Original Article

Impact of Bad Air Quality on Morphology of Lungs - a Radiological Cross-Sectional Study Conducted at a Tertiary Care Hospital in Lahore.

Nayab Haider[1], Muhammad Wasif[2]*

[1]Professor, Department of Medicine, Central Park Teaching Hospital, Lahore.

[2]Associate Professor, Department of Radiology, Central Park Teaching Hospital, Lahore.

Correspondence to

Dr. Nayab Haider
Professor, Department of Medicine,
Central Park Teaching Hospital, Lahore.
E-mail: *dr.nayabhaider@cpmc.edu.pk*

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Abstract

Objective: To radiologically examine the impact of bad air quality on the x-ray findings of patients visiting a tertiary care hospital in Lahore.

Methods: This cross-sectional study was conducted in the outpatient department of CPTH, Lahore, from 1st of Oct. to 1st of Dec. 2021. A total of 40 patients from age groups between 21 – 60 years and from both genders, who presented with respiratory symptoms, were included in the study for their x-ray findings. As this was a radiological study, there was only one clinical parameter taken into consideration and that was x-ray chest. The patients enrolled in the study were divided into 4 groups, based on the severity of symptoms and findings on x-rays. Only non-smokers were included in the study.

Results: Out of 40 patients, 18 showed no changes on x-ray chest, 12 showed minor appearance of unilateral peri bronchiolar shadows, 6 showed a more prominent appearance of peribronchiolar shadows bilaterally whereas 4 showed bilateral signs of lung fibrosis.

Conclusion: Exposure to smog filled air can be linked to accelerated development of lung damage, even among people who have never smoked.

Keywords: Bad air quality, Lungs, Inhalation, Air contaminants.

Introduction

Air pollution is an alarming global environmental calamity with adverse effects on public health.[1] Given that an adult inhales on average 10–15 m^3 of air per day, it is obvious that inhalation represents the fundamental exposure mechanism to airborne pollutants in man.[2] Lahore - the provincial capital of Punjab, has been declared as the most polluted city globally after its Air Quality Index crossed beyond 400 in the month of November, 2021.[3] There are many factors responsible for causing pollution of air in Lahore, including vehicle and industrial emissions, smoke from brick kilns, the burning of crop residue and general waste, and dust from construction sites. Other factors of air pollution include cutting of trees on a massive scale to construct roads and buildings.

As the city of Lahore expands in population, a lethal atmospheric layer of smog forms when nitrogen oxides and volatile organic compounds from vehicle, power, and other sources mix with sunlight and heat. Breathing in of pollutants in air leads to irritation of airways, resulting in difficulty in breathing, shortness of breath, coughing and chest pain. Exposure to air pollution increases the risk for lung diseases, including interstitial lung diseases, asthma, Chronic Obstructive Pulmonary Disease and lung cancer.

Air pollution is one of the biggest public concern globally. According to the World Health Organization, it is estimated that 7 million people die globally each year.[4] In Asia, an expected 852,000 people die hastily annually from experience with air contaminants.[5]

This study was conducted to investigate the effects of air pollution on the respiratory health of patients visiting the outpatient department of Central Park Teaching Hospital (CPTH), Lahore, in the months of October and November of 2021, when the concentration of smog in air was at its peak.

Methods

This cross-sectional study was conducted in the outpatient department of CPTH, Lahore, from 1st of September to 1st of December, 2021 after approval from ethical review committee and consent from the patients. A total of 40 patients from age groups between 21 – 60 years and from both genders, who presented with respiratory symptoms, including shortness of breath, coughing and chest pain were included in the study. Only those having respiratory symptoms for more than 3 months and non-smokers were approached for demographic details and x-ray findings.

As this was a radiological study, there was only one clinical parameter taken into consideration and that was x-ray chest. The patients enrolled in the study were divided into 4 groups, based on the severity of symptoms and findings on x-rays. Only those patients were considered who had no past history of lungs or heart disease. Another important exclusion criteria was any history of continuous drug intake which could result in fibrosis of the lung tissue. Moreover, the intake of biogas as a fuel was also excluded. All of these patients were from the same locality – a nearby town of Kamahan, a crowded industrial area on Kasoor

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Road, next to CPTH, with higher concentration of air pollution and smog. Patients from other places were not included in this study.

Results

The chest radiographs were graded according to the severity of symptoms and intensity of changes observed on x-ray chest.[6] Out of 40 patients, 22 patients showed changes on x-ray chest, out of which 6 were females and 16 were males. Temperature, blood pressure, frequency of respiration and heart rate were examined too.

Table 1- Grading of symptoms and signs on x-ray chest.

Groups with number of patients	Respiratory Symptoms	Chest X-ray findings	Mean Age group
Group-1 No change n = 18	Mild cough with low grade fever.	Normal lung size, normal heart shadow with well-defined size.	35±5 years
Group -2 Mild changes n = 12	Mild cough and breathlessness on exertion.	Minor appearance of peri-bronchiolar shadows.	40±5 years
Group -3 Moderate changes n = 6	Persistent cough and breathlessness on mild exertion affecting day to day activity.	More prominent appearance of peri-bronchiolar shadows.	50±5 years
Group -4 Severe changes n =4	Persistent cough and breathlessness at rest too with low grade fever.	Signs of lung fibrosis bilaterally.	55±5 years

