

An objective assessment of proximal and distal facial nerve exploration during superficial parotidectomy

Access this article online

Website:

www.amsjournal.com

DOI:

10.4103/2231-0746.83143

Quick Response Code:



Rohit Sharma, P. S. Menon¹, R. Sinha²

Department of Maxillofacial Surgery, MH Jalandhar Cantt, ¹Vydehi Dental College, Bangalore, ²DDGDS (P), IHQ of MoD, New Delhi, India

Address for correspondence:

Dr. Rohit Sharma, 11 CDU C/O 56 APO, Jalandhar, India.

E-mail: capt_rohit7@yahoo.com

ABSTRACT

Aim: This study was undertaken to compare the proximal and distal facial nerve exploration approach during superficial parotidectomy. **Materials and Methods:** A retrospective analysis of patients who underwent superficial parotidectomy at our center was conducted. Cases were divided into those who underwent superficial parotidectomy using distal facial nerve exploration and those who underwent standard proximal facial nerve exploration. Statistical comparisons of intraoperative blood loss and margin status (negative, focally, positive) were conducted between these two approaches. **Results:** A total of 39 patients underwent superficial parotidectomy at our center between 2008 and 2010. The technique used in most of the cases was conventional proximal nerve exploration technique (29 cases). Distal exploration of the buccal branch was undertaken only in 10 cases, on account of difficulty in locating the main trunk intraoperatively due to the presence of postinflammatory fibrosis. The average patient age was 48 years with a female preponderance (67%). Both the techniques consumed almost same average operative time (2.4 hours) and average intraoperative blood loss (68.0 cc vs 25.4 cc) was more in the cases where proximal nerve exploration was resorted (S.E (d) = 0.89). No significant difference in surgical margin status was noticed between the two techniques ($P > 0.05$). **Conclusion:** Both the techniques are efficient without compromising the surgical margins, but the average intraoperative blood loss is less in distal facial nerve exploration technique.

Keywords: Distal, facial nerve, proximal, superficial parotidectomy

INTRODUCTION

Parotid gland surgery is technique sensitive because of the close relationship of the gland with the extracranial facial nerve which is the motor supply to the muscles of facial expression. If the facial nerve is not involved preoperatively, its preservation is important for both aesthetic and functional outcome of the surgery. The most frequent morphology of the facial nerve is reported, in the literature,^[1-3] to be dichotomous, with cervicofacial and temporofacial divisions further dividing into temporal, zygomatic, buccal, marginal mandibular, and cervical branches. The superior temporofacial branch runs upward and medially and is generally larger. The anatomical evaluations reveal that all the five branches run in the substance of parotid isthmus, dividing the gland into superficial and

deep lobes. They are covered by glandular acini and rests on the aponeurosis of the masseter muscle, with its temporal and zygomatic component running to a thin adipose layer upon its emergence from the cranial pole of the gland. Facial nerve is identified by means of proximal surgical technique aimed at isolating proximally the main nerve trunk anywhere between stylomastoid foramen and parotid gland entry. Distal nerve identification techniques are rarely described in the literature, these being adapted, as necessary, by the surgeon, depending on the localization of the neoplasm, and approach the isolation of the nerve beginning from any of its peripheral branches. Rarely, after recurrent infection and fibrosis or previous radiotherapy, the trunk of facial nerve is difficult to be identified using conventional technique.^[4] In this situation, nerve is identified at the anterior border of the parotid and traced centrally toward the stylomastoid

foramen. This study was undertaken to compare the proximal and distal facial nerve exploration approach during superficial parotidectomy.

