

ORIGINAL

Asthma exacerbations after the East Japan Disaster

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Abstract : On March 11, 2011, a 9.0-magnitude earthquake struck east Japan, following tsunami. Many people are forced to live in evacuation shelters without enough life-saving drugs. Asthma control for management of health crisis is required, because asthma exacerbation is a major cause of morbidity, can need acute care and results in death. However, it remains obscure what parameter should be used in primary clinic of evacuation shelters. The objective of this study is to elucidate the practical efficacy of asthma assessment tool in primary clinic for victims of this disaster. Asthma control test (ACT), a brief and patient-based tool to evaluate asthma control, was conducted for 17 patients with asthma in evacuation shelters at Tohoku district. Total sum of ACT scores were significantly decreased after this disaster. Significant decreases were observed for the items ; “Asthma keeps you from getting much done at work”, “Shortness of breath”, “Asthma symptoms wake you up” and “Patient rating of control”. ACT, an easy and practicable tool, clearly demonstrated the asthma exacerbation in evacuation shelters without the use of lung function testing. ACT may contribute to the management of health crisis not only for this East Japan disaster but also for the other forthcoming unavoidable disasters. *J. Med. Invest.* 60 : 61-65, February, 2013

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INTRODUCTION

A 9.0-magnitude earthquake and following tsunami destroyed east coastal cities in Japan on March 11, 2011. Over 28500 persons were dead or still missing, and 350000 people are forced to live in 2500 evacuation shelters without enough life-saving drugs (1, 2). Management of health crisis is required for all physicians. It has been known about the increasing lower respiratory symptoms associated with worsened asthma after disaster (3-7). Management of asthma control is also required

because exacerbated asthma in disaster caused the increase in asthma admissions at the affected area (6, 7). A previous study indicated the efficacy of the restriction of airflow, expressed as the forced expiratory volume in one second (FEV_{1.0}) as % of predicted value, as it's predictor (5), but it is difficult to conduct pulmonary function tests for patients in evacuation shelters. Therefore, to assess asthma control, a simple and accurate tool is necessary for disaster medicine in emergency clinic.

The asthma control test (ACT) has been developed as a brief and patient-based assessment tool to evaluate asthma control without the use of lung function testing (8). It might be easily incorporated into the routine assessment of patients with asthma. We, therefore, conducted this study to elucidate the practical efficacy of ACT for patients with asthma in evacuation shelters.

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PATIENTS AND METHODS

Patients

We held outpatient emergency clinic in eight evacuation shelters at Kamaishi city of Tohoku district in Japan, from March 23 to 25 after a magnitude-9.0 earthquake on March 11, 2011. We conducted this study on daily practice for the victims in these evacuation shelters. All patients gave written informed consent prior to enrolment. A total of 179 patients visited our emergency clinics in this period. Diagnosis was made according to Internal Classification of Disease (ICD) (9). "Asthma" is also diagnosed based on ICD-9, 493; namely, bronchial disorder associated with airway obstruction, marked by recurrent attacks of paroxysmal dyspnea, with wheezing due to spasmodic contraction of the bronchi (9). Patients with leg edema were excluded because they had a fear of congestive heart failure.

Asthma Questionnaire

Patients gave written informed consent to conduct Asthma Control Test (ACT), a simple 5-questioned test for asthma, to examine depression and its severity according to their symptoms after this disaster. They were also retrospectively questioned as to their symptoms before the disaster. According to this purpose, we modulated ACT about the duration as below:

Q1) Before (After) the disaster, how often did your asthma prevent you from getting as much done at work, school or home?

Score 1. All of the time; Score 2. Most of the time; Score 3. Some of the time; Score 4. A little of time; Score 5. Not at all.

Q2) Before (After) the disaster, how often have you had shortness of breath?

Score 1. More than once a day; Score 2. Once a day; Score 3. 3 to 6 times a week; Score 4. Once or twice a week; Score 5. Not at all.

Q3) Before (After) the disaster, how often did your asthma symptoms (wheezing, coughing, shortness of breath, chest tightness or pain) wake you up at night or earlier than usual in the morning?

