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ORIGINAL ARTICLE

Increased local recurrence in advanced parotid malignancy treated with mastoidectomy without lateral temporal bone resection

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Abstract
Objective We analyzed patients with advanced parotid malignancy requiring proximal facial nerve exposure undergoing mastoidectomy versus lateral temporal bone resection to determine differences in local and distant recurrence.
Study design The study design is a case series with chart review.
Setting The setting is in Tertiary care practice in Fort Worth, Texas from January1998 to January 2014.
Subjects and methods The study included 120 patients with advanced parotid malignancy, 82 males between 19 and 87 years, and 38 females between 26 and 83 years. Patients with no overt bone involvement were treated with parotidectomy and mastoidectomy for exposure of the proximal facial nerve, and patients with clinically suspected (radiographic imaging or clinical fixation) bone involvement were treated with parotidectomy and lateral temporal bone resection. Follow up ranged from a minimum of 18 months to 11 years following surgery.
Results Sixty patients were treated with mastoidectomy and 60 were treated with lateral temporal bone resection. In patients treated with mastoidectomy, 13 had local recurrence and 7 had distal recurrence. In patients treated with lateral temporal bone resection, 2 had local recurrence while 9 had distant recurrence. Statistical analysis revealed that patients treated with mastoidectomy developed local recurrence ($p = 0.0022$) more commonly than those treated with lateral temporal bone resection. There was no significant difference in distant recurrence between both groups ($p = 0.5949$).
Conclusions Patients with advanced parotid malignancy should be treated aggressively with parotidectomy and lateral temporal bone resection regardless of bone involvement due to increased risk of local recurrence in those treated with mastoidectomy alone.
Level of evidence Level of evidence is a 4 case series.

Keywords Parotid · Malignancy · Mastoidectomy · Facial nerve · Temporal bone resection

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Introduction

In 1954, Parsons and Lewis first described the procedure for subtotal temporal bone resection, the time reserved for tumors of the external ear canal and temporal bone [1]. Several years later, the procedure was refined by Conley and Novack to what is now known as the lateral temporal bone resection due to the undue morbidity associated with aggressive temporal bone resection [2]. Although malignant tumors of the temporal bone and external ear canal continue to be uncommon, advances in imaging, surgery, and reconstruction have allowed for the development of lateral, subtotal, and total temporal bone resection depending on characteristics of the malignancy [3–5].

In current day, temporal bone resection also plays an important factor in the management of advanced parotid malignancy owing to the close proximity of the parotid gland with the temporal bone. Salivary gland cancer occurs in approximately one in 100,000 individuals, and primary parotid neoplasms only make up approximately 5 % of all head and neck malignancies [6, 7]. Surgery with post-operative radiation is accepted to be the standard of care for advanced parotid lesions, encompassing those characterized by high grade, late stage, and nodal disease [8–10]. Advanced parotid malignancy has the propensity to affect nearby structures such as the mandible, overlying skin, and temporal bone often times necessitating concurrent resection of these structures.

The extent of temporal bone resection is determined by imaging, clinical exam, and intra-operative findings. Patients with pre-operative facial nerve dysfunction or regional metastases may require more aggressive measures to obtain locoregional control. Patients in whom adequate facial nerve exposure is needed or patients with involvement of the mastoid tip may require only a mastoidectomy, while patients in whom the ear canal is grossly involved may require at least a lateral temporal bone resection encompassing excision of the bony ear canal, tympanic membrane, malleus, and incus. Patients with more aggressive cancers may require a subtotal or total temporal bone resection in which the stapes, otic capsule, and petrous apex need to be addressed [11].

In a study by Mehra et al. in 2011, 12 patients with advanced parotid cancers were treated with lateral temporal bone resection and followed for a median of 20.6 months post operatively. Five-year overall survival was found to be 22.5 % while disease specific survival was found to be 8.3 % [12].Eighty-three percent of patients had locoregional recurrence within 2 years, resulting in an actuarial rate of locoregional recurrence of 27 % [12]. This rate was comparable to that reported by Spiro and Kane in previous studies [9, 13]. Mehra et al. reported that survival and recurrence were not dependent on pre-operative facial nerve function, tumor site, or specific pathology of parotid tumor [12].

In 2011, Gidley et al. reported on 49 patients with parotid malignancy, 33 of which required mastoidectomy and the remainder of which were treated with lateral temporal bone resection. During the follow-up interval of 3 to 66 months, 35 % of patients were found to have recurrence—7 with a local recurrence, 2 with regional recurrence, 5 with distal recurrence, 2 with combined locoregional, and 1 patient with both regional and distal [11] recurrence.

