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Epidemiological and clinical profile of Korean travelers receiving international medical repatriation

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Abstract

The aim of this study was to investigate the experiences of medical transportation of Korean travelers who suffered accidents abroad and then transferred home by our aeromedical team.

We collected demographic and clinical data on patients injured while traveling abroad from January 2013 to July 2017. Descriptive analyses based on 4 different transportation methods and transport time since hospitalization were performed.

A total of 33 patients were repatriated during the study period. Of these, 28 (84.8%) were trauma cases with pedestrian injuries being the most common (11 cases; 39.3%). Twenty patients were repatriated by flight-stretchers, 6 by flight-prestige, 2 by ship, and 5 by air ambulance. The air ambulance was the most expensive (average 61,124 US Dollars) mode of transportation ($P = .001$) and the ship took the longest time (14 hours) to transport patients back to Korea from regions with similar distance ($P = .0023$).

We experienced medical repatriation of 33 seriously injured Korean travelers back to South Korea. Transfer time should be an important considering factor and directly contacting and communicating with the specialized staff of foreign hospitals could also be very important to reduce unnecessary overseas hospital stay and cost incidence.

Abbreviation: USD = US Dollars.

Keywords: aeromedical transportation, medical repatriation, ship, South Korea

1. Introduction

As a result of socioeconomic development and growing interest in travel, the number of South Koreans traveling abroad has increased markedly over the past 10 years. Between 2008 and 2018 the number of international travelling tripled from 9.5 million to 29 million in Korea,[1] and this upward trend is expected to be continued. With this increase in international travel, more people are thus exposed to a variety of health risks such as injuries and infectious diseases while traveling abroad. For example, the 2015 Korea outbreak of Middle East respiratory syndrome, which resulted in 186 cases including 38 fatalities was initiated from a returning traveler from the Middle East.[2,3] Generally, travel is associated with unfamiliar environments such as sudden changes in temperature, traffic rules, food culture, and exposure to a variety of infectious diseases that can result in hospitalization abroad. Nevertheless, many people often travel without travel insurance that protects them, including financially, in case of medical emergencies overseas,[4–6] assuming "it will not happen to me". Hospitalization abroad may involve considerable medical costs accrued within a short time, and communication may also be a problem. Most patients wish to return home quickly, but it can be delayed due to poor transportation systems and/or lack of specialized escort teams.[7] Despite increasing number of Korean travelers hospitalized abroad and transferred home by aeromedical team, there have been no studies investigating the medical transportation of Korean travelers from foreign countries. In this study, we analyzed the transportation experiences of Korean travelers who suffered accidents abroad and were then transferred home by our aeromedical team.

2. Methods

Aeromedical team and the process: This team consisted of an emergency physician with a licensed first-level and critical care paramedic who work at a university emergency center. When Korean travelers encounter medical emergency situations and hospitalize abroad, they contact to our aeromedical team through several routes (family, friends, domestic hospitals, government, etc) to be transported back to Korea. We discuss with them about transport method and consult with the foreign hospital. When transportation is approved by the patient's hospital physician abroad, we arrange transportation for the patient. Transportation of patients is via flight stretcher, flight-prestige, ship, or

