



Dana-Farber
Cancer Institute



Brigham Cancer Center

Mohs Surgery and Reconstruction A Handbook for Patients

Mohs and Dermatologic Surgery Center

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The Mohs and Dermatologic Surgery Center at Brigham and Women's Faulkner Hospital offers outpatient surgical removal of skin cancers with excellent outcomes. Mohs surgery is the most successful treatment for many forms of skin cancer. It has a remarkable 98 percent cure rate for new cancers and 95 percent cure rate for recurrent cancers, and conserves as much normal tissue as possible.

Skin Cancer Types

A skin cancer is a group of skin cells that grow at an uncontrollable and unpredictable rate. There are three main forms: basal cell carcinoma, squamous cell carcinoma, and melanoma. The names refer to the cell types in the top skin layer (the epidermis) from which these cancers arise (Figure 1). Cancer occurs when normal cells begin to multiply.

Mohs surgery is primarily used to treat basal cell carcinoma and squamous cell carcinoma. Superficial melanoma (in which abnormal cells are in the epidermis only) can be treated with Mohs surgery with the aid of special laboratory techniques. Other rare forms of cancer such as Merkel cell carcinoma and dermatofibrosarcoma protuberans (DFSP) can also be treated with Mohs.

Basal cell carcinoma (BCC) is the most common cancer with approximately 725,000 new cases diagnosed each year in the U.S. It has a low mortality rate and an excellent prognosis as it rarely spreads internally. However, if left untreated, it will continue to destroy skin and deeper tissues in the area resulting in a non-healing open wound and possible disfigurement.

Squamous cell carcinoma (SCC) is the second most common skin cancer after BCC with approximately 700,000 new cases annually in the U.S. Though the prognosis is generally excellent, an estimated 5,000-10,000 U.S. deaths from the disease occur each year in tumors with known factors associated with a worse prognosis. For example, SCC tumors that are bigger than a quarter, grow deeper than the subcutaneous fat layer, grow inside large nerves under the skin, or have very abnormal poorly differentiated cells have a higher chance of spreading and causing death.

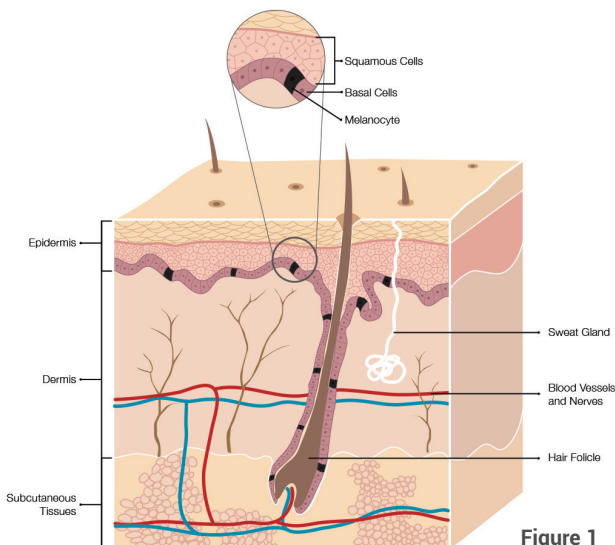


Figure 1

Causes of Skin Cancer

The cause of skin cancer, like other forms of cancer, is not completely known. Exposure to sunlight is the single most important factor associated with the development of skin cancers. Skin cells are damaged by sunlight and other types of ultraviolet light. Light-skinned individuals develop skin cancer more frequently than dark-skinned individuals who have pigment in their skin that protect them from the sun. Cancers of the skin are more common in the southern United States where there is more sunlight.

Melanoma has a hereditary component with higher risks for people who have a sibling, parent, or child with the disease. Our immune system also plays a role in destroying abnormal cells before they become cancers. Other possible causes of skin cancer include radiation treatments, chronic wounds and blistering diseases, and certain chemicals such as arsenic. There are ongoing studies to analyze these and other possible causes.

Growth of Skin Cancer

Skin cancer develops near the surface in the epidermis and grows both outward along the skin surface and downward to deeper parts of the skin. Deeper tumor extensions cannot be seen with the naked eye. Therefore, what is visible on the surface of the skin may actually be only a small portion of the actual tumor (Figure 2).

