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RESEARCH ARTICLE

ANATOMICAL RELATIONSHIP OF FACIAL NERVE WITH EXTRATEMPORAL MARKERS AND SURGICAL SIGNIFICANCE

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ABSTRACT

Purpose: Localization of the facial nerve trunk may be required during various surgical interventions such as parotidectomy. In these surgical applications, various and reliable landmarks are used to determine the localization of the facial nerve trunk. This anatomical cadaver study aims to evaluate the anatomical relationship between the facial nerve trunk, tragal pointer and mastoid tip.

Methods: Adult cadaver heads were used in 12 (6 Female - 6 Male) fresh frozen cadavers included in the cadaver collection of Dokuz Eylül University Faculty of Medicine, Department of Anatomy. Measurements were taken by determining the lower end of the Tragal pointer (TP) and the tip of the mastoid process (M) surrounding the nerve.

Results: The mean distance between facial nerve truncus and tragal pointer was 6,538 mm; the tip of the mastoid process, 8,225 mm. Facial nerve truncus is approximately 8.446 mm deep to the line extending between the Tragal pointer-Mastoid tip.

Conclusion: Tragal pointer and mastoid tip can be used separately for the detection of the facial nerve trunk, and it has also been observed that it can be found reliably in the depth of the plane passing through these two structures.

Keywords: Anatomy, Facial nerve trunk, Mastoid tip, Parotid surgery, Tragal pointer

INTRODUCTION

The parotid gland is the largest of the major salivary glands and is located deep in the skin and subcutaneous tissues in the preauricular region. The treatment of choice for most salivary gland neoplasms is complete surgical excision. Since the majority of tumors are located in the tail part of the gland and on the superficial part of the facial nerve, parotidectomy performed together with the identification and protection of the facial nerve constitutes the curative treatment for most cases (1). Complete or partial facial paralysis after parotidectomy is one of the early complications of the operation and seriously affects the quality of life of the patient. Despite the application of conservative surgical technique, the risk of temporary and permanent facial paralysis after parotidectomy has been reported as 65% and 4-7%, respectively (2-8). Even in patients operated on for benign parotid tumors, the incidence of temporary and permanent facial nerve paralysis has been reported as high as 26.3% and 1.7%, respectively (9). Main anatomical

landmarks commonly used in facial nerve trunk identification; tragal pointer is the tympanomastoid suture line, the attachment site of the digastric muscle to the digastric groove, the retrograde dissection of the distal branches of the nerve, and the recognition of the nerve in the temporal bone (1). In addition, The use of nerve stimulators in finding the facial nerve trunk is a popular tool used in recent years. However, when the studies conducted were examined, no significant difference was found between the groups in the comparison of the groups with and without facial nerve trunk in primary cases. It has been stated that protection from nerve damage is to use the correct dissection method (2,10). Therefore, the search for a safe and easily recognizable anatomical landmark for the facial nerve continues during parotidectomy.

According to the studies, the reliable points in the surgical incision area are the tragal pointer and the mastoid tip. In this study, it was tried to evaluate these points together. We sought to evaluate its potential as a landmark for reliable exposure of the facial nerve trunk. The aim of this study is to evaluate the anatomical relationship between the facial nerve trunk, tragal pointer and mastoid tip.

MATERIAL-METHOD

Adult cadaver heads were used in 12 (6 Female-6 Male) fresh frozen cadavers included in the cadaver collection of Dokuz Eylül University Faculty of Medicine, Department of Anatomy. None of the cadavers had previously suffered from parotid disease, and upon dissection we did not observe any external abnormality of the neck or encounter any other pathological process that might have had implications on the regional anatomy. Lateral facial dissection was performed on 24 sides. The facial nerve was found in the preauricular incision in the horizontal plane in accordance with the anatomy dissection rules. It was followed from the stylomastoid foramen to the trunk and branches formed in the parotid gland. Tragal pointer lower end (TP) and Mastoid tip (M) were determined (Fig.1), the following measurements were taken (Fig.2).

1- TPM: Distance between Tragal pointer (TP) and Mastoid tip (M)
2- TPFN: Distance between Tragal pointer (TP) and Facial nerve truncus (FN)
3- MFN: Distance between Mastoid tip (M) and Facial nerve truncus (FN)
4- FNtpm: Depth of the facial nerve truncus (FN) to the line (tpm) between the Tragal pointer-Mastoid tip

Length and depth measurements were measured with a 0.01 mm sensitive caliper. Measurement results were evaluated using IBM SPSS Statistics 22.0 program. Descriptive statistics of the measurements taken were presented. The

Figure 1. TP, Tragal pointer; M, Mastoid tip; SCM, Sternocleideomastoid muscle; D, Digastric muscle; Asterisk, Facial nerve trunk.

