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## Diagnostic Accuracy of Mantoux test And Chest X-Ray Compared to Gastric Lavage as a Diagnostic Test in Childhood Tuberculosis.

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### Research Article

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#### ABSTRACT

Tuberculosis remains a worldwide public health problem. Childhood tuberculosis is a common and highly prevalent disease amongst pediatric population causing high morbidity and mortality. India accounts for nearly 1/3<sup>rd</sup> of global burden of T.B. every year. Mantoux test was positive in 60% of cases, which still remains as an important diagnostic tool. In 92% of cases there was radiological evidence of pulmonary tuberculosis. Tubercle bacilli were isolated from gastric lavage in 20% of cases. High index of suspicion inclusion of history of contact, past history of measles and investigations such as Mantoux test, radiology, histopathological examination and bacteriological study is of great value in the diagnosis.

#### INTRODUCTION

Tuberculosis is one among the major causes of loss of manpower in developing countries. It has been described as the continuing scourge of India <sup>[1]</sup>. Because of the protean manifestations; tuberculosis eludes early diagnosis, which is essential to prevent morbidity and mortality.

Tuberculosis has been declared a global emergency in 1993. It is one of the most devastating and widespread infections in the world. It is important cause of mortality and morbidity, especially in developing countries. The disease burden affects both adults and children.

In 1990, the World Health Organization (WHO) estimated that there were 7.5million new cases of tuberculosis disease worldwide, of which 650,000 were children <sup>[2]</sup>.

The percentage of TB cases occurring in children estimated to vary between 15% in low income countries & below 5% in the United States & European countries <sup>[3]</sup>.

The developed world has no exception. In fact, the threat of HIV/AIDS alerted them to the potential danger of resurgence of tuberculosis. Multidrug resistant (MDR) tuberculosis has already assumed phenomenal proportions not sparing children <sup>[4]</sup>.

In most cases, the infection is transmitted from pulmonary smear positive cases (open cases) to other people.

Children are rarely smear positive, hence are much less likely to be a source of infection for other children though can transmit M.tuberculosis, as has been documented in large school based and community outbreaks <sup>[5,6]</sup>.

They are more likely to develop disease after infection and are significantly more likely to develop extra pulmonary and severe disseminated disease than adults. These clinical observations apparently reflect fundamental differences in the immune systems of young children and adults [7].

The risk of developing TB disease after infection with *M.tuberculosis* is, in the absence of HIV co-infection, estimated to be between 5 to 10 percent in adults, 15% in adolescents, 24% in children below 5 years and as high as 43% in children under one year [8].

If Children develop TB disease, it happens more often early after infection (progressive primary infection). The incubation time (time between infection and symptoms) generally varies between one and six months [9].

Diagnosis of TB infection in children is based on a positive mantoux test without signs or symptoms of the disease, and with a normal chest X-ray [10].

Diagnosis of TB disease through routine sputum smear microscopy rarely identifies TB in children, children under the age of 5 rarely expectorate sputum for evaluation; if they do, they may less subjected to sputum microscopy. If sputum is tested, they are less likely to be smear-positive compared to adults. Approximately 95 percent of children of less than 12 years old with TB are smear-negative [11].

The high rate of admission of tuberculosis cases to the hospitals forms only the tip of the iceberg, the base of which is in community.

The problems of diagnosis of tuberculosis in children are multifactorial. Widespread malnutrition and depressed cell mediated immunity, nonspecific radiological changes, denial of contact history because of social stigma, all add to the problem of diagnosis.

The magnitude of childhood tuberculosis is underestimated probably because of failure of isolation of organisms in majority of these cases. Early detection and management of childhood tuberculosis goes a long way in preventing the disease in adults.

As long as there is no single test to rule out tuberculosis over diagnosis and under diagnosis is likely to occur. As far as possible attempts should be made to isolate tubercle bacilli so that the child is spared from unnecessary long term antitubercular treatment.

## METHODOLOGY

This study was conducted in the pediatric department of the Head Quarters Hospital and V.I.M.S. Hospital, Bellary, during the period of December- 2006 to May-2008. This study comprises of 50 children with tuberculosis, only newly diagnosed and untreated cases were included in this study to avoid confusion and misinterpretation with regard to culture and isolation of tubercle bacilli from gastric lavage.

The cases included in this study were selected after a detailed clinical history, thorough physical examination and specific investigations such as Mantoux test, X-ray of the chest and gastric lavage.

X-ray of the other parts of the body was done in relevant cases. Biochemical and cytological examinations of C.S.F., peritoneal and pleural fluids were done whenever it was required. Lymph nodes biopsy was done in relevant cases.

