

# PLASTIC SURGERY ORIENTATION MANUAL

---



**Department of Surgery**

January 2023

## List of Contributors

### **Editors:**

Dr. Michael J. Weinberg

Dr. Melinda Musgrave

Dr. Sharon Kim

Max Solish (Class of 2023)

### **Student Contributors**

Eric Wang (Class of 2015)

Airiss Chan (Class of 2021)

David Lee (Class of 2023)

## Table of Contents

Wounds -----	3
Wound Closure -----	7
Skin Cancer -----	9
Burns -----	12
Facial Skeletal Injuries -----	13
Hand -----	15
Hand X-Rays -----	23
Appendix -----	27

# Wounds

## Wound Healing

Wound healing occurs in three phases:

1. Inflammatory phase (days 1-6) – hemostasis + chemotaxis
  - a. Occurs immediately after injury to the tissue
  - b. Vasoconstriction (for 5-10 min after injury), coagulation
  - c. Later, there is vasodilation/↑ permeability, chemotaxis, cell migration (marginination, diapedesis, fibrin), and cellular response
  - d. Cellular components
    - i. Neutrophils (1-2 days) = pro-inflammatory, phagocytosis
    - ii. Macrophages (2-3 days) – critical for wound healing
    - iii. Lymphocytes (5-7 days)
2. Fibroproliferative phase (day 4 to week 3) – collagen synthesis + angiogenesis + epithelialization
  - a. Formation of the wound matrix
  - b. Fibroblasts are dominant at 7 days, produce collagen
  - c. Glycosaminoglycan production
  - d. Angiogenesis (VEGF/NO)
  - e. Epithelialization (mobilization → migration → mitosis → differentiation)
3. Maturation/remodeling phase (week 3 to 1 year) – tissue contraction + scar formation + scar remodeling
  - a. Collagen I replaces collagen III
  - b. Peak tensile strength is 80% of original strength, occurs at ~60 days
  - c. Scar contraction mediated by myofibroblasts

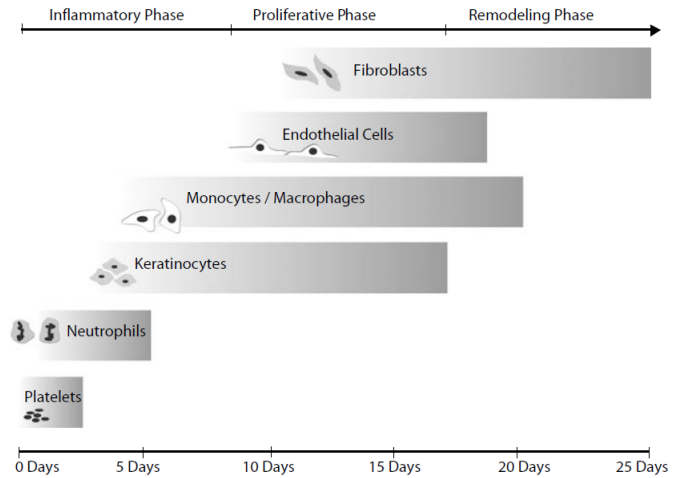


Figure 1 from Grabb and Smith's Plastic Surgery 6th ed.

Factors that affect wound healing:

1. Local = wound location, oxygen delivery (affected by atherosclerosis, for example), current infection, chronic wound, radiation to affected area, venous HTN, hematoma/seroma, foreign body
2. Systemic = medical comorbidities (eg. DM, kidney failure, immunodeficiencies, nutritional deficiencies, atherosclerosis), age, tobacco/alcohol intake
3. Genetic = predisposition to keloid/hypertrophic scar, skin type (eg. Elasticity, pigmentation), genetic conditions (Ehlers-Danlos, Progeria, Werner, Pseudoxanthoma elasticum, Cutis laxa)

Abnormal wound healing – hypertrophic vs. keloid scar:

1. Hypertrophic scar = elevated scar that remains within the borders of the original scar
2. Keloid scar = elevated scar that extends beyond the borders of the original scar
  - a. Type I and III collagen in disorganized orientation



Figure 2 Hypertrophic scar (left) and keloid scar (right) - from Essentials of Plastic Surgery, Jeffrey Janis

## Necrotizing Fasciitis

Necrotizing fasciitis is an aggressive and potentially lethal infection that, if left untreated, leads to necrosis of subcutaneous tissues and muscle fascia, and ultimately death. Thus, necrotizing fasciitis must be identified and treated promptly.

Pathophysiology/History/Physical Exam: infection that affects and transcends the muscle fascia, leading to pain out of proportion to physical symptoms. Etiology generally from gram-positive cocci, but polymicrobial infections may be of gram-negative and anaerobic bacteria. Findings on physical exam may include tenderness to palpation of affected area, crepitus, cellulitis, edema, changes to overlying skin (e.g., blistering, ecchymosis). Late findings include change of skin to dusky blue/black, bullae, induration, gangrene, subcutaneous emphysema.



Figure 3 García-Tarriño R, Ballesteros-Betancourt J, Soriano-Viladomiu A, Ríos-Guillermo J, Llusá-Pérez M, Combalia A. Necrotizing fasciitis: Usefulness of the LRINEC score in a third-level hospital. *Injury*. 2021 Jul;52 Suppl 4:S8-S15. doi: 10.1016/j.injury.2021.

Investigations/Diagnosis: generally a clinical diagnosis, but investigations may assist in forming diagnosis.

1. History and physical examination consistent with necrotizing fasciitis
2. Elevated CRP, leukocytosis, anemia, elevated creatinine, elevated glucose, elevated CK (late)
3. Incisional biopsy may be performed (“dishwater pus” may indicate group A infection)
4. Imaging if uncertain of diagnosis – CT scan

Risk Factors include diabetes, age >60, chronic medical disease, state of immunosuppression, malnutrition, IVDU, PVD, kidney failure, malignancy, obesity

Management:

1. ABCs, vigorous fluid resuscitation, and transfer to ICU
2. Urgent surgical consult and subsequent surgical intervention – debridement of necrotic tissue, irrigation
3. Wide spectrum IV antibiotics

## Pressure Ulcers

Most commonly affect bony prominences (e.g., ischial tuberosity > trochanter > sacrum > heel). 95% occur on the lower body.

Etiologies = extrinsic factors (shear forces, pressure, friction, moisture) and intrinsic factors (ischemia, sepsis, decreased autonomic control to affected area, infection, ↑ age, loss of sensation to affected area, vascular compromise (e.g., diabetes, PVD), anemia, malnutrition, altered level of consciousness)

Prevention of pressure ulcers:

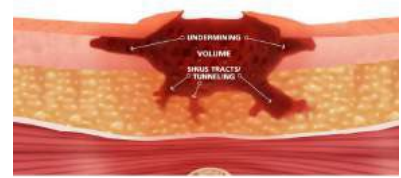
1. General preventative measures – addressing spasticity, careful observation if patient is incontinent, effective patient nutrition, optimize comorbidities
2. Local preventative measures – keep skin clean and dry, frequent repositioning, support surfaces, pressure dispersion

Pressure ulcer staging:






1. Stage I – non-blanchable erythema (skin is intact, non-blanchable erythema of localized area, may be painful)
2. Stage II – partial thickness (partial thickness loss of skin, dermis exposed)
3. Stage III – full thickness skin loss (may see subcutaneous fat)
4. Stage IV – full thickness tissue loss (may see exposed bone/tendon/muscle/cartilage)
5. Unstageable – unable to confirm stage due to presence of eschar/slough

## Describing Wounds

- Size
- Depth: involvement of muscle, tendon, bone
- Exudate: serous, serosanguinous, sanguineous, purulent
- Integrity: undermining, tunneling
- Edge & base: clean, necrotic, granulating, epithelializing





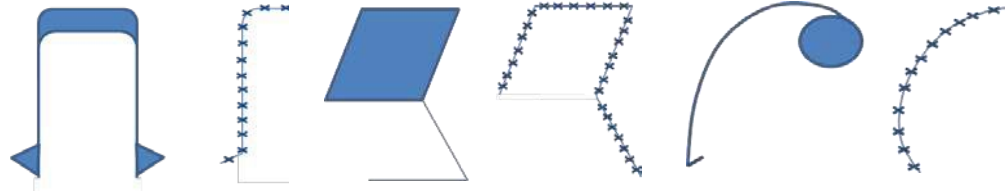

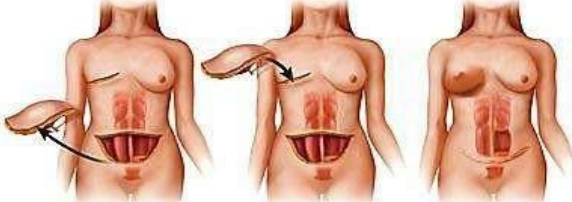
## Pressure Injuries & Wound Management

Stage	Description	Wound Management
Stage 1 – Non-blanchable erythema 	Intact skin with non-blanchable redness of a localized area, usually over a bony prominence. The area may be painful, firm, soft, warmer or cooler as compared to adjacent tissue.	No dressing required.  If friction irritates wound, use clear film layer.
Stage 2 – Partial Thickness 	Partial-thickness loss of skin with exposed dermis. The wound bed is viable, pink or red, moist. Granulation tissue, slough and eschar are not present.	Cleanse with N/S Inadine to wound bed
Stage 3 – Full Thickness Skin Loss 	Subcutaneous fat may be visible, but bone, tendon or muscle are not exposed. Slough may be present. May include undermining and tunneling.	Maintain moisture balance AMD/Silvercel for infection Foam dressing for exudate
Stage 4 – Full Thickness Tissue Loss 	Full thickness skin loss with exposed bone, tendon, muscle or exposed cartilage. Slough, eschar, undermining or tunneling may be present. Can extend into muscle and/or supporting structures (e.g. fascia, tendon or joint capsule) making osteomyelitis possible	Maintain moisture balance AMD/Silvercel for infection Alginate/foams for exudate
Unstageable Pressure Injury - Slough and Eschar 	Full-thickness skin and tissue loss in which the extent of tissue damage within the ulcer cannot be confirmed because it is obscured by slough or eschar. If removed, Stage 3 or Stage 4 pressure injury will be revealed.	Debride eschar and slough Prevent pressure and friction AMD/Silvercel for infection Alginate/foams for exudate





