Hyobranchial Apparatus In Ostrich (Struthio camelus)

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SUMMARY

One of the recent trends in the field of veterinary anatomy is studying the ostrich species. This trend leads to increase the demand for more information about this bird. A part of the ostrich upper digestive system , namely the hyobranchial apparatus which supports the tongue was chosen for this study.

The present study was carried out on 32 adult ostrich heads of freshly slaughtered birds. The birds were of both sexes and different ages ranges between 15-25 months. The morphological picture of the hyobranchial apparatus and its attached muscles was studied on twenty five of freshly slaughtered ostriches, while the histological study was done on other seven heads, using the normal histological techniques.

The hyobranchial apparatus of ostrich consists of central cartilaginous plate and lateral horns. The plate is formed by fusion of three median cartilages which are entoglossal (paraglossal cartilage) rostrally, rostral basibranchial (basihyal) cartilage and caudal basibranchial (urohyal) cartilage caudally. The lateral horns are partly bony and partly cartilaginous. The bony part is the ceratobranchial bone which articulates rostrally with the rostral basibranchial cartilage and caudally it joins the epibranchial cartilage.

The muscles which support the hyoid apparatus in the ostrich includes the mylohyoid, geniohyoid, basihyoid, basibranchial ceratobranchial (ceratohypid), ceratolaryngeal, mandibular caratobranchial, mandibular epibranchial, laryngeotracheal, laryngaeoparaglossal and paraglosso-ceratobranchial muscles.

Key Words : Ostrich, Hyobranchial Apparatus, Hyoid Bone, Entoglossal bone

INTRODUCTION

One of the recent trends in the field of veterinary anatomy is studying the ostrich species. This trend leads to increase the demand for more information about this bird. A part of the ostrich upper digestive system ,

precisely the hyobranchial apparatus which supports the tongue was chosen for this study.

Only few publications were found on some parts of the upper digestive tract of ostrich by *Bezuidenhout and Aswegen (1990), Bezuidenhout (1993,1999,1999), Shanawany (1999), El-Moursi etal. (2002) and Bahgat and Imam (2003). Nickel et al. (1977)* described the os hyoideum in birds as consisting of unpaired body (basihyoideum) which is prolonged rostrally and caudally by two hyoid rami. They added that in the fowl and pigeon the body of the hyoid bone is rod-like, in the duck and goose it is flattened. At the rostral end of the body there is the os entoglossum which is double in the fowl and shovel-like in the duck and goose. A third process, known as the keel or urohyale joins the body caudally in a synarthrosis or synostosis. This third process is connected to the thyroid cartilage. The rami of the hyoid bone consist of bony rods which form a movable joint with the body of the hyoid at one end and at the other extremity are connected by cartilage to a short, terminal bony segment.

MacAlister (1864) mentioned the origin and insertion of the extrinsic muscles of the ostrich tongue (maxillo-keratic, geniohyoid, hyoglossus, hyolaryngeal and thyrohyoid). Recently *El-Morsi et al. (2002)* described extrinsic lingual muscles supporting the hyobranchial apparatus as paraglossal cerato-branchial, laryngeal paraglossal and mandibulo ceratobranchial muscles. However, *McLelland (1968)* pointed out on five pairs of striated muscles which attach to paraglossal and rostralbasibranchial bone

MATERIALS AND METHODS

The present study was carried out on 32 adult ostrich heads of freshly slaughtered birds. The birds were of both sexes and different ages ranges between 15-25 months.

Gross morphological study:

The morphological picture of different components of the oropharynx studied on twenty five of freshly slaughtered ostriches. Ten heads were immersed in a solution composed of 10% formalin, 4% phenol and 1% glycerin, and left for fixation. The other fifteen heads were examined freshly and kept in deep freezer.

The oropharynx was opened, then the hyobranchial apparatus was dissected and examined grossly with naked eye, as well as, with stereomicroscope.

The hyobranchial muscles were examined from the ventral aspect of the inter ramal region after reflection of the skin while the extrinsic lingual muscles were best seen from the interior of the oropharyngeal floor after reflection of the mucous membrane .

