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SECTION 21.
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THE VALUE OF ETHAMSYLATE IN HEMOSTASIS IN PATIENTS WITH MULTIPLE PELVIC FRACTURES

Background. Multiple pelvic fractures are associated with large amounts of blood loss, hemorrhagic shock due to injury, and the inability of immediately stop bleeding. Hypovolemic shock is the main cause of mortality in patients with polytrauma and pelvic fractures. In these patients, the main source of blood loss and the formation of hypovolemia is the pelvic fracture itself, which in 60% of cases is the main cause of bleeding; the remaining 40% of patients experience hypovolemic shock due to the presence of concomitant injuries. Therefore, it is necessary to identify and treat a pelvic fracture, as well as identify any possible associated injuries that may be causing the bleeding. In patients with polytrauma, the main injuries associated with pelvic fractures are injuries to the abdomen, genitourinary system, chest and head. From 4% to 23% of abdominal injuries are associated with pelvic fractures. With multiple fractures of the pelvic bones, the volume of blood loss can reach 2500 ml. Due to blood loss alone in pelvic fractures the mortality rate for polytrauma reaches 10-23%. Almost 50% of patients with multiple pelvic fractures require significant blood transfusions in the first 24 hours after injury [1-3].

Hemostatic resuscitation aims to correct trauma-induced coagulopathy, and extensive literature supports improved survival with this strategy [1]. For patients with hemorrhagic shock due to trauma, early use of whole blood and fresh frozen plasma has currently considered the best option for resuscitation. Specialists in trauma patients believe it is best to use fresh frozen plasma first. Fresh frozen plasma helps eliminate the deficiency of blood clotting factors and reduces the rate of blood loss during fractures of the pelvic bones [4-6].

The high rate of administration of crystalloid solutions contributes to the development of hemodilution and coagulopathy, which causes an increase in the duration of blood loss and other related complications. Currently, intensive care specialists are trying to reduce bleeding with the use of antifibrinolytic drugs. Antifibrinolytics inhibit the activation of plasminogen to plasmin, prevent the break-up of fibrin and maintain clot stability. They have used to prevent excessive bleeding. Tranexamic acid is the best known and had used where the risk of haemorrhage is high due to increased fibrinolysis or short-term following acute haemorrhage. Tranexamic acid (TXA) has been used for quite some time to reduce bleeding and the total volume of blood loss.

Conversely, less support exists for TXA use in fractures of the acetabulum or pelvic ring. Compared with the non-TXA group, TXA use was associated with a significantly lower transfusion rate in patients who underwent pelvic and/or acetabular fracture surgery. Based on the current fracture-related studies, TXA does not seem to carry an increased risk of thromboembolism or other complications [7-9].

Ethamsylate is another drug that helps stop bleeding. Ethamsylate (2,5-dihydroxy-benzene-sulfonate diethylammonium salt) is a synthetic hemostatic drug indicated in cases of capillary bleeding. Ethamsylate acts on the first step of hemostasis by improving platelet adhesiveness [10]. Concomitant use of tranexamic acid and ethamsylate may reduce blood loss [11, 12]. We set the purpose of our work comparatively determination the effectiveness of the use of tranexamic acid and the combined use of tranexamic acid with ethamsylate in patients with polytrauma with pelvic fractures to reduce the volume of blood loss in the first day after the patient received injury.

Materials & Methods. We included in our study 40 patients with polytrauma who had pelvic fractures. The condition of all patients upon admission to the clinic was serious. In all patients, we identified signs of hemorrhagic shock due to trauma. Fluid resuscitation, which pre-hospital doctors managed to carry out, usually included liquid resuscitation in a volume of no more than 400 ml of crystalloid plasma replacement solutions and intravenous administration of 500 mg TXA. We formed two groups to conduct a comparative study. The average assessment of injury severity according to the main known injury severity assessment scales for patients in these two groups did not differ significantly. In 20 patients of the first group, we used only TXA as an antifibrinlytic agent. In another 20 patients (second group), to enhance the hemostatic effect, we used, in addition to TXA, an infusion of 1000 mg of ethamsylate in normal saline. We continued the administration of ethamsylate for patients in the second group after surgery at 250-500 mg every 4 hours intravenously.

Surgical correction for all patients included external metal osteosynthesis of the pelvic bones to stabilize it and stop blood loss. For all patients, we provided stress-inducing intravenous anesthesia with ketamine with tracheal intubation, mandatory mechanical ventilation, and muscle relaxants. All patients in both study groups received an infusion of 1000 mg TXA at the beginning of surgery. After surgery, within 24 hours of injury, all patients received TXA twice, 500 mg. For liquid resuscitation, we first used colloidal plasma replacement solutions based on modified gelatin in an amount of 1000 ml. All patients received 2-3 hemocons of fresh frozen plasma and 2-3 hemocons of erythrocytes, according to the blood group and Rh factor of the patients. We monitored changes in hemoglobin concentration in the blood, hematocrit value and stability of hemodynamic parameters.

Results. We calculated the volume of intravenous fluid infusion during surgery. In patients of the first group, it was 3115±260 ml. In patients of the second group it turned out to be almost the same and amounted to 3095±268 ml ($p>0.05$). During the first 24 hours after injury, the total volume of fluid resuscitation in patients of the first group reached 6112±368 ml. In patients of the second group, this volume also reached 6013±382 ml ($p>0.05$). The target indicators for determining the volume of resuscitation were to achieve a mean arterial pressure of 80 mm Hg and a diuresis rate of at least 0.5 ml/kg/hour. The level of central venous pressure in patients fluctuated within 20-50 mm H_2O. By the end of the first day, the hemoglobin concentration in the blood of patients in the first group was 99.7±7.2 g/l. In patients of the second group this indicator was 101.2±9.6 g/l ($p>0.05$). In patients of both study groups, we found a decrease in fibrinogen concentration to 0.8-1.3 g/l. The level of fibrinogen in patients of the first and second groups did not differ. Thus, we did not find any advantage of additional administration of ethamsylate in providing antifibrinlytic therapy with TXA in patients with polytrauma and pelvic fractures.

Conclusion. In patients with polytrauma, the main component of which is pelvic bone fractures with the development of shock, the main line of intensive care is the use of fresh frozen plasma and red blood cells, colloidal plasma substitutes and tranexamic acid. Adjunctive use of ethamsylate has not shown any benefit in these patients.

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