Original research

Predictive capability of PUMA score in detection of chronic obstructive pulmonary disease

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Abstract

Objective: Chronic obstructive pulmonary disease (COPD) is one of the top three causes of mortality worldwide. The overall incidence rate of COPD was 8.9/1000 person-years. Several studies have evaluated the prevalence of COPD underdiagnosis in different settings. Simple tool to identify COPD cases is extremely useful for physicians. PUMA pre-screening questionnaire is such a tool. The rationale of our study is as our institute is the only institute for 2 districts where pulmonary function test (PFT) is available, so by correlating PUMA score with PFT we could generate questionnaire and use it as as a screening tool in primary care centers where PFT is not available.

The aim of the current study was to evaluate predictive capability (sensitivity and specificity) of PUMA score in detecting COPD.

Methods: A prospective observational study was conducted from January to March 2024 on 50 patients with clinical suspicion of COPD attending tertiary care center. Seven variables of PUMA questionnaire were used in this study: age (40-49 years-0 points, 50-59 years- 1 point, 60-69 years -2 points), sex (female-0 points, male-1 point), pack years of smoking (<20-0 points, 20- 30-1 point, >30 -3 points), chronic phelgm-1 point, chronic cough-1 point, Dyspnea-1 point and history of previous spirometry -1 points. Details regarding 7 variables and spirometry data were taken and compared. Patient's consent and ethical committee approval were taken prior to the study.

Results: Out of 50 patients, 4 patients were excluded as 3 patients were having pneumothorax and 1 patient had recent eye surgery for which PFT can't be done. Out of 46 people, 34 (74%) were males and 12 (26%) were females. Most common age group involved was greater than 60 years, which represents 28 (60%) patients. Most common symptom was breathlessness seen in 46 (100%) patients. Past history of spirometry was noted in 9 (19%) patients. 32 (76%) of patients had history of smoking of which >30 pack years of smoking was seen in 21 (46%) of patients. PUMA score greater than or equal to 6 was seen in 32 (69%) of patients in whom obstructive pattern (post bronchodilator FEV1/FVC less than 0.70) in spirometry was seen in 27 (84%) of patients.

Conclusion: In primary care centers where spirometry is not available PUMA questionnaire can play a significant role in identifying patients with risk to develop COPD.

Key words: PUMA score, chronic obstructive pulmonary disease, spirometry, smoking pack-years, accuracy

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Introduction

Chronic obstructive pulmonary disease (COPD) is one of the top three causes of mortality worldwide (1). The overall incidence rate of COPD was 8.9/1000 person-year (2). COPD presents a significant global challenge, impacting health systems, economies and societies. Its prevalence is anticipated to rise owing to an aging demographic (3). The early stage of chronic obstructive pulmonary disease is not easily recognized (4). A wide range of comorbidities and risk factors are associated with the disease, including genetics, smoking, infections, malnutrition, ageing, occupational exposures, indoor and outdoor air pollutants, asthma, and low socioeconomic status (5, 6). Several studies have evaluated the prevalence of COPD underdiagnosis in different settings.

Simple tool to identify COPD cases is extremely useful for physicians. PUMA pre-screening questionnaire is such a tool.

