



The identification and ligation of the parotid duct during parotidectomy

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ABSTRACT

Objective: The complication rates after parotidectomy were reported to be 13-29% and many techniques were implemented to decrease these post-parotidectomy complications.

Material and Methods: Between August 2016 and June 2022, one hundred and twenty-five patients with parotid tumors had parotidectomy and ligation of the main parotid duct in the Department of Surgical Oncology, Oncology Center, Mansoura University with the observation of its effect on the postoperative outcomes.

Results: Superficial parotidectomy was performed in 87 (69.6%) patients, total parotidectomy in 31 (24.8%) patients, and quadrantectomy in 7 (5.6%) patients. The operative time was 130.76 ± 51.5 min, and the blood loss was 81.32 ± 45.02 mL. A suction drain was placed in 106 patients and a non-suction drain was used in 19 patients. Postoperative complications included facial nerve morbidity in 12% of the patients, bleeding in 1 patient, seroma in 5 patients, edema in 1 patient, wound gap in 1 patient, wound infection in 1 patient, and keloid in 1 patient.

Conclusion: The identification and ligation of the main parotid duct during parotidectomy has favorable impacts on the incidence of post-parotidectomy complications such as salivary fistula, seroma, sialocele, and wound infections.

Keywords: Parotid tumors, parotidectomy, main parotid duct

INTRODUCTION

The parotid gland is the largest salivary gland in the human body, and it secretes about 50% of all saliva (1). The incidence of parotid gland tumors is 3% of all head and neck tumors, and it is benign in about 80% cases. The common location of parotid gland tumors is in the superficial lobe, and presents as retromandibular swelling in the front and below the external auditory meatus (2). The complication rates after parotidectomy for parotid tumors were reported to be 13-29% (3). Short-term postoperative complications such as pain, skin problems, numbness, mouth dryness, and scar problems are frequently studied and reported. This is because benign parotid tumors are the most common type, and patients were followed up for a short postoperative duration. Limited data are available about the late and long-term complications after parotidectomy (4). Many techniques such as superficial musculoaponeurotic system flap, sternomastoid muscle flap, temporoparietal fascia flap, nerve, and soft tissue transfer were employed to decrease the post-parotidectomy complications (5,6).

Anatomically, the parotid duct passes superficial to the masseter anteriorly and below the zygomatic arch by about 1 cm. It pierces the buccinator medially at the anterior border of the masseter to enter the oral cavity opposite the second upper molar (7). Most of the parotid tumors occur in the superficial lobe in 80% of the cases. It provides about 85-89% of the parotid salivary secretions. Hence, the ligation of the main parotid duct during superficial parotidectomy decreases the risk of postoperative salivary leak and its subsequent complications (8).

MATERIAL and METHODS

Study Design

Between August 2016 and June 2022, we included 125 patients in the Department of Surgical Oncology, Oncology Center, Mansoura University with parotid tumors

Cite this article as: Abouzid A, Shetiwy M, Hamdy M, Ezzat M, Elghaffar MA. The identification and ligation of the parotid duct during parotidectomy. *Turk J Surg*. 2025;41(1):92-97

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Received: 22.01.2024

Accepted: 29.01.2025

Publication Date: 27.02.2025

DOI: 10.47717/turkjsurg.2025.6339

Available at www.turkjsurg.com



who underwent parotidectomy and ligation of the main duct with the observation of the postoperative outcomes. Patients excluded from this study were those with metastatic or locally advanced parotid cancer that needs reconstruction after resection, recurrent parotid tumors, or those unfit for general anesthesia. The procedure was explained to all patients, and they signed a written informed consent before surgery. The patients had preoperative neck ultrasound (US) and computed tomography for tumor size assessment and its relation to the deep parotid lobe. Fine-needle aspiration cytology was done for pathological confirmation.

The Institutional Review Board approval of the Faculty of Medicine, Mansoura University code (R.22.03.1663) was obtained.

