



## Pathology Biology Section – 2011

### G133 3D in Forensics: TIM Synthetic MRI and Virtobot – Forensic Imaging Workflow of the Future

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After attending this presentation, attendees will know the basic of virtual autopsy and the development in forensic 3D imaging of human corpses in the future.

This presentation will impact the forensic science community by covering new validated practical knowledge, and the professional practice gap in the area of virtual autopsy (CME/ACCME criteria).

Imaging has changed the world and greatly influenced modern medicine.

In the 2009 National Academy of Sciences Report, *“Medical Examiners and Coroners Systems: Current and Future Needs”* modern imaging technologies (Virtual autopsy, Virtopsy) was suggested as having a great potential to detect forensic relevant findings.

The advent of high resolution multi-detector row CT scanners and fast MRI scanners in the last decade has allowed the development of imaging techniques that have greatly enhanced the diagnostic potential of these two imaging modalities. While conventional radiographs have played a valuable role in forensic diagnosis and practice for over a century, recent investigations with both CT and MRI suggest that these imaging tools are capable of much greater contributions. A major innovation is the ability to display imaging findings in 2D and 3D planes that closely replicate the findings at conventional autopsy and make the interpretation of the studies more easily understood by non-radiologists. CT and MRI may be used to supplement traditional autopsy techniques, to provide a complete anatomic assessment prior to limited autopsy, or in certain circumstances to replace it, such as in blunt accidental trauma, or drowning deaths. These studies may also provide options in the setting of religious and cultural objections to conventional autopsy.

While CT has the advantage of providing rapid whole body imaging of great anatomic detail in a short time, the superior contrast resolution of MR provides soft tissue characterization that is not achievable by CT. MRI is less widely available and more time consuming but may be applied to the postmortem evaluation of specific body parts to aid in the diagnosis of specific causes of death that may be characterized by subtle soft tissue changes. Both CT and MRI provide a permanent pictorial record of anatomic findings that may be retained and analyzed for medical and legal purposes postmortem and offer advantages in quality assurance that may be difficult to replicate with conventional autopsy.

The forensic science and medical examiner communities have shown interest in the use of CT and MR autopsy imaging. However, while CT and MR imaging are widely available in the clinical care of the living, forensic facilities face problems of access to autopsy imaging due to financial, technical, transportation, interpretation, and related difficulties.

For the past 15 years, the Forensic Institute of the University of Bern has been concerned with imaging problems in forensics. In 2009 the robot-supported automated system integration of 3D surface scanning and multislice CT with postmortem biopsies was successful as a “Virtobot” developed. After what is now five years, the over 100 postmortem angiographies show impressive results from the research activities at the University Bern. In the early part of 2010, our Total Imaging Total Matrix TIM-MRI system that has been in operation since 2009 could be extended with the so-called synthetic MRI software. The advantage of this TIM synthetic MRI system lies in the fact that in one examination step various MRI sequences (such as T1-T2-PD, etc.) could be performed from tip to toe without any change of the surface traces. In the daily forensic service applications it has become evident that through applying this approach a increase in quality and a improvement in the forensic diagnostics can be achieved and the examination results based on the imaging are often quicker and, thanks to a more visual 3D reconstruction, can be displayed in a way that lay persons can understand and comprehend. Momentarily, in terms of workflow and process, this Virtopsy-system integration is the only forensic examination track in a forensic institute that has brought together all the modalities and technologies in this form for daily use and research. With “Axon Shadow,” the interdepartmental forensic IT structure, now being developed at our Institute, which comprises the functionalities of “ERP,” “LIMS” and document management, the forensic processes of all the IFM departments are displayed and supported in a workflow- oriented manner.

#### **Virtopsy, Virtual Autopsy, CT and MRI**