

## Mohs Surgery Outside Usual Indications: A Review

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**ABSTRACT** The body of literature supporting the use of Mohs micrographic surgery (MMS) in tumors outside the main indications (basal cell carcinoma, squamous cell carcinoma, dermatofibrosarcoma protuberans, lentigo maligna) is constantly growing, but it is still based on case reports, case series, or at best institutional case series that focus on a single malignancy. Our aim in this review was to assess use of MMS in an array of rare tumors outside the usual indications. A review was performed using the MEDLINE database and the search engine ClinicalKey®. We reviewed the use of MMS on atypical fibroxanthoma (AFX)/malignant fibrous histiocytoma, microcystic adnexal carcinoma, extramammary Paget's disease, Merkel cell carcinoma, pocrine/eccrine carcinoma/porocarcinoma, trichilemmal carcinoma, leiomyosarcoma, and angiosarcoma. Mohs micrographic surgery appears to be scarcely used in these tumors due to their low incidence. It is mainly performed for tumors in the H-zone of the face, and can be performed safely. The overall recurrence rate is lower compared with simple or wide local excision. MMS should be used in a more generalized fashion for these tumors.

**KEY WORDS:** Mohs surgery, micrographic surgery, skin cancer, skin tumors

### INTRODUCTION

Mohs micrographic surgery (MMS) is a specialized form of skin cancer surgery where cure rates are close to 100% and maximal preservation of healthy tissue is usually achieved when performed by a trained Mohs surgeon (1). Non-melanoma skin cancer (NMSC) is the most common form of cancer treated with MMS. NMSC includes basal cell carcinoma (BCC) and squamous cell carcinoma (SCC), with BCC being the most frequent and SCC the second most frequent type of tumor treated with this technique (2).

MMS is also recommended for other less frequent, although not uncommon, malignancies, such as dermatofibrosarcoma protuberans (DFSP) and lentigo maligna (LM) (3), and many series in the literature support its use as a first-line treatment (4,5).

Incomplete excisions and recurrences occur regularly in more infrequent cutaneous tumors (adnexal tumors, sarcomas...) that are sometimes treated with wide local excision (WLE) with excision margins ranging from 1 to 5 centimeters (6). MMS is indicated and recommended for these tumors in consensus guidelines, as the tumors are characterized by asymmetric or multifocal growth patterns (3); however, statistics from the National Cancer Data Base (NCDB) showed that MMS was only used for 8% of these tumors in which MMS is recommended, representing a clear underuse of the technique (7).

The body of literature to support the use of MMS in these rare tumors is growing constantly but is still based on case reports, case series, or at best institu-

tional case series that focus on a single malignancy. Our aim in this review was to assess the use of MMS in an array of rare tumors outside of the usual indications (BCC, SCC, DFSP, LM). The review was performed using the MEDLINE database and the search engine ClinicalKey®.

### **Atypical fibroxanthoma (AFX)/malignant fibrous histiocytoma (MFH)**

AFX and MFH are dermal fibrohistiocytic tumors that typically present as pink nodules on the head and neck of elderly Caucasian men. They carry a low risk of metastasis but a high rate of local recurrence.

AFX is the most common spindle cell skin tumor treatable with MMS. Recently, Tolkachjov *et al.* performed a systematic review of recurrence and metastatic rates following different surgical modalities (WLE versus MMS). Twenty-three studies were selected (914 tumors); 175 cases were treated with MMS with a recurrence and a metastatic rate of 2.0% and 1.9%, respectively, and 732 tumors were treated with WLE with a recurrence and a metastatic rate of 8.7% and 1.0%, respectively (8).

### **Microcystic adnexal carcinoma (MAC)**

MAC is likely the tumor on which the most data supporting the use of MMS are available. The most frequent location is the face, reaching up to 90% of the tumors reported (9-12). In our series, 71.4% appeared in the H-zone of the face.

MAC is a locally aggressive tumor, infiltrating the hypodermis in 57.14% and the muscle in 28.57% of the tumors in our series. It is also characteristic to find perineural invasion (PNI), for which data were not collected in our series, which can be present in up to 59.0% of primary tumors and 87.5% of recurrent tumors (9,13). PNI is one of the main factors that determines recurrence, and the presence of PNI in the periocular area has been associated with a bad prognosis related to the outcome of surgery, recurrence, intracranial extension, and even death in 1 patient (14). This is why some authors have proposed the use of paraffin-embedded sections (slow-Mohs) or staining with toluidine blue instead of HE, since the detection of PNI can be improved with these techniques (15-17).

In comparison, the local recurrence rate for MAC in patients treated with conventional wide excision reached 60% in several series (12,13,18).

### **Extramammary Paget's disease (EMPD)**

EMPD is a rare intraepithelial adenocarcinoma of skin regions with numerous apocrine glands. It most

commonly affects individuals aged 50 to 80 with a predominance in women and Caucasians (19). In our series, 83.33% of patients were female and the mean age was 66.6 years of age. The prognosis is associated with the presence of dermal invasion and lymph node metastases (20); of our patients, 2 (33.33%) had dermal and 1 (16.67%) had hypodermal invasion.

WLE is the technique of choice when there is no association with underlying neoplasms, however, the tumor's ill-defined margins and high recurrence rates (range 20-60%) (22) have raised the question of whether MMS has advantages over WLE. Several studies have demonstrated the effectiveness of MMS in treating EMPD, with lower tumor recurrence rates (range 8-26%) (22,23).

In different retrospective studies on the Asian population, it has been concluded that MMS is superior to conventional WLE for EMPD in Asians with a recurrence rate using MMS varying from 11.0% to 18.2% versus 26.5% to 36.4% for patients who underwent WLE (21,24,25). Nevertheless, no significant differences in metastases-free survival were observed and the authors found no evidence of a difference in overall survival between the 2 groups.

