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ORIGINAL RESEARCH—HEAD AND NECK SURGERY

Distal facial nerve exposure: A key to partial parotidectomy

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ABSTRACT

OBJECTIVES: 1) Compare outcomes of distal facial nerve identification with antegrade exposure in partial parotidectomy; 2) Be able to incorporate other modifications of parotidectomy including preservation of the great auricular nerve, superficial musculo-aponeurotic system (SMAS), and parotid duct.

STUDY DESIGN: Case series with chart review of partial parotidectomy for benign neoplasms and intraparotid lymph nodes, using antegrade (Group 1) or distal (Group 2) facial nerve exposure, and those conserving the great auricular nerve, SMAS, and parotid duct (Group 3).

SUBJECTS AND METHODS: Outcomes for the three groups were reviewed. The great auricular nerve, parotid duct, and SMAS were preserved when possible. Outcomes examined included postoperative facial nerve function, earlobe sensation, allograft use for SMAS defects, surgical duration, sialocele, or salivary fistula.

RESULTS: No difference in facial nerve function was found between the groups. Group 3 had better ear lobule cutaneous sensation. No sialoceles occurred in the 10 of 14 Group 3 cases in which parotid ducts were preserved.

CONCLUSIONS: Partial parotidectomy utilizing distal facial nerve exposure can reduce the extent of surgical dissection, facilitate preservation of the parotid duct and great auricular nerve, and allow greater flexibility in the choice of skin and SMAS incisions.

Complete superficial parotidectomy has been considered standard treatment for benign superficial parotid neoplasms, with partial parotidectomy becoming increasingly accepted.[1] A margin of 1 cm has been reported as sufficient to prevent recurrence after 10 years following resection of pleomorphic adenoma.[2] Other modifications of parotidectomy such as superficial musculo-aponeurotic system (SMAS) sparing, variations of incisions, and great auricular nerve and parotid duct preservation have been proposed,[3-5] but can be difficult to implement when using antegrade facial nerve identification (AFI) to locate the nerve trunk initially.

AFI incises the SMAS posteriorly at the juncture with auricular cartilage and sternocleidomastoid muscle, making SMAS preservation more challenging particularly in anterior or larger lesions, limiting skin incision options, and placing the great auricular nerve at risk for injury. More of the proximal facial nerve may be dissected than is necessary for adequate margins in distally situated lesions in partial parotidectomy. Main parotid duct preservation is usually precluded due to severing of glandular contributions to the duct posteriorly before the duct is isolated anteriorly. Overcoming these limitations requires a different approach to facial nerve exposure.

Retrograde facial nerve dissection has also been reported as efficacious[6] and may be preferred in larger lesions overlying the pes anserinus and trunk of the facial nerve as well in reoperations after AFI, where isolating the trunk is arduous. Retrograde exposure can refer to finding a facial nerve branch distally first, then dissecting proximally to isolate the trunk, which is in turn used to locate the other distal branches.[7] Retrograde dissection has also been described as the isolation of all distal facial nerve branches proximal and distal to the margin of excision without necessarily exposing the trunk.[8] To avoid confusion between these two retrograde approaches, the latter technique is termed distal facial nerve identification (DFI) in this paper, and is examined for its ability to facilitate an integrated conservation approach to partial parotidectomy by allowing customization of skin and SMAS incisions and SMAS closure without tension, as well as great auricular nerve and parotid duct preservation.

METHODS

A case series with chart review, approved by our Institutional Review Board, of 46 partial parotidectomies done for benign neoplasms or intraparotid lymphadenopathy by the senior author (R.C.W.) in a tertiary referral practice, was undertaken (Table 1). Thirty-two cases of standard parotidectomy approaches were performed between 2001 and 2007, with 20 utilizing AFI (Group 1) and 12 using DFI

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Table 1
Group characteristics

Group	Number of cases	Facial nerve identification method	Parotidectomy approach
1	20	Antegrade	Standard
2	12	Distal	Standard
3	14	Distal	Conservation*

*With attempted preservation of SMAS, great auricular nerve, and parotid duct.

