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Bacteriological Evaluation for Diagnosis of Tuberculosis in Children

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ABSTRACT

Background: During the last decade of the 20th century, the number of new cases of tuberculosis (TB) in children increased worldwide. Pulmonary TB in adults is diagnosed by isolation of *Mycobacterium tuberculosis*. In children; the diagnosis is based on diagnostic criteria and characteristics of the disease. The aim of this study was to evaluate bacteriological specimens from children with TB hospitalized in the pediatric tuberculosis ward of Masih Daneshvari Hospital. We assessed the results of smears, cultures and polymerase chain reaction (PCR) of gastric aspirates for confirmation of clinical findings.

Materials and Methods: A descriptive study was performed on 126 medical records of children with TB during a 5-year period. Demographic data including age and gender, pulmonary and extra-pulmonary TB presentations and gastric washing smear, culture and PCR were collected and then analyzed by SPSS software.

Results: The study patients were divided into three groups of age: 0-5 yrs, 6-10 yrs and 11-15 yrs. The highest frequency (68.3%) was observed in the 11-15 years age group; 47.6% of the patients were males and 52.4% were females. The tuberculin skin test was positive in 73% of patients. Gastric aspirate smears, culture and PCR were positive for *Mycobacterium tuberculosis* in 55.6%, 58.7% and 53.2% of cases, respectively. Computed tomography (CT) scan showed evidence of TB in 94.4% of patients. In 34 patients, chest x-ray was normal and TB was diagnosed via CT-scan of the lung.

Conclusion: The present study suggests that gastric lavage smears and cultures have high diagnostic value in TB diagnosis in children. In addition, chest CT-scan is recommended for diagnosis of TB in suspected children when other evaluations are normal. (*Tanaffos* 2009; 8(2): 42-45)

Key words: Tuberculosis, Bacteriology, Children, Diagnosis

INTRODUCTION

Tuberculosis is a major cause of morbidity and mortality of children in developing countries.

Although incidence of TB in developed countries was descending till the previous two decades, this rate has been increasing since 1985 due to various reasons such as increased prevalence of HIV, immigration, poverty and homelessness. Prevalence rate of TB in children had a 34% increase (1).

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According to WHO report, 13 million new cases of TB and 5 million deaths due to tuberculosis were detected in children less than 15 years of age during 1990-2000. Pulmonary tuberculosis is diagnosed by isolation of *M. tuberculosis*. Since sputum induction is difficult in children, the best method is culture of gastric aspirate which is positive in 20-50% of cases. A negative result never excludes the diagnosis of TB in children. In most children, TB diagnosis is based on diagnostic criteria including positive tuberculin skin test, evidence of TB on chest x-ray, positive bacteriology and a history of contact with adult TB patients. Polymerase chain reaction (PCR) is one of the newer methods of diagnosis (2-4). Other studies showed that PCR had 56.8% sensitivity in children with active pulmonary TB in comparison to 37.8% and 13.5% sensitivity in children with positive culture and smear, respectively (5-8). One of the recent advances in TB diagnosis is measurement of interferon-gamma in which some researchers found a higher specificity in contrast to the tuberculin skin test for TB diagnosis. However, it is not recommended as a routine test (2, 9, 10).

The aim of this study was to evaluate hospitalized children with TB in the pediatric tuberculosis ward of Masih Daneshvari Hospital. The results of the patients' smears, cultures and PCR of gastric washing were assessed on the basis of clinical and laboratory findings.

MATERIALS AND METHODS

A descriptive study was performed on 126 medical

records of TB patients hospitalized in the pediatric TB ward of Masih Daneshvari Hospital during a 5-year-period. Demographic data like age and gender, pulmonary and extra pulmonary presentation and the results of gastric washing smears, cultures and PCR were collected.

The diagnostic criteria for TB were as follows:

- 1- Presence of any clinical symptom in the child
- 2- History of contact with a TB patient
- 3- TB compatible radiological features
- 4- Positive pathologic/bacteriologic findings
- 5- Positive PPD

It is notable that presence of at least three above criteria is essential for diagnosis of TB and initiation of anti-TB therapy.