### **Merkel cell carcinoma (MCC)**

MCC is a rare cutaneous tumor of neuroendocrine origin with a high metastatic rate. These tumors are more common in the head and neck region and in elderly Caucasian men. In our series, 60% appeared on the trunk and limbs and 40% in the H-zone of the face (26).

Traditionally, WLE has been used for local control, but recurrence rates of 30-50% have been reported (27,28). Su *et al.* and Singh *et al.* (29,30) retrospectively reviewed MCC cases with clinical stages I-II from the NCDB and compared survival outcomes depending on treatment with MMS versus WLE. Of the 1795 patients, 1685 underwent WLE and underwent 110 MMS. There was no difference in overall survival between the two treatments, suggesting that both modalities are equally effective in treating early stage MCC. Shaik *et al.* reached the same conclusions in a retrospective population-based cohort study from 2004-2009 with a total of 2610 cases of MCC (2267 cases were treated with WLE and 174 with MMS) (31).

In the largest cohort from a single institution with 22 patients treated with MMS (26), the overall local recurrence rate was 5% (1/22), but 16 patients received radiotherapy (MCC is very radiosensitive and radiation of the primary site and regional lymph nodes after WLE is usually recommended) (32). Furthermore, a multicenter retrospective study compared

20 patients treated with MMS and radiotherapy versus 25 patients treated only with MMS. No local recurrence or metastases were observed in the group treated with MMS and radiation, however 1 marginal recurrence and 3 in-transit metastases occurred in the group treated with MMS alone (33).

### **Apocrine/eccrine carcinoma/porocarcinoma**

Porocarcinoma is a rare malignant cutaneous adnexal tumor that arises from eccrine or apocrine sweat glands. It usually occurs on the lower limbs and on the head and neck of elderly patients, with no differences between sexes (34).

The local recurrence rate was 35% in 23 patients treated with WLE in a retrospective study (35). Two different case series treated using MMS were combined, with a total of 21 cases, and only 1 nodal recurrence was reported after MMS (36,37).

### **Trichilemmal carcinoma (TC)**

TC is a rare malignant adnexal neoplasm of the outer root sheath. Most cases reported are solitary papules that arise in sun-exposed, hair bearing anatomic sites of elderly Caucasians (38). Traditionally, wide excision with at least 1 cm margins has been recommended (39).

Hamman *et al.* (40) performed a review of 103 cases of TC, where 7 cases had been treated successfully with MMS without any recurrence. Tolkachjov *et al.* (41) reported 7 new cases, the largest series described to date. All patients were Caucasian, and tumors were located on the head and neck. The average age of diagnosis was 70 years of age. The follow-up time was 2.5 years, and none of the tumors recurred or metastasized.

### **Leiomyosarcoma (LMS)**

Cutaneous LMS is a rare malignant mesenchymal tumor of smooth muscle origin with an infiltrative growth pattern generally classified as dermal or hypodermal. It comprises 4.0% to 6.5% of soft tissue sarcomas (42). WLE is the standard treatment with margins ranging from 1 to 5 cm (43).

Overall, there have been 26 reported cases of excisions of leiomyosarcoma by MMS with 2 recurrences in total (7.7%) (44,45) Starling *et al.* reported the largest series described to date with 11 patients. The mean age at the time of diagnosis was 54.5 years old. Forty-five per cent of the lesions were located on the extremities. The average fold increase of the preoperative clinical size to the final surgical defect was 3.18, which indicates a large subclinical extension. The recurrence rate was nil after a follow-up of 4.47 years (45).

### **Sebaceous carcinoma (SC)**

SC is a rare and potentially aggressive adnexal neoplasm. It can arise from any sebaceous gland in the skin, but areas with a greater density (the periocular area and the head and neck region) have a higher incidence (46).

WLE (variable 5-6 mm wide margins) is associated with local recurrence rates of 4% to 37% and nodal metastatic rates of 3% to 28%. The incidence of local recurrence and metastasis after MMS appears to be much lower than for WLE, 2.4% and 7.3%, respectively (47).

### **Angiosarcoma**

Angiosarcoma of the scalp is a vascular neoplasm associated with an unfavorable prognosis. In the largest and most recent series, the 5-year survival rate after multimodal treatment (surgery + radiotherapy + chemotherapy) varied between 15% and 54% (48) and was associated with free margins after surgery (without specifying the WLE margin width).

The use of MMS for angiosarcoma has scarcely been explored, and only two cases and one series from the past century can be found in the literature (49). In summary, 1 case remained relapse-free after an 18-month follow-up but the final outcome was unknown; the other 3 patients relapsed and died with a mean relapse-free survival of 34 months. It is noteworthy that the patient with the best outcome was an 80-year-old man that received adjuvant radiotherapy after MMS with a relapse-free survival of 72 months.

The dominant belief is that angiosarcomas are "multicentric" or "discontinuous", and that leads practitioners to reject the use of MMS. Trying to shed some light on this, Prodanovic *et al.* (50) reported a case of a large angiosarcoma of the scalp treated with a slow Mohs technique with the aid of CD31 margin examination. They postulated the actual existence of subtle and not easily observed microscopic growth patterns that are not discontinuous but connected, and tumor-free surgical margins could therefore be achieved with MMS.

### **CONCLUSION**

Mohs micrographic surgery appears to be scarcely used in these tumors due to their low incidence. It is mainly performed for tumors in the H-zone of the face, and can be performed safely. The overall recurrence rate is low compared with simple or wide local excision, and the authors believe it should be used in a more generalized fashion.

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