To avoid doubts regarding diagnosis "Kenneth Jones criteria for diagnosing childhood tuberculosis" were applied in all cases. Cases were taken up for the present study only if they scored sufficient points to come under the "Tuberculosis probable" or the "Tuberculosis unquestionable" group.

Apart from routine laboratory investigations like routine haemogram, urine routine etc., the following diagnostic investigations are done.

### Mantoux Test

Mantoux test was done in all cases with I.T.U. P.P.D., RT 23 with tween 80. The results were read after 48-72 hours. Maximum induration was noted and recorded in millimeters. Induration of 10 mm or more is considered as positive.

## X-ray examination

X-Ray of the chest was done in all cases to know the extent of involvement of the pulmonary system in tuberculosis. X-ray of the skull and other parts of the skeletal system were also taken in relevant cases.

## Gastric Lavage

During sleep, the lung's mucociliary system beats mucus up into the throat. The mucus is swallowed and remains in the stomach until the stomach empties. Therefore, the highest yield specimens are obtained first thing in the morning.

- H<sub>2</sub> blocker is administered to the patient in the night for 3 days before collecting gastric aspirate.
- Ideally, the patient being prepared for an early morning gastric aspirate should sleep for at least six hours without interruption.
- The patient should not eat or drink anything overnight to prevent the stomach from emptying

Traditionally, three gastric aspirates on consecutive mornings are performed for each patient. This is the number that seems to maximize yield. Of note, the first gastric aspirate collection has the very highest yield and should be collected using the best possible technique.

The technique of gastric lavage is relatively simple. As soon as the patient gets-up early in the morning the gastric contents are aspirated before any food or water is taken, by that patient. This is because, the secretions swallowed at night are collected in the stomach and if the aspiration is delayed, the stomach contents may be emptied into the duodenum thus preventing any chance of demonstrating tubercle bacilli in the aspirant fluid. The aspiration of the contents is done before giving the food or water to prevent contamination and to prevent false positive results, because of the presence of atypical mycobacterium that may be present in the material. A minimum of three samples are obtained on three consecutive mornings.

## RESULTS

**Table 1: Mantoux Reaction  
(A) BCG Scar Present**

| Types TB       | No. of cases | Mantoux negative | 10-14 mm | 15-19 mm | 20-30 mm | % positive |
|----------------|--------------|------------------|----------|----------|----------|------------|
| Pulmonary      | 23           | 9                | 7        | 5        | 2        | 60         |
| CNS            | 7            | 4                | 2        | 1        | -        | 42         |
| Abdominal      | 1            | -                | 1        | -        | -        | 100        |
| Lymph node     | 1            | -                | 1        | -        | -        | 100        |
| Disseminated   | 1            | 1                | -        | -        | -        | 0          |
| Bone and Joint | -            | -                | -        | -        | -        | 0          |
| Miliary        | 1            | 1                | -        | -        | -        | 0          |
| Total          | 34           | 15               | 11       | 6        | 2        | 56         |

**(B) BCG Scar Absent**

| Type of tuberculosis | No. of cases | Mx negative | 10-14 mm | 15-19 mm | 20-30 mm | % positive |
|----------------------|--------------|-------------|----------|----------|----------|------------|
| Pulmonary            | 8            | 2           | 2        | 3        | 1        | 75         |
| CNS                  | 5            | 1           | 2        | 2        | -        | 81%        |
| Abdominal            | -            | -           | -        | -        | -        | -          |
| Lymph node           | -            | -           | -        | -        | -        | -          |
| Disseminated         | 2            | 2           | -        | -        | -        | -          |
| Bone and joint       | 1            | -           | 1        | -        | -        | 100        |
| Miliary              | -            | -           | -        | -        | -        | -          |
| Total                | 16           | 5           | 5        | 5        | 1        | 68         |

In group 'A' Mantoux positivity was 56%. Mantoux test was negative in Disseminated TB and Miliary TB.

Mantoux test was positive in Abdominal TB.

In group 'B' Mantoux positivity was 68%. Mantoux was negative in Disseminated tuberculosis. Severe form of tuberculosis (CNS, Disseminated, Bone and Joint TB) was present in 16 cases, out of them 8 were not vaccinated with BCG.

