Analysis of cadaveric VOCs collected during autopsy using GC×GC-HRTOFMS

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Objectives: During autopsy, gases discovered within a body using postmortem multi-detector computed tomography (PMCT) can be withdrawn and analyzed for their contents. This can aid in determining cause of death in case scenarios (e.g. gas embolism) (1). As the sampling method has been developed to collect such gases, it is also possible to exploit this sample matrix by analyzing volatile organic compounds (VOCs) that may aid in determining the taphonomic state of the body. Such information may be useful in estimating postmortem interval in forensic casework. The objective of this work is to develop a VOC analysis method on cadaveric gases that can be used as a routine method in medicolegal institutions worldwide.

Method: Comprehensive two-dimensional gas chromatography coupled with high-resolution time-of-flight mass spectrometry (GC×GC-HRTOFMS) was used in a first proof-of-concept (2) study to determine whether any differences could be detected in gases between different areas of the body, as well as between different bodies. Following PMCT scanning and gas withdrawal, samples were subjected to headspace solid phase microextraction (HS-SPME) and analyzed using GC×GC-HRTOFMS. Following proof-of-concept, optimization studies were performed on SPME fiber type, exposure time, desorption time, desorption temperature, and split ratio. An internal standard approach was tested using on-fiber standardization with pre-exposure to a mix of deuterated VOCs. The optimized method was applied to samples from five bodies and differences between these bodies were compared.

Results: Initial proof-of-concept studies demonstrated the ability to differentiate samples of internal gases based on the VOC profile. An optimized SPME method was able to be determined that can be applied for future research studies focused on large scale sample collection from medicolegal centers worldwide. The internal standard approach was found to provide improved chromatogram alignment and normalization. Differences were detected between samples collected from various regions in each body. As such, it was recommended that samples from the heart and abdominal cavity be focused on in the future to reduce variation in sample composition coming from inter-personal differences.

Conclusions: The developed method is minimally-invasive and can provide valuable information about the status of the body prior to further more invasive surgical procedures. A broad study of individuals from various locations around the world would assist in developing a database that will aid in the interpretation of such samples in the future.

References:

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