



An Epidemiological Study of Skeletal Tuberculosis

Authors

Dr Sujith Thampy, Dr Kishore .S

¹Fellow in Arthroplasty and Arthroscopy, Department of Orthopedics, Rajagiri Hospital, Chunagamvely, Aluva, Ernakulam District, Kerala.

²Additional Professor, Dept. of Orthopaedics, Govt. Medical College, Trivandrum, Kerala

ABSTRACT

Background and Objectives: *Skeletal tuberculosis is a major debilitating disease in our community. There was an increase in the nonresident keralites with skeletal tuberculosis attending our department for treatment in the recent past. This epidemiological study is carried out to assess the increase in skeletal tuberculosis in emigrant keralites and demographic, person and illness related factors in contracting disease among the patients reaching Orthopaedics department, Government medical college, Kottayam.*

Materials and Methods: *124 skeletal tuberculosis patients, through 3year period were called for a follow up and data regarding demographic, person and illness related factors affecting disease were collected. Data collected were tabulated and represented in various charts and diagrams, and analyzed.*

Results: *In our study, the majority of the cases were in the older age group (61 to 70) and among young individuals (21 to 30). Whereas 31 to 60 age group showed a lower rate of incidence compared to them. Educational status, occupation, monthly income and working environment seems to have predisposing role in getting skeletal tuberculosis. And the result obtained reinforces the existence of skeletal tuberculosis in crowded environments and low socioeconomic strata of community. Spine was the commonest site involved among the 124 cases. Spinal involvement was predominant in dorsal spine followed by lumbar spine and dorsolumbar spine. The involvement of disease among health personals shows the role of working environment especially hospitals as a site for exposure to tuberculosis. 18.5% of all cases are nonresident Keralites.*

Conclusion: *The incidence of tuberculosis remains more or less same through the three year study period. The study reinforces the acquaintance of tuberculosis with low socioeconomic status, substance abuse and to some extent the debilitating diseases. Nonresident Keralites form a significant percentage in the total burden of tuberculosis in the state.*

Keywords: *Skeletal tuberculosis; Epidemiology; Predisposing factors.*

INTRODUCTION

Tuberculosis is an infectious disease caused by Mycobacterium tuberculosis. Pulmonary tuberculosis is the most common form of TB (more than 85% of all TB cases), while extra pulmonary tuberculosis can affect almost any organ in the body. Transmission occurs by the airborne spread of infectious droplets and droplet nuclei

containing the tubercle bacilli. The source of infection is a person with sputum smear-positive pulmonary TB. Bone and joint tuberculosis is always econdary to a primary lesion. It results from haematogenous spread from a pulmonary or other visceral or lymph node focus. Great majority of these lesions are healed by nature with one or two foci manifesting themselves from poor

nutritional status or lowering of immune responses of the individual. Lymph node involvement (mediastinal, mesenteric or cervical) and visceral lesions, like renal and hepatic tuberculosis, could also be the concomitant sites with skeletal tuberculosis ^[1,2].

The infection reaches skeletal system through vascular channels, generally the arteries as a result of bacilleemia or rarely in axial skeleton through Batson's plexus of veins. Bone and joint tuberculosis is said to develop generally 2 to 3 years after the primary focus. Once deposited at a site, the organisms are ingested by mononuclear cells. Mononuclear cells then coalesce into epithelioid cells, and a tubercle is formed when lymphocytes form a ring around a group of epithelioid cells. Caseation then develops within the center of the tubercle. The host inflammatory response intensifies, resulting in exudation and liquefaction, and a cold abscess is formed. A cold abscess is composed of serum, leukocytes, caseation, bone debris, and bacilli. The outcome depends on the characteristics and sensitivity of the organism, the status of the host immune system, the stage of disease at presentation, and the treatment. The range of end results may include resolution with minimal or no morbidity, healed disease with residual deformity, walled off lesions with calcification of caseous tissue, a low-grade chronic granular lesion, and local or miliary spread of the disease that may result in death ^[3,4].

