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SPECIFICITY AND SENSITIVITY OF PPA AND NTP GUIDELINES IN DIAGNOSIS OF TB IN CHILDREN

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INTRODUCTION

Background: Diagnosis of TB is still a challenge for paediatricians, physicians, radiologists, microbiologists, and serologists[1]. Clinical scoring systems are at present the most widely used method for arriving at the diagnosis of TB[2]. According to official estimates, the rate of open bacillary cases among adult population (18 years and above) was 17% and among children 5-9 years of age 13% were infected with TB. It is thought to be the 4th major cause of all deaths in Pakistan[3].
Objectives: To check the specificity and sensitivity of available scoring system of PPA and NTP clinical guidelines to diagnose TB in children.
Study design: Descriptive Cross sectional study.
Setting: Department of Peadiatrics ,liaquat University Hospital Hyderabad/ Jamshoro.
Duration with dates : Six months (17th January to 16th July 2009)
Subjects and methods: In this study 100 patients of age group in between 6 months to 12 years, clinically suspected as TB on the basis of history of chronic cough, unexplained fever, weight loss, history of close contact with TB patient in family, has been evaluated for specificity and sensitivity of PPA and NTP guidelines for diagnosis of TB in children. As there is no specific tool to confirm the diagnosis so we confirm our diagnosis by assessing the response of anti-tuberculous drugs in all suspected cases of TB on the basis of scoring system. Data of each patient was collected on preformed Performa and analyzed on SPSS version 10. Frequency and percentages of different variables were computed. Mean and standard deviation was computed for quantitative variables like age of child. Chi-square test was applied to compare different proportion at level of significance of $p < 0.05$.
Results: The sensitivity and specificity of PPA was 91.3% and 50%, while in NTP guidelines sensitivity and specificity was found to be 90.1% and 44.44% respectively.
Conclusion : PPA and NTP guidelines are more sensitive, but less specific parameter for the diagnosis of TB in children.

Key words : TB, children, diagnosis, guidelines.

INTRODUCTION

TB remains a leading cause of death among the medically and economically deprived persons throughout the world. It is estimated that 1.7 billion individuals are infected world wide, with 8-10 million new cases and 3 million deaths per year. Majority of these occurs in the underdeveloped countries[4-6]. It is reported that between 2000-2020 approximately one billion new cases will be infected, 200 million will get sick and 35 million will die from TB. Pakistan is unfortunately among the six countries where the incidence of TB is high[7].

Children almost always acquire this infection from adult sufferer with whom they are in close contact. The exact proportion of children suffering from TB is not known. The estimated proportion of children with TB is 3-13% of all TB cases[7,4,8].

Diagnosis of TB in children can be challenging. There is no single clinical feature or test that establishes beyond doubt the diagnosis of TB. Usually a constellation of clinical features are used for arriving at the diagnosis[9].

The diagnosis of TB in children relies on careful and thorough assessment of all the evidence derived from a careful history, clinical examination and relevant investigations, e.g. TST, CXR and sputum smear microscopy. The proposed approach to diagnose TB in children is based on limited published evidence and rests heavily on expert opinion[10]. Clinical scoring systems are at present the most widely used method for arriving at a diagnosis[8]. A number of diagnostic scoring charts based on constellation of signs and symptoms are being used. One such criterion was formulated by Kenneth Jones and his collegues[11].

TB is common problem of Pakistan, diagnosis of TB in children is a great problem. PPA guidelines (Modified Kenneth Jones scoring) and recommended approach by NTP to diagnose TB in children was used jointly to apply in all children who are suspected as cases of TB. Sensitivity and specificity of both criteria in diagnosis of TB in children was tested.

MATERIAL AND METHOD

100 patients clinically suspected as TB on the basis of history of chronic cough, unexplained fever, weight loss, history of close contact with TB patient in family, has been evaluated for specificity and sensitivity of PPA and NTP guidelines for diagnosis of TB in children. As there is no specific tool to confirm the diagnosis so we confirm our diagnosis by assessing the response of anti-tuberculous drugs in all suspected patients on the basis of scoring system. All patients were followed after 1 month and assessed for response of drugs given as per diagnosis. A positive response in correspondence with scoring is subjective (fever and cough, weight gain) and objective (investigation like X-ray chest, CSF DR, ultrasound abdomen) improvement after start of treatment.

