




Clinical Factors Predictive of COPD Diagnosis in a Community Hospital

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Abstract

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BACKGROUND: Chronic obstructive pulmonary disease (COPD) is an irreversible obstructive airway disease. Diagnosis can be made using a spirometry which may not be available in resource-limited setting or developing countries.

AIM: This study aimed to evaluate if clinical factors can be predictive of COPD diagnosis.

MATERIALS AND METHODS: This study was a retrospective cohort study conducted at community hospital. The inclusion criteria were adult patients who had clinical symptoms suggestive of COPD and had performed adequate pulmonary function tests. Patients were categorized into two groups by diagnosis of COPD. Clinical predictors of being COPD were executed by multivariate logistic regression analysis.

RESULTS: There were 200 patients who met the study criteria. Of those, 136 patients (68.00%) had compatible pulmonary function test with COPD. There were eight factors in the final predictive model for being COPD (Table 1). Among these factors, three factors were independently associated with being COPD: Productive sputum, body mass index, and hyperinflation by chest X-ray. The hyperinflation by chest X-ray had highest adjusted odds ratio of 10.93 (95% CI 3.23, 36.96).

CONCLUSIONS: Productive sputum, body mass index, and hyperinflation by chest X-ray were independent factors for COPD diagnosis. Physicians in resource-limited setting may use these clinical factors as diagnostic tool for COPD.

Introduction

Its prevalence in the United States was approximately 6.4%, but it was reported to be 25% in Sub-Saharan Africa [1]. COPD patients may have several comorbid conditions and consequences including dyslipidemia, sleep apnea, right sided-heart failure, or exacerbations [2], [3], [4], [5], [6]. The holistic management of COPD by multi-disciplinary care team is needed [7]. One aspect in the management chain is correct diagnosis. Up to 80% of COPD patients may be undiagnosed [8].

The BOLD's questionnaire is a tool used to identify COPD burden and diagnosis of COPD [9]. It is comprised information on symptoms, status, risk factors, and economic burden of COPD. However, the diagnosis of COPD is required spirometry which may not be available in resource-limited setting or developing countries. This study aimed to evaluate if clinical factors can be predictive of COPD diagnosis.

Methods

This study was a retrospective cohort study conducted at Chumpae Hospital, the largest community

hospital in Khon Kaen province, Khon Kaen, Thailand. The inclusion criteria were adult patients who had clinical symptoms suggestive of COPD including dyspnea, cough, sputum production, and history of smoking and had performed adequate pulmonary function tests. Those who had contraindications for pulmonary function test or being pregnant were excluded from the study. The study period was between May and November 2019.

Eligible patients were evaluated for baseline characteristics, smoking history, risk factor for COPD, symptoms, chest X-ray, and pulmonary function test. History of cough was defined by the presence of cough for more than 2 weeks, while productive sputum more than 2 months was recorded. Pulmonary function test was performed by FVC maneuver and met the acceptability and repeatability criteria. COPD was diagnosed by the presence of irreversible airway disease by pulmonary function test defined by forced expiratory volume in 1 s (FEV1) per forced vital capacity (FVC) of < 0.70 after bronchodilator [10].

Statistical analysis

Patients were categorized into two groups by diagnosis of COPD. The studied variables were compared between both groups by descriptive statistics.

Clinical predictors of being COPD were executed by multivariate logistic regression analysis. Those factors with $p < 0.20$ by univariate logistic regression were put in the subsequent multivariate logistic regression analysis. The goodness of fit of the final model was tested by Hosmer–Lemeshow method. The statistical analyses were executed by the STATA software (College Station, Texas, USA).

Results

There were 200 patients who met the study criteria. Of those, 136 patients (68.00%) had compatible pulmonary function test with COPD. The COPD group had slightly older mean age than the non-COPD group (64.12 vs. 63.32 years; $p = 0.565$). There were six different factors between both groups including male sex, chronic cough, productive sputum, smoking history, number of smoking pack-year, and hyperinflation by chest X-ray (Table 2).

Table 1: Factors predictive of being chronic obstructive pulmonary diseases

Factors	Unadjusted OR (95% CI)	Adjusted OR (95% CI)
Age	1.01 (0.98–1.03)	1.01 (0.97–1.04)
Sex	3.82 (1.40–10.39)	1.48 (0.27–7.90)
History of smoking	4.69 (2.12–10.39)	2.23 (0.57–8.61)
Number of smoking, pack-year	1.03 (1.01–1.05)	1.00 (0.97–1.03)
Cough	3.59 (1.90–6.79)	1.85 (0.70–4.90)
Sputum production	5.68 (2.91–11.06)	3.28 (1.25–8.59)
Body mass index	1.00 (0.92–1.08)	1.11 (1.01–1.23)
CXR: Hyperinflation	8.44 (2.89–24.65)	10.93 (3.23–36.96)

OR: Odds ratio, CXR: Chest X-ray, CI: Confidence interval

There were eight factors in the final predictive model for being COPD (Table 1). Among these factors, three factors were independently associated with being COPD: Productive sputum, body mass index, and hyperinflation by chest X-ray. The hyperinflation by chest X-ray had highest adjusted odds ratio of 10.93 (95% CI 3.23, 36.96). The Hosmer–Lemeshow Chi-square of the final model was 14.68 ($p = 0.07$).