Even though skeletal tuberculosis is an important debilitating disease, the literature in statistical data regarding the incidence and prevalence of disease is very scarce. This epidemiological study is carried out to assess the increase in skeletal tuberculosis in emigrant keralites and the demographic, person and illness related factors in contracting disease, among the patients reaching the Orthopaedics department, Government Medical College, Kottayam.

Tuberculosis remains a major global health problem. It causes ill-health among millions of people each year and ranks as the second leading cause of death from an infectious disease worldwide, after the human immunodeficiency

virus. In 2011 worldwide, there were an estimated 8.7 million new cases of tuberculosis (13% co-infected with HIV) and 1.4 million people died from tuberculosis, including almost one million deaths among HIV-negative individuals and 4, 30,000 among people who were HIV-positive. In 2010 there were an estimated 8.8 million incident cases of tuberculosis globally, 1.1 million deaths among HIV-negative cases of TB and an additional 3, 50,000 deaths among people who were HIV-positive ^[5,6].

The burden of TB is considerably greater in developing countries compared to the developed ones. Geographically, the burden of TB is highest in Asia and Africa. About 60% of cases are in the South-East Asia and Western Pacific regions. India and China together account for almost 40% of the world's TB cases. The African Region has 24% of the world's cases and the highest rates of cases and deaths per capita ^[7,8]. The present threat of tuberculosis is in terms of extra-pulmonary manifestations of disease, with increasing resistance seen to conventional antituberculous drugs (Multi-drug-resistant TB) and co-infection with Human Immunodeficiency (HIV) virus ^[9].

The geographic distribution of tuberculosis has changed considerably over time. Among the highest rates of tuberculosis ever recorded in human society were those of the aboriginal peoples of North America, who had annual risk of infection values greater than 10%. Next in rank were the populations of North America and northern Europe, both with annual risk of infection values about 10%. The highest recorded levels in Asia and Latin America were substantially lower, below 10%.

The present situation is considerably different annual risk of infection rates in India and China, from 2.0% to 1.5% ^[10,11].

With a population of about 1210 million India, the second most populous country in the world, ranks first among countries with the highest burdens of tuberculosis in the world. India has more new tuberculosis cases annually than any other country. In 2009, out of the estimated global annual incidence of 9.4 million TB cases, 2

million were estimated to have occurred in India, thus contributing to a fifth of the global burden of tuberculosis [12,13].

In India 85 percent of them have pulmonary tuberculosis and 15 percent extra pulmonary lesions of which 1 to 3 percent are bone and joint lesions. It is estimated that about 40% of Indian population is infected with tuberculosis bacillus. The recent estimate by WHO gives a prevalence of 3 million. On a national scale, the high burden of tuberculosis in India is illustrated by the estimate that tuberculosis accounts for 17.6% of deaths from communicable disease and for 3.5% of all causes of mortality (WHO, 2004). The estimated incidence were 168 and prevalence were 249 per 1, 00, 000 population for all forms of tuberculosis in 2009 [14].

Although osteoarticular tuberculosis is a disappearing problem in many western countries, in economically developing countries like India this continues to pose one of the major health problems. Vertebral tuberculosis is the commonest form of skeletal tuberculosis and it constitutes about 50 % of all cases. Other areas of predilection are hip, knee, foot, elbow, hand, shoulder and so on [15].

Tuberculosis is strikingly associated with poverty, particularly urban poverty. The cases of tuberculosis that still occur are generally concentrated in inner city ghettos within urban areas. Even where tuberculosis is uncommon in the general population, the disease persists in groups with a low socioeconomic level. Airborne transmission of bacilli from infectious patients to susceptible hosts is obviously enhanced by crowded living conditions and prolonged exposure. Transmission of tuberculosis has also been well documented to occur in other restricted environments such as hospitals, nursing homes and prisons. Tuberculosis will exist in man as long as there are pockets of malnutrition, poor environmental conditions and living standards such as poor sanitation, overcrowded housing and slum dwelling [1,9].

Almost 70% of tuberculosis patients are aged between the ages of 15 and 54 years of age. While two thirds of the cases are male, tuberculosis takes

a disproportionately larger toll among young females, with more than 50% of female cases occurring before 34 years of age [5,6]. Exactly how malnutrition favors the development of the disease is unknown.

