

Anatomicosurgical Orientation of the Intraglossal Neurovascular Termination of Egyptian Bovine

Mohamed A Nazih¹ and Mohamed W El-Sherif^{2*}

¹*Department of Anatomy, Faculty of Veterinary Medicine, New Valley University, El-Kharge, New Valley, Egypt*

²*Department of Surgery, Faculty of Veterinary Medicine, New Valley University, El-Kharge, New Valley, Egypt*

***Corresponding Author:** Mohamed W El-Sherif, Department of Surgery, Faculty of Veterinary Medicine, New Valley University, El-Kharge, New Valley, Egypt.

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Abstract

Although many surgical techniques of the bovine tongue are well established, the available literature lacks precise data about the anatomical structure of the bovine tongue, that may guide surgeons to improve their technique to obtain optimal results. The current study performed on eight fresh cattle cadaver heads. Tracking anatomy of the lingual blood vessels and nerves was performed. Cavernous property of the tongue tissue was detected, the deep branch of lingual nerve extends rostrally, parallel to the medial plane to the apex of the tongue. The hypoglossal nerve lies deeply at the medial-ventral aspect of the tongue. Lingual artery and vein originate at the root of the tongue and run on the floor of the apex of the tongue closely to the median plane. Surgical techniques presented for ventral aspect of the tongue represent resection of elliptical portion of the mucosa and muscles or suturing. Further study to evaluate healing process of each technique regarding tissue invasion.

Keywords: *Cattle; Glossectomy; Surgical Anatomy; Tongue*

Introduction

The tongue is an accessory digestive organ that is responsible for prehension, mastication, swallowing and regurgitation of food [1] in vertebrate and Igado [2] in dog. Tongue subjected to many infectious and noninfectious lesions, that may necessitate surgical intervention. Euthanasia is elected for congenital disorders except for bifurcated tongue that may be treated primarily. Acquired surgical disorders of the tongue are treated with primary closure, second intention or glossectomies. Some vice as wind sucking, self-sucking and lolling with tongue are not primarily tongue disorders, but, surgical treatment is directed to partial glossectomy to correct these disorders. Healing of tongue wounds is very good and fast because of high vascularization property. Although surgical procedures of the tongue are well established, available literature lack detailed surgical anatomy of the bovine tongue with special reference to vasculature and enervation and its accommodation for various surgical procedures especially glossectomy. The present article presents detailed descriptive surgical anatomy of the Egyptian crossbred bovine tongue; musculature, vasculature and enervation and its accommodation for ventral aspect tongue surgical procedures.

Material and Method

The anatomical preparation of the study based on obtaining 8 freshly cut heads adult apparently healthy Egyptian cattle of both sexes and age collected from the slaughtering house. The heads washed several time by the running water to remove the blood remnants and preserved in the formalin solution 10% for five days. Coloring the vessels by injecting colored milky latex solution red for the arteries and

blue for veins via external carotid artery and lingofacial vein respectively. The heads were left for two days allowing the latex solution to solidify and fill the terminal vascular branches. The dissection of the heads starts by reflecting the skin covering the face, facial muscles and structures and removing the mandibular ramus by using the bone cutter and hammer. The oral cavity, pharyngeal and laryngeal regions are now exposed and were dissected to determine the lingofacial artery, lingual vein, lingual nerve of mandibular, hypoglossal nerve and the lingual branch of the glossopharyngeal nerve. Tracking the intraglossal course of the above mentioned neurovascular structures from the torus to the apex linguae. For detecting the intraglossal orientation of the blood vessels and nerves, several cross sectional slices are allowed by using a sharp knife at four levels in order from the rostral to caudal; at the lingual tip, mid distance between the latter and frenulum linguae, frenulum linguae, between the corpus and torus linguae and at the middle part of the latter.

Results

The intraglossal neural orientation is represented in the lingual branch of the mandibular nerve of trigeminal cranial nerve, the lingual branch of glossopharyngeal nerve and the hypoglossal nerve. The vascular arborization includes the lingual vein and artery.

