



COMPARATIVE EVALUATION OF PUMA AND CAPTURE QUESTIONNAIRES FOR COPD SCREENING IN SMOKERS: A CROSS-SECTIONAL STUDY

Pulmonary Medicine

Dr. Malothu harish Postgraduate Resident, Department of Pulmonary Medicine Kamineni Institute of Medical Sciences, Narketpally, Nalgonda District, Telangana – 508254

Dr.MD.Mateenuddin salem* Professor & Head, Department of Pulmonary Medicine, Kamineni Institute of Medical Sciences, Narketpally, Telangana*Corresponding Author

ABSTRACT

Introduction Chronic obstructive pulmonary disease (COPD) is a major global health problem with a high burden of undiagnosed cases, particularly among smokers. Early screening tools such as the PUMA and CAPTURE questionnaires can facilitate timely diagnosis and management. **Methods** This cross-sectional study was conducted at a tertiary care center over 6 months, including 50 smokers aged ≥ 40 years with no prior diagnosis of COPD. All participants were assessed using PUMA and CAPTURE questionnaires, followed by spirometry for confirmation. Sensitivity, specificity, predictive values, and area under the curve (AUC) were calculated. **Results:** All 50 participants were male, with 66% being heavy smokers. Spirometry showed obstructive patterns in all patients, with 38% having severe obstruction. The PUMA questionnaire (cut-off ≥ 6) showed sensitivity of 97.05% and specificity of 25% (AUC = 0.624, $p = 0.160$). The CAPTURE questionnaire (cut-off ≥ 4) showed sensitivity of 58.8% and specificity of 43.75% (AUC = 0.720, $p = 0.013$). **Conclusion** PUMA is a highly sensitive screening tool, whereas CAPTURE demonstrates better specificity. Both questionnaires can be useful in clinical practice for early identification of COPD in high-risk populations.

KEYWORDS

Copd; Puma Questionnaire; Capture Questionnaire; Screening; Spirometry; Smokers

INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is a progressive respiratory disorder characterized by persistent airflow limitation and chronic inflammatory response^[1]. It is a leading cause of morbidity and mortality worldwide^[13].

The prevalence of COPD in India is estimated at approximately 7.4%, and the burden is expected to rise due to aging populations and continued exposure to risk factors such as tobacco smoking^[13].

Cigarette smoking is the most significant risk factor, increasing the likelihood of COPD by 3–5 times^[4]. Despite this, a large proportion of cases remain undiagnosed, leading to increased morbidity and mortality^[5].

Early detection of COPD is essential to prevent disease progression and complications^[1,2]. Screening questionnaires such as PUMA and CAPTURE have been developed as simple, non-invasive tools for identifying high-risk individuals^[6-9].

This study aims to compare the effectiveness of the PUMA and CAPTURE questionnaires in screening for COPD among smokers.

MATERIALS AND METHODS

Study Design and Setting

This was a cross-sectional study conducted at a tertiary care center (Kamineni Institute of Medical Sciences, Narketpally) over a period of 6 months (February 2024 to July 2024).

Study Population

A total of 50 smokers aged ≥ 40 years with no prior diagnosis of COPD were included.

Inclusion Criteria

- Age ≥ 40 years
- Current or former smokers
- No prior diagnosis of COPD

Exclusion Criteria

- Severe cardiovascular disease
- Bronchial asthma
- Major neuromusculoskeletal disorders
- History of major surgeries
- Inability to perform spirometry

Methodology

- Demographic and smoking history were recorded
- Smoking intensity classified as:

- Light (< 20 pack-years)
- Moderate (20–30 pack-years)
- Heavy (> 30 pack-years)
- Participants completed:
- PUMA questionnaire
- CAPTURE questionnaire
- Spirometry was performed for all participants to confirm COPD

Statistical Analysis

Data were analyzed using SPSS version 23.0. Sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and AUC were calculated. Spearman correlation was used for analysis.

Ethical Approval

Institutional ethical clearance was obtained, and informed consent was taken from all participants.

RESULTS

Demographic Profile

Table 1: Distribution of Participants by Smoking Status

Category	Number	Percentage
Heavy smokers (> 30 pack-years)	33	66%
Others	17	34%

Spirometry Findings

Table 2: Severity of Airflow Obstruction

Severity	Number	Percentage
Severe obstruction	19	38%
Others	31	62%

Diagnostic Performance

Table 3: PUMA Questionnaire Performance

Parameter	Value
Sensitivity	97.05%
Specificity	25%
PPV	80%
NPV	73.3%
AUC	0.624
p-value	0.160

Table 4: CAPTURE Questionnaire Performance

Parameter	Value
Sensitivity	58.8%
Specificity	43.75%
PPV	33.3%
NPV	68.9%
AUC	0.720
p-value	0.013

DISCUSSION

The present study provides a comparative evaluation of two widely used COPD screening tools—PUMA and CAPTURE—highlighting their diagnostic strengths and limitations in a population of smokers^[6,7].

One of the key findings of this study is the exceptionally high sensitivity of the PUMA questionnaire (97.05%). This suggests that PUMA is highly effective in identifying individuals with COPD, making it an excellent screening tool, particularly in primary care settings where the goal is to minimize missed diagnoses^[6,8]. High sensitivity ensures that most patients with the disease are correctly identified, which is crucial for early intervention and prevention of disease progression^[12].

However, the low specificity of PUMA (25%) observed in this study indicates a high rate of false positives. This limitation may lead to unnecessary referrals for spirometry, increasing healthcare burden and costs^[8,10]. Similar findings have been reported in previous studies, where PUMA demonstrated strong screening capability but limited discriminative power^[6,8].

