

# Transport of Trauma Patients by Airway: Turkish Experience

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## Abstract

**Aim:** Air transport is very useful for transporting patients between hospitals in the case of a trauma or illness that requires special care. Transporting trauma patients who require early intervention to large centers for effective treatment ensures both effective treatment and a reduction in mortality.

**Materials and Methods:** In our study, a retrospective review was performed using data collected for cases transported by airway organized by the Ministry of Health between January 2020 and May 2021. Patients transported by plane and helicopter due to trauma were included in the study. The patients were examined in terms of reason for transport, gender, age, medical condition, cities of transport, route of transport, transport vehicle.

**Results:** Two hundred and eighty-seven trauma patients were transferred, 125 by air ambulance and 162 by helicopter ambulance. Of the patients transported by plane, 103 were male and 22 were female. Among the number of patients transported by helicopter, 120 patients were male and 42 patients were female. The pediatric patients were 23 in patients transported by plane and 34 in helicopter. When the transported patients were evaluated in terms of indication; the most common indication for transportation of patients is multitrauma (blunt thoracic trauma, fracture) patients with 78 patients. Considering the major centers where patients were transferred, Ankara was in the first place with 107 patients. Considering the flight times, the average flight time for air transport was 77 minutes, and the average flight time for a helicopter ambulance was 69 minutes.

**Conclusion:** Transporting patients by air is critical in countries such as Turkey, which has a large area and difficult geographical conditions. Transporting trauma patients who require early intervention to large centers for effective treatment ensures both effective treatment and a reduction in mortality. We think that our country's successful air transport system plays a major role in the effective treatment of patients, thanks to its short average flight time and successful transport procedure.

**Keywords:** Air transport, trauma patient, multi-trauma, terrorist attacks, blunt thoracic trauma

## Introduction

Air transport is very useful for transporting patients between hospitals in the case of a trauma or illness that requires special care (1,2). Specialized medical services and technologies are often used in large cities. Air ambulance services included both plane and helicopters. Air ambulances are recommended for long-distance over 240 km. (3). Airplanes are considered safer for longer transport. Factors such as higher speed, more space to allow multiple patients to be transported, no weight limitations, and pressurized cabin have several advantages for patient care (4). The decision to use an air ambulance instead of a land

ambulance is often highly variable, further complicating the decision to use a plane or helicopter. The medical environment in air changes according to vibration turbulence, thermal changes, humidity, acceleration and deceleration movement, hypoxia, gas-volume changes and noise. Therefore, patient diagnosis, environmental and climatic conditions, distance, transfer time and cost are factors to be considered (3). Preparation and stabilization of the air-transported patient before transfer is critical to prevent physiological deterioration and complications during flight (5). The benefits and challenges of plane for long-distance patient transport have been described in the literature. However, few studies have described the epidemiology of



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patients transported by plane (6). Such information can be useful for planning resources, training of medical team, and improving clinical protocols. Therefore, in our study, we epidemiologically examined the airway transport of trauma patients in Turkey in 2020 and 2021.

## Materials and Methods

In our study, a retrospective review was performed using data collected for cases transported by airway organized by the Ministry of Health between January 2020 and May 2021. Approval was obtained for the data use ethical approval of the study with the letter from the Ministry of Health dated 04/06/2021 and numbered E-39942531-301.02. Patients transported by plane and helicopter because of trauma were included in the study. Non-trauma patients transported by air were excluded from the study. The patients were examined in terms of reason for transport, gender, age, medical condition, cities of transport, route of transport, transport vehicle. Safety, quality, reliability, traceability, compatibility, efficiency of program and cost were observed when transferring patients. The basic criteria of the patients to be transported by air are determined by the Ministry of Health. The lack of a physician who can intervene in the area where the incident occurred and the need for rapid and effective treatment of the patient are the main reasons for moving. Air transport activities were assessed on the basis of standards set country-wide. While helicopters are preferred for regional and short-distance, plane transportation is preferred in long-distance and adverse weather conditions. The aircraft operated even under unfavorable meteorological conditions, cabin crew were guaranteed 7 days and 24 h operation and pilots with maximum flight experience were provided. In cases that there was no airport in the city where the trauma patient was located, the patients were transferred by helicopter or arrived at the nearest airport by land ambulance.

