



Extracapsular dissection via single cervical incision for parotid pleomorphic adenoma

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Abstract

Objectives Surgical management of parotid pleomorphic adenoma ranges from total parotidectomy to extracapsular dissection (ECD). Minimalistic techniques aim to preserve function and minimize the rate of recurrence. This study assesses functional, aesthetic, and disease control outcomes post-ECD through a sole transverse cervical incision for parotid pleomorphic adenoma.

Materials and methods This longitudinal analysis enrolled 36 consecutive patients with pleomorphic adenoma who underwent ECD via a single cervical incision. Complications, satisfaction, salivary function, and tumor recurrence were evaluated. Salivary gland function was assessed using scintigraphy at 6 months post-surgery.

Results Tumors occurred in superficial (83%) or deep (17%) parotid inferior parts according to the European Salivary Gland Society level classification. The median tumor size was 2.8 cm (1.8–6.0 cm); the median operation time was 42 min (30–65 min). No tumor spillage or facial nerve injuries occurred. Facial nerve paralysis was only temporary in two (6%) patients, with minimal other complications. Operated parotid gland function matched the unoperated side. No recurrence was found during the median follow-up of 44 months (24–60 months).

Conclusions ECD via a single transverse cervical incision is a safe approach for benign parotid tumors, yielding excellent functional and disease control outcomes.

Clinical relevance These findings can provide clinically meaningful minimally invasive recommendations to treat pleomorphic adenoma with minimal complications.

Keywords Parotid gland · Pleomorphic adenoma · Function · Preservation · Recurrence

Introduction

Salivary gland tumors primarily occur in the parotid gland, encompassing about 80% of cases as benign tumors, with pleomorphic adenoma comprising roughly 80% of this subset [1]. These tumors often manifest as finger-like extensions infiltrating the normal glandular tissue, characterized by the absence of a distinct outer layer [2]. The histological attributes linked to an unfinished covering, capsule penetration, pseudopodia formation, and satellite nodules

can contribute to recurrence over time when growths are incompletely removed, or their capsules are disrupted [3]. Tumor enucleation is tied to elevated local recurrence rates, particularly in pleomorphic adenomas with unique histological attributes [3]. Traditional approaches to handling benign parotid growths generally involve total superficial or full parotidectomy [4]. Nevertheless, this method carries a significant risk of facial nerve paralysis and other complications [5, 6]. A comprehensive study indicates that partial parotidectomy, including extracapsular dissection (ECD), is a feasible choice for pleomorphic adenomas or other benign tumors [7]. This surgical method leads to decreased facial nerve paralysis and Frey syndrome rates, all without worsening the recurrence rate [7]. Partial parotidectomy or ECD has effectively replaced superficial or total parotidectomy in the treatment of benign parotid growths, all while keeping recurrence rates in check [8, 9]. Surgery that preserves gland

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function can potentially reduce postoperative facial nerve issues and maintain salivary flow rate [8, 10].

In the quest for enhanced postoperative aesthetics, various cosmetic incisional techniques have arisen in the context of parotidectomy [11, 12]. Once prominent, the conventional Blair incision often led to noticeable scarring, especially in cosmetically sensitive zones [13]. In response, alternative incision options, such as the modified facelift, retroauricular, periauricular, and postauricular methods, have gained popularity in the surgery of benign parotid tumors [11]. Additionally, minimally invasive techniques involving endoscopes or robotic tools have been introduced to shorten incision lengths and enhance cosmetic outcomes [14, 15]. The utilization of a sole transverse cervical incision, without prior, peri-, or retroauricular incisions, has been applied to ECD for Warthin's tumors [16, 17]. This approach offers an improved view for direct lesion access, employing a smaller skin incision and reduced flap elevation than other parotidectomy incisions [18]. Combining gland-preserving surgery with a lone transverse cervical incision can reduce operative time and morbidities while safeguarding facial nerve integrity and salivary function. Our previous work has demonstrated the clinical utility of ECD via a solitary transverse cervical incision for treating Warthin's tumor [19]. This technique has been extended to cover various types of benign parotid tumors. Hence, this study aims to comprehensively evaluate the cosmetic, functional, and disease control results of gland-preserving surgery employing the solitary cervical incision approach in patients with pleomorphic adenoma.

