ORIGINAL ARTICLE

Helicopter Emergency Medical Services in East Azerbaijan province: Assessment of patients' outcome

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ABSTRACT

BACKGROUND: In this study, we aimed to evaluate the outcomes of patients transported by Helicopter Emergency Medical Services in East Azerbaijan Province.

METHODS: This retrospective cross-sectional study was conducted on patients transported by the HEMS centre of Tabriz from August 2014 to March 2017. Records of the centre were used to collect data. Statistical analysis was performed by SPSS software version 20; the statistical significance level was considered below 0.05.

RESULTS: In this study, 268 patients were transferred to Tabriz hospitals by 167 missions performed. The mean age of patients was 34.26±19.43, and 173 (65%) patients were male. The most common reason for call-out was the need for professional care (91.4%). The target of the majority of missions was on countryside routes. The mean distance of destinations was about 99.13±35.9 Kms, with a mean transference time of 54.68±14.17 minutes, while the mean estimated ground route time was 86.38±26.26 minutes. The most prevalent diagnosis was trauma; The Glasgow Coma Scale (GCS) and vital signs of the majority of patients were above 13 and stable, respectively. About 98 percent of patients received fluid therapy, and 71 percent were immobilized, and only 6 percent needed intubation. Also, 28 percent of patients needed Intensive Care Unit (ICU), 56 percent of whom passed away later.

CONCLUSION: Our results suggest that Tabriz HEMS missions have reduced the patient transport time and also made the mortality rate closer to international standards.

Keywords: Air emergency; Helicopter Emergency Medical Services (HEMS); Iran.

INTRODUCTION

Approximately 75 percent of deaths in emergency settings occur before the ambulance could reach the hospital.[1] Hence, helicopter emergency medical services (HEMS) is considered a necessity to deliver healthcare; accordingly, the Iranian ministry of health and medical education (MOHME) decided to declare the promotion of HEMS as one of eight packages of the Health Transformation Plan (HTP) in 2014. As a result, 14 air emergency bases were established in 14 provinces, including East Azerbaijan.[2] East Azerbaijan is the largest and the most populated province of the northeast of Iran. It covers an area of 45,637 square kilometers with an altitude of 1345 meters above sea level, mostly cold weather (mean temperature about 12°C) and mountain climate. This province consists of 20 counties, 44 districts, 62 cities, 142 rural districts, and 3,076 villages with a total population of 3,909,652 people. Twenty-eight percent of whom are living in rural areas.[3,4] The main target of HTP for HEMS was to reduce patient wait times in 80 percent of cases to less than eight minutes in cities and less than 15 minutes on roads.[4,5] In this study, we aimed to evaluate the outcomes of patients who used the service from its very first day, August 2014 to March 2017.

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MATERIALS AND METHODS

This retrospective cross-sectional study, which evaluated the outcomes of patients transported by East Azerbaijan's HEMS, was approved by the research ethics committee of Tabriz University of Medical Sciences. The collected data from the HEMS center were recorded to a structured collection form; this format included data, such as the number of missions, a number of patients transferred, Hemodynamic status and Glasgow Coma Scale (GCS) at scene and admission, estimated mission duration by Ground, mission duration of airlifted patients, location of patients, destination hospital, reasons to request the service, services delivered during the mission, progress of the disease, mortality, diagnostic category and mechanism of injury in trauma category. The helicopter call-out indications are listed in Table 1.

We defined multi-trauma as an ISS score (Injury Severity Score) above 15. Moreover, head trauma was defined as AIS score (Abbreviated Injury Scale) above two; similarly, trauma to each of the regions, including chest, abdomen and pelvic, spine and extremities, was defined as AIS score above two in each of these anatomical regions. An unstable vital sign was defined as having a respiratory rate above 24 breaths per minute or Heart rate above 100 beats per minute or systolic blood pressure below 90 mmHg or Oxygen saturation below 90 percent. All data were extracted to the 20th version of IBM SPSS software. The statistical significance level was considered below 0.05 in the analysis process.

RESULTS

The findings obtained in this study showed that 167 missions were performed in 32 months; 15 missions were completed in 2014, 70 missions in 2015, 70 missions in 2016, and 12 missions in the first trimester of 2017. The mean number of missions per month was 5.68±4.36, with its peak in summer (Fig. 1).