Setting: Department of Pediatric Liaquat University Hospital Hyderabad.

Duration of Study: Six months (17th January to 16th July 2009)

Sample Size: 100 cases.

Study Design: Prospective descriptive type.

Inclusion Criteria

1, Age group 6 months to 12 years.
2, History of recurrent cough or cough of more than 2 weeks duration.
2, Children with history of unexplained fever.
3, Children with visible severe wasting.
4, Children with history of measles and unvaccinated.

Exclusion Criteria

1, Children less than 6 months or above 12 years of age
2, Children with known chronic illness like cystic fibrosis.
3, Children who are already on anti-tuberculosis therapy.

Operational Definitions

Chronic cough

Cough that lasts 30 days or more.

Unexplained fever

Fever with no apparent cause, temperature should be =37.5c

Visible severe wasting

Appears very thin and has no fat. There is severe wasting of the shoulders, arms, buttocks and thighs, with visible rib outlines.

DATA COLLECTION

After an informed consent of parents of patient a total of 100 cases of suspected TB were enrolled, who fulfilled the inclusion and exclusion criteria? Data was collected on preformed Proforma by taking history, examination and investigation where ever applicable. It is categorical, nominal data.

DATA ANALYSIS

The collected data was analyzed on SPSS version of 10.0. Frequency and percentages computed for presentation of all qualitative variables including sex of child, history of cough f 2 weeks duration, fever for more than 2 weeks duration and not responding to drugs, weight loss during this illness, age less than 2 years, history of TB in family and contact to child, absence of BCG scar, history of whooping cough/measles in last 3 or 3-6 duration. Examination suggestive of TB, X-ray findings suggestive of TB, montoux test, sputum/gastric lavage examination for AFB, other investigation of applicable were also included and type of TB. Frequency and percentages of different variables were computed. Mean and standard deviation was computed for quantitative variables like age of child. Chi-square test was applied to compare different proportion at level of significance of $p < 0.05$.

RESULTS

One hundred children, fulfilled criteria of inclusion were analyzed for diagnosis of TB on the basis of PPA and NTP guidelines by asking history, examination of patients and certain investigation where ever applicable.

On the basis of PPA guidelines out of 100 in 92 children TB was diagnosed and anti-tuberculous therapy was started. Age distribu-

TABLE-I

Frequency of age distribution with percentage (n-100)

Age	Number	Percentage
=1 year	20	20
2 years	17	17
3 years	17	17
4 years	4	4
5 years	9	9
6 years	7	7
7 years	3	3
8 years	3	3
9 years	2	2
10 years	6	6
11 years	6	6
12 years	6	6

Mean age 53.64 months
Standard Deviation 42.893 months

TABLE II
PPA guidelines (Kennethes jone's criteria) in each case with percentage (n-92)

Factors	Number	Percentage	P
Age <2 years	39	42%	0.000
Contact with TB patient	19	20.5%	0.002
Contact with sputum +ve	48	52%	
BCG scar absent	52	56.5%	0.689
Measles/ whooping cough with in 3 months	3	3%	0.000
Measles/ whooping cough within 3-6 months	32	36%	
Immunocompromised/ Immunosuppresed	00	0%	
PCM III	76	82.5%	0.000
EXAMINATION/INVESTIGATION			
Physical examination suggestive of TB	60	65%	0.000
Radiologic finding specific	85	92%	0.000
Tuberculin Skin Test	00	0%	0.000
Granuloma non-specific	00	0%	
Granuloma specific	00	0%	
Sputum/gastric aspirate AFB Positive	2	2%	0.000

TABLE III.
NTP guidelines in each case with percentage (n-91)

Factors	Number	Percentage	P- value
0-4 Years	58	63.7%	0.009
5 years and above	33	36.3%	
Close contact smear positive TB case	48	52%	0.002
Chronic cough	63	69%	0.009
Fever	89	97%	0.000
Weight loss	89	97%	0.000
Gibbus formation	1	1%	
Non-painful enlarged cervical lymph nodes			
with fistula formation	00	0%	
Tuberculin skin test	00	0%	0.000
Changes in X-ray chest suggesting TB	85	92%	0.000
Lumbar puncture	17	18.5%	
Pleural tap	5	5.5%	
Abdominal ultra sound & ascitic tap	6	6.5%	
Pericardial ultra sound and tap	1	1%	
CT scan brain (hydrocephalus)	17	18.5%	

tion was given in table number I.

