G63 A New Application of the Multi-Phase Postmortem CT Angiography (MPMCTA) in Sudden Death Cases

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The goal of this presentation is to examine a new approach to forensic autopsy by performing pre-autopsy Multi-Phase Postmortem CT Angiography (MPMCTA) presenting the results collected at the University of Foggia according to a standardized protocol actually used in an international multicenter study. The performance of the MPMCTA in cases of sudden death will be discussed, proposing a new application of that protocol in these cases. This presentation will impact the forensic science community by providing information for the necessity of a postmortem radiological examination, also performing CT angiography, especially in cases of sudden and unexpected death.

The postmortem CT has become the most common imaging technique used in the last decade representing a routine approach in forensic investigation. Pre-autopsy radiological imaging can reveal different diseases and wounds, but above all it is a significant tool to explain the cause of death as well as to plan the following autopsy examination. However, in the last years, it was concluded that the CT scan without the injection of a contrast agent provides little information about organic lesions and the vascular system.

On one hand, the forensic pathologist needs to visualize the vascular system obtaining nice images, but on the other hand, it seems necessary to perform exact radiological interpretation by decreasing artifacts due to perfusion and by reaching a complete filling of the vascular system. MPMCTA should become a standardized technique. The technique consists of the performance of a native (without contrast-agent injection) CT scan, followed by at least three angiographic phases (arterial, venous, and dynamic phase).

The angiographic phases consist of the perfusion of the vascular system with an oily contrast-agent mixed with paraffin oil, through the accesses in the femoral artery and vein. Accordingly with this technique the vascular system of the head, thorax, and abdomen can be investigated in detail and in a minimally invasive way mimicking the angiographic study in live people. The three phases (arterial, venous, and dynamic) allow a complete opacification of the vascular system and they could show very little vascular lesions or abnormalities as the exact source of bleeding that could be missed during the autopsy. The examination of soft tissues (musculature, subcutaneous tissue) is also significantly increased.

For this research, angiographic exams performed were reviewed for cases of sudden and unexpected death focusing on cases of Thromboembolism. In these series of the cases, it was observed that the access through the femoral artery and vein according to the technique protocol exclude the visualization of the vascular system under the point of injection where the cannulas are positioned. Here a case of a 53-year-old farmer who suddenly died while working in the fields is presented. No particular disease was known by his relatives. Before the autopsy examination, a postmortem CT angiography was performed which showed a filling defect in the right pulmonary artery. This finding suggested the suspicion of a sudden death due to pulmonary thromboembolism. So in order to detect the origin of the embolus, more CT scan images of the limb where the cannulas were not positioned were taken; however, no abnormalities arose from them. In this way, the angiographic study was completed just with the detection of the filling in the left leg. In the course of the autopsy examination, an embolus was detected in the right pulmonary artery, as confirmed by subsequent histological investigations.

In the meantime, the research of the exact site of thrombosis in the peripheral vessels could provide histological data about the age of the embolus itself, to assess the chronological transformation of the thrombus and to determine the causal relationship with pulmonary thromboembolism as cause of death.

In the following cases of sudden and unexpected death, a new application of the protocol is proposed in which the forensic pathologist has to locate and prepare the axillary artery and the axillary vein on one side to insert the cannulas that are regularly connected to the tube system of the perfusion device. All the other parameters of the standardized protocol were not modified.

In conclusion, the postmortem CT angiography using this new protocol is a useful tool to investigate all the vascular system in the cases of sudden and unexpected death, and on suspicion of pulmonary thromboembolism, it can detect the exact origin of the embolus. At last, the native CT scan and PMCTA have to be followed by conventional autopsy and histological examination of the findings.

Postmortem CT Angiography, Thromboembolism, Sudden and Unexpected Death

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