Helicopter Patient Transportation Service on the Ulleung Island, South Korea

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Abstract

Introduction: Despite numerous studies of helicopter emergency medical services, few reports have examined the outcomes of patients transported by helicopter across the sea from isolated islands. We analyzed helicopter transportation from the isolated Ulleung Island, which lies to the east of the South Korean mainland.

Methods: This study included 284 patients transported from the Ulleung Island to mainland hospitals between January 2007 and March 2013. Emergency Severity Index and Injury Severity Score were calculated. Hospital stay time and flight duration was measured. Data were analyzed using Student's t-test.

Results: The mean age of the patients was 53.5 years. Of the transported patients, 19.0% were visitors to the island and 29.6% were traumatically injured. The mortality rate after transportation was 11.6% (33 patients).

Conclusion: Helicopter transportation has been very beneficial for the treatment of emergency patients on Ulleung Island. A national level of interest and investment is required to improve this service.

Introduction

Because of the evolution of aircraft technology, the roles of helicopters in the health care industry have expanded widely to include rescue missions in primary scene responses,[1] the transport of patients from rural to urban hospitals,[2] and solid organ delivery for transplantation surgery.[3] Helicopter emergency medical services (HEMS) play an important role in modern emergency medicine. Thomas et al[4-8] have published several review articles that describe the usefulness of HEMS for the management of trauma and nontrauma patients in the United States.

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Ulleung and Dokdo are solitary islands located in the middle of the East Sea in South Korea. The Ulleung-gun Health Center and County Hospital is the only primary care hospital on Ulleung Island; because of its geographic location and lack of medical resources, efficient transport of emergency patients from this facility to mainland general hospitals is extremely important. Helicopters can travel faster than ships and can depart immediately; hence, they are a valuable resource for overseas patient transport. Despite extensive studies of HEMS outcomes in Western countries, information regarding the outcomes of patients transported by helicopter from single islands that are geographically isolated and medically vulnerable is currently lacking.[9-12] In this study, we examine the outcomes of patients transported by helicopter from the Ulleung-gun Health Center and County Hospital to mainland South Korea.

Materials and Methods

The study included 229 helicopter flight missions that transported 284 patients from the Ulleung-gun Health Center and County Hospital to mainland general hospitals between January 2007 and March 2013. There were no aircraft-related accidents during the study period. The helicopters were provided by 5 different institutions: the East Regional Headquarters of the Korea Coast Guard (192 missions, 239 patients), the Gyeongbuk Fire Service Headquarters (21 missions, 27 patients), the Republic of Korea Navy Air Wing 6 (14 missions, 16 patients), the Gyeongbuk Provincial Police Agency (1 mission, 1 patient), and the National 119 Rescue Service (1 mission, 1 patient). For each flight, the takeoff and landing times, flight destination, and transfer results were instantly recorded in the hospital's helicopter request note. After transportation, the treatment outcomes of every patient were recorded by the patient affairs department of the destination hospital and also noted in the medical chart maintained by the Ulleung-gun Health Center and County Hospital. The hospital records and helicopter request notes were retrospectively reviewed. The disease severity of each patient was determined using the classic Emergency Severity Index.[13] For trauma-related patients, the Injury Severity Score was calculated.[14] The duration of the hospital stay was recorded as the elapsed time from the reception of the patient at the Ulleung-gun Health Center and County Hospital to the transfer departure time. The flight duration was determined as the estimated time from takeoff to landing, which was recorded by the helicopter crew on a formal flight document.

Transfer delays were recorded when the initial helicopter request call was rejected because of poor weather conditions or risk of a night flight.

The clinicopathological characteristics of the patients were analyzed using Student *t*-tests. Statistical analyses were performed using the SPSS version 18.0 program (SPSS Inc, Chicago, IL). The numbers of patients transported to the mainland between January 2013 and March 2013 were not included in the annual and monthly incidence analyses. This study was approved by the institutional review board of the National Medical Center, Seoul, Korea (institutional review board no.: H-1311/036-007).

