Original Article

Prevalence of Dyspnea and its Associated Factors in Patients with Chronic Obstructive Pulmonary Disease

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Abstract

Background: Dyspnea is highly distressing experience of breathlessness that limits the activities of daily living and affects an increasingly large group of patients with respiratory diseases such as chronic obstructive pulmonary disease (COPD). **Aims:** The aim of our study was to investigate the prevalence of dyspnea and its associated factors in patients with COPD. **Patients and Methods:** This cross-sectional study was carried out among 221 COPD patients of Tribhuvan University Teaching Hospital, Nepal. Patients' dyspnea was assessed using the modified Medical Research Council Dyspnea Scale and Dyspnea 12 Questionnaire. Patient's anxiety and depression were measured using Hospital Anxiety and Depression Scale, and COPD Assessment Test (CAT) was used to measure the impact of COPD. Mann–Whitney and Kruskal–Wallis test were used to find out the association between variables. Multiple regression analysis was used to find out the most significant factor associated with dyspnea. **Results:** Out of 221 patients, almost all (92.8%) patients had some degrees of dyspnea. Dyspnea was statistically significantly associated with age ($P < 0.001$), education ($P < 0.001$), marital status ($P < 0.001$), type of family ($P = 0.009$), working status ($P < 0.001$), duration of illness ($P < 0.001$), history of previous hospitalization ($P < 0.001$), status of hospitalization in the last year ($P < 0.001$), domiciliary oxygen therapy ($P < 0.001$), other comorbidities ($P < 0.001$), anxiety ($P < 0.001$), and depression ($P < 0.001$). **Conclusions:** This study concludes that dyspnea is highly prevalent in COPD, and duration of illness, depression, and CAT score were the most significant factors associated with dyspnea in patients with COPD.

Keywords: Anxiety, chronic obstructive pulmonary disease, depression, dyspnea, factors, prevalence

INTRODUCTION

Dyspnea is a sensation of discomfort and distress associated with breathing.[1] It is a cardinal symptom experienced by patients with heart and lungs' disease. Although dyspnea is associated with a range of cardiorespiratory disease, it is particularly significant in chronic obstructive pulmonary disease (COPD), causing considerable limitations to functional status and quality of life as well as a considerable socioeconomic burden.[2]

The American Thoracic Society defines dyspnea as "a subjective experience of breathing discomfort that consists of qualitatively distinct sensations that vary in intensity."[3] These sensations are believed to originate from interactions among multiple physiological, social, psychological, and environmental factors. However, the extent to which these factors interact is not understood.[4-6]

Despite being extremely debilitating symptom, currently no effective treatment is available due to the limited understanding of mechanisms underlying this symptom. Little can be done to treat underlying cause as moderate-to-severe COPD as they are usually irreversible.[3,7]

The experience of dyspnea is thought to be influenced by activity at many levels of the nervous system including the respiratory centers in the medulla and the cortex and structures within the limbic system.[7,8] Many factors such as gender, history of smoking, a family history of respiratory disease, exposure to passive smoking, duration of disease, repeated hospitalization, other comorbidities, and oral corticosteroid therapy can influence the interpretation and quality of dyspnea, but there is limited evidence regarding this in the majority of countries.[9-12]

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The objective of this study was to report the prevalence of moderate-to-severe dyspnea and explore its associated factors among patients with stable COPD.

PATIENTS AND METHODS

This was a cross-sectional analytical study conducted at the Outpatient Department (OPD) of Tribhuvan University Teaching Hospital (TUTH), Kathmandu, Nepal. The total duration of study was 12 weeks. Clinically stable COPD patients visited at TUTH were considered eligible and invited to take part in the study. Informed consent was obtained from each COPD patient before data collection who met the inclusion criteria. They wee informed that their participation was voluntary and there was no foreseeable risk or harm involved with the study. Patients were also assured that their confidentiality will be maintained using code number in all forms, and information obtained will solely be used for research purpose. Patients were given liberty to discontinue participating in the study without any clarification.

