# H92 Micro-Computed Tomography (CT) Analysis of Deadly Gunshot Wounds

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After attending this presentation, attendees will be aware of the advantages and the limitations related to the application of micro-CT for the analysis of gunshot wounds.

This presentation will impact the forensic science community by demonstrating the importance of performing radiological postmortem investigations, including micro-CT analysis of firearm wounds, for reconstructing the shooting incident.

Radiological techniques for the study of gunshot wounds can be used to detect foreign bodies such as metallic fragments or projectiles, document the bullet path, discriminate osseous entry and exit wounds, and evaluate any associated tissue damage prior to autopsy.[1-5]

This study tested micro-CT (a radiological technique which provides greater spatial resolution with respect to clinical computed tomography) for the examination of gunshot wounds experimentally produced on human skin (fresh, decomposed, charred, submerged, and covered by textile specimens) in order to perform tridimensional reconstructions of the spatial distribution of Gunshot Residue (GSR) particles.[6-8]

The results of this experimental study demonstrated that micro-CT analysis is an objective and rapid tool for estimating the firing range in intermediate-range gunshot wounds as well as for differentiating Entry Wounds (EntW) from Exit Wounds (ExtW).

Presented is a case series of seven gunshot-related deaths (two dyadic deaths, two suicides, and one homicide). For each case, a comprehensive crime scene investigation, including criminalistics analysis, was performed. On each corpse, an unenhanced Multi-Slice Computed Tomography (MSCT) was performed before the autopsy. During the forensic autopsy, gunshot wounds were sampled (i.e., skin specimens comprising the substance defect and the surrounding epidermis, dermis, and subcutaneous fat) for micro-CT and histological analysis.

Twelve firearm wounds were analyzed. Eight were located on the head/skull (five EntW and three ExtW), and four were located on the thorax (two EntW and two ExtW). Micro-CT analysis evidenced radiopaque particles in all the entry lesions, providing information concerning the firing range and the differential diagnosis between the EntW and ExtW.

Hyperdense particles were also detected on the three exit lesions located on the head. The morphological evaluation of that material (cubic-shaped fragments and smaller roundish particles) suggested the presence of at least two kinds of material: metal GSR-like particles and bone fragments, which were indistinguishable based on the radiological density.

In all cases, the integration of radiological, autopsy, and histological data allowed the reconstruction of the trajectory of the gunshot and the most probable dynamics of the event.

The most important limit of micro-CT analysis is that this technique allows only a presumptive identification of the GSR particles and, consequently, substances with the same density of powder particles might be erroneously tagged as GSR, generating a false positive result. In particular, further studies are required to solve bone contamination problems whether on a radiological basis (i.e., low voltage micro-CT protocols, multiple thresholds, etc.) or on a chemical basis (i.e., decalcification of the specimen without altering its GSR content).

Considering that micro-CT is a non-destructive technique, a possible solution for the above-mentioned problem could be the identification of the chemical composition of the radiopaque residues by means of an environmental scanning electron microscope coupled to an X-ray fluorescence energy dispersive spectroscope.

In conclusion, micro-CT analysis may furnish important information on the trajectory of the gunshot and the dynamics of the event and, in combination with other autopsy and crime scene findings, may play an important role in reconstructing the shooting incident.

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**Micro-CT, Gunshot Wounds, Gunshot Residues**