ISSN: 2581 – 3633
PubMed - National Library of Medicine - ID: 101745081

International Journal of Medical Science and Advanced Clinical Research (IJMACR)

Available Online at:www.ijmacr.com

Volume – 9, Issue – 1, February - 2026, Page No.: 58 – 68

Corelation between Different HRCT Patterns and Spirometry Values According To Age and Gender at A Tertiary Care Center

[1]Dr Tanya Gupta, Department of Respiratory Medicine, Hind Institute of Medical Sciences, Safedabad, Barabanki, Uttar Pradesh

[2]Dr. Amiya Pandey, Assistant Professor, Department of Respiratory Medicine, Hind Institute of Medical Sciences, Safedabad, Barabanki, Uttar Pradesh

[3]Dr. Vinay Kumar Agarwal, Assistant Professor, Department of Respiratory Medicine, Hind Institute of Medical Sciences, Safedabad, Barabanki, Uttar Pradesh

[4]Dr. Abhishek Gupta, Assistant Professor, Department of Respiratory Medicine, Hind Institute of Medical Sciences, Safedabad, Barabanki, Uttar Pradesh

Corresponding Author: Dr Tanya Gupta, Department of Respiratory Medicine, Hind Institute of Medical Sciences, Safedabad, Barabanki, Uttar Pradesh

How to citation this article: Dr Tanya Gupta, Dr. Amiya Pandey, Dr. Vinay Kumar Agarwal, Dr. Abhishek Gupta, "Corelation between Different HRCT Patterns and Spirometry Values According To Age and Gender at A Tertiary Care Center", IJMACR- February - 2026, Volume – 9, Issue - 1, P. No. 58 – 68.

Type of Publication: Original Research Article

Conflicts of Interest: Nil

Abstract

Introduction: High-resolution computed tomography (HRCT) imaging clearly and rapidly reveals pulmonary pathologies invisible to the naked eye. Chronic Obstructive Pulmonary Disease (COPD) is a prevalent, preventable, and treatable disease characterized by persistent respiratory symptoms and airflow limitation due to airway and/or alveolar abnormalities.

Aims and Objectives

- To find out the severity of disease in COPD by correlating spirometric values with different patterns on HRCT.

Objective

- **Primary**: To determine different HRCT patterns and its co-relation with spirometric values in patients with COPD.
- **Secondary**: To determine the association of severity of disease in COPD patients with different HRCT patterns.

Material and Method

Study Design: Descriptive and Observational Study

Study Period: 18 months

Study Place: Department of Respiratory Medicine at Hind Institute of Medical Sciences, Barabanki.

Sample Size: Total Sample were 70.

Study participants: Patients with age group >35 years attending the OPD and IPD in the Department of Respiratory Medicine.

Sampling Method: Consecutive Sampling Technique

Result: In this study, male (64.29%), had a mean age of 58.25 years (SD ±9.53), with the highest prevalence (32.86%) in the 56–65 years age group, followed by 25.71% in the 46–55 years group.

Discussion: Patients in the study exhibited relatively uniform distributions of HRCT and spirometry patterns, enabling a clear examination of trends according to age, gender, and the interplay of both factors.

Keywords: Alveolar Abnormalities, COPD Patients, HRCT Patterns, Spirometric Values, Symptoms

Introduction

During the last few decades, high-resolution computed tomography (HRCT) has come up as a new diagnostic modality to diagnose emphysematous and chronic bronchitis components of chronic obstructive pulmonary disease (COPD). High-resolution computed tomography (HRCT) is a critical diagnostic tool that provides detailed information on lung morphology and disease extent. This study aims to find out the severity of disease in COPD by correlating spirometric values with different patterns on HRCT. The majority of COPD data is derived from high-income nations, low and middle-income countries accounts for 90% of all COPD-related fatalities. India and China constituted 66% of COPD-related fatalities and accounted for 33% of the global population, respectively.

Tobacco use and the inhalation of toxic particulates and gases from outdoor and indoor air pollution are the primary environmental exposures that causes COPD. the most significant genetic risk factors for COPD to date (despite being epidemiologically rare), other genetic variants with small individual effect sizes have also been linked to diminished lung function and an increased risk of developing COPD. On the basis of BOLD and other large-scale epidemiological investigations, the global prevalence of COPD is estimated to be 10.3%. Three million fatalities are attributed to COPD on a global scale, according to estimates.