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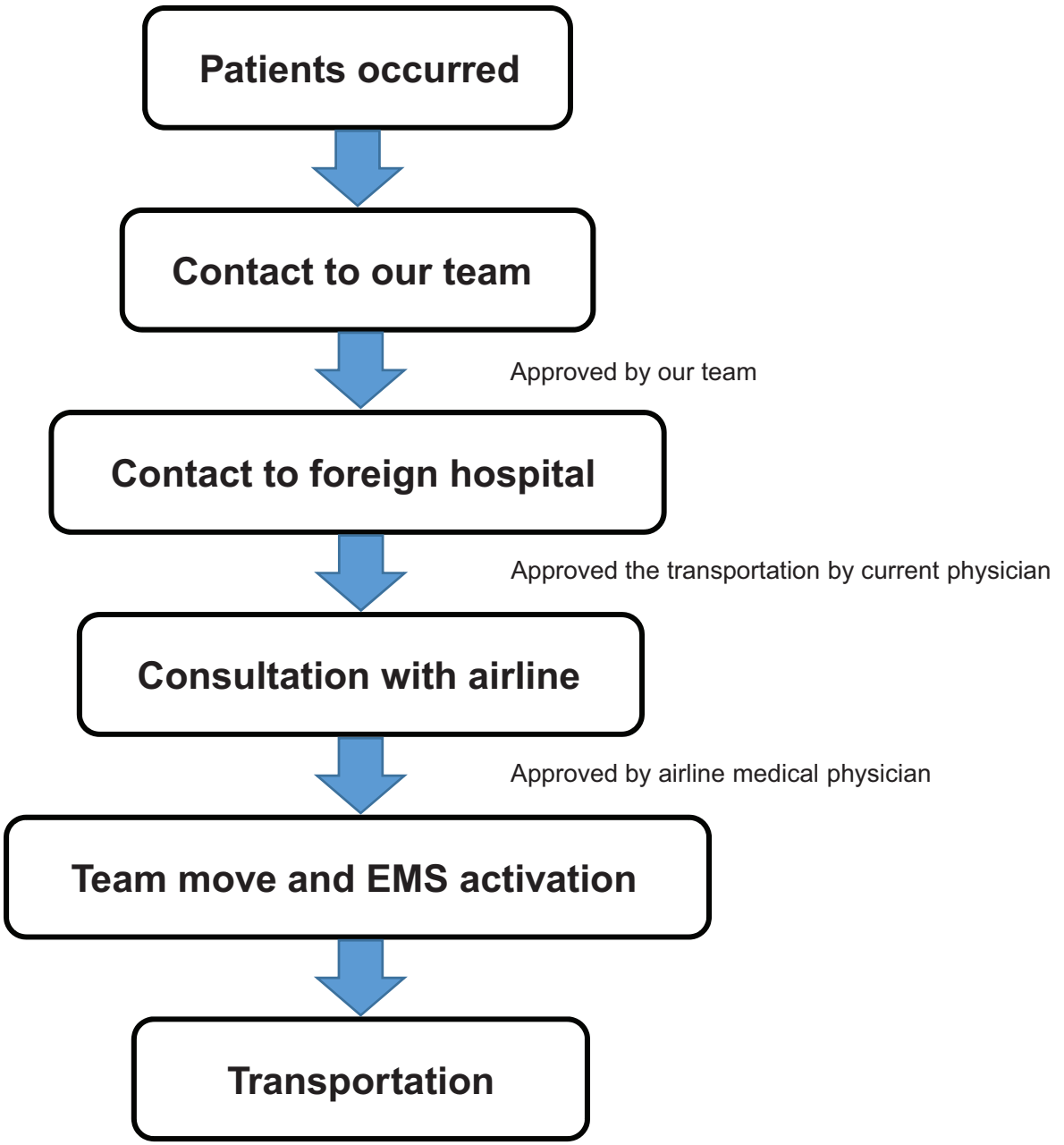

Figure 1. Sequence of transportation. EMS = Emergency Medical Services.

specified air ambulance. Flight stretcher is made with 6 economic class seats and flight-prestige is one business or first-class seat for the patient. Ship transportation is via regular international passenger ship and air ambulance is specified for 1 patient with all medical equipment. Once transportation is approved by both countries then we reserve the agreed method of transportation and emergency ambulances from both countries and transport the patient back to our country (Fig. 1).

2.1. Population

This study included all South Korean patients who were critically injured or became ill while traveling abroad and transported to Korea between January 2013 and July 2017.

2.2. Data collection

We retrospectively collected patients' demographic and clinical information based on our medical records. The collected information included sex, age, the nature of the accident, any operation performed at the foreign country, diagnosis, date when transfer team was contacted, transfer time, transfer method, and all communications with foreign hospitals and airlines, treatment, and outcomes.

2.3. Statistical analysis

Age data were reported in terms of means ± standard deviations, and data on other variables were presented as numbers and percentages. *P* values for age were calculated using the Kruskal-

Wallis test, and *P* values for other variables were calculated using Fisher exact test. Bar graph was constructed to compare the cost and hours among the patients transported from similar distance which was defined with officially 2 hours flight time of Korean air company. Average costs per individual cases were compared with 4 types of transport method (flight stretcher, flight-prestige, ship, and specified air ambulance).

All data were analyzed with software R and a *P* value <.05 was defined to be statistically significant.

Ethical approval was not necessary, because we obtained patients' consent for study before transportation.

