

## Larynx Anatomy in a Tiger (*Panthera tigris*, Linnaeus, 1758)

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**Abstract:** In this study the anatomy of the larynx of a male, 18 year old tiger that died in a local zoo is described. Topographically, the larynx of the tiger was situated over the median plane, in the cranial half of the neck. It had a length of 10.0 cm when measured from its ventral side. The cartilages that formed it were the classic five cartilages found in the domestic animals. The thyroid cartilage had a caudal notch well demarcated, closed in part by the cricothyroid muscle and by the cricothyroid ligament. The hyoepiglottic muscle was double. The cavity of the larynx had a dorso-ventral diameter measuring 3.5 cm in the glottis and a side to side diameter of 3.0 cm. The anatomy of the larynx in this animal was different from that of the cat.

**Key words:** Wildlife anatomy, apparatus respiratorius, vocal folds, laryngeal cartilages

### INTRODUCTION

The larynx, the phonetic organ, is a hollow organ that controls the transit of air between the pharynx and the trachea. Internally covered by mucosa, the larynx's structure is composed by cartilages which articulate with one another, are joined by ligaments and moved by means of a peculiar musculature<sup>[1]</sup>. Within the domestic carnivores, the larynx of the cat is different from that of the dog<sup>[1,2]</sup>.

Published material about the anatomy of the larynx of the tiger could not be found.

Hast<sup>[3-5]</sup> described the larynx of felines and of the genera *Panthera*, but the anatomical details studied focus of the vocal folds while the other parts of the organ are barely described. He found that all species of genus *Panthera* (roaring cats) including *Panthera tigris*, can be distinguished from non roaring cats by a large pad of fibro elastic tissue which constitutes the cranial portion of each of the proportionately very large undivided vocal folds. Because of their large mass, the *Panthera* vocal folds have a low natural frequency and, when vibrating, will produce a high acoustical energy<sup>[4]</sup>.

Hast<sup>[4]</sup> states that, as in other anatomical characteristics, the genera *Panthera* also can be distinguished from other cats by the proportionately very large cricothyroid muscle, a large vocalis muscle and a long and narrow median cricothyroid membrane. This work does not mention any other morphologic data.

In a recent work, structures of the hyoid apparatus, the pharynx and their topographical positions in the tiger and other Felidae was described<sup>[6]</sup>.

According to this author, the larynx of the lion, tiger and jaguar are situated much more caudal than in other species of the Felidae and the majority of other mammal taxa except humans, some bats, the koala and red or fallow deer. Weissengruber also mentions the synovial joint between the larynx and the hyoid apparatus.

Our objective is to complement the previous works done describing other anatomic features of the larynx of the tiger.

The larynx of the tiger was situated over the median plane, in the cranial half of the neck. It had a length of 10.0 cm. The cartilages that formed it were the classic five cartilages described in the NAV. The thyroid cartilage had a caudal notch well demarcated and the cricothyroid muscle was well developed. The hyoepiglottic muscle was paired.

The supraglottic part (*Vestibulum laryngis*) was largely reduced in length so that the entrance to the larynx (*Aditus laryngis*) was close to the glottis. The vocal folds did not bulge markedly, measured 1.5 cm dorsoventrally and 2.0 cm craniocaudally. There were no laryngeal ventricles.

### MATERIALS AND METHODS

The larynx of an 18 year old tiger obtained following its death at a local zoo constitutes the material studied. A necropsy of the animal was performed and the larynx was fixed in buffered formalin and later dissected.

Photographs were taken using a Nikon digital camera. The Nomina Anatomica Veterinaria<sup>[7]</sup> was used.

## RESULTS

Topographically, the larynx of the tiger was situated over the median plane, in the cranial half of the neck Fig. 1. Its ventral surface had a length of 10.0 cm, measured from a transverse plane that passed at the most cranial part of the epiglottis up to the caudal border of the cricoid cartilage.

The cartilages of the larynx of the tiger were five: Cricoid, thyroid, epiglottic and a paired arythenoid. There were no other type of cartilage.

The epiglottis Fig. 2 had no petiolus nor cuneiform process.

