



Comparison of Partial Versus Superficial or Total Parotidectomy for Superficial T1-2 Primary Parotid Cancers

Seung Hoon Han¹ · Jihae Lee¹ · Jeong Wook Kang² · Heejin Kim² · Dong Jin Lee³
Jin Hwan Kim³ · Il-Seok Park¹

¹Department of Otorhinolaryngology-Head and Neck Surgery, Hallym University Dongtan Sacred Heart Hospital, Hallym University College of Medicine, Hwaseong, Korea

²Department of Otorhinolaryngology-Head and Neck Surgery, Hallym University Sacred Heart Hospital, Hallym University College of Medicine, Anyang, Korea

³Department of Otorhinolaryngology-Head and Neck Surgery, Kangnam Sacred Heart Hospital, Hallym University College of Medicine, Seoul, Korea

Objectives. This study aimed to compare the oncological outcomes of partial versus superficial or total parotidectomy for superficial T1 or T2 primary parotid cancers and investigate their prognostic factors and recurrence patterns.

Methods. The medical records of 77 patients with T1–2 primary parotid malignancies between May 2003 and March 2022 were retrospectively reviewed. Univariate and multivariate analyses were performed to evaluate the prognostic factors associated with overall survival, disease-free survival, and local and distant recurrence.

Results. The average follow-up duration was 70.2 months (range, 12–202 months). The 5-year overall and disease-free survival rates were 88.7% and 77.1%, respectively. Twenty-two patients underwent partial parotidectomy, and 55 underwent superficial or total parotidectomy. There were no significant differences in the disease recurrence ($P=0.320$) and mortality rates ($P=0.884$) of the partial and superficial or total parotidectomy groups. The mean duration of surgery was shorter and the overall complication rates were significantly lower in the partial group than in the superficial or total parotidectomy group ($P=0.049$). Sixteen cases of recurrence occurred during the study period (20.8%). Univariate analyses showed that high-grade tumors ($P=0.006$), lymphovascular invasion ($P=0.046$), and regional lymph node metastasis ($P=0.010$) were significant risk factors for disease recurrence. Multivariate analysis identified regional lymph node metastasis as an independent prognostic factor for disease recurrence ($P=0.027$), and lymphovascular invasion as an independent prognostic factor for overall survival ($P=0.033$).

Conclusion. The conservative surgical approach of partial parotidectomy can yield oncological outcomes comparable to those of superficial or total parotidectomy with careful patient selection in T1-2 parotid cancers.

Keywords. Parotid Cancer; Parotid Gland; Adjuvant Radiotherapy; Survival; Recurrence

INTRODUCTION

Parotid cancer accounts for 1%–3% of head and neck tumors [1]. However, primary parotid cancer is rare and has diverse histological characteristics, which has led to varied perspectives on the appropriate surgical extent and indications for adjuvant therapy for parotid cancer. Generally, the surgical extent is based on the extent of the tumor and the invasion of the surrounding struc-

• Received October 18, 2023
Revised December 10, 2023
Accepted December 24, 2023

• Corresponding author: **Il-Seok Park**
Department of Otorhinolaryngology-Head and Neck Surgery, Hallym University Dongtan Sacred Heart Hospital, Hallym University College of Medicine, 7 Keunjaebong-gil, Hwaseong 18450, Korea
Tel: +82-31-8086-2670, Fax: +82-31-8086-2709
Email: ispark@hallym.or.kr

Copyright © 2024 by Korean Society of Otorhinolaryngology-Head and Neck Surgery.

This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (<https://creativecommons.org/licenses/by-nc/4.0>) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

tures, and various ranges of parotidectomy can be performed.

Parotidectomy is classified based on the range of excised parotid tissue and is a relatively standardized technique for facial nerve dissection. Total parotidectomy involves the removal of the entire parotid tissue, whereas superficial parotidectomy refers to the complete removal of the parotid tissue that lies superficial to the facial nerve. Partial parotidectomy involves the partial excision of the superficial lobe of the parotid gland, including the tumor and surrounding normal tissues [2].

