

PREVALANCE OF PNEUMOCONIOSIS AMONG COAL MINERS OF CHERAT, DISTRICT NOWSHERA - PAKISTAN

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ABSTRACT

Objective: The objective of this study was to assess the prevalence of pneumoconiosis among coal miners.

Methodology: This cross-sectional study was conducted among 400 coal miners of Cherat, District Nowshera, KPK, Pakistan, from July 2012 to June 2013. Coal miners who worked for more than six months were included. Medical camps were arranged in study areas in which Pulmonary Function Tests and CXR was conducted to estimate the prevalence of pneumoconiosis. The demographic variables were also noted on a semi structured proforma.

Results: The medical examinations of coal miner's revealed that approximately 71% (n=284) of coal miners have sign and symptoms of occupational respiratory health problems. The coal miners showed an increased prevalence of coal workers pneumoconiosis (49.50%) i.e. about 47% (n=188) on Chest X-rays (P/A View) and 52.50% (n=210) on Pulmonary Function Tests has findings of coal workers pneumoconiosis. Only 31.75% (n=127) of coal miners have normal pulmonary function tests and 35% (n=140) have normal chest x-ray findings during medical assessment.

Conclusion: The prevalence of the pneumoconiosis was high (49.50%) among the Cherat coal miners; and needs proper consideration and attention from the health sector and mining department in order to reduce the high burden of pneumoconiosis among coal miners.

Key Words: Prevalence, Pneumoconiosis, Signs & Symptoms, Pulmonary Function Tests, Chest X-rays, Coal Miners.

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INTRODUCTION

Occupational hazards are one of the most difficult and dangerous challenge and results in unnecessary mortality and morbidity throughout the world. Beside various occupational standards set by International Labor Organization and World Health Organization, there is inhalation of respirable dust causing pneumoconiosis and related respiratory conditions among coal miners¹. Various epidemiological studies indicated that exposure to coal dust during coal mining contributed to health risks^{2, 3}. The coal workers pneumoconiosis (CWP) is strongly related to cumulative coal dust exposure effects when the exposure exceeds the maximum permissible exposure limits (MPELs). Initially pneumoconiosis have no sign and symptoms but eventually progress to advance/ complicated CWP⁴.

Pneumoconiosis occurs as a reaction of the lung tissue parenchyma to the foreign coal dust particles which accumulate in lung parenchyma⁵. In coal miners there is mostly disordered pulmonary ventilation due to restrictive process⁶. The coal miner's chest x-rays shows micro nodular & macro nodular opacities and unilateral/bilateral calcifications⁷. In simple pneumoconiosis, there are micro-nodular opacities along with restrictive pattern of pulmonary function tests as investigated by local and international researchers⁸. In USA study, approximately 35.4% of advance pneumoconiosis was found⁹. In other studies, the prevalence of pneumoconiosis is 2-4% & 13.5%^{10, 11} while others reported the prevalence of 7.5%¹². In Pakistan, there are around 185 billion tons of coal reserves, out of which Khyber Pukhtunkhwa Province contributes about 90 million tons; i.e. from Hangu/Orakzai and Cherat/Nowshera¹³ but due to lack of occupational monitoring and evaluation practic-

es; the coal mining standards are not followed and coal miners' work under much hazardous environment and thus pose great risk. The coal miners of Cherat district Nowshera are one of the neglected groups and thus this study was carried to highlight its problem and to find the prevalence of pneumoconiosis among the coal miners.

METHODOLOGY

Approximately there are 90 to 100 coal mines in which 1000-1200 coal miners are working in Cherat, Nowshera, Khyber Pakhtunkhwa, Pakistan. A cross-sectional study was conducted from July 2012 to June 2013; in which 400 coal miners were selected to find the prevalence of pneumoconiosis based on 95% confidence interval, 50% prevalence and 5% precision. Coal miners who have more than six month of coal mining job were included in the study. The sampling technique

was probability cluster in which the whole area was divided into four clusters i.e. Shakot, Jaba Tar, Jaba Khushk and Dak Ismail Khel, and then from each cluster 40% coal miners were selected based on simple random technique/method as shown in Figure 1.

The presence of nodular opacities on Chest X-rays (P/A View) and restrictive pattern of pulmonary function tests in collaboration with signs and symptoms were used as a diagnostic criterion for coal workers pneumoconiosis.

A detailed structured questionnaire was formulated to collect data for important variables like age, duration of coal mining job, smoking history, years of smoking and number of cigarettes/day. Medical examinations of 400 coal miners were conducted to estimate the prevalence of pneumoconiosis among coal miners. Continuous variables were analyzed using means and standard deviations for example: age etc; categorical variables were analyzed using percentages.

