The co-occurrence of congenital anomalies and osteoarthritis in the foot and ankle

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Introduction

Skeletal defects present in the foot at birth, or congenital anomalies, are pervasive but often overlooked conditions in prehistoric populations (Case et al., 1998; Regan et al., 1999; Burnett and Case, 2005). Similarly, osteoarthritis and related inflammation of the joints are ubiquitous in human populations, especially in older adults (Weiss and Jarmain, 2007). Although both conditions have been studied, previous research has not explored the possible interrelationship of these conditions. Weiss and Jarmain (2007) list anatomical variation as an influence on the presence and severity of osteoarthritis, arguing that anatomical variation affects the torque and movement of joints, increasing the stress on a joint, and promoting arthritic change. It would follow that congenital anomalies, which are anatomical variants, would have some impact on the occurrence and degree of osteoarthritis. To evaluate the relationship between anomalies and arthritic change, a survey of anomalies in the foot was conducted on a series of 250 pre-Columbian Yema Indians from the Puye site in northern New Mexico (tree-ring dated to 1507-1561 AD) (Burnes, 1991). Four congenital anomalies were assessed and levels of arthritic change were recorded for each element of the foot.

Understanding the relationship between congenital skeletal anomalies and osteoarthritis not only contributes to the understanding of both conditions, but also has larger implications in understanding the relationship between congenital and pathological conditions. Additionally, this research provides a better understanding in the quality of life and living conditions of the individuals who inhabited Puye and other related prehistoric populations.

Materials and Methods

Due to time constraints, only the first ninety-one adults within the target age ranges were examined for this initial study, with a total of eighty-nine individuals used in this analysis. Each individual’s age and sex were obtained from data provided by the Repatriation Osteology Laboratory at the National Museum of Natural History. These data were used to determine whether the observed characteristics varied by age or sex. Scoring for each anomaly and level of arthritic change was derived from Wilczak and Jones, 2011; Silva, 2010; Regan et al., 1999; Case et al., 1998; and Buikstra and Ubelaker, 1994. The scoring systems ascribe a numeric code to an observable characteristic, providing a standardized expectation for observation. Of the anomalies scored, Os Trigonum was not present in this sample.

Scoring Os Trigonum

<table>
<thead>
<tr>
<th>Score</th>
<th>Meaning</th>
<th>Look For</th>
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<tbody>
<tr>
<td>1</td>
<td>Present</td>
<td>Accessory ossicle on the posterior end of the talus</td>
</tr>
<tr>
<td>2</td>
<td>Unobservable</td>
<td>Unable to view area where anomaly could be present</td>
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The poor preservation of some of the remains, because of their archeological context, resulted in a number of fragmented or missing bones, making some features unobservable, this affected the coding process. Historical archaeological excavation protocol also resulted in a number of comingled remains. Remains determined to be comingled were separated and coded as different individuals, and attempts were made throughout the project to re-associate these elements.

Results

No strong trends were observed in the co-occurrence of congenital anomalies and osteoarthritis in the foot and ankle. Chi-square tests confirmed these observations with a nominal p-value that did not strongly support an interrelationship between conditions (Figure 5). A strong relationship may not exist because congenital anomalies of the foot are largely subclinical, meaning they are without symptoms and may not have greatly affected movement or stress placed on joints. Exploiting congenital anomalies and osteoarthritis in other joints may provide greater insight into their relationship. Frequency data showed higher rates of congenital anomalies and osteoarthritis change among males (Figures 1, 4). These rates may reveal relationships between males and suggest a pathological presence in which adult females were more likely to be integrated into Puye from other communities. However, more data are required to confirm this hypothesis. The observed higher rates of osteoarthritic change among males were unexpected, since females in other studies tended to have higher rates of this condition (Weiss and Jarmain, 2010). This sex difference may be related to cultural practices, with the possibility of males participating in activities that could have increased osteoarthritic change, such as traveling more by foot. Finally, there were unexpectedly high frequencies of arthritic change among individuals in the young age category (12-20 years old). In modern populations, osteoarthritis usually increases with age, and is therefore not commonly found in younger people. Greater frequencies in younger individuals are likely a result of harsher living conditions, labor-intensive means of subsistence, and less advanced technology characteristic of pre-Columbian populations. To further explore the interrelationship between congenital anomalies and osteoarthritis, future research could be conducted on the entire collection from the Puye site to increase sample size. Additionally, these data could be compared to other collections to determine if these results were significant across pre-Columbian populations. Though results in this study were not strong, additional research may provide greater insight into both conditions.

Conclusions

References


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