

The Quality of Pre-hospital Circulatory Management in Patients With Multiple Trauma Referred to the Trauma Center of Shahid Beheshti Hospital in Kashan, Iran, in the First Six Months of 2013

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Abstract

Background: Circulatory management is a critical issue in pre-hospital transportation phase of multiple trauma patients. However, the quality of this important care did not receive enough attention.

Objectives: The aim of this study was to investigate the quality of pre-hospital circulatory management in patients with multiple trauma.

Patients and Methods: This was a cross-sectional study conducted in 2013. The study population consisted of all patients with multiple trauma who had been transferred by emergency medical services (EMS) to the central trauma department in Kashan Shahid Beheshti medical center, Kashan, Iran. We recruited a convenience sample of 400 patients with multiple trauma. Data were collected using the circulatory assessment questionnaire and controlling hemorrhage (CAQCH) that were designed by the researchers and were described by using frequency tabulations, central tendency measures, and variability indices. The chi-square test was used to analyze the data.

Results: The study sample consisted of 263 males (75.2%); 57.75% had lower levels of education and 28.75% were workers. The most common mechanism of trauma was traffic accident (85.4%). We found that the quality of circulatory management was unfavorable in 61% of the cases. A significant relationship was observed between the quality of circulatory management and type of trauma and staff's employment status.

Conclusions: The quality of pre-hospital circulatory management provided to patients with multiple trauma was unfavorable. Therefore, establishment of in-service training programs on circulatory management is recommended.

Keywords: Quality, Circulatory, Pre-hospital Care, Multiple Trauma

1. Background

According to the world health organization, trauma is the leading cause of death for people under the age of 45 years old (1). In Europe, nearly 800,000 people die from trauma every year (2). Iran is a country with a high rate of road traffic crash fatality and injury (3). Trauma is the fourth cause of death in the world (4, 5). According to statistics from the forensic medicine organization of Iran, between 2006 and 2008, traffic crashes resulted in an average of 24,000 people (i.e. 3 persons per hour) dead and around 240,000 cases injured, annually (6, 7).

Because trauma affects mostly young people, the burden to society in terms of lost productivity, premature death and disability is considerable (8-10). Despite improvements in trauma care, uncontrolled bleeding contributes to 30% - 40% of trauma-related deaths and is the leading cause of potentially preventable early in-hospital deaths (11-14). Consequently the early management of the

external bleeding of trauma may improve survival in the trauma victims (15).

Appropriate management of the massive bleeding in trauma patient includes the early identification of bleeding sources followed by prompt measures to minimize blood loss, restore tissue perfusion and achieve hemodynamic stability (13, 16, 17).

Emergency medical service (EMS) is the first step in managing trauma patient (18, 19). A key pre-hospital measure has been provided to trauma patients is circulatory management including stopping external bleeding. Otherwise, they may result in additional complications in the pre-hospital phase (20).

Circulatory managements require skills such as injections and dressing that are in the psychomotor domain of educational objectives (21). In this domain, the learner should pass the stages of perception, preparedness, directed response, mechanism, complex overt re-

response, adaptation and innovation. Evidence shows that, in the stage of adaptation, people may forget or ignore many basic rules or, on the contrary, pay more attention to them as a result of experiences gained in continuous work (22).

In a study of fitness of function and education of pre-hospital emergency technicians in dealing with trauma patients in Iran, Alimohammadi et al. have reported that about 10% of trauma patients who transported by the pre-hospital emergency medical system (PEMS), had no appropriate vascular access at hospital admission (23). However, the rate of having a proper vascular access at hospital admission was about 99% in a study of the medical pre-hospital management of patients with severe trauma in France (2). Ahmadi Amoli et al. have also investigated the efficacy of pre-hospital care in traumatic patients referred to an emergency ward in Tehran and reported that fluid replacement therapy did not start by the PEMS in 80% of patients who needed it (24). In another study, Azarbarzin et al. reported that the standards of intramuscular injections and dressings were not correctly followed in more than half of the cases (22). Despite, evaluating the quality of pre-hospital circulatory management is an important component of assuring pre-hospital care quality, this issue does not paid enough attention by the research community.

