



Pathology Biology Section – 2009

G114 Intersecting Fractures of the Skull and Gunshot Wounds: Case Report and Literature Review

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After attending this presentation, attendees will have a clear example of Puppe's rule utility in gunshot wounds analysis and will learn the advantages of a Multi-Slice Computed Tomography approach in such cases.

This presentation will impact the forensic community by demonstrating the ability of CT scanning to show gunshot wounds to the skull vault including entrance wound, exit wound with beveling, direction of the bullet path as well as differentiation between entrance and exit wounds using intersecting fractures (Puppe's rule).

This paper highlights the ability of CT scanning to show gunshot wounds to the skull vault including entrance wound, exit wound with beveling, direction of the bullet path as well as differentiation between entrance and exit wounds using Puppe's rule.

This rule, established by the German forensic pathologist Puppe in 1903, states that when two or more fracture lines of the skull produced by different blunt forces intersect, it is possible to reconstruct the sequence of injuries.

The intact skull allows fracture lines to develop normally while the presence of bone damages causes the subsequent injuries to stop in the point of intersection with the previous wounds. In other words this means that fracture lines produced by subsequent impacts are arrested at pre-existing fractures of the skull.

No exceptions to this rule have been found in systematic investigations on skulls, glass, and eggs stricken with subsequent blows.

Although multiple gunshots cause an extensive and sometimes very complex pattern of fractures due to the hydrodynamic effect produced by the bullet traversing the temporal cavity of the brain, in the majority of cases, Puppe's rule can be usefully applied.

This principle gains interest in sequencing multiple gunshot injuries and in determining the direction of fire. However, it may be useful also in differentiating entrance from exit wounds, especially if specific distinguishing features are absent (i.e., internal/ external beveling of the skull).

Herein a case of a 76-year-old man who shot himself in the mouth with a Walther PPK 7.65 handgun (caliber 9x17 mm) is reported.

Prior to autopsy a total body multislice computed tomography scan (MSCT) was performed. MSCT scanning was executed on a Mx 8000 Quad Diamond select unit (Philips Medical Systems, Andover, MA). In areas of forensic importance, axial MSCT was performed with 4 x 1, 25 mm collimation. The duration of MSCT scanning was approximately 15 min. Using an open-source workstation (OsiriX version 3.1) it was possible to calculate two-dimensional sagittal and coronal reformations and three-dimensional reconstructions.

Major radiological findings were: a bone defect of the hard palate, a complex pattern of fractures of the ethmoid bone with hemorrhagic filling of the ethmoid sinus, an anterior pneumoencephalus, a fracture of the anterior cranial fossa and a bone defect of the vault with external beveling of the outer table.

The abrupt termination of a fracture line belonging to the exit wound pattern (parietal bone) at a pre-existing damage caused by the entering bullet (temporal fracture originating from the entrance wound), well documented by the 3D-CT reconstruction, was used as an adjunctive tool to better distinguish the entrance from the exit wound.

This paper describes a clear visual example of Puppe's rule utility in the analysis of gunshot injuries of the skull and highlights the importance of postmortem forensic radiology.

In fact, MSCT allowed the investigation of the anatomical sites that are hardly accessible at autopsy (such as paranasal sinuses, temporal and ethmoid bones, etc.) and offers different views and angles of imaging improving the quality of the investigation.

Gunshot Wounds of the Skull, Intersecting Fractures, Puppe's Rule