On the basis of PPA guidelines (Kenneth Jone's criteria), history of contact with sputum positive adults was found in 48 (52%), sputum negative adults in 19 (20.5%) and no history of contact in 25 (27%). Fifty two (56.5%) patients had absence of BCG scar. History of measles/whooping cough in less than 3 months and 3-6 months prior to diagnosis was found in 3 (3%) and 32 (36%) respectively. None of child was immuno-compromised. PCM III was found in 76 (82.5%) patients.

Physical examination suggestive f TB was found in 60 (65%). An X-ray finding suggestive of TB was found in 84 (92%) patients. In only 2 patient sputum/ gastric aspirate was found to be positive for AFB. Detail with percentage was given in table number II.

Tuberculin skin test was not found in any patient positive (>10mm induration) that may either be due to faulty administration or most of the patients were malnourished and in malnourished children tuberculin skin test is negative due to depressed immunity.

On the basis of NTP guidelines out of 100 cases in 91 patients TB was confirmed. Age group of less than 4 years were 58 (63.7%) and 5 years and above were 33 (36.3%). In 48 (52%) cases there

TABLE- IV
Type of TB in patients with percentage (n-92)

Type of TB	Total Numbers	Percentages
Pulmonary	67	73%
Abdominal TB	6	6.5%
Pericardial TB	01	01
Pott's disease	01	01
TBM	17	18.5%
P-value	0.000	
Degree f freedom	6	6

TABLE V
Sensitivity and specificity of PPA (Kenneth Jone's criteria) Guidelines

Test	Disease present	Disease negative	Total
Positive	True positive 84	False positive 04	88
Negative	False negative 08	True negative 04	12
Total	92	08	100

Sensitivity = 84/92×100= 91.30%
Specificity = 04/08×100= 50%

TABLE VI
Sensitivity and specificity of NTP (National Tuberculosis Control program) guidelines

Test	Disease present	Disease negative	Total
Positive	True positive 82	False positive 05	87
Negative	False negative 09	True negative 04	13
Total	91	09	100

Sensitivity = 82/91×100= 90.10%
Specificity = 04/09×100= 44.44%

was history of contact with smear positive TB case in family. History of chronic cough, fever and weight loss was found in 63 (69%), 89 (97%) and 89 (97%) respectively. Gibbus formation was seen in 1 case with suggestive of pott's disease. Mostly patients had enlarged non-tender cervical lymph nodes, in no case there was fistula formation. X-ray changes suggestive of TB were found in 85 (92%). Lumbar puncture and CT scan of brain was done in 17 (18.5%) cases suspected of TBM. Pleural tap was done in 5 (5.5%) cases with pleural effusion. Abdominal ultra sound and ascetic tap was done in 6 (6.5%) cases with suspected abdominal TB. Pericardial ultra sound and pericardial was done in only 1 case suspected of pericardial TB. Details are given in table number III.

Pulmonary TB was diagnosis in 67 (73%) children followed in order by TBM 17 (18.5%), abdominal in 6 (6.5%), pericardial in 1 (1%) and bone in 1 (1%). Description with percentage was given in table number IV

All patients with score =7 on basis of PPA scoring system, anti-tuberculous therapy had been started, all patient were followed after 1 month to assess the response of drugs. Specificity and sensitivity of PPA (Kenneth jone's criteria) guidelines was found to be 91.3% and 50% respectively. Details are given in table number V.

In patients suspected of TB on the basis of history of prolonged fever, cough, weight loss and history of close contact to TB patient with either sputum positive or negative in family and changes in X-ray, ultrasound abdomen, CT scan brain, CSF DR, anti-tuberculosis therapy had been started, all patient were followed after 1 month to assess the response of drugs. Specificity and sensitivity of NTP guidelines was found to be 90.1% and 44.44% respectively. Details are given in table in VI.