Table 1: Demographics of Coal Miners of Cherat (n = 400)

Variables		Number of Coal Miners n = 400	Percentage
Age distribution	< 20 years	21	5.3%
	20-25 years	146	36.5%
	25-30 years	69	17.3%
	31-35 years	48	12.0%
	36 years & above	116	29.0%
Duration of mining job in years	1-4 years	112	28.0%
	5-8 years	112	28.0%
	9-14 years	68	17.0%
	15 years & above	108	27.0%
Smoking history	Smokers	288	72.0%
	No smokers	112	28.0%
No of cigarettes smokes/day (n = 288)	1-5 cigarettes	108	37.5%
	6-10 cigarettes	92	31.9%
	11-15 cigarettes	64	22.2%
	16 cigarettes and above	24	8.3%
Use of personnel protective equipments	Yes	257	64.25%
	No	143	35.75%
Concomitant disease(s)	Yes	76	19%
	No	324	81%

RESULTS

The demographics of the coal miners showed that the mean age of coal miners was 30 ± 1.26 years. Seventy two percent ($n=288$) of the coal miners showed positive history of smoking. Mean number of smoking years were 8 years with standard deviation ± 0.86 and the mean no of cigarettes was 10 cigarettes with standard deviation ± 2.36 . 35.75 % ($n=143$) of coal miners did not follow the standard personnel protective equipments as shown in Table 1.

During medical examinations; out of all chest symp-

toms 71 % ($n=284$); the coal miners showed high prevalence of dry cough and productive cough i.e. 26.50% ($n=106$) & 18.50% ($n=74$) respectively, followed by dyspnoea/shortness of breath 17% ($n=68$); and chest pain 9% (36), during medical examinations The Pulmonary Function Tests (PFTs) and Chest X-rays (P/A View) findings of the coal miners ($n=400$) are shown in Table 2 & 3. Out of all coal miners; 210 (52.50%) showed restrictive pattern on Pulmonary Function Tests (PFTs); and 47% ($n=188$) of coal miners showed nodular opacities on Chest X-rays (P/A View). The prevalence of pneumoconiosis on the basis of CXR and PFTs is shown in Figure 2 and Table 4.

Table 2: Pulmonary function tests findings among coal miners of Cherat (n=400)

S. No	Lung Disease Pattern	Disease	Frequency	Percentage
1	Restrictive Diseases	Simple Coal Workers Pneumoconiosis, Complicated Coal Workers Pneumoconiosis, Silicosis, Tuberculosis, Sarcoidosis, Interstitial, Lungs Diseases, Lung Cancer, Metastatic Lung Diseases	210	52.5%
2	Obstructive Diseases	Bronchial Asthma & Chronic Obstructive Pulmonary Diseases (COPD) i.e. Chronic Bronchitis, Emphysema	63	15.75%
3	Normal	Nil	127	31.75%
	Total		400	100%

Table 3: Chest X-Rays findings among coal miners of Cherat (n=400)

S. No	Chest X-Rays Findings	Disease	Frequency	Percentage
1	Normal	Nil	140	35%
2	Micro Nodular Opacities, Macro Nodular Opacities, Bilateral or unilateral Calcifications, (1 - 5 mm)	Simple Coal Workers Pneumoconiosis or Complicated Coal Workers Pneumoconiosis, Silicosis, Tuberculosis, Sarcoidosis, Interstitial, Lungs Diseases, Lung Cancer (Primary), Metastatic Lung Diseases (Secondary)	188	47%
3	Hyper Inflated Lungs	Bronchial Asthma OR Chronic Obstructive Pulmonary Diseases i.e. Chronic Bronchitis, Emphysema	72	18%
	Total		400	100%

Table 4: Prevalence of pneumoconiosis on the basis of CXR (P/A View) and PFTs

S. No	Laboratory Test/s	Findings	n	%
1	Chest X-Rays (P/A view)	Pneumoconiosis	188	47.00%
		Normal or other diseases	212	53.00%
		Total Population	400	100%
2	Pulmonary Function Tests	Restrictive Disease Patterns	210	52.50%
		Normal or other diseases	190	47.50%
		Total Population	400	100%

Figure 1: Map of Khyber Pukhtunkhwa and Nowshera District showing the number of coal miners selected from the four study areas

