

Diagnostics and Treatment of Polytrauma. Organizational and Tactical Aspects

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Abstract

Providing assistance to victims with polytrauma requires the development of modern approaches to diagnosis and treatment, both organizationally and tactically. Modern principles of care lead to the understanding that a thorough study of the victim's immune status, his metabolic response to trauma, is crucial for the possibility of preserving his life for a patient with polytrauma. The concept of "metabolic rehabilitation" has been developed, which is based on the following patterns: 1) in acute and early periods with polytrauma, cardiac activity and tissue oxygenation do not suffer from a decrease in erythrocyte counts to: erythrocytes 2.8, Hb 80, Ht 32%; 2) the principle of "permissible hypotension", blood pressure (100 mm Hg) Provides adequate tissue perfusion and reduces blood loss; 3) early minimally invasive surgery (external fixation of injuries of the musculoskeletal system using the concept of "separately controlled rod"); 4) operations are accompanied by early intensive therapy with long-term artificial ventilation of the lungs; 5) SIRS operations are excluded, with the exception of "rescue" operations. The main change in Damage Control Orthopedics is the approach to the patient with polytrauma from the standpoint of the balance of diagnostic manipulations with resuscitation. The system of therapeutic measures should include: a - a general complex for the elimination of the crisis state of the basic vital functions of the body and the correction of life support systems; b - directly measures to restore the anatomical structures and functions of damaged organs and segments, depending on the specific combination and nature of the damage.

Keywords: Polytrauma; Victims; Blood

Introduction

The growth of polytrauma affects the social indicators of the development of society [1,3]. Road deaths are no longer uncommon. This determines the relevance of the development of issues of polytrauma and the introduction of new organizational and tactical measures to provide assistance. The complexity of solving this problem is due to the attempts of practicing doctors of various specializations to achieve efficiency in the diagnosis and treatment of victims. The previously popular concept of "doctor's unfall" and the use of Early Total Care (ETC) have shown their ineffectiveness, and the concept of "Damage Control Orthopedics" that has come to its place is causing much controversy over the scope and timing of care for patients with polytrauma. There was a need for a unified conceptual platform that would combine the efforts of "narrow"

specialists for the effective use of their professional knowledge and skills, and made it possible to avoid, first complications of an iatrogenic nature. Some authors are on the path to improving organizational aspects - Early Appropriate Care (EAC), Safe Definitive Surgery (SDS) and Prompt-Individualized Safe Management (PR. ISM)) [6,7]. Others - are studying new approaches - introducing non-invasive diagnostics and atraumatic methods of surgical rehabilitation. In our clinic, we have developed the concept of care for polytrauma "METABOLIC REHABILITATION" - therapeutic and surgical counteraction of the generalized inflammatory response to polytrauma for practical health care, organizational aspects of the joint step-by-step work of various specialties of doctors providing assistance in polytrauma, the volume and concepts of care are not allowed.

Purpose of the article

To evaluate the concept of the volume of specialized care for polytrauma, the likelihood of complications and to substantiate the staging of care.

Materials and Methods

The results of treatment in the clinics of the Donetsk Regional Trauma Hospital and Republican Traumatology Center for the period 2000-2021 of patients with polytrauma were evaluated. All patients were divided into two groups. Group 1 (520 people) was treated using the concept of "metabolic rehabilitation". Group 2 - (346 people), were treated in the clinics before the implementation of the developed concept.

In the study groups, to assess both the general condition of the victim in the acute period and the dynamics of the state of organs and systems, including the musculoskeletal, a complex of clinical, biochemical, immunological, biomechanical, and radiological parameters was studied.

The severity of injury in both groups was assessed according to the combined scale of injuries and injuries (TRISS), which amounted to 2.94 ± 0.43 points and according to the criterion of the life prognosis of Yu.N. Tsybin - V.N. Pasternak (1998) [3] was $+T > 24$. Mortality directly depended on the organization of care and was different for the two groups: in the first it was 18%, and in the second - 32%.

Results and discussion. Objectively, in polytrauma, the life criteria of the victim (age, gender, severity of injury) have been proved, however, tactical and organizational issues remain relevant - the clinical features of the course of severe concomitant injury, its dependence on the area of the dominant injury and the nature of concomitant injury, impaired vital functions, blood loss. The nature, volume and sequence of surgical interventions have not been specified, the question remains who determines what to do with the patient? And when? The organizational problems of rendering assistance in polytrauma are still controversial - this is confirmed by a large number of seminars and master classes on assistance. And the founder of the Austrian School of Emergency Surgeons, Wilmos Veche, even asked the question "is trauma surgery necessary ???".

