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ANALYSIS OF THE REGIONAL AND FUNCTIONAL ANATOMY OF THE CRANIAL NERVES: A LITERATURE REVIEW

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Abstract: INTRODUCTION: In the field of neurology, the cranial nerve pairs are of fundamental importance in the mechanism of human evolution. There are a total of 12 pairs of nerves and they are closely linked to the maintenance of life and to the sensory, motor and consciousness disorders that individuals may experience during the process of birth, growth, development and senility. **OBJECTIVES:** To address the morphological and functional issues of the 12 pairs of cranial nerves and understand their correlation with homeostasis and the most obvious pathologies. **METHODS:** This is an integrative literature review based on the guiding question: "What is the real or apparent origin, pathway, function and clinical relationship of the twelve pairs of cranial nerves?". The descriptors "cranial nerves", "morphology", "functionality" and "nerve anatomy" were used to locate the articles in the databases. Virtual and physical books were included, as well as articles in Portuguese and English published from 2014-2021 and letter-type studies were excluded. The *snowball* strategy was used to capture new evidence. **DISCUSSION:** The word nerves is defined as a set of nerve fibers that are joined together from dense connective tissue and organized into bundles that are responsible for transmitting the nerve impulse. From the micro to the macro scale, the twelve pairs of cranial nerves depart from the encephalon with the aim of connecting to sense organs and muscles, mainly in the skull. **CONCLUSION:** In this study, it was found that the cranial nerves are related to responses to certain stimuli, in addition to some of the pathologies involved. After birth, primitive reflexes have a certain time to appear and disappear, and if they remain, for example, after the correct period, this indicates alterations that need to be investigated. In the case of traumas such as TBI, scales are used to assess the degree of impairment of these nerves and their relationship to the shortness of life. In this way,

the human body is seen as a perfect machine and the twelve pairs of nerves are responsible for maintaining this balance or not.

Keywords: anatomy, functionality, cranial nerve.

INTRODUCTION

In the field of neurology, the pairs of cranial nerves are of fundamental importance in the mechanism of human evolution. There are a total of 12 pairs of nerves and they are closely linked to the maintenance of life and the sensory, motor and consciousness disorders that an individual may experience during the process of birth, growth, development and senility. In addition, there are countless external factors that contribute to affecting the body's homeostasis, with Traumatic Brain Injury (TBI) being one of the trauma-related events that happens quite frequently on the national scene and which can lead to the patient's death.

Nerves are structures made up of neuron extensions covered in connective tissue. They can be classified as cranial or spinal, depending on where they originate. All the nerves in the body make up the peripheral nervous system, which is made up of all the nerves in our body and has the primary function of connecting the central nervous system to other parts of the body.

Thus, the twelve pairs of cranial nerves are: I. Olfactory nerve, II. Optic Nerve, III. Oculomotor nerve, IV. Trochlear Nerve, VI. Abducens Nerve, V. Trigeminal Nerve, VII. Facial Nerve, VIII. Vestibulocochlear Nerve, IX. Glossopharyngeal Nerve and X. Vagus Nerve. Some have very specific functions, while others, such as the glossopharyngeal and vagus nerves, are interrelated. In the meantime, it is important to realize that in neurology there are specific scales that are used to assess the integrity of the 12 pairs of nerves, as well as for the doctor to arrive at a diagnostic hypothesis and subsequent treatment, rehabilitation.

MATERIALS AND METHODS

This is an integrative literature review. The research question was defined as: "What is the functional and regional anatomy related to the function of each cranial nerve?". The review was conducted in the databases of the virtual and physical library of Faculdade Tiradentes using physical books and virtual books. The descriptors used were "anatomy", "cranial nerve" and "functionality" combined using the logical operator "AND".

The inclusion criteria for the study were: 1-Observational studies, case reports; 2-Books and articles published between 2012 and 2021; 3-Books published in English, Spanish or Portuguese. The following were excluded: 1- Books repeated in a database; 2- Letters to the reader or editorial comments; 3- Books that did not address the subject in its entirety.

