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ORIGINAL ARTICLE

Association of geriatric syndromes in older adults with chronic obstructive pulmonary disease

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Abstract

Background: Geriatric syndromes (GS) are multi-factorial conditions that make older adults vulnerable to morbidities and poor outcomes. The main objective was to observe the frequency of GS in older patients with COPD.

Methods: A case-control study was conducted in the Geriatric department of a tertiary care hospital in India to evaluate geriatric syndromes including falls, cognitive impairment, frailty, functional impairment, urinary incontinence, malnutrition, and depression in patients with COPD and controls without COPD. The factors having a significant association with the occurrence of these GS in COPD patients were observed.

Results: In this study, 150 cases and 150 controls were included. The mean age of the participant was 65.85±5.54, with 76% males. Functional impairment, cognitive impairment, frailty, urinary incontinence, and malnutrition were significantly higher in COPD patients. The independent variables which increased the odds of geriatric syndromes were dyspnoea (≥2 mMRC grade) (AOR:3.54,95% CI:1.06-11.8) and low socioeconomic status (AOR: 4.14, 95% CI: 1.03-16.54), while male gender showed inverse association (AOR: 0.08,95% CI: 0.01-0.99).

Conclusion: Geriatric syndromes are common in older COPD patients, and assessment for them should be done routinely in these patients.

KEYWORDS
chronic obstructive pulmonary disease, geriatric syndrome, dyspnoea

1 | INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is an inflammatory disease of the lung's parenchyma and airways that increase with aging.[1] Globally and in India, the growing burden of COPD is due to continuous exposure to the risk factors like environmental tobacco smoke, outdoor and indoor air pollution, and population aging.[2] This is the third leading cause of death worldwide and the second leading cause of disease burden in India, causing 8.7% of total deaths in India.[2,3] Over 80% of these deaths occur in low- and middle-income countries.[3] Prevalence of COPD in India has increased from 3.3% in 1990 to 4.2% in 2016, according to the global burden of disease study.[2] Whereas the prevalence and morbidity of COPD in older adults are high, it is often undiagnosed and remains undertreated in India.[2,4]

Most patients with COPD have an extra-pulmonary component which leads to morbidity and mortality.[5] These extra-pulmonary

conditions include both the systemic effects of COPD and the frequently occurring comorbidities. With increasing age, the occurrence of different geriatric conditions complicates the management of chronic diseases.

Geriatric syndromes (GSs) are multifactorial conditions which are caused when deficits in multiple domains: clinical, psychological, social, and environmental, accumulate compromising compensatory ability.[6] Due to the multisystemic nature of the disease, it is reasonable to expect a high prevalence of geriatric syndromes in patients with COPD. GS increases morbidity, mortality, medication nonadherence, and admission to acute care units.[7,8] Frailty has been the most studied geriatric condition in older patients with COPD, with an increased risk of adverse outcomes: falls, hospitalization, poor quality of life, or death.[9] The other components are understudied, with very few studies focused on the comprehensive assessment of GS in these patients.

In this study, the primary objective was to observe the frequency of GS in older patients with COPD and to explore factors associated with the presence of these syndromes. The secondary objective was to compare the distribution of GS between patients with COPD and non-COPD patients.

2 | METHODS

2.1 | Study design

This was a case–control study, carried out in the outpatient department (OPD) of the Geriatric Medicine Facility of a tertiary care hospital in India from July 2014 to October 2015. Because no literature on the prevalence of GSs in COPD was available in the Indian setup, the sample size was not calculated. All patients attending the OPD of the Geriatric Medicine Department during this period were screened for the study and those who satisfied the inclusion and exclusion criteria were included. In total, 150 cases and 150 age and sex-matched controls were studied during this period. Ethical clearance was taken from the institute ethics board (IEC/T-48/03.01.2014). Informed consent was taken from all participants before recruitment.

2.2 | Study population and data collection

The patients 60 years and above attending the OPD were screened for history of shortness of breath or cough for more than 3 months or their medical records were checked for diagnosis of emphysema, chronic bronchitis, or chronic obstructive lung disease. Those found positive during screening were advised to follow up with a spirometry report. The inclusion criteria for cases were: patients aged 60 years and above with the diagnosis of COPD (forced expiratory volume in the first second [FEV1] to forced vital capacity of <0.70 in the spirometry test). Patients with acute exacerbation, critically ill, or were bedridden were excluded. The patients who screened negative were chosen as controls after matching age and sex.