Surgical Technique

Whenever the medical condition allowed and the patient was fit, hypotensive anesthesia was used, as this considerably reduced oozing and thus made it easier to trace the facial nerve fibres. The modified Blair’s incision line [Figure 1] was marked and infiltrated with lignocaine hydrochloride with 1 : 80 000 adrenaline. The incision was made with a Colorado microdissection needle. The skin flap was raised in the plane of the preparotid fascia [Figure 2]. Blood-free plane, anterior to the external auditory meatus which leads the surgeon down to the base of skull, just superficial to the styloid process and the stylomastoid foramen, was then gently opened up in an inferior direction by blunt dissection until the trunk of the facial nerve is seen, but was generally misleading and hence was not our choice of entry in the region. We identified the posterior belly of the digastric muscle in the cervical extension of the incision. The anterior border of the sternocleidomastoid muscle was mobilized and retracted inferiorly to display the posterior belly of digastric muscle beneath it. This maneuver necessitated the sectioning of great auricular nerve. The posterior belly of the digastric was

traced upward and backward to its insertion onto the mastoid which lay immediately below the stylomastoid foramen, thus leading the operator to the facial nerve from below. Once the facial nerve trunk was identified, the superficial lobe of the parotid was “exteriorized” by opening along a plane in which the branches of the facial nerve run between the two lobes, by blunt dissection. Usually, as it leaves the stylomastoid foramen, the trunk of the facial nerve turns abruptly to become more superficial [Figure 3] and also divides into the larger zygomaticofacial trunk and smaller cervicofacial trunk [Figure 4]. The five main branches of the nerve [Figure 5] were then followed peripherally through the parotid until the superficial lobe was completely freed. This part of the operation was performed using fine scissors, opened up in the plane of the facial nerve branches, with care always taken to identify the nerve fiber before dividing parotid tissue. During dissection of the lower part, branches of the posterior facial vein were encountered immediately deep to the marginal mandibular branch. Great care was taken when vascular clamps are applied to these branches to avoid damaging the facial nerve. If the superficial parotidectomy was being performed for chronic infection, the duct was tied off as far forward as possible to prevent recurrent ascending infection from the oral cavity. Rarely, after recurrent infection and fibrosis or previous radiotherapy, the identification of the trunk of facial nerve was



