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Original Research Article

Prevalence of tuberculosis in silicosis patients in southern part of Rajasthan

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ABSTRACT

Background: Silicosis is an occupational lung disease which commonly occurs in workers involved in quarrying, mining, sandblasting etc. Tuberculosis (TB) in silicosis is more common. In southern part of Rajasthan, near Udaipur a lot of mining areas are there and workers are exposed to silica dust. The main objective of carrying out this study is to bring in focus the increasing prevalence of silicosis patients and its complications in mining areas around Udaipur in southern Rajasthan, so that the necessary prophylactic and preventive measures can be taken for the workers in future.
Methods: 150 patients of silicosis and old treated case of silicotuberculosis patient with respiratory symptoms were included in the study. In all the patients, sputum was sent for routine acid fast bacilli (AFB) smear examination and if it came negative then sputum was sent for GeneXpert multidrug resistant tuberculosis (MTB) and also for AFB culture examination wherever needed.
Results: The mean duration of exposure to silica particles was 10 years (5 to 15 years). Tuberculosis was diagnosed by microbiological examination in 40 cases, while 25 cases which were previously treated for tuberculosis were found negative on microbiological examination. So, the overall prevalence of TB (both old treated and new or relapse microbiologically confirmed cases) among patients of silicosis was found to be 44%.
Conclusions: Our study showed an increased prevalence of tuberculosis in silicosis patients. So, there should be regular health check up educational programme for all silica mines workers and all should use prophylactic measures.

Keywords: Silicosis, Silicotuberculosis, Silica dust, Southern Rajasthan, Sputum

INTRODUCTION

Silicosis continues to be a major disease worldwide, even in developed countries, affecting workers in mining and other occupations, including construction and foundries.[1,2] It is caused by the inhalation and accumulation of crystalline silica particles in the lung.[3] It is the most prevalent type of pneumoconiosis.[4,5] It is characterised by symptoms of shortness of breath, cough, chest pain etc. Exposure to large amounts of free silica can go unnoticed because silica is odourless, non-irritant and does not cause any immediate health effects. As silicosis is incurable, clinical management includes removing the worker from the industry and giving symptomatic treatment. Public health goals are to detect early cases through monitoring of currently and formerly exposed workers, to establish surveillance programmes, to slow progression and to reduce disability. There is currently interest in the use of therapeutic agents to treat silicosis and in lung lavage to remove silica from the lung but a favourable impact on progression of acute or chronic silicosis has not been demonstrated.[6]

Silicosis is associated with pulmonary and systemic co-morbidities. Some co-morbidities that have been documented in silicosis are tuberculosis, chronic obstructive pulmonary disease (COPD), lung cancer etc.[7] Pulmonary tuberculosis (PTB) is one of the leading cause of morbidity and mortality worldwide and in India. According to the recent estimates, the world had an estimated 10.4 million new TB cases as per the World Health Organization (WHO) estimates 2019. Over half of these were among men (5.9 million), and women constituted over a third (3.5 million). Ten percent of cases were among children. India had an estimated 2.84 million new cases of TB.[8] India has more new TB cases annually than any other country.[9]

The association between silicosis and PTB has been well established and together the entity is known as silico-tuberculosis.10Epidemiological and case studies have shown that workers exposed to silica dust have increased morbidity and mortality from PTB.[11,12] There are many predisposing and precipitating factors for PTB as genetics, physiological, environmental, toxic, immunological and debilitating conditions.[13] The potentiation of growth of tubercle bacilli by silica is probably due to altered immune response of macrophages to intracellular mycobacterium tuberculosis in the presence of silica. Mycobacterium tuberculosis grows more rapidly in macrophages that are fed with sub-lethal doses of silica and quartz particles and bacilli are released more rapidly into the surrounding medium.[14]

In the southern part of Rajasthan, there are a number of mining areas around the city of Udaipur and no such study is being done in this part of Rajasthan among silicosis patients. So this study was done to bring in focus the increasing prevalence of silicosis patients and its complications in mining areas around Udaipur, so that the necessary prophylactic and preventive measures can be taken for the workers in future.

