A134 Estimating Skeletal Differences Between Contact and Non-Contact Gunshot Wounds to the Head: The Role of Forensic Anthropologists in Understanding Circumstances of Death

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After attending this presentation, attendees will understand some of the skeletal differences observed between contact and non-contact gunshot wounds to the head and will appreciate the potential of skeletal trauma analysis in understanding circumstances of death.

This presentation impacts the forensic science community by contributing to bone trauma analysis and stressing the role of forensic anthropologists as valuable consultants to forensic pathological determination of cause and manner of death.

The analysis of gunshot trauma in medicolegal contexts is relatively straightforward for medical examiners when soft tissues are well preserved. One of the key factors to guide the estimation of manner of death is range-of-fire; however, in skeletonized remains, the task is more difficult because the analysis lacks soft tissue evidence. This project evaluates the contribution of skeletal injury, particularly fracture patterns, to evaluations of gunshot distance. This study was conducted using a case-based analysis approach to determine the presence or absence of skeletal differences between known contact and non-contact gunshot wounds to the head.

Fifteen contact gunshot cases to the head (12 suicides, one homicide, and two undetermined) and 23 non-contact gunshot cases (all homicides) were collected for a total of 38; ten from the McCormick Collection at The University of Tennessee, four from the Office of the Chief Medical Examiner in Knoxville, TN, three from the Wayne County Medical Examiner's Office in Detroit, MI, and 21 from the Modern Skeletal Collection of the National Institute of Legal Medicine and Forensic Sciences in Bogotá, Colombia.

Information on range-of-fire and type of caliber was provided in the autopsy and ballistic reports. All cases were wounded by low-velocity bullets. A total of 24 variables were collected to characterize the overall injury analysis, including quantitative data, such as entrance and exit diameters, number of radiating and concentric fractures associated with entrance and exit defects, number of secondary fractures, and average length of fractures. Qualitative data include anatomic location of entrance and exit defects and types and location of symmetric fractures. Kruskal-Wallis Non-Parametric test was conducted to find statistically significant differences between contact and non-contact gunshot wounds ($p=0.05$).

Results indicate that, compared to non-contact wounds, contact gunshot wounds are associated with higher frequencies of: (1) entrance fractures; (2) exit fractures; (3) average length of exit fractures; (4) total number of secondary fractures; and, (5) average length of secondary fractures.

Qualitative data results suggest statistically significant differences in the anatomic location of entrance defects. Common entrance locations for suicides are in the mouth, the temples, and the forehead. Non-contact gunshot wounds do not follow any pattern because homicidal wounds occur more randomly with less localization.

Two types of secondary symmetric radiating fractures occurred more frequently than others: (1) bilateral diagonal fractures going through the external acoustic meatus and the squamous portion of the temporal bone; and, (2) bilateral diagonal fractures on the maxilla going from the inferior orbital border to the alveolar process. The first type occurred equally often in contact and non-contact gunshot wounds with no specific entrance defect location associated. The second type appeared to be more frequently associated with contact gunshot wounds with no specific entrance location related. Findings indicate that no specific type of fracture is associated with range-of-fire and or specific entrance locations; however, it is suggested that the analysis of these types of fractures needs additional examination.

The results are based on a small sample and must be carefully considered. Further research is important to establish if these findings are consistent and, hopefully, to estimate the presence or absence of craniofacial fracture patterns associated with contact gunshot wounds to the head. Unfortunately, the number of cases in this study does not support evidence of any frequent type and/or location of fractures in relation to range-of-fire. Additionally, while the establishment of manner of death cannot be solely based on scientific analysis of the victim's remains — due to the significance of an interdisciplinary investigation of each case —the importance of the expertise of forensic anthropologists in the analysis of bone trauma and their contributions in the understanding of circumstances of death is emphasized.

Skeletal Gunshot Trauma, Bilateral Symmetric Fractures, Manner of Death

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