Figure 1: Marking of modified Blair’s incision

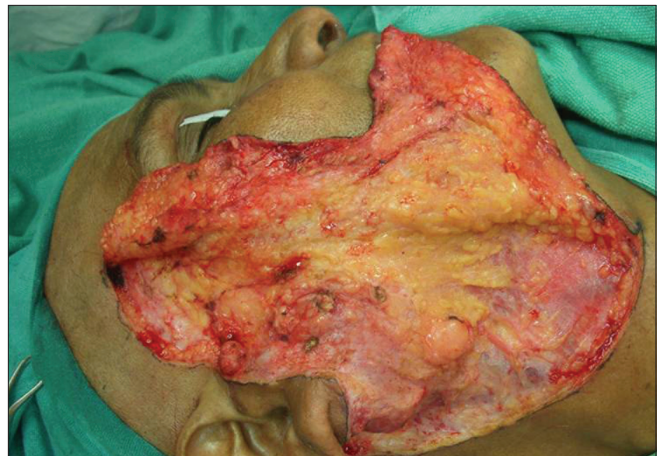


Figure 2: Dissection of preparotid fascia up to Stenson’s duct

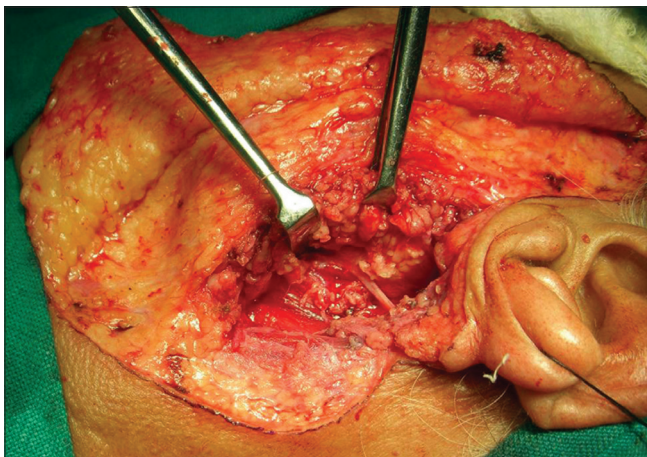


Figure 3: Exploration of proximal facial nerve main trunk

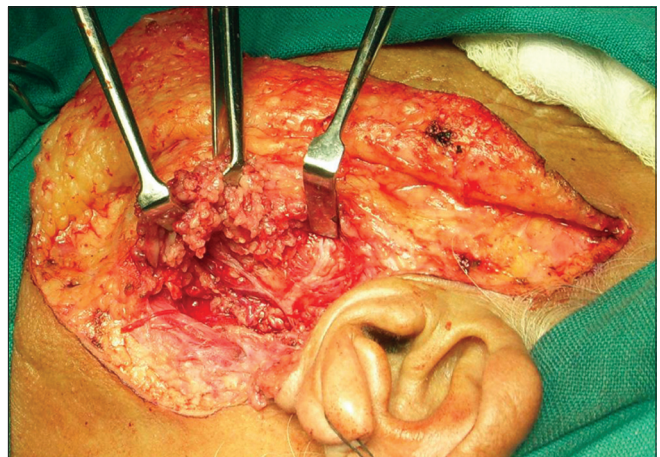


Figure 4: Dissection of upper and lower division of facial nerve

difficult using conventional technique. In this situation, nerve was identified at the anterior border of the parotid and traced centrally towards the stylomastoid foramen. In the distal nerve exploration method, we first identified the buccal branch of the facial nerve [Figure 6] about 4 cm anterior to the tragus along the alaragral line. This branch was dissected in a retrograde fashion as far as the main trunk of the facial nerve. The decision to resort to the identification of the buccal nerve was supported by the regular course and adequate size of this branch of facial nerve in its peripheral area collocated with Stenson's duct, which enables it to be easily identified during surgery. The remaining branches of the facial nerve were dissected in an anterograde fashion, displacing the parotid gland superiorly and inferiorly. Following removal of the parotid gland, the blood pressure was returned to normal, all bleeding points were controlled, a vacuum drain placed, and the wound closed in layers [Figure 7].

MATERIALS AND METHODS

A retrospective analysis of patients who underwent superficial parotidectomy at our center was conducted. Cases were divided

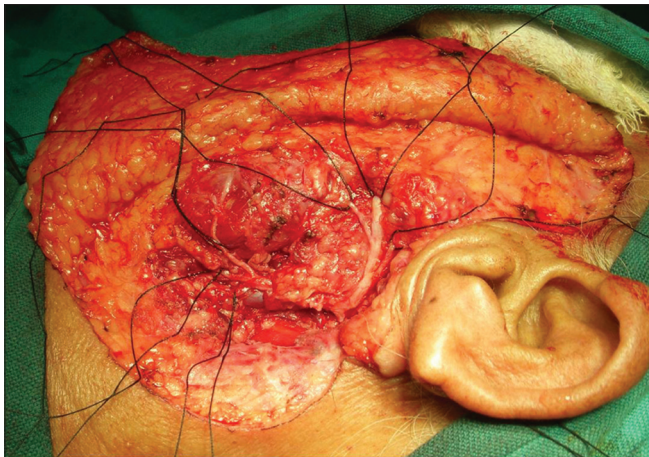


Figure 5: Branching of facial nerve exposed following superficial parotidectomy

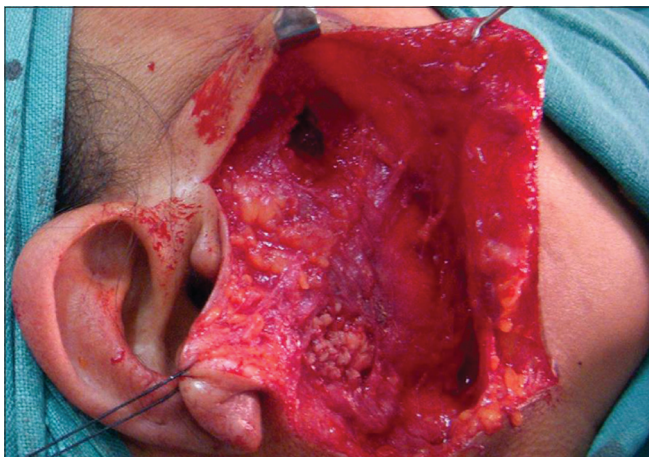


Figure 6: Distal facial nerve exposure (buccal branch)

