What Information in Postmortem Computed Tomography should Radiologist Provide to Forensic Doctor?

Poster No.: C-1799
Congress: ECR 2011
Type: Educational Exhibit
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Keywords: Forensic / Necropsy studies, CT, Diagnostic procedure, Foreign bodies, Infection
DOI: 10.1594/ecr2011/C-1799

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Learning objectives

To illustrate the correlation between post-mortem forensic CT findings and autopsy results, and outline the helpful information for forensic autopsy that radiologists should provide to forensic doctors.
Background

The use of post-mortem radiological imaging is becoming increasing widespread in forensic medicine [1-4]. Its utility has been shown and there is a possibility that post-mortem radiology will become established as a new sub-specialty of radiology [5].

One of the most important roles of post-mortem radiological imaging is to help identify the cause of death. In many cases, it is very difficult to determine the cause of death from radiological images alone and an autopsy is still necessary for an accurate diagnosis of the cause of death. Given these factors, the provision of information that aids the autopsy is one of the most important roles of post-mortem radiological imaging studies.

Image information that helps the autopsy includes the following:

(1) Information on deep disorders that cannot be checked visually from the surface of the body. The detection of such disorders could decrease missed diagnoses. Additionally, if the kind and location of disorders are determined, the forensic pathologist can plan the autopsy procedures beforehand and ultimately shorten the autopsy.

(2) The presence and location of foreign bodies inside the body are also very helpful information [6-8]. When the foreign body is sharp, knowledge of its location will protect the forensic pathologist from injury.

(3) Infection surveillance with radiological imaging is very important, such as knowledge of infection with pulmonary tuberculosis before an autopsy [8-10]. If an infection is confirmed beforehand, better infection control is possible.

In this poster, we present cases in which we located metal pieces from weapons and pulmonary tuberculosis on post-mortem computed tomography (CT) images before forensic autopsies.
Imaging findings OR Procedure details

MDCT Scanning protocol

- Aquilion 8 MDCT, Toshiba, Japan
- 120 kVp
- Head: conventional scan, 4.0-mm slice thickness
- Whole body: helical scan, 2.0-mm slice thickness

All cases underwent a conventional autopsy soon after the CT. After receiving the autopsy reports from forensic pathologists, we reviewed the CT images and discussed the correlation between the CT findings and autopsy results.

Case 1

Case History:
An elderly woman was stabbed numerous times with a sharp instrument. The victim was taken to a hospital, but declared dead in the emergency room. A kitchen knife was left at the crime scene, and its tip was broken off. It was suspected that part of the knife still remained inside the body.

CT Findings:
A high-density structure with a metal artefact was found in the right posterolateral part of the skull (Fig. 1). It was wedge-shaped, and most of its length was embedded in the skull (Fig. 2). Using volume rendering (VR) images, multiple stab wounds were seen in other parts of the head, face, chest, back, and abdomen (Fig. 3), but no metal fragment was found in those wounds.

Autopsy:
The length of the surface wound on the scalp, where the CT images detected the metal piece, was 0.5cm, and only a small sharp edge protruded from the skull surface (Fig. 4). If CT had not been performed, the forensic staff might have injured their fingers.

Case 2

Case History:
An elderly woman was found dead after she had been stabbed many times with a sharp pointed instrument. No weapon was found at the scene.
CT Findings:

Some circular wounds were found on the surface of the skull (Fig. 5). There were intracranial bone splinters just below the wounds (Fig. 6). Additionally, intra-axial, intraventricular, and brain-surface haemorrhages were seen (Fig. 7). In the left parietal wound, a slender high-density structure with a metal artefact was embedded in the skull (Fig. 8). It was presumed to be part of a murder weapon. Many wounds were seen on the chest and back, and a pneumothorax and haemothorax were present.

Autopsy:

As noted in the CT images, a sharp rod-like structure was stuck in the left parietal region of the skull (Fig. 9). It was identified as a broken piece of a murder weapon such as an ice pick. (In this case, the weapon itself is still missing.) There were some small round wounds on the scalp and back. Some of the round wounds on the scalp penetrated the skull and injured the brain. The CT of this case also enable the forensic staff to avoid injuring their fingers.

Case 3

Case History:

An elderly man was walking with his own shotgun. The shotgun went off by accident and the shot struck him directly.

CT Findings:

An oval cutaneous defect (approximately 25×35 mm) was seen in the right chest (Fig. 10). It was thought that this defect was the entry wound. Many small high-density structures with metal artefacts were scattered from the right chest to the upper abdomen (Fig. 11). They appeared to have penetrated the heart, liver, and subcutaneous tissue of the back. They were suspected of being shotgun pellets. A right pneumothorax and haemothorax were found.

Autopsy:

As noted in the CT images, there was a cutaneous defect in the right chest wall (Fig. 12). Beginning at the defect, many shotgun pellets 2#3 mm in diameter were spread inside the body. The pellets reached not only the right lung, but also the right atrium, liver, and subcutaneous tissue of the back. A hemorrhagic pleural effusion with a volume of 350 mL and blood clots had accumulated in the right thorax. In this case, the autopsy was able to proceed smoothly and effectively because the locations of the shotgun pellets had been determined beforehand from the CT images.

Case 4
Case History:

An elderly woman was found with her face immersed in the bathtub. Although she received emergency resuscitation, she died.

CT Findings:

Hemorrhagic bilateral pleural effusions and a pericardial effusion were observed (Fig. 13). It was thought that these findings suggested an injury of the heart or aorta.

In the lungs, there was a diffuse small nodular shadow, in addition to consolidations believed to be post-mortem changes (Fig. 14). The former was regarded as indicating pulmonary tuberculosis or pulmonary metastases.

Autopsy:

The right ventricle of the heart had exploded, and a hemorrhagic effusion had accumulated in the pericardium and thorax. After formalin fixation, multiple tubercles were found in the lungs (Fig. 15). Identical lesions were found in the spleen. In this case, the CT information prevented the transmission of pulmonary tuberculosis to the forensic staff.
Fig. 0: A high-density structure with a metal artefact in the right posterolateral part of the skull (arrow).

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**Fig. 0:** A wedge-shaped structure embedded in the skull (arrow).

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**Fig. 0:** Volume-rendered images of multiple stab wounds (arrowheads).

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**Fig. 0:** (a) A sharp edge of a metal piece on the skull (arrowhead). (b) A wedge shaped piece of the weapon (some areas of the skull was removed to exposure the metal.)

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**Fig. 0:** Some small circular defects on the surface of the skull (arrowheads).

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Fig. 0: Intracranial bone splinters just below the defect (arrow).

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**Fig. 0:** Intracerebral, intraventricular, and brain-surface haemorrhages (arrow). The arrowhead indicates meningioma.

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**Fig. 0:** A high-density structure with a metal artifact embedded in a left parietal wound in the skull (arrow).

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**Fig. 0:** A rod-like structure lodged in the skull (arrow).

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**Fig. 0:** An oval cutaneous defect in the right chest wall (arrow).

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**Fig. 0:** Many small high-density structures with metal artefacts scattered from the right chest to the upper abdomen.

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**Fig. 0:** An oval cutaneous defect in the right chest wall (arrow).
**Fig. 0:** Hemorrhagic bilateral pleural effusions and a pericardial effusion.
**Fig. 0:** Diffuse small nodular shadow and consolidations.

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**Fig. 0:** Multiple tubercles in the lungs.

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Conclusion

Post-mortem radiological imaging has a role not only in determining the cause of death, but also in providing helpful information for the autopsy. The radiologist should interpret the images with this in mind and give helpful information to the forensic pathologist.
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References


