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Original Research

An Analysis of Patients with Anaphylaxis Treated by a Physician-Staffed Helicopter

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A B S T R A C T

Objective: To determine whether anaphylactic patients treated by the doctor helicopter (DH) staff and transported from the scene obtained a favorable outcome by analyzing changes in vital signs and clinical manifestation before and after treatment during flight.

Methods: We retrospectively investigated all of the patients with anaphylaxis who were transported by the DH between March 2004 and February 2017.

Results: A total of 68 cases were enrolled in the present study. The average age was 48 years old, and most were men. The most frequent cause of anaphylaxis was a beesting or wasp sting followed by a food allergy. Adrenaline injections were executed at the scene for 48 cases. The condition of 64 (94%) subjects improved or totally subsided (n = 25, 37%) after arriving at the hospital. The Glasgow Coma Scale, peripheral capillary oxygen saturation, and systolic blood pressure after transportation to a hospital were higher than before transportation. All subjects who were treated by the DH staff obtained a survival outcome without sequelae.

Conclusion: The vital signs and clinical conditions of the patients who were treated by the DH staff when they were in an anaphylactic state at the scene showed improvement when they arrived at the hospital.

A physician-staffed helicopter in Japan is called a doctor helicopter (DH). The crew of the DH generally consists of 1 pilot, 1 mechanic, 1 doctor, and 1 nurse. Our hospital in eastern Shizuoka prefecture began to provide a DH service in 2004. Since then, the service has been used to directly transport patients with a variety of diseases and trauma, including patients with anaphylaxis, from the scene to a medical facility.[1-5] Eastern Shizuoka is a mountainous region of approximately 4,090 km^2 in size and a population of approximately 2 million with relatively few hospitals.[1] The journey from the southern tip of the peninsula to the critical care medical center of our hospital takes 1.5 hours by ambulance along a winding road that crosses over mountain passes. In contrast, the trip only takes 15 minutes by DH.[1] The road often becomes congested because eastern Shizuoka is a sightseeing resort area that is located near Tokyo. In such situations, ground ambulances take more time to transport patients. Only the fire department and doctors in hospitals that have a heliport can request the dispatch of the DH for critically ill patients, including trauma patients. The fire department requests the dispatch of the DH based on either the contents of the first call before emergency medical technicians (EMTs) contact patients or the presence of critically ill patients as confirmed by EMTs at the scene.

In Japan, local governments have established the emergency medical system as a public service, and anyone can call for an ambulance free of charge by dialing 119. Most local governments use a 1-tier emergency system. Usually, the fire department dispatches the emergency medical system team (3 EMTs) in an ambulance after receiving a 119 call. Recently, EMTs, who can secure a venous route, secure an airway with instruments, and inject

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adrenaline for patients in cardiac arrest, have been allowed to inject adrenaline for patients in anaphylactic shock who have already been treated with an adrenaline autoinjector in a previous anaphylactic attack.

Previous studies have reported the usefulness of the early injection of adrenaline for patients with anaphylaxis at the scene.[6-9] However, there has been only 1 report concerning the treatment of patients with anaphylaxis by air ambulances during transport from the scene because of the small number of patients.[10] In addition, an adrenaline autoinjector can be used to treat anaphylaxis today.[11,12]

We herein report the results of a retrospective analysis that investigated the changes in patients' vital signs and clinical manifestations during transportation and the outcomes of treating anaphylactic patients transported from the scene using a government-funded medical DH.

Methods

The purpose of the current study was to determine whether anaphylactic patients treated by staff of the DH while being transported from the scene obtained a favorable outcome by analyzing the changes in the vital signs and clinical manifestations before and after treatment. The protocol of this retrospective study was approved by our institutional review board, and the examinations were conducted in accordance with the standards of Good Clinical Practice and the Declaration of Helsinki.

