

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 the 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.

Advantages of the Mohs Surgical Procedure and 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 genitalia, in which the 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 is no greater than for more routine skin cancer surgeries.

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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, they should continue taking them unless otherwise specified by the surgeon.
4. Patients taking anticoagulants (Coumadin, Sintrom Pradaxa, Xarleto etc...) should consult with the surgeon and their family physician prior to surgery. These medications may be temporarily replaced, with a shorter acting anticoagulant (like Clexane). INR's should be kept under a maximum value of 2.0.
5. Blood thinners like Aspirin or Plavix should not be withheld prior to surgery.
6. Acamol (Tylenol) can be taken prior to surgery.
7. Patients with anxiety that might interfere with the course of surgery should, on the morning before surgery take a mild anxiolytic medicine (ie Valerian drops or Rescue etc.), in mild cases, and in more severe cases should be prescribed by their family physician an anxiolytic to facilitate an easier surgery day.
8. Smokers should discontinue their smoking at least 24 hours prior to surgery (preferably 2 weeks). This will improve the outcome by speeding the healing process and reducing surgical wound complications. Patients with a physical dependence/addiction should get temporary substitutes like nicotine stickers, Nicorette chewing gum or electronic cigarettes.

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What should one bring on surgery day?

1. Documents of financial coverage ('Hithayvut') from your HMO or medical insurer
2. A summary of the patients 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 will not cause sorrow if soiled with blood.
6. One should have an accompanying person to stay with during surgery and to help return 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. You are encouraged to bring a list of questions regarding the surgery that you can ask the physician or the nurse upon admission.

How is the MOHS surgery performed?

The surgery is an ambulatory procedure performed in a designated surgical suite.

Procedure:

1. The skin is first 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 surgical wound and the surgeon prepares a detailed "map" of the removed tissue and wound –

the "Mohs Map". This procedure takes only a few minutes, after which 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 an hour or more to complete.)
3. The Mohs surgeon carefully examines the entire undersurface and the entire 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 is 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 ensures the smallest possible wound, with minimal healthy tissue removal, while ensuring a complete or maximal removal of the tumor.

How long is the procedure?

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In most cases the procedure involves up to 3 stages and is therefore expected to take a total of 4-5 hours. However, one can't predict in advance the extent of tumor spread since tumor routes 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 in very rare cases have 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 before continuing surgery.

What happens after the Mohs surgery ends?

Once the tumor has been completely removed (or if the procedure had to be stopped prior) 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 (if the surgeon believes that this will result in 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 ward 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 ward, should the characteristics of tumor and findings during surgery indicate that further oncological treatment is required.

What are the possible ways to close the wound?

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 the 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 detached from deeper layers, and then rotated or moved forward to cover the surgical area. Stitches hold the skin flap in its new position producing an immediate cover of the wound. In some cases a skin graft is required to provide coverage. Skin in a size appropriate for that of the wound is removed from either the side of the neck, behind or in front of the ear, or over the collarbone etc. 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?

Every method of surgery which involves cutting the skin will leave a scar. However, Mohs surgery will result in the smallest possible surgical wound and therefore the final scars are also usually the smallest possible. In addition it is impossible to predict the method and form of wound closure before the tumor removal is complete. Most Mohs surgeries are completed with a procedure which results in an excellent cosmetic outcome and in time become almost unnoticeable.

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Will there be pain, bruising or swelling after surgery?

Most patients do not report significant post-surgical pain. In cases where there is discomfort or pain, significant relief can be obtained by mild pain killers like Acamol, Ophthalgin etc.. In case, of more significant pain - 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, ginkgo, garlic, ginseng, ginger, ephedra or other nutritional supplements.

What are the potential complications associated with Mohs surgery?

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

1. **Bleeding** – Significant bleeding may result from an intended or unintended severing of a large blood vessel. During surgery control of the bleeding is attained by localized pressure, cauterizing or suturing of the injured vessel. Following surgery bleeding may appear under the bandages, in the surgical wound or on margins of the wound. The risk for bleeding is highest in the first 12 hours following surgery. The treatment is usually prolonged pressure on the surgical wound site. 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 occur when removal of the cancer necessitates it (in such cases the surgeon will explain the situation and the 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. **THIS IS A RARE COMPLICATION!**
3. **Pain** – Most of the pain during surgery is the result of insufficient local anesthesia. Usually, additional anesthesia solves the problem. Most patients do not report significant post surgical pain. In case of discomfort or pain, significant relief is obtained by mild pain killers like Acamol, Opthalgin etc.. If there is a more significant pain – your physician may prescribe stronger analgesic medication. On rare occasions 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 additional exploration of the surgical wound.
4. **Infection** – Mohs surgeries are performed in maximal sterile 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 is concerned that 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 made to achieve the best possible aesthetic and functional closure of the surgery wound, without distortion. Effort is made to try to make the scar invisible within the 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 individual patient factors (eg. smoking, medication) influence the ability to achieve an aesthetic and optimal result.
6. **Tumor recurrence** – Despite the fact that Mohs surgery was especially designed to achieve maximal success in removal of the cancer, there are some cases where complete removal of the tumor is impossible due to adjacent essential structures which must not be harmed. Sometimes, even in cases where the Mohs procedure was performed with complete removal of the tumor, there might be a local recurrence or distant metastases. These cases are very rare, especially when compared to other ordinary surgeries. **In case where the surgeon suspects that a part of the tumor remained 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 procedure 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 care. 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 the physician requests, the patient should continue weekly follow ups of the surgical wound for 2-4 weeks. In most cases such a follow up will not be required and the patient will be invited for follow up and surgery outcome review after 2-3 months.
4. When there are no complications, the wound usually heals completely within 2-3 weeks. However, the appearance of the wound and the scar continue to improve up to 2 years post-surgery with noticeable improvement in the first several months.
5. For patients who smoke – 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 an aesthetic wound healing.
6. It is of the utmost importance that for at least 2 months following surgery, meticulous sun protection measures should be used and direct sun exposure should be avoided as much as possible.
7. It is important to remember that the most important factors that cause skin cancers are sun exposure and smoking.
8. Patients who have already had skin cancer in the past are prone to develop additional tumors and are therefore urged to avoid sun exposure as much as possible, and to use sun screen daily. They need 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, which is unresponsive to mild pain killers
2. Increasing swelling
3. Unstoppable bleeding, which continues even after 20 minutes of the application of firm localized pressure
4. Fever, above 38°C