CQ28 What are the modalities for diagnosing acute coronary syndrome with postmortem images and what are useful findings for its detection?

Grade of recommendations: C1

Postmortem coronary CT angiography may be considered the main choice, because it can delineate coronary artery thromboembolism as a filling defect, which cannot be delineated on unenhanced postmortem CT. Also, postmortem cardiac MRI may be considered, because it can visualize ischemic myocardium as an abnormal signal intensity region, which cannot be visualized by unenhanced postmortem CT.

Explanation----------

Acute coronary syndrome (CQ27)

Acute coronary syndrome is a comprehensive pathological condition including three cardiac diseases caused by sudden coronary stenosis: unstable angina, acute myocardial infarction, and ischemic sudden cardiac death [1]. In unenhanced postmortem CT it is difficult to identify direct findings of coronary arterial thromboembolisms and ischemic myocardium in patients with acute myocardial infarction and ischemic cardiac sudden death. Coronary postmortem CT angiography (PMCTA) [2-6] and postmortem cardiac MRI have been reported as postmortem image modalities to detect these two [7-8].

Coronary PMCTA (CQ12)

Coronary PMCTA is performed mainly to identify coronary thromboembolisms, utilizing the following four methods:

① A modified embalming method [9-12]: A catheter is inserted into the femoral artery/vein and a contrast agent is infused using an extracorporeal pump. Systemic blood vessels including the coronary arteries are identified in the images. An incision in the groin region is necessary for insertion of the catheter.

② Use of a urethral balloon catheter [13-15]: An urethral balloon catheter is inserted from the internal carotid artery and retained in the proximal part of the ascending aorta. Then, a contrast agent is injected retrogradely, after inflating the urethral balloon. This method is simpler than the modified embalming method (①) and the route from the ascending aorta to coronary artery can be shown in images, however other vessels are not shown in the images. An incision in the neck region is necessary for insertion of the catheter.

③ Chest compression method [16]: Chest compression is performed while injecting a contrast agent from the peripheral venous route that was placed at the time of cardiopulmonary resuscitation management in the emergency department. This method is easier than ① and ② mentioned above, and is performed in cases that do not require an autopsy, although the contrast effect is inferior.

④ Direct view method [17-19]: A contrast agent is injected from the coronary artery of a heart that has been resected from the body by autopsy.

