



D25 The Virtopsy Approach: Bridging Radiologic and Forensic Sciences

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After attending this presentation, attendees will be aware of the newest developments in forensic imaging.

This presentation will impact the forensic science community and/or humanity by providing an overview and outlook of upcoming imaging technologies.

Forensic science has experienced revolutionary changes in different fields, such as genetics, crime scene investigation methods and toxicology. Forensic pathology, by contrast, still utilises the time-old, evidence-based methods introduced centuries ago, namely the dissection of a corpse and an oral description and written documentation of the findings obtained; this has been augmented in the past decades by photography. Although conventional X-rays have found their way into daily forensic practice, newer, clinically established methods, such as CT and MRI, seem to lag behind in their forensic implementation.

This conservative attitude towards new technologies is surprising in a field in which prosecutors and defence lawyers are, depending on the case circumstances, often eager to test novel methods. Regardless of these obstacles, many different institutions have implemented CT in postmortem forensic investigations.

In Switzerland, this revolution in forensic science started off in the mid-nineties, when the Institute of Forensic Medicine of the University of Bern started a project with the Scientific Service of the City Police of Zuerich. The aim was to document body and object surfaces in a three-dimensional fashion. A few years later, the Institute of Forensic Medicine again started a joint research project, this time with the Institutes of Diagnostic Radiology and Neuroradiology of the University of Bern. This project had the ambitious aim of detecting forensic findings of corpses using MSCT and MRI, and of comparing these results with autopsy findings.

This was the beginning of the Virtopsy® project. Later on, further methods and tools were added in addition to MSCT and MRI, so that now the project implements an ever expanding variety of imaging methods. The transdisciplinary research project Virtopsy® is dedicated to implementing modern imaging techniques into forensic medicine and pathology in order to augment current examination techniques or even to offer alternative methods.

The project relies on three pillars: 3D surface scanning for the documentation of body surfaces, and both multislice computed tomography (MSCT) and magnetic resonance imaging (MRI) to visualise the internal body.

3D surface scanning has delivered remarkable results in the past in the 3D documentation of patterned injuries and of objects of forensic interest as well as whole crime scenes. Imaging of the interior of corpses is performed using MSCT and/or magnetic resonance imaging (MRI). MRI, in addition, is also well suited to examine surviving victims of assault, especially choking, and helps visualise internal injuries not seen at external examination of the victim. Apart from the accuracy and three-dimensionality that conventional documentations lack, these techniques allow for the re-examination of the corpse and the crime scene even decades later, after burial of the corpse and liberation of the crime scene. Virtual, non-invasive or minimally invasive approach will improve forensic medicine in the near future.

The Virtopsy approach is now used worldwide: The Office of the Armed Forces Medical Examiner (Armed Forces Institute of Pathology, Washington, DC, Dover, DE), which performs CT scans on military personnel killed in combat on a routine basis evaluated the usefulness of CT in the assessment of high velocity gunshot victims with promising results. Groups from the universities of Copenhagen (Denmark) and Linkoping (Sweden) have started CT scanning on corpses on a broad scale, here again with promising results. According to personal communication, every corpse delivered to the Victorian Institute of Pathology (Sydney, Australia) undergoes a CT scan prior to autopsy. Also dedicated to this novel approach, the Society for Autopsy Imaging in Japan was founded in 2003. CT scanning has also been introduced into forensic anthropology. A French group (Toulouse) actually obtained superior results when assessing the case a charred body with respect to anthropological aspects than with traditional methods.

In conclusion, the non-invasive or minimally invasive approach envisioned by postmortem surface scanning and MSCT as well as MRI has several advantages to current forensic examination techniques, namely:

- Precise, objective and clear documentation of forensic findings for the court
- Calibrated, 3D documentation of findings
- Quality assurance through digital data archivation and transfer
- Reduction of psychological trauma for the next-of-kin
- Improved judicature in cultures with low autopsy acceptance

In the talk the newest developments of the Virtopsy project will be presented.

Forensic Imaging, Virtopsy, Forensic Radiology