Studies in the English literature typically report on temporal bone resection as a singular entity encompassing all types of resection from mastoidectomy to total resection. While some studies, such as the above mentioned by Gidley et al., make mention of patients treated with mastoidectomy and lateral temporal bone resection, fail to differentiate recurrence rates between the types of temporal bone resection. As patients with advanced parotid malignancy have poor long-term survival, it is imperative to analyze types of temporal bone resection separately to determine how aggressively primary lesions should be treated. Patients with local recurrence are often times far advanced to benefit from revision surgery.

The data to support such claims is limited in the literature with scant studies on the subject and small subject populations. Our study seeks to analyze local and distal recurrence in patients with advanced parotid malignancy treated with mastoidectomy compared to lateral temporal bone resection in order to determine whether aggressive initial resection is more beneficial. To our knowledge, this represents the only study of its kind in the English literature and with the largest patient population of advanced parotid malignancy requiring temporal bone resection ever reported.

Methods

Prior to the start of this project, approval was granted from the Institutional Review Board (IRB) at John Peter Smith Hospital.

This project was a retrospective analysis of the difference in local and distal recurrence in patients with advanced parotid malignancy treated with mastoidectomy alone compared to those treated with lateral temporal bone resection. In these patients, advanced parotid disease was defined as malignancy involving the facial nerve causing paralysis, or malignancy that was inseparable from the facial nerve. Patients with advanced parotid malignancy from all etiologies that required temporal bone resection, including those treated with mastoidectomy alone for facial nerve exposure when no overt bone involvement was detected, were included in the study. Patients with metastases to the temporal bone and those treated with pre-operative radiation were not included in this study. Although some patients had pre-operative facial nerve dysfunction and some had post-operative paralysis from resection, those numbers have not been included in the overall analysis. All patients were treated by the senior author (Y.D.) between January 1998 and January 2014.

A total of 120 patients were included in the study, 60 of which were treated with parotidectomy and mastoidectomy alone, and 60 of which were treated with parotidectomy and lateral temporal bone resection. Mastoidectomy entailed drilling the entire mastoid until the facial nerve was exposed just distal to the geniculate ganglion. The lateral temporal bone resection included excision of the bony ear canal, tympanic membrane, malleus, and incus. Eighty-two male patients between the ages of 19 and 87 years were included, while 38 female patients between the ages of 26 and 83 years were included in the study. Table 1 and Table 2 illustrate the above mentioned subject information.

Table 1 Treatment stratified by sex

Intervention	Male	Female	Total
Mastoidectomy	43	17	60
Lateral temporal bone resection	39	21	60

Patients had a minimum follow up of 18 months, and the maximum follow up was approximately 11 years following surgery.

After all subject data was reviewed, the various parotid lesions were tabulated and local and distal recurrence was noted during the follow-up period. In order to analyze the data, a statistician was consulted and an unpaired two-tailed *t* test was used because the means of two separate outcomes were being measured. As the sets of data being studied were not before and after values, nor were they related in a temporal fashion, a paired *t* test was not appropriate. Using an unpaired two-tailed *t* test with an alpha value set at 0.05, local and distal recurrence was compared between patients treated with mastoidectomy alone and those treated with lateral temporal bone resection to determine if there was a statistically significant difference in outcomes with each treatment modality.

Results

Following surgery, parotid specimen were analyzed for final pathology and taken together with pre-operative workup, were categorized in Table 3 according to diagnosis. In the follow-up interval, it was noted that 13 patients treated with mastoidectomy alone were found to have local recurrence, and 7 were found to have distal recurrence. In patients treated with lateral temporal bone resection, 2 patients were found to have local recurrence while 9 patients had distal recurrence.

Unpaired two-tailed *t* test analysis of local recurrence between both treatment groups revealed a true statistically significant difference ($p = 0.0022$) while analysis of distal recurrence revealed no difference ($p = 0.5949$).

Discussion

While previous studies have examined survival and recurrence in parotid gland malignancy requiring temporal bone resection, no studies have separately analyzed differences in recurrence between mastoidectomy and lateral temporal bone resection. As many patients are treated solely with parotidectomy with mastoidectomy for exposure of facial nerve or for minimal mastoid tip involvement, it is imperative to examine the risks of local and distal recurrence to determine if mastoidectomy continues to be a viable treatment option or if all patients with suspicion of bony involvement should be treated with lateral temporal bone resection at minimum. This study represents the first study dedicated to comparing local and distal recurrence in patients treated with mastoidectomy and lateral temporal bone resection.

