FORENSIC MEDICAL ASSESSMENT OF DAMAGE TO SOFT TISSUE AND KIDNEYS DUE TO BLOOD LOSS

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Abstract: The article discusses the results of an experimental study on modeling mechanical trauma accompanied by damage to soft tissues and the kidney under conditions of blood loss and without it. A certain dynamics of pathomorphological changes was revealed both in soft tissues and in the kidney, depending on the duration of the damage.
Keywords: Experimental modeling, kidney, damage, pathomorphology.

INTRODUCTION

In the course of forensic medical research in various types of mechanical trauma, one of the most important issues is to establish signs of intravital formation of injuries and the age of their occurrence [1]. Resolution of these issues becomes possible as a result of morphological analysis of reactive changes in various tissues and organs that are characteristic of certain periods of the post-traumatic process, as well as the identification of acute circulatory disorders in the area of injury [3].

MATERIALS AND METHODS

The literature contains information that reflects the patterns of development of responses occurring in the body after injury, both in soft tissues and in internal organs [2]. However, according to the authors, the dynamics of the development of reactive changes in the post-traumatic period, in different organs and tissues, proceeds differently, which is associated with their morpho-functional characteristics [1]. Considering that severe blunt trauma is often accompanied by the development of blood loss and complicated by hemorrhagic shock, when planning this study, the possibility of the influence of hemorrhagic shock on the nature of reactive changes in injured tissues and organs was taken into account [5].

In connection with the above, it seemed appropriate to us to evaluate pathomorphological changes in blunt trauma accompanied by damage to soft tissues and kidneys against the background of hemorrhagic shock in the experiment.

RESULTS AND DISCUSSION

The first group consisted of animals that were anesthetized using diethyl ether and fixed on an operating machine. Modeling of hemorrhagic shock was carried out by collecting blood from the tail vein. Using a measuring tube, blood loss was monitored, which was 3.5–4 ml, which corresponded to 30–40% of the circulating blood volume of an animal weighing 180–200 g [1]. After simulating hemorrhagic shock, the animals underwent a dissection of the anterior abdominal wall 1.5 cm to the right of the midline. Using anatomical tweezers, mechanical damage was performed by local compression of the lower pole of the right kidney. The formation of damage was monitored visually by the resulting hemorrhage. Injury to soft tissues was carried out by applying a Hegar needle holder for 10 s to a folded area of the anterior abdominal wall, after which a hemorrhage also formed under the parietal peritoneum in the area of impact. After simulating a blunt injury to the kidney and soft tissues, the anterior abdominal incision was sutured in layers.

In order to identify pathomorphological changes in soft tissues and the kidney during mechanical trauma against the background of developing hemorrhagic shock, depending on the age of formation of the damage, the animals were divided into 7 groups of 11 animals each:

Group 1 - 1 hour after modeling injuries, 2nd group – 6 hours, 3rd group – 12 hours, 4th group – 24 hours, 5th group 72 hours (3 days), 6th group – 5 days, 7th group – control (samples of organs and tissues were taken immediately after modeling injuries to soft tissues and the kidney). In the experiment, soft tissues and kidneys from 77 animals were examined.

When microscopying specimens from animals from the 7th control group in the soft tissues and kidney, uneven blood filling of vessels of all calibers was noted; focal hemorrhages were represented by clusters of loose and compact masses of erythrocytes located perivascularly and in the intermuscular spaces of soft tissues .

In animals of group 1, 1 hour after injury during hemorrhagic shock, the appearance of neutrophilic leukocytes was observed in the soft tissue vessels, some of which migrated outside the vascular bed and were located perivascularly. The appearance of neutrophilic leukocytes in the area of the resulting hemorrhage was also noted.

When examining the kidneys, the microvasculature vessels were anemic and the arteries were spasmodic. The glomerular capillaries were unevenly filled with blood or empty. In the area of damage, hemorrhages were represented by loose masses of red blood cells with an admixture of single neutrophilic leukocytes. The epithelium of the proximal tubules was high, somewhat swollen, in a state of dystrophy, which was accompanied by a narrowing of the lumen of the tubules. In some areas, the tubular epithelium was “swollen,” eosinophilic clumps were observed in the cytoplasm of these cells, and the nuclei were also swollen.

In animals of the 2nd study group (6 hours after injury), increasing swelling was noted in the soft tissues, the connective tissue fibers were swollen, and the distances between them were increased. In foci of hemorrhages formed in places of traumatic impact, diffuse polymorphocellular infiltration was detected, characterized by the presence of neutrophils and the appearance of macrophages. Microscopic examination of the kidneys 6 hours after the formation of damage in animals with hemorrhagic shock revealed a diffuse leukocyte reaction in subcapsular hemorrhages with the appearance of single macrophages.

CONCLUSION

Thus, the results of the study indicate that in the post-traumatic period after blunt mechanical trauma caused by hemorrhagic shock, there is a more active development of reactive changes in the damaged soft tissues compared to the injured kidney. The identified differences in the dynamics of the development of reactive changes in soft tissues and in the kidney are likely associated with the characteristic features of the course of tissue and organ metabolism. The data obtained can be useful when conducting expert studies to establish the age of damage.

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