

Chapter

Early Warning Signs and Prodromal Symptoms of AECOPD Patients

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Abstract

An acute exacerbation of chronic obstructive pulmonary disease (AECOPD) is a major problem leading to the most cause of death in chronic obstructive pulmonary disease (COPD) patients. Most cases of AECOPD occurred at home and outside the hospital. The COPD patients have the pattern of AECOPD according to their individual experiences. When the patients had AECOPD, also the warning signs and prodromal symptoms were happened differently. However, the characteristics of warning signs and prodromal symptoms could be described in three categories: 1) early signs and symptoms, 2) signs and symptoms that make the patients worse, and 3) time of occurrence. If the patients have been ill with COPD for a period of time until they can learn his/her early warning signs and prodromal symptoms of AECOPD by themselves or/and with their caregivers or/and with healthcare professionals, they will be able to quickly recognize their signs and symptoms when they occur and will be able to manage them as soon as according to their competency individually.

Keywords: early warning signs, prodromal symptoms, an acute exacerbation of chronic obstructive pulmonary disease (AECOPD), chronic obstructive pulmonary disease (COPD), characteristics

1. Introduction

Chronic obstructive pulmonary disease (COPD) is currently a pulmonary problem around the world. It is the third leading cause of death in 2020 [1] and now is one of the top three in 2022 [2]. Most deaths of COPD patients are a cause of worsening of symptoms which it was called acute exacerbation or exacerbation of COPD or AECOPD or COPD flare-up. Exacerbations were cause of respiratory failure that induced the COPD patients to receive life support. Most of AECOPD patients have to receive mechanical ventilator and difficult to wean. It effects to prolong intubation and have low quality of life until those patients die. Moreover, more than 50% of COPD treatment costs were related to exacerbations [3, 4] and they are cause of the slow decline of the disease trajectory that make COPD patients often end of life.

An acute exacerbation can be met in all levels of COPD severity, but it usually occurs in the late stage of it. In 2013, forced expiratory volume in one second (FEV₁) is not suggested for categorizing the severities of COPD. In 2016, the exacerbation

was the one criterion that used for categorizing the severities of COPD. Nowadays, only FEV₁ is suggested for categorizing the severities of it [2]. AECOPD first appears in GOLD grade 1 and appears most frequently in grade 4. An exacerbation in COPD patients is an acute state of respiratory symptoms that occurs more than normal day such as dyspnea (shortness of breath), cough, sputum, and makes the patients need additional treatment [5–8]. It is similar to clinical trials, it was defined as “an increasing therapy more than regular day or urgent care is needed the using of antibiotics, systemic corticosteroids, or both in the hospital or/and emergency room” [9]. The severity of AECOPD could be classified into three levels: 1) mild, 2) moderate, and 3) severe. First, the mild level is when the COPD patient has an exacerbation but the treatment not change. Second, the moderated level is when an exacerbation occurs, the medication changes. Finally, AECOPD patient must go to the hospital [9, 10].

Most COPD patients unable to remember their AECOPD events. They do not know the signs and symptoms that happen during they face AECOPD state because they have the pattern of AECOPD according to their individual experiences. It is not similar with other COPD patients. They have to know and recognize it by themselves. It seems like AECOPD experiences are quite unclear. If healthcare professional can help COPD patients able to remember signs and symptoms of AECOPD, they will able to manage it successfully and quickly that it does not affect the bad quality of life.

2. Mechanisms of AECOPD

An acute exacerbation among COPD patients often stimulated by dyspnea (Shortness of breathe) that related with respiratory bacteria or viruses infection (which may coexist), environmental pollutants, or unknown factors. Most of respiratory infection can trigger AECOPD that is pneumonia. During exacerbation happened, there is increased hyperinflation and gas trapping, it resulted to reduced expiratory flow, so effect to dyspnea increased. Airflow limitation and air trapping are the cause of dyspnea and more dyspnea is the one symptom of AECOPD. The pathophysiology of COPD involves an inflammation, fibrosis, and luminal exudates in small airways. It is contributed to gas trapping during expiration and effected to decrease FEV₁ and FEV₁/forced vital capacity (FVC) ratio especially more severe disease. Hyperinflation increases end expiratory lung volume (EELV) and reduces inspiratory capacity (IC) such that functional residual capacity increase, particularly during exercise (dynamic hyperinflation), resulted in mechanical disadvantage (inspiratory muscle dysfunction), neuromechanical uncoupling (increased dyspnea), cardiovascular effects and worsening of gas exchange. Moreover, the increasing of ventilator drive and tachypnea stimulate the worsening of expiratory flow limitation and dynamic hyperinflation each other [5, 6].

