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Title: Pain and Related Pre-hospital Factors in Patients with Trauma: A Cross-Sectional Study

Author:

Jafar Hoseinzade, PhD.

Guilan University of medical Sciences, Rasht, Iran.

Email: jfr50h@yahoo.com

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Abstract

Background: Pain is an experience often caused by tissue damage and is proportional to the severity of the injury. The role of underlying factors in severity of the pain such as pre-hospital factors are expressed in some investigations. The current study aimed at assessing the effect of different parameters on pain severity in patients with trauma.

Material & Method: The current descriptive, cross-sectional study was conducted on 270 patients with trauma admitted to Poursina Hospital of Guilan, Iran,in 2016, with complete level of consciousness. They were assessed in terms of demographic and pre-hospital factors as well as mechanism and severity of trauma based on verbal rating scale.

Results: Linear regression analysis demonstrated that among various factors including age, sex, education, opium addiction, vehicle type, ventilation, blood pressure, pulse rate, mechanism of trauma, and type of trauma, the highest severity of pain was pertaining to the type of trauma including multiple trauma and large bone fracture with the mean of 9.26 and 9.13, respectively. It also revealed that among these parameters, mechanism of trauma, type of trauma, transfer time, type of vehicle, and pulse rates had a significant role in severity of the pain.

Conclusion: The current study showed that increasing the quality of vehicle and decreasing the transfer time and more attention to hemodynamic factors such as pulse rate, blood pressure, use of analgesic agents, and immobilization of damaged tissue can diminish the severity of pain in patients with trauma.

Keywords: Severity, Pain, Trauma, Pre-hospital, Factors

Introduction

Pain is an experience often caused by tissue damage, and is proportional to the severity of the injury. Pain is usually associated with hemodynamic changes, triggering stressful hormones, catechol-amines, and vasoactive agents, which can lead to changes in blood pressure, and increased sympathetic tone. These changes alter the clinical course of the disease, interfere with the assessment of therapeutic responses, and ultimately affect the mortality rate of the patients (1). In the initial and chronic stages after the accident, pain is one of the main factors in patients'

quality of life. Meanwhile, it has been demonstrated that the average pain during an accident is accompanied by some mental illnesses such as post-traumatic stress disorder (PTSD) or depression (2).

Underlying factors of the patient, such as demographic and individual factors, as well as pre-hospital ones, including the duration and type of patient transfer affect the average pain in them (3). The precise identification of these factors and the assessment of their influence on the patient's mean pain can be concluded as an effective factor to explain the pre-hospital patterns and predict the mean pain. Lastly, the mean pain should be used in appropriate and early therapeutic interventions for patients.

Since the Emergency and accident Department of Poursina Hospital of Rasht, as a trauma referral center in Guilan and neighboring provinces, receives a significant number of patients every day, investigating these factors and applying the results of their evaluation can be effective to improve the quality of care for patients in this center and similar centers.

The current study aimed at determining the mean score of pain in patients with trauma who were referred to Poursina Hospital in 2016 and divided based on traumatic mechanism, type of transporting vehicle, intraocular air temperature, patient`s age, sex, education, blood pressure, heart rate, and drug addiction. Moreover, we evaluated the effect of pre-hospital variables on average pain used the results of the current study to predict the factors affecting the mean score of pain, and utilized the information to determine the control protocols of patients with trauma. According to a study in 2016 by Prastika et al. (4), the mean score of pain and its effect on patient's sleep, activity, and walking were described as moderate to severe in order to determine the control protocols of patients with trauma (the mean pain based on numeric pain rating (NPR) or brief pain inventory (BPI). In a study by Gerhardt et al., (2015) on assessing the pre-hospital pain and prescribing analgesic drugs before hospitalization, its effect on post-admission pain score was confirmed (6). In a study by Paydar et al. (2015), the use of analgesic drugs had a positive impact on the improvement of patient's pain, and had no negative effects on their diagnostic and therapeutic measures(8).

Materials & Methods

Patients

The current descriptive, cross-sectional study was conducted on injured patients with complete level of consciousness.