Score 1. 4 or more times a week; Score 2. 2 to 3 nights a week; Score 3. 1 night a week; Score 4. Less than 1 night a week; Score 5. Not at all.

Q4) Before (After) the disaster, how often have you used your reliever medication (such as your blue inhaler or rescue inhaler)?

Score 1. 3 or more times a day; Score 2. 1 or 2 times a day; Score 3. 2 or 3 times a day; Score 4.

Once a week or less; Score 5. Not at all.

Q5) How would you rate your asthma control before (after) disaster?

Score 1. Not controlled; Score 2. Poorly controlled; Score 3. Somewhat controlled; Score 4. Well controlled; Score 5. Completely controlled.

There is a score of 1-5 for each question, and an overall score in a range of 5-25, with low scores corresponding to a high level of symptoms and therefore poor asthma control.

Data analysis

Data were analyzed using Stat View version 4.5 for Macintosh (Chicago, IL). Changes in each score were compared before and after the East Japan disaster by the Wilcoxon signed-ranks test. A *p*-value of less than 0.05 was taken as significant.

RESULTS

Patients' Clinical Characteristics

Twenty-six patients (14.5%) were diagnosed as asthma because of paroxysmal dyspnea, wheezing and cough from March 23 to 25, 2011 in our outpatient emergency clinic of eight evacuation shelters at Kamaishi city of Tohoku district in Japan. Five patients were excluded because they were under 12 years old (8). Written informed consent was obtained from 17 patients, but an 84 years old woman could not complete ACT enough. So, 16 patients (8 men and 8 women) were enrolled in this study with 67 years of age (median; range, 15-79 yr). Five patients (2 men and 3 women) were newly-onset asthma after this disaster. Other eleven patients (6 men and 5 women) had taken bronchodilator therapy, and five of them (2 men and 3 women) had undergone inhaled corticosteroid therapy before this disaster.

Asthma exacerbations after the East Japan disaster

Changes of total sum of ACT scores before and after the East Japan disaster are shown in Figure 1 (a). Significant decrease ($p < 0.005$) was observed after this disaster. Changes of the 5 items of ACT scores before and after this disaster are shown in Figure 1(b)-(f), respectively. "Comparisons of reliever medication" showed no statistically significant differences ($p = 0.18$), but many patients could not take out rescue inhaler to their evacuation shelters because tsunami washed away entire communities. Therefore, we can not evaluate exactly this item