The examination results furnish details pertaining to the scope and dispersion of emphysema, the existence of chronic bronchitis, and supplementary observations including bullae, bronchiectasis, and cysts. It is also crucial for preoperative evaluation prior to lung volume reduction surgeries or bullectomy in patients with COPD, in addition to excluding alternative diagnoses. HRCT is playing an increasingly significant role in the evaluation of early emphysema in asymptomatic smokers, chronic bronchitis patients, and the various phenotypes of COPD.

Aims and Objectives

- To find out the severity of disease in COPD by correlating spirometric values with different patterns on HRCT.

Objective

- **Primary**: To determine different HRCT patterns and its co-relation with spirometric values in patients with COPD.
- **Secondary**: To determine the association of severity of disease in COPD patients with different HRCT patterns.

Material and Method

Study Design: Descriptive and Observational Study

Study Period: 18 months

Study Place: Department of Respiratory Medicine at Hind Institute of Medical Sciences, Barabanki.

Sample Size: Total Sample were 70.

Study participants: Patients with age group >35 years attending the OPD and IPD in the Department of Respiratory Medicine.

Sampling Method: Consecutive Sampling Technique

Inclusion Criteria

1. COPD patients of age more than 35 years.
2. Patients with a history of bidi and cigarette smoking, occupational, environmental, indoor and outdoor pollution.
3. Patients who are diagnosed as a case of COPD clinically and have fixed airway obstruction based on spirometry.
4. Patients who have given consent.

Exclusion Criteria

1. Age less than 35 years
2. The patient has CT patterns other than those mentioned like ILD.
3. Patients with acute or active comorbid conditions like coronary vascular accident and cerebral vascular accident.
4. Patients with active pulmonary Tuberculosis infection.
5. Patients with any pre-existing genetic condition.
6. Patients who have not given consent.

Statistical Analysis

Data was entered in Microsoft Excel and analysed using statistical software SPSS version 26 (SPSS Inc., Chicago, IL, USA). The continuous variables were evaluated by mean (standard deviation) value when required. The dichotomous variables were presented in number/frequency and were analysed using the Chi-square test. To compare the means between the two or more groups, analysis by ANOVA test was used. A p-value of <0.05 or 0.001 was regarded as significant.

Result

Table 1: Distribution of the age of the enrolled patients

Parameter		Frequency (n=70)	Percentage (%)
AGE	35-45 years	12	17.14%
	46-55 years	18	25.71%
	56-65 years	23	32.86%
	66-75 years	15	21.43%
	76-85 years	7	10.00%
	Mean±SD	58.25±9.53	

Regarding age distribution, the cohort was relatively evenly spread across different age groups, with the highest frequency observed in the 56-65 years range, constituting 32.86% of the participants, followed by the 46-55 years group at 25.71%. The mean age of the cohort was 58.25 years with a standard deviation of 9.53, indicating a moderate dispersion around the mean age.

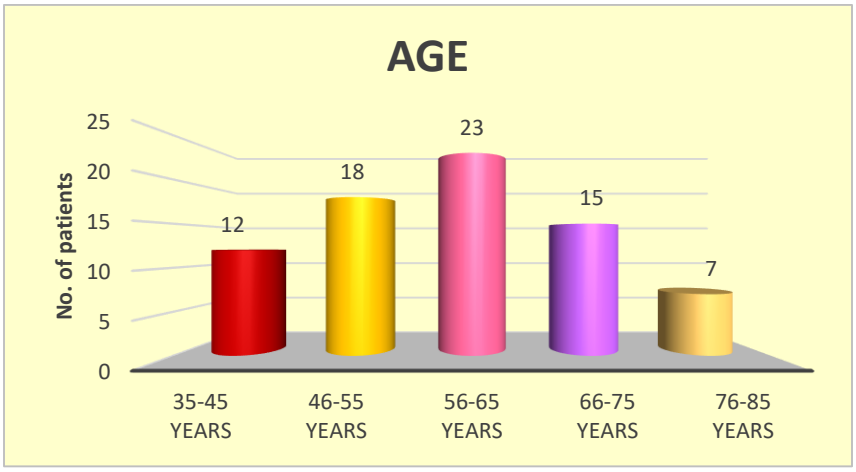

Figure 1: Distribution of the age of the enrolled patients.

Table 2: Distribution of the gender of the enrolled patients

Parameter		Frequency (n=70)	Percentage (%)
Gender	Male	45	64.29%
	Female	25	35.71%

The majority were male, comprising 64.29% of the sample, while females accounted for 35.71%.

