

# Chest radiological findings in Pakistani cement mill workers

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## ABSTRACT

**Objectives:** Even in the 21st century, in developing countries millions of people work daily in dusty environments. They are exposed to different types of health hazards namely, fumes, gases and dust, which are risk factors for developing occupational diseases. Therefore, the aim of this study was to perform chest radiology to determine the occupational hazards of cement dust on the lungs of cement mill workers.

**Methods:** This study was carried out in the Department of Physiology, Faculty of Health and Medical Sciences, Hamdard University Karachi, Pakistan, during the period June to August 2000. In this study 50, apparently healthy volunteer male cement mill workers were randomly selected with an average of 13 years exposure with age ranging from 20-60 years.

They were matched with 50, healthy male control subjects in terms of age, height, weight and socioeconomic status. Both groups met with exclusion criteria as per standard. Radiology was performed by Trophary radiology.

**Results:** The present study demonstrated 12% of cases with interstitial lung disease and 2% of cases with pleural thickening and chronic bronchitis in cement mill workers.

**Conclusion:** Exposure to cement dust causes interstitial lung disease, pleural thickening and chronic bronchitis in cement mill workers.

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Chest radiology is the most frequently requested radiological investigation. In spite of recent technological advances, chest radiology remains the cornerstone of thoracic imaging and is a valuable diagnostic investigation.<sup>1</sup> The chest radiographs together with occupational history, usually allows the physicians to make a presumptive diagnosis. It also helps in early diagnosis of different diseases in various occupational workers.<sup>2</sup> Occupational diseases are a result of an imbalance between human beings and their environment. The diseases of the respiratory system are induced by occupational dusts and are influenced by the type of dust and the duration of exposure.<sup>3</sup> Cement mill workers are exposed to dust at various manufacturing and production processes. Cement dust is classified into 2 main types, natural cement and artificial (Portland) cement. Portland cement is a mixture of calcium oxide (62%-66%), silicon oxide (19%-22%), aluminum trioxide (4%-8%), ferric

oxide (2%-5%) and magnesium oxide (1%-2%).<sup>4</sup> The effects of cement dust are due to its irritating properties. Cement dust has irritating effects on skin, eyes and the respiratory system. It induces atrophic and hypertrophic changes in nasal and pharyngeal mucosa, chronic exfoliative bronchitis and slight tissue fibrosis.<sup>5</sup> Cement dust also has hazardous effects on the gastro intestinal tract<sup>6</sup> and nervous system.<sup>7</sup>

**Methods.** This study was carried out in the Department of Physiology, Faculty of Health and Medical Sciences, Hamdard University Karachi, Pakistan, between June to August 2000. In this study, 2 groups were formed with 50 volunteers each. In the first group, 50 apparently healthy male cement mill workers aged 20-60 years were selected randomly from a cement mill located in Karachi, Pakistan. These workers did not

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**Table 1** - Comparison of anthropometric parameters between cement mill workers and controls (n=50).

Parameters	Control Subjects (mean $\pm$ SEM) (n=50)	Cement mill workers (mean $\pm$ SEM) (n=50)	Significance Level
Age (years)	37.80 $\pm$ 1.66	36.86 $\pm$ 1.50	N S
Height (cm)	165.24 $\pm$ 0.89	165.64 $\pm$ 0.85	N S
Weight (kg)	63.72 $\pm$ 1.10	63.70 $\pm$ 1.39	N S
NS - non significant			

**Table 2** - Chest radiological findings in control and cement mill workers (n=50).

Radiological findings	Control (n=50)	Cement mill workers (n=50)
<b>Soft tissue shadow</b>		
Skin	Normal	Normal
Breast	Normal	Normal
<b>Bony cage</b>		
Scapula	Normal	Normal
Spine	Normal	Normal
Clavicle	Normal	Normal
Sternum	Normal	Normal
Ribs	Normal	Normal
Costophrenic angle	Normal	Obliterated (one case) <sup>†</sup>
Cardiophrenic angle	Normal	Normal
Lymph nodes	Normal	Mild lymphadenopathy (2 cases) <sup>†</sup>
<b>Heart shadow</b>		
Shape	Normal	Normal
Size	Normal	Normal
Borders	Normal	Normal
<b>Lung</b>		
Pleural thickening	Absent	Present (one case) <sup>†</sup>
Pleural effusion	Absent	Absent
Chronic bronchitis	Absent	Present (one case) <sup>†</sup>
Bronchiectasis	Absent	Absent
Emphysema	Absent	Absent
Interstitial lung disease	Absent	Present (6 cases) <sup>‡</sup>
Lung collapse	Absent	Absent
Pneumoconiosis	Absent	Absent
Nodulation	Absent	Absent
Tuberculosis	Absent	Absent
Tumor	Absent	Absent
<sup>†</sup> Associated with 5-10 years exposure <sup>‡</sup> Associated with > 10 years exposure		

use any self-protective measures and worked 8 hours a day. They were matched in terms of age, height, weight and socioeconomic status with a second group of 50 healthy male control subjects selected from the local population of Karachi. These control subjects were composed primarily of shopkeepers and salesmen. Subjects with known cases of asthma, diabetes mellitus, cardiopulmonary diseases, malignancy, drug addicts, cigarette smokers and subjects with gross abnormalities of the vertebral column, thoracic cage and neuromuscular diseases were excluded from the study.