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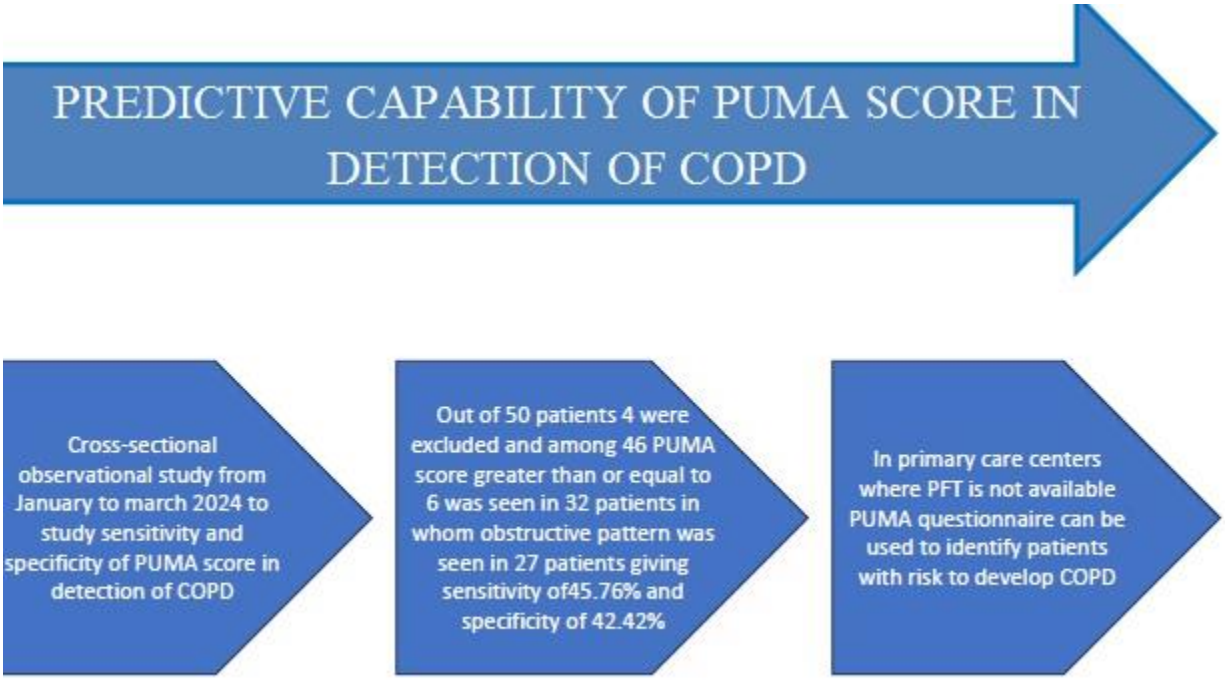
Graphical abstract



A predictive value of PUMA score is evaluated with gold standard test spirometry for diagnosis of COPD. The PUMA questionnaire was developed in a multicenter, multinational, cross-sectional study specifically for primary care settings in Latin America (7).

The accuracy of the PUMA cut-off point ≥5 was 76% for detecting COPD (7). Validation results from different countries show that the cut-off point can vary (8). The rationale of our study is as our institute is the only institute for 2 districts where pulmonary function test (PFT) is available, so by correlating PUMA score with PFT we could generate questionnaire and use it as as a screening tool in primary care centers where PFT is not available and in suspected COPD cases we can refer them for PFT to our institute.

The aim of the study was to evaluate the sensitivity and specificity of the PUMA score in prediction of COPD.

Methods

Study design and population

A cross-sectional observational study was conducted from January to March 2024 on 50 patients with clinical suspicion of COPD (consecutive sampling) using PUMA questionnaire attending tertiary care center.

Patients with active unstable angina, recent myocardial infarction, pneumothorax, recent eye/thoracic/abdominal surgery, hemoptysis of unknown origin, active tuberculosis and patients who are unable to perform spirometry were excluded from the study. Patients of age group 30-75 years who were clinically evaluated by PUMA scoring and had confirmed diagnosis of COPD using PFT were included in the study.

Patient's informed consent and Ethical Committee approval were taken prior to the study.

Baseline variables

We collected demographic (age, sex), occupation, occupational exposure, smoking history, complaints and history of PFT in all patients.

PUMA score

PUMA score was in the local language, which can be easily understood by the patients and it is valid. Seven variables of PUMA score were used in this study: age (40-49 years-0 points, 50-59 years- 1 point, 60-69 years -2 points), sex (female-0 points, male-1 point), pack-years of smoking (<20-0 points, 20- 30-1 point, >30 -3 points), chronic phelgm-1 point, chronic cough-1 point, dyspnea-1 point and history of previous spirometry -1 point. Details regarding 7 variables and spirometry were taken and compared.

