IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 18, Issue 7 Ser. 3 (July. 2019), PP 14-18
www.iosrjournals.org

Identification of Facial Nerve during Parotidectomy: a case series from Indian Sub-continent

Gopal Chandra Mondal[1], Debasis Ray[2], Rajib Chakrabarty[3], Swapan Kumar Majumder[4], Utpal Jana[5]

[1] *Associate Professor &MD in the Department Of Anatomy, Nil Ratan Sirkar Medical College, Kolkata, West Bengal India*
[2]*Associate Professor & MS in the Department Of Surgery, Nil Ratan Sirkar Medical College, Kolkata, West Bengal India*
[3]*MDS 3nd Year Post Graduate student, in the Department Of Dental Surger , R Ahmed Dental College, Kolkata, West Bengal India*
[4] *Professor & MDS in the Department Of Dental Surgery, R Ahmed Dental College, Kolkata, West Bengal India*
[5]*Professor & MS in the Department Of ENT, Nil Ratan Sirkar MedicalCollege, Kolkata, West Bengal India*
Corresponding author : Dr Debasis Ray

Abstract: Background: *Numerous soft tissue and anatomical landmarks have been proposed to assist the surgeon in the early identification of facial nerve However, there is a lack of consensus among surgeons for use of one landmark for reliably identifying the nerve.*

Objectives: *To review and measure the distance from three commonly used landmarks to the main trunk of the facial nerve-1) the posterior belly of digastric muscle (PBDM). 2) the tympanomastoid fissure(TMF). 3).the mastoid origin of sternocleidomastoid muscle (SCM) and to evaluate their consistency in locating facial nerve trunk.*

Methods: *This prospective crosssectional study was carried out among 17 patients with swelling of the parotid gland of neoplastic origin visiting the Oral and Maxillofacial Surgery OPD of Dr. R. Ahmed Dental College & Hospital, Kolkata in collaboration with localized Medical Colleges. A detailed relevant clinical history was taken as per the approved case record form after taking informed consent from the patient. Modified Blair incision was made and anterograde method was followed to locate the facial nerve. After locating the main trunk, shortest distance between the edge of the facial nerve trunk and SCM, PBDM and TMF was measured.*

Results: *Of 17 patients, there were 11 males; age varied from 21-70 years. Fifteen patients were operated for pleomorphic adenoma with one case each of Warthin's tumor and adenoid cystic carcinoma. The average distance of TMF from FNT was 3.12±0.78. Similarly, mean distance of PBDM and SCM was found to be 9.71±1.86 and 6.06±1.82, respectively. There was no statistically significant difference in the mean distances of these three landmarks as per age and sex. Nerve deficit was reported among nine cases, one being severe of these.0*

Conclusions: *TMF fissure is the closest anatomical landmark to the facial nerve trunk. It can be a reliable guide to locate the FNT near the stylomastoid foramen if identified at an early stage.*

Keywords: *landmarks, facial nerve identification, tympanomastoid fissure, posterior belly of digastric muscle, sternocleidomastoid muscle, parotidectomy*

Date of Submission: 26-06-2019 Date of acceptance: 13-07-2019

I. Introduction

Parotid gland surgery involves the facial nerve due to the anatomical location of gland and passing pathway of facial nerve. Ever since the introduction of superficial parotidectomy as the treatment of choice, which involved the identification of facial nerve first, followed by the removal of either superficial or deep lobe of the parotid; the safe identification and dissection of this 7th cranial nerve has remained a controversial challenge for surgeons (1).

The accidental injury of this nerve or its branches leaves the patient in a dreadful situation and may lead to functional, social and psychological disability to the patient. Identification of facial nerve accurately is imperative during surgery of the parotid gland owing to its vicinity with the parotid and extratemporal course. Two commonly used approaches to identify the facial nerve during parotidectomy includes conventional anterograde dissection of the facial nerve, and retrograde dissection. Numerous soft tissue and anatomical landmarks have been proposed to assist the surgeon in the early identification of this nerve like the tragal pointer, the styloid process, the tympanomastoid fissure, the posterior belly of digastric, the junction between

the bony and cartilaginous part of the external auditory meatus and mastoid attachment of the sternocleidomastoid muscle. Use of so many anatomical landmarks for identifying facial nerve itself indicates that there is lack of consensus among surgeons for use of one landmark for reliably identifying the nerve (2-5).

