Original article

Extratemporal fascicular study of facial nerve in human

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Abstract

Peripheral nerves are structures exposed to physical, chemical and mechanical traumas. These lesions can cause a varying magnitude of damages, between which compression, distention and section, which culminate in motor, psychological and aesthetic alterations, mainly with facial expression nerves, like the facial nerve. The objective of this study was to verify the fascicular disposition of the facial nerve through its histology. Ten human cadaver heads, with ages between 53 and 66, were dissected. Extratemporal segments of the facial nerve were collected and routine techniques for histological microscopic evaluation were applied. Results showed that the extratemporal segments of the facial nerve analyzed are oligofascicular and polyfascicular, with a number of 3 to 8 fascicules. We conclude that knowledge on the fascicular organization of nerves, particularly the facial nerve, is paramount in surgical procedures using grafts, interfascicular sutures, among other microsurgeries which involve nerve restoration.

Keywords: face nerve, nervous cases, neurorrhaphy, fascicles.

1 Introduction

The seventh cranial and facial nerve is a mixed nerve, sensory and motor. It consists of general visceral efferent fibers, efferent and afferent special, due to their connections represent an important function for the body (MAY JUNIOR and SHAMBAUGH, 1991).

The facial nerve can be divided into three regions: the intracranial sequence begins in the brainstem and ends at the medial margin of the internal auditory canal, the segment of the facial canal begins in the temporal bone and ends at the stylomastoid foramen, where the extracranial segment begins, it traverses the parotid gland and divides into peripheral motor nerves that control muscles of facial expression (MONKHOUSE, 1990).

Nerve's structure is composed by nerve fibers and conjunctive tissue. The nerve fiber, considered morphofunctional unit that forms groups that come together to form fascicles, each fascicle is surrounded by a membrane of connective tissue called perineurium. The endoneurium is among the nerve fibers, and epineurium involves all fascicles and protects them against trauma (JUNQUEIRA and CARNEIRO, 2004).

Transverse sections of a peripheral nerve can be observed three basic patterns fascicular: monofascicular, oligofascicular ranging from two to five fascicles and polifascicular over five issues (HORCH, 1995; MAGGI, LOWE, SUSAN et al., 2003).

Adequate knowledge of the anatomy of the facial nerve is very important for the location of their injuries and to understand the consequences they may cause. This knowledge enables the development of a precise topographic diagnosis and facilitates the surgical approach in cases of compression by infections, tumors or fractures (MAY JUNIOR and SHAMBAUGH, 1991).

The objective of this study was to establish the fasciculation of the extratemporal facial nerve segments of humans, also check the presence of blood vessels and connective sheaths: perineurium, epineurium and endoneurium.

2 Material and methods

We used ten heads from the collection of the anatomy laboratory of the Federal University of Pernambuco, and

they were previously fixed with 10% formaldehyde. The heads were from humans (*Homo sapiens*), male and age between 53 and 66 years. The research protocol was approved by Ethics Committee of University Federal of Pernambuco (164/2007).

According to the techniques of dissection of Mizeres and Gardner (1988), the ten faces were dissected bilaterally, the skin of the face was removed, watching the blade coating of cervical fascia that covers the parotid gland, after being sectioned and the surface's fascia of the parotid gland be lifted, the parotid duct was dissected to monitor the buccal branches of the facial nerve, these branches are used as a starting point to dissect the facial nerve trunk, as well as their other branches, broke away and got up the fragments of the parotid gland and then the têmporofacial and cervicofacial trunks were identified, which usually lie deeply the superficial part of the gland, so the parotid plexus can be dissected.

The temporal branch of the facial nerve was dissected in parotid angle, greater than parotid glands, the zygomatic branch in anterior region of the parotid gland above parotid duct and bucal branch, below the parotid duct. A section about three centimeters on each trunk and branch was made, and fixed in 10% formalin.

The fragments were subjected to dehydration in a series of increasing alcohols, and later became the routine procedure for paraffin embedding. Cuts of four micrometers were made and stained with hematoxylin-eosin, Gomori and special impregnation by the silver. The histological observations were performed by light microscopy and photographed at the Department of Animal Morphology and Physiology of the Federal University of Pernambuco, in the histology field which we used the optical microscope LEICA® ICC-50.

3 Results

Facial nerve showed both in their trunks and branches in a number of three to eight well-defined issues and is considered oligofascicular nerve and polifascicular. It became evident the well-defined presence of conjunctive sheaths, in addition to blood vessels (Figure 1).

4 Discussion

The fascicular pattern is the most important component of a nerve to consider a surgical reconstruction. The goal of nerve repair is to obtain full anatomical continuity of the majority of axons through a fascicular correct alignment (GUERRISSI and GIL MIRANDA, 2007). In our study we obtained the fascicular topography, noting also the presence of sheaths of connective tissue and blood vessels. These elements are key components to be considered in microsurgery (GUERRISSI and GIL MIRANDA, 2007).

