Facial Nerve Over View

Essay

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Introduction

Facial nerveis the seventh (VII) of twelve paired cranial nerves. It emerges from the brainstem between the pons and the medulla, and controls the muscles of facial expression, and functions in the conveyance of taste sensations from the anterior two-thirds of the tongue and oral cavity. It also supplies preganglionic parasympathetic fibers to several head and neck ganglia**(May and Schaitkin,2009).**

The facial nerve is developmentally derived from the hyoid arch (second pharyngeal branchial arch). The motor division of the facial nerve is derived from the basal plate of the embryonicpons, while the sensory division originates from the cranial neural crest**(curtin et al,.2003).**

The main function of the facial nerve is motor control of most of the muscles of facial expression. It also innervates the posterior belly of the digastric muscle, the stylohyoid muscle, and the stapedius muscle of the middle ear. The facial nerve also supplies parasympathetic fibers to the submandibular gland and sublingual glands via chorda tympani. Parasympathetic innervation serves to increase the flow of saliva from these glands. It also supplies parasympathetic innervation to the nasal mucosa and the lacrimal gland via the pterygopalatineganglion.The facial nerve also functions as the efferent limb of the corneal reflex. In addition, the facial nerve receives taste sensations from the anterior two-thirds of the tongue via the chorda tympani**(Heaton J et al ,.2007).**

There are many causes of facial nerve paralysis but, the most common cause of facial nerve paralysis is Bell's palsy i.e. idiopathic then trauma to facial nerve both accidental and surgical. Facial nerve paralysis can also be congenital. In some cases of congenital paralysis, a trauma at birth can be the cause **(Abbey,2006).**

A variety of techniques is available for facial nerve rehabilitation following paralysis. The surgeon needs to know the advantages and disadvantages of the various techniques in order to apply them properly in each clinical situation. Thorough knowledge of neuromuscular pathophysiology is also important in understanding how time affects the choice of rehabilitative procedures. When properly informed regarding the limitations of these operative procedures, most patients can be rehabilitated and many of their symptoms can be alleviated **(Sade ,2005).**

Aim of the essay

The aim of the present essay was to represent an overview of facial nerve **;**embryology, anatomy, physiology, histology, pathology, causes of facial paralysis and facial nerve surgery.

Embryology of the facial nerve:

Weeks 0-4 (0-6 mm):

The rhombencephalon (or hindbrain) is divided into the myelencephalon (caudal), which becomes the medulla oblongata, and the metencephalon (cranial), which becomes the pons and cerebellum. The facioacoustic (acousticofacial) primordium appears during the third week of life (4.2 mm crown-rump length [CRL]). It is attached to the metencephalon just cranial to the otic vesicle. The facial part of the acousticofacialprimordium migrates cranial and ventral to end adjacent to the epibranchialplacode, which is located on the dorsal and caudal aspect of the first branchial cleft**(May and Schaitkin,2009).**

By the end of the fourth week of gestation (4.8-6.5 mm CRL), the facial nerve splits into 2 parts: the caudal and rostral trunks. The chorda tympani nerve exits rostrally and courses ventrally to the first pharyngeal pouch to enter the mandibular arch. Shortly thereafter, the nerve approaches the epibranchialplacode, inducing the appearance of the large, dark nuclei of neuroblasts that represent the future geniculate ganglion **(Sataloff, 2005).**

Weeks 5-6 (7-17mm):

Mesenchymal concentrations that form the cephalic muscles are seen in association with their nerves, while the epibranchialplacode disappears and the geniculate ganglion is identifiable. The greater superficial petrosal nerve (GSPN) is present. The chorda tympani nerve enters the mandibular arch and terminates just proximal to the submandibular ganglion, near a branch of the trigeminal nerve that will

become the lingual nerve. The posterior auricular nerve appears near the chorda tympani **(Schaitkin and Eisenman, 2009).**

Complete separation of the facial and acoustic nerves is apparent, and a discrete nervusintermedius develops, making this an important temporal reference point for gestational disorders that affect both systems. The GSPN courses to the lateral aspect of the developing internal carotid artery (ICA), where it joins the deep petrosal nerve and continues as the nerve of the pterygoid canal. It terminates in a group of cells that will become the pterygopalatine ganglion. At this point, the most distal branches of the facial nerve are a loose network or interconnecting twigs**(Bailey et al,.2006).**

Week 7 (18-31 mm):

The nervusintermedius is now smaller than the motor root and enters the brainstem between the vestibulocochlear nerve and the motor root of the facial nerve. The chorda tympani and lingual nerve unite proximal to the submandibular gland. The posterior auricular nerve now divides into cranial and caudal branches**(Pasha and Raza,2006).**

Several branches are visible in the peripheral portion of the seventh nerve. All of the peripheral branches lie deep to the myoblasticlaminae that will form the facial muscles. At the end of the seventh week, the separations between the terminal branches continue to increase to the extent that all peripheral divisions can be identified **(Curtin et al ,.2003).**

The parotid gland is beginning to develop from the parotid bud at this stage. The temporal, zygomatic, and upper buccal branches are superficial to the parotid primordium, while the lower buccal, mandibular, and cervical branches are deeper. Multiple facial muscles appear at this time as well, including the zygomaticus major and minor, depressor angulioris, buccinators, and frontalis**(Schaitkin and Eisenman, 2009).**

