

The importance initial body temperature in critically ill trauma patients on to ICUs in prediction of the outcome

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Abstract

Introduction:

Different studies on evaluation of the outcome of multiple trauma patients have found many influential factors. The aim of this study was to determine the relationship of axillary body temperature with mortality in patients with multiple traumas hospitalized in the intensive care units and other clinical and paraclinical factors.

Materials and Methods:

This is a cohort study. All the patients between 16 and 75 years old with multiple traumas who were admitted to the ICU of Rasoul Akram Hospital from 21st of March 2008 till 20th of March 2009 were included in the study. Axillary temperature in the first and 2nd days of admission, Glasgow coma scale (GCS), systolic blood pressure, serum glucose levels and white blood cell counts of all patients at the first day were recorded and their relationships with each other and with the outcome were analyzed.

Results:

93 patients were included in the study. Axillary body temperature in the first and second days showed a statistically significant relationship with mortality and GCS. Lower body temperature was led to an increase in mortality, less GCS and systolic blood pressure.

Conclusion:

Our results show that axillary body temperature in the first day of multiple trauma patients can be a reliable indicator of their final outcome. Patients with higher body temperature will experience better outcome than those with lower body temperature.

Keywords: Trauma, Fever, Intensive Care Unit

Introduction

Trauma is the second leading cause of death after cardiovascular problems and the most prevalent cause of loss of years of the young in Iran (1-2). Moreover, trauma is the most common cause of mortality and disability of individuals between 1 and 34

years (3). Statistics show that trauma causes more than one million deaths and nearly 50 million physical injuries per year (4).

Several factors have been investigated on the prognosis of critically ill trauma

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patients. Factors such as age, severity of the injury, blood pressure, Glasgow coma scale and some laboratory measures such as the number of white cells and blood glucose could be noted (5-6)

Body temperature is another factor whose predicting value has interested researchers. Only few studies have investigated the advantages and disadvantages of temperature in these patients. Jentilelu's clinical trial investigated whether the low body temperature during resuscitation in critically ill trauma patients is beneficial or harmful. They concluded that low temperature increased intravenous fluid requirement as well as mortality (7). In another study on 173 trauma patients, it was observed that patients with lower temperatures experienced worse outcomes (8).

Both studies on the relationship between body temperature and trauma patients' outcome revealed that patients with low body temperature have a poorer prognosis. However, unlike these two studies, several studies on animals and human have shown that high body temperature in patients with head trauma accelerates the destruction of brain cells mechanisms and worsens the patients' prognosis (9-11).

Knowing the effective prognostic factors for these patients and controlling them would make assessment and treatment of trauma patients more successful. There is little information from few studies worldwide regarding the relationship between body temperature and outcome in critically ill trauma patients. Considering this, the best approach to critically ill trauma patients with a high body temperature admitted to the ICU is not known for certain.

Given the high prevalence of trauma in Iran and the high cost of therapeutic interventions, especially for patients admitted to the ICU, determining the predicting factors for these patients seems necessary and practical. Considering that such a study has not been conducted in Iran so far, the present study aimed to

investigate the relationship between body temperatures on admission and 10-day mortality in patients with multiple traumas in ICU.

Materials and Methods

The present study is a cohort study. All patients with multiple trauma admitted to the ICU of Rasul-Akram Hospital emergency department from March 2009 to March 2010 were included in the study by census.

Exclusion criteria included factors such as hospital discharge prior to the tenth day of hospitalization, less than 24 hours of stay in ICU, less than 16 and above 75 years of age, having diabetes (history of taking glucose-lowering medication or insulin), hypertension (history of taking anti-hypertensive medication or persistent hypertension above 140/90 mm Hg in the past), ischemic heart disease (history of CCU admission or knowing the result of heart scan, exercise test or coronary angiography indicating cardiac ischemia) or stroke (neurological deficit on examination or history taken from relatives), and being referred from other hospitals.

Based on the information recorded in patients' files, patients were divided into two groups with axillary temperature ≤ 37.3 °C on admission and the ones with axillary temperature > 37.3 °C on admission. Body temperature was measured with an electronic thermometer. Location of the temperature measurement in the ICU was patient's armpit that has been approved in other studies (12). A nurse measured the temperature by placing the thermometer in patients' armpit for 5 minutes. The ICU temperature was 25 °C. The axillary temperature, Glasgow coma scale, systolic blood pressure, blood glucose and white blood cell count were recorded on admission and the relationship between these factors and patients' 10-day outcome, recovery and mortality was investigated. The 10-day outcome was

considered according to previous similar studies (13).

