Research Paper

Comparison of Vital Signs of Traffic Accident Patients Transferred by Air and Ground Ambulance: Propensity Score Matching

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ABSTRACT

Background: Vital signs and level of consciousness are one of the most important components of patient examination in traffic accidents. Vital signs show a suitable measure of the initial condition of the patient and also the effect of the interventions. In this study, to evaluate the effects of the type of helicopter emergency medical service (HEMS) or ground emergency medical service (GEMS) ambulance transport, the changes in initial vital signs and arriving at the hospital in traffic accident patients were compared.

Materials and Methods: The data collected in this retrospective analytical descriptive study as a census included the type of transfer, age, gender, distance from the scene to the hospital, duration of the mission, mechanism of injury, patient's condition and vital signs, and level of consciousness. The propensity score matching was used to control confounding factors. The analysis of the outcomes of systolic blood pressure, heart rate, respiratory rate, and level of consciousness of patients when they arrived at the hospital was done with a generalized linear model. Before and after the matching of HEMS and GEMS patients, vital signs, level of consciousness, and other initial variables were compared with the t-test and the chi-square test.

Results: Initial vital signs before matching showed that HEMS patients had lower systolic blood pressure and consciousness in addition to higher respiratory and heart rates ($P<0.05$). After matching, no significant difference was observed in primary vital signs ($P<0.05$). After interventions and transfer, no significant difference was observed in vital signs arriving at the hospital in HEMS and GEMS ($P<0.05$).

Conclusion: After matching, HEMS and GEMS patients did not have significant differences in the level of consciousness and initial vital signs when they arrived at the hospital. There should be more accuracy in the triage and selection of patients who need to be transported by HEMS.

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Introduction

Assessing vital signs provides an image of the vital functions of the patient's body [1]. In trauma, the state of vital signs can predict the rate of mortality, complications, need for surgery, blood transfusion, and need for life-saving and resuscitation interventions in pre-hospital and hospital emergencies [2]. The main vital signs in pre-hospital conditions are heart rate, respiratory rate, and blood pressure [1]. Blood pressure, respiratory rate, heart rate, and level of consciousness can change under the influence of trauma [3]. Low blood pressure is still a most important clinical factor to consider when evaluating and caring for an injured patient with possible bleeding. Pre-hospital low blood pressure is associated with increased injury severity and the need for fluid therapy [4].

The nervous, respiratory, and circulatory systems are critical systems that work together to regulate, supply, and distribute oxygen. Anything that interferes with the supply of oxygen or the delivery of oxygenated red blood cells to the tissues of the body can lead to cell damage or death, and if not treated quickly, cause the death of the patient [3]. The evaluation and management of the patient in the pre-hospital emergency begins with the initial examination; therefore, the pre-hospital care provider needs to identify and correct problems affecting the delivery of oxygen to every cell in the body. Vital signs and level of consciousness are one of the vital components of patient examination in all types of trauma, including traffic accidents. Vital signs provide a suitable measure of the initial condition of the patient as well as the effect of the interventions made in the pre-hospital emergency [3, 5]. Also, vital signs are one of the crucial factors in the prognosis of emergency patients outside the hospital [3, 4].

Pre-hospital emergency with effective care reduces the risk of death of patients by 25% [6]. Traffic accidents are one of the common cases of pre-hospital emergency use [5, 7]. The most common vehicle used in the pre-hospital medical emergency system is the ground emergency medical service (GEMS), which reaches the scene of the accident and transports the patient by ground route [7]. Helicopter emergency medical service (HEMS) is another part of pre-hospital care, which is a crucial component of pre-hospital care. HEMS provides early medical interventions to patients and quickly transports them to the hospital [5]. The effectiveness of HEMS has been investigated in various studies and it has various advantages, such as faster transfer of patients from the scene of the accident to the hospital, transfer of specialist forces to the patient's bedside, the possibility of accessing impassable places and overcoming traffic [8-10]. However, in HEMS, operational costs and risks of operational accidents are more compared to GEMS. One of the actions performed by caregivers in GEMS or HEMS is to measure and record vital signs when arriving at the accident scene. Also, in the next stages of care, the vital signs are re-evaluated and recorded in the patient's file. Registration of vital signs is done at least two times (at the time of arrival at the scene of the accident and at the time of arrival at the hospital) [5].

