Comparison of the Utilization of Disaster Medical Assistance Teams (DMATs) and Multiple Physician-staffed Helicopters in Mass Casualty Responses

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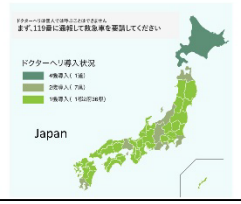
Introduction

In Japan, other than ambulance services, there are two primary methods through which physicians and nurses provide pre-hospital medical care in response to mass casualties: one involves the use of multiple physician-staffed helicopters (which are called doctor helicopters [DHs] in Japan) or doctor cars for medical treatment, the other is a disaster medical assistance team (DMAT) response.

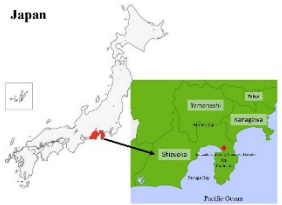
DMAT of our hospital

A DMAT is a medical team consisting of two doctors, two nurses, and one or two co-medical personnel (logistics), who are dispatched to an affected area immediately after a disaster occurs to provide acute care for victims. Although one DMAT consists of only five or six members in order to easily move to the designated area as quickly as possible, many DMATs are assembled to help at disaster base hospitals and aeromedical evacuation staging bases or airports in an affected area to stabilize and transport injured patients. DMATs also play an important role in gathering medical information in a very acute phase and inputting it into the emergency medical information system to map out a strategy for providing lifesaving interventions and coordinating their activities. Until March 2021, 1,747 DMATs were trained in Japan.

Among their roles, DHs perform interhospital transportation in cases that require advanced medical care and provide early medical intervention and transportation to severely ill or injured patients at the scene. They are often observed to fulfil the latter role in Japan. The indications for air evacuation in Japan are decided upon the receipt of a 119 (emergency) call based on the judgment of the emergency medical technician when he or she receives a dispatch request or is in contact with the patient(s). The DH can fly only during the day. The crews of physician-staffed helicopters generally consist of one pilot, one mechanic, one doctor, and one nurse, and the number can increase to seven in the case of a mass casualty event or simultaneously multiple dispatch requests. As of September 2023, 56 helicopters had been deployed in 47 prefectures across Japan.



Japan



Shizuoka Prefecture is an elongated region following the coast of the Pacific Ocean in Suruga Bay near Toky. In the west, the prefecture extends deep into the Japanese Alps. In the east, Mount Fuji becomes a narrower coast bounded in the north until it reaches the Izu Peninsula. The average number of physicians per 1,000 people in Shizuoka Prefecture was 2.10 in 2018, the 7th lowest among the 47 prefectures of Japan (Report from Shizuoka Prefecture in Reiwa 2). Two DHs cover the entire Shizuoka Prefecture, with an arrival time of 20 min.

Our hospital (Juntendo University Shizuoka Hospital) serves as the base hospital and is responsible for the eastern region of Shizuoka Prefecture, including Izu Peninsula. The journey from the southern tip of the peninsula to the Critical Care Medical Center of our hospital takes 1.5 - 2 hours by ambulance but only 15 min by helicopter. Medical resources, including physicians, are unevenly distributed in Shizuoka Prefecture, with most stationed in the western and central areas. Accordingly, the number of requests for aeromedical evacuation in eastern Shizuoka Prefecture is approximately triple that in the western areas in 2021, and overlapping requests for aeromedical evacuation in eastern Shizuoka Prefecture occur frequently. In order respond to such a volume of requests or to address multiple injured patients simultaneously, in August 2014, eastern Shizuoka Prefecture entered into an agreement with Kanagawa and Yamanashi Prefectures, in addition to cooperation with western Shizuoka, concerning collaboration on the use of DHs.

Background

There have been reports on the collaboration between DMATs and DHs in the context of catastrophic disasters. However, there has been no discussion regarding their differentiation in the case of localized disasters.

Purpose

The present study was conducted to investigate the differentiation between these two approaches based on past examples and the current situation in Shizuoka Prefecture.

Methods

First, we examined cases in Shizuoka Prefecture from 2014 to 2023, where incidents involving five or more injured individuals were simultaneously managed using multiple DHs, including the Eastern Shizuoka DH, in accordance with inter-prefectural agreements. Next, we investigated the presence of DMATs in Shizuoka Prefecture and assessed their role in disaster responses within Shizuoka Prefecture. Finally, we analyzed whether there are any discernible differences in the activities of DHs and DMATs.

