International Journal of Aging

Int J Agin, 2024, 2, e3
10.34172/ija.2024.e3
http://ijage.com

Original Article

The Relationship Between Pre-hospital High Blood Pressure and Mortality Risk in Trauma Patients

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Article History:
Received: November 23, 2023
Accepted: February 17, 2024
ePublished: May 19, 2024

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Abstract

Objectives: To identify and manage the factors that reduce the duration of time patients spend in the hospital or are associated with mortality rates are important. Therefore, this study was conducted to investigate the relationship between high blood pressure before admission to the hospital and mortality rates in trauma patients.

Design: A cross sectional descriptive study
this is a cross sectional descriptive study which was done in emergency department of Imam Reza hospital

Setting(s): Emergency department of Imam Reza hospital, Tabriz, Iran.

Participants: All the trauma patients admitted to the emergency department of Imam Reza Hospital in Tabriz by emergency medical services over 12 months were included in this study using the complete enumeration method.

Outcome Measures: Vital signs, including blood pressure, were recorded in vital sign sheets and forms designed by researchers. Other outcomes such as admission, discharge from the hospital, and death were also recorded.

Results: From a total of 331 trauma patients, 251 (75.8 %) were men, and the rest were women; moreover, the average age of women and men was 46.8±17.7 and 41.4±16.0, respectively. In addition, 41.3% of women and 18.3% of men (23.9% of all the patients) had a history of hypertension. Furthermore, gender and high blood pressure in the scene of trauma did not exhibit any relationship with patients' outcomes ($P>0.05$), while age had a significant relationship with the death of the patients ($P=0.002$).

Conclusions: A positive correlation between the probability of death and age in trauma patients was found, while high blood pressure in the scene did not seem to affect the mortality rates in trauma patients in the ED or the ward.

Keywords: Trauma, Mortality rate, Blood pressure, Emergency department

Please cite this article as follows: Shams Vahdati S, Ala A, Rajaei Ghafouri R, Gilani N, Ettehadi A, Tahmasbi F. The relationship between pre-hospital high blood pressure and mortality risk in trauma patients. Int J Aging. 2024;2: e3. doi: 10.34172/ija.2024.e3

Introduction

Trauma is one of the major causes of death and a social problem.[1] In the United States, Trauma is the leading cause of death among individuals up to the age of 45,[2] and more than 5 million deaths are caused by injuries, accounting for 9% of the world's deaths each year.[3]

The first on-the-field triage for attending to trauma patients was published by the American College of Surgeons Committee on Trauma (ACSCOT) in 1976.[4] Since then, medical care for trauma patients has developed into precise protocols, covering different levels of medical services from the beginning at the scene of trauma and following to admission in the emergency department (ED) and more specialized wards if necessary.[5,6]

A substantial step in attending to trauma patients is the evaluation of vital signs, including systolic blood pressure (SBP).[7] Blood pressure is an important indicator of the physiological status of a patient.[8]

Considering the high incidence of trauma globally and its adverse effects which are permanent and/or paralyzing in some cases, identifying the possible factors that affect the mortality rates or patients' outcomes has always been a research priority. Therefore, this study investigated the relationship between high blood pressure before admission and mortality rates in trauma patients.

Methods

This study employed a retrospective cross-sectional design. The population of the study consisted of all the trauma patients admitted to Imam Reza hospital

of Tabriz in one year using a complete enumeration method. Patients who left the hospital either before a certain diagnosis or after it and patients with incomplete documentation were excluded from the study.

After getting the list of admitted patients in the ED, dead patients were regarded as prehospital mortality. Moreover, vital signs were recorded in a vital sign sheet by the emergency medical technicians before admission and in a hospital triage sheet after admission. Additional data such as the length of hospital stay were also recorded in the latter.

Prehospital blood pressure was defined as high blood pressure recorded by an emergency medical technician before admission to the hospital. Patients' outcomes, including discharge from ED, admission to the ward, or death were also recorded.

Variables investigated in this study included age, gender, prehospital blood pressure, blood pressure while discharging from the hospital, duration of stay in ED, death before admission to the hospital, patients' ED, scene, and ward outcome.

