

Anatomy of facial nerve in maned wolf (*Chrysocyon brachyurus* - Illiger, 1815)

Anatomia do nervo facial em lobo-guará (*Chrysocyon brachyurus* - Illiger, 1815)

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Abstract:

Maned Wolf (*Chrysocyon brachyurus*) is considered one of the largest and most beautiful canids in South America, inhabits the Cerrado biome, and presents nocturnal habits, especially during the twilight period. It is in danger of extinction, mainly due to anthropic activity in its habitat. What certainly raises the importance of studying and better understanding its biology. The mammalian Facial Nerve is the seventh cranial pair and controls the functions of facial expression muscles and others. Once the anatomical descriptions of this canid are scarce, this paper aimed to describe the anatomy of Facial n. in Maned Wolf and correlate it with that of domestic canids, a phylogenetically close species whose anatomy is well known. For this research, four adult specimens were used, whose carcasses were collected along highways in southeastern Goiás State - Brazil (SISBIO 37072-2), or donated by the Wildlife Screening Center (CETAS) in Catalão - Goiás State. The specimens were fixed in a 10% aqueous formalin solution and stored in the same solution. Dissection was performed by macroscopic anatomical methods. The research was carried out with a favorable opinion of the Animal Use Ethics Committee (CEUA) of the Federal University of Uberlândia (UFU) (under n° 067/12). Anatomical preparations of post-mortem Maned Wolf did not reveal the presence of Caudal Auricular, Internal Auricular, nor Stylohyoid n.. Small ramifications of Facial n. can be considered as collateral branches. The Facial n. emerged as a single trunk, Facial n. Trunk, which branches into Auriculopalpebral, Dorsal Buccal, and Ventral Buccal n..

Keywords: Anatomy; Wild Animals; Neuroanatomy; Facial Nerve.

Resumo

O Lobo-Guará (*Chrysocyon brachyurus*) é considerado um dos maiores e mais belos cánídeos da América do Sul, habita o cerrado e apresenta hábitos notívagos, com preferência crepuscular. Motivado, principalmente, pela atividade

antrópica em seu habitat, encontra-se em risco de extinção, o que, certamente, eleva a importância de se estudar e compreender melhor a sua Biologia. Nesse contexto, sabe-se que o *Nervo Facial* de mamíferos é o sétimo par craniano e se envolve com o comando da função dos músculos da expressão facial e outros, porém como as descrições anatômicas desse canídeo são escassas, o objetivo desta pesquisa foi descrever e correlacionar a Anatomia do N. Facial de Lobo-Guará com canídeos domésticos, espécie esta filogeneticamente próxima. Para o desenvolvimento deste trabalho foram utilizados quatro exemplares de Lobo-Guará adultos, cujas carcaças foram recolhidas às margens de rodovias do sudeste goiano (SISBIO 37072-2) ou doadas pelo CETAS-Catalão. Os espécimes foram fixados em solução aquosa de formol a 10% e conservados em igual solução. A dissecação foi realizada sob a luz de técnicas usuais em Anatomia Macroscópica. Ressalta-se que a pesquisa foi desenvolvida com o parecer favorável do CEUA/UFU nº 067/12. As preparações anatômicas envolvendo o Lobo-Guará não revelaram a presença dos nervos: Auricular caudal, Auricular interno e Estilohioideo, apenas pequenos ramos, considerados como ramos colaterais. O n. Facial emerge como um tronco único, o Tronco do N. Facial, o qual se dividia em n. Auriculopalpebral, Bucal dorsal e Bucal ventral.

Palavras-Chave: Anatomia; animais silvestres; neuroanatomia; nervo facial.