Conservative partial parotidectomy has been reported to be effective for benign tumors of the parotid gland, as it requires shorter surgery and has lower morbidity, such as facial nerve injury, than superficial parotidectomy, which requires full facial nerve dissection [3,4]. For high-grade or advanced-stage parotid cancer, a radical surgical strategy is preferred; however, for small tumors (T1–2) confined to the superficial lobe of the parotid gland, the efficacy of conservative partial parotidectomy remains unclear. Therefore, this study aimed to compare the clinical outcomes of partial parotidectomy and radical surgical treatment, including superficial or total parotidectomy, for the management of T1–2 primary parotid cancers.

MATERIALS AND METHODS

Study population and variables

The medical records of 77 patients with T1–2 primary parotid malignancies between May 2003 and March 2022 were reviewed retrospectively. Patients with tumor extension into the deep lobes, facial nerve invasion during surgery, or preoperative facial nerve palsy were excluded. Patients with incomplete medical records, those with no specific description of the surgical extent of the parotid gland, or those with a history of previous parotid gland treatment were also excluded. Clinical characteristics, including age, sex, tumor size, T stage, preoperative biopsy results, extent of surgery, duration of surgery, tumor histology, tumor pathological data (extracapsular extension, perineural invasion, lymphovascular invasion [LVI], and resection margin status), postoperative complications, and postoperative radiation therapy were analyzed. Partial excision of the superficial lobe of the parotid gland,

including the tumor and surrounding normal tissues, was defined as partial parotidectomy. Total resection of all parotid tissues was defined as total parotidectomy, and complete removal of the superficial part of the parotid gland, which was defined as superficial parotidectomy, involved the full dissection of the facial nerve. According to the World Health Organization classification, the histologic grade of each cancer was classified as low/intermediate or high [5]. The pathological stages were evaluated according to the American Joint Committee on Cancer TNM staging system (8th edition) [6]. The overall survival was defined as the duration from the date of surgery to the date the patient died or was last known to be alive. Disease-free survival was defined as the duration from the date of surgery to the date of recurrence.

Approval for this study was obtained from the Institutional Review Board of Hallym University Dongtan Sacred Heart Hospital (No. 2022-07-005-002), and the requirement for informed consent was waived.

Statistical analysis

Fisher's exact test and Pearson's chi-square test were used to analyze categorical variables. Student *t*-test or the Wilcoxon rank-sum test was used to analyze the continuous and ranked variables, such as age, which were expressed as mean \pm standard deviation. Kaplan-Meier analyses were used to visualize the overall and disease-free survival rates. To assess the differences between the survival curves, the log-rank test was used for each predictor and covariate. A multivariate Cox proportional hazards regression model was used to assess the prognostic factors for overall and disease-free survival. All data were analyzed using IBM SPSS ver. 25.0 (IBM Corp.). For all cases, a *P*-value of <0.05 was considered statistically significant.

RESULTS

Clinical and histopathological characteristics

Table 1 summarizes the clinical and histopathological characteristics of the patients included in this study. The grades were low or intermediate for 50 tumors (64.9%) and high for 27 tumors (35%). Histologically, mucoepidermoid carcinomas were the most common ($n=30$, 38.9%); four of them were high-grade cancers. Of the 69 tumors for which fine-needle aspiration cytology or core needle biopsy was performed preoperatively, 45 (65.2%) were malignant. The remaining 24 (34.8%) were benign or indeterminate and were unexpectedly diagnosed as parotid cancer based on postoperative pathology.