At the initial stage, a search was made and then a selection was made by reading in general to analyze whether the study/book would be included or not. In addition, those that were included were critically read. This reduced the risk of methodological bias.

Thus, during construction, each cranial nerve was described in detail, describing its regional and functional anatomy, associating its function and clinical relationship, and finally, some examples of dysfunction in each cranial nerve were presented.

RESULTS AND DISCUSSION

OLFACTORY NERVE - I

REGIONAL AND FUNCTIONAL ANATOMY - Real and apparent origin and its course

The olfactory nerve is the first pair of cranial nerves and is responsible for the perception of smells by detecting odorous substances in the environment. The olfactory nerve is completely sensitive, conducting impulses associated only with the sense of smell. It is the only cranial nerve that penetrates the brain directly. This nerve is not a typical cranial nerve, with a peripheral fiber pathway and a central nucleus area. It is the first part of the olfactory tract in the CNS and is associated with the telencephalon (MOORE et al., 2018).

The olfactory neurons are located in the olfactory organ, the olfactory area of the mucous membrane of the nose, which is located in the nasal cavity, nasal septum and medial wall of the upper nasal concha. The apical faces of the olfactory neuron have olfactory cilia that are stimulated by odorous gas molecules. The basal surfaces give rise to a set of fine nerve fibers (olfactory filaments), forming the right or left olfactory nerve. This nerve contains axons which, from the olfactory mucosa, pass through the perforations of the lamina cribriformis of the ethmoid bone and extend to the anterior cranial fossa and the olfactory bulbs, located in the telencephalon. In the olfactory bulbs, nerve fibers synapse with neurons that go to the olfactory tracts. Each olfactory tract is divided into distinct bands of fibers called the lateral and medial olfactory striae. These fibers penetrate the brain and a large number of them project to the cerebral cortex of the medial aspect of the temporal lobes (MOORE et al., 2018).

FUNCTION AND CLINICAL RELATIONSHIP

Its function is to allow the patient to smell. Thus, the olfactory nerve can be severed in the anterior fossa of the skull in the area where it passes through the bone of the nasal cavity in a skull base fracture. This results in a reduced sense of smell (hyposmia) or even a complete loss of smell (anosmia) (MOORE et al., 2018).

OPTIC NERVE - II

REGIONAL AND FUNCTIONAL ANATOMY - Real and apparent origin and its course

The optic nerve is a hypoecho-genic structure that communicates with the brain and is responsible for capturing light stimuli. It is made up of fibers that originate in the retina and enter the skull through the optic canal, surrounded by a meningeal sheath made up of dura mater (pachymeninge), arachnoid and pia mater (both leptomeninges) (PAPALINI, 2018). The optic canal is located in the lesser wing of the sphenoid bone, receiving the optic nerve (cranial nerve II) from the interorbital region, bringing afferents from the retina. Each nerve joins with the one on the opposite side to form the optic chiasm, partially crossing the fibers that continue in the optic tract to the exclusively sensory lateral geniculate body. Decussation occurs in the chiasm and the fibers are already crossed in the tract (MACHADO, 2014). Injury to the optic nerve causes problems related to loss of vision, such as glaucoma. Inflammation of the nerve causes optic neuritis, with infectious, ischemic and demyelinating causes, usually accompanied by systemic diseases such as hypertension and diabetes or neurodegenerative diseases (MOORE et.al., 2018).

FUNCTION AND CLINICAL RELATIONSHIP

The optic nerve has 4 fibers, the visual afferent, responsible for transmitting visual impulses from the retina to the lateral geniculate nucleus of the thalamus, the pupillary afferents, which act by regulating the pupillary light reflex, the efferents pass through the retina but have an unknown function and the photostatic, responsible for the body's visual reflexes (MOORE et.al., 2018).

