H36 Bilateral Asymmetry and Handedness: Are they Really Related?

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After attending this presentation, attendees will better understand the statistical correlation between handedness and the bilateral asymmetry found in human skeletal remains.

This presentation will impact the forensic community and/or humanity by showing whether bilateral asymmetry can and should be used to determine handedness. Determining the handedness of an unknown individual would expand the biological profile. Every characteristic that strengthens the biological profile of an individual makes an impact on the forensic community.

Being able to recognize identifying characteristics from skeletal remains is essential in the practice of forensic anthropology. Any improvement in identification techniques is beneficial to those practicing in the field. Determining the handedness of an individual from their skeletal remains is a tool that can be used by the forensic scientist in helping to develop a more complete biological profile from which to identify an individual.

Bilateral asymmetry of the limbs has been used as an indicator of handedness in skeletal remains. When an individual has an arm (specifically the humerus) that is longer on the right side- it has been assumed that they were likely right handed. Another example, Kerley (1972) indicated that the bilateral asymmetry seen in clavicles could be used to determine handedness. In contrast, an individual with a longer right leg (especially the tibia) is believed to be left handed due to the use of the opposite leg as a "plant leg." While this practice of identifying handedness is widely (and loosely) used, the statistical significance of the difference has not been thoroughly examined; it has been seen as a given that the sides should differ because of difference in usage.

Numerous studies have been done that have examined the asymmetry that exists within an individual skeleton; this asymmetry has been used as an indicator of handedness. The reverse rationalization has also been given- handedness has been used to explain bilateral asymmetry. Steele and Mays (1995) examined upper limb bones within skeletons dating from the eleventh to the sixteenth century, while Èuk, Leben-Seljak, and Tefanèiè (2001) noted bilateral asymmetry within a medieval sample. Steele and Mays noted distinctive asymmetry while the medieval skeletons exhibited correlations between the humerus and the opposite tibia. However, obviously, the actual handedness is unknown in these samples. Glassman and Bass (1986) recognized the lack of known handedness, and instead, looked for correlations between jugular foramen size and limb length (both which have been used as indicators of handedness) within single individuals. They did not find significant association between the jugular formation size and the limb length within single individuals. Because handedness was unknown for this sample, determining which characteristic (if either) was related to handedness was not possible.

The lack of known handedness was a definite limiter in each of the above studies. In 1980, Schulter-Elli utilized medical school cadavers with known handedness. This study supported use related differences; however, the sample only included ten pairs of arms (humerus, radius and ulna) and scapulae. The current study was an effort to correlate bilateral asymmetry with handedness by utilizing a larger sample of skeleton with known handedness.

The William M. Bass Donated Skeletal Collection housed at the University of Tennessee in Knoxville was utilized in this study. Whenever possible, a biological questionnaire is completed when an individual is donated. These include a question related to handedness. This information in conjunction with the skeletal remains presented a good opportunity to examine the actual statistical correlation between handedness and bilateral asymmetry.

For this study, the maximum length of each pair of limb bones (arms and legs) and the clavicles were measured. After examining the 105 individual donations with known (self reported) handedness; the results were not particularly supportive of practiced identifications. Those individuals reported to be right handed exhibited significant difference between the sides; they exhibited bilateral asymmetry. However, lefties showed no significant asymmetry. In addition, when the left and right handed samples were joined, it was not possible to separate them into groups of handedness. The sample was made up more heavily of individuals noted as "right handed"; therefore, there was a sampling bias. However, the ratio of the sample does mimic the ratio of handedness seen in the general population. Establishing the handedness of an unknown sample would prove very difficult unless it was a more unique sample than was available here.

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