Although a quality care in the pre-hospital phase have a crucial role in survival and the health of trauma patients, the aforementioned evidence suggest some shortcoming in the care delivered by the PEMS workers. Given the important role of the PEMS staff and the lack of studies on the quality of bleeding control and circulatory management in trauma patients, this question comes to mind that "How is the quality of pre-hospital circulatory management in patients with multiple trauma?" Elucidating the weak points of pre-hospital trauma management would not only benefit the local authorities and trauma care system but also might have beneficial lessons for trauma management systems globally.

2. Objectives

This study aimed to assess the quality of pre-hospital circulatory management in patients with multiple trauma.

3. Patients and Methods

This was a cross-sectional study conducted from April till September 2013. The sample size was estimated based on the information gathered about the number of multiple trauma patients in the same period of the previous year

which obtained from the archives of the emergency department in Shahid Beheshti medical center (which is the main trauma center in Kashan and is governed by Kashan University of Medical Sciences), and from the records in the pre-hospital EMS in Kashan, Iran. Based on the recorded data, the number of samples was estimated to be about 350 patients. However, 400 patients with multiple trauma were referred during the present study.

The study population was consisted of all patients with multiple trauma who had been transferred by EMS to the trauma center of Shahid Beheshti medical center. The inclusion criteria included having multiple trauma, being alive at hospital admission, and being transferred to the trauma center by EMS. Then, all patients with inclusion criteria were recruited consecutively and no one was excluded.

The study instrument consisted of three parts including a demographic questionnaire, the 4-item trauma assessment questionnaire (TAQ), and the 8-item circulatory assessment questionnaire and controlling hemorrhage (CAQCH) that were designed by the researchers. The demographic questionnaire consisted of four questions regarding patients' age, gender, job, and education level. The 4-item TAQ included questions about the occurrence date of trauma, type of trauma (blunt, penetrating, or both), the mechanism of trauma (traffic accident, fall, street attack, and debris fall), site of injury and the place the trauma occurred. The CAQCH assessed the quality of providing blood circulation and controlling hemorrhage during transferring patient to the hospital and consisted of 8 items on: 1) lacking an active bleeding at the time of hospital admission of patients with penetrating traumas, 2) covering the wound with an appropriate dressing, 3) inserting a peripheral intravenous cannula (i.e. using 18 g or larger), 4) inserting of the intravenous cannulae in place away from the injured area, 5) appropriate fixation of the vascular cannulae, 6) selecting an uninjured limb for cannulation, 7) starting of fluid replacement therapy if the systolic blood pressure (SBP) if less than 90 mmHg, 8) inserting at least two cannulae for patients with SBP less than 90 mmHg (25).

The CAQCH items were scored on a three-point scale in which two stood for "Done properly", one for "Done improperly", and zero for either "Not done when it was needed" or "No indication." Accordingly, the total score of CAQCH ranged from zero to sixteen. Then, the total score was divided by 8 (the number of questions) to make a criteria for measuring the quality of circulatory management. Consequently, scores lower and higher than two were interpreted as unfavorable and favorable circulatory management, respectively. We developed the study questionnaires based on an in-depth literature review. Then, we invited six nursing lecturers to assess the content validity of

the questionnaires and their comments were included in the final version of the questionnaires. Content validity index (CVI) was calculated and was equal to one as all experts agree on item relevance (26). Also, the content validity ratio (CVR) was calculated using the Lawshe method and it was equal to one as all the experts were agree that all items in the instrument are essential (27). To ensure the reliability of the instruments, we employed the inter-rater method. Accordingly, two raters administered the study questionnaires to ten patients. The inter-rater correlation coefficient was equal to one. The Cronbach's alpha was also calculated using the data from 10 multiple trauma patients and was 0.75. All of the data were collected by the first researcher and a research assistant who was previously trained for this proposal.

3.1. Data Analysis

Data analysis was performed using the SPSS version 11.5 (SPSS Inc. Chicago, USA). No missing value was existed. All data were described using frequency tabulations, central tendency measures, and variability indices and chi-square test.

3.2. Ethical Considerations

The protocol of this study was approved by the research ethics committee at Kashan University of Medical Sciences and issued by number 463 on May 4, 2013. We explained the aim of the study to the participants or their companions and they were assured about the data confidentiality. A verbal consent was obtained from the participants or their companions. Permissions were also sought from the hospital and unit authorities. All the patients' rights were observed in accordance with the last version of the Helsinki Declaration.