The patients with COPD were classified into four grades of severity based on FEV1 (GOLD1: FEV1 ≥ 80%, GOLD2: FEV1 50–79, GOLD3: FEV1 30–49, and GOLD4: FEV1 < 30).[5] Data on demography, comorbidities, and age-related issues were collected from all the participants. Socioeconomic status was determined by Modified Kuppuswamy scale – standard scale for Indian population.[10] Any person who had smoked more than 100 cigarettes in his/her lifetime was known to be a smoker. Further, they were divided as current smokers (who continued smoking at the time of enrollment), former smokers (who had stopped smoking before enrollment), and never smokers (who never smoked or had taken < 100 cigarettes in their lifetime).[11] History of hospitalization in the last 1 year was asked. Comorbidities were assessed by Charlson Comorbidity Index (CCI). Patients were classified as low comorbidities (≤ 2) and high comorbidities (> 2).[12] Data on other comorbidities like anemia, hypertension, chronic kidney disease (CKD), or cardiovascular comorbidity, which consisted of any one or more of the following: hypertension, coronary artery disease, heart failure, or arrhythmia, were taken from their previous medical records and clinical assessment of the participants.

The patient was classified with anemia, when Hb < 13 g/dL in men and < 12 g/dL in women.[13] CKD was diagnosed when estimated glomerular filtration rate (calculated by the modification of diet in renal disease formula) < 60 mL/min (for > 3 months).[14] Hypertension was said to be present, when systolic blood pressure ≥ 140 mm Hg and/or diastolic blood pressure ≥90 mm Hg (European Society of Hypertension/European Society of Cardiology [ESH/ESC] guidelines, 2013) on two separate occasions or the patient is on antihypertensive medications.[15]

The following GSs were assessed in the study participants: activity of daily living (ADL) and instrumental activity of daily living (IADL) impairment, cognitive impairment, malnutrition, falls, urinary incontinence, depression, and frailty. These GSs were selected after a literature review, determining their significance in the old Indian population and syndromes which are relevant to an outpatient setting.[16–18]

Functional status was measured by the Barthel Index of Activities of Daily Living (ADL) and the Lawton and Brody Instrumental Activities of Daily Living (IADL) Scale.[19–21] Any score < 20 on the Barthel scale and score of < 8 in women and < 5 in men: in the IADL scale was considered as impaired functional status.[19–21] For cognitive impairment, the Hindi Mental State Examination (HMSE)[22] was used. A total score of < 24 indicated the presence of cognitive impairment. For malnutrition, Mini-Nutritional Assessment scale short-form (MNA-SF)[23] was used and patients with a score < 8 were considered malnourished. A fall history was defined as an unintentional event resulting in a laying position on the floor, the ground, or other lower level in the past 6 months.[24] Urinary incontinence was defined as a self-reported history of involuntary urine loss in the past 6 months.[25] The 15-item Geriatric depression scale (GDS-15) was used for assessing depression, with a score > 5 taken as presence of depression.[26] The Fatigue, Resistance, Ambulation, Illnesses, and Loss of

weight (FRAIL) scale was used for frailty assessment. This consists of measurement of five items: Fatigue, Resistance, Ambulation, Illnesses, and Loss of weight, with a score of zero being non-frail, one and two being pre-frail and three or more being frail.[27]

Cases were further classified into two groups according to the absence or presence of any of these GSs. One point was given for each of these GSs, and the total score was calculated.[28]

2.3 | Statistical analysis

Statistical software STATA/IC version 14.2 was used for data analysis. Qualitative variables were described as frequencies and related percentages. Quantitative variables were expressed as mean ± SD and/or median (interquartile range). The association between the two qualitative variables was assessed using chi-square test/Fisher's exact test. To compare quantitative variables between the two categories, unpaired *t* test/ Mann–Whitney *U* test was used. To find out the factor associated with the GS, the stepwise multivariable logistic regression approach was used with 10% entry and 15% removal probability. All the variables which were found to be significant under crude analysis at the level of 25% and/or on its clinical relevance were considered for the stepwise procedure. To describe the data sets, a diagrammatic presentation was also used. The results were considered statistically significant at the level of $P < 0.05$.

