A Retrospective Review of Malignant Minor Salivary Gland Tumors and a Proposed Protocol for Future Care

Nickolaos Papadogeorgakis, M.D., D.D.S., M.Sc., Ph.D.,¹
Eleni Parara, M.D., D.D.S., M.Sc.,¹ Vasilis Petsinis, M.D., D.D.S., M.Sc., Ph.D.,¹
Eleni Pappa, M.D., D.D.S.,¹ Anastasios Nikolaidis, M.D.,²
and Konstantinos Alexandridis, D.D.S., M.Sc., Ph.D.¹

ABSTRACT

Malignant tumors affecting minor salivary glands present a wide range of histopathologic types. The present study sought to design a protocol for management of patients with malignancy of minor salivary glands. The data of 22 patients with malignant tumors of the minor salivary glands, surgically treated at our department in the past 10 years, were accumulated and studied. All patients underwent a diagnostic workup prior to surgery. The most useful examinations were magnetic resonance imaging of the head and neck and computerized tomography of the thorax. Wide local excision was sufficient for the majority of patients. Adjuvant treatment is indicated for high-grade, tumor-positive lymph nodes and residual disease. Malignant tumors of minor salivary glands are very rare. Therefore, design of management protocols is challenging. Management of the neck is necessary in evidence of metastasis and in high-grade and advanced-stage disease. Adjuvant treatment should be included in the treatment protocol in certain indications. Most importantly, long-term follow up is very important for all patients with malignant minor salivary tumors.

KEYWORDS: Minor salivary gland malignancy, adenoid cystic carcinoma, mucoepidermoid carcinoma

Minor salivary glands (MSG) are numerous (700 to 900) exocrine glands, which are distributed in the submucosa of the oral cavity, nasopharynx, tonsils, hypopharynx, and larynx.¹⁻³ Heterotopic sites include lymph nodes, the thyroid gland, facial bones, and the hypophysis.²

Neoplastic disorders of salivary glands are in general relatively rare and account for 3 to 6% of head and

neck tumors.^{3,4} The reported incidence of neoplastic lesions of MSG does not exceed 25% of all neoplasms of salivary origin.^{2,4,5} However, most enlargements consist of malignant tumors,^{2,5} as opposed to tumors of major salivary glands, which are mainly benign.⁶ According to previous studies,³ gender and race may differentiate the incidence and frequency of malignant MSG neoplasms. Malignant tumors of MSG tend to have varied

¹Department of Oral and Maxillofacial Surgery; ²Department of Histopathology, Dental School, "Evangelismos" General Hospital, University of Athens, Athens, Greece.

Address for correspondence and reprint requests: Eleni Parara, M.D., D.D.S., M.Sc., 16 Koimiseos Theotokou Street, 151 24 Athens, Greece (e-mail: eparara@dent.uoa.gr).

Craniomaxillofac Trauma Reconstruction 2011;4:1-10. Copyright

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Received: January 25, 2010. Accepted after revision: September 3, 2010. Published online: November 30, 2010.

DOI: <http://dx.doi.org/10.1055/s-0030-1268515>.

ISSN 1943-3875.

presentation and are also histopathologically more diverse, compared with tumors of major salivary glands.

Due to the diversity of histopathologic features, classification of salivary gland tumors is advancing and therefore challenging. Additionally, tumor grading can be difficult and complex.⁷ The fact that such tumors can initially present in paranasal sinuses or other extraoral structures may render diagnostic procedure complicated and diagnosis delayed.^{1,2} The standard treatment of malignant MSG neoplasms is surgical excision. Controversial issues regard the management of the neck, adjuvant radiotherapy or chemotherapy, and safe and proper margins of resection.^{2,7-9} The purpose of this study was to design a protocol of management for patients with malignant MSG tumors, following retrospective analysis of patients with MSG malignancy, who were treated for the first time in our department.

