A39 Human Identification From Burnt Remains

Joe Adserias, DDS, PhD, C/ Balmes 62, Barcelona, SPAIN; Anna Hospital, MD, Figueres, Girona 08007, SPAIN; Luis L. Cabo, MS, Dept of Applied Forensic Sciences, 501 E 38th Street, Erie, PA 16546; Steven A. Symes, PhD, Mercyhurst College, Mercyhurst Archaeological Institute, 501 E 38th, Erie, PA 16546; and Dennis C. Dirkmaat, PhD, Mercyhurst University, Dept of Applied Forensic Sciences, 501 E 38th Street, Erie, PA 16546*

After attending this presentation, attendees will acquire a deeper understanding of the cremation process as well as of some alterations of human bone and teeth commonly associated with fire exposure.

This presentation will impact the forensic science community by describing the skeletal traits observed after a commercial cremation that can be used to estimate the biological profile as well as to achieve an individual identification.

Cremation of biological materials is a destructive and minimizing process. Brunt human remains identification is challenging at best. The most common methods for identification of burnt remains are odontology and DNA. However, these methods require the availability of antemortem records to be compared to postmortem data. In cases where no antemortem records are available, the first step in the identification process is to determine a biological profile of the victim through the assessment of sex, ancestry, age, and stature. Next, antemortem trauma or other pathology markers, particularly in radiographs, could serve as individualizing characteristics. Finally, antemortem and postmortem data are compared to assess the likelihood of the match.

Due to fracturing, deformation, shrinkage, and color changes, the amount of osteological data that can be extracted and accurately assessed from burnt remains is often limited. A greater understanding of fire-related bone alteration can serve to extend this information and is critical for its interpretation. Commercial cremation is one of the more destructive treatments of human remains. This process involves burning the body until all organic materials are destroyed by heat, followed by pulverization of the burnt remains before returning the ashes to the family. Literature on human cremations published before the previous decade mostly focuses on archaeological remains. More recent publications pay more attention to forensic contexts, focusing on fire related macro- and microstructural changes to bone. Examination of human bodies in commercial cremations can provide an optimal assessment of the skeletal markers that are more resilient to fire destruction and thus more useful for determining the biological profile of burnt victims.

The material for study includes the analysis of 30 bodies submitted to commercial cremations from Memora Funeral Home (Salt, Girona, Spain). Standardized pre-cremation observations of the body were recorded before placing the body into the crematorium. After cremation, and before pulverization, standardized post-cremation observations of the remains were completed. The crematorium conditions (temperature and time of exposure) were essentially the same for all individuals included in the study. Pre-cremation data included sex, ancestry, age-at-death, body constitution, cause of death, dental data, and *postmortem* alteration during autopsy or embalming, as well as cremation parameters such as the presence of clothes or shroud, and body position in the crematorium. Post-cremation data collection included the surviving skeletal and dental elements that would allow assessment of sex, ancestry, age, pathology, and individual identification of the body and dental prosthesis recovered and their significance for identification, and bone and teeth alterations due to fire exposure.

The observed color spectrum went from the predominant white color expected from complete calcination to orange/brown tones observed in the spongy bone of vertebral bodies, the inner layer of cranial diploe, and the ribs. Gray colors could be observed in long bones. The colors observed in teeth were white and gray. Skeletal preservation was higher in male individuals, which could be attributed to the increased robusticity and body size of the male skeleton. Maxilla, mastoid processes, orbital ridges, vertebrae, coxae, and long bone epiphyses proved to be the most resilient areas, while ribs, cranial vault, and long bone diaphyses displayed the highest degree of deformation. Long bones generally showed the presence of curved transverse fractures and longitudinal fractures. Patina fractures were conspicuous on the surface of vertebral bodies. Cranial fractures often coincided with the suture lines, while mandibles often presented condyle fractures. This study showed that it was not possible to estimate stature in any case, due to heat alteration of long bones; however, the burned elements that contributed to sex assessment were sciatic notch, femoral and humeral heads, orbital ridge, mastoids, inion, and nuchal crest. Age assessment was more often possible from long bone epiphyses, teeth, and degenerative traits such as vertebral osteophytes or osteoarthritis in joints. Body and teeth prostheses and consolidated fractures provided individualizing characteristics.

Burnt Human Remains, Commercial Cremation, Skeletal Identification