H70 A Prospective Study of Hyoid Fractures in Cases of Fatal Blunt Force Injuries to the Upper Body

Ericka N. L'Abbe, PhD, PO Box 5023, Pretoria, 0001, SOUTH AFRICA; Steven A. Symes, PhD, Mercyhurst College, Mercyhurst Archaeological Institute, 501 East 38th, Erie, PA 16546; Lenne Marnewick, BSc, University of Pretoria, Department of Anatomy Private Bag x323, Arcadia, 007, SOUTH AFRICA; Piet J. Becker, PhD, Medical Research Council, Biostatistics Unit Private Bag x385, Pretoria, 0001, SOUTH AFRICA; and Jeanine Vellema, Forensic Pathology Services Johannesburg, 25A Hospital Street, Braamfontein, 0083, SOUTH AFRICA*

After attending this presentation, attendees will better understand the relationship of hyoid fractures to mechanism of injury, sex and age-at-death, stage of bone union, and soft tissue hemorrhage.

This presentation will impact the forensic community by providing a clearer understanding of hyoid fractures, which will affect the manner in which forensic anthropologists and pathologists interpret this type of trauma, especially when the context of the injury is unknown and soft tissue has been lost.

The cause of hyoid fractures and its contribution to assessments of cause and manner of death are unresolved issues in forensic sciences. Neck compression injuries, strangulations and hangings, are often examined for fractures of the hyoid, as well as thyroid and cricoid cartilages. Due to an increase in death from motor vehicle accidents, anecdotal statements have been made that injuries associated with rapid deceleration, such as hyper-flexion or hyper-extension of neck, are more likely to fracture the hyoid than either strangulation or hanging. Isolated hyoid fractures have been reported in sports injuries, falls, and profuse vomiting (Padgham 1988; de la Grandmaison 2006; White 2010). While copious literature is available on the incidence of hyoid fractures with various mechanisms of death, the results are contradictory and do not provide a systematic approach to the assessment and interpretation of throat organ fractures. The purpose of this study is to assess the relationship of hyoid fractures with six mechanisms of injury, sex, age, bone fusion, and presence and location of soft tissue hemorrhage.

A total of 276 hyoids associated with motor vehicle accidents (MVA) (79), pedestrian vehicle accidents (PVA) (74), falls from heights (44), strangulations (15) (manual strangulations six; ligature strangulations six; and unknown two), and hangings (64) were examined. The sample was predominantly male (n=209) with 56 females; mean ages were 36.29 years and 38.05 years, respectively. Cases were examined during autopsy at the Forensic Pathology Services (FPS) in Johannesburg, South Africa from September 2009 to June 2011. The University of Witwatersrand authorized ethical clearance (R14/49; MO90728).

Neck structures were dissected in situ and in accordance with the Gordon method, a standard dissection technique for the neck. Presence and location of hemorrhage was recorded at autopsy. The hyoid bone was retained and processed free of soft tissues. The probability of obtaining a fracture with the above-mentioned independent variables was tested with logistic regression.

Fractured hyoids comprised 24% (n=67, 55 males and 12 females) of the sample. Fractures were noted on the greater horns; at the articular facets; and on the body, and were associated with two strangulations; eight falls; 14 PVAs; 20 MVAs and 23 hangings. Mechanism of injury, sex, and hemorrhage did not increase the probability of a bone fracture and did not show statistical significance. But, persons older than 50 years had a 4.3 increased likelihood of a fracture than younger persons (p-*value* < 0.003). Likewise, unilateral fusion of the greater horn on the left or right side were 2.9 and 2.7 times more likely to fracture than un-fused or completely fused bones (p-*value* = 0.019 and p-*value* = 0.041, respectively).

Although inconsistent with forensic anthropology and pathology literature, it appears that mechanism of injury, sex, and hemorrhage are disassociated with the presence of fractures in the hyoid. The interpretive circumstances surrounding a neck injury is likely biomechanical in nature, i.e. magnitude, direction, duration, and location of force. While older persons demonstrated a greater incidence of fractures, horn failure should not be associated with complete fusion of the greater horns of the hyoid to the body. The unique configuration of a unilaterally fused U-shaped structure, the histological composition of the bone, and the composition of muscle and cartilage may contribute more to fractures in older persons. While an association with hemorrhage and fracture indicates injury during life, an equal number of cases with fractures (n=27) and without fractures (n=30) presented with hemorrhage to neck structures. At autopsy, only 27% (n=18) of the above-mentioned fractures were recorded.

Recognition, physical examination and correct interpretation of trauma from the skeleton are invaluable tools to understanding total body trauma in violent deaths. This can only be achieved with accurate contextual information and a closer examination of fractured or presumed fractured bones.

Trauma Interpretation, Neck Structures, Mechanism of Injury