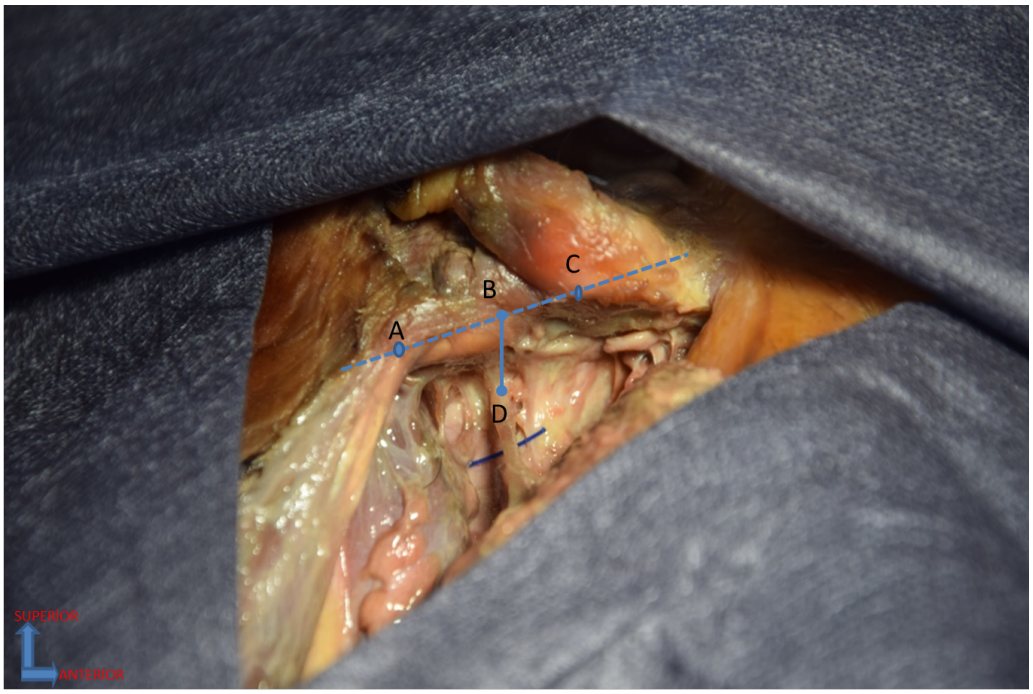

Figure 2. AC, Distance between Tragal pointer (TP) and Mastoid tip (M); BC, Distance between Tragal pointer (TP) and Facial nerve truncus (FN); AB, Distance between Mastoid tip (M) and Facial nerve truncus (FN); BD, Depth of the facial nerve truncus (FN) to the line (tpm) between the Tragal pointer-Mastoid tip.

significance of the difference between the right and left sides was evaluated using the Wilcoxon signed-rank test. P value of less than 0.05 was considered statistically significant.

RESULTS

To better locate the FN, its relationship with the structures surrounding the truncus was evaluated (Table.1). Measurements were taken on 12 left and 12 right sides. The Wilcoxon signed-rank test was used to determine whether the difference between right and left side measurements was significant. It was found that the difference between all right and left side measurements was not statistically significant (P> 0.05). The mean distance of TPM was 14,812 mm (11,4- 19,3 mm); TPFN, 6,538 mm (3,4- 11,4 mm); MFN, 8,225 mm (2,8 – 11,7mm); FNtpm, 8,446 mm (2,0 – 12,9 mm).

DISCUSSION

The aim of this study is to evaluate the anatomical relationship between the facial nerve trunk, tragal pointer and mastoid tip. Main anatomical landmarks commonly used in facial nerve trunk identification; tragal pointer is the tympanomastoid suture line, the attachment site of the digastric muscle to the digastric groove, the retrograde dissection of the distal branches of the nerve, and the recognition of the nerve in the temporal bone (1). In many studies, the FNT-TP relationship has been studied, and the distance between FNT and TP has been found in different lengths (11-18). The authors stated that the TP-FNT measurements differed because the tragal pointer has a cartilaginous structure, mobile, asymmetric and irregular types (15,19,20). It is emphasized that bone structures are more reliable than soft tissue landmarks due to their rigid and stable positions (21). Therefore, the mastoid tip is a reliable landmark due to its easy palpation, being in the dissection area during parotidectomy, not showing variation and being stable. The search for new landmarks continued, except for these structures, which are the main landmarks of parotidectomy. Vascular structures such as the stylomastoid artery (22), the posterior auricular artery (23, 29), and the retromandibular vein (24) have been defined in the detection of FNT. However, the small size of the stylomastoid artery, difficulty in recognizing it during dissection, and its proximity to the facial nerve increases the risk of iatrogenic trauma. Retrograde dissection of the distal branches of the nerve is not a common method because of the variation in branching patterns, variable relationships with surrounding venous structures and the risk of damage during the presence of nerve branches. However, it can be used as an alternative method in