Surgery

All patients underwent parotidectomy under general anesthesia. A modified Blair's incision was done in the preauricular skin, and the subcutaneous tissue and superficial fascia were dissected and retracted medially to expose the whole parotid gland to the anterior border of the masseter muscle. Then it was separated from the external cartilaginous auditory canal. The small branch of the great auricular nerve that enters the parotid gland was identified and divided. The external jugular vein was ligated and divided with a 2-0 silk suture. The facial nerve trunk was identified using the tragal pointer and the tips of the mastoid processes. The dissection of the facial nerve inside the parotid gland resulted in the identification of its main branches. The superficial parotid lobe was elevated and dissected free from the facial nerve branches until the tumor was removed completely. The main parotid duct was dissected cautiously from the surrounding tissues (Figure 1) because the transverse facial artery and the buccal branch of the facial nerve can be damaged. The main duct was identified by insertion of a Nylaton catheter sized 6-8 fr (Figure 2) or a small syringe cannula (Figure 3) and then it was ligated with a 2-0 Vicryl suture. The deep lobe was resected in cases of deep lobe tumors, or superficial lobe tumors suspicious of malignancy. Hemostasis was achieved and facial nerve branches were identified and ensured to be intact. A drain was placed, and the operative bed was closed.

Data Collection and Follow-up

Patient demographics and surgical data were collected and analyzed. Early complications such as facial nerve morbidities, bleeding, wound infection, seroma, and parotid fistula were reported in addition to late complications such as tumor recurrence.

Statistical Analysis

Statistical Package for Scientific Studies (SPSS) v.26 for macOS v11.3 was used for data analysis. Qualitative data were described using numbers and percentages. Quantitative data were described, after testing normality using the Kolmogorov-Smirnov test, using medians for non-parametric data and means and standard deviation for parametric data.

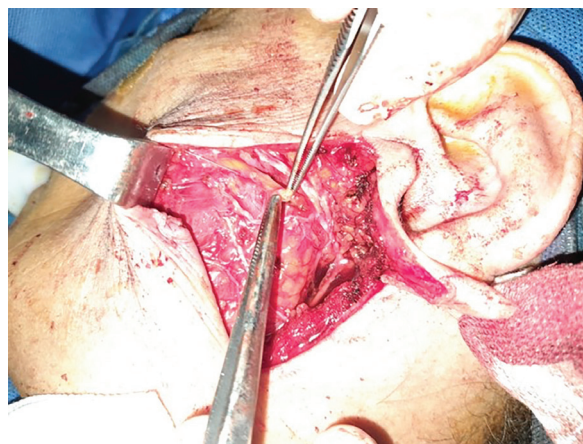


Figure 1. Dissection of the parotid duct from the surrounding tissue.

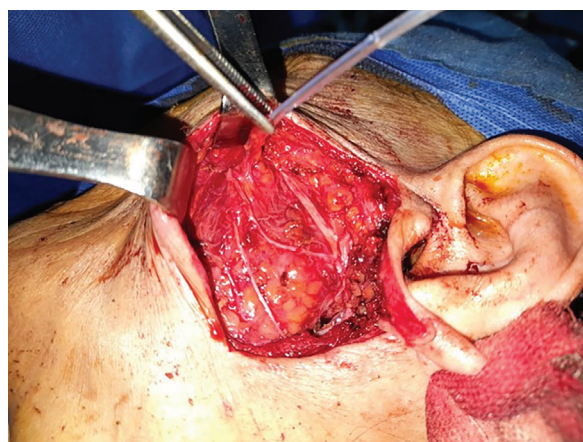


Figure 2. Insertion of a Nylaton catheter inside the parotid duct.

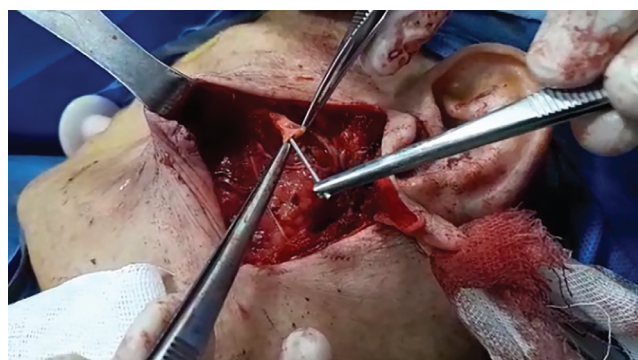


Figure 3. Insertion of a small syringe cannula inside the parotid duct.

