H168 Fatal Obstructive Asphyxia: Trans-Pulmonary Density Gradient Characteristic as a Relevant Identifier in Postmortem Computed Tomography (PMCT)

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Learning Overview: After attending this presentation, attendees will understand the key findings that may help identify cases of fatal obstructive asphyxia, such as smothering or manual strangulation.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by explaining how the forensic identification of fatal obstructive asphyxia may be of relevance when occurring early in the management of a given case. Hence, knowledge of relevant findings and their differential diagnoses may be of significance.

Background: The initial qualitative impression had been that obstructive asphyxia typically appeared to correlate with absence or reduced postmortem hypostasis as well as increased pulmonary radiotranslucency. Categories initially included within obstructive asphyxia were fatal aspiration of gastric contents into lungs, fatally blocked trachea or bronchi due to foreign body, fatal ligature strangulation, fatal manual strangulation, and smothering.

Method: To investigate the effects of obstructive asphyxia on the Postmortem Computed Tomography (PMCT) appearance of lungs, this study matched 24 cases of obstructive asphyxia with age-sex matched controls. Among the bodies that were examine routinely, there were a number of instances where there had been findings suggestive of some form of obstructive asphyxia: at the death scene, or when documenting the body's position in relation to the death scene, when examining the body. Routinely, such cases are subsequently admitted to this institute for PMCT and medicolegal autopsy upon which further findings emerge that then are evaluated in conjunction with the previous information.

Case selection was performed retrospectively by sampling all cases of 2014 through 2017 using criteria as detailed below. Only cases with full body PMCT, autopsy, and with a full final report were considered. Cases with fatal hypothermia, fatal blood loss, detectable injury of the lungs, or putrefaction with notable gas in soft tissues, vessels, or organs were excluded from the study.

This study manually placed density profile vectors, with a start at positionally dependent locations of each lung to derive PMCT densities for multivariate statistics. For each lung, such a vector was obtained, resulting in two vectors for each case.

As fatal gastric content aspiration cases did not significantly differ from the controls, they were re-grouped into the control group for further testing. The density vectors thus contained pulmonary densities starting from the positionally lowest to the opposite location of each lung.

Results: Quantitatively, the obstructive asphyxia case group featured reduced or absent postmortem hypostasis in the lungs and an overall lower density. Linear multivariate statistics (general linear models, linear discriminant analysis) performed relatively poorly, whereas "shallow" neural networks yielded significantly better discrimination. With disjunct training and test sets, neural networks achieved Correct Recognition Rates (CRR) of obstructive asphyxia cases of more than 95%.

Conclusions: Within a more narrowly defined collective of obstructive asphyxia, pulmonary PMCT data appears to contain sufficient information to reach a relatively high level of discrimination. This questions the value of an exclusively death scene-focused decision, making for further investigations and may justify a wider use of PMCT. Conversely, obstructive asphyxia remains difficult to diagnose conclusively based on PMCT alone.

Fatal Obstructive Asphyxia, Postmortem CT, Forensic Pathology