Based on the results of Blackman et al(5)., the mean± standard deviation (SD) of pain rate was 5.5±1.3 and a precision estimate of 4.2 on 216 patients, but taking into account 50 samples per 10 predictor, the final sample size was 266 persons using the following formula: $n = \frac{(P-1)p(Z_{\frac{1-\alpha}{2}})^2}{e^2}$.

In the current study, the mean pain induced by trauma was measured according to the considered variables.

Inclusion criteria

The inclusion criteria of the current study were trauma with the Glasgow coma score of 15, with the verbal or manual ability, to determine the mean pain based on the criteria for scoring 0 to 10 verbal Numerical Rating Scale (VNRS).

Exclusion criteria

Exclusion criteria were death during or after the first 24 hours of the occurrence of trauma, and verbal or manual disability.

Data collection

In the current study, a questionnaire was designed to evaluate the mean level of pain. The severity of pain was questioned and recorded. The questionnaire constituted of two parts: A: The demographic indicators (such as age, sex, education level, drug addiction), and biological features (such as blood pressure and heart rate); B: Pre-hospital variables (such as type of transfer vehicle, the temperature inside it, and total transfer time from scene to hospital), types of trauma mechanisms (such as falling, fires, road accidents, pedestrian accident, car-motorcycle accident), severity of trauma, and type of trauma (such as large bone fracture, burn, soft tissue damage, stiffness, cuts, and tissue lesion).

In the current study, at the onset of the patient's arrival to the trauma center, the severity of pain was determined based on a 10-point Likert-type verbal scoring criteria (VNRS).In addition, the patient's vital signs were measured and recorded at the time of admission and afterwards.

Statistical Analysis

Finally, the data were transferred into SPSS (Version 23) and analyzed by descriptive statistics of the absolute, relative, and mean ± standard deviation

(SD), analytical statistics, *t* test, and analysis of variance (ANOVA). If the difference between data were significant, the difference was determined by the Bonferroni post hoc test. Normality of data was evaluated by the Kolmogorov test.

A multivariate linear regression model was used to estimate the effect of each of the underlying variables on the mean pain. $P < 0.05$ was considered as the level of significance.

Results

The current study was performed on 270 patients with mean ±SD age of 40±42.1 years old.

Table 1 shows the distribution of patients based on the underlying characteristics. Most of the patients were men (n=177), with the education level of incomplete diploma, and the age range of 25-49 years old; in addition, 89 patient were addict.

Table 1: The Distribution of Patients based on the Underlying Characteristics

		Frequency	Percent
Sex	Men	177	65
	Women	93	35
Age (year)	< 25	53	19.2
	25 – 49	131	48.6
	50 – 60	43	16
	>60	44	16.2
Education level	Incomplete diploma	120	44
	Diploma	80	29
	Higher education	70	25
Type of transfer vehicle	Ambulance	129	48
	Private Car/motorcycle	141	52
Total transfer time from the scene to hospital (min)	<15	66	24.5
	15-30	122	48
	30-60	48	18
	>60	34	12.5
Air conditioner status of the vehicle	On	181	67
	Off	89	33
	Car accident	87	32

Trauma mechanism	Motorcycle accident	56	21
	Pedestrian-car accident	45	17
	Falling	33	12
	Miscellaneous	49	18
Type of trauma	Large bone fracture	30	11
	Small bone fracture	18	6
	Skull fracture	23	8.5
	Burn, Bruise	130	48
	Multiple trauma	69	25
Systolic blood pressure (mmHg)	< 100	91	33
	100-140	172	73
	> 140	7	2
Heart rate(bpm)	60 – 90	124	46
	> 90	146	54
Opium addiction	Yes	89	34
	No	181	66

Table 2: Comparison of the Mean Score of Pain based on the Study Variables

		Number	Mean Pain (SD)	P-value
Sex	Men	177	7.77(1.14)	0.594

	Women	93	7.88(1.55)	
Age (year)	<25	52	7.88(1.54)	0.978
	25 – 49	131	7.82(1.54)	
	50 – 60	43	7.73(1.49)	
	>60	44	7.81(1.50)	
Education level	Incomplete diploma	120	7.81(1.58)	0.030
	Diploma	80	7.59(1.38)	
	Higher education	70	7.64(1.49)	
Type of the transfer vehicle	Ambulance	136	8.1(1.25)	0.005
	Car/ motorcycle	141	7.5(1.66)	
Total transfer time from the scene to hospital (min)	< 15	66	8.24(1.38)	0.035
	15 – 30	122	7.69(1.49)	
	30 – 60	48	7.79(1.50)	
	>60	34	7.40(1.66)	