The lingual nerve of mandibular (Figure 1, 2 and 4-6) descends rostroventrally on the lateral posterior half of the styloglossus muscle. The nerve inclines on the ventral border of the latter muscle, where it detaches a superficial branch and a deep one. The former descends ventrally to pass along the sublingual salivary gland with the sublingual vein and artery, while the deep branch crosses the ventral border of the styloglossus muscle in a rostromedial direction, where it combines with the hypoglossal nerve. The nerve passes in a tortious manner and regresses in size to ramifies rostrally parallel to the medial plane of the tip of the lingual apex. Many ascending branches are detached along its course on the lateral aspect of the genioglossus muscle, they terminate in the substance of the tongue.

The hypoglossal nerve (Figure 1-4) is the mostly deeper one, it passes on the lateral aspect of the pharyngeal region caudally to the lingofacial artery. The nerve traverses rostroventrally to cross the facial artery ventral to the epihyoid, it extends on the lateral aspect of the hyoglossus muscle and detaches a branch to the geniohyoideous muscle. The nerve continues rostrally along the deep face of extendance of the styloglossus muscle and laterally to the genioglossus one. It receives a deep branch from the lingual nerve of mandibular and distribute in the substance of the tongue. The nerves proceed rostrally in a medioventral direction where at the level of the frenulum linguae, they terminate in the rostral end of the styloglossus muscle.

The lingual branch of glossopharyngeal nerve (Figure 3) passes caudally to the stylohyoid process and rostrally to the lingofacial artery. The nerve turns deeply on the medial aspect of the latter process and the epihyoid, where it inclines dorsally to reach the glossoepiglottic fold and embedded in the root of the corresponding site on the root of the tongue.

The lingual vein (Figure 1, 2 and 6) arises from both sides of the floor of the apex of the tongue. It is superficially detected from the midline of the lingual apex by about 1.5 - 2 cm, laterally to the terminal ramification of the lingual nerve of mandibular. It receives many descending branches which evacuate the venous blood from a bloody filled cavernous spaces. The latter formed from a minute fibrous septa derived from the lingual apical dorsum, the spaces are widely in diameter at the rostral and dorsal aspects of the lingual apex while they diminish in size on both lateral apical aspects. The vein runs caudally embedded in the muscular mass of the styloglossus muscle, it reaches the hyoglossus muscle where the vein turns medially on the lateral aspect of the latter muscle. It gradually descends in a caudoventral direction to terminate in the lingofacial vein.

The lingual artery (Figure 1-6) stout vessel arrives the root of the tongue ventrally to the level of the epihyoid. It erupts from the lingofacial artery and proceeds rostrally on the deep face of the hyoglossus muscle. Where the artery reaches the lateral face of the genioglossus muscle, an arterial branch detaches to the latter and passes on its caudolateral aspect. The branch runs in a rostroventral direction following the corresponding vein. The lingual artery extends rostroventrally and laterally to the genioglossus muscle where it reaches the deep aspect of the styloglossus muscle, it gradually diminishes in diameter accompanying the terminal branches of the lingual nerve of mandibular and hypoglossal nerve. The artery extends medially to the latter nerves and at the level of the frenulum linguae, it runs on the floor of the apex of the tongue closely to the median plane. Where many minute branches where detach along its passage.