3. Results

3.1. General characteristics

Thirty-three patients, 17 (51.5%) of whom were men, were repatriated (Table 1) during the study period. Twenty-eight (84.8%) patients had suffered traumas, with pedestrian injuries (11, 33.3%) being the most common. Five (15.2%) cases were nontrauma cases and acute myocardial infarction (4, 12.1%) was most common. Of all injuries, 29 (87.9%) were occurred during actually traveling to their destinations. The major diagnoses were brain injuries or edema (19; 57.6%), fractures (10; 30.3%), and other (4; 12.1%). In terms of consciousness status, 18 (54.5%) individuals were alert; 8 (24.2%) could give verbal responses, 3 (9.1%) could give pain responses, and 4 (12.1%) were unresponsive. Fourteen (42.4%) had received conservative management in intensive care units, 10 (30.3%) had undergone procedures in general wards, 7 (21.2%) had undergone postoperative management, and 2 (6.1%) had received no treatment (other than simple rest).

We categorized the countries based on Korean Air flight time from Korea: 17 (51.5%) cases were from countries "within 2 hours," 8 (24.2%) cases from "2< to ≤4 hours', 6 (18.2%) cases from "2< to ~≤4 hours," and 2 (6.1%) cases from '>6 hours'. Of all, 24 (72.7%) transported patients were discharged and 9 (27.3%) were expired.

Table 1

General characteristics of enrolled patients.

Variable	Total (N = 33)
Age, y	46.9 ± 14.2
Male	17 (51.5%)
Trauma	28 (84.8%)
Pedestrian	11 (33.3%)
Motor vehicle crash	7 (21.2%)
Fall	4 (12.1%)
Water sports related and drowning	4 (12.1%)
Others	2 (6.1%)
Nontrauma	5 (15.2%)
Acute myocardial infarction	4 (12.1%)
Cerebral infarction	1 (3.0%)
On traveling	29 (87.9%)
Diagnosis	
Fracture	10 (30.3%)
Cerebral injury	19 (57.6%)
Others	4 (12.1%)
Mentality AVPU (Alert, Voice, Pain, Unresponsive) sacle	
Alert (A)	18 (54.5%)
Voice (V)	8 (24.2%)
Pain (P)	3 (9.1%)
Unresponsive (U)	4 (12.1%)
Treatment	
Postoperation management	7 (21.2%)
Just procedure in general wards	10 (30.3%)
Conservative management in Intensive unit	14 (42.4%)
None	2 (6.1%)
Country (based on Korean Air flight time)	
Within 2 hours	17 (51.5%)
<2–≤4 hours	8 (24.2%)
<4–≤6 hours	6 (18.2%)
>6 hours	2 (6.1%)
Outcome	
Discharge	24 (72.7%)
Expire	9 (27.3%)

3.2. Transportation methods

Twenty patients were transported using stretchers, 6 used prestige (Table 2) accommodations, 2 traveled by ship, and 5 traveled by air ambulance. All 6 patients who were transported using prestige accommodations, all 2 who were transported via ship, 18 (90%) of those transported via stretcher, and 2 (40%) of the air ambulance patients had suffered traumas (*P* = .043). Cerebral injury was more frequent in patients transported via stretcher (60%), ship (100%), and air ambulance (60%), and fractures were more frequent in patients using prestige accommodations (66.7%). In terms of consciousness, 11 (55%) stretcher patients and 6 (100%) of those who traveled using prestige accommodations were alert, whereas 2 (100%) of those transported via ship exhibited pain responses only and 2 (40%) of those transported via air ambulance were unresponsive (*P* = .003). Conservative management in intensive care units was provided for 8 (40%) stretcher patients, 4 (80%) air ambulance patients, and 1 (50%) ship patient; 5 (83.8%) patients who used prestige accommodation were treated with ward procedures only. The need for a ventilator was the most common reason for use of an air ambulance (80% of patients) (*P* = .001). In terms of hospitalization duration, 9 (45%) stretcher patients, 3 (50%) of those using prestige accommodations, 2 (100%) traveling by ship, and 4 (80%) transporting via air ambulance patients had hospital stays of 1 to 2 weeks; these proportions did not differ significantly (*P* = .429). In terms of transport time after contact with domestic medical staff, the times for stretcher patients, and those using prestige accommodations were similar. However, ship transfer required <4 days for 1 and >8 days for the other patient, and air ambulance required 5 to 7 days for 3 (60%) patients and >8 days for 2 (40%).