The purpose of the present study is to review and measure the distance from three commonly used landmarks to the main trunk of the facial nerve-1) the posterior belly of digastric muscle (PBDM). 2) the tympanomastoid fissure(TMF). 3).the mastoid origin of sternocleidomastoid muscle (SCM) and to evaluate their consistency in locating facial nerve trunk.

II. Aims and objectives

To evaluate the relationship of three easily localizable landmarks, namely the mastoid origin of the sternocleidomastoid muscle(SCM), posterior belly of digastric muscle (PBDM) and tympanomastoid fissure(TMF) with respect to the facial nerve trunk for intraoperative localization of the facial nerve during parotidectomy.

III. Material and Methods

Study Design: Prospective cross sectional
Study period: Between January 2014 and June 2015
Study population: All patients with swelling of the parotid gland of neoplastic origin visiting the Oral and Maxillofacial Surgery OPD of Dr. R. Ahmed Dental College & Hospital, Kolkata; OPDs of Department of General Surgery, and Department of Otolaryngology and Head Neck Surgery of N.R.S Medical College & Hospital in Kolkata, India.
Sample size: Following proper clinical and radiological evaluation, 17 patients were diagnosed with lesion in the parotid gland, irrespective of the side of involvement.
Sampling technique: Patients were selected irrespective of age, sex, caste, creed, religion and type of lesion based on the following inclusion and exclusion criteria.

Inclusion criteria:
1. Patients with satisfactory general health; with no systemic disease
2. Patients who were willing to participate in the study along with informed consent.
3. Swelling of the parotid gland of neoplastic origin (benign or malignant).
4. No previous surgery has been performed on the parotid region.

Exclusion Criteria:-
1. Medically compromised patients.
2. Uncooperative patients.
3. Swellings of the parotid gland of inflammatory/non inflammatory origin not proved to be neoplastic.

Data collection tool: A case record form was developed to be filled for each patient. The first section captured the detailed history of patient and his illness. The first sub- section dealt with personal information like name, age, place of residence, date of admission, IPD number etc. The second sub-section dealt with the chief complaints or the presenting symptoms of present illness. The third sub- section explored the past medical history so as to address the exclusion criteria. Details of general physical and systemic examinations were recorded in the subsequent sections along with the information on vitals. The pre- operative investigations of blood and urine were carried out to assess the overall fitness of the patient before surgery.

The second section recorded the radiological findings of the lesion like ultrasound, CT scan and MRI. Ultrasonography was done for every patient. CT scan or MRI was done if required. The third section captured the findings of Fine Needle Aspiration Cytology (FNAC) and the fourth section recorded the measurements of caliper, nerve hook and measuring scale.
Pre-testing of the study tool was done on five patients who were operated in the Department of General Surgery to assess if it was capturing all the required information.

Data collection procedure: A detailed relevant clinical history was taken and physical examination including general, systemic and local examination was done for eligible cases as per the approved case record form. Investigations were carried out to assess the fitness of patients for surgery and anaesthesia.

Once the patients were deemed fit, all cases were done under General Anesthesia. The patient was placed supine (face up) and the head was turned away from the side of the lesion, with the head being placed in slight extension. The head of the operating room table was elevated slightly to reduce venous pressure in the parotid gland and surrounding tissues. The standard lazy 'S' shaped Cervico-mastoid-facial (modified Blair) incision was used in all cases. The details of the operating procedure have been described in detail in the corresponding MS thesis elsewhere.

After exposing the skin, sub- cutaneous tissue and platysma; the posterior part of the gland was released from the cartilaginous auditory canal superiorly. The flap was dissected and the anterior border of the sternocleidomastoid was exposed. The anterior border was then followed upward to its origin at the mastoid process. Inferiorly and posteriorly to the lobule, the skin was dissected to release the posterior extension of the gland in order to clearly visualise the mastoid origin of SCM. Dissection was then continued more deeply and the posterior belly of digastrics muscle was exposed as it attaches itself to the mastoid notch on the medial side of the mastoid process. The tympanomastoid fissure was then identified at the lateral attachment of parotid fascia. It gives attachment to a dense connective tissue called Lore's fascia comprising a rich venous lexus and the stylomastoid artery and has a transverse postero- anterior course from the tympanomastoid fissure to the posterior margin of the parotid gland.

