G50 Postmortem Multi-Phase Computed Tomography Angiography: Investigation of "Hemodynamic" Perfusion Parameters and Their Utility in Forensic Cases

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After attending this presentation, attendees will understand the interest of monitoring the "hemodynamic" pressures while performing a postmortem multi-phase computed tomography angiography in order to optimize the vascular filling of the corpse.

This presentation will impact the forensic science community by showing the significance of monitoring the "hemodynamic" perfusion pressures in order to understand their relation to parameters of the examined body and for developing an optimized injection protocol for the perfusion.

Since November 2008, the University Center of Legal Medicine performs postmortem Multi-detector Computed Tomography (MDCT) angiography on autopsy cases in order to complete the autopsy report by a detailed investigation of the vascular system. The recently developed method of Postmortem multi-phase computed tomography angiography (PMPCTA) permits to use a standardized protocol and includes the perfusion of the body with an oily contrast-agent mixed with paraffin oil using a specialized perfusion device. This method reveals its advantages in cases showing vascular lesions or abnormalities. Until now, the attention was focused on the obtained images for the forensic radiological interpretation. The quality of the radiological interpretation depends, among others, on the filling of the vascular system that remains in some cases incomplete, especially concerning the venous system of the head.

The present study focuses on the examination of the perfusion parameters. Employing the PMPCTA protocol, standardized injections parameters for each of the three phases (arterial, venous, and dynamic) are used. During each phase, the hemodynamic pressures can be measured. This study shows interest of investigating these pressure data, in order to determine: (1) if they are related to the filling of the vascular system; (2) if they could be useful to optimize the angio-CT perfusion protocol; and, (3) if they are related to the cause of death.

In order to answer these questions, the data of 64 PMPCTAs, realized between February and November 2010, were analyzed. They included especially the measured perfusion pressures (visual observation of pressure indicator on the perfusion device) during the three different phases, the filling of the venous system, the radiological interpretation of the images and the cause of the death determined by the forensic pathologist. In order to compare the filling of the vascular system, a grading system was used, assessing the opacification of the venous system of the head. The radiological diagnosis was extracted from the radiological report, performed jointly between a forensic pathologist trained in forensic imaging and at least one radiologist, specialized in vascular imaging. Cause of death was determined by the forensic pathologists in charge of the cases after conventional autopsy and additional analyses (histology, toxicology, neuropathology, etc.).

The different data was reported on a computer spread sheet for statistical analysis.

The comparison of the hemodynamic data revealed a relation between the pressure and the filling of the vascular system. Therefore, the necessity of exploring the possibility of performing the acquisitions with specific "intelligent" injection protocols seems evident. It was hypothesized that better filling could be reached by developing a new software for the perfusion device that adjust in real time the injection parameters in conjunction with the measured pressures instead of using fixed injection parameters. Concerning the relation between perfusion pressures and the cause of death, we noticed an indirect influence that could be observed in a better filling of the vascular system in persons who died without long periods of agony (cases of polytrauma, instant death, etc.).

The measurements of the pressure during the injection for the different phases lead to a software upgrade of the perfusion device which will include the automatic measure of pressure values and their backup. Additionally, new injection protocols could be calculated by the perfusion device depending on the perfusion pressure measured in the body.

In conclusion, our study showed that the measured perfusion data are related to the filling of the vascular system and indirectly to the cause of death. The development and implementation of intelligent perfusion software, based on real-time pressure monitoring, will be the next step to optimize the vascular filling during postmortem multi-phase computed tomography angiography.

Postmortem CT-Angiography, Vascular Perfusion, Pressures Monitoring

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