3. The perception of early warning signs and prodromal symptoms in AECOPD patients

The perception of early warning signs and prodromal symptoms in AECOPD patients is important to prevent and manage exacerbation among COPD patients. It was according to perception of exacerbation in each COPD patient who aware of exacerbation occurred that means it is different recognition in COPD patients

individually. Exacerbation was the event that was showed in ‘visible’ and ‘invisible’ symptoms. Visible symptoms were presented in struggles to breathe until cannot breathe and invisible symptoms were presented in really bad, massive anxiety, panic attack, and all things worse liked being trapped in a life-threatening situation that is differently in each person.

4. The characteristics of warning signs and prodromal symptoms of AECOPD

The characteristics of warning signs and prodromal symptoms among AECOPD patients is important to prevent and manage exacerbations. It is different recognition in COPD patients. AECOPD state is the event that was showed in ‘visible’ and ‘invisible’ symptoms [11]. Visible symptoms were presented in struggles to breathe until cannot breathe and invisible symptoms were presented in really bad, massive anxiety, panic attack, and all things worse like liked being trapped in a life-threatening situation that is differently in each person.

The specific factors influencing recognition of exacerbations were heterogeneity of exacerbations and habituation to symptoms. They made the patients know the beginning of exacerbation symptoms, included increased fatigue, increased respiratory symptoms (coughing, sputum production, and breathlessness), specific pain and fever [12]. As supported by Chin [13], he stated about exacerbation experiences and the awareness of prodromal symptoms in the days preceding an exacerbation that (1) patients had an unique, individual pattern of exacerbation symptoms that recurred with each exacerbation event, (2) two very distinct types of exacerbation presentations: sudden onset and gradual onset, a change from the participant’s typical day-to-day COPD symptom variation, exacerbation occurred from a few hours to 2 weeks, it changes individually, (3) treatment for their exacerbation based on the severity of their symptoms, with participants experiencing sudden, severe dyspnea presenting earliest for treatment, and (4) the severity of symptoms in these individuals precipitated a sense of urgency regarding their situation.

Moreover, COPD Foundation and WebMD reported 17 warning signs and symptoms of AECOPD that COPD patients able to know or recognize how much a COPD flare-up will affect them to make decision in how quickly they can be treated for prevention and treatment of an exacerbation before it becomes too severe, until unable to manage those signs and symptoms. They were consisted of (1) cough more than base line, (2) wheezing more than base line, (3) gurgling or rattle breathing, (4) more dyspnea, (5) more shallow breathing or rapid breathing, (6) produce more mucous than base line, (7) change color in the mucus from clear to green/yellow/tan/bloody, (8) excessive sleepy, (9) confusion, (10) swollen ankles and/or feet, (11) loss of appetite, (12) blue tinge to lips or fingertips, (13) yellow or gray skin, (14) difficult to talk, (15) headaches first thing in the morning, (16) abdominal pain, and (17) chest pain [14]. WebMD [15] stated that there are 9 early warning signs of AECOPD, included (1) noisy breathing, (2) irregular breathing, (3) worsening cough, (4) change color in nails or/and skin, (5) problem sleeping and eating, (6) unable to talk, (7) early-morning headaches, (8) swollen ankles or legs or belly pain, and (9) fever. Moreover, if COPD patients have 4 symptoms; (1) chest pain, (2) blue lips or fingers, (3) confuse or get very easily upset, and (4) dyspnea and unable to talk together, they have to visit the doctor and receive the treatment soon because they can start to become severe suddenly. National Institutes of Health (NIH) [16] divided the

