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Original Article

Geographical and demographic profile of tuberculosis in a pediatric population in Mumbai – A retrospective cross-sectional hospital-based study

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ABSTRACT

Aim: Pediatric tuberculosis (TB) is endemic in Mumbai, India. However, geographical distribution and demographic pattern of children affected with TB are not known. This study aims to determine a geographical and demographic profile of children with TB.

Methods: This is a cross-sectional study that included children from 0–15 years of age suffering from TB, who were referred to our Pediatric TB Clinic, and were seeking treatment at the clinic located in central Mumbai from 2010 to 2011. The patients were diagnosed with tuberculosis based either clinically (fever with cough for more than 2 weeks/loss of weight or failure to thrive/recent contact with an adult having tuberculosis), bacteriologically (positive AFB culture), or histopathology suggestive of caseous granulomas. Records of all the patients were reviewed and the age, gender, type of tuberculosis, drug-resistant (DR) TB, community of patient, and the region of residence were recorded. The association of age, gender, type of tuberculosis, and drug resistance with area of residence as well as type of community was analyzed.

Results: A total of 242 children were included in the study. Mean age of presentation was 5 ± 3.8 years. Male:female ratio was 1.1:1. Totally, 230 (95%) patients were from Mumbai whereas 10 (4.1%) patients were residing outside Mumbai. We were unable to record the residence of 2 patients. Of the 230 patients from Mumbai, 63 patients (26%) were from the Central Mumbai, 93 patients (38.4%) were from Central suburbs, 18 (7.4%) were from the South Mumbai and 57 (23.6%) were from Western suburbs of Mumbai. The association between the area of residence and type of tuberculosis (pulmonary TB, $p = 0.1349$; abdominal TB, $p = 0.063$; bone TB, $p = 0.871$; latent TB, $p = 0.0783$; disseminated TB, $p = 0.9$; adenopathy, $p = 0.6576$; neuro TB, $p = 0.2564$; serositis, $p = 0.170$), gender ($p = 0.7139$), drug resistance ($p = 0.5182$), and age ($p = 0.2403$) was not statistically significant. Overall, 195 (80.6%) patients were Hindus and the remaining 47 (19.4%) patients were Muslims. Similarly, the association between the community (Hindu and Muslim) and type of tuberculosis (pulmonary TB, $p = 0.7518$; abdominal TB, $p = 0.2146$; bone TB, $p = 1.0$; latent TB, $p = 0.2217$; disseminated TB, $p = 1.0$; adenopathy, $p = 0.3403$; neuro TB, $p = 0.8157$; serositis, $p = 1.0$), gender ($p = 0.2121$), drug resistance ($p = 0.3625$), and age ($p = 0.8721$) was also not statistically significant.

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Conclusion: TB at our center was predominantly seen in children from Central Mumbai, which may be due to the central location of our hospital. However, types of TB, DR-TB, were seen equally in children from all parts of the city and were not located to any specific region.

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1. Introduction

Tuberculosis (TB) is considered to be one of the top ten causes of mortality in children.¹ The worldwide burden of pediatric TB as estimated by World Health Organization (WHO) in 2011 was found to be about 0.5 million with 64,000 deaths among children due to TB.² The annual risk of TB infection in children in developing countries like India is 2–5%.³ India is considered a high-burden country of TB and is estimated to have 12,985 smear-positive cases and 34,026 extrapulmonary TB cases aged below 15 years in the year 2011.² Due to diagnostic difficulties, the exact incidence of pediatric tuberculosis cannot be estimated but roughly constitutes 10.2% of the adult incidence in the country.⁴ It has been reported that TB is developing more rapidly among children in Mumbai than it did a decade ago. The percentage of pediatric TB cases registered under RNTCP has increased from 5.6% (59,846 cases) in 2005 to 7% (84,064 cases) in 2011.⁵ This is attributed to the close proximity of adults with multidrug-resistant (MDR) TB.⁶ Childhood TB is however given a low priority by TB control programs.⁷ Since TB is more common among crowded areas in lower socioeconomic background,⁴ this study was undertaken to determine whether it is more common in a particular area or a particular community. So far, no study to ascertain the prevalence of TB specific to any community or geographical distribution has been carried out in children. We carried out a study to determine a geographical and demographic profile of TB in a pediatric population in Mumbai.