Air conditioner status of the vehicle	On	181	7.44(1.61)	0.005
	Off	89	7.99(1.42)	
Trauma mechanism	Car accident	87	8.05(1.5)	0.001
	Motorcycle accident	56	8.5(1.36)	
	Pedestrian-car accident	45	7.32(1.51)	
	Falling	33	7.25(1.50)	
	Other items	49	7.41(1.28)	
Type of trauma	Large bone fracture	30	9.13(0.66)	0.006
	Small bone fracture	18	7.9(1.04)	
	Skull fracture	23	8.5(0.59)	
	Burn, Bruise	130	6/5(1.03)	
	Multiple	69	9.2(0.54)	
Systolic blood pressure (mmHg)	< 100	91	8.63(1.29)	0.001

	100 – 140	172	7.36(1.44)	
	>140	7	8.07(0.97)	
Heart rate (bpm)	60 – 90		7.5(1.65)	0.003
	>90		8.06(1.31)	
Opium addiction	Yes	89	7.85(1.53)	0.712
	No	181		

1-In the type of trauma, the mean score of pain in multiple injuries, and the fracture of large bones were 9.26 and 9.13, respectively ($p<0.05$) (Figure 1).

2- Regarding the transfer time from the scene to hospital, the highest mean pain was less than 15 minutes (score = 2.8), which was significantly different from those of the time groups of 15-30 minutes and >60 minutes ($P<0.05$), but there was no significant difference between the groups of –30-60 minutes and other intervals (Figure 2).

3-Among trauma mechanisms, the highest mean pain was related to motorcycle accident (score=5.8), and the mean was significantly different among the types of mechanisms ($p<0.05$), except motorcycle and car crashes, and pedestrian-car accident (Figure 3).

4- The highest mean score of pain was related to the group transferred by the ambulance, compared with the ones transferred by personal car (p-value<0.05); but it was not significantly different from that of motor vehicle transferred ones (Figure 4).