After deepening for about 2mm-3mm a very fine natural plane of cleavage between the cartilages of the external auditory meatus posteriorly and the parotid gland anteriorly was found. This plane was extended downwards towards the neck. The larger bleeding points were usually ligated and the smaller bleeding points were coagulated with diathermy.

In all the cases, we located the facial nerve by using anterograde method i.e. first the facial nerve trunk was identified as it emerges from the stylomastoid foramen followed by its branches (details of the procedure followed to locate the nerve have been described elsewhere- thesis). After locating the main trunk, shortest distance between the edge of the facial nerve trunk and SCM, PBDM and TMF was measured. Point of measurement for each of the landmark was made with the help of slide calipers as follows:

a) The posterior belly of digastric muscle (PBDM): shortest distance from the edge of the main trunk of the facial nerve to the most superior aspect of the muscle belly closest to the nerve.

b) The tympanomastoid fissure (TMF): shortest distance between the edge of the main trunk of the facial nerve to the depth of the soft tissue depression corresponding to the TMF.

c) The mastoid origin of sternocleidomastoid muscle (SCM): shortest distance between the edge of main trunk of the facial nerve and the closest point of the muscle originated from the mastoid process.

After completing the total parotidectomy procedure, wound closure was done and patients were discharged from the ward on 8th post- operative day. All the surgery specimens were sent for histopathological examination.

Ethical considerations: The permission for this study was granted by Institute's Ethical Committee. Further, after explaining the purpose of the study and its benefit, informed consent was taken from the patient. Patient was allowed to withdraw from the study at any stage without having any implications of his further treatment.

Plan of Statistical analysis: Descriptive and comparative analysis was done by using SPSS 15 software. Average distance of each of the landmarks from the facial nerve trunk were determined, compared among each other to find if the data is statistically significant among them. Data for each of the landmarks were compared for both age and sex of the patient and analyzed to find the statistical significance if any by using unpaired t-test.

IV. Results

Of the 17 patients, there were 11 (64.7%) males and rest six (35.3%) were females aged 21-70 years. Majority of the participants (n=15, 88.2%) were in the middle age group of 31-60 years. There was one participant each in the age group of less than 30 years and more than 60 years (Table 1).

Of the 17 cases who were operated, there were 15 (88.2%) cases who had pleomorphic adenoma and one case each of adenoid cystic carcinoma and warthin's tumor. In majority of the cases (n=10, 58.8%), the lesion was on the right side (Table 2). All these cases were of pleomorphic adenoma. Among seven cases where lesion was on the left side, five cases had pleomorphic adenoma and rest had adenoid cystic carcinoma and Warthin's tumor.

For treating the lesion, superficial parotidectomy was done among 13 (76.5%) cases and in rest four cases, total parotidecomy was done. Following surgery, nerve deficit was found among nine patients (five cases who underwent superficial parotidectomy +all cases of total parotidectomy).

The average distance of SCM from the facial nerve trunk was found to be 9.71±1.86 (range= 8 to 16 mm). Similarly, the average distances of PBDM and TMF were recorded to be 6.06±1.82 (range= 4-10 mm) and 3.12±0.78 (range= 2-5mm), respectively. There was no statistically significant difference in the mean values of distance of SCM, PBDM and TMF from facial nerve trunk as per age groups (more than 50 years and less than 50 years). The p value was found to be 0.411, 0.223 and 0.145 respectively for the three anatomical landmarks. Similarly, there was no significant mean difference among males and females for average distance of SCM, PBDM and TMF from facial nerve trunk (p value= 0.324, 0.224, 0.567). Similarly, there were no variations in the distances of the landmarks from the FNT between right and left sides.

V. Discussion

In our study we operated the patients with parotid gland pathology which were of neoplastic origin. In our study, most common neoplasm was pleomorphic adenoma (88.2%) with high occurrence among middle aged patients. This finding is in accordance with the existing literature (6,7).

Out of 15 cases of pleomorphic adenoma, nine were males which contradicts the literature. It can be explained by the small sample size in our study (7). Most of our cases were found on the right side though in literature there is no evidence of side preponderance of pleomorphic adenoma.

Surgical approaches & nerve monitoring:

In our study, all the cases were operated for the first time with no history of past parotid surgery. Hence, we followed anterograde approach for all cases as advocated by C.A. Righini (8).