COPD diagnosis and severity

All patients underwent PFT. GOLD (global initiative for chronic obstructive lung disease) COPD severity classification was used to grade degree of obstruction; the degree of obstruction (forced expiratory volume in one second/ forced vital capacity, FEV1/FVC ratio <0.75) was interpreted as follows: stage I or mild (FEV1 ≥80% of the predicted value), stage II or moderate (FEV1 between 50%−79% of the predicted value), stage III or severe (FEV1 between 30%−49% of the predicted value), and stage IV or very severe (FEV1 <30% of the predicted value).

Statistical analysis

Descriptive statistics was used and calculation of test sensitivity, specificity and accuracy were calculated**.**

Results

Out of 50 patients, 4 patients were excluded as 3 patients were having pneumothorax and 1 patient had recent eye surgery for which PFT can't be done.

Out of 46 patients (Table 1), 34(74%) were male and 12(26%) were female. Most common age group involved were greater than 60 years, which represents 28(60%) patients followed by 50-59 years age group which represents 1 2(26%) patients and least 30-39 years age group which represents 1(4%) patient (Fig. 1).

Most common symptom is breathlessness seen in 46(100%) patients followed by chronic cough seen in 40(86%) patients and least was chronic phlegm was seen in 38(82%) patients. Past history of spirometry was noted in 9(19%) patients. 32(76%) patients had history of smoking, occupational exposure was seen in 14(30%) patients in which agriculture labor constitute 26(56%) patients followed by rice mill workers which constitute 6(13%) patients and biomass fuel exposure was seen in 10(21%) patients (Fi. 2). Based on pack years of smoking >30 pack years was seen in 21(46%) patients followed by <20 pack years seen in 9(20%) patients and least was 20-30 pack years seen in 8(17%) patients. 8 were never smokers.

Table 1. Clinical characteristics according to PUMA questionnaire

Dyspnea, n(%)	**46(100)**
Chronic cough	40(86)
Chronic phlegum	38(82)
Past h/o spirometry	9(19)
Smoking, n(%)	**32 (70)**
Exposure, n(%)	
Occupational exposure	14(30)
Biomass exposure	10(21)
Number of smoking pack- years	
Pack- year index, %	
<20	20
20-30	17
>30	46

PUMA score (Table 2) greater than or equal to 6 was seen in 32(69%) patients in whom obstructive pattern (post bronchodilator FEV1/FVC less than 0.70) in spirometry was seen in 27(84%) patients of which 10 had severe obstruction, 10 had moderate obstruction and 7 had mild obstruction according to GOLD severity classification (Table3).

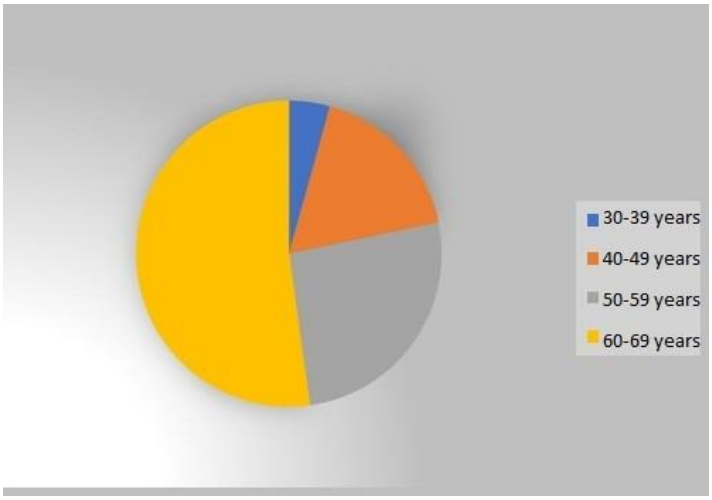


Figure 1. Age distribution of patients with COPD
COPD- chronic obstructive pulmonary disease