Figure 1: The mean score of pain depending on the type of truma

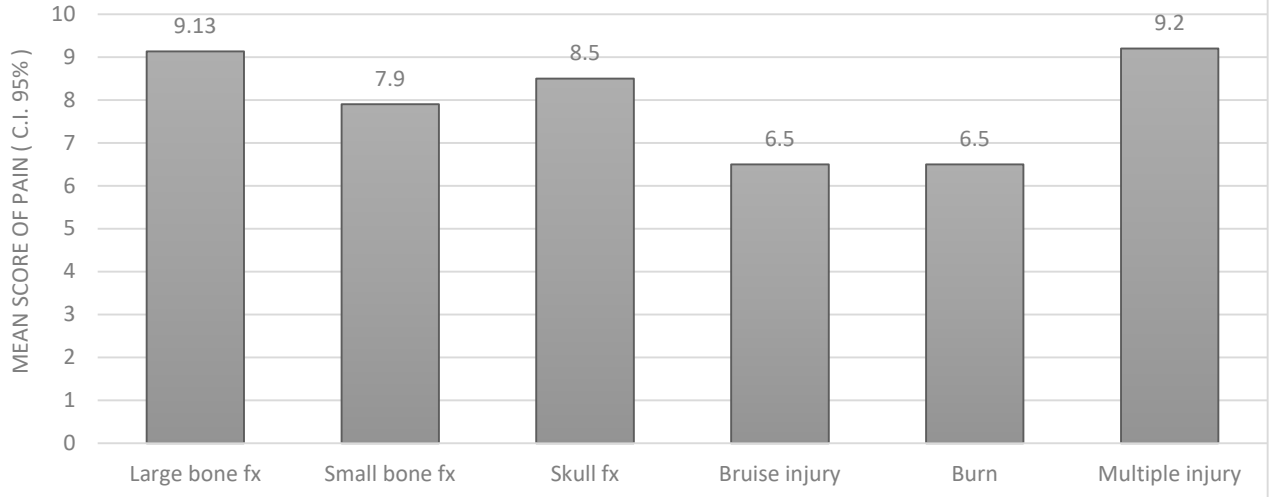