To evaluate the effects of transport and care in GEMS or HEMS, it is necessary to compare the change in the patient's condition with the change in vital signs. In the same injuries, the patient's prognosis is caused by two factors, the type of transmission and the manner of GEMS and HEMS interventions [5]. Due to the same equipment and expertise of caregivers in GEMS and HEMS in Qom City, Iran, the vital signs of patients can reflect the initial condition of patients as well as the outcome of the type of GEMS or HEMS transportation. In this study, the transfer and interventions in GEMS or HEMS can be related to the change in the vital signs of patients. Accordingly, the present study compares the vital signs of traffic accident patients transported to Shahid Beheshti Hospital in Qom City, Iran by GEMS or HEMS.

Materials and Methods

In this descriptive and analytical retrospective study, all road traffic accident patients who were transferred to Shahid Beheshti Hospital in Qom City by the GEMS or HEMS pre-hospital emergency between March 21, 2014, and March 19, 2018, were investigated by census method. The exclusion criteria were receiving treatment at the scene of the accident without transfer to the hospital, the lack of consent to transfer to the hospital, pre-hospital death, transfer during cardiopulmonary resuscitation, transfer by city ambulances, mission time from 20:00 to 6:00, and deficiencies in the pre-hospital file. To collect the information available in the pre-hospital emergency center of Qom Province, Iran, a researcher-made checklist whose content validity was confirmed was employed [11]. The collected information includes the type of transportation (GEMS or HEMS), age, sex, distance from the accident site to the hospital, duration of the mission (duration of arriving at the accident site, duration of being at the scene of the accident, duration of reaching the hospital), mechanism of injury (MOI) (type of vehicle collision, light vehicle with fixed obstacles, light vehicle with passenger, light vehicle with motorcycle, light vehicle with light vehicle, light vehicle with heavy vehicle, light vehicle rollover, motorcycle with fixed obstacles, motorcycle with passenger, motorcycle with motorcycle, motorcycle with heavy vehicle, motorcycle rollover, heavy vehicle with fixed obstacles, heavy vehicle with pedestrian, heavy vehicle with heavy vehicle, rollover of heavy vehicle, rollover with bicycle and chain accident), patient condition (passenger, bicycle driver, motorcycle driver, motorcycle passenger, light car driver, passenger of light car, driver of a heavy car, passenger of a heavy car), vital signs and level of consciousness at the beginning and when arriving at the hospital (systolic blood pressure, heart rate, respiratory rate, and level of consciousness based on the Glasgow coma scale [GCS]).

In Qom Province, Iran, the equipment available in the GEMS or HEMS is the same and has basic and advanced airway management equipment, mechanical ventilation, cardiac monitor, electroshock, blood pressure and blood oxygen saturation, IV access, fluid therapy, injectable and oral drugs, devices of stabilization of the spine and limbs, bleeding control devices and wound dressings, patient transportation equipment and other devices. In terms of the expertise of the medical team, GEMS and HEMS are the same and include two caregivers with a nurse, paramedic, or a combination of nurse and paramedic education [11]. Examination of respiratory rate, heart rate with number/min criteria, and level of consciousness is also performed by the emergency caregiver based on the GCS. GCS level is calculated using eye response (4 points), verbal response (5 points), and motor response status (6 points). The minimum total GCS score is 3 and the maximum total score is 15 [7]. A manual sphygmomanometer is used to measure blood pressure in GEMS and HEMS. To control confounding factors, propensity score matching was used using R software, version 3.6.2. Propensity score matching is a tool to control confounders in non-experimental studies [12]. In propensity score matching, pairs of people are formed from two groups under study, in such a way that matched people in two groups have similar values of basic variables and propensity score. The most common propensity score matching is one-to-one matching, which was used in this study. One of the matching methods, which in addition to determining the propensity score in the two groups under study, requires specifying a regression model for the outcome. Selecting a regression model depends on the nature of the outcome. In the outcome with continuous variables, a linear model is used [13-15]. Considering that the studied outcomes included the vital signs of systolic blood pressure, heart rate, respiratory rate, and level of consciousness of the patients when they arrived at the hospital, the generalized linear model was used. After matching, an analysis of the quantitative and qualitative variables of the two groups was performed with the t-test and the chi-square test, respectively [16]. A significance level of <0.05 was considered bilaterally.