## Factors Impacting Wound Care

- |                |                            |                 |
|----------------|----------------------------|-----------------|
| • Friction     | • Infection                | • Smoking       |
| • Moisture     | • O <sub>2</sub> perfusion | • Venous stasis |
| • Pressure     | • Chronic illness          | • Compliance    |
| • Incontinence | • Mobility                 | • Medications   |
| • Neuropathy   | • Cognition                | • Age           |
| • Nutrition    | • Diabetes                 |                 |





# The Reconstructive Ladder

<p>The reconstructive ladder</p>	<p>A systematic approach that facilitates decision making when reconstructing a defect.</p>	
		
<p>Wound Closure</p>	<p><b>Primary closure:</b> the direct apposition of wound edges to close the wound  <b>Secondary closure:</b> allows the wound to heal on its own  <b>Delayed primary closure:</b> also called tertiary closure. Performed after a period of secondary closure. Used for contaminated wounds.</p>	
<p>Graft</p>	<p>Grafts are classified according to the type (i.e. skin vs. bone graft) and number of tissues (i.e. <b>simple</b> – single tissue, <b>composite</b> – multi-tissue graft).</p>	
	<p><b>Simple:</b>  <b>Split-thickness skin graft (STSG):</b> Epidermis and partial- thickness dermis. Higher chance of take, but poorer cosmesis. Less primary contraction and greater secondary contraction. Donor site heals by re-epithelialization.  <b>Full-thickness skin graft (FTSG):</b> Epidermis and entire dermis. Has improved cosmesis, but more difficult take. Greater primary contraction and less secondary contraction. Donor site can usually be closed primarily. Preferred for facial defects, hands, and over joints.</p>	
	<p><b>Composite:</b>  <b>Dermis-fat graft:</b> Composed of dermis (epidermis removed) and underlying fat. Often used in anophthalmic sockets for volume replacement or soft-tissue reconstruction, usually after enucleation.</p>	
	<p>A <b>flap</b> is a segment of tissue that contains a network of blood vessels that may transferred from the donor site to reconstruct the defect. The base of the flap that contains the blood supply is the <b>pedicle</b>. Can be classified by body region (local vs. regional vs. free flap), or by tissue types (skin flap vs. musculocutaneous flap).</p>	
	<p><b>Local Flaps</b></p>  <p style="display: flex; justify-content: space-around;"><span>Advancement Flap</span> <span>Transposition (Limberg Flap)</span> <span>Rotational Flap</span></p>	
<p>Flap</p>	<p><b>Regional Flap</b></p>  <p><b>Transverse rectus abdominus myocutaneous flap (TRAM flap):</b> The transverse rectus abdominus muscle, along with overlying skin and fat, is tunneled under the skin to the chest to make a new breast.</p>	
	<p><b>Free Flap</b></p>  <p><b>Free TRAM:</b> The transfer of detached transverse rectus abdominus muscle, blood vessels, and overlying cutaneous tissue to the breast defect. Involves microsurgery to reconnect arteries and veins of donor and recipient sites.</p>	

# Wound Closure Methods

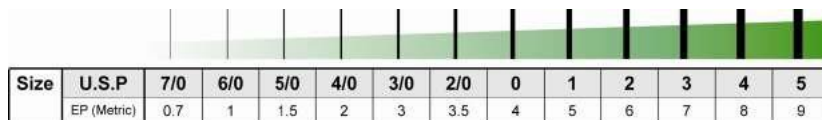
<b>Staples</b>		Staples create minimal reaction and are more rapid than suture closure, but less precise. They provide excellent strength and hemostasis for single-layer scalp wound closure.
<b>Surgical Tape</b>		Can be used alone or over sutures to help approximate, protect, and conceal the surgical wound (e.g. Steri-Strips). However, too much tension can cause epidermal blisters.
<b>Adhesive</b>		Can be used with or without sutures to provide closure and protection to a low-tension wound. Cosmetically appealing and more rapid than sutures. Precision of closure is sometimes compromised (e.g. DermaBond).
<b>VAC (Vacuum Assisted Closure)</b>		A negative pressure system that allows better apposition between wound and skin graft, and better fluid transport within the tissue. This creates an environment that is more conducive to wound healing.

Can be classified simply as absorbable or non-absorbable, and natural or synthetic.

	Absorbable	Non-Absorbable
<b>Natural</b>	<b>Gut (ovine or bovine intestine):</b> moderately reactive. Maintains tensile strength for 7 days. "Chromic gut" lasts 2 to 4 weeks. Ideal for rapidly healing tissues, like oral mucosa. 	<b>Silk:</b> braided, moderately reactive. Tensile strength loss starts at 1 year and undergoes significant proteolysis by 2 years. 
<b>Sutures</b>	<b>Polyglycolic acid (e.g. Vicryl):</b> synthetic, braided, minimally reactive, and absorbed within 90 days. Starts to lose strength by 2 weeks. Widely used for intradermal sutures. 	<b>Polypropylene (e.g. Prolene):</b> synthetic, monofilament, minimally reactive. Maintains strength for more than 2 years. Ideal for dermal closures. 

Sutures can be further classified by monofilament or braided, having tapered or cutting needle, and by suture size.

NEEDLE CUT	
 Blunt Point	 Conventional Cutting
 Round Body Taper Point	 Reverse Cutting
 Taper Cutting	 Spatulated Point
 T.Car Point	 Reverse Cutting Prime





# Wound Closure Techniques

Please refer to this video by Dr. Michael Zenn for a demonstration and step-by-step instructions of important surgical knots: [https://www.youtube.com/watch?v=TFwFMav\\_cpE](https://www.youtube.com/watch?v=TFwFMav_cpE)

Once the suture material is chosen, the choice then becomes the type of stitch that will be performed to effectively close the skin.

Options include, but are not limited to:

1. Simple interrupted suture (shown in figure 7)
2. Simple running suture
3. Simple buried suture
4. Running subcuticular suture
5. Horizontal mattress
6. Vertical mattress
7. Figure-of-8
8. Simple running locking suture

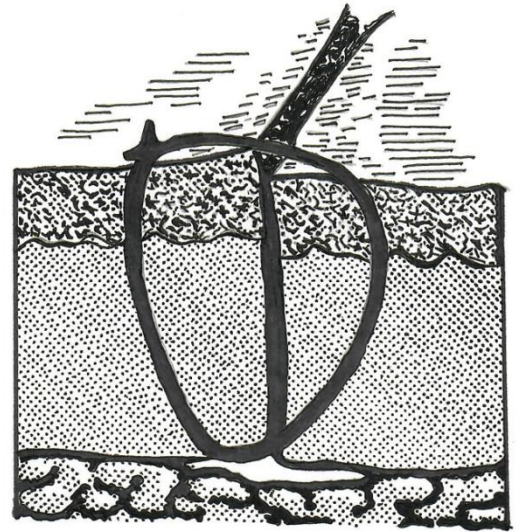


Figure 7 Illustration by Dora Velkovska

## Dog Ears

Dog ears are a common challenge that occur in plastic surgery. Dog ears are the result of puckered skin at the distal points of wounds, and may occur in various circumstances (eg. after the excision of irregular skin lesions). Please refer to Figure 8, which indicates a method of dog ear correction, requiring re-excision of the puckered tissue.

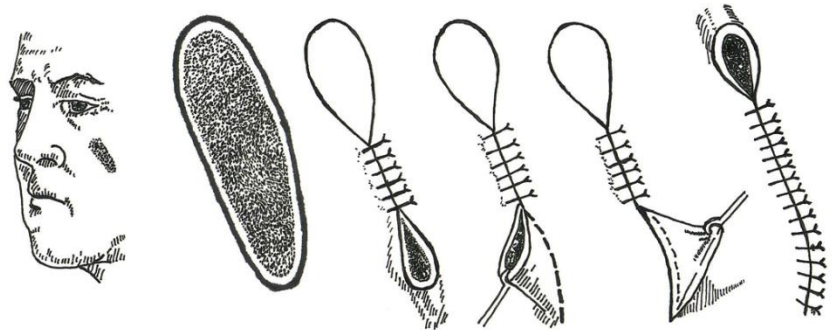


Figure 8 Illustration by Dora Velkovska

## Z-Plasty

The Z-plasty is a commonly used flap used in plastic surgery to lengthen and re-orient a scar to optimize healing and wound outcomes. A common use of Z-plasty is over joints (eg. after Dupuytren's contracture release to digits) due to its ability to reduce contracture over the joint from scarring.

In creating a Z-plasty, the three limbs must be equal in length and the angle between the central limb to each lateral limb must be equal.

