

A Crucial Role of Diatoms in Forensic Investigations in the Crime Scene of Haryana -A Case Study

Ayushi Khandelwal¹

Student

Department of Pharmacy

Chandershekar College of Pharmacy

Corresponding Author's E-mail: ayushikhandelwal01@gmail.com

Abstract

Diatoms, the most common kind of phytoplankton, are a large genus of eukaryotic algae found in a wide range of aquatic settings. These are important for connecting suspects and victims to crime scenes in or near water. When a person drowns, water is breathed into the lungs and into the circulatory system, therefore any diatoms present in the drowning medium can eventually make their way into internal organs such as a drowning victim's bone marrow, spleen, and brain. Any diatom detected in these organs would thus indicate ante mortem water inhalation, implying that drowning was either a cause or a contributing factor to death. One of the most significant challenges in the research of drowning in the past has been the search for a sensitive, precise, and simply applied test for the cause of death. As a result, the diatom test has emerged as the most important laboratory method for detecting drowning. In the current study, five drowning cases were investigated using the "Diatom Test" in the forensic science laboratory in Madhuban, Haryana (India). Four of these instances were determined to be positive for drowning, while one was judged to be negative.

Keywords: *Diatoms; Diatom Test; Drowning.*

INTRODUCTION

Death by drowning is described as death caused by submersion in a liquid, with

hypoxemia and irreversible cerebral anoxia being the mechanisms [1]. Although there are certain common

indicators of drowning, it is difficult to confirm a drowning death when post-mortem signs are impossible to locate in the case of deceased corpses [2]. Drowning is one of the most challenging diagnoses in forensic pathology, hence a plethora of tests have been developed to provide confirmation of a victim's death by drowning[3,4]. One of these tests is the diatom test, which is useful in determining drowning deaths. Diatom count, according to Peabody[5,6] and Auer and Mottonen[7], can be utilised to distinguish between drowning and non-drowning cases. Because the detection of diatoms in tissues may aid in the diagnosis of drowning, an effective technique of extraction and microscopic inspection of diatoms from tissues is critical.

Materials and Methods

The research was carried out in the Biology Division of the Forensic Science Laboratory in Madhuban, Karnal (Haryana), India, and all of the cases presented here are fresh water drownings. Internal organs (sternum, clavicle, femur, and lungs) and water samples (from where the dead corpses were collected) were delivered to the laboratory as criminal evidence following post-mortem of deceased bodies. Cases were opened and processed in accordance with regular

procedures. In each case, the exhibits were placed in separate jars. Each jar holding the sternum, clavicle, femur, and lungs received 50 cc of nitric acid. The samples were kept undisturbed overnight before being cooked for 30 minutes the next day. A transparent yellow solution with a fat layer on top was produced. The fat layer was removed, and the remaining samples were centrifuged for 10 minutes at 4000 rpm. The centrifugation procedure was done three times in the same manner. The supernatant was removed, and the pellets were rinsed with distilled water and centrifuged again. After washing the pellets, microscopic slides were made, dried on a hot plate, and examined under the microscope with immersion oil. Slides were also made from the water sample supplied to the laboratory where the drowning occurred. The diatom species detected in organ samples and water samples were compared, and relationships were formed as a result.

RESULTS

Case 1

The body of a 19 year old boy was found submerged in a water tank. No sign of injury were found at autopsy. Nitric acid extract of internal organs (sternum, clavicle, femur and lungs) revealed the presence of three types of diatom species

(*Navicula lanceolata*, *Navicula oblonga* and *Gomphonema gracile*). The same three types of diatom species were found in the water sample from which the body was recovered. So the cause of death was assigned due to drowning.

Case 2

The body of a 26 year old lady was recovered from a canal. Signs of head and neck injury were traced during autopsy. Nitric acid extract of sternum and clavicle showed the absence of any diatom species. However, two diatom species (*Nitzschia subtilis* and *Navicularadiosa*) were detected in the water sample from where the body was found. The cause of death was attributed to the reasons other than drowning which was later accepted by her husband that he murdered her wife because of having extra-marital affair.

Case 3

The body of a 23 year old lady was recovered from a village well. No sign of injury were found during autopsy. Father of the lady claimed that her daughter was being murdered and then thrown into the well to prove the case as suicide. Nitric acid extracts of sternum, clavicle and femur showed presence of three diatom species (*Nitzschiagracilis*, *Cymbella* and *Navicularadiosa*). Same three types of

diatom species were detected from the water sample of well in which the body was found. Drowning was the cause of death.

