Post Mortem CT Scan: An Alternative Method In Forensic Medicine And Trauma Research

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Abstract
In Israel, permission to conduct autopsy is very difficult to get. Postmortem CT PMCT scan allows a relatively quick diagnosis of causes for death. It also serves for quality assurance in trauma and trauma research. Seven cases of PMCT are demonstrated and discussed in this article.

INTRODUCTION
Since we have published our paper “Utility of postmortem computed tomography in trauma victims” (Donchin-Y; Rivkind-Al; Bar-Ziv-J; Hiss-J; Almog-J; Drescher-M J-Trauma. 1994 Oct; 37(4): 552-5; ) we have performed more than 90 postmortem CT scans.

We would like to present 7 cases to demonstrate the value of the postmortem CT scan PMCT. This method does not substitute formal necropsy, but if there is no other way to answer clinical question, like:

PMCT can be done within a few minutes and there is no need to touch the body. It is the method of choice when there is no time for further diagnostics or when permission for autopsy cannot be obtained. The following cases serve as an illustration of the possibilities of PMCT diagnostic.

CASE DESCRIPTIONS
Case 1: A 30-year-old Male was killed in a snapping accident. Head CT in soft tissue window demonstrates pneumocephalus (figure a, curved arrow). Intra-ventricular hemorrhage is also noted (figure a, straight thin arrow). A metallic fragment is seen in the nasopharynx, representing a dislodged tooth fragment with an amalgam feeling (figure b, straight block arrow). Figure c is a lateral cervical film demonstrating the metallic fragment within the nasopharynx (block arrow)
Case 2: A 24-year-old female was found in the driver’s seat within a completely damaged car. Death was pronounced upon arrival to the trauma unit. Figure a (CT slice at the level of the lower chest, lung window) shows a high position of the stomach as evidenced by demonstration of the stomach, the right lung and the visible parts of the left lung at the same level. A small pneumothorax is noted in the anterior part of the left hemithorax (figure a, thin arrow). Patchy infiltrates at the right lung base may represent aspiration or blood (figure a, straight block arrow). The patient most probably had traumatic rupture of the left hemidiaphragm.

Mediastinal windows of the same CT slice show a small heart with low density within the right ventricle as compared to the left ventricle (figure b star). This represents diluted blood in the left ventricle. Air is noted in the right ventricle (figure b, straight arrow). The heart is small due to massive blood loss. Demonstration of air within blood vessels and the heart represent postmortem changes and is frequently noted on PMCT within few hours following death.
Case 3: A 17-year-old male had a history of one day of fever and headache. The patient was found dead at home. Since the patient’s family was ultra-orthodox Jewish, postmortem examination was not performed. At PMCT of the chest, bilateral large alveolar infiltrates with multilobar pulmonary involvement was noted (figure a, lung window). Bilateral hilar lymph node enlargement was concomitantly seen on mediastinal window (figure b star). The patient most probably had an infectious disease, which caused his natural death.

Case 4: An 84 year old male with a known abdominal aortic aneurysm measuring 9 cm in diameter collapsed at home and was pronounced dead. At PMCT of the chest, a large amount of pericardial fluid was noted (figure a star, mediastinal window). The coronary arteries were calcified (figure a, straight arrow pointing at calcification of the LAD). An axial chest CT slice through the level of the ascending aorta shows two densities within the aortic lumen (figure b, straight block arrow). Slices through the mid-abdomen demonstrate a collapsed aorta measuring 7-cm in diameter with a large retro-peritoneal hematoma (figure c, curved block arrow and figure d, straight block arrow). The precipitating event was probably rupture of an abdominal aortic aneurysm with secondary dissection of the aorta and rupture into the pericardial cavity.
Case 5: A 23-year-old male was shot from behind by a high velocity bullet from a distance of about 20 meters. The patient was resuscitated in the trauma unit. He received 4 liters of volume replacement. Cardiac arrest eventually developed. Head CT (figures a and b, brain window, and c, bone window) showed soft tissue swelling of the left side of
the head. Metallic fragments were noted in the subcutaneous soft tissue as well as within the parietal lobe of the brain (figures a and b, straight arrows). Air is seen adjacent to the metallic shrapnel (Figure a, curved block arrow). The air within the brain is post-traumatic and is not related to postmortem changes.

**Figure 12**

**Figure 13**

**Figure 14**
Case 6: A psychiatric patient in an out-patient clinic killed a 24-year-old social worker. Chest CT, lung window (figure a) shows bilateral pleural effusions and a left pneumothorax. Air outside the thoracic cage represents subcutaneous emphysema (figure a straight arrows). Figure b (CT of the lower abdomen) shows an enlarged uterus with a calcified rim representing a fetal head (star). The head looks uneven due to trauma to the calvarial bones. The immediate diagnosis of pregnancy was of forensic value.

Figure 15

Case 7: A 20-year-old soldier was killed by terrorists. CT was performed 6 hours postmortem. Head CT, brain window (figure a) shows a shrunken brain with pneumocephalus (curved arrow). The bones are not intact and shrapnel is demonstrated within the brain and the surrounding soft tissue (figure a, straight arrow). A CT slice through the chest (figure b, mediastinal window) shows shrunken lungs containing air bubbles. This air is probably within the pulmonary blood vessels and not within the bronchial tree. This is an example of evolving postmortem changes, which should be familiar to the examining physician.

DISCUSSION

Even though this is a costly examination (for quality assurance in trauma research as well as in accident investigations) we have found the method to be of value for two main reasons:

Cultural differences among the nations of the world may warrant different techniques in forensic medicine, pathology
and trauma research. PMCT might be considered as one of the alternative postmortem diagnostic techniques when autopsies cannot be performed.

References

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