Please refer to Figure 9 which indicates the general principle behind the Z-plasty

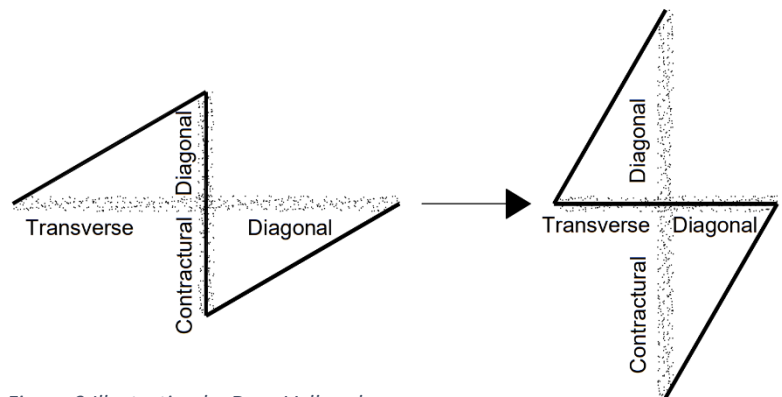






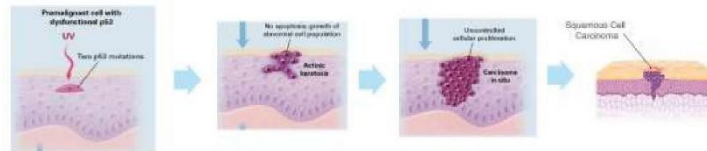
Figure 9 Illustration by Dora Velkovska

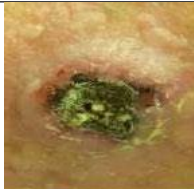



## Common Skin Cancers

The most common type of skin cancer in Caucasians. Risk factors include sun exposure, advancing age, fair complexion, and immunosuppression. Found on sun-exposed areas of the body. Locally invasive, but almost never metastasize.





<b>Basal Cell Carcinoma</b>		<b>Nodular</b> Most common type. Pearly papules with telangiectasias, pruritus, and occasional bleeding.		<b>Superficial spreading</b> Slow-growing, erythematous, with minimal induration.
		<b>Morpheaform</b> Also called sclerosing or fibrosing BCC. Flat, often yellowish or hypo-pigmented. High incidence of recurrence or incomplete excision.		<b>Pigmented</b> Similar to nodular BCC, but pigmented. Differential diagnosis includes nodular melanoma due to its deep pigmentation and nodularity.

Second most common type of skin cancer. Risk factors include sun exposure, immunosuppression, HPV and HSV, radiation and chemical exposure. Actinic keratosis is precursor to Bowen's Disease (SCC in situ) and SCC. High risk sites for SCC metastasis include the helices of ears and lips due to increased vascularity.




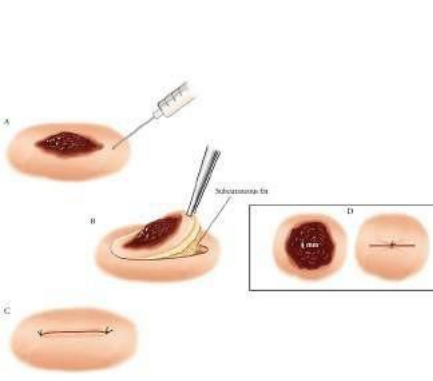
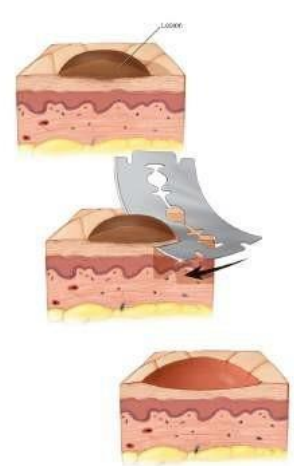
<b>Squamous Cell Carcinoma</b>		<b>Ulcerative</b> Aggressive tumor with raised, "dull" pink borders and central ulceration.		<b>Verrucous</b> Slow growing, exophytic, and less likely to metastasize.
		<b>Keratoacanthoma</b> Rapidly involuting course. Considered a variant of SCC.		<b>Actinic Cheilitis</b> Actinic keratoses of the lips. Thin, scaly, red-pink non-healing papules with rough-feel.

Common tumor with significant risk of metastasis. Risk factors include family history of melanoma, sun exposure and fair skin. Melanoma thickness (Breslow) is prognostic for survival. Look for ABCDEs: Asymmetry, Border irregularity, Colour variation, Diameter > 6 mm, and Evolution over time.

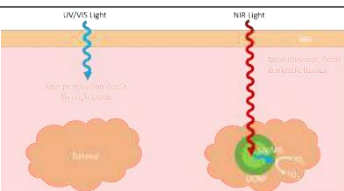
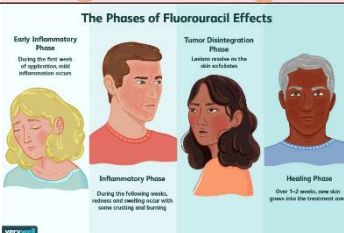
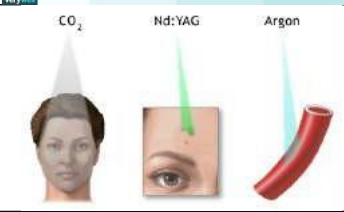
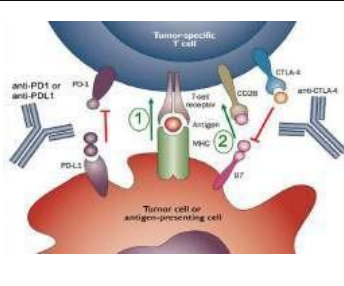
<b>Malignant Melanoma</b>		<b>Superficial spreading</b> Most common type. Usually arises from pre-existing nevus but can arise <i>de novo</i> .		<b>Nodular</b> Second most common and most aggressive type. Does not typically arise from pre-existing nevus.
		<b>Lentigo Maligna</b> Least aggressive and associated with cumulative sun exposure. Precursor is Hutchinson freckle.		<b>Acral Lentiginous</b> More common in Asians, Hispanics and Black people. Majority involve great toe or thumb.

# Management of Skin Cancers


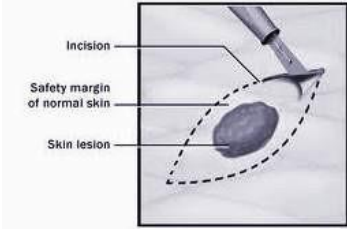
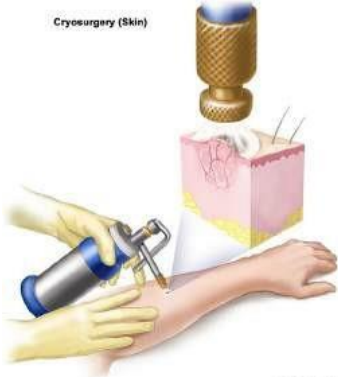

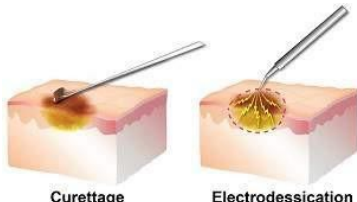
Investigations " please note pigmented lesions should be excised completely, not shaved

Punch Biopsy	Excisional Biopsy	Shave Biopsy
 <p>Punch Biopsy Video available <a href="#">here</a></p>	 <p>Source: Shave Y, Morita, Charles M, Sakoh, V, Suzanne Kilmberg, Timothy M, Pawlik, Mitchell C, Roemer, Kenneth K, Tarabji. <i>Textbook of Complex General Surgical Oncology</i>; <a href="http://www.accesssurgery.com">www.accesssurgery.com</a>; Copyright © McGraw-Hill Education, All rights reserved.</p>	

## Medical Management

Treatment	Description
<p><b>Photodynamic Therapy</b></p> 	<p>Often used for patients with extensive photodamage and numerous ill-defined lesions. e.g. Metvix (methyl aminolevulinat) Only used for Superficial BCCs</p>
<p><b>Topical Therapy</b></p> 	<p>Often used for patients with extensive photodamage and numerous ill-defined lesions. e.g. Efudex (5-fluorouracil) Used for Actinic Keratoses</p>
<p><b>Laser Therapy</b></p> 	<p>Can be used for non-melanoma skin cancers. Short bursts of intense light at wavelengths are used to cause selective thermal damage.</p>
<p><b>Targeted Therapy</b></p> 	<p>For melanoma:</p> <ul style="list-style-type: none"> <li>- Checkpoint inhibitors (ipilimumab, nivolumab, pembrolizumab)</li> <li>- Interferon alfa-2b (Intron A)</li> <li>- Interleukin-2 (aldesleukin, proleukin)</li> </ul> <p>For SCC:</p> <ul style="list-style-type: none"> <li>- EGFR inhibitor (cetuximab)</li> <li>- Checkpoint inhibitor (cemiplimab)</li> </ul> <p>For BCC:</p> <ul style="list-style-type: none"> <li>- Hedgehog pathway (vismodegib, sonidegib)</li> </ul>