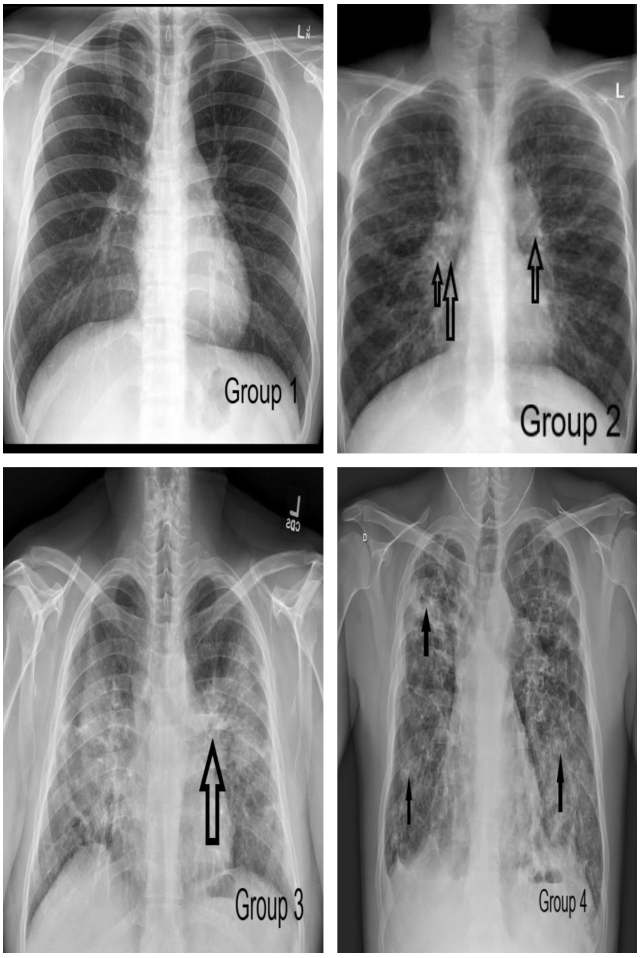

Figure 1 showing chest radiographs of all 4 groups.

Group 1 showing x-ray of a 36 year old patient. Group 2 representing a 48 year old patient, Group 3 shows x-ray of 53 year old patient, whereas Group 4 highlights changes in the chest x-ray of 57 year old patient. The details of the changes pointed out by arrows are given in table 1 for all groups.

Out of 40 patients, 16 were females and the remaining 24 were males. Out of 16 females, 10 were from the working class, who travelled through local transports to commute to work. All 4 groups of patients belonged to different professions and they were not confined to outdoor activities. Some of them spent most of their time at home, especially the females who were not working. Out of 40 patients, the radiological findings of those patients showed marked changes who were of higher age group (above 50 years), regardless of their occupation. The patients belonging to group 4 were further screened for any connective tissue disorders which might have led to lung fibrosis and the results came out negative.

Discussion

The current study has linked air pollution with early evidence of lung fibrosis on x-ray chest in adults living in a town exposed to air pollution and smog, adding insight into the hypothesis that smog could rapidly contribute to interstitial lung disease. Living in an atmosphere of elevated levels of pollutants may make a human more fragile, and thus it is more likely for infectious agents to cause prolonged respiratory problems.

As only non-smoker patients were included in this study, it was quite evident that the changes observed on x rays were solely due to air contaminants and smog. Breathing in of air pollutants can irritate airways resulting in cough and shortness of breath. Our results are not comparable to other local studies as to our knowledge, there have been none documented on changes in x ray chest due to bad air quality in Lahore. A similar study was conducted in USA by Sack et al in 2017,[7] which proved that ambient air pollutants were associated with signs of subclinical interstitial lung disease in community based people from all ages and genders, conducted not on patients but on citizens of a community of mixed ethnic groups.

There is a lot of literature accessible on the effects of air pollution on pulmonary health.[8] All of these studies have determined the long term effect of air pollution on the structure and function of the lungs.[9] This study conducted at CPTH did not study the long term effects of bad air quality on the structure of lungs. It was hypothesized that the particles in air were dense and deadly enough to effect the structure of lungs even in a shorter duration. Although the x-ray findings of only 4 patients out of 40 were severe enough to show signs of fibrosis, it did prove our hypothesis correct.

Evidence from the past suggests that air pollution is an important factor in causing pulmonary disease in the low socio-economic income group the world over. Our study was not confined to any particular socio-economic group, but to a specific location which contained a higher concentration of pollutants in air. Damage to the airways due to occupational exposure has also been frequently highlighted, but this current study was

not based on occupational exposure to smog, but on a specific group of people based on their locality and the resulting clinical findings on their chest x-rays. Moreover, it was ascertained that the patients had no past history of exposure to smoke from any source, to avoid confounders. This study also proved that the more the age of the patient, the higher chances of smog related damage to the lungs. One factor responsible for clinical changes in lungs might be weakening of the immune system with increasing age.[10]

Pakistan is labelled as the most rapidly developing country in South Asia, and its second-largest city Lahore, growing at a rate of 4% annually[11] is the most polluted city in Pakistan.[12] Metropolitan settlements frequently suffer from smog in Asia, and Lahore is a rapidly expanding city. The smog in Lahore is regarded as a health issue for the past few years, but this year, it has remarkably and disturbingly taken a toll on people's quality of lives.

Conclusion

Exposure to smog filled air can be linked to accelerated development of lung damage, even among people who have never smoked.

Limitations of study

This study could not be carried out on a larger sample size and expanded to various other locations of Lahore for comparison of results due to limited resources and time constraint.

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