# Treatment of Traumatic - Hemorrhagic Shock. Our experience at University Clinical Center of Kosovo.

**Nehat Baftiu[1]**


## *Abstract*

Shock represents a condition of inadequate tissue perfusion due to circulatory insufficiency. Hemorrhage is the most common cause of shock in injured patients. Traumatic hemorrhagic shock presents a life-threatening condition due to the development of multifunctional organ dysfunction syndrome, which can be diagnosed due to symptomatology and changes in vital parameters. This study aims to analyse the epidemiological characteristics of traumatic - hemorrhagic shock and to demonstrate the efficacy of therapy in hemodynamic stabilization in patients with shock during the first 12 hours of intensive treatment at University Clinical Center of Kosovo.


**Keywords:** *shock, hemorrhagic shock, trauma*

***Corresponding Author: Nehat Baftiu***

*E-mail: nehatbaftiu@hotmail.com*

[1] *Intensive Care Department, University Clinical Center of Kosovo, Pristina, Republic of Kosovo*

## Full Text

## Introduction

Hemorrhagic shock is a condition of reduced tissue perfusion, resulting in the inadequate delivery of oxygen and nutrients that are necessary for cellular function. Whenever cellular oxygen demand outweighs supply, both the cell and the organism are in a state of shock.
On a multicellular level, the definition of shock becomes more difficult because not all tissues and organs will experience the same amount of oxygen imbalance for a given clinical disturbance. Clinicians struggle daily to adequately define and monitor oxygen utilization on the cellular level and to correlate this physiology to useful clinical parameters and diagnostic tests.
The 4 classes of shock, as proposed by Alfred Blalock, are as follows:
*Hypovolemic*
*Vasogenic (septic)*
*Cardiogenic*
*Neurogenic*

In controlled hemorrhagic shock (CHS), where the source of bleeding has been occluded, fluid replacement is aimed toward normalization of hemodynamic parameters. In uncontrolled hemorrhagic shock (UCHS), in which the bleeding has temporarily stopped because of hypotension, vasoconstriction, and clot formation, fluid treatment is aimed at restoration of radial pulse or restoration of sensorium or obtaining a blood pressure of 80 mm

Hypovolemic shock, the most common type, results from a loss of circulating blood volume from clinical etiologies, such as penetrating and blunt trauma, gastrointestinal bleeding, and obstetrical bleeding. Humans are able to compensate for a significant hemorrhage through various neural and hormonal mechanisms. Modern advances in trauma care allow patients to survive when these adaptive compensatory mechanisms become overwhelmed.
Hemorrhagic shock is tolerated differently, depending on the preexisting physiologic state and, to some extent, the age of the patient. Very young and very old people are more prone to early decompensation after loss of circulating volume.

The primary treatment of hemorrhagic shock is to control the source of bleeding as soon as possible and to replace fluid.

Hg by aliquots of 250 mL of lactated Ringer's solution (hypotensive resuscitation).

***This study aims*** to analyse the epidemiological characteristics of traumatic - hemorrhagic shock patients treated at University Clinical Center of Kosovo during the July 2016 - December 2018 timeframe.

***Methodology***

The study has been conducted to demonstrate the efficacy of therapy in hemodynamic stabilization in patients with shock in the first 12 hours of intensive treatment. We categorized the patients according to hemorrhagic shock classes. The classification was done according to the criteria set by the American College of Surgeons. Parameters used in the evaluation of patients are: respiratory rate, respiratory load, systolic blood pressure (TAS), capillary replenishment and Glasgow Coma Scale (GCS).