Surgical extent of parotidectomy and neck dissection

Twenty-two patients (28.6%) underwent partial parotidectomy, and 55 (71.4%) underwent superficial or total parotidectomy. The total duration of partial parotidectomy, excluding the dura-

HIGHLIGHTS

- Partial parotidectomy may be a safe and effective alternative to superficial or total parotidectomy in patients with superficially located small primary parotid cancers.
- Partial parotidectomy has the potential to minimize surgical morbidity without compromising oncological outcomes.
- Regional lymph node metastasis was an independent prognostic factor for disease recurrence, and lymphovascular invasion was an independent prognostic factor for overall survival.

tion of neck dissection, was 143.2 ± 80.0 minutes, which was significantly shorter than that of superficial or total parotidectomy, at 225.5 ± 112.3 minutes ($P=0.004$). There was no significant

Table 1. Clinical and histopathological characteristics of the parotid tumors (n=77)

Variable	Partial parotidectomy	Superficial or total parotidectomy	P-value
Number	22 (28.6)	55 (71.4)	-
Age (yr)	49.3 ± 19	51.1 ± 16	0.683
Sex			0.943
Male	11 (50.0)	28 (50.9)	
Female	11 (50.0)	27 (49.1)	
Tumor size (mm)	2.3 ± 0.9	2.5 ± 0.8	0.232
T stage			0.053
T1	12 (54.5)	17 (30.9)	
T2	10 (45.5)	38 (69.1)	
Histopathology			0.050
Low/intermediate grade	18 (81.8)	32 (58.2)	
High grade	4 (18.2)	23 (41.8)	
Preoperative biopsy			0.959
Malignant	11 (50.0)	34 (61.8)	
Benign or indeterminate	6 (27.3)	18 (32.7)	
Undone	5 (22.7)	3 (5.5)	
ECE	2 (9.1)	10 (18.2)	0.491
PNI	1 (4.5)	6 (10.9)	0.666
LVI	0	8 (14.5)	0.096
Resection margin	5 (22.7)	11 (20.0)	0.765
Postoperative complication	3 (13.6)	20 (36.4)	0.049*
Facial nerve weakness	1 (4.5)	10 (18.2)	0.122
Others	2 (9.1)	10 (18.2)	0.491
Operation time (min)	143.2 ± 80.0	225.5 ± 112.3	0.004*
Postoperative radiation therapy	6 (27.3)	28 (50.9)	0.059

Values are presented as number (%) or mean \pm standard deviation. ECE, extracapsular extension; PNI, perineural invasion; LVI, lymphovascular invasion.

*Statistically significant ($P < 0.05$).

difference in the resection margin positivity between the two groups ($P=0.765$). Postoperative facial nerve palsy occurred in 11 patients, and all but one patient recovered completely between 3 and 6 months after surgery. Frey syndrome occurred in six patients, and seroma occurred in six patients after surgery; however, they were cured spontaneously with repeated aspiration. The postoperative facial nerve palsy rate was lower in the partial group than in the superficial or total parotidectomy group (4.5% vs. 18.2%, $P=0.122$), although the difference was not significant. The complication rate was significantly lower in the partial group than for the superficial or total parotidectomy group (13.6% vs. 36.4%, $P=0.049$). There was no significant difference in disease recurrence or mortality between the partial and superficial or total parotidectomy groups ($P=0.320$ and $P=0.884$, respectively).

Neck dissection was performed for 47 patients. Therapeutic modified radical neck dissection was performed in nine patients with clinically positive nodes. Occult metastases developed in nine (23.7%) of 38 patients who underwent elective neck dissection. Among them, eight had high-grade tumors (38.1%, 8/21; $P=0.020$).

Survival rate and prognostic factors

The mean follow-up duration for all the patients was 70.2 months (range, 12–202 months). The 5-year overall and disease-free survival rates were 88.7% and 77.1%, respectively (Fig. 1). The univariate analyses showed that histological grade ($P=0.006$), LVI ($P=0.046$), and pathologic cervical lymph node metastasis ($P=0.010$) were significantly associated with disease recurrence. However, age, sex, tumor size, resection margin, and postoperative radiation therapy were not significantly associated with recurrence (Table 2). Multivariate analyses showed that pathologic cervical lymph node metastasis was significantly associated with disease recurrence ($P=0.027$) (Table 3). LVI ($P < 0.001$) and age ($P=0.017$) were significantly associated with overall survival in

