REVIEW ARTICLE

Pulmonary Rehabilitation for Chronic Obstructive Pulmonary Disease in Natural Disaster Setting

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ABSTRACT

Introduction: The frequency of natural disaster in Indonesia has increased recently, while there were still less capacity to overcome the respiratory problem as an impact of disaster. Subjects who have chronic obstructive pulmonary disease (COPD) need to have more attention in dealing with disaster setting.

Methods: Literature reviews from the last ten years to find the data of the respiratory-related disease on disaster setting, which need pulmonary rehabilitation.

Discussion: Subjects with COPD can get worse aftermath of natural disasters. The number of COPD exacerbation aftermath disaster was increased 1.5 fold. Pulmonary rehabilitation by trained patient for the self-management of the symptoms was effective to reduce complication, increase the function and social integration.

Conclusion: Pulmonary rehabilitation by optimizing community based training for self-management was effective as preparedness for COPD patients in natural disasters.

Keywords: *Chronic Obstructive Pulmonary Disease (COPD), Community based training, Natural Disaster, Pulmonary Rehabilitation*

ABSTRAK

Pendahuluan: Frekuensi terjadinya bencana alam di Indonesia meningkat saat ini, sementara kapasitas untuk menangani masalah pernapasan sebagai dampak bencana masih terbatas. Subyek yang memiliki penyakit paru obstruktif kronik (PPOK) perlu mendapat perhatian terkait dalam menghadapi kondisi tersebut.

Metode: Kajian literatur dari sepuluh tahun terakhir untuk menemukan data penyakit yang berhubungan dengan pernapasan pada kondisi bencana yang membutuhkan rehabilitasi paru.

Diskusi: Subyek dengan PPOK memiliki lebih banyak masalah kesehatan setelah terjadinya bencana alam. Jumlah kekambuhan PPOK meningkat 1,5 kali lipat setelah kejadian bencana. Rehabilitasi paru yang telah diberikan pada pasien untuk manajemen mandiri untuk mengendalikan gejala, efektif untuk mengurangi komplikasi, meningkatkan fungsi dan integrasi sosial.

Kesimpulan: Rehabilitasi paru dengan pelatihan berbasis komunitas, efektif untuk manajemen mandiri pasien PPOK dalam persiapan menghadapi bencana alam.

Kata kunci: *Penyakit Paru Obstruktif Kronik (PPOK), Pelatihan berbasis komunitas, Bencana alam, Rehabilitasi paru*

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INTRODUCTION

The disaster risks have been increased recently due to the emergence of climate-related hazards which cause problems especially in coastal cities. Although the risks are obvious, many cities in Indonesia, which are surrounding by variety of potential natural disasters do not seem to have enough capacity to cope with the challenges and less disaster preparedness.[1,2]

The richness of natural resources along with the geographically located in the ring of fire mountain formations in equator region placed Indonesia as a supermarket of natural disaster. Pascapurnama et al studied some natural disasters in Indonesia to develop ideas on how to minimize health risks following natural disasters and to ensure good quality of life for people. For the past decade, Indonesia is a disaster-prone country that has natural disasters, i.e. earthquake, volcano erruption, tsunami or flood, landslide, liquifraction or forrest fire. Those situation have revealed the importance of disaster preparedness, mitigation of special needs people with certain kind of disease or disability and further emerging post disaster planning.[1,2,3]

DISCUSSION

Impact of Natural Disaster in Health Status

Disaster could be impact in subjects with respiratory disease, and it could be live threatening.[1,2,3]

Following such natural disasters, there were number of death victims and damaged of infrastructure, could be the threat to the health condition, especially the emergence of infectious diseases, the most frequent were diarrhea and acute respiratory infections (ARI). The infection on respiratory may interfere the breathing pattern, especially in subjects with COPD. Infection may cause by viral and bacteria, i.e. dengue, malaria, measles, and tetanus.

Natural disasters also result in "aftereffects" such as displaced populations (including internally displaced persons (IDPs) and refugees), poor sanitation, overcrowded space, and limited health supplies in evacuation center that might increase the possibility of infectious disease outbreak and worsen conditions for survivors. Aftereffects increase the transmission of infectious disease among survivors.

The spread of a disease becomes more likely as the number of evacuated people increases. Aside from environmental changes and poor situations at evacuation centres, it is considered that people's knowledge and awareness of health risks also becomes one factor determining the occurrence of the infectious diseases.