into those who underwent superficial parotidectomy using distal facial nerve exploration (n = 10) and those who underwent standard proximal facial nerve exploration (n = 29). Exclusion criteria included planned total parotidectomy for known high-grade malignancy, parotid biopsy of salivary tissue for diagnostic purposes (i.e., rule out Sjogren's syndrome), and revision parotidectomy. The study population comprised 26 females and 13 males, from 27 to 76 years of age. In none of the cases, a loupe/operative microscope was used or electrophysiological monitoring of facial nerve was undertaken. The average patient age was 48 years with a female preponderance (67%). Both the techniques consumed almost same average operative time (2.4 hours) and average intraoperative blood loss (68.0 cc vs 25.4 cc) was more in the cases where proximal nerve exploration was resorted. Statistical comparisons of average intraoperative blood loss and margin status (negative, focally, positive) were conducted between these two approaches. Postoperative complications, such as facial nerve weakness, and wound complications, such as sialocele formation, hematoma, and wound infection, were also recorded. Statistical comparisons were conducted for the significance with the standard error of difference between two means and Pearson's Chi-square, where appropriate, with significance set at $P < 0.05$.

STATISTICS

Standard error of difference between two means of intraoperative blood loss

Average intraoperative blood loss in distal nerve identification technique = 25.4 cc

Standard deviation = 1.44

Average intraoperative blood loss in proximal nerve identification technique = 68 cc

Standard deviation = 4.14

Standard error of difference between two means

$$= \sqrt{(4.14)^2/29 + (1.44)^2/10}$$

$$= \sqrt{0.598 + 0.207}$$

$$= \sqrt{0.805}$$

$$= 0.89$$



Figure 7: Wound closed in layers with vacuum drain *in situ*

The actual difference between the two means = $68-25.4 = 42.6$

Chi-square test for testing significance of difference of surgical margin status

Surgical margin status	Proximal nerve identification	Distal nerve identification
Negative margins	23	06
Close margins	05	03
Positive margins	01	01

Surgical margin in proximal nerve identification technique

Observed negative margins = 23

Expected = 21.56

Observed close margins = 05

Expected = 5.94

Observed positive margins = 01

Expected = 0.48

Applying the Chi-square test,

$$\begin{aligned} \chi^2 &= \sum (O-E)^2/E \\ &= 1.44^2/21.56 + 0.94^2/5.94 + 0.48^2/1.48 + 1.43^2/7.43 \\ &\quad + 0.95^2/2.05 + 0.74^2/0.26 \\ &= 0.096 + 0.149 + 0.156 + 0.275 + 0.440 + 2.106 \\ &= 3.222 \\ \text{Degrees of freedom} &= (\text{column}-1) (\text{row}-1) \\ &= (3-1) (2-1) = 2 \end{aligned}$$

Using published probability tables, for degree of freedom 2, the value of Chi-square for a probability of 0.05 is 5.99. Therefore, at the value of Chi-square 3.222, $P > 0.05$.

RESULTS

A total of 39 patients underwent superficial parotidectomy at our center between 2008 and 2010. The technique used in most of the cases was conventional proximal nerve exploration technique (29 cases). Distal exploration of the buccal branch was undertaken only in 10 cases, on account of difficulty in locating the main trunk intraoperatively due to the presence of postinflammatory fibrosis. The average patient age was 48 years with a female preponderance (67%). Both the techniques consumed almost same average operative time (2.4 hours) and intraoperative blood loss (68.0 cc vs 25.4 cc) was more in the cases where proximal nerve exploration was resorted (S.E (d) = 0.89). The standard error of difference between the two means is 0.89. The actual difference between the two means is 42.6, which is more than twice the standard error of difference between the two means, and therefore "significant." This signifies that the average intraoperative blood loss is less in distal facial nerve exploration technique. Among the standard parotidectomy using proximal facial nerve identification group, there were 23 negative margins, 05 focally close margins, and 01 positive margin, whereas among the distal facial nerve identification group, there were 06 negative margins, 03 focally close margins, and 01 positive margins. No significant difference in surgical margin status was noticed between the two techniques ($P > 0.05$).

Though there was no motor deficit in the case where distal nerve exploration was done, functional outcome of the surgery cannot be compared. Permanent facial nerve dysfunction of 01 branch was found only in one case [Table 1].

