

## SKIN AND SOFT TISSUE LESIONS

### Benign Lesions

#### I. Skin and soft tissue injuries

Wounds are classified as clean or contaminated. While all wounds have bacteria present within them, clean wounds are those that are less than 12 hours old and are free of significant bacterial contamination. Contaminated wounds are those that have a higher bacterial content determined by the mechanism of injury or the length of time elapsed since injury (>12 hr). Examples of contaminated wounds are human bites, farm injuries, and many occupational injuries. The classification of the wound is used to determine the method of closure.

When approaching a patient with a wound, you should start by initially cleaning and anesthetizing the area. Local anesthetic is used for the management of simple wounds. General anesthesia may be required for more complex wounds to allow for adequate debridement and repair. After obtaining appropriate anesthesia, the area is thoroughly irrigated and all non-viable tissue is debrided.

There are three types of wound closure: primary, secondary, and delayed primary.

1. *Primary wound closure* - direct re-approximation of the wound edges. This can be accomplished with suture, staples, or adhesive. There are many types of suture material but they can be classified into monofilament or braided and absorbable or non-absorbable sutures. Monofilament, non-absorbable sutures are used most commonly for simple skin repairs.
2. *Secondary wound closure* - the wound is allowed to heal without re-approximation of the skin edges. This process involves wound contraction and re-epithelialization. Wound contraction occurs by myofibroblasts working from the edges of the wound. Similarly, epithelialization occurs from the edges of the wound and progresses towards the center at a rate of 1 mm/day (in the absence of infection). Granulation tissue is the hallmark of a wound healing by secondary intention. It is beefy, red tissue that forms within a wound, and is an indication of the ongoing inflammatory process present as the wound heals. Wounds that heal by secondary intent may be allowed to fully epithelize, or the surgeon may choose to take the patient for excision of the granulation tissue and delayed primary closure.
3. *Delayed primary closure* - also called tertiary closure, is when a wound that has been healing by secondary closure is then primarily closed by re-approximating the skin edges after a delay of several days to several weeks. This is appropriately attempted in wounds with bacterial counts less than  $10^5$ . An alternative option for wounds healing by secondary intention is skin graft coverage to speed the epithelialization process.

Clean wounds can be closed primarily, if there is not a significant tissue defect. Contaminated wounds are more appropriately selected for secondary or delayed primary closure given the increased risk of infection.

## ACS/ASE Medical Student Core Curriculum Skin and Soft Tissue Lesions

Local anesthetics work by interrupting sodium movement through neuronal membranes, and therefore, disrupt signal conduction. Local anesthetics differ in the rapidity of onset and length of duration. Lidocaine has a relatively quick onset, but in the absence of a vasoconstrictor, is not long-lasting. Bupivacaine has a slower onset of action, but also has more durable anesthesia. The addition of a vasoconstrictor, like epinephrine, to a local anesthetic will slow its systemic absorption and prolong its effect. However, there should be caution when adding a vasoconstrictor to local anesthesia used in distal targets (digits, nose, and penis). The maximum dose of local anesthetic should be calculated prior to patient use (Table 1). The dose of local anesthetic is calculated using the percentage of the solution intended for injection. For example, a 1% solution of lidocaine has 10 mg/mL of lidocaine. A 0.5% solution of bupivacaine has 5 mg/mL of bupivacaine.

**Table 1**

| Local Anesthetic                | Maximum Dose |
|---------------------------------|--------------|
| Lidocaine without epinephrine   | 4.5 mg/kg    |
| Lidocaine with epinephrine      | 7 mg/kg      |
| Bupivacaine without epinephrine | 2.5 mg/kg    |
| Bupivacaine with epinephrine    | 3 mg/kg      |

When given in excess, local anesthetics can cause significant toxicity. Patients will often initially complain of perioral numbness or metallic taste. This can progress to chest pain, palpitations, syncope, dyspnea, convulsions, hypotension, and cardiopulmonary arrest. Great care should be taken to calculate the maximum dose and not to exceed it.

Bites are a unique form of soft tissue trauma. The most common types of bites are dog, cat, and human bites. These wounds are at increased risk for infection due to the bacterial content of the mouths of animals and humans. As with all wounds, bites should be thoroughly irrigated and inspected. All devitalized tissue should be removed. Bites on the face can be closed primarily as long as the patient, or caregiver, is provided with adequate education about the signs/symptoms of soft tissue infection. While not every patient with a bite wound needs antibiotic therapy, deep/penetrating bites, bites over a joint, bites to the genitalia, hands, or face, bites which are primarily closed, or bites in immunocompromised hosts should be considered for prophylactic antibiotics.