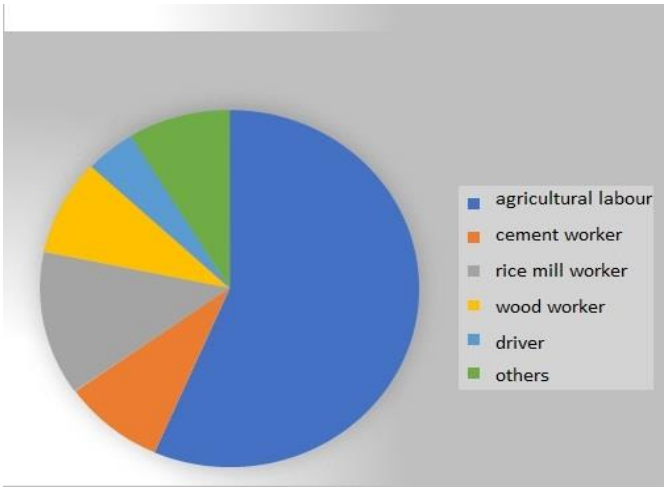


Figure 2. Occupation of patients with COPD
COPD- chronic obstructive pulmonary disease

Table 2. Correlation between PUMA score and post bronchodilator FEV1/FVC.

PUMA score	Number of patients, %	Post bronchodilator FEV1/FVC<0.7
3	2 4%	-
4	3 6.5%	-
5	9 19.5%	6 (**66%**)
6	11 24%	8 (**73%**)
7	8 17%	7 (**87.5%**)
8	9 19.5%	8 (**89%**)
9	4 8.5%	4 (**100%**)

COPD- chronic obstructive pulmonary disease, FEV1/FVC- forced expiratory volume in one second/ forced vital capacity, PUMA- prevalence study done in Latin America

Table 3. Severity of obstructive COPD by GOLD classification

Severity of obstruction	n
Mild	**7**
Moderate	**10**
Severe	**10**

Assessment of the accuracy of PUMA score prediction of COPD (Table 4) demonstrated that score had sensitivity of 45.6%, specificity of 42.2%, positive predictive value of 58.7% and negative predictive value of 30.43% and accuracy of 44.57%.

Table 4. Diagnostic value of PUMA score in prediction of COPD

Variable	Value	95% CI
Sensitivity	45.6%	32.72-59.25%
Specificity	42.2%	25.48-60.78
Positive likelihood ratio	0.79	0.53-1.19
Negative likelihood ratio	1.28	0.81-2.03
Disease prevalence	64.13%	53.46-73.87%
PPV	58.7%	48.69-68.03%
NPV	30.43%	21.62-40.97%
Accuracy	44.57%	34.19-55.30%

Discussion

In our study, most common age group was greater the 60 years, which was similar to previous studies (3, 7). Males were predominant in our study, which was similar to Au-doung et al. (3) study. Most common symptom in our study was dyspnea which was similar to study done by Lopez Varela et al. (7).

Past history of spirometry in our study was seen in only 19% of patients whereas in study done by Au-doung et al. (3) it was seen in 56% of patients. In our study 76% of patients had history of smoking with >30 pack yearss which was similar to study done by Au-doung et al. (3). Biomass fuel exposure was seen in 10% of patients in our study whereas in study done by Montes de Oca et al. (9) biomass fuel exposure was seen in 40% of patients.

In our study PUMA score greater than or equal to 6 was seen in 32(69%) patients in whom obstructive pattern (post bronchodilator FEV1/FVC less than 0.70) in spirometry was seen in 27(84%) patients which was similar to study done by Sebayang et al. (4) and Jeng et al. (10). Comparing PUMA with PFT which is gold standard for COPD, sensitivity of our study is 45.76% and specificity is 42.42% and in study done by Au-doung et al. (3) sensitivity is 76.5% and specificity is 63.3%.

Study limitations

We have following limitations of the study as a small sample size, poor socio-economic status of study population and inability to recall symptoms.

Conclusion

In primary care centers, where spirometry is not available PUMA questionnaire can play a significant role in identifying patients with risk to develop COPD. By using PUMA questionnaire physicians can identify patients with risk to develop COPD in their clinical setting and refer for spirometry test to confirm it in the tertiary care center.

Ethics: Patient's informed consent and Ethical Committee approval were taken prior to the study.
Peer-review: Internal
Conflict of interest: None to declare
Authorship: R.G., A.S., M.Y.R., G.N.R. S.D., and V.S.K. equally contributed to the study and fulfilled authorship criteria
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