

Original Research Article

A STUDY ON THE EPIDEMIOLOGICAL PROFILE AND CLINICAL CHARACTERISTICS AMONGST SILICOSIS CASES IN TB and CHEST DEPARTMENT AT SJP MEDICAL COLLEGE, BHARATPUR, RAJASTHAN

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ABSTRACT

Background: The problem statement with silicosis is that once the fibrosis & scarring of lung tissue starts it is irreversible & causes a lot of DALY & handicap and may lead to a crippling death. There are just a few studies on epidemiological & clinical characteristics of silicosis, but none so in the hub of sand stone mining ie 'The Dang' of the Bharatpur zone consisting of Karauli, Dholpur and Bharatpur districts in the eastern part of Rajasthan. Peculiarly it has been seen that silicosis here has devastated entire villages so much so that if a patient walks in from a particular village the diagnosis is already confirmed to silicosis in 90% of cases. These villages have lots of young widows in their 30s. Oxygen concentrator is known to every household. Thanks to APNA GHAR ashram which is doing good in supplying Oxygen concentrator to these terminally ill patients (virtue the Covid 19 pandemic). It has also been seen that silicosis runs in families, & in few cases it seems to have an earlier & aggressive onset in younger siblings. The data in this study throws new light in this area of DANG infested with silicosis, which differs considerably from studies in other locations.

Materials and Methods: In this observational study, 200 already Certified silicosis patients attending the OPD or admitted to IPD of the Chest & TB department of Sh JP MC Bharatpur located at RBMH hospital were scrutinized for various epidemiological & clinical characteristics.

Results: Mostly the patients were males aged 30-40 years average age (37.4yrs), either smoker or tobacco user, presented with an average of 12.32 years of TDI, after an average of 18.67 yrs of silica exposure in their workplace. Cough, Dyspnea, chest pain and hypoxia were the main sign and symptoms. The mean SPO2 was 94, Mean pt was undernourished with BMI of 17.8, & the mean 6 MWD was 244 meters.

Conclusion: Due to Ignorance & poor environment control practices the silicosis in DANG area is a menace, the patient dies young and the families suffer a crippling disease. The Government needs to focus more on preventive & environment control measures & to provide alternative livelihood to the poor in the area who are naturally attracted to this easy job. More research is required on various treatment options and molecular understanding of the disease for its effective control.

Keywords: Silicosis, Occupational lung disease, lung fibrosis, PMF, LTOT, DANG area.

INTRODUCTION

Silicosis is a major debilitating & crippling disease, seen mainly in sand stone workers, masons, miners, drillers, labourers in manufacturing units, denim sandblasting, etc; it is associated with unhealthy workplace practices and here in bharatpur, rajasthan is more commonly seen with sand stone workers. Classically its manifestation depends upon the intensity & extent of exposure to silica dust ranging from chronic silicosis with PMF to Accelerated or acute silicosis. Freshly fractured Crystalline Quartz form (Crocidolite) of silica is the most immunogenic & fibrotic of all silica forms. Silicosis remains to hound various labourers worldwide specially involved in stone industry, there is said to be around 230 million silica exposed individuals worldwide and around 10 million in India itself.^[1]

There are three classical clinical forms of silicosis: chronic (classic), accelerated, and acute (silicoproteinosis). The chronic form of silicosis is the most common and normally occurs after 15–20 years of exposure to free crystalline silica dioxide particles. Accelerated silicosis can occur after 5–10 years of exposure to increased concentrations of silica dust, and the acute form usually occurs after very high exposure to silica in a period of a few months to 2 years.^[1]

Pathogenetic Mechanisms

Inhalation of respirable silica particles leads to formation of mineral deposits in the terminal bronchioles and alveoli and induces pulmonary tissue reactions of the inflammatory type and proliferation of fibroblasts by complex pathogenic mechanisms, causing fibrosis. Disease severity and pathogenicity depend on the quantity of inhaled dust and the time of exposure. Under normal conditions, lung epithelial cells can replace damaged cells, due to exposure to silica dust through cell proliferation and differentiation. However, chronic overwhelming exposure to silica dust can lead to repetitive damage and repair of airway epithelia, resulting in depletion of airway epithelial stem cells in pulmonary silicosis. Lung tissue reactions result from the joint action of several mechanisms, such as the direct cytotoxic effects of silica particles on macrophages, activation of the surface receptors of the macrophages, rupture of lysosomes, production of free radicals, activation of inflammasomes, production of cytokines, growth factors, and cellular apoptosis, which finally lead to fibrosis⁸. Most of the studies investigating the pathogenesis of silicosis have focused on the roles of alveolar macrophages and alveolar epithelial cells, which secrete pro-inflammatory and profibrotic mediators secondary to exposure to silica.

