Research Paper: Outcomes of Traffic Accident Patients Transferred by Air and Ground Ambulance: Propensity Score Matching

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ABSTRACT

Background: The main task of the emergency medical system is to provide primary care and transfer the patients to hospital. Studies have been conducted to investigate the outcome of air and ground ambulance patients, but they show different results. These different results may be due to the type of study, statistical methods, differences in prehospital emergency systems, and insufficient control of confounding variables. Thus, it is difficult to compare and generalize the results. This study aimed to investigate the outcomes of injured people transported by air and ground ambulance in road traffic accidents in Qom Province, Iran, during 2015-2019.

Materials and Methods: In this retrospective analytical descriptive study, we used the numerical method and examined all road traffic accident patients transferred through ground or air to Qom Shahid Beheshti Hospital by the prehospital emergency from 2015 to 2019. The collected information included the type of transfer, age, sex, type of trauma, distance from the accident site to the hospital, initial vital signs, duration of the mission, and day of the accident. To control the confounding factors, we used propensity score matching. Outcomes studied included length of hospital stay, length of stay in the intensive care unit, duration of mechanical ventilation, and the need for immediate surgery. Logistic regression was used to analyze the need for immediate surgery and a generalized linear model for other consequences.

Results: After matching, the number of patients in each group transferred by ground ambulances and helicopter was 566. Trauma to the head (P=0.028) and back (P=0.002) were more common in helicopter-transported patients. The patients transported by helicopter had a longer time to reach the scene (7.70 ±5.18 min) (P<0.001), a shorter duration of presence on the scene (12.17±8.33 min) (P=0.041), and a shorter duration of transfer (13.12±4.75 min) (P<0.001) than the ground ambulance. There was no significant difference between the patients who transferred by ground and helicopter ambulance regarding the length of hospital stay in the intensive care unit (P=0.718), mechanical ventilation (P=0.507), and hospitalization (P=0.089). The need for immediate surgery in helicopter-transported patients was 84.8% higher than ground ambulance patients (95%CI: 0.086-0.267; P<0.001).

Conclusion: The patients transported by helicopter were not significantly different from ground ambulances transported patients regarding staying in the intensive care unit, mechanical ventilation, and hospitalization, but they more needed immediate surgery. If the patients are triaged adequately according to the type of injury and the level of consciousness at the scene and transferred to the appropriate hospital by ground or air, they can enjoy the benefits of the type of transfer.

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1. Introduction

Traffic accidents result in approximately 1.35 million deaths and more than 50 million injuries worldwide each year [1]. Traffic accidents are the leading cause of death in people aged 5 to 29 years and the second most common mechanism of injury in the elderly [1, 2]. These accidents are the main cause of disability, in the long term, so for every death, three severe injuries occur [3], and two injured people become permanently disabled [4]. According to Forensic Medicine Organization, in 2018, 17183 deaths and 367451 injuries were registered in the Iran due to traffic accidents [5]. Care and treatment in traffic accidents are time-dependent; a few minutes delay in providing medical services can mean the difference between life and death [6, 7]. Most deaths due to traffic accidents occur in the first hour after the accident [6].

Effective prehospital emergency care reduces the risk of death by 25% [8]. Air emergency medical service is a vital component of this care system [4]. The main task of the air emergency is to provide primary care at the scene of the accident and to transfer the patients to the hospitalquickly [9]. Today, air emergencies to transport patients are common in most developed countries [10]. Air emergencies can extend geographical access to a hospital [11]. One of the limitations of air emergency over ground emergency is the safety issue. The crash of emergency helicopters over the past few years has raised concerns about air emergency safety [12]. The next limitation of air emergency is its higher cost. The use of air emergencies in the United States shows a cost increase of $ 200-240 million compared to ground emergencies [13].

Studies have been conducted on the outcome of air and ground emergency transport patients. Some studies have confirmed an increased survival rate in air emergencies [7, 14-17]. Other studies have shown this increase in specific groups [18-20]. Another group of studies did not report a change in outcome [11, 21, 22]. These different results may be due to the type of study, statistical methods, differences in prehospital emergency systems in different countries, patients studied, the educational level of caregivers, limited sample size, and insufficient control of confounding variables. So, it is difficult to compare and generalize results [12, 19, 23]. Air emergency in Qom Province was established in August 2014 [24]. Qom is the second smallest province in Iran. This province has the highest urbanization rate and the shortest road routes in the country. But, it is the transportation route from and to 17 provinces of the country that increases the probability of traffic accidents [25, 26]. Therefore, the present study was designed and conducted to investigate the outcome of air and ground emergency patients in traffic accidents in Qom Province from 2015 to 2019.

