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Original Article

Adherence to guideline in hydrating traumatic patients with crystalloid fluids: A single center experience from Southern Iran

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Abstract

Objective: The adherence of the physicians to guidelines in resuscitation of the patients is of great importance since it can predict the outcome. To evaluate the adherence of the physicians of our center in hydration of traumatic patients with crystalloids regarding the Advanced Trauma Life Support (ATLS) guidelines.

Methods: We designed an algorithm obtained from ATLS guidelines using vital signs and status of bleeding of the traumatic patients to classify them. After categorizing the patients according to the algorithm, we evaluated the adherence of the physicians to the guideline in hydration of traumatic patients with crystalloids.

Results: This is a cross-sectional study in which 998 traumatic patients who were admitted to the emergency ward of Rajaee trauma hospital were enrolled. Most of the patients were men (89.6%) and the most common causes of traumatic injuries were traffic accidents. Proper hydration was seen in only 14.7% of the patients. Most of the patients were over-hydrated (85%) regarding both our algorithm and the patients' base excess.

Conclusion: The present study showed that the adherence of physicians in our center in resuscitation with crystalloid was low. Also, most of the traumatic patients were overhydrated with crystalloids. It is suggested that physicians retrain concerning the side effects of over hydration. In addition, we need a user friendly and more applicable guideline for hydration with crystalloids.

Keywords: Crystalloid Solutions, Shock, Hemorrhagic, Guideline Adherence, Advanced Trauma Life Support Care

Introduction

Shock is defined as hypoperfusion of the tissues and organs due to different mechanisms. This hypoperfusion status could be treated if it is managed in the right time and manner (1,2). Among traumatic patients, the most common cause of shock is hemorrhagic shock. Diagnosis of hemorrhagic shock in traumatic patients is based on vital signs such as pulse rate, blood pressure, and clinical signs such as cold extremities, prolonged capillary refill time, and altered level of consciousness (2-4).

One of the most important strategies in resuscitation of the patients in hemorrhagic shock status is fluid replacement with crystalloid solutions (2). According to ATLS in management of patients in shock status, an initial warmed fluid bolus is given. The usual dose is 1 to 2 liters for adults. Absolute volumes of resuscitation fluids should be based on patients' responses (4). Although proper hydration of the patients with shock can be resuscitative, their over-hydration can cause some undesirable side effects (5,6). Over-hydration of the patients with crystalloid fluids can cause coagulopathy, acidosis, and hypothermia (7-9). Also, rapid increase in blood pressure by over-hydration of the traumatic patients in hemorrhagic shock with IV fluids can cause re-bleeding (4). Thus, in order to enhance the long-term prognosis of the traumatic patients with hemorrhagic shock, it is important to avoid over- or under-hydration with crystalloids (5,6).

The present study investigates the practice of the physicians of our center in hydration of traumatic patients with crystalloids and compares it with the current guidelines in this regard.

Methods

This cross-sectional study was conducted in Shahid Rajaee hospital. It is a busy Trauma center affiliated with Shiraz University of Medical Sciences of Iran with 335

beds including 52 ICU beds. Our center is dedicated to multiple trauma patients. In the present study, we included all multiple trauma patients who were admitted to the emergency department during 12 months. The trauma patients admitted to the emergency unit were visited by a resident of general surgery at first.

The aim of the present study was to evaluate the appropriateness of the volume of hydration with crystalloids among traumatic patients with different states of shock. We compared the practice of the physicians in our center with suggestion of the ATLS and Schwartz textbook of surgery (2, 4). In order to do this systematically, we used an algorithm to classify the traumatic patients to identify those who needed hydration, as shown in Figure 1. In this algorithm, we used the vital signs and status of bleeding of the traumatic patients to classify them. As illustrated in Figure 1, we categorized the patients into three groups:

Ia: The patients with systolic blood pressure (SBP) ≤90 mm Hg **Ib:** The patients with SBP≥90 mm Hg and tachycardia (heart rate>100 pulses/minute) and hemorrhage (both internal and external bleeding) **II:** The patients with SBP≥90 mm Hg but without tachycardia (heart rate>100 pulses/minute) or hemorrhage.