Three-sequential gastric lavage samples were obtained from all patients in 3-consecutive days (according to WHO standards) and evaluated by smear, culture and PCR for detection of acid-fast bacilli (AFB). Chest X-ray and CT-scan of the lungs were performed in all cases. Additionally, a purified protein derivative (PPD) test was done with intradermal injection of 0.1 ml containing 5 tuberculin units (TU) of PPD solution for all patients. The patients were assigned to three groups: 0-5 years group (n=22, 17.5%), 6-10 years group (n=18, 14.3%) and 11-15 years group (n=86, 68.3%). Data were recorded in a questionnaire and then analyzed by SPSS software.

RESULTS

The results of reviewing 126 medical files of hospitalized patients with pulmonary and extra pulmonary tuberculosis were as follows:

The highest frequency belonged to the third age group (Fig. 1).

Regarding gender, 60 patients (47.6%) were males and 66 patients (52.4%) were females. Sixty patients were Iranian and 66 were Afghan. Tuberculin skin test was positive in 92(73%) patients (induration >10 mm in cases with no contact with active TB patients and induration >5mm in those who had contact, were considered as positive.)

Smears and cultures were positive for AFB in 70 (55.6%) and 74 (58.7%) patients, respectively. Fifty-

six and 52 patients had negative sputum smears and cultures, respectively. PCR of gastric lavage or aspirate was positive in 67 (53.2%) patients (Fig. 2). Fifty-nine patients (46.7%) had a negative PCR.

Furthermore, 7 patients with negative smears and cultures were positive for PCR. Chest x-ray and lung CT-scan showed evidence of TB in 82(65.1%) and 119 (94.4%) patients, respectively. Thirty-four patients with normal chest x-ray had a CT-scan of the lung indicating Tuberculosis. Pulmonary involvement was observed in 111 cases (88.1%); 10.9% of patients had extra-pulmonary TB.

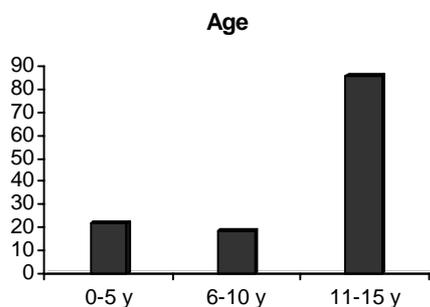


Figure 1. Age distribution of children with TB in the study population

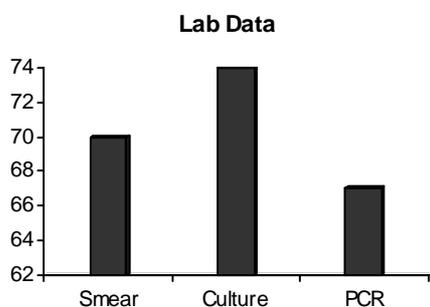


Figure 2. Frequency of smear, culture and PCR of gastric lavage in the study population

DISCUSSION

The most important step in the management of TB in children is a prompt, early and proper diagnosis. Inability to achieve a positive specimen for *M. tuberculosis* is a major diagnostic problem in children. A study conducted by Corrigan et al. in 2007 showed a positive sputum smear in less than

10-15% of cases and a positive culture in 30-40% (2, 11). In 2007, Brinza and colleagues studied 254 children with pulmonary TB in Romania. A positive bacteriology was detected in 24.8% of his cases (12). Among our study group (n=126), 55.6% had positive smears and 58.7% had positive cultures for AFB. The rates of positive smears and culture specimens in our study were higher than those of other studies. Since our hospital is a referral center for TB patients and most of them have fulminant TB, this difference may be significant. In our study, 7 patients with negative smears and cultures had positive PCR indicating that PCR can help in TB diagnosis in children who have negative bacteriology.

The present data showed that 88.1% and 10.9 % of the patients had pulmonary and extra-pulmonary TB, respectively. In a study conducted by Marias et al. in 2006, pulmonary and extra-pulmonary TB was observed in 70% and 8% of patients, respectively (13). In another study by Feja et al., pulmonary and extra-pulmonary TB was detected in 76.9% and 9-23% of the cases respectively. He showed that primary or extra-pulmonary TB can be seen as a complication of primary infection with *M. tuberculosis* in children which is less frequent in adults (14). Amsalu et al. studied 212 children with TB in Ethiopia in 2007 and showed 91% involvement with pulmonary TB (15).

