



### G6 Utility of Multi-Phase Postmortem Computed Tomography Angiography in Two Lethal Cases of Great Height Falls: A French Experience

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After attending this presentation, attendees will understand the utility of investigating great height fall deaths by postmortem CT angiography.

This presentation will impact the forensic science community by showing how the pre-autopsy postmortem CT angiography can complete the conventional autopsy results and help to understand more precisely the death chronology.

**Background:** Multi-Slice Computed Tomography (MSCT) has been introduced in forensic sciences in the last decade and the efficacy of this technique has been proven, especially for bone injuries. The use of enhanced MSCT has been recently developed in order to improve detection of vascular injuries and traumatic solid organ injuries.

In the beginning of 2012, the forensic hospital department associated with the University Radiological Center of Toulouse (France) introduced the use of Multi-Phase Postmortem Computed Tomography Angiography (MPMCTA). Since then, two cases involving falls from significant heights have been studied at the department. The relevant literature was reviewed in order to compare the observed cases with the actual knowledge and to establish the contribution of MPMCTA to the forensic purpose.

**Summary of Cases:** The first case studied (F1) was that of an 81-year-old woman with known suicidal tendencies. The second case (M2) was that of a 45-year-old man with documented suicidal attempts and previous psychiatric hospitalizations. The estimated heights of fall were about 13 and 12m (42 and 39 ft), respectively.

**Methods:** For the purposes of MPMCTA, both corpses were prepared with a surgical cannulation of femoral vessels (MAQUET GmbH & co.KG). The non-enhanced MSCT phase, performed on a 16-units MSCT (Sensation 16, Siemens), facilitated sampling of biological liquids for further toxicological and biochemical analyses. The controlled perfusion device used (Virtango, Fumedica AG) and the injection of paraffin oil mixed to Angiofil® (the contrast agent) allowed acquisitions at three different times: arterial, venous, and dynamic (arterial phase with venous aspiration).

The first radiological view was performed by a Forensic Radiologist, who also performed the autopsies. The second radiologist proceeded to the MDMCTA data analysis without knowing the autopsies' results. Neither of the radiologists knew the radiological reports of the other.

**Results:** The comparison of MPMCTA-derived data with autopsy reports led to different findings. Most of the pathologic findings, like important cephalic, thoracic, and abdominal injuries, were diagnosed by both techniques. Some diagnoses, observed only by autopsy, included T7-T8 discal disjunction (F1), testicular fractures and contusions (M2). The diagnoses established exclusively with MPMCTA were hemopneumatoceles (F1) and deep bone fractures of fibula's head and a metacarpal bone (M2).

In addition to these classical findings, rare injuries such as double thoracic aortic rupture (F1), right coronary avulsion, and inferior vena cava laceration with right atrium extension (M2) were diagnosed by both techniques.

**Discussion:** Classical lesions seen in great height falls have been described in the literature data set for decades. These lesions are mostly due to a deceleration mechanism. All typical lesions were found by both MPMCTA and autopsy; however, there are some subtleties.

The posterior rib fractures, a typical finding in high deceleration lesions, were underestimated during the autopsies. This is due to the difficult access to this anatomical region. It is almost the same for the haemopneumatocele. Indeed, the pulmonary macroscopic dissection collapses the haemopneumatocele, making the diagnosis difficult. On the other hand, some lesions were only found during autopsy. The soft tissues, like the testes, are poorly seen with MSCT, which explains the lack of diagnosis in this case. The discal disjunction has been seen with MPMCTA but was misdiagnosed as a degenerative lesion.

Rare lesions (double aortic rupture and right coronary desinsertion) were clearly individualized by both approaches. Epidemiology and mechanism of aortic traumatic ruptures have been studied by many authors. Depending on the series, aortic lesions due to great height falls represent up to 15% of traumatic aortic injuries. The distinctiveness of our case is the association between an isthmus and descending aortic ruptures. Multifocal aortic lesions, including those involving the descending aorta, are least frequent. Post-traumatic lesions of the right coronary ostium are also rare, with a sparse literature data. The existence of this lesion in our case highlighted torsion and shearing force mechanisms due to the great deceleration velocity. Until now, the few reported cases concerned only object projection or motor vehicle accidents.



## Pathology/Biology Section - 2013

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**Conclusion:** The study of these two cases of great height fall deaths using the MPMCTA shows the different injuries related to the high velocity death mechanisms. Compared to the non-enhanced MSCT, MPMCTA has a better sensibility, especially for vascular lesions. Furthermore, this new technique helps in understanding the chronology of injuries before death. For example, the death chronology for M2 was inferior vena cava rupture associated to the right coronary desinsertion, haemopericardium, communication between pericardium and right pleura via a penetrating rib fracture, hemopneumothorax.

**CT Angiography, Great Height Falls, Postmortem Imaging**