## Statistical Analysis

Data were evaluated using the Statistical Package for the Social Sciences 23.0, IBM, USA. Data are presented in mean±standard deviation or n (%), where appropriate. Comparison of the categorical data between groups was used chi-square test. Analysis of variance (ANOVA) was used for comparing normally distributed continuous data of more than two groups. Correlations between continuous variables were tested using Spearman's rho.  $P < 0.05$  was considered as statistically significant.

## Results

In our study, a retrospective review was performed using data collected for cases transported by airway organized by

the Ministry of Health between January 2020 and May 2021. During this period, 287 trauma patients were transferred, 125 by air ambulance and 162 by helicopter ambulance (Table 1). Of the patients transported by plane, 103 were male and 22 were female. Among the number of patients transported by helicopter, 120 patients were male and 42 patients were female. The pediatric patients were 23 in patients transported by plane and 34 in helicopter.

When the transported patients were evaluated in terms of indication; the most common indication for transportation of patients is multitrauma (blunt thoracic trauma, fracture) patients with 78 patients. In the second place, 58 patients were transported due to the terrorist attack; in the third place, 52 patients were transported due to traffic accident injuries (Table 2). The most common indication in patients transported by plane was patients injured due to terrorist attack, while multitrauma patients were in the first place with 54 patients transported by helicopter. Considering the major centers where patients were transferred, Ankara was in the first place with 107 patients. Most patients transported by plane consisted of patients transported to Ankara (Table 2). In patients

**Table 1. Number of patients transferred and distribution by years**

		n	
Number of patients transferred	Plane	125 (43%)	
	Helicopter	162 (57%)	
Distribution by years		<b>Plane</b>	<b>Helicopter</b>
	2020	52 (19%)	94 (33%)
	2021	73 (25%)	68 (23%)
Distribution by gender	Male	103	120
	Female	22	42

**Table 2. Distribution by indication and transferred centers**

		Plane (n)	Helicopter (n)
Indications	Multitramas	24	54
	Terrorist attacks	34	24
	Traffic accident injuries	12	40
	Burns	28	18
	Amputations	16	14
	Gunshot injuries	11	12
Patients transferred centers (cities with the most transfers)	Ankara	93	14
	İstanbul	7	9
	Adana	4	5
	Malatya	3	4
	İzmir	2	11

transported by helicopter, more patients were transported to centers within a short distance, due to the extensive regional helicopter network. Therefore, the provincial distribution is more homogeneous.

Considering the flight times, the average flight time for air transport was 77 minutes, and the average flight time for a helicopter ambulance was 69 minutes (Table 3). Transporting patients to large centers as soon as possible has very positive contributions to morbidity and mortality. We think that our country's successful air transport system plays a major role in the effective treatment of patients.

## Discussion

In our study, patients who were transported by plane and helicopter due to trauma in our country were included. Most patients were 41-57 years of age, with multitrauma patient being the most common clinical diagnosis. Mostly blunt thoracic trauma patients were present multitrauma patients. The benefits and challenges of plane for long-distance patient transport are described in the literature. However, few studies have described the epidemiology of patients transported by plane (7). In our country, trauma cases usually require primary medical intervention. Often the helicopter service provides emergency medical intervention, but where the distances are long, plane may often be used as the primary medical intervention team. Similarly, a Norwegian study reported that trauma was the most common clinical condition in patients transported by air ambulance over long distances (8). Such results show that trauma patients are a common medical problem that often require specialized treatment. Also, this condition may be because most multiple trauma specialists are located in capitals or major cities.