PATIENTS AND METHODS

The medical records of all patients with primary malignant tumors of MSG, treated for the first time, in the 10-year period (1997 to 2007) were retrieved and reviewed. Operating notes and histopathology reports were also retrieved and studied. Staging and histopathologic typing were performed according to international standards of the World Health Organization and the American Joint Committee on Cancer.^{7,10} Demographic data, clinical characteristics, diagnostic investigations, histological typing, treatment, follow-up, recurrence, and survival were noted. Exclusion criteria were malignancy of major salivary glands and previous treatment modalities for the malignancy of MSG.

The preoperative evaluation included appropriate imaging for local and disseminated disease. In our department, an orthopantomogram, computerized tomography scan (CT), or magnetic resonance imaging (MRI) lately, bone scintigram if bone invasion was suspected clinically, chest radiograph (CR), and chest CT scan if indication of suspicious pulmonary metastases was present from the CR.

CT was preferred for cases with bone involvement, whereas MRI was reserved solely for soft tissue invasion.

All patients had a histopathologic diagnosis prior to surgery, which in most cases had been obtained by open biopsy, as most tumors were approachable intraorally. If the tumor was not accessible to open biopsy, or if open biopsy would compromise excision with 1-cm disease-free margins, fine-needle aspiration biopsy was performed. Surgical management of the tumors aimed at complete excision with a margin of 1 cm. For tumors of the maxilla, the operative procedures were performed according to the classification of Brown et al.¹¹ Reconstruction was undertaken mainly with the use of local and regional flaps. In our depart-

ment, conservative means of reconstruction such as an obturator or tamponade were also used. Selective supra-omohyoid neck dissection (levels I to IV) was performed for patients with high-grade tumors, large tumor size (T2b and larger), and intraosseous location. In the case of metastatic lymphadenitis, confirmed by intraoperative fresh frozen section biopsy, modified radical neck instead of selective neck dissection was performed.

The time between the first therapeutic module and the most recent examination was defined as the follow-up period. Disease-free interval was considered the time from first therapeutic course to the time of diagnosis of a local recurrence, or a regional or distant metastasis. Standard patient workup was undertaken for the follow-up period (i.e., monthly review and MRI scans every 6 months thereafter for a period not less than 10 years). Statistical analysis was performed with the Statistical Package for Social sciences (SPSS 17.0, SPSS Inc., Chicago, IL).

RESULTS

In the 10-year period of 1997 to 2007, 27 patients with minor salivary gland malignancy were examined in our institution. Three of those patients were previously treated elsewhere and presented with local recurrence; two patients were in stage IV of the disease and were inoperable, and therefore they were excluded from the study.

All the patients with minor salivary gland malignancy, who were included in the present study (22), were operated on by the same chief surgeon (N.P.). Most patients were female (15 patients) and seven were male. The patients' age ranged from 26 years to 89 years with median age 64.5 years (Table 1).

The chief complaint on presentation was an intraoral swelling (54.6%), followed by an ulcerated lump (27.3%). Overall 81.9% of the patients presented an intraoral lump with or without ulceration of the surface. Two patients initially sought medical advice because of mucosal ulceration. One patient with paranasal sinus invasion presented with a swelling on the nasal bridge, which caused disfigurement and was accompanied by nasal congestion symptoms. One patient was asymptomatic and referred to our department by their general dental practitioner, for bone resorption on the retromolar area of the mandible, which was revealed by a panoramic radiograph (Table 1).

Regarding tumor site, eight lesions appeared on the hard and soft palate, six on the maxilla, two on the floor of the mouth. Two tumors occupied the buccal space, one was located on the nasal bridge, one was intraosseous, one was located on the tongue, and one had expanded from the soft palate to the submandibular triangle (Table 1).

