Factors Associated with Hospitalization of Chronic Obstructive Pulmonary Disease Patients with Acute Exacerbation in the Emergency Department, Rajavithi Hospital

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Background: *Chronic Obstructive Pulmonary Disease with acute exacerbation (AECOPD) is a condition, which frequently results in patients visiting the emergency department (ED). Recently, many studies have reported new factors, which cause AECOPD-patients (AECOPDs) to require urgent hospital admission.*

Objective: *To determine the crucial factors of AECOPDs that are associated with patients who visit the ED being admitted to Rajavithi Hospital.*

Material and Method: *This retrospective cross-sectional study was performed from May 1, 2011 to June 30, 2013. Seventy patients were included and their medical records were reviewed. A logistic regression model (SPSS v17) was used to analyze the prognostic factors associated with hospitalization.*

Results: *The study found that patients with a respiratory rate >24 breaths per minute (OR = 3.43; 95% CI = 1.10-10.84; p = 0.040), pulse rate >120 beats per minute (OR = 4.10; 95% CI = 1.31-12.74; p = 0.020), and oxygen saturation <90% (OR = 5.25; 95% CI = 1.20-23.00; p = 0.030), were prone to be admitted to the hospital. Furthermore, such patients more often required hospitalization if they had met any of the following criteria: had respiratory-infection related Global Initiative for Chronic Obstructive Lung Disease standard stages 3-4; were receiving home oxygen therapy; had an annual rate of ED visits of more than 2; had higher leukocytes; classified in the ED emergency triage as emergent; or who received antibiotics at the ED.*

Conclusion: *Respiratory rate, heart rate and oxygen saturation are the crucial symptoms of AECOPDs to which physicians at ED should pay special attention. Such factors are reasonable indicators for hospitalization in order to reduce ED overcrowding. The study also found that patients treated early with antibiotics in the ED may be associated with subsequent hospitalization for ongoing management. However, further studies are required for verification.*

Keywords: *COPD, Chronic obstructive pulmonary disease, Acute exacerbation, Hospital admission, Emergency department*

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Chronic obstructive pulmonary disease (COPD) is a major public health problem caused by a rapid deterioration of the underlying respiratory function. Acute exacerbation of COPD from moderate to severe is a crucial occurrence leading to hospital admission, and there is a trend toward higher hospital mortality rates if such patients receive inappropriate therapy. Recently, a remarkable analysis has shown that COPD will rise from the fourth to the third most common cause of death worldwide by 2020[1]. In relation to COPD awareness, many public health professional groups, including the World Health Organization (WHO), have formed the Global Initiative for Chronic Obstructive Lung Disease (GOLD) to help thousands of COPD patients who die prematurely from its complications. Similarly, the Thoracic Society of Thailand under Royal Patronage has announced COPD treatment guidelines in Thailand to provide appropriate advice on the diagnosis and treatment of the disease. These guidelines are accordingly referred to as GOLD standard and published by National Health Security Office (NHSO), Thailand[2]. Patients with acute exacerbation of COPD commonly present to the emergency department (ED) because of progressive

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respiration failure. Subsequently, such patients often require hospitalization for ongoing management and more intensive treatment. All of this contributes to escalating the serious problem of ED overcrowding. Therefore, the aim of this study was to determine the most significant factors associated with hospitalization and to examine compliance with the guideline recommendations for assessment and management of COPD with acute exacerbation patients who attend at the emergency room of Rajavithi Hospital, Bangkok, Thailand.

Material and Method

The ethics committee of Rajavithi Hospital reviewed and approved the protocol of this research (No. 099/2556).

A retrospective cross-sectional study was conducted at the emergency room of Rajavithi Hospital, Bangkok, Thailand. Sample size was calculated by the conventional statistical method, and a sample size of at least 58 patients was recommended. Twenty percent of the sample size was added to compensate for the expected dropout rate, and therefore 70 patients who visited the ED were enrolled in the study between May 1, 2011 and June 30, 2013.

Inclusion criteria

Patients who were more than 18 years of age, and who had been diagnosed as having COPD with acute exacerbation.

Exclusion criteria

Patients who had been diagnosed as having asthma, tuberculosis, lung cancer, lung infection, pneumonia, or occupational asthma.

Patients whose first diagnosis reported for ED visit was congestive heart failure, kidney disease with fluid, or electrolyte and acid-balance disorder.

