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Emergency Medicine's Role in the Management of a Respiratory Illness Multiple Casualty Incident

Maryam Feli, Kambiz Masoumi, Arash Forouzan, Ali Asgari Darian, Ali Delirrooyfard, Alireza Rafati Navaii and Farshad Fathi

Department of Emergency Medicine, Imam Khomeini Hospital, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran

Corresponding Author: Arash Forouzan, Department of Emergency Medicine, Imam Khomeini Hospital, Azadegan Ave, Ahvaz, Iran Tel/Fax: +986112229166

ABSTRACT

This cross-sectional retrospective descriptive study was performed to determine the role of the emergency medicine in the management of thunderstorms associated asthma Multiple Casualty Incident (MCI) and to give an overview of affected patient characteristics. Eligible participants were all patients presented to the ED with acute bronchospasm, between 2nd-7th November, 2013. Not only available medical records of all patients were gathered and analyzed, retrospectively but also the effectiveness of the MCI plan designed by emergency medicine was reviewed. There was no gender priority in the studied population (201 male, 242 female). The majority of affected patients were aged between 20-40 (278 out of 443). Only 40 patients of all 443 were admitted (37 in the pulmonary ward and 3 in the ICU). No mortality in the ED was reported. Over 50% of patients had a positive history of asthma, allergies have been treated at least once for shortness of breath or asthma previously. Our findings illustrate that described respiratory illness MCI seems to have a benign course, since the majority of patients discharged home. Besides, the designed protocol for treatment of patients and managing the MCI were obviously effective.

Key words: Emergency medicine, multiple casualty incident, thunderstorm associated asthma, air pollution, acute bronchospasm

INTRODUCTION

Emergency Medicine (EM) serves a crucial role in the evaluating, preventing, managing and treating unexpected illness and injuries (Hawkins, 2004). It provides access to unplanned but needed health care. Besides, EM is supposed to implicate rapid assessment and treatment of undifferentiated diseases (Richardson and Hwang, 2001). The EM not only meet the day-to-day treatment needs but also provide planning and leadership for disaster and multiple casualty incident preparedness.

Multiple Casualty Incident (MCI) is essentially any medical emergency with more than one patient, where the number of patients and the severity of their injuries do not exceed the capability of the facilities (Albanese *et al.*, 2014; Murray and Goodfellow, 2002; Sammut *et al.*, 2001). This term is used to trigger a change in handling patients and allocating resources to the most patients possible. After declaration of the MCI, patients are handled in order of severity rather than first come. In the other words patients with life-threatening or multiple system injuries are treated first. This process is called triage, which is a fundamental part of the MCI plan (Iserson *et al.*, 2007).

In November, 2013, Blinded for Peer Review, a city in southwest of Blinded for Peer Review experienced, a sudden surge in respiratory illness following the occurrence of a thunderstorm. During the night of Saturday, 2nd November, 2013 nine major hospitals of the city met a respiratory illness MCI, which was continued for several days. Although, thunderstorm associated asthma does not assume that a formal asthma diagnosis has been made but this term has been used widely throughout the world to describe any observed increase in the number of acute bronchospasm cases following thunderstorms (Dabrera *et al.*, 2013). Several previous episodes have been reported this phenomenon but none of them were in Blinded for Peer Review (Dabrera *et al.*, 2013; Elliot *et al.*, 2014; Forouzan *et al.*, 2014; Howden *et al.*, 2011).

In the present study, we chose one out of nine hospitals and aimed to review the role of emergency medicine in a comprehensive management of the thunderstorm associated asthma MCI during the first six days. Moreover, an overview of affected patients in regard to demographic data, treatment response and their outcome was provided.

MATERIALS AND METHODS

This cross-sectional descriptive study was conducted retrospectively with two folds. First, reviewing the role and preparedness of the Emergency Department (ED) of Blinded for Peer Review in response to a respiratory illness MCI. Second, giving an overview of subjects in regards to age, gender, previous history and treatment of asthma and the outcome of patients, including; (discharge, admission to the ward and ICU admission). Blinded for Peer Review Hospital has 500-beds with almost 100,000 patients consumes each year in the ED.

For the purpose of analysis, the episode period was defined as the six day period from 2nd-7th November, 2013. The episode period patient number was compared with the mean number of acute bronchospasm patients four weeks prior to the MCI. The eligible subjects were patients presenting to the ED with dyspnea, wheezing and cough, which were considered as acute bronchospasm presentations.

