



Original article

Comparison of the utilization of disaster medical assistance teams and multiple physician-staffed helicopters in mass casualty responses

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Abstract

Objective: To investigate the differences between doctor helicopters (DHs) and disaster medical assistance teams (DMATs), based on past examples and the current situation in Shizuoka Prefecture.

Materials and Methods: First, we examined cases in Shizuoka Prefecture from 2014 to 2023, wherein incidents involving five or more injured individuals were managed using multiple DHs simultaneously. Next, we investigated the presence of DMATs in Shizuoka Prefecture and assessed their role in disaster responses within the prefecture.

Results: Since 2014, there have been eight incidents in Shizuoka Prefecture wherein multiple DHs were deployed to respond to mass casualties. Shizuoka DMATs were placed on standby thrice during the same period, with one active deployment during a disaster caused by a landslide in Atami. The other two cases were managed solely by DHs and ambulance teams.

Conclusion: Localized disasters in Shizuoka Prefecture have seen the effective use of multiple DHs for timely patient transportation, particularly when weather conditions were suitable. By contrast, DMATs are primarily deployed for extended medical activities lasting more than one day. This differentiation highlights the importance of choosing an appropriate medical response approach based on the nature and scope of a disaster.

Key words: disaster medical assistance team, doctor helicopter, activity

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Introduction

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

A DMAT is a medical team comprising one or two doctors, one or 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^{1, 2)}. Although one DMAT comprises only five or six members that can easily move to the designated area as quickly as possible, many DMATs are assembled to help at disaster base hospitals, aeromedical evacuation staging bases, or airports in an affected area, to stabilize and transport injured patients^{1, 2)}. DMATs also play an important role in gathering medical information in the acute phase of disaster and entering it into the emergency medical information system to map out a strategy for providing lifesaving interventions and coordinating DMATs' activities¹⁾. As of March 2023, 1,773 DMATs were trained in Japan.

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 disaster scene³⁾. They are often observed fulfilling the latter role in Japan. The indications for air evacu-

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ation in Japan are decided following the receipt of a 119 (emergency) call, based on the judgment of the emergency medical technician when they receive a dispatch request or are in contact with the patient(s). The DH can fly only during the day. The crews of physician-staffed helicopters generally comprise 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 multiple simultaneous dispatch requests. As of September 2023, 56 helicopters had been deployed in 47 prefectures across Japan.

Shizuoka Prefecture is an elongated region along the coast of the Pacific Ocean in Suruga Bay near Tokyo (Figure 1). In the west, the prefecture extends deep into the Japanese Alps. In the east, the northern part consists of the foothills of Mount Fuji, while the southern part comprises the Izu Peninsula. The average number of physicians per 1,000 people in Shizuoka Prefecture was 2.10 in 2018, the 7th lowest among Japan's 47 prefectures (Report from Shizuoka Prefecture in Reiwa 2). Two DHs cover the entire Shizuoka Prefecture, with an arrival time of 20 min. Juntendo University Shizuoka Hospital serves as the base hospital and is responsible for the eastern region of Shizuoka Prefecture, including the Izu Peninsula. The journey from the

southern tip of the peninsula to the Critical Care Medical Center of the hospital takes 1.5–2 h 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 was approximately triple that in the western areas in 2021, and overlapping requests for aeromedical evacuation in eastern Shizuoka Prefecture occur frequently. To respond to such a volume of requests or address multiple injured patients simultaneously, in August 2014, eastern Shizuoka Prefecture entered into an agreement with Kanagawa and Yamanashi Prefectures, in addition to cooperating with western Shizuoka, concerning collaboration on the use of DHs⁴.

There have been reports on the collaborations between DMATs and DHs in the context of catastrophic disasters^{5–9}. However, there has been no discussion regarding their differentiation in the case of localized disasters. The present study investigated the differences between these two approaches based on past examples and the current situation in Shizuoka Prefecture.