Introduction

Maned Wolf (*Chrysocyon brachyurus*) is considered one of the largest and most beautiful canids in South America. It belongs to the phylum Chordata, order Carnivora, class Mammalia, and family Canidae. The species has very peculiar characteristics among canids, such as long and thin legs and dense reddish coat. They live in the Brazilian Cerrado and are predominantly nocturnal, solitary, and furtive animals, with twilight activity peak. They are omnivores and generalists, their food sources vary from animal origin (rodents, birds, eggs, reptiles, and insects) to plant origin (fruits, sugarcane, and honey)⁽¹⁾. Gestation lasts up to 65 days, with black newborns weighing between 340 and 430 g. Adults weigh between 20 and 30 kg and exhibit up to 90 cm at withers. Its greatest threat is the destruction of its habitat by anthropic action, which is why they are listed as an endangered species^(2,3).

Anatomical descriptions of Maned Wolf are scarce. Among them, we can cite Machado et al.⁽⁴⁾ and Machado et al.⁽⁵⁾ who referred to spinal cord skeletopia and spinal cord topography, respectively, and Simões et al.⁽⁵⁾, who described its telencephalon anatomy⁽⁴⁻⁶⁾. Most of the studies in the literature are regarding the general and external aspects of its biology, as reported by Dietz⁽⁷⁾. Several authors have already reported in detail the Facial n. of domestic canids, but no description has been published for Maned Wolf⁽⁸⁻¹¹⁾.

The Facial n. or VII cranial n. is a mixed nerve that emerges from the brainstem and provides somatic and visceral innervation to facial structures. This nerve corresponds to the second pharyngeal arch nerve. It emerges from the rostral part of the pons, very

close to the vestibulocochlear nerve, and its intracranial course is directed towards the internal acoustic meatus. The Facial n. in dogs provides motor innervation to the facial expression Mm. and caudal portion of digastric m.⁽⁸⁾. The sensory part of the Facial n. provides innervation to the two rostral thirds of the tongue and palate, being responsible for tasting. In carnivores, after emerging from the stylomastoid foramen, the Facial n. ramifies into the Caudal and Internal Auricular nn., as well as Digastric and Stylohyoid nn.. The Caudal Auricular n. emerges from the dorsal surface of the Facial n., still in the stylomastoid foramen, and follows dorsally to supply the caudal auricular musculature⁽¹⁰⁾. Given the above, this paper aimed to study and describe the anatomy of the Facial n. of Maned Wolf, and correlate it with that of domestic canids, a phylogenetically close species whose anatomy is already well established. Hence, we can provide the veterinarians with knowledge about the macroscopic anatomy of this innervation, which has a variety of functions. Lastly, the management and clinical assistance of such wild animal species can be improved, such as anesthetic techniques and surgical procedures.

Material and methods

The present study is a descriptive anatomical study with two male and two female specimens of Maned Wolf (*Chrysocyon brachyurus*) (Figure 1), obtained from accidental death on the roadsides of southeastern Goiás State (Brazil), under the authorization of the Biodiversity Authorization and Information System (SISBIO/ n°37072-2). Considering the descriptive approach of this study, statistical analysis was needless. All procedures were conducted according to ethical principles and approved by the Research Ethics Committee of the Federal University of Uberlândia (CEUA/UFU, n°067/12).

The study was carried out at the Comparative Anatomy Laboratory of the Federal University of Goiás - Catalão Region (RC), Goiás State, Brazil. The specimens were placed in an aqueous medium with a 10% formaldehyde solution for conservation, prior to the macroscopic anatomical analysis. Dissection was performed under consecrated techniques in Macroscopic Anatomy, using scalpels bearing n°10 and n° 24 blades, scissors, and tweezers. The Nikon® D7000 18-105 digital camera was used for photographic documentation, and nomenclature description was based on the Veterinary Anatomical Nomina (2017)⁽¹²⁾.



Figure 1. Adult specimen of Maned Wolf (*Chrysocyon brachyurus*). Photography by Adriano Gambarini.

Results and discussion

Comparative studies have great value in identifying morphofunctional relationships between organs and anatomical structures in different species, contributing to the understanding of evolutionary interrelationships among different taxonomic groups and to the improvement of veterinary clinical practices⁽¹³⁾. As the literature on wild canine anatomy is scarce, the purpose of this paper was to compare compiled data on domestic canine anatomy, for which descriptions are relatively established.