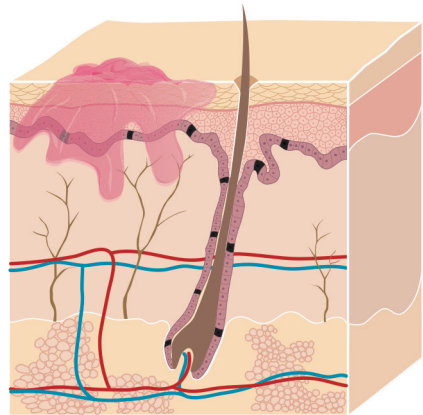


Figure 2

Skin Cancer Treatment

There are several methods of treating skin cancer, all of which are highly successful in the majority of patients. Aside from Mohs surgery, these methods include excision (non-Mohs surgical removal), curettage and electrodesiccation (scraping with a curette then burning with an electric needle), radiation, cryosurgery (freezing) and injectable chemotherapy. Laser and topical treatments are not generally recommended as a skin cancer treatment except for certain forms of superficial cancer and pre-cancerous growths. Which treatment we recommend depends on several factors, such as the location of the cancer, its size, its depth, its growth pattern, and previous therapies. This handbook focuses on Mohs surgery. Please feel free to discuss the risks and benefits of various treatment options with your dermatologist or Mohs surgeon.

Mohs Surgery

In Mohs micrographic surgery, tissue is removed and examined under the microscope, indicating how much of the tumor has been eliminated. Developed in the 1930's by Frederic E. Mohs, MD, Mohs surgery is a technique to remove skin cancer that results in an excellent chance of cure.

Mohs micrographic surgery is a specialized type of surgery developed for the precise and complete removal of skin cancers. It has the following unique hallmarks:

- The entire cut surface (margin) is examined under the microscope.
- The same physician is both surgeon and pathologist. That is, the Mohs surgeon who removes your cancer also reviews the cut surface under the microscope and determines if cancer is still present (margin). If cancer is present, the Mohs surgeon knows exactly where the cancer is and removes more tissue precisely at that location.

Steps in Mohs Surgery

There are several steps in Mohs surgery:

1. **Anesthesia:** Mohs surgery is performed with the administration of local anesthesia (an injection of numbing medication) into the skin. There may be slight pain with the injection but otherwise you should feel no pain. We also can give you a mild sedative by mouth if desired.
2. **Cleaning/sterilizing of the area:** This will be performed with a surgical cleanser to minimize the risk of infection.
3. **Debulking:** The visible portion of the tumor will be removed with a scalpel (surgical knife).

4. **Removing stage 1:** A thin layer of tissue (usually including the full thickness of the skin) will then be removed with a scalpel and processed for microscopic examination by the surgeon. Marks are placed on the patient and on the tissue to ensure that orientation of the tissue (right side vs. left side, upper vs. lower) is maintained throughout processing, microscopic examination, and subsequent surgical stages if needed (Figure 3). The surgical Figure 3 wound is cauterized to stop bleeding and bandaged while the patient waits for results. A paper map is made that shows where the cancer was removed. It is color coded to show right from left, top to bottom (Figure 4). Colored dyes are placed on the tissue to match the paper map.

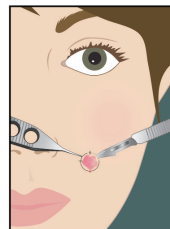


Figure 3

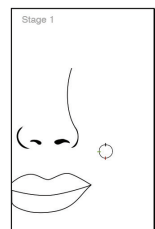


Figure 4

5. Laboratory processing of tissue: Our histology technicians freeze the tissue to harden the tumor, cut thin slices (sections) of the tissue, and place them on glass slides to stain them (usually with hematoxylin and eosin) so that the cells are highlighted in the tissue. This process takes between 30 minutes and two hours depending on the size of the tumor. During this time, you may read, go to the cafeteria, or walk around the hospital while you are waiting. Please tell our staff if you leave the Mohs Center and please bring a cell phone.

6. Microscopic examination of tissue: The Mohs surgeon then examines the perimeter and undersurface of the removed tissue under the microscope (Figure 5). In about 70 percent of patients, the margins are free of cancer. In 30 percent, cancer is found at the margins (Figure 6).