## II. Pressure Ulceration

A pressure ulcer is, “localized injury to the skin and/or underlying tissue usually over a bony prominence, as a result of pressure, or pressure in combination with shear and/or friction.” Pressure ulcers are classified according to the depth of injury and associated tissue loss. The National Pressure Ulcer Advisory Panel’s staging system is listed in Table 2 which follows.

**Table 2**

| Stage                       | Description   |
|-----------------------------|---|
| Stage 1                     | Intact skin with localized area of non-blanchable erythema  |
| Stage 2                     | Partial-thickness loss of skin with exposed dermis  |
| Stage 3                     | Full-thickness loss of skin   |
| Stage 4                     | Full-thickness skin and tissue loss with exposed fascia, muscle, tendon, ligament, cartilage, or bone   |
| Deep Tissue Injury          | Intact or non-intact skin with purple/maroon discoloration following significant pressure or shear injury, can rapidly develop into full thickness injury |
| Unstageable pressure injury | Full-thickness skin and tissue loss with slough/eschar at base making deep extent of ulcer not visible  |

Pressure ulcers are best treated with prevention. Proper patient positioning and frequent turning can prevent the development of ulceration to an area of prolonged pressure. Following the development of pressure ulcers, patients are often management by a multidisciplinary team including a wound specialist for serial debridement and coverage.

### III. Skin and Soft Tissue Infections

Cellulitis is a soft tissue infection often presenting after a minor cut/wound becomes secondarily infected. Patients present with blanching erythema extending beyond the area of injury. There is often associated pain, warmth, and edema. Occasionally, the break in the skin surface is not immediately evident. The most common associated organisms are Staphylococcal and Streptococcal species. In the absence of systemic signs of infection (fever, malaise, etc.), patients can be treated with an outpatient course of antibiotic therapy. Concerning signs of more serious infection are bullae, hemorrhage, skin sloughing, or evidence of gas within the tissue. These findings would warrant additional testing, imaging, and potentially surgical debridement.

Folliculitis, Furuncles, and Carbuncles are also types of soft tissue infection. Folliculitis is inflammation of the hair follicle often secondary to bacterial infection. It is often caused or exacerbated by shaving, waxing, plucking, or friction. It can be treated with oral or topical antibiotic therapy. For folliculitis associated with hair removal, recurrent episodes are best treated with cessation of hair removal for 2-3 months to allow for recovery and natural hair growth. A furuncle, also called a boil, is an abscess around a hair follicle involving the surrounding tissue. A carbuncle is a cluster of furuncles connected subcutaneously. These are typically also caused by skin flora (Staphylococcal and Streptococcal species). Furuncles can

## ACS/ASE Medical Student Core Curriculum Skin and Soft Tissue Lesions

frequently be treated with incision and drainage. Carbuncles may require systemic antibiotic treatment secondary to the extent of surrounding tissue involvement.

Hidradenitis suppurativa (also known as acne inversa) is a chronic inflammatory condition of the apocrine gland-bearing skin. It is characterized by inflamed nodules, sinus tracts, and abscess formation. Pathogenesis involves atrophy of the sebaceous glands, inflammation, follicular destruction, and granuloma formation. It typically occurs in intertriginous areas (axilla, groin, perineal, perianal, and inframammary). There is often a delay in diagnosis as the patient is thought to have a simple, inflammatory condition. Patients with abscesses treated with incision and drainage almost uniformly recur. Women are more commonly affected than men, and affected patients are typically diagnosed in their 20's. There is a familial association of the disease, and the disease course is negatively affected by obesity and cigarette smoking. For mild cases, patients can be treated with topical antibiotic creams or intralesional steroid injections. For moderate disease, patients can be treated with systemic antibiotics, hormonal manipulation, or immunosuppression. For severe disease, treatment involves surgical excision of the affected area of skin with subsequent graft or flap coverage.