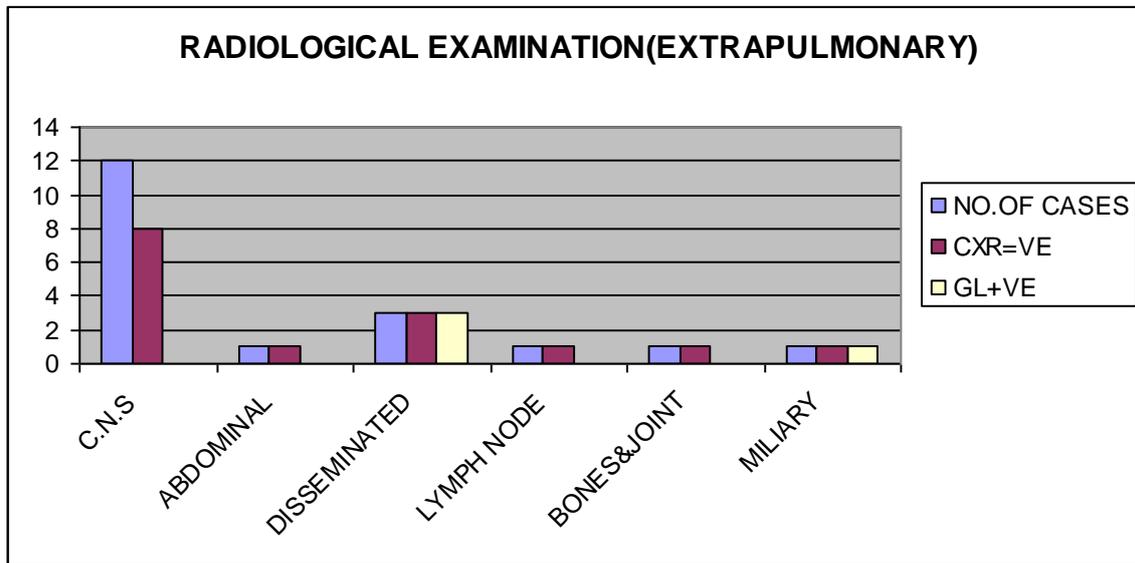


Figure 1

It may be noted that Parenchymal lesion was present in 32% of pulmonary tuberculosis, in 1 case (3.2%) cavity was present.

Also in 78.9% of extra-pulmonary tuberculosis, radiological evidence of pulmonary TB was present.

It can be observed that more the parenchymal. lesion in the lungs, more the isolation of tubercle bacilli from gastric lavage

Table 2: Specific Investigations Done

| Type of investigation     | No. of cases done | No. of positive | Percentage position |
|---------------------------|-------------------|-----------------|---------------------|
| Mantoux test              | 50                | 30              | 60                  |
| X-ray chest               | 50                | 46              | 92                  |
| Pleural fluid analysis    | 4                 | 4               | 100                 |
| Peritoneal fluid analysis | 1                 | 1               | 100                 |
| CSF analysis              | 15                | 12              | 80                  |
| Lymph node FNAC           | 7                 | 3               | 43                  |
| Gastric lavage smear AFB  | 50                | 10              | 20                  |

Mantoux reaction was positive in 60% of cases.

X-ray chest was positive in 90% of cases.

Definite evidence of tuberculosis in the form of isolation of bacilli was done in 10 cases from gastric lavage (20%).

Lymph node FNAC for tuberculosis was positive in 3 (43%) of cases.

Table 3: Bacteriological Studies - Usefulness of Gastric Lavage.

| TYPE OF TUBERCULOSIS | NO.OF CASES | GASTRIC LAVAGE+VE | %    |
|----------------------|-------------|-------------------|------|
| PULMONARY            | 31          | 6                 | 19.3 |
| C.N.S                | 12          | 0                 | 0    |
| DISSEMINATED         | 3           | 3                 | 100  |
| MILIARY              | 1           | 1                 | 100  |
| ABDOMINAL            | 1           | 0                 | 0    |
| LYMPH NODE           | 1           | 0                 | 0    |
| BONE&JOINT           | 1           | 0                 | 0    |

In the following types of tuberculosis –Pulmonary, CNS, Abdominal, Lymph node, Bone & joint further tests like gastric lavage can be used to prevent false positives.

## DISCUSSION

Correct diagnosis is the basis of good medicine. Even though spectacular advances have been made in the field of Medicine, the last word has not been said in the diagnostic field of tuberculosis.

Tuberculosis as seen in developing countries has many differences from that seen in Europe or North America. These differences are because of nutritional state, intercurrent infections, genetic factors and possibly the size of the infective dose (David Morley) <sup>[12]</sup>.

Mantoux test was positive in 30 (60%) cases irrespective of type of tuberculosis. In pulmonary tuberculosis 20 out of 31 was positive (64.5%). In CNS out of 12 cases 7(58.3%) were positive, in abdominal tuberculosis 1(100%) positive, in lymphnode tuberculosis 1(100%) positive, in disseminated tuberculosis it was negative in all 3 cases, in bone and joint tuberculosis 1(100%) positive and in the only miliary case it was negative.

Mantoux was strongly positive (i.e., more than 20 mm) in 3(6%) out of 50 cases. The Mantoux negative reaction was seen in 11 cases of pulmonary tuberculosis, 5 cases of CNS, in all cases of disseminated and miliary tuberculosis. In those with B.C.G. scar absent the Mantoux reaction was positive in 11(68%) cases and the reaction was more than 15 mm in 11 cases.

