

Research Paper:

Pain and Related Pre-Hospital Factors in Patients With Trauma: A Cross-Sectional Study



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ABSTRACT

Background and Aim: 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 prehospital factors have been discussed in some investigations. The current study aimed to assess the effect of different parameters on pain severity in patients with trauma.

Methods and Materials/Patients: The current descriptive, cross-sectional study was conducted fully conscious 270 fully patients with trauma admitted to Poursina Hospital in Rast, Guilan, Iran, in 2016. 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 like age, sex, level of education, opium dependence, 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 such as multiple trauma and large bone fracture with mean scores 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 rate were significantly associated with the severity of the pain.

Conclusion: The current study showed that increasing the quality of vehicle, decreasing the transfer time, and paying 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.

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1. Introduction

Pain is an experience often caused by tissue damage, and is proportional to the severity of the injury. Prior research suggests that pain is usually associated with hemodynamic changes, triggering stressful hormones, catecholamines, 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]. Pain plays an important role in patients' quality of life after experiencing the initial injury and during the chronic phase after the trauma. Furthermore, a number of authors have recognized that the average pain during an accident is usually accompanied with some types of mental illnesses such as Post-Traumatic Stress Disorder (PTSD) or depression [2].

Some authors have assessed the development of some underlying factors that may affect the average pain, including demographic and individual characteristics of the patient, as well as prehospital care, like the duration and type of patient transfer to hospital [3]. Precise identification of these aspects and assessment of their influence on patient's mean pain can be an indicator to explain the prehospital care elements and predict the mean pain. To conclude, the mean pain score could be used in appropriate and early therapeutic interventions for patients.

The Rasht Poursina Hospital accident and emergency department, as a trauma referral center in Guilan and neighboring provinces, admits a significant number of patients every day. Therefore, investigating the above-mentioned factors and applying the results of the evaluation can be effective in improving the quality of care for patients referred to this hospital and similar health care centers.

The current study aimed to explore the mean score of pain in patients with trauma who were referred to Poursina Hospital in 2016. Subjects were selected based on traumatic injury, type of transporting vehicle, intra-ocular air temperature, age, sex, education, blood pressure, heart rate, and histories of drug use. Moreover, we evaluated the effect of prehospital variables on average pain score, using results of the current study to predict the factors affecting the mean score of pain, and eventually, 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 protocol of patients with trauma (the mean pain score based on Numeric Pain Rating (NPR) or Brief Pain Inventory (BPI)).

In Gerhardt et al. study, a positive correlation between prehospital pain and prescribing analgesic drugs before hospitalization, and after admission pain score was confirmed [5]. Another investigation by Paydar et al. demonstrated that prescribing analgesic drugs had a positive impact on the improvement of patient's pain, with no negative effects on their diagnostic and therapeutic measures [6].

2. Methods and Materials/Patients

Sampling

The current descriptive, cross-sectional study was conducted on injured patients with complete level of consciousness. Based on the Blackman et al. study results, the mean (SD) pain score was 5.5(1.3) on 216 patients with precision estimate of 4.2 [7]. But with taking into account 50 samples per 10 predictors, the final sample size was calculated as 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

Inclusion criteria of the current study samples consisted of traumatic patients with the Glasgow coma score of 15 and able to determine the mean pain score (verbally or manually) in accordance with the criteria for scoring 0 to 10 Verbal Numerical Rating Scale (VNRS).

Exclusion criteria

Subjects who passed away during or after the first 24 hours of the occurrence of trauma, or lost their verbal or manual ability were excluded from the investigation.

Data collection

For this study, we analyzed the data collected from a researcher-developed questionnaire, designed to evaluate the mean level of pain. The main data in this work consisted of the severity of pain. The questionnaire

consisted of two parts: first, personal features including demographic indicators (i.e. age, sex, level of education, histories of drug use) and biological features (i.e. blood pressure, heart rate); second, prehospital variables (i.e. type of transfer vehicle, temperature inside the transfer vehicle, and total time in transfer), types of trauma mechanisms (i.e. falling, fires, road incidents, pedestrian accidents, car-motorcycle accidents), severity of trauma, and type of trauma (i.e. large bone fracture, burns, soft tissue injuries, stiffness, cuts, and tissue lesion).

Severity of pain was determined based on a 10-point Likert-type Verbal Numerical Rating Scale (VNRS), on patient's arrival to the trauma center. In addition, the patient's vital signs were measured and recorded at the time of admission and thereupon.

Statistical analysis

The collected data were analyzed using descriptive statistics of the absolute, relative, mean and Standard Deviation (SD), also inferential statistics, including t test and Analysis of Variance (ANOVA) in SPSS V. 23. The differences were determined by the Bonferroni post hoc test. We also utilized Kolmogorov-Smirnov test to evaluate normality of data. A multivariate linear regression model was used to estimate the effect of each underlying variable on the mean pain score. We considered $P < 0.05$ as the level of significance.