RESULTS

Patients' Demographics

The patients had a mean age of 48.17 years. Sixty-four patients were males, and 61 patients were females. Most of the patients (74.4%) had an American Society of Anaesthesiologists score of I; 59 patients had right parotid tumors and 66 patients had left parotid tumors. Pleomorphic adenoma was the most common preoperative pathology in 74 (59.2%) patients and Warthin's tumor was the second most common in 33 (26.4%) patients. The mean preoperative tumor size was 3.16±1.12 cm (Table 1).

Table 1. Baseline characteristics of the patients	
	Patients, n=125 (%)
Age, years (mean ± SD)	48.17±14.31
Gender	
-Male	64 (51.2%)
-Female	61 (48.8%)
BMI, kg/m² (mean ± SD)	32.64±5.24
Comorbidities	
-None	91 (72.8%)
-Diabetes	6 (4.8%)
-Hypertension	11 (8.8%)
-Hepatic	3 (2.4%)
-Bronchial asthma	3 (2.4%)
-Cardiac	2 (1.6%)
-Combined	9 (7.2%)
ASA score	
-I	93 (74.4%)
-II	28 (22.4%)
-III	4 (3.2%)
Side	
-Right	59 (47.2%)
-Left	66 (52.8%)
Preoperative tumor size, cm (mean ± SD)	3.16±1.12
Preoperative pathology	
-Warthin's tumor	33 (26.4%)
-Pleomorphic adenoma	74 (59.2%)
-Oncocytic neoplasm	1 (0.8%)
-Mucoepidermoid carcinoma	2 (1.6%)
-Adenoid cystic carcinoma	1 (0.8%)
-Acinar structures	1 (0.8%)
-Atypical smear	3 (2.4%)
-Inflammatory lesions	5 (4%)
-Acinic cell carcinoma	2 (1.6%)
-Epithelial and myoepithelial cells	1 (0.8%)
-Basal cell neoplasm	1 (0.8%)
-Atypical squamous differentiation	1 (0.8%)
Preoperative biopsy methods	
-Fine needle aspiration cytology	121 (96.8%)
-Core-needle biopsy	4 (3.2%)
BMI: Body mass index, ASA: American Society of Anesthesiology, SD: Standard deviation	

Operative Outcomes

About 102 (81.65%) of the tumors were firm in consistency (Table 2), and 101 (80.8%) of the tumors were in the superficial parotid lobe. Superficial parotidectomy was done in 87 (69.6%) patients, total parotidectomy in 31 (24.8%) patients, and quadrantectomy in 7 (5.6%) patients. The tumors were related to both trunks of the facial nerve in 67 patients and were related to the lower nerve trunk in 52 patients. The mean operative time was 130.76±51.5 min with estimated blood loss of 81.32±45.02 mL. A suction drain was placed in 106 patients and a non-suction drain was used in 19 patients.

Postoperative Outcomes

Postoperative complications were in the form of facial nerve morbidity in (12%) of the patients, bleeding in 1 patient, seroma in 5 patients, edema in 1 patient, wound gap in 1 patient, wound

Table 2. Surgical characteristics of the patients	
	Patients, n=125 (%)
Tumor consistency	
-Cystic	20 (16%)
-Firm	102 (81.65%)
-Hard	3 (2.4%)
Intraoperative tumor location	
-Superficial lobe	101 (80.8%)
-Deep lobe	11 (8.8%)
-Both superficial and deep lobes	13 (10.4%)
Type of parotidectomy	
-Superficial	87 (69.6%)
-Total	31 (24.8%)
-Quadrantectomy	7 (5.6%)
Associated block neck dissection	
-No	117 (93.6%)
-Yes	8 (6.4%)
Sternomastoid dissection	
-No	111 (88.8%)
-Yes	14 (11.2%)
Relation of the tumor to the facial nerve	
-Lower trunk	52 (41.6%)
-Upper trunk	6 (4.8%)
-Both upper and lower trunks	67 (53.6%)
Operation time (min; mean ± SD)	130.76±51.5
EBL (mL; mean ± SD)	81.32±45.02
Operative complications	
-None	117 (93.6%)
-Bleeding	2 (1.6%)
-Extensive fibrosis	3 (2.4%)
-Facial nerve injury	1 (0.8%)
-Buccal nerve injury	1 (0.8%)
-Cervical branch injury	1 (0.8%)
Methods of drainage	
-Suction drain.	106 (84.8%)
-Non-suction drain	19 (15.2%)
EBL: Estimated blood loss, SD: Standard deviation	

infection in 1 patient and 1 patient had keloid. The patients stayed in the hospital for 1 day (range 1-3 days). The tumors had a pathological size of 3.54 ± 1.27 cm and the pathological tumor types were reported in Table 3. The median duration of follow-up was 11 months (range 4-61 months); tumor recurrence was reported in 2 (1.6%) patients; and the patient's overall survival was 28.5 ± 14.77 months.

