MORPHOLOGICAL CHANGES IN INTERNAL ORGANS IN ACUTE DESOMORPHINE POISONING: FORENSIC HISTOPATHOLOGICAL ASSESSMENT

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Abstract

Background. Acute poisoning with psychoactive and semi-synthetic narcotic substances remains an important problem in forensic medicine because toxic exposure may cause pronounced structural and functional disturbances in several internal organs. Desomorphine, a semi-synthetic opioid commonly referred to as “krokodil”, is characterized by a pronounced toxic effect and may be associated with severe systemic pathological changes. In forensic practice, the diagnosis of acute poisoning cannot always be based exclusively on toxicological findings. Therefore, the identification and systematization of characteristic morphological and histopathological alterations may provide additional evidence for establishing the mechanism and circumstances of death. The present study was aimed at evaluating the morphological changes in internal organs associated with acute desomorphine poisoning and at identifying histopathological features that may be useful for forensic medical diagnosis.

Objective. To investigate the clinical, morphological and pathological changes associated with acute poisoning by semi-synthetic desomorphine and to establish morphological criteria that can contribute to the improvement of postmortem forensic medical diagnosis.

Materials and Methods. The study was performed on materials obtained from the Bukhara Regional Branch of the Republican Scientific and Practical Center of Forensic Medical Examination. The research included retrospective analysis of forensic medical examination reports of individuals who died following acute poisoning with modern psychoactive substances. A total of 108 forensic cases were selected for detailed analysis, including 31 women and 77 men. In addition, clinical and laboratory data from 23 patients who had been hospitalized because of acute poisoning were analyzed for comparison. The majority of the deceased belonged to the 25–30-year and 35–40-year age groups.

Forensic examination included external examination, assessment of anthropometric parameters, detailed examination of internal organs, toxicological assessment and morphological investigation. Tissue samples were obtained from major internal organs, including the heart, liver, pancreas, brain and blood vessels. Tissue specimens were fixed in 10% neutral buffered formalin for 48 hours, processed through graded alcohol and chloroform, and embedded in paraffin. Histological sections

measuring approximately 4–7 μm were prepared. Routine hematoxylin and eosin staining was used for evaluation of general tissue architecture and pathological alterations. Histochemical methods, including periodic acid–Schiff reaction and Van Gieson staining, were applied for assessment of glycogen and connective tissue components, respectively. The obtained data were subjected to statistical analysis.

Results. The retrospective and morphological analysis demonstrated that acute desomorphine poisoning was associated with a complex pattern of pathological changes involving several internal organs. The observed lesions reflected predominantly vascular, circulatory, dystrophic, degenerative and necrotic processes.

Particular attention was paid to hepatic pathology. Mixed vacuolar and fatty degeneration of hepatocytes was detected in 70.9% of the investigated cases. Central lobular coagulative necrosis was identified in 43.2% of cases, while hemorrhagic changes in the liver were observed in 67.6%. Histological examination additionally demonstrated pronounced vascular disturbances, including congestion of central veins and sinusoids, edema of the perisinusoidal spaces and the presence of fibrinous and fibrin–erythrocyte thrombi in a number of venous vessels. These findings indicate substantial impairment of intrahepatic microcirculation in cases of acute desomorphine poisoning.

The morphological assessment also demonstrated significant pathological changes in the cardiovascular system. Cardiac hypertrophy was recorded in a considerable proportion of examined cases. Histological examination revealed myocardial dystrophic and necrotic changes, while changes in myocardial color, consistency and surface observed during autopsy were regarded as nonspecific and potentially subjective when assessed retrospectively. The presence of vascular disturbances and myocardial lesions indicates that cardiovascular involvement may contribute to the thanatogenetic mechanisms of acute poisoning.

The pancreatic tissue also demonstrated a range of structural abnormalities. In the retrospective material, pancreatic morphology was incompletely documented in a substantial proportion of forensic reports. Among the recorded findings were changes in lobular organization, edema, cystic alterations, lipomatosis and calcifications. A lobular pattern of pancreatic architecture was observed in 23.3% of cases, while pancreatic edema was recorded in 27.7%. Cystic changes were identified in 15.3% and lipomatosis in 11.6% of the investigated cases. These observations indicate that pancreatic involvement should not be overlooked during comprehensive forensic examination of deaths associated with desomorphine poisoning.