warning signs of AECOPD quite differently among COPD Foundation and WebMD reported, it divided the warning signs into two groups, included common early signs and other possible signs. The common early signs consisted of three warning signs; (1) trouble catching patients' breathe, (2) noisy and wheezing sounds, and (3) cough, sometimes has more mucus than normal day or change color in the mucus. The other possible signs consisted of 10 warning signs; (1) unable to take deep breathing, (2) difficult to sleep, (3) morning headache, (4) abdominal pain, (5) anxiety, (6) difficult to talk, (7) swollen ankles or legs, (8) gray or pale skin, (9) blue or purple lips or nail tips, and (10) unable to talk in full sentences.

According to above reporters, awareness of warning signs and prodromal symptoms depended on the perception of each patient who has experienced exacerbation individually. Most warning signs and prodromal symptoms, such as increasing of fatigue, cough, sputum production and breathlessness through hours into 2–7 days [3].

Chatreewatanakul et al. [3] studied about exacerbation experiences among COPD Thai patients. In Thailand, COPD is the fourth most common cause of death and the number of deaths due to COPD is increasing every year. In 2012–2014, there were 1421, 1597, and 1619 COPD-related deaths [17]. The mortality of COPD patients increased from 7.7 deaths per one hundred thousand people in 2013 to 11.4 deaths per one hundred thousand people in 2017. Furthermore, there were 8598 deaths/fiscal year and exacerbation is the most cause of death [18], which is the same cause of death as the world's population that a slow decline of the disease trajectory in COPD, punctuated by dramatic exacerbations that often end in unexpected death or unpredictable death [19]. They found that the characteristics of warning signs and prodromal symptoms could be described in three categories: 1) early signs and symptoms, 2) signs and symptoms that make the patients worse, and 3) time of occurrence.

4.1 Early signs and symptoms

COPD patients recognizes warning signs and prodromal symptoms according to their individual experiences. Early signs and symptoms of AECOPD consisted of two types; 1) frequent early signs and symptoms that are coming before cannot breathe and 2) other early possible signs and symptoms that are coming before cannot breathe.

4.1.1 Frequent early signs and symptoms that are coming before cannot breathe

Most COPD patients have three early signs and symptoms that frequent early occurs before the beginning of AECOPD, included: (1) cough, (2) more dyspnea, and (3) cannot exhale. Cough is the most of signs and symptoms that frequent early occurs before the beginning of AECOPD. More dyspnea and cannot exhale are the second and third respectively.

Since the mechanism of an exacerbation in COPD patients makes cough, more dyspnea, and cannot exhale are related each other. AECOPD is often stimulated by dyspnea which related to respiratory tract infection by bacteria or virus infection, environmental pollution, or unknown factors. During exacerbation state, increasing

of hyperinflation and gas trapping, reduce expiratory flow, consequently dyspnea increase [5, 6, 20]. When the participants are ill with respiratory bacteria or viral infection, they will have a cough. This sign will induce dyspnea and result in unable to exhale continuously. Finally, this will induce AECOPD occurring.

4.1.2 Other early possible signs and symptoms that are coming before cannot breathe

COPD patients have early possible signs and symptoms that are coming before cannot breathe different individually. There were twenty-three other early possible signs and symptoms, included: (1) edgy/nervous/moody, (2) difficult breathing, (3) increasing cough, (4) cough with sputum, (5) sticky sputum, (6) a lot of sticky clear white mucus, (7) runny nose, (8) sneeze, (9) stuffy nose, (10) feeling tight like something obstructing in the throat, (11) wheezing, (12) inspiratory wheezing, (13) breathe not all over the stomach, (14) dry cough, (15) tinnitus, (16) hoarse voice, (17) change color in sputum, (18) agitation, (19) sick at heart/heart pain, (20) unsettledness, (21) sweating, (22) frequent cough, and (23) leg pain.

Because COPD patients have different durations of illness and comorbidities, they have early possible signs and symptoms that are coming before cannot breathe differently.