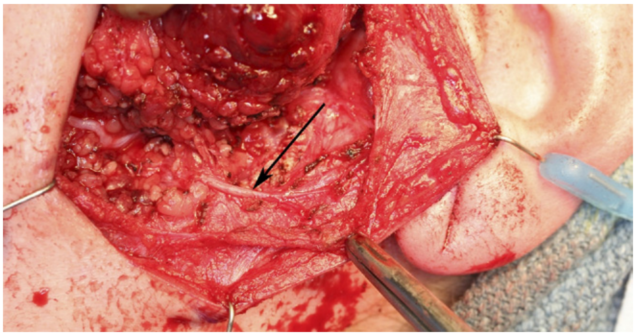

Figure 2 Great auricular nerve situated deep to SMAS flap (grasped with forceps).

(Group 2). From 2005 to 2008, 14 cases of partial parotidectomy were done using DFI while employing additional conservation techniques to preserve the great auricular nerve, SMAS, and parotid duct when possible (Group 3). Priorities of surgery throughout the series remained the preservation of facial nerve function and complete excision of neoplasms with at least 1-cm glandular margins, except for lymph nodes (in which extracapsular dissection was performed), or when the lesion was adjacent to the facial nerve and the SMAS (in which cases the SMAS was resected).

Surgical Technique

Standard parotidectomy incisions were made for Groups 1 and 2, with facial trunk exposure initially followed by a proximal-to-distal nerve dissection for Group 1. In Group 3, infra-auricular incisions were made for parotid tail lesions, and more anteriorly based incisions within skin creases away from the conchal cartilage and lobule made for anterior lesions. A representative Group 3 case is demonstrated in Figures 1 through 4.

Unlike Groups 1 and 2, where SMAS incisions were made at the junction of the parotid gland with the anterior sternocleidomastoid muscle (SCM) border (where the great auricular nerve courses deep to the SMAS layer before innervating the skin) and the anterior conchal cartilage, Group 3 SMAS incisions were made anterior to this junctional region directly over the lesion. An island of SMAS was left over lesions when the superficial surface of tumors was juxtaposed to the deep SMAS layer. SMAS flaps were then elevated around the lesion in Group 3 to provide exposure for DFI (Figs 1 and 2).

Initial distal nerve exposure in Groups 2 and 3 was done anterior to posteriorly situated lesions, and posterior to more anterior lesions, using a thin layer-by-layer dissection at facial nerve branch locations. Circumferential dissection of nerve branches beyond a satisfactory margin around the lesion was then completed. Either one of two reliable empiric approaches are used to locate the first distal facial nerve branches beyond the margin around the tumor. The ramus mandibularis branch is usually within 10 mm posterior and inferior to the angle of the mandible. The frontal nerve branch passes over the middle portion of the zygomatic arch and is often palpable over the arch bony surface. Nerve branches are usually found without the use of a nerve stimulator and without triggering the EMG monitoring system by gentle, superficial dissection of parotid tissue over the nerves. Dissection in close proximity to a nerve branch will trigger a low-level scratching sound from the EMG

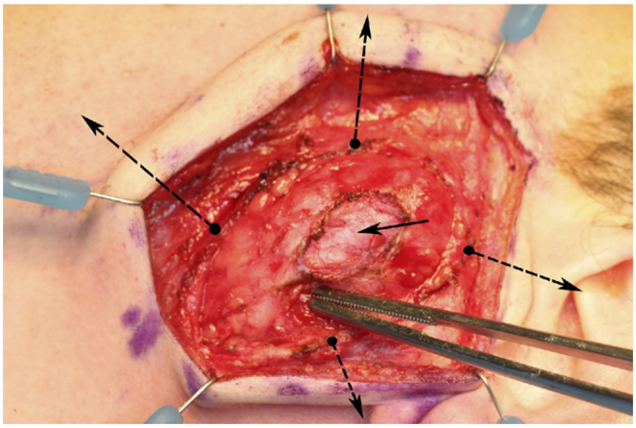

Figure 1 SMAS incision: SMAS island left on most superficial aspect of tumor (*solid arrow*); direction of SMAS flap elevation surrounding lesion (*broken arrow*).