At first, the OPD record card was reviewed for confirmation of the diagnosis. Data were collected by researcher herself through face-to-face interview method. Privacy was maintained by carrying out the data collection procedure from each participant separately and in a separate room of the OPD of TUTH. General information related to demographic, socioeconomic, and treatment-related information was collected by interviewing with the respondent. After that, validated questionnaires of dyspnea (modified Medical Research Council [mMRC] Dyspnea Scale and Dyspnea-12 Questionnaire), health impairment (COPD Assessment Test [CAT]), and Hospital Anxiety and Depression Scale were applied. In this study, patients with acute exacerbation, acute chest infection, heart disease, and severe case of COPD were excluded from the study. Clinical stability was defined as the absence of exacerbation for the previous 4 weeks.

The collected data were checked daily and organized for completeness and accuracy. The data were then edited, coded, classified, and then entered into Excel spreadsheet, which was later transferred to Statistical Package for the Social Sciences version 24 (IBM)**.** Descriptive statistics such as frequency and percentages were used for categorical variables and mean and standard deviation were used for continuous variables. The relationship of various factors with dyspnea was analyzed using Mann–Whitney test and Kruskal–Wallis test. Multiple regression was done to find out the most significant associated factor for dyspnea. The significance level was set at $P < 0.05$ and 95% confidence interval.

This study was approved by the Research Committee Maharajgunj Nursing Campus and Institutional Review Board of Tribhuvan University, Institute of Medicine, Kathmandu, Nepal.

RESULTS

A total of 221 patients constituted the study population. The mean age of patients with COPD was 66.15 ± 10.14 years

that ranged between 44 and 90 years. More than half of the patients (53.8%) were female. Similarly, 35.3% of COPD patients were literate. Most of the COPD patients (67.4%) were married and majority of the patients (76%) were living with their children in joint family. Similarly, 61.1% of patient's household income was low. Regarding occupation, majority of the patients (76.9%) were not currently involved in any occupation. About 62.9% of COPD patients were former smokers. Similarly, more than half (57.5%) of the patients had no history of exposure to passive smoking. Likewise, half of the COPD patient's (50.7%) duration of illness was <5 years. Mean duration of illness was 6.99 ± 6.34 days. More than half of the COPD patients (57%) had been hospitalised previously and 48.4% were hospitalized once in the last year. Among COPD patients, 20.8% required domiciliary oxygen and 24% had other comorbidities such as hypertension, diabetes, benign prostate hypertrophy, and others.

Perceived level of dyspnea of COPD patients was measured by the mMRC Dyspnea Scale. Almost all (92.8%) patients had some degrees of dyspnea. Most of the COPD patients (72%) had mMRC dyspnea score ≥2. Among the total patients, 32.6% patients had dyspnea Grade 3, i.e., patients had to stop for breath after walking about 100 m or after a few minutes on the level and 7.2% of patients had dyspnea Grade 0, i.e., patients had developed dyspnea only during strenuous exercise [Table 1].

Similarly, in physical dimension of Dyspnea-12 Questionnaire, most of the COPD patients had moderate (Score 3) level in all descriptors such as their breathing does not go in all the way, breathing requires more work, feeling short of breath, difficulty in catching breath, not getting enough air, uncomfortable breathing, and exhausting breathing. Similarly, 38.9% of patients reported that breathing makes them feel moderately depressed, 37.1% felt that breathing makes them feel mildly miserable, 40.7% had moderate distress during breathing, 27.1% had no agitation in breathing while 31.7% had mild irritating breathing. Difficulty in catching breath was the commonest symptom [Table 2].

