

Mohs Micrographic Surgery: An Update for the Clinician

As the incidence of non-melanoma skin cancer continues to rise, clinicians must be prepared to educate patients and refer for this curative and cost-effective intervention.

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Mohs micrographic surgery is a cost-effective surgical procedure¹ for the management of skin cancers at sites where tissue conservation is most critical, including eyelids, lips, nose, ears, genitals and digits. The procedure provides cure rates approaching 100 percent for previously untreated basal cell carcinoma and exceed those for traditional surgical excision, radiation therapy, electrodesiccation and curettage, cryosurgery, photodynamic therapy, and topical chemotherapeutic agents.¹ Evidence also supports the efficacy of Mohs micrographic surgery for other cutaneous tumors, including recurrent basal cell carcinoma, primary and recurrent squamous cell carcinoma (SCC), SCC in situ, dermatofibrosarcoma protuberans (DFSP), microcystic adnexal carcinoma (MAC), extramammary Paget's disease (EMPD), Merkel cell carcinoma (MCC), Leiomyosarcoma, and sebaceous carcinoma (SEB CA).²

Mohs surgery is indicated when the cancer is in a difficult area where it is important to preserve healthy tissue for maximum functional and cosmetic result. Other indications include recurrent tumors, poorly defined surgical margins, large skin cancers, rapidly growing skin cancers or skin cancers with aggressive histologic patterns (e.g. morpheaform

BCC, anaplastic SCC), and skin cancers in patients with underlying immunosuppression.

The Mohs micrographic surgery process includes a specific sequence of surgery and pathological review. One person acts as both pathologist and surgeon. Once the visible tumor is removed or debulked, the Mohs surgeon removes an additional, thin margin of tissue from the tumor site; creates a "map" or drawing of the removed tissue to be used as a guide to the precise location of any remaining cancer cells, and microscopically examines the removed tissue thoroughly to check for evidence of

Take-Home Tips. Mohs micrographic surgery is a cost-effective surgical procedure for the management of skin cancers at sites where tissue conservation is most critical, including eyelids, lips, nose, ears, genitals and digits. Patients benefit from the confidence that further surgery will be unnecessary; fellowship-trained Mohs surgeons have extensive experience in the reconstruction of the wound, so patients will not need to see another reconstructive or plastic surgeon in most cases. As the incidence of non-melanoma skin cancers is nearing "epidemic" proportions (estimates show more than 3.5 million people were diagnosed with NMSCs in the US in 2006), the number of patients who are candidates for Mohs micrographic surgery will continue to grow. ●

Photos courtesy of Andrew J. Kaufman, MD



A full thickness graft was used to repair the defect following Mohs micrographic surgery on the ear of this patient. Post-op healing is shown (bottom, right).


remaining cancer cells at the surgical margin. If any of the sections contain cancer cells, the Mohs surgeon returns to the specific area of residual tumor as indicated by the map; removes another thin margin of tissue only from the specific area where cancer cells were detected, and again microscopically examines the newly removed tissue for additional cancer cells until the surgical margins are “clear.” Unlike traditional processing of tissue,

which samples a small percent of the actual margin, Mohs surgery evaluates 100 percent of the peripheral and deep surgical margins. This way the Mohs surgeon does not guess and remove too much or too little skin. Only skin containing cancer is removed.


As the incidence of non-melanoma skin cancers is nearing “epidemic” proportions, the number of patients who are candidates for Mohs micrographic

The Mohs Surgery Process


STEP 1




STEP 2




STEP 3



STEP 4



STEP 5



Step 1: The roots of a skin cancer may extend beyond the visible portion of the tumor. If these roots are not removed, the cancer will recur.

Step 2: The visible portion of the tumor is surgically removed.

Step 3: A layer of skin is removed and divided into sections. The ACMS surgeon then color codes each of these sections with dyes and makes reference marks on the skin to show the source of these sections. A map of the surgical site is then drawn.

Step 4: The undersurface and edges of each section are microscopically examined for evidence of remaining cancer.

Step 5: If cancer cells are found under the microscope, the ACMS surgeon marks their location onto the "map" and returns to the patient to remove another layer of skin - but only from precisely where the cancer cells remain.

Step 6: The removal process stops when there is no longer any evidence of cancer remaining in the surgical site. Because Mohs surgery removes only tissue containing cancer, it ensures that the maximum amount of healthy tissue is kept intact.

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Table 1. Indications for Mohs Surgery
<p>Mohs surgery is especially indicated when:</p> <ul style="list-style-type: none"> • The cancer is large • The edges of the cancer (clinical margins) cannot be clearly defined • Prior treatment has failed, i.e. recurrent tumor • The cancer is located in a cosmetically sensitive or functionally critical area of the body (such as eyelids, nose, ears, lips, fingers, toes, and genitals) • The histologic pattern of the cancer is aggressive (e.g., morpheaform, infiltrative, metatypical BCC; anaplastic SCC) • The patient is immunosuppressed

surgery will continue to grow. Recent data estimates that in the US in 2006, more than 3.5 million people were diagnosed with NMSCs and over two million received treatment for NMSC.³

How does Mohs micrographic surgery compare to other modalities in terms of costs?