The more detailed and accurate knowledge of the topographical relationships and fascicular organization of the facial nerve is necessary, to facilitate the healing process after surgical maneuvers, because in order to regenerate neurotmesis, one must align the fascicles so that when the axons proliferate end proximal toward the distal end there are no obstacles to be overcome. (HORCH, 1995; CAPTIER, CANOVAS, BONNEL et al., 2004).

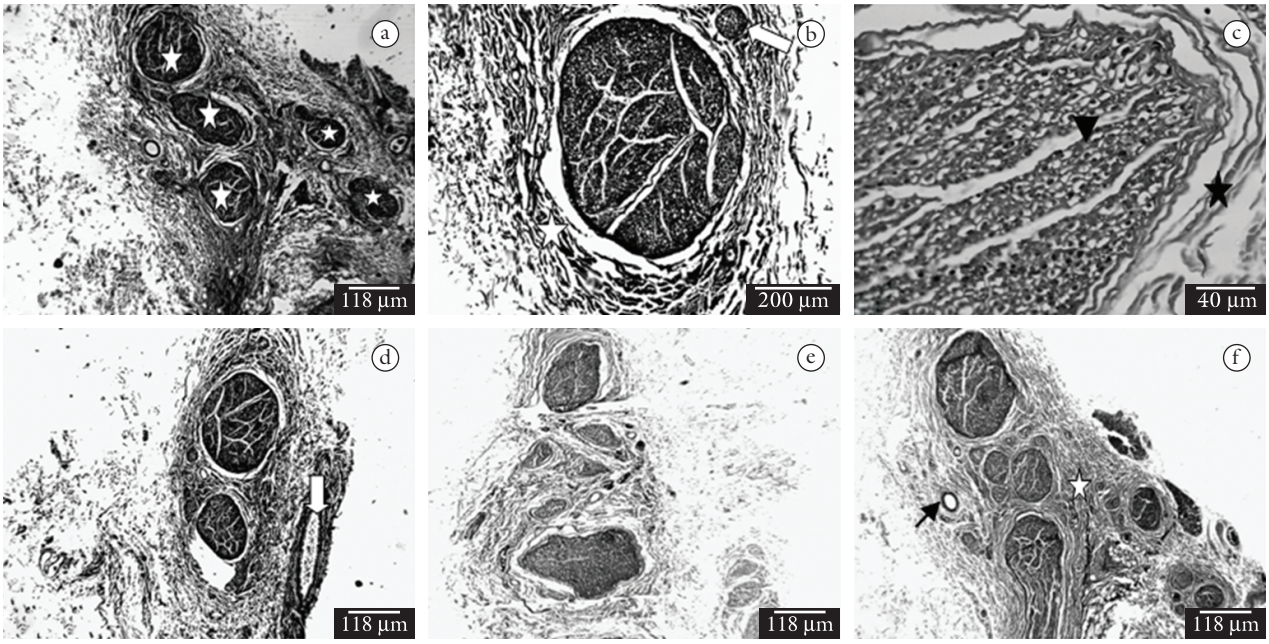

Figure 1. Photomicrograph of human facial nerve in cross section. Figure 1a: Buccal branch, stained by silver impregnation, observe five nervous fascicles (star). ×40 magnifications. Figure 1b: Zygomatic branch, stained with hematoxylin-eosin to observe the perineurium (star), involving the greater fascicle, also noted a small fascicle (arrow). Increased 100×. Figure 1c: Temporal branch stained with Masson's trichrome, detail of the fascicle nervous, and observe the perineurium (star) and the endoneurium between the nerve fibers (arrowhead). Magnifications of 400×. Figure 1d: Cervicofacial trunk stained with hematoxylin-eosin, observed two nervous fascicles and a large blood vessel (arrow). ×40 magnifications. Figure 1e: Temporofacial trunk stained with Gomori's trichrome, observe the nervous fascicles, involved by epineurium (star). ×40 magnifications. Figure 1f: Buccal branch, stained with hematoxylin-eosin, notice several bundles of nervous fascicles between the epineural sheath (star), observe the presence of blood vessel (arrow). ×40 magnifications.

The number of fascicles provides protection to the nerve, because when a peripheral nerve is multifascicular, a greater pressure is needed to affect the nerve fibers than when there is a smaller number of fascicles (MACHADO, 2003). Many patients suffer from disfiguring entire face due to deep burn injuries, an extensive ablation of tumors or serious injury (YU, LI, ZHENG et al., 2010). In addition to these disorders that may affect the facial nerve, facial paralysis is a problem in the medical routine that can be devastating, because it occurs associated with severe functional limitations and aesthetic. (HADLOCK, KOWALESKI, LO et al., 2010). Advanced studies on intraneural anatomy allow efficient surgical planning, contributing to a good result and well being of these patients.

5 Conclusion

The fascicular distribution, conjunctive tissue sheaths and blood vessels found for the facial nerve of human, They contribute to microsurgical practices for repairing nerves, that when applied respecting to the microscopic anatomy of the nerve and its topography, much of the nervous connection will be restored.

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