CQ12 Is postmortem angiographic CT (PMCTA) useful for estimating the cause of death?

Grade of recommendations: B

Postmortem CT angiography (PMCTA) using a contrast agent is highly useful for vascular diseases including infarction, bleeding, and vascular injury in trauma. Sometimes it is possible to point out abnormalities that are difficult to detect with an autopsy, so that PMCTA plays a complementary role with the autopsy. However, PMCTA are not commonly performed in Japan. In order to implement PMCTA in Japan, a legal system for this should be established.

Explanation----------

Background

Since the bleeding site in organ or vascular injury is difficult to identify on non-contrast postmortem CT, PMCT using a contrast agent has been reported. Since there is no blood circulation after death, it is necessary to use an enforced contrast medium administration method. As a method for imaging the whole body, a method of inserting a catheter into the femoral or axillary artery and vein and using an extracorporeal circulation device [1-3] or a dedicated device that can monitor the injection pressure [4] is reported [5-7]. In recent years, a multiple-phase PMCTA has been developed. Catheters are inserted into arteries/veins, respectively, and three phase contrast enhancements, which are 1) an arterial phase from arteries, 2) venous phase from veins, and 3) dynamic phase while injecting contrast agent from arteries, are performed. By using this multi-phase imaging, it is possible to determine whether the vascular injury is an artery or a vein [4]. Japanese researchers have reported a simple PMCTA method for performing anterior chest compression in accordance with cardiopulmonary resuscitation by administering a contrast medium from a peripheral vein in an emergency outpatient [8, 9]. Other methods of local imaging include placing a catheter in the ascending aorta and imaging the coronary artery [10] and placing a catheter inside the body to obtain an image of the target blood vessel [11-13]. A method of injecting a contrast medium into organs removed by autopsy (the brain or the heart) [14, 15] has been reported. The contrast agents used are water-soluble [1, 3], oil-based [4], negative (gas), gelatin barium [16, 17], resins, and there are others, and each has its advantages and disadvantages [18]. However, in Japan, acts that cause mutilation of a corpse, such as the administration of contrast media to the corpse are legally regulated and caution is required when implementing PMCTA [19].

Usefulness of PMCTA (CQ28)

Traumatic or iatrogenic vascular injuries [20, 24], vascular ruptures due to dissection [25], cardiac ruptures due to myocardial infarction [23], coronary or intestinal artery thrombosis [22, 23, 26 -28],

pulmonary thromboembolism [23, 29], neonatal vascular malformations [30], and identification of blood vessels responsible for the cause of cerebral hemorrhage /subarachnoid hemorrhage [14, 23] have been reported using PMCTA. In particular, PMCTA has been reported to be able to clearly evaluate the condition of blood vessels in cases where it is difficult to make an evaluation by autopsy due to postoperative changes, and there are more [31]. Other than the evaluation of blood vessels, enhancement of an infarcted myocardium due to myocardial infarction has been reported [15, 26, 28], however there is also a report that there is no myocardial contrast effect when the coronary arteries are completely occluded, [27]. In addition, it has been reported that liver tumors, which were unclear on postmortem CT before enhancement, were clearly demonstrated on PMCTA by imaging from the inferior vena cava [32].

In order to investigate unexpected deaths of hospitalized patients, it is also useful to consider the location where medical devices are in the body or where there are post-procedure conditions in the diagnosing. At the same time, it considered to be a practical means to maintain the quality of an autopsy [22, 33].

In addition, measuring blood vessel diameters and heart chambers is easier on postmortem-enhanced CT than on usual postmortem CT [34].

PMCTA & autopsy

In a study comparing PMCTA and autopsies, there are reports that PMCTA has the same or better diagnostic ability of detection of damaged sites in vascular injuries and vascular occlusions than an autopsy [4, 10, 35-38]. If the cause of death is accompanied by morphological abnormalities in blood vessels, it is considered possible to point out abnormalities with PMCTA. Diagnosis is more difficult for cardiomyocyte lysis and myocardial necrosis without morphological abnormalities when performed by PMCTA than when performed by an autopsy [15, 23, 28, 39].

The PMCTA and autopsy are complementary diagnostic techniques, and their usefulness may differ depending on the target problems and the characteristics of the cases. Therefore, it is considered desirable to use PMCTA and autopsy together in estimating the cause of death [37, 40]. However, there is a report that it is possible to reduce the targeted cases for an autopsy by performing PMCTA [41].

Relationship with other inspections, artifacts, etc.

Various samples, blood, urine, and cerebrospinal fluid, are collected from the cadaver in the histopathological and toxicological examinations used in combination with corpse inspection and autopsy examination. At the time of the examination, the effects of the contrast medium administered intravascularly should be considered. It has been reported that it is difficult to distinguish an oil-based contrast agent penetrating to the periphery from a fat embolism [18]. It has also been reported that the

contrast agent has no influence on the vitreous body [19] and pericardial cavity storage fluid [20] on biochemical tests. Specimens should be collected before the contrast enhancement.

Artifacts, pitfalls, and complications of PMCTA include insufficient blood vessel contrast, uneven intravascular contrast effects, leakage of contrast agent into the digestive tract, incorrect insertions of vascular catheters, and vascular damage during catheter insertion or injection of contrast agent have all been reported [25, 42-44]. This makes it important that the operator is careful when performing a PMCTA. Among these issues, the unevenness of the contrast effect can be eliminated by performing a multi-phase contrast examination or by changing the body position of the cadaver during the examination [45].

Literature search formula and literature selection (2019/8/5)

PubMed

#	Search formula	Number of documents
1	Search (((((("postmortem CT" OR "postmortem imaging") OR "postmortem CT") OR "post-mortem imaging"))) AND angiography) Filters： published in the last 10 years	109
2	Search ((((("postmortem CT" OR "postmortem imaging") OR "post-mortem CT") OR "post-mortem imaging"))) AND "contrast enhancement") Filters： published in the last 10 years	3
3	Search ((((((((("postmortem CT" OR "postmortem imaging") OR "postmortem CT") OR "post-mortem imaging"))) AND angiography)) AND "last 10 years"[PDat])) OR (((((((("postmortem CT" OR "postmortem imaging") OR "post-mortem CT") OR "post-mortem imaging"))) AND "contrast enhancement")) AND "last 10 years"[PDat]) Filters： published in the last 10 years	109

Ichushi (Medical Journal)

#	Search formula	Number of documents
1	(死後/AL) and ((FT=Y) and PT=原著論文,会議録除く and CK=ヒト)	4,603
2	(死亡時/AL) and ((FT=Y) and PT=原著論文,会議録除く and CK=ヒト)	711
3	((画像診断/TH or 画像診断/AL)) and ((FT=Y) and PT=会議録除く and CK=ヒト)	274,385
4	((X 線 CT/TH or X 線 CT/AL)) and ((FT=Y) and PT=会議録除く and CK=ヒト)	105,695

5	#1 or #2	5,102
6	#3 or #4	274,576
7	#5 and #6	1,177
8	((造影/TH or 造影/AL)) and ((FT=Y) and PT=原著論文,会議録除く and CK=ヒト)	70,189
9	#7 and #8	139
10	(#9) and (DT=2009：2019)	60

From other than search formula

[1, 3, 8, 9, 18, 36, 39, 44]

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