Patients who had incomplete essential information on their medical records.

Statistical analysis

The variables involved in the study were collected and then analyzed in relation to hospital admission for COPD with acute exacerbation. Continuous data were reported as mean $\pm$ SD and categorical data were presented as number (%). Chi-square test and Fisher-exact test were used to compare categorical variables, and student t-test was used to analyze continuous variables for normal distribution. In the case of non-Gaussian distributions, Mann-Whitney test was performed. The likelihood of hospitalization was estimated by multivariate logistic regression including the evaluation of differences between patients admitted and not admitted. Statistical significance was indicated by *p*-value of less than 0.050. All data were analyzed using the Statistical Package for Social Sciences (SPSS) version 17 of SPSS Inc., Chicago Illinois, US.

Results

The study was conducted in order to determine the frequency of COPD with acute exacerbation patients (AECOPDs) at our emergency room as well as their hospitalization-related factors. Therefore, 96 AECOPDs were enrolled in the program during the period of study; however, 26 patients were excluded from the program because they met the exclusion criteria. For analytical purposes, months and times of visits were recorded as shown in Fig. 1 and 2. The highest numbers of ED visits in a month were in February (17.1%) and January (14.3%). Interestingly, the time of ED visits was frequently during the period 4 PM to midnight. However, such a period of time was not statistically significant for hospital admission compared with the other factors. In perspective, 70 AECOPDs were divided into admitted (n = 35) and not admitted (n = 35) groups. Neither group showed any statistically significant difference in gender ($p = 0.550$) or age ($p = 0.070$) as detailed in Table 1.

Univariate analysis (Table 1) revealed a higher

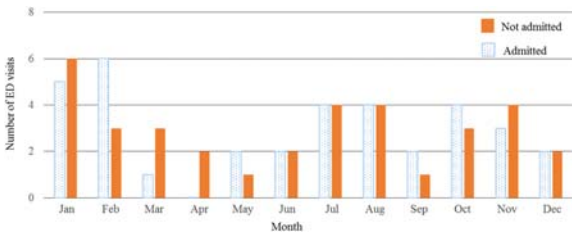

Fig. 1 ED visits per month during the study period.

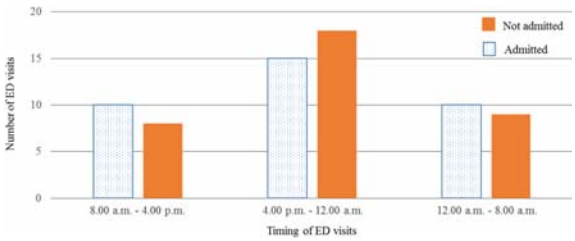

Fig. 2 Time in days of ED visits during the study period.

Table 1. Demographic and clinical characteristics of patients assessed by the ED for COPD with acute exacerbation, sorted by hospital admission

Predictors	Admitted, n (%)	Not admitted, n (%)	*p*-value
Gender			
Male	27 (48.2%)	29 (51.8%)	0.550
Female	8 (57.1%)	6 (42.9%)	
Age (mean ± SD)	71.43±9.74	66.54±12.28	0.070
Emergency severity index			
Emergent	20 (80.0%)	5 (20.0%)	0.045*
Urgent	15 (33.3%)	30 (66.7%)	
ED visits			
By patients' relatives	28 (45.9%)	33 (54.1%)	0.070
By EMS-ambulance	15 (42.9%)	2 (22.2%)	
Physical examinations			
Temperature			
<37°C	31 (47.7%)	34 (52.3%)	0.360
>37°C	4 (80.0%)	1 (20.0%)	
SBP (mmHg)			
<140	14 (48.3%)	15 (51.7%)	0.810
>140	21 (51.2%)	20 (48.8%)	
DBP (mmHg)			
<80	15 (60.0%)	10 (40.0%)	0.210
>80	20 (44.4%)	25 (55.6%)	
Pulse rate (beats per minute)			
<120	14 (35.0%)	26 (65.0%)	0.040*
>120	21 (70.0%)	9 (30.0%)	
RR (breaths per minute)			
<24	9 (28.1%)	23 (71.9%)	0.010*
>24	26 (68.4%)	12 (31.6%)	
Oxygen saturation (%)			
<90	15 (83.3%)	3 (16.7%)	0.010*
>90	20 (38.5%)	32 (61.5%)	
Increased sputum			
Yes	25 (80.6%)	6 (19.4%)	0.046*
No	10 (25.6%)	29 (74.4%)	
Change in sputum color			
Yes	3 (50.0%)	3 (50.0%)	1.000
No	32 (50.0%)	32 (50.0%)	
Drowsy and Confused			
Yes	0	0	1.000
No	35 (50.0%)	35 (50.0%)	
Dyspnea			
Yes	35 (50.0%)	35 (50.0%)	1.000
No	0	0	
GOLD standard			
1 and 2	26 (81.2%)	6 (18.8%)	0.045*
3 and 4	9 (23.7%)	29 (76.3%)	
Smoker			
Yes	35 (50.0%)	35 (50.0%)	0.046*
No	0	0	
Oxygen therapy at home			
Yes	6 (100.0%)	0	0.030*
No	29 (45.3%)	35 (54.7%)	

