Validation of Multi-phase Post-mortem Computed Tomography Angiography: Preliminary Results of a European Multicenter Study

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Introduction

Post mortem imaging, most notably post mortem CT (PMCT), is becoming a routine technique in forensic medicine. However, the diagnostic value of unenhanced CT is limited. The injection of contrast agent can improve post mortem imaging as it enhances soft tissue and parenchyma diagnostics and reliably allows detecting even discrete vascular pathologies.

Methods

We report the results of the first 200 of 500 planned cases. All cases received previously published1 Multi Phase Post Mortem Angiography (MPMCTA, including unenhanced PMCT) followed by conventional autopsy. All findings were recorded for each method, and categorized by anatomical structure (bone, parenchyma, soft tissue, vascular) and importance to the forensic case (essential, useful, not important). A total of 4836 findings were evaluated.

Results

The majority of findings were visualized with both techniques. MPMCTA was superior to autopsy at identifying essential lesions and allowed distinguishing post-mortem and intra-vital vascular occlusions. Best results were obtained when combining autopsy and MPMCTA.

Conclusion

Combining autopsy with MPMCTA increases the quality of post mortem diagnostics and the diagnostic confidence at determining the cause of death. Both MPMCTA and autopsy are able to detect potentially essential lesions not detected by the respective other method. Results indicate that in a variety of case categories autopsy should no longer be considered the gold standard for post mortem diagnostics, but rather the combination of autopsy with contrast enhanced post mortem imaging techniques like MPMCTA.

Figure 1: MPMCTA of the thoracoabdominal arterial system, coronal MIP and 3D. Note the complete vascular filling, high contrast, and sharpness of even the smallest vessels due to absence of motion artifacts.

Figure 2: Axial MPMCTA images of a 59 year old patient who died from blood loss during abdominal surgery. MPMCTA revealed a paravertebral supradiaphragmatic rupture of the 11th left intercostal artery causing massive left-sided hemothorax. The source of the hemorrhage could not be seen at autopsy.

Figure 3: The graphs visualize relative quantities of findings detected by both MPMCTA and autopsy as well as findings detected by only one of the two methods. The green sections represent findings missed by MPMCTA in our study; the red sections represent findings not detected by autopsy.

Figure 4: The graphs visualize relative quantities of findings detected by both MPMCTA and autopsy as well as findings detected by only one of the two methods. The green sections represent findings missed by MPMCTA in our study; the red sections represent findings not detected by autopsy.

Figure 5: The graphs visualize absolute quantities of all and essential findings detected by unenhanced PMCT, MPMCTA and autopsy, categorized by the anatomical structure concerned. While MPMCTA’s superiority for detecting bony and vascular lesions were expected, its excellent sensitivity for soft tissue and parenchyma findings is remarkable.

* = single largest difference between groups is statistically significant
** = two largest differences between groups are statistically significant
*** = differences between all three groups are statistically significant

1 Grabherr et al., IJLM 2011 Nov;125(6):791-802.