The present study showed evidence of TB in 94.4% of the cases on chest CT-scan. On the other hand, 34 patients whose chest x-rays were normal, showed evidence of TB on their chest CT-scan. In conclusion, CT-scan of the chest is recommended as an effective diagnostic tool for TB diagnosis in children. According to other studies such as a study conducted at our hospital in 2005, the diagnostic value of the lung CT-scan in comparison to other diagnostic criteria including history of contact,

clinical findings, chest radiograph and tuberculin skin test, had 100% sensitivity and 40% specificity (16).

The results of this study indicated high diagnostic value of smear and culture of gastric aspirate in children suspected to have TB. When TB is suspected on chest-x-ray, it is recommended to perform a chest CT-scan to help diagnosis of TB in children.

REFERENCES

- Richard E. Behrman, Robert M.Kliegman, Hal B. Jenson. Nelson Text book of Pediatrics, 17th ed. Philadelphia: Saunders; 2004: 958-72.
- Corrigan DL, Paton JY. Tuberculosis in Children. *Breathe* 2007; 3 (4): 351-63.
- Walls T, Shingadia D. Global epidemiology of paediatric tuberculosis. *J Infect* 2004; 48 (1): 13- 22.
- Nelson LJ, Wells CD. Global epidemiology of childhood tuberculosis. *Int J Tuberc Lung Dis* 2004; 8 (5): 636- 47.
- William N. Rom, Stuart M. Garay. Tuberculosis. 2nd ed. Lippincott Williams Wilkins; 2004: 609 – 24.
- Zar HJ, Hanslo D, Apolles P, Swingler G, Hussey G. Induced sputum versus gastric lavage for microbiological confirmation of pulmonary tuberculosis in infants and young children: a prospective study. *Lancet* 2005; 365 (9454):130-4. Erratum in: *Lancet* 2005; 365 (9475): 1926
- Cruz AT, Starke JR. Clinical manifestations of tuberculosis in children. *Paediatr Respir Rev* 2007; 8 (2): 107- 17.
- Lobato MN, Loeffler AM, Furst K, Cole B, Hopewell PC. Detection of Mycobacterium tuberculosis in gastric aspirates collected from children: hospitalization is not necessary. *Pediatrics* 1998; 102 (4): E40.
- Dheda K, Udwardia ZF, Huggett JF, Johnson MA, Rook GA. Utility of the antigen-specific interferon-gamma assay for the management of tuberculosis. *Curr Opin Pulm Med* 2005; 11 (3): 195- 202.
- Andersen P, Munk ME, Pollock JM, Doherty TM. Specific immune-based diagnosis of tuberculosis. *Lancet* 2000; 356 (9235): 1099- 104.
- Nelson LJ, Schneider E, Wells CD, Moore M. Epidemiology of childhood tuberculosis in the United States, 1993-2001: the need for continued vigilance. *Pediatrics* 2004; 114 (2): 333- 41.
- Brînză N, Mihăescu T. Diagnostic difficulties in pulmonary tuberculosis in children. *Rev Med Chir Soc Med Nat Iasi* 2007; 111 (1): 65- 9.
- Marais BJ, Gie RP, Hesselring AC, Schaaf HS, Enarson DA, Beyers N. Radiographic signs and symptoms in children treated for tuberculosis: possible implications for symptom-based screening in resource-limited settings. *Pediatr Infect Dis J* 2006; 25 (3): 237- 40.
- Feja K, Saiman L. Tuberculosis in children. *Clin Chest Med* 2005; 26 (2): 295- 312, vii.
- Amsalu S, Hurrisa Z, Nuri S. Tuberculosis in children, Northwest Ethiopia. *Ethiop Med J* 2007; 45 (2): 159- 63.
- Baghaie N, Bakhshayesh Karam M, Khalilzadeh S, Arami S, Masjedi MR, Velayati AA. Diagnostic Value of Lung CT- scan in Childhood Tuberculosis. *Tanaffos* 2005; 4 (16): 57-62.