We categorically insist on not only the necessity, but also the need for assistance by traumatologists. There are many related specialties that also treat trauma, but collaboration does not al-

ways work. Multiple damage to the ribs with hemopneumothorax and multiple comminuted damage to the pelvic wing bones - a combined mechanical asphyxia is formed (both thoracic and abdominal ventilation functions are impaired), which requires urgent surgical measures. We have adopted the modus not to operate on injuries of the ribs, despite the fact that this is a bone injury that significantly disrupts the excursion of the chest, it is supported by thoracic surgeons. However, the main condition for saving the victim's life is restoring the integrity of the bone frame, which is a priority for many clinical centers.

Another question that requires discussion is whether the patient has enough oxygen at the stages of treatment for metabolic processes. Our experience in developing the concept of metabolic rehabilitation in traumatic illness has shown that in the acute period it is important to assess the oxygen component of polytrauma. Therefore, the mitochondrial storm, which reduces tissue oxygenation, is treated in parallel with the restoration of vital functions, such as measures to prevent dysfunction of the immune system caused by excessive intake of antigens. This is consistent with Carl Hauser's idea of the formation of a "mitochondrial storm" in a patient with extensive hematoma, the disintegration of which aggravates the patient's condition - mitochondria from damaged tissues activate the primary innate immune defense, its effector link is polymorphonuclear neutrophils of granulocytes.

We have developed and are actively implementing the concept of "metabolic rehabilitation" by which we mean the therapeutic and surgical restoration of the total metabolic response of the body to a generalized inflammatory response caused by hypermetabolism, manifested by dyselectrolythemia, protein deficiency and progressive traumatic exhaustion. The concept is based on the identified patterns:

1. In the acute and early periods of traumatic disease, cardiac activity and tissue oxygenation do not suffer with a decrease in red blood counts (under conditions of normovolemia) to quantitatively: erythrocytes 2.8 g/l, Hb 80g/l, Ht 32 vol.%. And a blood transfusion is an operation to transplant a foreign tissue and requires a separate metabolism and oxygenation.
2. The principle of "permissible hypotension", provides tissue perfusion with blood pressure (100 mm Hg), and helps to stop bleeding.

3. Early minimally invasive surgical resuscitation provides stopping bleeding from a bone wound and stopping painful efferent impulses from damaged areas - which is ensured by early external fixation of injuries to the musculoskeletal system using the concept of a "separately controlled rod".
4. Surgical treatment is accompanied by early anticipatory intensive care, with prolonged mechanical ventilation.
5. In the midst of the SSV0, all operations are excluded, except for the "life-saving" ones, in order to avoid the development of the "second strike" phenomenon.

It has been proven that in hemodynamically unstable patients with life-threatening post-traumatic systemic inflammatory response syndrome (SIRS) there are no indications for invasive fracture fixation operations, which is confirmed by the works of Israeli scientists who have proven the relationship of Toll-like receptor 9 polymorphism with cytokine levels and post-traumatic symptoms in trauma and on this basis make a conclusion about the need to operate on life-threatening injuries on the first day. In the period of 5-10 days, a "window of opportunity" is formed for surgical treatment, after which operations are prohibited until the end of 3 weeks. In the post-Soviet space, the concept of Gumanenko E.K., Kozlov V.K. has been empirically proven. (2008) - optimal primary surgical treatment - up to 3 days, then up to 10 days, refusal from operations due to the high risk of complications, then, if necessary, various types of reconstructive surgical treatment [4, 8]. We adhere to these conditions, but if it is necessary to save lives, we perform surgical treatment immediately when diagnosing, for example, two momentary rupture of the spleen.

Generalized metabolic response, late delivery of the victim (more than 10 days) sharply limited the operative activity. For the musculoskeletal system, the delay in surgical treatment was characterized by a significant retraction of the muscles, and, accordingly, the impossibility of primary anatomical reduction of injuries arose - even using surgical forceps and various types of levers. Accordingly, it was necessary to solve the problem of the volume of cutting off the muscles, their refixation and ensuring the contact of the bones along the fracture line in order to ensure fusion and adequate function after injury. This was especially significant in cases of injuries to the bones of the pelvis and spine, to which powerful muscles are attached to ensure balance of the trunk and upright posture. Retracted muscles, altered elasticity of