DISCUSSION

The classic approach to facial nerve requires four anatomical landmarks leading to the identification of the trunk of the facial nerve,^[4] as it leaves the stylomastoid foramen which are as follows: (a) The cartilaginous external auditory meatus forms a "pointer" at its anterior inferior border indicating the direction of the nerve trunk; (b) Just deep to the cartilaginous pointer is a reliable bony landmark formed by the curve of the bony external meatus and its abutment with the mastoid process. This forms a palpable groove leading directly to the stylomastoid foramen. Unfortunately, this groove is filled with fibrofatty lobules that often mimic the trunk of the facial nerve which can lie as much as 1 cm deep to this landmark; (c) The anterior, superior aspect of the posterior belly of the digastric muscle is inserted just behind the stylomastoid foramen; (d) The styloid process itself can be palpated superficial to the stylomastoid foramen and just superior to it. The nerve is always lateral to this plane and passes obliquely across the styloid process. A branch of the postauricular artery is usually encountered just lateral to the nerve. This technique is most frequently used and generally held to be the safest for anatomical and functional nerve preservation. Satisfactory results are obtained after partial or total conservative parotidectomy procedures with proximal nerve identification technique, in which the percentage of permanent nerve paralysis is less than 1 to 2% in cases of benign pathologies,^[5-8] while the rate of temporary deficits ranges from 20 to 55%.^[9-11] In very few cases, the proximal approach to facial nerve is extremely difficult, even with the use of an operative microscope and with intraoperative monitoring of the facial nerve, and it is, therefore, necessary to use the distal nerve localization technique. The technique of identifying the facial nerve by means of the isolation of its peripheral branches has been codified for years: in the 80s, even Work and Bailey presented several examples of the retrograde approach from the buccal, mandibular, and temporal rami in those cases in which they reach the surface of the parotid gland. These authors recommend following the deep parotid vein as reference for the mandibular rami, which crosses it laterally.^[4] In our opinion, both proximal and distal nerve exploration can be used to identify the facial nerve without compromising the outcome of the surgery, though at our center, distal nerve exploration is only used when proximal nerve isolation is found to be extremely difficult intraoperatively. In our case, after the preparation of the skin flap, dissection in the parotid region was found difficult due to fibrosis, because of recurrent parotid and periparotid inflammation preoperatively. In our opinion, identification of the buccal nerve is supported by

Table 1: Complications

Complication	Numbers
Temporary dysfunction of the facial nerve	04
Permanent dysfunction of the facial nerve	01
Frey syndrome	01
Haematoma	-
Wound infection	-
Hypertrophic scar	-
Salivary fistula	-
Sialoceles	02

the regular course and adequate size of this facial branch in its peripheral area co-located with Stenson's duct which enables it to be easily identified. Intraoperative monitoring of facial nerve function, using electromyographic techniques, is proposed in parotid surgery to identify the principal nerve trunk and its peripheral branches in complex cases or during retrograde approaches.^[12-14] Following parotidectomy using facial nerve monitoring, Terrell *et al.*^[15] achieved a low percentage of early postoperative facial nerve paralysis in the group monitored, albeit there was no significant statistical difference in long-term nerve function; Witt,^[11] on the other hand, demonstrated a high rate of facial paralysis in a group monitored during superficial parotidectomy, concluding that electrophysiological monitoring is optional and must not be considered a standard technique in such surgery. The validity of facial nerve monitoring can play an important and advantageous part in the surgical treatment of recurrent parotid neoplasms.^[12,15] Facial nerve monitoring along with distal nerve exposure is well supported in literature and found to be efficacious in cases of partial parotidectomy. The distal facial nerve identification technique causes less intraoperative bleed.^[16] The main point of reference in the isolation of the facial nerve is the posterior belly of the digastric muscle; when, however, if proximal nerve exploration is difficult, isolation of the nerve through the distal nerve exploration from the buccal branch can be carried out.^[17,18]

CONCLUSION

Both proximal and distal facial nerve exploration techniques for superficial parotidectomy are efficient without compromising the surgical margins status. From the results we have achieved, we can conclude that the average intraoperative blood loss is less in distal facial nerve exploration technique, but further studies on larger group of patients are required to draw definitive conclusion.