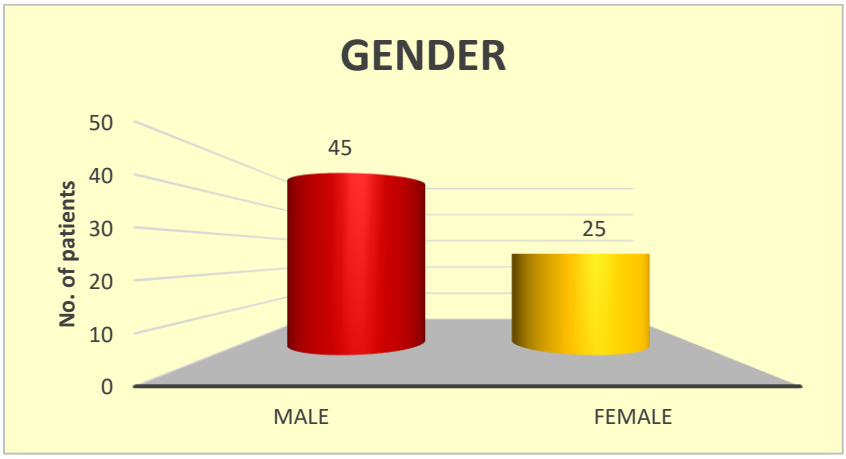

Figure 2: Distribution of the gender of the enrolled patients.

Table 3: History of Hospital Admission

History of Hospital Admission	Frequency (n=70)	Percentage (%)
Yes	30	42.86%
No	40	57.14%

Among the 70 participants, 42.86% reported a history of hospital admission, while 57.14% indicated no such history. This suggests that a considerable proportion of individuals with COPD have experienced exacerbations or disease-related complications requiring hospitalization.

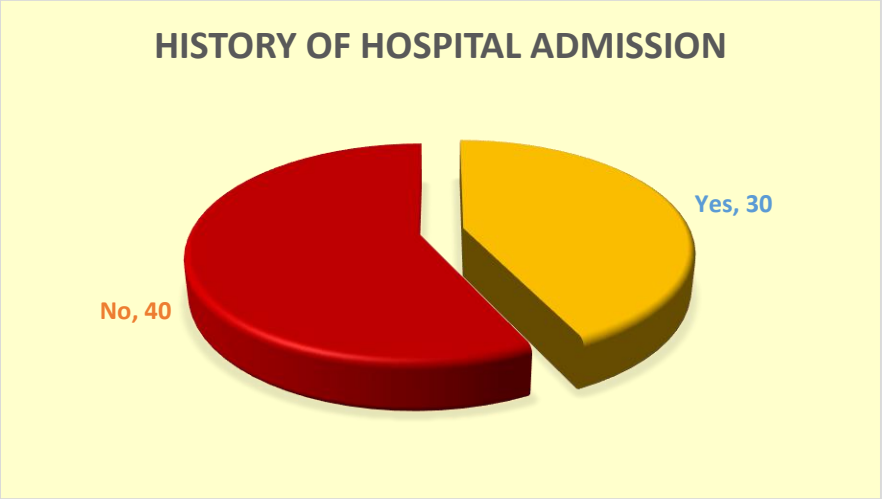

Figure 3: History of Hospital Admission of the enrolled patients

Table 4: Previous drug usage history of the enrolled patients

Previous Drug Usage	Frequency (n=70)	Percentage (%)
Inhalers	28	40.00%
Oral steroids	17	24.29%
Antibiotics	25	35.71%

Among the 70 participants, inhaler usage was the most common form of previous drug usage, with 40.00% of individuals reporting its use. Antibiotics were also frequently used, with 35.71% of participants indicating their usage. Oral steroids were reported by 24.29% of individuals

