УДК: 617-001-06 : 616.151.5-08-039.35
DOI: https://doi.org/10.25284/2519-2078.4(85).2018.151493

Ivanova V.O., Fizor V.D., Maksimenko O.V.

USING OF TRANEXAMIC ACID AS COMPONENT OF TRAUMA INDUCED COAGULOPATHY TREATMENT

Odessa national medical university, Odesa, Ukraine
Private clinic Odrex

The aim of the study was to determine the effectiveness of tranexamic acid in patients with multiple skeletal trauma for reducing blood loss and correction of hemostatic disorders.

Materials and methods. The initial state of the hemostasis system was studied in 104 patients with multiple trauma. All patients was in class II (15-30 % of blood loss) according to ATLS protocol, and NISS – 28,34±2,06. Was provided complex evaluation of patients state, including continuous monitoring of temperature and lactates level, the hemostasis system was evaluated using laboratory tests and low-frequency pyezoelectric thromboelastography (LPTEG). Patients in Group I (n = 33) did not receive tranexamic acid, Patients in Group II received tranexamic acid 15 mg / kg every 6 hours for 3 days. **Results**. In patients who received tranexamic acid, there was a positive dynamics of hemoglobin, creatinine phosphokinase, lactate, less need for transfusion of blood products and duration of treatment in ICU. **Conclusions.** The use of antifibrinolytic drugs positively influences the course of traumatic disease in patients with polytrauma, by correcting coagulopathy and reducing blood loss.

Key *words:* trauma, fibrinolysis, tranexamic acid

ACTUALITY

Condition "trauma induced coagulopathy" is pathophysiological basis of uncontrolled post-traumatic bleeding. Actuality determined by high mortality in trauma patients, because of development of coagulopathy bleeding. [1,2]. About one-third of all trauma patients with bleeding present with a coagulopathy on hospital admission [3, 4].

Development of early traumatic acute coagulopathy has recently been recognized as a multifactorial primary condition that results from a combination of shock, tissue injury-related thrombin generation and the activation of anticoagulant and fibrinolytic pathways. [5, 6, 7].

The aim of the study was to evaluate the effectiveness of tranexamic acid in patients with multiple skeletal trauma for reducing blood loss and as part of complex treatment of traumatic disease.

MATERIALS AND METHODS

The initial state of the hemostasis system was studied with 104 patients with multiple trauma (multiple skeletal trauma, comminuted femur fracture, fracture of pelvic bones) in females and males aged 18-44 from admission to the intensive care unit. A complex evaluation of the hemostasis system was provided using the low-frequency pyezoelectric thromboelastography (LPTEG) method, and a comparative analysis of the effectiveness of various intensive care regimens for hemostatic disorders in this group of patients was carried out. LPTEG allows to comprehensively evaluate all links of the hemostatic system, where A0, R(t1) and intensity of contact coagulation (ICC) characterize the activity of vascular-platelet hemostasis; constant of thrombin activity (CTA), time of clotting (TC), intensity of coagulation drive (ICD), intensity of clot polymerization (ICP) and maximum density (MA) for coagulation link and the intensity of retraction and lysis of the clot (IRLC). Blood samples were obtained on arrival at the emergency room (initial time) and at 24, 48 and 72 hours later. All patients are divided into groups, depending on the method of prevention and correction of hemostatic disorders. Groups were randomized according to the intensive care regimen. All patients was in class II (15-30% of blood loss) according to Advanced Trauma Life Support (ATLS) protocol. Excluding criteria: hemostatic disorders or thromboembolic events in anamnesis, indication to operation treatment during 72 hours after admission, fat embolism during 72 hours after admission, open fracture of any area, penetrating injuries with necessary of surgical bleeding control, signs of internal bleeding. **Group 1 (n = 52)** – patients who did not receive tranexamic acid in the intensive care unit. **Group 2 (n = 52)** – patients who received intensive administration of tranexamic acid, 15 mg / kg every 6 hours for 3 days.

Instrumental, laboratory tests were performed to determine the diagnosis, and dynamics of the disease. In research were checked the general condition, heart rate, respiratory rate, arterial pressure, central venous pressure, oxygen saturation, body temperature, diuresis during 72 hours. All patients underwent a total clinical laboratory tests. *Intensive therapy* for patients with multiple trauma was carried out in the following areas: support of vital functions (resuscitation); stopping of external bleeding; respiratory protection and adequate oxygenation and ventilation (oxygen therapy through the face mask and nasal catheter, using the lowest possible FiO2 to maintain oxygen saturation of 97-98%); immobilization of affected extremities (an external fixation device was applied to the affected area of the limbs), an infusion-transfusion therapy (hydroxyethyl starch preparations – 10% 500-1000 ml / day at the maximum daily dose of 33 ml/kg, infusion of crystalloid solutions – Ringer's solution, normal saline of 1500-2000 ml / day (3: 1 – 300 ml of electrolyte solution for every 100 ml of blood loss), maintenance of hemoglobin target level up to 90 g / l, fresh frozen plasma) prevention of fat embolism and infectious lesions, gastroprotection, antifibrinolytic therapy according to the above schemes.