Materials and methods

Patient recruitment

This prospective longitudinal investigation was centered on participants who underwent parotid tumor excision through the single cervical incision method between 2018 and 2020. The study encompassed patients exclusively diagnosed with pleomorphic adenoma who underwent ECD utilizing the single cervical incision approach. The inclusion criteria also encompassed patients with pleomorphic adenoma located in the parotid inferior parts according to the European Salivary Gland Society level classification. Individuals with prior alternative procedures or recurrent parotid tumors were omitted. Patients presenting with Warthin's tumors or other histological types were also excluded from the study. Before surgery, patients with parotid masses underwent contrast-enhanced imaging accompanied by fine-needle aspiration guided by high-resolution ultrasonography. Regardless of tumor location within the superficial or deep parotid lobes, all eligible patients underwent extracapsular dissection using

the single cervical incision technique. The patients were provided informed consent and expressed their willingness to participate in postoperative follow-up. Postoperatively, patients were followed closely for at least 2 years to assess cosmetic outcomes, salivary function, and potential tumor recurrence. Ethical approval was obtained from the institutional review board and informed consent was acquired from all patients.

Surgical approach

Under general anesthesia, a single transverse cervical incision was made along the skin crease beneath the parotid mass (Figs. 1 and 2). The skin flap was meticulously elevated, along with the outer parotid capsule and sternocleidomastoid (SCM) muscle. Preservation of the greater auricular nerve was ensured during the elevation of the flap. The tumors within the gland were exposed and meticulously resected, with careful attention to wide margins and the excision of adjacent salivary tissues adhering to tumor capsules. The marginal mandibular nerve and other peripheral branches of the facial nerve distal to the tumor site were identified during capsular dissection and meticulously dissected following the course of the nerve. Preserving peripheral facial nerve branches were carefully executed through precise dissection, particularly when tumors were close to the facial nerve plane. Special care was taken to prevent capsule disruption and minimize the potential dissemination of tumor cells into the surgical site. When a lesion near the superficial parotid layer was readily identifiable, the parotid capsule was directly incised along the path of the facial nerve to expose the lesion. Throughout the dissection of the lesion, meticulous identification and preservation of the facial nerve were ensured. In cases involving the parotid deep lobe, the superficial lobe was carefully elevated from the lower and middle ends to provide access to the deep lobe tumors. Tumors were dissected along with the adjacent salivary tissues adhering to capsules, and the facial nerve trunk and/or branches were meticulously identified for removal.

Stringent assessments were performed to confirm complete lesion removal and facial nerve integrity. Hemostasis and thorough cleaning of the surgical field were carried out using bipolar bovie and saline solution. Following lesion removal, the remaining parotid tissue and capsules were meticulously approximated to enclose the exposed parotid gland. After removing deep lobe tumors, the residual superficial lobe covered the parotidectomy bed and facial nerve. Hemostasis was achieved, and fibrin sealant was applied to the surgical field. The parotid gland was securely anchored to the SCM muscle. The skin incision was closed using absorbable sutures without drainage. Tissue adhesive was carefully applied over the incision site.