Week 8 (32-49 mm):

A sulcus develops around the facial nerve that is the beginning of the fallopian canal. The orbicularis oris, levatorangulioris, and orbicularis oculi muscles appear**(Sataloff, 2005).**

Week 9 (50-60 mm):

Auricularis anterior, corrugator supercilii, occipital and mandibular platysma, and levatorlabiisuperiorisalaequenasi muscles appear. All the cranial nerves **(Hager andJoseph ,.2003).**

Weeks 10-15 (61-80 mm):

Extensive branching of the peripheral portions of the facial nerve occurs at this stage. Communication with the trigeminal nerve (via infraorbital, buccal, auriculotemporal, and mental branches) occurs in the perioral and infraorbital regions. The vertical portion of the facial nerve begins in the middle ear, and its overall relationship to external and middle ear structures is far more anterior than in the adult. Branches that will supply sensation to the external auditory canal arise between the stapedius and chorda tympani nerves **(Curtin et al ,.2003).**

Intricate connections between the superficial and deep lobes of the parotid and their relation to the facial nerve develop. By the fifteenth week, the geniculate ganglion is fully developed, and the facial nerve's relationship to middle ear structures is more fully developed **(Schaitkin and Eisenman, 2009).**

Week 16 to birth (146 mm):

All definitive communications of the facial nerve are established by the 16th week. At 26 weeks, ossification has progressed to partial closure of the previously formed sulcus into the fallopian canal**(Pasha and Raza,2006).**

In late fetal life, the fallopian canal is closed by bone in most areas, except in the anterior cranial portion, where it remains open to form the facial hiatus along the floor of the middle cranial fossa. At least 25%, and as many as 55%, of fallopian canals are dehiscent, with the most common location adjacent to the oval window (**Cisneros et al, 2011).**

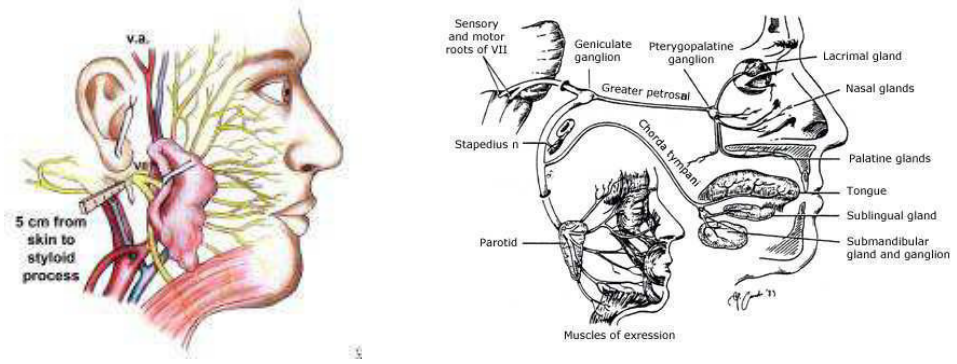
At birth, the anatomy of the facial nerve approximates that of the adult, except for its exit through the more superficially located stylomastoid foramen. Adult anatomy will form in this region as the mastoid tip develops after birth**(Hager and Joseph ,.2003).**

Pharyngeal Arch	Nerve	Artery	Muscles	Skeleton
II = Hyoid (Reichert cartilage)	Cranial nerve VII (Facial nerve)	Stapedial	• Muscles of facial expression • Buccinator • Posterior bellyof digastric • Stylohyoid muscle • Stapedius muscle	• Manubrium of malleus • Long process incus • Stapes (except for footplate) • Facial canal • Styloid process • Stylohyoid ligament • Lesser cornu of hyoid • Upper body of hyoid

Table 1. Summary of the Derivatives of the Second Branchial Arch **(Cisneros et al., 2011)**

Facial nerve anatomy

The facial nerve or cranial nerve (CN) VII, is the nerve of facial expression. The pathways of the facial nerve are variable, and knowledge of the key intratemporal and extratemporal landmarks is essential for accurate physical diagnosis and safe and effective surgical intervention in the head and neck **(HarkerandMcCabe,2007).**



Facial nerve landmark**(Larrabee and Makielski ,2006).**

The facial nerve composed of approximately 10,000 neurons, 7,000 of which are myelinated and innervate the nerves of facial expression. Three thousand of the nerve fibers are somatosensory and secretomotor and make up thenervusintermedius**(Rouviere andDelmas,2005).**

Segment	Location	Length,mm
Supranuclear	Cerebral cortex	NA
Brainstem	Motor nucleus of facial nerve, superior salivatory nucleus of tractussolitarius	NA
Meatal segment	Brainstem to internal auditory canal (IAC)	13-15
Labyrinthine segment	Fundus of IAC to facial hiatus	3-4
Tympanic segment	Geniculate ganglion to pyramidal eminence	8-11
Mastoid segment	Pyramidal process to stylomastoid foramen	10-14
Extratemporal segment	Stylomastoid foramen to pesanserinus	15-20

Table 2. Segmental Description of the Facial Nerve and Central Connections **(De Moura and Gilbert,2003).**

The objective of this article is to briefly review the anatomy of the facial nerve in each of these segments and to follow the nerve from its most proximal origin to its end organ; ie, the muscles of facial expression.

Central Connections

The most complete descriptions of the facial nerve;s central connections. The reader is referred to these references for a more detailed