Table 1. Dispatch criteria of the Iranian HEMS

1) Unexpected or accidents
2) Amputation
3) Penetrating trauma to the thorax, abdomen and skull
4) Flail chest due to thoracic trauma
5) Acute ischemic stroke and cerebrovascular accident in which cannot be transferred by ground routes or
6) Burns covering above 10 percent of the body surface and loss of consciousness
7) Fracture of two or more Long bones, Severe hip fracture
8) Paraplegia due to vertebral column trauma
9) Helicopter dispatches according to EOC requirements of university, pole or ministry of health and medical education following unexpected events and medical emergency services coverage
10) Dispatch helicopters at the request of the director or deputy director of the 115 emergency services to cover emergency medical services
11) Specialist and equipment transfer to the scene of the accident in the event of an unexpected event, if necessary, with the decision of the head of the provincial / county emergency department.
12) Accident zone assessment in the event of an unexpected accident, with the decision of the head of the provincial / county emergency department.
13) Deploying helicopters at the request of the 115 emergency forces present at the scene, in case transportation via ground route is not possible or could be life-threatening.
14) Emergency medical coverage in mountainous, impassable, malleable and islands with no access to land
15) Transportation of blood and blood products, transplanted organs and brain death patients for organ donation, which transportation via ground routes may prolong the service process and threaten the patients' lives.
16) To provide specialty care to high-risk pregnant women or those giving birth in centers of the first level of care with the decision of semi-professional (Behvers).
17) Dispatching helicopters to transport injured or patients between care facilities are based on the following:
    17-1) Referral of the large number of patients to the health center simultaneously and inability to manage patients due to lack of facilities and inability to transport casualties by ground.
    17-2) A care center lacking facilities or delayed transportation of the patients may pose serious risks and ground transportation may be time-consuming and can be lifeth reatening.
18) Dispatch helicopters at special gatherings and events upon request of the Provincial Emergency Service Provider (country, Province) in coordination with the EOC of Ministry of Health and Medical Education ministry and approval of the Emergency Department's Air Ambulance Administration
19) Dispatching helicopters in specific traffic conditions, such as unilateral or blocked roads, to transport patients and maintain the capacity of ground emergency services.

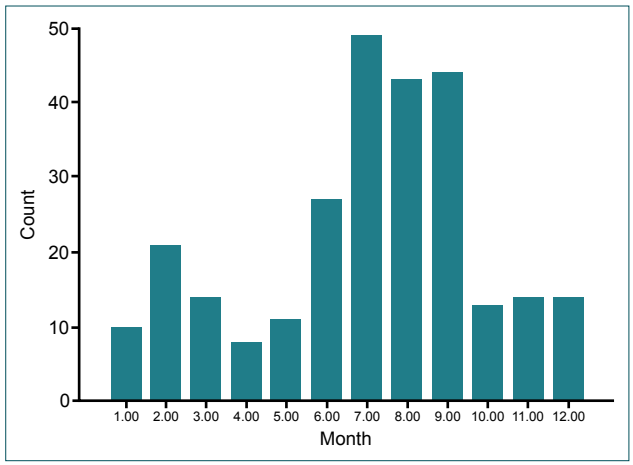

Figure 1. Distribution of missions concerning months.

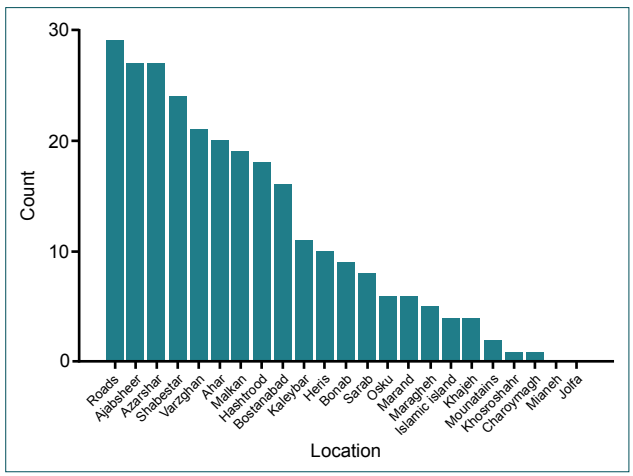

Figure 2. Number of missions to the territories of the cities.