Presumably, various components of the immune system, including T-lymphocyte function and cell-mediated immunity, are impaired. It is also not known which dietary elements (proteins, vitamins, micronutrients, or other substances) are necessary to protect against the occurrence of tuberculosis; most probably, multiple factors are involved. Experimental studies suggest an important contributory role for protein under nutrition. These trends keep tuberculosis at the forefront among the deadly infections of humankind [6,12].

Spinal TB is the most common form of skeletal system TB, comprising 50% of all cases. Tuberculosis involving the spine is often referred to as Pott's disease. Spinal disease is seen in approximately half of the patients with bone and joint tuberculosis, and challenges include establishing the diagnosis early in the disease process, and preventing or treating kyphotic deformities. The estimated number of spinal tuberculosis cases in India is between 30,000 and 90,000 cases per year. A number of authors have confirmed this high rate of occurrence. The disease typically involves the thoracic and thoracolumbar spine, although any region may be affected, and "skip lesions" occur rarely [1]. A deformity in the spine can be present as kyphosis along with local tenderness. Neurologic dysfunction is a dreaded complication of spinal tuberculosis. In the Indian population, spinal tuberculosis is predominantly a disease of the young, the usual age of presentation being the first three decades of life [1].

The objectives of our study were to study the epidemiology of skeletal tuberculosis patients attending the Orthopaedics outpatient and casualty of Medical College, Kottayam from August 2009 to August 2012 and to assess the role of different environmental and patient related factors in contracting disease.

MATERIALS AND METHODS

This prospective and retrospective study was conducted at Department of Orthopaedics, Government Medical College, Kottayam. All patients who reported to the Orthopaedics Outpatient and casualty of Government Medical College, Kottayam with skeletal tuberculosis during the period August 2009 to August 2012 were included in the study.

Data collected was tabulated in excel software and analysis was done using SPSS software SPSS version 16 and MATLAB software. Tabulated data were represented in charts and diagrams. Percentage analysis of individual variables was done to find the epidemiologic distribution of cases. The details of all patients with skeletal tuberculosis during the study period, registered in the RNTCP unit, Medical College Kottayam, were collected from the records maintained by the Department of Orthopaedics, RNTCP unit and Medical records library, Medical college hospital, Kottayam. Patients were called for a follow up. Case sheets along with the investigation details were examined and confirmed. With an informed written consent, a pre-prepared questionnaire is used to collect epidemiological and clinical details directly from patients and analyzed with the help of a computer program.

RESULTS

During the study period, total number of patients studied were 124, out of that 37 patients in the first one-third (1 year), 45 patients in 2nd one-third (1 year) and 42 patients in 3rd one-third (1 year). All patients studied were of Kerala origin.

Table: 1. Age distribution of skeletal tuberculosis cases.

Age in years	Number	Percentage
11-20	1	.8
21-30	24	19.4
31-40	21	16.9
41-50	18	14.5
51-60	23	18.5
61-70	25	20.2
71-80	11	8.9
Above 80	1	.8

In age groups analyzed maximum number of cases was seen in 61-70 age group (20.2%), followed by 21-30 age group (19.4%) showing that the disease was more common in elderly and young individuals, middle age groups (31 to 60) showed a lesser incidence rates compared to them.

Male to female ratio was 48: 52. Articular tuberculosis affects both genders almost equally with a slight increased occurrence in females.

Table: 2. Educational status of skeletal tuberculosis patients.

Education	Frequency	Percentage
Below 10 th	59	47.6
Below 12 th	32	25.8
Graduate	31	25.0
Post graduate	2	1.6

Below 10th standard education group shows maximum number of cases, 47.6%, and as education status increases the occurrence rates decrease. Poor educational status is associated with increased existence of skeletal tuberculosis. 43.5% of patients were manual labourers again directing the increased occurrence rates in poor socioeconomic conditions. 7.3 % of total cases were from health care community. Health care personals include a laboratory staff, an assistant staff, two nursing students and majority was nurses.

