ORIGINAL ARTICLE

RISK ASSESSMENT OF LUNG CANCER IN ASBESTOS CEMENT INDUSTRY WORKERS OF PESHAWAR DIVISION

Muhammad Owais Essa[1], Natasha Junaid[2], Maria Maqsood[1], Muhammad Saad Khan[1], Noor Fatima[1], Syeda Maria Kakakhel[1], Abdullah Wahdan Yahya[1], Muhammad Abdal Khan[1], Muhammad Owais Essa[1], Noor Ul Huda[1], Nishat Waheed[1], Nimra Waheed[1]

[1]MBBS students of Khyber Medical College, Peshawar - Pakistan

[2]Department of Community Medicine, Khyber Medical College, Peshawar - Pakistan

ABSTRACT

Objectives: The study aimed to analyze the risk of developing lung cancer by asbestos exposure and its association with other risk factors.

Material and Methods: A Structured and internationally validated UK Lung Cancer Screening Questionnaire was used to collect data from 152 asbestos-cement industry workers in the Peshawar division of Khyber Pakhtunkhwa, Pakistan. The sample only included male workers over 49 and those who have worked in the cement industry for at least 4 years. Besides asbestos exposure, the questionnaire took into account age, lung diseases, malignancies, family history of cancer, smoking history, and radiation exposure. The data was later analyzed using the Liverpool Lung Project (LLP) risk model for assessment of the risk of developing lung cancer. The Statistical Package for Social Sciences 20 (SPSS-20) was used to investigate the association of asbestos with other risk factors.

Results: Our analysis with the LLP risk model showed that among the 152 subjects, 42(27.6%) individuals were at low risk, 22(14.5%) individuals were at moderate risk and 2 (1.3%) individuals were at high risk of developing lung cancer in the next 5 years. The association of asbestos with other risk factors was calculated through a chi-square test and the results showed a strong correlation between asbestos and cigarette smoking (75 individuals) and age in causing lung cancer with a p-value of 0.000 and 0.001 respectively. Having a family member diagnosed with cancer before the age of 60 also had a significant association with lung cancer in asbestos-exposed workers with a significance of 0.001. However, the study could not establish an association between radiation exposure (Xray {p-value = 0.277}, CT scan {p= 0.539}) and lung diseases like asthma {p=0.902}, bronchitis {p=0.020}, pneumonia {significance value=0.116}), except for tuberculosis (significance value=of 0.000) with asbestos as risk factors for lung cancer.

Conclusion: We concluded that there is a significant risk of developing lung cancer among workers in asbestos-cement industries in the next 5 years with the elderly, smokers, and those with a family history of cancer being at a higher risk.

Keywords: Lung cancer, asbestos exposure, cement industry, LLP risk model, risk assessment, smoking, age, family history of cancer

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INTRODUCTION

An uncontrolled cell growth whether primarily originated or metastasized from a secondary site that involves the lung parenchyma or the bronchi is referred to as lung cancer. Clinically the disease is presented mainly with cough, dyspnea, and weight loss while hemoptysis is the most specific symptom. [1] It is the second most common cancer worldwide and is a matter of grave concern and a major cause of chronic morbidity, mortality, and economic loss due to the absence of any effective screening methods. According to the World Health Organization factsheet, lung cancer was the leading cause of cancer deaths in 2020 with 1.80 million confirmed deaths while it was the second most common cancer by incidence with 2.21 million cases which makes its mortality rate 81%. [2] Referencing the data provided by Cancer Research UK, it is deduced that the mortality rate of lung cancer has mounted up to as much as 90% from the year 2016-2018, ranging the incidents to an average of 48500 yearly. [3] With a mortality of 1,112,571, it has confirmed itself as the most common cause of cancer in Asia, with a survival of about 10%, contributing most to the mortality rate associated with cancer. [4] Nevertheless, in Pakistan, the data provided by WHO regarding the mortality figures for lung

Correspondence
Dr Natasha Junaid
Assistant Professor
Department of Community Medicine, Khyber Medical College, Peshawar - Pakistan
Cell: +92-333-5564081
Email: drjunaidsethi@gmail.com
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cancer has scaled up to 7.8% in 2018 for all cancer-affiliated deaths. [5] The main causative agents for lung cancer include tobacco smoking, environmental pollutants, mutations, infectious organisms, genetic predisposition, and occupational exposures. [6]

