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Original Article

Chronic Pulmonary Obstructive Disease (COPD) On High Resolution Computed Tomography

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ABSTRACT

The prevalent, preventable, and treatable chronic lung illness known as chronic obstructive pulmonary disease (COPD), which may be accurately detected on HRCT, affects both men and women worldwide. **Objective:** To evaluate the diagnostic features of chronic pulmonary obstructive disease (COPD) using high resolution computed tomography. **Methods:** This study included 120 patients with COPD at least having a comprehensive clinical record of 6MWT defined as COPD by a post-bronchodilator FEV1/FVC 70% with sustained expiratory flow limitation. The sample size was computed at 120 patients using convenient approach and non-contrast HRCT was performed using 64 slides scanning from the apex of the lung to the diaphragm. Emphysema scoring and -950 HU criteria were used to automatically partition the lungs without including the central airways. The data were entered and analyzed on SPSS version 22. **Results:** HRCT scan findings show that patients with parenchymal bands were 9(7.5%) with bronchial wall thickening, nodules were (24)20%, bronchiectasis were (23)19%, apical fibrosis were (19)15%, and tree on bud pattern were (12)10%. **Conclusions:** It is concluded that COPD is common in males and worsens in cigarette or tobacco smokers, with a prevalence of parenchymal bands, bronchial wall thickening, nodules, bronchiectasis, apical fibrosis, and tree-on-bud patterns.

INTRODUCTION

Smoking has been established as the primary cause of chronic obstructive pulmonary disease (COPD), which is increasingly becoming a global public health problem [1]. Chronic inflammatory pulmonary disease, usually known COPD, decreases lung airflow [2]. The hallmark of COPD is tissue alterations that cause the walls of the airways to thicken and become blocked [3]. As the illness progresses, there is an increase in mucosal metaplasia, sub mucosal hypertrophy, per bronchial fibrosis, and airway smooth muscle mass [4]. Worldwide, men and women are both affected by the widespread, preventable, and curable chronic lung condition known as COPD [5]. For the past 20 years, smoking has been the main contributor of COPD in both industrialized and developing countries [6]. One's likelihood of developing COPD increases with the amount of cigarettes they smoke [7]. However, some smokers can quit for years without developing COPD [8]. In 2019, 3.23 million people worldwide died from chronic pulmonary obstructive disease, which is the third highest cause of mortality globally [9]. A low or middle-income nation accounts for 90% of COPD deaths among people under the age of 70. According to recent research on the topic, 50% of smokers eventually develop COPD, which is described by the Global Initiative for Chronic Obstructive Lung Disease (GOLD) criteria [10, 11]. Another research that divided patients into emphysema and airway-predominant groups revealed that emphysema patients had lower FEV1, greater functional limitations; higher BODE scores, and lower BMI. They were also more severely affected by the disease. Four groups of participants with distinct characteristics were

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effectively created by the researcher. It is possible to measure the numerous morphological characteristics of lung illnesses using HRCT pictures and abnormalities [12]. The patient's clinical history, symptoms, including chronic severe dyspnea, and pulmonary function tests, which showed irreversible airflow limitation, was all used to determine the existence of COPD in accordance with the GOLD criteria [13]. The mortality rate of COPD is steadily increasing, making it the fourth leading cause of death worldwide [14]. The leading disease and mortality cause in the world is COPD, which has a substantial and growing economic and social impact [15]. The lungs of a person with chronic obstructive pulmonary disease become worse over time [16]. Smoking has been recognized as the main risk factor for COPD, along with chronic bronchitis and emphysema, which are further symptoms of the illness [17, 18]. The purpose of this study was to examine the relationships between symptoms, lung function, physical changes that are measured and have clinical significance and the degree of emphysema assessed using HRCT in COPD patients, as well as the relationship between smoking and COPD [19, 20]. It is now possible to advise smokers that if they continue to smoke throughout their lives, they have at least a one in two probability of acquiring COPD [21]. The results of this study will help radiologists identify COPD on HRCT patients.