Any bleeding laceration in any region of the body was considered as external bleeding. We defined the internal bleeding according to the site mechanism of injury as below: fracture or deformity in the extremities or pelvis, hemothorax in the chest, and positive focused assessment with sonography for trauma, diagnostic peritoneal lavage, or sonography finding in favor of internal bleeding in the abdomen.

This algorithm is obtained from the Advanced Trauma Life Support (ATLS) and Schwartz textbook of surgery suggestions for the hydration of traumatic patients with crystalloids. Thus, baseline information and medical information (including age, sex, cause of injury, injury severity score, on arrival Glasgow Coma Score, and their vital signs) of the traumatic patients and the prescribed volume of the crystalloids during the first two hours from their admission were recorded. Those patients who aged less than 16 years of age and patients with burn injuries were excluded from the study. After categorizing the patients according to the algorithm, we evaluated the adherence of the physicians to the guidelines in hydration of traumatic patients with crystalloids.

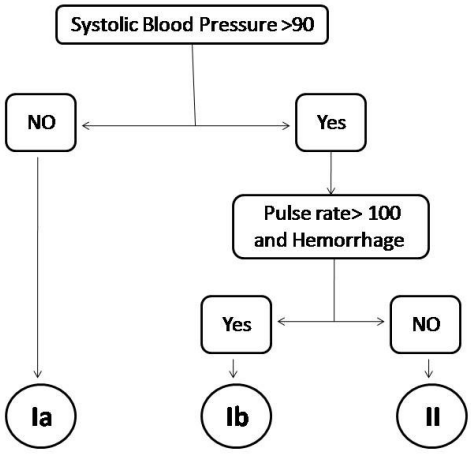

Figure 1. Schematic view of the categorization of traumatic patients regarding their shock status (2,4).

Data were analyzed using Statistical Package for the Social Sciences, version 15.0 (SPSS Inc., Chicago, IL). Descriptive statistics are presented as mean ± standard for 95% confidence interval (CI) or proportions wherever appropriate.

Results

A total of 998 traumatic patients admitted to the emergency ward of Rejaee trauma hospital were included in our study (Table 1). Because of missing information in data, the percentages were calculated based on the available records. Most of the patients were men (86.6%). The most common causes of traumatic injuries were traffic accident, falling down and stab wound injury with prevalence of 64.9%, 12.2%, and 11.2%, respectively. Also, 68.7% of the patients had an injury severity score less than 15; Glasgow Coma Scores of 61.3% of the patients were more than 12

Table 1. Baseline characteristics of the traumatic patients admitted to the hospital

Variable	Value
Age, mean (SD)	35.2 (18.1)
Gender, No. (%)	
Male	864 (86.6)
Female	134 (13.4)
Cause of injury, No. (%)	
Traffic accident	643 (66.4)
Falling down	119 (12.3)
Stab wound	109 (11.2)
Assault injury	37 (3.8)
Gunshot	16 (1.7)
Sharp object	14 (1.4)
Shotgun	11 (1.1)
Others	20 (2.1)
Injury severity score, No. (%)	
>15	310 (31.3)
≤15	680 (68.7)
On arrival Glasgow Coma Scale, No. (%)	
13-15	604 (61.3)
9-12	150 (15.2)
≤8	232 (23.5)

-The mechanisms of injury in 29 patients were missed. so the percentages were calculated based on all available records (n=969)
-The initial Injury Severity Score could not be retrieved in eight cases (n=990).
-The on arrival Glasgow coma scale was missed in 12 patients (n=986).

Table 2. The hydration volume and base excess of traumatic patients with crystalloids compared with the ATLS guideline

	Patients with different volume hydration, N (%)			
	No IV infusion	<1000 cc	1000-2000 cc	>2000 cc
I_a=61	2 (3.3)	31 (50.8)	25 (41.0)	3 (4.9)
I_b=24	0	17 (70.8)	7 (29.2)	0
II=901	62 (6.9)	648 (71.9)	180 (20.0)	11 (1.2)

BE: Base Excess; I_a: patients with SBP < 90; I_b: patients with SBP ≥ 90 who had pulse rate > 100 with hemorrhage and hydration; II: patients who were not in shock; Yellow box: Under treatment; Green box: Appropriate treatment; Red box: Over treatment.

and 23.5% of the patients were under 8. After categorizing the patients, 61 belonged to group Ia, 24 to Ib, and 901 to group II. The result is illustrated in Table 2.