Necrotizing soft tissue infections (NSTIs) are a broad category of infections including fasciitis, myositis, and cellulitis. They are characterized by significant tissue destruction and high mortality. Infections are classified as Type 1 (monomicrobial) or Type 2 (polymicrobial). Monomicrobial infections are most commonly clostridia, streptococci, or bacteroides species. Bacteria produce endotoxins which act as hemolysins, collagenases, lecithinases, and proteases allowing for the destruction of surrounding tissue and formation of deep tissue infections. Most patients present with pain out of proportion to physical exam findings and tenderness extending beyond the area of clinical concern. Skin findings may include bullae/blisters, grayish discoloration, or "dishwater" drainage. Crepitus is often discussed, but less commonly seen clinically. Computed tomography scanning may reveal evidence of stranding or inflammation in the deep tissue layers or gas present within the tissues. When the diagnosis is uncertain, surgical exploration can be undertaken to evaluate the deeper tissues. At the time of exploration, patients will have "dishwater" drainage, absence of bleeding, or easy separation of affected tissue planes. NSTIs are considered a surgical emergency. Patients often present with severe inflammatory responses including sepsis and septic shock. Patients should be urgently treated with fluid resuscitation, broad spectrum antibiotics, and surgical debridement of all affected tissue. Debridement may require multiple trips to the operating room and result in significant tissue loss.

### IV. Burns

There are three different types of burn injury: thermal, chemical, and electrical. Burn wounds are classified as epidermal burns (first-degree), partial-thickness burns (second-degree), and full-thickness burns (third-degree). Characteristics of each are listed in Table 3 which follows.

**Table 3**

| Burn classification    | Description   |
|------------------------|---|
| 1 <sup>st</sup> degree | <ul style="list-style-type: none"> <li>Involve only the epidermis</li> <li>Appear red</li> <li>Moderately painful</li> <li>Blanch with pressure</li> </ul>  |
| 2 <sup>nd</sup> degree | <ul style="list-style-type: none"> <li>Extend into the dermis</li> <li>Can be superficial or deep</li> <li>Often associated with blistering</li> <li>More superficial burns are associated with pain as there is exposure of the dermal cutaneous nerve fibers</li> </ul> |
| 3 <sup>rd</sup> degree | <ul style="list-style-type: none"> <li>All layers of the skin are burned</li> <li>Covered with dry, avascular tissue</li> <li>Insensate</li> </ul>  |

Patients with epidermal burns can often be treated expectantly with pain control and do not require admission and resuscitation. Patients with deeper burns require more thorough evaluation and treatment.

It is necessary to calculate the total body surface area (TBSA) that has been burned as this is used to guide resuscitation and management. This can be completed using the “Rule of 9’s” or the Lund-Browder chart.

**Rule of Nines for Establishing Extent of Body Surface Burned**

| Anatomic Surface      | % of total body surface |
|-----------------------|-------------------------|
| Head and neck         | 9%                      |
| Anterior trunk        | 18%                     |
| Posterior trunk       | 18%                     |
| Arms, including hands | 9% each                 |
| Legs, including feet  | 18% each                |
| Genitalia             | 1%                      |

Second and third degree burn patients require significant fluid resuscitation. In many centers, the required volume of fluid for resuscitation is calculated using the Parkland Formula:

$$4 \text{ mL} \times \text{weight (kg)} \times \text{TBSA burned} = \text{Total fluid required for first 24 hours}$$

## ACS/ASE Medical Student Core Curriculum Skin and Soft Tissue Lesions

It is recommended that  $\frac{1}{2}$  of the fluid total be given over the first 8 hours and the second  $\frac{1}{2}$  be given over the following 16 hours. Individual patients may require more or less fluid depending on how they are responding to the ongoing resuscitation, and patient care should be adjusted to each patient's response targeting a urine output of 0.5 mL/kg/hr.

When initially evaluating these patients, the most important step is to stop the burning process. For thermal burns, immediate application of cool compress can reduce the amount of damaged tissue. This action must be guarded in large burns and in children due to precipitation of a dangerous hypothermia. For electrical burns, the offending source should be removed from the victim with a non-conducting object. In chemical injuries, the agent should be diluted with copious water. Assessment of an adequate airway is vital. Endotracheal intubation may be necessary prior to patient transport or referral due to gradual increase of edema over the first 18-24 hours. If the patient does not require intubation, 100% oxygen should be delivered via mask in significantly burned patients to decrease the likelihood of problems from pulmonary dysfunction or carbon monoxide poisoning. Burns should be initially covered with clean, dry linen. Burns of less than 15% TBSA in the conscious and cooperative patient can often be resuscitated orally or with maintenance IV fluids. Patients with >15% TBSA involvement requires intravenous access for planned resuscitation. Patients with significant burns should receive 0.5 mL of tetanus toxoid. If prior immunization is absent/unclear, his/her last booster was more than 10 years ago, or there is a severely contaminated wound, 250 units of tetanus immunoglobulin should also be administered.

