FORENSIC MEDICAL ASSESSMENT OF PATHOMORPHOLOGICAL SIGNS IN THE MYOCARDIUM IN STAB WOUNDS

S.Sh.Gamidov, S.A.Khakimov

ANNOTATION

Pathomorphological characteristics of myocardium resulting from injuries to the heart are described with reference to their localization in different regions of the wound canal at different time periods after the injury. The studies were carried out with the use of light microscopy.

Key words: Pathomorphology, forensic medicine.

Injuries caused by sharp objects occupy one of the leading positions in the structure of total mortality from various injuries, and stab wounds are leading in this group and account for about 80% of all injuries caused by sharp objects [1]. Taking into account that from stab wounds and their complications in the vast majority of cases die people aged 20-40 years, that is, the most able-bodied population.

Determining the duration of damage is important in mechanical trauma. The solution to this question is based primarily on reactive changes in tissues, the reaction of the vessel bed, and also on the development of a cellular reaction in the affected tissues.

The purpose of the study is to – assessment of pathomorphological signs in the myocardium in penetrating stab wounds of the chest with damage to the heart.

Materials and methods of research. A comparative analysis of cardiomyocyte status in different zones of the wound canal was conducted at different intervals of the post-traumatic period. In all cases, the duration of death did not exceed 24 hours.

The material for microscopic examination was taken from 27 corpses of both sexes aged 15 to 60 years, who were admitted to the morphology department of the 1st branch of the Bureau of Forensic Medicine of Tashkent for 2013-2015.

Microscopic studies were conducted using the MBC-10 microscope.

According to the data obtained from the time of injury to death, all cases were divided into five main groups: up to 1 hour - 1st; 1-3 hours - 2 hours; 3-6 hours - 3rd; 6-12 hours - 4 hours; 12-24 hours - 5th.

Myocardial changes were assessed in 4 zones of the wound canal: 1) wound canal lumen; 2) the marginal or terminal zone of the wound canal (formed by areas of the myocardium which are the walls of the wound canal); 3) the marginal zone of the wound canal (the area of the myocardium around the marginal zone); 4) the zone of the intact myocardium (the areas of the myocardium outside the wound canal and adjacent areas of the myocardium).

The identified pathomorphological changes were assessed on a 4-point scale: 0 points - absence of the trait, up to 4 points - maximum severity of the trait. The following features were assessed: presence and extent of hemorrhage; vascular wall morpho-functional state and their permeability; hemodynamic disturbances in the vessels of the microcirculatory bed; impaired blood rheological properties; types of degenerative-dystrophic changes in cardiomyocytes; contracture damage to cardiomyocytes.

The obtained data can be used in the practical work of the gistological departments of the SME bureau to determine the lifespan and duration of formation of cardiac lesions in the areas of trauma from stabling tools.

Results and discussion. When examining the lumen of the wound canal (the first zone), blood clots of varying severity are detected, which in rare cases cover the entire lumen of the canal, often spreading through the intermuscular spaces into the depths of the myocardium. During the first hour, blood clots are represented by erythrocytes with well-defined contours.

As the time after the injury increases (1-3 hours), the first zone of post-traumatic hemorrhages in the central part of the hemorrhages showed the first signs of the onset of hemolysis. The erythrocytes look like granular masses of orange or yellowish color, with blurred cell contours. Between 6 and 12 hours after the injury, the hemorrhage is represented by erythrocytes with a pale, leached cytoplasm.

For all the time intervals in the lumen of the wound canal (the first zone), besides bleeding, fibrin masses, as well as damaged vessels, fragments of damaged cardiomyocytes and connective tissue fibers are characteristic, especially in cases of severe cardiac sclerosis.

In the examination of the marginal (terminal) zone of the wound canal, in addition to characteristic changes in cardiomyocytes, trapezoidal enlargements of the distal sections of the muscular fibers intersected at the time of injury were observed. The maximum width of the so-called trapezoids was 3-6 hours after the injury. As coagulation necrosis progresses, the trapezoidal parts of the cardiomyocytes look homogenized, have a pronounced eosinophilic colour, and do not exhibit any transverse or fibrillar lines. Such a picture was observed in the period from the time of injury to 12 hours or more.

Trapezoidal dilatations of cardiomyocytes of the second zone of the wound canal were replaced by fragmentation, dissociation, re-shrinkage and wave-like deformation of cardiomyocytes, which are part of muscle fibers at the level of the third zone of the wound canal.