OCULOMOTOR NERVE - III

REGIONAL AND FUNCTIONAL ANATOMY - Real and apparent origin and its course

The oculomotor nerve is the third cranial nerve of the twelve that exist. It is the main motor nerve for the extrinsic and intrinsic muscles of the bulb of the eye, providing motor and proprioceptive innervations. The muscles in this region include the inferior, medial and superior rectus, inferior oblique, as well as the levator palpebrae superioris. This nerve is formed by efferent fibers, divided into general visceral efferent fibers, which form the ganglionic root, and general somatic efferent fibers, which innervate the aforementioned muscles. Furthermore, the origin of the oculomotor nerve is of paramount importance, with the oculomotor nucleus and the Edinger-Westphal nucleus being the sites of this origin (MOORE et al., 2018).

After expressing itself in the midbrain, the oculomotor nerve pierces the dura mater and continues through the roof and wall of the cavernous sinus. After leaving the cranial cavity, it enters the orbit via the superior orbital fissure, and it is there that it divides into the superior and inferior branches. The superior branch innervates the levator palpebrae superior muscle and the superior rectus muscle. The inferior branch, on the other hand, innervates the inferior oblique and medial and inferior rectus muscles. Also in the inferior branch, pre-synaptic parasympathetic fibers are conducted to the ciliary ganglion, where the synapse occurs. Furthermore, they continue until they reach the bulb of the eye, specifically the short ciliary nerves, where they innervate the ciliary muscles and the pupil sphincter, being of paramount importance (MOORE et al., 2018).

FUNCTION AND CLINICAL RELATIONSHIP

When it comes to the clinical practice of this nerve, paralysis is quite common. It occurs mainly as a reflex to cranioencephalic trauma. The lesion can be isolated or complete, when it affects other nerves. When there is an isolated lesion, it can be incomplete or complete, sparing the patient's pupils or not (MOORE; DALLEY, 2019). Depending on the location of the nerve lesion, manifestations tend to occur in different ways, such as upper branch lesions resulting in ptosis and impaired eye elevation, through deficits in the rectus and levator muscles of the upper eyelid. In the lower branch, abduction, changes in pupillary reaction and ocular depression occur (MOORE; DALLEY, 2019).

TROCHLEAR NERVE - IV

REGIONAL AND FUNCTIONAL ANATOMY - Real and apparent origin and its course

The trochlear nerve, or also called the fourth cranial nerve (CN IV), is considered the thinnest cranial nerve and is formed by general somatic efferent fibers (GSE). It originates in the midbrain, at the level of the inferior colliculus, just above the pons and caudally to the lateral nucleus of the third cranial nerve (oculomotor nerve) (FREITAS, 2020). This nerve is the only one with an apparent exit in the posterior region of the brainstem. As such, the trochlear nerve has the longest route in the intracranial region when compared to the other cranial nerves. It bypasses the entire brainstem, then heads forwards, passing alongside the superior cerebellar and posterior cerebral arteries (one of the arteries responsible for blood supply), continuing along the tentorium of the cerebellum (FREITAS, 2020).

Next, the trochlear nerve continues its course and penetrates the dura mater, in a portion just behind and lateral to the posterior clinoid processes, entering the anterior direction of the cavernous sinus, in the lateral portion, close to the third cranial nerve (CN III) and just above the branches of the trigeminal nerve, the fifth cranial nerve (CN V) (FREITAS, 2020). It crosses the superior orbital fissure and enters the orbit (DRAKE et al., 2013). Soon after, the trochlear nerve crosses the third cranial nerve superiorly and innervates the superior oblique muscle (extrinsic muscle of the eye) (FREITAS, 2020).

FUNCTION AND CLINICAL RELATIONSHIP

Thus, by innervating the superior oblique muscle of the eye, this nerve allows the eye to move and its activation causes the eyeball to twist both inwards and downwards (CONSENZA, 2012). Injuries to the trochlear nerve can lead to various clinical features. These include lesions in the fascicular region, the cisternal and cavernous segments (FREITAS, 2020). Fascicular lesions that occur in the post-decussion region of the nerve fibers result in weakness of the ipsilateral superior oblique muscle. In lesions of the cisternal segment, due to compression of the posterior cerebral peduncle or possible contralateral ataxia due to compression of the superior cerebellar peduncle, contralateral hemiparesis is observed. Lesions in the cavernous segment are associated with multiple cranial nerve palsies and orbital apical syndromes (FREITAS, 2020).

