UNDERSTANDING OF THE PATHOGENESIS OF TRAUMATIC SPINAL CORD INJURY AND POSSIBLE WAYS OF THERAPEUTIC INTERVENTION: LITERATURE REVIEW*

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The paper presents a literature review on the pathogenesis of traumatic spinal cord injury. Spinal and spinal cord injury is of particular significance in the structure of human traumatic injuries due to the severity of socioeconomic consequences, difficulties of treatment, and high rate of disability among injured persons. In recent years, there has been a clear upward trend in the frequency of injuries to the spine and spinal cord. The spinal cord is an essential part of the nervous system having great physiological significance for the integrative activity. The total effect of spinal cord injury can be estimated as the sum of primary destruction of the nervous tissue and secondary extensive apoptosis near the injury site and at a distance from it. This results in the development of complex structural and functional changes manifested in multiple neurotrophic, metabolic, dyscirculatory and infectious complications, which greatly aggravate traumatic disease as a whole and affect vital functions of a patient immediately after spinal cord injury and in the late period. The current understanding of possible ways of therapeutic intervention to improve the existing treatment strategy for patients with spinal cord injury is reviewed.
Key Words: spinal cord injury, apoptosis, necrosis, inflammation, neurotoxicity.

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Spinal cord injury in the structure of human traumatic injuries is of particular significance due to its complexity and severity of socioeconomic consequences, difficulty of treatment, and the high rate of disability among injured persons. In recent years, there has been a clear upward trend in the frequency of injuries of the spine and spinal cord associated with the development of industry, mechanization of construction, agriculture, growing production intensification, traffic accidents, and urbanization. According to recent statistics, the frequency of spinal injuries has increased over the 70-year period by more than 200 times [2].

The spinal patients' rehabilitation potential is mostly assessed as pessimistic being an example of the therapeutic skepticism toward spinal cord injury care [4].

Despite the small frequency of spinal cord injury, spinal injured patients have always been the focus of neurosurgeons, traumatologists, and emergency physicians mostly due to unfavorable immediate outcomes of complex treatment. As a result of the development of medicine, mortality rates during the first three months of traumatic spinal cord disease fell from 92.0 % at the beginning and middle of the XX century to 27.9 % at present. High rates of mortality are associated with that spinal cord injuries are often accompanied by complications in the form of pressure ulcers (47–90 %), pneumonia (57 %), urological abnormalities (77 %), and sepsis. About 50 % of victims of spinal cord injury live more than 25 years, but most of them suffer from severe disabilities and require constant care [6, 9].

The spinal cord is of great physiological significance in the integrative activity of the nervous system. Vertebral fractures with spinal cord injury lead to complex structural and functional changes that manifest in multiple neurotrophic, metabolic, discirculatory, and infectious complications that aggravate significantly traumatic disease and affect the functions of the patient's body immediately after spinal cord injury and in the late period [3, 5].

The high density of the nerve centers in the spinal cord and the specificity of its circulation are the first reason that determines the complexity of the problem, and the second one is the low regenerative capacity of the spinal cord leading to that even a small contused area results in severe disturbances of vital functions, which are difficult to restore [7].

The pathophysiological changes that occur in the site of spinal cord injury have always been intensely studied [10].

The modern concept of traumatic spinal cord injury pathogenesis considers the engagement of two major interrelated pathways of cell death: apoptosis and necrosis. Historically, understanding of these processes was gained at different times. Virhow in his paper [55] conducted a detailed morphological descrip-