SPSS 17 statistical software and chi-square test, t-test and one way ANOVA were used for data analysis. P value of less than 0.05 was considered significant. Consent from was obtained from patients and/or their first-degree relatives and they were assured of confidentiality of their personal details. The 26 codes of ethics were observed during the research.

Results

In this study, 93 patients admitted to the ICU after multiple trauma were included in the study. The patients' mean age was

28.23±10.38 years old, 88 patients (94.6%) were male and 5 patients (5.4 %) were female.

One patient had a WBC count higher than 10500/mm³. Mean blood glucose level was 152.71±38.8 mg/dl. Patients' information is shown in table 1. Patients were divided into two groups of febrile and afebrile based on body temperature shown in table 2.

The two groups were not significantly different in terms of age, Glasgow coma scale and systolic blood pressure but were significantly different in terms of heart beats per minute, temperature and ICU stay duration.

Table 1: Information of trauma patients admitted to the ICU of Rasul-Akram Hospital over a year

Data	Numbers (%)
Mean age (year)	28.23±10.38
Sex (Male)	88 (95)
ICU stay (day)	7.84±6.70
Glasgow coma scale on admission	
<8	7(7)
9-12	46(49)
≥13	40(43)
Systolic hypertension on admission	
<90 mmHg	36(39)
≥90 mmHg	57(61)
Heart rate on admission	
<100 bpm	58(62)
≥100 bpm	35(38)

Table 2: Comparison of parameters measured on admission in both febrile and afebrile trauma patient groups admitted to the ICU of Rasul-Akram Hospital over a year

	Febrile, T>37.3 °C	Afebrile, T<37.3 °C	P-value, t-test
Age (year)	27.32±11.86	28.92±10.86	Insignificant
Glasgow coma scale	10.24±3.01	9.84±3.88	Insignificant
Systolic hypertension mm Hg	12.42±4.12	11.84±4.12	Insignificant
(per minute) Heart beat	98.43±26.22	87.77±27.21	<0.05
Axillary temperature (°C)	38.24±0.70	36.92±1.98	<0.001
ICU stay (day)	6.22±6.34	7.88±7.66	<0.05

Seventy-four patients had fever on the first day of admission. Axillary temperature of the first day was significantly related to mortality (p=0.001). Moreover, axillary temperature of the first day showed a significant relationship with Glasgow

coma scale and systolic blood pressure on admission (respectively p=0.006 and p=0.014). On the other hand, there were no significant relationship observed between the axillary temperature of the first day with parameters such as white blood cell

counts and patients' pulse rate on admission. (respectively $p=0.204$ and $p=0.130$)

On the second day of admission, 82 patients had fever. The mortality rate of patients was significantly related to the axillary temperature of the second day.

The relationship between body temperature and patients' outcome are shown in table 3. The high body temperature on the second day of hospitalization showed a significant relationship only with the Glasgow coma scale on the first day ($p=0.006$).

Table 3: The relationship between fever and 10-day outcome of trauma patients admitted to the ICU of Rasul-Akram Hospital over a year

	Febrile		Afebrile		P-value
	Alive	Dead	Alive	Dead	
First day	72(97.3)	2(2.7)	13(69)	6(31)	0.001
Second day	79(96.4)	3(3.6)	6(54.6)	5(45.4)	<0.001

Numbers in parentheses are percentage.

The mean age of those who died and those who survived was not significantly different. Moreover, their mean blood glucose level was also not significantly different (respectively $p=0.174$ and $p=0.070$) but the mean ICU stay in people who eventually died was significantly higher than patients who survived ($p=0.001$).

Discussion

The present study was conducted in order to investigate the relationship between body temperature on admission and 10-day mortality in the ICU in patients with multiple trauma. In this study, patients with a higher body temperature had fewer deaths than the other group on the first and the second day.

Mizushima et al. in 2009 conducting a retrospective study investigated 253 trauma patients who were admitted to the ICU during three years. Core body temperature of patients was measured and recorded through tympanic and bladder catheter temperature measurement on admission. Patients were evaluated in terms of the outcome. The mortality rate in patients who were afebrile on the first and the second day of admission was more than that of the febrile group. Finally, it was concluded that patients whose body temperature does not reach higher than

37.5 shortly after trauma face more mortality (13).

