ISNN 3030-3907

2026/3
VOLUME 8

# DEVELOPMENT OF SCIENCE

## ILMIY JURNAL



# Development of science

## Ilmiy jurnal

2026/3 VOLUME 8

ISSN 3030 -3907

Ilmiy jurnal OAK rayosatining 2024 yil 27 sentabrdagi 361-son qaroriga asosan 02.00.00 kimyo fanlari hamda 2025 yil 12 fevral 367- son qaroriga asosan 05.00.00 texnika fanlari bo‘yicha falsafa doktori (PhD) va fan doktori (DSc) ilmiy darajasiga talabgorlarning dissertatsiya ishlari yuzasidan dissertatsiyalari asosiy ilmiy natijalarini chop etish tavsiya etilgan milliy ilmiy nashrlar ro‘yxatiga kiritilgan.

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ISSN 3030-3907

**Development of science** ilmiy jurnali 2024 yil 15 aprel kuni №256445 sonli guvohnoma bilan Davlat ro‘yxatidan o‘tgan.

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ISSN 3030-3907

УДК: 576.31.616.36.613.83

# EXPERT DIAGNOSIS OF DEATH IN ACUTE POISONING WITH NARCOTIC SUBSTANCES.

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**Abstract.** At present, one of the most pressing tasks of forensic medical science and practice remains the diagnosis of poisoning with narcotic and psychotropic substances. Numerous studies have been devoted to the development of various criteria for fatal poisoning caused by narcotics and other toxic psychotropic agents. The scientific literature contains several works proposing diagnostic approaches for determining the cause of death due to intoxication with narcotic substances of the opiate group.

**Keywords:** Narcotic substances, opiates, toxicological examination, pathomorphology.

**Annotatsiya.** Hozirgi vaqtda sud-tibbiyot fan va amaliyotining eng dolzarb vazifalaridan biri giyohvand va psixotrop moddalar bilan zaharlanishni aniqlash hisoblanadi. Narkotiklar va boshqa zaharli psixotrop moddalar sababli yuzaga keladigan o‘lim holatlarini aniqlash mezonlarini ishlab chiqishga ko‘plab tadqiqotlar bag‘ishlangan. Ilmiy adabiyotlarda opiat guruhiga mansub narkotik moddalar bilan zaharlanish natijasida yuzaga kelgan o‘lim sababini aniqlashga qaratilgan bir qator diagnostik yondashuvlar bayon etilgan.

**Kalit so‘zlar**: Giyohvand moddalar, opiatlar, toksikologik tekshiruv, patomorfologiya.

**Аннотация.** В настоящее время одной из наиболее актуальных задач судебно-медицинской науки и практики остаётся диагностика отравлений наркотическими и психотропными веществами. Многочисленные исследования посвящены разработке различных критериев установления смертельных отравлений, вызванных наркотиками и другими токсическими психотропными агентами. В научной литературе имеется ряд работ, предлагающих диагностические подходы к определению причины смерти при интоксикации наркотическими веществами опиатной группы.

**Ключевые слова**: Наркотические вещества, опиаты, токсикологическое исследование, патоморфология.

## INTRODUCTION.

**MATERIALS AND METHODS:** The study material consisted of 226 blood analyses obtained from 27 cadavers of individuals who died from acute poisoning with narcotic substances, with the cause of death verified by



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toxicological examinations. The control group included 20 cadavers of individuals whose cause of death was cardiovascular disease.

**RESULTS.** The level of myoglobin in whole blood in cases of overdose with opiate-group narcotics was 20 times higher than in the comparison group (individuals who died from cardiovascular diseases and mechanical asphyxia; total of 20 cases). The concentration of myoglobin in blood serum proved to be even more indicative. In cases of narcotic poisoning, serum myoglobin levels increased by 300-fold or more compared to the control group. The level of myoglobin in urine in this group was eight times higher than in the control group.

**CONCLUSIONS.** An increase in myoglobin concentration by more than tenfold in blood, twofold in urine, and more than twofold in the myocardium of the left ventricle, skeletal muscle, and the interventricular septum, along with a more than twofold decrease in myoglobin content in the myocardium of the right ventricle, indicates the presence of fatal narcotic intoxication.

The diagnosis of poisoning by narcotic and psychotropic substances remains one of the pressing issues in modern forensic practice. Numerous studies have proposed diagnostic criteria and parameters for fatal poisonings involving narcotic and psychotropic agents; however, these criteria have not been fully elucidated.

**OBJECTIVE:** To develop new diagnostic methods for acute poisoning cases involving narcotic substances (opiates).

**MATERIALS AND METHODS.** The study material consisted of 226 blood samples obtained from 27 corpses who had died as a result of acute poisoning with narcotic substances. Of these cases, 20 involved male corpses (74.07%) and 7 involved female corpses (25.93%), which underwent forensic medical examination.