## Non-Medical Management

Treatment	Description	
<p><b>Mohs Micrographic Surgery</b></p>	 <p><b>HOW MICROGRAPHIC SURGERY WORKS</b></p> <p>1. Visible portion of tumour removed in a thin layer for closer examination. Surgeon identifies cancer and records its location on map.</p> <p>2. Surgeon removes only cancerous tissue from next layer using map.</p> <p>3. Tied repeated until layers removed until surgeons find site to be cancer-free.</p> <p><small>CAUTION: Surgeon makes a history of wounds to prevent.</small></p>	<p>Visible mass is removed with a very thin layer of tissue. As the patient waits, the excised tumour is frozen, stained, mapped and studied extensively under a microscopy. If cancer is still present in the outer regions of the tissue, the procedure is repeated and re-tested until there are clear margins.</p>
<p><b>Excisional Surgery</b></p>	 <p>Incision</p> <p>Safety margin of normal skin</p> <p>Skin lesion</p>	<p>Mass and surrounding border of benign skin are excised with a safety margin. The specimen is sent to a laboratory for examination. An additional procedure may be deemed necessary if cancer is found in the outskirts of the tissue.</p>
<p><b>Cryosurgery</b></p>	 <p>Cryosurgery (Skin)</p>	<p>The tumour tissue is frozen with liquid nitrogen. This procedure does not require cutting or anesthetic. It may be repeated multiple times to ensure the malignant cells are destroyed. The area will become hard and crisp, and eventually fall off.</p>
<p><b>Radiation</b></p>	 <p>Prior to radiation therapy</p> <p>Tissue conservation post radiation therapy</p>	<p>X-ray beams are directed towards the growth. Multiple treatments are required. Only recommended for patients in critical health or for whom surgery is not advised.</p>
<p><b>Electrodessication &amp; Curettage</b></p>	 <p>Curettage</p> <p>Electrodessication</p>	<p>For non-melanoma skin cancers (SCC, BCC). An initial shave biopsy may be done to remove nodular components of the tumour. Electrodesiccation or cautery is applied to the lesion base, and a curette is used to scrape the tumour down. The procedure is repeated until the tumour is removed. Rarely used by surgeons</p>

## Burns

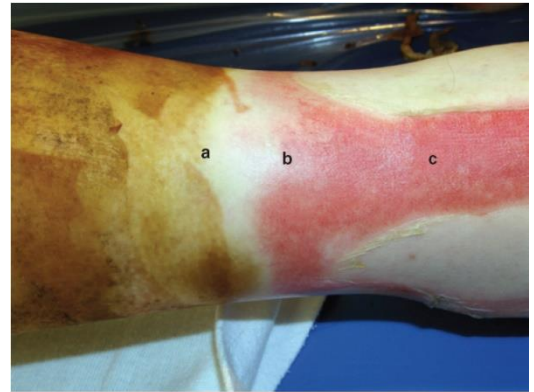
Burn injuries represent an important source of patient burden and should be treated seriously. Predictors of mortality generally include total body surface area affected (TBSA), presence of inhalation injury, and age (increasing age  $\alpha$  worse prognosis). Etiologies of burns include thermal injury, chemical injury, radiation, and/or electrical injury. In children, scald burns are most common, whereas in adults, flame burns are the most common etiologies.

### Pathophysiology/Anatomy

Injury depth is dependent on source of burn, contact time, thickness of skin, and temperature of source.

There exist 3 zones within a burn:

1. Zone of coagulation (centre of burn) – no blood flow to this region  $\rightarrow$  necrosis
2. Zone of stasis – reduced perfusion to this area, progressive tissue necrosis if left without proper treatment
3. Zone of hyperemia (periphery of burn) – inflammation occurs here, cells are viable and can recover within 7 days; major systemic consequences seen as a result of this zone



**Figure 22.3.** Jackson's three zones of injury on an ankle burn. **a**, Zone of coagulation; **b**, zone of stasis; **c**, zone of hyperemia. (Reprinted from Herndon, D.N. [Ed.], 2012. *Total Burn Care*, 4th ed. Elsevier, 125-130.)

Figure 4 from *Review of Plastic Surgery* by Donald W. Buck II

Burns may be characterized based on depth:

1. Superficial = epidermis – skin erythema and pain, blanching with no blistering
2. Superficial-partial thickness = superficial (papillary) dermis – painful, blanching, clear blister, erythema, hair follicles present
3. Deep-partial thickness = deep (reticular) dermis – loss of sensation, non-blanching, blistering
4. Full thickness = through epidermis, dermis, +/- underlying tissue – insensate, eschar formation, no hairs

TBSA – rule of 9s may be used to predict adult burn percentage:

1. 9% per each upper limb (4.5% for anterior aspect, 4.5% for posterior aspect)
2. 9% for the full head (4.5% for front, 4.5% for back)
3. 9% per each side of the lower limb (ie. 18% for each entire lower limb)
4. 18% for anterior torso, 18% for posterior torso
5. 1% for genital region

### Acute Management of Burns

1. ATLS protocol
2. Fluid resuscitation (lactated ringer's) – based on Parkland formula =  $4\text{ml/kg} \times \text{weight (kg)} \times \%TBSA$ 
  - a. Value from Parkland formula is the total amount of fluid in mL to be infused over 24h period from burn onset (not arrival to hospital). First half to be given in first 8h, second half to be given in subsequent 16h
  - b. E.g., A 68kg male with a burn to 35% of his body presents to the hospital two hours after his injury. How much fluid will he require and when?
    - i. Parkland formula =  $4 \times \text{weight} \times \%TBSA = 4\text{ml/kg} \times 68\text{kg} \times 35\% = 9520\text{mL} \rightarrow 4760\text{mL}$  over the first 8h (ie. Over the next 6h since he presented 2h after the burn) and 4760mL over the remaining 16h
  - c. Note: greater fluid needed if  $>80\%$  TBSA, electrical burn, inhalational burn, pediatric burns, delayed resuscitation, traumatic injury, full thickness burn
3. Support burn – dependent on type:
  - a. Superficial = topical creams, oral NSAIDs

- b. superficial-partial = daily dressing, topical antimicrobials
- c. Deep-partial/full thickness = prevent infection (may use antibiotics), debride necrotic tissue
- 4. Burn nutrition – adult protein requirements 1-2g/kg/d, enteral feeding > parenteral feeding
- 5. Topical antimicrobials = silver nitrate, silver sulfadiazine, mafenide acetate
- 6. Surgical management may be indicated (e.g., escharotomy, burn reconstruction)

**American Burn Association Transfer to Burn Center Criteria** = burn involving specific anatomic areas (e.g., hands, feet, face, ears, genitalia, major joints, perineum, eyes), children at hospital without pediatric care specialists, special emotional/social/rehab needed, simultaneous trauma, medical comorbidities that may complicate burn management and recovery, inhalational injuries, electrical burns, chemical burns, full thickness  $\geq 5\%$  TBSA, partial thickness  $\geq 10\%$  TBSA in children  $\leq 10/\geq 50$  or  $\geq 20\%$  TBSA if 10-50y/o

## Facial Skeletal Injuries

Facial injuries represent an important and potentially dangerous cause of patient morbidity and mortality. The facial skeleton is an important source of protection for the brain, therefore injuries to the face must be taken seriously.

### General Approach to Facial Skeletal Injuries

1. ATLS protocol for emergencies (in patients with high-energy injuries, crucial to rule out C-spine injuries)
2. Detailed history (mechanism of injury, injury location, time since injury, loss of consciousness, signs/symptoms)
3. Physical examination = inspection and palpation for assessment of face and underlying structures
4. Imaging with CT scan

### LeFort Classification of Maxillary Fractures

1. LeFort I – horizontal fracture that separates the maxilla from the midface
  - a. Resulting mobility of hard palate and maxilla from the midface
2. LeFort II – pyramidal fracture involving the zygomaticomaxillary suture, pterygoid process of sphenoid bone, nasofrontal suture, and frontal sinus
  - a. Resulting collective mobility of upper jaw/nasal bones
  - b. May involve orbit, leading to clinical visual symptoms
3. LeFort III – fracture involving zygomatic arches, pterygoid processes, medial/inferior/lateral orbital walls, and nasal bones
  - a. Resulting mobility at maxillary/nasofrontal/zygomaticofrontal regions
  - b. May also involve orbit, leading to clinical visual symptoms



Le Fort I

Le Fort II

Le Fort III

Figure 5 Phillips BJ, Turco LM. Le Fort Fractures: A Collective Review. Bull Emerg Trauma. 2017 Oct;5(4):221-230. doi: 10.18869/acadpub.beat.5.4.499.. PMID: 29177168; PMCID: PMC5694594.

Treatment of LeFort fractures generally involves open reduction and rigid fixation, with the goal of restoring facial anatomy and jaw occlusion.

## Orbital Fractures

Orbital fractures may affect any of the seven bones that contribute to the orbit and may occur in isolation or in conjunction with complex facial fractures. As a result, if a face CT is positive for an orbital fracture, maintain high suspicion of other facial fractures. Orbital floor fractures present a unique and important cause of potential morbidity for patients.