Table 1. The Descriptive Statistics and The Wilcoxon signed-rank test results

		N	Minimum-Maximum (mm)	Mean (mm)	Std. deviation	Z	p*
TPM	Right	12	11,6 - 19,3	14,475	2,5867		
	Left	12	11,4 - 18,6	15,150	2,1450	-0,589	0,556
	Total	24	11,4 - 19,3	14,812	2,3493		
TPFN	Right	12	3,4 - 9,1	6,292	1,8367		
	Left	12	3,6 - 11,4	6,783	2,5114		0,289
	Total	24	3,4 - 11,4	6,538	2,1663	-1,059	
MFN	Right	12	2,8 - 11,7	8,083	2,4282		
	Left	12	3,2 - 11,3	8,367	2,2472	-0,550	0,583
	Total	24	2,8 - 11,7	8,225	2,2926		
FNtpm	Right	12	3,4 - 12,9	8,650	2,9094		
	Left	12	2,0 - 12,6	8,242	2,7164	-0,785	0,433
	Total	24	2,0 - 12,9	8,446	2,7606		

TPM: Distance between Tragal pointer (TP) and Mastoid tip (M); TPFN: Distance between Tragal pointer (TP) and Facial nerve truncus (FN); MFN: Distance between Mastoid tip (M) and Facial nerve truncus (FN); FNtpm: Depth of the facial nerve truncus (FN) to the line (tpm) between the Tragal pointer-Mastoid tip; Z: Wilcoxon signed-rank test statistics; *p > 0.05 no significant.

revision surgeries and large tumors (25). The superior edge of the posterior belly of the digastric muscle is another landmark used. The advantage is that it is easy to recognize and is located superficially of the facial nerve trunk. However, it is affected by retraction due to its soft tissue structure (12). The styloid process, another bone landmark, is located in the deep plane of the facial nerve trunk and carries the risk of nerve damage during recognition; It is not seen as a useful landmark due to its variation (3).

The posterior part of the ramus mandible is one of the identified landmarks. However, it is not preferred much because of its variable distance to the nerve trunk and its structure between genders (26). Keefe et al. suggested to find the facial nerve trunk by retrograde dissection of the posterior auricular nerve (27). However, it was stated that the nerve is difficult to recognize from the soft tissue because it is located deep in the auricular tissue and it is not always located lateral to the mastoid tip (23). Meybodi et al. stated that the digastric branch of the facial nerve can be used to find the facial nerve trunk. The advantage is that the nerve is in an area that does not require additional dissection; The disadvantage is that the nerve can be easily damaged because it is a weak branch. It has been stated that it may be difficult to find it especially in large parotid tumors (28).

In the results of our study, the length of the plane extending between the TP-M was measured as 14.812 mm (SD 2.34), and the length of the plane extending perpendicular to the facial nerve from this line was measured as 8.446 mm (SD 2.7606). The intersection point of the line extending from the facial nerve to the plane was marked and the distance of this point to TP was 6.538 mm (SD 2.1663), and its distance to M was measured as 8.225 mm (SD 2.2926). Cartilaginous TP and bone M are one of the most common and long-used landmarks and do not require additional dissection. They also do not pose a risk of nerve damage due to their presence on the surface of the FN. There is no need for an additional dissection, which may increase the risk of nerve damage and prolong the operation time, in the use of these two structures that routinely occur during parotidectomy by supporting each other.

CONCLUSION

The search for the most reliable and easily recognizable landmark in studies continues. In our study, we aimed to present the FNT depth to the TP-M plane as an alternative method that can be used during parotidectomy in the literature. According to the information obtained, the FNT is located at an average distance of 8.225 mm from the plane extending from M to TP, and at a depth of 8.446 mm perpendicularly from this point. Our results belong to the cadaveric study and give metric data for the anatomical relationship between the structures. Clinical studies in living patients and tumor tissue need to be evaluated.

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