Topographic anatomy of the peripheral branches of the facial nerve

Yalcin Kirici¹, Cenk Kilic¹, Mustafa Kazkayasi²

¹Department of Anatomy, Gulhane Military Medical Academy, Ankara, Turkey.
²Department of Otorhinolaryngology, Faculty of Medicine, University of Kirikkale, Kirikkale, Turkey.

Summary

Objective: The facial nerve and close relationship between its branches and parotid duct were investigated.

Methods: This study was performed on 31 half heads of 16 fixed cadavers. The extracranial course of the nerve was exposed. The posterior auricular nerve originated from facial nerve and branches forming the parotid and buccal plexuses were investigated. The parotid duct and anastomoses between branches of the nerve were also investigated.

Results: We observed differences in the course of the branches of the facial nerve. The posterior auricular nerve was arised directly from the facial nerve before entering the parotid gland in 20 sides, arised from onset of cervicofacial ramus in 10 sides and arised from temporofacial ramus in one side. Pattern differences of parotid and buccal plexuses and especially anastomoses between the branches were identified.

Conclusion: We are in the opinion that the knowledge of courses and relationships of the branches of the facial nerve will actually provide a great benefit in preventing surgical complications.

Key words: Facial nerve; Peripheral branches; Topographic anatomy;

Correspondence: C. Kilic
Gulhane Askeri Tip Akademisi,
Anatomi Anabilim Dali,
06010 Ankara, Turkey.
ckilicmd@yahoo.com

Received: April 07, 2011
Accepted: June 19, 2011
Published online: July 4, 2011
J Exp Integr Med 2011; 1:201-204
DOI:10.5455/jeim.040711.br.005

Introduction

Injury to the facial nerve (FN) is much possible during surgical procedures including facial cosmetic surgery and surgery for tumors of the parotis as well. The loss of even one branch of this nerve is of utmost clinical importance because of the facial expression and for this reason the topographic anatomy of FN must exactly be known as a route map of surgery. Paralysis of the facial expression muscles also results in esthtetic problems which eventually will cause psychological problems. The surgical anatomy of the peripheral branches of the FN has been well documented in the literature [1-7]. However, it is almost inevitable to find significant variations. In this study, we aimed to improve the knowledge of topographic anatomy of the FN, and to define the ramification and also the connections between the branches.

Materials and methods

This study was conducted on 31 facial halves of 16 adult cadavers fixed in 10% formaldehyde solution at the laboratory of the anatomy department. There were 11 men and 5 women, ages ranged from 37 to 77 with a median age of 52. The faces were carefully dissected by removing of the skin, subcutaneous tissue, platysma and superficial layer of deep cervical fascia, leaving all branches of the FN and the parotid gland. The subsequent phases of dissection was made with the aid of a stereomicroscope (Stemi 2000, Carl Zeiss, Jena, Germany). Under dissecting microscope, dissection was initiated by trying to search small subdivisions of the FN on the anterior border of the parotid gland and all ramifications were followed posteriorly to the main trunk. In addition, the anastomoses between the branches of the facial nerve, parotid and buccal plexuses were investigated. The origin of posterior auricular nerve was diligently examined. The parotid duct was dissected from its point of exposure at the anterior border of the parotid gland until it turned around the anterior border of the masseter muscle where it enters to the oral cavity through the buccinator muscle.

Results

The discrepancies in the course of the branches of the facial nerve were observed in 2 of 31 sides. In other 29 sides common patterns of FN were present (Fig.1). In one facial halve, the cervical branch of the facial nerve exited from the cervicofacial ramus. But the other branches exited from temporofacial ramus (Fig.2). In another facial halve, external carotid artery traveled within both temporofacial and cervicofacial rami, and this localization results in the separation of the both rami as superficial and deep parts (Fig.3).
In twenty sides (64.5%) posterior auricular nerve originated from facial nerve directly whereas in ten sides (32.3%) it originated from the cervicofacial ramus and in one side (3.2%) from the temporofacial ramus (Fig. 2). The temporal branches of the FN usually divided into three parts in 80.6% of all facial halves; the zygomatic branches were divided into two and three branches in 77.4% and 22.6% of the facial halves, respectively. The zygomatic branches joined into the buccal branches in only 12.9% of the facial halves. In one facial half, after exiting from only the temporofacial ramus, the two buccal branches united and formed the buccal plexus (Fig. 2).

