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# Disorders in the Hemostastic System in the Toxemic Stage of Acute Burning in Persons with Burning Injuries

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**Abstract** Thermal injury poses a serious medical, social, and economic problem. The development of heavy industry and chemical industry, as well as the widespread use of electricity in domestic and industrial environments will lead to a significant increase in burn injuries. Purpose. The state of the hemostasis system and blood biochemical parameters were studied in 59 patients aged 18 to 75 years in the acute toxemia phase of burns in the burn area of more than 20% of the body surface in the period 4-5 to 12 days after injury. In 59 patients with severe burns in the acute toxemia phase, we examined the state of the hemostasis system. At the stage of toxemia, we performed various surgical interventions after complex therapy against shock in the main group: 23 necrotomies with deep burns of 11-15% of the body surface, early necrectomy in 40 patients and autodermoplasty in 49 patients. Analysis of the blood coagulation system and fibrinolytic activity after surgical interventions showed a tendency to normalize all parameters. Our studies have shown that early surgical necrectomy and slice autotransplantation show bleeding from donor areas (6-10 ml per 100 cm2 area), sudden application of hemostatic powder "Geprotsel" completely stops bleeding and the wound surface becomes shiny due to the adhesion of the film takes shape. The sensation of pain is very low. It has been observed that when the wound defect is closed with a donor autoimmune tissue, the skin tissue adheres well to the wound beneath it. In view of the above, comprehensive anti-shock measures aimed at improving water-salt balance, acid-base balance and homeostasis disorders should be carried out when all patients are hospitalized.

**Keywords** Disseminated vascular transfusion (DCS) - syndrome, Circulating blood volume (CBV), Recovery time, Antithrombin, Prothrombin index, Burn injury

## 1. Introduction

Any injury triggers the process of blood clotting, but thermal injuries, which are characterized by shock, lead to abrupt changes in all coagulation systems. Jilinskiy E.V., Tsvirko V.N.2018y. Any damage to the vascular wall, "blood damage", on the one hand, leads to varying degrees of plasma loss, on the other - can be considered physiological, and then pathological changes in the hemostasis system can lead to spontaneous death of the organism. Legitimate severe and common complications of massive injury include acute disseminated vascular hardening syndrome, hemostasis disorder in patients with severe burns is manifested by QDTQ-syndrome. Krylov K.M., Shlyk I.V., Pivovarova L.P., 2010y. Disseminated vascular hemorrhage (DV) - the syndrome is not completely detectable, or is detected at the stage of giving a clear clinical picture, such as hemorrhage and organ dysfunction. There are several forms of QDTQ-syndrome: severe, acute, acute, chronic, recurrent, latent. The acute form is characterized by an acute period of burns.

**Purpose of the study** was to study the disturbances in the hemostasis system in the stage of burn toxemia in patients with burn injuries.

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## 2. Materials and Methods

Coagulation tests in different directions, which are characteristic for the onset of the development of acute DCS-syndrome in the first 4-5 days of burn toxemia in patients after burn injury, were identified (Table 1). This means that if the testosterone ICA, prothrombin time, SFMC values are clearly increased compared to the norm, then fibrinogen, plasminogen and AT-III - decreased, clot dissolution is accelerated. Indications for the development of acute DCS- syndrome were in the form of increased consumption of coagulation substrates - platelets and

fibrinogen. In our study, thrombocytopenia occurred in the majority of patients, with a platelet count of 100.0 ± 7 × 109 / l, 32.8% lower than normal (r <0.05), and a fibrinogen level of 1.7 in patients with burn toxemia. times lower. More severe differences between patients with a severe course of burn toxemia and the control group were identified on the basis of one of the markers of thrombinemia: the presence of large amounts of intermediate products of fibrinogen to fibrin transformation in plasma. The amount of SFMC was 5.3 times higher in patients with burn toxemia. In patients with burn shock, significant physiological anticoagulants C were found to be significantly reduced by 1.6 times and AT III by 20% (r <0.05) compared to the norm. In parallel, the amount of plasminogen in the anti-coagulation system decreased by 1.3 times (p <0.05) compared to the norm.

