Spectrum of Childhood Tuberculosis in BCG Vaccinated and Unvaccinated Children

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Abstract

Background: Childhood tuberculosis remains a major public health problem in India. We evaluated the impact of BCG vaccination on childhood tuberculosis and the underlying risk factors.

Methods: 100 consecutive children below 12 years diagnosed to have tuberculosis based on the WHO and IAP consensus statement were included in the study.

Result: Majority(42%) of children with tuberculosis were below four years of age. History of contact with a case of tuberculosis was present in 41 cases. BCG scar was present in 77 cases indicating a poor coverage/uptake of BCG vaccination. Pulmonary form of tuberculosis was seen in 52 and extra pulmonary form in 41 cases. Tubercular lymphadenitis was seen in seven cases, of which more than 70 % were in BCG vaccinated group. There was no statistically significant difference in the type of tuberculosis (pulmonary or extra pulmonary) and BCG vaccination. In the extra pulmonary form, 13 children had neuro-tuberculosis, of which 66% were in BCG unvaccinated group, which was statistically significant ($p=0.011$). The underlying risk factors were poor socio-economic status (62%), malnutrition (61%) and poor immunization coverage.

Conclusion: Higher incidence of pulmonary tuberculosis in BCG vaccinated group was not statistically significant. However, high incidence of neuro-tuberculosis in BCG unvaccinated group was statistically significant. The underlying risk factors were poor socio-economic status, malnutrition and poor immunization coverage and should be taken into consideration in order to prevent morbidity and mortality due to tuberculosis in children.

MJAFI 2009; 65 : 305-307

Key Words : Bacille Calmette Guerin vaccine; Tuberculosis

Introduction

Tuberculosis (TB) still remains a major public health problem in developing countries including India. In spite of introduction of directly observed treatment short course (DOTS) strategy, it still contributes significantly to the mortality and morbidity in children. According to WHO, one third of the world's population is infected with tuberculosis. Approx 9 million people develop TB every year, of which about 2 million die [1,2]. The Bacille Calmette Guerin (BCG) vaccine introduced in 1924 has not made the impact in prevention of tuberculosis that was expected, however it modifies the course of the disease [3]. This study was undertaken to evaluate the clinical spectrum of tuberculosis and its risk factors in BCG vaccinated and unvaccinated children.

Material and Methods

A total of 100 consecutive children below 12 years of age suffering from various forms of tuberculosis attending pediatric out patient department/ receiving inpatient care at a tertiary care service hospital since Jan 2007 constituted the study population of this prospective study. Detailed history was obtained from the parents including nutrition, BCG status,

contact history and socio-economic status. After a thorough clinical examination, necessary investigations were done. These include hemoglobin, ESR, chest radiograph and histopathological examination. Isolation of acid fast bacilli from different specimens and body fluids was attempted by direct smear examination and culture. Cerebrospinal fluid (CSF) examination and neuro-imaging was done in suspected cases of neuro-tuberculosis. Mantoux test was done for all cases and induration exceeding 10 mm was considered a positive reaction. A child with history of BCG vaccination and having a scar was considered to be BCG vaccinated. The diagnosis of tuberculosis was based on the WHO criteria and IAP consensus statement on tuberculosis [1,2].

Results

Of 100 cases of childhood tuberculosis, there were 77 BCG vaccinated and 23 unvaccinated children. Majority (42%) were less than four years, followed by 35% in 5 to 8 years of age. There were 45 male and 55 female patients. Prevalence of disease was more in low socioeconomic status (62%) and malnourished children (61%). History of intra-familial or extra familial contact with an adult tuberculosis patient was present in 41 cases. There was no significant difference between BCG vaccinated and unvaccinated children ($p>0.05$) with respect

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Table 1**General characteristics of study population**

	BCG Vaccinated n = 77 (%)	BCG Unvaccinated n = 23 (%)	Total n = 100 (%)	Statistical analysis
Age				Non significant, p = 0.62
0-4	33 (79)	9 (21)	42 (100)	
5-8	28 (80)	7 (20)	35 (100)	
9-12	16 (70)	7 (30)	23 (100)	
Sex				Non significant, p = 0.43
Male	33 (73)	12 (27)	45 (100)	
Female	44 (80)	11 (20)	55 (100)	
Socio-economic status				Non significant, p = 0.69
Upper	5 (83)	1 (17)	6 (100)	
Middle	26 (81)	6 (19)	32 (100)	
Lower	46 (74)	16 (26)	62 (100)	
Nutritional status				Non significant, p = 0.98
Normal	30 (85)	9 (15)	39 (100)	
Malnourished	47 (77)	14 (23)	61 (100)	
History of contact				Non significant, p = 0.49
With contact	33 (80)	8 (20)	41 (100)	
Without contact	44 (75)	15 (25)	59 (100)	

Table 2**Mantoux reactivity and radiological profile**

Investigation	BCG Vaccinated n = 77 (%)	BCG Unvaccinated n = 23 (%)	Total n = 100 (%)	Statistical analysis
Mantoux test				Non significant, p = 0.95
<10 (Negative)	44 (77)	13 (23)	57 (100)	
>10 (Positive)	33 (77)	10 (23)	43 (100)	
Chest radiograph				Non significant, p = 0.69
Normal	30 (75)	10 (25)	40 (100)	
*Abnormal	47 (78)	13 (22)	60 (100)	

*Hilar lymphadenopathy, Pleural effusion, Unresolving pneumonia

Fig. 1 : Pulmonary tuberculosis and BCG status

to age, sex, socioeconomic status, nutritional status and history of contact in the study population (Table 1).

