

## **Features of Morphological Diagnostics of Drowning**

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**Abstract:** The article is devoted to the forensic diagnosis of drowning. In addition to the well-known specific features when drowning, special attention is paid to the identification of diatom plankton. The necessity of creating a catalog of diatom plankton of the country's water bodies was noted.

**Keywords:** forensic medical examination, drowning, death, diatom plankton.

In forensic practice, drowning should be understood as a separate type of violent death, which is caused by a complex of external effects on the human body when the body is immersed in liquid. Drowning in water is most common. According to statistics, mortality from drowning is on average 10-15% among fatal mechanical asphyxia and about 1% of the total number of autopsies [6,7].

According to annual reports, drowning as a type of violent death in one of the regions of the Russian Federation (in the Republic of Tatarstan) is second only to hanging, car accidents and blunt force trauma [11]. Thus, in 2009, 234 cases of drowning were recorded, and in the hot 2010 - 334 cases. According to the International Amateur Swimming Federation, from 250 to 300 thousand people drown in the world every year, that is, on average, one person every two minutes [2,3].

**The aim of the study** was to establish specific signs of drowning, taking into account the presence of diatom plankton.

Materials and methods of the study. As the material, we examined the conclusions of forensic medical examinations of corpses, compiled in connection with drowning in the Samarkand regional branch of the Republican scientific and practical center of forensic medical examination of the Republic of Uzbekistan. In addition to the generally accepted methods of examining corpses, special attention was paid to collecting material and examining it for the presence of diatom plankton. Since one of the important pieces of evidence of this type of death is the detection of plankton (diatoms), which has specific features: species, class, etc., allowing us to draw a conclusion about the place of death [1,4].

Plankton (from the Greek "wandering") is a collection of organisms that live in the water column and are unable to resist being carried by the current. It consists of numerous bacteria, diatoms and some other algae (phytoplankton), protozoa, some coelenterates, mollusks, crustaceans, tunicates, fish eggs and larvae, and the larvae of many invertebrates (zooplankton). Plankton, directly or through intermediate links in the food chain, serves as food for all other animals living in water bodies. The section of hydrobiology that studies plankton, its species composition, spatial distribution, seasonal changes, food relationships, etc., has developed so much that it has become a separate branch - planktonology.

Pseudoplankton are grains of sand, starch, etc. suspended in water, which can enter the bloodstream with water from the lungs. Diatoms (diatoms, siliceous algae), a division (or type) of algae. Unicellular and colonial organisms. Their cells have a hard siliceous shell, consisting of two halves - the lower (pshoteca) and the upper (epitheca). Reproduction is by division, and after several generations - sexual. About 20 thousand species in fresh and sea water, on damp soil, etc. Fossil diatoms have been known since the Jurassic period, sometimes forming thick deposits - diatomites [5,8].

**Results of the study and their discussion.** The obtained data indicate that the average annual rate of fatal drownings is unstable and ranges from 37 to 72 cases per year, i.e. from 2.0 to 3.9% of the total number of mechanical asphyxia. At the same time, it was established that death from drowning is registered in - 12% of cases - at the age of up to 16 years; 6% of cases - at the age of 60 years and older; 82% of cases - in the working age population (from 16 to 60 years).

The main causes of drownings are the same year after year. First of all, this is the swimming of intoxicated persons in places not designated for swimming, the use of homemade watercraft, the rescue of a drowning person, cases of falling into the water at night, etc.

The most important thing in the forensic examination of the corpses of persons pulled out of the water is to establish the factors that contribute to drowning. At the same time, it is difficult to clarify the circumstances of drowning without knowing the specific location of the incident. Therefore, it is important to develop new objective methods that allow you to clarify the location of the drowning.

In some cases, it was noted that drowning does not necessarily require complete immersion of the body; it is sufficient to immerse only the head or part of it in water with the respiratory openings closed (in a state of alcoholic intoxication, during an epileptic seizure, etc.).

To establish a specific type of drowning, the authors proposed a diagnostic tetrad: fluid in the sinus of the sphenoid bone, acute pulmonary emphysema, air embolism of the left heart, "reflux" of erythrocytes into the thoracic lymphatic duct, which objectively characterizes the patho- and thanatogenesis in various types of drowning [12].

In most cases, the "true" type of drowning in fresh water was observed, which penetrates the blood, causing its dilution, as a result of which the hemoglobin content decreases, the number of erythrocytes decreases, blood chlorides, specific gravity of the blood and other indicators decrease. The blood is more diluted in the left half of the heart than in the right. At the same time, around the openings of the nose and mouth, in the respiratory tract, there is persistent fine-bubble foam - the most valuable diagnostic sign of drowning. At first, the foam is snow-white, then takes on a pinkish tint due to the admixture of serous fluid. Foam is formed during drowning as a result of mixing mucus and desquamated epithelium of the respiratory tract with water and air. The foam disappears after 2-3 days, after which only serous fluid is released from the openings of the nose and mouth of the corpse due to the development of imbibition and hemolysis processes.