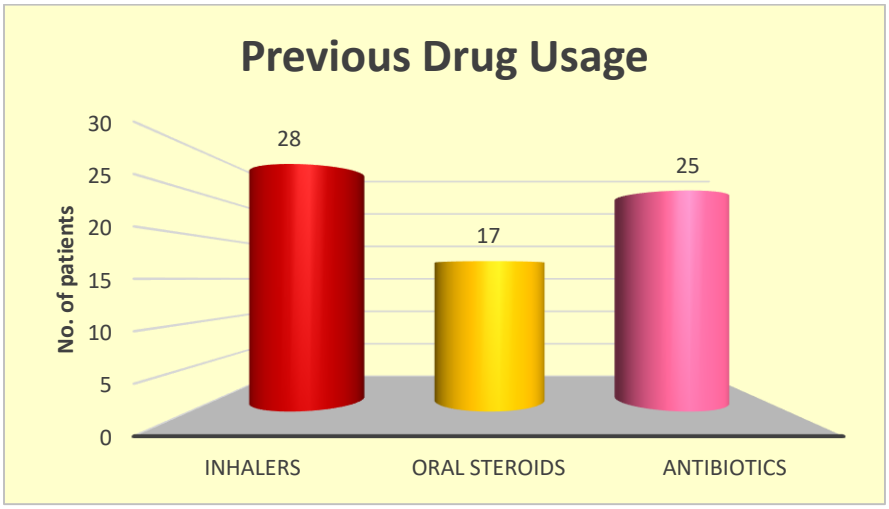

Figure 4: Previous Drug Usage of the enrolled patients.

Table 5: Investigations

Investigation	Frequency (n=70)	Percentage (%)
Findings from chest X-ray		
- Normal	10	14.29%

- Hyperinflation	24	34.29%
-Flattening of diaphragm	16	22.86%
-Tubular shaped heart	11	15.71%
Focal Bullae	9	12.86%
Pre and post bronchodilator FEV1, FVC, FEV1/FVC (Spirometry)		
- Obstructive	70	100.00%
- Restrictive	0	0.00%
FEV1/FVC		
<0.70	33	47.14%
<0.50	24	34.29%
<0.30	13	18.57%
Findings from high-resolution CT scan of the thorax		
Vascular attenuation	59	84.29%
Vascular distortion	5	7.14%
Mosaic attenuation	13	18.57%
Emphysema	43	61.43%
-Centriacinar	24	34.29%
-Panacinar	12	17.14%
-Paraseptal	7	10.00%
Bullae	16	22.86%
Cyst	9	12.86%
Bronchiectasis	31	44.29%
Pulmonary hypertension	8	11.43%

Chest X-ray results showed that 10 patients (14.3%) had normal findings, while 24 patients (34.3%) exhibited hyperinflation. Flattening of the diaphragm was observed in 16 patients (22.9%), and a tubular-shaped heart was seen in 11 patients (15.7%). Focal bullae were noted in 9 patients (12.9%). Spirometry tests revealed obstructive patterns in all 70 patients (100.0%), with no cases of restrictive patterns. The FEV1/FVC ratios indicated that 33 patients (47.1%) had values less than 0.70, 24 patients (34.3%) had values less than 0.50, and 13 patients (18.6%) had values less than 0.30. High-resolution CT scans of the thorax showed vascular attenuation in 59 patients (84.3%) and vascular distortion in 5 patients (7.1%). Mosaic attenuation was present in 13 patients (18.6%), and emphysema was found in 43 patients (61.4%), with centriacinar emphysema being the most common subtype (24 patients, 34.3%), followed by panacinar (12 patients, 17.1%) and paraseptal emphysema (7 patients, 10.0%). Other CT findings included bullae in 16 patients (22.9%), cysts in 9 patients (12.9%), bronchiectasis in 31 patients (44.3%), and pulmonary hypertension in 8 patients (11.4%).