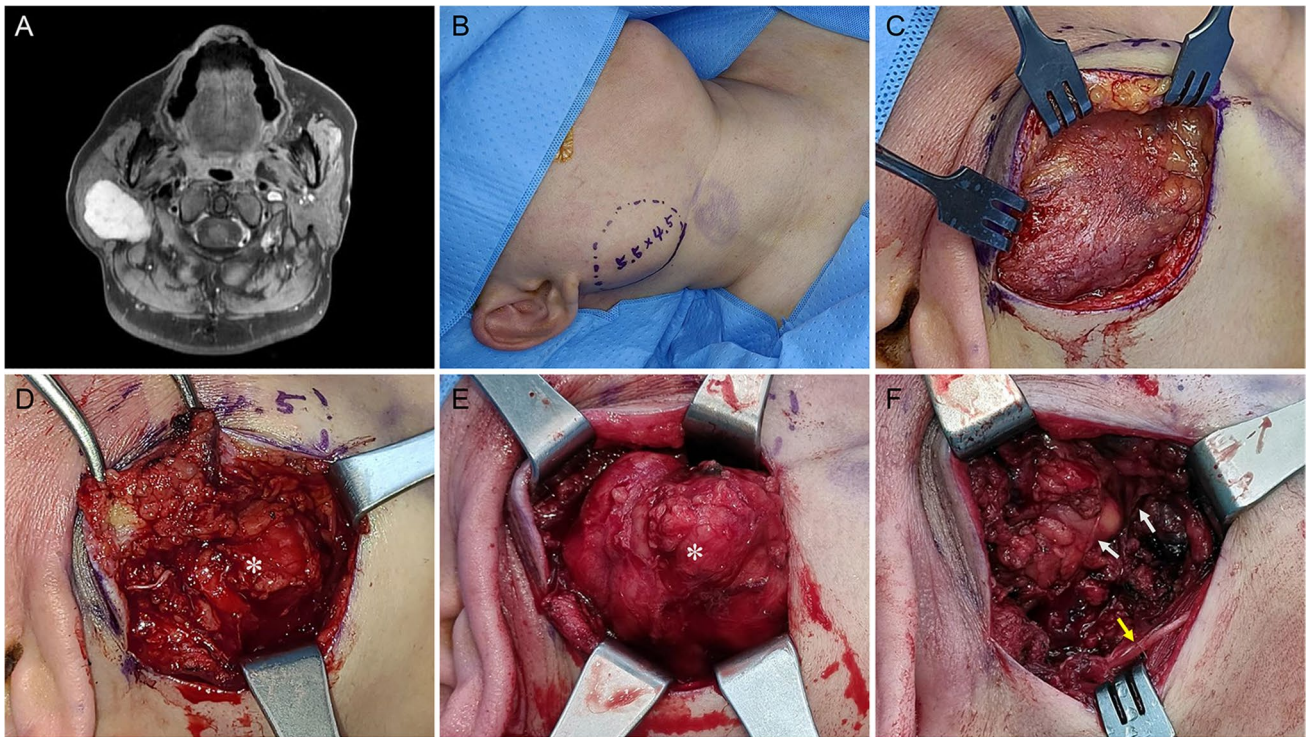


Fig. 1 Extracapsular dissection via single cervical incision for parotid pleomorphic adenoma. **A–C** A MR image, and single cervical incision and flap elevation. **D–F** Tumor excision (asterisk) while preserving the facial nerve (arrows) and the greater auricular nerve (yellow arrow)