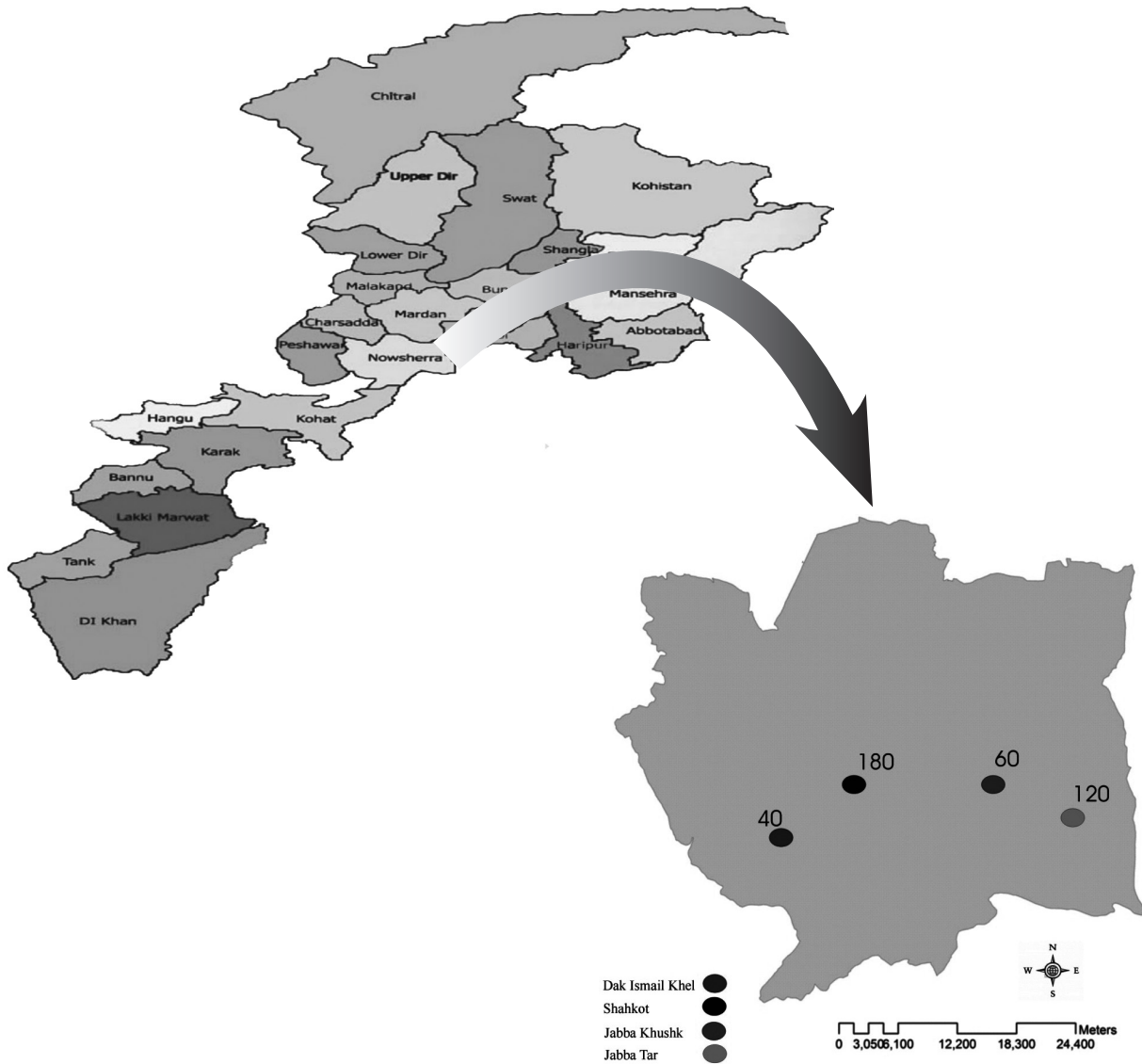
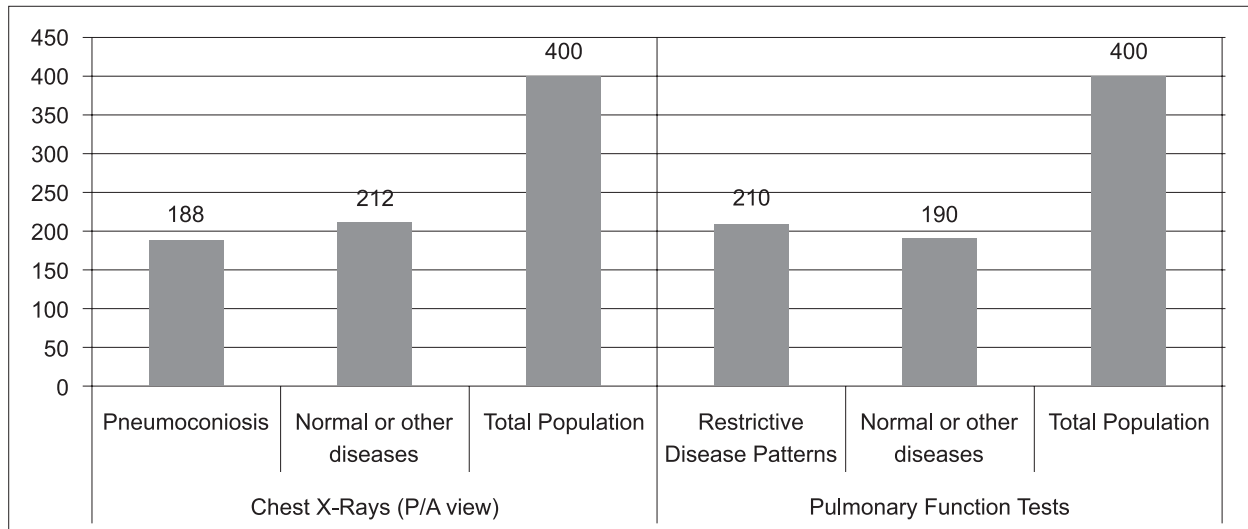