TRIGEMINAL NERVE - V

REGIONAL AND FUNCTIONAL ANATOMY - Real and apparent origin and its course

The peripheral extensions of the ganglion neurons form three branches: the ophthalmic nerve (CN V1), the maxillary nerve (CN V2) and the sensory component of the mandibular nerve (CN V3). The ophthalmic nerve is the first branch, originating in the trigeminal ganglion. It runs from the trigeminal ganglion, through the cavernous sinus, into the superior orbital fissure, then the terminal branches and finally into the respective anatomical structures. Responsible for innervating the forehead of the nose and the ophthalmic region of the face. Most of the fibers of this nerve enter the orbit through the superior orbital fissure, from the middle fossa of the skull. This nerve is subdivided into 3 larger branches, the names of which indicate the functions of the innervation area: n. Frontal, n. Lacrimal, n. Nasociliary. Next comes the maxillary nerve, the second branch of the trigeminal nerve, which is only sensory. It runs from the trigeminal ganglion through the cavernous sinus towards the foramen rotundum, arriving at the pterygopalatine fossa and then the infratemporal fossa, inferior orbital fissure, nerve (terminal branch) and finally the respective anatomical structures. Its fibers are general sensory, distributing to the skin and its mucous tunics associated with the maxilla, innervating the dura mater of the middle cranial fossa, mucosa of the nasopharynx, palate, nasal cavity and oropharynx. Skin over the nose, lower eyelid and upper lip. The third and final branch of the trigeminal nerve is the mandibular nerve. It is related to the sensory innervation of the lower third of the face and the motor innervation of the muscles of mastication, the hyoid millus and the anterior belly of the digastric muscle. It travels from the foramen ovale to the infratemporal fossa.

FUNCTION AND CLINICAL RELATIONSHIP

A clinical dysfunction of the trigeminal nerve would be paroxysmal facial neuralgia, which is usually caused by compression of the trigeminal nerve at its root by a loop in the maxillary division. The pain lasts up to 2 seconds, but attacks can occur several times a day. The pain is stabbing, excruciating and can sometimes be disabling.

ABDUCENS NERVE - VI

REGIONAL AND FUNCTIONAL ANATOMY - Real and apparent origin and its course

The abducens nerve, also called the sixth cranial nerve (CN VI), is a somatic motor nerve formed by general somatic efferent fibers (GSE). It originates in the brainstem, more precisely in the bulb-pontine sulcus (between the bulb and the pons), penetrating the dura mater that covers the clivus, emerging anteriorly in the median region of the pons (DRAKE; VOGL; MITCHELL, 2013).

Immediately after penetrating the dura mater, this nerve travels superiorly through a canal within this meningeal and crosses the upper margin of the petrous region of the temporal bone, through which it enters the cavernous sinus along with the trochlear, oculomotor and first branches of the trigeminal nerve (ophthalmic nerve), crossing it inferiorly and laterally to the internal carotid artery, thus reaching the orbit through the superior orbital fissure (DRAKE; VOGL; MITCHELL, 2013), to reach the lateral rectus muscle of the eye, which is its destination (FREITAS, 2020).

FUNCTION AND CLINICAL RELATIONSHIP

As such, it is one of the nerves responsible for the extrinsic ocular motricity functions of the eye, together with the third and fourth cranial nerves, i.e. the oculomotor and trochlear nerves (FREITAS, 2020). The abducens nerve is responsible for the lateral rectus muscle, which is responsible for the abduction of the eyeball, i.e. moving the eye away from the midline, allowing the person to look to the side (COSENZA, 2012). In a secondary way, it also innervates the contralateral medial rectus muscle via the medial longitudinal fascicle, promoting the coordinated lateral movement of both eyes (FREITAS, 2020).