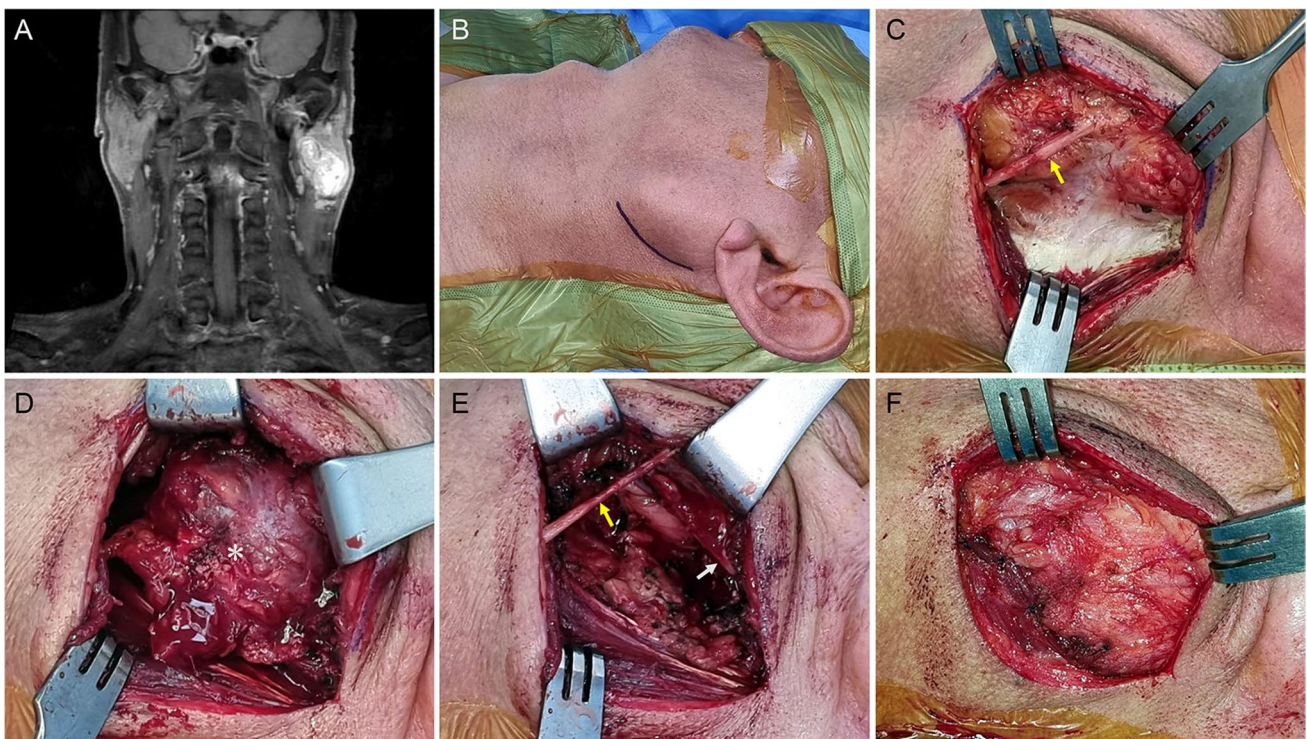


Fig. 2 Deep lobe tumor removal via single cervical incision. **A–C** A MR image and surgical exposure of the superficial lobe after utilizing the single cervical incision. **D–F** Tumor removal (asterisk) while preserving the facial (arrow) and greater auricular nerves (a yellow arrow)

External compression of the surgical site was maintained for 2 days before self-removal at home. Subsequently, patients were discharged either on the day of the procedure or the following day, with a prompt resumption of their daily activities. Comprehensive pre- and post-discharge evaluations included scrutiny of the surgical site, facial nerve function, pain assessment, and cosmetic satisfaction. All surgical interventions were conducted exclusively by a single surgeon (J.-L.R.).

Assessment of aesthetic and salivary function

Patient evaluations encompassed a thorough assessment of subjective discomfort, wound status, and neurologic outcomes. Pain perception was quantified using a visual analog scale (VAS), with higher scores indicating greater pain intensity. Individual satisfaction and salivary gland performance were meticulously evaluated at the 6-month postoperative mark through VAS scoring and salivary scintigraphy. Similarly, the assessment of incision scar aesthetics and facial contour irregularities utilized VAS scoring, with higher scores indicating increased patient contentment. Salivary scintigraphy involved the utilization of an advanced gamma camera (E. CAM; Siemens, Erlangen, Germany) to sequentially capture scintigraphic images following intravenous infusion of 10 mCi ^{99m}Tc -pertechnetate and salivary stimulation using lemon juice. The ratio of glandular uptake before stimulation was precisely calculated by dividing glandular uptake by background uptake. Subsequently, the salivary excretion fraction was determined by dividing the difference between the maximal uptake ratio post-stimulation and the maximal uptake ratio pre-stimulation by the maximal uptake ratio pre-stimulation. Evaluation of the parotid gland's secretory function entailed a comprehensive juxtaposition of continuous variables as medians and ranges, performed using SPSS 22.0 for Windows (SPSS Inc., Chicago, Illinois).