DISCUSSION

Many complications may occur after parotidectomy, and the most common early postoperative complications are hematoma and morbidities affecting the facial nerve (9). Parotidectomy and main duct ligation were performed for adequate removal of the parotid gland without facial nerve damage and sufficient

safety margin; however, postoperative complications such as Frey's syndrome and facial contour deformity can occur (10). The connection between the superficial lobe of the parotid gland and the main parotid duct has made the ligation of the duct necessary to avoid possible salivary leakage after tumor excision. If the major branch connecting the excised area after superficial parotidectomy with the main duct is not ligated, there will be a regurgitation of saliva from the remaining parotid tissue, leading to a salivary leak. In 2004, Richards et al. (7) reported in their cadaveric study on the surgical anatomy of the duct system inside the parotid gland. They found that the main parotid duct had major branches running in or beyond the deep lobe in 62.1%, while it showed no branches in 37.9%. They also found small ducts connected the superficial parotid lobe and its main duct (7).

Superficial parotidectomy without main parotid duct ligation was the standard of care for chronic sialadenitis; and total parotidectomy was performed for deep-lobe diseases and cancers (11). The deep parotid lobe undergoes spontaneous atrophy following superficial parotidectomy and duct ligation (12). If the duct is left open or transected, there will be subsequent strictures, cheek swelling, fistulae, and obstructive sialadenitis (13). Various types of intraductal stents were used for duct identification, such as an epidural catheter, a double-J catheter, and a Vitallium wire (Stryker Corporation) (14). In this study, we used a small-caliber Nylaton catheter or small syringe cannula in all cases. The main parotid duct was ligated in all cases to decrease the postoperative complications related to salivary leaks, such as fistula, seroma, sialocele, and wound infections.

In this study, the mean operative duration was 130.76 min and we found extensive fibrosis in 3 patients, which made dissection and identification of the main duct difficult. Another study has reported a mean operative time of 210 min (15). The overall postoperative facial nerve complications were 12%, including early neuropraxia (7.2%) and permanent palsy (4.8%). The patients with neuropraxia were treated with neurotropic and eye drops if the upper trunk was involved; and patients with permanent nerve palsy had physiotherapy and rehabilitation. The literature reported that the early post-parotidectomy facial nerve morbidity rate was 42-45%, and the rate of permanent facial nerve paralysis was 0-3.9% (9). It has been reported that the histopathological characteristic of parotid tumors affects the rate of facial nerve paralysis. The rates of its permanent complications are 12-14% in patients with malignant parotid tumors (16). We had 15 patients with malignant parotid tumors in the current study; permanent facial nerve palsy was encountered in 4 cases with mucoepidermoid carcinoma, 1 case with acinic cell carcinoma, and 1 case with squamous cell carcinoma. Another study reported an incidence of 28.57% for transient facial nerve palsy after ligation of the main parotid duct with superficial parotidectomy for chronic sialadenitis (17).

Table 3. Postoperative outcomes and follow-up of the patients	
	Patients, n=125 (%)
Postoperative complications	
-Facial nerve complications:	
Lower trunk neuropraxia	4 (3.2%)
Lower trunk palsy	4 (3.2%)
Upper trunk neuropraxia	2 (1.6%)
Upper trunk palsy	1 (0.8%)
Both trunks neuropraxia	3 (2.4%)
Both trunks palsy	1 (0.8%)
-Bleeding	1 (0.8%)
-Seroma	5 (4%)
-Edema	1 (0.8%)
-Wound gap	1 (0.8%)
-Wound infection	1 (0.8%)
-Keloid	1 (0.8%)
Hospital stay (days; median, range)	1 (1-3)
Postoperative tumor size (cm; mean \pm SD)	3.54 \pm 1.27
Postoperative tumor type	
-Warthin's tumor	39 (31.2%)
-Pleomorphic adenoma	65 (52.0%)
-Mucoepidermoid carcinoma	5 (4.0%)
-Adenoid cystic carcinoma	1 (0.8%)
-Acinic cell carcinoma	5 (4.0%)
-Basal cell neoplasm	1 (0.8%)
-Salivary duct carcinoma	2 (1.6%)
-Chronic non-specific sialadenitis	2 (1.6%)
-Lymphoepithelial cyst	1 (0.8%)
-Salivary duct cyst	1 (0.8%)
-Capillary hemangioma	1 (0.8%)
-Squamous cell carcinoma	1 (0.8%)
-Myoepithelial carcinoma	1 (0.8%)
Follow-up (months; median, range)	11 (4-61)
Recurrence	
-No	123 (98.4%)
-Yes	2 (1.6%)
Treatment of recurrence	
-Surgical resection	1 (0.8%)
-Chemotherapy	1 (0.8%)
Overall survival (months; mean \pm SD)	28.50 \pm 14.77