Histological examination:

Seven heads of freshly slaughtered specimens were opened. Small pieces of about 0.5 cm. were taken from different parts of the tongue. The specimens

were fixed in 10% neutral formalin solution for at least 48 hrs. Routine histological techniques were performed. Paraffin sections of 4-6 μ in thickness were prepared then stained with:Harri's heamatoxylin and eosin (H&E) for general demonstration.

All the aforementioned methods and techniques were outlined after Drury and Wallington (1980), Culling, Allison and Bar (1985) and Bancroft and Stevens (1996). The terms used in this work are on the line of the Nomina Anatomica Avium (1993).

RESULTS

The hyobranchial apparatus of ostrich is unpaired median structure that gives support to the tongue, larynx and part of the oropharyngeal floor. It consists of series of cartilaginous and bony rods that joined together. These segments are a central cartilaginous plate and two lateral horns.

The central cartilaginous plate consists of the fused three median cartilages which are entoglossal cartilage (paraglossal cartilage) rostrally (Fig.1/1), rostral basibranchial (basihyal) cartilage (Fig.1/2) and caudal basibranchial (urohyal) cartilage (Fig.1/3) caudally. There is no line of demarcation between the aforementioned cartilages except that the caudal basibranchial cartilage is elongated and tapered caudally.

The paraglossal part of the hyoid bone supports the base of the tongue and extends along its texture to reach its apex. Moreover, it divides the lingual texture longitudinally into a thin dorsal part and a thick ventral part (lingual body) forming what we called it ;lingual pouch (Fig.2). The paraglossal cartilage and the two ventrolateral cartilaginous rods are of the hyaline type (Fig.3).

The lateral horns of the hyobranchial apparatus are partly bony and partly cartilaginous. The bony part is the ceratobranchial bone (Fig.1/4) which is a cylindrical curved bone, its convexity facing laterally and its concavity facing medially. The ceratobranchial bone articulates rostrally with the rostral basibranchial cartilage (middle piece of the central cartilaginous plate) and caudally it joins with the epibranchial cartilage(Fig.1/5) .

In addition to the before mentioned parts of the hyoid bone there are two other rods of cartilage (cornuae) (Fig.1/6) joined to each other and to the entoglossal cartilage by connective tissue. They begin rostral to the entoglossal cartilage and extend caudolaterally up to the level of the articulation between the ceratobranchial bone and the rostral basibranchial cartilage.

The hyoid muscles

The group of muscles which support the hyoid apparatus in the ostrich include the mylohyoid, geniohyoid,,basibranchial-ceratobranchial (ceratohypid), ceratolaryngeal, mandibular caratobranchial, mandibular epibranchial, laryngeotracheal, laryngaeoparaglossal and paraglosso-ceratobranchial muscles.

1) Mylohyoid muscle

Arises from the ventral borders of the mandible and unites with the muscle of the opposite side to form a thin sheet of muscle. The muscle fibers of both sides are transversally arranged (Fig.4/1) forming a sling like structure that supporting the tongue.

2) Geniohyoid muscle

Originates from the internal surface of the mandible around the mandibular symphesis and runs caudalwards to insert partly in the ventral surface of the median cartilaginous plate and partly in the ceratobranchial bone. The fibers of this muscle are arranged longitudinally (Fig. 4/2 & 5/3).

3) Basibranchialceratobranchial muscle

This muscle extends between the caudal basibranchial cartilage and ceratobranchial bone, hence it take its name (Fig.4/3) .

4) Ceratolaryngeal muscle

Is situated dorsal to the previous one and extends between the ventral surface of the trachea and the concavity of the ceratobranchial bone (Fig.4/4 & 5/2) .

5) Ceratotracheal muscle

It is a delicate muscle. Its fibers stretch between the concavity of the ceratobranchial bone and the dorsal aspect of the trachea (Fig. 5/4) .

6) Mandibular epibranchial muscle

It extends from the ventral border of the ramus of the mandible to end caudally at the epibranchial cartilage.