Table: 3. Working environment of skeletal tuberculosis cases.

Working Environment	Frequency	Percentage
Open environment	69	55.6
Factory	22	17.7
Office rooms	14	11.3
Air conditioned rooms	7	5.6
Hospitals	12	9.7

Manual labourers who are working in open environment and exposed to tough climatic conditions and heavy work are more affected with tuberculosis (55.6%). 9.7% were working in hospitals, of which two were nursing students and one laboratory technician student studying outside Kerala.

51.6% of cases had monthly income below 5000 and 31.5% between 5000 and 10,000. As income goes higher the occurrence rates decreased sharply, showing the existence of disease among low economic status.

81.5% of all patients were resident Keralites, 14.5% resided outside Kerala and 4% outside India. 18.5% of patients were residing outside Kerala.

Past history of tuberculosis was present for 4% patients three had pulmonary tuberculosis and two had extra pulmonary involvement earlier Contact history was there for 25.8%, of which 56.25% had contact from family members and 36.5% got the exposure from patients.

Table: 4 .Co- morbidities in skeletal tuberculosis cases.

Co- morbidities	Frequency	percentage
Diabetes mellitus	5	4.0
HIV	2	1.6
Malignancy	3	2.4
Chronic drug intake	9	7.3
None	105	84.7

7.3% of the patients had chronic drug intake including immunosuppressants and steroids, 4% had diabetics, 2.4% had malignancy and 1.6% had HIV. But the majority 84.7% had no associated co morbidities.

Table: 5 .Substance abuse history among skeletal tuberculosis cases.

Substance abuse	Frequency	Percent
Alcohol	6	4.8
Smoking	7	5.6
Pan chewing	24	19.4
None	37	29.8
Alcohol and Smoking	26	21.0
Smoking and Pan chewing	7	5.6
Alcohol and Pan chewing	11	8.9
Alcohol Smoking & panchewing	6	4.8

39.5% of patients had significant intake history of alcohol, 37.09% of patients were having significant smoking history and 29.84% had pan chewing. Pan chewing was the commonest

addiction among female patients. But 29.8% of the patients had no substance abuse.

Table: 6 .Distribution of site of skeletal tuberculosis among cases.

Site of skeletal tuberculosis	Frequency	percentage
Spine	74	59.7
Hip	12	9.7
Knee	8	6.5
Elbow	5	4.0
Shoulder	4	3.2
Sternoclavicular joint	5	4.0
Wrist	3	2.4
Ankle	7	5.6
Osteomyelitis	6	4.8

Predominant site of tuberculosis among patients studied was spine accounting 59.7% of total cases, followed by hip 9.7%, knee 6.5%. Least affected region was wrist 2.4%

Table: 7 .Regional distribution of spinal tuberculosis among cases.

Site of spinal tuberculosis	Number	Percentage
Cervical Region	4	5.41%
Cervico dorsal	1	1.35%
Dorsal	35	47.30%
Dorso Lumbar	11	14.86%
Lumbar	17	22.97%
Lumbo sacral	6	8.11%

Regional distribution in spine shows predominant involvement in dorsal region 47.30% followed by lumbar 22.97%, then dorsolumbar spine 14.86% 5.6% had tuberculosis involvement at other sites whereas majority 94.4% had no other detected sites of involvement. Pulmonary tuberculosis was the secondary site involved in all cases. Majority 87.9% have not taken of BCG vaccination. Only 12.1% had BCG vaccination. 48.4 % patients have done a mantoux test. Among them 66.6% were positive and 33.3% were negative. 51.6% haven't done a mantoux test. Majority haven't done a sputum AFB examination 69.4%. Among those who have done 84.2% had negative results and only 15.8% had a sputum positive for acid fast bacilli suggestive of a active pulmonary disease.