RESEARCH RESULTS

Patients with trauma injuries have disturbances of hemostatsis system: significant increasing of primary hemostasis system (statistically significant increase in A0 for 41.28%, and ICC for 23.54 % and decreasing R(t1) for 46.87 %) and decreasing of coagulation hemostasis (decreasing of CTA for 39.84%, ICD for 29.67%, ICP for 33.78%, MA for 55.67% and increasing of clotting time for 35,15%). Fibrinolytic activity according to LPTEG results was significantly increased: the ICRL (the index of clot retraction and lysis) of the in patients with multiple trauma were 52,18±*0,47*, increased for 217,20% compared with normal. After 24 hours of treatment patients of both groups have pathologic hemostatic state: patients of group 1 had significant disorders in all parts of the hemostasis, while group 2 patients maintained a state of reduced platelet activity, hypocoagulation and hyperfibrinolysis, but less pronounced compared with group 1 patients ($p < 0.05$). 48 hours later patients of 2 group didn't have statistically significant differences in comparison with reference indicators with the exception of ICRL, and patients of 1 group preserved initial disturbances in the hemostatic system with a slight positive dynamics towards normalization of hemostasis disorders in all links. After 48 hours of intensive therapy in patients of the 1st group the ICRL was increased by 137.93%, and in patients of the 2nd group by 22.67%. 72 hours later patients of 1 group had normal indicators of platelet activity A0, R(t1), ICC, statistically significant ($p < 0.05$) decreased coagulation link indicators (KTA, TC, ICD and ICP) and increased ICRL. Patient of 2 group had normal indicators of all links of hemostasis. Clinical confirmation of the obtained laboratory data was lactate dynamic, CP dynamic, need for RBC transfusion and hemoglobin dynamic, as well as the length of stay of patients in the ICU.

The lactate is a product of anaerobic metabolism; it can be used as a marker on demand and availability of oxygen. Changes in lactate levels can be effectively used as a marker in resuscitation maneuvers, even in patients with stable vital signs. Reference interval was 0.5-2.2 mmol/l. According to our results trauma patients had peak lactate level 12 hours after admission to ICU – 6.92 mmol/l in 1st group and 4.38 mmol/l in 2nd group. In 2nd group lactate level became to reference interval 24 hours after admission to ICU, but patients of 2nd group had increased level even 72 hours of treatment. Dynamic of lactate level on figure 1.

At the moment of admission level of hemoglobin in 1 group was 104,38 g/l, in 2 group 105,15 g/l. During treatment patients of the 2nd group in comparison with the patients of group 1 was more favorable: the level of hemoglobin was significantly higher ($p < 0.05$), after 24 hours (group 1 – 82,45 ± ±2,37 g / L, group 2 – 94,16 ± 2,95 g / l), after 48 hours of treatment (group 1 – 79,14 ± 3,52 g / l, group 2 – 96,18 ± 2,89 g / l), and after 72 hours

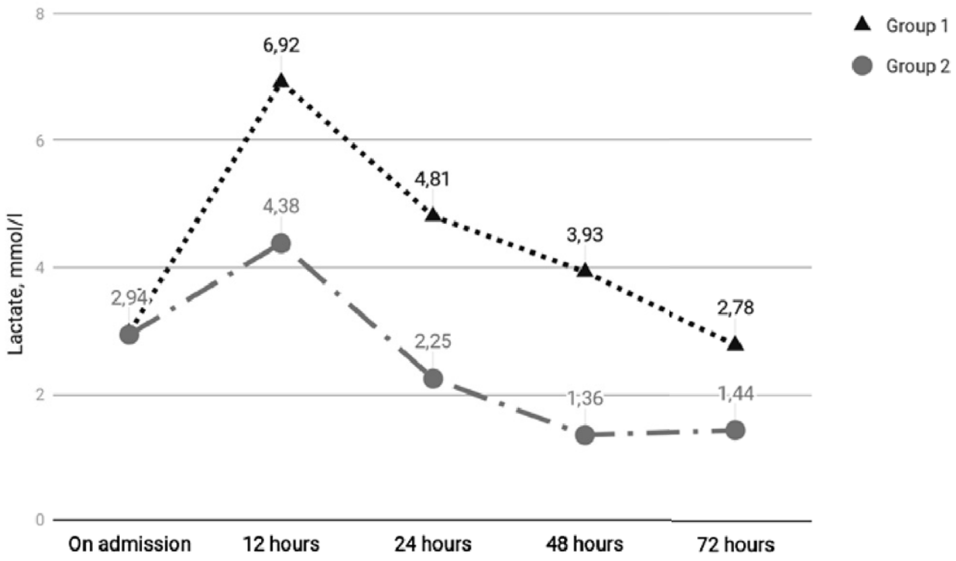

Figure 1. Lactate level in patients with traumatic injuries.