Mann–Whitney U-test and Kruskal–Wallis test were used to find the differences of dyspnea mean score between

Table 1: Dyspnea level of the patients (modified medical council research dyspnea score) (*n*=221)

Item description	Grade	*n* (%)
I only get breathless with strenuous exercise	0	16 (7.2)
I get shortness of breath when hurrying on the level or walking up a slight hill	1	46 (20.8)
I walk slower than people of the same age on the level because of breathlessness or have to stop for breath when walking at my own pace on the level	2	41 (18.6)
I stop for breath after walking about 100 meters or after a few minutes on the level	3	72 (32.6)
I am too breathless to leave the house or I am breathless when dressing	4	46 (20.8)

Mean score 2.38±1.22

different groups. This analysis showed that dyspnea score was higher in age 70 and more ($P < 0.001$), in males but statistically not significant, higher among illiterate ($P < 0.001$), widow and widower ($P < 0.001$), joint family ($P = 0.009$), not currently employed ($P < 0.001$), duration of illness 10 years and more ($P < 0.001$), history of previous hospitalization ($P < 0.001$), more than once hospitalization in the last year ($P < 0.001$), patient with domiciliary oxygen therapy ($P < 0.001$), and patient having other comorbidities ($P < 0.001$). Similarly, dyspnea mean score is higher among patient with anxiety ($P < 0.001$) and patient with depression ($P < 0.001$) [Tables 3 and 4].

Likewise, the association of dyspnea with CAT score measured by Spearman's correlation revealed that there was a strong positive correlation between dyspnea and CAT score ($r = 0.75$, $P < 0.001$) [Table 5].

A multiple regression analysis was done to predict dyspnea from age, educational status, marital status, type of family, occupational status, duration of illness, history of previous hospitalization, number of hospitalization in the last year, use of domiciliary oxygen therapy, presence of other comorbidities, anxiety, depression, and CAT score. These variables statistically significantly predicted mMRC score,

Table 2: Dyspnea of the patients (Dyspnea 12 Questionnaire) (n=221)

Item description	None 0, n (%)	Mild 1, n (%)	Moderate 2, n (%)	Severe 3, n (%)	Mean±SD
My breath does not go in all the way	65 (29.3)	62 (28.1)	68 (30.8)	26 (11.8)	1.24±1.00
My breathing requires more work	46 (20.8)	67 (30.3)	79 (35.7)	29 (13.2)	1.41±0.96
I feel short of breath	53 (24.0)	61 (27.6)	75 (33.9)	32 (14.5)	1.39±1.00
I have difficulty catching my breath	23 (10.4)	72 (32.6)	83 (37.5)	43 (19.5)	1.66±0.90
I cannot get enough air	65 (29.4)	59 (26.7)	70 (31.7)	27 (12.2)	1.27±1.01
My breathing is uncomfortable	25 (11.3)	78 (35.3)	94 (42.5)	24 (10.9)	1.53±0.83
My breathing is exhausting	45 (20.4)	67 (30.3)	88 (39.8)	21 (9.5)	1.38±0.91
My breathing makes me feel depressed	47 (21.3)	72 (32.6)	86 (38.9)	16 (7.2)	1.32±0.89
My breathing makes me feel miserable	41 (18.6)	82 (37.1)	78 (35.3)	20 (9.0)	1.35±0.88
My breathing is distressing	31 (14.0)	72 (32.6)	89 (40.3)	29 (13.1)	1.52±0.89
My breathing makes me agitated	60 (27.1)	57 (25.8)	59 (26.7)	45 (20.4)	1.40±1.09
My breathing is irritating	54 (24.4)	70 (31.7)	66 (29.9)	31 (14.0)	1.33±0.99

SD: Standard deviation

Table 3: Association of dyspnea with sociodemographic characteristics (n=221)

Characteristics	Frequency	Mean rank	Mann-Whitney U-test/Kruskal-Wallis value	P
Age (years)				
<60	62	89.01	21.594[b]	<0.001*
60-69	82	103.95		
70 and more	77	136.22		
Gender				
Male	102	114.97	5664.50[a]	0.379
Female	119	107.60		
Educational status				
Literate	78	96.14	4418.00[a]	0.009*
Illiterate	143	119.10		
Marital status				
Married	149	97.63	21.25[b]	<0.001*
Widow/widower	72	138.67		
Types of family				
Nuclear	53	91.47	3417.00[a]	0.009*
Joint	168	117.16		
Current working status				
Yes	51	79.97	2752.50[a]	<0.001*
No	170	120.31		
Smoking status				
Current smoker	34	105.68	3.15[b]	0.207
Former smoker	139	116.47		
Non smoker	48	98.93		