Fractures, tumors, aneurysms or increased intracranial pressure can lead to impairment of the abducens nerve in the superior orbital fissure and, with this, generate clinical characteristics in the patient, such as the inability to abduct the eye ipsilaterally, that is, causing the person to be unable to look laterally, tending to make them look more medially, due to the supply of the action of the deficient oculomotor nerve (abducens). However, there are also other causes that lead to damage to this nerve, such as neuropathies, infections, demyelinating syndromes, meningitis and lack of blood supply (FREITAS, 2020).

FACIAL NERVE - VII

REGIONAL AND FUNCTIONAL ANATOMY - Real and apparent origin and its course

The facial nerve is located in the anterolateral part of the pons of the brainstem and arises from the relationship between the pons and the bulb, divided into two parts: the first, also called the motor root or facial nerve proper, considered the largest, which will innervate the muscles of facial expression, and the second, intermediate, the smallest, which will conduct the taste, somatic sensory and parasympathetic fibers. The facial nerve (CN VII) passes through the fossa at the back of the skull, the internal acoustic meatus, followed by the facial canal, the stylomastoid foramen of the temporal gland, ending in the parotid gland. Immediately after passing through the internal acoustic meatus, the facial nerve will continue quickly through the temporal and then make a sharp turn at the back, to continue through the medial wall of the tympanic cavity (MOORE et al., 2018).

FUNCTION AND CLINICAL RELATIONSHIP

The facial nerve has both motor and sensory roots, made up of efferent fibers, which are motor and parasympathetic, and afferent, sensory fibers. Its function is therefore the movement of facial expression, lacrimal and salivary secretion, as well as gustation in the portion 2/3 anterior to the tongue. There are four significant points on the facial nerve where injuries cause clinical alterations: the chorda tympani nerve, the facial muscles, the stapedial muscle, which causes ipsilateral hypoacusis, and the greater petrosal nerve. From this, it is possible to identify peripheral facial paralysis, which is caused by lesions that can affect any part of the VII nc nucleus, while central facial paralysis is caused by lesions that affect the supranuclear pathways. Peripheral facial paralysis is characterized by complete paralysis of the hemiface, since its innervation is ipsilateral. However, the central innervation is altered in the contralateral part located in the lower part of the face and receives both ipsilateral and contralateral fibers, the latter being found in the lower part of the face (MOORE, et al., 2018).

VESTIBULOCOCHLEAR NERVE - VIII

REGIONAL AND FUNCTIONAL ANATOMY - Real and apparent origin and its course

The vestibulocochlear nerve, also known as the eighth cranial nerve (CN VIII), has two different parts, the vestibular and the cochlear. The apparent origin of this nerve is in the bulbo-pontine sulcus, lateral to the facial nerve (CN VII). However, the origin of the vestibular portion is in the receptors of the labyrinth of the inner ear, more precisely in the semicircular canals (saccule and utricle), which are highly sensitive to the position of the head and its movements, and are important in maintaining body balance. As for the origin of the cochlear portion, it arises in the receptors of the cochlea, in the organ of Corti, which is responsible for the sensitivity of hearing (COSENZA, 2012).

FUNCTION AND CLINICAL RELATIONSHIP

The fibers of this nerve are somatic sensory (SSA), i.e. fibers responsible for the special senses in the ear (hearing and balance). They extend from the various receptors found in the vestibulocochlear nerve to their respective nuclei in the brainstem (NORTON, 2018). The two portions (vestibular and cochlear) run together and enter the brain in the lateral region of the bulbopontine sulcus (COSENZA, 2012).

Injuries to the vestibulocochlear nerve are most commonly caused by fractures and intracranial injuries involving the petrous portion of the temporal bone, causing deafness due to trauma involving the middle ear. This clinical presentation results from the presence of blood or cerebrospinal fluid in the middle ear, as well as displacement of the ossicles or tensor tympani muscle, rupture of the tympanic membrane and damage to the auditory tube itself (CANNONI et al., 2012).

