

The Importance of Hyoid Bone in Personal Identification

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Abstract:

Neck, a part of human body consists so many bones in which hyoid bone is one of them. The hyoid bone has unique structure and also support the different functions of the speech and swallowing. At the time of birth, the hyoid bone consists of the central body and pairs of right and left greater and lesser cornua. The fusion of greater cornua occurs with normal body at certain age, but not occur in all individuals. The hyoid bone plays a crucial role in the identification of cause of death as it is fractured in cases of throttling, hanging and strangulation that is come under the department of Forensic Medicine for the purpose of examination of post-mortem. During the post mortem, the forensic pathologist try to find out the cause and manner of death, if hyoid bone is found to be fractured, the suspicion arouse and that leads to the investigation to solve the mystery. In this paper, we discussed about the role of hyoid bone in solving the case.

Keywords: Hyoid Bone, Greater and Lesser Cornua, Hanging, Strangulation, Throttling

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Introduction

Biological profile is developed for the identification of the unknown skeletal remains in which using the least likely bone, that is hyoid bone (Kindschuh, 1). Hyoid bone is visualize in “U”, “V”, “horseshoe” and asymmetrical shape which is present in the neck’s anterior part, tucked between the larynx and mandible and not joint with any other bones. It is contain many functions include support to the tongue and attached with various muscles which is helpful in speech, swallowing, maintenance of airway and prevention of regurgitation. (Nikita, 22; Fakhry, *et.al*, 2013). The hyoid bone is useful for anthropologist to estimate the age, sex and ancestry. In several studies, the morphology (shape and size) is useful for the purpose to differentiate the sexes using statistical methods, analysis of discriminant function and standard method through recovered hyoid bone. Ancestry is one of the most important and difficult part of the biological profile which can be identified by new methods like metric methods for their precision. Physical anthropologist uses the equation of discriminant function analysis (DFA) to estimate ancestry and sex (Kindschuh, 1). This type of bone contain greater importance in the examination of forensic pathologic includes decomposed, skeletonized and fresh bodies where occur the possibility of strangulation because of greater force was applied onto the neck due to which hyoid bone was fractured (Matshes, *et.al*,136).

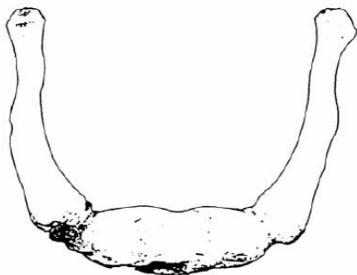


Figure: Hyoid Bone

Three center of ossification is helpful in the development of hyoid bone. It compose with discrete parts that is:

- The body – It is appear after the 6 months of the birth. It is present slightly in the cup-shaped and center of the bone and contain numerous sites for the purpose of muscle attachment which is used for speech.
- Two greater horns – It is appear after the medial ends of the 6 months. It is present at postero-laterally portion from the body and attached

with the ligaments to the larynx’s thyroid cartilage.

- Two lesser horns – It is present on superior-laterally portion of the body and attached with the process of temporal styloid.

The puberty is helpful for completed the ossification in the body and greater horns of the hyoid bone but lesser horns does not show any changes throughout the life (Burns, 50).

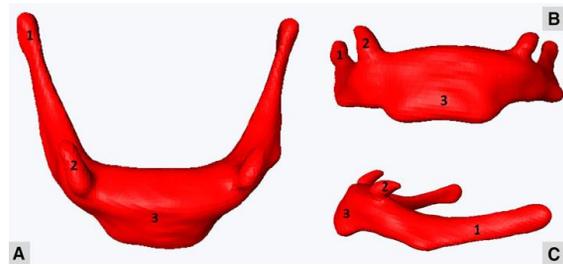


Figure: Parts of Hyoid Bone: (A) Superior (B) Anterior (C) Lateral, Views (1) Greater horn (2) Lesser horn (3) Body

The three parts of the hyoid bone are fused which is variable and not to be known the age and sex. This type of bone is play an important role in forensic context which is used as an evidence like in strangulation case (Tersigni-Tarrant and Shirley, 50, 51; Fakhry, *et.al*. 2013; Burns, 50). In most of the case, fusion of the hyoid bone is consider as to be estimate the age of unknown dead bodies (Biswas, Mazumdar and Sardar, 14).

The hyoid bone is importantly attached with the ligaments and several muscles of the neck and head. The lesser horns of the hyoid is attached with the process of styloid of temporal bone by stylohyoid ligaments. Some other ligaments help in attached the hyoid with larynx that is voice box. The mouth’s floor muscles are also attached with the hyoid bone which is helpful in movement (Burns, 50).

The hyoid bone is found in the form of free-floating in primates but not in the mammals. It is a very most important part for examination purpose during autopsy because it reveals that the asphyxial deaths was occur due to compression of neck and also reveal whether the breakage of hyoid bone was antemortem and postmortem. The ante-mortem of fractured hyoid bone is detected by pre-autopsy X-ray. The hyoid bone is fractured in some cases like hanging, throttling and hanging and in the range 0% to 68%. (Chandrasekhararao, *et.al*, 2016; Naik and Patil, 149)

The hyoid bone is fractured by some causes, which is as follows:

- Constriction's force
- Constriction's level
- Drop's distance from suspect
- Victim's age and sex (Naik and Patil, 149)

Fracture of Hyoid Bone

In 50-70% cases, hyoid bone is mainly fractured at the age of 40 years which is classified as:

Compression Fracture in Inward (Side-Wise)

- This type of fracture mainly occur in case of throttling in which the fingers of hand crush the neck due to which greater cornu is compression inward side which cause fracture the hyoid bone with damaging periosteum in outer side but not inner side.
- Compression fracture may be occur in both sides (left and right).
- This type of fracture may be occur at joint portion between center of the body of hyoid and greater cornu.