*P significant at ≤0.05, [a]Mann-Whiteny U-test, [b]Krukal-Wallis test

Table 4: Association of dyspnea with clinical variables (_n_=221)

Characteristics	Frequency	Mean rank	Mann-Whitney U-test/Kruskal-Wallis value	P
Duration of illness (years)				
<5	112	86.63	21.577[b]	<0.001*
5-9	60	109.67		
10 and more	49	138.57		
History of previous hospitalization				
Yes	126	125.81	4119.000[a]	<0.001*
No	95	91.36		
Status of hospitalization in last year (_n_=126)				
No hospitalization	35	59.99	14.569[b]	<0.001*
Once	61	55.23		
> Once	30	84.42		
Steroid therapy				
Yes	26	109.10	2485.500[a]	0.868
No	195	111.25		
Domiciliary oxygen therapy				
Yes	46	163.42	1613.500[a]	<0.001*
No	175	97.22		
Other comorbidities				
Present	53	140.56	2885.500[a]	<0.001*
Absent	168	101.68		
Anxiety				
Present	140	139.76	1643.000[a]	<0.001*
Absent	81	61.28		
Depression				
Present	148	138.40	1347.000	<0.001*
Absent	73	55.45		

*P significant at ≤0.05, [a]Mann-Whiteny U-test, [b]Krukal-Wallis test

Table 5: Association of dyspnea with chronic obstructive pulmonary disease assessment test score in chronic obstructive pulmonary disease patients (_n_=221)

Variables	Mean value	SD	r_s value	P
CAT score	11.37	6.89	0.75	<0.001*

*P significant at ≤0.05. r_s: Spearman rank correlation, SD: Standard deviation, CAT: COPD assessment test, COPD: Chronic obstructive pulmonary disease

$F_{(12,113)} = 30.400$, $P < 0.0005$, and $R^2 = 0.764$. Variables, such as duration of illness ($P = 0.036$), depression ($P < 0.0005$), and CAT score ($P < 0.0005$), were the most significant factors associated with dyspnea [Table 6].

DISCUSSION

In this study, we assessed the dyspnea level using two standard tools, i.e., mMRC Dyspnea Scale and Dyspnea-12 Questionnaire. Results showed that almost all patients (92.8%) felt some degree of dyspnea and most of the COPD patients (72%) reported moderate or severe dyspnea (mMRC score ≥2). Among the COPD patients, 32.6% of patients had mMRC dyspnea Grade "3," meaning that "the patient had to stop for breath after walking about 100 m or after a few minutes on the level" and 7.2% of patients had mMRC dyspnea Grade 0, i.e., patient had developed dyspnea "only during strenuous exercise." Barnes _et al._, in contrast reported that 38% of their patients were classified as mMRC ≥ 2.[13] Similarly, Mullerova _et al._ and Punekar _et al._ reported that 40% and 47.3% of their patients respectively, reported moderate or severe dyspnea.[6,12] The mean dyspnea score in this study was 2.38 ± 1.22, whereas study by Haruna _et al._ showed a mean dyspnea score as 1.1 ± 0.8.[14]

Association of sociodemographic characteristics of dyspnea revealed that dyspnea was significantly associated with age ($P < 0.001$). These findings are supported by Bestall _et al._, (1999) who showed that age had the highest level of association ($P < 0.005$) with MRC grade.[15] The findings of the present study showed no statistically significant association between gender and dyspnea level. This result is contrast to the findings by Guenette _et al._, and Koblizek _et al._ which showed women with COPD had significantly greater dyspnea than men.[16,17] A study by de Torres _et al._ also reported that, compared with men, women with COPD report more functional dyspnea for the same degree of airway obstruction. The values of mMRC were higher for women in all stages of the disease. Intergender difference was statistically significant ($P = 0.028$, Chi-square test).[18]

