



D29 Features of Gunshot Wounds to the Head on Postmortem Computed Tomography

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After attending this presentation, attendees will be able to identify the characteristic features of gunshot wounds to the head, as seen on Postmortem Computed Tomography (PMCT).

This presentation will impact the forensic science community by providing pictorial information of characteristic features of fatal gunshot injuries to the head on PMCT. With the increasing use of postmortem imaging methods, forensic pathologists should be aware of special imaging characteristics of gunshot wounds to the head, such as entry and exit wounds, projectile paths and projectile localization. After the presentation, the audience will improve knowledge on typical patterns of bullet wounds to the head and learn about the limitations and advantages of PMCT concerning this topic.

Purpose: Fatal head injuries due to gunshots can be either penetrating or perforating and projectiles may or may not be found inside the cranial cavity. Describing the exact path of the projectile, beveling, and resulting injuries, as well as determining the entry and exit wounds, are of great importance in forensics. There are special macroscopic characteristics, which a forensic pathologist uses to distinguish between entry and exit wounds during autopsy. Reconstruction of events is feasible based on these findings. The goal of the present retrospective case study was to determine if PMCT examination in cases of gunshot fatalities to the head could answer relevant forensic queries. Similar studies in the past, with fewer cases, have already stated the importance of PMCT when investigating such fatalities.

Material and Methods: The Forensic Institute database was retrospectively evaluated for lethal gunshot wounds to the head. In a five-year period (March 2005 to March 2010) 46 cases were identified. The postmortem interval (time interval between death and the CT imaging), the manner of death (suicide, homicide, accident) as well as the age and sex distribution of the fatalities were evaluated. Axial, sagittal and coronal multiplanar reformations, as well as volume rendered models, were constructed. Primary image review and 3D reconstructions were carried out on a CT workstation and on the local picture archiving and communication system (PACS).

Results: Image findings were analyzed for projectile-type, penetrating or perforating injuries and specific location of entry wound. Typical imaging characteristics for each group were determined. The presence of gas, metal parts, projectiles, or osseous fragments in the cranial cavity as well as parenchymal brain injuries and intracranial hemorrhages were evaluated.

Discussion: PMCT is a reliable technique to depict fatal gunshot injuries to the head. Identification of beveling, reconstructions of a bullet path and identification of gunshot entry or exit wounds are feasible. Moreover, PMCT as a cross-sectional imaging modality allows for precise anatomic localization of bullets in penetrating trauma, clearly superior to two-dimensional plain radiography. Identification of millimeter-sized foreign objects (e.g. metal or osseous fragments) is feasible on PMCT whereas such findings might be missed during manual dissection or not even be dissected (e.g. face, cranio-cervical junction, vertebral column). Image reconstructions of PMCT are easy understandable for lay-people and at court, besides the advantage of permanent documentation and the possibility of re-evaluation. Findings are displayed in a time saving manner without any obligatory destruction during classical autopsy. Limitations of PMCT imaging, such as depiction of soot residues, skin patterns and vascular lesions are discussed. Besides external inspection, these limitations can (partially) be overcome by complementary surface scanning, photogrammetry and PMCT-angiography/magnetic resonance imaging.

Conclusions: PMCT is an excellent tool for displaying perforating and penetrating gunshot wounds to the head and allows for reconstruction of events. In order to improve quality in the field of forensic pathology, PMCT should be applied in routine investigation of legal cases, especially in cases with fatal gunshot wounds to the head.

Virtopsy, Gunshot Wound, Postmortem CT