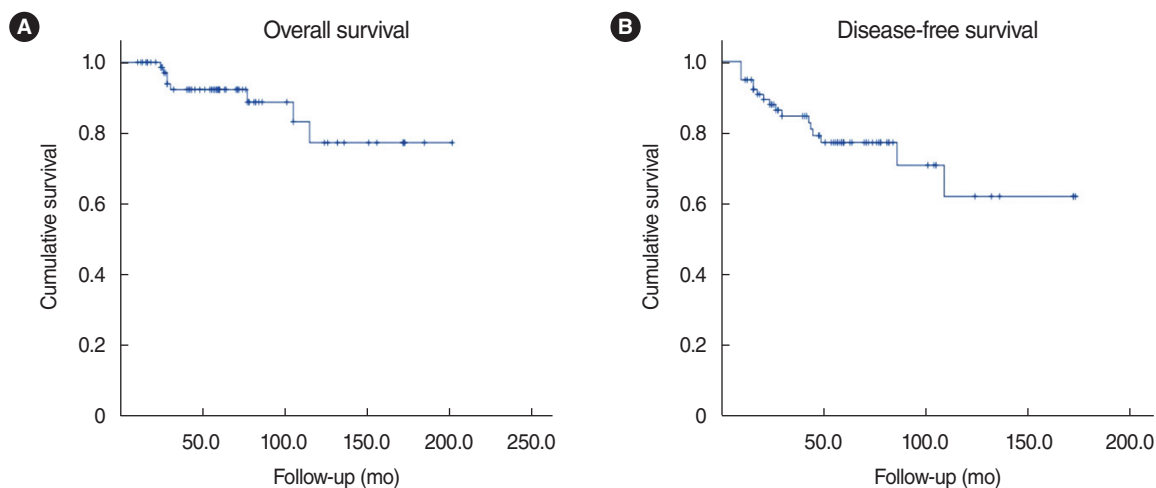


Fig. 1. Survival curves of patients with T1-2 primary parotid cancers. (A) Overall survival rates. (B) Disease-free survival rates.

Table 2. Results of univariate analysis for prognostic factors on disease-free survival and overall survival in T1-2 parotid gland cancer

Variable	Number	5-Year DFS (%)	<i>P</i> -value	5-Year OS (%)	<i>P</i> -value
Age (yr)			0.520		0.017*
≤65	63	80.4		94.2	
>65	14	59.9		83.9	
Sex			0.292		0.215
Male	39	76.7		93.8	
Female	38	77.9		90.9	
T stage			0.344		0.312
T1	29	83.8		95.5	
T2	48	73.7		90.6	
Histopathological grade			0.006*		0.574
Low/intermediate grade	50	84.6		92.4	
High grade	27	63.5		92.0	
ECE			0.305		0.287
No	65	91.7		92.6	
Yes	12	74.5		90.9	
PNI			0.056		0.213
No	70	77.7		94.7	
Yes	7	71.4		71.4	
LVI			0.046*		<0.001*
No	69	79.0		96.4	
Yes	8	62.5		62.5	
Resection margin			0.586		0.684
No	61	77.5		92.3	
Yes	16	74.9		92.3	
Parotidectomy			0.320		0.884
Partial	22	88.1		92.9	
Superficial or total	55	74.1		92.1	
Postoperative radiation therapy			0.225		0.998
No	43	80.6		94.4	
Yes	33	72.4		89.6	
LN metastasis			0.010*		0.147
No	59	69.4		95.8	
Yes	18	57.9		81.9	

DFS, disease-free survival; OS, overall survival; ECE, extracapsular extension; PNI, perineural invasion; LVI, lymphovascular invasion; LN, lymph node.

*Statistically significant ($P < 0.05$).

the univariate analyses (Table 2). Only LVI was significantly associated with overall survival in the multivariate analyses ($P = 0.003$) (Table 3). Regarding the prognostic factors according to the recurrence patterns, histopathological grade ($P = 0.033$) showed a significant association with local recurrence, and LVI ($P = 0.021$) showed a significant association with distant metastasis (Fig. 2).