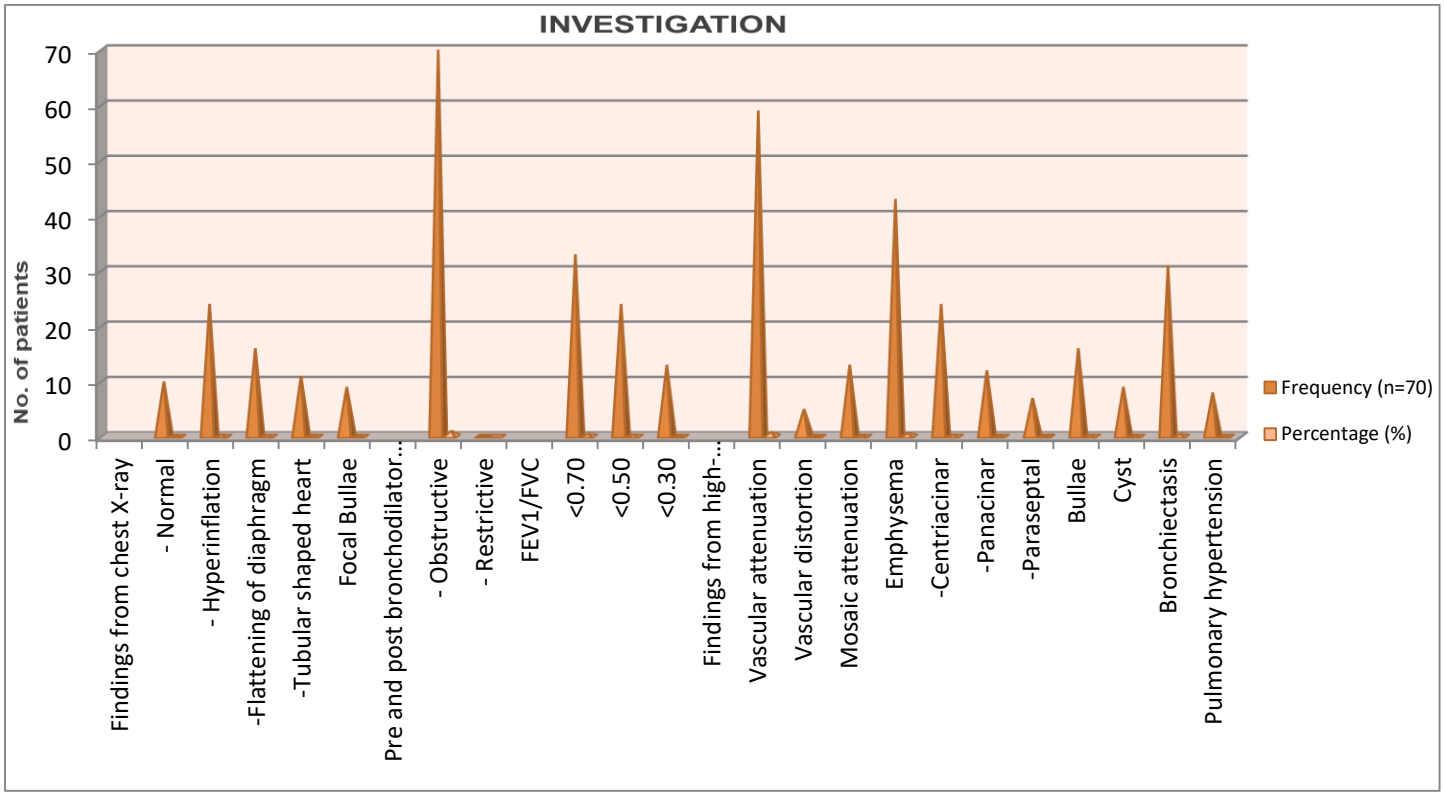

Figure 5: Investigation of the enrolled patients

Table 6: Distribution of emphysema types (centriacinar, panacinar, and paraseptal) across different gender of the enrolled patients.

Gender	N	Centriacinar				Panacinar				Paraseptal			
		Grade-I	Grade-II	Grade-III	Grade-IV	Grade-I	Grade-II	Grade-III	Grade-IV	Grade-I	Grade-II	Grade-II	Grade-IV
Male	45	0 (0.00%)	8 (17.8%)	12 (26.7%)	9 (20.0%)	0 (0.00%)	3 (6.7%)	5 (11.1%)	3 (6.7%)	0 (0.00%)	2 (4.4%)	2 (4.4%)	1 (2.2%)
Female	25	0 (0.00%)	5 (20.0%)	7 (28.0%)	4 (16.0%)	0 (0.00%)	2 (8.00%)	3 (12.0%)	2 (8.0%)	0 (0.00%)	1 (4.0%)	1 (4.0%)	0 (0.0%)

For the male group, which consists of 45 subjects, centriacinar emphysema was observed in 17.8% of subjects for >0.7 involvement, 26.7% for >0.5 involvement, and 20.0% for >0.3 involvement. Panacinar emphysema was present in 6.7% of subjects for >0.7 and >0.3 involvement and in 11.1% for >0.5 involvement. Paraseptal emphysema appeared in 4.4% of subjects for >0.7 and >0.5 involvement and in 2.2% for >0.3 involvement.

In the female group, consisting of 25 subjects, centriacinar emphysema was found in 20.0% of subjects for >0.7 involvement, 28.0% for >0.5 involvement, and 16.0% for >0.3 involvement. Panacinar emphysema was seen in 8.0% of subjects for >0.7 and >0.3 involvement and in 12.0% for >0.5 involvement. Paraseptal emphysema was present in 4.0% of subjects for >0.7 and >0.5 involvement, with no cases observed for >0.3 involvement.