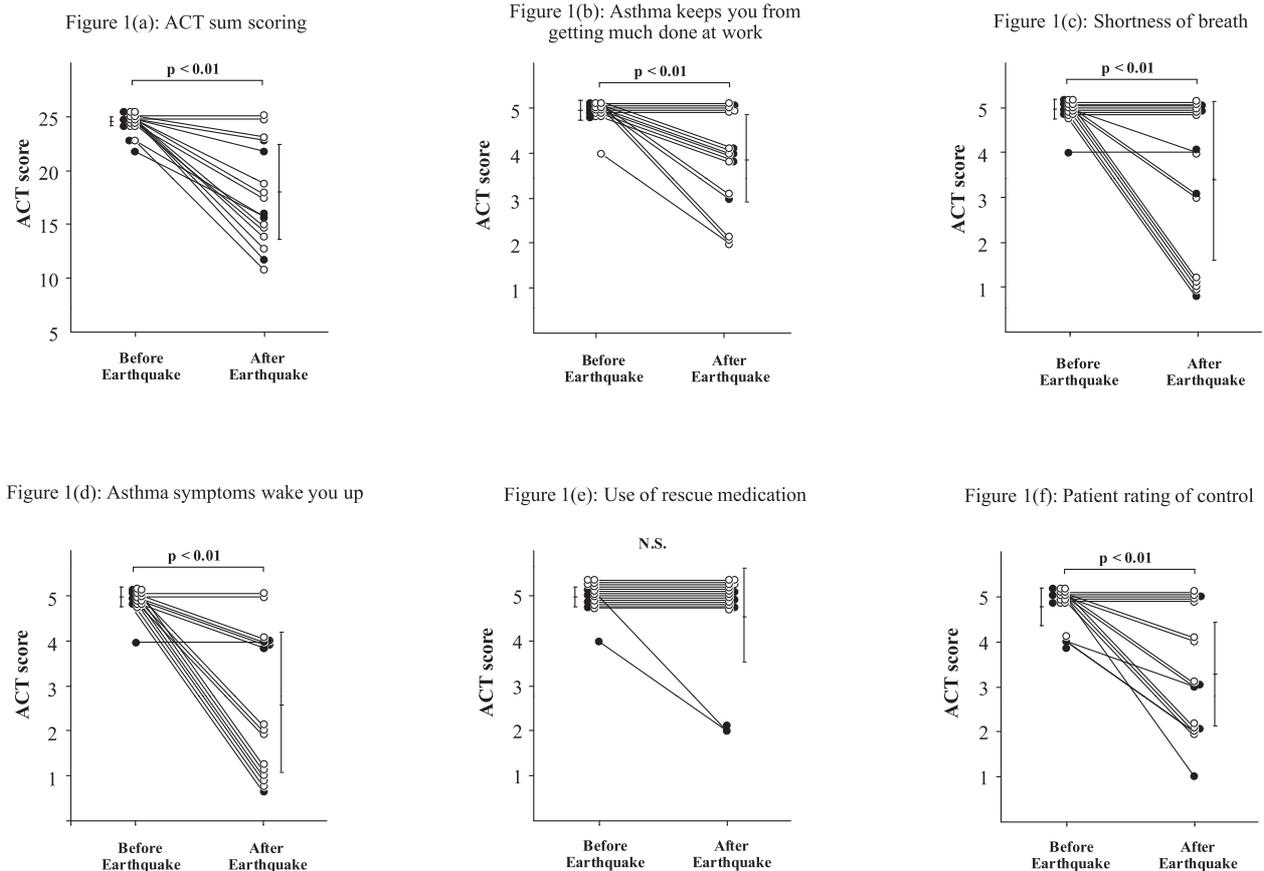


Figure 1 Individual data of Asthma control test (ACT) scores before and after the East Japan disaster. Each horizontal bar represents mean score (\pm standard error of the mean ; SEM). Closed circles and open circles represent patients undergoing steroid inhalation therapy and patients without steroid inhalation therapy, respectively. P values : Wilcoxon signed-ranks test.

Figure 1(a) : Individual data of ACT sum scores before and after the East Japan disaster.

Figure 1(b) : Individual data of ACT about “Asthma keeps you from getting much done at work” before and after the East Japan disaster.

Figure 1(c) : Individual data of ACT about “Shortness of breath” before and after the East Japan disaster.

Figure 1(d) : Individual data of ACT about “Asthma symptoms wake you up” before and after the East Japan disaster.

Figure 1(e) : Individual data of ACT about “Use of rescue medication” before and after the East Japan disaster.

Figure 1(f) : Individual data of ACT about “Patient rating of control” before and after the East Japan disaster.

for this disaster. Changes of ACT scores in other items questioned as Q1, 2, 3 and 5 are decreased significantly before and after this disaster ($p < 0.005, 0.01, 0.005$ and 0.05 , respectively). Statistically significant differences were not observed between with and without inhaled corticosteroid therapy.

DISCUSSION

The present study showed the asthma exacerbation in the East Japan disaster caused by a 9.0-magnitude earthquake on March 11, 2011 (1, 2, 10). Though an item about reliever medication was thought to be inadequate after tsunami disaster, ACT was useful for assessing asthma control of

outpatient emergency clinic in evacuation shelters without pulmonary function testing.

