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ORIGINAL ARTICLE

The role of elective superficial parotidectomy in the treatment of temporal region squamous cell carcinoma

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Abstract
Objective In order to determine rates of metastasis and efficacy of elective superficial parotidectomy, we examine parotid specimens in patients with temporal region cutaneous squamous cell carcinoma treated with local excision and ipsilateral parotidectomy.
Study design This paper is a retrospective review.
Setting This study was conducted at a private tertiary referral practice in Fort Worth, Texas, from 1998 to 2013.
Subjects and methods Ninety-three patients between ages 27 and 98 with primary squamous cell carcinoma of the temporal region greater than or equal to 2 cm were included in this study. Subjects had no evidence of adenopathy or parotid involvement on exam or imaging. Patients were treated with local excision and ipsilateral parotidectomy. The primary tumor was studied for vascular involvement and perineural invasion while the parotid specimen was analyzed for occult cancer. Patients were post-operatively followed for a minimum of three years.
Results Twenty-three (24.7 %) parotid samples were found to harbor occult malignancy. Of these, nine (39.1 %) patients had vascular involvement of the primary tumor and 14 (60.8 %) had perineural invasion. Thirteen out of 58 affected males and 10 out of 35 affected females were found to have intraparotid node positivity. Vascular involvement ($p = 0.0004$) and perineural invasion ($p = 0.0001$) in the primary malignancy were found to be greater in patients with positive specimen. Sex was not statistically significant.
Conclusions In patients with cutaneous squamous cell carcinoma of the temporal region at least 2 cm in size, elective superficial parotidectomy may be a beneficial part of treatment, especially in primary tumors showing perineural and/or vascular involvement.
Level of evidence Level 2b (retrospective cohort)

Keywords Temporal · Cutaneous · Squamous · Carcinoma

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Introduction

In present day, non-melanoma skin cancers are the most common malignancies seen in the USA. Approximately 20 % of these cancers are squamous cell carcinoma (SCCA), with 75 % occurring more commonly in sun-exposed areas [1, 2]. A large majority of these malignancies occurs in the head and neck [3, 4].

The greatest risk factor for the development of cutaneous SCCA is prolonged exposure to ultraviolet radiation, commonly from sunlight. Both ultraviolet-A (UVA) and ultraviolet-B (UVB) can be causative; however, UVB rays are more dangerous than UVA. Cutaneous SCCA is more commonly seen in Caucasian males, typically in the sixth decade of life [5]. Blond hair, fair skin tone, and blue eyes

are also associated with a higher risk of SCCA of the skin [6–8].

Cutaneous SCCA of the head and neck has the potential to cause significant change in quality of life, high public health cost, and devastating psychosocial outcomes especially in advanced cases [1]. As such, rapid evaluation and treatment are desired for afflicted patients. A thorough history along with comprehensive physical examination is a crucial part of evaluation, with imaging and biopsy providing definitive diagnosis and extent of disease.

Head and neck cutaneous SCCA is often managed with a wide local excision; however, a small subset of these cutaneous malignancies metastasize to regional lymph nodes [9]. In this patient population, neck dissection and/or chemoradiation may be required as a crucial part of treatment. There are patients with no evidence of regional metastasis who may also benefit from treatment of the neck. D'Souza and Clark have suggested elective treatment of the neck in patients with cutaneous SCCA of the head and neck greater than 2 cm, invasion of subcutaneous fat, perineural involvement, and lymphovascular invasion [10].

The role of parotidectomy in the treatment of head and neck SCCA has been controversial, especially in patients with clinically and radiographically negative disease. Robust evidence in the English literature supporting elective parotidectomy has been sparse, despite the fact that the parotid and upper cervical nodes are primary basins for lymphatic drainage from head and neck SCCA [11, 12]. Elective parotidectomy in patients with auricular SCCA has been reported on; however, there have been no studies examining the efficacy of parotidectomy in patients with temporal regional SCCA (TRSCCA). For the purposes of this paper, the temporal region is described as the skin overlying the temporal fossa. The temporal fossa is a shallow depression in the lateral skull composed of the frontal, parietal, temporal, and sphenoid bones. The temporal fossa is interconnected with the infratemporal fossa through a tunnel between the zygomatic arch and the skull.