Concern for inhalational injury is important in the evaluation of burn patients. Concerning elements of the patients' presentation include: burn in an enclosed space, unconscious patient, presence of noxious chemicals, soot within the mouth, nose, or airways, carbonaceous sputum, hoarseness, stridor, tachypnea, and agitation. Patients are definitively evaluated by bronchoscopy. Initiation of endotracheal intubation is important if the diagnosis is suspected.

After the initial evaluation and resuscitation, deeper burn wounds are managed with excision and grafting. Burn wounds are a source of ongoing fluid loss and potential infection for patients. Early excision and grafting are recommended to improve outcome. First, the burned tissue is excised and then covered. Coverage is typically completed with skin grafting. This is most commonly taken from the patient's own skin (autograft). If there is insufficient skin for grafting, patient's wounds can be covered with allografts (cadaveric skin) or other biologic products.

Patients with more significant burns are often recommended for referral to burn centers. Indications for transfer include: >10% second degree burn; third degree burns; burns of the face, hands, feet, genitalia, perineum, and/or major joints; electrical burns; presence of polytrauma in addition to burn; presence of inhalational injury; patient co-morbidities that complicate treatment; or non-qualified personnel to care for children.

## **V. Characteristics and treatment of benign skin and soft tissue lesions**

Epidermal and dermoid cysts are classified together because they both contain epithelial lining away from the skin surface. Dermoid cysts are somewhat unique in that they contain skin and skin structures including sweat glands, hair follicles, and other structures.

Epidermal cysts, also called epidermoid cysts, epidermal inclusion cysts, or “sebaceous cysts,” are similar to dermoid cysts in that they are lined with epithelium, but they do not contain the other skin appendages. These are very common and present as a superficial cyst with a central sinus or punctum. When opened or removed, they are found to be thin-walled cysts containing a keratinous material which is often thick, white, and can be malodorous. They can become infected and then present with erythema, pain, and contain purulent material. When infected, these can be incised and drained. Excision, which is the primary treatment, is best undertaken when the cyst is not infected. The clinician must be sure to remove the entire cyst including the cyst wall to decrease the risk of recurrence.

Keratosis (pl. keratoses) is a general term referring to a growth of keratin on the skin. Most commonly, there are two types – seborrheic keratoses and actinic keratoses. Seborrheic keratoses are very common skin lesions occurring primarily in older individuals. They are generally tan to brown to gray plaques with a “stuck on” appearance. The cause is not known but they are associated with lifetime sun exposure and have a hereditary predisposition. They can become irritated, particularly in areas of friction. As these lesions are benign, they do not require removal. They can be treated with cryoablation (liquid nitrogen), shave removal, or Bovie electrocautery.

Actinic keratoses are pre-malignant lesions with the potential for progression to squamous cell carcinoma. These typically have a central white plaque surrounded by erythematous skin. They have a rough texture. These are also associated with lifetime sun exposure and are more common in fair-skinned individuals. These lesions can be treated topically with destructive agents or excision.

Nevus (pl. nevi) is the medical word for “mole.” These are frequently referred to as melanocytic nevi and arise from a proliferation of melanocytes. They appear as pigmented lesions of the surface of the skin. They can be associated with progression to malignancy. Classically, nevi are evaluated using the “ABCDE” criteria. Lesions are monitored for (A) asymmetry, (B) irregular borders, (C) color, (D) diameter > 8 mm, and (E) evolution, or change overtime. Lesions which are found to have concerning features are recommended for biopsy.

Hemangiomas of the skin are typically referred to as infantile hemangiomas and are a very common skin lesion of infancy. These are benign lesions which are cherry red in appearance and formed by superficial collections of vascular endothelium. Typically, these regress by 5 years of age. The most common management is observation, or expectant management. Larger lesions or lesions in cosmetically sensitive areas can be treated topically with beta blocker cream, intralesional steroids, or systemic beta blockers.

Arteriovenous malformations (AVMs) are a superficial connection between an artery and vein without intervening capillaries. The resulting lesion is red and spongy in appearance. These

## ACS/ASE Medical Student Core Curriculum Skin and Soft Tissue Lesions

lesions can become very large, undergo rapid expansion, and potentially ulcerate. Small, asymptomatic lesions can be observed. For symptomatic or larger lesions, options for treatment include selective embolization, sclerotherapy, or surgical resection. These lesions can be very large and result in significant disfigurement.