Differential diagnosis: Millitary TB, Non Tuberculous Mycobacteria, Fungal infections, Pulmonary Alveolar Proteinosis, Sarcoidosis, Pneumocystis Carini Pneumonia, Rheumatoid nodules, etc are few of the common differentials

Current treatment available in silicosis

Smoking cessation, Psychosocial support, Anti-inflammatory treatment (corticosteroids), Antifibrotics, Symptomatic treatment (bronchodilators, oxygen), Prevention of infection, Early detection of pulmonary TB and institution of ATT, Whole lung lavage, Pulmonary rehabilitation, Lung transplantation etc, are described. Although none claims to cure the disease.

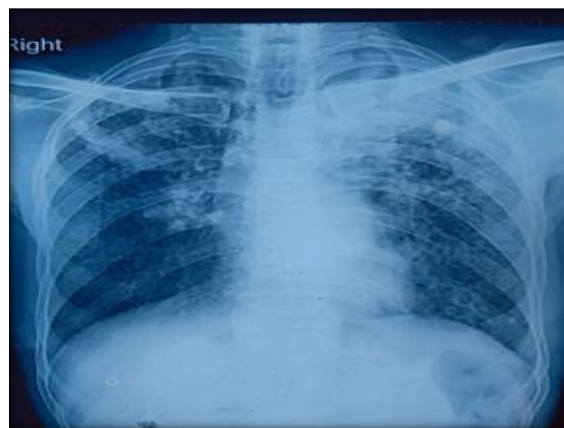


Figure 1 Silicosis with PMF



Figure 2: Silicosis with PMF with cavitation

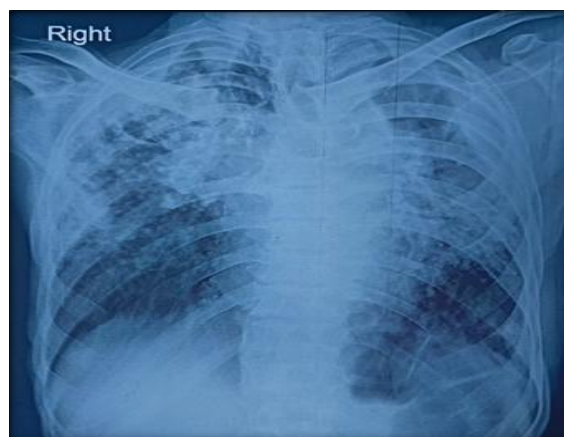


Figure 3: Silicosis with PMF with cavitation & aspergilloma

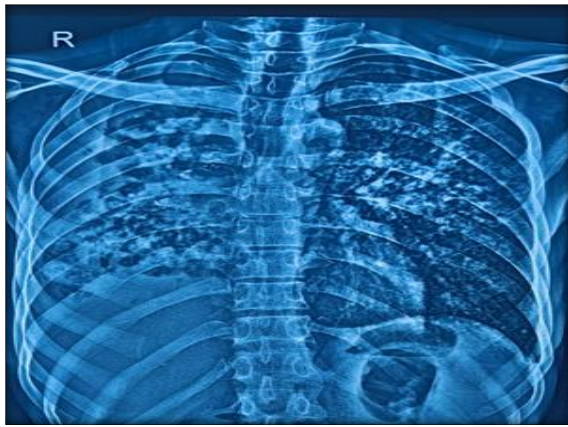


Figure 4: Silicotuberculosis with MDR TB

MATERIALS AND METHODS

Study population: 200 certified silicotic patients of the DANG belt of Bharatpur zone of Rajasthan.

Study duration: One Year (October 2023 to September 2024)

Data Collection: Certified Silicotic patients attending OPD & IPD of Chest & TB department situated at RBM Hospital, Sh J P Medical College, Bharatpur. These patients were interviewed, examined, investigated, treated and managed as necessary during their course of stay in the hospital. Data Analysis- Data analysis with Microsoft excel sheet.