METHODS

A prospective observational study in which 150 patients of silicosis diagnosed by historical, clinical evaluation and radiological evidence who visited chest outpatient department (OPD) at Geetanjali Hospital and Luhadia's Chest clinic, Udaipur between July, 2017 to June, 2020 with respiratory symptoms suggestive of PTB were enrolled in the study. Such patients with history of working in stone mines and radiological evidence of silicosis were thoroughly interrogated regarding occupation, nature of work, duration of exposure to dust and silica particles before inclusion in the study. These patients were working in the mines near Udaipur region in Rajasthan. In all the patients, recent chest x-ray was done and sputum was sent for Acid fast bacilli (AFB) smear examination by Zeihl-Nealsen (Z-N) staining in the laboratory as per National Tuberculosis Elimination Program (NTEP) guidelines and if it came negative then sputum was sent for GeneXpert multi-drug resistant tuberculosis (MTB) and then if needed also for AFB culture examination wherever needed. Mathematical percentage statistics is used to analyse the results.

RESULTS

Among 150 patients of silicosis, 140 were males and 10 patients were females. 120 male patients had history of smoking. The mean duration of exposure to silica particles was 10 years (5 to 15 years) (Table 1). Higher prevalence of tuberculosis was found in patients with longer duration of exposure to silica (Table 2). All the silicosis patients were diagnosed on basis of occupational, historical, clinical and radiological evaluation.

Table 1: Duration of silica dust exposure and number of silicosis patients.

Duration of silica exposure (years)	Number of silicosis patients (n=150)
<5	35
5 – 10	62
>10	53
Total	150

Table 2: Co-relation of number of TB patients with duration of exposure to silica dust.

Duration of silica exposure (years)	Number of pulmonary TB patients		Total
	New	Old	
<5	7	4	11
5 – 10	15	9	24
>10	18	12	30
Total	40	25	65

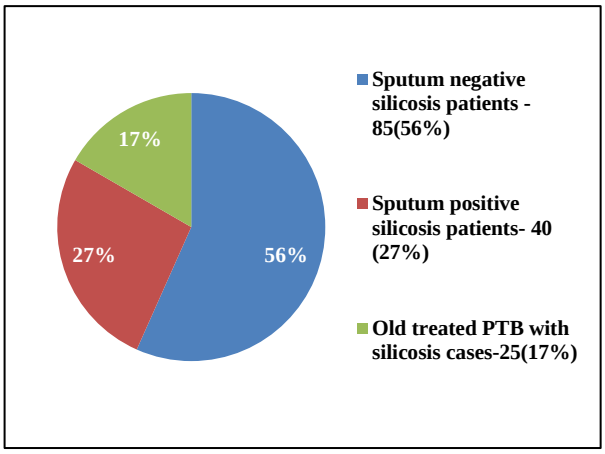

Figure 1: Total silicosis and silico-TB (old treated plus new sputum positive) patients.

All the patients had varying degrees of respiratory symptoms. Chest X-rays of patients mainly revealed

bilateral, widespread reticulonodular and nodular shadows along with cavitation in 40 patients, bilateral hilar popcorn calcification in 15 patients, pneumothorax in 30 patients, upper zone infiltrates in 30 patients, progressive massive fibrosis lesions in 18 patients who had history of long and continuous exposure to silica particles (Figures 3-8).

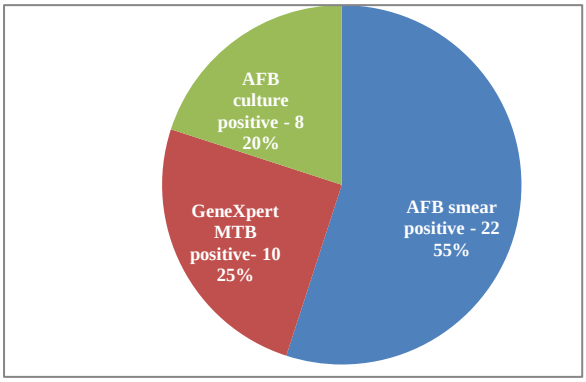

Figure 2: Microbiological confirmation of sputum by various methods.