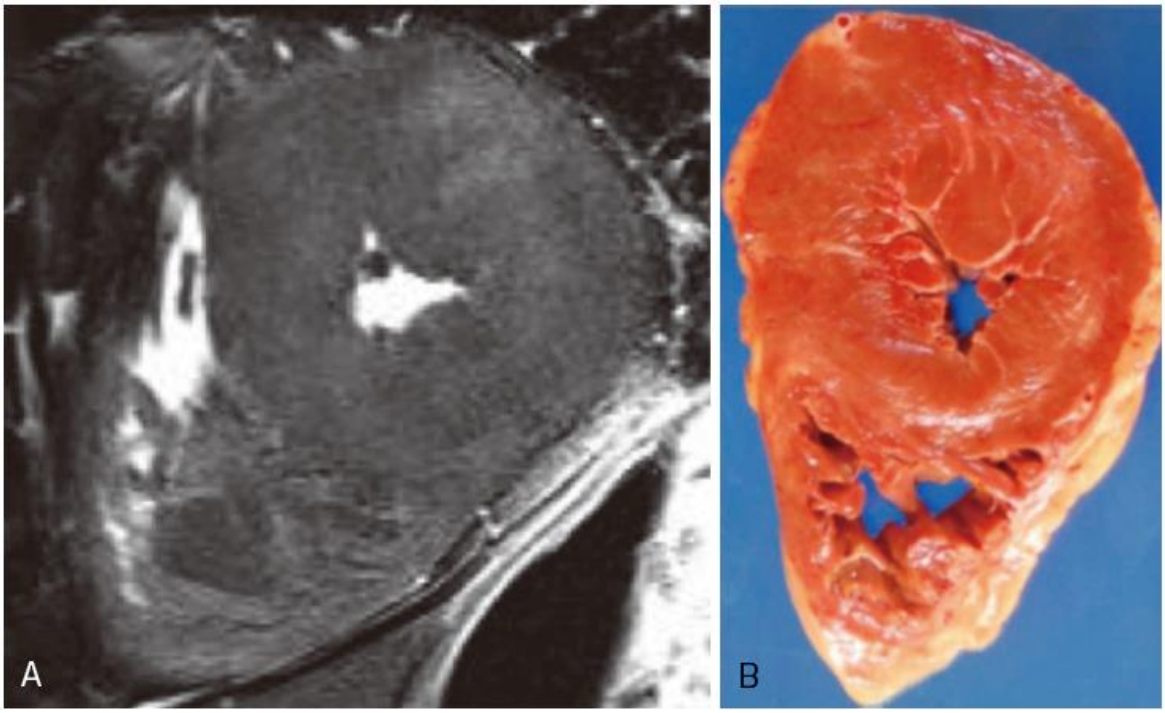
Postmortem cardiac MRI

Postmortem cardiac MRI is performed mainly to detect ischemic myocardium. Pathological changes due to myocardial infarction appear microscopically several hours after the onset and macroscopically 6 to 12 hours after the onset [1]. A pathological diagnosis is extremely difficult in ischemic sudden cardiac death cases with death occurring a few minutes to 1 hour from the onset. Postmortem cardiac MRI has been reported to make it possible to differentiate ischemic myocardium into the hyperacute phase, subsequent acute phase, subacute phase, and chronic phase [20]. T2-weighted images of postmortem cardiac MRI show ischemic myocardium in the hyperacute phase as a low signal intensity region. The cause of the low signal intensity is considered acidification of the myocardium and/or a decrease in arterial blood flow while venous return is maintained [20]. Within approximately 3 hours after the onset of coronary artery occlusion, myocardial edema appears due to ischemia and reperfusion disorders. Therefore, ischemic myocardium in the acute phase is visualized as a high signal intensity region on T2-weighted images [20-22]. In addition to the visual assessment, a quantification assessment has been attempted by measuring the relaxation time of normal and ischemic myocardium [23-25].

Postmortem cardiac MRI may allow detection of coronary arterial thromboembolisms [26]. Significant stenosis may be absent when chemical shift artifacts of the coronary artery are noted on postmortem cardiac MRI, while significant stenosis is present when dark bands of the coronary arteries are identified [27]. There is a report on the use of postmortem cardiac MRI to evaluate the state of coronary arteries by injecting an oil-based contrast agent for CTA from the coronary artery of the heart that was resected from the body by an autopsy [28].

Image protocols specified for the heart are required rather than image protocols for the entire chest, when evaluating the heart by postmortem MRI.

Figure: A case of (suspected) catecholamine cardiomyopathy due to heat injury of the entire body



This person died after severe burn injuries to the entire body. (A) On a T2-weighted short axis cardiac MRI, mottled high signal intensities are distributed throughout the left ventricular wall. The heterogeneous high signal intensity extends to the right ventricular wall. (B) Macroscopic view of the coronal section of the heart specimen shows diffusely spotted whitish portions of the left ventricular wall (histologically corresponds to fibrosis); no lesions corresponding to the mottled high signal intensity on cardiac MRI can be macroscopically identified.

Literature search formula and literature selection (2019/6/18)

PubMed

1) Coronary artery stenosis on post-mortem CT/MRI

#	Search formula	Number of documents
1	Search(((((("postmortem CT")OR "postmortem MRI")OR "postmortem imaging")OR "post-mortem CT")OR "post-mortem MRI")OR "postmortem imaging" (((((((postmortem CT)OR postmortem MRI)OR postmortem imaging) OR postmortem angiography)OR post-mortem CT)OR post-mortem MRI)OR post-mortem imaging)OR post-mortem angiography	24,142
2	Search(#1)AND " coronary artery "	1,420
3	Search(#2)AND " stenosis "	258

2) Myocardial ischemia on post-mortem CT/MRI

#	Search formula	Number of documents
1	Search(((((("postmortem CT")OR "postmortem MRI")OR "postmortem imaging")OR "post-mortem CT")OR "post-mortem MRI")OR "postmortem imaging"	22,668
2	Search(#1)AND " myocardium "	821
3	Search(#2)AND " ischemia "	97

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