Lipomas are benign, fatty tumors. They are most commonly located in the subcutaneous tissue, less commonly below the muscular fascia, on the trunk and upper extremities. They consist of mature fat cells encased in a thin capsule. Diagnosis is typically based on clinical presentation. Lesions presenting with concerning clinical features, such as rapid growth or firm texture, mandate a biopsy to ensure the absence of malignancy. Many patients have multiple lesions. These can be observed or removed for cosmetic appearance. If incompletely removed, these lesions have the potential for recurrence.

Acrochordons, also known as skin tags, are an outgrowth of normal skin. They appear as flesh-colored lesions with a narrow base. They occur most commonly in older patients in areas of friction. They are more common in obese patients. They have no risk of malignant potential. Lesions can become symptomatic if they catch on clothing or jewelry. Treatment for symptomatic lesions is excision under local anesthesia.

### **Malignant Lesions**

Squamous cell carcinomas and basal cell carcinomas are often classified together as non-melanoma skin cancers.

#### **I. Squamous Cell Carcinoma**

Squamous cell carcinoma (SCC) is the second most common type of skin cancer. It most commonly presents on the head, neck, and trunk. Lesions are flat or raised, skin-colored to pink, smooth or irregular, and can be associated with ulceration, bleeding, or itching. Risk of SCC is significantly increased with sun exposure, particularly sun exposure during childhood resulting in sunburns. Additionally, fair skin, ionizing radiation exposure, human papilloma virus infection, chemical exposure, immunosuppression (like that used for organ transplantation), or long-standing ulcers/open wounds are risk factors for development of SCC. Actinic keratoses, as described above, are considered to be precursor lesions to SCC. Bowen's disease, or squamous cell carcinoma in situ, can progress to invasive disease, and is also considered to be a precursor lesion. Bowen's disease presents as flat, erythematous plaques on sun exposed areas. Incomplete treatment or excision of these areas can allow progression to invasive SCC.

Treatment can range from topical therapies to surgical excision. Small, favorable lesions can be treated with electrodesiccation, curettage, or cryoablation. Surgical excision is undertaken for larger, less-favorable lesions. For lesions less than 2 cm, 4 mm margins are considered appropriate for surgical excision. For larger lesions (> 2 cm) occurring in areas worrisome for recurrence, a 6 mm margin is recommended.

## **ACS/ASE Medical Student Core Curriculum Skin and Soft Tissue Lesions**

Mohs microsurgery is an option for SCC excision. Lesions are excised horizontally in stages with the margins examined serially by a pathologist to ensure complete excision. This technique is particularly useful for lesions located in cosmetically sensitive areas.

External beam radiation can be used for lesions which are unresectable or for symptomatic lesions in patients who are not operative candidates. Radiation is also recommended for lesions which are completely excised but are found to have extensive perineural invasion or large nerve involvement.

When nodal disease is suspected in these patients, confirmation is recommended via biopsy. If there is no evidence of distant metastatic disease, regional nodal dissection is recommended in addition to excision of the primary lesion. If the nodal disease is inoperable, these areas can also be treated with external beam radiation.

SCC has the potential to both recur and metastasize, although at a lower rate than melanoma. Local recurrence rates increase the risk of metastasis. Recurrent and metastatic potential are increased by the size of the lesion. Additionally, primary site locations associated with higher recurrence rates are lip, ear, scalp, forehead, temple, eyelid, nose, mucous membranes, dorsal surface of the hands, penis, scrotum, and anus. SCCs arising in chronic, non-healing wounds also have a very high risk of recurrence and metastasis.

## **II. Basal Cell Carcinoma**

Basal cell carcinoma (BCC) is the most common type of skin cancer. There are three types of basal cell carcinoma: nodular, superficial, and morpheaform. The most common site of presentation is the face followed by the trunk and extremities. Risk factors include ultraviolet light exposure (particularly in childhood and adolescence), fair skin, tendency to sunburn, ionizing radiation exposure, and immunosuppression including HIV infection and transplant patients. Lesions present as nodules or papules with a pearly, shiny quality and can be associated with peripheral telangiectasias which are superficial blood vessels that can have a spider web appearance. The central lesion can ulcerate and crust over, and the areas are easy to bleed. Typically, the “rolled” border remains and is considered diagnostic.