During autopsies of people who died from drowning, the lungs are found to be greatly enlarged. Their anterior sections cover the pericardium. Strip-like imprints of the ribs may be visible on the surfaces of the lungs. The surface of the lungs often has a "marbled" appearance. The lungs do not always look the same. In hyperaeria, the lungs are greatly inflated, but dry on section, or a small amount of fluid flows from the surface. Hyperaeria depends on the penetration of air into the tissue under the pressure of the liquid. The alveoli rupture, and air penetrates into the intercellular tissue. Hyperhydria occurs when a person falls under water after a deep exhalation, and it is less common than hyperaeria.

Subpleurally located are Rasskazov-Lukomsky-Palshtauf spots, which are vague hemorrhages in the form of spots or stripes under the pleura of the lungs. They are pale pink. Water from the

lungs enters the left half of the heart with blood, so the blood here is diluted with water and has a cherry-red color.

Drowning is accompanied by swallowing water, especially in cases where this process is delayed and the head appears above the surface. In such cases, a large amount of liquid in which drowning occurred is found in the stomach.

Water may also be present in the initial section of the intestine. In the sinus of the main cranial bone, liquid is found in which drowning occurred.

In some cases, with a perforated eardrum, water irritates the receptors of the middle ear, and death occurs reflexively (according to the so-called auriculo-cardiopulmonary reflex).

When jumping into water head first, damage to the cervical spine was detected upon impact with the surface of the water or the ground.

Rarely, hemorrhages are found in the muscles of the neck and chest: along the sternocleidomastoid muscles, in the pectoral muscles. It has been established that such hemorrhages occur as a result of strong muscle tension during attempts to save oneself.

In more than half of the cases, alcohol intoxication (moderate and severe) is noted, which often contributes to drowning.

The detection of diatomaceous plankton in the internal organs of a corpse is of great importance for the diagnosis of drowning.

Diatoms are single-celled algae with a strong mineral shell (carapace). Diatoms penetrate into the lungs with water during drowning, and then into the bloodstream. Their detection in internal organs indicates drowning. If diatoms are found only in the lungs, postmortem exposure of the body to water should be ruled out.

For the study, sections of the lungs, heart, spleen, kidneys, bone marrow, and fluid from the sinus of the sphenoid bone were taken. A water sample from the body of water where the body was found was necessarily tested for diatom plankton.

When assessing morphological features, the following should be kept in mind: 1) morphological features are not always found together; 2) rotting processes that develop rather quickly change the morphological picture of drowning (in this case, important features either disappear completely or change significantly); 3) many features found during the examination of a corpse and mistakenly attributed to diagnostic ones are only signs of the body being in water; 4) individual morphological features can be found with the same frequency in deaths from drowning, as well as belong to the group of general asphyxic features found in drowning.

In forensic practice, the fact of establishing the correct diagnosis of drowning is important, and, even more so, the answer to the question of its place and duration. This determination is possible as a result of comparing the generic composition of diatoms obtained as a result of mineralization of objects from the corpse with the characteristics of the diatom plankton of the reservoir [9].

Diatom plankton is regularly found in the blood and internal organs during drowning, and the size of the particles penetrating the blood can reach up to 70-100 microns [10].

It has been established that diatom plankton is specific to a certain body of water, and its structure may not change for decades due to the high preservation of its main features. It should be noted that the silicon shell of diatoms can withstand high temperatures, strong acids and alkalis.

The stability of diatom plankton species allows us to solve issues related to determining the location of a drowning incident, since in certain bodies of water plankton, while maintaining its structural properties, changes little or does not change at all.

According to accepted standards, the main objects for examination may be the following fluids, organs and tissues from a corpse in various combinations: kidney; blood (at least 100 ml) from the left half of the heart; brain matter (at least 100 g); spinal cord; heart muscle (at least 100 g); skeletal muscle in intact fascia (at least 100 g); spleen with intact capsule; fragment of femur or humerus with bone marrow (10-15 cm); lung tissue (subpleural plate about 1 cm thick and weighing at least 100 g); water samples (1 l) from a body of water (at the place where the corpse was found and from the presumed place of drowning) in different containers.

According to the literature, to really achieve the research objective, it is necessary to take all the fluid from the sinus of the main bone, 200 g of the lung (marginal sections), 1 kidney in a capsule (with preliminary ligation of the leg) in a separate container. Provided that the material is properly prepared for the study, the number of diatoms found is sufficient to confirm the cause of death from drowning. It is also necessary to solve the problem of the study of diatom plankton and the specificity of its species in the territory of the Republic.

The issue of plankton identification is currently very relevant. It should be borne in mind that the types of diatoms found and their relative quantitative content may indicate not only the fact of drowning, but also the specific body of water in which it occurred. It is also necessary to systematically carry out work to create a catalog of diatom plankton in the country's water bodies. It is necessary to familiarize yourself with the accumulated information on this issue and conduct a study of labeled water samples (at least one liter in volume) from all water bodies.

**Conclusions.** Thus, the obtained data indicate that all morphological signs that can be detected during the examination of a corpse taken from water, in our opinion, should be divided into three groups, since these signs are revealed either during external and internal examination, or during laboratory tests. Cases of drowning were mainly noted in people of working age, more often in men, and in more than half of the cases were accompanied by alcohol intoxication. Research aimed at identifying regional features of the qualitative and quantitative composition of diatom plankton in all river basins and reservoirs is necessary.

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