



Physical Anthropology Section – 2007

H43 Hyoid Fusion and the Relationship With Fracture: Forensic Anthropological Implications

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After attending this presentation, attendees will understand that fracture of the hyoid bone is dependent on the type of traumatic force applied to it. The research presented here was tested on a sample of hyoid bones from the McCormick Collection curated at the University of Tennessee. Fracture was statistically compared with fusion of greater horns to the body and results indicate that the hyoid is a diagnostic element for reconstructing various kinds of trauma. However, the relationship between fusion and fracture is statistically insignificant in this sample.

This presentation will impact the forensic community and/or humanity by stressing that hyoid bones should be carefully examined in any instance of suspected neck trauma and that fusion of the great horns to the body is not a statistically significant indicator of the presence or absence of fracture.

Although hyoid fractures only comprise a mere 0.002% of all bony fractures (Bagnoli *et al.* 1988), their importance in forensic contexts cannot be overlooked. Oftentimes such fractures are indicative of direct trauma to the neck resulting from manual strangulation, ligature strangulation, or hanging (Ubelaker 1992; Pollanen and Chiasson 1996; Polannen and Ubelaker 1997). While some hyoids may be more likely to fracture than others, numerous factors influence the likelihood of such occurrences (Pollanen and Chiasson 1996). Such variables include the magnitude and position of applied force, rigidity of the bone itself, and shape (Pollanen and Chiasson 1996).

The union of the parts of the hyoid is correlated to the age and sex of the individual to which they belong. Over time, the greater cornua fuse to the hyoid body and “essentially become one bone” (Guilbeau 1992). In order to determine the occurrence of hyoid fusion, O’Halloran and Lundy (1987) examined hyoid bones of 300 autopsy case from Oregon and California. According to their findings, some fusion was observed in the third decade and increased with age, resulting in “70% of the joints in men and 60% of the joints in women fused by age 60” (O’Halloran and Lundy 1987). Unlike the previous study, Miller and coworker’s examination 188 male and 127 female hyoid bones found “little evidence for a sex difference in the age at which bilateral fusion occurs” (Miller *et al.* 1998). Furthermore, the author’s argue that numerous elderly individuals present hyoids with either unilateral or bilateral non-fusion.

In theory, a hyoid with bilateral fusion would be more likely to fail than a hyoid with unfused cornua. The literature reveals variable frequency rates of fracture dependent on the type of trauma inflicted and the degree to which the hyoid bone is ossified. Ubelaker’s (1992) review of hyoid bone fracture delineated three types of trauma that characteristically result in bone failure. He writes that hyoid fractures resultant of hanging have an incidence that ranges from 6 to 20%. Luke *et al.* (1985) note that the variable location of ligature placement, along with other mechanical factors such as drop height, account for the low frequency of hyoid fracture during hanging. The frequency of fracture due to ligature strangulation is substantially higher with rates ranging from 13 to 54% (Ubelaker 1992). Manual strangulation rates appear to be the highest with frequencies ranging from 17 to 71% (Ubelaker 1992). Furthermore, in an attempt to qualify prior reports, Pollanen and Chiasson (1996) evaluated the radiographs of twenty hyoid bones of victims of manual strangulation. Of the twenty hyoids utilized in their study, ten exhibited fracture and ten displayed no sign of fracture. Their data illustrated that 70% of fractured hyoids were fused, whereas 30% of unfractured hyoids were fused. Pollanen and Chiasson assert “this data indicates that age-dependant fusion of the hyoid bone increases the probability of hyoid bone fracture.”

In order to evaluate the relationship between hyoid fusion and its propensity for fracture, hyoid bones from the McCormick Collection curated by the Department of Anthropology at the University of Tennessee were examined. Condensed case reports ranging from 1986 to 1996 were evaluated to determine instances of fatal neck trauma including manual strangulation, ligature strangulation, and hanging. Hyoids for which all data (sex, age-at-death, and manner-of-death) were available were exclusively examined (n=28). Mean age-at-death of the sample was 37.28 years and 32.1% (n=9) of hyoids in the sample were fractured. Interestingly, 100% (n=4) of manual strangulation cases were fractured while 20.8% (n=5) of hanging cases were fractured. Although the sample size is small, these results produce similar frequencies to those of Luke and colleagues (1985) and Ubelaker (1992).

Non-parametric chi-square analyses tested the relationship between the state of fusion and fracture and produced statistically insignificant results (P=.600). Such results do not indicate a significant relationship between fusion of the greater cornua and fracture. These findings suggest that forensic



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anthropologists should carefully examine all suspect cases of fatal neck trauma and that predictable patterns between hyoid fusion and fracture are elusive as evidenced by this sample.

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