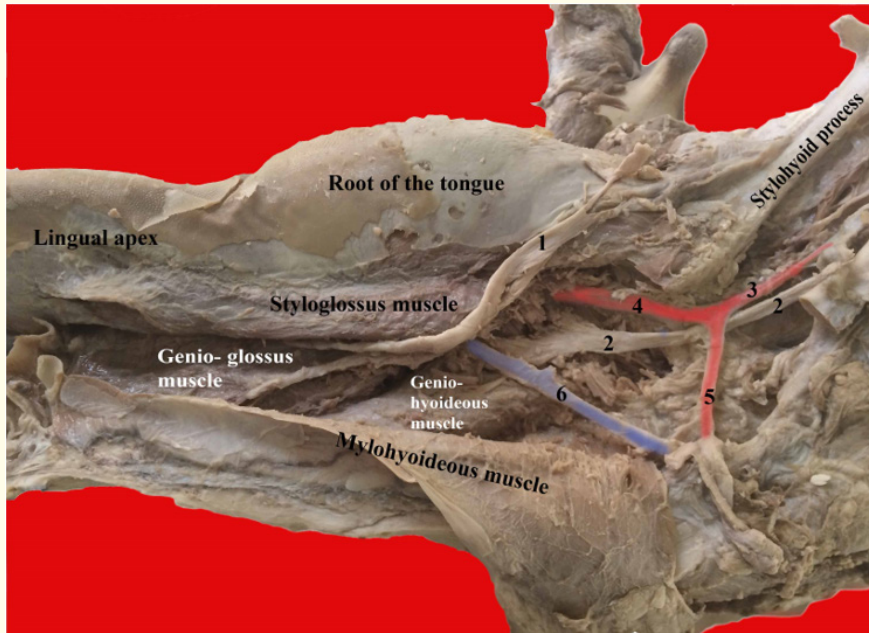


Figure 1: A photograph showing deep anatomical structures after removing the mandibular ramus (left side). 1- Lingual nerve of mandibular, 2- Hypoglossal nerve, 3- Lingofacial artery, 4- Lingual artery, 5- Facial artery, 6- Lingual vein.

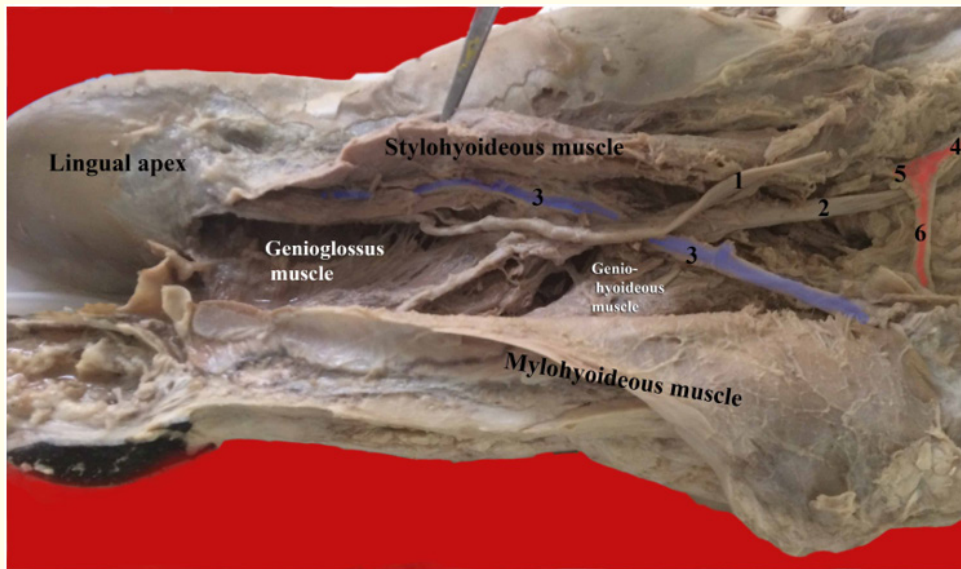


Figure 2: A photograph showing deep anatomical structures after removing the mandibular ramus and cutting styloglossus muscle (left side). 1- Lingual nerve of mandibular, 2- Hypoglossal nerve, 3- Lingual vein, 4- Lingofacial artery, 5- Lingual artery, 6- Facial artery.



Figure 3: A photograph showing the deep anatomical structures after removing the left mandibular ramus. 1- Epihyoid, 2- Stylohyoid process, 3- Glossoepiglottic fold, 4- Hypoglossal nerve, 5- Lingofacial artery, 6- Lingual artery, 7- Facial artery. The arrows indicate the lingual branch of glossopharyngeal nerve.