METHODS

It was descriptive cross-sectional research at the teaching hospital Aziz Bhatti Shaheed Teaching Hospital (Gujrat Punjab Pakistan). Patients who have completed a 6-minute walking test (6MWT) in the respiratory therapy division were included. Younger people under the age of 40 were excluded. Based on the correlations of the HRCT results, the sample size was computed at 120 patients. A non-contrast High Resolution Computed Tomography was performed from the apex of the lung to the diaphragm. The Medical Research Council (MRC) questionnaire, which is commonly used to grade the influence of dyspnea on everyday activities, was used to assess dyspnoea. It has been linked to various indicators of health status and prognosis. The MRC scale runs from not bothered by breathlessness unless during severe activity to breathless when dressing or undressing. To assess symptoms and functional status, the clinical COPD questionnaire (CCQ) was employed. It has been verified for clinical control trials in COPD patients. The 10 item CCQ is self-administered, and patients are asked to recollect symptoms from the preceding week. Each item is rated on a scale of 0 to 6, and the overall CCQ score is computed by dividing the whole sum by the number of things. Hence, CCQ spans from 0 (excellent control) to 6 (Extremely poor control). A body plethysmograph (Master Screen Body/Diffusion; Viasys Healthcare) was used to evaluate FEV1, vital capacity (VC), total lung capacity (TLC), residual volume (RV), functional residual capacity (FRC), and carbon monoxide diffusion capacity (DLCO). Spirometry was done in accordance with Swedish Board for Accreditation and Conformity Assessment (SWEDAC) accreditation, meeting the norms of ISO/IEC 17025. All measured values were represented as a percentage of expected (e.g., % FEV1). The absolute ratio of FEV1/VC was also shown. The value of VC provides the best of both forced VC (FVC) and gradual VC. HRCT scanning was conducted with the patients in the supine position, using a multi detector CT scanner, to cover the whole lung. The lung algorithm was used to build 1 mm thick trans axial images; patients were assessed with HRCT. HRCT scans were visually evaluated with a focus on the type, location, and amount of emphysema. The degree of emphysema was calculated as a percentage of total lung volume (Emphysema HRCT). Findings included bronchiectasis, bronchial wall thickening, and mucus plugs, which were not further investigated in this study. The review was conducted by an experienced chest radiologist who was not aware of the V/P SPECT data. V/P SPECT The V/P SPECT was done in accordance with the European Association of Nuclear Medicine's (EANM) recommendations. In short, a broad field of view dual-head gamma camera with a low-energy collimator was employed. The acquisition was done in a 64 64 matrix, magnified to a pixel size of 6.8 mm, using 128 projections across 360°. During the breathing research, 64 steps of 10 seconds each were employed, and for the perfusion study, 5 seconds were used. The whole acquisition time was around 20 minutes, and all patients tolerated it well. V/P SPECT was done on a single day. The test began with the inhalation of Techne gas (Cyclomedica Ltd.) until 30 MBq had been delivered to the lungs. After that, ventilation tomography was performed. Following that, 100-120 MBq of 99mTc-labeled human albumin macroaggregates (Malinckrodt Medical BV) were progressively given intravenously without patient movement and in a carefully maintained supine posture. The procedure was then followed by perfusion tomography. With this procedure, the effective dosage is 1.8 mSv. V/P SPECT images were provided for blinded assessment by an independent technician after reconstruction.

RESULTS

Table 1 represents the data about the age having 3-subgroups, 60-69 years age group were mostly affected by COPD 70(58.3%), 50-59 were affected 45(37.5%) and only 5(4.2%) were affected during the age group of 40-49. The prevalence percentage of chronic obstructive pulmonary

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disease was observed more in males 67(55.8%) and 53(44.2%) in females only.

Table 1: Age, gender, and smoking effect

Variables		Frequency (%)
Age	40-49	5(4.2)
	50-59	45(37.5)
	60-69	70(58.3)
	Total	120 (100)
Gender	Male	67(55.8)
	Female	53(44.2)
	Total	120(100)
Smoking	Smoker	99(82.5)
	nonsmoker	21(17.5)
	Total	120(100)

Table 2 represents that the exposure to the toxic gases such as the wood smoke factory worker. 72(60%) patients were affected from the exposure to toxic gases and 48(40%) were never experienced any toxic gas. The smokers have more risks to getting the chronic pulmonary obstructive disease. 99(82.5%) patients were smokers and only 21(17.5%) were non-smokers. Exposure to the toxic gases such as the wood smoke factory worker. 72(60%) patients were affected from the exposure to toxic gases and 48(40%) were never experienced any toxic gas. The HRCT scan findings 5(4.3%) COPD patients have the chronic obstructive pulmonary disease with normal parenchymal bands, COPD patients with parenchymal bands were 9(7.5%), with bronchial wall thickening were 28(23.3%), nodules were 24(20%) bronchiectasis were 23(19%), apical fibrosis were 19(15%) and the most chronic from that is tree on bud pattern are 12(10 %) in the chronic obstructive pulmonary disease.