Clinical features of orbital floor fractures = none, restricted extraocular movement (**particularly up gaze if inferior rectus entrapment**), ecchymosis/edema, ptosis, orbital rim step-off, subconjunctival hemorrhage, enophthalmos/exophthalmos, diplopia, paresthesia in infraorbital nerve distribution

Inferior rectus entrapment requires swift surgical management

For uncomplicated orbital fractures without entrapment, decision to operate is dependent on clinical features and CT findings (ie. Diplopia may resolve when edema resolves, for example)

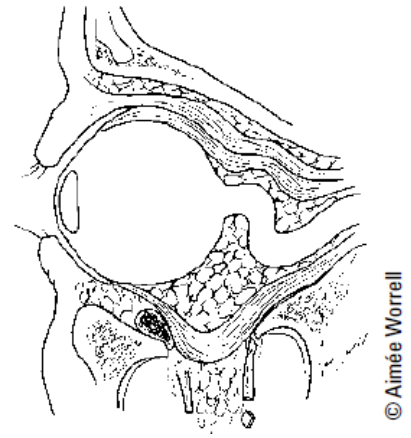
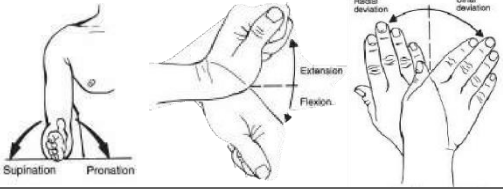
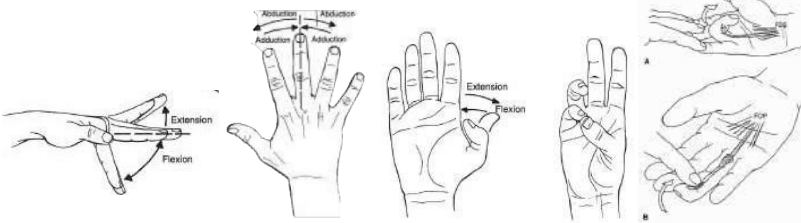
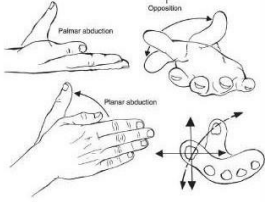



Figure 6 from Toronto Notes

© Aimée Worrell

# Hand Examination

## Basic Exam: Look – Feel – Move

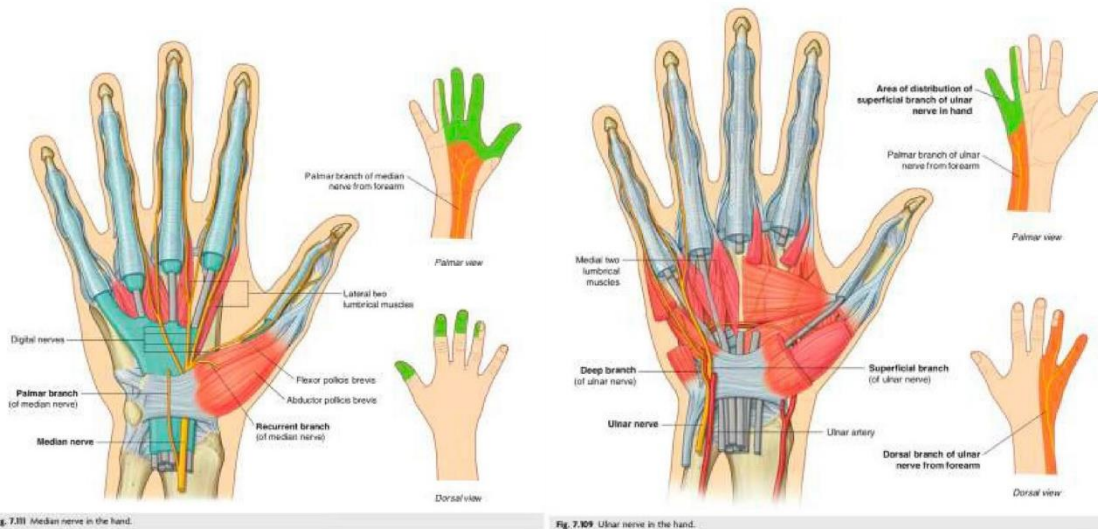
	Dorsal & Palmar Aspects	<ul style="list-style-type: none"> <li>- Masses, scars, lesions               <ul style="list-style-type: none"> <li>o Firm pits and nodules are often visible in Dupuytren's Contracture</li> </ul> </li> <li>- Erythema, particularly over joints</li> <li>- Thickened skin, shininess, tight skin</li> <li>- Cuts, abrasions, bruising</li> <li>- Swelling</li> <li>- Atrophy – median (thenar wasting) or ulnar distribution (hypothenar wasting)</li> <li>- Fasciculations</li> </ul>
Look	Nails	<ul style="list-style-type: none"> <li>- Pitting and other changes of psoriasis (onycholysis, subungual hyperkeratosis)</li> <li>- Fungal infections (onychomycosis)</li> <li>- Subungual hematoma</li> <li>- Periungual erythema</li> <li>- Infarcts, hemorrhages (stigmata of infective endocarditis)</li> <li>- Masses (glomus tumours)</li> </ul>
	Joints	<ul style="list-style-type: none"> <li>- Malalignment/deformities/contractures               <ul style="list-style-type: none"> <li>- Rheumatoid arthritis: ulnar drift, Swan Neck and Boutonnière deformity</li> </ul> </li> <li>- Swelling</li> <li>- Loss of valleys between MCP heads (present in edema, scleroderma)</li> <li>- Bouchard's nodes (bony nodules in PIP, indicative of osteoarthritis)</li> <li>- Heberden's nodes (bony nodules in DIP, indicative of osteoarthritis)</li> </ul>
Feel	Bones	<ul style="list-style-type: none"> <li>- Tenderness</li> <li>- Thickening</li> </ul>
	Joints (above and below)	<ul style="list-style-type: none"> <li>- Masses or nodules – firm, fluctuant, fixed</li> <li>- Triggering/locking (trigger finger)</li> </ul>
	Palms & flexor tendons	<ul style="list-style-type: none"> <li>- Edema – pitting or non-pitting</li> <li>- Effusion</li> <li>- Deformities</li> </ul>
	Wrist	<p>Should be tested with elbow flexed at 90°</p> 
Move	Hand	<p>Composite flexion and extension (can test MCP, PIP and DIPs all together or separate) *testing for flexor digitorum superficialis and profundus can be done</p> 
	Thumb	 <div style="border: 2px solid blue; border-radius: 15px; padding: 10px; display: inline-block;"> <p>Quick Thumb Exam: #4, OK, Thumbs Up</p>  <p>flexion      opposition      extension</p> </div>



## Neurovascular Testing

Neurologic:

2-point discrimination, pinprick, and light touch sensation in median, ulnar & radial nerve distributions



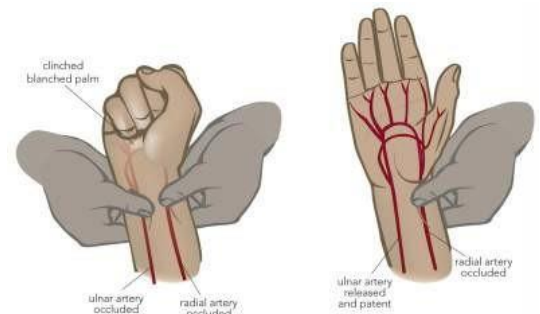
LOAF Mnemonic for Median Nerve Muscle Innervation:

**L**ateral two lumbricals  
**O**pponens pollicis  
**A**bductor pollicis brevis  
**F**lexor pollicis brevis

## Vascular:

Capillary Refill

(Modified) Allen's Test - test both radial and ulnar artery patency  
 e.g. to test ulnar artery →



## Strength Testing

Modified Medical Research Council Scale

Grade 5: full active range of motion & Normal muscle resistance

Grade 4: full active range of motion & Reduced muscle resistance

Grade 3: full active range of motion & No muscle resistance

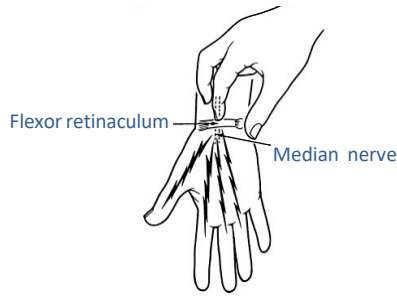
Grade 2: Reduced active range of motion & No muscle resistance

Grade 1: No active range of motion & Palpable muscle contraction only

Grade 0: No active range of motion & No palpable muscle contraction

## Special Tests

Tinel's Sign



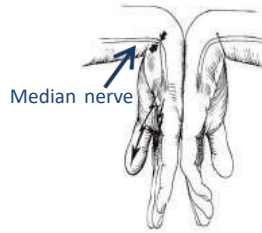
**Use:** Diagnosis of compressive neuropathy (i.e. carpal tunnel syndrome).

**Principle:** Compressed nerves are irritable.

**Test:** The examiner taps index and middle fingers on the patient's flexor retinaculum. Test is positive if the patient experiences tingling shocks or shooting pain in the distribution of the median nerve.

*\*Tinel's sign is not specific to the wrist or to the median nerve. It can also be used to check nerve function after trauma, or nerve recovery. The examiner percusses the nerve to trace where it has been damaged, or to trace the recovery of the nerve after surgical repair.*

Phalen's Sign



**Use:** Diagnosis of median neuropathy (i.e. carpal tunnel syndrome).

**Principle:** Flexion causes compression and dysfunction of the median nerve.

**Test:** The patient flexes both wrists at 90 degrees until reproduction of symptoms. Test is positive if the patient experiences pain, numbness or tingling in the distribution of the median nerve.

Pressure Provocative Test for Carpal Tunnel

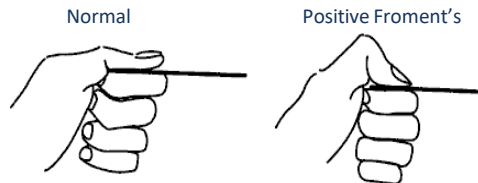


**Use:** Diagnosis of median neuropathy (i.e. carpal tunnel syndrome).

**Principle:** Compressed nerves are sensitive.

**Test:** Examiner uses both thumbs to apply pressure to the flexor retinaculum for 30 to 45 seconds. Test is positive if the patient experiences pain, numbness or tingling in the distribution of the median nerve.