3. Results

The current study was performed on 270 patients with the mean (SD) age of 40(42.1) year (age range: 25-49 years).

Table 1 shows distribution of patients based on their underlying characteristics. Most of the study participants were male ($n=177$), with the education level of

below high-school diploma. Of all subjects, 89 suffered from substance dependence. The mean score of pain in multiple injuries, and the fracture of large bones were obtained as 9.26 and 9.13, respectively ($P < 0.05$) in respect of the trauma type (Figure 1).

The highest mean pain score was reported for less than 15 minutes (score=2.8) for the total time in patients transfer from the incident scene to the hospital, which was significantly different with the time groups of 15-30 minutes and >60 minutes ($P < 0.05$), although no significant difference was observed between the groups of 30-60 minutes and other time intervals (Figure 2).

Among trauma mechanisms, the highest mean pain score was related to motorcycle accidents (score=5.8), which its mean score was significantly different compared to other types of mechanisms ($P < 0.05$) except for the motorcycle and car crashes and, pedestrian-car incidents (Figure 3).

The highest mean score of pain was reported for the group transferred by the ambulances, compared to those transferred by private cars ($P < 0.05$); nevertheless, there was no significant difference between these groups (Figure 4). There was a significant difference between the studied patients in terms of hypotension and normal level of blood pressure.

As demonstrated in Tables 2 and 3, R^2 equals 0.72, which means that the pain score changes were predictable by the model. According to the multivariate model, a statistically significant relationship exist between the mean score of pain and trauma type variables, patient's transfer pattern, trauma mechanism, and heart rate, after adjusting the effect of other variables. Our results showed a significant rise in the mean score of pain following increased trauma severity. Hence, the pain score of patients with large bone fracture was 2.70 units

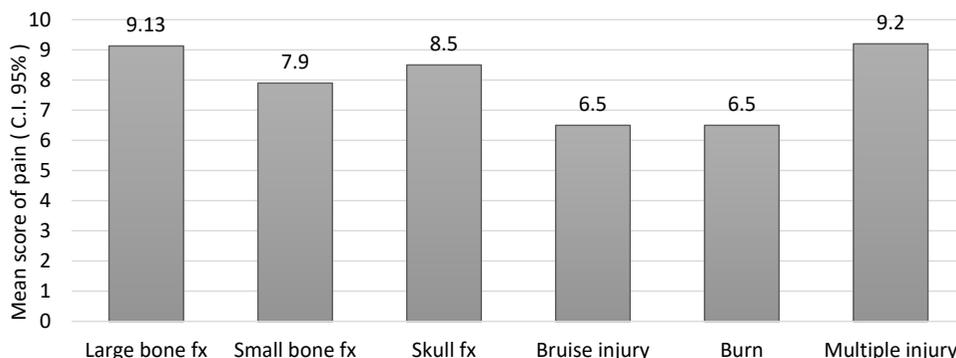


Figure 1. The mean pain score in respect of the type of trauma

Table 1. Distribution of patients' characteristics

Characteristics		No.	%
Sex	Male	177	65
	Female	93	35
Age (y)	<25	53	19.2
	25-49	131	48.6
	50-60	43	16
	>60	44	16.2
Level of Education	Below high-school diploma	120	44
	High-school Diploma	80	29
	Higher education	70	25
Type of transfer vehicle	Ambulance	129	48
	Private car/motorcycle	141	52
Total time in transfer (min)	<15	66	24.5
	15-30	122	48
	30-60	48	18
	>60	34	12.5
Vehicle air conditioning	On	181	67
	Off	89	33
Trauma mechanism	Car accident	87	32
	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
	Burning, bruise	130	48
	Multiple trauma	69	25
Systolic blood pressure (mm Hg)	<100	91	33
	100-140	172	73
	>140	7	2
Heart rate (bpm)	60-90	124	46
	>90	146	54
Opium dependence	Yes	89	34
	No	181	66

Table 2. Comparison of the mean pain score based on the study variables

Characteristics		No.	Mean (SD) Pain Score	P
Sex	Male	177	7.77(1.14)	0.594
	Female	93	7.88(1.55)	
Age (y)	<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)	
Level of education	Below high-school diploma	120	7.81(1.58)	0.030
	High-school 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 time in transfer (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)	
Vehicle air conditioning	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)	
	Burning, bruise	130	6.5(1.03)	
	Multiple	69	9.2(0.54)	
Systolic blood pressure (mm Hg)	<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 dependence	Yes	89	7.85(1.53)	0.712
	No	181		