In a 2005 study by Moore, 52 % of patients with parotid metastasis had primary lesions found in pre-auricular and frontotemporal regions [13]. Patients with TRSCCA without evidence of clinically or radiographic parotid metastasis pose a unique challenge to the surgeon as the elective removal of the parotid gland can be associated with increased morbidity.

In our study, we examined 93 patients with TRSCCA treated with elective superficial parotidectomy to determine the frequency of occult parotid malignancy for patients with clinically and radiographically negative regional disease. Our data showed that approximately 25 % of these patients had occult parotid malignancy, suggesting that elective superficial parotidectomy may be beneficial for patients with TRSCCA of at least 2 cm in size and especially so in tumors with perineural or vascular invasion at the primary site. To our knowledge, this is the largest and only retrospective study in the English literature addressing this subject.

Twenty-three (24.7 %) parotid samples were found to harbor occult malignancy. Of these, nine (39.1 %) patients had vascular involvement of the primary tumor and 14 (60.8 %) had perineural invasion. Thirteen out of 58 affected males and 10 out of 35 affected females were found to have intraparotid lymph nodes involvement. Vascular involvement ($p = 0.0004$) and perineural invasion ($p = 0.0001$) in the primary malignancy was found to be greater in patients with positive specimen. Sex was not statistically significant.

Materials and methods

The Institutional Review Board (IRB) of John Peter Smith Hospital was consulted prior to beginning the study, and clearance to proceed with the study was granted.

Our study originally involved 96 patients who were found to have biopsy-proven primary SCCA of the temporal region. Patients greater than 17 years of age with SCCA of the temporal region treated surgically, who had a minimum follow-up of 3 years, were included in the study. Patients not treated surgically were excluded from the study along with patients with recurrent disease, non-temporal region primaries, and pre-existing facial nerve paralysis. It is important to note that as the focus of the study was to evaluate for occult disease, patients with pre-operative clinically positive parotid or neck disease were excluded. Three patients were found to have facial paralysis in the frontal branch following Mohs resection and were appropriately excluded, yielding a total of 93 patients for the study.

Sixty-one patients underwent computed tomography (CT), 28 underwent magnetic resonance imaging (MRI), and six underwent positron emission tomography (PET) to assess for regional metastasis. It is important to note that several patients had multiple imaging modalities. Only patients with radiographically negative regional disease were included in the study.

All subjects were treated between 1998 and 2013 with excision of the primary carcinoma along with ipsilateral superficial parotidectomy by the senior author (YD). The treatment took place at a tertiary referral center in Fort Worth, Texas. All patients had normal facial nerve function preoperatively.

The patient population was comprised of 93 total patients, 58 male and 35 female between the ages of 27 and 98 with a mean age of 64.8 years.

After completion of superficial parotidectomy, specimens were sent to pathology for analysis of malignancy and involvement of lymph nodes. As superficial parotidectomy was performed, all of the associated lymph nodes, both intraglandular and tail, were examined. For the purposes of

this paper, a positive parotid specimen is one that includes involved lymph nodes and not parenchymal involvement. Thorough analysis of the primary tumor was also performed to examine for vascular invasion and perineural involvement. The pathology lab at the treatment center routinely comments on the presence of the above-mentioned parameters. The same pathology team studied all of the cases in this study, and all positive specimens were re-examined by a second pathologist.

Statistical analysis was conducted using an unpaired *t* test with an alpha value of 0.05. As mentioned above, perineural invasion, vascular involvement, and sex were all examined between groups with cancer-positive and cancer-negative parotid glands to determine significant differences between the two test groups. A chi-square test was employed to determine an association between lesion size and parotid gland involvement. The odds ratio was also calculated for patients with positive parotid specimen having perineural or vascular involvement at the primary site.

Results

Our study examined 93 patients with temporal region squamous cell carcinoma of at least 2 cm in size, without evidence of regional disease based on imaging and clinical exam. Of these 93 patients, 58 were male and 35 female. Thirteen (22.4 %) of the male patients were found to have positive parotid specimen, and 10 (28.5 %) of females. Sex was not found to be significant factor in patients with parotid involvement ($p = 0.51$).