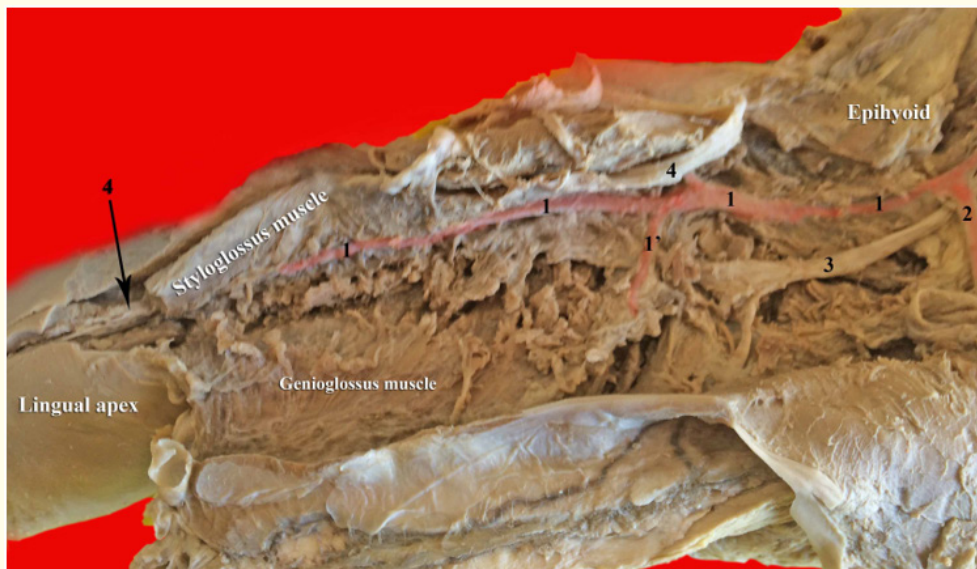


Figure 4: A photograph showing the deep anatomical structures after reflecting the styloglossus muscle. 1- Lingual artery, 2- Facial artery, 3- Hypoglossal nerve, 4- Lingual nerve of mandibular.

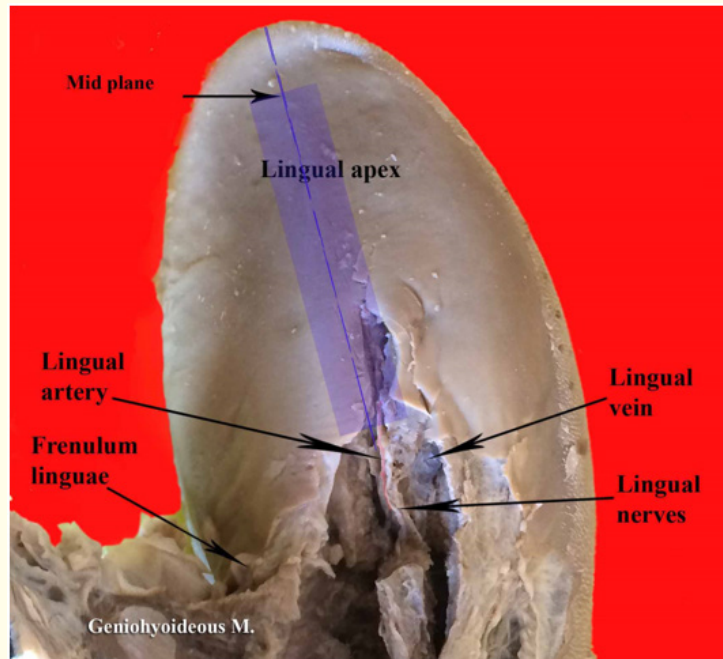


Figure 5: A photograph showing the lingual apex (ventral view). The bluish area indicates the region of the neuroarterial termination (1 - 1.5cm) laterally to the mid plane.

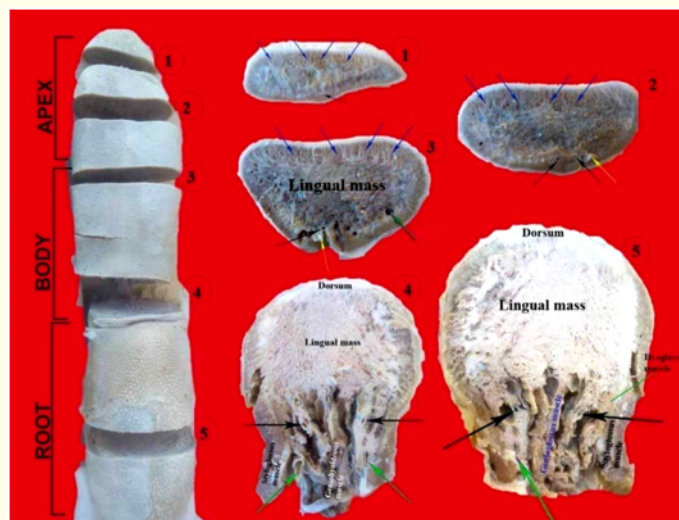


Figure 6: A photograph showing cross sectional slices of the tongue at different levels. 1- Section at the tip of apex linguae, 2- Section at mid distance between the frenulum linguae and the tip of apex linguae, 3- Section at the level of the frenulum linguae, 4- Section at the level between the torus and corpus linguae, 5- Section the mid of torus linguae. The blue arrows indicate the venous cavernous spaces. The yellow arrows indicate the terminal branches of the lingual branch of mandibular nerve. The black arrows indicate the lingual artery. The green arrows indicate the lingual vein.