Results

Participant characteristics

Initially, 38 eligible participants were recruited for the study. However, two participants were lost to follow-up and consequently excluded from the final analysis. The remaining group comprised 36 individuals, 16 males and 20 females, and a median age of 54 years (range 42–76 years). All tumors were identified as pleomorphic adenomas, unilaterally situated within the parotid gland, with 17 on the right side and 19 on the left. The median tumor size measured 2.8 cm (1.8–6.0 cm). Tumor distribution was categorized according to the European Salivary Gland Society's criteria:

83% located in the superficial inferior part (level II) and 17% in the deep inferior part (level III). The median duration of the operation was 42 min (30–65 min), accompanied by an average blood loss of 22 mL (10–46 mL). No statistical differences in operation time or blood loss were observed based on tumor location (t -test; $P > 0.1$). None of the participants required an extension of the Blair incision. The greater auricular nerve was successfully preserved in 31 participants (86%), and no instances of the facial nerve or Stensen's duct injury were documented. Furthermore, there were no occurrences of tumor capsule rupture or tumor spillage during excision. Intraoperative and postoperative evaluations confirmed the absence of malignancy within the specimens, and all resection margins were clear.

Adverse events, functional outcomes, and recurrence

As measured by VAS scores (0–10), postoperative pain perception remained generally low, with a median score of 2 (range, 0–5). Hematoma and sialoceles were observed in four (11%) and three (8%) participants, respectively, with all cases spontaneously resolving within the first postoperative month. No claims of surgical site infection were recorded. Temporary numbness within the auricular region was reported by 13 participants (36%), and temporary paralysis of the marginal branch of the facial nerve occurred in two participants (6%). Both facial nerve paralysis and auricular numbness were transient, with complete recovery within 6 months postoperatively. The incidence of each complication was consistent across various tumor locations (t -test; $P > 0.1$). Participants expressed high satisfaction with the appearance of the incision scar and facial contour, yielding median VAS scores of 8 (5–10) and 10 (9–10), respectively. No participants developed any depressions or indentations in the operated region, and the incision scars were somewhat noticeable, maintaining facial contours (Fig. 3). The postoperative secretory function of the operated gland closely mirrored that of the unoperated gland ($P > 0.1$). Throughout the median follow-up period of 44 months (24–60 months), no occurrences of tumor recurrence were detected.

Discussion

Our study reinforces these findings, demonstrating the preservation of facial nerve function, salivary secretion, and cosmetic outcomes while ensuring effective local tumor control. Advancements in gland-preserving surgical techniques have been accompanied by cosmetic-oriented approaches that selectively expose the parotid gland and adjacent facial nerve [11]. Our study underscores the efficacy of the single cervical incision approach, resulting in



Fig. 3 Follow-up assessment of incision scar and facial contour. **A–C** The scar on the infraauricular neck 6 months post-surgery. **D–F** The scar exhibits some visibility while maintaining facial contour after the procedure

smaller incisions that lead to minimal postoperative complications while preserving salivary function and facial contour. While the modified Blair, facelift, and retroauricular hairline incisions offer adequate visual fields, they require long skin incisions [8, 20]. Though the operative field may appear restricted compared to other approaches, meticulous flap elevation provides an adequate visual field for tumor excision [18, 21, 22]. The single cervical incision allows direct access to and removal of benign parotid tumors without tumor spillage or facial nerve injury [19]. Although incision scars may be somewhat visible on the upper lateral neck, patients express high satisfaction with scar appearance and facial contour. Our study demonstrates the safety and efficacy of ECD via the single cervical incision for parotid tumors in the inferior compartment of parotid glands, regardless of superficial or deep lobe location.

This approach offers advantages such as shorter operative times, reduced blood loss, and lower facial nerve complication rates. Postoperative pain is minimal, leading to shorter hospital stays. Moreover, gland-preserving surgery maintains parotid gland secretory function, potentially benefiting oral health [20]. Proficiency in this technique may require experience, and endoscopy may prove advantageous in some instances. It is important to note the potential for facial nerve compromise due to a confined visual field and the theoretical risk of tumor spillage. Comparative studies contrasting this

approach with alternative parotidectomy methods are needed for further validation.