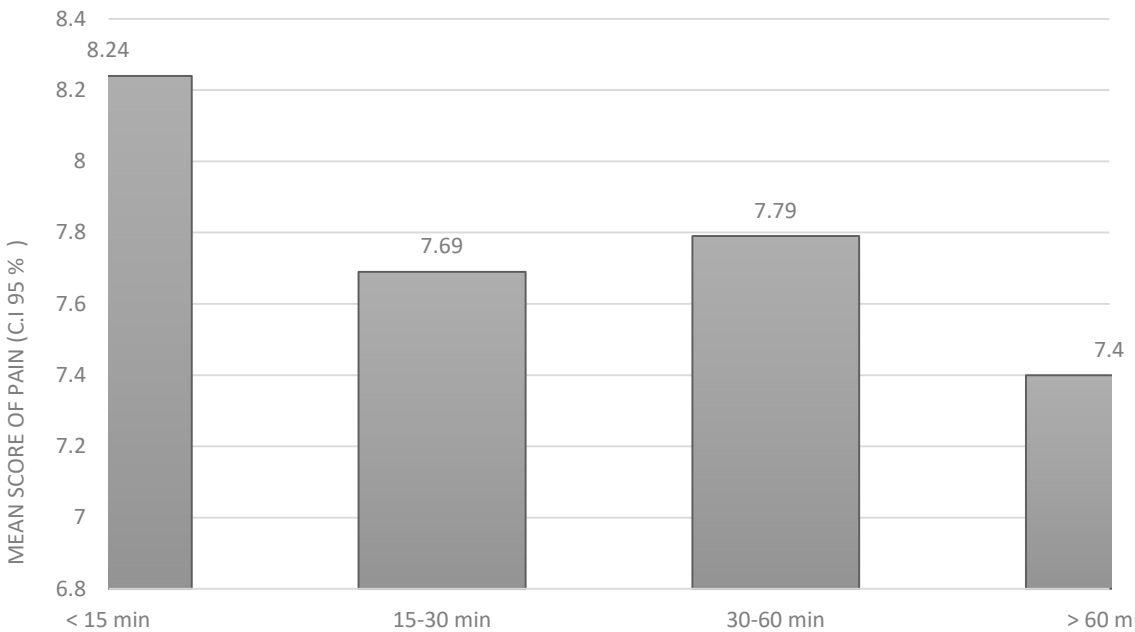
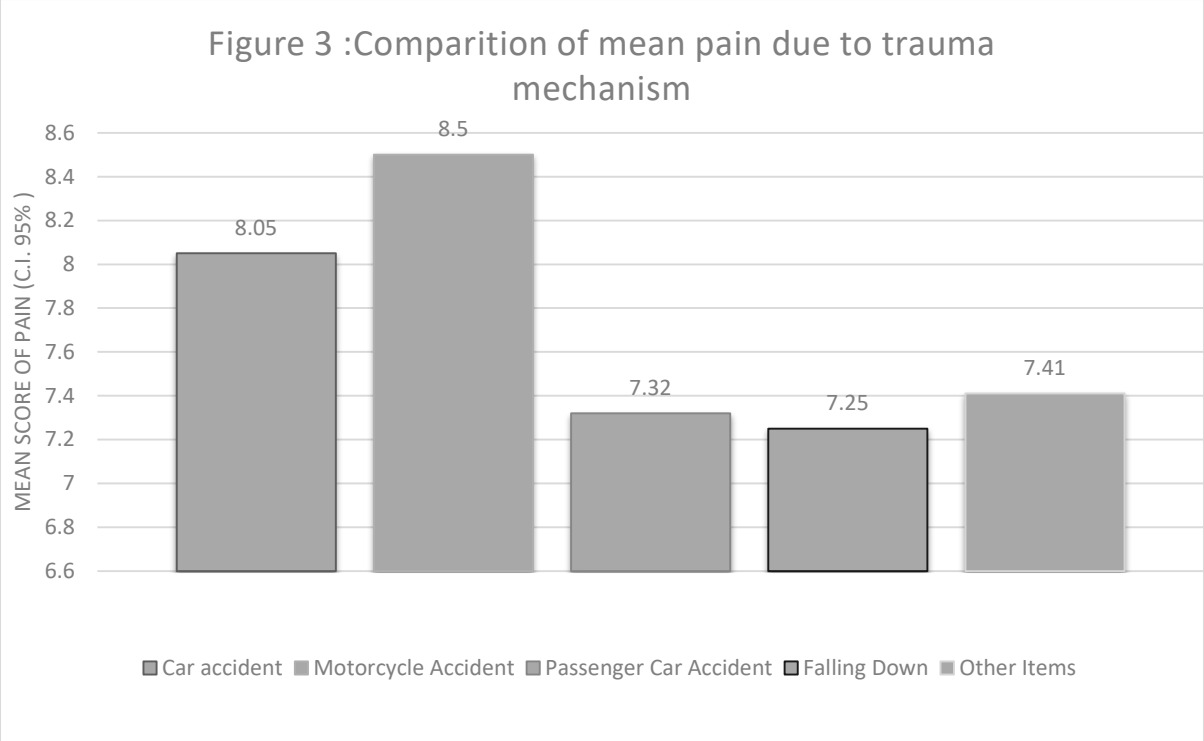
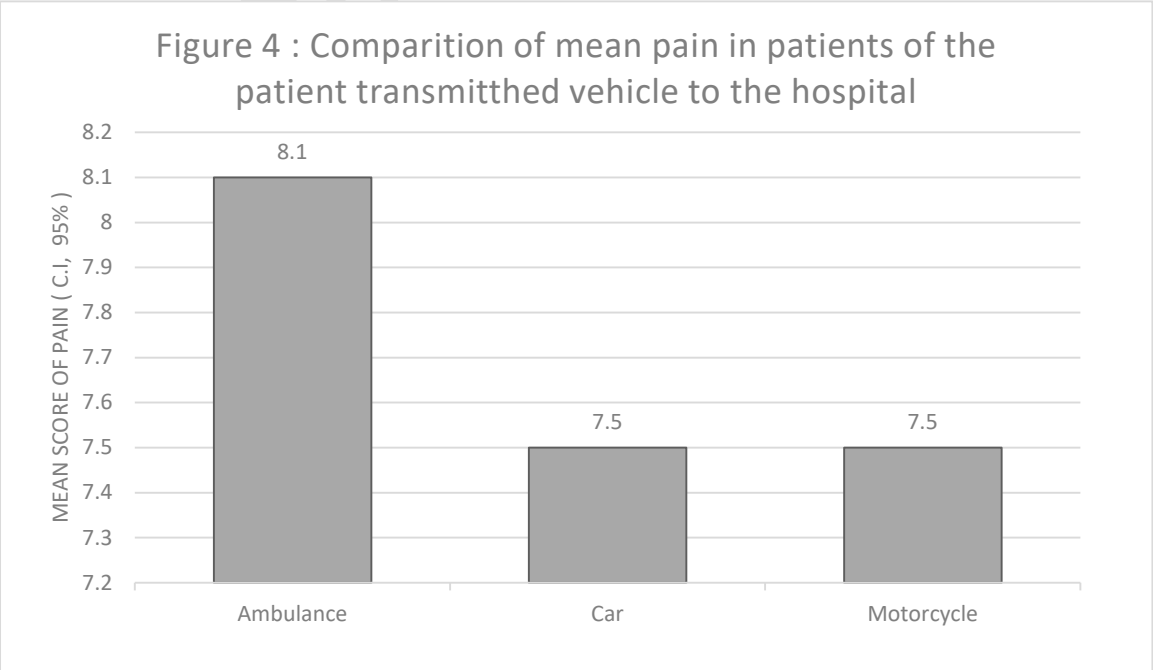