2. Materials and Methods

In this retrospective descriptive-analytical study, we examined by numerical method all road traffic accident patients transferred to Shahid Beheshti Hospital in Qom by ground or air from March 21, 2015, to March 20, 2019. Prehospital exclusion criteria included treatment at the accident scene without transferring to a hospital, against medical advice with transfer to a hospital, death at the scene, cardiopulmonary resuscitation during transfer, burns, intra-city accidents, mission time from 20:00 to 6:00, and prehospital record deficiencies. Hospital exclusion criteria also included hospital death, against medical advice to discontinue treatment, transfer to another hospital to continue treatment, escape from the hospital, and deficiencies in the hospital record. A researcher-made checklist whose content validity was approved by faculty members was used to collect study data. The collected data included the type of transfer, age, sex, type of trauma (head and face, neck, chest, abdomen, hands, feet, back, and genital area), distance from the hospital, primary vital signs (systolic blood pressure, heart rate, respiration rate and level of consciousness according to the Glasgow Coma Scale [GCS]), duration of the mission (duration of arrival at the scene: receiving the mission until arrival at the scene, duration of presence at the scene: reaching the scene of the accident until the transfer to the hospital, duration of arrival at the hospital: movement from the scene of the accident to the arrival of the patients to the hospital) and the day of the accident (official holiday or weekend [Thursday and Friday], working days).

To control the confounders, we used propensity score matching using R software version 3.6.2. After matching, data analysis was performed by the t test and Chi-square test. A significance level less than 0.05 was considered for the two-tailed tests. Outcomes studied included length of hospital stay, intensive care unit, duration of mechanical ventilation, and need for immediate surgery. The duration of hospitalization in the hospital and intensive care unit was measured in days, and the duration of mechanical ventilation was measured in hours. The need for immediate surgery was defined as surgery in the first 24 hours of hospitalization. The generalized linear model evaluated the outcome of the length of hospital stay, length of stay in the intensive care unit, and duration of mechanical ventilation. Logistic regression was used to

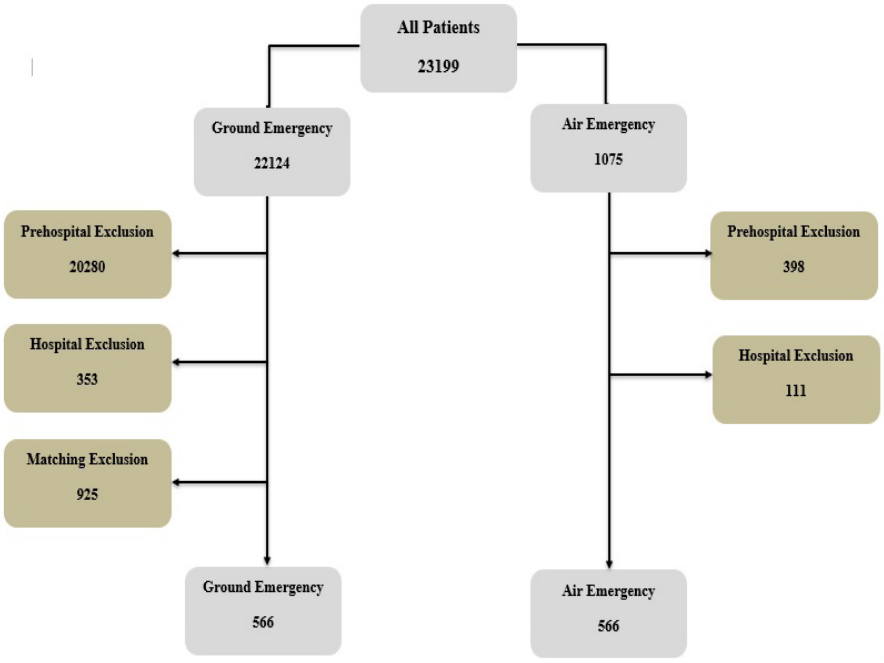

Figure 1. Workflow diagram and sample size

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analyze the outcome of the need for immediate surgery. This article is part of an approved Master's degree dissertation submitted to Qom School of Nursing, approved by the Ethics Committee of Qom University of Medical Sciences (Code: IR.MUQ.REC.1399.067).