GLOSSOPHARYNGEAL NERVE - IX

REGIONAL AND FUNCTIONAL ANATOMY - Real and apparent origin and its course

It is characterized by being a mixed nerve that emerges directly from the posterior lateral sulcus of the bulb in the form of radicular filaments. These filaments are responsible for joining together to form the glossopharyngeal nerve trunk. Anatomically, this trunk exits the skull through a foramen known as the jugular foramen. The nerve is also characterized by passing through the jugular foramen, presenting two ganglia named superior or jugular and inferior or petrous, which are specifically made up of sensory neurons. The (Gf), after leaving the region of the skull, presents a descending path, branching off at the root of the tongue and in the pharynx. The functional components of the vagus and facial nerve fibers are similar to those of the glossopharyngeal nerve (ROMANO et al., 2019).

FUNCTION AND CLINICAL RELATIONSHIP

In this context, it can be seen that the general visceral afferent fibers are related to the general sensitivity of the carotid sinus and body, auditory tube, tonsil, uvula, pharynx and, more superiorly, the posterior third of the tongue. On the other hand, the general visceral efferent fibers end in the optic ganglion, where the nerve fibers of the auriculotemporal nerve, which are responsible for innervating the parotid gland, exit. Neuralgia is one of the conditions affecting the glossopharyngeal nerve and is characterized by painful crises in the pharynx, the posterior third of the tongue and which can radiate to the ear. This condition is also similar and has already been described in relation to the trigeminal nerve (ROMANO et al., 2019).

VAGUE NERVO - X

REGIONAL AND FUNCTIONAL ANATOMY - Real and apparent origin and its course

The vagus nerve originates from the lateral faces of the brainstem bulb, from 8 to 10 rootlets. They leave the skull through the jugular foramen, located between CN IX and CN XI, and then start in the superior mediastinum located posterior to the brachiocephalic veins and sternoclavicular joints. In addition, they form the recurrent nerves, both right and left, which from the esophageal plexus, transform into vagal trunks, either anterior or posterior, continuing into the abdomen. They also have three nuclei: the sensory nucleus, the main nucleus of the trigeminal nerve and the solitary tract, the motor nucleus, which would be ambiguous, and the parasympathetic visceral motor nucleus, also known as the posterior nucleus of CN X. The CN X has a superior ganglion located in the jugular foramen which is not only related to the general sensory component of the nerve, but also has connections with the CN IX. On the other hand, in the lower portion of the foramen, there is the nodose ganglion which is associated with the special sensory and visceral elements of the nerve, thus sending branches to the palate, pharynx and larynx (MOORE et al., 2018).

The NC X then runs down the neck through the carotid sheath, located between the carotid artery and the jugular vein, passing through the thyroid cartilage and the common carotid vein, ending at the base of the neck. The branches that start from the jugular foramen supply the meninges and the ear, while those that leave distally supply the pharynx and larynx, and finally, the main part of the nerve enters the thorax. It is possible to find 10 terminal branches that originate at various levels of the CN X, namely the meningeal, pharyngeal, auricular, superior and recurrent laryngeal, carotid, cardiac, pulmonary, esophageal and finally, the gastrointestinal. The vagus nerve's functionality is based on parasympathetic innervation of the cervical, thoracic and a portion of the abdomen. The somatic sensory nerve is responsible for the lower part of the pharynx and larynx, i.e. for taste, starting at the base of the tongue and the gustatory canaliculi located in the epiglottis. The visceral nerve is also responsible for the thoracic and abdominal organs. The branches of the internal laryngeal nerve, also one of the branches found in the CN X, supply not only a small area with emphasis on the somatic sensory, but also the palate. The somatic nerve moves to the soft palate, pharynx, inner laryngeal muscles responsible for phonation and an external tongue muscle. And finally, the visceral motor, or also parasympathetic, to both the thoracic and abdominal viscera (MOORE et al., 2018).