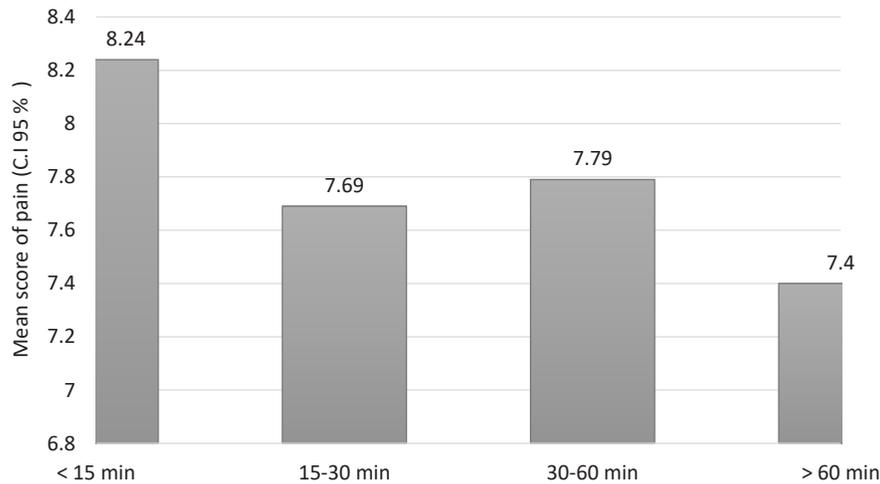


Figure 2. Comparison of the mean pain score in terms of the total time of patients's transfer to the hospital



higher than the subjects in the burning trauma group. The pain score of patients transported by car and motorcycle was 0.72% lower than the ones transferred by ambulance. The data regarding mechanism of trauma reveals significant differences in increased pain of falling cases compared to those suffering from other mechanisms of trauma. Our data also address that the mean pain of patients with tachycardia was 0.34 times higher than the subjects with normal heart rate.

4. Discussion

In the study conducted by Mohseni et al. in Poursina Hospital of Rasht [8], the mean age of the patients was reported as 35 years and the number of male and female patients was equal, which was in line with the results of the current study. Another study was done by Yeguiyan et al. in France [7], in which most of the partici-

pants were male within the age range of 30-50 years. In the current investigation, our first two groups of study had the highest traumatic cases of traffic accidents; i.e. 39% of them had motorcycle accident and 32% experienced car crashes.

In addition, there were two groups of car crash incidents, followed by motorcycle and pedestrian-car accidents. Perhaps higher number of men and high incidence of trauma in the age range of 25-49 years 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. This result corresponds with previous studies, in terms of age range and sex [9, 10].

Prastika et al. reported moderate to severe mean pain score in patients with orthopedic and musculoskeletal trauma [4]. In a study on traumatic events by the Law

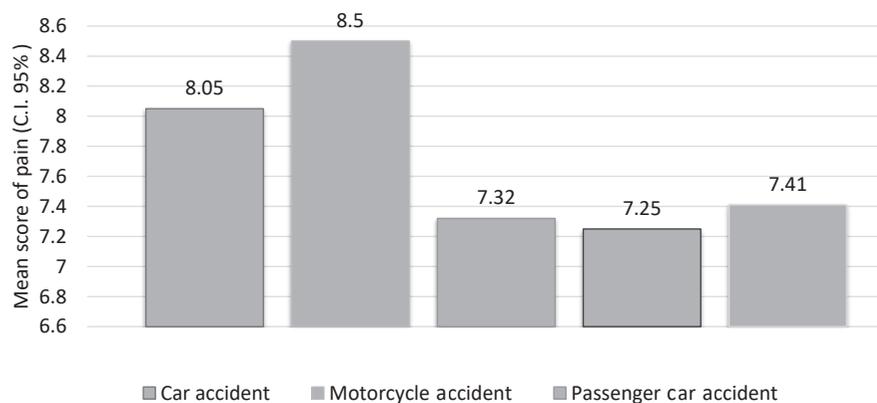


Figure 3. Comparison of mean pain scores due to trauma mechanism



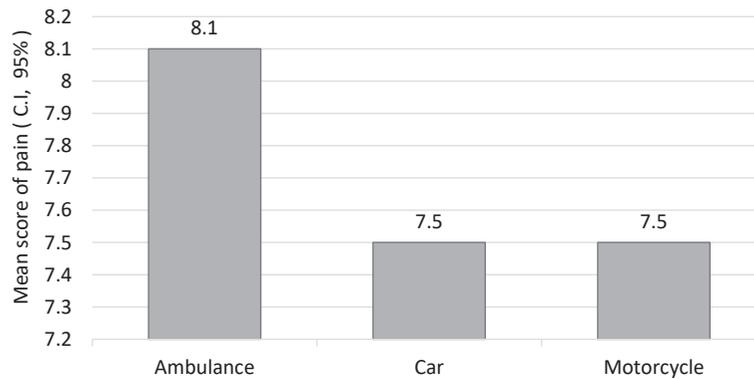


Figure 4. Comparison of mean pain score with respect to the patient transfer vehicle to the hospital



Enforcement Force of the Islamic Republic of Iran, the highest mean pain score was related to traumatic fractures [7]. According to the results of the present research, the highest mean score of pain was associated with musculoskeletal traumas as per following order: large bones fractures, small bones fractures, skull fractures, and penetrating traumas, which was in accordance with the findings of previous studies [3].

