A89 Analysis of the Interactions Between Taphonomic and Pathological Processes

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After attending this presentation, attendees will better understand how taphonomic events interact with different pathological processes and how these interactions affect overall skeletal preservation.

This presentation will impact the forensic science community by providing information regarding how the taphonomic environment of a burial can affect the preservation and presentation of pathology. As pathological conditions are often used along with the biological profile to create a positive identification and forensic remains are found in a variety of taphonomic circumstances, it is vital to understand how these factors interact.

Variation in pathological processes and damage associated with taphonomic processes can greatly affect observable skeletal material. Research into how these processes interact with each other is therefore important to combat biases that arise from incomplete or damaged skeletal material. Understanding the specific effects of taphonomy on pathology, and their cumulative relationship with preservation, is valuable to forensic practitioners. Pathological conditions are often used to help create a positive identification with a missing persons report. The National Missing and Unidentified Persons System (NamUs) often includes health information that can be used to identify unknown remains. As forensic remains are found in a variety of taphonomic circumstances, it is vital to understand how those factors influence the identification of pathology in skeletal remains.

This study tests the hypothesis that taphonomic events differentially affect bone exhibiting pathologies that increase or decrease bone density. Taking into account density-mediated attrition, taphonomic events are examined separately against pathologies that build or remove bone matrix.

Data were collected from three samples. The first was the Santa Clara Valley Medical Center (VMC) collection, a historic pauper cemetery currently housed at California State University, Chico (CSUC). The second sample was the forensic modern collection at the same location. The final sample included the New York City Office of the Chief Medical Examiner (NYC OCME) forensic anthropology cases. In total, 77 individuals were analyzed. Taphonomic processes were coded as present/absent based on skeletal presentation. Pathological indicators were also coded as present/absent. Attempts at diagnosis were not undertaken; instead, pathological indicators were considered based on the cellular response they elicited. Categories used included osteoblastic, osteoclastic, mixed response, mechanical destruction (e.g., eburnation), and healed trauma. Preservation was recorded in quartiles based on percent present. Chi-square and Cramer's V were conducted using R.

Of the 13 taphonomic events present in the sample, two have significant relationships with bone that exhibited no pathology: scavenging (p<=0.01, V=0.20) and weathering (p=0.04, V=0.08). Osteoblastic response is significantly associated with the same two processes: scavenging (p<=0.01, V=0.14) and weathering (p=0.04, V=0.08). Healed trauma is only significantly associated with overall skeletal preservation (p<=0.01, V= 0.14). Pathological processes that reduce bone density produce a greater number of significant associations. Osteoclastic response is associated with burning (p=0.04, V=0.08). Mixed reaction has significant relationships with staining (p=0.02, V=0.09), Postmortem Damage (PMD) (p=0.01, V=0.10), and acid corrosion (p<=0.01, V=0.11). Mechanical destruction is significantly associated with four taphonomic events: PMD (p=0.02, V=0.09); acid corrosion (p<=0.01, V= 0.12); adhered material (p=0.01, V=0.09); and exfoliation (p<=0.01, V=0.11).

The number of significant interactions demonstrates that taphonomy does differentially interact with pathologies that reduce or increase bone density. Pathological processes that build bone only interacted significantly with two taphonomic events, while pathological processes that remove bone interacted with six, including the more damaging taphonomic processes like acid corrosion and PMD; however, when the direction of the relationships is analyzed, pathological processes that remove bone have lower percentages of taphonomic damage than elements that do not exhibit those pathologies. This may be a byproduct of the extremely poor preservation found in the VMC collection. The high rates of acid corrosion and PMD at this site may have resulted in the removal of elements with reduced structural integrity before excavation, producing a sample with above-average density. While this result is possibly a product of the samples used and further analysis must be undertaken to assess these differences, it may indicate that the interaction between pathology and taphonomy encompasses more than just overall bone density.

Taphonomy, Pathology, Skeletal Preservation