Statistical Analyses

Data were imported into IBM SPP Statistics version 15 and analyzed based on defining the statistical significance lower than 0.05. The intraclass correlation coefficient was used to estimate the reliability of measurement scales. To summarize the data in descriptive parts, frequency (percentage) for qualitative variables, mean (standard deviation) for normal distribution, and median (interquartile range) for non-normal distribution were applied. Moreover, descriptive analysis, including mean, median, mode, and variance was used for demographic features, and linear regression was applied for modeling the connection between data.

Results

Of a total number of 331 multiple-trauma patients, 251 (75.8%) were men, and the rest were women. Data were analyzed via the Kolmogorov-Smirnoff test and followed a normal distribution. Mean age in men and women was 41.4 ± 16.0 and 46.8 ± 17.7, respectively. In addition, 41.3% of women and 18.3% of men (23.9% in all the patients) had a history of hypertension, and 90.9% of women and 87.0% of men with hypertension history had taken antihypertensive medication. From the perspective of injury mechanism, car accidents (49.5%) and fighting (0.3%) were the most and least frequent causes of trauma in the population of the study, respectively. The distribution of trauma mechanism is presented in Table 1.

It was found that high blood pressure in women reduced with time; however, this reduction is statistically insignificant according to the Cochran test ($P = 0.279$).

Tables 2, 3, and 4 present the distribution of patients' outcomes in three time sections. Accordingly, 2.4% of patients died at the scene of the accident, 6.5% in the ED of the hospital, and 28.7% in the ward. This data indicated a significant increasing trend according to the Cochran test ($P < 0.001$).

According to the univariate logistic regression model, the age of patients has a significant correlation with hypertension in three time sections: scene of trauma, ED, and the ward ($P < 0.001$). In other words, one year increase in age increases the chance of developing hypertension by one percent.

In addition, the gender of patients also has a significant correlation with hypertension in the scene of trauma according to the univariate logistic regression model ($P = 0.006$), and being a woman increases the chance of developing hypertension by 2.5 times. However, this correlation does not exist in the ED and the ward ($P = 0.311$, $P = 0.295$)

Furthermore, the findings of the univariate logistic regression model depict that gender has a significant correlation with high blood pressure in the scene, that is, being female increases the probability of developing high blood pressure in the scene of trauma ($P = 0.006$). In contrast, gender did not seem to affect the blood pressure in the ED and the ward ($P = 0.311$ and $P = 0.295$, respectively)

Applying the multiple logistic regression model, the age increase has a positive correlation with developing high blood pressure in all three time sections. In addition, having a history of hypertension increases the risk of developing high blood pressure at each level by 7 to 8 times ($P = < 0.001$).

The findings of the Generalized Estimating Equation analysis using the logit function indicated that by modifying the effects of gender and history of the disease, age had a significant correlation with the high blood pressure process. This means that by modifying the effects of other variables, with each year of age increase, the risk of developing high blood pressure in these patients increased by 22%. In addition, the chance of developing high blood pressure increased by 8 times in patients with a history of high blood pressure ($P < 0.001$).

Applying the multiple logistic regression model suggested that gender and high blood pressure in stage 0 do not correlate with patients' outcomes ($P > 0.05$), whilst age had a significant correlation with patients' deaths ($P = 0.011$).

Likewise, applying the multiple logistic regression

Table 1. Mechanism of Trauma

Trauma Mechanism	Frequency	Percent
Bicycle	11	2
Car crush	263	48.8
Car to pedestrian	51	9.5
Fall from height	63	11.7
Falling	36	6.7
Fight	2	0.4
Motor accident	81	15.0
Rollover	32	5.9

Table 2. Outcome of Patients at the Scene

Variable Name	Variables	Scene Outcome				Total	*P* Value
		Alive		Dead			
		Frequency	Percent	Frequency	Percent		
Gender	Female	78	97.5	2	2.5	80	0.956
	Male	245	97.6	6	2.4	251	
Total		323	97.6	8	2.4	331	

Table 3. Outcome of Patients in ED

Variable Name	Variables	ED Outcome						Total	*P* Value
		Discharge		Admission		Death			
		Frequency	Percent	Frequency	Percent	Frequency	Percent		
Gender	Female	18	23.1	52	66.7	8	10.3	78	0.267
	Male	67	27.3	165	67.3	13	5.3	245	
Total		85	26.3	217	67.2	21	6.5	323	

Note. ED: Emergency department.