* Statistical significance at $p<0.050$

Table 1. Cont.

Predictors	Admitted, n (%)	Not admitted, n (%)	*p*-value
Annual rate of ED visits			
<2	6 (23.1%)	20 (76.9%)	0.045*
>2	29 (65.9%)	15 (34.1%)	
ED treatment			
Oxygen cannula			
Yes	15 (83.3%)	3 (16.7%)	0.010*
No	20 (38.5%)	32 (61.5%)	
Oxygen mask with bag			
Yes	25 (80.6%)	6 (19.4%)	0.045*
No	10 (25.6%)	29 (74.4%)	
Endotracheal tube			
Yes	8 (100.0%)	0	0.047*
No	27 (43.5%)	35 (56.5%)	
Systemic Corticosteroids			
Yes	26 (50.0%)	26 (50.0%)	1.000
No	9 (50.0%)	9 (50.0%)	
Nebulized Corticosteroids			
Yes	12 (57.1%)	9 (42.9%)	0.430
No	23 (46.9%)	26 (53.1%)	
Antibiotics			
Yes	32 (86.5%)	5 (13.5%)	0.046*
No	3 (9.1%)	30 (90.9%)	
Sample blood tests			
Leukocytes (per mm^3)			
<12,000	12 (71.9%)	26 (28.1%)	0.010*
>12,000	23 (31.6%)	9 (68.4%)	
Neutrophil count			
<75%	13 (41.9%)	18 (58.1%)	0.230
>75%	22 (56.4%)	17 (43.6%)	

* Statistical significance at $p<0.050$

frequency of hospital admissions for AECOPDs in the following cases: those with highest priority for initial care according to emergency triage classified as emergent at ED visits ($p = 0.045$); those with respiratory-infection related GOLD standard stages 3 and 4 ($p = 0.045$); those with breathing-related problems such as high pulse rate ($p = 0.040$), fast respiratory rate ($p = 0.010$) and low levels of oxygen in the blood ($p = 0.010$). Hospitalized AECOPDs were typically those who used home oxygen therapy ($p = 0.030$), had high leukocytes ($p = 0.010$), and received antibiotics at ED ($p = 0.046$). Moreover, an annual rate of ED visits of more than 2 was significantly associated with hospital admission ($p = 0.045$). Multivariate analysis (Table 2) showed that the factors having statistically significant impacts on hospital assessment were pulse rate >120 bpm (OR = 4.10; 95% CI = 1.31-12.74; $p = 0.020$), oxygen saturation <90% (OR = 5.25; 95% CI = 1.20-23.00; $p = 0.030$) and respiratory rate >24 bpm (OR = 3.43; 95% CI = 1.10-10.84; $p = 0.040$).

Information was obtained from medical records and by interviewing patients during their stay at the ED. It was clearly confirmed that co-morbid diseases such as diabetes mellitus (DM), hypertension (HT), high cholesterol, acute myocardial infarction, atrial fibrillation (AF) and chronic kidney failure were not statistically significantly associated with hospitalization of AECOPDs. However, it is important to note that HT was the most common co-morbid disease of AECOPDs who visited the emergency room (34 out of 70 patients).