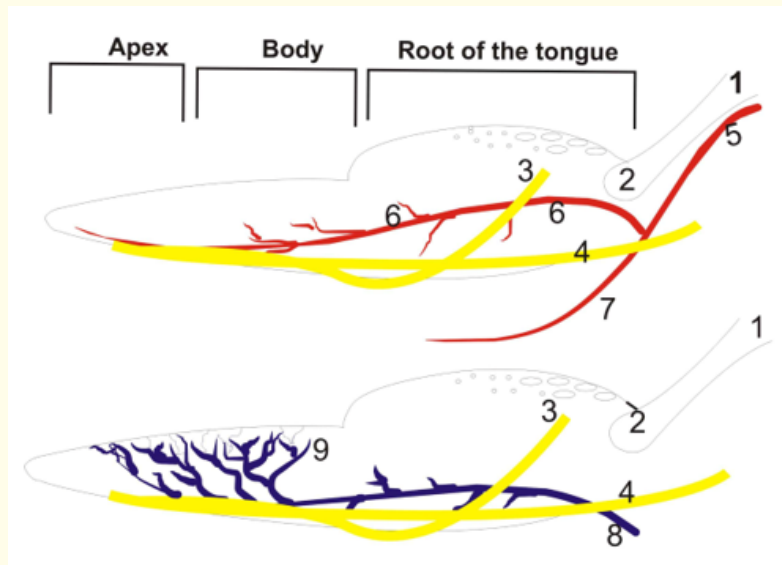


Figure 7: A diagram showing the intraglossal neurovascular orientation (Lateral view). 1- Stylohyoid process, 2- Epihyoid, 3- Lingual nerve of mandibular, 4- Hypoglossal nerve, 5- Lingofacial artery, 6- Lingual artery, 7- Facial artery, 8- Lingual vein, 9- Lingual cavernous spaces.

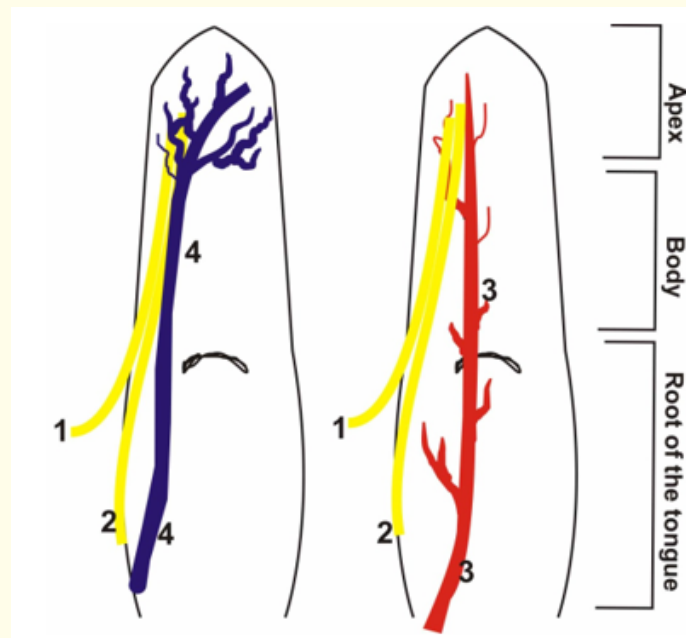


Figure 8: A diagram showing the intraglossal neurovascular orientation (Dorsal view). 1- Lingual nerve of mandibular, 2- Hypoglossal nerve, 3- Lingual artery, 4- Lingual vein, 5- Lingual cavernous spaces.

