Post-Mortem Cardiac MRI in deceased with a history of mental illness
Jacobsen, Christina; Banner, Jytte; Vejlstrup, Niels; Jensen, Karl Erik; Thomsen, Carsten; Baandrup, Ulrik; Banner, Jytte

Publication date: 2014

Document Version
Peer reviewed version

Citation for published version (APA):
Post-mortem cardiac MRI in deceased with a history of mental illness
C Jacobsen1, N Vejlstrup2, KE Jensen3, C Thomsen3, U Baandrup4, J Banner1
1Section of Forensic Pathology, Department of Forensic Medicine, University of Copenhagen, 2 Department of Cardiology and 3Department of Radiology, Rigshospitalet, University Hospital Copenhagen, 4Center Clinical Research, Vendsyssel Hospital/Aalborg University

Background
The Danish Departments of Forensic Medicine have established a nationwide, cross-disciplinary study: “SURVIVE” for research in forensic autopsy cases involving mentally ill deceased. A major focus is CVD. Opposed to clinical cardiology the use of pmcMRI in forensic pathology is a fairly unknown area.

Aim
The aim of this ongoing study is to implement pmcMRI in a forensic pathology setting and to describe cardiovascular morphological changes focusing on hypertrophy and presence of edema as it can occur in myocarditis and ischemia.

Material
So far 347 deceased with confirmed or suspected mental illness have been included in the SURVIVE study. 20 of these deceased, without signs of putrefaction on pmCT, were randomly included in this sub study (table 1).

Methods
Prior to autopsy a pmcMRI is performed (1T Siemens Harmony MRI-scanner). The image analysis is done using the software OsiriX®. The wall thickness of the left ventricle and presence of edema on the pmcMRI are registered, measured and correlated to autopsy findings and histopathology results. For correct correlation the 17-segment classification of the American Heart Association is used (figure 1). The papillary muscles are excluded when measuring the width of the segments (figure 2).

Preliminary results
The measurement of the left ventricular wall thickness shows varying agreement between the two methods (Bland-Altman Plot) with a mean bias between the measurement methods of 0.3 mm (SD 3.185 mm). The outliers are caused by difficulty to differentiate papillary muscle from myocardium thickness on pmcMRI (figure 3).

Hypertrophy (ventricular wall thickness > 15 mm) is diagnosed more often on the pmcMRI than at autopsy (table 2). The correlation between the frontal, septal and posterior segments is good, but poor between the lateral segments (data not shown).

Edema is diagnosed on pmcMRI by comparing the segmental signal intensities. A segment with a signal intensity higher than 2SD of the segment with the lowest signal is defined as having edema (figure 3). Guided by the pmcMRI samples from the myocardium are taken and freeze dried to correlate the diagnosed edema with the myocardial water content (figure 4). Further samples are taken for histopathology (HE and van Gieson).

Discussion
The preliminary results show a good correlation between the measurements of ventricular wall thickness regarding the anterior, posterior and septal segments. The measurement of lateral segments was generally too wide on pmcMRI compared to the autopsy results resulting in a too frequent hypertrophy diagnosis.

The correlation between the diagnosis of edema and the results from the freeze drying were overall good. In a few cases the results did not match which needs to be elucidated further. The overall correlation between the macro- and microscopic findings with the pmcMRI was acceptable.

The results show good reason to continue the study and we believe that the use of pmcMRI in cardiovascular pathology is a useful adjunct to the forensic autopsy.

Table 3. The difference in signal intensities and water content after freeze drying

Table 5. Macroscopic atherosclerotic change

Table 6. Histopathologic changes

Table 2. Correlation of hypertrophy diagnosis on pmcMRI vs. autopsy

Table 1. Baseline data for the deceased

Table 4. The registered histopathologic changes

Correlating edema with macroscopic atherosclerotic, myocardial and histopathologic changes showed an overall good agreement (table 5).

Figure 1. Literature:
5Corpeaux MB et al. Circulation 2003;105:530-541

Corresponding author: christina.jacobsen@undk.dk.
For further information on the SURVIVE study use the QR-code or visit the website http://retsmedicin.ku.dk/english/research/surviveprojects/