Figure 2: Graph showing prevalence of pneumoconiosis among coal miners (n=400)

DISCUSSION

The pulmonary function tests (PFTs) for 400 coal miners showed the following findings: 210 (52.50%) showed restrictive pattern of respiratory diseases as were studied previously⁷; 63 (15.75%) showed obstructive pattern of respiratory diseases; and only 127 (31.75%) showed normal pulmonary function tests. The PFTs are used to measure the air flow limitation/ restrictive pattern, due to coal dust exposure of the coal miners as were confirmed in previous studies¹⁴ and these findings were confirmed and supported by this study which has prevalence of 52.5%. On the basis of restrictive disease pattern of pulmonary function tests, we can conclude that 52.50% (n=210) of the coal miners may have simple or complicated CWP.

The chest x-rays (P/A View) of coal miners (n=400) during medical examinations showed the following findings: micro nodular opacities, bilateral or unilateral calcifications and macro nodular opacities in 47% (n=188) of coal miners; which were also reported in recent international studies^{7, 15} and normal chest x-ray findings were observed in 35% (n=140). The hyper inflated lung fields have prevalence of about 18% (n=72) in this study. A study was conducted by Goldyn et al., (2008) in which there were findings in lungs parenchymal tissue and had diffuse lung diseases and was confirmed by this study; which showed high prevalence of restrictive diseases on CXR and PFTs.

The prevalence of pneumoconiosis as calculated is higher in this study (49.50%) but it is far less as compared to other international studies, which had 2-4%¹⁰ and 13.5%¹¹. On the basis of findings of pulmonary function tests and chest x-rays it can be estimat-

ed that approximately half of the coal miners may have pneumoconiosis i.e. simple coal workers pneumoconiosis or complicated coal workers pneumoconiosis.

CONCLUSIONS

From the medical examinations, chest X-rays (CXR) and pulmonary function tests (PFTs); it is concluded that 71% have sign and symptoms of occupational respiratory health problems and 49.50% of the coal miners showed prevalence of pneumoconiosis on CXR and PFTs. The overall situation of occupational safety & health measures in Cherat coal mines is not encouraging and miners work under hazardous conditions. The coal miners showed an increased prevalence of pneumoconiosis. There are large number of coal workers who need immediate referral and treatment to prevent their disease progress and their ultimate consequences of high morbidity and mortality.

RECOMMENDATIONS

It is suggested that coal mines are one of the neglected sectors and needs proper and immediate attention of the concerned authorities, coal miners should be educated and trained regarding the occupational health & safety measures; and regular surveillance and monitoring of these coal mines be conducted. Moreover, provision of personnel protective equipments (PPEs) and their compliance should be strictly maintained in coal mines. Moreover, the Government, Coal mine owners, private sectors as well other concerned institutions should implement measures regarding prevention and control of pneumoconiosis to avoid unnecessary mortality and morbidity among coal miners.

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CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest.

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CONTRIBUTORS

MI conceived the idea and planned the study. RN, KK, HK, SZ, GS and NJ helped in data collection and manuscript writing. All authors contributed significantly to the final manuscript.