In other halves, the buccal branches of temporofacial and cervicofacial rami which normally form the buccal plexus were observed (Fig. 1). In this study, the buccal branch of the facial nerve had two branches in 26 of the halves (both superior and inferior branches). In the remaining 5 cases, a single buccal branch leaves the parotid gland run inferior to the parotid duct after forming the buccal plexus. The buccal branches of the facial nerve were always observed lateral to the parotid duct. We found two marginal mandibular branches (MMB) in 61.3% of the specimens, and the others were single. The MMB had interconnections to the buccal branch and to the cervical branch in 25.8% and 12.9 cases, respectively. In all facial halves, the MMB descended behind the ramus of the mandible, and then divided within the substance of the parotid gland. In all the specimens, we detected the MMB below the inferior border of the mandible deep to the platysma muscles.

**Discussion**

In this study we aimed to identify the patterns and variability of the branches of the FN. A solid understanding of the anatomy of the parotid gland
Figure 3. A: The facial nerve in left side (lateral view). B: The schematic drawing. The external carotid artery (Eca), and parotid duct (Pd), stylomastoid foramen (Sf); superficial (STr), and profound (PTr) parts of temporofacial (Tr) rami; superficial (SCr), and profound (PCr) parts of cervicofacial (Cr) rami; temporal (T), zygomatic (Z), buccal (B), marginal mandibular (M), and cervical (C) branches of the facial nerve.

was accepted as a basic clinical knowledge for doing surgery safely. The branches anterior to the parotid gland are very thin and susceptible to surgical or other kind of injuries. The knowledge of the anterior edge of the parotid gland can minimize the risk of injury of the branches, because especially the midfacial nerve branches exit just on that point. Hence, since the parotid duct has a simple view on the parotid gland, detailed knowledge on the topographic anatomy of it and the branches of the FN is essential for parotid surgery. The majority of parotid tumours within the gland were located in the body and not in the tail of the parotid gland [1]. Therefore the close association between the tumour with the two major divisions of the facial nerve (the zygomatic branches and the buccal branches) is important [2].

The temporal branch was found usually dividing into three and four rami in the %87 and %13 of the cadaveric heads, respectively. Similar description was done by Gosain et al [8]. In the study of Saylam et al [9], the zygomatic branches were divided into two and three rami in 70% and 26% of the facial halves, respectively. Erbil et al [2] found similar results to Saylam et al, but instead of three rami they noted only one ramus in 30% of their facial halves. Saylam et al found that these branches were always under the oblique line between the tragus and the lateral palpebral commissure. They also noted that these branches had a close anatomic relationship with the buccal rami under this anatomic landmark and only 9% of the zygomatic branches had connections to the buccal rami [9].

In accordance with the literature we found 12.9% connection between the zygomatic and buccal branches. The buccal branches of the FN were noted as having a close relationship with the parotid gland as it crosses anteriorly. In Pogrel et al’s study [6], the nerve was found only having one branch in 85% of the cases and the branch or branches coursed inferior and superior to the Stensen’s duct in 75% and 25% of the cases, respectively. He noted that the nerve and the duct usually runs parallel to each other and hence he advised to use the parotid duct as the main anatomic landmark for describing the ramification pattern of the buccal branches of FN [6]. Similarly, the buccal branch was found in contact with the parotid duct as passing inferiorly or superiorly in the study of Erbil et al; the buccal branch was noted as single in 40% and double in 60% of these cases [2]. Saylam et al found in 52% of the patients inferior, 35% superior and mixed patterns in the rest [10]. No regular pattern of arborization was found in their study and for this reason it is inconveniable to develop rigid models of the FN [10]. Erbil et al noted that in 90% of all cases both inferior and superior zygomatic branches crossed the FN anteriorly and all buccal branches were inferior to the duct and none of them crossed the duct [2]. Richards et al mentioned that the branches of the FN were always lateral to the parotid duct [11]. In our study, the buccal branches of the facial nerve have both superior and inferior branches which all pass lateral to the parotid duct.

Woltmann et al found that 43% of the FN was localized below the inferior border of the mandible [5]. It passed the facial artery superficially in 42% and ran on both sides of it in 54% [12].

The mandibular rami had one and two anostomoses with the buccal ramus in 42-59% of the specimens [5]. The MMB communicated with the buccal branch in only 24% of the specimens [12]. Our findings in this work are consistent with those of the previous studies. The MMB had connections to the buccal branch and to the cervical branch in 25.8% and
12.9% of the cases, respectively. There were single and two ramii in 28-35% and 51-60% of the facial halves, respectively [5, 12, 13]. However, some authors reported that MMB had at least three branches in their specimens [14]. We found two MMBs in 61.3% of the specimens, and the others were single.

In conclusion, the FN has a complex pattern of branching which greatly varies between patients. We are in the opinion that the knowledge of courses and relationships of the branches of the facial nerve will actually provide a great benefit in preventing surgical complications.

References