Recurrences and cause of death

Sixteen cases of recurrence occurred during the study period (20.8%). The mean duration from initial treatment to disease relapse was 27.6 months. Seven cases were high-grade (25.9%, 7/27), and nine were low-grade (18%, 9/50). There were six cases of local recurrence, four cases of regional recurrence, one case

Table 3. Results of multivariate Cox regression analysis for prognostic factors on disease-free survival and overall survival in T1-2 parotid gland cancer

Variable	HR	95% CI	<i>P</i> -value
Disease-free survival			
LN metastasis	3.542	1.152–10.893	0.027*
Histopathology grade	3.275	0.863–12.437	0.081
LVI	1.807	0.370–8.815	0.464
Overall survival			
LVI	8.778	2.127–36.226	0.003*
Age	4.039	0.971–16.801	0.055

HR, hazard ratio; CI, confidence interval; LN, lymph node; LVI, lymphovascular invasion.

*Statistically significant ($P < 0.05$).

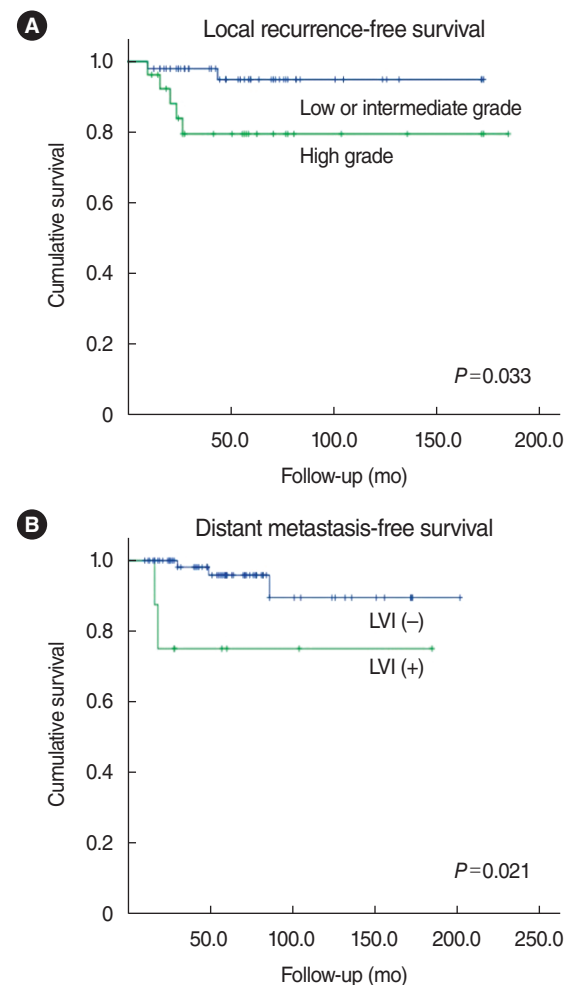


Fig. 2. Survival curves of recurrence patterns. (A) Local recurrence-free survival rates according to the histopathological grade. (B) Distant metastasis-free survival rates according to lymphovascular invasion (LVI).

of loco-regional recurrence, and five cases of distant metastasis. Of the five patients with distant metastasis, four died due to disease progression during the study period.

DISCUSSION

The efficacy of partial parotidectomy has been reported in previous studies, including randomized clinical trials, mainly for the treatment of benign tumors [3,4]. Conservative partial parotidectomy has been reported to be advantageous for functional preservation of the facial nerve over complete superficial parotidectomy or total parotidectomy for malignant tumors of the parotid gland [7]. However, there has not yet been a randomized clinical trial on the oncological outcomes of partial parotidectomy, and comparative studies conducted under the same conditions have not yet been reported. Partial parotidectomy is acceptable for the treatment of superficial T1–2 low-grade parotid cancers because of the low recurrence rate after complete excision, similar to that of other benign salivary neoplasms [8]. Additionally, in cases where there are no adverse histopathological features, studies have suggested favorable oncological outcomes after complete tumor excision alone without adjuvant treatment, despite close surgical margins [9-11].