(group 1 – 89,47 ± 2.89 g / l, group 2 — 95,17 ± ±3,09 g / l), (Fig. 2). The need for transfusion of blood products (red blood cells, fresh frosen plasma, albumin solution) in the group of tranexamic acid was less for 21,28% less ($p < 0.05$) than in group 1.

The dynamics of decrease in the level of general CFC was better among patients in group 2 at the baseline level of 3212.87 ± 112.47 U / L, and reached the level of 1945.72 ± 96.44 U / L in 72 hours. Among patients in group 1, the baseline level was 3268.31 ± 105.21 U/L, with an increase in 24 hours to 4685.01 ± 94.56 U/L, and a slight decline in 48 hours to a level of 3218.65 ± 79, 85 U/L after 72 hours.

The duration of intensive care also in group 2 was significantly less than in group 1 (Fig.3)

Deep vein thrombosis of the lower limbs were detected on the 3-5th day after the traumatic event in 4 patients (12.12%) of the first group. In 3 patients (9.38%) of the second group, deep vein thrombosis with clinically asymptomatic flow were observed.

In all patients, at the time of admission to the hospital, the body temperature level was 36.0°C and during the treatment a constant level of normothermia was maintained. Between the groups there was no statistically significant difference in body temperature within 72 hours.

CONCLUSIONS

The appointment of antifibrinolytic agents in patients with trauma induced coagulopathy can correct hemostatic disorders and reduce blood loss

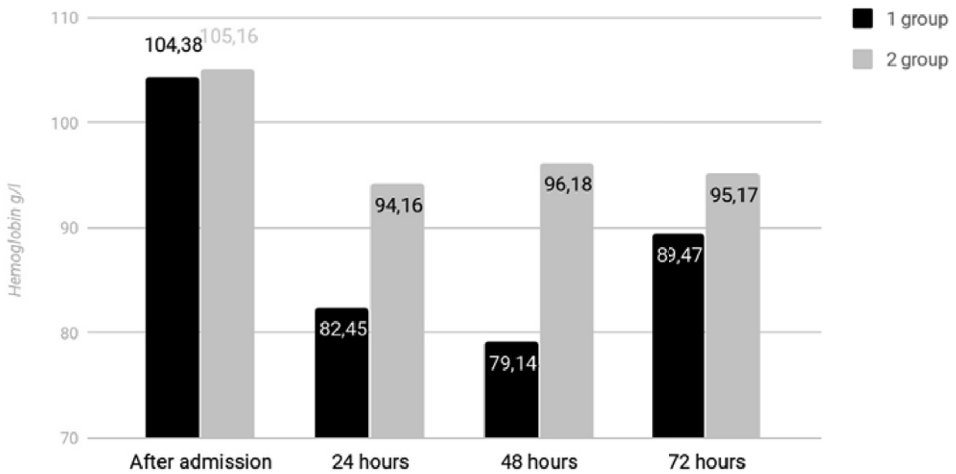

Figure 2. Dynamics of hemoglobin immediately after admission, 24, 48 and 72 hours of treatment.

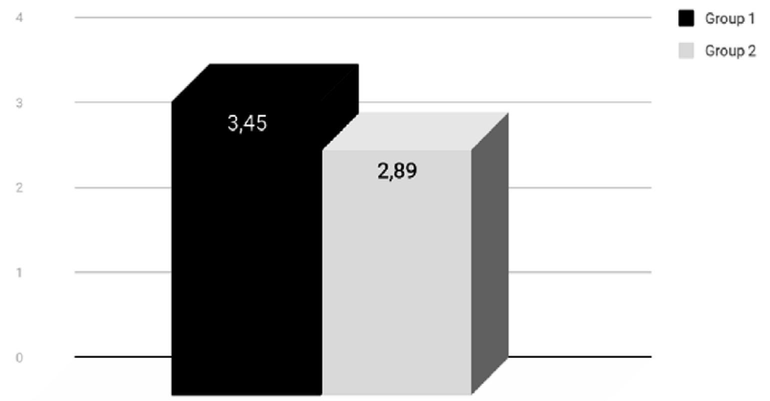

Figure 3. Duration of patients stay in intensive care unit.

the volume of transfusion of red blood cells and fresh frozen plasma, duration of patients stay in intensive care unit.