**RESULTS.** In cases of acute poisoning with narcotic substances belonging to the opiate group, the concentration of myoglobin in blood and urine was found to be 20 times higher compared to deaths from other causes (control group).

**CONCLUSION.** A tenfold increase in blood myoglobin levels, a twofold increase in urine, and a twofold increase in the left ventricular myocardium and skeletal muscles indicate acute poisoning caused by narcotic substances.

**RELEVANCE OF THE STUDY:** At present, one of the most relevant tasks of forensic medical science and practice remains the diagnosis of poisoning with narcotic and psychotropic substances. Numerous studies have been devoted to the development of various criteria for fatal poisoning caused by narcotics and other toxic psychotropic agents. The literature contains several works proposing methods for diagnosing the cause of death resulting from intoxication with narcotic substances of the opiate group [2,3,4,5,6].



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However, traditional methods for detecting narcotic substances in blood during forensic medical examinations require careful sample preparation as well as significant time and material resources [4,5].

Currently, the main directions in postmortem diagnosis of acute poisoning with narcotic and psychotropic substances include morphological examination (morphometric methods comprising standard autopsy and histological examination), chemical, and biochemical investigations. Among these, biochemical methods are the most advantageous in terms of time efficiency and economic costs when addressing this diagnostic task.

In cases of narcotic and alcohol intoxication, indicators of renal and hepatic failure as well as the activity of certain enzymes are usually examined. However, to date, there are no reliable biochemical criteria specific for diagnosing death from these types of intoxication. Moreover, the structure of forensic medical bureaus still lacks a biochemical laboratory with an appropriate staff of specialists. Nevertheless, there are data indicating a significant and reliable change in myoglobin levels in cases of poisoning with opiate-group narcotic substances [1].

**Aim of the Study:** To develop a fundamentally new method for diagnosing death resulting from narcotic intoxication, particularly opiate poisoning.

**MATERIALS AND METHODS:** The study material consisted of 226 blood analyses obtained from 27 cadavers of individuals who died from acute poisoning with narcotic substances, with the cause of death verified by toxicological examinations. Autopsies were performed during the period from 2016 to 2018 in the thanatology department of the Republican Bureau of Forensic Medical Examination.

Among the deceased, males accounted for 74.07% (n = 20) and females for 25.93% (n = 7) [7]. The mean age of the victims was 33.71 ± 0.21 years. In most cases, the circumstances of poisoning were unknown. According to the orders appointing the forensic examination and the “protocol of the primary examination of the body at the place of discovery,” the bodies were found in apartments.

The control group consisted of 20 cadavers of individuals whose cause of death was cardiovascular disease.

Myoglobin levels in blood, urine, skeletal muscle, and myocardium were determined at the Department of Biochemistry and Medical Chemistry of the Tashkent Medical Academy using well-established standard methods [1].

**RESULTS AND DISCUSSION.** The study was conducted in several stages. At the first stage, the concentration of myoglobin in blood and urine was determined. In cases of fatal narcotic intoxication, an increase in this parameter was



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observed, which, when considered together with pathomorphological changes, provides grounds for further forensic toxicological examination.

The level of myoglobin in whole blood in cases of overdose with opiate-group narcotics was 20 times higher than in the comparison group (individuals who died from cardiovascular diseases and mechanical asphyxia; total n = 20). An even more indicative parameter was the concentration of myoglobin in blood serum. In cases of narcotic poisoning, serum myoglobin levels increased by 300-fold or more compared to the control group. The level of myoglobin in urine in this group was eight times higher than in the control group (Table 1).

**Table 1.**

**Myoglobin Concentration in Whole Blood, Blood Serum, and Urine in Fatal Narcotic Poisoning (M ± m)**

| **Parameter** | Control group (n = 20) | Fatal intoxication (n = 27) |
|---|---|---|
| **Myoglobin (whole blood), ng/mL** | 8965±331 | 169913±2458* |
| **Myoglobin (blood serum), ng/mL** | 45,5±2,7 | 15975±1241* |
| **Myoglobin (urine), ng/mL** | 38±15 | 304±47* |

Asterisks (*) indicate statistically significant differences in myoglobin concentrations in cases of fatal narcotic intoxication compared with the control group ($p < 0.001$). MG – myoglobin.

**Stage 2:** Determination of myoglobin content in three myocardial regions and skeletal muscle. The myoglobin concentrations in the myocardium and skeletal muscle are presented in Table 2.

**Table 2.**

**Myoglobin Concentration in the Myocardium and Skeletal Muscle in Fatal Narcotic Poisoning (M ± m)**

| **Group** | **Right ventricle** | **Left ventricle** | **Interventricular septum** | **Skeletal muscle** |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |
| Control, n=20 | 14,4±0,4 | 13,8±0,3 | 12,4±0,4 | 16,4±0,4 |
| Fatal narcotic intoxication n=27 | 8,1±1,2* | 30,4±1,8* | 35,1±1,4* | 38,8±2,1* |



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Asterisks (*) indicate statistically significant differences in myoglobin concentration in cases of fatal narcotic intoxication compared with the control group ($p < 0.05$).