4. Results

From a total of 400 multiple trauma cases, 75.25% were male, 58% had lower levels of education and 28.75% were workers. The mean age of the victims was 34.36 ± 18.59 years. Most of the accidents happened in urban streets (65.25%) and country roads (28.75%). Moreover, 84.25% of the patients had a mix of penetrating and blunt injuries among them 60% were on the head and neck areas. Totally, 11% of the patients had penetrating injuries (Table 1).

Among the total cases with multiple trauma, only 39% had received an appropriate circulatory management while in 69% of the cases, the quality of circulatory management was unfavorable (Table 2).

As Table 2 shows, 25.3% of the trauma cases were patients transported to hospital without establishing a vascular access. Moreover, in 16.1% of the cases the intravenous

Table 1. Patients' Occupation and Characteristics of Trauma

Variable	No. (%)
Gender	
Male	301 (75.25)
Female	99 (24.75)
Level of education	
Primary school	232 (58)
Secondary school	78 (19)
Diploma and higher	92 (23)
Mechanism of trauma	
Traffic accident	349 (87.25)
Fall	37 (9.25)
Street attack	10 (2.5)
Debris fall	4 (1)
Place the trauma occurred	
Home	10 (2.5)
Work settings	13 (3.3)
Urban streets	261 (65.25)
Country roads	116 (29)
Site of injury	
Head and neck	210 (60)
Upper limb	228 (65.14)
Chest	41 (11.71)
Abdomen, back, and pelvis	113 (32.28)
Lower limb	213 (60.85)
Type of trauma	
Penetrating	44 (11)
Blunt	19 (4.75)
Mix	337 (84.25)

cannulae have been inserted in an inappropriate place (i.e. in the injured limb), and in one fourth of the cases, the inserted vascular access was not suitable for rapid fluid replacement. Also, in 38 cases with a SBP < 90 mmHg, only one intravenous cannula have been inserted.

Using the chi-square test, a significant relationship was observed between the quality of circulatory management and type of trauma ($P = 0.01$), so that in 51.17% of penetrating traumas and 60.54% of mixed traumas the quality of circulatory management was unfavorable. Moreover, a significant relationship was observed between the quality of circulatory management and the staff's employment status ($P = 0.02$), so that more than 56% of the interventions for circulatory management implemented by perma-

Table 2. The Quality of Pre-Hospital Circulatory Management in Patients With Multiple Trauma Referred to the Emergency Department^a

Quality of Circulatory Management	Done		Not Done	No. Indication
	Done Properly	Done Improperly		
Lacking an active bleeding at the time of hospital admission of patients with penetrating traumas	357 (89.2)	5 (1.3)	10 (2.5)	28 (7)
Covering the wound with an appropriate dressing	156 (39)	125 (31.2)	78 (19.5)	41 (10.3)
Inserting a peripheral intravenous cannula (i.e. using 18 g or larger)	86 (21.5)	301 (75.25)	13 (3.25)	NA
Inserting of the intravenous cannula in a place away from the injured area	336 (84)	51 (12.8)	13 (3.2)	NA
Appropriate fixation of the vascular cannula	379 (94.8)	8 (2)	13 (3.2)	NA
Selecting an uninjured limb for cannulation	378 (94.5)	5 (1.2)	17 (4.3)	NA
Starting of fluid replacement therapy if the systolic blood pressure if less than 90 mmHg	26 (6.5)	4 (1)	11 (2.75)	359 (89.7)
Inserting at least two cannulae for patients with systolic blood pressure less than 90 mmHg.	3 (0.8)		38 (9.4)	359 (89.8)

^aOverall assessments: favorable, 156 (39 %); unfavorable, 244 (61 %).

ment staff and more than 75% of the interventions by sub-contract staff were unfavorable (Table 3). No significant relationships were observed between the mechanism of trauma and quality of circulatory management.

5. Discussion

This study showed that a large number of patients with multiple trauma received unfavorable circulatory management. Bleeding control is the most important action in pre-hospital circulatory management and was performed inappropriately in most cases. Many patients with trauma die from internal or external bleeding in the first few minutes or the first post trauma hours. Therefore, quick and appropriate bleeding control and circulatory management play an important role in survival of trauma patients, especially in the first few minutes and the first hours after the trauma (28, 29).