3 | RESULTS

3.1 | Characteristics of study participants

The mean age of patients with COPD was 65.9 ± 5.4 with 75.3% men. Table 1 shows the sociodemographic profile and clinical characteristics of patients with COPD. Patients with COPD were observed to have less formal education, more pack-years of smoking, and had a larger number of current and former smokers as compared

TABLE 1 Sociodemographic, clinical, and laboratory parameters of recruited patients

	COPD (n = 150)	No COPD (n = 150)	*P* value
Age (mean ± SD)	65.98 ± 5.43	65.72 ± 5.65	NS
Females (%)	37 (24.7)	36 (24)	NS
BMI (mean ± SD)	22.5 ± 4.5	23.5 ± 4.7	0.050
Pack-years of smoking	24.2 ± 35.7	04.7 ± 12.3	**<0.001**
Smoking status			**<0.001**
Never	49 (32.7)	95 (63)	
Former	71 (47.3)	43 (28.7)	
Current	21 (14)	08 (5.3)	
Socioeconomic status			**<0.001**
Upper class	10 (06.7)	0	
Middle class	88 (58.7)	101 (67.3)	
Upper lower	42 (28)	46 (30.7)	
Lower	10 (06.7)	03 (2)	
Less than high school education	89 (59.3)	58 (38.7)	**0.001**
Moderate to severe dyspnea[a]	99 (66)	20 (13)	**<0.001**
Comorbidity count (CCI)			**<0.001**
Low comorbidity[b]	60 (40)	108 (72)	
High comorbidity[c]	90 (60)	42 (28)	
CCI (mean ± SD)	2.1 ± 1.2	1.1 ± 1.3	**<0.001**
Coronary disease	17 (11.3)	21 (14)	0.487
Heart failure	26 (17.3)	02 (01.3)	**<0.001**
Anemia	57 (38)	64 (42)	0.410
CKD	17 (11.3)	21 (14)	0.474
S. Creatinine (mg/dl)	0.9 ± 0.4	1.0 ± 0.6	0.791

Note: Significant values are in bold.

Abbreviations: BMI, body mass index; CCI, Charlson Comorbidity Index; CKD, chronic kidney disease; COPD, chronic obstructive pulmonary disease; NS, not significant.

[a]Dyspnea: when modified Medical Research Council (mMRC) grade ≥ 2.

[b]Low comorbidity ≤ 2.

[c]High comorbidity > 2.

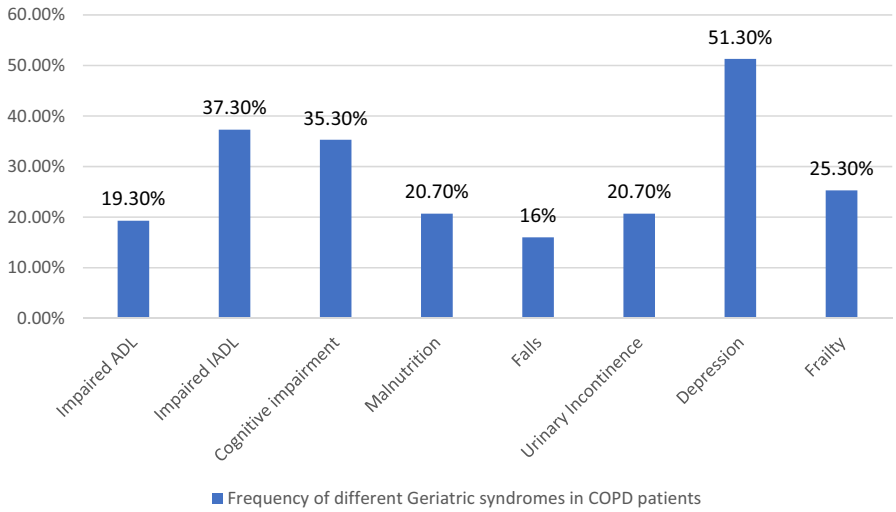

FIGURE 1 Frequency of individual geriatric syndromes in patients with COPD patients. Abbreviations: ADL, activities of daily living; COPD, chronic obstructive pulmonary disease; IADL, instrumental activities of daily living

TABLE 2 Frequency of different geriatric syndromes in patients with COPD and non-COPD patients

	COPD, n (%)	No COPD, n (%)	*P* value
ADL	18.2 ± 3.7	18.4 ± 4.0	0.067
IADL	5.8 ± 2.1	6.1 ± 2.4	**0.013**
Functional impairment			
Impaired ADL	29 (19.3)	28 (18.67)	1.000
Impaired IADL	56 (37.3)	34 (22.7)	**0.006**
Cognitive impairment	53 (35.3)	30 (20)	**0.003**
Malnutrition	31 (20.7)	17 (11.3)	**0.027**
Falls	24 (16)	23 (15.3)	0.874
Urinary incontinence	31 (20.7)	18 (12)	**0.042**
Depression	77 (51.3)	74 (49.3)	0.729
Frailty			**0.032**
Pre-frail	77 (51.3)	68 (45.3)	
Frail	38 (25.3)	27 (18.0)	
Geriatric syndromes (mean ± SD)	2.7 ± 2.0	2.2 ± 2.1	**0.001**

Note: Significant values are in bold.