In Shafi study, the body temperature of 38550 trauma patients on admission was examined in a 9-year period. Patients based on their body temperature were divided into two groups of low temperature group ($T < 35^{\circ}\text{C}$) and normal temperature group ($T \geq 35^{\circ}\text{C}$). Head, neck, face, chest and abdominal traumas were observed more in hypothermic patients, who also had more complications during hospitalization. These results may be interpreted as the head and face trauma damages temperature control center in the thalamus through an unknown mechanism, disrupts body temperature settings and consequently results in body temperature reduction. Therefore, this relationship was observed because head and face injuries result in more deaths (14).

Another study was conducted in 2003 on 493 critically ill patients admitted to the ICU. In this study, various demographic factors (age, gender), clinical (heart rate, respiratory rate, mean arterial pressure, Glasgow coma scale) and laboratory were recorded for each patient.

To measure patient's core body temperature, rectal temperature, or the temperature of the pulmonary artery in patients with pulmonary artery catheters were used. If these methods were not

possible, the core body temperature was calculated by adding 0.5 °C to axillary temperature. Then patients were divided into three groups of low temperature (<36 °C), normal temperature (36-38.3 °C) and fever (>38.3 °C) based on the core body temperature.

Performing statistical calculations, it was determined that 76.3% of patients had fever on admission in the ICU and 23.7% of them had fever during the ICU stay. The mortality rate in patients with low and high temperature was higher than patients with normal temperature. The differences between this study and the present study can be justified by considering that normal temperature was 36 °C to 38.3 °C (15).

In Jentilelu study on 57 trauma patients, low body temperature had a direct relationship with patients' increasing need for fluid therapy and mortality rate (7).

In the present study, the axillary temperature of patients on the first day showed a significant relationship with mortality rate and Glasgow coma scale on admission. Of these findings, it can be concluded that if the initial body temperature of trauma patients is lower than normal, their consciousness is lower and they are more likely to die. But other factors such as white blood cells, heart rate and blood glucose levels on admission do not affect these patients' prognoses.

In the present study, the mean age of the people who had higher temperatures was less than that in other patients. The older people, due to the decrease of temperature rising metabolism or other underlying problems have less ability to maintain temperature in the normal range or create less inflammation, therefore, the body temperature decreases with high stress such as trauma. This finding has been proved in other studies (16).

In addition to body temperature, other factors also play a role in the prognosis of trauma patients. In the present study, white blood cell count, blood glucose and age showed no significant relationship with mortality. Results of other studies are quite

inconsistent with the findings of the present study. Rolyas study has reported blood cell count as an appropriate index for the prognosis of the trauma patients' outcome (17).

Since the temperature increase and white blood cells increase along with increased heart rate and decreased blood pressure are signs of systemic inflammatory response syndrome, usually all these symptoms, especially in trauma, are investigated together. If an increase in white blood cells is considered a symptom of acute phase, it will increase in infection or trauma.

Numerous studies have been conducted on the relationship between the increase of blood glucose levels and mortality. Although no relationship was observed in this study, some studies confirm it (18).

In the present study, no significant relationship was found between systolic blood pressure on admission and patients' mortality. In contrast to this finding, two other studies have reported hypotension as one of the strongest predictors of the need for emergency measures and its consequences such as infections, increased hospital stay and death (19-20).

The limitation of this study is the low sample size which has probably caused some result differences between this study and some studies having larger sample sizes. In this study, all patients were critically ill and were admitted to the ICU and the severity of the damage was almost the same.

On the other hand, the number of patients in febrile and afebrile groups and the number of male and female patients were not the same. The authors of this study suggest that similar studies with larger sample size and considering other factors such as urinalysis, CRP, ESR and the severity of trauma be conducted for longer periods.

Conclusion

In this study, the axillary temperature of the first and the second day and Glasgow coma scale of patients with multiple

trauma who were transferred to the ICU and died was significantly lower than those who were discharged. The findings of the present study indicate that the temperature and the consciousness level of multiple trauma patients on the first and

the second day of admission to the ICU is inversely related to their outcome.

Conflict of interests

Authors had no conflict of interests in this study.

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