About one fourth of the trauma patients in the present study were transported to hospital without establishing a vascular access. In a previous study in Tehran, more than 91% of trauma patients transported by the PEMS had a vascular access at the time of hospital admission although the vascular access in a few patients were not appropriately functioning (24). In another study, from a total of 440 vascular access inserted by PEMS technicians 10% were inappropriate (23). However, in a study by Yeguiayan et al., 99% of patients transported by the PEMS had a suitable vascular access at hospital admission (2). Establishment of a good vascular access is the cornerstone of circulatory management in multiple trauma patients that allows health-care providers to start the fluid replacement therapy or

blood transfusion (30). Such interventions need knowledgeable and skilled EPMS staff. The findings of the present study might be an alarm for shortcoming in knowledge and skills for circulatory management in the PEMS staff in Kashan city. Therefore, the authorities should establish appropriate programs to prepare their staff in these vital procedures (31).

In the present study, some of the intravenous cannulae were inserted in an inappropriate place or were not suitable for rapid fluid replacement. Moreover, fluid therapy did not start in some cases that needed it. Consistent with our finding, Tatarpour et al. have reported that the staff had not an appropriate performance in the fluid replacement therapy (32). Ahmadi Amoli et al. reported that in 46% of the cases, the intravenous cannulae inserted by the PEMS staff were inappropriate for rapid fluid replacement. They also reported that 80% of trauma patients did not receive any fluid therapy in the pre-hospital transportation phase (24). Our finding along with results of Ahmadi Amoli et al. (24) and Tatarpour et al. (32), shows that the PEMS staff had not received appropriate educations on selection of appropriate intravenous cannulae and emergency fluid replacement therapy.

Although, the quality of circulatory management in the present study was in relation with the staff's employment status and the type of trauma, in most cases (61%) the quality of circulatory management by the PEMS staff was unfavorable. Although the poor knowledge and skills of the PEMS staff might be a reason for this finding, lack of adequate practical training and lack of motivation among employees (18) and also the quality of supervisions and regulations (33) might affect the staff's performance. Perhaps,

Table 3. The Relationship Between Quality of Circulatory Management and Type of Employment and Type of Trauma

	Quality of Circulatory Management		P Value
	Unfavorable	Favorable	
Type of employment			0.02
Permanent	65 (56.56)	43 (43.44)	
By contract	98 (57.30)	73 (42.69)	
By subcontract	60 (75.94)	19 (24.05)	
Compulsory governmental services	30 (58.82)	21 (41.17)	
Type of trauma			0.01
Penetrating	22 (51.17)	21 (48.83)	
Blunt	18(90)	2 (10)	
Mixed	204 (60.54)	133 (39.46)	
Total	244 (61)	156 (36)	

repeating a wrong or incorrect practice along with the lack of appropriate quality assurance system and vague protocols may result in normalization of an incorrect practice. Then such practice might be continued among the staff as a routine work.

In conclusion, the quality of pre-hospital circulatory management of trauma patients was unfavorable in the present study. Although we did not study the knowledge and practice of the PEMS staff, inadequate knowledge and skills and also inappropriate supervisory and quality assurance systems might be attributed in this condition. Therefore, establishment of in-service training programs on circulatory management is recommended. Then the effect of such programs on the staff's performance can be assessed. Moreover, the result of this study might be beneficial not only for educators in nursing schools to be considered in curriculum planning but also for authorities in the PEMS to be included in their supervisory strategies. Furthermore, designing standard and clear protocols for the PEMS procedures might help the staff in the provision of higher levels of care during the pre-hospital and transporting phase of the trauma patients. The observations in this study were performed in the emergency department, when the patients were being delivered into the hospital emergency department. Observing the PEMS staff in the scene of the trauma might be helpful in better evaluation of the care they are providing and understanding the barriers to the standard pre-hospital emergency care. Moreover, replication of similar studies in longer periods, larger sample sizes, and other areas of the country are recommended.

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Footnotes

Authors' Contribution: Mohsen Adib-Hajbaghery and Farzaneh Maghaminejad were responsible for the study conception and design. Farzaneh Maghaminejad performed data collection and prepared the first draft of the manuscript. Mohsen Adib-Hajbaghery did the data analysis, made critical revisions to the manuscript for important intellectual content, and supervised the study.

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