The prevalence of tuberculosis among patients with silicosis in the southeastern part of Rajasthan,India.

Abstract: Silicosis is a fibrotic lung disease caused by inhalation of free crystalline silicon dioxide or silica. Silicosis is caused by inhalation of respirable particles of crystalline silica (usually quartz). Workers at greatest risk are those who move or blast rock and sand (miners, quarry workers, stone cutters, construction workers) or who use silica-containing rock or sand abrasives (sand blasters, glass makers, foundry, gemstone, and ceramic workers, potters)[1]. Silicotuberculosis is a condition characterized by the co-existence of silicosis and tuberculosis (TB). The incidence of tuberculosis in patients with silicosis is higher than general population. Tuberculosis (TB) in silicosis is more common[2]. Methods:120 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 acid fast bacilli (AFB) , GeneXpert 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 46 cases, while 31 cases which were previously treated for tuberculosis were found negative on microbiological examination. 12 patients were diagnosed to be silicotuberculosis on clinico-radiological basis. Overall prevalence of TB among patients of silicosis was found to be 74%.Conclusions: study has shown a higher prevalence of tuberculosis (TB) among patients with silicosis, emphasizing the need for proactive health management in silica mining industries. Regular health monitoring, education, and strict use of PPE—are necessary to safeguard the health of silica mine workers and prevent the spread of TB in this high-risk group. Keywords: Silicosis, Silicotuberculosis, Silica dust, Stone worker,Rajasthan.

INTRODUCTION:Silicosis is caused by the inhalation of crystalline silicon dioxide or silica and is one of the most important occupational diseases worldwide. The disease has a long latency period and may clinically present as an acute, accelerated, or chronic disease[3]. The pathophysiology of chronic silicosis involves chronic inflammation arising as a result of the accumulation of various inflammatory mediators and fibrogenic factors. Under the influence of these factors, pulmonary silicoproteinosis develops as eosinophilic proteinaceous material accumulates in the pulmonary alveolar spaces. The rate of disease progression appears to depend upon the rate of silica deposition in the lungs, as well as the total amount of crystalline silica that is actually retained in the lung[4].

Chronic silicosis, the most common form of the disorder, generally develops slowly and typically appears decades after initial exposure. Chronic silicosis includes simple and complicated (progressive massive fibrosis) forms.Accelerated silicosis is similar to chronic silicosis but develops more rapidly in patients with high levels of exposure, with onset of disease within 5 to 10 years after initial exposure.Progressive massive fibrosis (PMF, or conglomerate or complicated silicosis) is the advanced form of chronic or accelerated silicosis. It is characterized by widespread masses of fibrosis, typically in the upper lung zones.Acute silicosis, also known as acute silicoproteinosis, is caused by intense silica dust exposure over short periods (several months or years). The development of silicoproteinosis usually occurs weeks to a few years after initial high-concentration exposure to respirable crystalline silica. The clinical presentation can be similar to pulmonary alveolar proteinosis[5]. Silicosis is usually recognized on the basis of chest x-ray or CT appearance in patients with a history of silica exposure. Chest CT is more sensitive than chest x-ray for detecting silicosis and monitoring for disease progression[6].

For chest x-rays, severity is graded on a standardized scale developed by the International Labor Organization (International Classification of Radiographs of Pneumoconioses). Chronic silicosis is categorized on chest imaging as simple or complicated. In patients with simple silicosis, there is upper lobe predominance of bilateral 1- to 3-mm reticulonodular opacities. Calcified hilar and mediastinal lymph nodes are common and occasionally resemble eggshells; however, eggshell calcification is not pathognomonic for silicosis[7]. Pleural thickening is uncommon unless a severe parenchymal disease abuts the pleura. On chest imaging, a number of disorders can resemble chronic silicosis. They include sarcoidosis, chronic beryllium disease, hypersensitivity pneumonitis, coal worker pneumoconiosis, miliary tuberculosis, fungal pulmonary diseases, and metastatic cancer. Complicated silicosis is characterized by large opacities on chest x-ray or conglomerate opacities with calcifications on chest CT[8].
Accelerated silicosis resembles chronic silicosis on chest imaging but develops more rapidly. In acute silicosis, chest CT findings include diffuse alveolar bibasilar opacities in a pattern that mimics pulmonary alveolar proteinosis. Acute silicosis can also be mistakenly characterized as an acute infection[6].

METHODS

A prospective observational study in which 120 patients of silicosis diagnosed by historical, clinical evaluation and radiological evidence who visited outpatient department (OPD)/ Emergency of Respiratory medicine department of Medical college Kota,Rajasthan between December 2023 to January, 2025with respiratory symptoms suggestive of Pulmonary tuberculosis were included in the study.Patients with a history of working in stone mines and radiological evidence of silicosis were extensively questioned about their occupation, the nature of their work, and the duration of their exposure to dust and silica particles prior to being included in the study. The patients were employed in mines located in the districts of Kota, Bundi, Baran, and Jhalawar in Rajasthan. For all the patients, a recent chest X-ray was performed, and sputum samples were collected for Acid-Fast Bacilli (AFB) smear examination using Ziehl-Neelsen (Z-N) staining in the laboratory, following the guidelines of the National Tuberculosis Elimination Program (NTEP). In cases where the AFB smear result was negative, the sputum was further tested using CBNAAT.