Our anatomical findings revealed that the Facial n., or seventh cranial nerve, emerges from the skull through the stylomastoid foramen and supplies several small branches to the outer ear and related structures, including Auricular Caudal, Auricular Internal, stylohyoid and other n.. The inner ear branches exit from the Facial n. and then pierce the ear cartilage to supply the external acoustic meatus, coming in closely proximity to the tympanic membrane. In domestic canids, the Facial n. emerges as a single trunk

(Facial n. Trunk), which emerges from the skull through the facial canal and the internal acoustic pore of the petrous part of the temporal bone via the internal acoustic meatus, exactly as we found in the Maned Wolf. The Facial n. small branches (considered as collateral branches) were apparently absent, whereas the large branches (considered as terminal branches) were always present^(8,10,14).

Anatomical preparations showed that Maned Wolf nerve have the same origin as in domestic dogs, but their branches were not observed (Figure 2). In Maned Wolf, the Facial n. Trunk is also present but outside the skull, it runs craniolaterally, circumventing the cartilage of the auricular pavilion caudoventrally and deeply to the parotid salivary gland.

According to Brudas⁽¹⁴⁾, the Facial Intermediate n. consists of one of the parts, the Facial n. and the Intermediate n.. In the sensory geniculate ganglion, it discharges the Intermediate n. from which the tympanum cord crosses the petrotympanic fissure to join the Lingual n.. The Greater Petrosal n., a parasympathetic nerve, also arises from the Facial n.. After joining the Deep Petrosal n., also a sympathetic nerve, the Greater Petrosal n. continues as a n. of the pterygoid canal up to the pterygopalatine ganglion. Still within the facial canal, the Facial n. issues the Stapes n. up to the Stapes m. Except for its predominantly sensory internal ear branches, the Facial n. transmits only motor fibers. The sensory fibers of its internal auricular branches are carried over to the Facial n. by the auricular branch of the vagus nerve⁽¹⁴⁾.

In Maned Wolf, the craniolateral path of Facial n. Trunk takes it into the glandular parenchyma, a complication also described in domestic canids^(8,10,14). In the glandular parenchyma of dogs and domestic carnivores, the Facial n. ends branching into Auriculopalpebral, Dorsal Buccal, and Ventral Buccal n.^(12,15).

The origin of those nerves was from the Facial n. in Maned Wolf. Nevertheless, we believe that it would be imprudent to classify them all as terminal branches. This is because the Ventral Buccal n. emerged before the terminal branch of the Facial n., still deep to the parotid gland, following the main n., like a trunk, the Bucopalpebroauricular Trunk. This trunk is not clearly identified in the relevant literature and was not described by Miller; Christensen & Evans⁽⁸⁾ and Getty in Sisson & Grossman⁽¹⁰⁾. However, it was present in Maned Wolf and was divided into Dorsal Buccal n. and Auriculopalpebral Trunk (Figures 2 and 3). As we observed in Maned Wolf, the Auriculopalpebral n. had already been described in dogs^(8,10).

For Getty in Sisson & Grossman⁽¹⁰⁾, the Auriculopalpebral n. is located dorsally and rostrally to the annular cartilage of the outer ear and then divides into Zygomatic n. and Rostral Auricular n.. Yet for Miller; Christensen; Evans⁽⁸⁾, Auricular and Eyelid Nn. appear as terminal branches of the Facial n.. In Maned Wolf, there was an Auriculopalpebral Trunk divided into Eyelid n. and Rostral Auricular n.^(8,10). Miller; Christensen & Evans⁽⁸⁾ cited that Rostral Auricular n. enters Scutular Mm., as we found in Maned Wolf⁽⁸⁾. According to Koning, Liebich⁽¹⁶⁾, after the facial canal, the first branch to emerge is the Caudal Auricular n., which bends around the base of the ear providing sensory innervation to the skin at the bottom of the outer ear. The Auriculopalpebral n. arises at the base of the ear, crosses the zygomatic arch, covered by the parotid gland, and emits branches

to the rostral auricular muscles and a zygomatic branch⁽¹⁶⁾.