A protocol for the management of the illness along with a Multiple Casualty Incident (MCI) plan were designed by emergency medicine faculty members. In the present survey, we investigate the efficacy of these protocols.

During the first hour, the emergency medicine specialist, who were in charge of the ED, provided an early notification to prepare the hospital for larger than expected numbers of patients. After confirmation of an alert was determined, the MCI management plan was activated to provide guidance, coordination and awareness in the hospital. A fundamental part of the plan was triage, which was conducted based on the Emergency Severity Index, version 4 (ESI, 4) by a trained nurse (Green *et al.*, 2012; Jafari-Rouhi *et al.*, 2013; Tanabe *et al.*, 2007). Patients stratifying as level 5 were referred to the fast tract, they discharged home after prescription of adequate medicine. Level 3 and 4 were referred to the acute care and level 1 and 2 were transferred to the CPR immediately. Other parts of the MCI plan were consisted of mobilizing enough medical resources and staff to control the overcrowded ED.

The MCI plan, designed by emergency medicine faculty members, was supervised by an emergency medicine specialist in each shift. This individual was effectively in charge of completing the diagnostic and therapeutic cascade for all patients. A senior hospital administrator worked along side to mobilize hospital resources to control the incident. Additional supplies of oxygen and drugs were restocked in the earliest time possible. Portable cylinders of oxygen were borrowed from

wards to be used for patients seated in the corridors or extra beds in the ED. In the case of overcrowded ED, additional medical staff including; emergency medicine residents and ED nurses called from home.

Acute bronchospasm treatment was consisted of: Short-acting β_2 agonist, anticholinergic (inhaled or nebulized) and systemic corticosteroid as the first line treatment. Moderate to severe attacks or patients with an inappropriate response to the first line drugs were treated with intravenous magnesium sulfate. In the case of severe attacks or near to arrest patients, intramuscular epinephrine was administered.

All medical records of mentioned subjects were gathered and a questionnaire was completed for each individual. The total number of documented patients along with their demographic data were analyzed.

RESULTS

During six days MCI the report of 443 patients with acute bronchospasm attended the ED were documented. This number compared to the mean number of attending patients during the past four weeks, which was almost 44 patients, was considerably high (Table 1). Of all 443 subjects (201 male, 242 female), 278 were aged between 20-40, only 21 patients were over 60 years old. The majority of patients (45.8%) present to the ED during the evening till midnight (Table 2).

Almost all patients complained of dyspnea and the second most frequent symptom was cough, that was presented in 330 (75.3%) of patients. Previous medical history in 385 of the patients was recorded and that of 58 of them was not available. Of all 385, 227 (59%) had a positive history of asthma, allergies or have been treated at least once for shortness of breath or asthma previously. Anticholinergic and β_2 agonist were administered for 404 patients. Single dose oral corticosteroid was administered in the majority of patients, single dose intravenous corticosteroid was administered in patients with severe symptoms or in the case of shortage of tablets. Twenty eight and 11 patients received magnesium sulfate and epinephrine as the first line, respectively. This happened as a result of severe symptom of patients or a shortage of nebulizer and Metered Dose Inhaler (MDI). Totally 110 and 26 patients received magnesium sulfate and epinephrine

Table 1: No. of affected patients with acute bronchospasm during control periods

Control period	No. of patients	Mean
3rd-8th October	40	44
10th-14th October	45	
17th-23th October	48	
26th-30th October	43	

Table 2: Characteristics of patients presenting with acute bronchospasm during 5 days respiratory multiple casualty

Parameters	No.	%
Age (year)		
<20*	28	6.1**
20-40	278	62.8
40-60	116	26.2
>60	21	4.7
Gender		
Female	242	45.4
Male	201	54.6
Time of presentation		
6 am-12 am	56	12.6
12 am-6 pm***	89	20.1
6 pm-12 pm	203	45.8
12 pm-6 am	95	21.4

*Years old, ***Am: after midnight, Numbers (%), **Pm: Pre-midnight

Table 3: Relationships between different factors and outcome of patients presenting with acute bronchospasm during 5 days respiratory mass casualty

Parameters	Discharge	Admit	Total	p-value
PMH*				
Negative	143	15	158	0.936
Positive	206	21	227	
Age (year)				
<20**	20	0	20	0.014
20-40	245	33	278	
40-60	112	4	116	
>60	18	3	21	
Gender				
Female	208	34	242	<0.001
Male	195	6	201	
Time				
6 am-12 am	53	3	56	0.083
12 am-6 pm***	76	13	86	
6 pm-12 pm	189	13	202	
12 pm-6 am	84	11	95	