3.3. Factors associated with transport time

We found no significant differences in transport time by sex, age, trauma type, or major (Table 3) diagnosis. In terms of return to consciousness, 6 (60%) of those who were originally not alert were alert within 4 days, and 8 (72.7%) were alert within 5 to 7 days. Unresponsive patients remained in this state for 4 days, but 3 (27.3%) became alert at 5 to 7 days. At ≥8 days, 5 such patients (41.7%) had recovered verbal communication (*P* = .045). Conservative management in intensive care units was provided for 4 (40%), 5 (45.5%), and 5 (41.7%) days to those who were alert, partially responsive, and unresponsive, respectively; these proportions did not differ significantly (*P* = .667). Eight (66.7%) patients were released from local hospitals after ≥8 days, and 5 (45.5%) were released after 4 to 7 days (*P* = .003). However, the airlines did not allow 6 (50%) patients to fly for ≥8 days, and 5

Table 2

Characteristics according to transportation methods.

Variable	Total (N = 33)	Flight-stretcher (N = 20)	Flight-prestige (N = 6)	Ship (N = 2)	Air ambulance (N = 5)	*P*
Age, y	46.9 ± 14.2	47.5 ± 13.8	40.5 ± 21.7	54.0 ± 4.2	49.4 ± 3.8	.811
Male	17 (51.5%)	8 (40.0%)	5 (83.3%)	1 (50.0%)	3 (60.0%)	.298
Trauma	28 (84.8%)	18 (90.0%)	6 (100.0%)	2 (100.0%)	2 (40.0%)	.043
Diagnosis						.15
Fracture in chest	10 (30.3%)	6 (30.0%)	4 (66.7%)	0 (0.0%)	0 (0.0%)	
Cerebral injury	19 (57.6%)	12 (60.0%)	2 (33.3%)	2 (100.0%)	3 (60.0%)	
Others	4 (12.1%)	2 (10.0%)	0 (0.0%)	0 (0.0%)	2 (40.0%)	
AVPU						.003
A	18 (54.5%)	11 (55.0%)	6 (100.0%)	0 (0.0%)	1 (20.0%)	
V	8 (24.2%)	7 (35.0%)	0 (0.0%)	0 (0.0%)	1 (20.0%)	
P	3 (9.1%)	0 (0.0%)	0 (0.0%)	2 (100.0%)	1 (20.0%)	
U	4 (12.1%)	2 (10.0%)	0 (0.0%)	0 (0.0%)	2 (40.0%)	
Treatment						.046
Full operation	7 (21.2%)	5 (25.0%)	0 (0.0%)	1 (50.0%)	1 (20.0%)	
Just procedure	10 (30.3%)	5 (25.0%)	5 (83.3%)	0 (0.0%)	0 (0.0%)	
Conservative management	5 (15.2%)	4 (20.0%)	1 (16.7%)	0 (0.0%)	0 (0.0%)	
Intensive internal management	9 (27.3%)	4 (20.0%)	0 (0.0%)	1 (50.0%)	4 (80.0%)	
None	2 (6.1%)	2 (10.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	
Refusal from local hospital	13 (39.4%)	9 (45.0%)	2 (33.3%)	1 (50.0%)	1 (20.0%)	.88
Refusal from local airline	11 (33.3%)	6 (30.0%)	2 (33.3%)	0 (0.0%)	3 (60.0%)	.493
Ventilator	9 (27.3%)	3 (15.0%)	0 (0.0%)	2 (100.0%)	4 (80.0%)	.001
Transportation time						.737
≤4 days	10 (30.3%)	7 (35.0%)	2 (33.3%)	1 (50.0%)	0 (0.0%)	
5–7 days	11 (33.3%)	6 (30.0%)	2 (33.3%)	0 (0.0%)	3 (60.0%)	
>8 days	12 (36.4%)	7 (35.0%)	2 (33.3%)	1 (50.0%)	2 (40.0%)	
Time to domestic admission						.429
≤1 wk	9 (27.3%)	6 (30.0%)	3 (50.0%)	0 (0.0%)	0 (0.0%)	
1–2 wk	18 (54.5%)	9 (45.0%)	3 (50.0%)	2 (100.0%)	4 (80.0%)	
>2 wk	6 (18.2%)	5 (25.0%)	0 (0.0%)	0 (0.0%)	1 (20.0%)	

Data were reported as mean ± standard deviation for age and n (%) for the others. *P* values were calculated by Kruskal-Wallis test for age and Fisher exact test for the others.

