

Unusual variation of the hyoid bone: bilateral absence of lesser cornua and abnormal bone attachment to the corpus

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Abstract The hyoid bone is a horseshoe-shaped and a solitary bone located at the neck just above the thyroid cartilage. It consists of a body, two greater cornua and two lesser cornua. In this report, we demonstrated an extra bone variation which is attached to the hyoid bone and located at the left side of its corpus. In addition to this abnormal bone attachment to the corpus, lesser cornua were absent bilaterally. Abnormal bone attachment was approximately 3.79-cm long and 0.38–0.50-cm wide and heads toward the upper left of the hyoid bone. We believe that clinicians should be aware of such abnormalities of the hyoid bone because of the functional and clinical importance of its variations and abnormal relations within nearby structures. These abnormalities have a great importance for the surgical operations and radiological studies of the neck region and for the forensic medicine because of the susceptibility of the hyoid bone to the fractures in relation to the strangulation cases.

Keywords Hyoid bone · Variation · Lesser cornu · Abnormal bone attachment

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Introduction

The hyoid bone is a horseshoe-shaped bone located at the neck. It is a solitary bone and situated in the anterior mid-line of the neck just above the thyroid cartilage. It has attachments from nearby muscles but has no bony articulations. Hyoid bone consists of a body, two greater cornua and two lesser cornua and it is ossified from six centers: two for the body and one for each cornua. Lesser and greater cornua of the hyoid bone are developed from the second (hyoid arch) and third visceral arches, respectively. Lower and upper parts of the body are also developed from fused ventral ends of these two arches. Ossification processes begin at the end of the fetal period for the greater cornua, around birth for the body and around puberty for the lesser cornua. Hyoid bone has a great importance for the forensic sciences especially in strangulation cases. A recent study showed that the fracture rate of the hyoid bone alone is determined as 15% and rate of the thyroid cartilage and hyoid bone together is determined as 5% in the ligature strangulation cases [2]. Revealing the hyoid bone fracture is very important for the cause of the death as an autopsy finding [2, 6, 8]. Thus, awareness of the anomalies of the hyoid bone is very important prior to the forensic investigations. Hyoid bone abnormalities are also found in different clinical conditions such as Pierre Robin Sequence and cleft lip and palate cases [3].

Case presentation

During the dissection of a 16-year-old male case, at the Bursa Branch of the Council of Forensic Medicine of Turkey, in a suspected case of hanging, we found an extra bone which is attached to the hyoid bone at the left side of the

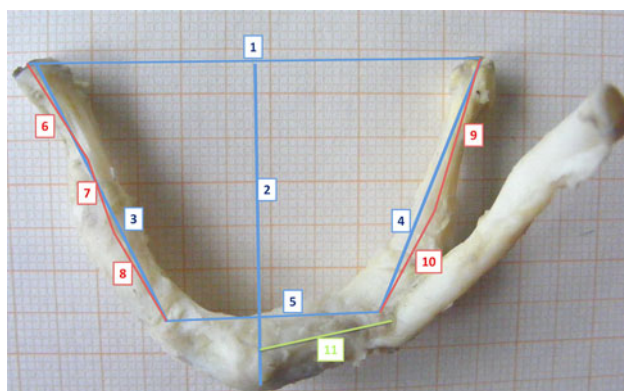


Fig. 1 Measurements of the hyoid bone from above. Transverse and antero-posterior lengths of the hyoid bone (parameters 1, 2 and 5), greater cornua lengths at right and left sides (parameters 3 and 4), lengths of the angulated parts of the greater cornua (parameters 6–10) and abnormal bone attachment site distance to the midline (parameter 11). See Table 1 for results

corpus in addition to bilateral absence of the lesser cornua (Fig. 1). After the dissection and removal, the hyoid bone was photographed and then morphometric measurements were performed on the digital images with the aid of a computer program (Scion image ver. 4.0.2). Calibrations were made on a millimetric paper. Twenty parameters were used for the measurements of the hyoid bone and the abnormal bony attachment. Transverse and antero-posterior lengths of the hyoid bone were 4.96 and 3.68 cm, respectively (Fig. 1, parameters 1 and 2). Height of the corpus was 1.47 cm (Fig. 2a, parameter 1). Greater cornua lengths were 3.16 and 2.98 cm at right and left sides, respectively (Fig. 1, parameters 3 and 4). The anomalous bone was attached to the corpus at upper side and 1.59 cm left from the midline (Fig. 1, parameter 11) near the location of the minor cornua. It was approximately 3.79 cm long (Fig. 2b, parameter 1) and 0.38–0.55 cm wide (Fig. 2b, parameters 4–6) and head toward to the upper left of the hyoid bone. 147° angulation was also observed in the middle of this bony attachment (Fig. 2b, angle between lines 2 and 3). Muscle attachments to the bony variation of the hyoid bone were not observed and traced accurately because of the accompanied soft tissue and muscular injuries of the case. Other measurements can be found in Figs. 1, 2a, b and Table 1.