Not only is Mohs micrographic surgery most effective at curing skin cancer, it is also cost-effective. In a recent analysis conducted at one clinic, Mohs surgery was found to be \$292 less expensive than traditional surgical excision.⁴

A literature analysis published last year showed that Mohs micrographic surgery is equivalent in cost to excision with permanent sections, costs less than office-based excision with frozen sections (12 percent difference) or excision with frozen sections in an ambulatory surgical center (27 percent less). Of note, 32-39 percent of cases treated with surgical excision were found to require a second procedure for clear margins. In addition to increased costs, subsequent procedures increase the likelihood of a greater amount of tissue removed, risking functional and cosmetic problems.¹

Beyond the high cure rates and cost-effectiveness, patients benefit from the confidence that further surgery will be unnecessary. Because fellowship-trained Mohs surgeons have extensive experience in the reconstruction of the wound caused by

Photos courtesy of Steven M. Rotter, MD



This patient who underwent Mohs micrographic surgery is shown at baseline (top, left) with final defect (top, right), post-repair (bottom, left), and healed (bottom, right).

removing the tumor, patients will not need to see another reconstructive or plastic surgeon in most cases.

Patients worry that Mohs surgery will take all day and “I’ll be left with a huge hole in my face.” How can referring dermatologists advise patients?

When advising a patient about their surgery, a Mohs surgeon will tell the patient to anticipate that the pro-

cedure will take the better part of a day. Most surgeries themselves are relatively brief, so the largest portion of the patient’s day will be spent in the reception or designated waiting area as the surgeons process and examine the tissue they have removed.

While the Mohs process is time-consuming, it ensures that the entire tumor is removed and the surrounding healthy tissue preserved. Other types of skin cancer surgery, which involve removing the

Referring for Surgery

The American College of Mohs Surgery is the professional society for fellowship-trained Mohs micrographic surgeons. The College was founded in 1967 as the American College of Chemosurgery. In 1988 the name changed to the American College of Mohs Micrographic Surgery and Cutaneous Oncology. To coincide with the College's 40th anniversary, the name was shortened to the American College of Mohs Surgery (ACMS).

The Mohs micrographic procedure and the Mohs College were named after Dr. Frederic Mohs, the surgeon who first pioneered the treatment 70 years ago and founded the College in 1967.

To be admitted to the American College of Mohs Surgery, a member must have completed an approved fellowship in which he or she has participated in the surgery of at least 500 patients under the supervision of a trained instructor.

In addition, other dermatologists may also perform Mohs surgery but have not taken one to two years of additional training in the specialty before performing Mohs surgery, and are not eligible to be members of the college.

To find a Fellowship-trained Mohs Surgeon in your area, visit www.mohscollege.org.

tumor, closing the wound, and sending the tumor to a pathologist who will report several days later whether or not all the cancer was removed, may require subsequent additional excisions or additional procedures aimed at closing the wound. If the tumor is not completely removed, a subsequent surgery at a later date would need to be scheduled. With the Mohs micrographic surgery procedure, the one-day process may require more time initially, but patients know immediately that all cancer was removed, which can be very reassuring. In the vast majority of cases, the wound is closed at that time, and the patient need only return for brief follow-up appointments to monitor healing.

The best method of managing the wound resulting from surgery is determined after the cancer is completely removed. Once the final defect is known, management is individualized to achieve the best

results and to preserve functional capabilities and maximize aesthetics. The Mohs surgeon is also trained in reconstructive procedures and usually will perform the reconstructive procedure necessary to repair the wound. It is of critical importance that reconstruction is not performed before all of the margins are clear. Non-Mohs surgery may involve rearranging tissue that still has cancer in it or under it.

Results of the Mohs College membership survey show that primary closure is the most common method of repair, followed by the use of flaps, and only six percent of cases were referred to other specialties for closure.⁵

What is the referring dermatologist's role in long-term patient management?

In most cases, the relationship between the dermatologist and the Mohs surgeon mirrors that of a referring physician seeking a specialist consult. The surgeon will treat the specific complaint, in this case skin cancer, but does not take on the overall management of the patient.

The referring dermatologist maintains responsibility for helping the patient maintain healthy skin, will conduct follow-up skin exams, will educate the patient on UV safety and skin self-exams, and meet any other dermatologic needs of the patient.

The Mohs surgeon should contact the referring doctor to report on the patient's surgery and to advise regarding the prognosis. ■

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Associated video content available on DermTube.com.