4.2 Signs and symptoms that make the patients worse

There are two categories of signs and symptoms that make the patients worse, included: 1) common signs and symptoms that make the patients worse and 2) signs and symptoms that make the patients decide to go to the hospital.

4.2.1 Common signs and symptoms that make the patients worse

There are four signs and symptoms that make AECOPD patients worse: (1) coughing, (2) wheezing, (3) tightness, and (4) difficulty breathing. Coughing is the sign that most participants have experienced before getting worse but some study said that difficulty breathing is the sign of respiratory system illness which will impact COPD patients' immediate response because it results in airflow limitation and air being trapped which are the cause of increased dyspnea until exacerbation occurs.

4.2.2 Signs and symptoms that make the patients decide to go to the hospital

Seven signs and symptoms make AECOPD patients need to receive the treatment from the doctor at the hospital, included: (1) still dyspnea, (2) cannot exhale, (3) cannot inhale, (4) after receiving bronchodilator therapy, still dyspnea, (5) dyspnea until the body shakes, (6) tinnitus, and (7) when wheezing results in dyspnea. Still dyspnea was the most symptom which the participants decided to go to the hospital to receive treatment from the doctor. It is the symptom that AECOPD patients usually unable to control or manage because they have pulmonary function test (PFT); forced expiratory volume in one second/forced vital capacity (FEV1/FVC) < 0.70% (confirms the presence of airflow limitation). Thus, they have difficulty to control dyspnea.