tendons and pelvic floor provided shockogenic damage and instability under conditions of changes in neurology and microcirculation of these segments. During an attempt at surgical treatment, we repeatedly noted massive hemorrhage associated with bleeding from severed bones and excised scars. Attempts to ligate wound bleeding were not successful, given the specific anatomy of the vessels and bone wound. For hemostasis, we used tamponade with Tachocomb plates and a hemostatic sponge, clamped the bleeding vessel with bone fragments - the latter were fixed with an external fixation apparatus. Extrafocal osteosynthesis of unstable pelvic injuries, in our version, provided the possibility of stopping bleeding from damaged structures, eliminating pathological impulses of damaged or compressed nerve plexuses, allowing for sanitation and treatment of pelvic wounds, which we consider traumatic and ineffective without reduction. Only reposition, elimination of the displacement of the pelvic bone structures created the conditions for the correct adaptation of damaged soft tissues and thereby reduced the risk of developing purulent-inflammatory complications. When carrying out the surgical aid, not only the nature of tissue damage was taken into account, but also the time elapsed since the moment of injury. In order to prevent urinary leakage in case of rupture of the bladder and urethra, in the period of surgery more than 10 hours from the moment of injury, a necessary condition was drainage of the small pelvis according to Buyalsky-McWarter and the imposition of an epicycstostomy for urine diversion. Extrafocal osteosynthesis with the inclusion of a damper suspension of the pelvis in the therapeutic complex made it possible to exclude the pathogenetic mechanisms of the development of local neurotrophic disorders, and optimized the tactics of treating soft tissue injuries in the pelvic region. Analysis of long-term results showed that the most favorable course of fractures was operated either by the method of extrafocal osteosynthesis, or by immersion structures in the early stages.

The analysis of the circumstances of the injuries showed that the main number of injuries occurred as a result of transport accidents - 345, of which road accidents prevailed - 220, while 15 of them were industrial; injuries (21) associated with rail transport were much less common. The main vehicle that caused the collision with a pedestrian was a passenger car - 157 observations. The second place is taken by injuries received inside the car - 23.53% (cases of collision of cars, collision with an obstacle, rollover). Mine injury prevailed in the structure of industrial injuries (161) - 120 observations. The main reasons were: moving mechanisms, intra-

mine transport - 53, collapse of roof, coal, rocks, structure fall - 45, injuries during drilling and blasting operations - 12.

Accurate topical diagnostics, which allows to determine the type and nature of injuries with concomitant injuries, is the determining link in choosing a method of treatment. Severely injured victims were not always able to identify areas of damage. And we didn't use whole body research. There was a connection between traumatic shock in victims and the type of trauma: with isolated trauma, it occurred in 12.90%, with multiple trauma - in 45.24%, with concomitant trauma - in 72.82%. It was important to combine diagnostic manipulations with resuscitation ones. When providing assistance to group 1, we performed a complex of diagnostics and treatment: - resuscitation (the main one is the identification and treatment of metabolic disorders of homeostasis) and - trauma-surgical (identification of the main sources of pain and bleeding and restoration of damaged anatomical structures to the possibility of functioning). This made it possible to compare the metabolic disorder detected by the resuscitator and the signs of local injuries, bleeding, identified by the traumatologist and the surgeon, thereby comparing the severity of injuries and the severity of the condition. The diagnostic sequence used is focused on instrumental methods carried out in the nearest time from the moment of admission, since the general condition of victims with concomitant trauma does not allow long-term observation of the clinic in dynamics. This tactic made it possible to quickly exclude intact anatomical areas, thereby providing the ability to narrow the search area and focus on the damaged areas.

Analysis of injuries showed that multiple injuries prevailed in both study groups (91.34%), which confirmed the complex mechanismogenesis of injuries. The system of therapeutic measures (the concept of "metabolic rehabilitation") included: 1 - a general complex of elimination of the crisis state of the basic vital functions of the body and correction of life support systems; 2 - directly measures to restore the anatomical structures and functions of damaged organs and segments, depending on the specific combination and nature of the damage. Poor functional outcomes - occurred with conservative methods - 72.5%. The use of active tactics of polytrauma management made it possible to reduce hypostatic complications - by 16%, the number of post-traumatic contractures of the lower extremities - by 19%; reduce the average duration of bed rest to 8

days and inpatient treatment from 96 to 38 days.

Conclusions

- We believe that the main change in Damage Control Orthopedics is the approach to a polytraumatized patient from the standpoint of a balance of diagnostic manipulations with resuscitation ones. The system of therapeutic measures should include: a - a general complex for the elimination of the crisis state of the basic vital functions of the body and the correction of life support systems; b - directly measures to restore the anatomical structures and functions of damaged organs and segments, depending on the specific combination and nature of the damage.
- The life of a victim with polytrauma depends on the correct organizational approach. First, we treat a "mitochondrial storm", which justifies the formation of a "cytokine storm" and leads to multiple organ failure (traumatic disease). These are primarily activities aimed at saving lives, restoring metabolism and adequate oxygenation, as the development of COVID-19 proves. New concepts of polytrauma care - SDS, EAC, P.R.I.S.M. still require clinical evidence.
- The use of primarily stable and minimally invasive methods as early as possible, taking into account the condition of the victim, allows achieving adequate reduction and obtaining good functional outcomes and results in case of unstable injuries of the musculoskeletal system at the stages of rehabilitation and reducing disability of the 1st group - by 7.28%, 2 groups - by 13.81%, 3 groups - by 18.5%.

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