3. Results

Out of all injured people, 1075(4.7%) were transported to the hospital by helicopter and 22124(95.3%) by ambulance. The patients included 566 air emergency patients and 1491 ground road emergency patients. After matching the two groups, the number of patients in each ground and air group reached 566 (Figure 1). Most of the patients were men (62.3%). The Mean±SD age of the patients was 30.64±16.39 years. The Mean±SD distance of the patients was 39.12±20.84 km. The Mean±SD time to reach the scene of the accident was 12.12±7.7 minutes and the Mean±SD time to be present at the scene of the accident was 15.39±10.56 minutes and the Mean±SD time to transfer the patients to the hospital was 15.46±5.10 minutes (Table 1).

The incidence of traffic accidents on holidays and weekends in air emergencies was higher (53%) (P=0.028). Head and face trauma was higher in air emergency patients (9.2%) (P=0.028). Also, back trauma was more in this group (21.7%) (P=0.002). Duration of arrival at the scene in air emergency patients were significantly longer than ground emergency patients (7.70±5.18 min) (P<0.001). But duration of presence at the scene (12.17±8.33)(P=0.041) and duration of arrival at the hospital (13.12±4.75) (P<0.001) in air emergency patients were significantly shorter than ground emergency patient.

Ground emergency patients stayed 0.15 days (about 3.6 hours) more than air emergency patients in the intensive care unit, but this difference was not statistically significant (P=0.718). The length of hospital stay increases by 0.93 days (approximately 22.3 hours) per unit reduction in the GCS before treatment (P<0.001). Injured patients with leg trauma were hospitalized in the intensive care unit for 1.11 days (about 26.6 hours) more than non-traumatized patients (P=0.005).

Ground emergency patients were under mechanical ventilation 8.40 hours longer than that for air emergency patients, but this difference was not significant (P=0.507). Male patients were under mechanical ventilation 9.93 hr longer than female patients (P<0.001). This time increases for each unit decrease in GCS before arriving the hospital by 14.82 hr (P<0.001). Also, the patients with leg trauma were mechanically ventilated for about 22 hr more than those without leg trauma (P=0.004).

Air emergency patients were hospitalized in the hospital 1.27 days (about 30.6 hours) more than ground emergency patients, but this increase was not significant (P=0.089). This period increases by 1.58 days (approximately 37.9 hours) per unit decrease in GCS (P<0.001).

Table 1. Comparison of studied variables by air and ground groups

Variables			No. (%)/Mean±SD			P
			Total Injuries (N=1132)	Air Emergency (n=566)	Ground Emergency (n=566)	
Gender	Male		705(62.3)	332(58.7)	373(65.9)	0.688
	Female		427(37.7)	234(41.3)	193(34.1)	
Day of accident	Holiday-weekend		563(49.7)	300(53)	263(46.5)	0.028
	Weekdays		569(50.3)	266(47)	303(53.5)	
Age (y)			64.30±16.39	29.29±16.05	32±16.62	0.406
Distance of the accident site from the hospital (km)			39.12±20.84	53.11±18.30	25.13±11.93	0.266
Systolic blood pressure (mm Hg)			112.14±18.41	110.58±18.75	113.69±17.96	0.266
Heart rate (beats/min)			85.53±10.98	87.21±11.63	83.84±10.02	0.134
Respiratory rate (breaths/min)			17.02±2.57	17.33±2.70	16.71±2.39	0.890
Glasgow Coma Scale			14.77±1.07	14.61±1.04	14.93±0.56	085.0
Duration of arrival to the scene of the accident (min)			12.12±7.07	16.54±5.86	7.70±5.18	<0.001
Duration of presence at the scene of the accident (min)			15.39±10.56	12.17±8.33	18.61±11.54	0.041
Duration of transfer to the hospital (min)			15.46±5.10	13.12±4.75	17.82±4.33	>0.001
Rigion of trauma	Head and face	Yes	83(7.3)	52(2.9)	31(5.5)	0.028
		No	1049(92.7)	514(90.8)	535(94.5)	
	Neck	Yes	224(19.8)	135(23.9)	89(15.7)	0.380
		No	908(80.2)	431(76.1)	477(84.3)	
	Chest	Yes	127(11.2)	79(14)	48(8.5)	0.735
		No	1005(88.8)	487(86)	518(91.5)	
	Abdomen	Yes	107(9.9)	73(12.9)	34(6)	0.971
		No	1025(90.5)	493(87.1)	532(94)	
	Hand	Yes	264(23.3)	109(19.3)	155(27.4)	0.214
		No	868(76.7)	457(80.7)	411(72.6)	
	Leg	Yes	90(0.8)	44(7.8)	46(8.1)	0.143
		No	1042(92.0)	522(29.2)	520(91.9)	
	Back	Yes	185(16.3)	123(21.7)	62(11)	0.002
		No	947(83.7)	443(78.3)	504(89)	
	Genital area	Yes	5(0.4)	2(0.4)	3(0.5)	0.747
		No	1127(99.6)	564(99.6)	563(99.5)	