(45.5%) were prevented from flying for 4 to 7 days ($P = .019$). Although air transport was the most common transfer method, the difference among transportation modes did not reach statistical significance ($P = .443$). Most patients were admitted for 1 to 2 weeks; 6 (60%) in 4 days below, 6 (54.5%) in 5 to 7 days, and 6 (50%) in >8 days. These intergroup differences, however, did not reach statistical significance ($P = .089$).

3.4. Differences in the transport costs and duration according to the methods used to transport patients home from similar distant with Korean air flight time

Our comparison of the transport costs among similar distance locations, measured (Fig. 2) by Korean Air flight time, revealed that ship travel was the least expensive (6832 US Dollars [USD]) and that the difference between the costs of air travel involving stretchers (11,543 USD) and that involving prestige accommodations (11,813 USD) was minimal. The air ambulance was the most expensive mode of transportation (61,124 USD) ($P = .001$). The mean duration of flight was the fastest (2 hours for both stretcher and prestige) and air ambulance was 6 hours. Ship took the longest transport time with mean duration of 14 hours ($P = .0023$).

4. Discussion

Several problems arise when transporting patients back to South Korea. First, it is illegal for Korean doctors to engage in medical activities in foreign countries. Thus, after obtaining permission from the hospital and the airline, domestic medical personnel and equipment should be prepared. Such preparation should include access to information about the patient's condition and ability to synchronize the flight schedule of the patient with availability of medical personnel. Also, the domestic hospital receiving the patient must be identified. An air ambulance with dedicated equipment and medical staff is the fast and efficient mode of international medical transportation, but extremely expensive (5–10-fold the cost of other transportation modes). In previous studies, the main causes of death among travelers were conditions associated with age, cardiovascular disease, and motor vehicle traffic accidents.[8–13] Marine sports–related injuries were the next most common cause, but the most common cause of all traumas, including death, was pedestrian accidents.[6,14–16] According to our research, air ambulances are very effective for seriously injured patients who require intensive care, and the cost of this service can be reduced if specialists operate portable intensive care equipment. In this study, an air ambulance was used twice, once upon the aggressive insistence of a family member and once when a patient was in shock. However, 12 patients who had received recommendations from foreign hospitals for air ambulance transport were successfully transferred just with stretcher of flight without fatal outcomes, because our portable equipment was adequate. These patients had already undergone all required operations, had stable vital signs, and were not in shock. The transfer time of air ambulance had been increased by not only the need to refuel often due to the

Table 3

Factors related with transport time since the hospitalization in the hospitals.

Variable	Total (N=33)	≤4 days (N=26)	5–7 days (N=2)	>8 days (N=5)	P
Age, y	46.9±14.2	47.0±12.3	41.5±16.6	51.9±12.4	.344
Male	17 (51.5%)	5 (50.0%)	4 (36.4%)	8 (66.7%)	.383
Trauma	28 (84.8%)	9 (90.0%)	10 (90.9%)	9 (75.0%)	.584
Diagnosis					.391
Fracture	10 (30.3%)	3 (30.0%)	5 (45.5%)	2 (16.7%)	
Cerebral injury	19 (57.6%)	6 (60.0%)	6 (54.5%)	7 (58.3%)	
Others	4 (12.1%)	1 (10.0%)	0 (0.0%)	3 (25.0%)	
AVPU					.045
A	18 (54.5%)	6 (60.0%)	8 (72.7%)	4 (33.3%)	
V	8 (24.2%)	3 (30.0%)	0 (0.0%)	5 (41.7%)	
P	3 (9.1%)	1 (10.0%)	0 (0.0%)	2 (16.7%)	
U	4 (12.1%)	0 (0.0%)	3 (27.3%)	1 (8.3%)	
Treatment					.667
Full operation	7 (21.2%)	2 (20.0%)	3 (27.3%)	2 (16.7%)	
Just procedure	10 (30.3%)	2 (20.0%)	3 (27.3%)	5 (41.7%)	
Conservative/intensive management	14 (42.4%)	4 (40.0%)	5 (45.5%)	5 (41.7%)	
None	2 (6.1%)	2 (20.0%)	0 (0.0%)	0 (0.0%)	
Decline from local hospital	13 (39.4%)	0 (0.0%)	5 (45.5%)	8 (66.7%)	.003
Decline from local airline	11 (33.3%)	0 (0.0%)	5 (45.5%)	6 (50.0%)	.019
Ventilator	9 (27.3%)	1 (10.0%)	3 (27.3%)	5 (41.7%)	.301
Transportation method					.443
Flight	26 (78.8%)	9 (90.0%)	8 (72.7%)	9 (75.0%)	
Ship	2 (6.1%)	1 (10.0%)	0 (0.0%)	1 (8.3%)	
Air ambulance	5 (15.2%)	0 (0.0%)	3 (27.3%)	2 (16.7%)	
Time to domestic admission					.089
≤1 wk	9 (27.3%)	0 (0.0%)	4 (36.4%)	5 (41.7%)	
1–2 wk	18 (54.5%)	6 (60.0%)	6 (54.5%)	6 (50.0%)	
>2 wk	6 (18.2%)	4 (40.0%)	1 (9.1%)	1 (8.3%)	

