—**Short Communication**—

Early Access to Patients with Life-threatening Cardiovascular Disease by an Air Ambulance Service

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Abstract

The purpose of this study was to determine whether use of an air ambulance service using a helicopter with a critical care physician and nurse on board (doctor helicopter service; DHS) could shorten the prehospital delay. We evaluated the initial treatment time and the transport time in 30 patients transported by DHS and 30 patients transported by ground ambulance service (GAS). The initial treatment time was significantly shorter in the DHS group (11.3+/−5.4 min) than in the GAS group (29.5+/−15.3 min). But the transport time in the DHS group (26.1+/−8.6 min) was not different from that in the GAS group. The difference in the initial treatment time was remarkable for patients transported from distant areas (12.7+/−5.6 min for DHS, and 42.1+/−13.8 min for GAS) and DHS shortened the initial treatment time by 30 min compared with GAS. The transport time was shorter for DHS (30.5+/−9.9 min) than for GAS (42.1+/−13.8 min) for patients transported from distant areas, but it was not significantly different for patients transported from nearby areas (22.3+/−5.0 min for DHS, and 18.4+/−2.4 min for GAS). In conclusion, DHS is important in the management of life-threatening cardiovascular diseases, and has a significant impact when GAS cannot transport a patient to the hospital within 20 min.
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Key words: air ambulance, doctor helicopter, cardiovascular disease, emergency care, ground ambulance

Introduction

The most important problem in the treatment of severe cardiovascular diseases is how to shorten the duration time from the onset of the disorder to the arrival in the intensive care unit[1]. In Chiba Prefecture an air ambulance service, using a helicopter with a critical care physician and nurse on board, was established in October 2001 (doctor helicopter service; DHS). In the first year of DHS use, 333 patients were transferred to our institute, 30 of whom were suffering from cardiovascular disease. The aim of this study was to determine whether this transport system could shorten the prehospital delay in treating patients with life-

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threatening cardiovascular diseases, such as acute coronary syndrome, pulmonary embolism, and acute aortic dissection.

Materials and Methods

Thirty patients with severe cardiovascular disease were transported to the intensive care unit of our institute by DHS between October 2001 and September 2002. The diagnosis was acute myocardial infarction in 17 patients, congestive heart failure in 3 patients, acute aortic dissection in 4 patients, impending rupture of an aortic aneurysm in 2 patients, and other cardiovascular diagnoses in 4 patients. Twenty-three men and 7 women were included, and the average age was 69.1 +/− 11.5 years (DHS group). Control data were obtained from patients transported by the ground ambulance system (GAS) from the same geographic region as that for DHS (68.0 +/− 9.8 years; 23 men and 7 women). DHS can be used from sunrise to 20 min before sunset. The operation center of the Fire Department determines the use of DHS after evaluating the patients' and weather conditions.

The transport time was defined as the period from the emergency call to the arrival of the patient at the hospital. The initial treatment time was defined as the period between the emergency call and the start of the initial treatment. Initial treatment includes the stabilization of circulation and respiration, and basic and advanced cardiovascular life support. In the DHS, the on-board medical doctor and nurse can start the initial treatment soon after the helicopter reaches the patient. In contrast, the initial treatment starts after arrival at the hospital for patients transported by the GAS. In the GAS group, the initial treatment time was the same as the transport time. Both the initial treatment time and the transport time were compared between the DHS and the GAS group. We also evaluated the relationship between the benefits of DHS and transport distance. Transport distance was classified into nearby areas in which the GAS could transport patients within 20 min, and distant areas in which the GAS transportation was more than 20 min. The initial treatment time and transport time were compared in cases from both nearby areas and distant areas.

Paired continuous variables were analyzed with the Wilcoxon test. A p value < 0.05 was considered statistically significant.