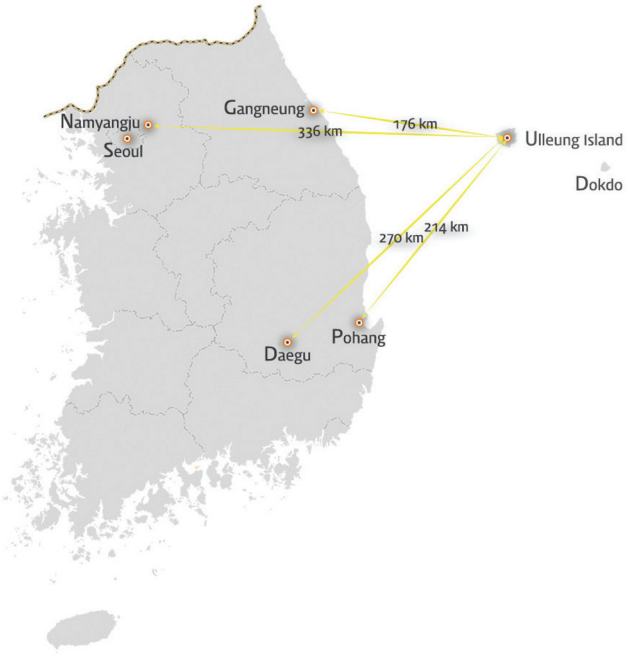
Results

Between January 2007 and March 2013, 229 helicopter flight missions transported 284 patients from the Ulleung-gun Health Center and County Hospital to general hospitals at 4 different mainland locations that have airstrips suitable for helicopter takeoff and landing (Fig. 1). Overall, 164 patients (57.7%) were transported 176 km to Gangneung, 74 patients (26.1%) were transported 214 km to Pohang, 45 patients (15.8%) were transported 270 km to Daegu, and 1 patient (0.4%) was transported 336 km to Namyangju. The number of patients transported from Ulleung Island to the mainland each year increased gradually during 2007 to 2012 (Fig. 2). Notably, the number of transported patients who were native residents of Ulleung Island increased markedly from 2010 to 2012. The number of transported patients who were visitors to the island increased slightly and steadily each year. Figure 3 shows the monthly distribution of patients transported to the mainland by helicopter in 2007 to 2012. The total number and number of native Ulleung Island patients who were transported peaked in April and September. The number of transported visitors was highest in June and December, which are the peak tourist seasons for Ulleung Island.

Table 1 shows the general clinical characteristics of the helicopter-transported patients included in the study. The patients were separated into trauma (84 patients) and medical (200 patients) groups. The mean age of the 284 patients was 53.48 years, and the mean ages of the patients in the trauma and medical groups were 46.85 and 56.27 years, respectively. In both groups, the number of male patients was higher than the number of female patients (trauma: 67 men and 17 women; medical: 169 men and 81 women). The percentages of native residents in the total, medical, and trauma groups were 81.0%, 84.5%, and 72.6%, respectively. The mean hospital stay time was significantly shorter for the trauma group than the medical group, but the flight duration was similar for both groups. The overall mean flight time was 58.25 ± 9.65 minutes (range = 30-105 minutes).

There were 81 transfer delays during the study period. Among them, 5 patients died after transportation; the clinical diagnoses were hypovolemic shock because of an abdominal stab wound, upper gastrointestinal bleeding, esophageal variceal bleeding with liver cirrhosis, intracranial haemorrhage, and cerebral infarction.

Figure 1. The distances between Ulleung Island and the mainland destinations. Distances provided by the National Geographic Information Institute, Korea (http://www.ngii.go.kr/en).



The mean Emergency Severity Index scores for the total, trauma, and medical group patients were 2.43, 2.64, and 2.34, respectively, indicating that the clinical condition of the medical group was worse than that of the trauma group. The mean Injury Severity Score of the trauma patients was 21.8, and 76.4% of the trauma patients (64 patients) had an Injury Severity Score of less than 15, which indicates a critical status.[14]

The clinical outcomes of the helicopter-transported patients are listed in Table 1. Surgical operation and general medical care were the most common methods of treating the transported patients. Interventional procedures, which included gastrointestinal endoscopy and cardiovascular and neurovascular interventions, were also an important treatment modality for the medical group. There was 1 case of baby delivery by a preterm labored mother after helicopter transportation.

Most of the helicopter-transported patients were successfully treated and discharged from the mainland hospitals; however, 28 patients in the medical group and 5 patients in the trauma group died after helicopter transportation. The overall mortality rate was 11.6%, and those for the trauma and medical groups were 6.0% and 14.0%, respectively (Table 1).

Table 2 shows the patient treatment modalities and outcomes related to the injury mechanism, trauma location, and anatomic distribution of the medical disease. In the