After complete exposure of the chest, subjects were advised to stand upright with their back to the x-ray tube. The chest was pressed against a metal cassette containing the film and the arm were positioned out of the way. All subjects were advised to suspend respiration at total lung capacity and an ideal posteroanterior (PA) view chest radiograph was taken by Trophy Radiology (N-50057, France). The cassette was immediately transferred to the dark room for development process. When required, for necessary quality control purpose, the radiograph was repeated. Each radiograph was clinically read by 2 radiologists and 2 pulmonologists, they interpreted the films independently of each other and without knowledge of exposure status.

**Results.** Anthropometric parameters for the total number of cement mill workers and control group is shown in **Table 1**. There were no significant differences between the means in anthropometric parameters of age, height or weight in both groups. The mean duration of exposure in the cement mill workers was 12.94  $\pm$  1.00 years (mean  $\pm$  SEM), range 2-28 years. The chest radiological findings for total cases of cement mill workers and similar number of matched controls are presented in **Table 2**. In cement mill workers abnormal clinical findings were found on chest radiology as compared to control subjects. These abnormal findings are single cases of pleural thickening, chronic bronchitis and 6 cases of interstitial lung disease.

**Discussion.** The present study demonstrates that pulmonary radiological abnormalities are associated with the inhalation of dust produced in the manufacture of cement. We found radiological abnormalities in cement mill workers based on coarse interstitial markings and ground glass opacity prominent in middle and lower zones of lungs, obliteration of costophrenic angle and small ill defined opacities. Kalacic,<sup>8</sup> studied radiographs of 847 cement mill workers. They reported that obstructive ventilatory change appears in early stages, while, restrictive changes in later stages. In addition, Oleru,<sup>4</sup> reported no abnormality in radiographs of cement mill workers. In our opinion, the difference in the radiological findings of Oleru,<sup>4</sup> and the present work, is the period of employment. It is therefore suggested that employment period is one of the

important factors in the development of interstitial lung disease. It is important to note that Oleru,<sup>4</sup> observed cement mill workers who were employed for 6 years only, while the present study reports abnormalities in a period of employment of >10 years. This period is higher at >20 years in the report of Kalacic.<sup>8</sup>

In the present study we observed pleural thickening in 2% of cement mill workers. Scansetti et al,<sup>9</sup> also found pleural thickening in approximately 25% of cases out of 100 Italian cement mill workers. In addition, Abrons et al,<sup>10</sup> observed the prevalence rate of approximately 2% for pleural abnormalities, predominantly bilateral diffuse pleural thickening in cement mill workers after age and smoking adjustment. However, the overall prevalence was significantly elevated over controls. In light of the above study along with the present report, it is suggested that subjects exposed to cement dust might be subject to infections that lead to exudation of fluid along with the formation of plaques resulting in plural thickening.<sup>11</sup>

Present results demonstrate that 2% of cement mill workers suffer from chronic bronchitis compared to controls. This findings support the results demonstrated by Giuliani and Belli,<sup>12</sup> Vyskocil,<sup>13</sup> Hadziolov,<sup>14</sup> Popovic<sup>15</sup> and Malceva and Tatanov.<sup>16</sup>

In the present study, an attempt was also made to explore micronodulation and nodulation on radiographs obtained from cement mill workers, however, none were found. In contrast, Prosperi and Barsi<sup>17</sup> and Sander<sup>18</sup> found micronodulation after only 15 years and 20-45 years of employment. In addition, Gardner et al,<sup>19</sup> demonstrated a few cases of nodulation. A probable reason for the difference in the present study and the study observed by Gardner et al<sup>19</sup> is quartz dust exposure. In the present study, none of the cement mill workers had any occupational dust exposure before their employment in the cement industry.

In this study, radiological findings did not demonstrate any case of pneumoconiosis. Similarly, Bazas,<sup>20</sup> reported the radiographs of 7 cement plants in Greece and revealed no cases of pneumoconiosis. In addition, Rom<sup>21</sup> also mentioned that most investigators have not found radiographic abnormalities suggestive of pneumoconiosis among cement mill workers. On the contrary, Maestrelli et al<sup>22</sup> reported radiographic changes of pneumoconiosis among 7.2% in Italian cement mill workers. Popovic<sup>23</sup> identified pneumoconiosis in 17.4% in Yugoslavian cement workers. A probable reason for the difference in the present study and the study observed by Maestrelli et al,<sup>22</sup> Popovic<sup>23</sup> is the difference in number of observations and duration of exposure. They have selected 318, 244 and 304 cement mill workers with period of employment longer than 10 years. The other possible reason that may have caused pneumoconiosis in Yugoslavian cement mill workers as reported by Popovic<sup>23</sup> is failure of the protective system especially the mucociliary system, that expels the dust from the respiratory system.<sup>24</sup>

In addition to the absence of micronodulation, nodulation and pneumoconiosis in the present study,

tuberculosis or emphysema was also not detected on radiological examinations in cement mill workers. Similarly, Gardner et al<sup>19</sup> and Sander,<sup>18</sup> reported that the incidence of tuberculosis of the lungs is lower in cement mill workers than controls. In addition, Stancari and Penazzato<sup>25</sup> and Popovic<sup>15</sup> reported that, the prevalence of lung tuberculosis among cement workers was found to be equal or even less than in the general population.

In conclusion, the present study result show that, exposure to cement dust causes interstitial lung disease, pleural thickening and chronic bronchitis. Keeping in view the effects of cement dust we recommend that cement mill workers should wear apparel, use masks and have pre employment medical clearance and periodic surveillance, especially chest radiography. These measures reduce the risk of occupational diseases in cement mill workers and help to identify the occupational respiratory diseases in earlier stages when the therapy is amenable.

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