Discussion and Conclusion

The present study spotted a light on the anatomical orientation of the intraglossal neurovascular terminations. This allows the veterinary surgeons to improve their knowledge about the nerve and blood supply of the bovine tongue during lingual operations. Our work was not attended the mind of the authors among the available literatures, mostly focused on scanning the lingual papillae Parvez and Rahman [3] in cow, Eerdunchaolu., *et al.* [4] in Bactrian camel and Sari., *et al.* [5] in zavot cattle. Others recorded a statistical study on the tongue dimensions, Igado [2] in dog. While O'Brien and Williams [6] used only a new technique for the radiological studding of the head vascularization in some domestic animals, without vascular details.

Our study detected the emergence of the lingual artery from the lingofacial artery similarly findings were cited by Getty [7] in domestic animals, Ashdown and Done [8] in ruminants and Koing and Liebich [9] in domestic mammals. While Evans and Delahunta [10] in dog, O'Brien., *et al.* [11] in Girrafe, O'Brien [12] in alpaca and Jerbi and Perez [13] in camel recorded that both arteries did not formed a common lingofacial trunk and the lingual artery arose separately from the ventral surface of the external carotid artery. The intraglossal course of the lingual artery has been described in our recent work and revealed that it extended along the tongue musculature in a cranio-ventromedial direction and within the torus linguae, the artery appears dorsally situated while it diminishes in diameter and descend gradually on the floor of the lingual apex to be terminated closely to the median plane at the tip of the lingual apex. A description which not mentioned in the available literatures. In this regards, Barone [14] in domestic mammals and Jerbi and Perez [13] in camel cited that the lingual artery penetrates the hyoglossus muscle and passed along the tongue.

The recently recorded anatomical features of the lingual artery allowed surgeons to safely operate at the peripheral aspects of lingual apex where the termination of the artery was much smaller and medially located.

Concerning the lingual venous drain, the present describes the cavernous venous spaces on the dorsum of the apical region of the tongue which drained in the lingual vein at the peripheral aspects of the lingual apex. The vein emerged caudally within the styloglossus muscle and terminated in the lingofacial vein. A study which not met by the most of the available literatures.

Two surgical techniques for altering the contour of the tongue for the treatment of wind and self-sucking vices were described. The first technique was to resect 5 elliptical portion from the ventral aspect of the tongue, including mucosa and partial or full thickness of the muscle followed by apposition with interrupted sutures McCormack [15], Dietz and Ludwig [16], Kersjes., *et al.* [17] in cattle, Abou-El-Ella [18] in cattle (Figure 9). The other technique was to interrupt the contour of the tongue by applying several inverting sutures without resection of the ventral aspect of the tongue (Figure 10). Regarding anatomical findings, healing of the tongue for both procedures was rapid, may be awing to the cavernous property of the tongue tissue. Meanwhile, the technique reported recently, kept blood vessels and nerves at the ventral aspect of the tongue unaffected when anatomical relations are considered. Resection of an elliptical portion with variable thicknesses from the ventral aspect of the tongue involves more tissue invasion and destruction of vessels and nerve terminals. Further study should be initiated to evaluate healing process in each procedure [19,20].

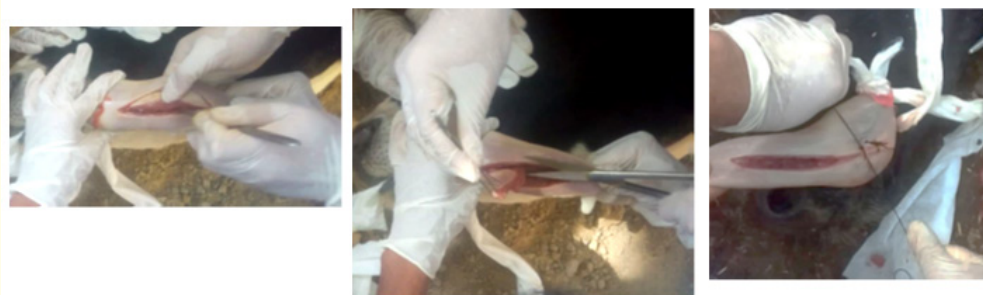


Figure 9: A photograph showing resection steps of an elliptical portion of the mucosa and muscle from the ventral aspect of the tongue.



Figure 10: A photograph showing suturing the ventral aspect of the tongue without resection.

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