Table 1 Concentrated Data of All Patients

Sex	Age (y)	Clinical Appearance	Site	Size	Stage	Surgery	Histology	Subtype	Margins	Bone Invasion	Paranasal Invasion	Neck Pathology	N	Perineural Invasion	Adjuvant Type	Survival (mo)	AND
M	51	Tumor	Max	T2b	II	WLE	Ductal	High grade	N	Yes	No			Yes	RTX	29	Yes
M	82	Tumor	Max	T2b	II	WLE	ACC	Tubular	N	Yes	No			No	RTX	28	Yes
F	89	Lump	Fil	T2b	II	END	ACC	Combination	P	No	NA	N		No	Combination	24	Yes
F	26	Ulcer	Buc	T3b	III	END	ACC	Cribriform	N	No	NA	N		Yes	RTX	30	Yes
M	74	Tumor	Ton	T4b	IV	END	ACC	Cribriform	C	No	NA	N		Yes	NA	0	No
F	50	Lump and ulcer	Pal	T3b	III	WLE	ACC	Combination	C	Yes	No			Yes	NA	36	Yes
F	54	Tumor	Max	T2b	II	WLE	PLGA	Low grade	N	Yes	Yes			Yes	RTX	48	Yes
M	50	Lump and ulcer	Pal	T2a	II	WLE	NOS	Low grade	N	No	No			No	NA	49	Yes
M	53	Intraosseous	Man	T3b	III	END	MEC	Low grade	N	Yes	No	N		No	NA	47	Yes
M	34	Lump and ulcer	Buc	T2b	II	WLE	PLGA	Intermediate	N	No	NA	N		No	NA	45	Yes
F	70	Ulcer	Fil	T2b	II	END	ACC	Cribriform	N	No	NA	N		No	NA	48	Yes
F	40	Tumor	More	T2b	IV	END	ACC	Cribriform	N	No	No	P	N2	Yes	Combination	64	Yes
F	36	Tumor	Max	T3b	III	WLE	ACC	Combination	C	Yes	Yes			Yes	Combination	66	Yes
F	78	Face lump	Paran	T2b	II	WLE	ACC	Tubular	P	Yes	Yes			No	RTX	65	Yes
F	62	Lump and ulcer	Pal	T1a	I	LE	MEC	Low grade	N	No	No			No	NA	68	Yes
F	67	Tumor	Pal	T3b	III	WLE	MEC	Intermediate	C	Yes	No			No	NA	75	Yes
F	64	Lump	Pal	T1a	I	WLE	MEC	Intermediate	N	No	No			No	NA	74	Yes
F	65	Lump	Max	T3a	II	WLE	BCA	Low grade	N	No	No			Yes	NA	70	Yes
F	76	Lump and ulcer	Pal	T2b	II	WLE	ACC	Combination	C	No	No			No	Combination	72	Yes
M	77	Tumor	Max	T2b	II	WLE	ACC	Solid	N	Yes	No			No	NA	80	No
F	85	Lump	Pal	T3a	II	WLE	MEC	Low grade	N	Yes	No			No	NA	133	Yes
F	70	Lump and ulcer	Pal	T3b	IV	END	ACC	Cribriform	C	Yes	Yes	P	N2	Yes	NA	48	No

ACC, adenoid cystic carcinoma; AND, alive no disease; BCA, basal cell adenocarcinoma; buc, buccal space; C, close; ductal, ductal adenocarcinoma; END, excision neck dissection; F, female; fil, floor of mouth; LE, local excision; M, male; max, maxilla; MEC, mucoepidermoid carcinoma; mo, months; more, more than one space; N, negative; NA, not applicable; NOS, adenocarcinoma not otherwise specified; P, positive; pal, palate; paran, paranasal sinuses; PLGA, polymorphous low grade adenocarcinoma; RTX, radiotherapy; ton, tongue; WLE, wide local excision.

All patients had the standard assessment for staging, including orthopantomogram, CT or MRI scan, tissue specimen histopathologic examination, CR. All patients had an open biopsy, but one female patient with a tumor of the bridge of the nose. As it was thought that an open biopsy would hinder radical excision and impede reconstruction, fine-needle aspiration biopsy was performed and provided an accurate diagnosis. Furthermore, all patients underwent a bone scintigram for local bone invasion inspection. In addition to the above, three-dimensional CT scan was undertaken in one patient with spread of the lesion to the ipsilateral paranasal sinuses and the orbit. Magnetic resonance angiography was performed for the patient with expansion of the lesion to the submandibular area and the parapharyngeal space, where proximity to the great vessels of the neck was suspected.