DISCUSSION

The analysis of incidence in three 1-year intervals in total study period, showed almost same level of incidence in skeletal tuberculosis among patients reaching Government Medical College, Kottayam during the last three years. In our study, the majority of the cases were in the older age group (61 to 70) and among young individuals (21 to 30), whereas 31 to 60 age group showed a lower rate of occurrence compared to them. In Assam clinical study 1999, the majority of the cases (60.29%) were in the first 3 decades of life ^[16]. An analysis of 194 patients with osteoarticular TB in Meerut, India, reported that the highest incidence was in the second decade (30%), followed by the first (22%), the third (18%), and then the fourth decade (14%). In a national survey of tuberculosis in England & Wales, in Indian patients 55% were under 35 years of age ^[17].

Male to female ratio in our study with 124 patients was 48: 52 with females having increased rate. In Netherlands study, 2004 with 532 patients having bone and joint tuberculosis, 49% were men and 51% women [18]. With the 136 cases, Assam clinical study found Male: Female ratio 2.09:1 (male predominance) ^[16]. S.M. Tuli had 52:48 as Male: Female ratio ^[19].

Educational status, occupation, monthly income and working environment seems to have predisposing role in getting skeletal tuberculosis, and the results obtained reinforces the existence of skeletal tuberculosis in crowded environments and low socioeconomic strata of community. The involvement of disease among health personals shows the role of working environment especially hospitals as a site for exposure to tuberculosis. This also reminds us the need of adequate precautionary measures to be taken when treating open tuberculosis cases. 18.5% of all cases are nonresident Keralites. Thus they have a significant contribution to the burden of disease in Kerala.

From the literature it is evident that predisposing factors for tuberculosis include HIV, diabetes mellitus, chronic intake of drugs that cause immunosuppression and substance abuse. Most of the patient having either of addictions of alcohol,

smoking or pan chewing in study is leading us towards that literature. The role of HIV and other debilitating illness are not so evident in our study population, may be due to the particular sample population.

In our study, the regional distribution among the 124 cases showed higher occurrence rates of spinal tuberculosis 59.7% compared to the study series of skeletal tuberculosis in 980 cases (1074 lesions) of B.H.U. hospital study by S.M. Tuli in 1965-67, where spine involvement was 40.96%, Hip 7.54%, Knee 8.29%, S.I. Joint 6.42%, elbow 4.74%, ankle 4.08% ^[19]. The involvement of other sites was comparable with the literature statics.

In our study spinal involvement was predominant in dorsal spine followed by lumbar spine and dorsolumbar spine, which is comparable with Assam study, in which spinal involvement was 56.02% with a regional distribution predominating dorsal spine (38%), followed by lumbar spine (23%) ^[16]. In series by K.N. Rao (1991) in a total number of 519 cases of skeletal tuberculosis, the spinal involvement was 44%. The breakup was Cervical - 4.4%, Dorsal D1 to D6 - 9.6%, Dorsal D7 to D12 - 44.3% and Lumbar - 41.7%. Mukhopadhyaya (1957) recorded that spinal T.B. occurred in maximum numbers in the dorsal region. In Paus (1964) series of 141 cases, the order of frequency was lumbar 50 cases, Dorsal 35 cases, dorsolumbar 25 cases, lumbosacral 22 cases, cervicodorsal 8 cases, sacral 1 case. In Hodgson series the peak incidence was found in LI vertebra. Simultaneous involvements of extra skeletal sites are seen in 5.6% of cases ^[20]. In Netherlands study there were about 31 % cases having extra skeletal Involvement ^[18]. Percentage of BCG vaccination (12%) was very less as majority of patients belongs to middle age and old age groups. most of the patients have not done a Mantoux test 51.6%. Among all the patients who have done Mantoux test 66.66% got a positive results and 33.33 % false negative, may be due to severe disease or malnutrition affecting the normal immune mechanism.

CONCLUSIONS

From this epidemiological study we conclude that the number of skeletal tuberculosis patients attending our department remains more or less same through the study period with predominant involvement in females. Disease was common among young adults and old age people. The study reinforces the acquaintance of tuberculosis with low socioeconomic status, substance abuse and to some extent the debilitating diseases. Spinal tuberculosis remains as the most common site of skeletal tuberculosis. Even though skeletal tuberculosis affecting health care personals is comparatively less, it has to be dealt with serious attention as it will produce a new epidemiologic chain to the spread of disease. Nonresident Keralites form a significant percentage in the total burden of tuberculosis in the state. This study warrants the need of proper screening of health personals and emigrant Keralites as it will help to control the added burden of skeletal tuberculosis in Kerala. Many of the patients had tuberculosis even after taking BCG vaccine and having a BCG scar. So the standard and efficacy of BCG vaccine has to be improved so that the Epidemiological principle of "Prevention is better than cure" will prevail.