Froment's Sign

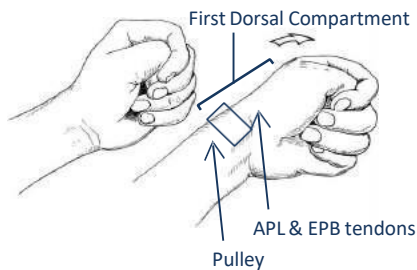


**Use:** Diagnosis of ulnar neuropathy.

**Principle:** The deep branch of the ulnar nerve supplies the adductor pollicis. Lesion to this nerve results in the compensatory use of flexor pollicis longus.

**Test:** Ask the patient to squeeze a piece of paper between the thumb and index finger PIP joint as you try to pull it away. A positive test is flexion of IP joint of thumb.

Finkelstein's Test

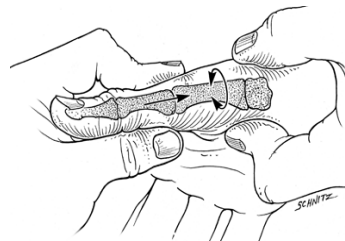


**Use:** Diagnosis of De Quervain's tenosynovitis.

**Principle:** Inflammation of first dorsal compartment aggravated by wrist ulnar deviation. To stretch the abductor pollicis longus (APL) and extensor pollicis brevis (EPB).

**Test:** Ask the patient to tuck their thumb in their palm, then ulnar deviate the wrist. A positive test occurs if the patient experiences pain at the first dorsal compartment.

1<sup>st</sup> CMC Grind Test

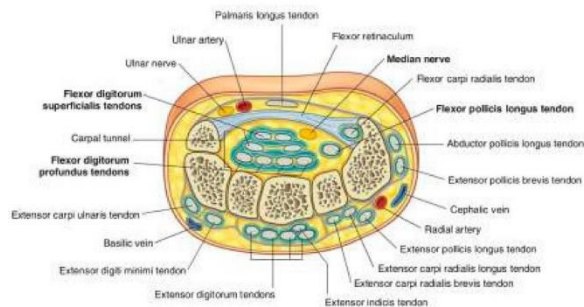
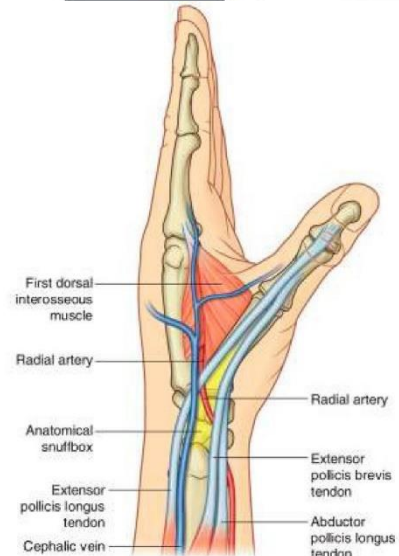
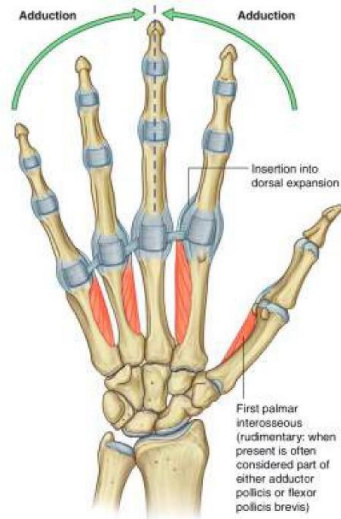
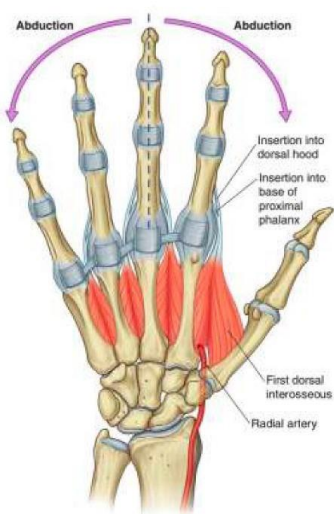
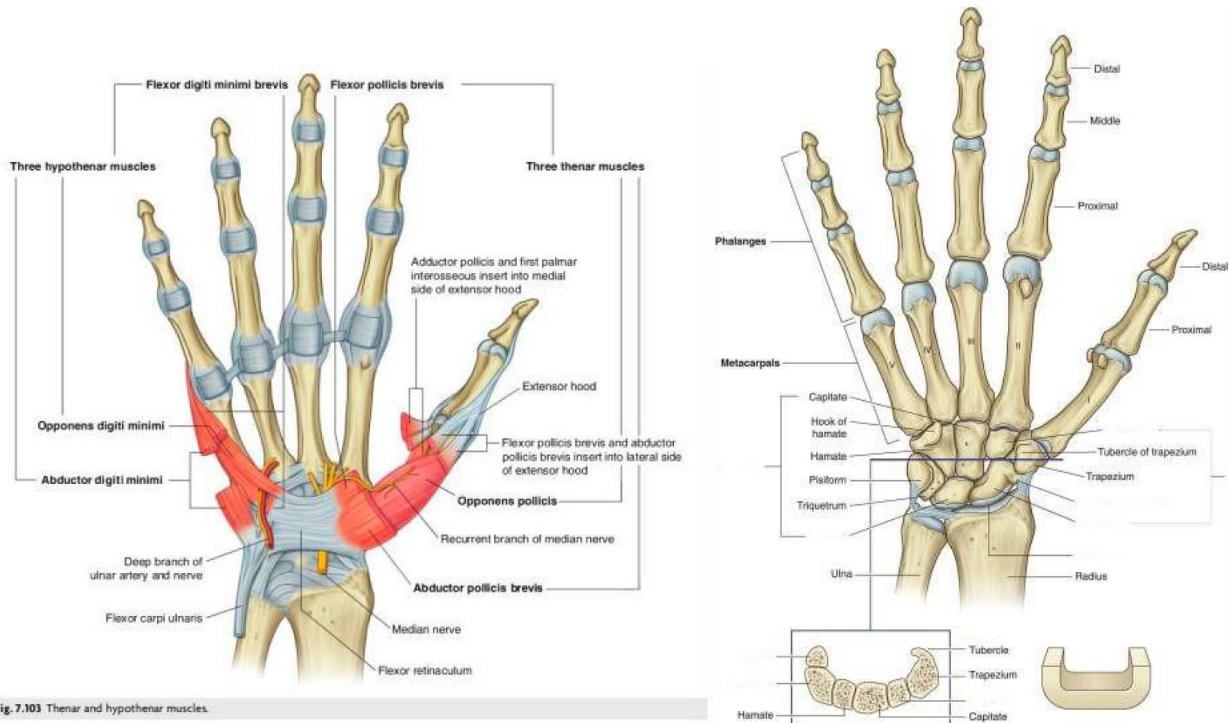


**Use:** Determine 1st CMC joint arthritis.

**Principle:** Damaged joint movement is painful.

**Test:** Examiner holds the metacarpal bone of the thumb and circumducts the thumb with axial pressure. Test is positive if the patient experiences sharp pain during the test.





# Hand Anatomy (images from Gray's Anatomy 3e)


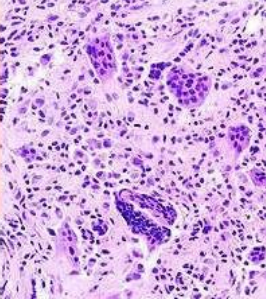


# Conditions of the Hand & Wrist

## Soft Tissue Masses

The most common benign tumour of the hand. They consist of a mucin-filled cyst attached to a tendon, tendon sheath capsule, or joint. Cysts can be observed, aspirated, or removed.


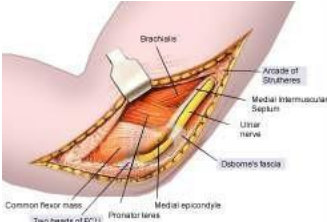

<b>Ganglion</b>		<b>Dorsal Ganglion</b> Usually arises directly over the ligament. More prominent with flexion.		<b>Volar Ganglion</b> Usually arises over the scaphotrapezial trapezoid (STT) joint - distal edge of the radius or over the scaphoid tubercle.
		<b>Finger Ganglion</b> Arises over the A1 pulley. Usually presents as a tender mass under the metacarpal flexion crease.		<b>Mucus Cyst</b> Located at the DIP joint. Due to osteoarthritis.

