Jurnal Kedokteran Syiah Kuala
Volume 22, Number 3, September 2022
Pages: 122-123

ISSN: 1412-1026
E-ISSN: 25500112
DOI: 10.24815/jks.v22i3.26767

The role of the diatom test: homicide or suicide?

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Abstract. Drowning is one of the asphyxia types caused by fluid entry into the airway. Death-related drowning is one of the hardest things to diagnose in forensic medicine, primarily if the victim is found to be in a decomposed state. Examination of decomposed often does not show typical signs. Laboratory examinations using bone marrow samples are considered the best as they prove the hypothesis of antemortem drowning and are the least affected by contamination during post-mortem submersion. A corpse was found in the residential area on the east side of the beach, Tambaksarioso Village, Asemrowo District, on Tuesday, May 18, 2021, at 13.30 West Indonesian Time and reported to the police for investigation. The body was then identified at Dr. Soetomo General Hospital by a forensic expert. External, internal, and laboratory investigations were conducted. A positive diatom result was obtained in the acid destruction test using the right femur. The diatom test is a standard to confirm drowning as a cause of death and localize the drowning site. The diatom analysis is the only forensic tool used to ascertain whether the cause of death is due to drowning or not.

Keywords: Bone Marrow; Diatom test; Drowning; Homicide.

Introduction

The diagnosis of drowning is challenging in forensic pathology. External examination and autopsy results are, in most cases, not specific, and laboratory investigations are controversial in the scientific community. Mainly if the drowned victim is decomposing, there are no typical signs. The diagnosis of drowning may be achieved after reviewing all the forensic examination results, including external, internal, and laboratory examinations [1].

In death-related drowning, there is a suspicion of antemortem or postmortem drowning. In these medico-legal aspects, the diatom test plays a very important role in ascertaining the cause of death. The diatom test has emerged as one of the most important tests in forensic science. Therefore, in drowning-related death, a correlation must be established between the diatoms extracted from the organ samples and the water samples collected from the scene to determine drowning deaths in Forensic laboratories successfully [2].

Case report

A decomposed corpse with no identity was found in a drowned position on the east side of the beach of Surabaya on Tuesday, May 18, 2021, at 13.30 West Indonesia Time and reported to the police for investigation. A forensic expert then identified the body.

On the external examination, we found signs of advanced decay and saponification in the form of soft-tissue destruction on the face, loss of eyeballs, Blackish skin, destruction of genital organs, maggots 'infestations with the most effective measurement of 1.5 cm; washer's woman's hand, pink teeth, blood infiltration in orbital cavity, right and left head, right upper arm, left lower leg, and fracture of right forearm, left palm, right lower leg, and left lower leg (postmortem).

On the internal examination, the organs were decomposing. We found Sands in the throat, main airways, bronchial branches, aortic hemolytic staining, edema aquosum, paltauf's spots, and Neil's sign. Blood infiltration was found on both sides of the skull. In the laboratory, a destruction test using the left femur was conducted. On examination under a microscope, we found the presence of translucent diatoms.

Discussion

Although the recovery of the corpse from the water was highly suggestive of drowning, medico-legal investigations confirmed the occurrence of homicide because we found blood infiltration in the orbital cavity, right and left head, right upper arm, and left

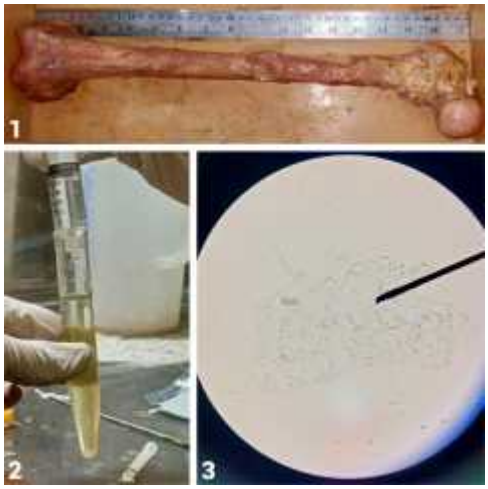

Fig. 1 Right femur bone. **Fig.2** Laboratory diatom procedures. **Fig.3** Transluscent diatoms with 40x magnification.

lower leg. Violent crimes are often associated with intense physical contact between the victim and the perpetrator due to struggling at the crime scene [3]. As far as the classic signs of drowning are concerned, they include a washer's woman's hand, pink teeth, sands in the throat, main airways and bronchial branches, aortic staining in the aorta, edema aquosum, and Paltauf's spots in the lungs, and Neil's sign in the middle ear and temporal bone.

Additional tests that can be done to strengthen the diagnosis of death due to drowning are diatom examinations. This diatom examination was carried out on the bone marrow of the femur because the body had decomposed (Figure 1). Diatoms are microscopic unicellular algae that inhabit virtually all aquatic environments. There are about 15000 known diatoms species. Their wall is silica, which resists acid digestion, heat, and putrefaction. Most species occupy a size between 10 microns to 80 microns [4]. If a person dies from drowning, the liquid with diatoms will enter the respiratory or digestive tract and into the bloodstream through the damaged capillary walls when the victim was alive. We performed the diatom examination technique on a sample of the right femur in the following way. The right thigh bone was cut approximately 5 centimeters and put into a measuring cup, then added 10 ml of saturated nitric acid [HNO3] and 0.5 ml of saturated sulfuric acid [H2SO4]. We keep it until the color of the tissue turns black because of the carbon. Then add a few drops of sodium nitrate [NaNO3] until a clear color is obtained. Sometimes the nature of the acid liquid is difficult to test; therefore, a small amount of weak NaOH is added (often not done because too much will destroy the chitin). Then we centrifuged at a speed of 1000 rpm for 1-2 minutes, washed with distilled water, and the pellets were stored/taken slightly for inspection, dripped on a glass object, and then dried over low heat. Then we put drops of immersion oil and examined them under a microscope [5] (Figure 2). On examination under a microscope, we found the presence of translucent diatoms (Figure 3).

The presence of diatoms in the biological sample indicates drowning, proving that such organisms are present in the submerging medium. For the suspected drowning, the diatom method is supportive of forensic expertise. The recovery of diatoms from various examined organs, and their qualitative and quantitative composition, if possibly treated without the possibility of contamination, can be reliable proof of the time and place of drowning. Thorough forensic investigations are required to determine the cause of death in bodies recovered from wells, pits, water supplies, and sewer systems because the death may result from various factors and lesions on the corpse [4]. The diatom test is considered a standard to confirm drowning as a cause of death and localize the drowning site. The diatom analysis is the only forensic tool used to ascertain whether the cause of death is due to drowning or not [5].

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