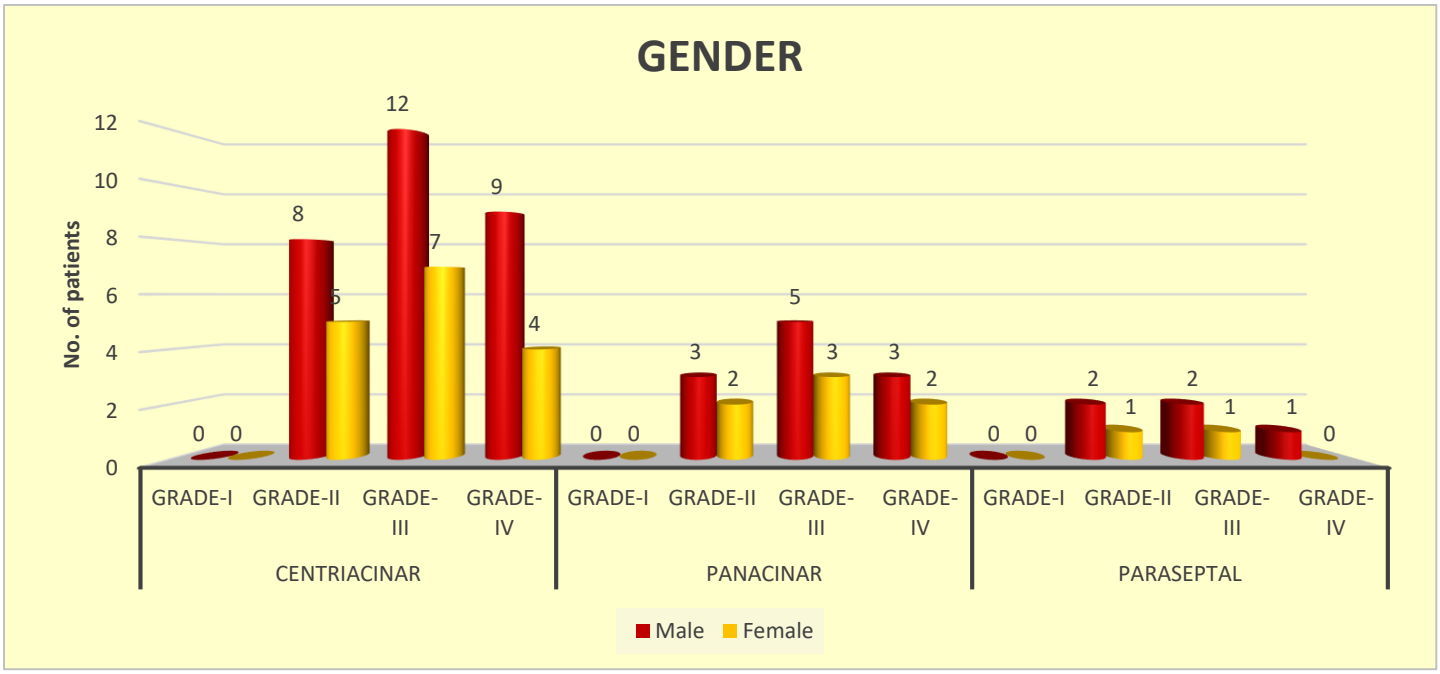

Figure 6: Distribution of emphysema types (centriacinar, panacinar, and paraseptal) across different gender of the enrolled patients.

Discussion

The cohort consisted of 70 participants, with a mean age of 58.25 years and a moderate dispersion around the mean. Age distribution was relatively even, with the highest frequency in the 56-65 years range (32.86%). Males comprised the majority (64.29%) of the sample. Patients in the study exhibited relatively uniform distributions of HRCT and spirometry patterns, enabling a clear examination of trends according to age, gender, and the interplay of both factors.

Age and gender both exerted effects of clinical substance on how patterns associated with spirometry; specified emphysema conveyed notably disparate correlations according to these factors.

This data highlights the prevalence and distribution of different types of emphysema and their degrees of involvement across genders, showing a slightly higher prevalence of centriacinar emphysema in females compared to males, while the distribution of panacinar and paraseptal emphysema is relatively similar between the two groups. In all Gender groups, none of the patients found in Grade-I category

Conclusion

An exploration of HRCT patterns relate to spirometry across age and gender, weaving clinical insight with patient-centered storytelling to illuminate patterns, variability, and implications. This study to reinforce the critical role of HRCT in evaluating emphysema in COPD patients and highlight significant correlations with demographic and clinical variables. These insights can aid in tailoring more effective treatment strategies, emphasizing the need for targeted interventions based on individual risk factors such as age, smoking history, and occupational exposure. Future research should continue to explore these associations to develop more refined guidelines for the management and prevention of COPD-related emphysema.