Results

The study population was 2057 patients, including 566 HEMS patients and 1491 GEMS patients. Before matching, HEMS patients had lower initial systolic blood pressure (110.58±18.75) and lower level of consciousness (14.61±1.40), compared to GEMS (P<0.05); however, the initial heart rate (87.21±11.63) and initial respiratory rate (17.33±2.70) were higher in HEMS patients (P<0.001). The number of patients in each group after matching was 566 patients (Table 1). After matching, no significant difference was observed in initial systolic blood pressure, initial heart rate, initial respiratory rate, and initial level of consciousness in HEMS and GEMS patients. Also, after matching, no significant difference was observed in the variables of age, gender, mechanism of injury, patient condition, and distance from the accident site to the hospital (Table 2).

According to the β coefficients shown in Table 3, the difference in systolic blood pressure when arriving at the hospital in HEMS and GEMS patients was not significant (P=0.219). On average, this blood pressure was about 23 mm Hg in the patients with rollover motorcycles and about 14 mm Hg in the motorcycle accident with a heavy car less than the patients in the chain accident (P<0.05). Also, in patients who had a light car accident with fixed obstacles, a light car with a motorcycle, a light car with a light car, rollover of a light car, a heavy car with a heavy car, and rollover of a heavy car, more than 10 mm Hg of low blood pressure was observed compared to chain accident patients (P<0.05). In the accident between a light car and a heavy car, about 9 mm Hg low blood pressure was observed (P<0.05). The decrease in systolic blood pressure when arriving at the hospital had a significant relationship with the decrease in initial systolic blood pressure and the increase in initial heart rate (P<0.05).

The difference in heart rate when arriving at the hospital in HEMS and GEMS patients was not significant (P=0.176). Heart rate on arrival at the hospital in the MOI of the light vehicle with fixed obstacles, light vehicle with a motorcycle, light vehicle with a light vehicle, light vehicle rollover, motorcycle with a motorcycle, motorcycle with a heavy vehicle, and motorcycle rollover is significantly more than chain crash (P>0.05). Also, the increase in the heart rate when arriving at the hospital was significantly related to