To minimize the impact, it need collaboration among institution for preventive post-disaster infectious diseases, The preventive programs should be integrated into disaster risk reduction (DRR) and management plans, and must be done together as integrated team by government, non-government organization (NGO), non-profit organization (NPO), public health and humanitarian professionals.[2,4]

Impact of Disaster on Individu with COPD

Cold winter temperatures and damaged houses or emergency shelters compounded these conditions. Such unfavorable conditions are likely to result in the increased occurrence of respiratory infections. The inhalation of dust and fine particles from rubble and tsunami-sludge also make breathing difficult. It has been reported that air pollution is an important risk factor for the exacerbation of COPD. Many buildings in Ishinomaki were destroyed by the tsunami, and a thick layer of mud covered the entire area. Thus, chemicals, particulates, and biological materials from debris and tsunami-sludge may have contributed to the worsening of respiratory symptoms among COPD patients in the area hit by the tsunami.

The direct cause of respiratory disturbance by many inhalant materials will enter the respiratory system during periods of disaster, developed inflammation of the airway, allergic reaction, obstructions, infections, irritations, suffocations might happened. The indirect cause of respiratory disturbance by the neuromuscular problem cause by traumatic brain injury, high spinal cord injury and multiple thoracic trauma that effect the breathing mechanism, impaired of lung compliance or central cough mechanism.[3,5,6]

People with chronic diseases, especially related with respiratory disease its self, such as chronic respiratory disease, in example; COPD or asthma, determined to be worsen after a disaster. These disasters may exacerbate those chronic respiratory diseases.. 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. [1,3,4,5,6]

All COPD patients enrolled in COPD network in Japan before the great earthquake had a better self-management for their COPD symptoms which continued with optimal post disaster program and good adherence in following prescribe pulmonary rehabilitation program.[4,6]
According to literature review around the last ten years, were collected to find the data of the respiratory related disease in disaster setting with the needed of pulmonary rehabilitation after a disaster for certain disease as chronic respiratory disease.[4,6]

Similar with an earthquake with tsunami that was happened in Aceh, Sumatera, Indonesia on the year of 2004, a 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. 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.[3,4,6]
Recent reports have also demonstrated that physical inactivity is a risk factor for symptom aggravation and mortality in COPD. After the earthquake and tsunami in the Ishinomaki region, over 40,000 evacuees stayed at crowded emergency shelters, where they had to lie down on the floor without beds. Elderly patients with COPD were largely sedentary, which led to ADL deterioration. Furthermore, impaired ADLs and poor oral hygiene induced swallowing dysfunction, which can in turn exacerbate COPD

The Prevalence of COPD in Disaster
Kobayashi et al identified 100 COPD patients (112 episodes) who presented at the emergency department and required hospitalization within 6 months after the Tohoku disaster. During the 6-month study period, 63 patients with exacerbations (68 episodes) presented at the emergency department requiring hospitalization. Five patients were hospitalized twice during the study period.

The number of patients hospitalized due to COPD exacerbations each week is shown the total number increased 1.5- fold and 1.3-fold compared to the corresponding periods in 2010 and 2009, respectively. The number of patients increased during the period from 3 to 5 weeks after the earthquake and then decreased.[4]

Kobayashi classified the patients into 3 groups in terms of the time of hospitalization after the disaster: the acute phase (first 2 weeks after the earthquake), the sub acute phase (from weeks 3 to 5), and the chronic phase (from 6 weeks to 6 months). The number of patients admitted while in the sub acute phase significantly increased compared to the corresponding periods in 2010 and 2009.

Clinical Finding and Functional Status of COPD Patients in Disaster

There were no significant differences between the patients in the acute and sub acute phase group as compared to those in the chronic phase group in terms of age, FEV1, percentage of predicted FEV1, regular medication, or long-term oxygen therapy.

The deterioration in ADL upon admission was significantly different between the groups. The ADLs of patients were significantly decreased compared to that before the earthquake in the acute phase and sub acute phase group. In contrast, no reduction in ADL was observed during the chronic phase. All patients with exacerbations were treated in accordance with the consensus guidelines.

Nevertheless, there was a high incidence of symptom exacerbation among those patients staying at the evacuation center. Symptom severity was likely exacerbated by the facility's poor insulation and the interruption of regular treatment. Some patients had been drenched by the tsunami, while others, prior to their hospital visit, stayed in houses or shelters that not only lacked oxygen supplies but also lacked heating systems or water supplies. Some patients were also deprived of their prescribed drugs, and this interruption of regular treatment may have partly contributed to the worsening of symptoms.[4]

The findings of our study indicate that the Great East Japan Earthquake had a strong negative impact on clinical out- comes among COPD patients. In the acute phase of the disaster, patients with very severe COPD sought refuge in our hospital and were provided with oxygen therapy. A population 3 times as big was admitted due to exacerbated symptoms. During the chronic phase, the frequency of admission due to exacerbations returned to baseline levels.[4]

The symptoms of many patients worsened during the sub acute phase. The number of patients hospitalized due to exacerbated symptoms was 3 times higher than those hospitalized during the corresponding period in 2009 or 2010. First, interruption of regular treatment may have resulted in increase in exacerbations of COPD. In addition to the factors cited above, tracheobronchial infections may be associated with worsened COPD symptoms. Previous reports demonstrated that respiratory infections increased in the aftermath of a massive earthquake.