DISCUSSION

Various factors in PPA guidelines (Kenneth jone's criteria) were analyzed in each of patient, age of patient was also one of factor, in this study mean age was found to be 53.64 months and 39 (42%) were under age of 2 years. This was compared with other studies, like study done at Lahore shows 51.1% under the age of 2 years[12] age group was limited up to the age of 5 years, one study done at Islamabad shows 19% under the age of 2 years[13]. Another study done at Lahore shows 52% were under 5 years age group[14]. History of close contact with patient having TB either

sputum positive for AFB or not, was also one of significant factor responsible for TB in children. In this study 19 (20.5%) and 48 (52%) cases were in close contact with patients having history of TB with sputum negative/positive for AFB respectively. This was compared with other studies like study done at Karachi shows 12% and 38% cases in close contact with patients having TB with sputum negative/positive for AFB respectively[15], study done at Faisalabad shows 27% of children suffering from TB had close contact with an adult suffering from TB[16], an other study done at Lahore shows 63.3% patients had history of close contact with patient having TB[14], study done at Faisalabad shows history of close contact with patient having TB was 48%[16], study done at Islamabad also shows history of contact with TB patient in 64.5% cases[13]. History of BCG vaccination or presence of BCG scar was also an important factor helping in diagnosis of TB in children. In this study 52 (56.5%) cases having absence of BCG scar. In study done at Karachi shows 40% patients had absence of BCG scar[15], study done at Faisalabad shows 74% were not immunized[16]. Study done at Banglore shows 20.5% was unimmunized[17]. In this study history of measles/whooping cough, within 3 months was found in 3 (3%) and in 32 (36%) cases, within 3-6 months. One study done at Islamabad shows 20.5% children had history of measles/whooping cough[13], study done at Banglore shows in 58.9% patients there was previous history of recurrent infections/measles[17]. Malnutrition is another important factor which depresses the immunity of children thereby making them more prone to infection. In this study 76 (82.5%) cases were malnourished. One study done at Karachi shows 60% were malnourished[15], study done at Faisalabad shows 18% were having 1st degree malnutrition, 26% 2nd degree and 23% had 3rd degree malnutrition[17], study done at Islamabad shows 60% were malnourished[13]. Examination and radiological findings suggestive of TB were found in this study in 60 (65%) and 85 (92%) cases respectively. When compared this with other studies like done a Karachi shows 32% and 84% respectively[15], study done at Faisalabad shows, in 80% cases X-ray findings suggestive of TB[16], study done at Dhaka shows radiological evidence of TB in 58%[18].

In NTP guideline the age was divided into two groups, one was below 4 years and other was above 4 years. In this study patient under 4 years of age were found to be 54 (59%). One study done at Banglore shows 31.3% of children were under age of 4 years[17]. Factors in history like chronic cough found in 63 (69%) cases, fever in 89 (97%) and weight loss in this illness in 89 (97%) were found in my study. These factors were compared with other studies done like one study done at Islamabad shows cough in 69.7% cases, fever in 80.5%, weight loss in 69.5% cases[13], study done at Faisalabad shows fever in all patients but of more than 2 weeks found in 54%[16]. Sensitivity and specificity of PPA guidelines (modified Kenneth Jone's criteria) was fund to be 91.3% and 50% respectively, while for NTP guidelines it was found to be 90.1% and 44.44% respectively. This sensitivity and specificity was difficult to compare because work for NTP guidelines for sensitivity and specificity was not done before as well as for PPA guidelines (modified Kenneth Jone's criteria). Few studies were done for Kenneth jone's criteria, according to one study done at India shows specificity of Kenneth jone's 73%[19], another study done at Brazil shows sensitivity of 56% and specificity of 94%[20].

CONCLUSION

In Pakistan PPA scoring (modified Kenneth jones criteria) and NTP guidelines are commonly used tools to diagnose TB in children. In this study both tools were used to assess the children suspected as patient of

TB and found to be effective in diagnosing TB in children in early stages. Still more studies are required to test the sensitivity and specificity of scoring system to diagnose TB in children.

GLOSSERY

AFB Acid Fast Bacilli
BCG Bacilli Calmette Guerin
CSF DR Cerebro-Spinal Fluid Detail Report
CT Computerized Tomography
CXR Chest X-Ray
PPA Pakistan Paediatric Association
NTP National Tuberculosis control Programm,
TB Tuberculosis
TBM Tuberculous Meningitis
TST Tuberculin Skin Test

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