Results

The initial treatment time (**Fig. 1A**) was significantly shorter in the DHS group (11.3 +/− 5.4 min) than in the GAS group (29.5 +/− 15.3 min). However, the transport time in the DHS group (26.1 +/− 8.6 min) was not different from that in the GAS group (**Fig. 1B**). The relationship between the initial treatment time, the transport time, and the transport distance, are showed in **Table 1**. The shortening of the initial treatment time was remarkable for patients transported from distant areas (12.7 +/− 5.6 min for DHS, and 42.1 +/− 13.8 min for GAS); then, the DHS decreased the initial treatment time by 30 min compared with the GAS group. In patients transported from the nearby areas, the DHS decreased the initial treatment time by 9 min compared with the GAS group. The transport time was shorter in the DHS group (30.5 +/− 9.9 min) than in the GAS group (42.1 +/− 13.8 min) for patients transported from distant areas, but it was not significantly different for patients transported from nearby areas (22.3 +/− 5.0 min for DHS, and 18.4 +/− 2.4 min for GAS).

Discussion

During the first year of DHS, 333 patients were transferred to our institute using this system. The majority of patients (55%) were transferred after suffering trauma, but 30 patients (9.0%) were suffering from severe cardiovascular diseases. The use of air ambulance services for critically ill patients was reported in 1982[2], and Topol et al.[3] and Kaplan et al.[4] suggested that the transport of patients with acute myocardial infarction using a helicopter was clinically indicated and safe. In contrast, Schneider et al.[5] reported that the incidence of cardiogenic shock, bradycardia, arrhythmia, chest pain, and seizure was more