Cardiomyotsitic fragmentation had varying degrees of severity at different time intervals. In the initial manifestations, within 1 hour after the injury, the appearance of transverse cracks in cardiomyocytes was noted. When the process was more

pronounced, individual cardiomyocytes were detected as rectangular cell fragments with narrow gaps between them.

In all time periods, deformed nuclei of cardiomyocytes were found in the marginal or terminal zone of the wound canal. The cross-sectional size of these nuclei could exceed their length by 2-3 times. Nuclear deformation was caused by pronounced cardiomyocyte contracture. Single cardiomyocytes with nucleus loss in the structure were found in all groups. The alternation of contraction and relaxation zones causes deformation of muscle fibers. The relaxed muscle fibers were wavy, saw-shaped, or curved. The severity of this symptom reached its peak when the injury lasted at least 6 hours (Group 4). In the areas of the intact myocardium (zone 4), cardiomyocyte fragmentation, re-contraction and wave-like deformation were less pronounced and mosaic in nature.

In the examination of the vascular bed of the marginal or terminal zone of the wound canal in the first 3 hours from the moment of injury, the greatest number of spasmodic arteries were found, which in subsequent intervals of time were replaced by paresis.

In the 3rd zone (at the edge) of the wound canal, the maximum number of spastic arteries was observed within the first hour. This sign was moderately expressed in the intact parts of the myocardium up to 6 hours. Moderate and small vessels of the myocardium were found to be under-blooded in the marginal and peripheral zones of the wound canal within 1 to 6 hours. Furthermore, due to the activation of compensatory-adaptive processes of blood redistribution from the deposit, it was possible to characterize vessels as moderately under-blooded.

In the marginal or terminal zone of the wound canal (zone 2), the most frequent form of cardiomyocyte damage is fragmentary myofibrilla breakdown, which is the most severe and irreversible alteration due to coagulation necrosis of the wound cell, and the cardiomyocytes perceive the dye unevenly. In the polarized light, a colorful picture with the illumination of dead cardiomyocytes was observed. This type of damage was detected in the first hours after the injury.

Subsegmental cardiomyocyte contractures, which are multiple focal contractures of individual groups of cardiomyocyte sarcomers, were found in all groups. They are widespread in the period of 3-6 hours in the marginal and peripheral zones of the wound canal.

Along with subsegmental contractures, segmental contractures of cardiomyocytes were observed. Contractures of the first and second degree were detected within 1 hour from the moment of injury, with a maximum development of the symptom by 12-24 hours of the post-traumatic period.

Contract injuries of the 3rd degree were more pronounced by the end of the 1st day (group 5). Cardiomyotsites with such lesions are most densely located in the

marginal and peripheral zones of the wound canal. In the area of the intact myocardium (zone 4), all the aforementioned types of acute lesions are less pronounced, the area of the lesions is minimal, and the nature of their spread is mosaic.

CONCLUSION:

1. Evaluation of the pathomorphological changes of the myocardium in penetrating stab wounds of the chest with damage to the heart allows to solve the question of the duration of damage formation.

2. In expert evaluation, characteristic pathomorphological features can be identified for each zone of the wound canal:

a) in the lumen of the wound canal - the presence of hemorrhages, fibrin masses, fragments of damaged cardiomyocytes;

b) in the marginal or terminal zone formed by the areas of the myocardium, which are the walls of the wound canal, - shortening and thickening of cardiomyocytes in the form of "trapecies" with the greatest severity of contracture lesions and lump breakdown;

c) in the peripheral zone, marked fragmentation of cardiomyocytes accompanied by transverse deformation of the nuclei;

g) In the zone of the intact myocardium - wave-like deformation of cardiomyocytes, perivascular and stromal edema, mosaic nature of contractures.

Literature:

1. Иванов И.Н. Судебно-медицинское исследование колото-резаных ран кожи. Автореф. дис… д-ра мед. наук. Ст-П, 2000, 20 с.

2. *Асташкина О.Г., Столярова Е.П., Полтарев С.В., Терешина Н.А.* Установление прижизненности механической травмы по биохимическим показателям. Мед. эксперт и право, 2010, 3, 43-45.

3. *Новоселов В.П., Савченко С.В., Романова Е.А., Циммерман В.Г.* Патоморфология миокарда при ушибах сердца. Новосибирск: Наука, 2002.