In contrast, the CAPTURE questionnaire showed moderate sensitivity (58.8%) but relatively higher specificity (43.75%). This indicates that CAPTURE is better at correctly identifying individuals without COPD, thereby reducing false-positive diagnoses^[7,9]. The statistically significant p-value (0.013) further supports its diagnostic reliability^[7]. The difference in performance between the two tools can be attributed to their design. PUMA emphasizes symptom presence and smoking exposure, which increases its sensitivity but reduces specificity^[6]. CAPTURE, on the other hand, incorporates additional clinical parameters such as exacerbation risk, improving its ability to distinguish between true and false cases^[7].

When compared with previous literature, the findings of this study are consistent with global evidence. Studies by Martinez et al. and Au-Doung et al. have reported similar trends, with PUMA being highly sensitive and CAPTURE demonstrating better specificity and predictive accuracy^[6,7].

From a clinical perspective, these findings suggest that neither tool alone is sufficient for optimal COPD screening. Instead, a combined or sequential approach may be more effective^[10,11]. For example, PUMA can be used as an initial screening tool to identify high-risk individuals, followed by CAPTURE or spirometry for confirmation. This strategy can improve diagnostic accuracy while optimizing resource utilization^[10].

Another important aspect highlighted by this study is the role of screening tools in resource-limited settings. In many parts of India and other developing countries, spirometry is not readily available. In such scenarios, validated questionnaires like PUMA and CAPTURE can serve as valuable alternatives for early detection and risk stratification^[5,12].

CONCLUSION

This study demonstrates that both the PUMA and CAPTURE questionnaires are valuable tools for COPD screening among smokers, each with distinct advantages^[6,7,8].

PUMA, with its high sensitivity, is highly effective as a primary screening tool, ensuring that most COPD cases are identified at an early stage^[6,8]. However, its low specificity limits its standalone diagnostic utility^[8].

CAPTURE, on the other hand, offers better specificity and statistically significant diagnostic performance, making it more suitable for confirming suspected cases and reducing false positives^[7,9].

The findings of this study support the use of a combined screening approach, where PUMA is used for initial identification and CAPTURE for further evaluation. Such a strategy can enhance early diagnosis and improve clinical outcomes^[10,11].

In resource-constrained settings, these tools provide a practical and cost-effective alternative to spirometry, facilitating wider implementation of COPD screening programs^[5,12].

Further large-scale, multicentric studies are recommended to validate these findings and to develop optimized screening algorithms for routine clinical practice^[13,14].

LIMITATIONS

- Small sample size
- Single-center study
- All participants were male
- Lack of long-term follow-up

REFERENCES

- [1] Qaseem A, Wilt TJ, Weinberger SE, et al. Diagnosis and management of stable chronic obstructive pulmonary disease: a clinical practice guideline update from the American College of Physicians. *Ann Intern Med*. 2011;155(3):179–191.
- [2] U.S. Preventive Services Task Force. Screening for chronic obstructive pulmonary disease: recommendation statement. *JAMA*. 2016;315(13):1372–1377.
- [3] Walters JA, Hansen EC, Johns DP, et al. A mixed methods study to compare models of spirometry delivery in primary care for COPD diagnosis. *Cochrane Database Syst Rev*. 2017; Issue 3.
- [4] Llordés M, Jaén A, Almagro P, et al. Prevalence, risk factors and diagnostic accuracy of COPD among smokers in primary care. *BMC Pulm Med*. 2015;15:64.
- [5] Lamprecht B, Soriano JB, Studnicka M, et al. Determinants of underdiagnosis of COPD in national and international surveys. *Chest*. 2015;148(4):971–985.
- [6] Au-Doung PLW, van der Molen T, van den Berge M, et al. External validation of the PUMA questionnaire for COPD screening in primary care. *PLoS One*. 2022;17(3):e0264506.
- [7] Martinez FJ, Mannino DM, Leidy NK, et al. A new approach for identifying patients with undiagnosed chronic obstructive pulmonary disease: the CAPTURE study. *JAMA*. 2023;329(8):676–685.
- [8] Varela MVL, Montes de Oca M, Halbert RJ, et al. Development and validation of the PUMA COPD screening questionnaire. *Int J Chron Obstruct Pulmon Dis*. 2019;14:1543–1552.
- [9] Bhatt SP, Kim YI, Harrington KF, et al. Clinical and spirometric predictors of COPD and validation of CAPTURE tool. *JAMA*. 2022;327(19):1876–1885.
- [10] Haroon S, Adab P, Griffin C, et al. Case finding for chronic obstructive pulmonary disease in primary care: a pilot randomized controlled trial. *BMJ Open*. 2015;5:e006475.
- [11] Jones RC, Price D, Ryan D, et al. Opportunistic screening for COPD in primary care: a systematic review. *npj Prim Care Respir Med*. 2014;24:14016.
- [12] Global Initiative for Chronic Obstructive Lung Disease (GOLD). Global strategy for the diagnosis, management, and prevention of COPD: 2024 report. Available from: <https://goldcopd.org>
- [13] Soriano JB, Abajobir AA, Abate KH, et al. Global, regional, and national deaths, prevalence, and disability-adjusted life years for COPD. *Lancet Respir Med*. 2020;8(6):585–596.
- [14] Zhou Y, Zhong NS, Li X, et al. Tiotropium in early-stage chronic obstructive pulmonary disease. *Thorax*. 2019;74(4):364–371.