Facial nerve is known to have many variations. In majority of cases, the main trunk bifurcates into two branches among 99% of cases (2,9). However, in all our cases, we found a single trunk of the facial nerve coming out of the cranial cavity and its initial course was directed anterolaterally before entering the posteromedial surface of parotid gland.

Various bony and soft tissue landmarks have been advocated by surgeons to locate facial nerve precisely(10-13). After reviewing the literature, we choose to review the reliability of the three landmarks- posterior belly of digastric muscle,sternocleidomastoid muscle and tympanomastoid fissure- which are easy to identify .

Tympanomastoid fissure : It is a bony landmark. Reasons in favor of selecting this as a landmark are: a)it is easy and safe to find b) constant and fixed in its position c) leads to the stylomastoid foramen and therefore has a direct and reliable relationship with the facial nerve and, d) allows the facial nerve to be identified close to the stylomastoid foramen where it is least subject to displacement. In our study we didn't elevate the periosteum over the mastoid rather identified the tympanomastoid fissure at the lateral attachment of the deep parotid fascia where it fuses with the periosteum over the face of the mastoid process. This intraoperative method of identifying the TMF is consistent with the procedure described by M.S.Robertson and P.Black (14).

However, there are various methods adopted by different surgeons for measuring this distance like Hogg and Kratz based their measurements on the "inferior end of the lateral margin of the fissure" and said the nerve was 6-8 mm deep to this point (15). Purcelli and Tabb et al. used a reference point called the "drop-off point" and measured this distance to be 7.2 mm (16).

Rea et al found that TMF was the closest landmark to the FNT (mean distance of 2.5±0.4 mm). In our study, we also found that the TMF was the closest of all the three landmarks from the FNT with the mean distance of 3.12±.78 mm. this may be due to racial variation between the study populations (17). Bushey et al also found similar results with variation in mean distance of TMF and FNT (4.9 ±1.35mm) (18).

Posterior belly of digastric muscle: Few researchers have advocated the selection of PBDM as a consistent landmark because it is easily palpable and minimum risk of injury to the facial nerve trunk. However, we found TMF to be more consistent as PBDM is a soft tissue landmark and TMF has bony anatomy which makes it more reliable.

James J. Holt in his study showed that the closest distance between the facial nerve at the stylomastoid foramen and the anterior border of the posterior belly of digastric was a mean of 9mm, with a median of 10mm and a range of 2 to 12mm.Although we got a lesser distance of PBDM from FNT(6.06±1.82 mm), the reason could be that in his study he had taken the distance from FNT at the stylomastoid foramen (19).

Sternocleidomastoid muscle: A few surgeons like Beahrs and Heeneman53,65,66 and Justin X. O'Brien et al. have used SCM as a surface landmark for the identification of the FNT via finger tip method (10,20, 21). We also used this classical method and found that SCM is a useful guide in localizing FNT particularly in those cases of parotidectomy where parotid pathologies distort the local anatomy. The authors didn't report intraoperative measurement of the distance of the SCM from FNT. Hence, it's a first study to document this mean distance of 9.71mm with a standard deviation of 1.86 which may be considered as a strength of our study.

Complications:

Facial nerve deficit was reported among nine cases in the immediate post operative period. In eight cases of nerve deficit, this was 'slight' according to House-Brackmann Facial Nerve Grading System (22) and resolved completely within three months post operatively. This finding is consistent with the literature that documents that in most cases of parotidectomy, post operative facial nerve palsy is temporary in nature. But in one case of a deep lobe parotid neoplasm in a middle aged, short statured, thin built woman; the peripheral branches of the facial nerve, its two principal branches along with a portion of the trunk were displaced superficially (Fig. 1) by the tumor mass. We found great difficulty in identifying the FNT and when actually we could identify the trunk it was found inadvertently transected. We immediately approximated the cut ends of the

nerve trunk by using 8-0 prolene suture under loop magnification. We identified the undisplaced segment of the FNT measured the distances of the trunk from the three landmarks after approximating the cut ends but and the findings were similar as in rest of the female patients. There was 'severe' facial nerve paralysis on the right side-House-Brackmann grade V-post operatively. Immediate medicinal therapy was instituted and later on she was referred to the dept. of physical medicine for rehabilitation but there was no sign of improvement at six months post op. follow up. Now we are planning for the reanimation procedure to rehabilitate the patient. In all our cases the surgical wound were healed satisfactorily with no evidence of wound dehiscence & infection.
Further multicentre studies with larger patients group and longer duration of follow-ups are recommended to corroborate the findings of the present study for their accurate application in clinical practice.