Table 1. Comparison of studied variables by GEMS and HEMS after matching

Variables		No. (%)/Mean±SD			P
		Total Patients	HEMS (n=566)	GEMS (n=566)	
Gender	Male	705(62.3)	232(58.7)	373(65.9)	0.688
	Female	427(37.7)	234(41.3)	193(34.1)	
MOI	A light vehicle with fixed obstacles	61(5.4)	14(2.5)	47(83)	0.500
	A light vehicle with a passenger	17(1.5)	1(0.2)	16(2.8)	0.764
	Light vehicle with a motorcycle	34(3)	6(1.1)	28(4.9)	0.430
	Light vehicle with light vehicle	355(31.4)	194(34.3)	161(28.4)	0.699
	Light vehicle with heavy vehicle	35(3.1)	24(4.2)	11(1.9)	0.653
	Rollover of a light vehicle	460(40.6)	265(46.8)	195(34.5)	0.855
	Motorcycle with fixed obstacles	1(0.1)	0(0)	1(0.2)	>0.999
	Motorcycle with passenger	6(0.5)	4(0.7)	2(0.4)	0.830
	Motorcycle with motorcycle	14(1.2)	11(1.9)	3(0.5)	0.789
	Motorcycle with heavy vehicle	5(0.4)	2(0.4)	3(0.5)	0.665
	Rollover of motorcycle	74(6.5)	17(3)	57(10.1)	0.489
	Heavy vehicles with fixed obstacles	3(0.3)	0(0)	3(0.5)	0.999
	Heavy vehicle with a passenger	2(0.2)	0(0)	2(0.4)	>0.999
	Heavy vehicle with heavy vehicle	29(2.6)	12(2.1)	17(3)	0.728
	Rollover of heavy vehicle	31(2.7)	14(2.5)	17(3)	0.930
	Rollover with a bicycle	1(0.1)	0(0)	1(0.2)	>0.999
	Chain accident	4(0.4)	2(0.4)	2(0.4)	0.253
Patient condition	Passerby	20(1.8)	3(0.5)	17(3)	0.725
	Bicycle driver	2(0.2)	0(0)	2(0.4)	0.580
	Motorcycle driver	83(7.3)	22(3.9)	61(10.8)	0.360
	Motorcycle passenger	42(3.7)	15(2.7)	27(4.8)	0.504
	Light vehicle driver	222(19.6)	89(15.7)	133(23.5)	0.247
	The passenger of a light vehicle	698(61.7)	412(72.8)	286(5.5)	0.628
	Heavy vehicle driver	38(3.4)	13(2.3)	25(4.4)	0.767
	The passenger of a heavy vehicle	27(2.4)	12(2.1)	15(2.7)	0.092
Age (y)		30.64±16.39	29.29±16.05	32±16.62	0.406
Distance from the accident site to the hospital (km)		39.12±20.84	53.11±18.30	25.13±11.93	0.266

Variables	No. (%)/Mean±SD			P
	Total Patients	HEMS (n=566)	GEMS (n=566)	
Duration of reaching the accident scene (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
Transfer duration to the hospital (min)	15.46±5.10	13.12±4.75	17.82±4.33	<0.01

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Abbreviations: HEMS: Helicopter emergency medical service; GEMS: Ground emergency medical service; M: Minute.

the decreased age, decreased initial systolic blood pressure, increased initial heart rate, increased initial respiratory rate, decreased initial GCS, and increased duration of transfer to the hospital (P<0.05).

The difference in respiratory rate when arriving at the hospital in HEMS and GEMS patients was not significant (P=0.550). However, increased respiratory rate when arriving at the hospital is related to the decreased initial systolic blood pressure, increased initial heart rate, increased initial respiratory rate, and increased initial consciousness (P<0.05).

The difference in the level of consciousness when arriving at the hospital was not significant based on the GCS in HEMS and GEMS patients (P=0.808). On average, the consciousness level when arriving at the hospital in the MOI was significantly lower than in the chain accident (P<0.05). This level of consciousness when arriving at the hospital in patients who were drivers and passengers of motorcycles was significantly lower than the consciousness of patients who were passengers of heavy vehicles (P<0.05). Decreased consciousness when arriving at the hospital was associated with increased initial heart rate and decreased initial GCS (P<0.05).

Discussion

This study evaluated the effect of the type of HEMS or GEMS transport using the comparison of changes in initial vital signs and when arriving at the hospital. Primary vital signs before matching showed that HEMS patients had lower systolic blood pressure and consciousness, and higher respiration rate and heart rate. After matching, no significant difference was observed in primary vital signs. After interventions and transfer, no significant difference was observed in vital signs when arriving at the hospital in HEMS and GEMS.

Before matching, HEMS patients on average had lower mean systolic blood pressure and higher initial heart rate and respiration, which is consistent with the results of some other studies [17-19]. These symptoms are regarded as shock indicators. Shock caused by trauma has been known for more than three centuries and still plays a major role in the causes of death of patients [3]. According to the preliminary results of this study, many HEMS patients usually have unstable hemodynamic conditions and are in shock. One of the crucial reasons for transferring patients by HEMS is the same unstable clinical conditions [18].