In the toxicity stage of burn disease is observed the initial stage of development of DCS-syndrome: thrombocytopenia, the amount of SFMC increases against the background of a decrease in the anti-coagulation mechanisms of hemostasis systems.

## 3. Results and Discussion

Disorders of the hemostasis system in the stage of toxemia in patients with burn injuries. Studies showed that a reduction in blood clotting time (5.5 ± 0.5 min) was observed in 15 patients of group 1 (with sepsis). Plasma recalculation time was 66 ± 3.8 seconds and increased to 82 ± 4.2 seconds by the end of the third day. In group 2 patients (with severe sepsi), the blood clotting time was 3.6 ± 0.3 minutes.

At this time, plasma recalculation was reduced to 40 ± 5.0 s and by the end of the third day was 76 ± 3.8 s. In group 3 burns (with septic shock refractory hypotension), blood clotting time was 4.0 ± 0.4 minutes and increased to 5.8 ± 0.5 minutes on the third day. Plasma reclamation time was reduced to 33 ± 7.8 seconds on the first day and decreased to 45 ± 3.5 seconds by the end of the third day. In both the 2nd and 3rd groups of the lesions, increased fibrinogen concentrations were found on the first day after burns.

Fibrinogen concentrations increased significantly by the first day alone, averaging 5.3 ± 0.3 g / l. The reaction to fibrinogen "V" was sharply positive. The results of studies show that burn injury leads to a decrease in anticoagulant activity of the blood. Similarly, in patients with FI 90 units and above, fibrinolytic activity decreased to 3.7 ± 0.6% in the first days and remained abruptly reduced until the end of the third day.

**Table 1.** Laboratory diagnosis of acute DCS in the toxemia phase of acute burns

| Indicators | Norm | Acute toxemia after burns, n = 59 | |
|---|---|---|---|
| | | 4-5 days | 6-12 days |
| Blood clotting time according to Lee-White, minutes | 5-12 | 7,8±0,3 | 8,7±0,8 |
| Coagulation spontaneous lysis test | N | Accelerated lysis | Accelerated lysis |
| Thrombin test, seconds | 7-11 | 16,4±0,1 | 17,8±0,3 |
| Platelet count, x109 / l | 175-425 | 100,0±7,0 | 105,0±8,5 |
| PTT (partially activated thromboplastin time), sec | 21-35 | 40,5±0,01 | 38,45±0,01 |
| International Coordinating Approach (ICA) | 0,7-1,1 | 1,6±0,01 | 1,5±0,01 |
| Fibrinogen concentration, g / l | 2-4 | 1,8±0,1 | 1,75±0,1 |
| Thrombin time, seconds | 24-34 | 47,5±0,1 | 46,5±0,1 |
| AT III,% | 80-100 | 65±1,0 | 68±1,0 |
| SFMC, mg / l | 0-35 | 185,0±9,3 | 192,4±10,3 |
| Plasminogen, v% | 100-105 | 80,8±4,5 | 92,5±5,2 |

Note: PTT - partially activated thromboplasty time; ICA patient prothrombin time donor prothrombin time; AT III - antithrombin III; SFMC are soluble fibrin-monomer complexes.

**Table 2.** Disorders of the blood coagulation system after autodermoplasty in patients with deep burns (n = 49)

| Coagulogram indicators | Main group (shock level by plasma loss) | | | Norm |
|---|---|---|---|---|
| | I даража | II с даража | III даража | |
| Pti% | 91,6±3,9 | 91,0±1,0 | 95,6±12,1* | 90,2±1,0 |
| Fibrinogen, g / l | 2,3±0,3* | 2,92±0,29* | 2,15±0,25* | 3,4±0,2 |
| Thrombotest, sec. | 5,0±0,14* | 4,4±0,2* | 4,06±1,1* | 5,0±0,1 |
| Hematocrit (%) | 46,0±3,9 | 53,1±1,4* | 59,4±2,1* | 44,0±0,8 |
| Recovery time, sec. | 92,6±2,6* | 97,3±3,0* | 85,0±5,6* | 74,0±3,2 |
| Tolerance to heparin, sec. | 252,3±32,3* | 215,6±8,4* | 282,3±6,1 | 290±7,4 |
| Fibrinolysis,% | 20,1±0,45* | 7,7±0,45* | 7,4±1,9 * | 15,4±0,6 |

Note: * - The level of results is undoubtedly R <0.05.

