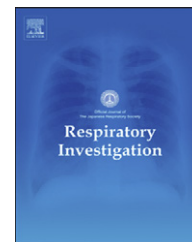




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## Original article

## Chest injuries and the 2011 Great East Japan Earthquake

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## ABSTRACT

**Background:** Chest injuries caused during a major earthquake remain unclear. We have described profiles of patients with chest injuries who were diagnosed and treated at the area that was most affected by the Great East Japan Earthquake in 2011.

**Methods:** We retrospectively reviewed medical records of 3938 patients who were transferred to the Japanese Red Cross Ishinomaki Hospital during the first week after the earthquake (March 11–17). In total, 77 patients were declared dead on arrival at the hospital. Of the remaining 3861 patients, 42 (1.1%) sustained chest injuries. Diagnosis of the chest injury was based on results of physical examination, chest radiography, and computed tomography.

**Results:** Chest injury was diagnosed in 42 patients, including 22 men and 20 women (age range, 21–99 years). The most common cause of injury was tsunami ( $n=21$ ), followed by falls ( $n=9$ ), and traffic accidents ( $n=1$ ), although this information was missing in 11 cases. The most common type of chest injury was superficial trauma such as laceration and contusion ( $n=37$ ). Only 5 patients had rib fractures with intrathoracic damages such as pneumothorax ( $n=3$ ), hemothorax ( $n=1$ ), and aspiration ( $n=1$ ).

**Conclusions:** The number of patients with chest injury was surprisingly small. Most patients did not require hospitalization. The small number of survivors with serious chest injuries can most likely be explained by the tsunami caused by the earthquake.

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## 1. Introduction

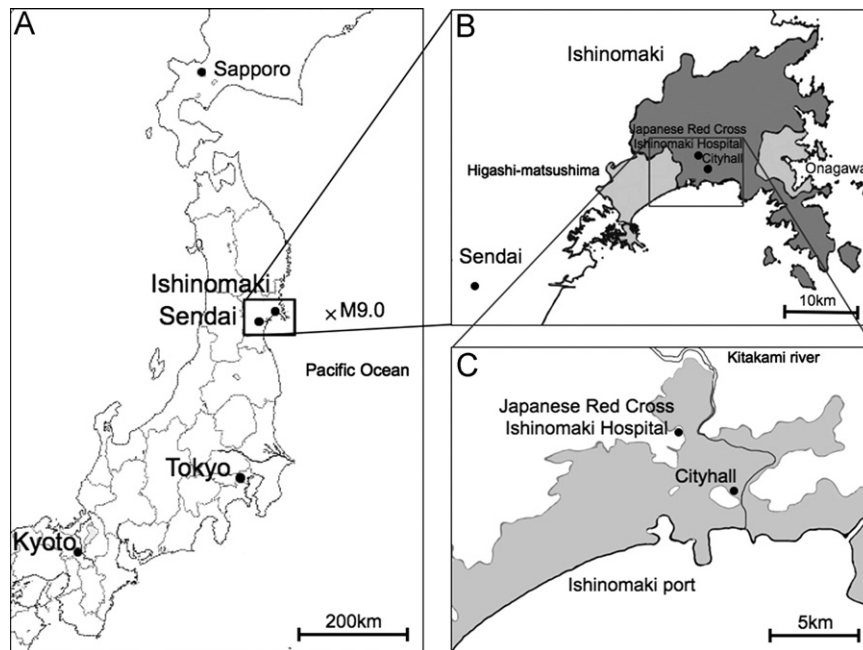
The 2011 Great East Japan Earthquake, measuring 9.0 on the Richter scale, struck Japan at 14:46 on March 11, 2011. A tsunami hit the northern part of Honshu (the main island), covering more than 800 km of the Pacific coastline and claimed nearly 20,000 lives. The greater Ishinomaki area (Ishinomaki city with the neighboring city of Higashi-Matsushima and the town of Onagawa), which is located on the coast and very near the epicenter (Fig. 1), had a population of approximately 220,000

before the earthquake; however, more than 4500 people were killed, and nearly 1300 are still missing.

Five kilometers inland, the Japanese Red Cross Ishinomaki Hospital (402 beds) was spared by the tsunami, and its facilities maintained an almost normal status. We continued to provide medical services for casualties, although scheduled outpatient services and surgical procedures had to be cancelled. Because our hospital was the only facility able to treat emergent patients from the devastated area, most injured patients were directly transferred to our hospital. In this study, we have described

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**Fig. 1 – Location of Ishinomaki city and the Japanese Red Cross Ishinomaki Hospital. (A):** The epicenter of the 2011 Great East Japan Earthquake was only 130 km from Ishinomaki city. **(B):** The greater Ishinomaki area (Ishinomaki city with the neighboring city of Higashi-Matsushima and the town of Onagawa) had a population of approximately 220,000 before the earthquake. More than 4500 people were killed and nearly 1300 are still missing. **(C):** More than 10% of urban Ishinomaki city, where nearly 100,000 people lived, was flooded due to the tsunami (shaded). The Japanese Red Cross Ishinomaki Hospital, 5 km inland, was spared from the tsunami.

profiles of patients with chest injuries, who were diagnosed and treated at the area that was most affected during the Great East Japan Earthquake in 2011.

## 2. Materials and methods

We retrospectively reviewed medical records of 3938 patients who were transferred to the Japanese Red Cross Ishinomaki Hospital during the first week after the earthquake (March 11–17). In total, 77 patients were declared dead on arrival at our hospital. Further, 42 (1.1%) of the remaining 3861 patients sustained chest injuries. Diagnosis of chest injury was based on results of the physical examination, chest radiography, and computed tomography.

## 3. Results

### 3.1. Changes in the number of patients

The numbers of patients with chest injuries who were treated and hospitalized are summarized in Table 1. During the first night (March 11), chest injuries were identified in 5 (5.2%) out of 97 patients who were treated at our hospital, and 2 patients were hospitalized. The number of patients who were treated increased to 768 on the second day; chest injuries were identified in 12 (1.6%) patients, including 3 who were hospitalized. The total number of treated patients further increased to 1228 on the third day; however, the number of patients treated for chest injuries decreased to 10 (0.8%), and none required hospitalization. Only 1

patient (0.3%) was treated for chest injury on the sixth day, and 3 (1.8%) patients were treated on the seventh day for chest injuries.

### 3.2. Cause of chest injury

The 42 patients with chest injury included 22 men and 20 women who were aged 21–99 years. The most common cause of injury was the tsunami in 21 (50.0%) cases, followed by falls in 9 (21.4%) cases and a traffic accident in 1 (2.4%) case. Information pertaining to the cause of injury was missing for 11 (26.2%) cases. One slightly wounded patient, who visited our hospital on the first night, had been hit by a vehicle while fleeing the tsunami. Four patients, who presented during the last 2 days, had lacerations on their thorax caused by falls in the shelters for evacuees.

### 3.3. Types of chest injuries

The most common type of chest injury was superficial trauma, such as laceration and contusion, which was observed in 37 (88.1%) cases; multiple rib fractures were found in 5 (11.9%) patients. These 5 patients also suffered intrathoracic damage, such as pneumothorax ( $n=3$ ), hemothorax ( $n=1$ ), and tsunami aspiration ( $n=1$ ). None of the patients had injuries to the cardiovascular system.

### 3.4. Profile of the hospitalized patients

As shown in Table 2, five patients with intrathoracic damage were hospitalized for further treatment. Their injuries were

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