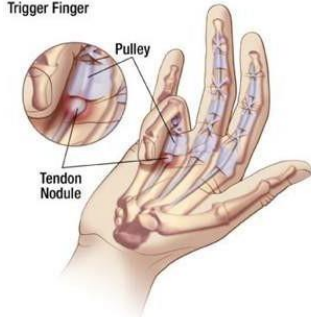
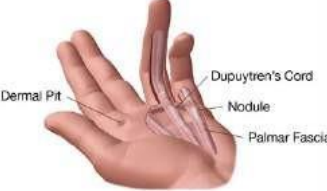

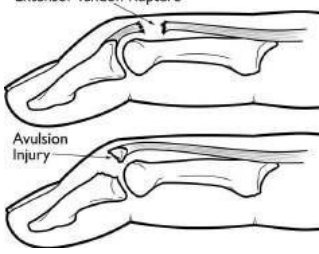
<b>Giant Cell Tumour</b>			Second most common hand mass. Often presents as a firm, indolent, painless mass on the volar surface of the fingers or hand. Arises from a tendon sheath and can be lobulated. No malignant potential but locally invasive and has high recurrence rate.
--------------------------	--	--	--


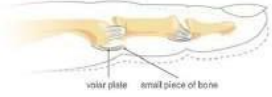



<b>Epidermal Inclusion Cyst</b>			The third most common hand tumour. Often presents as a slow-growing mass on the volar surface of the distal phalanx. Caused by the embedment of epithelial cells in subcutaneous tissue. Common after trauma. May present with a punctum.
---------------------------------	---	---	---

<b>Lipoma</b>			A less common tumour of the hand. Composed of adipose cells. Soft and mobile mass in the hypodermis.
---------------	---	---	--

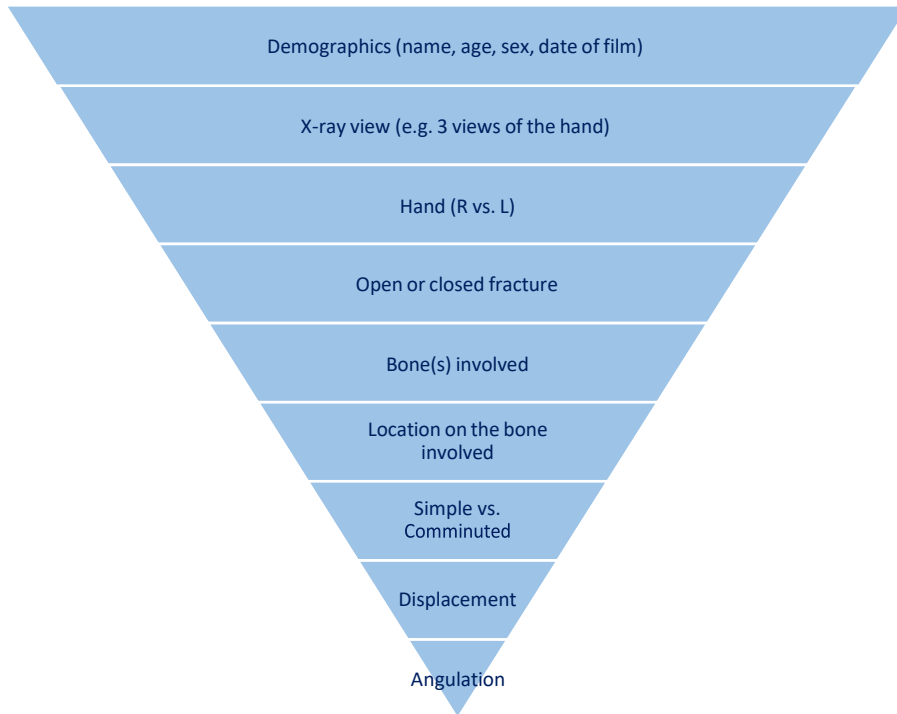
## Common Hand & Upper Extremity Pathology

	Definition	Etiology	Clinical Features	Exam	Investigations	Treatment
<b>Carpal Tunnel Syndrome</b>	Results from compression on the median nerve within the carpal tunnel	Caused by excessive pressure on median nerve				
	<p>The carpal tunnel holds 9 tendons:</p> <ul style="list-style-type: none"> <li>- Flexor digitorum superficialis (4)</li> <li>- Flexor digitorum profundus (4)</li> <li>- Flexor pollicis longus (1)</li> </ul> 	<p>Due to swollen synovium within the tendons, which increases pressure within the tunnel</p> <p>3x more likely in women</p> <p>Associated with pregnancy, diabetes, hypertension, arthritis, and repetitive wrist movement</p> <p>Most common entrapment syndrome</p>	<p>Pain</p> <p>Numbness</p> <p>Paresthesia</p> <p>Weakness and functional impairment</p> <p>Burning</p>	<p>APB weakness and atrophy</p> <p>Tinel's Test</p> <p>Phalen's Test</p> <p>Pressure Provocative Test</p>	<p>X-ray</p> <p>Nerve Conduction Studies (NCS)</p>	<p>Nocturnal Wrist Splint</p> <p>Steroid injection</p> <p>NSAIDs</p> <p>Hand Therapy</p> <p>Carpal Tunnel Release Surgery</p>
<b>Cubital Tunnel Syndrome</b>	Ulnar nerve entrapment at the level of the elbow; posterior to medial epicondyle	Occurs with overuse of elbow				
		<p>Associated with arthritis, bone spurs, and previous fractures or dislocations of the elbow</p>	<p>Numbness</p> <p>Weakness</p> <p>Cramping</p>	<p>Ulnar hypothenar wasting</p> <p>Tinel's Sign</p> <p>Froment's Sign</p>	<p>X-ray</p> <p>NCS</p>	<p>Elbow pads at elbow</p> <p>Behavioural therapy (no bending, elbow offloading)</p> <p>Surgical release of ulnar nerve</p>
<b>De Quervain's Tenosynovitis</b>	Inflammation of the tendons in first dorsal compartment	Commonly caused by repetitive motion of the thumb/hand (pinching, squeezing, grasping, etc.)				
	<p>De Quervain's Tenosynovitis</p> 	<p>Pregnancy, arthritis or previous injury around the thumb may predispose.</p>	<p>Pain – acute or gradual</p> <p>onset, with intensity increasing over time</p> <p>Tenderness</p> <p>Swelling</p> <p>Reduced ROM and functional impairment</p> <p>Thumb may trigger or "creak"</p>	<p>Finkelstein Test</p>	<p>X-ray to r/o CMC arthritis</p>	<p>Rest &amp; reassurance</p> <p>Splint</p> <p>Steroid injection</p> <p>Hand Therapy</p> <p>Surgery</p>

	Definition	Etiology	Clinical Features	Exam	Investigations	Treatment
<b>Trigger Finger (adult)</b>	<p>Stenosing tenosynovitis causing fingers or thumb to click and lock in a position (typically bent).</p> 	<p>Occurs when tendon or tendon sheath becomes inflamed and irritates the tendons</p> <p>Unknown cause and can occur suddenly</p> <p>More common in women</p> <p>Associated with arthritis, diabetes, and hypothyroidism</p>	<p>Pain</p> <p>Swelling</p> <p>Catching or popping of finger tendons</p> <p>Stiffness</p> <p>Tenderness</p>	<p>Palpate the base of digit tendons to feel for catching with quick flexion</p>	<p>X-ray</p>	<p>Steroid injection</p> <p>Hand Therapy</p> <p>Surgery</p>
<b>Dupuytren's Contracture</b>	<p>Palmar fibromatosis along fascial bands under the skin, creating a cord or nodule that can pull one or more fingers into a bent position.</p> 	<p>Unknown etiology. Often gradual progression.</p> <p>Commonly in ring and little finger</p> <p>Associated with diabetes, age, sex, family history</p>	<p>Reduced extension</p> <p>Functional impairment</p>	<p>Limited extension only</p> <p>Firm pits, cords, and nodules in palmar surface</p>	<p>X-ray</p> 	<p>Percutaneous aponeurotomy</p> <p>Surgery</p> <p>Xiaflex (collagenase) injections</p>
<b>Mallet Finger</b>	<p>A condition in which the fingertip is bent and cannot be straightened.</p> 	<p>Commonly caused by sporting accidents (jamming, cutting)</p> <p>Due to extensor tendon rupture ± DIP avulsion fracture.</p> <p>Can be associated with joint subluxation or malalignment.</p>	<p>Swelling</p> <p>and pain at site of tear</p>	<p>Limited ROM and pain</p>	<p>X-ray</p>	<p>Splint &amp; Hand</p>

	Definition	Etiology	Clinical Features	Exam	Investigations	Treatment
<b>Volar Plate Injury</b>	<p>PIP joint is hyperextended causing ligament injury,</p>  <p>small piece of bone volar plate</p>  <p>volar plate small piece of bone</p>	<p>Commonly caused by sporting accidents</p> <p>Ligament may partially or completely tear off a small piece of bone</p> <p>Degrees of volar plate injury:</p> <ul style="list-style-type: none"> <li>- Sprain – ligament is stretched</li> <li>- Dislocation</li> <li>- Avulsion fracture – ligament &amp; bone are torn</li> </ul>	<p>Swelling</p> <p>Pain</p> <p>Bruising at PIP</p>	<p>Pain</p> <p>Limited ROM</p> <p>Instability if associated with collateral ligament injury</p>	<p>X-ray</p> 	<p>Buddy taping</p> <p>Block splinting</p> <p>Hand Therapy</p> <p>Surgery (rarely necessary)</p> 
	<p>Can be associated with collateral ligament injury, joint subluxation or malalignment</p>	<p>Can be associated with collateral ligament injury, joint subluxation or malalignment</p>				
<b>Ulnar Collateral Ligament Injury</b>	<p>Also known as Skier's thumb (acute) or Gamekeeper's thumb (chronic or repeated injury).</p>  <p>Torn ulnar collateral ligament Metacarpal Phalanx MCP joint</p>	<p>Hyperextension of thumb from sporting or traumatic injury</p> <p>May involve soft tissue only, or potential avulsion fracture</p> <p>Can be associated with collateral ligament injury, joint subluxation or malalignment</p>	<p>Pain</p> <p>Swelling</p> <p>Bruising</p> <p>Weakness</p>	<p>Limited flexion and extension at thumb</p> <p>Instability of MCP</p>	<p>x-ray to r/o fracture</p>	<p>Thumb spica splint</p> <p>Hand Therapy</p>

## How to Read Hand X-Ray



<b>Do</b>	Demographics
<b>Explain</b>	X-ray views
<b>Hand</b>	Right vs. left hand
<b>Film</b>	Fracture – open vs. closed
<b>Before</b>	Bone(s) involved
<b>Local</b>	Location on the bone
<b>Staff</b>	Simple vs. Comminuted
<b>Darts</b>	Displacement
<b>Away</b>	Angulation

The inverted triangle illustrates the “big to small” approach to describing an x-ray. The goal is to be able to describe the x-ray so that your staff doesn’t even have to look at the film. Start with the patient demographic information, then the hand and the views and drill it down to the exact bone and the fracture configuration.