VI. Conclusions

TMF fissure is the closest anatomical landmark to the facial nerve trunk. It can be a reliable guide to locate the FNT near the stylomastoid foramen if identified at an early stage. TMF the closest bony landmark which is consistent and reliable, SCM and PBDM both are soft tissue landmarks and are subject to variation but these three landmarks can be used in conjunction especially in complicated cases where FNT trunk gets displaced by the tumor grossly. And post operative facial nerve deficit is usually temporary in nature and most cases get resolved within six months.

References

[1]. Eric R.Carlson, Robert A. Ord. Textbook and color atlas of salivary gland pathology, Diagnosis and management.1st edition 2008.
[2]. Davis Richard A. et al.: Surgical anatomy of the facial nerve and the parotid gland based upon a study of 350 cervicofacial halves. Surgery Gynecology and Obstetrics.April 1956, 102(4):385-412.
[3]. Tabah EJ.: The Surgical Management of Parotid Tumours, Canad. M. A. J Nov.1954; 7:456-465.
[4]. Benedict EB. Tumors of the Parotid Gland: A Study of Two Hundred and Twenty-five Cases with Complete End-results in Eighty Cases. Surg Gynecol Obstet 1930; 1:626–647.
[5]. Pia F. Centripetal approach to the facial nerve in parotid surgery: personal experience, Acta Otorhinolaryngol Ital 2003; 23:111-115.
[6]. Batsakis J, ed. Tumor of the Head and Neck: Clinical and Pathological Considerations. 2nd ed. Baltimore: Williams & Wilkins, 1979; 1–120.
[7]. Shafer's Textbook of Oral Pathology,5th edition.2006;© Elsevier.
[8]. Righini C.A. Facial nerve identification during parotidectomy.European Annals of Otolaryngology,Head and Neck disease,2012,129:214-219.
[9]. Bailey H. The Surgical Anatomy of the Parotid Gland, British Medical Journal July31, 1948; 245-248.
[10]. Wong David S. Y.:Surface landmarks of the facial nerve trunk:a prospective measurement study.ANZ J.Surg.,2001,71:753-756.
[11]. Janes RM.:Treatment of tumors of the salivary glands by radical excision.CMAJ,1940;43:554-9
[12]. Byars Louis T.: Preservation of the facial nerve in operations for benign conditions of the parotid area.Annals of Surgery 1952, 136(3):412-419.
[13]. Brintnall E. S. et al.: A simplified and rapid anatomical approach to parotidectomy.Arch. Surg.,Sep 1955,71:331-336.
[14]. Robertson M.S. & Black P.: A method of using the tympanomastoid fissure to find the facial nerve at parotidectomy.Aust. N.Z.J.Surg.,1984,54:369-373.
[15]. Hogg S. P. & Kratz R.C.:Surgical exposure of the facial nerve.Arch. Otolaryngol,1957;67:560-1.
[16]. Tabb HG,Scalco AN,Fraser SF.:Exposure of the facial nerve in parotid surgery.Laryngoscope 1970;80:559-67.
[17]. Rea PM et al. The precision of four commonly used surgical landmarks for locating the facial nerve in anterograde parotidectomy in humans, Annals of Anatomy 2010; 192: 27–32.
[18]. Bushey Andrew et al.:Utilization of the tympanomastoid fissure for intraoperative identification of the facial nerve: a cadaver study.J Oral Maxillofac Surg,2011,69:2473-2476.
[19]. Holt James J.: The stylomastoid area: Anatomic-histologic study and surgical approach.Laryngoscope,1996,106:396-400.
[20]. Beahrs OH.:The surgical anatomy and technique of parotidectomy.Surg. Clin.North Am.1977;57:477-93.
[21]. Heeneman H.:Identification of the facial nerve in parotid surgery.Can.J.Otolaryngol.1975;4:145-51
[22]. House JW, Brackman DE. Facial nerve grading system. Otolaryngol Head Neck Surg. 1985;93:146-147.

Dr Debasis Ray" Identification of Facial Nerve during Parotidectomy: a case series from Indian Sub-continent" IOSR Journal of Dental and Medical Sciences (IOSR-JDMS), vol. 18, no. 7, 2019, pp 14-18.