SD: Standard deviation

Other postoperative complications reported in the current study were bleeding at 0.8%, mild seroma at 4%, edema at 0.8%, wound gap at 0.8%, wound infection at 0.8%, and keloid at 0.8%. All these complications were mild and managed conservatively. A study has reported that 17 patients with chronic sialadenitis underwent superficial parotidectomy with preservation of the main parotid duct. The postoperative complications included temporary facial palsy in 76.47%, Frey's syndrome in 17.64%, temporary paresthesia of the cheek in 17.64%, and painful neuroma of the greater auricular nerve in 11.76%. Moreover, there was an infection in the remnant of the parotid duct (11.76%) (18). Duct excision with superficial parotidectomy was performed in another study that included 17 patients with refractory chronic obstructive parotitis. The entire duct was removed in 13 cases. The posterior part of the duct was removed in the remaining 4 cases. One patient with a remnant duct developed an infection and needed its complete removal (19). The rate of sialoceles after parotidectomy was usually under-reported (20), and a study has detected it using US in 15 patients (10%) during the follow-up period (21). This high incidence was consistent with previous reports (22). It was hypothesized that the remaining functioning parotid tissue after superficial or partial parotidectomy promotes sialocoele formation, especially when the main parotid duct is not ligated (23). We did not encounter any case of sialocoele in the current study.

During follow-up, tumor recurrence had developed in 2 patients: one patient with salivary duct carcinoma that recurred after 22 months and was treated with surgical resection, and another patient with myoepithelial carcinoma that recurred after 30 months and received chemotherapy. Regarding mouth dryness, the patients did not complain during the follow-up period, which was consistent with the study by Chaushu et al. (24) that reported no change in the patient's mouth dryness after parotidectomy compared to their pre-operative period.

Study Limitations

The limitation of this study, is that it is a case series without comparative data for those who underwent parotidectomy without duct ligation. A randomized controlled trial may be needed in the future to compare parotidectomy with or without duct ligation.

CONCLUSION

The identification and ligation of the main parotid duct during parotidectomy have favorable impacts on the incidence of post-parotidectomy complications such as salivary fistula, seroma, sialocoele, and wound infections.

Ethics

Ethics Committee Approval: The Institutional Review Board approval of the Faculty of Medicine, Mansoura University code (R.22.03.1663) was obtained.

Informed Consent: All the patients had signed written consent before inclusion in this study.

Acknowledgments

The authors are grateful to all patients and colleagues at the Department of Surgical Oncology, Oncology Center, Mansoura University.

Footnotes

Author Contributions

Concept - A.A.; Design - A.A., M.A.E.; Supervision - A.A.; Materials - A.A., M.S.; Data Collection or Processing - A.A., M.H.; Analysis or Interpretation - A.A., M.S.; Literature Search - A.A., M.E.; Critical Review - A.A.; Writing - A.A.

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declared that this study received no financial support.