7) Mandibular ceratobranchial muscle

A muscle which extends from the ceratobranchial bone rostrally to insert caudally at the angle of the mandible.

8) Laryngeoparaglossal muscle

It stretches between the ventrolateral surface of the cricoid cartilage and the paraglossal cartilage (median cartilaginous plate) (Fig.5/1).

9) Paraglossalceratobranchial muscle

This muscle stretches between the ventral surface of the paraglossal cartilage and the lateral (dorsolateral) surface of the ceratobranchial bone.

DISCUSSION

The skeleton of the tongue is formed by the paraglossal (entoglossal) and rostral basibranchial (basihyal) parts of the hyoid bone (McLelland, 1975). He added that the unpaired, median, triangular paraglossal bone lies in the free part of the tongue and is rostrally joined to the apex of the tongue by connective tissue sustentaculum described by Tucker (1966) .

The current study revealed that the only bony segment of the hyoid bone in ostrich is the ceratobranchial . It is clearly seen by the naked eye or with radiographic examination. The other segments of the hyoid bone are cartilaginous in nature. However, the hyoid bone in other domestic birds is totally a bony structure (Sisson and Grossman,1969; Tucker ,1966 and Nickel et al. 1977).

Examination of the median cartilaginous plate of the hyoid bone revealed that it is articulated in its middle part with the ceratobranchial bone, a finding that is coincide with those given by Bradley and Grahame (1960), Sisson and Grossman (1964) and Nickel et al (1977) in the domestic birds. The before mentioned authors agreed with our finding that the caudal basibranchial is a median elongated cartilaginous rod that extends caudally ventral to the trachea and to which it is joined with connective tissue.

On the contrary to the statement of El-Morsi et al. (2002) in ostrich that the rostral basibranchial structure is bony in nature, the findings of this study in the same species revealed its cartilaginous nature.

The results of the present work revealed the presence of two cartilages that attach to the paraglossal cartilage, one on each side, which are directed laterally. In the same species El-Morsi et al. (2002) mentioned that the core of the ostrich tongue is supported by central entoglossal cartilaginous plate, together with two un-named cartilaginous rods which extend ventrolateraly to the entoglossal cartilage.

The paraglossal cartilage and the two ventrolateral cartilaginous rods are of the hyaline type as described in this study. According to Tucker (1966), the paraglossal bone in three to nine day old chicks is mainly hyaline cartilage. In older birds, however, the caudal part is ossified.

The extrinsic lingual muscles described in this study agreed with the findings of El-Moursi et al. (2003) in the same species. However, the rest of hayobranchial musculature is not pointed out by them (namely the ceratotracheal, certolaryngealand mandibular ceratotracheal). They attach to the ceratobranchial bone.

Conclusion

1- The hyoid bone is cartilaginous in nature except the ceratobranchial part which is bony.

2- Segments of the hyoid bone are a central cartilaginaous plate (formed of entoglossal, rostral basibranchial and caudalbasibranchial cartilages) and two lateral horns.
3- The paraglossal (entoglossal) part of the hyoid divides the tongue into thin dorsal and thick ventral parts, leaving the lingual pouch inbetween. It extends to the apex of the tongue.
4- There are ten muscles attach to the hyoid bone.

