—Short Communication—

Medical Relief Activities Conducted by Nippon Medical School in the Acute Phase of the Great East Japan Earthquake 2011

Akira Fuse, Yuki Shuto, Fumihiko Ando, Masafumi Shibata,
Akihiro Watanabe, Hidetaka Onda, Tomohiko Masuno and Hiroyuki Yokota

Department of Emergency and Critical Care Medicine, Graduate School of Medicine, Nippon Medical School

Abstract

At 14:46 on March 11, 2011, the Great East Japan Earthquake and tsunami occurred off the coast of Honshu, Japan. In the acute phase of this catastrophe, one of our teams was deployed as a Tokyo Disaster Medical Assistance Team (DMAT) to Kudan Kaikan in Tokyo, where the ceiling of a large hall had partially collapsed as the result of the earthquake, to conduct triage at the scene: 6 casualties were assigned to the red category (immediate), which included 1 case of cardiopulmonary arrest and 1 of flail chest; 8 casualties in the yellow category (delayed); and 22 casualties in the green category (minor). One severely injured person was transported to our hospital. Separately, our medical team was deployed to Miyagi 2 hours after the earthquake in our multipurpose medical vehicle as part of Japan DMAT (J-DMAT). We were the first DMAT from the metropolitan area to arrive, but we were unable to start medical relief activities because the information infrastructure had been destroyed and no specific information had yet reached the local headquarters. Early next morning, J-DMAT decided to support Sendai Medical Center and search and rescue efforts in the affected area and to establish a staging care unit at Camp Kasuminome of the Japan Self-Defense Force. Our team joined others to establish the staging care unit. Because information was still confused until day 3 of the disaster and we could not adequately grasp onsite medical needs, our J-DMAT decided to provide onsite support at Ishinomaki Red Cross Hospital, a disaster base hospital, and relay information about its needs to the local J-DMAT headquarters. Although our medical relief teams were deployed as quickly as possible, we could not begin medical relief activities immediately owing to the severely damaged information infrastructure. Only satellite mobile phones could be operated, and information on the number of casualties and the severity of shortages of lifeline services could be obtained only through a "go and see" approach. Because there was no way to transmit or receive this vital information, disaster workers in the affected areas faced many challenges. For the future, network data links need to be made more resistant to infrastructure damage, and redundant or reach-back systems involving multitiered satellite, wireless, and radio frequency data links would provide definitive solutions. Such integrated systems should be designed around seamless connectivity based on an "always best connected" principle for maintaining communication quality.
(J Nippon Med Sch 2011; 78: 397–400)

Key words: earthquake, tsunami, medical informatics, disaster planning

Correspondence to Akira Fuse, MD, PhD, Department of Emergency and Critical Care Medicine, Nippon Medical School, 1–1–5 Sendagi, Bunkyo-ku, Tokyo 113–8603, Japan
E-mail: fuse@nms.ac.jp
Journal Website (http://www.nms.ac.jp/jnms/)

Table 1 Time course of our activities

Date	Time	Events
Mar 11, 2011	14:46	Great East Japan Earthquake occurred
	15:40	Deployment to Kudan Kaikan as a Tokyo DMAT
	16:40	Deployment to Tohoku region as a Japan DMAT
Mar 12	0:12	Arrival at Sendai Medical Center
		Management of staging care unit
Mar 13		Medical support of disaster base hospital (Ishinomaki Red Cross Hospital)
Mar 14		Same as above
		Conclusion of our mission in acute phase

Introduction

At 14:46 on March 11, 2011, a magnitude 9.0 earthquake occurred off the coast of Honshu, Japan. The epicenter was 130 km offshore of Sanriku. This earthquake, named the Great East Japan Earthquake, was followed by a powerful tsunami that hit the east coast of Japan and caused extensive damage to the Tohoku and Kanto regions. The exact extent of the damage is still being assessed, and as of September 26, 2011, the death toll had reached 15,989, with 3,917 persons still missing and 6,115 injured[1].

In the acute phase of this catastrophe, our teams were deployed as a Tokyo Disaster Medical Assistance Team (T-DMAT) and part of Japan DMAT (J-DMAT). We conducted a range of activities, including onsite triage, management of a staging care unit (SCU), and medical support for a disaster base hospital in the disaster area. This report presents our medical relief activities (**Table 1**) and discusses the issues involved in providing a medical response immediately after an earthquake and tsunami disaster, especially information infrastructure issues.

Responding as a T-DMAT

Our DMAT was deployed as a T-DMAT to Kudan Kaikan in Tokyo, where the ceiling of a hall with a capacity of 1,112 persons had partially collapsed as a result of the earthquake. Triage was immediately performed at the scene: 6 casualties were assigned to the red category (immediate), which included 1 case of cardiopulmonary arrest and 1 of flail chest; 8 casualties in the yellow category (delayed); and 22 casualties in the green category (minor). One severely injured person was transported to our hospital. At the same time, another part of our T-DMAT was deployed to a parkade that had collapsed at a shopping center in Machida, Tokyo, where there were 11 injuries and 2 fatalities.