Table 2. Generalized linear analysis of the duration of hospitalization in the intensive care unit

Variables			Duration of Hospitalization in the Intensive Care Unit			Duration of Mechanical Ventilation			Duration of Hospitalization		
			Beta	SD	P	Beta	SD	P	Beta	SD	P
Transfer type	Ground		0.153	0.424	0.718	8.406	8.152	0.507	-1.275	0.748	0.089
	Aerial (Ref)		0	-	-	0	-	-	0	-	-
Gender	Male		0.516	0.233	0.027	9.932	69.693	<0.001	0.945	0.410	0.021
	Female (Ref)		0	-	-	0	-	-	0	-	-
Accident day	Holiday - Weekend		0.238	0.207	0.253	-0.176	3.835	0.963	0.544	0.366	0.138
	weekdays (Ref)		0	-	-	0	-	-	0	-	-
Age (y)			0.022	0.008	0.007	0.322	0.135	0.018	0.053	0.014	<0.001
Systolic blood pressure			-0.006	0.007	0.428	-0.006	0.007	0.428	-0.016	0.012	0.187
Heart rate			-0.005	0.011	0.638	-0.089	0.215	0.681	-0.013	0.020	0.508
Respiratory rate			-0.002	0.044	0.957	0.144	0.846	0.865	0.001	0.079	0.992
Glasgow Coma Scale			937.0-	098.0	001.0>	829.14-	869.1	<0.001	-1.580	0.172	<0.001
Distance to the accident site			0.001	0.007	0.943	0.022	0.148	0.880	0.013	0.013	0.342
Duration of arrival at the scene			0.013	0.019	0.502	0.028	0.382	0.942	0.006	0.035	0.872
Duration of presence at the scene of the accident			0.003	0.010	0.754	0.034	0.200	0.866	0.017	0.018	0.343
Duration of transfer to the hospital			-0.014	0.025	0.580	0.308	0.480	0.520	-0.042	0.044	0.340
Region of trauma	Head and face	Yes (Ref)	0	-	-	0	-	-	0	-	-
		No	-0.271	0.217	0.214	-3.725	4.177	0.373	-0.410	0.383	0.285
	Neck	Yes (Ref)	0	-	-	0	-	-	0	-	-
		No	0.047	0.257	0.855	2.300	4.941	0.642	-0.630	0.454	0.165
	Chest	Yes (Ref)	0	-	-	0	-	-	0	-	-
		No	-0.519	0.325	0.110	-6.745	6.240	0.280	-0.603	0.572	0.293
	Abdomen	Yes (Ref)	0	-	-	0	-	-	0	-	-
		No	-0.637	0.345	0.066	-9.078	6.629	0.171	-2.637		<0.001
	Hand	Yes (Ref)	0	-	-	0	-	-	0	-	-
		No	-0.598	0.397	0.132	-13.006	7.624	0.088	-1.124	0.700	0.109
	Leg	Yes (Ref)	0	-	-	0	-	-	0	-	-
		No	1.111	0.392	0.005	-22.009	7.528	0.004	-2.708	0.691	<0.001
	Back	Yes (Ref)	0	-	-	0	-	-	0	-	-
		No	0.165	0.277	0.552	3.711	5.321	0.486	-0.683	0.488	0.162
	Genital area	Yes (Ref)	0	-	-	0	-	-	0	-	-
		No	0.099	1.474	0.946	-0.425	28.293	0.988	-3.659	2.597	0.159