2. Methods

This cross-sectional analysis was carried out at a pediatric tuberculosis clinic in a centrally located pediatric hospital in the city of Mumbai after approval of the intrahospital academic council. Records of all children diagnosed with tuberculosis and being treated for the same at the Pediatric TB Clinic from 2010 to 2011 were reviewed and the age, gender, type of TB, drug-resistant (DR) TB, and the region of residence were recorded. The area of residence of each patient was recorded and accordingly each case was divided as belonging to South Mumbai, Central Mumbai, Central suburbs, or Western suburbs. Patients with area of residence extending from Colaba to Dadar were considered to be from South Mumbai. Patients from the eastern suburbs also known as Central suburbs included those with area of residence beyond Dadar up to Dombivli. Patients from Central Mumbai were from the places including Wadala, Dharavi, Dadar, Parel, Sewri, Lalbaug, and Dadar. Patients with area of residence as in areas along the Western Railway line extending from Dadar to

Dahanu Road were listed as a part of the Western suburbs. Communities of each patient were noted and were divided into Hindus, Muslims, and Christians. Hindus also included Jains and Buddhists.

Patients diagnosed with tuberculosis based either clinically (fever with cough for more than 2 weeks/loss of weight or failure to thrive/recent contact with an adult having tuberculosis), bacteriologically, or histopathology, suggestive of caseous granulomas were included in the study. Patients not having tuberculosis were excluded from the study.

Patients were classified as pulmonary TB if lung parenchymal involvement was present; neurological TB if they had hydrocephalus, basal exudates, tuberculomas, and/or meningitis; and abdominal TB if there was presence of ascites, abdominal lymph node with histopathology, or culture suggestive of TB and/or intestinal involvement. Patients with involvement of the serous linings of the body like lungs, heart, and abdomen were labeled as TB serositis whereas those with involvement of lymph nodes were diagnosed as TB lymphadenopathy. Patients with radiological evidence of bone lesion, spinal tuberculosis and TB abscesses with biopsy/microbiological evidence of tuberculosis were included under the category of Bone TB. A patient was diagnosed as latent TB if the patient was in close contact with an adult having active tuberculosis in the past two years and with a positive Mantoux/Interferon Gamma Release Assay. A positive Tuberculin skin test/Mantoux test was defined as an induration of 10 mm or more, measured 48–72 h after intradermal injection with Tuberculin 0.1 ml of PPD injected intradermally. Patients with involvement of 2 organs were labeled as disseminated TB. Drug-resistant tuberculosis was diagnosed on the basis of Drug Sensitivity Test on TB culture.

Association between the area of residence of the patients and community of patients with gender, type of TB and DR-TB was determined by Chi-square test or by Fishers exact test. One-way ANOVA was applied to find an association between age and area of residence and community. Association was considered statistically significant if the *p* value was <0.05.

3. Results

A total of 242 patients were included in the study (refer to Fig. 1). Mean age was 5 ± 3.8 years. Male to female ratio was 1.1:1 (127 males:115 females). Totally, 230 (95%) patients were from Mumbai whereas 10 (4.1%) patients were residing outside Mumbai. We were unable to record the residence of 2 patients. Of the 230 patients from Mumbai, 63 patients (26%) were from the Central Mumbai, 93 patients (38.4%) were from Central suburbs, 18 (7.4%) were from the South Mumbai, and 57 (23.6%)

Fig. 1 – Flowchart with details of patients admitted, included and excluded from the study.

were from Western suburbs of Mumbai. Overall, 195 (80.6%) patients were Hindus and the remaining 47 (19.4%) patients were Muslims.

Pulmonary TB was seen in 95 (39.3%) patients, abdominal TB in 18 patients (7.4%), bone TB in 12 patients (4.9%), latent TB in 31 patients (12.8%), disseminated TB in 19 patients (7.9%), adenopathy in 20 patients (8.26%), neuro TB in 31 patients (12.8%), and serositis in 16 patients (6.61%). Sixteen (6.6%) patients had DR-TB. Association of the area of residence of the patients with the type of tuberculosis, age, gender, and drug

resistance has been depicted in [Table 1](#) and that of community is depicted in [Table 2](#).

4. Discussion

Mumbai consists of 12% of the population of Maharashtra state, but accounts for 22% of notified cases of TB and 50% of people undergoing retreatment after relapse.⁸ No study or records in literature were found associated with the areas in

Table 1 – Association with type of TB, age, gender and drug resistance with residence.

	Central Suburbs (n = 93)	Central Mumbai (n = 63)	Western Suburbs (n = 57)	Southern Mumbai (n = 18)	p value
Type of TB					
Pulmonary TB	30 (32.3%)	27 (42.9%)	27 (47.4%)	10 (55.6%)	0.1349
Abdominal TB	12 (12.9%)	3 (4.8%)	2 (3.5%)	0 (0%)	0.0636
Bone TB	5 (5.4%)	3 (4.8%)	2 (3.5%)	0 (0%)	0.871
Latent TB	10 (10.8%)	11 (17.5%)	4 (7%)	5 (27.8%)	0.0783
Disseminated TB	9 (9.7%)	3 (4.8%)	5 (8.8%)	1 (5.6%)	0.6900
Adenopathy	7 (7.5%)	7 (11.1%)	3 (5.3%)	1 (5.6%)	0.6576
Neuro TB	10 (10.7%)	6 (9.5%)	11 (19.3%)	1 (5.6%)	0.2564
Serositis	10 (10.7%)	3 (4.8%)	2 (3.5%)	0 (0%)	0.170
Drug resistance	8 (8.6%)	2 (3.2%)	4 (7%)	2 (11.1%)	0.5182
Gender					0.7139
Male	45 (48.4%)	34 (54%)	32 (56%)	8 (44%)	
Female	48 (51.7%)	29 (46%)	25 (44%)	10 (55%)	
Age (mean ± SD) (years)	5.6 ± 3.8	4.5 ± 3.7	4.6 ± 3.6	5.2 ± 3.9	0.2403