REFERENCES

1. Kay RN. The influence of saliva on digestion in ruminants. *World Rev Nutr Diet.* 1966;6:292-325.
2. Tian Z, Li L, Wang L, Hu Y, Li J. Salivary gland neoplasms in oral and maxillofacial regions: a 23-year retrospective study of 6982 cases in an eastern Chinese population. *Int J Oral Maxillofac Surg.* 2010;39:235-242.
3. Bron LP, O'Brien CJ. Facial nerve function after parotidectomy. *Arch Otolaryngol Head Neck Surg.* 1997;123:1091-1096.
4. Ciuman RR, Oels W, Jaussi R, Dost P. Outcome, general, and symptom-specific quality of life after various types of parotid resection. *Laryngoscope.* 2012;122:1254-1261.
5. Orabona, Dell'aversana Orabona G, Salzano G, Petrocelli M, Iaconetta G, Califano L. Reconstructive techniques of the parotid region. *J Craniofac Surg.* 2014;25:998-1002.
6. Yla-Kotola T, Goldstein DP, Hofer SO, Patel SN, Brown DH, Irish JC, et al. Facial nerve reconstruction and facial disfigurement after radical parotidectomy. *J Reconstr Microsurg.* 2015;31:313-318.
7. Richards AT, Digges N, Norton NS, Quinn TH, Say P, Galer C, et al. Surgical anatomy of the parotid duct with emphasis on the major tributaries forming the duct and the relationship of the facial nerve to the duct. *Clin Anat.* 2004;17:463-467.
8. You HJ, Yun TK, Jeong SH, Dhong ES, Han SK. Salivary duct carcinoma of the deep lobe of the parotid gland: A rare clinical finding. *Arch Plast Surg.* 2016;43:107-110.
9. Kaya BV, Kılıç C, Özlügedik S, Tuncel Ü, Cömert E. Long-term effects of parotidectomy. *Eur Arch Otorhinolaryngol.* 2016;273:4579-4583.
10. Wennmo C, Spandow O, Emgård P, Krouthén B. Pleomorphic adenomas of the parotid gland: superficial parotidectomy or limited excision? *J Laryngol Otol.* 1988;102:603-605.
11. Nouraei SA, Ismail Y, McLean NR, Thomson PJ, Milner RH, Welch AR. Surgical treatment of chronic parotid sialadenitis. *J Laryngol Otol.* 2007;121:880-884.
12. Antoniadis D, Harrison JD, Epivatianos A, Papanayotou P. Treatment of chronic sialadenitis by intraductal penicillin or saline. *J Oral Maxillofac Surg.* 2004;62:431-434.
13. Etöz A, Tuncel U, Özcan M. Parotid duct repair by use of an embolectomy catheter with a microvascular clamp. *Plast Reconstr Surg.* 2006;117:330-331.
14. Öztürk MB, Barutca SA, Keskin ES, Atik B. Parotid duct repair with intubation tube: Technical note. *Ann Maxillofac Surg.* 2017;7:129-131.
15. Chang JW, Leem SS, Choi HJ, Lee JH. Modified functional superficial parotidectomy with ligation of the major branch of the parotid duct extending to the superficial lobe. *Ann Plast Surg.* 2017;78:507-510.

16. Gaillard C, Périé S, Susini B, St Guily JL. Facial nerve dysfunction after parotidectomy: the role of local factors. *Laryngoscope*. 2005;115:287-291.
17. Sharma R. Superficial parotidectomy for chronic parotid sialadenitis. *Int J Oral Maxillofac Surg*. 2013;42:129-132.
18. Bhatti MA, Piggot TA, Soames JV, McLean NR. Chronic non-specific parotid sialadenitis. *Br J Plast Surg*. 1998;51:517-521.
19. Zhang L, Guo CB, Huang MX, Ma DQ, Yu GY. Parotidectomy for treatment of chronic obstructive parotitis. *Chin J Dent Res*. 2007;10:36.
20. Tuckett J, Glynn R, Sheahan P. Impact of extent of parotid resection on postoperative wound complications: a prospective study. *Head Neck*. 2015;37:64-68.
21. Grosheva M, Pick C, Granitzka T, Sommer B, Wittekindt C, Klusmann JP, et al. Impact of extent of parotidectomy on early and long-term complications: A prospective multicenter cohort trial. *Head Neck*. 2019;41:1943-1951.
22. Koch M, Zenk J, Iro H. Long-term results of morbidity after parotid gland surgery in benign disease. *Laryngoscope*. 2010;120:724-730.
23. Witt RL. The incidence and management of siaolocele after parotidectomy. *Otolaryngol Head Neck Surg*. 2009;140:z71-74.
24. Chaushu G, Dori S, Sela BA, Taicher S, Kronenberg J, Talmi YP. Salivary flow dynamics after parotid surgery: a preliminary report. *Otolaryngol Head Neck Surg*. 2001;124:270-273.