Figure 2 :Comparition of the mean pain in terms of the duration of the patients transfer to the hospital







There was a significant difference between patients regarding hypotension and normal blood pressure.

Table 3: Adjusted Variables Estimation in relation to the Mean Score of Pain Based on Multiple Regression Test

		Beta Factor (Coefficient)	%95 Confidence Interval	P-value
Sex	Male	Reference	-	-
	Female	-0.356	-0.029 , 0.150	0.538
Age (year)	<25	Reference	-	-
	25 – 49	-0.003	-0.278 , 0.280	0.98
	50 – 60	0.127	-0.245 , 0.500	0.50

	>60	0.90	0.278 , 0.457	0.63
Education	Incomplete diploma	Reference	-	-
	Diploma	0.290	-0.001 , 0.510	0.051
	Higher education	0.109	-0.157 , 0.376	0.42
Type of transfer vehicle	Ambulance	Reference	-	-
	Car/motorcycle	-0.27	-0.50 , -0.06	0.013
Air conditioner system status of the vehicle	On	0.006	-0.235 , 0.230	0.970
	Off	-	-	-
Trauma mechanism	Car accident	0.260	-0.067 , 0.586	0.119
	Motorcycle accident	0.352	0.009 , 0.670	0.044
	Pedestrian-car accident	0.307	-0.690 , 0.685	0.109
	Falling	0.480	0.127, 0.830	0.008
	Miscellaneous	Reference	-	-
Type of trauma	Large bone fracture	2.724	2.30 , 3.14	0.001

	Small bone fracture	1.655	1.15 , 2.15	0.001
	Skull fracture	2.280	1.90 , 2.68	0.001
	Burn, Bruise,	Reference	-	-
	Multiple	2/690	2.39 , 2.99	0.001
Systolic blood pressure (mmHg)	< 100	-0/077	-0.374 , 0.22	0.609
	100 – 140	Reference	-	-
	>140	-0/29	-0.993– 0.410	0.414
Heart rate(bpm)	60 – 90	Reference	-	-
	>90	0/341	0.088 , 0.549	0.008
Opium addiction	Yes	-0/140	-0.50 , -0.06	0.013
	No	-	-	-

In Table 4-3, R2 = 0.72, which means that the pain score changes was predictable by the model. In multivariate model, trauma type variables, patient's transfer pattern, trauma mechanism and heart rate, after adjusting the effect of other variables, had a significant relationship with the mean score of pain. The mean score of pain significantly increased with increasing trauma severity; hence, the pain score of patients with large bone fracture was 2.70 units higher than those of the subjects with burns. The pain score of patient transported by car and

motorcycle was lower by 0.72% than those of patients transferred by ambulance. In the mechanism of trauma, an increased pain of falling cases was significant compared to those of the other mechanisms of trauma. Finally, the mean pain of patients with tachycardia was 0.34 times higher than the ones with normal heart rate.

Discussion

In the study by Mohseni et al. (2013) in Poursina Hospital of Rasht (9), the mean age of the patients was 35 years old and the number of male and female patients was equal, which was parallel to the results of the current study. In the study by Yeguiyan et al., (2011) in France (5), most of the patients were men and in the age group of 30-50 years old. In this study, the first two groups had the highest traumatic cases of traffic accidents; thus, 39% of them had motorcycle accident and 32% had car crashes. In the current study, two groups were car crashes followed by the motorcycle and pedestrian-car accidents. Perhaps higher number of men and high incidence of trauma in age range of 25-49 years old were due to the fact that, these groups were young and active, more exposed to social activities and more likely to be involved in accidents. Thus, these studies, similar to ours, have found similar age range and sex (10-11).

Prastika et al., (2016) (4) found that the mean pain was moderate to severe in patients with orthopedic and musculoskeletal trauma. In a study on traumatic events by the Law Enforcement Force of the Islamic Republic of Iran (5), the highest mean pain belonged to traumatic fractures. In the current study, the highest mean pain was associated with musculoskeletal traumas as follows: large bones fractures, small bones fractures, skull fractures, and penetrating traumas, which was parallel to other studies (3).

In the current study, the mean pain was range than that of other studies, which may be due to the following reasons: in the current study, the forms of pain severity were filled by the patients, while in some studies the forms were filled by physicians and nurses (16-14-15); misconceptions in some indigenous and regional groups; hence, they can receive more attention from treatment centers with a higher mean pain rate; use of different analgesic drugs after trauma in various studies. In the current study, most of the patients had normal systolic blood pressure, although the two groups had a lower frequency with high and low blood pressures, the mean of their pain severity was significantly higher than the normal range (7).

