



### G19 Incidence of Laryngeal and Hyoid Fractures in Hangings and Strangulations Using Enhanced Examination Procedures

Dana Austin, PhD, and Marc A. Krouse, MD, Tarrant County Medical Examiner, 200 Feliks Gwozdz Place, Fort Worth, TX 76104-4919

After attending this presentation, attendees will understand that enhanced examination of the larynx and hyoid will reveal subtle injuries of bony and cartilaginous structures that might otherwise not be found

The rate of injury of the larynx and hyoid is significantly higher when examination of these structures is enhanced by high-resolution radiography and maceration and removal of soft tissues followed by macroscopic examination. This presentation will impact the forensic community and/or humanity by demonstrating how these simple and inexpensive procedures can reveal subtle injuries of bone and cartilage that otherwise might not be seen and complete the forensic examination of the neck in cases of known or suspected strangulation, hanging or other neck injury.

Between 1996 and 2005 the examination of the larynx and hyoid in cases of suspected or known neck injury was enhanced by the following methodologies:

1. Visual inspection and palpation of the larynx and hyoid at autopsy, in situ and after en bloc resection and limited dissection of soft tissues
2. High-resolution radiography of the fresh en bloc specimen utilizing mammography film
3. Maceration of soft tissue in water with removal of residual tissue and macroscopic visual inspection of laryngeal and hyoid bone and cartilage

The sample consists of 105 individuals who died of hanging or strangulation or suspected strangulation between 1996 and 2005. The sample population contains 52 males and 53 females with an age range of 8 to 81 years (mean of 36.32 years). For analytical purposes the ages were divided into decades: the first decade and the ninth decade each represented by one individual; the second through eighth decades ranged from four individuals (eighth decade) to 31 individuals (third decade). The ancestry of the sample was 62% European, 18% African, 18% Hispanic, and 2% Asian.

Examined were 62 hangings, 20 manual strangulations, 10 ligature strangulations and 13 strangulations not otherwise specified (mechanism unknown or evidence of arm lock or combination of manual and ligature). Sixty-one hangings were ruled suicide or consistent with suicide, one 15-year-old was ruled accidental and was consistent with autoerotic asphyxiation - this was the only hanging where padding was included with the ligature. The strangulations cases were all ruled homicide.

Of the hanging cases (N=62), 19.4% had hyoid fracture and 48.4% had thyroid fracture. Of cases of ligature strangulation (N=10), 20% had hyoid fracture and 40% had thyroid fracture. Of cases of manual strangulation (N=20), 45% had hyoid fracture and 50% had thyroid fracture. In cases of strangulation, not otherwise specified (N=13), 7.7% had hyoid fracture and 46.2% had thyroid fracture.

The most commonly fractured sites in the hyoid were the midshaft of the greater cornu either unilaterally (18.5% for left side, 25.9% right side) or bilaterally, 18.5%. This agrees with findings on a much smaller sample by Pollanen et al (1995). The most commonly fractured sites in the thyroid cartilage were bilateral fractures of the left and right superior cornua (32%), left superior cornu unilaterally (24%) or right superior cornu unilaterally (30%). The most common location for the superior cornu fracture was at its juncture with the lamina (18% left; 16% right). Ubelaker's review of the literature (1992) cites a cohesive fracture rate of 8% hyoid fractures and 15% thyroid fractures in hangings, 11% fractures hyoid and 32% fractures thyroid in ligature strangulations, and 34% hyoid and thyroid fractures in manual strangulations.

The data of the group support earlier contention that the supple nature of these structures in children and young adults does not lend them to easy fracture (O'Halloran & Lundy, 1987; Pollanen & Chiasson, 1996). The earliest age of hyoid fracture in this series occurs in the third decade with 19% fractured, all in the mid-portion of the greater cornua. The fourth through seventh decades show fracture rates varying between 14 to 26%. In the eighth and ninth decades the fracture rates are 100%; however this number is based on a total of five individuals. The earliest age of thyroid cartilage fracture is the second decade with one 18-year-old individual with a fracture of the left superior cornu at the base. Fracture rates of the thyroid cartilage range from 32% to 70% in the third through seventh decades and are at 80% in combined eighth and ninth decades.

In cases where ligature type is known for hangings and ligature strangulations, the frequency of fracture type with ligature type was detailed. Cord type ligatures, which included ropes, electrical cords, telephone cords, shoelaces, and other small diameter strings, resulted in 22% hyoid and 44% thyroid fractures. Strap type ligatures, which included cargo straps and belts, resulted in 12% hyoid fractures and 53% thyroid fractures. Fabric type ligatures, which included clothing such as t-shirts, sheets, curtains and neckties, resulted in 18% hyoid fractures and 45% thyroid fractures. In three cases where the ligature was not recovered at the scene, all had hyoid fractures and 2 out of 3 had thyroid fractures.



## Pathology Biology Section – 2006

---

### References:

- Pollanen MS & Chiasson DA (1996) Fracture of the hyoid bone in strangulation: comparison of fractured and unfractured hyoids from victims of strangulation. *JFS* 41:110-113. Pollanen MS, Bullger B and Chiasson DA (1995) The location of hyoid fractures in strangulation revealed by xeroradiography. *JFS* 40:303-305. Ubelaker DH (1992) Hyoid fracture and strangulation. *JFS* 37:1216-1222. O'Halloran RL and Lundy JK (1987) Age and ossification of the hyoid bone: forensic implications. *JFS* 32:1655-1659.

### Larynx, Hyoid, Examinations