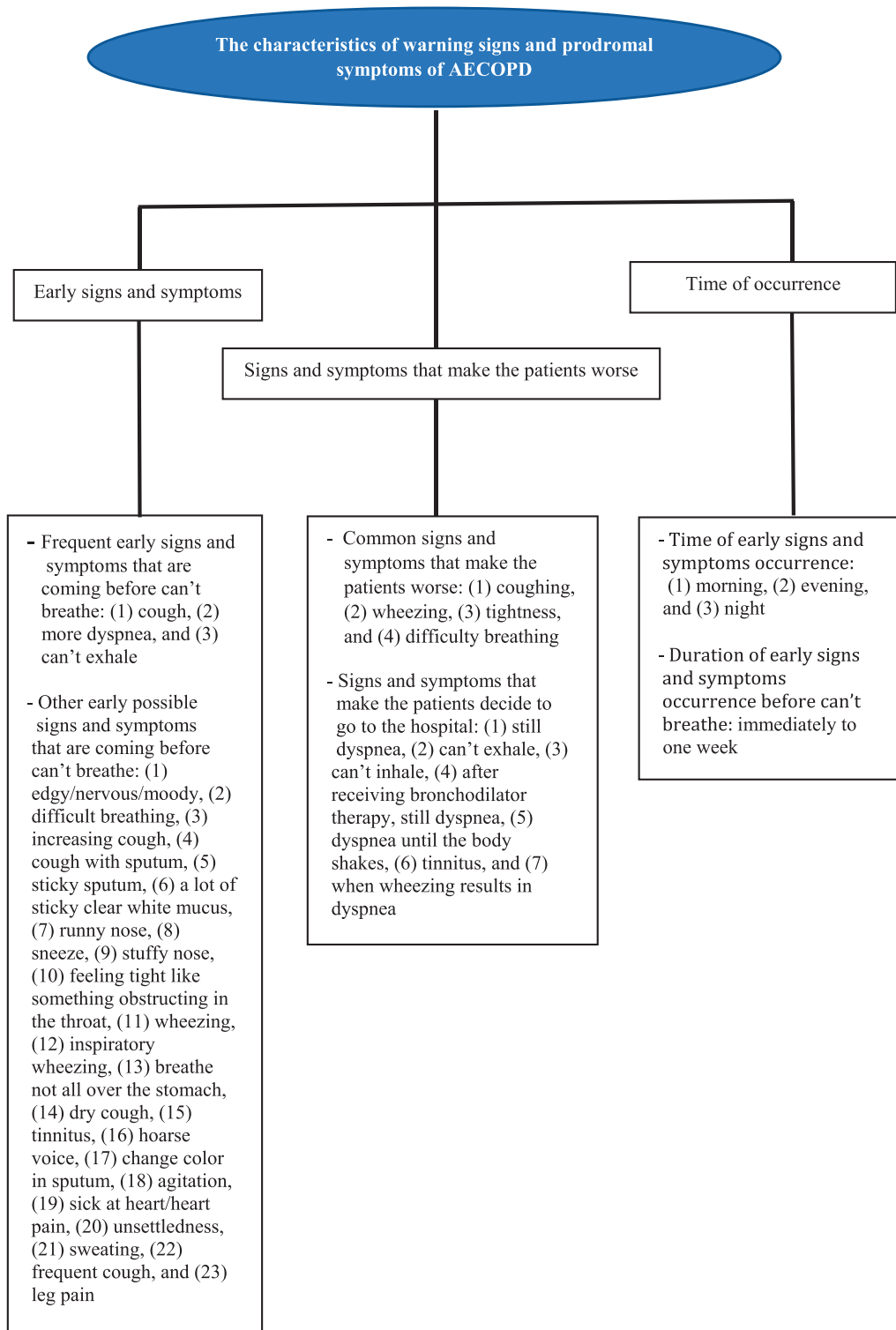


Figure 1.
The characteristics of warning signs and prodromal symptoms of AECOPD.

4.3 Time of occurrence

Time of AECOPD occurrence was included two characteristics: 1) time of early signs and symptoms occurrence and 2) duration of early signs and symptoms occurrence before cannot breathe.

4.3.1 Time of early signs and symptoms occurrence

Most AECOPD patients cannot tell the specific time of early signs and symptoms of exacerbations occurrence. They can be appeared at any time. However, there are some COPD patients who can identify the time of early warning signs and symptoms usually occurring: (1) morning, (2) evening, and (3) night. AECOPD can happen any time. Some patients have signs and symptoms in the morning or/and in the evening or/and in the night or all the day. It occurs different individually.

4.3.2 Duration of early signs and symptoms occurrence before cannot breathe

The duration of early signs and symptoms occurrence before cannot breathe able start from immediately to 1 week. It is different individually that similar to time of early signs and symptoms occurrence.

Although healthcare professionals especially the doctor can know all characteristics of warning signs and prodromal symptoms from COPD patients, they need to assess all signs and symptoms from the patients' caregivers as well. Because some patients cannot tell their all signs and symptoms by themselves. Their caregivers able to help them to inform or encourages the patients to notice those signs and symptoms more clearly. When the clinicians can combine all data from the patients and their caregivers successfully which the data can be gathered early in the onset of exacerbation, it is even better to help the patients manage those signs and symptoms early. As a result, the level of PET dose not decrease rapidly due to each exacerbation which induces the patients to die quickly. The clinicians must also plan for manage those early warning signs and prodromal symptoms early and communicate appropriate methods to manage them with COPD patients and their families by providing the management methods both medication and non-medication treatments or the methods that the patients could learn on their own from previous exacerbation events.

According to early warning signs and prodromal symptoms of AECOPD patients, the characteristics of it can be described in **Figure 1** as follow.

5. Conclusions

In regard to early warning signs and prodromal symptoms of AECOPD patients, COPD patients recognize the warning signs and prodromal symptoms according to their individual experiences. If they able to early recognize the warning signs and prodromal symptoms, they will able to manage it rapidly by themselves or their care givers. As a result, COPD patients will not have the declining of PFT immediately, decreasing of mortality rate, and have a better quality of life. Consequently,

healthcare professionals should help and provide the recommendation about early warning signs and prodromal symptoms of AECOPD to COPD patients in order to make it through COPD illness in a period of time during with the patients can learn this knowledge on their own.

6. Recommendations

In healthcare professional area, the various healthcare professionals should help the patients and their care givers by providing the warning signs and prodromal symptoms knowledge appropriately to each COPD patients individually. They should enhance patients care and their management of the early warning signs and prodromal symptoms of AECOPD. Furthermore, supporting AECOPD patients able to plan for recognition of their warning signs and prodromal symptoms by themselves.

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