Table 4. Outcome of Patients in Ward

Variable Name	Variables	Ward Outcome				Total	*P* Value
		Alive		Dead			
		Frequency	Percent	Frequency	Percent		
Gender	Female	36	69.2	16	30.8	52	0.706
	Male	118	72.0	46	28.0	164	
Total		154	71.3	62	28.7	216	

model revealed that gender and high blood pressure in the scene of trauma do not correlate with patients' outcomes ($P < 0.05$), while age had a positive correlation with patients' deaths ($P = 0.002$)

Discussion

Different physiological parameters, treatable and untreatable, have been suggested to play a role in predicting the mortality rate in trauma patients, including, age, Glasgow Coma Score (GCS), coagulopathies, low SBP, elevated base deficit, organ failure, and acute respiratory distress syndrome.[9-11] Nevertheless, predicting the value of vital signs has been questioned by many articles.[12] Vital signs such as blood pressure, pulse rate, and respiratory rate play a crucial role in the primary evaluation of trauma patients.[13-15] SBP is also considered an important clinical marker to evaluate the severity of trauma.[16] Low SBP is considered to be < 90 in healthy adults.[17] In our study, no significant variation existed in patients' blood pressure at the scene of trauma, the ED, or when admitted to the ward. Moreover, merely hydration in the ED increased the blood pressure of some patients with low blood pressure before admission, which was also not statistically significant. Many studies revealed that hypertension and high blood pressure play a role in lower survival rates in trauma patients,[14,18] especially increasing early mortality (within 24 hours after the trauma).[18] However, the results obtained in the present study did not support this proposition and showed no evidence of an association between high blood pressure and increased mortality rates in trauma patients. Nevertheless, high blood pressure at the scene of trauma did not increase the mortality rates in the ED or the patients' final outcomes. In addition to high blood pressure, low blood pressure is also suggested to play a role in predicting mortality rates.[19] In one study, 110 mm Hg SBP was associated with a significant mortality, so for each 10 mmHg decrease in SBP, the mortality rate increased by 4.8%.[20] Hypotension can reflect altered physiological mechanisms and needs to be precisely investigated.[21]

Other physiological indicators have been investigated for their plausible role in predicting the mortality rate, hypotension (losing 30%-40% of blood volume), bradycardia, and base deficit,[21,22] thus these factors should be considered an important guide for future reference. Furthermore, our results suggested that patients with a history of hypertension have a higher blood pressure in the scene of trauma compared to the patients without such a history. Approximately, one-quarter of the patients had a history of hypertension, of which almost 80% took antihypertensive medications.

Gender, as another possible predictor of patients' outcomes and mortality in trauma patients, has been proposed by some studies.[23,24] Female gender might be associated with lower mortality and probability of admission to ICU.[25] In one study on blunt trauma patients, male patients were at a higher risk of mortality compared to female ones.[26] According to our results, the

gender of the patients did not seem to affect the blood pressure overall; nevertheless, women displayed higher blood pressure in the scene of trauma compared to men. Furthermore, the gender of the patients did not show a significant association with patients' final outcomes.

The age of the trauma patients is another factor suggested to predict mortality.[27,28] Age has been proven so important that a new statistical model is suggested for predicting mortality rates in trauma patients along with admission systemic inflammatory response syndrome (SIRS) and GCS. [29] In conclusion, our findings suggested that the only significant factor affecting patients' outcomes is the age of the patient which has a positive correlation with the mortality rate. Nevertheless, given that other factors such as the remaining vital signs were not applied, the final decision is not included in these terms.

Conclusions

Our findings showed higher rates of mortality in trauma patients with older age at the scene of trauma and in the ED. In addition, high blood pressure at the scene, in the ED, and in the ward did not seem to affect the mortality rates.

Acknowledgements

The authors would like to express their appreciation to the Imam Reza General Hospital staff for their cooperation. Moreover, this study is the result of a thesis for degree specialization conducted by Dr. Arezou Ettehadi under the registered number 63636. Also, We would like to appreciate the cooperation if Clinical Research Development Unit of Imam Reza General Hospital, Tabriz, Iran in conducting this research.

Author contributions

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Funding

None.

Data availability statement

Not applicable.

Ethical approval

The present study was approved by the ethics committee of Tabriz University of Medical Sciences (IR.TBZMED.REC.1398.514).

Consent for publication

Not applicable.

Conflict of interests

The authors declare that there is no conflict of interests.

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