At the stage of toxemia, we performed various surgical interventions after complex therapy against shock in the main group: 23 necrotomies with deep burns of 11-15% of the body surface, early necrectomy in 40 patients and autodermoplasty in 49 patients. Analysis of the blood coagulation system and fibrinolytic activity after surgical interventions showed a tendency to normalize all parameters (Table 2).

Patients with grade 1 plasma loss showed a tendency to normalize all coagulogram parameters due to adequate preoperative therapy in the postoperative period. Statistically, the undisputed PTI was 91.6 ± 3.9%, fibrinogen - 2.3 ± 0.3 g / l, thrombotest - 5.0 ± 0.14 (R <0.05). However, the time of inpatient response of patients was also maintained with a slight decrease in fibrinolytic activity of 20.1 ± 0.45% (R <0.05). Plasma loss was found to significantly improve patient response time even at moderately severe levels. This is evidenced by the normalization of PTI, fibrinogen and blood hematocrit.

The effect of conservative and surgical treatments on the blood coagulation system. Early necrectomy leads to an improvement in the overall condition of the patient in exchange for the removal of necrosis, which is the substrate for the development of intoxication and sepsis. The difference between early surgical treatment and staged surgical treatment is that it accelerates the healing of patients by reducing the development of scar tissue with good functional and cosmetic long-term results. The need for antibacterial therapy is reduced due to the reduction of treatment time [94; 6-9.]. Expansion of the surgical volume in patients with deep burns in the burn units requires improvement of perioperative preparation methods. Necrectomy and autodermoplasty are characterized by blood loss of 0.5-1.5 ml / cm2 from the wound surface, impaired hemostasis and microcirculation, while the preparation of a skin autotransplant requires a more superficial removal of the skin incision, which leads to further bleeding. Adequate infusion preparation and hemotransfusion care are important at all stages of burn disease at this time. However, infusion and hematransfusion should be based on volume determination. In this regard, in deep burns autodermoplasty is still relevant to improve the methods of preparation of patients for burns and surgery, balanced infusion and hemotransfusion therapy, reduction and replenishment of blood loss, and detoxification.

Thus, adequate local hemostatic therapy performed at the time of surgery can prevent blood loss and therefore improve treatment outcomes in patients in this contingent. For this purpose, the use of local hemostatic agent "Geprotsel" is promising.

All patients underwent early necrectomy and simultaneous autodermoplasty until the appearance of capillary bleeding at the border of healthy tissue. Hemostasis was performed by applying hemostatic powder "Geprotsel" from a cellulose product at a dose of 10 mg per day for 3 days.

Clinical evaluation included the following criteria: the amount and nature of fluid released from the wound; bleeding from the wound; time of epithelialization of transplanted autodermotransplants in donor areas; completeness of epithelialization; the extent to which pain is expressed in the injury. Surgical intervention in 35 patients with deep burns consisted of the use of the hemostatic drug Geprotsel to stop bleeding after incision of necrotic skin and subcutaneous structures.

Our studies have shown that early surgical necrectomy and slice autotransplantation show bleeding from donor areas (6-10 ml per 100 cm2 area), sudden application of hemostatic powder "Geprotsel" completely stops bleeding and the wound surface becomes shiny due to the adhesion of the film takes shape. The sensation of pain is very low. It has been observed that when the wound defect is closed with a donor autoimmune tissue, the skin tissue adheres well to the wound beneath it.

## 4. Conclusions

In view of the above, comprehensive anti-shock measures aimed at improving water-salt balance, acid-base balance and homeostasis disorders should be carried out when all patients are hospitalized.

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