
Skin Cancer *and* Mohs Micrographic Surgery



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Skin Cancer Incidence in the U.S.

- Most common type of cancer
- 5 million people treated each year, 1 in 5 will get it
- Each year, more new cases of skin cancer than cancers of the breast, prostate, lung and colon ***combined***
- More people have had skin cancer than all other cancers combined over last 3 decades
- Treatment costs ***\$8.1 billion*** each year

Source: Skin Cancer Foundation

Melanoma Incidence in the U.S.

- Nearly 10,000 people will die of melanoma in 2015
- Estimate: 73,870 new cases will be diagnosed in 2015
- Melanoma accounts for $< 2\%$ of skin cancer cases, but the vast majority of skin cancer deaths
- Of the 7 most common cancers, melanoma is the only one whose incidence is increasing ($\sim 2\%$ per year)
- ***1 in 50*** people will be diagnosed with melanoma

Source: Skin Cancer Foundation

Why the Rapid Increase?

- Sun exposure habits
- Prevalence of indoor tanning
- Ozone layer depletion
 - 4% - 5% increase in UVB radiation reaching earth (at latitudes that cover the U.S.)⁶
- Other unknown factors

Causes of Skin Cancer

- Ultraviolet radiation – a proven human carcinogen
 - UVB (290nm - 320nm)
 - Most important: **cause burning**
 - UVA (320nm - 400nm)
 - More penetrating: **cause aging**
- Ionizing radiation (X-rays)
- Chemicals (arsenic, coal tars)

The Impact of Indoor Tanning

- 419,000+ cases of skin cancer linked to tanning each year
- Tanning beds classified alongside plutonium, cigarettes by WHO
- More people develop skin cancer because of tanning than develop lung cancer because of smoking
- A single tanning session increases risk of SCC by 67%, BCC by 29%

Source: Skin Cancer Foundation

Causes of Skin Cancer

- “Marjolin’s ulcers”
- Immunosuppression
 - Organ transplant patients
 - 10% - 45% of transplant patients develop skin cancers^{[7,8](#)}
 - 2 to 3 times more SCCs than BCCs^{[8](#)}
- Human papillomavirus - HPV 16
- Inherited diseases - XP, BCNS, albinism

Basal Cell Carcinoma

- Most common cancer in America
- Usually seen in the middle-aged and elderly
- Usually due to solar radiation
- Most common locations:
 - Face - nose, cheeks, forehead, periocular
 - Ears, neck, trunk, extremities
- Frequently develop another within 5 years

Basal Cell Carcinoma

Subtypes

- Nodulo-ulcerative (most common)
- Pigmented
- Morpheaform (sclerosing, infiltrative)
- Micronodular
- Metatypical (basosquamous)
- Superficial (“multicentric”)

Basal Cell Carcinoma

Subtypes

- Nodulo-ulcerative (most common)

Basal Cell Carcinoma

Subtypes

- Pigmented

Basal Cell Carcinoma

Subtypes

- Morpheaform BCCs

Basal Cell Carcinoma

Subtypes

- Superficial “Multicentric”
- Can be misdiagnosed as psoriasis or eczema

Basal Cell Carcinoma

Course

- Slow progressive growth
- Bleeding, ulceration
- Enlarges over months, years
- Capable of extensive tissue destruction (invading muscle, cartilage, bone) if untreated ➡

Basal Cell Carcinoma

Histopathology

- Dark purple staining basal cells in mass
- Peripheral palisading
- Retraction

Basal Cell Carcinoma

Sometimes what is seen at the surface is only the tip of the iceberg

Squamous Cell Carcinoma

Arise primarily on sun-damaged skin

- Often from precursor actinic keratosis

May occur anywhere on skin

- Face
- Lips, mouth
- Ears
- Dorsal hands
- Chest and back
- Anogenital
- Extremities

Squamous Cell Carcinoma

Cases where SCCs > BCCs:

- Immunocompromised patients
- Black patients
- On lips and dorsal hands
- PUVA treatment patients

Squamous Cell Carcinoma

Metastasis more likely in:

- Recurrent tumors
- Those with diameter > 2 cm
- Those with depth > 4 mm
- Mucosal sites, periauricular skin
- Those arising from chronic wounds (Marjolin's)
- Perineural invasion
- Immunocompromised patients

Squamous Cell Carcinoma

Subtypes

- Keratoacanthoma
- SCC from Bowen's Disease
- Verrucous carcinoma
- Well-differentiated SCC
- Acanthiolytic SCC
- Lymphoepithelioma-like carcinoma
- Desmoplastic SCC
- Adenosquamous SCC
- Cystic SCC

Squamous Cell Carcinoma

Subtypes

- Keratoacanthoma
 - Initial rapid growth
 - Exophytic nodule with central keratin-filled crater ➡
 - Remains stable for a few months
 - May spontaneously resolve

Squamous Cell Carcinoma

Subtypes

- Bowen's Disease
 - Squamous cell carcinoma *in-situ*
 - Thin, erythematous, scaling plaques ➡
 - Often progress into, and/or coincide with invasive SCCs
 - Can be misdiagnosed as psoriasis or eczema

Squamous Cell Carcinoma

Subtypes

- Verrucous Carcinoma
 - Exophytic, verrucous, or fungating tumor
 - Usually in genital or oral regions but also found on the sole of the foot
 - May be related to human papillomavirus

Non-Melanoma Skin Cancer

Sometimes what is seen at the surface is only the tip of the iceberg.

Treatment of BCCs and SCCs

Electrodesiccation and Curettage (EDC)

- Scrape and burn lesion until a healthy base is achieved
- Cure rate dependent on experience
- Lacks margin control (pathologic confirmation)
- “Blind procedure”

Treatment of BCCs and SCCs

Curettage

Treatment of BCCs and SCCs

Electrodesiccation

Treatment of BCCs and SCCs

Cryotherapy

- Liquid nitrogen
- Used frequently to destroy benign or premalignant (AKs)
- May be used to treat malignancies
- Lacks margin control
- Method of blind destruction

Treatment of BCCs and SCCs

Cryotherapy

Treatment of BCCs and SCCs

Radiation therapy

- May be very effective in certain areas
- Primary vs. adjuvant role (with surgery)
- Requires multiple treatments over 4 to 8 weeks
- Tumor may recur in more aggressive form
- Used in certain patients, such as those unable to tolerate surgery

Treatment of BCCs and SCCs

Radiation therapy

- Malignancies may develop within irradiated skin

Treatment of BCCs and SCCs

Lasers

- Carbon dioxide
- Erbium: YAG
- Photodynamic therapy

Treatment of BCCs and SCCs

Surgical Excision

- Traditional excision with safety margins
 - 3 mm to 5 mm margin →
- Make ellipse and close in linear fashion
- Larger lesions may require flaps or grafts
- Common method of removing skin cancers
- Approximately 90% cure rate⁹

Treatment of BCCs and SCCs

Mohs Micrographic Surgery

- Highest cure rate (97-99%)[9, 10](#)
- Spares healthy tissue
- Evaluates the entire surgical margin microscopically
- Standard of care when:
 - tumor is in critical location (cosmetic or functional)
 - tumor is recurrent
 - tumor has ill-defined margins
 - tumor is large (> 2 cm) or aggressive

Mohs Surgery

- Used on tumors with contiguous growth
- Precise microscopic margin control of tumor margins
- 100% of peripheral & deep margin examined
 - Traditional vertical sections examine less than 1%

Mohs Surgery

Recurrent Tumors

- Tumors that have recurred after prior treatment
- Can be more aggressive than original tumor
 - More difficult to cure
 - Have even higher subsequent recurrence
 - More ill-defined
 - Have higher metastatic potential

Mohs Surgery

Critical Location

(Cosmetic and Functional)

- Periorbital
- Perioral
- Periauricular
- Perinasal
- Hands and feet
- Genitalia

Mohs Surgery

Aggressive Histology

- Infiltrating BCC
- Micronodular BCC
- Morpheaform BCC
- Metatypical BCC
- Perineural invasion
- Poorly differentiated SCC
- Acantholytic SCC

