yrazinamide* and ethambutol combination, then four months of *isoniazid and* rifampin, and 2) 12 months of therapy, which has been recommended by several authors [12,19,32]. The use of steroids in TBM as an adjunctive treatment has been shown to effectively decrease the rates of death and severe disability [19,33,34]. With regard to the challenges of noncompliance for a number of patients, which affects the outcomes and causes treatment failure, a new strategy has been recommended: Directly Observed Therapy (DOT), particularly in the paediatric setting [3,28].

The current study showed that physicians do follow the guidelines. Previously, a retrospective study was carried out at the King Khalid National Guard Hospital in Jeddah, between June 1993 and June 1999, involving 147 patients with positive TB cultures. Only 126 completed treatment, and the others were considered to be treatment failures. The overall rate of success was 69.4%, while the rate of was failure was 30.6%, and the authors reported that the two factors which caused the failures were drug resistance and the lack of commitment [35]. Even though the National Tuberculosis Program (NTP) and DOT were implemented, a drug resistance situation decreased the WHO's target of healing 85% of TB patients. This was likely due to the lack of commitment from the patients and the availability of over the counter anti-TB drugs [16].

Study limitations

This study did have a number of limitations. For example, it was a retrospective study, which introduced a problem in the availability of a sufficient level of information (missing data) about the patients, leading to the exclusion of otherwise qualified cases. In addition, the small sample size restricted the statistical analyses. Moreover, most of the diagnoses were dependent on the clinical presentations and not the investigations, so many cases may have been missed. Additionally, treatment resistance could not be detected due to the retrospective nature of this study. Finally, only patients from one health centre were included, which makes the generalization of these results throughout the healthcare centres in Jeddah difficult. However, this study did describe and characterize the challenges faced by many clinicians in the diagnosis and management of PTB and TBM.

Conclusions

Two important factors that play large roles in the prevention and control of TB are the national TB program and the laboratories status. The results of the present study suggested that the diagnosis and treatment of children with TB are quite challenging, and that the tools currently employed in our facility are inadequate, leading to a high mortality rate, specifically among TBM cases. Effective management demands immediate recognition and treatment, especially in the paediatric population. The results of this study suggest that in order to increase the rate of early TB diagnoses, the diagnostic laboratory standards must be uniform across the country.

References

1. Organization WH: Global tuberculosis report 2013: World Health Organization 2013. Link: https://bit.ly/2XYxP8v
2. Graham SM, Cuevas LE, Jean-Philippe P, Browning R, Casenghi M, et al. (2015) Clinical case definitions for classification of intrathoracic tuberculosis in children: an update. Clin Infect Dis 61: S179-S187. Link: https://bit.ly/2BuqaaH
3. Berti E, Galli L, Venturini E, de Martini M, Chiappini E (2014) Tuberculosis in childhood: a systematic review of national and international guidelines. BMC Infect Dis 14: S3. Link: https://bit.ly/2Mrr7ma
4. Faddoul D (2015) Childhood tuberculosis: an overview. Advances in pediatrics 62: 59-90. Link: https://bit.ly/2zW7TT9
5. Holmberg PJ, Temesgen Z, Banerjee R (2019) Tuberculosis in Children. Pediatr Rev 40: 168-178. Link: https://bit.ly/2MnXpP3
6. Sia IG, Wieland ML (2011) Current concepts in the management of tuberculosis. In: Mayo Clin Proc Elsevier 348-361. Link: https://bit.ly/2BkJmaD
7. Turel O, Kazanci S, Gonen I, Aydogmus C, Karaoglan E, et al. (2016) Paediatric tuberculosis at a referral hospital in Istanbul: analysis of 250 cases. Biomed Res Int 2016. Link: https://bit.ly/2zO3HFb
8. Nemeth GO, Nemeth J, Altpeter E, Ritz N (2014) Epidemiology of childhood tuberculosis in Switzerland between 1996 and 2011. Eur J Pediatr 173: 457-462. Link: https://bit.ly/2Auj717
9. Marais BJ, Schaaf HS (2014) Tuberculosis in children. Cold Spring Harb Perspect Med 4: a017855. Link: https://bit.ly/2XT91Pv
10. Jahromi MK, Sharifi-Mood B (2014) Pulmonary tuberculosis in children. Int J Infect 3: e21116.
11. Brancusi F, Farrar J, Heemskerk D (2012) Tuberculous meningitis in adults: a review of a decade of developments focusing on prognostic factors for outcome. Future microbiol 7: 1101-1116. Link: https://bit.ly/3cuRS3U
12. Luma HN, Tchaleu BCN, Ngahane BHM, Temfack E, Doualla MS, et al. (2013) Tuberculous meningitis: presentation, diagnosis and outcome in hiv-infected patients at the douala general hospital, cameroon: a cross sectional study. AIDS Res Ther 10: 16. Link: https://bit.ly/376We09
13. Marx GE, Chan ED (2011) Tuberculous meningitis: diagnosis and treatment overview. Tuberc Res Treat 2011: 798764. Link: https://bit.ly/2Xv49RI
14. Cherian A, Thomas S (2011) Central nervous system tuberculosis. Afr Health Sci 11: 116-127. Link: https://bit.ly/3eLBFZD
15. Nabi S, Khattak S, Badshah M, Majid Rajput H (2014) Neuroradiological manifestations of tuberculous meningitis. Pakistan Journal of Neurological Sciences (PJNS) 9: 16-21. Link: https://bit.ly/3duv5GK
16. Al-Hajoj S, Varghese B (2015) Tuberculosis in Saudi Arabia: the journey across time. J Infect Dev Ctries 9: 222-231. Link: https://bit.ly/3eLEud0