As seen from the data in Table 2, a significant decrease in myoglobin levels (1.8-fold) was observed in the right ventricle of the heart compared with the control group. Conversely, a significant increase (2.2-fold) in myoglobin concentration was detected in the left ventricle of the heart in narcotic victims relative to the control group. A similar significant elevation in myoglobin levels was observed in the interventricular septum, amounting to a 2.8-fold increase compared with the control group. Evaluation of myoglobin concentration in skeletal muscle during narcotic overdose revealed a significant increase of 2.4-fold relative to the control group.

Thus, the diagnostic method for determining death from narcotic intoxication developed in this study is summarized in Table 3.

**Table 3.**

**Diagnosis of Fatal Narcotic Intoxication Based on Myoglobin Content**

| **Biological Sample** | **Myoglobin** | |
|---|---|---|
| | **Content** | **Fatal Narcotic Intoxication** |
| **Blood** | до 10000 нг/мл+ | **Increased, at least 10** |
| **Urine** | до 160 нг/мл | **Increased, at least 2** |
| **Myocardium of Right Ventricle** | 14-14,8 мкг/мг ткани | **Decreased, at least 1.8** |
| **Myocardium of Left Ventricle** | 12,8-14,4 мкг/мг ткани | **Increased, at least 2** |
| **Interventricular Septum** | 12-12,8 мкг/мг ткани | **Increased, at least 2** |
| **Skeletal Muscle** | 16-16,8 мкг/мг ткани | **Increased, at least 2** |

**Practical Examples**

**Example 1:** Blood from the femoral vein, myocardium of the right and left ventricles, and skeletal muscle were collected from the cadaver of Mr. N., 35 years old, for the study.

**Objective of the study:** Myoglobin content.

**Case circumstances:** "The body was found in the deceased's apartment."

**Table 4.**

**Laboratory Test Results**

| **Biochemical Parameter** | **Sample** (или **Biological Sample**) | **Concentration** | **Normal Range** |
|---|---|---|---|



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| | | | |
|---|---|---|---|
| Myoglobin | **Blood** | 122880 ng/mL | до 10000 ng/mL |
| | **Urine** | 307 ng/mL | до 160 ng/mL |
| | **Myocardium of Right Ventricle** | 6 µg/mg | 14-14,8 µg/mg tissue |
| | **Myocardium of Left Ventricle** | 32 µg/mg | 12,8-14,4 µg/mg tissue |
| | **Interventricular Septum (IVS)** | 37 µg/mg | 12-12,8 µg/mg tissue |
| | **Skeletal Muscle** | 41 µg/mg | 16-16,8 µg/mg tissue |

**Result Assessment:** Death resulted from acute narcotic poisoning (morphine).

**Example 2:** Blood, urine, myocardium of the right and left ventricles, and skeletal muscle were collected from the cadaver of Mr. N., 65 years old, for biochemical analysis.

**Objective of the study:** Determination of myoglobin content.

**Case circumstances:** "The body was found at a bus stop."

**Table 5.**

**Laboratory Test Results**

| Biochemical parameter | Object of study | Concentration | **Normal range** |
|---|---|---|---|
| Myoglobin | **Blood** | 122880 ng/mL | up to 10000 ng/mL |
| | **Urine** | 307 ng/mL | up to 160 ng/mL |
| | Right ventricular myocardium | 6 **µg/mg** | 14-14,8 **µg/mg tissue** |
| | **Left ventricular myocardium** | 32 **µg/mg** | 12,8-14,4 **µg/mg tissue** |
| | Interventricular septum | 37 **µg/mg** | 12-12,8 **µg/mg tissue** |
| | Skeletal muscle | 41 **µg/mg** | 16-16,8 **µg/mg tissue** |

**Assessment of Results:** An increase in myoglobin concentration of more than 10-fold in blood and more than 2-fold in skeletal muscle was observed. Myoglobin was not detected in urine. In the myocardium of the left and right ventricles, as well as in the interventricular septum, myoglobin levels were within



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the reference range. According to the results of this analysis, no narcotic (opioid) poisoning was detected.

**CONCLUSIONS.** An increase in myoglobin concentration of more than 10-fold in blood, 2-fold in urine, more than 2-fold in the myocardium of the left ventricle, skeletal muscle, and interventricular septum, along with a more than 2-fold decrease in myoglobin content in the myocardium of the right ventricle, indicates the presence of fatal narcotic intoxication.

The results obtained using the proposed method, together with forensic chemical, toxicological, and morphological (forensic-histological) analyses, allow the forensic medical expert to scientifically and objectively establish a postmortem diagnosis in cases of acute poisoning with narcotic substances.

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ISSN 3030-3907