REFERENCES

1. Sankaran B .Oration tuberculosis of bones & joints. *Ind J Tub.*1993; 40:109
2. Hodgson AR, Skinsnes OK, Leong CY. The pathogenesis of Pott's paraplegia. *J Bone Joint Surg.*1967;49a:1147-1156
3. Kumar K, Saxena MBL. Multifocal osteoarticular tuberculosis. *International Orthopaedics (SICOT)* 1988; 12:135-138.
4. Aggarwal AN, Dhammi IK, Jain AK. Multifocal skeletal tuberculosis. *Tropical Doctor* 2001; 31:219-220.
5. WHO report global tuberculosis control 2011, dated on 30th august 2012
6. Willam. N. Rom & Stuart. N. Garay : *Tuberculosis*, 2nd ed. Page 3-45, 565-586, 663-681.
7. Cain KP, Haley CA, Armstrong LR, Garman KN, Wells CD, Iademarco MF, Castro KG, Laserson KF. Tuberculosis among foreign-born persons in the United States: Achieving tuberculosis elimination. *Am J Respir Crit Care Med* 2007; 175: 75-79.
8. Mathers CD, Loncar D. Projections of global mortality and burden of disease from 2002 to 2030. *PLoS Med.* 2006;3:e442.
9. Sanchez-Olmos. V. *Skeletal Tuberculosis*, 1948, Williams & Wilkins Co. Baltimore.
10. Taylor PM, Scragg R, Collison G. B. Trends in tuberculosis incidence in the Auckland region, 1974-1983. *NZ Med J* 1986; 99:309-12.
11. Tuberculosis in the South-East Asia Region The Regional Report: 2011 WHO website dated 12/ 8/ 2012
12. Antony SJ, Harrell V, Christie JD, Adams HG, Rumley RL. Clinical differences between pulmonary and extra pulmonary tuberculosis: A 5-year retrospective study. *J Natl Med Assoc* 1995; 87:187-92.
13. Babhulkar SS, Pande SK. Tuberculosis of the hip. *Clinical Orthop Rel Res* 2002; 398:93-99.
14. Jutte PC, van Loenhout-Rooyackers JH, Borgdorff MW, et al. Increase of bone and joint tuberculosis in The Netherlands. *J Bone Joint Surg Br* 2004; 86:901-4.
15. Babhulkar SS, Pande SK. Unusual manifestations of osteoarticular tuberculosis. *Clin Orthop Rel Res* 2002; 398:114-120.
16. Lahkar Shantanu, Borthakur Bipul, Hussain Syed Nazim. A Clinical Study Of Skeletal Tuberculosis In Upper Assam, *Indian Journal of Orthopaedics*, Year 1999, Volume 33, Issue 3 [p. 223-225]
17. PD. Davies, MJ. Humphries, SP. Byfield, AJ. Nunn, JH. Darbyshire, KM. Citron, W. Fox, *Bone and joint tuberculosis. A survey of notifications in England and Wales*, From the Medical Research Council

Tuberculosis and Chest Diseases Unit,
Brompton Hospital, London.jbjs

18. Jutte PC, van Loenhout-Rooyackers JH, Borgdorff MW, et al. Increase of bone and joint tuberculosis in The Netherlands. *J Bone Joint Surg Br* 2004; 86:901–4.
19. Tuberculosis of the Skeletal System: Bones, Joints, Spine and Bursal Sheaths. Author, SM Tuli. Edition, 4
20. Hodgson AR, Skinsnes OK, Leong CY. The pathogenesis of Pott's paraplegia. *J Bone Joint Surg* 1967;49a:1147–1156.