A histopathologic diagnosis was obtained for each patient preoperatively, as surgery was considered appropriate initial therapeutic module for all patients included in the study. The histopathologic categories of the tumors of MSG in our series were: adenoid cystic carcinoma (ACC), mucoepidermoid carcinoma (MEC), polymorphous low-grade adenocarcinoma (PLGA), adenocarcinoma not otherwise specified (NOS), monomorphic basal cell adenocarcinoma (BCA), and salivary duct adenocarcinoma (Table 1).

The majority of patients presented ACC (12 patients, 54.5%). Seven of those tumors were classified as T2b, four as T3b, and one T4b. Accordingly, the patients were in stage II (six patients), III (three patients), and IV (three patients). The histopathologic subtypes for ACC found were cribriform in five patients, solid in one patient, and combination in four patients. Two tumors were classified as tubular ACC (Table 1). MEC was found in five patients. Two were in stage I at presentation, two in stage III, and one in stage II.

MEC tumors were all palate lesions, but one was intraosseous, in the mandibular bone. High-grade MEC was encountered in one patient, intermediate grade in two, and low grade in two, one of whom presented the intraosseous tumor (Table 1). Regarding other histopathologic types, PLGA was encountered in two patients, BCA in one patient, adenocarcinoma NOS in one patient, salivary duct carcinoma in one patient.

As for the anatomic site of the various tumor categories, the palate was the most common location for all tumor types (8 tumors, 36.4%). Three ACC, four of the five overall MEC, and the NOS adenocarcinoma were located in the palate. One PLGA and one ACC were located on the cheek mucosa. One MEC was central in the mandibular body. Expansion to the submandibular and parapharyngeal space, the orbit, and paranasal sinuses was noted at presentation in two patients with ACC and one patient with PLGA. The intraoral location of various histological types is depicted in Fig. 1.

- : ACC
- : ductal
- : BCA
- ⊖ : PLGA
- △ : NOS
- ☆ : MEC
- : floor of the mouth

Figure 1 Location of intraoral tumors. Paranasal sinuses, extension to more than one space, and intraosseous tumors not depicted. ACC, adenoid cystic carcinoma; BCA, basal cell adenocarcinoma; PLGA, polymorphous low-grade adenocarcinoma; NOS, adenocarcinoma not otherwise specified; MEC, mucoepidermoid carcinoma.

As previously noted, all stages of the disease were noted at presentation. Eight patients were already in stage III and IV at presentation. However, most patients were in stage II (12 patients). The patients' staging is assembled in Table 1 and Fig. 2.

Surgery was the treatment of choice for all patients. The resection plan included margins of at least 1 cm. Surgical treatment of ACC ranged from wide local excision (four patients), partial maxillectomy (one patient), and total maxillectomy with extirpation of the ipsilateral orbital contents (one patient). Two patients with MEC underwent wide local excision, three had partial maxillectomy, and one had subtotal maxillectomy. The two patients with PLGA, one with BCC,

Figure 2 Histopathologic type and stage of patients with minor salivary gland tumors. ACC, adenoid cystic carcinoma; BCA, basal cell adenocarcinoma; ductal, ductal adenocarcinoma; PLGA, polymorphous low-grade adenocarcinoma; NOS, adenocarcinoma not otherwise specified; MEC, mucoepidermoid carcinoma.

and one with NOS adenocarcinoma underwent wide local excision.

Complete surgical removal with histologically negative surgical margins was achieved for 14 of the 22 patients (63.6%). Close margins, less than 1 cm, were observed in five patients with ACC and one patient with MEC, whereas two more patients with ACC proved to have residual disease. Those patients' tumors were T2b and were located on the floor of the mouth and the bridge of the nose, respectively. Concerning close margins, they were found in patients with large tumors (T3, 4). Although the difference between ACC and MEC concerning positive and close margins was not statistically significant (Pearson $p = 0.319$; Fig. 3), the fact that most MEC were on the palate, in contrast to ACC tumors, which had expanded to other perioral structures should be emphasized. Involved margins were not found to correspond to the stage of the disease.