Responding as Part of J-DMAT

In the early aftermath of the earthquake, a wide, muddy stream of water was seen on live television moving rapidly across a residential area near Natori River in Miyagi. This was the tsunami, which also reached Sendai Airport and submerged the runway. Seeing this, every team member, all of whom had participated in medical relief activities following the Great Sumatra Earthquake-Indian Ocean Tsunami, assumed this earthquake and tsunami would be, at the least, as bad as or possibly worse than the Great Sumatra Earthquake-Indian Ocean Tsunami. Two hours after the earthquake, our medical team was deployed in our multipurpose medical vehicle to Miyagi as part of J-DMAT (**Fig. 1**). We were able to deploy several DMATs simultaneously because 44 of our staff are official J-DMAT members and 14 are T-DMAT members. However, the speed of our response was due to our staff's desire to save lives.

The rendezvous point for J-DMAT was Sendai Medical Center, the base of the local J-DMAT headquarters in Miyagi. We were the first DMAT from the metropolitan area to arrive, reaching the rendezvous point, where 7 DMATs from the

Fig. 1 Multipurpose Disaster and Emergency Medical Vehicle
Our medical relief team was deployed in this vehicle. At Camp Kasuminome, Miyagi prefecture, the vehicle worked out of the staging care unit headquarters to perform wide-area evacuation.

Tohoku region had already gathered, at 0:12 on March 12. However, we were unable to start medical relief activities because the destruction of the information infrastructure had prevented specific information from reaching the local headquarters. Early next morning, 20 J-DMAT members met and decided to support the emergency room at Sendai Medical Center and search and rescue efforts in Wakabayashi, Takasago district, and to establish an SCU at Camp Kasuminome of the Japan Self-Defense Force (JSDF). Our team joined others to establish the SCU, the first time we had managed an SCU where a wide-area medical evacuation was being conducted in Japan. We received patients with a variety of conditions (e.g., hypothermia, burns, multiple trauma, and crush syndrome) transported by JSDF helicopter from a disaster base hospital in the disaster area. We treated the patients in the SCU and accompanied them during transfer via the medical helicopter system to hospitals outside the disaster area. In fact, the SCU was underutilized because there were not many casualties following the tsunami—a situation totally different from that after the Great Hanshin-Awaji Earthquake, for example.

The following day, we continued our J-DMAT activities assigned to other missions. Until day 3 of the disaster, information was still confused, and we could not adequately grasp onsite medical needs. Our J-DMAT, therefore, decided to deploy onsite to support one of the disaster base hospitals, Ishinomaki Red Cross Hospital, and inform local J-DMAT headquarters of the needs there. By day 2 after the earthquake, 80 patients assigned to the red category, 100 to the yellow, and 600 to the green had been admitted there. Moreover, the hospital received many of the injured persons who had been isolated by the tsunami but were rescued and transferred by the JSDF, fire department, or other helicopters. Our team supported hospital staff and performed triage for incoming patients until day 3 (March 14). Because the staff at Ishinomaki Red Cross Hospital had worked without sleep or relief for 24 hours and were extremely tired, we were able to provide medical support to ease their burden somewhat. We concluded our mission in the acute phase of the disaster on March 14.

Discussion

Our medical relief teams were deployed and reached the affected areas of Miyagi prefecture within 12 hours of the disaster, but were unable to begin medical relief activities due to the severely damaged information infrastructure. As a result, only satellite mobile phones could be operated, and information on the number of casualties and the severity of shortages of lifeline services could be determined only through a “go and see” approach.

Despite these clear issues with information and communications, the hyperacute phase of this extremely rare event was widely covered by the Japan Broadcasting Corporation (NHK)[2]. When the director of a local child welfare facility in Miyagi prefecture and numerous children became trapped by the tsunami and threatened by fire, the director sent an e-mail message to her son living in the United Kingdom. Fortunately, her son received the message, but because he was unable to contact his mother or a fire department in Japan, he decided to “tweet” his mother’s “SOS” on the Twitter social networking service. The tweet was picked up by the

Tokyo Fire Department, which responded to the situation. This event illustrates the effectiveness of the Internet for sharing information in disaster areas during the acute phase of a disaster if local networks remain operational[3].

Although social networking services enabled information to be disseminated or forwarded, disaster workers in the affected areas were faced with many challenges because there were no means of transmitting or receiving vital information on lifeline shortages and casualties. Network data links need to be made more resistant to infrastructure damage, and redundant or reach-back systems involving multitiered satellite, wireless, and radio frequency data links would provide definitive solutions[4]. Such integrated systems should be designed around seamless connectivity based on an "always best connected" principle for maintaining communication quality.

This recent catastrophe has reinforced the idea that up-to-date information is vital to search, rescue, and medical relief activities that provide lifeline services in the acute phase of a disaster. A robust information infrastructure is of the utmost importance in such circumstances.

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(Received, September 30, 2011)
(Accepted, November 9, 2011)