In Ishinomaki and the surrounding areas, habitants suffered insufficient fuel supplies, power failures, water and food shortages, and an inability to maintain the appropriate level of personal hygiene.

The deterioration of ADLs in the acute and sub acute phases after the disaster resulted in increased number of hospitalizations. It was previously reported that physical disability was an independent risk factor for death after the Hanshin–Awaji earthquake and the 1999 Taiwan earthquake. However, those reports investigated mortality in the acute phase, but not hospitalizations in the sub acute or chronic phases.4

Management of COPD in Disaster

Mechanical ventilation was required in 7 patients with NPPV and 1 patient with invasive

mechanical ventilation. The in-hospital and 90-day mortalities of patients with exacerbations of COPD were 5.9% (4/68) and 13.6% (8/59), respectively. At 90 days, 9 patients had been lost to follow-up. Six patients were treated conservatively, and 2 patients underwent thoracoscopic surgeries. Seven patients were cured, but 1 patient with very severe COPD required invasive mechanical ventilation and died due to complicating pneumonia. Six and 7 patients with pneumothorax were identified in the years 2009 and 2010, respectively. No patient included in the study experienced a pulmonary embolism.[4]

During the acute phase, most of the COPD patients who presented at the hospital were seeking oxygen therapy. In Japan, home oxygen therapy is widely used for patients with chronic respiratory failure and is covered by the national healthcare insurance system.

Since the Hanshin–Awaji earthquake in 1995, medical personnel and oxygen-service providers have recognized the importance of managing oxygen-dependent patients during a disaster and have established emergency operation measures. The wide-scale disaster of 2011, however, was more catastrophic than predicted in even the most pessimistic scenarios. Fortunately, we were able to accept many oxygen-dependent patients who were normally treated at other clinics in addition to our own outpatients.[4]

The evacuees were not hospitalized because casualties who were seriously ill occupied all of the hospital beds. Instead, each COPD patient was provided with a continuous oxygen supply via the central gas piping system in the outpatient ward. The unexpectedly high number of patients exceeded the facility's capacity for sound care. A temporary oxygen therapy center inside the hospital using electric oxygen concentrators. This area had been used as a rehabilitation center before the disaster and lacked an oxygen piping system. Trained nurses in the Respiratory Medicine Department were assigned to the evacuation center to provide medical care, and respiratory physicians visited each outpatient every day.

The number of patients presenting with COPD exacerbations declined in the chronic phase as compared to the sub acute phase.

The recovery of water and food supplies, the restoration of vital infrastructure and medical services, and the improvement in living conditions may have contributed to this phenomenon. In Ishinomaki and the surrounding cities, medical relief teams circulated around community evacuation centers and prescribed medications for patients with chronic disease. These efforts minimized the interruption of treatment during the chronic phase.

Complication of COPD in Disaster

Diagnoses of pneumothorax and pulmonary embolism should be considered in COPD patients reporting exacerbated symptoms, even in the aftermath of natural disasters. In this study, we identified 8 patients with pneumothorax, and none with pulmonary embolism. Patients whose symptoms had worsened underwent comprehensive evaluation, including chest radiography, which led to the detection of pneumothorax in several patients. This Kobayashi report is the first retrospective study to determine outcomes in patients with COPD

who experienced a large-scale natural disaster in a developed nation with an aging population.[4]

Although pulmonary complications, such as chest trauma or respiratory infection, are commonly recognized after natural disasters, the impact on the outcomes of COPD patients had not previously been clarified. The results of many study indicate that patients with COPD will suffer substantially in the aftermath of natural disasters, except those who trained to have self-management for their COPD symptoms and good behavior in maintaining previous pulmonary rehabilitation program.[4,6]

Pulmonary Rehabilitation on Individu with COPD in Disaster

Since medical rehabilitation services are often poorly developed in disaster affected regions and not highly prioritized by responding teams, physical and rehabilitation medicine (PRM) has historically been underemphasized in global disaster planning and response. Recent development of the specialties of "disaster medicine" and "disaster rehabilitation" has raised awareness of the critical importance of rehabilitation intervention during the immediate post-disaster emergency response.[3]