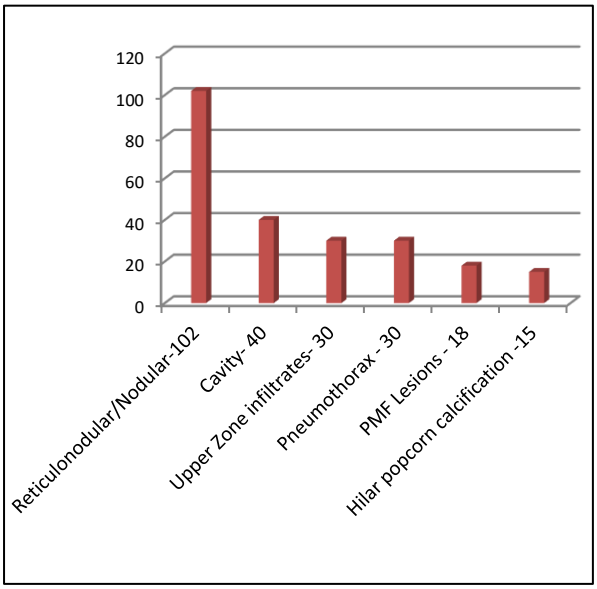

Figure 3: Various radiological appearances in silicosis patients.

Sputum for AFB smear by ZN staining was positive in 22 cases. In patients whose sputum AFB smear came negative, in them GeneXpert MTB was sent and it came positive in 10 cases and in patients with both sputum AFB smear and Genexpert MTB negative, in them AFB culture was sent and it came positive in 8 cases (Figure 2). 25 cases which were previously treated for tuberculosis were found negative on microbiological examination. Past history of Anti TB treatment was taken from these patients. So, the overall prevalence of TB (both old treated and new or relapse microbiologically confirmed cases) among patients of silicosis was found to be 44 % (Figure 1).

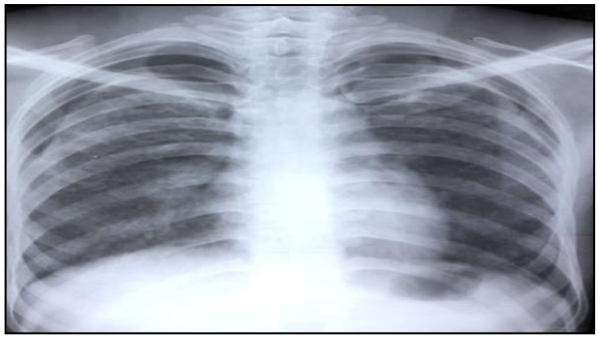

Figure 4: Bilateral minimal pneumothorax.

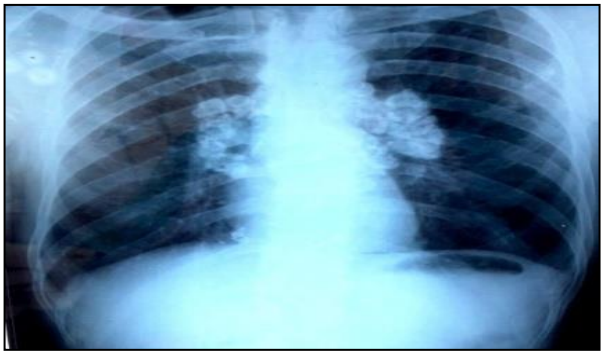

Figure 5: Bilateral hilar popcorn calcification.

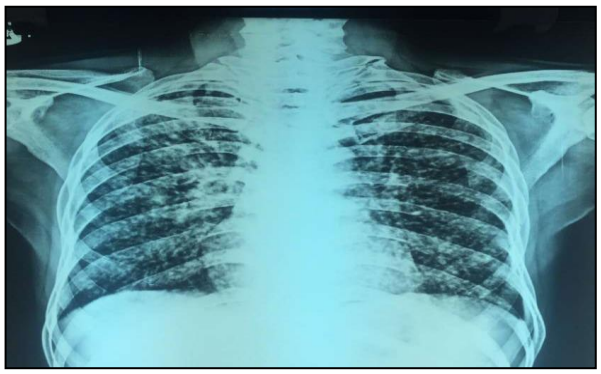

Figure 6: Bilateral nodular opacities.

Figure 7: Cavity with nodular opacities.