The thyroid cartilage Fig. 1 and 3 had a well marked caudal notch and the median part were the two laminae on each side join measured 1.5 cm in length. There was no laryngeal prominence. The oblique line was placed at the limit between the dorsal and middle thirds of the lateral surface of the laminae of the thyroid cartilage. Dorsal to the oblique line was a foramen for the passage of the cranial laryngeal nerve into the interior of the larynx. The thyroid cartilage had no caudal horn.

The cricoid cartilage was the most developed of all the laryngeal cartilages; it measured 6.0 cm in height and the craniocaudal length of the laminae 4.0 cm. Its median crest had a height of 0.4 cm and a length of 1.0 cm in its dorsal part. Seen ventrally, the cranial notch of the arch stood out, occupying half the extension of the ventral cricoid arch. It occupied 1.5 cm while the arch measured 3.0 cm craniocaudally.

The cricoid and thyroid cartilages were joined by means of a synovial joint named cricothyroid. The facing articular surfaces were circular with a diameter of 0.7 cm. The other synovial joint was found between the cricoid and arythenoid cartilages. In this case the articular surfaces were wider and measured 1.0 cm in diameter. Both joints were separated 2.0 cm.

The intrinsic muscles found were: cricothyroid, dorsal and lateral cricoarythenoid, transverse arythenoid and thyroarythenoid, the latter having two parts, vocal and ventricular. The cricothyroid muscle Fig. 3 had a length of 4.5 cm measured ventrally and from cranial to caudal and from dorsal to ventral measured at its most caudal part 4.0 cm. Its widest part measured 0.5 cm. The caudal notch of the thyroid cartilage was closed in part by the cricothyroid muscle and by the cricothyroid ligament Fig. 3. The median part of this space was not covered by the cricothyroid muscle, so that the caudal notch was closed only by ligament in its median portion. This portion extended 3.0 cm from cranial to caudal and had a width of 0.5 cm caudally which increased to 0.8 cm cranially at the junction of both thyroid laminae.

Fig. 1: Ventral view of the cervical region of the tiger showing the caudal location of the larynx. TC: thyroid cartilage; T: trachea

Fig. 2: Ventral view of the larynx. TC: thyroid cartilage, CTL: cricothyroid ligament; CTM: cricothyroid muscle

Fig. 3: Ventral view of the larynx. E: epiglottis; HM: hyoepiglottic muscles; HB: hyoid bone

Within the extrinsic muscles, the hyoepiglottic was paired Fig. 2. This muscle is single in the domestic animals and also was found to be single in a puma dissected by us (unpublished data).

The cavity of the larynx had a dorsoventral diameter that measured 3.5 cm at the level of the glottis and 3.0 cm from side to side. The supraglottic part (Vestibulum laryngis) was largely reduced in length so the entrance to the larynx (Aditus laryngis) and the glottis were close to each other. The vocal folds were not well marked, measured 1.5 cm dorsoventrally and 2.0 cm craniocaudally. There were no laryngeal ventricles.

### DISCUSSION

In general terms, the anatomy of the larynx of this animal differs from that described for the domestic cat<sup>[1,2]</sup> and is not identical to it as it has been stated<sup>[3]</sup>.

The topography of this organ is as described and illustrated by Weissengruber<sup>[6]</sup>.

The caudal notch of the thyroid cartilage was much deeper than that of the cat, having similarity with that of the horse. This constitutes a suitable place for entering the larynx cavity surgically. The oblique lines were more pronounced than in the cat. As in the cat, the arythenoid cartilages had no corniculate processes and the epiglottis had no petiolus nor cuneiform process.

Differences were found in the muscles, as shown by the presence of the paired hyoepiglottic muscle, which in the domestic mammals is always single<sup>[1]</sup>.

The cavity of the larynx was similar to that of the cat, without laryngeal ventricles.

The anatomy of the larynx of the tiger was different to that of a puma dissected by us. This latter animal was very similar to the domestic cat. Because of the fact that only one tiger was studied it is not possible to draw major conclusions. It will be necessary to perform more detailed

studies with a larger number of animals and then establish more differences with the domestic cat. The irrigation and the innervation were not studied.

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