Discussion

Variations of the hyoid bone are well documented in the literature; however, to our knowledge, this is the first study to report such anomaly of the hyoid bone which consisted of two different major variations of this bone. Morphological variations of the hyoid bone are closely related to the race and geographical locations. Thus, population-based studies

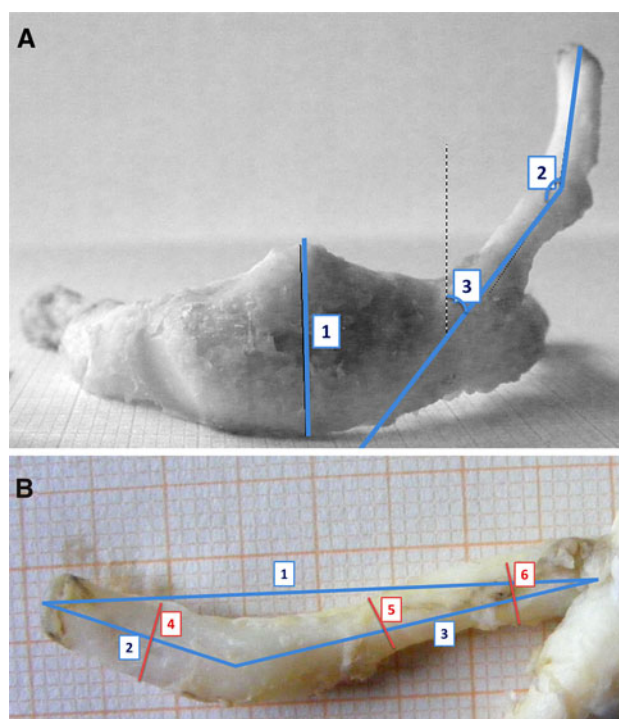


Fig. 2 Measurements of the hyoid bone from front (a) and measurements of the abnormal bone attachment (b). Height of the corpus (parameter 1) and the angulations of the abnormal bone attachment from front (parameters 2 and 3) shown in (a). Linear measurements of the abnormal bone attachment (parameters 1–3) and widths from different levels (parameters 4–6) are shown in (b). See Table 1 for results

Table 1 Measurements of the selected parameters (P) of the hyoid bone and its abnormal bone attachment

Measurements from above (Fig. 1) (cm)	Measurements from front (Fig. 2a)	Measurements of the abnormal bone attachment (Fig. 2b) (cm)
P1 = 4.96	P1 = 1.47 cm	P1 = 3.79
P2 = 3.68	P2 = 71°	P2 = 1.40
P3 = 3.16	P3 = 37°	P3 = 2.49
P4 = 2.98		P4 = 0.55
P5 = 2.30		P5 = 0.38
P6 = 1.18		P6 = 0.50
P7 = 0.79		
P8 = 1.23		
P9 = 1.58		
P10 = 1.46		
P11 = 1.59		

have an importance for such anomalies [6]. The time of fusion between the body of the hyoid bone and the greater cornua was found to increase with the age [7]. The possibility of the dynamic actions between the body and the greater cornua in the deglutition and the mastication was reviewed

and discussed by Shimizu et al. [10]. The hyoid bones are also more vulnerable to fractures after the fusion. Fractures occur preferentially in the elderly and this is more likely due to the bone mineral loss inherent to the age. This is probably the most important variable contributing to the fractures of the neck structures in the hanging cases [1, 8]. On the contrary, Pollard et al. [9] stated that age did not appear to be significantly correlated with the anthropometric measurements of the hyoid bone. Beside these, there are significant sex differences in hyoid bone's shape and it is well known that the distal ends of the greater cornua of women are significantly longer than those of men. However, there is very little knowledge about the age and the gender-based variations of the lesser cornua [5]. Sexually dimorphic features of the hyoid bone also have an importance for the sex determination studies [4]. It is known that the apex of each lesser cornu gives attachment to the stylohyoid ligament and in some cases this ligament may become calcified. Elongated temporal styloid process or calcified stylohyoid ligament can be seen in the Eagle syndrome. However, we did not find any indication of such anatomical abnormalities besides the absence of the minor cornua. Abnormalities of the hyoid bone were also observed in the patients affected with the cleft lip and palate, micrognathia or Pierre Robin Sequence which are mostly involving the third branchial arch derived muscles and other tissues [3]. In our case, abnormalities of the hyoid bone are not in any combination with the other abnormalities of the related pharyngeal arch structures.

Hyoid bone is an important component of the neck region in terms of the function and the support. In addition to its variations which are related to the age, sex and population it also has separate and rare anomalies like the presented case. We believe that the clinicians should be aware of such abnormalities of the hyoid bone because of the functional and clinical importance of its variations and

abnormal relations within nearby structures. These abnormalities have significance for surgical operations and radiological studies of the neck region, and for forensic medicine because of its susceptibility to fractures of the strangulation cases.

Conflict of interest The authors declare that they have no conflict of interest.

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