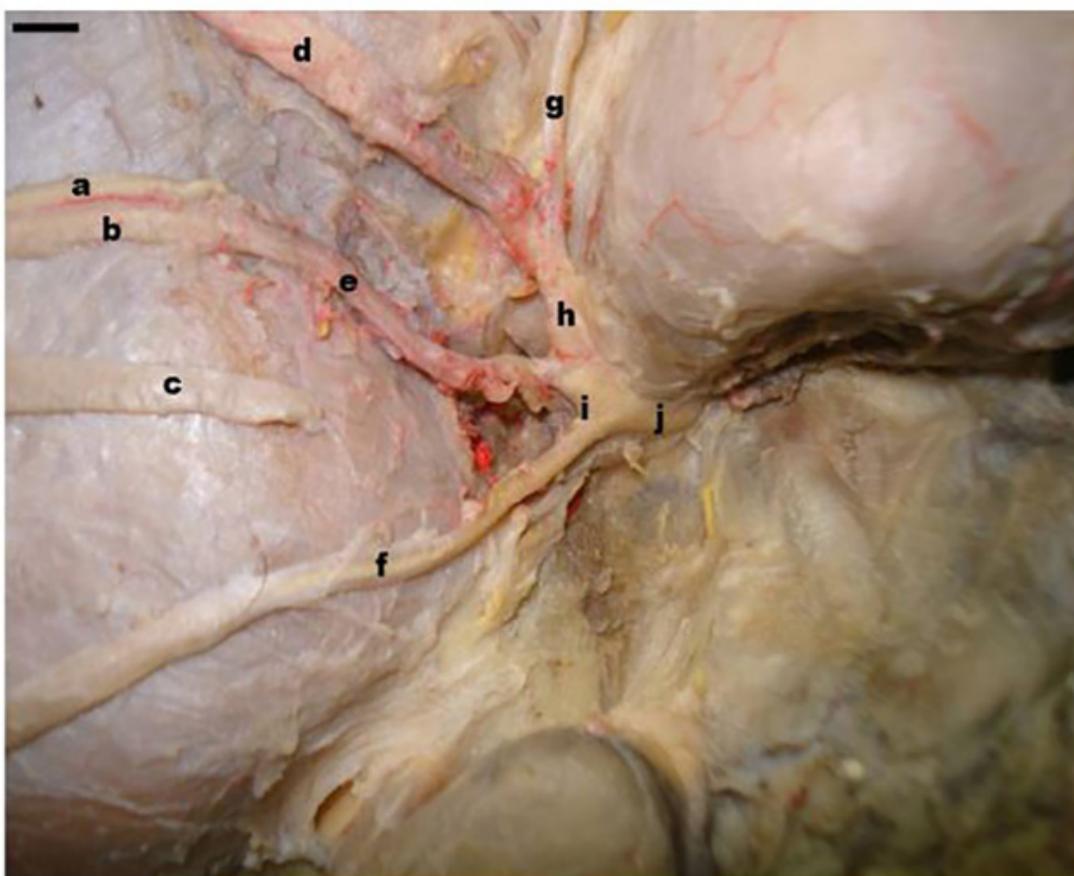


Figure 2. Left lateral view of the dissected head of Maned Wolf (*Chrysocyon brachyurus*). a - Dorsal branch of the Eyelid n., b - Ventral branch of the Eyelid n., c - Parotid duct, d - Eyelid n., and - Dorsal Buccal n., f - Ventral Buccal n., g - Rostral Auricular n., h - Auriculopalpebral Trunk, i - Bucopalpebroauricular Trunk, j - Facial n.. Scale 0.25 cm.