Table 3. Logistic regression analysis of the outcome of the need for immediate surgery

Variables			Beta	Exponential Beta	Standard Error	95%CI		P
						Min	Max	
Type of transfer	Ground (Ref)		0	-	-	-	-	-
	by air		-1.884	0.152	0.288	0.086	0.267	<0.001
Gender	Male		0.035	1.035	0.187	0.718	1.493	0.853
	Female (Ref)		0	-	-	-	-	-
The accident day	Holiday - Weekend		0.421	1.523	0.162	1.108	2.093	0.010
	Weekdays (Ref)		0	-	-	-	-	-
Age (y)			0.019	1.020	0.006	1.007	1.032	0.001
Systolic blood pressure			-0.006	0.994	0.005	0.984	1.005	0.266
Heart rate			0.013	1.013	0.009	0.996	1.030	0.134
Respiratory rate			0.005	1.005	0.035	0.937	1.077	0.890
Glasgow Coma Scale			-0.131	0.877	0.076	0.756	1.018	0.085
Distance to the accident site			0.006	1.006	0.006	0.995	1.017	0.266
Duration of arrival at the scene			-0.023	0.977	0.016	0.946	0.009	0.161
Duration of presence at the scene of the accident			0.017	1.017	0.008	1.001	1.033	0.041
Duration of transfer to the hospital			-0.037	0.963	0.016	0.934	0.994	0.018
Region of trauma	Head and face	Yes	-0.537	0.584	0.165	0.423	0.807	0.001
		No (Ref)	0	-	-	-	-	-
	Neck	Yes	-0.173	0.841	0.194	0.575	1.229	0.371
		No (Ref)	-	-	-	-	-	-
	Chest	Yes	-0.342	0.710	0.240	0.444	1.138	0.155
		No (Ref)	-	-	-	-	-	-
	Abdomen	Yes	-0.816	0.442	0.247	0.272	0.718	0.001
		No (Ref)	-	-	-	-	-	-
	Hand	Yes	-0.195	0.823	0.188	0.569	1.190	0.300
		No (Ref)	-	-	-	-	-	-
	Leg	Yes	-0.448	0.639	0.204	0.428	0.953	0.028
		No (Ref)	-	-	-	-	-	-
	Back	Yes	-0.690	0.501	0.201	0.338	0.743	0.001
		No (Ref)	-	-	-	-	-	-
	Genital area	Yes	-1.966	0.140	1.045	0.018	1.085	0.060
		No	-	-	-	-	-	-

Also, the patients people with abdominal trauma were hospitalized 2.63 days (about 63.2 hours) more than injured people without abdominal trauma (P<0.001) and the patients with leg trauma for 2.70 days (approximately 64.8 hours) more than the patients without leg trauma (P<0.001) (Table 2).

The chance of surgery in air emergency patients is 84.8% higher than ground emergency patients (95%CI: 0.086-0.267; P<0.001). The chance of immediate surgery in patients with head and face trauma is 41.6% higher than patients without head and face trauma (95%CI: 0.423-0.807; P=0.001). The chance of immediate surgery in patients with abdominal trauma is 55.8% higher than those without abdominal trauma (95%CI: 0.718-0.272; P=0.001). The chance of immediate surgery in patients with back trauma is 49% higher than patients without back trauma (95%CI: 0.338-0.743 P=0.001) (Table 3).

4. Discussion

The present study used prehospital and hospital information of traffic accident patients and analyzed them to evaluate the outcome of road traffic accident patients regarding the transfer method. Considering the relatively recent use of helicopters in transporting the patients in Qom Province, our findings can help evaluate and inform practical, evidence-based solutions for prehospital transportation of the patients. This study compared the outcome of patients in a type of trauma caused by a traffic accident just outside the city, transported by nurses and paramedics with the same continuing training courses, by helicopter, in a province, to a hospital. These criteria prevent or reduce the damaging effects. In addition, to minimize the bias of selecting air or ground emergency patients, a propensity score matching was used to adjust the variables. The use of generalized linear model analysis and logistic regression methods also increased the study's accuracy.