Until now, total parotidectomy has been preferred for the treatment of high-grade parotid cancer [12,13] because the rate of lymph node metastasis for high-grade parotid cancer is high. Additionally, the parotid gland is considered a lymphatic basin, and there are intraparotid lymph nodes in the deep lobe of the parotid gland to which tumors can metastasize. Therefore, total resection, including the deep lobe, is considered appropriate [14]. However, Lim et al. [15] reported favorable results of conservative parotidectomy in 43 patients with parotid gland cancer, including high-grade malignancies (37%, 16/43), with 5-year overall survival and disease-free rates of 88% and 79%, respectively. Furthermore, Park et al. [16] reported no significant differences in the treatment outcomes of patients who underwent and those who did not undergo total parotidectomy for T1–2 high-grade parotid gland cancers. Lee and Chuang [17] reported that, according to their analysis of the Surveillance, Epidemiology, and End Results Program database, total parotidectomy did not significantly increase disease-specific survival and overall survival relative to partial parotidectomy in early-stage adenoid cystic carcinoma. In this study, partial parotidectomy also showed no significant differences in recurrence and survival relative to superficial or total parotidectomy. The incidence of facial palsy was lower in the partial group than in the total or superficial parotidectomy group (4.5% vs. 18.2%). The rate of complications, including Frey syndrome, was also significantly lower for the partial group than for the total or superficial parotidectomy group.

In this study, patients who underwent extracapsular dissection (ECD) were excluded. ECD is a surgical technique that involves removing the tumor with a capsule and thin rim of surrounding glandular tissue, without planned facial nerve identification. Although it has been reported that there was no significant difference in survival or recurrence between ECD and superficial parotidectomy in unexpected malignancy cases misdiagnosed as a

benign tumor before surgery, there are concerns about resection margin involvement or a close margin [18].

The comparable recurrence and survival rates of partial parotidectomy and superficial or total parotidectomy may be attributed to the role of adjuvant radiation therapy after surgery. In this study, nine of the 11 patients developed local or regional recurrence, even though their resection margins were negative. In contrast, all 16 patients with positive resection margins received radiation therapy after surgery, and only two of them showed loco-regional recurrence; therefore, postoperative radiation therapy appears to be effective for local control. In early-stage adenoid cystic carcinoma of the parotid gland, total parotidectomy did not show superior oncological outcomes over partial parotidectomy [17]. Postoperative radiation therapy is thought to have contributed to this, as it is mostly administered because of the characteristics of adenoid cystic carcinoma.

Even for high-grade parotid cancers with adverse features that are likely to metastasize to the intraparotid lymph nodes, the benefit of radical parotid surgery is diminished because the extent of postoperative radiation therapy includes the remaining parotid gland. Furthermore, if total parotidectomy is performed and adverse features are observed in postoperative pathology results, adjuvant radiation cannot be omitted. Additionally, determining the histological risk grade through preoperative biopsies or intraoperative frozen section pathology results is challenging. This study suggests that partial parotidectomy can be an acceptable surgical option for selected cases, including high-grade parotid cancer, if it is limited to the superficial lobe of the parotid gland and an appropriate surgical margin can be obtained.

Previous studies have reported that tumor grade, tumor size, histopathological adverse features, facial nerve invasion, and regional or distant metastasis affect the recurrence and survival rates of parotid cancer [19,20]. In this study, the histological grade, LVI, and regional metastasis were significantly associated with disease recurrence in the univariate analysis, but only regional metastasis was a significant factor for recurrence in the multivariate analysis. Therefore, neck node management is important for prognostication, even for early-stage parotid cancer. In terms of recurrence patterns, high histopathological grades were associated with local recurrence, and LVI was significantly associated with distant metastasis. Therefore, close observation of local recurrence along with postoperative radiotherapy should be considered for patients with high-grade tumors. Patients with evidence of LVI require careful follow-up for distant metastasis. Some reports have stated that adjuvant concurrent chemoradiotherapy had no survival benefit relative to adjuvant radiotherapy alone; however, additional research is needed on the application of systemic therapy for selected patients, such as those who are positive for LVI [21,22].