Table 2 Age and sex breakdown for subjects involved in the study

Sex	Total	Age range	Mean age
Male	82	19–87 years	68.5 years
Female	38	26–83 years	66.7 years

In our study, 120 patients with advanced parotid malignancy of varying pathology, both primary and metastatic as shown in Table 3, were treated with parotidectomy and either mastoidectomy or lateral temporal bone resection. According to our results and the post-operative follow up, 13 out of 60 patients treated with mastoidectomy had local recurrence and 7 out of 60 patients had distal recurrence. Of the 60 patients treated with lateral temporal bone resection, 2 had local recurrence while 9 had distal recurrence. After performing a *t* test between local and distal recurrences individually, it was found that the number of patients afflicted with local recurrence was significantly greater ($p = 0.0022$) in the mastoidectomy group, while the number of patients afflicted with distal recurrence were not statistically different ($p = 0.5949$).

Based on our findings, it seems that patients treated solely with mastoidectomy are more likely to recur locally than patients treated more aggressively with lateral temporal bone resection. Interestingly, the surgical approach does not affect rates of distal recurrence. This data suggests that patients with clinical suspicion of bone involvement or nerve involvement should be treated with lateral temporal bone resection to prevent local recurrence, which often times proves to be far advanced and unable to be surgically extirpated without significant risk of morbidity and mortality.

As mentioned previously, Gidley et al. reported a 35 % recurrence rate in patients with advanced parotid malignancy treated with mastoidectomy or lateral temporal bone resection, the majority of which were local recurrences [11]. While this study mentioned patients treated with mastoidectomy and lateral temporal bone resection, it did not differentiate the recurrence rates in each category. Based on our results, it is plausible that the high local recurrence rate could have been largely attributed to the majority of patients in the study treated with mastoidectomy.

In 2012, Morris et al. reported a 5-year overall survival rate of 62 %, disease specific survival of 70 %, and recurrence free survival of 45 % in a study of 72 patients with external auditory canal or temporal bone malignancies. However, only 7 of those patients had primary parotid malignancy. They reported a 5 year local recurrence rate of 20.5 % and a distal recurrence rate of 22.9 % overall. T-stage and histologic category were not predictive of survival, but parotid or regional disease were

Table 3 Classification of parotid gland malignancy in study patients

Pathology	Total treated with mastoidectomy	Mastoidectomy local recurrence	Mastoidectomy distal recurrence	Total treated with lateral temporal bone resection	Lateral temporal bone resection local recurrence	Lateral temporal bone distal recurrence
Cutaneous squamous cell carcinoma with contiguous spread to parotid	10	4	3	13	0	2
Metastatic upper aerodigestive tract malignancy to parotid nodes	9	2	2	4	0	2
Metastatic from auricular carcinoma to parotid	16	0	0	17	0	0
Adenoid cystic carcinoma of parotid	0	0	0	6	0	2
Mucoepidermoid carcinoma of parotid	12	3	2	8	1	0
Acinic cell carcinoma of parotid	1	0	0	1	0	0
Melanoma of parotid	0	0	0	2	0	1
Carcinoma ex-pleomorphic carcinoma of parotid	2	2	0	3	0	1
Myoepithelial carcinoma of parotid	3	0	0	0	0	0
Basal cell carcinoma of cheek extending into parotid	6	1	0	2	0	0
Sarcoma of parotid	1	1	0	3	1	1
Metastatic adenocarcinoma from unknown source to parotid	0	0	0	1	0	0
	60	13	7	60	2	9

negative prognostic factors [5]. Moreover, the highest recurrence rate was noted in the category of patients with primary salivary gland malignancy all of whom had distal metastases within 2 years. Only 29 % of patients with local recurrence could be salvaged due to skull base involvement [5]. While this study portrays the poor prognosis of patients requiring temporal bone resection for malignancy, only a small subset of those patients had a parotid malignancy.

