

Mohs micrographic surgery for the treatment of cutaneous leiomyosarcoma

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Background: Cutaneous leiomyosarcoma is an extremely rare, malignant mesenchymal tumor of smooth muscle origin. Although generally considered a low-grade malignancy, there may be significant local invasion and subclinical extension. Rare cases of metastasis have been reported.

Objective: We sought to review the clinical characteristics and outcome of patients with cutaneous leiomyosarcoma treated with Mohs micrographic surgery (MMS) at our practice.

Methods: This study is a retrospective chart review of 11 consecutive patients with cutaneous leiomyosarcoma treated with MMS from 1995 through 2009. Patient demographic data, tumor size, location, previous treatment, number of Mohs stages to obtain clearance, surgical defect size, follow-up data, and presence or absence of recurrence were compiled and tabulated.

Results: The average age of our 11 patients at time of diagnosis was 54.5 years. Three lesions were located on the head/neck and trunk, respectively, and 5 lesions were located on the extremities. Average preoperative clinical lesion size was 4.69 cm². Average number of MMS stages required for tumor clearance was 2.4. Average size of the surgical defect was 14.95 cm². One lesion was recurrent at the time of presentation. All remaining tumors were untreated. Mean follow-up after diagnosis was 4.47 years. No tumors recurred after MMS.

Limitations: Our retrospective study had a small patient population, and follow-up data were less extensive for some patients.

Conclusions: These data represent the largest series in the literature of leiomyosarcoma treated with MMS, and establish that MMS is a useful modality for treating cutaneous leiomyosarcoma, a rare spindle cell malignancy that is not commonly encountered by physicians. (J Am Acad Dermatol 2011;64:1119-22.)

Key words: cutaneous leiomyosarcoma; Mohs micrographic surgery; recurrence; treatment.

Cutaneous leiomyosarcoma is an extremely rare soft-tissue malignancy comprising only 4.0% to 6.5% of soft-tissue sarcomas.¹ Approximately 400 cases of cutaneous and subcutaneous leiomyosarcoma have been reported in the

literature.^{2,3} These tumors are often misdiagnosed clinically and require histopathologic examination for a direct diagnosis.

The general histologic appearance of leiomyosarcoma is a dermally based proliferation of spindle cells with blunt-ended, "cigar-shaped" nuclei and multiple mitotic figures. Leiomyosarcoma histology can range from well-differentiated lesions resembling leiomyoma to poorly differentiated lesions that can resemble atypical fibroxanthoma and malignant fibrous histiocytoma.

Diagnosis usually requires adjuvant immunohistochemical stains such as vimentin, smooth muscle actin, and desmin. Superficial leiomyosarcoma expresses vimentin and smooth muscle actin in 100% of cases, but express desmin in only 60% of cases.⁴ Cytokeratin and S100 protein may also be used to rule

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out other spindle cell neoplasms such as squamous cell carcinoma, melanoma, and nerve sheath tumors, respectively. Leiomyosarcoma must also be distinguished from dermatofibrosarcoma protuberans.

Leiomyosarcoma presenting on the skin include superficial leiomyosarcoma and metastatic leiomyosarcoma (uterus, retroperitoneum). Superficial leiomyosarcomas are subdivided into cutaneous and subcutaneous tumors based on skin location. Cutaneous leiomyosarcomas are situated primarily in the dermis and extend occasionally into the subcutaneous fat. These tumors are thought to arise from the arrector pili muscle of the hair follicle. Subcutaneous tumors are found mainly in the subcutaneous tissues and are thought to arise from smooth muscle of blood vessels.

Although development of metastases from cutaneous leiomyosarcoma is exceptional, these tumors may exhibit aggressive biologic potential causing significant deformity and local destruction. Wide local excision has long been considered appropriate for treatment of cutaneous leiomyosarcoma, but can present significant reconstructive challenges in obtaining outcomes that are both aesthetically and functionally acceptable with a relatively high recurrence rate. Mohs micrographic surgery (MMS) has been demonstrated to provide high cure rates and maximum tissue preservation in commonly encountered malignancies such as basal cell carcinoma, squamous cell carcinoma, and melanoma.⁵⁻⁷ MMS has recently been shown to offer the same advantages in the treatment of cutaneous leiomyosarcoma.⁸⁻¹⁰ We herein report our experience in treating leiomyosarcoma with MMS during 16 years of practice at a high-volume dermatologic surgery center.

