

Mohs micrographic surgery - information brochure

What is Mohs Micrographic Surgery?

Mohs micrographic surgery is a specialized, highly effective technique for the removal of skin cancer. The procedure was developed in the 1930s by Dr. Frederic Mohs at the University of Wisconsin and is now practiced throughout the world. Mohs surgery differs from other skin cancer treatments in that it permits the immediate and complete microscopic examination of the removed cancerous tissue, so that all "roots" and extensions of the cancer can be eliminated. Due to the methodical manner in which tissue is removed and examined, Mohs surgery has been recognized as the skin cancer treatment with the highest reported cure rate.

Special Qualifications of the Mohs Surgeon

Physicians performing Mohs surgery should have specialized skills in dermatology, dermatologic surgery, dermatopathology, and Mohs surgery. Basic and advanced training in Mohs surgery is available through selected Residency programs, specialized fellowships, observational preceptorships, and intensive training courses. In addition, the Mohs surgeon must have the required surgical and laboratory facilities and must be supported by a well-trained Mohs nursing and histotechnological staff. Your Mohs surgeon can provide you with detailed information regarding his or her training in the above disciplines, as well as all applicable professional affiliations. Some skin cancers can be deceptively large – far more extensive under the skin than they appear to be from the surface. These cancers may have "roots" in the skin, or along blood vessels, nerves, or cartilage. Skin cancers that have recurred following previous treatment may send out extensions deep under the scar tissue that has formed at the site. Mohs surgery is specifically designed to remove these cancers by tracking and removing these cancerous "roots." For this reason, prior to Mohs surgery it is impossible to predict precisely how much skin will have to be removed. The final surgical defect could be only slightly larger than the initial skin cancer, but occasionally the removal of the deep "roots" of a skin cancer results in a sizeable defect. The patient should bear in mind, however, that Mohs surgery removes only the cancerous tissue, while the normal tissue is spared.

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Advantages of the Mohs Surgical Procedure, Special Indications for Mohs Surgery

It is important to note that Mohs surgery is not appropriate for the treatment of all skin cancers. Mohs micrographic surgery typically is reserved for those skin cancers that have recurred following previous treatment or for cancers that are at high risk for recurrence. Mohs surgery also is indicated for cancers located in areas such as the nose, ears, eyelids, lips, hairline, hands, feet, and genitals, in which maximal preservation of healthy tissue is critical for cosmetic or functional purposes. Typically, Mohs surgery is performed as an outpatient procedure in the physician's office. Although the patient is awake during the entire procedure, discomfort is usually minimal and no greater than it would be for more routine skin cancer surgeries. The Mohs surgical procedure is illustrated in the following diagrams:

How to prepare for the MOHS surgery?

1. Get a good night rest on the night prior to surgery and have a good breakfast on the morning of surgery.
2. On the surgery day fasting is not indicated. You should bring a snack with you.
3. If the patient is taking prescription medication regularly, one should continue taking them unless otherwise specified by the surgeon.
4. Patients taking anticoagulants (Coumadin, Sintrom etc...) should consult with the surgeon and their family physician prior to surgery. These medications should temporarily be replaced, if deemed medically justified, with a shorter acting anticoagulant (like Clexane).
5. Blood thinners like Aspirin or Plavix should not be withheld prior to surgery.
6. Acamol (Tyolanol) can be self prescribed prior to surgery.

7. Patients knowing themselves to have significant anxiety that might interfere with the course of surgery should take on surgery day mild anxiolytics like Valerian drops or Rescue etc., in mild cases and in more severe cases should be prescribed by their family physician a proper medical anxiolytic to facilitate an easier surgery day.
8. Smoking patients should discontinue their habit at least 24 hours prior to surgery (preferably 2 weeks). This will improve outcome by speeding the healing process and reducing surgery wound complications. Patients with a physical dependence/addiction should get temporary substitutes like nicotin stickers, Nicorrete chewing gum or electronic cigarettes.

What should one bring on surgery day?

1. Documents of financial coverage ('Hithayvut') from your HMO or medical insurer
2. A summary of medical background including prescribed medication and allergies
3. A referral letter from the referring physician.
4. An up to date results of tests (blood count, clotting function) and an ECG.
5. One should refrain from putting on makeup and wear an old shirt that could be soiled with blood.
6. One should have an accompanying person to stay with during surgery and help with getting home after surgery.
7. The average stay at the clinic on surgery day is 4-5 hours. Therefore it is recommended to have with you some reading materials or any other thing to help with passing the waiting time.
8. A list of questions regarding the surgery that you can ask the physician or the nurse upon admission.

How is the MOHS surgery performed?

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The surgery is an ambulatory procedure performed in a dedicated surgery room.

