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DIFFERENTIAL DIAGNOSIS OF ANTEMORTEM AND POSTMORTEM HEMORRHAGES OF THE PANCREAS

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Introduction. In forensic medical practice, one of the most challenging and relevant tasks remains the differential diagnosis of antemortem and postmortem injuries (1, 2, 4). Establishing the vitality of trauma and determining its time of occurrence are of fundamental importance for reconstructing the mechanism of the incident and formulating scientifically substantiated expert conclusions. Despite the availability of a wide range of morphological, biochemical, and instrumental methods, there are still no universal, highly specific, and accessible criteria that allow these issues to be resolved with a high degree of reliability, particularly in the early pre- and postmortem periods (3, 5, 7).

Histomorphological examination remains the primary method in routine forensic practice; however, its diagnostic value is significantly reduced in cases with pronounced autolytic and putrefactive changes. In this regard, the search for objective biochemical markers reflecting vital tissue reactions to trauma is of particular relevance. One such marker is hemin, a stable product of hemoglobin degradation formed when blood exits the vascular bed and interacts with surrounding tissues. The intensity of its formation is directly related to the level of metabolic activity, which makes it a promising indicator for differentiating between antemortem and postmortem hemorrhages (6, 8).

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Objective. To determine the quantitative content of hemin in pancreatic tissue in antemortem and postmortem traumatic hemorrhages using thin-layer chromatography and to assess its diagnostic significance.

Materials and Methods. The study material consisted of pancreatic tissue samples obtained during forensic autopsies of 60 individuals who died from traumatic injuries. All cases were divided into two groups: the main group (n=45) included confirmed antemortem hemorrhages based on clinical and morphological data, while the control group (n=15) comprised postmortem injuries experimentally inflicted 2–4 hours after death.

Samples weighing 1.0 g (or at least 0.1 g when necessary) were collected from hemorrhagic areas and morphologically intact regions of the organ. The tissue was minced and subjected to extraction with acidified acetone containing hydrochloric acid, followed by incubation at 3-5°C for 24 hours. The extracts were then filtered and adjusted to a standard volume.

Qualitative and quantitative determination of hemin was performed using thin-layer chromatography with subsequent assessment of spot intensity and application of calibration data. Statistical analysis was carried out using Student's t-test, with a significance level of $p < 0.05$.

Results and Discussion. Morphological changes in the pancreas following trauma were characterized by extensive hemorrhages, interstitial edema, pronounced leukocytic infiltration, and areas of necrosis. As early as 30 minutes after injury, signs of functional activation of the islet apparatus were observed, which were subsequently replaced by dystrophic and degenerative changes.

Chromatographic analysis revealed statistically significant differences in hemin content between the study groups. The mean hemin concentration in antemortem hemorrhages was 12.7 ± 0.9 $\mu\text{g/g}$ of tissue, whereas in postmortem injuries it was 4.3 ± 0.6 $\mu\text{g/g}$ ($p < 0.01$). Chromatograms of antemortem

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hemorrhages demonstrated a pronounced hemin peak with a characteristic retention time, while control samples showed markedly lower signal intensity.

The observed differences are attributable to the preservation of hemodynamic pressure and active redox processes in living tissues, which promote more intensive hemin formation. After death, these processes rapidly diminish, resulting in reduced hemin concentrations.

Thus, the quantitative content of hemin reflects the degree of vital tissue reactions and can serve as an objective indicator of the vitality of hemorrhages. The findings are consistent with current concepts regarding the role of metabolic activity in the formation of biochemical markers of trauma and confirm their potential application in forensic practice.

Conclusions. Thin-layer chromatography provides a reliable, highly sensitive, and specific method for determining hemin content in biological tissues. It has been established that the concentration of hemin in antemortem pancreatic hemorrhages is statistically significantly higher than in postmortem injuries (on average by 2–3 times), which allows its quantitative determination to be considered an objective additional criterion for assessing the vitality of traumatic injuries of internal organs. The implementation of this approach in forensic practice, along with further standardization of threshold values, will enhance the accuracy, reproducibility, and evidential value of expert conclusions.

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