Treatment includes electrodesiccation, curettage, or surgical excision with 4-mm margins. Smaller lesions can be treated with topical therapies. Larger lesions are typically recommended for surgical excision. Mohs microsurgery can be used for lesions in cosmetically sensitive areas, similar to SCC. Like SCC, BCCs which are not amenable to surgical excision can be treated palliatively with external beam radiation.

Characteristics associated with increased risk of recurrence are large size, location on the head and neck, history of radiation to the area, immunosuppression, and perineural involvement. Metastasis, both nodal and distant, is very rare in basal cell carcinoma and prognosis is considered to be very good.

**III. Melanoma**

Similar to non-melanoma skin cancers, ultraviolet light exposure, fair skin, and immunosuppression are risk factors for the development of melanoma. However, the most significant risk factors for melanoma are a family history of melanoma, a personal history of melanoma, and multiple nevi. Precursor lesions to melanoma include congenital nevi, dysplastic nevi, and Spitz nevi. Congenital nevi are those lesions that are present at birth, and larger lesions are more frequently associated with melanoma formation. Large congenital nevi are recommended for excision prior to adulthood. Dysplastic nevi are typically 5 mm or larger, have a flat or flat with raised center appearance, have non-uniform coloring, and irregular borders. These occur in both sporadic and familial cases, and are considered both a precursor to melanoma and a “marker” for those at increased risk of melanoma. Spitz nevi can often be confused histologically for melanoma. These lesions typically develop in childhood and can be atypical.

While not significant clinically, melanoma is classified into 4 subtypes: lentigo maligna melanoma, superficial spreading melanoma, nodular melanoma, and acral lentiginous melanoma (Table 4).

**Table 4**

| <b>Melanoma subtype</b>        | <b>Characteristics</b>  |
|--------------------------------|---|
| Lentigo maligna melanoma       | <ul style="list-style-type: none"> <li>• Location: Head, neck, and face of older individuals</li> <li>• Appearance: Occurs in Hutchinson’s freckle and appears large, flat, and light brown. As the vertical growth phase develops, there can be color discrepancy and elevation.</li> <li>• Prognosis: Most favorable</li> </ul> |
| Superficial spreading melanoma | <ul style="list-style-type: none"> <li>• Location: Legs in women and back in men</li> <li>• Appearance: Irregularity in coloration with pink discoloration at edges, palpable nodularity</li> <li>• Prognosis: Considered favorable</li> </ul>  |
| Nodular melanoma               | <ul style="list-style-type: none"> <li>• Location: Most common on the trunk of men</li> <li>• Appearance: Blue/black coloration, nodular secondary to prolific vertical growth</li> <li>• Prognosis: Considered most aggressive</li> </ul>  |
| Acral lentiginous melanoma     | <ul style="list-style-type: none"> <li>• Location: Palms, soles, subungual</li> <li>• Appearance: Pigmented lesion with both radial and nodular growth phases</li> <li>• Prognosis: Considered to be moderately aggressive</li> </ul>   |

**ACS/ASE Medical Student Core Curriculum  
Skin and Soft Tissue Lesions**

Melanomas are described using Breslow’s thickness, Clark’s levels, ulceration, and mitotic index (Table 5).

**Table 5**

| <b>Characteristics</b> | <b>Description</b>   |
|------------------------|--|
| Breslow’s thickness    | Measures the tumor thickness in millimeters. A thicker tumor conveys a worse prognosis.  |
| Clark’s level          | Based on the level of invasion of the tumor: <ul style="list-style-type: none"> <li>• I: Confined to the epidermis</li> <li>• II: Invade the papillary layer of the dermis</li> <li>• III: Invade the junction of the papillary and reticular dermis</li> <li>• IV: Invade the reticular dermis</li> <li>• V: Invade the subcutaneous fat</li> </ul> |
| Ulceration             | +/- intact overlying epidermis. The presence of ulceration conveys a worse prognosis.  |
| Mitotic index          | Measurement of the mitotic activity of the tumor. Higher mitotic activity (>1) in an otherwise thin melanoma conveys a worse prognosis.  |

Unlike non-melanoma skin cancers, melanoma should not be treated with topical destruction or Mohs surgery. Surgical excision, called wide local excision, is the recommended treatment for the primary site of melanoma. Margins are determined by the depth of the primary tumor. (See Table 6). Excision is to include the skin and underlying subcutaneous tissue down to the level of the muscular fascia.