We retrospectively investigated all of the patients with anaphylaxis who were transported by the DH between March 2004 and February 2017 using the registry data of the DH control room of our hospital. We did not include the anaphylactic patients who were transported to our hospital by self-transport or ground ambulance. The exclusion criteria were as follows: 1) dispatch of the DH after taking off was canceled based on the judgment of the EMTs after seeing the patients or 2) patients were in cardiac arrest. The diagnosis of anaphylaxis was determined by an interview and physical examination.

The patients' age; sex; cause of anaphylaxis; month of dispatch; duration from first call to first contact; duration from dispatch call to first contact; treatment; clinical manifestations (respiratory and/or cardiovascular and none); improvement of clinical manifestations; vital signs, including Glasgow Coma Scale, systolic blood pressure, heart rate, and peripheral capillary oxygen saturation during flight (at first contact, when it was checked by the DH staff, and on arrival at the hospital); and admission and survival rates were investigated. Changes in the vital signs and the resolution of the clinical manifestations during the flight at first contact and on arrival at the hospital were statistically analyzed.

The data were analyzed using the Wilcoxon test for the Glasgow Coma Scale; the paired Student *t*-test for variables, including systolic blood pressure, heart rate, and peripheral capillary oxygen saturation; and chi-square analysis for the resolution of clinical manifestations during the flight. The data were expressed as the mean ± standard deviation or median (interquartile range) for continuous variables and as the number for categoric variables. *P* values < .05 were considered to indicate statistical significance.

Results

There were 72 cases in which anaphylaxis was diagnosed in patients transported by the DH during the investigation period. The following cases were excluded from the study: cases in which dispatch of the DH was canceled (n = 3) and cases in cardiac arrest (n = 1). The 68 remaining cases were enrolled in the present study. Among them, 7 cases were interhospital transportation, and the rest (61 cases, 90%) were directly evacuated from the scene.

Table 1 shows the background characteristics of the subjects. The average age was 48 years old, and most were men. The most frequent cause of anaphylaxis was a beesting or wasp sting followed by a food allergy (Fig. 1). Most dispatches were received from July to October (Fig. 2).

Figure 3 shows the clinical manifestations of the patients. Figure 4 describes the treatments executed at the scene. Adrenaline injections were executed at the scene for 48 cases. Among them, 3 cases had already received adrenaline via an autoinjector. Two of the 3 underwent additional adrenaline at the judgment of the staff of the DH. Aside from these 3 cases, 5 additional subjects received adrenaline from doctors at the local medical facilities. The EMTs provided only oxygen before patients encountered the staff of the DH. There were no subjects who underwent tracheal intubation at the scene in this study.

Table 1
The Background Characteristics of the Subjects (N = 68)

Age (years)	48.1 ± 24.0 (1-81)
Sex (male/female)	53/15
First call to first contact (min)	29.8 ± 11.5 (14-62)
Dispatch call to first contact (min)	16.3 ± 6.9 (7-36)

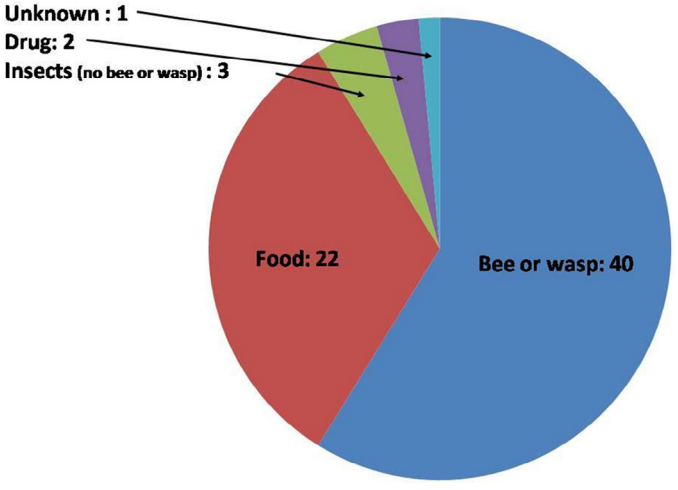

Figure 1. The causes of anaphylaxis. The most frequent cause of anaphylaxis was a beesting or wasp sting followed by a food allergy.