H2 The Human Petrous Temporal Bone: Potential for Forensic Individuation

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After attending this presentation, attendees will learn about the potential utility of the petrous temporal bone, as seen on computed tomography images, as a means to make individual forensic identifications of persons from highly fragmentary skeletal remains.

This presentation will impact the forensic community and/or humanity by demonstrating the utility of the petrous temporal bone, as seen on CT images, as a means to make individual identifications in cases in which human remains are heavily fragmented as is often the case in mass disaster investigations. The petrous bone is of particular utility because of its resistance to taphonomic influence and frequent availability, in the form of CT images, to investigators.

Personal identification is of primary importance in forensic investigations involving decomposed human remains. Frequent complications of the identification process can result from a vast number of taphonomic influences, particularly in mass disaster and human rights investigations. Remains are often heavily fragmented and commingled due either to myriad destructive circumstances in the case of mass disasters, or by intentional efforts to hinder identification efforts in the case of human rights related criminal activity.

The forensic scientist has at his/her disposal numerous techniques which yield more or less definitive identifications, but that are often vulnerable to taphonomic complications. DNA identification for example, which is generally preferred for individual identification, is on many occasions not possible because the DNA has been destroyed by taphonomic influence, most commonly fire, or because there is not an antemortem DNA sample to which comparisons can be made. The literature is also inundated with published attempts to find means of extracting diagnostic information directly from fragmentary skeletal remains themselves. Most of these efforts have focused on developing methods from areas of the skeleton which are of known diagnostic significance. Unfortunately, the most individually diagnostic portions of the skeleton, such as the midface are often those that are most susceptible to taphonomic destruction. Even dental remains are often not complete enough for identification due to destruction of the surrounding skeletal matrix. Thus, in spite of the efficacy of these techniques under ideal conditions, they are rarely of practical utility in mass disaster and human rights investigations. A different tact is proposed here. Rather than developing further techniques for identification based on portions of the skeleton that harbor known diagnostic value in spite of their low representation in mass disaster, human rights, and even archaeological settings, this investigation will focus on establishing the as yet undiscovered diagnostic value of a portion of the skeleton which most frequently survives taphonomic destruction.

The petrous portion of the temporal bone is widely considered to be the densest bony structure in the human skeleton (Swartz 1990). The consequent resistance of the petrous bone to taphonomic destruction is broadly appreciated in the forensic literature. However, little effort has been levied on extracting information of individually, sexually, or ancestrally diagnostic value from this portion of the skeleton, although recently some scholars have begun to explore it superficially.

This poster tests the following hypotheses: 1) as visualized in computed tomography imaging, the morphology of the petrous portion of the temporal bone is individually variable; 2) by means of comparing ante- and postmortem CT images, this variability can be used to make individual positive identifications; and/or 3) that the same variability will provide a reliable means to resolve issues of commingling of individual remains associated with exposure to the taphonomic processes associated with mass disasters, and archaeological excavations. More specific is the hypothesis that an antemortem CT image can be matched to a cranium from which the image is known to have been taken. Finally, it is hypothesized that an antemortem CT image can be correctly associated with the skull from which it was taken in cases in which the identity is not known, and there is more than one skull for comparison.

The head CT scans of 120 adults (60 males and 60 females) were assessed statistically in three dimensions. Coordinate data were collected from 3D reconstructions of the petrous portion of the temporal bone (along the x, y and z axes) as distance matrices. The landmark locations and the measurement distances between them were tested for repeatability, and variability. Coordinate data collected for 18 independent landmarks were included in this study. The poster will show which landmarks were diagnostic and in which combinations they were effective in their support of the above stated hypotheses. It will also discuss the statistical reliability with which ante and postmortem CT images could be matched using these data.

Mass Disaster, Personal Identification, Petrous Temporal Bone

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