Table 2. Basic vital signs in HEMS and GEMS

Vital Signs	Pre-matching Mean±SD			P	Post-matching Mean±SD			P
	Total Patients	HEMS (566)	GEMS (1491)		Total Patients	HEMS (566)	GEMS (566)	
Systolic blood pressure (mm Hg)	112.57±18.07	110.08±18.75	113.33±17.76	0.002	112.14±18.41	110.58±18.75	113.69±17.96	0.266
Number of heart rate (number/min)	84.51±10.71	87.21±11.63	83.47±10.16	<0.001	85.53±10.98	87.21±11.63	83.84±10.02	0.134
Respiratory rate (number/min)	16.84±2.62	17.23±2.70	16.65±2.56	<0.001	17.02±2.57	17.33±2.70	16.71±2.39	0.890
Level of consciousness (based on the Glasgow coma scale)	14.85±0.87	14.61±1.40	14.94±0.53	<0.001	14.77±1.07	14.61±1.40	14.93±0.56	0.085

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Table 3. Generalized linear analysis of vital signs when arriving at the hospital

Variables		Level of Consciousness			Respiratory Rate			Heart Rate			Systolic Blood Pressure		
		P	SD	β	P	SD	β	P	SD	β	P	SD	β
Transfer type	GEMS	0.808	0.067	0.016	0.550	0.174	0.104	0.176	0.650	-0.272	0.219	0.968	-1.190
	HEMS	-	-	0	-	-	0	-	-	0	-	-	0
Gender	Male	0.175	0.036	0.500	0.192	0.095	0.125	0.450	0.356	0.269	0.242	0.531	0.622
	Female	-	-	0	-	-	0	-	-	0	-	-	0
MOI	Light vehicle with fixed obstacles	0.648	0.269	-0.123	0.909	0.697	-0.080	0.019	2.605	6.121	0.002	3.880	-12.158
	Light vehicle with a passenger	0.180	0.344	-0.462	0.777	0.894	-0.253	0.067	3.339	6.120	0.270	4.974	-5.483
	Light vehicle with a motorcycle	0.005	0.342	-0.954	0.906	0.888	-0.105	0.018	3.318	7.841	0.031	4.943	-10.659
	Light vehicle with light vehicle	0.704	0.261	-0.099	0.797	0.678	0.175	0.013	2.534	6.328	0.006	3.775	-10.410
	Light vehicle with heavy vehicle	0.944	0.276	-0.019	0.772	0.716	0.208	0.070	2.675	4.853	0.021	3.985	-9.213
	Rollover of a light vehicle	0.670	0.261	-0.111	0.861	0.676	0.119	0.009	2.527	6.595	0.005	3.765	-10.693
	Motorcycle with fixed obstacles	0.170	0.628	-0.862	0.339	1.629	-1.556	0.009	6.084	-15.817	0.663	9.062	-3.945
	Motorcycle with passenger	0.120	0.387	-0.603	0.827	1.005	-0.220	0.180	3.755	5.031	0.354	5.594	-5.188
	Motorcycle with motorcycle	0.002	0.354	-1.106	0.928	0.918	0.083	0.003	3.431	10.135	0.058	5.111	-9.673
	Motorcycle with heavy vehicle	<0.001	0.374	-2.615	0.346	0.971	0.915	0.006	3.626	9.907	0.010	5.401	-13.971
	Rollover of motorcycle	0.001	0.337	-1.137	0.680	0.873	-0.360	0.012	3.263	8.159	0.241	4.861	-5.700
	Heavy vehicles with fixed obstacles	0.640	0.435	0.204	0.207	1.129	-1.425	0.969	4.219	-0.164	0.183	6.284	-8.372
	Heavy vehicle with a passenger	0.426	0.506	-0.403	0.378	1.313	-1.159	0.283	4.905	5.266	0.349	7.305	-6.842
	Heavy vehicle with heavy vehicle	0.845	0.322	0.063	0.639	0.835	-0.392	0.683	3.120	1.274	0.010	4.647	-11.904
	Rollover of heavy vehicle	0.675	0.319	0.134	0.991	0.827	-0.009	0.523	3.090	1.973	0.029	4.602	-10.029
	Rollover with a bicycle	0.851	0.780	-0.146	0.705	2.023	-0.767	0.783	7.557	2.081	0.040	11.256	-23.162
	Chain accident	-	-	0	-	-	0	-	-	0	-	-	0