While several other studies have described larger patient populations transported by air ambulances, few studies have investigated subgroups of patient populations. The study focused on the epidemiology of pediatric patients aged 17 years and younger who were transported by an airplane ambulance, over a 12-month period, 313 pediatric aircraft transport were reported. A total of 99.6% of these cases involved an interhospital transfer, and 62% involved a non-traumatic disease

(9). In our study, approximately 10% of the transferred patients consisted of pediatric patients and the most common reason for transportation was burns.

Compared to studies in the literature involving the use of helicopter medical emergency services, we detected few studies involving the use of air ambulances internationally. Many emergency medical systems use helicopters for primary medical intervention and transfer between short transport distances (6). However, due to Turkey's wide geography, the use of planes for medical patient transfer provides advantages. In Turkey, air ambulance service transports a wide variety of patients with complex medical problems over 500 km. Providing air transport to these patients also provides timely care and operational benefits. Transporting a complex patient by road for a distance of 500 km deprives an emergency ambulance of a regional area for more than 12 h. Because advanced care requires for such patients (10). Therefore, air transport allows approximately 40% of the emergency ambulances to remain in the established area and continue to provide care to the patients.

Another advantage of the air ambulance service is the transportation of more than one patient at the same time. Transporting up to 4 patients requiring special care is faster than multiple transport and potentially inexpensive than using road ambulance services. Also, considering the distance, speed and logistics, air ambulances may be inexpensive than helicopter transfers. It has been reported in the literature that air ambulances are the most cost-effective for long-distance transfers (11). However, the air environment has challenging features compared to land transportation. Vibrations, turbulence, thermal changes, humidity, acceleration and deceleration movement, hypoxia, gas-volume changes and noise are disadvantages of air transfer and should be considered when transporting critical patients (12).

In our study, the transport system of patients by airway organized by the Ministry of Health was examined and 277 trauma patients were transferred. When the transported patients were evaluated in terms of indication; the most common indication for transportation of patients is multitrauma (blunt thoracic trauma, fall, fracture) patients with 78 patients. In the second

**Table 3. Average transferred times of patients**

		Plane	Helicopter
Average flight time (minutes)		77	69
Average flight time according to indications (minutes)		Plane	Helicopter
	Multitraumas	84	72
	Terrorist attacks	73	64
	Traffic accident injuries	66	70

place, 58 patients were transported due to the terrorist attack; in the third place, 52 patients were transported due of traffic accident injuries. In similar studies in the literature, the most transported patients were multitrauma patients (13,14). We think that the geography of our country affects the results of patients injured in terrorist attacks in the second place in our study.

Considering the flight times, the average flight time for air transport was 77 minutes, and the average flight time for a helicopter ambulance was 102 minutes. In many publications in the literature, it was reported that transporting patients to large centers as soon as possible has very positive contributions to morbidity and mortality (15,16). We think that our country's successful air transport system plays a major role in the effective treatment of patients, thanks to its short average flight time and successful transport procedure.

### Study Limitations

The short working time, the vital signs of the patients who were transported, and the lack of knowledge of the treatments are the most important limitations.

### Conclusion

Transporting patients by air is critical in countries such as Turkey, which has a large area and difficult geographical conditions. Transporting trauma patients who require early intervention to large centers for effective treatment ensures both effective treatment and a reduction in mortality. We think that our country's successful air transport system plays a major role in the effective treatment of patients, thanks to its short average flight time and successful transport procedure.

### Ethics

**Ethics Committee Approval:** Approval was obtained for the data use ethical approval of the study with the letter of the Ministry of Health (approval no: E-39942531-301.02, date: 04.06.2021)

**Informed Consent:** Retrospective study.

**Peer-review:** Externally peer-reviewed.

### Authorship Contributions

Surgical and Medical Practices: Ş.Y., A.G., Concept: Ş.Y., A.G., Design: Ş.Y., A.G., Data Collection or Processing: Ş.Y., A.G., Analysis or Interpretation: Ş.Y., A.G., Literature Search: Ş.Y., A.G., Writing: Ş.Y., A.G.

**Conflict of Interest:** No conflict of interest was declared by the authors.

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