*PMH: Past medical history, Am: After midnight, **Years old, ***Pm: Pre-midnight

respectively. Four hundred and three patients were discharged after controlling the clinical signs and symptoms, 37 patients were admitted to the Pulmonary ward and 3 were admitted to the Intensive Care Unit (ICU). One of three ICU admitted patients was incubated. The admission was not significantly higher in patients with positive history of asthma ($p = 0.94$) or who received epinephrine and magnesium sulfate ($p = 0.64$, $p = 0.97$). The number of female patients who need admission was significantly higher than that of male patients (34 of 242 vs. 6 of 195, $p < 0.001$). Besides, a significant difference was detected in different age group in regard to admission ($p = 0.015$), admission rate was not higher in patients with a positive past medical history ($p = 0.93$) (Table 3). The MDI β_2 agonist, systemic methylxanthine and oral corticosteroids were prescribed for those who discharged to be used at home. All patients were referred to the Pulmonology clinic for further evaluation.

DISCUSSION

The present study is the first reported Blinded for Peer Review occurrence of epidemic asthma or shortness of breath after a thunderstorm. The effects of respiratory illness MCI on the health care services and the general population is not clear. More observational studies of the affected patients along with a follow-up protocol should be designed to clarify that "who are at risk for such respiratory illness episodes?" and "what is the long-term outcome of them?". Although, there are several studies on the thunderstorm associated asthma and its probable etiology but the available evidences in Blinded for Peer Review or even Blinded for Peer Review are too little.

Published evidence suggested a considerable impact of thunderstorm for excess asthma episodes (D'Amato *et al.*, 2008; Girgis *et al.*, 2000). However, patient characteristics were different throughout the episodes. Several descriptive studies suggest that affected people may not have been previously known cases of asthma (Venables *et al.*, 1997). Some other surveys reported that positive history of hay fever or atopy could increase the risk of the thunderstorm associated asthma (Dabrera *et al.*, 2013). In the present study, 59% of our patients were asthmatic or at least have been treated before with MDI because of asthma or shortness of breath.

Previous studies revealed the thunderstorm associated asthma affect young adults the most (Al-Rubaish, 2007). These findings are in a line with ours, since the majority of our patients (62.8%) were aged between 20-40. The etiology of the thunderstorm associated asthma has not been

well-recognized but the possible role of aeroallergens such as pollen grains and fungi, spores or molds has been investigated previously. Sudden rise in such air-born allergens before and during a thunderstorm could trigger airway hyperactivity and bronchospasm. The second possible cause is chemical pollutants. Nitrogen dioxide, ozone, sulfur dioxide and particle matters are the main factors of air pollution. The last cause is meteorological conditions i.e. dust, humidity, temperature, atmospheric pressure and lightning strikes (Al-Rubaish, 2007; Celenza *et al.*, 1996; Dabrera *et al.*, 2013).

Comparing the total number of presenting patients during the 6 days MCI with the equivalent number of 4 control period reveals that the ED encountered to approximately 10 folded higher patients than that of its usual. This overcrowded ED without a comprehensive management and a clear treatment plan could result in considerable numbers of misdiagnosed and mistreated patients. Our findings declared that the respiratory illness MCI, apart from its poor known cause, was inclusively controlled with mentioned plan. It seems that an exclusive supervising of all medical and human resources of the ED by an emergency medicine specialist, as the commander, led to this favorable consequence.

In view of the fact that, there is obviously little evidence in regard to mentioned parameters in our region. We suggest a systematic collaborative study for daily measurement of aeroallergens, chemical pollutants and meteorological conditions. Such comprehensive data, along with an organized approach for daily record of the number of hospitalizations and the mortality rate of respiratory illnesses could reveal which pollutants would be more associated with or which individuals are more susceptible to the episodes. The more imperative consequence of this systematic approach is designing an effective and feasible early warning system. Such system could warn the emergency departments about the potential outbreak of respiratory illness. Therefore, they can easily restock required medical resources and staff.

CONCLUSION

Our findings illustrate that described respiratory illness MCI seems to have a benign course, since the majority of patients discharged home. Besides, the designed protocol for treatment of patients and managing the MCI were obviously effective.

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