1. The area to be treated is cleansed, marked, and injected with a local anesthetic. The Mohs surgeon removes the visible cancer, along with a thin layer of additional tissue. The removed tissue is then photographed near the surgery wound and the surgeon prepares a detailed "map" of the removed tissue and wound – the "Mohs Map". This procedure takes only a few minutes, and the patient returns to the waiting room.
2. The tissue is marked and sent to the lab to be processed and examined. The removed tissue specimen is cut into sections, stained, and marked on a detailed diagram (Mohs map). Tissue is frozen on a cryostat, and the lab technician removes very thin slices from the entire edge and undersurface. These slices are then placed on slides and stained for examination under the microscope. (This is the most time-consuming portion of the procedure, often requiring one hour or more to complete.)
3. The Mohs surgeon carefully examines the entire undersurface and complete edge of the specimen, and all microscopic "roots" of the cancer are precisely identified and pinpointed on the Mohs map. Upon microscopic examination, if residual cancer is found, the Mohs surgeon utilizes the Mohs map to direct the removal of additional tissue (Stage II). Note that additional tissue is removed only where cancer is present.

This process is repeated as many times as necessary to locate any remaining cancerous areas within the tissue specimen (Stage III, Stage IV, etc.). When microscopic examination reveals that there is no remaining tumor, the surgical defect is ready for repair.

In this manner the Mohs procedure facilitates the smallest possible defect, with minimal healthy tissue removal, while ensuring a complete or maximal removal of the tumor.

How long is the procedure?

In most cases the procedure involves up to 3 stages and therefore expected to take a total of 4-5 hours. However, one can't predict in advance the extent of tumor spread since tumor roots may spread under normal appearing skin. Therefore, it is advisable to reserve the entire day for this surgical procedure, in case the removal of additional layers is required.

It must be emphasized that the goal of surgery is the complete removal of cancer. Achieving this goal may sometimes involve severe aesthetic and functional consequences (i.e. damage to nerves, removal

of essential structures). Should such a development be anticipated or encountered during surgery, the surgeon will stop and explain the situation to the patient, and ask for his approval for the continuation of surgery.

What happens after the Mohs surgery ends?

Once the tumor has been completely removed (or the procedure had to be stopped prior to that end) the surgeon will discuss with the patient his options. These may include:

1. Allowing the wound to heal naturally, without the necessity of additional surgery (which may produce the best cosmetic result).
2. Simple or complex wound repair performed by the Mohs surgeon at the end of surgery on the same day
3. An invitation for delayed simple or complex wound repair performed by the Mohs surgeon after one or a few days.
4. Referral for continuation of surgery or treatment in another word in the hospital (i.e. Plastic surgery, ENT, Maxillofacial surgery, Oral surgery etc.) as the findings at the end of surgery indicate.
5. Referral to continue treatment in the Oncology word, should the characteristics of tumor and findings during surgery indicate that further oncology treatment is needed.

What are the possible forms of wound closure?

For small postsurgical sites, direct closure by suturing the sides of the wound together may be possible. However, in certain areas of the body, there is very little tissue that can be stretched for coverage of a wound, and either a skin graft or skin flap must be used. In closing wounds with a skin flap, the skin adjacent to the surgical defect is partially cut free, and then rotated or moved forward to cover the surgical area. Stitches are then placed to hold the flap in its new position. This provides immediate coverage for the wound. Other areas may require a skin graft to provide coverage. Skin from the side of the neck, behind or in front of the ear, or over the collarbone may be cut free, placed over the wound, and then sewn into place. The original site of the graft is then closed with stitches or allowed to heal on its own.

Will there be a scar after surgery?

Yes!

Every method of surgery involving cutting the skin leaves a scar. However, Mohs surgery will result in the smallest possible surgery wound and therefore the final scars are also expected to be the smallest. In addition it is impossible and ill advised to predict the method and form of wound closure before the tumor removal is complete.

Most Mohs surgeries are completed with a small plastic procedure which results in an excellent cosmetic outcome and are eventually almost in apparent.

Will there be pain, bruising or swelling after surgery?

Most patients do not report significant post surgery pain. In case of discomfort or pain, a significant relief can be obtained by mild pain killers like Acamol, Opthalgin etc.. In any case, where more significant pain is anticipated or encountered – your physician may prescribe stronger analgesic medication.

Bruising and swelling are possible side effects of surgery, especially when it involves areas close to the eyes (forehead, cheeks, nose, eyelids) resulting in hematomas, or to the mouth (lips). Bruising is expected and much more common in patients taking blood thinning medications such as coumadin, Plavix, aspirin, aspirin substitutes (such as Advil, Motrin, Nafton, Naprosyn, etc.), vitamin E, gingko, garlic, ginseng, ginger, ephedra or other nutritional supplements.

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What are potential complications associated with Mohs surgery?