METHODS

We conducted a retrospective chart review on all patients referred to and treated for cutaneous leiomyosarcoma in the senior author's practice (B. M. C.) during a 16-year period from 1994 through 2009. All patients were treated with MMS. Permanent sections were used to confirm clearance after each tumor was clear on frozen section Mohs layers. A vertical specimen of each primary tumor was included to aid in permanent section interpretation. Immunostains were not used on Mohs frozen sections, but instead were

used on the permanent sections as deemed necessary by consulting dermatopathologists. We collected demographic data, preoperative tumor size and location, dates of MMS, number of Mohs stages required for clearance, postoperative defect size, follow-up data, and previous treatment information for each patient. Postoperative defect sizes were calculated

using the formula for the area of an ellipse, or "oval." The area of an ellipse = πab , where $2a$ = length of the longest side (measured as the ellipse's greatest width) and $2b$ = length of the shortest side (measured as the ellipse's greatest height).¹¹ Recurrence rates and duration of follow-up were calculated. Similar to Huether et al,⁹ we measured duration of follow-up as the length of time from MMS to the most recent outpatient follow-up either in our office or that

of the referring physician. For patients who had died or moved away, we established telephone contact with the patient, patient's relative, or referring physician to determine if the tumor had recurred.

RESULTS

During a 16-year period there were 11 patients with cutaneous leiomyosarcoma treated with MMS at our practice. Follow-up data were available for all 11 patients identified, and are detailed in Table I. All patients were Caucasian. There were 7 men (64%) and 4 women (36%) in the group. The mean age at diagnosis was 54.5 years (range 7-84 years). One tumor (9.1%) was recurrent and 10 tumors (90.9%) were untreated at the time of consultation for MMS. Three tumors (27.3% each) presented on each of the following locations: head and neck, upper extremities, and trunk. Two tumors (18.1%) were located on the lower extremities. The average preoperative tumor size was 4.69 cm² (range 0.60-25.92 cm²). The average number of MMS stages needed for tumor clearance was 2.4, and the average defect size was 14.95 cm² (range 1.60-107.99 cm²). No tumors recurred after MMS (0% recurrence rate). Mean follow-up after treatment with MMS was 4.47 years (1631.4 days) (range 123-4273 days).

DISCUSSION

Leiomyosarcomas of the skin are often solitary, deeply seated, firm nodules with variable erythema and hyperpigmentation. The clinical appearance is not distinctive, which leads to frequent clinical

CAPSULE SUMMARY

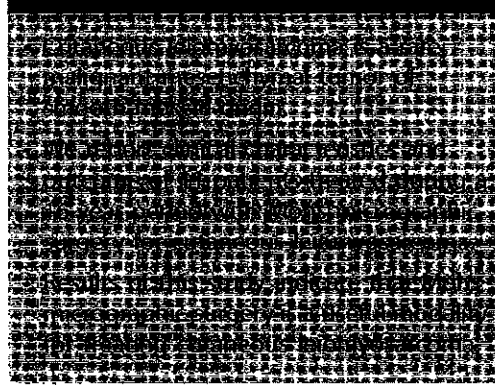


Table I. Patients treated with Mohs micrographic surgery for cutaneous leiomyosarcoma

Age, y	Sex	Primary/recurrent	Location	Preoperative tumor dimensions,* cm	Postoperative defect dimensions,† cm	No. of Mohs stages to clear	Follow-up duration, d	Recurrence s/p MMS
66	M	Primary	Left side of forehead	1.4 × 1.0	1.9 × 1.6	1	123	No
67	F	Primary	Lower aspect of left leg	1.8 × 1.4	3.2 × 2.8	4	145	No
68	F	Primary	Left arm	3.8 × 2.5	5.0 × 3.5	3	998	No
48	M	Primary	Right shoulder	1.5 × 1.4	2.3 × 2.1	1	1208	No
44	F	Primary	Back	1.4 × 0.9	2.2 × 1.6	1	1356	No
84	M	Primary	Back	1.8 × 1.6	2.5 × 2.2	2	528	No
7	M	Recurrent (status post excision × 3)	Left lateral canthus	2.0 × 1.0	3.5 × 3.0	4	1848	No
59	M	Primary	Front aspect of left shoulder	1.1 × 0.7	1.7 × 1.2	1	1885	No
53	M	Primary	Upper aspect of left leg	6.0 × 5.5	12.5 × 11.0	5	2279	No
39	F	Primary	Right deltoid	2.8 × 2.6	3.3 × 3.2	2	3202	No
65	M	Primary	Left temple	1.9 × 1.6	2.5 × 2.2	2	4373	No

F, Female; M, male; MMS, Mohs micrographic surgery; s/p, status post.

*Preoperative tumor dimensions represent greatest width and height of tumor, respectively.