Mohs Surgery

Other Cutaneous Tumors

- Dermatofibrosarcoma protuberans (DFSP)
- Atypical fibroxanthoma (AFX)
- Sebaceous carcinoma
- Merkel cell carcinoma
- Microcystic aonexal carcinoma
- Verrucous carcinoma
- Angiosarcoma

Mohs Surgery Procedure

1. Tumor identified and debulked
2. Saucer-shaped piece of tissue is excised with 1-2 mm margin around and underneath curetted borders
3. The skin is marked for orientation
4. Excised tissue is color-coded and mapped by sections for orientation
5. Tissue sections processed with frozen horizontal technique
6. Mohs surgeon evaluates slides for residual tumor
7. If residual tumor found, it is marked on map with proper orientation
8. Second Mohs layer taken *only* in positive area
9. Process repeated until margins clear
10. Defect repaired with appropriate technique

Mohs Surgery Procedure

Tumor identified and debulked with curette

Mohs Surgery Procedure

Hatch mark(s) made on skin for orientation

Mohs Surgery Procedure

Beveled incision with minimal (*1-2 mm*) border

Mohs Surgery Procedure

Tissue removed just under curreted base

Mohs Surgery Procedure

Tissue grossed, color coded and mapped

Mohs Surgery Procedure

Sections embedded for horizontal sectioning

Mohs Surgery Procedure

Sections processed and read by Mohs surgeon

Mohs Surgery Procedure

Pathology read by surgeon and mapped

Mohs Surgery Procedure

Only small area with tumor re-excised

Mohs Surgery Procedure

Process continued until no tumor at margins

Mohs Surgery Advantages

Highest Cure Rate

- 97-99% for primary tumors^{[9, 10](#)}
- 94% for recurrent tumors^{[10](#)}
- Entire margin evaluated microscopically
- Cost effective
- Cure rates of other methods:
 - Standard excision 89.9%^{[9](#)}
 - Destruction 81-96%^{[9, 10, 11](#)}
 - Radiation 91%^{[9](#)}

Mohs Surgery Advantages

All of peripheral & deep margin examined

- Less than 1% examined in standard vertical sections
- Standard breadloafing of tissue provides only small sample:

Mohs Surgery Advantages

Tissue Conservation

- All tumor roots are traced and removed
- Preserves maximal amount of healthy skin
- *Smallest surgical defect possible*
- Smallest margin but greatest confidence
- Standard excision takes guess at margins and excises additional tissue (3-5mm in each direction)

Mohs Surgery Advantages

Cost-Effective^{9, 10, 11, 12}

- Outpatient office setting (not OR), pathology reading included, local anesthesia (not general), lowest recurrence

	<u>cost</u>	<u>recurrence</u>
Mohs surgery	\$1,243	1%
Destruction	\$652	4% - 19%
Office excision: perm. sections	\$1,167	10.1%
Office excision: frozen sections	\$1,400	10.1%
Ambulatory surgical facility excision	\$1,973	10.1%
Radiation therapy	\$4,558	9%

Mohs Surgery Advantages

Extremely high cure rate gives Mohs surgeons confidence to repair with most appropriate technique

- Second intention healing
- Simple or complex linear closures
- Local flaps
- Full and split thickness skin grafts

Mohs Surgery Results

Second intention healing

Mohs Surgery Results

Complex/Layered linear closure

Mohs Surgery Results

Local flap reconstruction

Mohs Surgery Results

Local flap reconstruction

Mohs Surgery Results

Local flap reconstruction

Mohs Surgery Results

Reconstruction with skin grafts

Mohs Surgery: Summary

- Highest cure rate (97-99%)[9, 10](#)
 - Entire margin evaluated
 - Fewer recurrences
- Leaves the smallest surgical defect possible
 - Preserves maximal amount of tissue
 - Increases the chance of a good aesthetic result
- Most cost-effective treatment of select tumors
 - Outpatient setting, local anesthesia, pathology included

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