This study had some limitations; therefore, caution is required when generalizing our results. This was a retrospective study involving a relatively small sample of patients. Parotid cancer has

a low prevalence and various histological characteristics, and it requires a long follow-up duration to observe recurrence. Several reports have compared the extent of surgery for the treatment of parotid cancer; however, this study is the first to compare less than superficial parotidectomy and superficial or total parotidectomy [16,17]. Although there has been no randomized trial, if data from settings similar to that of this study are reported and shared by multiple centers, subgroup analyses could be performed to establish clinical recommendations based on higher-quality evidence.

We compared the clinical outcomes of conservative partial parotidectomy with those of more aggressive superficial or total parotidectomy in patients with T1–2 primary parotid cancer limited to the superficial lobe of the parotid gland. With careful patient selection, the conservative approach of partial parotidectomy yielded oncological and clinical outcomes comparable to those of superficial or total parotidectomy. In clinical practice, approximately one-third of parotid malignancies are unexpectedly diagnosed after surgery. Additionally, determining the histopathological grade using frozen sections during surgery is challenging, and the diagnostic accuracy of malignancy is only approximately 70%. For these cases, it is not easy to opt for aggressive surgical ablation of the parotid gland as the initial treatment; therefore, the results of this study are valuable for decision-making regarding the treatment of early-stage primary parotid cancer. Adjuvant radiation therapy is recommended and active follow-up for recurrence is necessary when postoperative histopathology shows a high-grade cancer, positive resection margins, or LVI.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

ACKNOWLEDGMENTS

This research was supported by Hallym University Research Fund (No. HURF-2022-28).

ORCID

Seung Hoon Han <https://orcid.org/0000-0001-7156-993X>
 Jihae Lee <https://orcid.org/0009-0001-5423-1192>
 Jeong Wook Kang <https://orcid.org/0000-0002-0305-1255>
 Heejin Kim <https://orcid.org/0000-0001-6157-3636>
 Dong Jin Lee <https://orcid.org/0000-0002-2661-3361>
 Jin Hwan Kim <https://orcid.org/0000-0002-3221-9408>
 Il-Seok Park <https://orcid.org/0000-0001-8143-8968>

AUTHOR CONTRIBUTIONS

Conceptualization: SHH, ISP. Data curation: SHH, JL, JWK, HK, DJL, JHK. Formal analysis: SHH. Methodology: SHH, JL. Writing—original draft: SHH. Writing—review & editing: all authors.