Discussion

Acute Exacerbation is an essential aspect of

Table 2. Predictors of hospital admission in accordance with multivariate analysis

Factors	OR	95% CI	*p*-value
Pulse rate >120 bpm	4.10	1.31-12.74	0.020*
Oxygen saturation <90%	5.25	1.20-23.00	0.030*
Respiratory rate >24 bpm	3.43	1.10-10.84	0.040*

* Statistical significance at $p<0.050$

COPD patients that generates costs from hospital admissions[4]. AECOPDs often attend at the emergency room because of their developing symptoms. The decision to admit a patient with AECOPD is based on the interpretation of a series of clinical data including severity of dyspnea, respiratory failure and deficient response to treatment during the patient's stay at the emergency room[5]. In keeping with our results, respiratory decompensation in AECOPDs was a frequent cause of hospital admission in other studies[3,6-10], inflammatory markers could also be used as an indicator of AECOPD severity[5]. Some authors reported that both neutrophilia and leukocytes in peripheral blood significantly correlated with hospitalization[3]; however, in the present study, only leukocytes in peripheral blood were significantly higher among those admitted for ongoing management. Additionally, determination of hospitalization in AECOPDs in our environment depends heavily on certain characteristics of the acute exacerbation, such as fast pulse rate (>120 bpm), low oxygen saturation (<90%) and high respiratory rate (>24 bpm). Interestingly, such factors associated with hospitalization involve non-invasive patient monitoring, and physicians in ED can exploit these factors to confirm diagnosis and reduce ED overcrowding. Some authors have reported significant relationships between impaired oxygenation, exacerbation severity and the frequency of hospital admission in AECOPDs[3,6], and in this study, low oxygen saturation was significantly higher among those admitted. Moreover, the factors reported in this study are similar to the main crucial indicators of COPD treatment guidelines for hospital assessment in those patients[2,5].

Since antibiotic treatment for AECOPDs is not clearly defined, the choice of antibiotic therapy should be based on clinical criteria[7-10], and some physicians may prescribe it as a precaution against the likelihood of infection[9-12]. In the present study, it is worth noting that starting antibiotic treatment at the emergency room seems to be a significant factor leading to hospital admission of AECOPDs. However, it should be confirmed by further studies using objective criteria at the emergency room.

Conclusion

Several factors associated with hospitalization of AECOPDs have already been identified in the study, which showed that 50% of AECOPDs who visited our ED required hospital admission. Fast pulse rate, lower oxygen saturation and higher respiratory rate are important factors affecting hospitalization. Interestingly, antibiotic prescription at the ED may increase the rate of hospital admission. Awareness of these factors may be beneficial in the design of future AECOPD management in order to reduce overcrowding at the emergency room.

What is already known on this topic ?

It is challenging to treat COPD patients with acute exacerbation at emergency service visits. Recently, many studies have reported new concerned factors of COPD with acute exacerbation patients (AECOPDs) that strongly suggest the need for hospital admission. Many studies recommended COPD guidelines referred to GOLD standard for assessment and management of AECOPDs. Moreover, there are only few studies on the Thai population.

What this study adds ?

Besides the recommendations of COPD guideline, the study found that determinants of hospitalization in AECOPDs in our environment relied heavily on some characteristics such as fast pulse rate (>120 bpm), low oxygen saturation (<90%) and high respiratory rate (>24 bpm). Moreover, receiving antibiotics at the emergency room is prone to increase hospitalization of such patients. Awareness of these factors is beneficial for the design of future AECOPD management to reduce overcrowding at emergency room.

Potential conflicts of interest

None.

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ปัจจัยที่สัมพันธ์กับการนอนรักษาตัวในโรงพยาบาลของผู้ป่วยโรคปอดอุดกั้นเรื้อรังที่มาด้วยภาวะหอบกำเริบเฉียบพลันที่เข้ามารับการรักษาที่ห้องฉุกเฉิน โรงพยาบาลราชวิถี

กิตติยาพร วิวัชรโกเศศ, ขวัญชนก ลือวีระวงษ์

ภูมิหลัง: *ภาวะหอบกำเริบเฉียบพลันในผู้ป่วยโรคปอดอุดกั้นเรื้อรังเป็นภาวะที่พบบ่อยในห้องฉุกเฉินและเป็นสาเหตุสำคัญที่ทำให้ผู้ป่วยต้องเข้ารับการนอนรักษาในโรงพยาบาล มีรายงานอื่นๆที่ศึกษาพบว่ายังมีปัจจัยเพิ่มเติมอีกหลายอย่างที่อยู่นอกเหนือข้อบ่งชี้ แต่มีความสัมพันธ์กับการนอนรักษาตัวในโรงพยาบาล*