Histological evidence of perineural invasion was found in five ACC tumors, the ductal carcinoma, the BCA, and one of the two PLGAs. No MEC presented perineural spread. Statistical comparison of the two largest groups (i.e., ACC and MEC) showed significant difference at the level of 10% (Fisher exact test, $p = 0.1$).

Five patients had undergone supraomohyoid ipsilateral neck dissection with the tumor excision, because of high-grade histopathologic type, or large T (more than or equal to T2b) or both. Two patients underwent modified radical neck dissection because of clinical or CT or MRI detection of metastatic neck disease. Those two patients presented histologically confirmed metastatic lymph nodes, both with N2a disease. Both patients were females with cribriform subtype of ACC. The tumors of those patients, who were in stage IV at presentation, were on the palate, extending from the palate to the submandibular space in one of them. The younger of those two patients is still alive with no disease, after adjuvant treatment.

All patients underwent reconstruction as required. The patient who underwent extirpation of the eye was immediately reconstructed with temporalis myofascial flap and a free skin flap for coverage of the orbit. Another patient with MEC of the palate underwent immediate reconstruction with utilization of osseous muscle and fascia temporalis flap following subtotal maxillectomy. The patient with intraosseous MEC had iliac crest bone graft for reconstruction of the mandible. The above-mentioned restorative techniques were in

Figure 3 Involved margins for patients with adenoid cystic carcinoma and mucoepidermoid carcinoma. ACC, adenoid cystic carcinoma; MEC, mucoepidermoid carcinoma.

some cases combined with the use of local flaps and the buccal fat pad. Local flaps were also a sole method of reconstruction in certain cases, as was the tamponade with “Whitehead’s varnish” and the use of an obturator.

Histopathologic diagnosis with evidence of marginal excision, cervical lymph node involvement, high-grade histology, and stages III and IV were the criteria for adjuvant radiotherapy. Twelve patients, mainly all patients with ACC, one of the patients with PLGA, and the patient with ductal adenocarcinoma were thus offered postoperative radiotherapy of 60 to 66 Gy within 6 weeks after surgery. Three patients with ACC denied further treatment, and one died of cardiopulmonary arrest in the intensive care unit on postoperative day 3, so finally only seven patients with ACC, the patient with salivary duct adenocarcinoma, and one of the patients with PLGA received postoperative radiotherapy. Involved margins had been noticed in four of the nine patients. Regarding the stage of the disease, all nine patients were in stage II to III. Combined treatment with adjuvant chemotherapy with cisplatin 80 to 100 mg/m² and docetaxel 10 to 15 mg/m², was offered to four of our patients with ACC on the basis of high-grade histopathology, positive or close margins, and perineural invasion (Table 1). The patients with BCA and PLGA

with perineural invasion are currently in a close monthly follow-up program.

Patients were followed for 10 years (range 2 to 10 years), with a median of 4.5 years. The review was monthly for the first year, every 3 months for the first 5 years, and every 6 months thereafter. All patients under review were examined locally and clinically as well for neck metastases with yearly MRIs. Local recurrence was recorded in one patient with ACC and one patient with MEC 5 years and 22 months postoperatively, respectively. Lung hematogenous metastases were observed in one patient with ACC 16 months after completion of their therapeutic course, which comprised surgery and radiotherapy. Overall, 19 patients were free of local or disseminated disease at the last follow-up. Three patients died during the course of our study. One died while in the intensive care unit postoperatively of unrelated causes, and two of disseminated metastases. All three patients had ACC (Table 1).

Survival was estimated by the Kaplan-Meier analysis. Overall survival of patients with MSG malignancies was 90.5% (Fig. 4). Comparison between the two major groups (ACC and MEC) did not reveal any statistically significant difference in survival. However, as can be noticed in Fig. 5, the survival for ACC tumors

Figure 4 Overall survival plot.