RESULTS

Observation Tables--N=200, Males 197, Females 3

Table 1: Age group

Sr. No	Age group	Total patients
1	20-30	18
2	30-40	102
3	40-50	44 (female 3)
4	50-60	26
5	More than 60	10
	Mean Age	37.4 yrs

Table 2: Substance abuse- Smoking, Tobacco/Gutkha chewing, Alcoholic, H/O of TB/ATT

Smoker	Non smoker	Alcohol	Non alcohol	Tobacco Chewer	Non Tobacco	H/o ATT	H/o MDR	Active TB
177	23	56	144	113	87	85	3	38

Table 3: Smoking pack years, Total exposure to silica, Total duration of illness

Smoking pack years	No of patients	Silica exposure years	No of patients	Total duration of illness	No of patients
5-10	20	0-5	6	0-5	10
10-20	64	5-10	9	5-10	51
20-30	56	10-20	90	10-20	107
30-40	29	20-30	69	20-30	26
40-50	8	30+	26	30+	6
Mean -26.61 yrs	177	Mean- 18.67 yrs	200	Mean- 12.32 yrs	200

Table 4: Nature of work

Stone Miner	Stone blaster	Stone dresser	Stone mason	Stone Loader	Stone Grinder	Misc. labour, Foundry etc
46	9	42	25	37	31	10

Table 5: Clinical sign & symptoms at presentation

Cough	Expectoration	Chest pain	Dyspnea	Hemoptysis	Pedal edema	Cor Pulmonale
145	34	48	153	23	19	9
Fever	Heart failure	Pleural effusion or pneumothorax	Wheeze	Arthritis	Hypoxia Type I RF	Respiratory Fail Type II
36	2	21	89	3	120	26

Table 6: Silicosis form, radiological findings, associations and clinical attributes

Acute	Accelerated	Chronic simple	Chronic with PMF	Chronic with PMF and cavitation	Chronic with PMF, cavitation & aspergilloma
3	12	120	65	23	4
Chronic with PMF, cavitation, aspergilloma & hemoptysis		With Active TB	With Arthritis	With signs of cor pulmonale	With Pl effusion or pneumothorax
3		38	16	26	21

Small nodules	Large nodules	Linear shadows	Media. LAP	Hilar egg shell calc.	Compensatory Emphysema	Pleural thickening
121	40	191	106	56	98	116

Table 7- 6 Minute Walk Distance, Body Mass Index, SPO2

6 MWD mts		BMI	Chronic Energy Deficiency		SPO2	
Less than 100	32	Less than 16	CED III	15	Less than 80	13
100-200	45	16-17	CED II	40	80-84	12
200-300	99	17-18.5	CED I	58	84-88	19
300-400	19	18.5-24.9	Normal	54	88-92	34
400-500	5	25-30	Overweight	25	92-95	42
Mean- 244 mts		More than 30	Obese	8	95-98	49
			Mean- 17.8		98-100	31
					Mean- 94	

Table 8: Pattern of Respiratory Insufficiency based on spirometry

Obstructive	Mixed	Restrictive	Normal	Couldn't perform
21	25	45	21	88

legislature involved

Silicosis causes enormous economic loss to the nation as a whole and industry in particular. Silicosis is a notifiable disease under Factories Act of India 1948, & Mines Act 1952 in India.

Silicosis is a compensable injury under the Employees' State Insurance Act (1948) and the Workmen's Compensation Act (1923) (India).

Prevention of silicosis is a constitutional obligation of the government Under Article 246, Union List - Entry 55 of Constitution of India. Safety, Welfare & Health of persons employed in mines is concern of Central Governments and in case of factories it is the concern of State Government. The objective is regulated by the Mines Act, 1952 and Factories Act, 1948 and rules & regulations made under Mines Act, 1952; which are administered by Directorate General of Mines Safety. Rules & regulations of Factories Act 1948 administered by Chief Inspector of factories of the respective state.

In 1995, the World Health Organization and the International Labour Organization began a public awareness and prevention campaign to eliminate silicosis from the world by 2030²

The National Human Rights Commission of India (NHRC) has directed the governments of the states and union territories of India to provide complete information about all measures taken to prevent and eliminate the problem of silicosis²

DISCUSSION

Age Group- The most common age group at presentation was 30-40 years, mean being 37.4 yrs, the cohort being younger than the Haryana study,^[13] with mean age of 43. And the JNU Jaipur study,^[19] with mean age of 44.3.