The conglomerate data revealed that 44 of the 93 patients had primary lesions measuring 2–2.9 cm, and five of those patients had positive parotid specimen. Thirty-one patients had lesions measuring 3–3.9 cm with eight of them having parotid disease. Eighteen of the 93 patients had primary TRSCCA measuring 4 cm or larger, and 10 of those subjects had involvement of the parotid gland. The above data are displayed in Table 1. Utilizing a chi-square test, we determined that the size of the primary lesion was strongly associated with development of parotid disease ($p = 0.0001$), suggesting that patients with larger primary lesions have a greater chance of having occult parotid malignancy.

Table 1 Parotid involvement stratified by primary lesion size

Size of primary lesion	Total patients	Positive parotid	Negative parotid
2–2.9 cm	44 (47.3 %)	5 (21.7 %)	39 (55.7 %)
3–3.9 cm	31 (33.3 %)	8 (34.7 %)	23 (32.8 %)
4 cm or larger	18 (19.3 %)	10 (43.4 %)	8 (11.4 %)
Total	93	23	70

Perineural and vascular involvement in the primary lesion were compared amongst patient with and without parotid involvement. Of the 23 patients who had positive parotid specimen, nine (39.13 %) had vascular involvement at the primary site and 14 (60.87 %) had perineural invasion. Of the 70 patients with negative parotid specimen, six (8.57 %) had vascular involvement and four (5.71 %) had perineural invasion. Examining the data with an unpaired *t* test and an alpha value of 0.05, the difference in vascular involvement ($p = 0.0004$) and perineural invasion (0.0001) was found to be statistically significant between patients with and without parotid positivity. The above information is shown in Tables 2 and 3. In order to determine whether there was a relationship between the above-mentioned features and parotid positivity, the odds ratio was calculated as shown in Table 4. The odds ratio for vascular involvement in patients with parotid positivity was 6.75 ($p = 0.0016$), and the odds ratio for perineural invasion in patients with parotid involvement was 24.889 ($p = <0.0001$), suggesting that the presence of vascular or perineural involvement confers a greater risk of developing parotid disease in this patient population.

All 23 patients found to have positive parotid specimen were referred for external beam radiation therapy (EBRT) at a minimum of 60 Gy. Eighteen of those patients followed through with the recommendation while five did not. Of the compliant patients, one had a regional recurrence in level 5 and was salvaged with neck dissection. Another patient receiving post-operative EBRT recurred in the lung and died of disease after 2.5 years. At a minimum follow-up of 3 years, the remainder of patients receiving post-operative EBRT were disease free. In the four patients who did not undergo EBRT, two recurred regionally, one had dermal metastasis. In this group, 1 patient deceased.

In the group of 70 patients without parotid involvement, 11 patients received EBRT to the primary site due to advanced local disease high-risk features such as perineural invasion

Table 2 Vascular involvement in primary lesion of patients with and without parotid involvement

	Vascular involvement of primary lesion in patients with positive parotid specimen	Vascular involvement of primary lesion in patients with negative parotid specimen
Patients with involvement	9	6
Mean	0.39	0.09
Standard deviation	0.5	0.28
Standard error measurement	0.1	0.03
N	23	70
p value	0.0004	
Significance	Statistically significant	

Table 3 Perineural invasion in primary lesion of patients with and without parotid involvement

	Perineural invasion of primary lesion in patients with positive parotid specimen	Perineural invasion of primary lesion in patients with negative parotid specimen
Patients with nerve involvement	14	4
Mean	0.61	0.06
Standard deviation	0.5	0.23
Standard error measurement	0.1	0.03
N	39	65
p value	0.0001	
Significance	Statistically significant	

and vascular involvement. In this group receiving radiation, there were no failures recorded within the 3-year follow-up period. In the 59 patients with negative parotid specimens and not receiving radiation, one patient had a regional recurrence in level 2 of the neck and was salvaged with surgery.

