H67 A Quantitative Investigation of Diatom Dispersion in Lung Tissue of Confirmed Drowning Iincidents

Dominik Hagen, BS, Salzburg 5020, AUSTRIA; Astrid Obermayer, Salzburg 5020, AUSTRIA; Walter Stoiber, University of Salzburg, Salzburg 5020, AUSTRIA; Walther Gotsmy, Salzburg 5020, AUSTRIA; Fabio Carlo Monticelli, Interfacultary Department Forensic Pathology, Salzburg 5020, AUSTRIA; Stefan Pittner, PhD, University of Salzburg, Salzburg, AUSTRIA*

Learning Overview: The goal of this presentation is to provide additional information about the mechanism and dispersion of diatom inhalation during a drowning event.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by demonstrating how a quantitative method of diatom analysis is a sufficient tool for the diagnosis of drowning and how microorganisms are distributed within lung tissue upon inhalation of a drowning medium.

According to the World Health Organization (WHO) in 2020, drowning is the third most-common cause of unintentional injury-related death worldwide. A reliable identification of death by drowning can be subtle and not always possible, if certain drowning signs like foam cones, emphysema aquosum, or Paltauf's spots are absent. Therefore, diagnoses are often arrived at by combining the findings from autopsy, toxicological tests, and fine-structural examination of internal organs. A quantitative investigation of diatoms present in lung tissue serves as another good indicator to confirm a drowning. Based on the consideration that diatoms are present in almost every natural water body and are incorporated when water is inhaled as a result of the respiratory reflex, their presence in lung tissue and other internal organs is thus proposed as a sign of death by drowning. According to previous research, however, a diagnosis of drowning by the mere presence of diatoms in peripheral organs remains controversial due to the high inaccuracy and susceptibility for contamination effects.

While the classical diatom test focuses on qualitative analysis per light microscopy, a recently developed method utilizes a quantitative assessment by comparing the concentration of diatoms between lung tissue and the corresponding drowning medium, which allows for the calculation of an L/D value. The adaption of this technique (Microwave Digestion-Vacuum Filtration-Automated Scanning Electron Microscopy) achieves a maximum recovery of diatoms, ensures an easy identification with high resolution, and was optimized and validated for implementation. As part of routine autopsies of drowned individuals, tissue samples of lung, liver, and kidney as well as the drowning medium were taken as evidence for analysis. To determine a ratio between tissue and drowning medium, a conventional acid digestion, automated filtration, and quantification by scanning electron microscopy was applied. For previous case studies, lung tissue samples were taken from the upper left tip of the lung, the area of lowest inhalation pressure, due to the assumption that the probability of a possible drowning event was highest if diatoms were present there. It is unclear whether different parts of lung tissue would display different diatom concentrations. To investigate regional differences in general, and to determine which part of the lung is best qualified for valid results, the diatom ratio of multiple sampling sites within the lungs were compared. Seven different regions allocated across both pulmonary lobes of three confirmed drowning cases were examined to obtain a broader understanding of the mechanisms of diatom inhalation and ultimately the replicability, accuracy, and precision of this technique.

Drowning, Diatom Test, Scanning Electron Microscopy

*Presenting Author