The findings substantiate the effectiveness of gland-preserving surgery for parotid tumors, particularly benign variants. However, caution is needed when considering this approach for malignant tumors, and obtaining a preoperative pathological diagnosis is crucial. This technique is suitable for patients with non-multifocal tumors localized in the inferior or posterior parotid gland region. Alternative approaches with larger incisions may be recommended for complex cases, including large tumors, deep lobe locations, or lesions with compromised visibility. Long-term observational outcomes from this study, combined with future randomized controlled trials, will further solidify the effectiveness of this surgical approach. While challenges may arise due to the rarity of parotid tumors for large-scale trials, this longitudinal single-arm study provides valuable insights into the safety and functional benefits of gland-preserving surgery for parotid tumors, reinforcing its viability as a compelling treatment option.

Conclusions

ECD via a single cervical incision offers numerous advantages in managing benign parotid tumors. This technique stands as a testament to favorable functional, aesthetic, and

disease control outcomes. It effectively preserves facial nerve integrity, salivary function, and aesthetics while reducing surgical morbidity and operative times and achieving excellent cosmetic results. Building upon the conclusions drawn from this study, functional gland-preserving surgery utilizing a single cervical incision proves to be a productive and secure therapeutic approach for parotid pleomorphic adenoma and other benign tumors, ensuring robust local control without compromising functional outcomes.

Author contributions Jong-Lyel Roh, conception and design of the study, data acquisition, analysis and interpretation of data, drafting the manuscript, and accountable for all aspects of the work.

Declarations

Ethics approval and consent to participate The research was approved by the Ethics Committee. Informed consent was provided by all patients.

Consent for publication Informed permission for publication was acquired from all patients.

Competing interests The authors declare no competing interests.