REFERENCES

- Bussu F, Rigante M, Giglia V, Bastanza G, De Corso E, Almadori G, et al. Clinical history, prognostic factors, and management of facial nerve in malignant tumors of the parotid gland. *Clin Exp Otorhinolaryngol*. 2014 Jun;7(2):126-32.
- Cracchiolo JR, Shaha AR. Parotidectomy for parotid cancer. *Otolaryngol Clin North Am*. 2016 Apr;49(2):415-24.
- Huang G, Yan G, Wei X, He X. Superficial parotidectomy versus partial superficial parotidectomy in treating benign parotid tumors. *Oncol Lett*. 2015 Feb;9(2):887-90.
- Roh JL, Kim HS, Park CI. Randomized clinical trial comparing partial parotidectomy versus superficial or total parotidectomy. *Br J Surg*. 2007 Sep;94(9):1081-7.
- Slootweg PJ, El-Naggar AK. World Health Organization 4th edition of head and neck tumor classification: insight into the consequential modifications. *Virchows Arch*. 2018 Mar;472(3):311-3.
- Amin MB, Edge SB, Greene FL, Byrd DR, Brookland RK, Washington MK, et al. *AJCC cancer staging manual*. Springer; 2017.
- Bron LP, O'Brien CJ. Facial nerve function after parotidectomy. *Arch Otolaryngol Head Neck Surg*. 1997 Oct;123(10):1091-6.
- Xiao CC, Zhan KY, White-Gilbertson SJ, Day TA. Predictors of nodal metastasis in parotid malignancies: a national cancer data base study of 22,653 patients. *Otolaryngol Head Neck Surg*. 2016 Jan;154(1):121-30.
- Zenga J, Yu Z, Parikh A, Chen JX, Lin DT, Emerick KS, et al. Mucoepidermoid carcinoma of the parotid: very close margins and adjuvant radiotherapy. *ORL J Otorhinolaryngol Relat Spec*. 2019;81(1):55-62.
- Zenga J, Parikh AS, Emerick KS, Lin DT, Faquin WC, Deschler DG. Close margins and adjuvant radiotherapy in acinic cell carcinoma of the parotid gland. *JAMA Otolaryngol Head Neck Surg*. 2018 Nov;144(11):1011-6.
- Stodulski D, Mikaszewski B, Majewska H, Wisniewski P, Stankiewicz C. Close surgical margin after conservative parotidectomy in early stage low-/intermediate-grade parotid carcinoma: outcome of watch and wait policy. *Oral Oncol*. 2017 May;68:1-4.
- Lombardi D, McGurk M, Vander Poorten V, Guzzo M, Accorona R, Rampinelli V, et al. Surgical treatment of salivary malignant tumors. *Oral Oncol*. 2017 Feb;65:102-13.
- Geiger JL, Ismaila N, Beadle B, Caudell JJ, Chau N, Deschler D, et al. Management of salivary gland malignancy: ASCO Guideline. *J Clin Oncol*. 2021 Jun;39(17):1909-41.
- Klussmann JP, Ponert T, Mueller RP, Dienes HP, Guntinas-Lichius O. Patterns of lymph node spread and its influence on outcome in resectable parotid cancer. *Eur J Surg Oncol*. 2008 Aug;34(8):932-7.
- Lim YC, Lee SY, Kim K, Lee JS, Koo BS, Shin HA, et al. Conservative parotidectomy for the treatment of parotid cancers. *Oral Oncol*. 2005 Nov;41(10):1021-7.
- Park YM, Yoon SO, Koh YW, Kim SH, Lim JY, Choi EC. Clinical-pathological prognostic factors and treatment failure patterns in T1-2 high-grade parotid gland cancer. *Oral Oncol*. 2020 Nov;110:104884.
- Lee KC, Chuang SK. Does total parotidectomy improve survival over partial parotidectomy in early-stage adenoid cystic carcinoma of the parotid gland? *J Oral Maxillofac Surg*. 2022 Sep;80(9):1550-6.

18. McGurk M, Thomas BL, Renehan AG. Extracapsular dissection for clinically benign parotid lumps: reduced morbidity without oncological compromise. *Br J Cancer*. 2003 Nov;89(9):1610-3.
19. Renehan AG, Gleave EN, Slevin NJ, McGurk M. Clinico-pathological and treatment-related factors influencing survival in parotid cancer. *Br J Cancer*. 1999 Jun;80(8):1296-300.
20. Carinci F, Farina A, Pelucchi S, Calero C, Fini-Storchi O, Merlo R, et al. Parotid gland carcinoma: 1987 and 1997 UICC T classifications compared for prognostic accuracy at 5 years. *Eur Arch Otorhinolaryngol*. 2001 Mar;258(3):150-4.
21. Gebhardt BJ, Ohr JP, Ferris RL, Duvvuri U, Kim S, Johnson JT, et al. Concurrent chemoradiotherapy in the adjuvant treatment of high-risk primary salivary gland malignancies. *Am J Clin Oncol*. 2018 Sep; 41(9):888-93.
22. Amini A, Waxweiler TV, Brower JV, Jones BL, McDermott JD, Raben D, et al. Association of adjuvant chemoradiotherapy vs radiotherapy alone with survival in patients with resected major salivary gland carcinoma: data from the National Cancer Data Base. *JAMA Otolaryngol Head Neck Surg*. 2016 Nov;142(11):1100-10.