Disaster has been thought to be catastrophic events caused by supernatural forces, involving primarily the consequences of earthquakes, volcanic eruptions, cyclones and floods. Because it can occur on every continent in all over the world, it is important to prevent or mitigate disaster-related health events of victims. In this East Japan disaster, many people are still forced to live in evacuation shelters without enough life-saving drugs (1, 2). Therefore, management of health crisis is required for all physicians in devastated area. It has been known about the increasing lower respiratory symptoms associated with worsened asthma after disaster (3-7). Previous studies showed that mechanisms of asthma

exacerbation after disaster might be the results of viral respiratory infection in evacuation shelters, exposure to air pollutions and social anxiety (3-7, 11-15). Succeeding study (16) showed the persistent bronchial hyperreactivity in victims and discussed about the role of ambient particles after disaster. Another study also revealed that acute psychological stress alone increases airway inflammatory markers (17). Recently, importance of asthma control has been increasingly recognized because asthma exacerbation is a major cause of morbidity, can need acute care and results in death (8). Therefore, management of asthma control is also required for people in evacuation shelter. A previous study indicated the efficacy of the restriction of airflow, expressed as the FEV_{1.0} as % of predicted value, as its predictor (5). Since it is difficult to conduct pulmonary function tests for patients with asthma in evacuation shelters, it remains obscure what parameter should be used to predict exacerbations during and after disaster.

ACT, a simple 5-question test for asthma, was a brief, easy and accurate tool for assessing asthma control without requiring pulmonary function tests (8, 18). The 5 questions take less than a minute to answer and can be by the health care professional or the patient can complete the test themselves. The ACT was initially developed in a study which looked at 22 of the most common questions that doctors ask when talking to patients about asthma control, with 5 questions standing out as being the most accurate predictors (8). It has been shown that the ACT score is highly effective as a screen for uncontrolled asthma and predict Global Initiative for Asthma (GINA)-defined partly controlled or uncontrolled asthma in over 90% of cases (8, 18). The content of ACT is similar to other previously developed tools, such as Asthma Control Questionnaire (ACQ) and Asthma Therapy Assessment Questionnaire (ATAQ), that quantify asthma control. However, the distinguishing feature of ACT may be a patient-based asthma control. Additionally, the sum of counts method might be more practical in busy practice by reducing the time necessary to compute and to interpret an ACT score. It can be easily incorporated into the routine assessment of asthmatic patients by a patient-based method. It is also a more simplified assessment tool of asthma control than other previously developed tool, such as Asthma Control Questionnaire (ACQ) and Asthma Therapy Assessment Questionnaire (ATAQ) (8). As ACT is easy, valid and reliable instrument for asthma

control assessment, we conducted this practical study in patients with asthma evacuated from devastation of the East Japan disaster. The item about rescue inhaler or nebulizer medication was thought to be inadequate for this East Japan disaster, because many people evacuated from tsunami could not take out their life-saving drugs. But the results obtained in this study clearly indicate the usefulness of other items and total sum of ACT scores in a busy and confused temporary clinic with limited resources. According to ACT scores, we conducted Salmeterol/Fluticasone or Formoterol/Budesonide combination therapy. Decreases of symptomatic patients with asthma were observed one month after the outpatient emergency clinic in the same evacuation shelters (19). Therefore, we consider that ACT can provide a more simplified adequate assessment to prevent acute asthma exacerbation in evacuation shelters.

CONCLUSION

In conclusion, the present study clearly showed the asthma exacerbation after the East Japan disaster caused by a 9.0-magnitude earthquake followed by tsunami. ACT is a simple, accurate and practicable patient-based tool for assessing asthma control of evacuated patients. This finding indicates that ACT may contribute to the management of health crisis, not only for this on-going disaster but also for other forthcoming unavoidable disasters on every continent. This is a lesson from our East Japan disaster.