In the analyzed specimens of Maned Wolf, the Eyelid n. follows rostrally in close relationship with the zygomatic arch, as also described in dogs by Miller; Christensen & Evans⁽⁸⁾. These authors, however, only mentioned that the n. follows rostrally, establishing multiple anastomoses with the rostral Auricular plexus⁽⁸⁾. On the other hand, Getty in Sisson & Grossman⁽¹⁰⁾ highlighted in a clearer way the proximity relationship of the Eyelid n. with the zygomatic arch, which was so intense that they called the Zygomatic n.. In dogs, Miller; Christensen & Evans⁽⁸⁾ stated that the Eyelid n. supplies the Orbicularis m. of the eye, as we found in Maned Wolf.

Still according to Miller; Christensen & Evans⁽⁸⁾, the Dorsal Buccal n. is the second terminal branch of the Facial n.. It crosses the Masseter m. rostrorodorsally and follows approximately parallel to the zygomatic arch in the rostral direction, establishing anastomoses with the Ventral Buccal n., near the angle of the mandible. Branches of the Ventral Buccal n. pass through the Orbicularis m., ending as the Maxillonasolabial n.. In turn, Getty in Sisson & Grossman⁽¹⁰⁾ stated that the Dorsal Buccal n., after superficially crossing the entire Masseter m., establishes numerous anastomoses with the Ventral

Buccal n., forming a large retrobuccal plexus. In Maned Wolf, the provision of the Dorsal Buccal m. seems to have a close similarity with these citations in domestic canids^(8,10).

In Maned Wolf, Dorsal Buccal n. is born in a common trunk with the Auriculopalpebral n., namely Bucopalpebroauricular Trunk, being its ventral branch (Figure 3). The Dorsal Buccal n. is positioned dorsally to the parotid duct, with which it runs rostrally over the aponeurosis of the Masseter m.. At the level of the rostral edge, the Masseter m. was divided into dorsal, middle, and ventral branches. The ventral branch was thin and established anastomoses with the retrobuccal plexus. The middle and dorsal branches were larger and performed anastomoses with each other, contributing to the formation of the retrobuccal plexus. After the plexus, the middle branch followed rostrally as a Dorsal lip n., while the dorsal branch was directed towards the lateral face of the nose as a Lateral Nasal n.