During these missions, 268 patients were transferred to the hospitals. The mean age of Patients was 34.26±19.43 years, and 173 (65%) patients were male.

The most common reasons for call-out were the need for professional care (91.4%), need for medical equipment (45.9%), and severe state of patient's condition (14.2%) (Table 2). The target of most missions was on the roads of rural areas, Azarshahr, Ajabshir, and Shabestar (Fig. 2).

The mean distance of destinations was approximately 99.13±35.9 km, which took a mean transportation time of 54.68±14.17 minutes, and while it was estimated that the same missions by ground route would take a mean time of 86.38±26.26 minutes, this difference was statistically significant (p<0.001) (Fig. 3).

We did not find any significant correlation between the transport time or distance and mortality in our study (r=0.84, p=0.172; r=0.104, p=0.09, respectively).

The hemodynamic status of the majority of the patients was stable and only 49 (18.3%) and 52 (19.4%) patients were hemodynamically unstable. No significant difference was observed between these two time points, which indicate that the patients were well taken care of (p=0.740). Similarly, the GCS of the 183 (68.3%) and 184 (68.7%) patients were above 13 which did not show a significant statistical difference (p=0.513) (Table 3).

The most common diagnostic category was trauma, followed by obstetrics and cardiovascular emergencies. 29.9 percent of cases had an ISS score above 15 and therefore considered

Table 2. Demographical and practical features of the patients

		N
Age, years, mean (SD)	34.26 (19.43)	258
Distance, km, mean (SD)	99.13 (35.90)	268
Air Transport time, min, mean (SD)	54.68 (14.17)	268
Estimated ground transport time, min, mean (SD)	86.38 (26.26)	268
Admission duration, days, mean (SD)	5.12 (13.58)	251
Gender, n (%)		268
Male	174 (64.9)	
Female	94 (35.1)	
ICU need, n (%)	77 (28.7)	268
Critical care intervention, n (%)		268
Intubation	16 (6.0)	
Immobilizing	189 (70.5)	
Fluid therapy	262 (97.8)	
Final condition, n (%)		268
Relative improvement	211 (78.7)	
Not improved	2 (0.7)	
Discharge with own will	8 (3.0)	
Mortality, n (%)	47 (17.5)	268
Reason for request, n (%)		268
Need for specialist	245 (91.4)	
Long-distance	23 (8.6)	
Sever patient condition	38 (14.2)	
Occlusion of ground routes	1 (0.4)	
Need for special facilities	123 (45.9)	
Destination hospital, n (%)		267
Imam Reza	215 (80.2)	
Al-Zahra	16 (6.0)	
Shaheed Madani	9 (3.4)	
Aalinasab	4 (1.5)	
Sina	3 (1.1)	
Taleghani	4 (1.5)	
Children	4 (1.5)	
Shohada	3 (1.1)	

ICU: Intensive Care Unit; SD: Standard deviation.

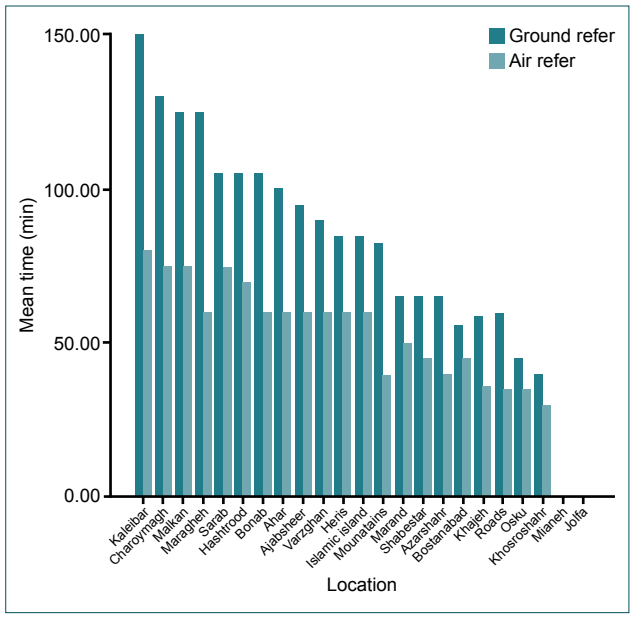

Figure 3. Comparison of Air vs. Ground transport time (There was no mission to Jolfa and Mianeh.).