According to some studies on the period of patient transfer to the hospital (18-19-20), the usefulness of reducing this period is still ambiguous. Studies indicated that indeterminable regional factors, ethnicity, different tastes in choosing the study population, different measurement tools, and the impact of different factors on outcomes, etc., influence the outcome (18). The study by Dinh et al., (2013) (22) showed that during the transfer of patients with head trauma in more than 60 minutes, per minute delay was associated with an increase of 0.2% in mortality .In the current study, patients with trauma were often transferred to hospital in less than 30 minutes, and it was concluded that the duration of patient's transmission to the hospital, based on linear regression, had a significant impact on the mean pain. In addition, in several studies, shortening the transfer time had a positive impact on reducing mortality in traumatic patients (23-24).

In the current study, patients with ventilated vehicles had an average pain less than others, but no significant difference was observed. Most people with severe trauma were transferred to Poursina Hospital by ambulance, and patients with lower pain rates did not use ambulance and were taken to hospital without ventilation or even motor vehicles; hence, the higher mean pain in the group transferred with ambulance can be expected. And the group transferred with no

ventilation and motor vehicles had less median pain due to less traumatic and non-intentional use of ambulance. Perhaps in future studies, by comparing the average pain in ventilated vehicles, a more accurate indicator of the type of transferred airborne patient could be obtained.

In a study by Berben et al. (2008) (3), use of epinephrine, NSAID benzodiazepines, and opium significantly reduced post-traumatic pain in patients. In the current study, the average pain sensation was measured in two groups of opium and non-opium addicts, which did not differ significantly. Perhaps this lack of difference was due to the fact that no opium was used for the patients in the current study.

Unlike some other studies, the current study only examined patients with acute traumas (GCS ≥14). Therefore, there were some differences between the current study and other investigations due to the lack of examination of patients with trauma and reduced consciousness in them.

CONCLUSION

The current study investigated the mean pain in 270 patients with trauma referring to Poursina Hospital in Rasht. The population included 171 men and 93 women with the mean age of 40 years old. The variables of the study included age, sex, education, type of transfer, transferring time, trauma mechanism, type of trauma, addiction, and hemodynamic factors. Among these variables, type of trauma, type of transferring patients, traumatic mechanism, transferring time, and heart rate were significantly correlated with the mean score of pain. Based on linear regression, most of the factors influencing the mean pain in multiple injuries and fractures of large bones were 9.26 and 9.13, respectively.

It is recommended to examine the role of hemodynamic factors such as blood pressure and heart rate, and employ an acceptable pain assessment criteria in patients with reduced consciousness in further studies.

Since trauma is a major cause of death and often affects the hemodynamic system; the recommendation to control pain can be effective on hemodynamic parameters; perhaps using pain relief methods including regurgitation block, injectable denture, and immobilization of the damaged limb.

REFERENCE

1-Stephen McMahon, Wall & Melzack's Textbook of Pain, 6th Edition, Elsevier Canada 2014 : p 38-40

2-Ronald D. Miller, Miller's Anesthesia, 2-Volume Set, 8e, Saunders. p: 2460-2543

3-Sivera A.A. Berben, Tineke H.J.M. Meijs, Robert T.M. van Dongen. Pain prevalence and pain relief in trauma

patients in the Accident & Emergency department, International Jurnal of the care of the injured 2008 (39), 5: p578-582

4-Deya Prastika, Luppana Kitrungrote, Jintana Damkliang. Pain intensity and pain interference among trauma patients: a literature review. Belitung Nursing Journal 2016; 2:6: 131-139

5-Virginia Schmied Blackman, Bruce A. Cooper, Kathleen Puntillo, Linda S. Franck. Prevalence and Predictors of Prehospital Pain Assessment and

Analgesic Use in Military Trauma Patients, 2010–2013. Prehospital Emergency Care 2016; 6:20: 737-751.

6-Gerhardt RT, Reeves PT, Kotwal RS, Mabry RL, Robinson JB, Butler F. Analysis of Prehospital Documentation of Injury-Related Pain Assessment and Analgesic Administration on the Contemporary Battlefield. Prehospital Emergency Care. 2016;20(1):37-44.