Variables		Level of Consciousness			Respiratory Rate			Heart Rate			Systolic Blood Pressure		
		P	SD	β	P	SD	β	P	SD	β	P	SD	β
Patient condition	Passerby	0.126	0.299	0.458	0.749	0.775	-0.248	0.086	2.896	-4.976	0.453	4.314	-3.235
	Bicycle driver	0.710	0.557	0.207	0.942	1.445	0.105	0.943	5.399	-0.389	0.243	8.043	9.385
	Motorcycle driver	<0.001	0.278	-1.242	0.544	0.722	-0.438	0.034	2.699	-5.721	0.773	4.020	-1.159
	Motorcycle passenger	0.001	0.284	-0.960	0.434	0.736	-0.577	0.025	2.750	-6.163	0.512	4.097	-2.686
	Light vehicle driver	0.184	0.185	0.246	0.086	0.481	-0.827	0.047	1.797	-3.569	0.797	2.676	0.690
	The passenger of a light vehicle	0.216	0.184	0.229	0.145	0.478	-0.697	0.046	1.788	-3.575	0.916	2.663	-0.280
	Heavy vehicle driver	0.935	0.145	0.012	0.069	0.378	-0.686	0.737	1.411	0.475	0.737	2.102	0.707
	The passenger of a heavy vehicle	-	-	0	-	-	0	-	-	0	-	-	0
Age (y)		0.582	0.001	-0.001	0.268	0.003	-0.004	0.001	0.012	-0.041	0.022	0.018	0.042
Distance from the accident site (km)		0.460	0.001	0.001	0.288	0.003	0.003	0.420	0.011	-0.010	0.886	0.017	0.003
Duration of reaching the accident scene (min)		0.114	0.003	0.005	0.717	0.008	-0.003	0.807	0.030	-0.008	0.046	0.045	-0.090
Duration of presence at the scene of the accident (min)		0.345	0.001	0.002	0.785	0.004	-0.001	0.397	0.015	-0.014	0.282	0.023	0.026
Transfer duration to the hospital (min)		0.303	0.004	0.004	0.924	0.010	-0.001	0.017	0.038	0.091	0.299	0.057	0.059
Systolic blood pressure (mm Hg)		0.055	0.001	-0.002	0.046	0.002	-0.006	0.038	0.010	-0.022	<0.001	0.016	0.791
Number of heartrates (number/min)		0.046	0.001	-0.004	0.023	0.004	0.011	<0.001	0.017	0.783	0.001	0.025	-0.082
Respiratory rate (number/min)		0.276	0.007	-0.008	<0.001	0.018	0.769	0.002	0.068	0.216	0.137	0.102	-0.152
Level of consciousness (based on the Glasgow coma scale		<0.001	0.015	0.968	0.026	0.040	0.089	<0.001	0.149	-0.759	0.113	0.223	0.354

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After matching HEMS and GEMS patients, no significant difference was observed in initial systolic blood pressure, initial heart rate, initial respiratory rate, and initial level of consciousness. These results can indicate the formation of two identical groups of HEMS and GEMS patients. Also, after matching the outcomes of the study, no significant difference was observed in systolic blood pressure when arriving at the hospital, heart rate when arriving at the hospital, or respiration rate when arriving at the hospital, which is consistent with the results of some studies [8, 20, 21]. In the study conducted by Brown et al., who examined an equal sample size of HEMS and GEMS, no significant difference was observed in the systolic blood pressure, heart rate, and respiration of the patients [8]. However, in some studies, inconsistent results are found [17, 18, 22]. In the study conducted by Zhu et al. despite matching, a significant difference was observed in the vital signs of HEMS and GEMS patients, so that HEMS patients had lower systolic blood pressure, higher heart rate, and higher abnormal breathing rate [18]. Differences in pre-hospital emergency systems can affect this outcome. One of the influential factors in the treatment of shock is the duration of care and treatment [7]. Some pre-hospital emergency systems perform special treatments for shock, such as the transfusion of blood and its products, but others focus on rapid transfer and performing procedures in hospitals. This difference in pre-hospital measures can affect this outcome [3].

