



## Physical Anthropology Section - 2014

### H35 Skeletal Characteristics of Quadrilateral Defects in Cranial Bones: A Mixed Mechanism Category of Trauma Associated With Pointed Axes

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After attending this presentation, attendees will have a better understanding of the skeletal characteristics of quadrilateral defects in cranial bones.

This presentation will impact the forensic science community by describing patterned entry and exit wounds in a human rights case and a bioarchaeological sample. These wounds are associated with a mixed mechanism category of skeletal trauma likely caused by a particular class of objects: pointed axes.

This study assesses characteristics of quadrilateral defects on crania from two skeletal samples, including from the Tuskulena Case and the Battle of Towton. The Tuskulena case consists of 767 prisoners executed in the Lithuanian Soviet Socialist Republic by the Soviet state from 1944 to 1947. In this study, peri-mortem trauma was examined in 155 individuals. Twenty-two of these individuals demonstrated 30 quadrilateral entry wounds and 9 quadrilateral exit wounds. Similar quadrilateral defects were observed in remains from the Battle of Towton (A.D. 1461) in North Yorkshire, England. Associated with the Wars of the Roses, this bioarchaeological sample included four individuals who exhibited a total of seven quadrilateral entry wounds. Quadrilateral defects observed in both of these cases were examined with regard to macroscopic characteristics, including entry versus exit wounds, wound shape, wound size, edge damage, and radiating fractures.

Combining the samples, a total of 46 defects were evaluated including 37 entry wounds and 9 exit wounds. Quadrilateral entry defects generally exhibited four linear sides and four 90° angles, resulting in square or rectangular-shaped wounds. However, when accompanied by a high degree of fragmentation, irregular wounds also occurred. The maximum length (mean: 20mm) and maximum width (mean: 16mm) of entry wounds varied considerably, likely due to differing sizes, depths, and angles of penetrating objects. Radiating fractures were observed in 84% of entry wounds and ranged from one to four linear fractures. Finally, all quadrilateral entry wounds demonstrated associated edge damage, including internal beveling or delamination (88%) and external beveling or delamination (87%). Quadrilateral exit wounds were far more variable in size than entry wounds, with only 25% exhibiting square or rectangular shapes. Radiating fractures were observed with all exit wounds and ranged from one to three in number. While internal bevels were limited or lacking on exit wounds, external bevels were present on all exit defects. Finally, crushing, peeling, and lipping were frequently observed on the margins of both entry and exit defects.

This study proposes a class of weaponry, pointed axes, as a primary cause of these quadrilateral defects. Objects associated with these wounds are square or rectangular-shaped in cross-section, have a pointed tip, taper from base to tip, and have sufficient mass to penetrate bone. When impacting bone, these objects represent a combination of sharp force and blunt force trauma. Implements categorized under the class of pointed axes may include pick axes, ice axes, poleaxes, and war hammers.

This study reports the characteristics of quadrilateral entry and exit defects in cranial bones from two skeletal samples. Specifically, quadrilateral entrance wounds were commonly square or rectangular in shape, while exit wounds were more variable in shape and size. While internal and external beveling was observed on entrance wounds, only external beveling was observed on exit wounds. However, both entry and exit wounds exhibited radiating fractures as well additional types of edge damage. Quadrilateral defects likely result from a combination of both sharp and blunt force trauma. Additionally, this study proposes a class of weapon (i.e., pointed axes) commonly associated with these patterned defects. The goal of this presentation is to report a typology of quadrilateral defects and an associated class of weaponry to the forensic science community.

#### **Skeletal Trauma, Quadrilateral Defects, Pointed Axes**