H117 Diatom Test: Still an Irreplaceable Analysis

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The goals of this presentation are to verify how: (1) the standardization of a diatom test on femoral bone marrow allows for more scientifically correct data to increase the accuracy of the diagnosis of death by drowning and to discriminate it from other causes of death; and, (2) this work seeks to confirm the high specificity of the diatom test.

This presentation will impact the forensic science community by showing how exceptional knowledge of the method, and the ability to apply it rigorously, could be a useful means of confirming a diagnosis of drowning.

Since the early 1900s, the diatom test has been included among tests that allow the diagnosis of drowning. There are many studies on this subject that confirm the diagnostic reliability of this test, while acknowledging its obvious limits (no rigorous implementation by the operator and false positives).

Diatoms are aquatic unicellular algae, widespread in both fresh and salt waters worldwide. They contain a cell wall made of silica (frustule) of various shapes, which reveal gaps for external exchanges (pores). Frustule is highly resistant to chemical and physical treatments that can dissolve human tissues, and for this reason it can be pointed up.

The theory behind the diatom test is that when fluid enters the lung, diatoms enter within the fluid and pass the alveolar-capillary barrier. If the circulatory system is functioning, diatoms are disseminated to peripheral organs; this is an indication of breathing activity at the entrance of the drowning medium in airways. After their diffusion, diatoms can be found in several tissues. The femoral bone marrow is preferred both because of its resistance to external contamination and in cases of a highly decomposed body.

It is important to consider that diatoms decrease their concentration during the transit from outside to the bone marrow, decreasing by 100 to 1,000 times (finding an excess of diatoms means there was a contamination). Moreover, high-dimension diatoms are most likely contaminants (not rigorous implementation by the operator and false positives). It is also important to match the diatoms found in bone marrow and those found in the drowning medium. This comparison could lead to a clear identification of the drowning area.

This study is based on the analysis of 53 corpses recovered from water, of which 36 drowned and 17 died from other causes. In all cases, a complete autopsy, histological investigations, and the diatom test were performed.

In the diatom test, a sample of femoral bone marrow was collected during the autopsy using sterile surgical devices further cleansed with diatom-free alcohol. From this sample, 10ml of bone marrow was processed with nitric acid and successively examined with an optic microscope, using bright field and phase contrast.

Among the drowned subjects examined, 28 tested positive (77.77%) and 8 negative (22.22 %); among the decedents found dead in water, none showed diatoms in the bone marrow. The Fisher test was performed, demonstrating that these two groups were significantly different ($p<0.0001$).

Therefore, a diatom test, executed in a meticulous and standardized manner, could be considered essential support for a drowning diagnosis, in addition to more common practices (analysis of the circumstances, postmortem examination, and histological findings). This method, inexpensive and easy to reproduce, could be an important aid for the pathologist to differentiate drowning cases from other cases of death occurring in water.

Drowning, Diatoms, Forensic Pathology