For example: Mr. Smith a 24-year-old male. Here are 3 x-ray views of his right hand. The injury is closed and involves the little finger metacarpal neck. It is transverse, not comminuted, extraarticular, mildly volarly displaced and has 35 degrees of apex dorsal angulation and flexion.



## Common Hand Radiographs

### Boxer's fracture

Closed transverse fracture of the little finger metacarpal neck. Not comminuted, mildly displaced, and 35 degrees of volar angulation.



### Bony Mallet fracture

Closed avulsion fracture of the 5th dorsal distal phalanx base.



### Bennett's fracture

Closed oblique fracture of the thumb metacarpal base. Intra-articular, not comminuted.



### Tuft fracture

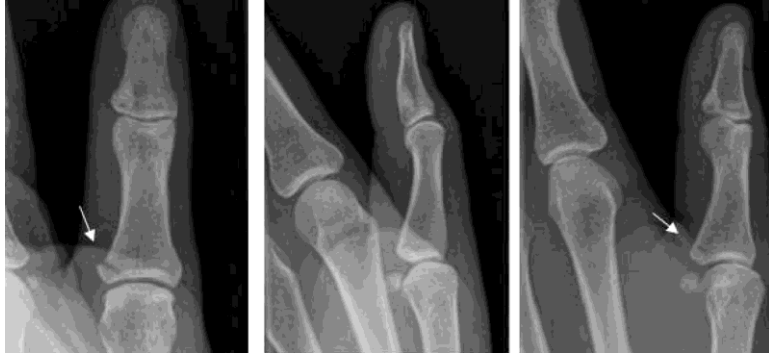
Crush fracture of the distal phalanx head.



---

### Ligament avulsion fracture

In this example, there is a closed fracture of the thumb proximal phalanx base. Intra-articular fracture, not comminuted, minimal displacement, minimal rotation.



---

### Osteoarthritis

Thumb carpometacarpal joint osteoarthritis.

Features:

1. Loss of joint space
2. Erosion
3. Subchondral sclerosis
4. Deformity and subluxation
5. Cysts
6. Osteophytosis



---

### Enchondroma

Most common primary benign bone tumor of the hand. Lytic lesion with cortical scalloping. Presents here with a pathological fracture.



---

### Oblique metacarpal shaft fracture

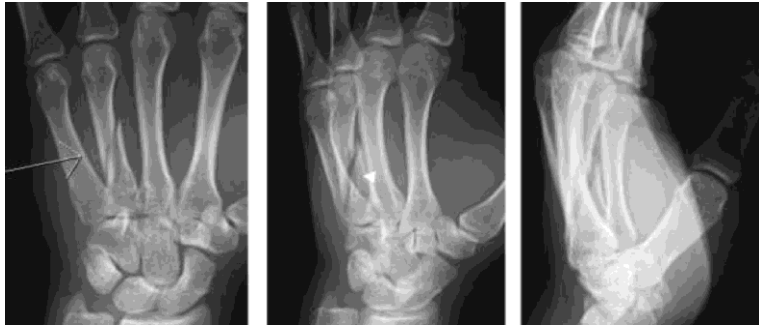
In this example, there is a closed oblique fracture of the 4th metacarpal shaft. Not comminuted, minimal displacement, no angulation.



---

### Spiral metacarpal shaft fracture

In this example, there is a closed spiral fracture of the 4th metacarpal shaft. Not comminuted, mild displacement (i.e. shortening), no angulation.



---

### Transverse metacarpal shaft fracture

Closed transverse fracture of the metacarpal mid-shaft. In this example, it is not comminuted, minimal displacement, no angulation. Is usually unstable.



---

### Salter-Harris Type II Fracture

Fracture of the pediatric population. Type II is most common - 75% incidence. Fracture is through the metaphysis and growth plate but spares the epiphysis.

Salter-Harris Types: "SALTR"

- Type 1 – Straight
- Type 2 – Above
- Type 3 – beLow
- Type 4 – Through
- Type 5 – cRushed











---

### Osteomyelitis

Infection of the distal phalanx bone. Requires debridement and IV antibiotics.



Appendix: Images in Plastic Surgery

<p><b>Squamous Cell Carcinoma</b></p>	<p><b>Ulcerative</b></p> 	<p><b>Verrucous</b></p> 
<p><b>Melanoma</b></p>	<p><b>Nodular</b></p> 	<p><b>Acral Lentiginous</b></p>  <p><b>Amelanotic</b></p> 
<p><b>Basal Cell Carcinoma</b></p>	<p><b>Pigmented</b></p>  <p><b>Nodular</b></p> 	<p><b>Sclerosing</b></p> 

**Hand Lipoma**



**Single Lipoma**



**Multiple Lipoma**



**Pyogenic Granuloma**

Vascular lesion with an overgrowth of vascular tissue. Prone to bleeding



**Chondrodermatitis nodularis chronica helicis**

Common, benign, painful condition of helix or antihelix. May be precipitated by trauma, pressure, or cold



**Necrotizing Fasciitis**



**Frostbite**



**Breast Cancer**



**Skier's Thumb (UCL thumb injury)**



**Septic Arthritis** (most commonly after penetrating trauma)



**Scissoring of 5<sup>th</sup> finger** (due to metacarpal fracture)



**Paronychia** (infection of nail fold. Pain, erythema, edema of tissue surrounding nail)



**Keloid scar**



**Ulnar Nerve Palsy**

Dysthesia in palmar and dorsal ulnar side of hand and "ulnar clawing hand" – clawing, increased hand span, hypothenar wasting, intrinsic muscle wasting



**Dupuytren's Contracture**

Abnormal fibrous tissue development in the palmar fascia, resulting in nodules and cords that cause flexion contracture. Commonly in 4<sup>th</sup>/5<sup>th</sup> fingers



**Calcifying Epithelioma**



**Spitz Nevus**



**Junctional Nevus**



**Intradermal Nevus**



**Dysplastic Nevus**



**Nevus Sebaceous**



**Congenital Melanocytic Nevus**














**Sebaceous Hyperplasia**














**Contact Dermatitis (reaction to Polysporin after skin surgery)**



<b>Miller-Senn retractor</b>		Most commonly used retractor. It is especially useful in hand surgery.
<b>Curved iris scissors</b>		Used for fine dissection.
<b>Short straight scissors</b>		Used for cutting sutures.
<b>Stevens scissors</b>		Preferred dissecting scissors for plastic surgeons.
<b>Metzenbaum scissors</b>		Curved scissors used in dissection large areas. Not for cutting sutures.
<b>Gillies (Olsen Hegar) needle driver</b>		Needle driver with built-in scissors. Way faster!
<b>Adson forceps (single-toothed)</b>		Used when suturing the skin.
<b>Adson forceps (multi-toothed)</b>		Forceps, to hold cartilage for instance.
<b>Skin hook</b>		Skin retractor that allows atraumatic handling of the skin.
<b>Straight and curved hemostat (mosquito, snap)</b>		Used for holding onto small vessels or ends of sutures, to hold a finger tourniquet.
<b>Scalpel</b>	 <p>Blades #10</p> <p>Blades #11</p> <p>Blades #15</p>	<p>10 blade – used in general surgery for skin</p> <p>11 blade – plastic surgeon's preferred blade</p> <p>15 blade – used in ear &amp; lip surgeries</p>

## Wound Care Products (adapted from THP Skin & Wound Product Guide)

Tissue Issue	Product Type	Product Name	Usage considerations
Protection	Transparent dressing	3M Transparent; Tegaderm acrylic	 Creates barrier to protect against friction/shear.
	Contact layer	Adaptic	 Protects by preventing dressing adherence to wound bed and minimizes discomfort with dressing changes.
Moisture Management	Calcium alginate	Tegaderm Alginate	 For minor bleeding and wet wounds, turns into gel with moisture
	Hypertonic		 Contains salt to absorb moderate-large amounts of exudate.
	Foams	3M Tegaderm adhesive foam	 Moderate to heavy exudate for partial and full thickness wounds
	Gauze padding	Mesorb; Abdominal Pads	 Absorbent non-adherent pad for highly draining wounds
Bacterial Balance		Inadine	 For superficial infections. Can be cut into ribbon for packing. *caution for iodine allergic pts.
	Antimicrobial	Covidien AMD ribbon/roll	 For packing or topical use in wet wounds.
		Silvercel	 For colonized/infected wounds with moderate-heavy drainage.
Edema	Compression	Coban 2/Coban 2 Lite	 Tx for venous leg ulcers. Lite version has less compression. *must have BP and ABI checked for blood flow before initiating therapy.
		Tubigrip	 Support for soft tissue injuries, general edema, post-burn scarring.