H125 Down to the Wire: Radiographic Positive Identification Using Midline Sternotomy Wires

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The goal of this presentation is to report the findings of research investigating the use of midline medical sternotomy wires as a means for positive radiographic identification of unknown human remains.

This presentation will impact the forensic science community by addressing the feasibility of making a positive identification using medical chest radiographs when sternotomy wires are present.

Forensic anthropologists are regularly called upon to positively identify hitherto unknown individuals using comparative medical radiography. Given the *Daubert* criteria for evidence admissibility, and the need for validated forensic methods, this study was conducted to document the statistical validity of employing sternotomy wires as a method of positive identification. This research follows numerous other radiographic studies which have focused on the hyoid, hand, frontal sinuses, vertebrae, clavicle, maxillary sinuses, ankle, and orthopedic surgical devices to identify human remains. While previous studies have tested the reliability of surgically implanted devices, these findings have focused on the type of device, such as hip implants and plates/screws related to fracture repair, or the manufacturer and lot number and serial number of the device. These devices can be useful for refining potential matches, but they are not unique discriminating elements since many individuals have their hip or knee replaced and fractures surgically repaired.

This study is unique in that it evaluates surgically implanted metal sutures for their distinct and individualizing characteristics. To the knowledge of the authors, this is the first radiographic positive identification study in which sternotomy wires have been analyzed. Additionally, this study has the largest participant sample size (46 professionals and students) of any medical radiography comparison study to date.

Sternotomy wires, or sternal wires, are metal sutures used to secure the sternum after open heart surgery or any other surgical procedure in which the sternum is bisected. Sternotomy wires are typically midline along the sternum and can vary in size, shape, and number since they are hand-tied by surgeons. The foundation of this study was the comparison of antemortem and postmortem radiographs with sternotomy wires. The 46 participants were forensic anthropologists and graduate students trained in this identification technique. Participants were asked to match five antemortem radiographs to 20 postmortem radiographs and complete an anonymous survey detailing their education level, degree held, experience making radiographic comparisons, the number of cases they have completed involving radiographic comparisons, and whether they had ever made an identification using sternotomy wires. Additionally, they were asked which aspect of the wires they found most useful in making a match. The chest radiographs with sternotomy wires were obtained from the Michigan State University Forensic Anthropology Laboratory (MSUFAL), the Michigan State University Anatomy Laboratory, the Office of the Chief Medical Examiner in Genesee County, Michigan, and Sparrow Forensic Pathology Services in Lansing, Michigan.

The anonymous survey responses were used to assess accuracy, sensitivity, and specificity. Collectively, participants were 99.5% accurate in correctly matching the antemortem radiographs to the postmortem radiographs. When separated by highest degree held, those with a PhD were 99.7% accurate, those with a Master's were 99% accurate, and those with a Bachelor's were 99.5% accurate. The sensitivity of the 46 examiners was 98.7% and the specificity was 99.7%, indicating very few false positives and false negatives (only two false positives and three false negatives). The majority of participants (65%) found the shape of the sternotomy wire loops the most useful characteristic in determining a match. This was followed by the shape or location of the sternotomy wire ties (26%).

The results of this study demonstrate that sternotomy wires can be used as a reliable method for making radiographic positive identifications. Regardless of a participant's education level or case experience, the presence of sternotomy wires in antemortem and postmortem radiographs yielded high sensitivity and specificity. As the high accuracy rates indicate, sternotomy wires are unique; therefore, the shape, size, and various characteristics of the wires are individualizing and can be used to confidently make positive identifications. This research has contributed a new, statistically acceptable method of positive identification to the forensic anthropology community, and satisfies the *Daubert* standards.

Sternotomy Wires, Positive Identification, Comparative Radiography

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