Proper hydration was seen in only 14.7% of the patients. Most of them were over-hydrated (85%). In addition, 99.7% of the patients in group Ia, who had an SBP < 90, were hydrated with crystalloids. Only 2 (0.3%) of the patients of this group did not receive any fluid since they had to be resuscitated regarding ATLS. Besides, According to *Schwartz Textbook of Surgery* we should hydrate the patients with base excess (BE) < -8. If we want to consider the BE, all participants in group Ia must have BE < -8 which indicates a cellular shock status. All of the patients in group Ib were properly hydrated regarding ATLS. Besides, 62.5% of them had BE > -8.

Group II consisted of those patients who were not in the shock status, i.e. they did not need hydration. However, 6.9% of them were not hydrated. Only 3.2% of them had a BE < -8. Also, 93.1% of the patients were hydrated while they did not have to be, according to ATLS; among them 30.9% had a BE < -8.

Discussion

The aim of the present study was to evaluate the adherence to the guideline in hydrating traumatic patients and we found proper hydration in only 14.7% of the patients. Most of the patients were over-hydrated.

Previous studies reveal that adherence of the physicians to the guidelines is an important predictor of the patients' outcome (10). Many guidelines have been suggested in different settings in order to improve the adherence of the physicians in diagnosis of the traumatic patients with shock and their resuscitation. But these guidelines are not applicable for all settings and centers because of their variations in their working load and their facilities (11-15).

Many probable reasons could lead to ignoring the guidelines. It was shown that most of the physicians did not use systematic reviews and evidence-based information for practice; instead, this is the result of their contact with drug retailers and their previous practice habits (16,17). Also, for our center some reasons could be regarded for non-compliance. Complexity of the guideline can be one of the reasons. The table provided in ATLS for detecting traumatic patients in hemorrhagic shock status shows that it is a little complicated and time consuming, at least for beginners. These can lead to the detection of traumatic patients in higher stages of hemorrhagic shock. Since the first health care providers who visit the traumatic patients in trauma centers are not always trauma specialists, we need some simpler and more user friendly guidelines for non-trauma specialized health care providers (18,19). Also, the health care providers tend to use their previous knowledge in resuscitation of traumatic patients and they need ongoing training courses in order to remain up-to-date (20). Another reason is that some health care providers are not aware of the undesirable side effects of over-hydrating (5).

Although the administration of crystalloid fluids is considered as the first line management for traumatic patients, it can lead to various complications, such as tissue edema, hemodilution, and a decrease in concentration of the coagulation factors (21,22). On the other hand, infusion of crystalloids leads to a significant decrease in hemoglobin hematocrit WBC in traumatic patients with mild injuries (5). Moreover, excessive fluid administration can exacerbate the lethal triad of coagulopathy, acidosis and hypothermia with activation of inflammatory cascade (4). Thus, probably this strategy to hydrate most of the patients on admission in the emergency ward has saved many lives at the first hours of admission. However, it can lead to potential side effects as mentioned above.

In our study, we only recorded the volume of the crystalloids which were prescribed in the emergency ward. Also, we did not include the hydration of emergency medical services (EMS) workers. Thus, the results are underestimated and the volume of crystalloids prescribed for traumatic patients is much more than their needs in our hospital.

Moreover, if we had recorded the long-term outcome of these patients, we could have probably shown the complications and side effects of over-hydration among the traumatic patients.

Conclusion

The present study showed that the adherence of physicians in our center in resuscitation with crystalloid was low. Also, most of the traumatic patients were over-hydrated with crystalloids.

Author Contributions

SP: Conception and study design, Critical revision of the article, Final approval of the version. AA: study design, Data analysis and interpretation, Drafting the article, Final approval of the version. LN: Data collection, Drafting the article, Final approval of the version. VM: Data collection, Critical revision of the article, Final approval of the version.

Ethical issues

The study protocol was approved by ethics committee of Shiraz

University of Medical Sciences (Ethics No. 12887).

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