***Results and Discussion***

Traumatic hemorrhagic shock presents a life-threatening condition due to the development of multifunctional organ dysfunction syndrome, which can be diagnosed due to symptomatology and changes in vital parameters. During the review period, most patients with traumatic hemorrhagic shock were males (p <0.000001).

| | | (n=155) | |
|---|---|---|---|
| Demographic data | Nr | (%) | p |
| **Sex** | | | |
| Females | 28 | (18.06) | 0.000001 |
| Males | 127 | (81.94) | |
| | **Mean** | **(StdDev)** | |
| **Age** | 28.90 | (12.83) | |
| Mean Age acc. sex | | | |
| Females | 29.79 | (13.94) | 0.68 |
| Males | 28.70 | (12.62) | |

***Table 1:*** *Demographic data of traumatic hemorrhagic shock patients*

Patients with traumatic hemorrhagic shock comprised different ages (in the range of 2 to 69 years), with a significant difference in the distribution of cases by age groups. The largest number of cases were between 26 and 35 years old. (45.81%). From 1-15 were 10.97%, and from 16 to 55 years old 83.87% of the cases. Most of the injured were with politrauma (67.10%). More than 1/5 (23.23%) of injuries have been caused by firearms. Anatomical regions of injury over 1/3 of cases, were: abdominal region (50.97%), lower anterior (37.42%) and thoracic cervix (35.48%). With head injuries were 30.97% of cases. Average of patients had 2 traumatized regions. Nearly 2/3 of the cases were with body injuries (67.74%), bone (62.58%), and over half of the cases (58.71%) had bleeding in the internal cavities. Nearly 1/3 of the cases had long bones injury (32.26%), while the spleen, the small intestine, and the liver were most traumatized organs. Most report cases had hemorrhagic shocks of class III and IV (86.45%), (table 2) with an average physiological traumatic rate of TS = 9.

| | (n=155) | | |
|---|---|---|---|
| Hemorrhage Class | Nr. | % | p |
| Class – II | 21 | (13.55) | |
| Class – III | 75 | (48.39) | 0.00008 |
| Class – IV | 59 | (38.06) | |

***Table 2:*** Class of hemorrhage in traumatized patients

In conclusion, the patients have manifested the typical symptomatology of hypovolemic shock. All patients with traumatic hemorrhagic shocks manifested tachycardia (average cardiac frequency 130 beats per minute). Hypotension was manifested 86.09% of cases (average value of systolic arterial pressure - SAP: 59 mmHg). All patients manifested tachypnea (average respiratory rate 35 / min.) And significantly reduced diuretic rate (10.72 ± 8.4 ml / h) (Table 3).

With the rise of the bleeding category, we found heart rate increase, significant TAS decrease, average respiratory rate rise, and diuretic reduction averaging 12 mL / h between each class.

| | Class – II of hemorrhage | | Class – III of hemorrhage | | Class – IV of hemorrhage | | Total | |
|---|---|---|---|---|---|---|---|---|
| | (n=21) | | (n=75) | | (n=59) | | (n=155) | |
| | Mean | (StdDev) | Mean | (StdDev) | Mean | (StdDev) | Mean | (StdDev) |
| Heart Rate – HR(/min.)§ | 111.29 | (5.75) | 125.75 | (4.14) | 142.10 | (2.64) | 130.01 | (11.31) |
| SAP (mmHg) [7] | 101.81 | (6.02) | 69.56 | (7.11) | 29.64[a] | (21.77) | 58.74 | (29.01) |
| Respiratory Rate – RR(/min.) [7] [7] | 23.71 | (2.69) | 33.49 | (3.16) | 39-54 | (3.81) | 34-47 | (6.11) |
| Diuresis (ml/h) [6] | 25-.48 | (4.07) | 13.64 | (1.95) | 1.76[b] | (2.24) | 10.72 | (8.40) |

***Table 3**: Traumatic - hemorrhagic patient's vital signs*

All patients with circulatory insufficiency have initiated Ringer lactation initiation therapy. We have fixed the amount of the solution for the substitution according to the volume, respectively the calculated percentage of the lost blood (Table 4).