Discussion

This retrospective study of 93 patients with TRSCCA is the single largest study of this patient population in the English literature. Our results suggest that patients with TRSCCA greater than or equal to 2 cm with radiographically and clinically negative nodal disease would benefit from elective superficial parotidectomy as the 24.7 % of our patients had occult parotid disease. We found that there was a strong correlation between size of the initial lesion and parotid positivity ($p=0.001$), with larger lesions having a greater tendency to spread to the parotid gland.

In patients with positive parotid specimens, we examined the primary lesions for perineural ($p=0.0001$) and vascular involvement ($p=0.0004$) and found that there was a significant difference in association between patients with and without parotid positivity. Taking this data together with the odds ratio of vascular (OR 6.75, $p=0.0016$) and perineural invasion (OR 24.889, $p=<0.0001$), we can surmise that primary TRSCCA displaying either of these features has a stronger propensity to develop parotid metastasis and would therefore benefit from elective superficial parotidectomy.

Table 4 Odds ratio calculation for vascular involvement and perineural invasion in patients with parotid positivity

	Vascular involvement and positive parotid specimen	Perineural invasion and positive parotid specimen
Odds ratio	6.75	24.8889
Confidence interval	2.06 to 22.01	6.70 to 92.43
p value	0.0016	<0.0001
Significance	Statistically significant	Statistically significant

The parotid gland contains approximately 20 lymph nodes in the lateral portion of the gland, and another five in the deep portion of the gland. This nodal basin is responsible for lymphatic drainage from the temporal region as well as the cheeks [14]. The temporal region, along with the cheek, auricle, and forehead, is one of the most common sites of SCCA that metastasizes to the parotid gland [15].

As there are no dedicated studies in the English literature regarding temporal region SCCA, our results have been compared with prior studies on head and neck cutaneous SCCA providing conglomerate information of different head and neck sub-sites. In a study by Hoch et al., 13 patients with cutaneous SCCA of the head underwent elective superficial parotidectomy and only one patient was noted to have parotid involvement. Based on their results, they recommended against elective superficial parotidectomy due to the low rate of occult metastasis [16]. This finding was corroborated by Osborne et al., who studied 19 superficial parotidectomy specimens in patients suffering from auricular SCCA with no nodal disease and found that the parotid specimens were all negative for occult disease. As such, they recommended against routine elective superficial parotidectomy for auricular SCCA [17].

Veness in 2007 stated that patients with parotid disease often presented with metastasis after the initial treatment of the primary lesion [18]. The rate of parotid involvement was quoted as high as 80 % for cutaneous SCCA in a 2006 multicenter study [19]. Although elective superficial parotidectomy comes with added risk of facial nerve injury, a more thorough oncologic resection may be beneficial in reducing recurrence and preventing patients from needing secondary operations.

Our study suggests that in patients with N_0 TRSCCA, superficial elective parotidectomy may be useful in treatment. Patients with occult parotid malignancy found after surgery are encouraged to pursue post-operative radiation. Pathology results may assist in decision-making regarding further treatment in this patient population. Radiation without surgical treatment could also be considered for patients with perineural or vascular invasion at the primary tumor site. In patients with contraindications to surgery, radiation may be an equally efficacious alternative.

As mentioned previously, there are no studies examining only TRSCCA, and it may be difficult to draw conclusions from other studies analyzing cutaneous SCCA of the head and neck as a whole due to the confounding results from other head and neck sub-sites. It is important to consider the

behavior of cutaneous SCCA globally, but the behavior of SCCA based on sub-site may be quite different when analyzed separately. In the future, multicenter prospective randomized trials would be beneficial in discovering true differences in treatment between sub-sites in the head and neck; however, ethical considerations may play a limiting role in the extent of these investigations. As this study was a retrospective review and is reported as an initial experience, there was no comparison group of N_0 patients that was treated without surgery. As such, further prospective trials examining this group of patients and comparing them with the control group would be advantageous in determining optimal treatment recommendations.

Conclusions

Based on our study, we recommend that patients with primary TRSCCA of at least 2 cm in size without clinical or imaging suggesting nodal disease should undergo elective ipsilateral superficial parotidectomy.

Compliance with ethical standards

Conflict of interest The authors declare that they have no competing interests.

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