**Table 6**

| <b>Depth of primary tumor</b> | <b>Recommended margin</b> |
|-------------------------------|---------------------------|
| In situ                       | 5 mm                      |
| <1 mm                         | 1 cm                      |
| 1-2 mm                        | 1-2 cm                    |
| >2 mm                         | 2 cm                      |

In addition to excision of the primary lesion, for lesions greater than 0.8 mm without clinical evidence of nodal metastasis, sentinel lymph node mapping and biopsy is recommended.

## **ACS/ASE Medical Student Core Curriculum Skin and Soft Tissue Lesions**

Sentinel lymph node mapping is completed with the use a radiolabeled dye that identifies the lymph node(s) responsible for the drainage of that portion of skin. An instrument is used intraoperatively to identify and remove the labeled lymph node(s). Presence of melanoma within the sentinel lymph node conveys a worse prognosis and is an indication for consideration of additional therapies including additional surgery or immunotherapy. The presence of clinically evident lymph node metastasis is an indication for regional lymph node dissection.

Immunotherapy is used for patients with nodal and distant metastasis. These therapies take advantage of the patient's own immune system to treat the melanoma. The immune system is "turned on" and the patient's own cells mount a response against the melanoma cells. This is an evolving method treatment with many anticipated advances in the future. Radiation can also be used to decrease local recurrence in regional nodal basins with significant volumes of metastatic disease.

Melanoma is the most aggressive of the described skin cancers and is associated with risk of recurrence and metastatic disease. The depth of the primary lesion, presence of ulceration, and presence of nodal metastasis are all indicators of more aggressive disease and increased risk of recurrence/metastasis. Surgical resection can be considered for singular sites of metastatic disease in selected patients.

### **IV. Skin surveillance and prevention**

All skin cancers are associated with lifetime sun exposure, particularly sun exposure obtained as a child resulting in sunburns. Sun protection and avoidance should be recommended for all patients concentrating on fair-skinned individuals more at risk for sunburns. Sunscreen should be broad spectrum (UVA and UVB coverage), SPF 30 or higher, and water resistant. Patient should reapply sunscreen every 2 hours, after swimming, or after strenuous exercise. Patients with previous skin cancer or many congenital or acquired nevi should be recommended for dermatologic skin surveillance. Patients should be encouraged to perform self-skin exams to identify changing or evolving lesions.

### **V. Soft Tissue Sarcoma**

Sarcomas are a rare group of malignancies that arise from mesenchymal cells. There are more than 50 subtypes of sarcoma. Relatively, sarcomas are a more common malignancy in pediatric patients. In children and adolescents, the most common type of sarcoma is rhabdomyosarcoma. In adults, undifferentiated pleomorphic sarcoma, gastrointestinal stromal tumors (GISTs), liposarcoma, leiomyosarcoma, synovial sarcoma, and malignant peripheral nerve sheath tumors are the most common types. Risks factors for sarcoma are prior radiation, chemical exposure, familial/genetic predispositions, and lymphedema. Multidisciplinary care is stressed in the management of soft tissue sarcomas with recommendation for treatment at high-volume centers.

## ACS/ASE Medical Student Core Curriculum Skin and Soft Tissue Lesions

Prognostically, tumor grade is the strongest indicator of patient course. Additionally, smaller size, female gender, location on the extremity, and superficial depth are associated with better outcomes. For patients presenting with a palpable mass, imaging should be undertaken first for further evaluation. Magnetic resonance imaging is most commonly recommended for lesions of the extremities. Generally speaking, percutaneous biopsy via fine needle aspiration (FNA) or, preferably, core needle biopsy (CNB) using image guidance is recommended. Alternatively, incisional biopsy (removing a small piece of the tumor) versus excisional biopsy (removing the entire tumor) are options. Biopsy planning should be undertaken to include the path of biopsy in the surgical resection. If possible, surgical resection with a 2 cm margin is recommended for treatment of soft tissue sarcomas. Radiation can be used prior to surgery or after surgery to decrease local recurrence rates. Chemotherapy is used less commonly for sarcoma. However, there are certain subtypes that are more responsive to systemic chemotherapy.

Metastatic disease can be treated with chemotherapy, radiation, or surgery. Single sites of metastatic disease can be treated with surgical resection or ablation in favorable patients. Stereotactic body radiation (SBRT) can be used for single sites of metastatic disease with curative intent or palliation in patients with multiple sites of disease.