In the present study, 4.7% of the patients were transported by air emergency. A study by Abe et al. in Japan shows that 8.6% of patients were transported by air. This study was performed on different types of trauma and was not specific to traffic accidents [16]. Three previous studies from Germany also reported more use of air emergencies (31.2%-37.7%) [19, 27, 28]. In some prehospital systems, the transfer of urban patients is also done by air, but in Qom Province, air emergency is not sent to inside city missions. This issue can make a difference in the use of air emergencies.

The time to reach the accident scene in the air emergency was longer than the ground emergency. Some factors can affect this time. According to a study by al-Thani et al. in Qatar, due to the weather conditions, the helicopter must be stationed inside the hangar, and it takes approximately 7 minutes for the air emergency to be ready to fly [11]. But the Qom emergency helicopter is not in the hangar, and this period is probably shorter. Nevertheless, much time is spent preparing and coordinating air emergency flights that could not be accounted for in the present study. This time of preparation and coordination increases the time to reach the accident scene. Ground-based road emergency bases are also located in the area and are sent on a traffic accident mission. Still, the air emergency is located in Qom and needs to be sent for a longer distance (53.11 ±18.30 km) than the ground emergency (25.13 ±11.93 km). The average duration of presence at the scene in the air emergency was less than the ground emergency. This result is in line with the study of Eghbali et al. in Qom [29].

In Qom Province, a direct air ambulance is not usually sent to the scene. First, a ground emergency is sent to the scene, and then an air emergency. In a situation where the number of injured is high, and there is a need to transfer some injured by the ground emergency, the ground emergency remains at the scene until the air emergency arrives and delivers the patients, and then the patients are transferred to the hospital. This procedure can affect the duration of presence at the scene in the ground emergency. The average transfer time from the accident scene to the hospital was also shorter in the air emergency. The arrival time at the hospital is usually announced when the helicopter grounds at the hospital. The helicopter grounding pad is located in the open area of Shahid Beheshti Hospital in Qom, and the patients are transported from the yard to the emergency department by a hospital ambulance. This time required to transfer from the pad to the emergency department is not calculated and recorded, but the patients of the ground emergency go directly to the hospital's emergency department.

In severely injured and time-sensitive injuries, cutting the duration of presence at the scene and transporting the patients to a hospital may be a valuable component of an air emergency. Therefore, given the greater chance of emergency surgery in air emergency patients, a different outcome might have occurred if these patients had been transported by ground emergency. Although in this study, air emergency showed a shorter duration of presence at the scene and transfer to the hospital, in some studies, no correlation was observed between the time and outcome of the patients. After adjusting for the severity of the injury and the characteristics of the patients, Ringburg et al. found no association between the

long duration of the arriving scene and the death [30]. Newgard et al. also evaluated the golden hour in the prehospital emergency department. They found that shorter prehospital time was ineffective in survival in traumatic adults [23]. Brown et al. examined prehospital time in ground and air emergency patients. They found that only prehospital airway transfer time between 6 and 30 minutes increases survival, while transfer time less than 5 minutes and more than 30 minutes was not affected by the type of transport [7].

In this study, the difference in the length of hospital stay in the two groups of air and ground emergencies was not significant. The length of hospital stay varies in different studies [11, 15, 31]. In the study of Michael et al., the average length of hospital stay in the air emergency (8 days) was significantly longer than the ground emergency (5.2 days). But Kim et al. stated that this value does not differ between the two groups [4]. In the present study, the difference in the length of hospital stay was not only related to the type of transfer to the hospital but also several other factors, including male gender, older age, decreased level of consciousness before the hospital, and type of trauma to the abdomen and legs. It may also be related to the severity of the injury, underlying illness and medical history, and the actions of the hospital team that were not examined in this study. In the present study, the difference in the length of hospital stay in the intensive care unit between the air and ground emergency groups was not significant.