Case 4

The body of a 48 year old lady was recovered from a river. No specific reason of death was found at autopsy. Microscopic studies of slides prepared from nitric acid extracts of sternum, clavicle, femur and lungs proved the presence of three diatom species (*Cymbellacymbiformis*, *Gomphonemaspheroporum* and *Nitzschiafrustulum*) which were the same species as traced from the water sample of river (From which the body was recovered). Death was attributed to drowning. The family members also accepted that the lady was mentally disturbed and left the home a couple of days before the death.

Case 5

A highly putrefied body of 30 year old male was recovered from a canal. No information about causes of death was obtained at autopsy. Studies from extracts of nitric acid of sternum, clavicle and femur proved the presence of two species of diatom (*Cymbellaventricosa* and *Cocconeisplacentula*). Water samples from

multiple sites were sent to the laboratory to trace the original site of drowning. Same two types of diatom species were found in the water sample from a site distant from the site from where the body was recovered. The cause of death was drowning which was also proved by further police investigation.

Discussions

The preceding instances demonstrate the importance of diatom tests in the medicolegal analysis of drowning situations. However, there is some debate concerning the reliability of the diatom test. Few researchers have reported finding diatoms in the tissues and bone marrow of people who died by reasons other than drowning [8,9,10,11,12, and 13]. However, if sufficient care is taken with all specifications and analysis is completed without contamination, it is indicated that it can serve as major supportive evidence in criminal investigations. In terms of sample preparation contamination, it is well known that instruments, gloves, papers, water supplies, and chemicals are all possible sources of contamination, and tap water may contain diatoms [14,15]. However, in the current investigation, precautions are taken to avoid contamination, and the use of tap water is fully avoided throughout the sample

preparation method. The medico-legal value of the diatom test for drowning may be greatly increased by enhancing its sensitivity, and the use of polymerase chain reaction (PCR) to amplify the minute quantities of diatom genome deposited in the bone marrow was suggested [16]. In conclusion, the diatom test for drowning was used to solve five instances reported in our study, and it was found to be highly significant in giving the true cause of death.

REFERENCES

1. DiMaio DJ, DiMaio VJM (1989.) Drowning. In: Forensic pathology. Elsevier, Amsterdam pp. 357-365.
2. <http://www.svazi.com/v1/forensic/index.htm>
3. Reh H (1969). Diagnostik des Ertrungstodes und Bestimmung der wasser-zeit. Triltsch, Dusseldorf, pp. 180.
4. Schneider V, Kolb KH (1969). Über den nachweis von radioaktivmarkierten Diatomeen in den Organen. Beitr Gerichtl Med, 25: 158–164
5. Peabody AJ (1989). Diatoms and Drowning: A review. Med. Sci. Law, 20: 254-61.

6. Peabody AJ (1997). Diatoms in Forensic Science. *J Forensic Science*, 17: 81-87.
7. Auer A, Mottonen M (1988). Diatoms and drowning, *Rechtsmed*, 101: 87-98. (22)
8. Mueller B and Marchand EI (1929). 'Introduction den Lungenalveolen, in des Kreislaufwährend des Ertrinkungsvorganges. *Dtsch. Z. GesamteGerichtl. Med*, 9: 149-47.
9. Peterson F (1963). Diatomeenbefunde bei Wasserleichen. *Deutsch.Ztschr. ger. Med.*, 54: 376-78.
10. Otto H (1961). Über den Nachweis von Diatomeen in menschlichen Lungenstäuben. *Frankf Z Pathol.*, 71: 176-81.)
11. Porawski F (1963). Investigation on the occurrence of diatoms in organs in death from various causes. *J For Med.*, 13: 134-87.
12. Karkola K, Neittaanmaki H (1981). Diagnosis of Drowning by Investigation of Left Heart Blood. *Forensic Sci Int.*, 18: 149-53.
13. Foged N (1983). Diatoms and Drowning-Once More. *Forensic Sci. Int.*, 21: 153-9.
14. Pachar JV, Cameron JM (1993). The diagnosis of drowning by quantitative and qualitative diatom analysis. *Med Sci Law*, 33:291-9.
15. Koseki T (1968). Fundamental examinations of experimental materials and control animals on the diagnosis of death from drowning by the diatom method. *Acta Med. Biol.*, 15: 207-19.
16. Pollnen M S (1998). Diatoms and Homicide. *Forensic Science International*, 91: 29-34.
17. Timperman J (1969). Medico-legal problems in death by drowning: Its diagnosis by the diatom method, *J. Forensic Med.*, 16(2): 45-75.