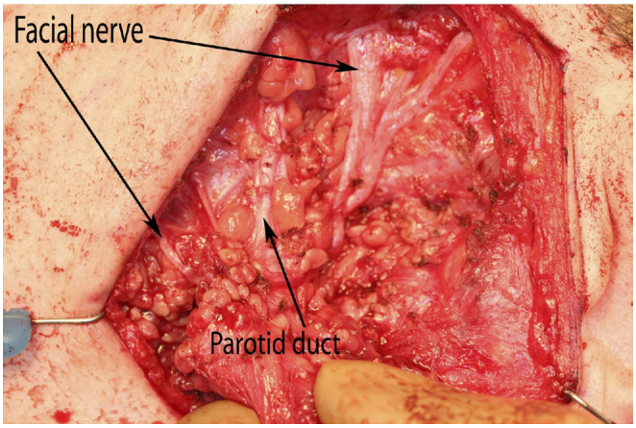

Figure 3 Facial nerve and parotid duct exposed before transecting between superficial and deep parotid gland.

Figure 4 SMAS closure.

monitor. When this occurs, dissection more superficially is done to isolate the underlying nerve. Once an initial nerve is exposed, further branches may be found by tracing the first nerve in a retrograde fashion to find the next branching point. However, when the branching point is very proximally situated, it is faster and easier to dissect through parotid gland over the expected area of the adjacent distal branches.

Parotid duct identification in Group 3 was performed anterior to parotid tissues and traced posteriorly (Fig 3). The parotid duct is normally located in the region of the middle third of a line connecting the tragus to the midpoint of the upper lip vermilion border. After the distal facial nerve branches are located, the duct is found to arise from a tongue of parotid tissue, devoid of nerve branches, between the branches arising from the upper and lower main branches of the pes anserinus of the facial nerve. The parotid duct can be mistaken for a large facial nerve branch, but unlike a distal facial nerve branch, it does not stimulate, nor does it taper or branch distally, while it does taper and branch abruptly into parotid tissue proximally. After all other margins are dissected free from surrounding tissues, branches from the margin around the lesion to the main duct are ligated, and the parotid gland is finally incised between the margin around the lesion and the remaining deeper parotid tissues contributing to the main duct to be preserved.

The SMAS incision was extended from the posterior initial incision to over the resection margins of parotid gland and facial nerve dissection in Groups 1 and 2. Following resection of the lesion, the SMAS layer was apposed to the conchal cartilage and SCM in Groups 1 and 2, or to itself in Group 3 (Fig 4), using a watertight closure. Implantable acellular dermis was used to reconstruct SMAS defects too large to close primarily.

The harmonic scalpel and facial nerve EMG monitoring of the upper (frontal and orbicularis oculi mm), middle (nasolabial fold), and lower (depressor anguli oris and orbicularis oris) face were utilized in all cases. No drains were used in any case, and all except two patients were discharged home the same day as surgery.

Outcomes analyzed were: 1) facial nerve function using the House-Brackmann classsification[8] at one week postoperatively, and up to six months after surgery if initial weakness was present, after which paresis was considered permanent; 2) ear lobule sensation at one week postoperatively; 3) sialocele or salivary fistula formation persisting over one week after surgery (edema or undrained collections reported by the patient before the first visit at one week, but not found by exam at one week, were not considered significant salivary fistulas or sialoceles); 4) use of allograft to close SMAS defects; and 5) duration of superficial parotidectomy in previously untreated cases.

Tumor recurrence was not used as an outcome measure as there were no recurrences in this series, in both the previously untreated and the recurrent pleomorphic adenoma groups.

Statistical analysis was performed using SPSS 16.0 (SPSS, Inc, Chicago, IL). Descriptive statistics were produced to determine the n-values of patient histopathology, mean (SE) age of patients at surgery, and mean (SE) follow-up times. Analyses of variance (ANOVA, $P < 0.05$) were used to determine if significant differences existed between various independent variables (ie, temporary facial paresis, allograft reconstruction of SMAS defects, earlobe sensation, procedure duration, and presence or absence of sialoceles) and the surgical approaches. ANOVA and Pearson χ^2 analyses were used to determine if significant differences were found between groups (age, size of lesion, superficial and deep locations), surgical approaches (antegrade, retrograde standard, and retrograde conservative), and whether ducts were preserved in relation to postoperative sialoceles or salivary fistulas over one week.