Among the positive patients, 37 were males and 3 were females. Among the 25 old treated cases of TB patients, 23 were males and 2 were females. 55 of the 60 male TB

patients were smokers. Human immunodeficiency virus (HIV) testing was done in all the silicosis patients and five of them came HIV positive and these five were also positive for sputum for AFB examination.

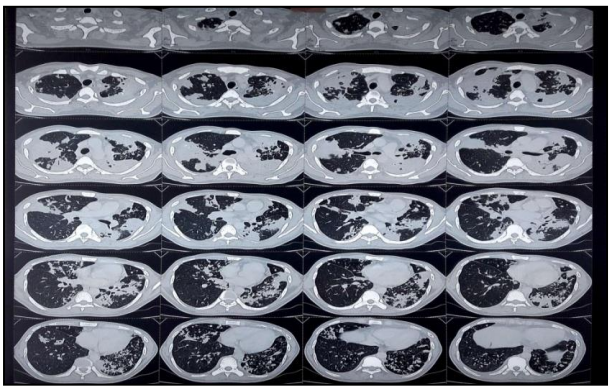

Figure 8: CECT chest- bilateral PMF lesions.

DISCUSSION

The association between silicosis and TB has long been recognized. Studies have shown that patients with silicosis have increased risk of developing PTB.[11,12,15] Factors which influence the development of tuberculosis include the severity of silicosis, the prevalence of tuberculosis in the population from which the work force was drawn, as well as their age, general health and HIV status.[16] Exposure to silica, without silicosis, may also predispose individuals to TB.[17] In our study, the mean duration of exposure to silica dust was 10 years (5 to 15 years). Higher prevalence of tuberculosis was found in patients with longer duration of exposure to silica.

The prevalence of HIV infection in developing countries has and will increase the burden of TB in miners exposed to silica dust. A study on the effect of HIV infection on silicosis and TB incidence in black South African gold mineworkers found that HIV infection increased the incidence of TB by five times and silicosis increased the incidence of TB by three times.[18] In our study, HIV testing was done in all the silicosis patients and five of them came positive and these were also positive for sputum AFB examination.

In our study, 55 of the 60 male TB patients were smokers. indicating that smoking could be one of the risk factors for TB in silicosis patients also. However, it remains unclear whether smoking predisposes exposed miners to silicosis or nonspecific radiographic changes from smoking are misinterpreted as silicosis.[19]

India has many mining industries situated in various states. In 1999, the Indian Council of Medical Research reported that around 3 million workers are at high risk exposure to silica. Among the various complications of silicosis is tuberculosis (called silico-tuberculosis), a disease which is still a major public health concern in developing countries. Chronic exposure to silica increases workers risk of getting tuberculosis infection and may even aggravate pre-existing pulmonary tuberculosis.[15,17] Sikand BK , et al showed an incidence of 28.6% of silicotuberculosis in India.[20] In our study, the overall prevalence of TB (both old treated and new or relapse microbiologically confirmed cases) among patients of silicosis was found to be 44%. In another study done in western part of Rajasthan at Jodhpur, incidence and prevalence of silicoTB was found to be 45%.[21]

Our study has few limitations. Lung biopsy and bronchoscopy could not be performed to establish the histopathological diagnosis in silicosis patients due to risk involved in invasive procedure and also due to financial constraints. The diagnosis of silicosis was made on basis of history of mining exposure and clinico-radiological basis in all the patients.

CONCLUSION

The present study shows higher prevalence of tuberculosis among silicosis patients working in mining areas near Udaipur in the southern part of Rajasthan. Also, the duration of silica dust exposure and smoking are important factors for this increased risk. Very few of the stone mine workers in our study were aware of the safety measures regarding protection from silica dust in mining areas. So, for workers protection, various prophylactic measures should be taken. There should be regular health check up educational programme for all silica mines workers. Smoking should be prohibited in these workers and all workers should be advised to wear face mask while working in mines. Any respiratory illness should be taken care immediately. Action needs to be taken on active case-finding for documenting the burden of silicosis and silicotuberculosis. Guidelines are needed to be made under the National Tuberculosis Elimination Program (NTEP) for management of those at risk of developing silico TB.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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