References

- Iyer J, Hariharan A, Cao UMN, Mai CTT, Wang A, Khayambashi P, Nguyen BH, Safi L, Tran SD (2021) An overview on the histogenesis and morphogenesis of salivary gland neoplasms and evolving diagnostic approaches. *Cancers (Basel)* 13. <https://doi.org/10.3390/cancers13153910>
- Kalwaniya DS, Meena R, Kumar D, Tolat A, Arya SV (2023) A review of the current literature on pleomorphic adenoma. *Cureus* 15:e42311. <https://doi.org/10.7759/cureus.42311>
- Witt RL (2002) The significance of the margin in parotid surgery for pleomorphic adenoma. *The Laryngoscope* 112:2141–2154. <https://doi.org/10.1097/00005537-200212000-00004>
- Huang G, Yan G, Wei X, He X (2015) Superficial parotidectomy versus partial superficial parotidectomy in treating benign parotid tumors. *Oncol Lett* 9:887–890. <https://doi.org/10.3892/ol.2014.2743>
- Infante-Cossio P, Gonzalez-Cardero E, Garcia-Perla-Garcia A, Montes-Latorre E, Gutierrez-Perez JL, Prats-Golczer VE (2018) Complications after superficial parotidectomy for pleomorphic adenoma. *Med Oral Patologia Oral y Cirugia Bucal* 23:e485–e492. <https://doi.org/10.4317/medoral.22386>
- Bonavolontà P, Dell'Aversana Orabona G, Maglitto F, Abbate V, Committeri U, Salzano G, Improta G, Iaconetta G, Califano L (2019) Postoperative complications after removal of pleomorphic adenoma from the parotid gland: a long-term follow up of 297 patients from 2002 to 2016 and a review of publications. *Br J Oral Maxillofac Surg* 57:998–1002. <https://doi.org/10.1016/j.bjoms.2019.08.008>
- Foresta E, Torrioni A, Di Nardo F, de Waure C, Poscia A, Gasparini G, Marianetti TM, Pelo S (2014) Pleomorphic adenoma and benign parotid tumors: extracapsular dissection vs superficial parotidectomy—review of literature and meta-analysis. *Oral Surg Oral Med Oral Pathol Oral Radiol* 117:663–676. <https://doi.org/10.1016/j.oooo.2014.02.026>
- Roh JL, Kim HS, Park CI (2007) Randomized clinical trial comparing partial parotidectomy versus superficial or total parotidectomy. *Br J Surg* 94:1081–1087. <https://doi.org/10.1002/bjs.5947>
- McGurk M, Thomas BL, Renehan AG (2003) Extracapsular dissection for clinically benign parotid lumps: reduced morbidity without oncological compromise. *Br J Cancer* 89:1610–1613. <https://doi.org/10.1038/sj.bjc.6601281>
- Mlees MA, Elbarbary AH (2020) Superficial or partial superficial parotidectomy for the treatment of primary benign parotid tumors. *J Surg Oncolo* 122:1315–1322. <https://doi.org/10.1002/jso.25970>
- Colaianni CA, Richmon JD (2021) Cosmetic approaches to parotidectomy. *Otolaryngol Clin North Am* 54:583–591. <https://doi.org/10.1016/j.otc.2021.02.010>
- Ahn D, Lee GJ, Sohn JH (2020) Individualized use of facelift, retroauricular hairline, and V-shaped incisions for parotidectomy. *J Oral maxillofac Surg* 78(2339):e2331–2339.e2338. <https://doi.org/10.1016/j.joms.2020.08.021>
- Zhang Q, Yang Y, Yang P, Tan Y, Liu X, Xiong B, Qiu J (2020) Cosmetic approach selection in parotidectomy for benign parotid gland tumour according to its location. *J Plast Reconstr Aesthet Surg* 73:921–926. <https://doi.org/10.1016/j.bjps.2019.10.012>
- Li T, Liu Y, Wang Q, Qin Y, Gao W, Li Q, Schiferle E, Xiao S (2019) Parotidectomy by an endoscopic-assisted postauricular-groove approach. *Head Neck* 41:2851–2859. <https://doi.org/10.1002/hed.25720>
- Park YM, Kim DH, Kang MS, Lim JY, Kim SH, Choi EC, Koh YW (2020) Real impact of surgical robotic system for precision surgery of parotidectomy: retroauricular parotidectomy using da Vinci surgical system. *Gland Surg* 9:183–191. <https://doi.org/10.21037/gs.2020.01.05>
- Mantsopoulos K, Goncalves M, Koch M, Traxdorf M, Schapher M, Iro H (2019) Going beyond extracapsular dissection in cystadenolymphomas of the parotid gland. *Oral Oncol* 88:168–171. <https://doi.org/10.1016/j.oraloncology.2018.12.001>
- Mantsopoulos K, Goncalves M, Koch M, Iro H (2018) Extracapsular dissection for warthin tumors despite the risk of ipsilateral metachronous occurrence. *The Laryngoscope* 128:2521–2524. <https://doi.org/10.1002/lary.27166>
- Levy D, Ronen O (2022) Assessment of a limited-access parotidectomy technique's complications and scar characteristics - a cohort study. *J Plast Reconstr Aesthet Surg* 75:4416–4422. <https://doi.org/10.1016/j.bjps.2022.08.066>
- Roh JL (2022) Function-preserving surgery via single transverse cervical incision for Warthin's tumor in the parotid gland. *Head Neck* 44:1335–1341. <https://doi.org/10.1002/hed.27027>
- Yu G, Peng X (2019) Conservative and functional surgery in the treatment of salivary gland tumours. *Int J Oral Sci* 11:22. <https://doi.org/10.1038/s41368-019-0059-9>
- Nair S, Aishwarya JG, Jain A, Pavithra V, Mohan S (2022) Mini-incision parotidectomy—our technique. *Indian J Otolaryngol Head Neck Surg* 74:6174–6179. <https://doi.org/10.1007/s12070-021-02882-5>
- Roh JL (2022) Gland-preserving surgery of benign parotid tumours via postauricular sulcus incision: is it safe and effective with the scarless incision? *Oral Oncol* 127:105808. <https://doi.org/10.1016/j.oraloncology.2022.105808>

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