Figure 5 Survival plot for patients with adenoid cystic carcinoma and mucoepidermoid carcinoma. ACC, adenoid cystic carcinoma; MEC, mucoepidermoid carcinoma.

is considerably lower after 5 years than survival for MEC. Considering other specific risk factors with possible influence on survival, our limited series failed to depict any significant relations such as age ($p=0.5$), gender ($p=0.2$), stage of the disease ($p=0.3$), histopathologic type ($p=0.3$), and margins ($p=0.4$) to have a significant role in the specific series of patients. The only marginally significant difference was observed for tumor size regarding survival (Cox regression $p=0.06$).

DISCUSSION

The present study involved only a limited number of patients and therefore suggests but does not confirm assertions statistically. Single-institution surveys often present this limitation. However, suggestions regarding design of a standard management protocol for MSG tumors were made.

Higher incidence of ACC and MEC compared with other entities is in agreement with other studies.^{2,3,12} In contrast to recent valid publications,^{3,4} our series of patients presented with ACC more commonly than MEC. The majority of MSG tumors in the present study (95.5%) originated from the oral cavity. The most commonly affected site was the hard and soft palate, followed by the buccal space, the floor of the mouth, and the tongue. A few patients presented tumor expansion to the paranasal sinuses, near to or in the orbit, or the submandibular area, reaching back to the parapharyngeal space.

However, none of the tumors presented on the upper or lower lip, or the retromolar fossa, which is a paradox considering the high incidence of such sites for MSG tumors in other studies.^{3,4} As a reference center for maxillofacial surgery, the observed higher incidence of intraoral tumors is justified. However, the lack of equal number of tumors involving the paranasal sinuses does not permit any comparison of the biological profile of malignant tumors of MSG, according to their site.

Patients were more often female than male in our data, with a ratio of 2.1:1. Gender is probably of questionable importance considering occurrence and prognosis of MSG tumors, as there is a lot of discrepancy between studies. Strick et al² found a 3:1 ratio favoring male preponderance, whereas in a study by Jansisyanont et al⁵ including 49 MSG tumors, the female-to-male ratio was 1.9:1. The age of patients at presentation in this series ranged from 26 years to 89 years with median age of 64.5 years. Other studies found that people older than the third and fourth decades in similar studies were more commonly affected,² which may be explained by late diagnosis, intraoral location, and lack of symptoms.

Although intraoral in 95.5% of cases in our series, the tumors of MSG had a variety of clinical presentations. Most were asymptomatic swellings with or without ulceration. Symptoms of nasal congestion were

reported by one patient with PLGA of the palate extending to the maxillary sinus, whereas hypoesthesia of the infraorbital nerve was the first symptom in a young patient with ACC of the maxilla. CT and MRI are useful in determining extension of the disease and the possibility of adequate resection. These investigations are also valuable in demarcation of metastatic neck lymph nodes.

In the present series, seven patients had neck dissection. Of those, only two proved positive for metastasis, which abides to the general proportion of 4 to 10% recorded in other studies.^{5,6} The neck management in patients with MSG tumors and clinically negative neck (N0) is ambivalent.⁸ Many factors usually dictate selective neck dissection, such as the site and size (T) of the tumor, the histological grade, and the age of the patient. Parsons et al have classified MSG tumor sites according to the incidence of node positivity.¹ According to this classification, low incidence (less than 10%) is observed in MSG tumors of the hard palate, nasal cavity, paranasal sinuses, lip, and buccal mucosa. The intermediate risk of positive neck at presentation should be expected in MSG tumors of the floor of the mouth and tongue.

The higher risk for node metastases lies with MSG tumors of the pharynx and larynx. However, other authors advocate significantly lower lymph node infiltration than hematogenous metastases for MSG tumors.⁷ The standard regimen, which is currently applied in our department regarding management of the neck in patients with MSG tumors, is modified radical neck dissection for clinical or radiographic or frozen section evidence of metastasis. Selective supraomohyoid neck dissection is reserved for patients with tumors of high grade or advanced stage (III to IV). Site is not estimated as important for the decision of a neck dissection, nor is the patient's age.