Table 2 – Association with type of TB, age, gender and drug resistance with community.

Community	Hindus (n = 195)	Muslims (n = 47)	p value
Type of TB			
(1) Pulmonary TB	78 (40%)	17 (36.2%)	0.7518
(2) Abdominal TB	12 (6.1%)	6 (12.8%)	0.2146
(3) Bone TB	10 (5.1%)	2 (4.3%)	1.000
(4) Latent TB	28 (14.4%)	3 (6.4%)	0.2217
(5) Disseminated TB	16 (8.2%)	3 (6.4%)	1.000
(6) Adenopathy	14 (7.2%)	6 (12.8%)	0.3403
(7) Neuro TB	24 (12.3%)	7 (14.9%)	0.8157
(8) Serositis	13 (6.7%)	3 (6.4%)	1.000
Drug resistance	11 (5.6%)	5 (10.6%)	0.3625
Gender			
Male	98 (50.3%)	29 (61.7%)	0.2121
Female	97 (49.7%)	18 (38.3%)	
Age (mean ± SD) (years)	5.2 ± 3.8	5.1 ± 3.9	0.8721

Mumbai where TB cases were maximally found. In our study, predominantly patients were from central Mumbai, which probably could be due to the convenient location of the hospital, which is also located in Central Mumbai. However, type of TB, gender, and age groups involved were not related to any particular residence of the patient. Also, TB was equally seen in both Hindus and Muslims.

We had earlier reported a 6.8% incidence of drug resistance in our patients.⁹ However, when we analyzed whether drug-resistant tuberculosis was more frequent in a particular area of the city, it was not found that all areas were equally affected suggestive that there is no concentration of DR-TB in any locality in Mumbai and that DR-TB in Mumbai is widespread. However, Muslim patients were found to have a slightly higher percentage (10.64%) of drug resistance as compared to Hindus (5.64%). It is interesting to note that central suburbs recorded the maximum cases of drug resistance in our study (of the 9 MDR TB cases, 7 were from central suburbs). Only 1 case of polyresistant TB (resistance to two or more first-line drugs but not to both isoniazid and rifampicin, i.e. not multidrug resistant) was recorded in our study from the western suburbs. Disseminated tuberculosis has been reported to occur in large numbers in children living in overcrowded slums in Mumbai with a high death rate consequently, which is attributed to deaths due to MDR TB.¹⁰ A study similar to ours was carried out in Bangalore Mahanagar Palike Area – this sociodemographic profile concluded that pediatric tuberculosis is a major problem especially among the under-five age group and most of the cases occur in undernourished children and those belonging to a low socioeconomic status.¹¹ However, we did not record the socioeconomic status and conditions of living in our study. Suburban Mumbai has a 3-fold higher population than the island city of Mumbai and the major slum dwellers are concentrated in this area.¹² Thus, it is not surprising to note that in our study the maximum number of TB cases was reported from Central and Western suburbs. However, in terms of percentage, affection of TB is seen in all areas of Mumbai. A similar study carried out in Bhutan recorded the demographic and clinical characteristics of children seeking treatment for tuberculosis under the NTCP in 2010 and additionally compared these findings with the treatment outcomes but found no such association.¹³

5. Conclusion

TB in children in Mumbai is not restricted to any particular type of residence or community. Drug-resistance TB is seen more in Muslims in terms of percentages but absolute number of patients affected with drug-resistance TB is more in Hindus.

We acknowledge that the study does have certain limitations. It is a single hospital based retrospective study and hence does not represent the entire population of Mumbai.

However, this is the only study carried out in Mumbai concentrating solely on the demographics of pediatric tuberculosis – to help ascertain the prevalence of TB specific to any

community and geographical distribution. So far, no such study has been carried out in the pediatric population. Such studies are necessary as TB has become an epidemic in India and equal priority is not being given to TB in children as compared to TB in adults even though the number of TB cases in children has been on the rise. The results of such studies can be used cumulatively to help modify strategies and obtain better control over this devastating disease.

Conflicts of interest

The authors have none to declare.

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