Our results indicate a higher mean pain score compared to similar other studies, which may be explained by the following reasons: first, pain severity was self-reported by the patients in our research, while in prior investigations, the pain intensity was reported by physicians and nurses [11-13]; second, misconceptions in some indigenous and regional groups; a they falsely believe that they can receive more attention from treatment centers

in case of reporting higher mean pain rates; third, use of different analgesic drugs after trauma in various studies could be a determining factor in such differences. Based on the findings of the current study, most patients had normal systolic blood pressure, and although the two groups had a lower frequency with high and low blood pressures, the mean score of their pain severity was significantly higher than the normal range [14].

According to the results of previous studies on the total time in patient's transfer to the hospital [15-17], advantages of reducing this period is still ambiguous. Prior studied highlighted that indeterminable regional factors, ethnicity, different tastes in selecting the study population, different measurement tools, impact of different factors on outcomes, and so on may influence the research outcome [15]. A study by Dinh et al.

Table 3. The results of adjusted variables estimation in relation with the mean pain score by the multiple regression test

Characteristics		Beta Factor (Coefficient)	95% CI	P
Sex	Male	Reference	-	-
	Female	-0.356	-0.029, 0.150	0.538
Age (y)	<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
Level of education	Below high-school diploma	Reference	-	-
	High-school 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
Vehicle air conditioning	On	0.006	-0.235, 0.230	0.970
	Off	-	-	-

Characteristics		Beta Factor (Coefficient)	95% CI	P
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
	Burning,bruise,	Reference	-	-
	Multiple Trauma	2.690	2.39,2.99	0.001
Systolic blood pressure (mm Hg)	<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 Dependence	Yes	-0.140	-0.50 ,-0.06	0.013
	No	-	-	-



showed that each minute delay was associated with an increase of 0.2% in mortality, during the transfer of patients with head trauma which lasted more than 60 minutes [18].

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 score of pain. In addition, several studies confirmed that shortening the total time in transfer had a positive impact on reducing mortality in traumatic patients [19, 20].

In the current study, patients with ventilated vehicles had a lower mean pain score compared to others, but such difference was not found statistically significant. 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 the hospital without ventilation or even with motor vehicles; hence, the higher mean score of pain in the group transferred with ambulance could have been expected. On the other hand, the group transferred with no ventilation and motor vehicles reported lower median score of pain due to less traumatic and non-intentional use of

ambulance. Future studies should aim to replicate results and compare the mean pain score in vehicles equipped with ventilation, and perhaps more accurate indicator of the patient's transfer vehicle could be obtained.

Berben et al. reported that use of epinephrine, Non-steroidal Anti-inflammatory Drugs benzodiazepines, and opium significantly reduced post-traumatic pain in patients [3]. In the present study, the mean pain sensation was measured in two groups of opium and non-opium dependents, which results did not differ significantly. A probable reason to such lack of difference might be due to the fact that opium was abused by the patients in the current study.

Unlike prior research studies, the current study solely examined patients with acute traumas (GCS \geq 14). As a result, there were some differences between analytical achievements of the current study and other investigations due to lack of examination of patients with trauma and reduced consciousness in them.

5. Conclusion

The current study investigated the mean score of pain in 270 patients with trauma referring to Poursina Hospi-

tal in Rasht. The sample population included 171 men and 93 women with the mean age of 40 years. Variables of our study included age, sex, level of education, type of transfer, total time in transfer, trauma mechanism, type of trauma, substance dependence, and hemodynamic factors. Among these variables, type of trauma, transfer vehicle, traumatic mechanism, transferring time, and heart rate were significantly correlated with the mean score of pain. Based on the results of linear regression, most factors influencing the mean pain score in multiple injuries and fractures of large bones were measured as 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 criterion in patients with reduced consciousness in the further studies.

Since trauma is a major cause of death and often affects the hemodynamic system, it is recommended that the pain be controlled that can be effective on hemodynamic parameters. Perhaps using pain relief methods including regurgitation block, injectable denture, and immobilization of the damaged limb could be helpful in this regard.

Ethical Considerations

Compliance with ethical guidelines

Ethics Committee of Guilan University of Medical Sciences has approved this paper with the ethics code of IR.GUMS.REC.1396.50.

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Conflict of interest

The authors declared that they have no conflict of interest.

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Data collecting; Jafar Hosseinzadeh and Roshanak Sanjabi: Conception and design.

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