Kaposi's sarcoma is a unique form of sarcoma occurring in immunocompromised patients, particularly patients with human immunodeficiency virus (HIV) infection. It presents with superficial purple to blue lesions. This sarcoma is associated with Human herpes virus 8 infection. It is not considered curable, but can be managed with correction of the immunosuppression. If lesions are limited, they can be treated locally with radiation or cryoablation.

### Problems

1. An 8-year-old boy with a 6 cm soft tissue mass on his right thigh.
  - a. Further data of history and physical exam?
  - b. Differential diagnosis?
  - c. Diagnostic work-up?
  - d. Most likely location of metastasis?
2. A 45-year-old deeply tanned blonde woman with an irregular raised pigmented lesion on her shoulder.
  - a. Further data on history and physical exam?
  - b. Findings suggestive of malignancy?
  - c. Diagnostic work-up?
  - d. If lesion was 0.5 mm in depth, treatment?
3. A 32-year-old man with a 3 cm dog bite on his left forearm.
  - a. Further data on history and physical exam?
  - b. Describe management of wound including local anesthesia and closure.

**ACS/ASE Medical Student Core Curriculum**  
**Skin and Soft Tissue Lesions**

4. A 75-year-old man with a waxy lesion with pearly rolled borders and a central ulcer on his nose.
  - a. Further data on history and physical exam?
  - b. Differential diagnosis?
  - c. Diagnostic work-up?
  
5. A 25-year-old woman with bilateral axillary lesions consisting of multiple draining sinus tracts.
  - a. Further data on history and physical exam?
  - b. Differential diagnosis?
  - c. Treatment options for acute versus chronic lesions?

**References**

1. Alam M, Ratner D. Cutaneous squamous-cell carcinoma. *N Engl J Med* 2001; 344:975-983.
2. Becker DE, Reed KL. Local anesthetics: review of pharmacological considerations. *Anesth Prog* 2012; 59:90-101; quiz 102-3.
3. Edsberg LE, Black JM, Goldberg M, McNichol L, Moore L, Sieggreen M. Revised National Pressure Ulcer Advisory Panel Pressure Injury Staging System: Revised Pressure Injury Staging System. *J Wound Ostomy Continence Nurs* 2016; 43:585-597.
4. Elluru RG. Cutaneous vascular lesions. *Facial Plast Surg Clin North Am* 2013; 21:111-126.
5. Jemec GB. Clinical practice. Hidradenitis suppurativa. *N Engl J Med* 2012; 366:158-164.
6. Kaafarani HM, King DR. Necrotizing skin and soft tissue infections. *Surg Clin North Am* 2014; 94:155-163.
7. Kanzler MH, Mraz-Gernhard S. Primary cutaneous malignant melanoma and its precursor lesions: diagnostic and therapeutic overview. *J Am Acad Dermatol* 2001; 45:260-276.
8. Marzuka AG, Book SE. Basal cell carcinoma: pathogenesis, epidemiology, clinical features, diagnosis, histopathology, and management. *Yale J Biol Med* 2015; 88:167-179.
9. Monafu WW. Initial management of burns. *N Engl J Med* 1996; 335:1581-1586.
10. Patil PD, Panchabhai TS, Galwankar SC. Managing human bites. *J Emerg Trauma Shock* 2009; 2:186-190.
11. Woodruff CM, Charlie AM, Leslie KS. Hidradenitis Suppurativa: A Guide for the Practicing Physician. *Mayo Clin Proc* 2015; 90:1679-1693.
12. National Comprehensive Cancer Network: Guidelines for Management of Basal Cell Carcinoma, Squamous Cell Carcinoma, and Melanoma. [www.nccn.org](http://www.nccn.org). February 11, 2018.

**ACS/ASE Medical Student Core Curriculum  
Skin and Soft Tissue Lesions**

13. Lewis G, Heimbach D, Gibran N. Evaluation of the burn wound: management decisions. In: Herndon D (ed.), Total Burn Care, 4th ed. London: W.B. Saunders; 2012:125–135.

**Authors/Contributors**

Linda M. Barney, MD, FACS (Section Editor)  
Wright State University Boonshoft School of Medicine, Dayton, OH

Rebecca M. Tuttle, MD, FACS (Content Author)  
Wright State University Boonshoft School of Medicine, Dayton, OH

Andrew S. Kastenmeier, MD, FACS (Assessment Consultant)  
Medical College of Wisconsin, Milwaukee, WI