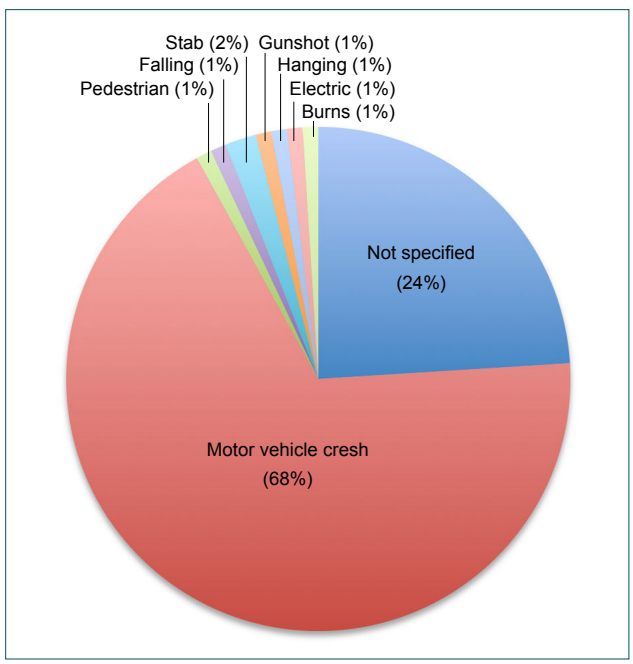

Figure 4. Mechanism of injury in trauma cases.

multi-trauma cases. Head trauma was the most common anatomical injured area. The most common mechanism of injury was multi-vehicle crashes which accounted for 68 percent of the cases (Fig. 4).

Approximately 98 percent of patients received fluid therapy, and 71 percent were immobilized during the operation, and only 6 percent needed intubation. Moreover, 28 percent of patients required ICU, which 56 percent of them passed away later (Table 2).

The mortality rate among the study population was 17.5%.

Table 3. Clinical features of the patients

	At scene n (%)	Admission n (%)
Glasgow Coma Score		
14–15	183 (68.3)	184 (68.7)
9–13	48 (17.9)	40 (14.9)
<=8	37 (13.8)	44 (16.4)
Hemodynamic status		
Stable	219 (81.7)	216 (80.6)
Unstable	49 (18.3)	52 (19.4)
Diagnosis		
Cardiovascular emergencies	13 (4.9)	
Cardiac arrest	2 (0.7)	
Myocardial Infarction	9 (3.4)	
Height related	2 (0.7)	
Neurological emergencies	11 (4.1)	
CVA	9 (3.4)	
ICH	2 (0.7)	
Respiratory emergencies	6 (2.0)	
Asphyxia	2 (0.7)	
RDS	4 (1.5)	
Trauma	209 (78.0)	
Head	84 (31.3)	
Spinal	12 (4.5)	
Abdominal	12 (4.5)	
Thoracic	20 (7.5)	
Extremities	23 (8.6)	
Obstetrics	20 (7.5)	
Other medical conditions	8 (3.0)	
Pneumonia	1 (0.4)	
Meningoencephalitis	1 (0.4)	
Epilepsy	2 (0.7)	
ARF	1 (0.4)	
Malignancy	2 (0.7)	
Non-cardiac chest pain	1 (0.4)	

CVA: Cerebrovascular accidents, ICH: Intracranial hemorrhage, RDS: Respiratory distress syndrome; ARF: Acute renal failure.

DISCUSSION

The mean age of patients was 34.26±19.43 years, and 173 (65%) patients were male, while almost all studies reported that the majority of their patients were male, the mean age of the patients varied between 40 to 60 years.[6–8]

Based on our results, trauma was the most frequent diagnosis, mean transfer time was around one hour, and 60 percent of missions were done in June, July, August, and September,

which coincides with the school summer break in Iran. Several studies pointed out that cardiovascular emergencies were the most common diagnostic category; half of all fractures happened in April and August. This time was the busiest time of service.[8,9] Rzońca et al.[10] (2019), in a similar study, showed that the most common diagnosis of the patients rescued by Poland HEMS in rural areas was injuries and cardiovascular disease in the second place; they also showed that the majority of missions were accomplished in spring and summer.