Abbreviations: ADL, activities of daily living; COPD, chronic obstructive pulmonary disease; IADL, instrumental activities of daily living.

with patients without COPD. Among comorbidities, the distribution of coronary artery disease, anemia, and CKD was similar, whereas heart failure was more common in patients with COPD. CCI scores were significantly higher in patients with COPD than the control group (2.1 ± 1.2 vs 1.1 ± 1.3, *P* value < 0.001).

3.2 | Geriatric syndromes in patients with COPD and controls

Depression was the most common GS, present in 51.3% of patients with COPD. Impaired IADL was seen in 37.3% (56/150), cognitive impairment in 35.3% (53/150), and frailty in 25.3% (38/150) of patients with COPD. Malnutrition and urinary incontinence were present in 20.7% of the patients, falls in 16%, and ADL dependence in 19.3% of the patients (Figure 1).

Geriatric syndromes were more common in patients with COPD than controls (128 vs 105 and 2.7 ± 2.0 vs 2.2 ± 2.1, $P = 0.001$). Table 2 shows the frequencies of individual syndromes. Patients with COPD were more impaired for IADL (5.8 ± 2.1 vs 6.1 ± 2.4, $P = 0.013$). Patients with COPD had more cognitive impairment, malnutrition, urinary incontinence, and frailty. Among other geriatric syndromes, frequency of falls, ADL dependence, and depression were similar between the two groups.

3.3 | Factors associated with the presence or absence of GSs

Out of a total of 150 patients with COPD evaluated for geriatric syndromes, 128 patients (85.3%) had one or more GSs. Patients with GS had less formal education (less than high school), were more dyspneic (≥ 2 modified Medical Research Council [mMRC] grade), and had more comorbidities (as recorded by CCI), lower body mass index (BMI), and FEV1 as compared with patients with no geriatric syndromes, as shown in Table 3. On multivariable analysis, it was found that low socioeconomic status and the presence of moderate to severe dyspnea had a significant positive association, whereas the male gender had a significant negative association with the presence of any geriatric syndromes in patients with COPD (Table 4).

4 | DISCUSSION

In this study, older patients with COPD had an increased frequency of co-existing GSs as compared with those without COPD. Functional impairment, urinary incontinence, malnutrition, cognitive impairment, and frailty were found to be more common in patients with COPD.

TABLE 3 Comparison of patients with and without geriatric syndromes in patients with COPD

Characteristics	No geriatric syndrome (n = 22)	Geriatric syndrome present (n = 128)	*P* value
Age (mean ± SD)	64.5 ± 4.8	66.2 ± 5.8	0.248
Sex (% females)	2 (9.1)	35 (27.3)	0.065
Pack years of smoking (mean ± SD)	14.9 ± 17.3	25.6 ± 37.9	0.344
Less than high school education	6 (27.3)	83 (64.8)	**0.001**
Low socioeconomic status[a]	4 (18.2)	48 (37.5)	0.079
Moderate to severe dyspnea[b]	8 (36.4)	91 (71.1)	**0.001**
Any cardiovascular comorbidity	14 (53.6)	78 (60.9)	0.810
Hospitalization history	2 (9.1)	36 (28.1)	0.056
Total CCI (mean ± SD)	1.5 ± 0.86	2.1 ± 1.2	**0.017**
High CCI	7 (31.8)	83 (64.8)	**0.003**
BMI	24.2 ± 4.7	22.2 ± 4.4	**0.038**
FEV1	54.5 ± 15.9	45.2 ± 15.5	**0.011**

Note: Significant data are in bold.

Abbreviations: BMI, body mass index; CCI, Charlson comorbidity index; COPD, chronic obstructive pulmonary disease; FEV1, forced expiratory volume in the first second.

Data are presented as mean ± SD.

[a]Class IV (upper-lower) and V (lower) of modified Kuppuswamy scale.

[b]Dyspnea, when modified Medical Research Council (mMRC) grade ≥ 2.

TABLE 4 Factors associated with geriatric syndromes (Logistic regression analysis)

Characteristics	UOR (95% CI)	AOR (95% CI)
Age	1.06 (0.97–1.16)	
Sex, male	0.26 (0.05–1.19)	**0.08 (0.01–0.99)**
BMI	0.91 (0.83–1.00)	0.86 (0.74–1.01)
Literacy, more than high school	0.20 (0.07–0.55)	
Low socioeconomic status	2.70 (0.86–8.45)	**4.14 (1.03–16.54)**
FEV1	0.96 (0.94–0.99)	
Hospitalization history	3.91 (0.86–17.60)	7.70 (0.78–76.29)
Dyspnea, when present	4.30 (1.16–11.11)	**3.54 (1.06–11.8)**
CCI (high)	3.95 (1.50–10.40)	

Note: Significant data are in bold.

