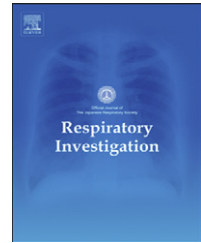




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Original article

The impact of a large-scale natural disaster on patients with chronic obstructive pulmonary disease: The aftermath of the 2011 Great East Japan Earthquake

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ABSTRACT

Background: A large-scale natural disaster may exacerbate chronic respiratory diseases, such as chronic obstructive pulmonary disease (COPD). The aftermath of a natural disaster can include poor access to medication, medical equipment, and medical supplies. Little is known about the impact on patients with COPD.

Methods: A retrospective cohort study was conducted at a regional medical center in Ishinomaki, the area affected most severely by the Great East Japan Earthquake in 2011. The study was performed 6 months after the disaster. The characteristics, clinical courses, and outcomes of COPD patients hospitalized after emergency visits during the study period were investigated and compared.

Results: One hundred patients (112 episodes) were identified. Within a few days after the disaster, patients undergoing oxygen therapy at home came to the hospital to receive oxygen. In the subacute phase (from the third to the fifth week), the number of hospitalizations due to COPD exacerbations was significantly increased compared to the numbers observed before the earthquake ($p < 0.05$). On admission, COPD patients reported significantly reduced participation in the activities of daily living (ADLs) after as compared to before the disaster. The incidence of cases of exacerbated COPD normalized 6 weeks after the earthquake.

Conclusions: The large-scale natural disaster that hit Japan in 2011 had a serious negative impact on the clinical outcomes of COPD patients in the disaster-affected area.

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Abbreviations: ADL, activities of daily living; FEV1, forced expiratory volume in 1 s; FVC, forced vital capacity; GOLD, Global Initiative for Chronic Obstructive Lung Disease; NPPV, noninvasive positive pressure ventilation

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1. Introduction

Large-scale natural disasters, such as earthquakes or tsunamis, destroy buildings, vital infrastructure, communication technology, and transportation facilities, often resulting in many deaths and traumatic injuries. Medical resources and public health services are also often severely impaired. These disasters may exacerbate chronic respiratory diseases, such as chronic obstructive pulmonary disease (COPD). In the aftermath of the disaster, COPD patients often endure limited access to medication, medical equipment, and/or medical supplies. However, no systematic investigation has examined the impact of natural disasters on patients with COPD.

An earthquake of magnitude 9.0 occurred in Japan on March 11, 2011, most severely affecting the Tohoku region on the northeast coast of the country. A devastating tsunami followed the earthquake and caused widespread damage on Japan's eastern coast. Approximately 20,000 people were killed or went missing, and over 380,000 houses were destroyed [1]. In the aftermath of this catastrophe, we dealt with respiratory emergencies at a regional medical center set up in Ishinomaki to deal with the disaster's aftermath. We conducted a retrospective cohort study to evaluate the impact of the disaster on clinical outcomes among COPD patients.

2. Material and methods

2.1. Study design

We conducted a retrospective cohort study at the Japanese Red Cross Ishinomaki Hospital in Ishinomaki, Japan. The institution is a 402-bed tertiary hospital, which provides medical services to over 220,000 people in Ishinomaki and the surrounding cities. Ishinomaki is a port town located in the coastal area of Tohoku region and was one of the most affected cities by this disaster. The Japanese Red Cross Ishinomaki Hospital was designated as the region's primary medical center after this disaster. Although other medical facilities in Ishinomaki were either destroyed or damaged by the tsunami, the Japanese Red Cross Ishinomaki Hospital continued to operate at full capacity [2]. Remarkably, the electronic medical record system remained functional as well. Clinical laboratory and radiology services were also available. In the first 7 days after the disaster, we were able to treat 3938 emergency patients at the hospital.

This study was carried out in accordance with the Declaration of Helsinki and was approved by the Ethics Committee at the Japanese Red Cross Ishinomaki Hospital (December 5, 2011).

2.2. Inclusion and exclusion criteria

We reviewed the medical records of patients who made an emergency visit and required a hospital stay during the period from March 11 to September 10, 2011, and identified patients diagnosed with COPD in accordance with the GOLD criteria [3]. Each patient presenting with aggravated

symptoms underwent a comprehensive assessment that included a physical examination, pulse oximetry, chest radiography, and electrocardiography. COPD exacerbation was defined as a sudden worsening of symptoms such as increased breathlessness, coughing, or sputum production, thereby requiring additional treatments [3]. Patients with symptoms exacerbated by congestive heart failure were excluded from the study. Patients with advanced cancer whose disease stabilization could not be achieved were also excluded. Patients who had received oxygen therapy at home and required emergency visits were included. We reviewed the medical records of COPD patients hospitalized due to exacerbations in the corresponding periods of 2009 and 2010 as controls.

2.3. Data collection

Sociodemographic characteristics, smoking status, and maintenance treatments at baseline were recorded for each patient. The presence of comorbidities, including congestive heart failure, ischemic heart disease, chronic liver disease, chronic renal disease, diabetes, and cancer was also assessed [4]. Pulmonary function tests were performed under stable conditions within a year before the emergency visit or after recovery from the symptoms induced by the disaster. The severity of COPD was defined in accordance with the GOLD criteria [3]. The ADLs of patients upon admission and before the earthquake were evaluated by interviewing patients or their caregivers. ADLs were classified as "good" if they could live without support, "fair" if they could not leave their residence without support or "poor" if they spent days in bed or in a chair and had lost the ability to move independently. Data relating to symptom exacerbation including the final diagnosis, treatment, and length of hospital stay were collected as well.

Patients were followed up at the outpatient clinic for over 3 months after discharge. If a patient was referred to another hospital, we contacted the institution and inquired about the patient's clinical course.

2.4. Statistical analyses

Individual comparisons were performed using the Wilcoxon signed-rank test. The non-parametric Wilcoxon rank sum test was used for the comparisons of categorical variables. Simple regression analysis was performed using the least squares method. P values less than 0.05 were considered significant. All analyses were performed using JMP software (SAS Institute Inc., NC).

3. Results

We identified 100 COPD patients (112 episodes) who presented at the emergency department and required hospitalization within 6 months after the disaster. The characteristics of the patients are shown in Table 1. The diagnosis and clinical course of each patient is presented in Tables 2 and 3. The details are provided below.

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