RESULTS:Among 120 male patients of silicosis, 78 patients had history of smoking. The mean duration of exposure to silica particles was 10 years (5 to 15 years) (Table 1). All the silicosis patients were diagnosed on basis of occupational, historical, clinical and radiological evaluation.All the patients had varying degrees of respiratory symptoms. Chest X-rays of patients mainly revealedbilateral, widespread reticulonodular and nodular shadows.

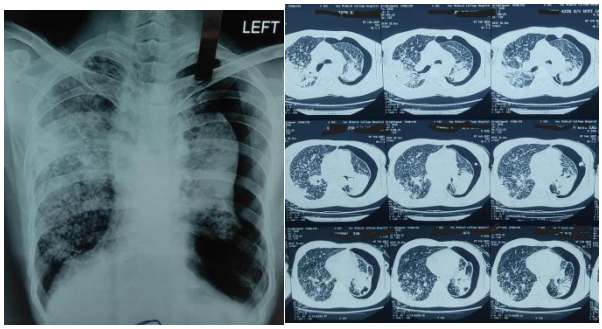
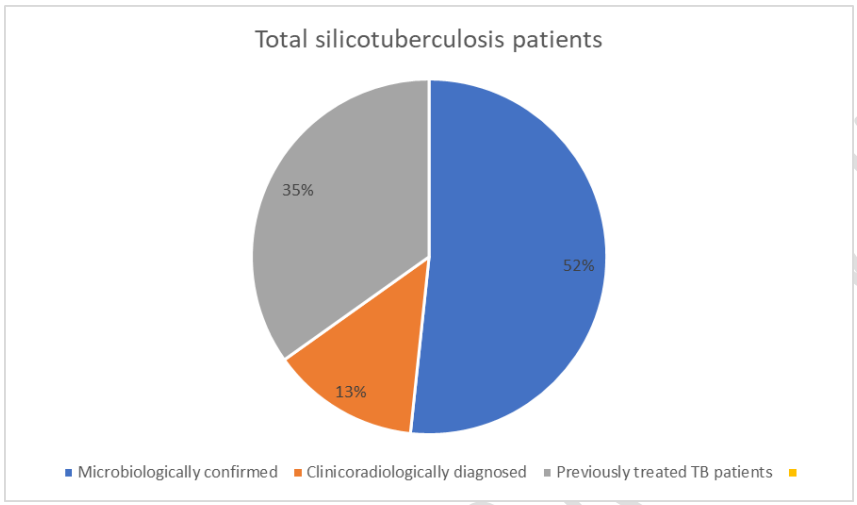


Figure:1 Chest xray&HRCT Chest suggestive of left pneumothorax.



Pneumothorax was present in 30 patients, Progressive massive fibrosis lesions in 18 patients who had history of long and continuous exposure to silica particles .Sputum for AFB smear by ZN staining was positive in 34 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 2 cases . 12 cases were diagnosed as silicotuberculosis based on clinicoradiological basis.31 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 74 % .Human immunodeficiency virus (HIV) testing was done in all the silicosis patients and seven of them came HIV positive and these seven were also positive for sputum for AFB examination. Out of 54 admitted patients 13 patients expired during hospital stay.Chronic exposure to silica increases workers risk of getting tuberculosis infection and may even aggravate pre-existing pulmonary tuberculosis. In our study, the overall prevalence of TB (both old treated ,clinicoradiologically diagnosed cases and new or relapse microbiologically confirmed cases) among patients of silicosis was found to be 74%. 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 current study reveals a higher prevalence of tuberculosis among silicosis patients working in mining areas near Kota, located in the southern part of Rajasthan. The duration of exposure to silica dust and smoking are significant factors contributing to this increased risk. A limited number of stone mine workers in our study were aware of safety measures to protect themselves from silica dust exposure. Therefore, to safeguard workers' health, several preventive measures should be implemented. This includes regular health check-ups and educational programs for all workers in silica mines.

Smoking should be banned in the workplace, especially for miners, and all workers should be advised to wear face masks while working in the mines. Immediate attention should be given to any respiratory illnesses. Active case finding should be prioritized to document the prevalence of silicosis and silicotuberculosis.

Studies have highlighted a higher prevalence of tuberculosis (TB) among individuals with silicosis, underscoring the importance of proactive health management in silica mining industries. To address this, it is essential to conduct regular health check-ups for all workers to monitor for both silicosis and TB. In addition to medical surveillance, educational programs should be implemented to raise awareness among workers about the risks of silica dust exposure and the critical need for protective measures.It is also crucial to enforce the use of effective prophylactic measures, such as personal protective equipment (PPE), to reduce the risks associated with inhaling silica dust. Workers should receive proper education on safety protocols, including adequate ventilation and dust control methods, to minimize exposure. These efforts—regular health monitoring, safety education, and mandatory PPE usage—are vital to protect the health of silica mine workers and prevent the spread of TB within this high-risk group. Additionally, guidelines under the National Tuberculosis Elimination Program (NTEP) should be developed to manage individuals at risk of silico-TB.

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