Abbreviations: AOR, adjusted odds ratio; BMI, body mass index; CCI, Charlson comorbidity index; CI, confidence interval; FEV1, forced expiratory volume in the first second; GSs, geriatric syndromes; UOR, unadjusted odds ratio.

Patients with COPD had a high smoking index, lower formal education, more comorbidities, and poor socioeconomic status than non-COPD patients, similar to previous studies.[12,29,30] Patients with COPD had low BMI, which has been seen as a risk factor for lung function decline, whereas high BMI is shown to have a protective effect, also called the "obesity paradox."[31]

Although there was no difference in the impairment in basic ADL scores, a higher number of patients with COPD were impaired for IADLs. This finding is similar to previous studies,[29,32] and could be due to the deteriorative effect of COPD on exercise tolerance.[33]

About 35.3% of patients with COPD in our study had cognitive impairment, similar to the study by Ranzini et al.[34] Cognition is associated with functionality, treatment compliance, and adherence to rehabilitation programs in patients with COPD.[34]

In our study, 20.7% had malnutrition, which is similar to previous studies.[35,36] Poor nutrition contributes to respiratory muscle dysfunction, reduced lung function, the severity of disease, and progression of disability. This increases the risk of complications and mortality in patients with COPD.[35]

Urinary incontinence was more common in patients with COPD in this study, similar to previous studies.[37] Association between urinary incontinence and COPD is largely unexplored, mostly because urinary incontinence remains unreported and tends to be attributed to the aging process. Chronic cough, fatigue, difficulty in breathing, and cigarette smoking leading to cough increases the likelihood of incontinence, which further has a negative impact on quality of life (QOL).[37] Hence, these patients should be screened for urinary incontinence and advised non-pharmacological interventions, which

can improve their QOL. No difference was seen in falls and depression in our study between patients with COPD and their controls. Other studies have reported more falls in patients with COPD with a pooled prevalence of 30%,[38] and more depression in patients with COPD.[39] This could be due to selection bias in our study, as most of the control group were patients with some other illness attending OPD and not healthy controls.

In our study, frailty was seen in 25.3% and pre-frailty in 51.3% of patients with COPD using the FRAIL scale, similar to a previous study.[40] Frailty can increase the risk of mortality and morbidity in patients with COPD, whereas COPD can accelerate the progression of pre-frailty to frailty. Timely diagnosis and intervention of pre-frail patients with COPD, can prevent progression of prefrailty, improve frailty, and improve disease outcome.[9]

When patients with COPD were compared by the presence or absence of GSs, female gender, low socioeconomic status, and presence of moderate to severe dyspnea had a significant association with the occurrence of GSs. A similar finding was seen in a previous study done by Pengpid S et al,[8] based on the Longitudinal Aging Study in India (LASI) in community-dwelling older adults, which showed that lower education, ≥ 2 chronic conditions, female gender had an association with higher prevalence of geriatric conditions. Hospitalization in the previous year was higher in patients with COPD with GS, similar to previous data by Shin et al.[41] Patients with COPD with GS had higher grades of dyspnea, poor FEV1, and lower BMI. Timely management of dyspnea with medications and pulmonary rehabilitation might have an indirect impact on the occurrence of these GSs.[42]

The main limitation of this study was that it was conducted in a single tertiary care hospital setting, limiting the generalizability of the results. Study design and participant selection can also affect the generalizability of results. Prospective studies in different settings with larger sample size may help to establish the causal relationship between COPD and GSs.

5 | CONCLUSION

The GSs were found in higher frequency in older patients with COPD than in controls. Socioeconomic status and demography, apart from the presence of dyspnea play an important role in the occurrence of GS in these patients. Assessment for GS should be done routinely in older adults with COPD, which may help in better management of these patients.

CONFLICT OF INTEREST

There are no conflicts of interest to disclose.

AUTHOR CONTRIBUTIONS

N.S. was responsible for the conception, design, analysis, interpretation of results, and writing of the paper. V.S. was responsible for the statistical analysis for the paper. J.B., V.G., M.S., and P.K. helped in reviewing, editing, and writing the paper. P.C., A.C., and A.B.D. were responsible for the critical review.

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CONSENT TO PARTICIPATE

Obtained from all study participants.

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