The difference in the length of hospital stay in the intensive care unit is significant in some studies [4, 11, 15]. In the study of Michael et al., the mean duration of hospitalization in the intensive care unit in the air emergency (3 days) was longer than the ground emergency (0.5 days). In the present study, this period was longer for the patients of the ground emergency. In this study, male gender, older age, decreased level of consciousness before the hospital, and the type of leg trauma during hospitalization in the intensive care unit were influential factors. In this study, the type of injury was examined, but the severity of the injury to different parts of the body was not determined, a factor that could be effective during your stay in the intensive care unit. Also, in this study, there was no significant difference between air and ground emergency patients in the duration of mechanical ventilation. The duration of mechanical ventilation of air and ground emergency patients was significantly different in the study of Michael et al. [15] but was not significant in some studies [7, 11, 31]. In the present study, male gender, older age, decreased level of consciousness before the hospital, and leg trauma increased the chance of mechanical ventilation in traffic accident patients. The need for immediate surgery was greater in air emergency patients than in ground emergency patients. Some studies have not found a significant difference in the need for immediate surgery [4, 7, 31]. In this study, air emergency transfer, older age, increasing the duration of the presence and duration of the transfer, the trauma to the head and face, abdomen, legs, back, and transfer during the holidays and weekends, show an increase in the need for immediate surgery. With older age, the length of hospital stay and intensive care unit and mechanical ventilation, and the need for immediate surgery increases. Hranjek et al. found that the severity of the injury, blood pressure, and mechanical ventilation were independent predictors of mortality in the elderly [32]. Therefore, more attention should be paid to the triage of the elderly injured.

One of the factors affecting the outcome of the patients is the triage at the scene of the accident, and based on that, the choice of transfer method is chosen. Because of the small area of Qom Province (11526 km^2), which is the second smallest province in Iran [25], the long distance from the hospital was probably not the main reason for using the air emergency, but age and clinical condition, such as the severity of injury and level of consciousness, significantly affect the use of air emergency. Gries et al. evaluated 2111 patients and reported no clinical advantage in sending an air ambulance regardless of triage criteria. The researchers suggested that the presence of an emergency physician on the scene and the care of complex emergencies and the reduction of prehospital time should be the primary uses of air emergencies [18]. According to the findings of Shaw et al. and Verkreus et al., a prehospital system should use more straightforward and more accurate criteria to reduce overuse of air emergencies and demonstrate the benefits of time and survival [33, 34]. For more effective use of air emergencies, basic guidelines should focus on clear criteria for reducing prehospital transfer time, clinical triage (level of consciousness and severity of injury), and environmental factors (access to ground emergency and distance from hospital).

Researchers often debate whether air emergency was cost-effective in survival gains in the case of higher-level triage of minor injuries, higher costs, or the risk of transportation in air emergency versus ground emergency [17, 35-37]. Delgado et al. addressed these issues in their cost-effectiveness model based on the relative reduction in mortality risk, higher triage, transfer cost and risk, and other factors. They found that air emergencies would be cost-effective by reducing the transfer of minor injuries or improving the outcome of long-term disability and

caused at least a 15% reduction in deaths or a significant improvement in long-term disability [13].

This observational study may have intrinsic defects, including the possibility of incorrect information entry. The present data may have a measurement error. This study lacks the Severity Injury Scale (ISS) data. This study limited its analysis to the initial outcome at the hospital and did not evaluate the long-term outcome in the patients. We did not analyze the effect of the type of treatment on the scene on the outcome of the patients. The present study may not be generalizable to other geographical areas. For these reasons, larger studies in different areas need to be repeated to prove the findings.

5. Conclusion

There was no significant difference between air and ground emergency patients in the duration of hospitalization in the intensive care unit, duration of mechanical ventilation, and length of hospital stay. Air emergency patients needed more immediate surgery. In general, male patients, old age, decreased level of consciousness before the hospital, and leg traumas were predictors of increased length of hospital stay, intensive care unit, and mechanical ventilation. Older age, longer stay at the accident scene and transfer to the hospital, trauma to the head and face, abdomen, back, legs, and transfer during the holidays and weekends were predictors of an increased need for immediate surgery. This study can determine the criteria of clinical triage and key environmental factors. If the patients are properly triaged based on the type of injury and the level of consciousness before arriving at the hospital and transferred to the hospital by air emergency for treatment, they can enjoy the benefits of the transfer type. More research is needed to make the best use of air emergencies and identify relevant subgroups.

Ethical Considerations

Compliance with ethical guidelines

This article was approved by the Ethics Committee of Qom University of Medical Sciences (Code: IR.MUQ.REC.1399.067).

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Authors' contributions

All authors equally contributed to preparing this article.

Conflict of interest

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