RESULTS

Mean age at surgery was 50 (SE = 0.04) years, with a male to female ratio of 19:27. Age, size of lesion, and location were not significantly different among the three groups. All cases had preoperative evaluation with fine needle aspiration, CT scanning, and/or MRI scanning. Average follow-up was 10 months (SE = 0.03). Histopathologic analysis revealed 32 pleomorphic adenomas, nine Warthin's tumors, two Hodgkin lymphomas, one non-Hodgkin lymphoma, one myoepithelioma, and one angiolymphoid hyperplasia with eosinophilia. None had positive margins. Four cases treated for recurrent pleomorphic adenomas had the following prior surgeries: one by submandibular approach to the parapharyngeal space deep parotid gland (Group 1), one by resection of a 1-cm tumor encasing the ramus mandibularis nerve (Group 3), and two by partial superficial parotidectomy with AFI (Group 3). There were no postoperative infections, bleeding, or hematomas. Three of four parapharyngeal space tumor resections resulted in first-bite syndrome.

Temporary facial paresis occurred in five of 46 (11%) overall, two of 20 (10%) in Group 1, two of 12 (17%) in Group 2, and one of 14 (7%) in Group 3 ($P = 0.645$, NS).

Paresis affected the ramus branch in two, buccal in one, and frontal in one, with House-Brackmann grade 2 in three cases, and 3 in two cases at one week. All temporary paresis resulted after resection in five of 19 (26%) tumors with deep components as compared to no weakness occurring after 26 superficial parotid resections ($P = 0.005$). All recovered full function without permanent weakness. Tumors with components deep to the facial nerve (excepting tail of parotid lesions) were found in 19 of 46 (41%) overall, and 10 of 20 (50%), five of 12 (42%), and four of 14 (29%) of Groups 1, 2, and 3, respectively. No DFI case required conversion to AFI.

The average duration of superficial parotidectomy for previously untreated lesions was 132 (SE = 16) minutes (range, 57-175 minutes) for Group 1, 119 (SE = 21) minutes (range, 76-170 minutes) for Group 2, and 110 (SE = 16) minutes (range, 45-184 minutes) for Group 3. There were no significant differences between the groups ($P = 0.64$).

Allografts of acellular dermis were used to reconstruct SMAS defects in six of 46 (13%) overall, and two of 20 (10%), three of 12 (25%), and one of 14 (7%) of Groups 1, 2, and 3, respectively ($P = 0.433$, NS). Mean size of lesions was 3.6 cm, 2.8 cm, and 3.0 cm in Groups 1, 2, and 3, respectively, with one case in Group 3 having had three separate pleomorphic adenomas and no prior parotid surgery.

Ear lobule sensation was intact at one week in all but two Group 3 cases, but all had hypesthesia in Groups 1 and 2 despite routine attempts at preservation of the posterior branch of the great auricular nerve ($P = 0.005$).

Sialoceles/salivary fistulas persisting more than one week were found in six instances (13%), with three in Group 1, two in Group 2, and one in Group 3. One patient early in the series reconstructed with allograft had needle drainage of a sialocele collection, but it reaccumulated within 48 hours and was treated successfully, as were other subjects having sialoceles such as after parotid duct sacrifice, with pressure dressings for up to four weeks postoperatively.

The parotid duct was exposed and preserved in 10 of 14 Group 3 procedures, with seven others from Groups 1 and 2 deemed preserved due to the margin of partial parotidectomy being distant from the duct. None of these 17 developed sialoceles or salivary fistulas, compared with six of 29 (21%) with duct transection or no duct preservation attempted ($P = 0.001$).