The examination of cerebral vessels revealed alterations in their structural characteristics. Thin elastic vessels were described in 71.25% of cases, whereas dense tortuous vessels and thickened vascular walls were identified in 19.7% and 5.7% of

cases, respectively. Retrospective analysis demonstrated that information concerning the degree and distribution of cerebral vascular sclerosis was frequently insufficiently documented. This finding emphasizes the importance of standardized morphological description during forensic examination.

Factor analysis of the pathological findings indicated a predominant sequence of circulatory disturbances. Arterial spasm, venous congestion and ischemic alterations appeared to constitute an important morphological component of acute desomorphine intoxication. These circulatory disturbances were accompanied by subsequent dystrophic, degenerative and necrotic changes in internal organs. Thus, the morphological picture of poisoning should be considered not as an isolated lesion of a single organ but as a systemic pathological process involving the vascular bed and parenchymal tissues.

An important finding of the study was the identification of a combination of pathological features that may have forensic diagnostic significance. The simultaneous presence of vascular congestion, ischemic changes, dystrophic and necrotic alterations, together with toxicological evidence of desomorphine exposure, provides a more comprehensive basis for postmortem diagnosis than the assessment of an individual morphological sign alone.

Discussion. The findings demonstrate that acute desomorphine poisoning produces a multisystem morphological response. The liver appears to be particularly vulnerable, with frequent combinations of hepatocellular degeneration, necrosis, hemorrhage and microcirculatory disturbances. Such alterations may reflect direct toxic injury as well as secondary hypoxic and circulatory mechanisms.

From a morphological perspective, vascular disorders represent an important component of the pathological process. Arterial spasm, venous congestion and impaired microcirculation may contribute to tissue hypoxia, followed by dystrophic and necrotic changes. This sequence was supported by factor analysis of the morphological findings. The presence of such alterations in several organs suggests that the pathogenesis of acute desomorphine poisoning involves systemic vascular and metabolic disturbances rather than isolated organ toxicity.

The study also demonstrates the importance of integrating gross autopsy findings, histopathological examination and toxicological data. Some macroscopic characteristics, particularly tissue color and consistency, may be influenced by subjective assessment and therefore should not be considered independently diagnostic. In contrast, histopathological examination allows more objective documentation of cellular and tissue-level alterations.

The obtained findings have practical importance for forensic medicine. A standardized assessment of the liver, heart, pancreas, brain and vascular structures may

improve the completeness of postmortem examination in suspected cases of acute desomorphine poisoning. The combination of morphological findings with forensic chemical examination may increase the evidentiary value of the final expert conclusion.

Conclusion. Acute desomorphine poisoning is associated with pronounced systemic morphological alterations in internal organs. The most characteristic findings include hepatic fatty and vacuolar degeneration, central lobular necrosis, hepatic hemorrhage, vascular congestion, fibrin-containing thrombi, edema and signs of impaired microcirculation. Cardiovascular and pancreatic lesions, as well as alterations of cerebral vessels, may accompany these changes.

The results support the concept that circulatory disturbances, including arterial spasm, venous congestion and ischemic changes, play an important role in the development of subsequent dystrophic and necrotic lesions. A comprehensive combination of forensic medical examination, histopathological assessment and forensic chemical analysis is therefore appropriate for the postmortem diagnosis of acute desomorphine poisoning.

The study provides a morphological basis for improving forensic diagnostic criteria in deaths associated with acute poisoning by semi-synthetic psychoactive substances. The developed set of postmortem pathological criteria was reported in the dissertation as having been introduced into forensic medical practice.

Keywords: desomorphine poisoning, acute intoxication, forensic medicine, histopathology, morphology, liver, heart, pancreas, cerebral vessels, necrosis, dystrophy, microcirculation, forensic diagnosis.