H119 Postmortem Protein Degradation as a Tool to Estimate the Postmortem Interval (PMI): A Systematic Review

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Learning Overview: The goal of this presentation is to provide an overview of the research on forensic postmortem protein degradation of the past 20 years, discuss limitations and the current state of knowledge, and address future perspectives and important open research questions.

Impact on the Forensic Science Community: Estimation of the PMI is of critical importance in forensic routine, but often extremely difficult. Novel techniques to contribute to the current methodic spectrum are certainly required, but published research often just scratches the surface. This presentation will impact the forensic science community by highlighting the immense potential of protein degradation for PMI estimation and provides the basis for targeted future research.

Background: Estimation of the PMI is a critical task in forensic practice. In recent years, biochemical analysis of the postmortem breakdown of biomolecules, especially proteins, has become of significant interest in this regard. Numerous "novel methods for PMI estimation" have been proposed, addressing proteolytic processes, and according postmortem alterations in a variety of tissues. However, much of the existing work consists of basic research studies, using animal models or a small number of human cases, and/or does not take the numerous possible influencing factors, such as environmental temperature, age, or others, appropriately into account. This literature review aims to investigate the current state of knowledge and the future perspectives of postmortem protein decomposition for the use in forensic PMI estimation.

Objectives: A systematic review of the literature to evaluate the current research status of protein degradation-based PMI estimation is provided. Special attention is dedicated to the applicability of the proposed approaches/methods in routine forensic practice.

Method: A systematic review of the literature on protein degradation in tissues and organs of animals and humans was conducted. A search of the scientific databases PubMed® and Ovid for articles published between 1999 and December 2019 was performed. Additional searches were performed in Google® Scholar and the reference lists of eligible articles.

Results: A total of 36 studies were included. This enabled this study to consider the degradation pattern of over 130 proteins from 11 different tissues, studied with different methods, including well-established and modern approaches. Although comparison between studies is complicated by the heterogeneity of study designs, tissue types, methods, proteins, and outcome measurement, there is clear evidence for a high explanatory power of protein degradation analysis in forensic PMI analysis.

Conclusion: Although only few approaches have yet exceeded a basic research level, the current research status provides strong evidence in favor of the applicability of a protein degradation-based PMI estimation method in routine forensic practice. Further targeted research efforts toward specific aims (also addressing influencing factors and exclusion criteria) will be required to obtain a robust and reliable laboratory protocol and collect sufficient data to develop accurate multifactorial mathematical decomposition models.

PMI, Protein, Review

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