Data were reported as mean ± standard deviation for age and n (%) for the others.

P values were calculated by Kruskal-Wallis test for age and Fisher exact test for the others.

small size of airplanes, but also transit problems due to use of airplane of nearby country caused by absence of airplane in patient's located country. The costs and durations of stretcher and prestige transport differed minimally when regular passenger planes were used. A stretcher required 6 economy seats. Given the 2 accompanying medical personnel, the cost of the 8 seats was almost the same as that of 3 seats in using prestige. Ship was the least expensive mode of transportation, and it was also much less stressful than air transport; however, the transfer time for this mode was very long. The ship also had certain disadvantages: the boarding time was very long, and motion adversely affected both the patients and the medical personnel. It should be noted that a short transfer time is very important for seriously ill patients. As in earlier studies, 5 patients received a recommendation to travel by ship because of the pressure problems expected after neurosurgical operations in foreign hospitals.[17,18] However, patients who underwent procedures such as vascular clipping who had experienced 3 postsurgical days without incident did not develop complications during transfer. Arranging transport prior to surgery and establishing good communication with local staff are crucial to ensuring that patients are transported as safely and quickly as possible. These arrangements also reduce costs. The most important

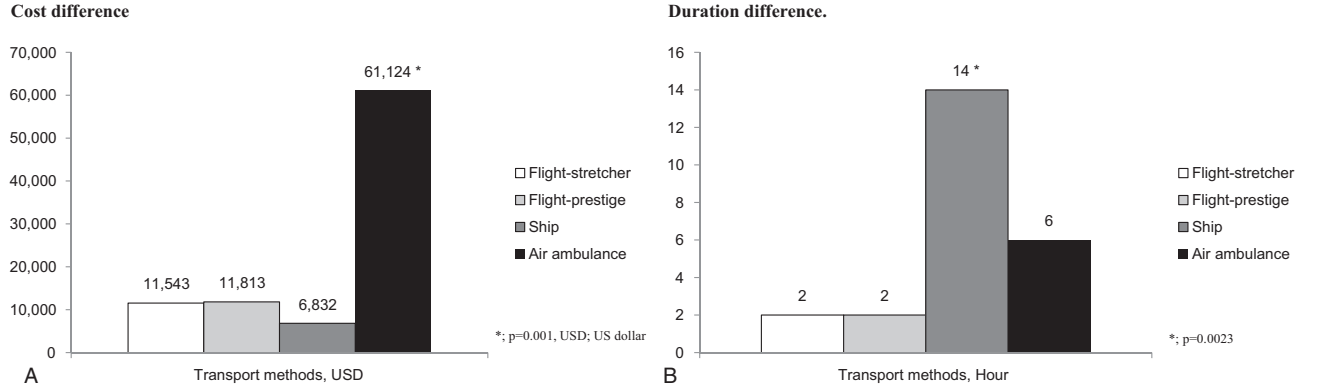

Figure 2. Cost and duration differences between each transport methods from 2 hours distance with flight (USD). USD=US Dollars.

obstacles in this process are the refusal by foreign hospitals to release patients and the refusal by airlines to let patients fly. Of course, the patients' state of consciousness also affects the transfer time, which is associated with the abovementioned problems. However, as consciousness changes over time, it may be inappropriate to decide whether to transfer a patient by reference to only 1 symptom. We found that the required approvals followed when we personally called the medical staff of foreign hospitals or visited the hospitals; under such conditions, the obstacles vanished. Therefore, directly contacting and communicating with the specialized staff of foreign hospitals is essential for reducing unnecessary overseas hospital stays and costs. One limitation of this study was small number of cases. This is the first study on this topic in South Korea and has contributed to our establishment of a system to transport seriously ill or injured South Korean patients back to Korea.

Author contributions

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