†Postoperative defect dimensions represent greatest width and height of postoperative defect, respectively.

misdiagnosis. The classic location of both cutaneous and subcutaneous leiomyosarcomas is that of the lower extremities.^{1,12} Bernstein and Roenigk¹³ first noticed in 1996 a discrepancy in the anatomic locations of cutaneous versus subcutaneous leiomyosarcomas. The minority of cutaneous lesions were found to be on the extremities (33%), but 62% of subcutaneous lesions presented on the extremities. A more recent review⁸ confirmed these differences, and added that the most common location for cutaneous leiomyosarcomas was found to be the head and neck. Our study showed that cutaneous tumors presented evenly on the head and neck (27.3%), upper extremities (27.3%), and trunk (27.3%). The minority of cutaneous tumors (18.1%) presented on the lower extremities.

Cutaneous leiomyosarcoma is capable of significant local invasion and subclinical extension. However, the metastatic potential of these tumors is considered to be extremely low. In contrast, subcutaneous tumors have been reported to metastasize, most commonly to the lung, in up to 30% of cases.¹⁴ The reported biologic behavior and response of cutaneous leiomyosarcoma to treatment varies widely in the literature. Annest et al⁶ noted that systematic review of treatment responses of leiomyosarcoma is difficult because of 3 factors: leiomyosarcomas are extremely rare, calculations and reports include either or both cutaneous and subcutaneous tumors, and many published series do not specify surgical margins. The overall recurrence rate for

cutaneous leiomyosarcomas is approximately 30%, but rates vary widely from 0% to 48% depending on available follow-up data and treatment modality used.^{1,3,4,9,13-19} Our study of 11 patients with leiomyosarcoma revealed no recurrences with a mean follow-up duration of 4.47 years (1631.4 days, range 123-4373 days).

A well-defined treatment algorithm for superficial cutaneous or subcutaneous leiomyosarcoma is not detailed in the literature, but the American Joint Committee on Cancer (AJCC) GTNM (grade, tumor, nodes, metastasis) staging criteria has been shown to be useful in the assessment of both cutaneous and subcutaneous leiomyosarcoma. A recent multivariate analysis of 105 cases of superficial leiomyosarcoma showed that high AJCC stage and tumor size were the only statistically significant and most reliable parameters when assessing 5-year patient prognosis/survival.²⁰

Surgical excision is the well-established primary treatment for cutaneous and subcutaneous leiomyosarcoma. Although wide local excision is considered standard of care for treatment of these leiomyosarcoma subtypes, it is difficult to consistently determine from the literature the exact excisional margins used. Historical accounts of exact surgical margins are sporadic and range from 2 to 5 cm.²¹ Such margins can present significant reconstructive challenges in obtaining outcomes that are aesthetically and functionally acceptable. The use of wide surgical margins also has not demonstrated a clear benefit in

survival or in decreasing local recurrence when compared with other surgical approaches.^{1,2,13,21}

The survival benefits of adjuvant radiotherapy, systemic chemotherapy, or both in treating superficial leiomyosarcoma are unclear. Both narrow margin excision^{3,19} and MMS^{8,10,13,21-23} have been used to successfully treat cutaneous leiomyosarcoma. Huether et al⁹ most recently reported their 19-year experience using MMS to treat 7 patients with leiomyosarcoma. The recurrence rate was 14% (1/7), and the one tumor that recurred after treatment with MMS was recurrent at the time of initial MMS. The mean follow-up after diagnosis was 4.3 years. Our 16-year experience in treating cutaneous leiomyosarcoma with MMS revealed a recurrence rate of 0% at 4.47 years. To our knowledge, our series of 11 patients is the largest group reported to date treated by MMS.

Reading frozen sections of spindle cell tumor specimens is well within the scope of practice of the Mohs surgeon, and is part of the American College of Mohs Surgery core curriculum.²⁴ Exposure to the diagnosis of different spindle cell tumors begins in dermatology residency training. The most salient challenge of reading frozen sections of spindle cell tumors is obtaining sufficient exposure to gain familiarity with these uncommon tumors. In our fellowship experience, we have created a slide library, complete with Mohs maps, of all spindle cell and other uncommon tumors encountered since inception of the fellowship program. The fellow reviews each case independently and with the fellowship director to determine concordance and proficiency in interpretation of frozen sections of uncommon tumors.

Although the AJCC staging criteria for soft-tissue sarcomas provides valuable information regarding prognosis in superficial leiomyosarcoma, optimal surgical intervention and appropriate use of adjuvant treatment has yet to be determined, and further studies are needed to develop clear standards for evaluation and treatment of patients presenting with these tumors. However, this report further establishes the effectiveness of MMS in the treatment of cutaneous leiomyosarcoma.

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