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American Academy of Forensic Sciences

75th Anniversary Conference

AMERICAN ACADEMY OF FORENSIC SCIENCES

75

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PROCEEDINGS

of the American Academy of Forensic Sciences 75th Anniversary Scientific Conference

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PROCEEDINGS

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TABLE OF CONTENTS

Special Sessions 1

Case Break Sessions 5

Luncheon Seminars 8

Workshops 11

Scientific Sessions

Anthropology 38

Criminalistics 171

Digital & Multimedia Sciences 353

Engineering & Applied Sciences 387

Forensic Nursing Science 428

General 449

Jurisprudence 589

Odontology 631

Pathology/Biology 654

Psychiatry & Behavioral Science 782

Questioned Documents 813

Toxicology 836

Last Word Society 903

Young Forensic Scientists Forum Posters 909

Financial Disclosure Indexes 938

Key Word Index 957

Presenting Author Index 971

I96 A Pilot Study to Investigate If and How Postmortem Micro-Computed Tomography (Micro-CT) Can Be Used to Differentiate Stillbirths From Livebirths

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Learning Objective: After attending this presentation, attendees will better understand the importance of postmortem data to differentiate stillbirths from livebirths.

Impact Statement: This presentation will impact the forensic science community by reporting the first study that deals with the use of a novel postmortem technique (micro-CT) to differentiate stillbirths from livebirths.

Differentiating stillbirths from livebirths is one of the most challenging tasks for forensic pathologists. Historically, the main method used in determination of live birth was the flotation test, also known as hydrostatic test. The test is based on the premise that if an infant has breathed before dying, the lungs will be inflated. Therefore, if the lungs float when immersed in water, this indicates that they are inflated, and the test is considered positive. If the infant has not breathed, the lung sinks, and the test is considered negative. However, there are arguments about the reliability of the floatation test: in fact, it can be considered at best as a suggestive pointer, but never a definitive test itself. Sometimes this method can be helped by performing microscopic examination of the lungs. The latter is based on the evaluation of alveoli's aeration—that supposes live birth—while uniformly unaerated is indicative of stillbirth. Nevertheless, according to literature, histological studies are more indicative of fetal lung maturity than the presence or respiration. In past years, a great contribution was made by postmortem imaging. The utility of postmortem imaging is widely acknowledged, with the major advantage being that it can occur before the autopsy without disruption of the body. The postmortem Computed Tomography (PMCT) has been used to investigate the presence and the distribution of air in lungs or in the gastrointestinal tract in infants. Gas distribution may be regarded as indicating inhaled and swallowed air in the lungs and in the gastrointestinal tract, and is, therefore, used as a proof of live birth.

Recently, higher resolution than PMCT has been reached through Micro-Computed Tomography (micro-CT). Indeed, common CT scans are limited to a resolution of one millimeter. Instead, micro-CT scanners can work at the level of one micron, which is a thousandth of a millimeter. However, until now, no studies in which micro-CT is used to differentiate stillbirths from livebirths are available in the scientific literature. For this reason, the authors investigated two samples by micro-CT (one from the upper lobe and one from the lower lobe of the right lungs) of two groups: (1) group A, consisting of 14 stillbirths of ≥ 24 weeks of gestational age; (2) group B, consisting of 4 livebirths and 10 adults. The samples were scanned by an X-Ray microtomography (SkyScan1172, Bruker). For each case, micro-CT images were analyzed by the CTvox software. In all cases of group A, the authors demonstrated the absence of areas with attenuation suggestive for the presence of air/gas. On the contrary, in group B, air/gas was identified in all fields.

In light of the above, the present study allows us to suggest the micro-CT as a powerful tool to clearly distinguish between aerated and non-aerated lungs. However, further studies on broader samples are necessary to standardize techniques and procedures.

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Stillbirth; Postmortem Imaging; Micro-CT

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