FUNCTION AND CLINICAL RELATIONSHIP

As the vagus nerve innervates the laryngeal muscles from the superior and recurrent laryngeal branches, it can have thoracic pathologies. An example of this is a unilateral lesion of the vagus nerve, which causes the soft palate to deviate to the normal region when the patient speaks the vowels "a" and "e". Or a bilateral lesion, which ends up hitting the palate and as a result, the palate is unable to rise. In lesions that occur in isolation and only involve the laryngeal branch, the individual has dysphonia (MOORE et al., 2018).

ACCESSORY NERVE - XI

REGIONAL AND FUNCTIONAL ANATOMY - Real and apparent origin and its course

This cranial nerve is purely motor and is supplied by a single nucleus, the accessory nucleus which resides in the dorsolateral portion of the spinal cord. It is also worth noting that the axons of the motor neurons of the accessory nerve do not leave the spinal cord via the ventral root, but exit the spinal cord immediately dorsal to the dentate ligament, between the dorsal and ventral roots. The accessory rootlets, on the other hand, join one another as they ascend through the subdural space, along the lateral portions of the spinal cord. Entering the skull through the foramen magnum, they join up slightly with the roots of the vagus nerve before leaving the skull through the jugular foramen. As soon as it leaves the skull, the accessory nerve separates from the vagus nerve and innervates the ipsilateral sternocleidomastoid and trapezius muscles (MOORE et al., 2018).

FUNCTION AND CLINICAL RELATIONSHIP

It participates in the individual's postural composition, through rotational cranial movements and shoulder elevation; the other portion, together with the vagus nerve, forms the inferior laryngeal nerve which innervates the laryngeal muscles. The main function of this nerve activation is to position the individual in relation to the stimulus, expressing an attitude which expresses security and self-esteem or submission and low esteem. Its secondary function is to activate the speech process, modulating the voice according to the attitude to be expressed. An example of this activation is when a person infantilizes their voice when they feel embarrassed, making it higher or thicker when they puff out their chest (MOORE et al., 2018).

HYPOGLOSSAL NERVE - XII

REGIONAL AND FUNCTIONAL ANATOMY - Real and apparent origin and its course

The hypoglossal nerve is purely motor and served by only one nucleus in the bulb. The nucleus of the hypoglossal nerve is found below the fourth ventricle and is wide enough to form a bulge in the ventricular floor. When they leave the nucleus, the axons of the hypoglossal nerve take a ventral and slightly lateral course and emerge from the brainstem, between the medullary pyramid and the inferior olive. The hypoglossal nerve leaves the skull through the hypoglossal canal. Its axons innervate the ipsilateral tongue, supplying the intrinsic muscles of the tongue and the styloglossus, hyoglossus, genioglossus and geniohyoid muscles (MOORE et al., 2018).

FUNCTION AND CLINICAL RELATIONSHIP

This nerve controls the movement of the tongue by innervating the somatic skeletal muscles. When this nucleus or axon is destroyed, the tongue muscles become paralyzed. A lesion or tumor in this area can lead to atony or atrophy of the tongue. This nerve, which activates the movement of the tongue, as well as helping with swallowing or yawning, is intrinsically linked in humans to the function of speaking. By controlling the movements of the tongue, it is essential for the articulation of words. The "speaking" function is unrelated to the comprehension of words. As we saw earlier, when examining the relationship of the parietal lobe to speech, a destructive lesion, particularly in the supramarginal gyrus of the left cerebral hemisphere, can result in conduction aphasia and although comprehension remains intact and the patient knows what they want to say, they become unable to do so. They won't be able to repeat simple sentences, read aloud or write dictation. This is because Broca's area is disconnected from the posterior speech realization zones. In order to be able to speak, i.e. articulate sounds so that they are understood by another person, it is essential that the hypoglossal nerve is mobilized and activated (MOORE et al., 2018).

CONCLUSION

Based on most of the studies and books that were used to build this research, it was possible to analyze that the cranial nerves have very important functions for the necessary adaptation of some of the human body's activities. In addition, when there is some abnormality, such as injury and/or inflammation of the cranial nerve, it ends up corroborating a dysfunction of the area in which the respective nerve is responsible for innervating, that is, the individual compromises some activity necessary for anatomical functionality.

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