H64 Detection of Pulmonary Thrombembolism and Postmortem Clotting on Postmortem Magnetic Resonance Imaging (MRI)

Lars Ebert, PhD, Universitat Zurich, IRM/Forensic Institute, Winterthurerstrasse 190/52, Zurich CH-8057, SWITZERLAND; Dominic Gascho, Universitat Zurich, IRM/Forensic Institute, Wintherthurerstrasse 190/52, Zurich CH-8057, SWITZERLAND; Michael Thali, MD, Universitat Zurich, IRM / Forensic Institute, Winterthurstrasse 190/52, Zurich CH-8057, SWITZERLAND; Patricia M. Flach, MD, Universitat Zurich, IRM/Forensic Institute, Winterthurerstrasse 190/52, Zurich CH-8057, SWITZERLAND; and Barbara Fliss, MD, MSc, Universitat Zurich, IRM/Forensic Institute, Winterthurerstrasse 190/52, Zurich CH-8057, SWITZERLAND*

The goal of this presentation is to learn how to detect and distinguish between postmortem clotting and Pulmonary Thromboembolism (PE) in postmortem MRI.

This presentation will impact the forensic science community by providing another tool to detect natural causes of death by using MRI without performing an autopsy.

The purpose of this study was to develop a feasible imaging protocol superior to Postmortem Computed Tomography (PMCT) and to establish diagnostic parameters for diagnosing PE on Postmortem Magnetic Resonance (PMMR) imaging. The PMCT and PMMR protocol developed here should enable further users to distinguish between postmortem clotting and pulmonary embolism by using postmortem imaging.

The study of 113 subjects consisted of 67 males and 46 females ranging from 17 to 89 years of age (mean 55.8 years in males and 53 years in females). This collective was taken from cases which were brought to the Institute of Forensic Medicine in Zurich. The autopsy of each case was ordered by a district attorney. If the case history provided information which led to the suspected diagnosis of a pulmonary embolism, it was included in the study group and was prospectively investigated by PMCT and PMMR for the presence of PE and/or postmortem clotting (cruor). After the postmortem imaging process, an autopsy was performed to verify the radiological findings.

Pulmonary embolism was detected in 20 cases; the remaining 93 cases were investigated for the morphology of cruor (clotted blood). Age graduation of the pulmonary embolism was performed by PMMR, autopsy, and histology using hematoxylin and eosin and elastic van Gieson staining. The postmortem sedimentation effect in which the cellular components of blood split from the plasma and deposit according to gravity was used for the applied imaging protocol on PMMR (supine and prone position).

Visual distension of the pulmonary arteries in PE was observed in all cases, but not in the cases with postmortem clotting. Repositioning of the corpse from a supine to a prone position proved to be beneficial in 90% of cases; pulmonary embolism did not exhibit any relocation after repositioning of the corpse, except in two cases of hyperacute PE. All cases with cruor showed movement of the clot within the blood vessel. Postmortem motion artifacts are first described in 20.4% of cases.

Hyperacute PE (grade 1) presented with a homogenous and hypointense signal on T2w images; acute PE (grade 2) presented with slightly heterogeneous, but still homogenous hypointense signal; subacute PE (grade 3) presented with heterogeneous and slightly hyperintense signal; and chronic PE (grade 4) presented with predominately homogenous with scarce portions of heterogeneous but hyperintense signal. In contrast, the cruor pattern was homogenous hypointense when the cruor was of a “red currant jelly clot” type and heterogeneous hyperintense in the “chicken fat clot” type.

In conclusion, this study shows that reliable detection of pulmonary embolism is feasible by PMMR and that this method allows for determination of the age and composition of an embolus based on morphology and signal intensity in the PPMR without performing an autopsy.

Postmortem Imaging, MRI, Pulmonary Thromboembolism

*Presenting Author