Results

Table 1. Incidents involving five or more injured individuals who were simultaneously managed using multiple doctor helicopters

No	Year	Contents of casualty incident	Number of casualties	Name of doctor helicopter	Approximate duration of activities	DMAT standby
1	2015	Electric shock from current flowing in the river	7	Kanagawa, Eastern Shizuoka	2 hours	no
2	2015	Minibus slid backwards and collided with a van	28	Kanagawa, Eastern Shizuoka	4 hours	no
3	2017	Car-to-car traffic accident	5	Kanagawa, Eastern Shizuoka	3 hours	no
4	2017	Chemical factory explosion	15	Yamanashi, Eastern Shizuoka	3.5 hours	yes
5	2019	Car-to-car traffic accident	9	Yamanashi, Eastern Shizuoka	2 hours	no
6	2020	Car failed to make turn and collided with utility pole	5	Kanagawa, Eastern Shizuoka	1.5 hours	no
7	2022	Tourist bus lost its brakes and overturned	28	Kanagawa, Eastern Shizuoka	3 hours	yes
8	2023	Car-to-car traffic accident	5	Kanagawa, Eastern & Western Shizuoka	2 hours	no

From 2014, when the formation of the agreement collaboration of the DHs among the three prefectures (Shizuoka, Yamanashi, Kanagawa), to April 2023, there were 117 dispatches. One hundred fifteen of these requests were from eastern Shizuoka to other prefectures. Among them, there have been eight incidents in Shizuoka Prefecture where multiple DHs were used to respond to mass casualties. The contents of the eight activities are summarized in Table 1. In contrast, the Shizuoka DMAT was put on standby for mass casualty incidents three times during this period. Among these three cases, one involved an active deployment. This occurred during a disaster caused by a linear rainfall band that led to a landslide in Atami, where medical services were provided by Shizuoka DMATs in 23 disaster base hospitals to evacuees over a period of approximately two weeks using a rotation system. The remaining two cases involved an explosion at a printing chemical factorial company and a tourist bus rollover accident due to the loss of its braking function. These incidents were managed solely by multiple DHs and ambulance teams, with DMATs in 23 disaster base hospitals being placed on standby but not actively deployed.

Discussion

Table 2. Characteristics of DMAT and doctor helicopter

	DMAT	Doctor helicopter
Number of staffs	5 or 6	4 to 7
Contents of staffs	Doctor, nurse, logistic	Doctor, nurse, pilot, mechanic
The time that dispatch takes	A few hours	A few minutes
Working time	All hours	Daytime
Action time	A few days	Daytime only
Weather condition	No influence except for severe conditions like typhoons	Helicopter can only fly in fine weather
Distribution	Each prefecture	Each prefecture
Number	1773 teams as of March 2023	56 helicopters in 2023
Number of dispatches	From zero to a few times per year	25,469 dispatches in 2020

DMAT, Disaster Medical Assistance Team

This is the first report to investigate the current status of the actual activity of DMATs and DHs in Shizuoka Prefecture in relation to local mass casualty events. Based on the results, the characteristics of DMATs and DHs are summarized in Table 2. Basically, DH staff are routinely on duty. Accordingly, they can board the DH for a few minutes when they receive the dispatch order. However, the staff of DMATs are not on standby, and are usually occupied with regular jobs or off work. DMAT staff are selected from members who work in the hospital or who are scheduled to be off from work when the dispatch of DMATs is requested by a local government. Simultaneously, permission to dispatch DMATs should be obtained from the director. Accordingly, it takes time for DMATs to be dispatched to disaster areas.

Generally, the dispatch criteria for the Shizuoka DMAT are as follows: 1) when it is anticipated that 20 or more seriously or moderately injured or ill individuals will be affected by a disaster or a similar event within the prefecture; 2) when a request for the dispatch of Shizuoka DMATs is received from another prefecture within Japan or from the national government; 3) in other cases, where there is an urgent need for the response and deployment of Shizuoka DMATs. Obtaining such disaster information is also one of the reasons for delays in the deployment of DMATs. In addition, DMATs use cars to travel to disaster areas. In comparison to helicopters, cars lack mobility. The staff of DHs do not have materials for independent living; thus, engaging in overnight activities is not possible. However, DMATs have such materials to survive in areas where lifelines have been disrupted by a disaster. Accordingly, most local mass casualty events were managed by multiple DHs collaborating with the fire department. In the case of activities spanning multiple days for mass casualty events, DMATs played a crucial role.

One limitation of the present study is that it focuses only on Japan and Shizuoka Prefecture. Prior to 2022, Tokyo did not have a DH. Instead, Tokyo DMATs collaborated with the Tokyo Fire Department for local mass casualty events.

Conclusion

In the case of localized disasters, when DHs can operate within suitable timeframes and weather conditions, appropriate patient transportation can be achieved using multiple DHs. On the other hand, it has become evident that DMATs are primarily deployed for extended medical activities that last more than one day.