Pulmonary rehabilitation has been defined as "a multidimensional continuum of services directed to persons with pulmonary disease and their families, usually by an interdisciplinary team of specialists, with the goal of achieving and maintaining the individual's maximum level of independence and functioning in the community". [5]

Pulmonary Rehabilitation interventions can include exercise, respiratory muscle rest and support, education, emotional support, oxygen, airway secretion clearance, promoting compliance with medical care, facilitating return to work, and a more active and emotionally satisfying life. These goals are appropriate for any patients with diminished respiratory reserve whether due to obstructive or intrinsic pulmonary diseases (oxygenation impairment) or neuromuscular weakness (ventilatory impairment). [5]

Regarding the Kobayashi report on dividing the post disaster as acute, sub acute and chronic setting, in the first and applicable management in every kind of setting is breathing retraining. Effective breathing management, combine with relaxation techniques, pulsed lip breathing, diaphragm breathing and energy conservation in activity daily living as tolerated with the situation.[4,5]

Airway secretion clearance is crucial because exacerbations of COPD are common in the disaster setting and frequently caused by trapping of airway secretions in the peripheral airways. Many patients also got lack of medication for stabilizing their symptoms, even limited access to home oxygen therapy due to destruction of the infrastructure at disaster. The patient's cough may be weak or ineffective as a result of increased airway collapse in more central airways, and frequent bouts of coughing are fatiguing. Providing a comprehensive airway secretion management in rehabilitation intervention is also one of the very important strategies to apply.[3,5,6,7,8]

The first main goals in Pulmonary Rehabilitation in Disaster Setting are maintaining the pulmonary compliance, lung growth in

developmental lung or children, and chest-wall mobility, also continuously maintain normal alveolar ventilation by assisting inspiratory muscles as needed and provide functional coughs by assisting expiratory muscles.[3,5]

Pulmonary compliance is lost because the ability to expand the lungs to the predicted inspiratory capacity is lost as the VC decreases. As the VC decreases, the largest breath that one can take can only expand a small portion of the lungs. Like limb articulations and other soft tissues, regular range of motion (ROM) is required to prevent chest-wall contractures and lung restriction. This can only be achieved by providing deep insufflations, air stacking, or nocturnal NIV. This is a function of bulbar muscle integrity. Patients who cannot close the glottis and, therefore, cannot air stack, must be passively insufflated using a Cough-Assist (Respironics International Inc., Murrysville, PA) or pressure-cycling ventilator at pressures of 40 to 70 cm H2O. The maximum passive insufflation volume can be termed the "Lung Insufflation Capacity" or LIC. [5]

Adaptation techniques to ADL in further setting depends on patient conditions and regular endurance exercise such sit to stand, walking and functional ADL exercise also variety of community based breathing exercise in group or individually can be applied as tolerated.[5,6,8,9,10]

The Goal of Rehabilitation Program on COPD in Disaster

The Committee of Rehabilitation on Disaster Relief (CRDR) of International Society of Physical and Rehabilitation Medicine (ISPRM) seeks to 'effectively focus the resources of ISPRM and its membership on optimizing the health, functioning and quality of life of persons who sustain injuries or impairments due to a large-scale natural disaster". As defined by the WHO's International Classification of Functioning, Disability, and Health (ICF), "functioning" comprises health domains such as body functions and structures as well as activity and participation in the persons' environment. [1,3]

Strategic goals developed by the CRDR to achieve its mission include providing post-disaster rehabilitative services, including an emergency rapid response team capability facilitating coordination between various disaster responders, including humanitarian relief and governmental organizations, disabled persons organizations and local providers over the disaster response, providing rehabilitation education and training to disaster responders, host personnel, caregiver and community.

Specifically for survival victims with previous chronic respiratory disease, such as COPD or the aftermath respiratory patient to respiratory disruption due to disaster, based on functional management of rehabilitation, to be concerned into these criteria, consist of neuromuscular impairment (restrictive problems), obstructive problems, airway secretion problems, endurance problem and ADL limitation. [1,3,5]

CONCLUSION

Subjects with COPD may have aggravated of clinical symptom and decline physical function as the impact of natural disaster. The strategy of Rehabilitation Medicine Program with specific goals on COPD patients in disaster

is needed to improve respiratory function, activity daily living, and quality of live. The committee of Rehabilitation on Disaster Relief (CRDR) in Indonesia need to establish, as a team of collaboration among government, non-government, NGO, public health community, and volunteer.

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