Before matching, HEMS patients on average had a lower level of consciousness, which is consistent with the results of some other studies [17, 18]. Patients with brain injury can be the most challenging patients. Pre-hospital care includes ensuring adequate delivery of oxygen and nutrients to the brain and rapid identification of patients with increased intracranial pressure and brain herniation. Effective pre-hospital care can not only reduce mortality from this type of injury but also reduce the incidence of permanent neurological disability [3]. The level of consciousness according to the GCS should be carefully recorded so that specific changes over time can be noted [3, 7]. Calculating GCS is crucial as it can help classify the severity of brain damage. A GCS score of 13 to 15 indicates the possibility of mild brain damage, a score of 9 to 12 indicates moderate brain damage, and a score of 3 to 8 indicates severe brain damage. Standard guidelines recommend intubation for GCS scores equal to or less than 8 [3]. After matching, no significant difference was observed between the level of consciousness before arriving at the hospital (P=0.085) and when arriving at the hospital in HEMS and GEMS patients (P=0.808). In a study by Tsuchiya et al. the consciousness level of the patients was different before matching, but it was very close after matching [19]. This issue shows that the matching of basic variables can be effective in choosing a matched sample in terms of the consciousness level.

This cross sectional study may have shortcomings. One of the most effective criteria in the selection of matched patients is the injury severity score (ISS), which was not recorded in the Emergency Department of Shahid Beheshti Hospital in Qom Province, Iran. Due to the measurement of initial vital signs and when arriving at the hospital in HEMS and GEMS manually and according to the emergency conditions, the possibility of error exists in the measurement. Despite the use of vital signs, pre-hospital caregivers face difficulties in measuring and recording them. Incomplete documentation of vital signs is observed in HEMS and GEMS and when they are measured manually, especially in pre-hospital care environments and increased patient numbers. To overcome this problem, some pre-hospital emergencies use automatic monitors that regularly measure vital signs and upload them to the electronic medical record [2]. Although the equipment and caregivers are similar in each of the transportation methods, the conditions of care in HEMS and GEMS can be different depending on the level of mastery of the personnel in the provided care. Therefore, it is suggested to conduct studies on the effect of the type of interventions on the outcome of patients' vital signs. This study only limited its analysis to initial vital signs and on arrival at the hospital. Considering the faster transfer of patients by HEMS, examining the long-term outcome of patients may lead to a different outcome. Due to the same equipment and expertise of HEMS and GEMS careers in Qom Province, it is suggested to conduct studies of different careers and different equipment in HEMS and GEMS. According to the survey conducted in a province and a treatment center, to prove the findings, it is required to repeat the study on a wider level and with a larger sample size.

Conclusion

After matching, no significant difference was observed in HEMS and GEMS patients in the level of consciousness and initial vital signs when they arrived at the treatment center. Considering the lack of effect of the type of transfer on the level of consciousness and vital signs of the patients, the provision of equipment and specialized caregivers can be effective in the condition of the patients. Also, there should be more accuracy in the triage and selection of patients who need to be transported by HEMS.

Ethical Considerations

Compliance with ethical guidelines

This article is approved by the Ethics Committee of Qom University of Medical Sciences (Code: IR.MUQ.REC.1399.067). All ethical principles in research have been observed in this article.

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Authors' contributions

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Conflict of interest

The authors declared no conflict of interest.

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