Figure 5

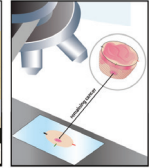


Figure 6

7. Additional stages: If cancer is found at the margins, it is marked on the diagram at the location where it is present (Figure 7). The patient is then brought back into the procedure room, another anesthetic injection is given, and another thin layer of tissue is removed from the cancerous location (Figure 8). Steps 5 and 6 are then repeated. The great majority of patients have clear margins after a second stage of Mohs surgery. However, there are some unusual tumors that are larger than they look on the surface and require several stages of Mohs surgery.

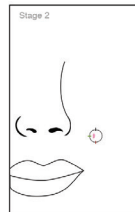


Figure 7

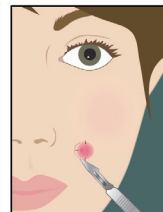


Figure 8

Duration of Mohs Surgery

For most patients, Mohs surgical removal of skin cancer takes three to six hours. However, since we cannot predict how many surgical stages you will need, and your wound will likely need reconstruction after the cancer is removed (see “Reconstruction of the Surgical Wound” on Page 8); ***please plan to spend the entire day at our office.*** Very large tumors may require more than one visit.

Effectiveness of Mohs Surgery

The precision of Mohs micrographic surgery results in two major advantages.

1. The surgery has the highest published cure rates for skin cancer (98 percent for BCC and SCC), making it less likely for cancer to grow back
2. The surgery provides maximal preservation of healthy skin, which leads to the best possible cosmetic and functional result

These advantages make Mohs micrographic surgery especially useful for treatment of skin cancers that are large, have poorly defined edges, have grown back after previous treatments, or are located on areas of the body (such as the face and hands) where keeping the surgical wound as small as possible is critical to maintaining cosmetic and functional out-comes. Mohs also offers a high cure rate for rare cancers such as Merkel cell carcinoma and DFSP, and for superficial melanoma.

Advantages of Mohs Surgery

Examination of 100 percent of the surgical margin

In non-Mohs surgery, only a sample of the cut surface (surgical margin) is examined under the microscope. The tissue is removed (Figure 9, top) and only one percent of the margin is actually examined in most cases. In Mohs surgery, nearly 100 percent of the margin is examined microscopically (Figure 9, bottom) decreasing the risk that small areas of residual tumor will be missed.

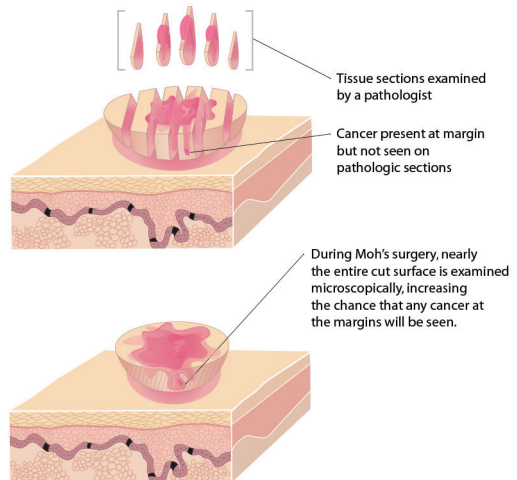


Figure 9

Microscopic examination of surgical margins by the surgeon

In Mohs surgery, the surgeon is specially trained to examine tissue under the micro-scope and detect cancer. Since the surgeon examines the tissue, he or she knows exactly where cancer remains (for example near the skin surface or down deep) without having to interpret a report from another physician.

In non-Mohs surgery the tissue is examined under the microscope by a pathologist who then gives a report to the surgeon about where the cancer remains. Since the surgeon does not look at the tissue, he/she must rely on accurate communication with the pathologist so that additional tissue is removed from the right area.

The above advantages combine to create the highest chance of cure while preserving as much normal tissue as possible.

Reconstruction of the Surgical Wound

Mohs surgeons are trained in reconstructive surgery and use the same techniques and materials to close wounds as other surgeons who perform reconstructive surgery such as plastic surgeons and head and neck surgeons. Over 90 percent of our Mohs surgical patients have facial cancers and we reconstruct nearly all of the surgical wounds created during Mohs surgery. Thus, we perform hundreds of facial reconstructions each year with excellent cosmetic and functional results. However, if you have a reconstructive or plastic surgeon whom you would like to perform your reconstruction, please let our staff know and we will gladly coordinate appointments with his/her office.