By far the leading risk factor for lung cancer is tobacco smoking, accounting for 80-90% of all lung cancer diagnoses with secondhand smokers also at a great risk of developing lung cancer, leading to about 7000 deaths from lung cancer annually. [7, 8] However, besides smoking, occupational exposures have also been established to be a significant etiology for lung cancer with research in the UK attributing 14.5% of all lung cancer cases to occupational exposures. [9]

Among these, Asbestos is touted as one of the most significant lung cancer-causing environmental and occupational exposure. [10] Asbestos is a fibrous form of mineral silicates belonging to the rock-forming minerals used in automobile parts, ceiling and tiles, cement, textiles, and as insulating material due to its strong, chemical and heat resistant, and non-conducting nature. [11] Asbestos includes 6 types of fibrous minerals found in nature that have been grouped into 2 classes, the serpentine type which chiefly includes chrysotile and the amphibole type which includes amosite, crocidolite, actinolite and anthophyllite. [12]

Amphibole fibers being more resistant in lungs with longer residence are responsible for 10 to 50 times more incidences of lung cancer than chrysotile. [13, 14]

The study aimed to analyze the risk of developing lung cancer by asbestos exposure and its association with other risk factors.

MATERIALS AND METHODS

A Structured and internationally validated UK Lung Cancer Screening Questionnaire was used to collect data from 152 asbestos-cement industry workers in the Peshawar division of KP, Pakistan. [1] The sample only included male workers over the age of 49 and those who have worked for at least 4 years in the cement industry. Besides asbestos exposure, the questionnaire took into account age, lung diseases, malignancies, family history of cancer, smoking history, and radiation exposure. The data was later analyzed using the Liverpool Lung Project (LLP) risk model for assessment of the risk of developing lung cancer. [2] The Statistical Package for Social Sciences-20 was used to determine the association of asbestos with other risk factors.

RESULTS

Our analysis with LLP risk model showed that among the 152 subjects, 42 (27.6%) individuals were at low risk, 22 (14.5%) individuals were at moderate risk and 2 (1.3%) individuals were at high risk of developing lung cancer in the next 5 years. The association of asbestos with other risk factors was calculated through a chi-square test and the results showed a strong correlation between asbestos and cigarette smoking (75 individuals) and age in causing lung cancer with a p-value of 0.000 and 0.001 respectively, which are greater than a significant value of 0.05. Having a family member diagnosed with cancer before the age of 60 also had a significant association with lung cancer in asbestos-exposed workers with a p-value of 0.001.

However, the study could not establish an association between radiation exposure {X-ray (p-value = 0.277), CT scan (p-value = 0.539)} and lung diseases, {asthma (p-value = 0.902), bronchitis (p-value = of 0.020), pneumonia (p-value = of 0.116)}, except for tuberculosis (p-value = of 0.000) with asbestos as risk factors for lung cancer.

Among the 152 subjects in our study, 86 (56.6%) individuals were at minimal risk, 42 (27.6%) individuals were at low risk, 22 (14.5%) individuals were at moderate risk and 2 (1.3%) individuals were at high risk of developing lung cancer in the next 5 years.

In our study population, 49.34% (75) people have smoked cigarettes, (only 40 people among these people still smoke cigarettes), while the remaining 50.66% (77) have never smoked a cigarette at any point in their life. The means of pack years and duration of smoking for our study population are 3.80 years and 12.34 years respectively.

Among the 86 individuals at minimal risk, 42 individuals at low risk, and 22 individuals at moderate risk; 74 are of the age group 50-55 years and 12 are of the age group 56-60 years, 29 are of the age group 50-55 years and 13 are of age group 56-60 years, 12 are of age group 50-55 years and 10 are of age group 56-60 years respectively. Both the high-risk individuals are of the age group 56-60 years.

No individual in the age group 50-55 years is at high risk of developing lung cancer. Among the 34 individuals included in our study with relatives diagnosed with cancer, 12 individuals were at minimal risk, 10 were at low risk, 10 were at moderate risk and 2 were at high risk of developing lung cancer in the next 5 years.