The mean distance of patients from hospitals in our study was about 100 km; mean transport time was less than an hour; as we see in the work of Rzońca et al.,[10] the mean distance from the hospital was about 40 kms and the mean transport time was around 15 minutes which is faster than our study.

While Rhinehart et al.[11] (2013) showed that the mortality rate was associated with the distance of a base from the patient, we could not identify such an association in our findings.

Moradian et al.[12] (2012) studied the data of all patients transported by the HEMS center of Fars province in Iran over six years and demonstrated findings similar to ours, with trauma was the most common diagnosis; they also found that ground route missions were faster than air in some cities. Despite their findings, HEMS was faster in all the cases we studied. Before the implementation of the Health transformation plan in Iran, most studies were dedicated to developing criteria for HEMS utilization. As Shojamoradi et al.[13] (2008) demonstrated, 518 patients were transported to Imam Khomeini Hospital by Tehran HEMS in just one year, they believed that there was an over-triage in patient selection. They proposed the need for national criteria of patient selection. This need was met in HTP, and an approach was circularized to the medical education of the country in February 2014 (5). Our study assessed the cases after this circularization, and therefore, it is based on the proposed criteria.

Multi-trauma patients accounted for 30 percent of cases. Previous studies on these patients showed that carrying patients by HEMS to a university-affiliated hospital could lower the mortality to half. Our mortality rate for multi-trauma patients was 15 percent, which was close to other studies.[9,14–16] Giri et al.[17] (2019), in a similar study, demonstrated that the overall survival rate of patients who were transported by Bhutan's first HEMS was 73.1 percent, which was lower than our study population. It has also been shown that HEMS transport in isolated severe traumatic brain injury can improve survival;[18] This might be achieved through faster transportation. As the study of Svenson et al.[19] (2006) and the present study have demonstrated, HEMS significantly reduces the inter-facility transport time. On the other hand, De Jongh[21] (2012) could not identify any difference in survival of traumatic brain injury patients transported by HEMS or GEMS and in line with this finding, Chappell et al.[20] (2002) pointed out that discontinuation of HEMS in their care setting did not negatively affect the mortality or transport time of patients. The findings of previous studies are inconclusive; this could be due to differences in measuring the transference time. As Karanicolas et al.[22] (2006) mentioned, although the time taken to transfer patients was significantly lower in HEMS, the time from decision to transfer to actual departure is almost double in the case of HEMS. Therefore, surprisingly, the whole transfer process by air took a mean time of 30 minutes more.

Only about 4 percent of our study population was diagnosed with cardiovascular disease (CVD); Lyon et al.[23] (2013) reported that 11 percent of all HEMS calls of the population they studied in the united kingdom are for out of hospital arrests. Several studies discussed that a helicopter service with physician and nurse on-board could lower the transfer time, thus making in-hospital prognosis better in acute myocardial infarction.[24–26] On the other hand, Funder et al.[27] (2018), in an observational study on 1604 suspected STEMI patients, could not identify any difference between HEMS and GEMS in mortality rates.

HEMS transferred three burn patients. One of the patients was in a critical state and passed away later. Chipp et al.[28] (2010) studied 27 patient transported by air to a burn center in the UK and found that HEMS could be beneficial in severe cases of the burn; they suggested that an algorithm for calling HEMS service could ensure the best results as well as lower financial costs.

In our study, two of the missions were headed to the Mountainous areas of the country; due to their low incidence and different nature of management, general knowledge in this field should be reviewed, and training must be done regularly.[29]

Sixty-eight percent of the airlifted patients had a GCS score above 13, while only 54 percent of the patients Alstrup et al.[9] (2019) studied were in such condition.