Table 2: Baseline characters of patients with suspected of chronic obstructive pulmonary diseases

Factors	Non-COPD (n = 64)	COPD (n = 136)	p
Age, years	63.32 (12.45)	64.12 (9.27)	0.565
Male sex, n (%)	7 (10.94)	129 (94.85)	0.008
Occupation: Agricultural, n (%)	58 (90.63)	124 (91.18)	0.871
Diabetes mellitus, n (%)	51 (98.08)	135 (100)	0.278
Hypertension, n (%)	23 (35.94)	59 (43.38)	0.357
Dyspnea, n (%)	62 (96.88)	136 (100)	0.101
Cough, n (%)	19 (29.69)	82 (60.29)	< 0.001
Sputum production, n (%)	16 (25.00)	89 (65.44)	< 0.001
Smoking history, n (%)			
None	20 (31.25)	12 (8.82)	< 0.001
Ex-smoker	33 (51.56)	98 (72.06)	
Current smoker	11 (17.19)	26 (19.12)	
Number of smoking, pack-year	15.21 (16.34)	23.07 (20.01)	0.006
Exposure to noxious particles, n (%)	1 (1.59)	8 (5.88)	0.277
BMI (kg/m ²)	21.33 (3.80)	21.36 (3.76)	0.962
CXR, n (%)			
Normal	42 (65.63)	72 (52.94)	0.095
Hyperinflation	4 (6.25)	49 (36.03)	< 0.001

Data presented as mean (SD) unless indicated otherwise. SD: Standard deviation, BMI: Body mass index, COPD: Chronic obstructive pulmonary diseases, CXR: Chest X-ray

Discussion

Sputum production is one suggestive symptom of COPD. It may be found approximately 45% in COPD patients [11]. In this study, we found that sputum production was found more common than cough in COPD group (65.44% vs. 60.29%) and less common in non-COPD group (25.00% vs. 29.69%), as shown in Table 2. It is related with smoking and chronic bronchitis in COPD [12]. These differences may result that cough was found to be significantly suggestive for COPD in this study.

Obstructive sleep apnea (OSA) is a common disease that may be accompanied with COPD. The combination of OSA and COPD, an overlap syndrome, has an approximate prevalent up to 29% [13]. As obesity is a common risk factor of OSA, it may an indicator for COPD as well. A previous study conducted on overlap syndrome found that the medians body mass index of both OSA and overlap syndrome was equal at 31.1 kg/m² [14]. Therefore, body mass index may be a suggestive factor for overlap syndrome. Note that, the body mass index in this study was not high as the previous study. OSA patients in Asian population may not be obese [15]. A previous study found that 63.4% of Asian OSA patients were not obese with body mass index of <25 kg/m². The other 36.6% may drive the average body mass index in COPD group to be higher than the non-COPD.

A screening chest X-ray may be a tool to diagnose COPD. Typical COPD on chest X-ray may be detectable in 7–30% of patients evaluated preoperatively [16]. Physicians may be able to diagnose COPD by chest X-ray with sensitivity of 90% [17]. However, only 44.80% of COPD patients had findings compatible with COPD [18]. In this study, hyperinflation indicating emphysema is a strong predictor for COPD as it may relate to COPD severity as well. Even though smoking is an important risk factor for COPD, it was not an independent factor for COPD diagnosis after adjusted for other factors including age, sex, history of smoking, numbers of cigarette smoking (pack-year), cough, sputum production, body mass index, and chest X-ray as hyperinflation (Table 1). Both smoking status and number of smoking in pack-year were not suggestive for COPD diagnosis (Table 1).

This study had some limitations. First, we did not evaluate severity or associated of COPD such as OSA [19], [20], [21]. However, this study focused on diagnosis of COPD; not treatment which may be required severity assessment as well as treatment of other related conditions [22], [23], [24], [25]. Second, the study population was community hospital. The results of this study may not be applied for more complicated COPD patients. Finally, there were some missing data including history of exposure to noxious particles and

numbers of cigarette smoking in pack-year due to retrospective study design. However, this issue was found in few factors with small proportions.

In conclusion, productive sputum, body mass index, and hyperinflation by chest X-ray were independent factors for COPD diagnosis. Physicians in resource-limited setting may use these clinical factors as diagnostic tool for COPD.

Ethical Statement

The study protocol was approved by the Institutional Review Board, Ministry of Public Health, Khon Kaen Branch, Thailand (61165).

Data Availability Statement

All data relevant to the study are included in the article.

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