REFERENCES

1. *Martini W.Z. Coagulation complications following trauma / Martini W.Z.// Mil Med Res. – 2016. – N.22(3). – P.35.*
2. *Early coagulopathy in multiple injury: an analysis from the German Trauma Registry on 8724 patients / Maegele M, Lefering R, Yucel N, Tjardes T, Rixen D, Paffrath T, [et al.] // Injury. – 2007. – N.38(3). – P.298–304.*
3. *Overwhelming tPA release, not PAI-1 degradation, is responsible for hyperfibrinolysis in severely injured trauma patients / Chapman M.P., Moore E.E., Moore H.B.// J Trauma Acute Care Surg. – 2016. – N.80. – P.16–23.*
4. *Cap A. The pathogenesis of traumatic coagulopathy / Cap A1, Hunt BJ. // Anaesthesia. – 2015. – N.70 (1). – P.96-101, e32-4.*
5. *Fries D. Role of fibrinogen in trauma-induced coagulopathy / Fries D, Martini WZ // Br J Anaesth. – 2010. – N.105(2). – P.116-121.*
6. *iTACTIC – implementing Treatment Algorithms for the Correction of Trauma-Induced Coagulopathy: study protocol for a multicentre, randomised controlled trial / Baksaas-Aasen K., Gall L., Eaglestone S. [et al] // Trials. – 2017. – N.18;18(1). – P.486.*
7. *Early haemorrhage control and management of trauma-induced coagulopathy: the importance of goal-directed therapy / Stensballe J., Henriksen H.H., Johansson P.I. // Curr Opin Crit Care. – 2017. – N.23(6). – P.503-510.*

REFERENCES

1. *Martini W.Z. Coagulation complications following trauma. Mil Med Res. 2016; 22(3):35.*
2. *Maegele M, Lefering R, Yucel N, Tjardes T, Rixen D, Paffrath T, et al. Early coagulopathy in multiple injury: an analysis from the German Trauma Registry on 8724 patients. Injury. 2007;38(3):298–304. doi: 10.1016/j.injury.2006.10.003.*
3. *Chapman M.P., Moore E.E., Moore H.B. Overwhelming tPA release, not PAI-1 degradation, is responsible for hyperfibrinolysis in severely injured trauma patients. J Trauma Acute Care Surg. 2016;80:16–23.*
4. *Cap A., Hunt B.J. The pathogenesis of traumatic coagulopathy. Anaesthesia. 2015;70 (1):96-101, e32-4. doi: 10.1111/anae.12914.*
5. *Fries D., Martini W.Z. Role of fibrinogen in trauma-induced coagulopathy. Review. Br J Anaesth. 2010; 105(2):116-21. doi: 10.1093/bja/aeq161.*
6. *Baksaas-Aasen K., Gall L., Eaglestone S., Rourke C., Juffermans N.P., Goslings J.C., Naess P.A., van Dieren S., Ostrowski S.R., Stensballe J., Maegele M., Stanworth S.J., Gaarder C., Brohi K., Johansson P.I. iTACTIC – implementing Treatment Algorithms for the Correction of Trauma-Induced Coagulopathy: study protocol for a multicentre, randomised controlled trial. Trials. 2017;18(1):486. doi: 10.1186/s13063-017-2224-9.*
7. *Stensballe J., Henriksen H.H., Johansson P. Early haemorrhage control and management of trauma-induced coagulopathy: the importance of goal-directed therapy. Curr Opin Crit Care. 2017;23(6):503-510. doi: 10.1097/MCC.0000000000000466.*

Иванова В.А., Физор В.Д., Максименко О.В.

Целью исследования было определение эффективности транексамовой кислоты для комплексной терапии индуцированной травмой коагулопатии. **Материалы и методы**. Изучались особенности течения травматической болезни у 104 пациентов с травматическими повреждениями. Все пациенты имели II класс (кровопотеря 15-30% ОЦК) согласно протоколу ATLS, тяжесть травм по шкале NISS – 28,34±2,06. Пациенты I группы (n = 33) не получали транексамовую кислоту, пациенты II группы получали транексамовую кислоту 15 мг/кг каждые 6 часов на протяжении 3 дней. **Результаты.** У пациентов, которые получили транексамовую кислоту, отмечалась положительная динамика уровня гемоглобина, креатининфосфокиназы, лактата, меньше потребность в трансфузии препаратов крови и продолжительность лечения в ИТ.

Выводы. Применение антифибринолитических препаратов положительно влияет на течение травматической болезни у больных с политравмой, путем коррекции коагулопатии и снижения кровопотери.

***Ключевые слова**: травма, фибринолиз, транексамовая кислота.*