References

1. Macklem PT, Hogg JC, Thurlbeck WM. The flow resistance of central and peripheral airways in

human lungs. In: Cumming G, Hunt LB, editors. Form and function in the human Lung. Edinburgh: Livingstone; 1967. p. 76.

2. Gupta PP, Yadav R, Verma M, Agarwal D, Kumar M. Correlation between high-resolution computed tomography features and patients' characteristics in chronic obstructive pulmonary disease. Ann Thorac Med. 2008 Jul;3(3):87-93. doi: 10.4103/1817-1737.39676. PMID: 19561886; PMCID: PMC2700439.
3. Antó J, Vermeire P, Vestbo J, Sunyer J. Epidemiology of chronic obstructive pulmonary disease. Eur Respir J. 2001 May;17(5):982-94.
4. Pauwels RA, Buist AS, Calverley PM, Jenkins CR, Hurd SS. 2001. Global strategy for the diagnosis, management, and prevention of chronic obstructive pulmonary disease. NHLBI/WHO Global Initiative for Chronic Obstructive Lung Disease (GOLD) workshop summary. Am. J. Respir. Crit. Care Med. 163:1256–76
5. Rabe KF, Hurd S, Anzueto A, Barnes PJ, Buist SA, et al. 2007. Global strategy for the diagnosis, management, and prevention of chronic obstructive pulmonary disease: GOLD executive summary. Am. J. Respir. Crit. Care Med. 176:532–55
6. Hnizdo E, Sullivan PA, Bang KM, Wagner G. 2004. Airflow obstruction attributable to work in industry and occupation among U.S. race/ethnic groups: a study of NHANES III data. Am. J. Ind. Med. 46:126–35
7. Ekici A, Ekici M, Kurtipek E, Akin A, Arslan M, et al. 2005. Obstructive airway diseases in women exposed to biomass smoke. Environ. Res. 99:93–98
8. Saetta M, Di Stefano A, Maestrelli P, Ferraresso A, Drigo R, et al. 1993. Activated Tlymphocytes and macrophages in bronchial mucosa of subjects with chronic bronchitis. Am. Rev. Respir. Dis. 147:301–6
9. Saetta M, Di Stefano A, Maesterelli P, Turato G, Ruggieri MP, et al. 1994. Airway eosinophilia in chronic bronchitis during exacerbations. Am. J. Respir. Crit. Care Med. 150:1646–52
10. Di Stefano A, Turato G, Maestrelli P, Mapp CE, Ruggieri MP, et al. 1996. Airflow limitation in chronic bronchitis is associated with Tlymphocyte and macrophage infiltration of the bronchial mucosa. Am. J. Respir. Crit. Care Med. 153:629–32
11. Saetta M, Turato G, Facchini FM, Corbino L, Lucchini RE, et al. 1997. Inflammatory cells in the bronchial glands of smokers with chronic bronchitis. Am. J. Respir. Crit. Care Med. 156:1633–39
12. McLean KH. 1957. The histology of generalized pulmonary emphysema. I. The genesis of the early centrolobular lesion: focal emphysema. Australas. Ann. Med. 6:124–40
13. McLean KH, Gough J. 1957. The histology of generalized pulmonary emphysema. II. Diffuse emphysema. Australas. Ann. Med. 6:203–17
14. McLean KH. 1958. The pathogenesis of pulmonary emphysema. Am. J. Med. 25:62–74 26
15. Leopold JG, Gough J. 1957. The centrilobular form of hypertrophic emphysema and its relation to chronic bronchitis. Thorax 12:219–35
16. Wright JL, Lawson L, Pare PD, Hooper RO, Peretz DI, et al. 1983. The structure and function of the pulmonary vasculature in mild chronic obstructive pulmonary disease: the effect of oxygen and exercise. Am. Rev. Respir. Dis. 128:702–7
17. Wright JL, Petty T, Thurlbeck WM. 1992. Analysis of the structure of the muscular pulmonary arteries in patients with pulmonary hypertension and COPD:

National Institutes of Health nocturnal oxygen therapy trial. Lung 170:109–24

18. Thurlbeck WM, Simon G. Radiographic appearance of the chest in emphysema. AJR Am J Roentgenol. 1978;130:429–40.
19. Brenner DJ. Radiation risks potentially associated with low-dose CT screening of adult smokers for lung cancer. Radiology 2004;231:440-5.
20. Pierce DA, Sharp GB, Mabuchi K. Joint effects of radiation and smoking on lung cancer risk among atomic bomb survivors. Radiat Res 2003;159:511-20.
21. Tokarskaya ZB, Scott BR, Zhuntova GV, Okladnikova ND, Belyaeva ZD, Khokhryakov VF, et al. Interaction of radiation and smoking in lung cancer induction among workers at the Mayak nuclear enterprise. Health Phys 2002;83:833-46.
22. India State-Level Disease Burden Initiative CRD Collaborators The burden of chronic respiratory diseases and their heterogeneity across the states of India: the Global Burden of Disease Study 1990–2016. Lancet Glob Health. 2018;6:e1363-74. 10.1016/S2214-109X(18)30409-1
23. Sinha B.Vibha, Singla R, Chowdhury R. An epidemiological profile of chronic obstructive pulmonary disease: A community-based study in Delhi. J Postgrad Med. 2017;63:29-35. 10.4103/0022-3859.194200
24. Salvi SS, Manap R, Beasley R.Understanding the true burden of COPD: the epidemiological challenges. Prim Care Respir J. 2012;21:249-51. 10.4104/pcrj.2012.00082
25. Cho MH, Hobbs BD, Silverman EK. Genetics of chronic obstructive pulmonary disease: understanding the pathobiology and heterogeneity of a complex disorder. Lancet Respir Med 2022; 10(5): 485-96.
26. Adeloye D, Chua S, Lee C. Global and regional estimates of COPD prevalence: Systematic review and metaanalysis. J Glob Health 2015; 5(2): 020415.
27. Mortality GBD, Causes of Death C. Global, regional, and national age-sex specific all-cause and cause-specific mortality for 240 causes of death, 1990-2013: a systematic analysis for the Global Burden of Disease Study 2013. Lancet 2015; 385(9963): 117-71.
28. Barnes PJ. Inflammatory mechanisms in patients with chronic obstructive pulmonary disease. J Allergy Clin Immunol 2016; 138(1): 16-27.
29. Global Initiative for Chronic Obstructive Lung Disease (GOLD). Global Strategy for the Diagnosis, Management and Prevention of COPD. 2014. [Last accessed on 2015 Apr 11]. Available from: http://www.goldcopd.org .
30. Singh A, Kumar S, Mishra AK, Kumar M, Kant S, Verma SK, Kushwaha RA, Garg R. Correlation between clinical characteristics, spirometric indices and high resolution computed tomography findings in patients of chronic obstructive pulmonary disease. Lung India. 2016 Jan-Feb;33(1):42-8.
31. Lynch DA, Austin JH, Hogg JC, Grenier PA, Kauczor HU, Bankier AA, Barr RG, Colby TV, Galvin JR, Gevenois PA, et al. CT-definable subtypes of chronic obstructive pulmonary disease: a statement of the Fleischner Society. Radiology 2015;277:192–205.
32. Connor GT, Sparrow D, Weiss ST. A prospective longitudinal study of methacholine airway responsiveness as a predictor of pulmonary-function

decline: the Normative Aging Study. Am J Respir Crit Care Med 1995; 152: 87–92.

33. Tashkin PD, Detels R, Simmons M, et al. The UCLA population studies of chronic obstructive respiratory disease: XI. Impact of air pollution and smoking on annual change in forced expiratory volume in one second. Am J Respir Crit Care Med 1994; 149: 1209–1217.
34. Holland WW, Reid DD. The urban factor in chronic bronchitis. Lancet 1965; i: 445–446.
35. Van der Lende R, Kok TJ, Peset Reig R, Quanjer PhT, Schouten JO, Orie NGM. Decreases in FVC and FEV1 with time: indicators for effects of smoking and air pollution. Bull Eur Physiopathol Respir 1981; 17: 775–792.
36. Detels R, Tashkin DP, Sayre JW, et al. The UCLA population studies of CORD: X. A cohort study of changes in respiratory function associated with chronic exposure to SOX, NOX, and hydrocarbons. Am J Public Health 1991; 81: 350–359.
37. Hendrick DJ. Occupation and chronic obstructive pulmonary disease. Thorax 1996; 51: 947–955.
38. Strachan DP, Cox BD, Erzinclioglu SW, Walters DE, Whichelow MJ. Ventilatory function and winter fresh fruit consumption in a random sample of British adults. Thorax 1991; 46: 624–629.
39. Schwartz J, Weiss ST. Dietary factors and their relation to respiratory symptoms. Am J Epidemiol 1990; 132: 67–76.
40. Prestcott E. Socioeconomic status and chronic obstructive pulmonary disease. Thorax 1999; 54: 737–741.