Forty three children had positive mantoux test with more than 10 mm induration, of which 33 (77%) were in vaccinated group and 10 (23%) in unvaccinated group. Chest radiograph was abnormal in form of hilar lymphadenopathy, non-resolving pneumonia and pleural effusion in 60 cases, of which 47 (78%) cases were in BCG vaccinated group and 13 (22%) in BCG unvaccinated group. The association of mantoux positivity with BCG status was not significant ($p > 0.05$) (Table 2). The clinical spectrum of childhood tuberculosis in two groups is highlighted in Table 3.

Fig. 2 : EPTB and BCG status

Pulmonary tuberculosis in the form of primary complex and progressive primary complex was present in 52 children, of which over 80% were in BCG vaccinated group. Extra-pulmonary tuberculosis was seen in 41 children, of which 32 were in BCG vaccinated group. Seven cases were asymptomatic and diagnosed on contact screening. There was a no statistically significant association between the type of tubercular infection and BCG status ($p > 0.05$). In the extra pulmonary group (Table 4), 13 children were found to have neuro-tuberculosis in form of tubercular meningitis, tuberculoma and spinal tuberculosis, of which 7/32 (22%) were in BCG vaccinated group and 6/9 (66%) in BCG

Table 3**Clinical spectrum of tuberculosis among BCG vaccinated and unvaccinated group**

Type of tuberculosis	BCG Vaccinated n = 72 (%)	BCG Unvaccinated n = 21 (%)	Total n = 100 (%)	Statistical analysis
Pulmonary	40 (55.5)	12 (57)	52	Non significant, p > 0. 05
Extra Pulmonary	32 (44.5)	9 (43)	41	

* seven children were asymptomatic, five in vaccinated group and two in BCG unvaccinated group.

Table 4**Extra pulmonary tuberculosis among BCG vaccinated and unvaccinated group**

Type of tuberculosis	BCG Vaccinated n = 32 (%)	BCG Unvaccinated n = 9 (%)	Total n = 41 (%)	Statistical analysis
NeuroTuberculosis	7 (21.8)	6 (66.66)	13	Significant p = 0. 011
# Others forms	25 (78.2)	3 (33.33)	28	

include osteo articular, pericardial, military, lymph node and disseminated tuberculosis

unvaccinated group. This difference between two groups is statistically significant ($p=0.011$). Tubercular lymphadenitis was seen in seven cases, mainly in BCG vaccinated group (70%). Seven children were asymptomatic and put on anti tubercular treatment on contact screening, nutritional status and positive mantoux test.

Discussion

India accounts for the highest TB burden country in the world. There are more than 1.8 million new cases of tuberculosis in India every year of which children constitute 6-8% [1]. Primary tubercular infection can occur at any age, but children are most often affected in areas of high prevalence and high population density. In addition to the agent and host factors, socio economic factors (e.g. poverty, illiteracy, ignorance, poor sanitation, large families) play a significant role in the outcome of tuberculosis. In the present study, 42 children were in the 0-4 years age group indicating the high prevalence of childhood tuberculosis in the younger age group. The probable reasons for this may be due to low resistance, increased prevalence of malnutrition and close contact with infected adults in younger age group. Narain et al [4], reported the prevalence of TB in 38.9% children below four years of age, while Chakraborty et al [5], reported in 54.3% cases. In our study 41 children had a positive contact history, which correlates with a similar study which showed positive contact in 30.4% cases [6]. Seven children who were otherwise asymptomatic could be diagnosed on the basis of contact.

There was no significant difference in the pulmonary or extra pulmonary type of tuberculosis in the two groups. Our results are comparable with other studies done in India [3-5]. In the children with extra pulmonary tuberculosis group, neuro-tuberculous was the commonest form, the incidence of which was higher in BCG unvaccinated children. Somu et al [7], observed that tuberculous meningitis was seen in the ratio of 1:3 among the BCG vaccinated and unvaccinated children.

In conclusion, the study showed a high incidence of pulmonary form of tuberculosis in BCG vaccinated children, which was not statistically significant. In the extra pulmonary group, higher incidence of neuro-tuberculosis was seen in BCG unvaccinated children, which was statistically significant. The underlying risk factors were poor socio-economic status, malnutrition and poor immunization coverage. These factors should be taken into consideration for prevention of morbidity and mortality due to tuberculosis.

Conflicts of Interest

None identified

Intellectual Contribution of Authors

Study Concept : Col R Gupta*Drafting & Manuscript Revision* : Sqn Ldr A Garg*Statistical Analysis* : Wg Cdr V Venkateshwar*Study Supervision* : Col M Kanitkar

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