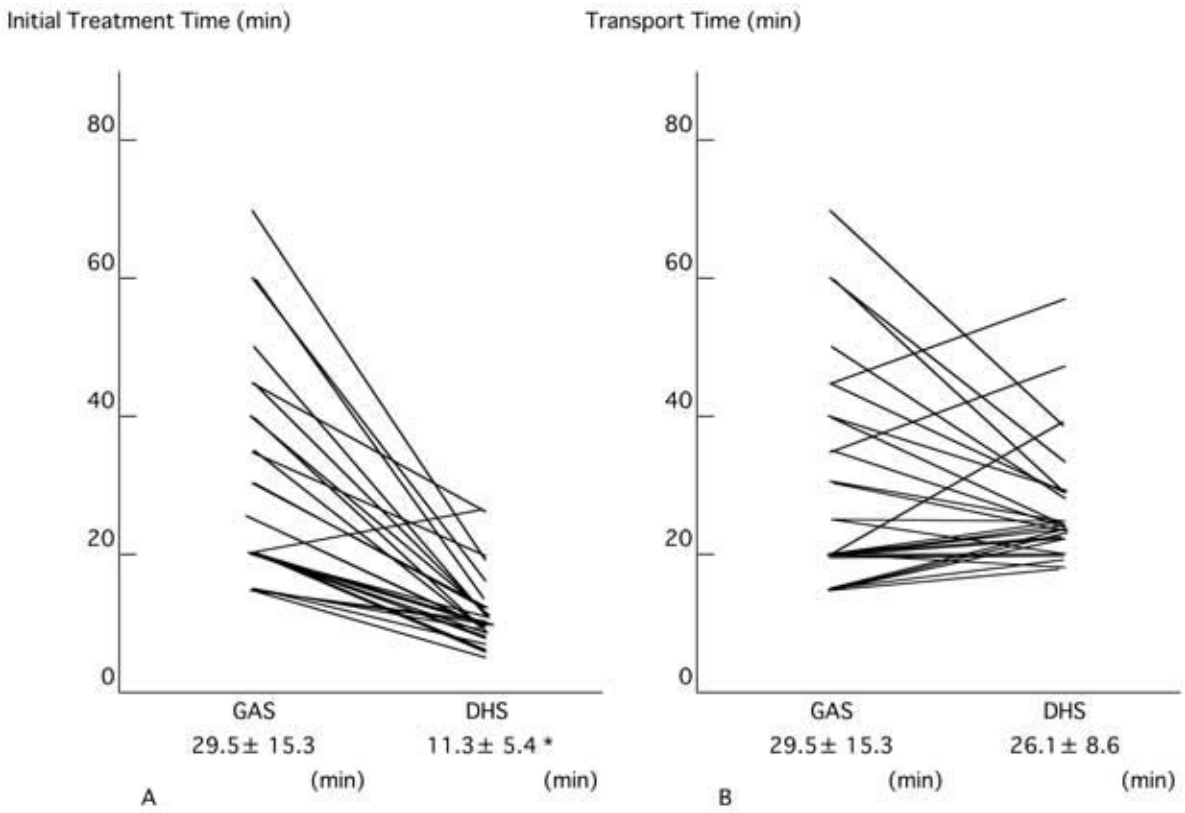

Fig. 1. The initial treatment time (A) was significantly shorter in the DHS group (11.3+/−5.4 min) than in the GAS group (29.5+/−15.3 min). The transport time in the DHS group (26.1+/−8.6 min) did not differ from that in the GAS group (B). *, $p<0.05$ versus GAS

Table 1 The prehospital time and the distance of the patient site from the hospital

	Distant areas	Nearby areas
Transport time in DHS (min)	30.5 + / − 9.9	22.3 + / − 5.0
Initial treatment in DHS (min)	12.7 + / − 5.6	9.6 + / − 5.0
Transport time in GAS (min)	42.1 + / − 13.8	18.4 + / − 2.4

In the ground ambulance service (GAS) group, the initial treatment time was the same as the transport time. The distant area was defined based on a transport time by GAS of more than 20 min. The nearby area was defined based on a transport time by GAS of less than 20 min. DHS, doctor helicopter service

frequent in patients transported by air ambulance (41%) in comparison to those transported by ground ambulance (7.5%). Tyson et al.[6] found that serum catecholamine concentrations are higher in patients transported by air ambulance than by ground ambulance, and that this is associated with the development of arrhythmias. Stone et al.[7] reported that the interhospital transport of cardiac patients by air ambulance offered no outcome advantage over transport by ground ambulance.

Recently, the majority of investigators have been reporting the safety and efficacy of early transport of patients with acute coronary syndrome by the air ambulance[8,9–19]. In our report, DHS was found to be safe, and no unexpected cardiac events occurred. Severe cardiovascular diseases require early diagnosis and prompt initial treatment[20]. As a result, prehospital delay is recognized as an important

problem in critical care medicine[1]. For the treatment of acute coronary syndromes, early revascularization, including coronary thrombolysis, percutaneous coronary angioplasty, and coronary bypass surgery have to be performed in specialized hospitals. In the setting of large myocardial infarcts with congestive heart failure, artificial support with intra-aortic balloon counter pulsation and percutaneous cardiopulmonary support have to been performed in the early phase. Accurate information gained by the on-board medical doctor and nurse also allow us to prepare specific advanced treatments. The staff of the intensive care unit in our hospital can anticipate the arrival of the patients with sufficient support for the emergency cardiac catheterization, emergency radiography, hemodynamic supports, and external cardiac pacing.

We suggested that patients with life-threatening cardiovascular disease could be managed earlier by the air ambulance service with an on-board medical doctor and nurse who could start initial treatment.

Another aspect of this study was the relationship between the benefits of DHS and the transport distance. The transport time was significantly shorter in the DHS group than the GAS group, when the patients were transported from distant areas. We suggest that DHS should be used when the GAS cannot transport the patient within 20 min. It should be kept in mind that the transport time for DHS was the same or greater than for GAS, although the initial treatment time was shorter for DHS.

In conclusion, DHS is safe and useful in the management of life-threatening cardiovascular diseases. The benefits of DHS are more remarkable when GAS cannot transport the patients within 20 min.

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