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Legend

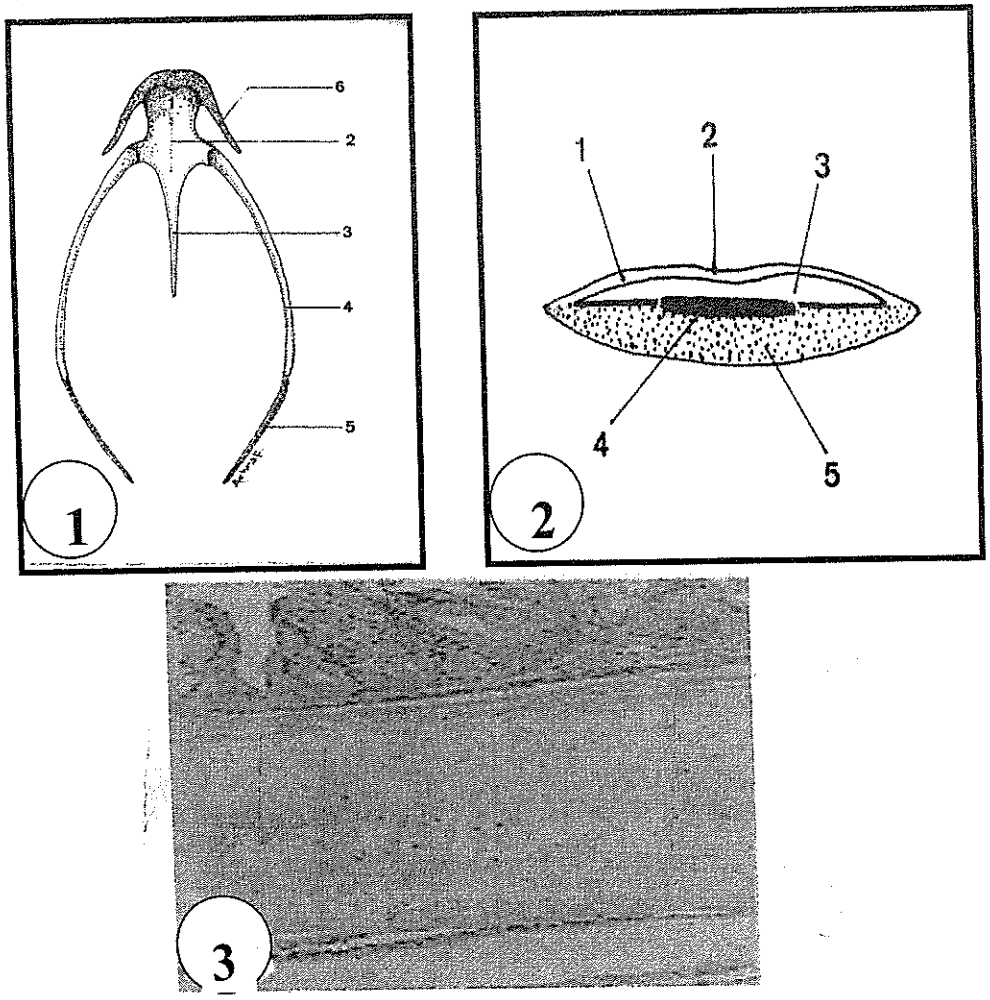
(Fig.1) Diagram of the os hyoideus of ostrich showing :
1 paraglossal cartilage, 2 rostral basibranchial cartilage, 3 caudal basibranchial cartilage, 4 ceratobranchial bone, 5 epibranchial cartilage, 6 rod of cartilage.

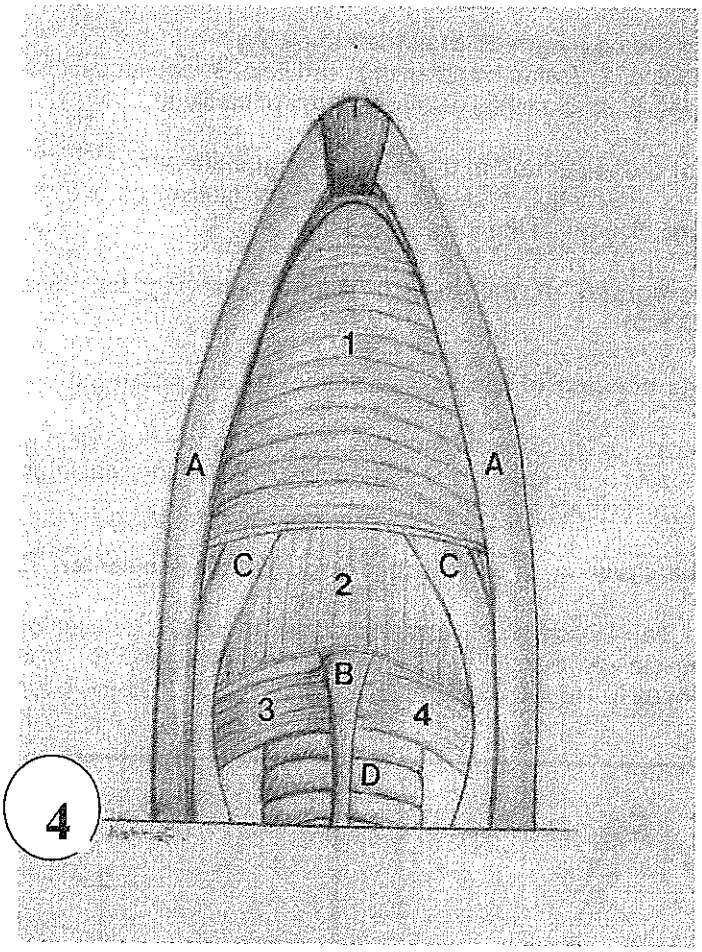
(Fig. 2) Diagram of cross section in the ostrich tongue showing :
1 dorsal surface of the tongue (dorsal part),2 dorsal median groove, 3 lingual pouch, 4 paraglossal cartilage, 5 body of the tongue (ventral part).