Similarly, dyspnea level was higher among illiterate patient ($P < 0.001$), widow and widower patient ($P < 0.001$), and those who were living with their children in joint

Table 6: Multiple regression analysis for most significant associated factor ($n=221$)

Variables	B	SE	Adjusted OR (β)	95% CI		P
				Lower	Upper	
Age	−0.095	0.091	−0.061	−0.274	0.450	0.223
Education status	0.138	0.128	0.053	−1.116	0.391	0.297
Marital status	0.026	0.063	0.023	−0.099	0.151	0.677
Occupation	0.260	0.173	0.080	−0.083	0.602	0.136
Duration of illness	0.019	0.009	0.109	0.001	0.036	0.036
Times	−0.048	0.072	−0.033	−0.190	0.094	0.502
Domiciliary oxygen therapy	−0.0267	0.139	−0.111	−0.543	0.008	0.057
Other comorbidities	−0.108	0.128	−0.044	−0.361	0.145	0.400
Anxiety	0.010	0.018	0.061	0.589	0.631	0.557
Depression	0.082	0.021	0.419	0.041	0.123	<0.001
CAT score	0.494	0.091	0.354	0.314	0.674	<0.001

SE: Standard error, OR: Odds ratio, CI: Confidence interval, CAT: COPD assessment test, COPD: Chronic obstructive pulmonary disease

family ($P = 0.009$). Similar findings were reported by Holm et al. that age was not associated with dyspnea among individuals who were in a couple relationship and more breathlessness was found in patients who were single.[19]

Furthermore, there was no statistically significant association between dyspnea and smoking status, exposure to passive smoking, and history of COPD in family. Regarding smoking status, Lu et al. (2012) have previously shown to present no association between smoking and dyspnea.[9] However, this result is contrary to the finding of Roche et al. where dyspnea was significantly associated with smoking, a family history of respiratory disease, and exposure to passive smoking.[10]

This study showed dyspnea is significantly associated with duration of illness ($P < 0.001$), history of previous hospitalization ($P < 0.001$), and status of hospitalization in the last year ($P < 0.001$). These findings are in line with Bilgic et al. showing statistically significant difference between dyspnea and disease length (year) ($P < 0.05$) and repeated hospitalization ($P < 0.01$).[11]

Similarly, there was also a significant association of dyspnea level with domiciliary oxygen therapy ($P < 0.001$) and other health problems ($P < 0.001$). These findings are supported by Punekar et al., who found association of dyspnea with long-term oxygen therapy ($P < 0.0001$) and Lu et al., (2012) found that a higher risk of more severe dyspnea was associated with most comorbid diagnoses.[9,12]

This study also explored that there was no association of steroid therapy with dyspnea. Whereas Lu et al. (2014) show contrast findings as there was a significant association of oral corticosteroid therapy with dyspnea ($P < 0.0001$).[9]

In this study, dyspnea mean score is higher among patient with anxiety ($P < 0.001$) and patient with depression ($P < 0.001$). And also, there was strong positive correlation between dyspnea and CAT score ($r = 0.75$, $P < 0.001$). The current findings are supported by previous work of researcher, which shows the mMRC dyspnea score was significantly associated with anxiety and depression.[20] Similarly, Gianjoppe-Santos

et al. have shown that depression and anxiety symptoms had an association with dyspnea ($P = 0.01$).[21] In contrary, Borges-Santos et al. found that dyspnea was associated with depression ($P < 0.01$) but not statistically associated with the anxiety ($P < 0.77$).[22] Similarly, in some studies, the mMRC score displayed a moderate correlation with CAT score ($r = 0.731$, $P < 0.001$).[23,24]

CONCLUSIONS

Patient's disease duration, presence of depression, and CAT score were the most significant factors that are associated with dyspnea in patient with COPD. Hence, these factors should be taken in consideration while managing dyspnea. Health promotion and educational interventions need to be intensified, and the educational intervention should focus on reducing or modifying those factors that have a direct impact on dyspnea.

Conflicts of interest

There are no conflicts of interest.

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