## H42 Sudden Cardiac Death (SCD) Visualized by Postmortem Magnetic Resonance Imaging (PMMRI) — How to Make the Invisible Visible

*Christian Jackowski, MD, EMBA*, Institute of Forensic Medicine, University of Bern, Bühlstr. 20, Bern, Canton Bern, SWITZERLAND; Nicole Schwendener, HF, Institute of Forensic Medicine, University of Bern, Bühlstr. 20, Bern 3012, SWITZERLAND; Anders Persson, MD, PhD, CMIV, Linköpings Universitet/US, Linköping 581 85, SWEDEN; and Wolf-Dieter Zech, MD, University of Bern, Institute of Forensic Medicine, Dept of Forensic Medicine and Imaging, Bühlstrasse 20, Bern 3012, SWITZERLAND*

After attending this presentation, attendees will better understand the possibilities of PMMRI for the detection and visualization of very early stages of myocardial infarction as a possible source for lethal ventricular arrhythmias often appearing as SCDs.

This presentation will impact the forensic science community by introducing a solution for a long-term problem, namely the impossibility to morphologically visualize an SCD postmortem.

SCD cases have challenged forensic pathologists for several decades as they often do not present with any myocardial finding at autopsy and/or histology. Lethal arrhythmic events are thought to cause these sudden deaths. Since PMMRI was implemented on a routine basis in forensic institutes, it was recognized that postmortem MR exams not only show chronic, subacute, and acute infarction but often also show myocardial findings in SCD cases which may represent very early (peracute) stages of myocardial infarctions thus far invisible at autopsy and/or histology.1-7

Therefore, this study investigated whether there is a correlation between these PMMRI findings (invisible at autopsy) and coronary artery findings that may be able to explain an early myocardial ischemic event as a possible source for a lethal arrhythmic event.

In 136 human forensic corpses, a postmortem cardiac MR examination was performed prior to forensic autopsy. Short-axis and horizontal long-axis MR images were acquired *in situ*. PMMRI findings were correlated to the autopsy findings.

In 76 study cases, myocardial findings could be documented and correlated to the autopsy findings. Within these 76 study cases, a total of 124 myocardial lesions were detected on PMMRI (chronic: 25; subacute: 16; acute: 30; and peracute: 53). Chronic, subacute, and acute infarction cases correlated very well to the myocardial findings obtained at autopsy. Peracute infarctions (age range: minutes to approximately 1h) were not visible on macroscopic autopsy. Peracute infarction areas detected on PMMRI could be verified in targeted histological investigations in 62.3% of cases and could be related to a matching coronary finding in 84.9% of cases. A total of 15.1% of peracute lesions on PMMRI lacked a matching coronary finding but presented with severe myocardial hypertrophy or cocaine intoxication facilitating a cardiac death without verifiable coronary stenosis.

PMMRI visualizes chronic, subacute, and acute myocardial infarction *in situ*. In peracute infarction as a possible cause of sudden cardiac death, it demonstrates affected myocardial areas not visible at autopsy. PMMRI can help to morphologically visualize so far invisibly affected ischemic myocardium postmortem and should be considered as a feasible postmortem investigation technique for sudden cardiac death cases.





*Presenting Author

**Reference(s):**

1. Jackowski C. Special issue on postmortem imaging. *Forensic Sci Int* 2013;225:1-2.
2. Jackowski C., Grabherr S., Schwendener N. Pulmonary thrombembolism as cause of death on unenhanced postmortem 3T MRI. *Eur Radiol* 2013;23:1266-70.
3. Jackowski C., Warntjes M.J., Kihlberg J., et al. Quantitative MRI in isotropic spatial resolution for forensic soft tissue documentation. Why and how? *J Forensic Sci* 2011;56:208-15.
4. Jackowski C., Christe A., Sonnenschein M., et al. Postmortem unenhanced magnetic resonance imaging of myocardial infarction in correlation to histological infarction age characterization. *Eur Heart J* 2006;27:2459-67.
5. Jackowski C., Warntjes M.J., Berge J., et al. Magnetic resonance imaging goes postmortem: noninvasive detection and assessment of myocardial infarction by postmortem MRI. *Eur Radiol* 2011;21:70-8.
6. Jackowski C., Hofmann K., Schwendener N., et al. Coronary thrombus and peracute myocardial infarction visualized by unenhanced postmortem MRI prior to autopsy. *Forensic Sci Int* 2012;214:e16-9.
7. Jackowski C., Schwendener N., Grabherr S., et al. Postmortem cardiac 3-T magnetic resonance imaging: visualization of sudden cardiac death? *J Am Coll Cardiol* 2013;62:617-29.

**Sudden Cardiac Death, Postmortem MRI, Forensic Imaging**