7-Browne LR, Studnek JR, Shah MI, Brousseau DC, Guse CE, Lerner EB. Prehospital Opioid Administration in the Emergency Care of Injured Children. Prehospital Emergency Care. 2016;20(1):59-65.

8-Paydar, Shahram; Masoumeh Alizadeh; Reza Taheri & Seyed Mohsen Mousavi. The Prevalence of Pain and the Role of Analgesic Drugs in Pain Management in Patients with Trauma in Emergency Department. Academic Journal of Surgery 2015. 2(3-4):45-51.

9-Mina Mohseni , Tahere khaleq Doust & et al ; conditions of Pre-Hospital Neurologic cares and Relative Factors in Traumatic patient in Traumatic research Center of guilan University of medical sciences in 2013.

10-Naghavi M, Shahraz S, Bhalla K, Jafari N, Pourmalek F, Bartels D, Puthenpurakal JA, Motlagh ME. Adverse health outcomes of road traffic injuries in Iran after rapid motorization. Arch Iran Med. 2009 May;12(3):284-94.

11-Zargar M, Khaji A, Karbakhsh M. Pattern of motorcycle-related injuries in Tehran, 1999 to 2000: a study in 6 hospitals. East Mediterr Health J. 2006 Jan-Mar;12(1-2):81-7.

12- Williamson OD, Epi GD, Gabbe BJ, et al. Predictors of moderate or severe pain 6 months after orthopaedic injury: a prospective cohort study. Journal of Orthopaedic Trauma. 2009;23(2):139-144.

13- Clay FJ, Newstead SV, Watson WL, Ozanne-Smith J, Guy J, McClure RJ. Bio-psychosocial determinants of persistent pain 6 months after nonlife-threatening acute orthopaedic trauma. The Journal of Pain. 2010;11(5):420-30.

14- Guru V, Dubinski I. The patient versus caregiver perception of acute pain in the emergency department. J Emerg Med 2000;18(1):7—12.

15- Salmon P, Manyande A. Good patients cope with their pain: postoperative analgesia and nurses' perceptions of their patients' pain. Pain 1996;68:63—8.

16- Bijur PE, Be´rard A, Esses D, et al. Lack of Influence of patient self-report of pain intensity on administration of opioids for suspected long-bone fractures. J Pain 2006;7(6):438—44.

17-Nordin M, Fagius J. Effect of noxious stimulation on sympathetic vasoconstrictor outflow to human muscles. J Physiol. 1995 Dec 15;489 (Pt3):885-94. PubMed PMID: 8788952;

18- Newgard CD, Schmicker RH,; Resuscitation Outcomes Consortium Investigators.. Emergency medical services intervals and survival in trauma: assessment of the "golden hour" in a North American prospective cohort. Ann Emerg Med. 2010 Mar;55(3):235-246.e4.

19-Sampalis JS, Denis R, Lavoie A, et al. Trauma care regionalization: a process-outcome evaluation. J Trauma 1999;46:565–581. [PubMed: 10217218]

20- Samplais JS, Lavoie A, Williams JI, et al. Impact of on-site care, prehospital time, and level of inhospital care on survival in severely injured patients. J Trauma 1993;34:252–261. [PubMed:8459466]

21- De Maio VJ, Stiell IG, Wells GA, et al. Optimal defibrillation response intervals for maximum outof- hospital cardiac arrest survival rates. Ann Emerg Med 2003;42:242–250. [PubMed: 12883512]

22- Dinh MM, Bein K, Roncal S, Byrne CM, Petchell J, Brennan J. Redefining the golden hour for severe head injury in an urban setting: the effect of prehospital arrival times on patient outcomes. Injury. 2013 May;44(5):606-10.

23- Becker LR, Zaloshnja E, Levick N, et al. Relative risk of injury and death in ambulances and other emergency vehicles. Accid Anal Prev 2003;35:941–948. [PubMed: 12971929]

24- Davis DP, Hoyt DB, Ochs M, Fortlage D, Holbrook T, Marshall LK, Rosen P. The effect of paramedic rapid sequence intubation on outcome in patients with severe traumatic brain injury. J Trauma. 2003 Mar;54(3):444.