The above-mentioned studies illustrate the dearth of literature pertaining to this subject. While our study suggests the need for more aggressive treatment of the temporal bone for parotid malignancy, the study has several shortcomings that should be addressed for future endeavors. Although Mehra et al. have reported no association between survival and recurrence with pre-operative facial nerve function or pathology, it is well known that patients with pre-operative paralysis as evidence of perineural invasion have a poor prognosis [12]. While our study categorized lesions by pathology, it would have been of great utility to conduct the analysis in each subcategory while including information on pre-operative facial nerve function. However, the rarity of these cases proves challenging in aggregating large numbers of patients for such a substratified study. It is well accepted that specific tumor pathology can greatly influence the outcome of treatment and prognosis. While the authors accept this, the dearth of information on certain pathology types makes it quite difficult to conduct outcomes analyses. The pathology type could even be a confounding variable in that less aggressive tumors may be treated with more conservative surgery and predict favorable outcomes compared to aggressive pathology.

Secondly, the effect of pre-operative and post-operative radiation could be included in future studies to see if post-operative radiation plays in role in local or distal recurrence. Although many patients in our study were treated with post-operative radiation, several patients declined post-operative treatment. It is challenging to incorporate the effect of radiation as an overarching treatment as different pathologies vary in their degree of radiosensitivity.

Advanced parotid malignancy proves to be a challenging entity to treat owing to its poor prognosis and capacity for bony invasion. It is important for the surgeon to thoroughly discuss the risks and benefits of aggressive surgical therapy with patients who are of sound health and suitable candidates for ablation due to the increased chances of recurrence free survival. Aggressive surgical resection is not without morbidity however, and patients should fully understand the differences between the various surgical treatment options. Lastly, patients should be offered post-operative radiation for aggressive disease especially in those patients declining more aggressive resection.

Conclusion

Based on our findings, we recommend the use of parotidectomy with lateral temporal bone resection in patients with advanced parotid malignancy with suspicion of bony involvement due to the lower risk of local recurrence compared to those patients treated with only mastoidectomy.

Compliance with ethical standards No ethical concerns.

Conflict of interest The authors declare that they have no conflict of interest.

References

1. Parsons H, Lewis JS (1954) Subtotal resection of the temporal bone for cancer of the ear. Cancer 7(5):995–1001
2. Conley JJ, Novack AJ (1960) The surgical treatment of malignant tumors of the ear and temporal bone. Part I. AMA Arch Otolaryngol 71:635–652
3. Lodge WO, Jones HM, Smith ME (1955) Malignant tumors of the temporal bone. AMA Arch Otolaryngol 61(5):535–541
4. Madsen AR, Gundgaard MG, Hoff CM et al (2008) Cancer of the external auditory canal and middle ear in Denmark from 1992 to 2001. Head Neck 30(10):1332–1338
5. Morris LG, Mehra S, Shah JP, Bilsky MH, Selesnick SH, Kraus DH (2012) Predictors of survival and recurrence after temporal bone resection for cancer. Head Neck 34(9):1231–1239
6. Bron LP, Traynor SJ, Mcneil EB, O'brien CJ (2003) Primary and metastatic cancer of the parotid: comparison of clinical behavior in 232 cases. Laryngoscope 113(6):1070–1075
7. National Cancer institute. Cancer Incidence: Surveillance Epidemiology and End Result 17. 2010: Bethesda, MD.
8. Armstrong JG, Harrison LB, Spiro RH, Fass DE, Strong EW, Fuks ZY (1990) Malignant tumors of major salivary gland origin. A matched-pair analysis of the role of combined surgery and postoperative radiotherapy. Arch Otolaryngol Head Neck Surg 116(3): 290–293
9. Spiro RH (1998) Management of malignant tumors of the salivary glands. Oncology (Williston Park, NY) 12(5):671–680
10. Noh JM, Ahn YC, Nam H et al (2010) Treatment results of major salivary gland cancer by surgery with or without postoperative radiation therapy. Clin Exp Otorhinolaryngol 3(2):96–101
11. Gidley PW, Thompson CR, Roberts DB, Weber RS (2011) The results of temporal bone surgery for advanced or recurrent tumors of the parotid gland. Laryngoscope 121(8):1702–1707
12. Mehra S, Morris LG, Shah J, Bilsky M, Selesnick S, Kraus DH (2011) Outcomes of temporal bone resection for locally advanced parotid cancer. Skull Base 21(6):389–396
13. Kane WJ, Mccaffrey TV, Olsen KD, Lewis JE (1991) Primary parotid malignancies. A clinical and pathologic review. Arch Otolaryngol Head Neck Surg 117(3):307–315