REFERENCES

- Davis RA, Anson BJ, Bundiger JM, Kurth LE. Surgical anatomy of the facial nerve based upon a study of 350 cervicofacial halves. *Surg Gynecol Obstet* 1956;102:385-412.
- Katz AD, Catalano P. The clinical significance of the various anastomotic branches of the facial nerve. Report of 100 patients. *Arch Otolaryngol Head Neck Surg* 1987;113:959-62.
- McCormack LJ, Cauldwell EW, Anson BJ. The surgical anatomy of the facial nerve. *Surg Gynecol Obstet* 1945;80:620-30.
- Work WP, Bailey DG. Surgery of the major salivary glands. In: Paparella MM, Shumrick DA, editors. *Otolaryngology*. Vol 3. Philadelphia: WB Saunders Company; 1980.
- Dimitrov SA. Our experience with surgical dissection of the facial nerve in parotid gland tumours (a preliminary report). *Folia Med (Plovdiv)* 2000;42:37-40.
- Leverstein H, van der Wal JE, Tiwar RM, van der Wal I, Snow GB. Results of the surgical management and histopathological evaluation of 88 parotid gland Warthin's tumours. *Clin Otolaryngol* 1997;22:500-3.
- Moody AB, Avery CM, Walsh S, Sneddon K, Langdon JD. Surgical management of chronic parotid disease. *Br J Oral Maxillofac Surg* 2000;38:620-2.
- Webb AJ, Evenson JW. Plemorphic adenomas of the major salivary glands: A study of the capsular form in relation to surgical management. *Clin Otolaryngol* 2001;26:134-42.
- Rea JL. Partial parotidectomies: Morbidity and benign tumor recurrence rates in a series of 94 cases. *Laryngoscope* 2000;110:924-7.
- Sungur N, Akan IM, Ulusoy MG, Ozdemir R, Kilinc H, Ortak T. Clinicopathological evaluation of parotid gland tumors: A retrospective study. *J Craniofac Surg* 2002;13:26-30.
- Witt RL. Facial nerve function after partial superficial parotidectomy: An 11 years review 1987-97. *Otolaryngol Head Neck Surg* 1999;121:210-3.
- Lin SD, Tsai CC, Lai CS, Lee SS, Chang KP. Endoscopyassisted parotidectomy for benign parotid tumors. *Ann Plast Surg* 2000;45:269-73.
- Brennan J, Moore EJ, Shuler KJ. Prospective analysis of the efficacy of continuous intraoperative nerve monitoring during thyroidectomy, parathyroidectomy and parotidectomy. *Otolaryngol Head Neck Surg* 2001;124:537-43.
- Isaacson G, Martin WH. First branchial cleft excision with electrophysiological facial nerve localization. *Arch Otolaryngol Head Neck Surg* 2000;126:513-6.
- Terrell JE, Kileny PR, Yan C. Clinical outcome of continuous facial nerve monitoring during primary parotidectomy. *Arch Otolaryngol Head Neck Surg* 1997;157:1081-7.
- Bhattacharyya N, Richardson ME, Gugino LD. An objective assessment of the advantages of retrograde parotidectomy. *Otolaryngol Head Neck Surg* 2004;131:392-6.
- O'Regan B, Bharadwaj G, Elders A. Techniques for dissection of the facial nerve in benign parotid surgery: A cross specialty survey of oral and maxillofacial and ear nose and throat surgeons in the UK. *Br J Oral Maxillofac Surg* 2008;46:564-6.
- O'Regan B, Bharadwaj G, Bhopal S, Cook V. Facial nerve morbidity after retrograde nerve dissection in parotid surgery for benign disease: A 10-year prospective observational study of 136 cases. *Br J Oral Maxillofac Surg* 2007;45:101-7.

Cite this article as: Sharma R, Menon PS, Sinha R. An objective assessment of proximal and distal facial nerve exploration during superficial parotidectomy. *Ann Maxillofac Surg* 2011;1:3-7.

Source of Support: Nil, **Conflict of Interest:** None declared.