DISCUSSION

Combining the concepts of partial parotidectomy and DFI has been reported to decrease operative time and the amount of parotid tissue resected.[8] In addition to limiting the number of facial nerve branches dissected especially in tail of parotid lesions, the length of the nerve exposed can be curtailed, which may decrease paresis.[9,10] In two cases of anterior recurrent pleomorphic adenoma having had prior antegrade exposure at other institutions, DFI obviated the need to isolate the trunk where previous dissection had been performed. In this series, no permanent facial weakness occurred, and no differences in temporary paresis were found between antegrade and distal nerve approaches. By isolating the frontal branch distally in cases of large, superiorly extending superficial tumors, dissection can be done posterior to the branch and deep to the gland safely as the nerve is traced proximally. This allows for easier en bloc resection of posterior margins and sequential ligation of superior temporal artery branches rather than incising through the gland toward the frontal branch, as with antegrade exposure.

By committing to DFI, the skin and SMAS incisions can be varied according to lesion location. When incising the SMAS anteriorly over the lesion, the great auricular nerve can be preserved with less manipulation of the posterior SMAS, and the amount of SMAS excised is minimized without the need to raise large SMAS flaps or incise the SMAS over antegrade nerve exposure routes. It is our impression that the SMAS is closed with less tension in Group 3 than Group 1 or 2, although the incidence of allograft use to reconstruct large SMAS defects was similar. SMAS watertight closure, with or without allograft, was performed in all cases in this series, to improve facial contour and limit subcutaneous salivary collection. Drains were not used, as deep drainage would broach the watertight closure, and the superficial layer between SMAS and skin flap was not felt to require drainage. There were no postoperative explorations for bleeding or hematomas.

Partial parotidectomy has previously been associated with almost double the incidence of salivary fistula (11%) compared with complete superficial or total parotidectomy, presumably due to the greater amount of salivary tissue left with partial parotidectomy.[10] In other studies, parotid duct preservation during complete superficial lobectomy has produced no salivary fistulas.[5] Applying parotid duct preservation to partial parotidectomy in 71 percent of Group 3 cases (the remainder had tumor close to or involving the duct), no sialoceles or salivary fistulas resulted when the duct was saved. Anterior exposure of the parotid duct was facilitated by distal facial nerve dissection, leading to the division between superficial and deep parotid gland as the last step in excising the specimen, in an anterior-to-posterior direction to allow better preservation of deep parotid drainage to the parotid duct. In contrast, antegrade facial nerve dissection with posterior-to-anterior division of parotid tissue may transect the duct proper or deep parotid drainage channels to the main duct before the duct is exposed anteriorly.

There are potential pitfalls and limitations of partial parotidectomy using DFI. Partial parotidectomy is not indicated for metastatic lymph nodes to the parotid gland or primary parotid malignancies, which require complete superficial or total parotidectomy to widely encompass the cancer and nodes at risk, with sacrifice of facial nerve branches when invaded by neoplasm. Care must be taken in incising the SMAS where the facial nerve is situated more superficially, both anteriorly and over deep tumors. Imaging studies showing the tumor to be in close approximation to, or indenting, the masseter muscle are clues that the facial nerve may be superficial to the lesion. Additionally, facial nerve branches may also not follow expected courses when displaced by lesions or their vessels. The facial nerve EMG monitor is an added expense, but it can be helpful in exposing branches by recognizing low-level alarms when dissecting in close proximity to the nerve, and in distinguishing great auricular nerve branches that travel anteriorly and superiorly over the tail of parotid just beneath the SMAS from facial nerve branches.

CONCLUSION

Distal facial nerve identification in partial parotidectomy is safe and reliable. Facial nerve dissection is minimized, with no increased facial paresis compared with antegrade identification, while leaving at least 1-cm glandular margins around benign neoplasms. This approach allows for greater flexibility in skin and SMAS incisions, as well as easier preservation of the great auricular nerve and parotid duct, resulting in improved sensation and fewer sialoceles/salivary fistulas.

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AUTHOR CONTRIBUTIONS

Robert C. Wang, MD, study design, writer, data collection; **Annabel E. Barber, MD**, data collection, writer; **Marcia Ditmyer, PhD**, statistical analysis; **Paul Vantine, BS**, data collection.

DISCLOSURES

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