Your Mohs surgeon will advise you about your reconstruction options. Many wounds can simply be stitched in a straight line. Others may require moving skin from areas nearby (a flap) or from another area of the body (a graft). Some wounds look best if allowed to heal naturally. Your Mohs surgeon will tell you which of these options is likely to give you the best result taking into account the size, shape, and position of the wound.

In rare cases of extensive cancers, reconstructive surgery may not be possible without sedation or general anesthesia. In such cases, we arrange for reconstruction in an operating room by a head and neck surgeon, plastic surgeon or surgical oncologist.

Pre-operative Instructions

We strongly recommend that you have someone drive you to and from the hospital since swelling from surgery can sometimes affect vision and some patients require relaxation medications. It is a good idea to bring a book or magazines with you for the times during the day that you will be waiting.

Try to get a good night's rest, eat breakfast, and come to the office 15 minutes before your appointment. If you are taking medication, take it as usual unless we direct otherwise (please see below under "Pre-operative Medications"). You should bring your daytime medications and take them as usual during the day.

Pre-operative Medications

- **Antibiotics:** Some patients may require pre-operative antibiotics. Pre-operative antibiotics are usually given if you have had an artificial joint placed within the past year. Please alert our office staff if you have such a condition or if another physician has advised you to take antibiotics prior to surgery.
- **Coumadin/Warfarin:** If you are on coumadin or warfarin, we recommend that you continue taking it as prescribed. We will ask you to have a coumadin level (INR) checked within 72 hours of surgery with the report faxed to us.

Healing Process and Scars after Surgery

All surgical wounds heal with a scar. This is true no matter how they are reconstructed. Your Mohs surgeon will perform your reconstruction in such a way as to minimize scarring. Most patients' scars after Mohs surgery are not noticeable to others once healed. However, the appearance depends upon many factors including the size and location of the wound.

You should expect some bruising and swelling after surgery. This usually resolves within three weeks. However, some swelling can persist in unusual cases for several months. The surgical area will initially appear red and perhaps slightly bumpy. This appearance will gradually improve over several months.

If your scar is still noticeable six months after surgery, please return to us for a visit. There are several ways to improve a noticeable scar including injections of medicine, dermabrasion, laser treatment, or surgical corrections.

Although the vast majority of our patients do not need additional treatments to improve the appearance of scars, your surgeon will be happy to discuss whether you would benefit from such treatments at any time.

Post-operative Instructions and Limitations of Activity

After Mohs surgery and reconstruction, you will be asked to return in one to two weeks for removal of stitches. You may want to stay home from work for approximately one week if it involves interactions with the public or hard physical labor. You may want to avoid speaking engagements or big events (weddings, anniversaries, etc.) for one month after surgery if the cancer is on your face. We will ask you to avoid travel, exercise and swimming for up to three weeks depending upon the location of your wound and type of reconstruction required. When making your appointment, please tell our staff if you anticipate having to travel soon after surgery.

Follow-up Care

Studies have shown that once you develop a skin cancer, there is a high risk you will develop it in the years ahead. We recommend that you be seen every six months by your dermatologist so he or she may determine whether you have developed any new skin cancers. Also, should you notice any areas on your skin that are growing or changing color, or any pimples or dry areas that do not resolve in six weeks, please check with your dermatologist immediately to see if a biopsy is needed.

Future Sun Exposure

Studies have shown that daily application of sunscreen decreases the number of future skin cancers that skin cancer patients get. Therefore, we recommend you apply an SPF 15 UVA/UVB blocking sunscreen to any skin not covered by clothing every day. If the weather is hot, you should use a waterproof sunscreen. If you are spending time outdoors, reapply your sunscreen every two hours. Your goal should be to maintain your natural skin color all year round. You should never allow yourself to get sunburned or tanned. You should never use tanning beds. However, you should continue to enjoy the outdoors utilizing sunscreen, beach umbrellas, hats, sunglasses, long sleeves and pants. Participate in outdoor activities (including beach, pool, and sports) before 11 am and after 4 pm.



Where to Learn More

You can read more about Mohs surgery and watch a video about the surgery on the American College of Mohs Surgery (ACMS) website at: www.mohscollege.org

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