While 15 percent of patients in the study of Rzońca et al. (2019) were intubated, only 6 percent of our subjects were intubated during the flight. The most prevalent indication for intubation was Multi-trauma. As we see in the work of Stassen et al.[30] (2018), the most common reason for intubation was traumatic brain injury. Previous efforts to explore the safety of such practice in HEMS identified several factors that make the process challenging. However, still, endotracheal intubation is considered a safe approach in the HEMS setting.[31,32] It has been demonstrated that air transport programs have a low incidence of adverse events, and the most common cause of such events is reported to be communication problems.[33]

Approximately 98 percent of patients in our study received intravenous fluid resuscitation, which was more than similar studies.[10]

Seventy-one percent were immobilized during the operation, which was more than similar studies.[10] Moreover, 28 percent of patients required ICU, of which 56 percent of them passed away later.

To our knowledge, this study is the first to evaluate outcomes of patients transported by HEMS in Iran after implementation of HTP. However, the main limitation to our study was that our database was not online, and some of the data were incomplete; to overcome this issue, we tried to extract the data from hospital registries. The development of an online system in future studies and addressing the need for complete filling the forms could raise our knowledge regarding the system and its pitfalls.

In conclusion, our findings suggest that the HEMS service has made patient transportation faster and made the overall mortality rate closer to some developed countries. Further assessments are required to ensure such findings.

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Ethics Committee Approval: This study approved by the Tabriz University of Medical Sciences Clinical Research Ethics Committee (Date: May 20, 2015, Decision No: 95/3-7/9).

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Authorship Contributions: Concept: A.G.; Design: F.R.; Supervision: A.G.; Resource: R.R.G., H.R.M.B.; Materials: A.G.; Data: A.G., F.D.; Analysis: F.D., F.R.; Literature search: A.G., A.Ghala.; Writing: F.D., H.R.M.B.; Critical revision: A.G., A.Ghala., R.R.G., H.M.

Conflict of Interest: None declared.

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ORİJİNAL ÇALIŞMA - *ÖZ*

Doğu Azerbaycan bölgesinde helikopter acil sağlık hizmetleri: Hastaların sonuçlarının değerlendirilmesi

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AMAÇ: Doğu Azerbaycan bölgesinde helikopter ile acil sağlık hizmetleri yoluyla taşınan hastaların sonuçlarını değerlendirmeyi hedefledik.
GEREÇ VE YÖNTEM: Bu retrospektif kesitsel çalışma, Ağustos 2014–Mart 2017 arası Tebriz Helikopter ile Acil Sağlık Hizmetleri merkezi tarafından taşınan hastalar üzerinde gerçekleştirildi. Veri toplamak için merkezin kayıtları kullanıldı. İstatistiksel analiz SPSS v.20 yazılımı ile yapıldı; istatistiksel anlamlılık düzeyi 0.05'in altında kabul edildi.
BULGULAR: Tebriz hastanelerine 167 görevle toplam 268 hasta sevk edildi. Hastaların ortalama yaşı 34.26±19.43 idi ve 173 (%65) hasta erkekti. Çağrıların en yaygın nedeni profesyonel bakım ihtiyacı idi (%91.4). Görevlerin çoğu kırsal yollar üzerindeydi. Hedeflerin ortalama mesafesi yaklaşık 99.13±35.9 km, ortalama transfer süresi 54.68±14.17 dakika iken, ortalama tahmini kara rota süresi 86.38±26.26 dakikaydı. En yaygın tanı travmaydı; Glasgow Koma Skalası (GCS) 13'ün üzerinde ve hastaların çoğunun yaşamsal bulguları stabildi. Hastaların yaklaşık yüzde 98'i sıvı tedavisi almış ve yüzde 71'i immobil idi ve sadece yüzde 6'sının entübasyona ihtiyacı vardı. Ayrıca, hastaların yüzde 28'inin Yoğun Bakım Ünitesine (YBÜ) ihtiyacı vardı ve bunların yüzde 56'sı daha sonra vefat etti. Ayrıca, hastaların yüzde 28'inin Yoğun Bakım Ünitesine (YBÜ) ihtiyacı vardı ve bunların yüzde 56'sı daha sonra hayatını kaybetti.
TARTIŞMA: Sonuçlarımız, Tebriz helikopter acil sağlık hizmetlerinin hasta nakil süresini kısalttığını ve ölüm oranını uluslararası standartlara yaklaştırdığını göstermektedir.
Anahtar sözcükler: Hava yolu ile acil bakım; helikopter acil sağlık hizmetleri; İran.

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