Compression Fracture in Anteroposterior Side

- This type of fracture mainly occur in hanging case in which hyoid bone is shifted directly in backward and increased the divergence of greater cornu with causing fracture in posterior portion due to the compression of anteroposterior.
- Anteroposterior compression also occur in greater cornu at its junction region with the center of the body and may be also occur bilateral (both side).
- This type of fracture may be also seen in strangulation case when motor vehicle run over the person due to which fracture was occur in neck.

Traction or Tug or Avulsion Fracture

These fracture is seen due to muscular overactivity or hyperextension of the neck, through which, avulsion or tug or traction fracture found on thyrohyoid ligament and it also may be occur due to lateral or downward compression or direct pressure which is applied directly between thyroid and hyoid bone (Biswas, 173).

Review of Literature

Naik and Patil, (2005), discuss about the hyoid bone. In case of partial hanging, authors said that it was very difficult to differentiate strangulation from hanging where ligature mark was appear in low part

of the neck in the manner of horizontal. In which, damage the laryngeal cartilage as well as internal tissue with hyoid bone due to which identified the actual cause or manner of death. The incidence of the fractured hyoid bone was increased after the age of 40. The hyoid bone was fractured using constricted force in case of ligature strangulation.

Charoonnate, et.al, (2010), in this paper, authors took approximate 20 suicidal hanging cases in which they identified 5 cases of fractured thyroid cartilage and hyoid bone. Two cases of fractured thyroid cartilage, two cases of fractured hyoid bone and one case of both fractured bone. Mean age of fracture, non-fracture cases and all cases were 61.80, 35.93 and 42.40 years respectively. The knot was appeared in 12 cases at back of the neck and also two, four and two cases in which knot was appeared at the right, left, and front. It does not shown any relation between fracture of the thyroid cartilage and hyoid bone and knot at the neck.

ITO, et.al, (2012), discussed about the hyoid bone in which authors said that morphological researches were conducted in early 1900 while metrological researches were conducted after that. In this paper, authors examined the 600 cases, through which, they identified that male's hyoid bone is larger than the female hyoid bone. In this, authors used cadaver or dried skull due to which they were not collected more information because three-dimensional measurement of hyoid bone with radiography or soft tissue using calipers or rulers was very difficult to identify. Finally, they use Multi detector row Computed Tomography (MDCT) due to which easily observe and measure the hyoid bone with high accuracy.

Biswas, et.al, (2013), in this paper, several investigation was conducted by authors related hyoid bone. They identified the age of greater cornu which is dependent on the studies and methods of author. Some author identified that fusion of hyoid bone occurs at 40 years ago but some other authors identified that at earlier age. Several studies was conducted before 170 years from dead bodies which belong to age group 25-60 years in which fusion was occurred earlier in female as compared to male. In male, the mean age of bilateral and unilateral of fusion was 53.16 and 38.25 years while 48.5 and 37 years in female.

Yada, et.al,(2013), in this paper, various studies learned that shows considerable difference regarding frequency of fractured hyoid bone. It gives result from as low as nil or rare to high 67%. In different countries, the studies was conducted in variable time

related to fractured hyoid bone which shows different findings. But in hanging case, hyoid bone was fractured in rare case. In case, fracture was occurred in hanging, then case should be studied thoroughly in respect of eyewitness and circumstantial evidence. This paper identified the hyoid bone actually fractured or not by using histology (after dissection) and radiography (before dissection).

Fakhry, et.al, (2013), in this paper, identified the quantitative measurement of hyoid bone using tools of three-dimensional reconstruction. Authors were conducted the study on 92 bones that were taken from CT scan images of living bodies and 88 bones from cadavers. By using Amira 5.3.3. Software, CT scan image created the three-dimensional reconstructions. Authors were using the metric and morphological analyses for the anatomical and anthropological studies. In metric and morphological analysis, identified the size and relationship of the hyoid bone respectively.

Ali, et.al, (2018), in this paper discuss about the death by hyoid bone. In United States, strangulation is third most common cause due to which medicolegal death was occur but in India, it is fourth most common cause. According to the study by authors, concluded that asphyxia and strangulation comes in data at fourth number in autopsy. Authors also determine the frequency of fractured hyoid bone

in neck which is caused by strangulation. According to the author (Kaheri), 14.7% cases of fractured hyoid bone were occurred but in case of Charoonnate, 25% cases were occurred and 68% cases were occurred by Nikolic. In 2017, Singh reported that male preponderance is more (68.3%) as compared to the female (31.7%).

Conclusion

Hyoid bone play a very important role in human body due to which individual can be speech, swallowing, prevention of vomiting etc. It is present at the anterior portion of the neck and tugged between the mandible and larynx. Hyoid bone is fractured not compulsory in hanging case but it may be fracture in strangulation, throttling and garroting cases. This paper concluded that we can identified the sex, age and ancestry using fracture hyoid bone which can be recovered from dead bodies. Sex, age and ancestry are determine by metric and morphological method (size and shape). Hyoid bone is fractured or not confirmed by using histology (after dissection) and radiography (before dissection) methods. Most of the adult individual are involved in hanging case because they committed the suicide in their financial, moral and social reason.



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