Substance abuse- The most common addiction was smoking 86% followed by tobacco/Gutkha chewing 56% and alcoholism 28% which was not considerably different from other Indian studies Mean total duration of illness being 12.32 years, which differs from the study done in Udaipur,^[11] where TDI was less than 5 yrs in most cases, mean

exposure to silica at workplace was 18.67 yrs and mean smoking pack years were 26.61 years. This also is in sharp contrast to the Polish registry^[12] with 2006 cases where more than 70% cases had an exposure history of more than 20 yrs and latency for symptoms more than 40 years, and also to Chongqing study where in the observed latency is much more.^[4]

Nature of work – Mostly patients were either stone miner (23%), stone dresser (21%), stone loader (18.5%) or stone grinder (15.5%) in contrast to Polish, Australian & USA study where manufacturing units, denim sandblasting, engineered stone industry etc were the main causes due to mechanized labour in stone in those countries.

Clinical sign & symptoms- Cough (72.5%) with or without expectoration, dyspnea (76.5%) and chest pain (24%) were the most common symptoms, which were broadly similar to the findings of Udaipur study.^[11] Type I Respiratory failure was present in most of the patients (62%) & Type II Respiratory failure was present in (13%), Besides Fever, Hemoptysis, & pedal edema was also present in significant number of patients.

Wheezing was a main finding in 44% patients, Pleural effusion in (14) 7% & Pneumothorax in (7) 3.5% patients

Form of silicosis- Chronic form of silicosis was the most common wherein 120 patients (60%) had Chronic simple and 65 patients (32.5%) had chronic with PMF, while acute silicosis was seen in 3 (1.5%) patients & accelerated with 12 (6%) patients.

Comorbid condition- 23 patients had cavitation in the conglomerate PMF out of which 4 had aspergilloma & further 3 out of 4 had hemoptysis on presentation, Besides, hemoptysis was also present in 20 other patients whose cause could not be ascertained, yet it was managed conservatively. Arthritis was present in 12 patients. AFB positive status or radiologically active TB was present in 38 patients, Signs of right ventricular failure or Cor pulmonale were present in 26 patients.

BMI, SPO2, 6 MWD

The mean BMI was 17.8 ie undernourished, The mean SPO2 was 94 & mean 6 MWD was 244 meters.

Radiological findings

Linear shadows were seen in 191 patients, round shadows in 171 patients, large nodules in 40 patients, Pleural thickening in 116 patients, Mediastinal LAP was seen in 106 patients, compensatory emphysema was seen in 98 patients, Characteristic hilar egg shell calcification was seen in 56 patients

Spirometry classification

Majority couldn't perform 88 (44%) the test successfully, Restrictive pattern was observed in 45 (22.5%), mixed pattern was seen in 25 (12.5%), normal spirometry & obstructive pattern both were seen in 21 patients each ie (10.5%) each in contrast to ESI Medical college Faridabad Haryana,^[13] where most patients were able to perform the test.

CONCLUSION

The menace of silicosis is far from control despite government's & WHO's thrust on safe workplace practices & compensation. It causes morbidity & mortality in the young rendering their families unprotected. The more gruesome fact is the young patient dies with a crippling disease where in their activity is restricted to daily chores, many patients get bedridden at an early stage requiring LTOT at their homes, Silicosis not only causes respiratory failure but also a host lot of problems like Right ventricular failure, cor pulmonale & re infection with tubercular bacilli, many a times MDR pathogen along recurrent episodes of hemoptysis and pneumothorax in their remaining miserable life for which they have to seek medical attention repeatedly. Pneumothoraces in silicotics take a long time to heal and resolve (simply due to the weight of the lung which keeps falling down & so pneumothorax is most commonly seen in upper zones only) & generally no surgical intervention can be done as it's a widespread disease affecting all lobes rendering the patient unfit for any possible surgery. Silicotic patient is generally malnourished and poor adding to the misery.

In our study the average patient was found to be younger (avg age 37.4yrs), with smoking or tobacco chewing as major addictions, TDI was 12.32 yrs, exposure history of 18.67 yrs, the patient had repeated hospital visits with repeated painful hospitalizations before painful death.

So special drive is required to identify such unprotected toxic exposure to silica dust well before the disease onset and more stringent legislation is required to ban illegal & unprotected mining practices. Also much research is required in the field of silicosis as till now no drug has proven benefit in the treatment. Alternative medicine like homeopathy should also be tried as it claims to reverse fibrosis in such patients.

Use of protected & safe mining practices and PPE should be the prerequisite to starting any such activity on commercial level & patient knowledge should be

enhanced about the nature, cause and extent of the disease. A reduction from 4 to 2 mg/m³-years in cumulative RCS exposure corresponded to substantial risk reductions among miners¹⁸.

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