(Fig.3) Photomicrograph of the ostrich tongue showing the hyaline paraglossal cartilage. (H&E, X100).

(Fig. 4) Schematic drawing of the ventral aspect of the intermandibular space of the ostrich showing :
1 mylohyoid muscle, 2 geniohyoid muscle, 3 basibranchial ceratobranchial muscle, 4 ceratolaryngeal muscle, A ramus of the mandible, B caudal basibranchial cartilage, C ceratobranchial bone, D tracheal cartilage.

(Fig 5) Schematic drawing of the oropharyngeal floor (dissected from the interior) showing :
1 laryngopharyngeal muscle, 2 ceratolaryngeal muscle, 3 geniohyoid muscle, 4 ceratotracheal muscle, A mandible, B paraglossal cartilage, C rod of cartilage, D ceratobranchial bone, E rostral basibranchial cartilage, F Glottis boundaries (arytenoid cartilage).





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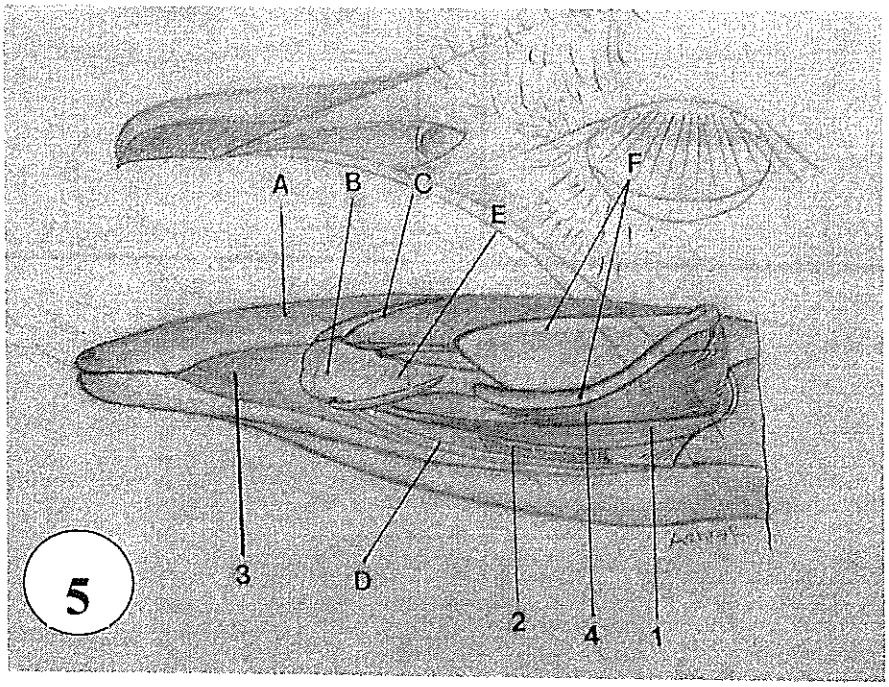

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