Thus it can be observed that the assumption-“a negative Mantoux with or without B.C.G. scar rules out tuberculosis” is not true. In such cases clinical and radiological evidences should be looked for carefully.

In a study of post vaccinal allergy after B.C.G. at birth by V.B. Raju et al <sup>[13]</sup> observed that the mean size of Mantoux in children without B.C.G. scar in 3 months to 3 years age group was 3.5 mm to 6.5 mm. And in the same age group with B.C.G. at birth, the mean size of Mantoux reaction was 3.8 to 5.4 mm.

In a study of postvaccinal tuberculin reaction, Mehta and Merchant observed that the postvaccinal allergy is short lived and invariably wanes after 24 months.

Mantoux conversion rate in 24 months was 9%. So, a strongly positive Mantoux with clinical and other supportive evidences for tuberculosis is helpful in diagnosis of tuberculosis in B.C.G. vaccinated.

The following observations were made in the X-rays of the chest of 31 pulmonary tuberculosis. Paratracheal, mediastinal and or hilar adenitis were seen in 8 (25.8%) cases. Pleural effusion in 4(13%) cases, segmental lesion in 6(19%), parenchymal lesions alone in 10(32%), parenchymal with glandular lesion in 2(6.4%) and cavity in 1(3.2%) of cases.

Radiological findings in extra-thoracic forms of tuberculosis in this study were as follows. Out of 12 cases of C.N.S. tuberculosis 8(66%) had evidence of pulmonary tuberculosis on X-ray chest. Benakappa et al <sup>14</sup>observed that in 48.8% of them there was X-ray evidence of pulmonary tuberculosis in their study of 125 cases of tubercular meningitis.

Out of 3 cases of disseminated tuberculosis 3(100%) had evidence of pulmonary tuberculosis, in 1(100%) case of lymphnode tuberculosis, in 1(100%) case of bone and joint tuberculosis & in1 (100%) case of abdominal tuberculosis there was evidence of pulmonary lesion.

Of the 50 cases studied there was evidence of pulmonary lesion in 46(92%) cases, and no radiological evidence of tuberculosis were seen in 4(8%) cases.

Out of the 46 cases the types of lesion being:

- Hilar, paratracheal adenitis 17(44.4%)
- Pleural effusion 4(8.6%)
- Segmental lesion 6(13%)
- Parenchymal lesion 10(21.7%)
- Parenchymal and glandular lesion 7(15.2%)

- Cavities 1(2.2%)
- Miliary 1(2.2%)

Emery and Lorbar <sup>[15]</sup> showed that in a series of 52 histo-pathologically proved miliary tuberculosis only 18 were diagnosed by X-ray, 25 by retinoscopy and 28 by combination of both.

The following observations were made by X-ray examination in 100 cases of autopsy proved pulmonary tuberculosis. By Udani et al <sup>[16]</sup>, that out of 34 bronchopneumonia cases in only 21 cases X-ray was suggestive, out of 28 cases of hilar nodes 18 were suggestive, out of 27 cases of miliary 17 cases of segmental lesion 13 were suggestive, and out of 11 primary complex only 1 was suggestive on X-ray examination.

The only proves that in spite of pulmonary lesions in tuberculosis, there may not be any obvious X-ray evidence which emphasis the fact that a negative X-ray does not rule out tuberculosis.

In the present study in 10(20%) out of 50 cases of tuberculosis, tubercle bacilli was isolated from gastric lavage by smear examination.

Gastric juice either natural or artificial has been shown to be harmful to tubercle bacilli by Veera Lester <sup>[17]</sup> in 1934. Ames et al 1946 have found a germicidal factor present in gastric lavage affecting tubercle bacilli <sup>[18]</sup>.

Linger <sup>[19]</sup> reported an interesting case of primary pulmonary tuberculosis in pre-allergic stage. In this case mother was suffering from pulmonary tuberculosis, but on examination of the child, tuberculin test was negative. X-ray examination and auscultation revealed no abnormality but gastric lavage showed tubercle bacilli. At a later date repeat tuberculin test had a positive reaction. Poulsen and Anderson <sup>[19]</sup> have also seen similar cases in their study.

## CONCLUSION

- Even though in most of the cases the isolation of bacteria from gastric lavage may not be of any additional value it may be of great importance in occult or borderline cases of tuberculosis (probable and possible cases) in clinching the diagnosis.
- Comparison among the Mantoux test and chest x-ray shows sensitivity and negative predictive values are higher for chest x-ray and specificity and Diagnostic accuracy is more in Mantoux test than chest x ray.

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