The potential complications are similar to every ordinary skin surgery. They are:

1. **Bleeding** – a significant bleeding may result from an intended or un intended severing of a large blood vessel. During surgery control of the bleeding is attained by local pressure, cauterizing or suturing of the injured vessel. Following surgery bleeding may appear under the bandages, in the surgical wound or from the edges of it. The risk for bleeding is highest in the first 12 hours following surgery. The treatment is usually prolonged pressure over the wound. Sometimes, if the bleeding persists, the surgical wound may be reopened to find and treat the source of bleeding.
2. **Nerve injury** may be followed by sensory loss and or functional loss at or near the surgery site. The extent of damage depends on the location of the tumor, the depth of penetration, and the presence of significant nerves in the tumor area. The injury may be intended and premeditated when removal of the cancer necessitates it (in such cases the surgeon will explain the situation and ramifications during surgery) or unintentional when a nerve or a nerve branch are present in the tumor bed and are accidentally injured during surgery. In these cases there is sometimes improvement and even complete recovery of the nerve within several months. In other cases the damage may be irreversible.
3. **Pain** – Most of the pain during surgery is the result of injection or insufficient local anesthesia. Usually, additional anesthesia will solve the problem. Most patients do not report significant post surgery pain. In case of discomfort or pain, a significant relief can be obtained by mild pain killers like Acamol, Ophthalgin etc.. In any case, where more significant pain is anticipated or encountered – your physician may prescribe stronger analgesic medication. Seldom, pain or tenderness appears several weeks or months following surgery. Usually this pain is the result of a 'neuroma' – a benign, malfunctioning recovering nerve which was injured during surgery. This complication is more difficult to treat and may sometimes require exploration of the surgical wound.
4. **Infection** – Mohs surgeries are performed in maximal sterility conditions. However, the prolonged process involves an open wound, exposed avascular tissues like cartilage and bone and therefore increases the risk of infection. Despite that, the infection rate is quite low (1-2%). In special cases where the surgeon appreciates the risk for infection is increased – a prophylactic oral antibiotic will be prescribed.
5. **Scar & Distortion** – Like all skin surgeries, Mohs surgeries end with a scar. However, in all cases, a maximal effort is being made to achieve the best possible aesthetic and functional closure of the surgery wound, without distortions and while trying to make the scar invisible within normal face folds and creases. It must be pointed out that the size of the tumor, its location, the size of the final defect and independent patient factors (smoking, medication) influence the ability to achieve an aesthetic and qualitative result.
6. **Tumor recurrence** – Despite the fact that Mohs surgery was especially designed to achieve maximal success in removal of the cancer, there might be, and there are, cases where a complete removal is impossible due to local topography or adjacent essential structures that must not be harmed. Sometimes, even in cases where the Mohs procedure was performed until completion and apparent complete removal of the tumor, there might be a local recurrence. These cases are very rare, especially when compared to other ordinary surgeries.

In case where the surgeon suspects tumor remaining in the skin or when the findings indicate an increased risk of recurrence, the surgeon will recommend additional adjuvant post surgery treatment in the form of radiotherapy or local chemotherapy.

What is the expected process following surgery?

1. The patient will receive a summary letter with details about the procedure and instructions for the continuation of treatment or follow up. If your wound requires daily care at home, you will be given detailed instructions following your surgery.
2. The patient should schedule an appointment for suture removal after 7-10 days as stated in the discharge letter. This visit requires a separate payment arrangements to be prepared in advance with the HMO/medical insurer.
3. If deemed desirable, the patient shall continue weekly follow up for the surgery wound for 2-4 weeks. In most cases such a follow up will not be needed and the patient will be invited for follow up and surgery outcome revision after 2-3 months.
4. When no complications happen, the wounds usually heal completely within 2-3 weeks. However, the surgery site and scar continue to improve up to 2 years post surgery with especially rapid improvement in the first several months.
5. For smoking patients – It is extremely important not to smoke in the immediate period after surgery and at least up to 10-14 days post surgery. Smoking in this period increases the risk that the skin graft or flap used to cover and close the surgical wound will suffer from reduced oxygenation and become damaged or even necrotic, thus damaging and reducing the chances of good and aesthetic wound healing.
6. In the immediate period post dressing removal and for at least 2 months following, meticulous sun protection measures should be applied and direct sun exposure should be avoided as much as possible.
7. It is important to remember that the most important factors in skin cancer induction are sun exposure and smoking.
8. Patients which have already had skin cancer are prone to develop additional tumors and are therefore urged to avoid sun tanning as much as possible, adhere to regular and meticulous daily use of sun screen, and a regular dermatological check up to ensure early detection and treatment of precancerous or cancerous lesions. These patients are also urged to completely quit smoking.

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When should I seek medical help?

With any post surgical problem that develop it is important to contact the surgeon or the family physician. Problems that could require consultation include:

1. Increasing pain, un responsive to mild pain killers
2. Increasing swelling
3. Un stoppable bleeding, continuing even after 20 minutes of application of firm local pressure
4. Fever, above 38°C