REFERENCES

1. Shibahara S : The 2011 Tohoku earthquake and devastating tsunami. *Tohoku J Exp Med* 223 : 305-307, 2011
2. McCurry J : Japan ; the aftermath. *Lancet* 377 : 1061-1062, 2011
3. Tomita K, Hasegawa Y, Watanabe M, Sano H, Hitsuda Y, Shimizu E : The Tottori-Ken Seibu earthquake and exacerbation of asthma in adults. *J Med Invest* 52 : 80-84, 2005
4. Lin S, Gomez MI, Gensburg L, Liu W, Hwang SA : Respiratory and cardiovascular hospitalizations after the World Trade Center disaster. *Arch Environ Occup Health* 65 : 12-20, 2010
5. Reibman J, Lin S, Hwang SA, Gulati M, Bowers

- JA, Rogers L, Berger KI, Hoerning A, Gomez M, Fitzgerald EF : The World Center resident's respiratory health study : new-onset respiratory symptoms and pulmonary function. *Environ Health Perspect* 113 : 406-411, 2005
6. Wagner VL, Radigan MS, Roohan PJ, Anarella JP, Gesten FC : Asthma in Medical managed care enrollees residing in New York City : results from a post-World Trade Center disaster survey. *J Urban Health* 82 : 76-89, 2005
 7. Brackbill RM, Hadler JL, DiGrande L, Ekenga CC, Farfel MR, Friedman S, Perlman SE, Stellman SD, Walker DJ, Wu D, Yu S, Thorpe LE : Asthma and posttraumatic stress symptoms 5 to 6 years following exposure to the World Trade Center terrorist attack. *JAMA* 302 : 502-516, 2009
 8. Nathan RA, Sorkness C, Kosinski M, Schatz M, Li JT, Marcus P, Murray JJ, Pendergraft TB : Development of the Asthma Control Test : A survey for assessing asthma control. *J Allergy Clin Immunol* 113 : 59-63, 2004
 9. [http : //www.icd9data.com/2011/Volume1/460-519/490-496/493/default.htm](http://www.icd9data.com/2011/Volume1/460-519/490-496/493/default.htm)
 10. Wiwanitkit V : Post-crisis ; earthquake, tsunami, radiation leak and rural health crisis in Japan. *Rural Remote Health* 11 : 1770-1771, 2011
 11. Busse WW, Lemanske RF, Gern JE : Role of virus respiratory infections in asthma and asthma exacerbations. *Lancet* 376 : 826-834, 2010
 12. Samoli E, Nstos PT, Paliatsos AG, Katsouyanni K, Priftis KN : Acute effects of air pollution on pediatric asthma exacerbation ; evidence of association and effect modification. *Envir Res* 111 : 418-424, 2010
 13. Strine TW, Mokdad AH, Ballz LS, Berry JT, Gonzalez O : Impact of depression and anxiety on quality of life, health behaviors, and asthma control among adults in the United States with asthma, 2006. *J Asthma* 45 : 123-133, 2008
 14. Bruzzese JM, Fisher PH, Lemp N, Warner CM : Asthma and social anxiety in adolescents. *J Ped* 155 : 398-403, 2009
 15. Wright RJ, Rodriguez M, Cohen S : Review of psychosocial stress and asthma : an integrated biopsychosocial approach. *Thorax* 53 : 1066-1074, 1988
 16. Banauch GI, Alleyne D, Sanchez R, Olender K, Cohen HW, Weiden M, Kelly KJ, Prezant DJ : Persistent hyperreactivity and reactive airway dysfunction in firefighters at the world trade center. *Am J Respir Crit Care Med* 168 : 54-62, 2003
 17. Ritz T, Ayala ES, Trueba AF, Vance CD, Auchus RJ : Acute stress-induced increases in exhaled nitric oxide in asthma and their association with endogenous control. *Am J Respir Crit Care Med* 183 : 26-30, 2011
 18. Schtz M, Sorkness CA, Li JT, Marcus P, Murray JJ, Nathan RA, Kosinski M, Pendergraft TB, Jhingran P : Asthma Control Test : reliability, validity, and responsiveness in patients not previously followed by asthma specialists. *J Allergy Clin Immunol* 117 : 549-556, 2006
 19. Ishiura Y, Fujimura M, Yamamoto Y, Ohkura N, Myou S : Importance of Allergic diseases in outpatient emergency clinic of evacuation shelters for the East Japan disaster. *Arerugi* 60 : 1321, 2012