Citation: Fida NM, Farouq M, Daghistani R, Alnajar A, Alamawi D (2020) Pulmonary and Meningeal Tuberculosis Patterns in Children at King Abdul-Aziz University Hospital in Jeddah, Saudi Arabia: A Retrospective Study. Glob J Infect Dis Clin Res 6(1): 031-036. DOI: https://doi.org/10.17352/2455-5363.000032

17. Al-Hajoj S (2012) Tuberculosis in Saudi Arabia. Understanding Tuberculosis: Global Experiences and Innovative Approaches to the Diagnosis 71. Link: https://bit.ly/2XT9IZa

18. Al-Orainey I, Alhedaithy MA, Alanazi AR, Barry MA, Almajid FM (2013) Tuberculosis incidence trends in Saudi Arabia over 20 years: 1991-2010. Ann Thorac Med 8: 148-152. Link: https://bit.ly/2Ya1JXR

19. Tsai KS, Chang HL, Chien ST, Chen KL, Chen KH, et al. (2013) Childhood tuberculosis: epidemiology, diagnosis, treatment, and vaccination. Pediatr Neonatol 54: 295-302. Link: https://bit.ly/3eJwPvR

20. Pediatrics AA, Diseases CoI, Pickering LK (2013) Red book: report of the Committee on Infectious Diseases: American Academy of Pediatrics.

21. Pickering LK, Baker CJ, Kimberlin DW: Red Book, (2012) Report of the Committee on Infectious Diseases: Am Acad Pediatrics.

22. Phongsamart W, Kitai I, Gardam M, Wang J, Khan K (2009) A population-based study of tuberculosis in children and adolescents in Ontario. Pediatr Infect Dis J 28: 416-419. Link: https://bit.ly/3gOG8fX

23. Graham SM, Ahmed T, Amanullah F, Browning R, Cardenas V, et al. (2012) Evaluation of tuberculosis diagnostics in children: 1. Proposed clinical case definitions for classification of intrathoracic tuberculosis disease. Consensus from an expert panel. J Infect Dis 205: S199-S208. Link: https://bit.ly/3cuTw5A

24. Ramos S, Gaio R, Ferreira F, Leal JP, Martins S, et al. (2017) Tuberculosis in children from diagnosis to decision to treat. Revista Portuguesa de Pneumologia (English Edition) 23: 317-322. Link: https://bit.ly/2XqGmlC

25. Jain SK, Ordonez A, Kinikar A, Gupte N, Thakar M, et al. (2013) Pediatric tuberculosis in young children in India: a prospective study. Biomed Res Int Link: https://bit.ly/2AB4l8G

26. George SA, Ko CA, Kirchner HL, Starke JR, Dragga TA, et al. (2011) The role of chest radiographs and tuberculin skin tests in tuberculosis screening of internationally adopted children. Pediatr Infect Dis J 30: 387-391. Link: https://bit.ly/3gYAiZA

27. Bandichhode ST, Nandimath VA (2016) Health profile of paediatric tuberculosis patients on directly observed treatment short course therapy. International Journal of Contemporary Pediatrics 3: 1401. Link: https://bit.ly/30fj6Jt

28. Swaminathan S, Rekha B (2010) Pediatric tuberculosis: global overview and challenges. Clin Infect Dis 50: S184-S194. Link: https://bit.ly/2ZZMVNX

29. Pasco PM (2012) Diagnostic features of tuberculous meningitis: a cross-sectional study. BMC Res Notes 5: 49. Link: https://bit.ly/3cs36WL

30. Vinnard C, Macgregor RR (2009) Tuberculous meningitis in HIV-infected individuals. Curr HIV/AIDS Rep 6:139-145. Link: https://bit.ly/2XWT4YI

31. Tahan TT, Gabardo BM, Rossoni AM (2020) Tuberculosis in childhood and adolescence: a view from different perspectives. J Pediatr 96: 99-110. Link: https://bit.ly/36UNYA4

32. Berti E, Galli L, Venturini E, de Martini M, Chiappini E (2014) Tuberculosis in childhood: a systematic review of national and international guidelines. BMC Infect Dis 14 Suppl 1: S3. Link: https://bit.ly/3drJofe

33. Karstaedt A, Valtchanova S, Barriere R, Crewe-Brown H (1998) Tuberculous meningitis in South African urban adults. QJM 91: 743-747. Link: https://bit.ly/2zP9TwC

34. Daley C, Lewinsohn DM (2019) Tuberculosis, An Issue of Clinics in Chest Medicine. E-Book: Elsevier Health Sciences 40. Link: https://bit.ly/3ePmqip

35. Samman Y, Krayem A, Haidar M, Mimesh S, Osoba A, et al. (2003) Treatment outcome of tuberculosis among Saudi nationals: role of drug resistance and compliance. Clin Microbiol Infect 9: 289-294. Link: https://bit.ly/3gSyvVY

Citation: Fida NM, Farouq M, Daghistani R, Alnajar A, Alamawi D (2020) Pulmonary and Meningeal Tuberculosis Patterns in Children at King Abdul-Aziz University Hospital in Jeddah, Saudi Arabia: A Retrospective Study. Glob J Infect Dis Clin Res 6(1): 031-036. DOI: https://doi.org/10.17352/2455-5363.000032