Table 1: Showing the number of participants with different risk levels in the study population

Does the subject smoke cigarette?	Lung cancer risk				Total
	Minimal Risk	Low Risk	Moderate Risk	High Risk	
	18	33	22	2	75
	68	9	0	0	77
Total	86	42	22	2	152

DISCUSSIONS

In our research study, we evaluated the probability that workers in the cement industry who are exposed to asbestos-containing cement may get lung cancer during the following five years. We also looked into how other lung illnesses and risk factors were related to asbestos-induced lung cancer. The overall population of Peshawar district was 4,331,959 at the time of the 2017 census. [14] Our study exclusively included males who have worked in cement factories for more than four years and are at least 50 years old. The mean percent risk of developing lung cancer in our study population, according to the LLP risk model is 0.784 and standard deviation of 0.755 which shows that they are at significant risk of developing lung cancer in the following 5 years. In our sample of 152 people, 75.66% were between the ages of 50 and 55, whereas 24.34% were between the ages of 56 and 60. Among the 152 participants, 56.6% had a low chance of having lung cancer in the following five years, 27.6% had a medium risk, 14.5% had a moderate risk, and 1.3% had a high risk. We have discovered a substantial correlation between age and the probability of acquiring lung cancer. According to our research, those between the ages of 56 and 60 are at significantly greater risk than those between 50 and 55. It implies that as people age, their chance of having lung cancer rises. Recent statistics from the Surveillance, Epidemiology and End Results (SEER) Program of the National Cancer Institute show that as people get older, the incidence rates of cancer as a whole rise steadily with age. [15] In our research population, 75 smoked cigarettes; of them, only 40 continued to smoke cigarettes, while the remaining 77 persons have never smoked cigarettes in their lives.

The means of pack years and duration of smoking for our study population are 3.80 years and 12.34 years respectively. We established that smoking cigarettes significantly increases your chance of developing lung cancer. In 2014, a comprehensive review of the scientific literature on the relationship between asbestos and lung cancer revealed that, while asbestos is associated with lung cancer, the interaction between asbestos and smoking in terms of lung cancer risk is additive or multiplicative depending on the degree of exposure. [12] According to another research study on lung cancer mortality among insulation workers, smoking data collected between 1981 and 1983, found that the combined impact of asbestos and smoking was additive.

Their death rate from lung cancer decreased by half, ten years after they stopped smoking. A population-based case-control study conducted in Canada from 1994 to 1997 discovered that the risk of lung cancer in people exposed to medium or high quantities of asbestos was multiplicatively related to the number of cigarettes smoked each year. [5] In our study, only 34 participants have first-degree relatives who have cancer, 22 persons were diagnosed before the age of 60, while the remainder were diagnosed after the age of 60. We discovered that cancer diagnosis in first-degree relatives before the age of 60 is substantially related to the probability of having lung cancer. According to a 2020 comprehensive meta-analysis of 84 publications, the incidence of familial 64 lung cancer is greater among Asians and is impacted by both hereditary and environmental factors. [16]

After analyzing the data of 152 individuals for interstitial lung diseases such as asthma (3 cases), bronchitis (8 cases), pneumonia (16 cases), and tuberculosis (12 cases), we discovered that the correlation between asthma, bronchitis, and pneumonia and risk of lung cancer is not significant, while the correlation between tuberculosis and risk of developing lung cancer in the following five years is marginal. Previous lung diseases have been associated with an increased prevalence of lung cancer in epidemiological studies. The two diseases are intricately linked at the molecular level. [8]

The LLP risk model, which was developed in 2006, distinguishes between those who have a high and low 5-year absolute chance of developing lung cancer. People who had previously been diagnosed with pneumonia were at a much-increased risk. Participants who had previously been diagnosed with emphysema were likewise more at risk. Previous asthma, bronchitis, and tuberculosis had no effect.18 However, a 2011 systematic analysis found that a history of COPD, bronchitis, emphysema, TB, or pneumonia is associated with a higher risk of lung cancer. [6]

According to our analysis of 152 people's radiation exposure data, the number of X-rays and CT scans a person had during the previous 12 months had no noticeable effect on their probability of developing lung cancer. Although radiotherapy is the treatment of choice for individuals with early-stage lung cancer who are medically inoperable, normal tissue damage from off-target radiation exposure can occur. [6] Several studies have connected older radiation treatment to a considerably increased risk of ipsilateral lung cancer in persons who had previously been treated for early-stage breast cancer. [5]

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AUTHOR'S CONTRIBUTION

Following authors have made substantial contributions to the manuscript as under

Essa MO: Concept, planning, study design, study conduction, critical review, analysis, manuscript writing.

Junaid N: Critical review, discussion, interpretation, manuscript writing, study conduction.

Maqsood M: Analysis, critical review, study conduction.

Khan MS: Critical Review, study conduction, interpretation.

Fatima N: Study design, study conduction.

Kakakhel SM : Study design, study conduction.

Yahya AW: Critical review, discussion.

Khan MA: Planning, Study conduction, analysis

Essa MO: Study design, study conduction.

Huda NU: Study conduction, critical review.

Waheed N: Critical review, facilitation of expenses.

Waheed N: Concept, planning, study design.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.