Table 2: Clinical history and HRCT findings

Variables		Frequency (%)
Exposure to the toxic gases	Yes	72(60.0)
	No	48(40.0)
	Total	120 (100)
	Normal	5(4.2)
HRCT finding in the COPD	Parenchymal bands	9(7.5)
	Bronchial wall thickening	28(23.3)
	Nodules	24(20)
	Bronchiectasis	23(19.2)
	Apical fibrosis	19(15.8)
	Tree in bud pattern	12(10)
	Total	120(100)

Figure 1A shows hyper inflated lung with flattening of right hemi diaphragm. Figure 1B shows herniation of right upper lobe towards left. Figure 1C shows thin-walled cysts early changes of COPDs. Figure 1D shows thick-walled cysts are noted that cause emphysematous changes.

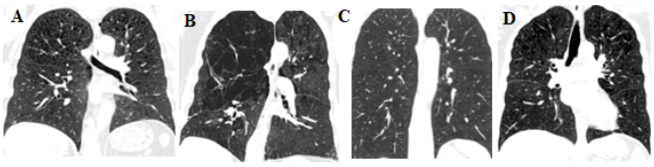

Figure 1: High resolution computed tomographic (HRCT) images

Table 3 shows that the chronic pulmonary obstructive disease patients have low capacity of exercise in the above COPD patients have a test of 6 mint walk about the 78(65%) patients get tired during the walk text and 42(35%) were normal after the six min walk test. 95(79.2%) patients of the chronic obstructive pulmonary disease were obese, and 25(20.8%) were normal. Obesity was one of the major causes of the pulmonary restrictive disease.

Table 3: BMI and Exercise Capacity

Variables		Frequency (%)
Exercise capacity (6 mints walk test)	Normal	42(35)
	Abnormal	78(65)
	Total	120(100)
Body Mass index	Normal	25(20.8)
	Obese	95(79.2)
	Total	120(100)

DISCUSSION

With a global incidence of 10.1% in adults 40 years of age or older, COPD is a prevalent, preventable, and curable condition [22]. COPD, a condition that is rapidly impacting public health across the world, has been linked to smoking as its main cause [23]. The more cigarettes someone smokes, the more likely they are to get COPD. Some smokers, meanwhile, can stop for years without acquiring COPD. In the current study, data were collected from 120 patients and non-contrast HRCT was performed. Kesimer *et al.*, discovered that men account for 76% of COPD prevalence, which is consistent with our study's findings that men make up the majority of the afflicted patients 67(55.8%) men with COPD [24]. Another research found that the prevalence of chronic obstructive pulmonary disease (COPD) was 9.23% in men and 6.16% in women throughout the population, indicating that it is no more a condition that just affects males [25]. Women may be more sensitive to the effects of cigarette smoke due to the higher prevalence of COPD in women, although smoking less than males [26]. Kojima *et al.*, unlike our study, it was discovered that the age group (25-49) has the highest prevalence of COPD in Japan. According to our study most affected age group was (60-69) [27]. Contrarily, a large number of other studies find that the prevalence of COPD increased dramatically with ageing, from 1.9% in the 40–49 year age group to 28.6% in the group of those over 70 years [28]. While some studies suggest that adults over 60 have a two- to three-fold greater frequency of COPD than do people in younger age groups [29]. The results of the

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current study were similar to the results of Moreira *et al.*, which states that patients with wood smoke-related COPD had lung abnormalities shown on HRCT scans that were much more severe than those in the control group, who had no history of exposure to wood smoke. Another finding that was similar to our study was that the COPD group had considerably more parenchymal bands, thickened bronchial walls, bronchiectasis, mosaic perfusion patterns, and laminar atelectasis than did the control group [30].

CONCLUSIONS

COPD can be developed in any age group and common in males but worsens in cigarette or tobacco smokers. The condition progresses, thickening the bronchial wall causing emphysema. There were 20% nodules, 19% bronchiectasis cases, 15% apical fibrosis cases, and 10% of COPD cases had a tree-on-bud pattern. High Resolution Computed Tomography (HRCT) play important role in the diagnosis of chronic obstructive pulmonary disease. HRCT is golden modalities in lung interstitial disease, such as tuberculosis, bronchitis, pneumonia, and chronic obstructive pulmonary disease. With attention to reduce dose with concern to ALARA principle.

Conflicts of Interest

The authors declare no conflict of interest.

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