วัตถุประสงค์: *เพื่อศึกษาปัจจัยที่สัมพันธ์กับการนอนรักษาในโรงพยาบาลของผู้ป่วยโรคปอดอุดกั้นเรื้อรังที่มาห้องฉุกเฉินด้วยภาวะหอบกำเริบเฉียบพลัน ณ โรงพยาบาลราชวิถี*

วัสดุและวิธีการ: *เป็นการศึกษาแบบ Retrospective cross-sectional study โดยเก็บข้อมูลผู้ป่วยโรคปอดอุดกั้นเรื้อรังที่เข้ามารับการรักษาที่ห้องฉุกเฉิน โรงพยาบาลราชวิถี ด้วยภาวะหอบกำเริบเฉียบพลันตั้งแต่วันที่ 1 พฤษภาคม พ.ศ. 2554 ถึง 30 มิถุนายน พ.ศ. 2556 มีผู้ป่วยในเกณฑ์คัดเข้าทั้งสิ้น 70 ราย จำแนกผู้ป่วยเป็นกลุ่มที่ต้องนอนรักษา และไม่ต้องนอนรักษาในโรงพยาบาล โดยเก็บรวบรวมข้อมูลประวัติทางการรักษาของกลุ่มผู้ป่วยจากเวชระเบียนแล้วมาวิเคราะห์หาความสัมพันธ์ทางสถิติโดย Multiple Logistic Regression โดยโปรแกรมสำเร็จรูป SPSS v17.*

ผลการศึกษา: *ปัจจัยที่สัมพันธ์กับกลุ่มผู้ป่วยที่ต้องนอนรักษาในโรงพยาบาลได้แก่ อัตราการหายใจมากกว่า 24 ครั้ง/นาที (OR = 3.43; 95% CI = 1.10-10.84; p = 0.040), อัตราการเต้นชีพจรมากกว่า 120 ครั้ง/นาที (OR = 4.10; 95% CI = 1.31-12.74; p = 0.020) และระดับออกซิเจนในเลือดน้อยกว่า 90% (OR = 5.25; 95% CI = 1.20-23.00; p = 0.030) มากไปกว่านั้นการศึกษานี้พบปัจจัยเพิ่มเติมที่เป็นไปตามข้อบ่งชี้ในการรับผู้ป่วยไว้นอนรักษาในโรงพยาบาลได้แก่ ผู้ป่วยที่มีระดับความรุนแรงของโรคปอดอุดกั้นเรื้อรังระดับ 3 และ 4 (GOLD standard), มีการบำบัดด้วยออกซิเจนที่บ้าน, เคยเข้ามารับรักษาที่ห้องฉุกเฉินมากกว่า 2 ครั้งต่อปี, มีจำนวนเม็ดเลือดขาวในเลือดที่สูง, ถูกคัดกรองที่ห้องฉุกเฉินระดับ Emergent และได้รับยาปฏิชีวนะระหว่างการรักษาที่ห้องฉุกเฉิน*

สรุป: *การศึกษาแสดงให้เห็นว่า อัตราการหายใจ อัตราการเต้นชีพจร และระดับออกซิเจนในเลือด เป็นปัจจัยสำคัญที่ช่วยให้แพทย์ผู้ปฏิบัติงานที่ห้องฉุกเฉินสามารถตัดสินใจให้ผู้ป่วยโรคปอดอุดกั้นเรื้อรังด้วยภาวะหอบกำเริบเฉียบพลัน เข้ารับการรักษาตัวในโรงพยาบาลได้รวดเร็วยิ่งขึ้น ส่งผลให้ลดความแออัดของผู้ป่วยที่ห้องฉุกเฉินได้ ส่วนปัจจัยอื่นที่พบร่วมนั้นอาจต้องนำมาศึกษาเพิ่มเติม เพื่อรวบรวมเป็นแนวทางในการรับผู้ป่วยที่ต้องนอนรักษาในโรงพยาบาลต่อไปในอนาคตโดยเฉพาะการได้รับยาปฏิชีวนะที่ห้องฉุกเฉิน*