| | Class II of hemorrhage | | Class III e hemorrhage | | Class IV of hemorrhage | | Total | |
|---|---|---|---|---|---|---|---|---|
| | (n=21) | | (n=75) | | (n=59) | | (n=155) | |
| | Nr. | (%) | Nr. | (%) | Nr. | (%) | Nr. | (%) |
| Crystaloid Sol. [a] | 21 | (100) | 75 | (100) | 55 | (100) | 151 | (100) |
| Coloid Sol. [b] | 0 | (0) | 75 | (100) | 55 | (100) | 130 | (86.09) |
| PRBCs | 1 | (4.76) | 44 | (58.67) | 37 | (67.27) | 82 | (54.3) |
| FFP | 0 | (0) | 27 | (36) | 29 | (52.73) | 56 | (37.09) |

[a] = Ringer lactate has been administered as crystaloid solution.
[b] = Gelatine polymers have been administered as coloid – *Gelatina* (Haemaccel®).
PRBCs: Packed Red Blood Cells.
FFP: Fresh Frozen Plasma.

***Table 4:** Fluid resuscitation therapy according to class of hemorrhage*

Patients with Class II hemorrhagic shock have only been treated with crystalline solution (LR). On average, every liter of lost blood was replaced with 3.1 L crystalline tincture. Patients with Class III, IV hemorrhagic shock have been treated by combining crystalloids colloids and blood substitution therapy. From colloidal solvents only gelatin polymers have been used. Among all the traumatized complete blood transfusion has been administered in 54% of cases. Blood transfusions have been administered to all cases with high volume blood loss (Table 5).

| | Class – II (n=21) | Class – III (n=75) | Class – IV (n=55) | Total (n=151) |
|---|---|---|---|---|
| Mean blood volume loss | 25987.5 | 139902 | 137060 | 302949.5 |
| Compensation for every L/blood loss | | | | |
| Crystaloid Sol. | 3.10 | 0.84 | 1.27 | 1.23 |
| Coloid Sol. | 0.00 | 0.54 | 0.40 | 0.43 |
| PRBCs | 0.01 | 0.44 | 0.52 | 0.44 |
| FFP | 0.00 | 0.13 | 0.16 | 0.13 |
| PRBCs/FFP Ratio | 0.00 | 3.44 | 3.21 | 3.32 |
| Compensation Total Ratio | 3.11 | 3.03 | 3.15 | 3.09 |

***Table 5**: Mean blood volume loss /Compensation for every L/blood loss*

On average, for every 3.32 units of complete blood transfused we have administered a plasma unit. In patients with grade III and IV hemorrhages we administered for every liter of lost blood ,1 L crystalline (0.84 - 1.27 L), while one liter of other fluids were offset with colloids, full blood and plasma. In the undergone therapy, 45% of cases reacted quickly and 28% intermittently. All cases with minimal response and no response at all ended with death

(Table 6).

| | Class - II (n=21) | | Class – III (n=75) | | Class – IV (n=55) | | Total (n=151) | |
|---|---|---|---|---|---|---|---|---|
| Effect | Nr. | (%) | Nr. | (%) | Nr. | (%) | Nr. | (%) |
| Rapid | 21 | 100.00 | 36 | 48.00 | 11 | 20.00 | 68 | 45.03 |
| Intermediary | 0 | 0.00 | 31 | 41.33 | 12 | 21.82 | 43 | 28.48 |
| Minimal/or no reaction | 0 | 0.00 | 8 | 10.67 | 32 | 58.18 | 40 | 26.49 |

***Table 6:*** *Effect of fluid resuscitation therapy on traumatic-hemorrhagic patients according to hemorrhage class*

In most surviving patients hemodynamic stabilization was achieved 8 hours after administration of therapy, with full hemodynamic stabilization 12 hours after therapy. In the largest number of cases (77.27%), death occurred within the first 4 hours of hospitalization. As risk factors that significantly increased mortality risk were TS ≤ 5 (OR = 333), TAS receiving 55 mmHg (OR = 80.35), admission <10 ml / h (OR = 38.26%).

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