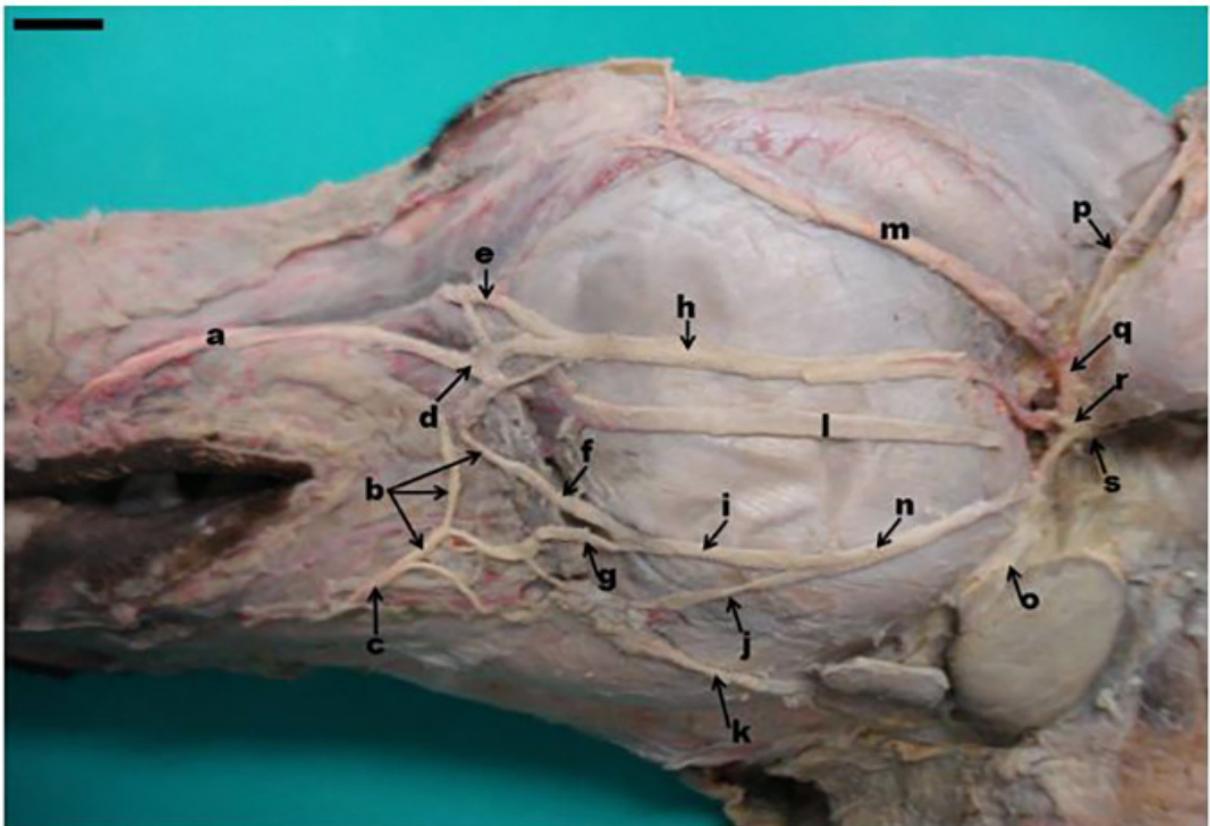


Figure 3. Left lateral view of the dissected head of Maned Wolf (*Chrysocyon brachyurus*). a - Dorsal Labial n., b - Retrobuccal Plexus, c - Ventral Labial n., d - Ventral Branch of the Dorsal Buccal n., e - Nasal Lateral n., f - Dorsal Ramus of the Dorsal Branch of the Ventral Buccal n., g - Ventral Ramus of the Dorsal Branch of the Ventral Oral n., h - Dorsal Buccal n., i - Ventral Buccal n., j - Ventral branch of the Ventral Buccal n., k - Mandibular Gland Duct, l - Parotid Duct, m - Eyelidn., n - Ventral Buccal n., o - Cervical Branch of the Facial n., p - Rostral Auricular n., q - Bucopalpebroauricular Trunk, r - Bucopalpebroauricular Trunk, s - Facial n.. Scale 1 cm.

that it is directed rostrally and slightly inclined ventrally; after a short space, it ventrally issues the cervical branch of the Facial n. and then follows rostrally over the lateral surface of the Masseter m.. Near and caudally to the labial commissure, it is divided into numerous branches that enter peri-buccal structures and establish anastomoses with each other and with branches of the Dorsal Buccal n., forming the retrobuccal plexus, and then they follow as a Ventral lip n.. In Maned Wolf, the disposition of the Ventral Buccal n. is consistent with the descriptions of Miller, Christensen & Evans⁽⁸⁾, and those of Getty in Sisson & Grossman⁽¹⁰⁾ in dogs. However, at the level of the middle part of the Masseter m., we observed that it was divided into dorsal and ventral branches, what was not reported by the above-cited authors. The ventral branch is smaller and follows the ventral border of the mandible, while the larger dorsal branch slopes slightly dorsally towards the angle of the mouth, where it establishes anastomoses in the retrobuccal plexus^(8,10).

Conclusion

The macroscopic anatomical findings of Facial n. in Maned Wolf specimens showed a close resemblance to the descriptions in domestic dogs, but with differences that may suggest evolutionary and clinical adaptations. Comparative anatomy revealed that the Facial n. of Maned Wolf has the same origin as that of domestic canids, but with differences in the number of branches. The Bucopalpebroauricular Trunk was present in the studied Maned Wolf specimens; yet, small branches to the outer ear and related structures, among them the Auricular Caudal n., Internal Auricular n., and Stylohyoid n. were not observed.

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