



A46 Anthropological Examinations of the Hyoid, Thyroid Cartilage, and Cricoid Cartilage in Cases of Possible Neck Trauma

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Learning Overview: After attending this presentation, attendees will understand the importance of evaluating the thyroid and cricoid cartilages, in addition to the hyoid, in cases of possible neck trauma. Attendees will also understand fracture patterns with respect to hyoid fusion, manner of death, and presence of soft tissue hemorrhage.

Impact on the Forensic Science Community: This retrospective study will impact the forensic community by providing data for fracture patterns of the hyoid, thyroid cartilage, and cricoid cartilage analyzed by anthropologists in a medical examiner's office.

The hyoid, thyroid cartilage, and cricoid cartilage are critical in trauma interpretation as fractures of the neck organ block are commonly associated with strangulation, hanging, and direct blunt force. Between 2001 and 2019, the Forensic Anthropology Unit (FAU) at the New York City Office of Chief Medical Examiner evaluated 187 cases in which some combination of the hyoid ($n=168$), thyroid cartilage ($n=89$), and/or cricoid cartilage ($n=77$) were submitted for an anthropological analysis of possible peri-mortem blunt force trauma. The FAU protocol for examining these cases begins by radiographing the removed specimen in standard Antero Posterior (AP) and AP oblique views to visualize the horns. The hyoid is then macerated. The larynx is fixed in a 10% buffered formalin solution and the soft tissues and perichondrium are carefully removed with small forceps and a scalpel, often under magnification. Data from these cases has been retrospectively compiled to assess interactions between fracture location and frequency, age, fusion of the hyoid, manner of death, and presence of hemorrhage in the surrounding soft tissues.

Of the 168 hyoids evaluated, there were 66 fractures noted on 54 cases. Fractures of the hyoid were categorized by location: right greater horn midpoint ($n=28$), left greater horn midpoint ($n=25$), right joint ($n=6$), left joint ($n=7$), right posterior end ($n=0$), left posterior end ($n=0$), and the body ($n=0$). Greater horn midpoints were the most frequently fractured location (80.3%) with no side preference. Similarly, no relationship could be determined between the fracture location and the state of fusion. The fracture side frequency was similar in cases where the greater horns were bilaterally fused and bilaterally unfused. When cases were unilaterally fused, there were six fractures on the fused side and four fractures on the unfused side. The average age of individuals with bilateral unfused greater horns was younger than those with the left, right, and both greater horns fused (39.7 versus 50.5, 54.8, and 55.2, respectively) but a significant relationship between age and state of fusion was not identified. The youngest individual exhibiting bilateral fusion was 27, while the oldest individual exhibiting bilateral non-fusion was 88.

Of the 89 thyroid cartilages evaluated, there were 82 fractures noted on 49 cases. Fractures of the thyroid cartilage were categorized by location: right superior horn ($n=16$), left superior horn ($n=19$), right base of the superior horn ($n=11$), left base of the superior horn ($n=12$), right inferior horn ($n=3$), left inferior horn ($n=4$), right lamina ($n=5$), left lamina ($n=8$), and midline lamina ($n=4$). Of the 77 cricoid cartilages evaluated, there were 29 fractures noted on 20 cases. Fractures of the cricoid cartilage were categorized by location: midline ($n=3$), right of midline ($n=8$), left of midline ($n=13$), right lateral ($n=3$), and left lateral ($n=2$). No fracture side preference was noted on either the thyroid or cricoid cartilages.

In total, at least one fracture was observed on nearly half of the cases (91/187). Trauma was noted on about half of the cases certified as homicide or undetermined. Suicides were more likely to exhibit trauma whereas accidents and natural deaths were less likely. The presence of hemorrhage in the surrounding soft tissues was slightly more likely to be associated with an underlying fracture (66 with trauma, 45 atraumatic). A lack of hemorrhage was about twice as likely to be associated with no trauma (36 atraumatic, 17 with trauma).

Of the 187 cases, 70 had both hyoid and laryngeal cartilages present for evaluation. Twenty-seven exhibited no trauma while 14 exhibited fractures of both bone and cartilage. Only 1 hyoid exhibited trauma when the cartilages were atraumatic, yet 28 cartilages exhibited trauma when the hyoid was atraumatic. This contrast underscores the importance of examining the thyroid and cricoid cartilage, in addition to the hyoid, in cases of possible neck trauma.

Hyoid, Larynx, Blunt Force Trauma