H60 Fracture Patterns in Postcranial Flat Bones Inflicted With High-Velocity Expanding Ammunition From Two Different Ranges

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After attending this presentation, attendees will gain insight into the fracture patterns created on postcranial flat bones shot by high-velocity expanding ammunition. The goal of this study is also to aid in better understanding the influence which shooting distance has on the pattern of injuries inflicted on postcranial skeletal elements.

This presentation will impact the forensic science community by furthering the understanding of gunshot injuries on flat bones caused by a civilian rifle. The information gained from this presentation will assist forensic anthropologists to infer the type of weapon and the approximate shooting distance based on the fracture patterns of postcranial flat bones. This is crucial in both civilian and military frameworks when reconstructing the circumstances of an individual's death.

The majority of the studies published on gunshot injuries have been focused almost exclusively on the cranium.[1-3] Very limited research regarding projectile trauma to the postcranial skeleton has been published and even less related to gunshot traumas inflicted by high velocity weapons.[4-8] Most of this published research does not involve experimental studies; nor in many instances are the variables (bullet caliber, trajectory, etc.) involved in the production of the observed fractures actually known. Logic has been used to interpret these sequelae, but in the absence of experimentally derived data, the likelihood is equivocal.

An experimental study was carried out in both the TRACES facility and the forensic anthropology laboratory of the University of Central Lancashire using the domestic pig (*Sus scrofa*). Fifteen half-carcasses and eight heads were shot from a muzzle-to-target distance of 5m and fifteen half-carcasses and seven heads from a range of 20m, respectively, with a 0.243 caliber hunting rifle and as perpendicular as possible to the target. The scapulae, the ribs, and the mandibles were successively defleshed, macerated, and reconstructed. The resulting fracture patterns were classified according to the respective observations for each type of bone separately and compared for the two ranges. Radiographs of the mandibles and the scapulae were also obtained.

Preliminary results showed that the six mandibles which were directly hit by the bullet from the 20m distance presented a wide irregular entrance site on the target-ramus with a characteristic radiating pattern and with no or minimal fracturing of the opposite ramus. On the contrary, the three mandibles shot from the 5m-range showed either a through-and-through pattern (i.e., entrance on the target-ramus and exit on the opposite ramus) or comminuted fracture of the opposite ramus. The higher amount of kinetic energy transferred to the bone tissue in the case of the 5m shooting range in combination with the composition of the mandibular bone tissue represent possible explanations for this difference in the pattern.[9] The mandibles that were indirectly fractured (i.e., the maxilla was accidentally shot instead of the mandible) either from the 5m or the 20m distance showed similar pattern, comminuted in nature, implying that the expansion of the bullet inside the oral cavity caused this pattern irrespective of the distance of shooting.

The "Tree statistical analysis" performed for the scapulae revealed, with an accuracy of approximately 82%, that the presence of comminuted fractures was the main characteristic that differentiated the bones shot from the two distances. Additionally, the majority of the scapulae shot from the 5m distance presented exfoliation both toward the direction of fire and opposite to it; on the contrary, the scapulae shot from the 20m range showed exfoliation only on the surface toward the direction of fire. The higher degree of plastic deformation of the bone tissue caused by the missile in the case of the shorter distance of shooting may explain this observation. The analysis of the ribs revealed preliminarily that in order to determine the distance of firing, the specific location of the fracture (i.e., on the vertebral, middle or sternal third) plays an important role in the morphology of the resulting fracture patterns.

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