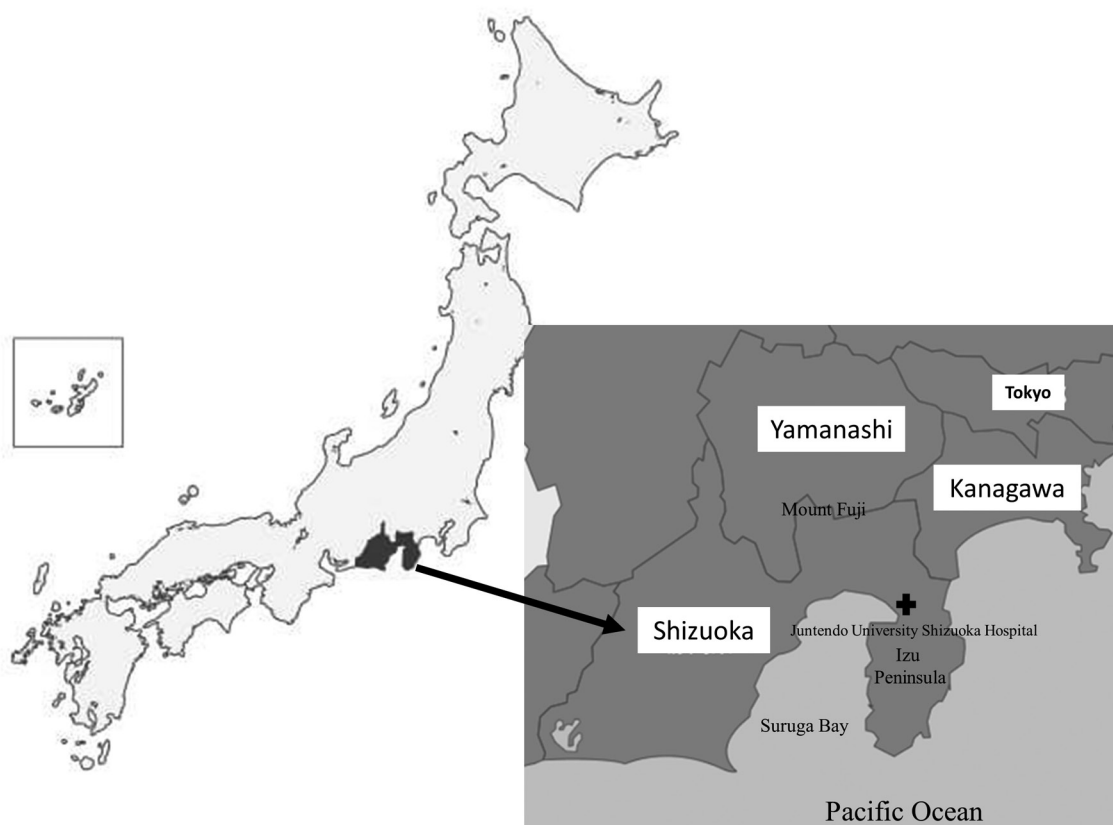


Figure 1 Map of Shizuoka Prefecture. Shizuoka Prefecture is an elongated region following the coast of the Pacific Ocean at Suruga Bay, near Tokyo.

Materials and Methods

The protocol for this retrospective study was approved by our institutional review board (approval number: 733), and the examinations were conducted according to the standards of good clinical practice and the Declaration of Helsinki.

First, we examined cases in Shizuoka Prefecture from 2014 to 2023, wherein incidents involving five or more injured individuals were managed using multiple DHs simultaneously, 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

There were 117 dispatches from 2014, when the agreement collaboration of the DHs was formed among the three prefectures (Shizuoka, Yamanashi, and Kanagawa), to April 2023⁴). Of these requests, 115 were from Eastern Shizuoka to the other prefectures. Among them, there were eight incidents in Shizuoka Prefecture wherein multiple DHs were used to respond to mass casualties. The details of these eight incidents are summarized in Table 1^{10–13}). By contrast, the Shizuoka DMAT was put on standby for mass casualty incidents three times during this period. Among these three cases, one involved 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^{14–16}). 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^{12, 13}). These incidents were managed solely by multiple DHs and

ambulance teams, with DMATs in 23 disaster-based hospitals placed on standby but not actively deployed.

Discussion

This is the first report to investigate the current status of the activities of DMATs and DHs in Shizuoka Prefecture in relation to local mass-casualty events. The characteristics of the DMATs and DHs are summarized in Table 2. The results demonstrate that DH staff are routinely on duty. Accordingly, they can board the DH for a few minutes after receiving a 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 Shizuoka DMATs are as follows: 1) when it is anticipated that 20 or more seriously or moderately injured or ill individuals are 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; and 3) in other cases, when there is an urgent need for the response and deployment of Shizuoka DMATs. Obtaining such disaster information is another reason for delays in the deployment of DMATs. Additionally, DMATs use cars to travel to disaster-affected areas. Compared with helicopters, cars lack mobility. DHs' staff do not have materials for independent living; therefore, engaging in overnight activities is not possible. However, DMATs have materials to survive in areas where lifelines have been disrupted by disasters. Accordingly, most local mass-casualty events are managed by multiple DHs collaborating with the fire department, whereas DMATs play a crucial role in activities spanning multiple days for mass-casualty events.

Table 1 Incidents involving five or more injured individuals, managed using multiple doctor helicopters simultaneously

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

DMAT: Disaster Medical Assistance Team.

Table 2 Characteristics of disaster medical assistance teams and doctor helicopters

	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.

One limitation of this study is that it focused 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 events¹⁷⁾.

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. However, it has become evident that DMATs are primarily deployed for extended medical activities that last more than one day.

Conflict of interest: The authors do not have conflicts of interest to declare.

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Ethics approval: The protocol for this retrospective study was approved by our institutional review board, and examinations were conducted according to the standards of good clinical practice and the Declaration of Helsinki. The approval number for this study was 733.

Consent for publication: All authors approved the manuscript for publication in the Journal of Rural Medicine.

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