Although evaluation of the neck for head and neck cancer patients has greatly evolved, it remains a subject of debate, as happens with its management. Ultrasound evaluation, especially combined with ultrasound-guided fine-needle aspiration cytology, has been proposed as a means of increasing preoperative accuracy in staging.¹³ However, it is generally accepted that pathological staging is the most decisive parameter for further management and prognosis. Furthermore, micrometastasis may not be diagnosed, but only cured with a neck dissection. In our institute, supraomohyoid neck dissection is a common procedure with minimal morbidity, therefore we usually include it in the operation scheme, instead of "wait and see" or postoperative radiotherapy modules.

Adjuvant radiotherapy was offered to patients who presented with advanced stage, histopathologically proven positive neck metastases, close or positive margins, and perineural invasion. All ACC tumors, a high-grade ductal adenocarcinoma, and one of the two PLGA

tumors were submitted to postoperative radiotherapy. The main criterion for adjuvant treatment was highly aggressive histological subtype (i.e., combination of histological subtypes, perineural or bone invasion). Combination of radiotherapy and cisplatin with or without docetaxel was offered to patients with positive or close margins and advanced stage of the disease at presentation. Other authors reserve such a therapy for patients with distant metastases,^{2,9} or as palliative treatment.^{7,14} Even though the presented series of patients is limited, combination therapy appeared to improve the prognosis of patients with MSG tumors. As 10-year survival is poor among such patients,^{2,9,14} an effective chemotherapeutic agent may inhibit and prevent late hematogenous metastases.

In our limited series of patients, local control of disease was achieved, which is in accordance to other studies recommending radical surgical excision as the therapeutic intervention of choice.^{1,8} Adjuvant radiotherapy is also supported as further means of achieving locoregional control of the disease.^{8,14} Metastases to the lungs observed in one of our patients with ACC also support the vascular pattern of dissemination corroborated by previous studies.

Late recurrences and metastases that were also noted in our study confirm the necessity of long-term follow-up of these patients, more than 5 years. The prognosis of malignant tumors of minor salivary glands depends on the affected anatomic site, symptoms of nerve involvement, the stage of the disease, and particularly the histological subtype and grade of the tumor.^{1,7,8,15} Although increasing evidence is lately available to maxillofacial surgeons regarding MSG tumors, there is still progress to be made in the field of diagnosis, staging, and management. Detailed immunohistochemical and biological studies of these tumors will certainly affect treatment, perhaps by addition of more effective chemotherapeutic agents.

CONCLUSIONS AND PROTOCOL PROPOSAL

As tumors of MSG are uncommon, a standard protocol should direct patients' workup and surgical management. We concluded that for intraoral tumors, such a protocol should include preoperative evaluation with panoramic radiograph, MRI, bone scanning for lesions with evidence of bone involvement, and open biopsy. Grading should be accomplished. Chest radiographs or chest CT is of value and should be undertaken in patients with large tumors and histologically high-grade malignancy.

Wide local excision is proposed for intraoral tumors of MSG. Modified radical neck dissection should be included in the treatment plan when evidence of metastasis exists. Ideally, evidence should be by histopathology or cytology, by means of an ultrasound or CT

fine-needle aspiration. However, one should always bear in mind the difficulties of such a protocol, as well as occasional problems due to interdepartment discrepancy. Selective supraomohyoid neck dissection should be offered to patients with tumors of high grade (solid adenoid cystic adenocarcinoma, high-grade MEC) or advanced stage (III to IV). If the histopathologic report is positive for lymph node metastases, adjuvant radiotherapy has satisfying results. Adjuvant chemotherapy is possibly overtreatment, but in our department it has produced good results without significant morbidity. Finally, a follow-up of over 10 years is absolutely necessary, with review monthly for the first year, every 3 months for the next 5 years, and every 6 months thereafter. All patients under review should be examined locally and for neck metastases. Physical examination, as well as yearly MRI, is necessary in follow-up.

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