

**MEDAVIE**

**HealthEd**

**ÉduSanté**



# SOFT TISSUE ILLNESS AND INJURY

Advanced Care Paramedicine

Module: 08

Section: 05a

- Skin is the first tissue in the body to experience trauma
  - Great significance at all stages of patient assessment
- Injuries infrequently threaten life
  - Highly capable of repairing itself

- Soft-tissue injuries are by far the most common form of trauma
- Open wounds
  - Most require simple care and suturing
  - Significant minority can lead to permanent damage to arteries, tendons, and nerves
  - ~6.5 % will become infected
- Closed wounds
  - Similar epidemiology
  - More common but most never reach the paramedic

- Closed Wounds
  - Contusions
    - Erythema
      - Redness caused by capillary congestion
    - Ecchymosis
      - Blood in the tissue
  - Hematomas
  - Crush Injuries
- Open Wounds
  - Abrasions
  - Skin tears
  - Lacerations
  - Incisions
  - Decubitus ulcer
  - Punctures
  - Injections
  - Bites
  - Impaled Objects
  - Avulsions
  - Amputations

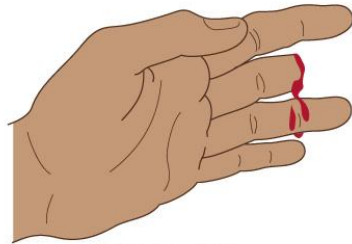
- Blunt non-penetrating injuries that crush and damage small blood vessels
  - Erythema
    - Reddening caused by blood being drawn to inflamed tissue
  - Ecchymosis
    - Hemoglobin in the blood loses its oxygen, colouration becomes dark red then blue



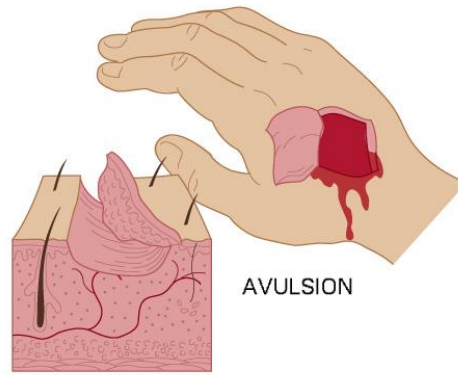
- Bleeding within the tissue is significant enough to separate the tissue
- Blood pools in a pocket
  - Pronounced in a head injury
  - Less obvious in other body areas
  - Hematoma to the thigh can accumulate up to one litre of blood before it is noticeable



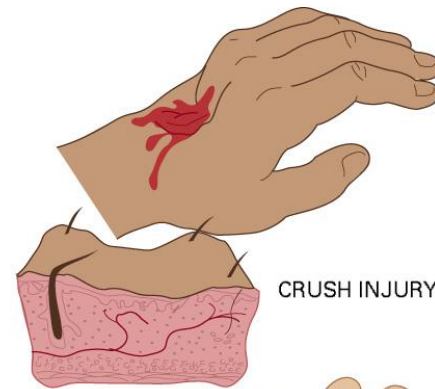
# Types of Open Soft-Tissue Injuries



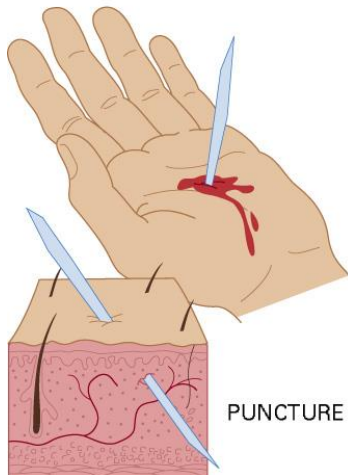
AMPUTATION



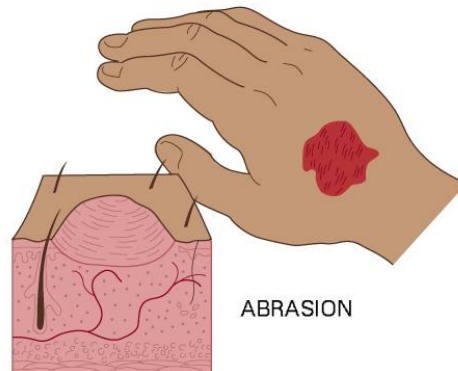
AVULSION



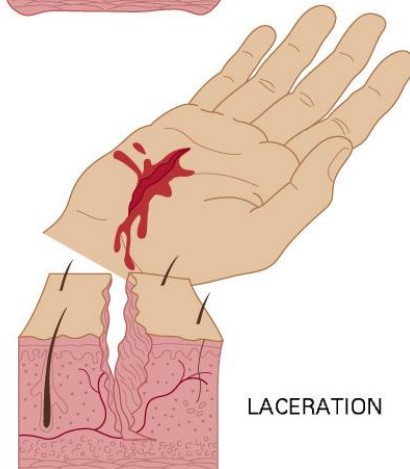
CRUSH INJURY



PUNCTURE



ABRASION



LACERATION

- Most minor of injuries
- Scraping or abrading of skin
- Involves epidermis only
- Bleeding tends to be limited
- Risk of infection





- Common in elderly
- Effect of aging on skin
- Caused by shearing and/or friction forces
- Epidermis separates from dermis (partial)
- Epidermis and dermis separate from underlying structures (full thickness).



- Open wound that penetrates more deeply into dermis
- Involves smaller surface area but deeper structures
- Potential for significant bleeding



# Tension lines of the skin

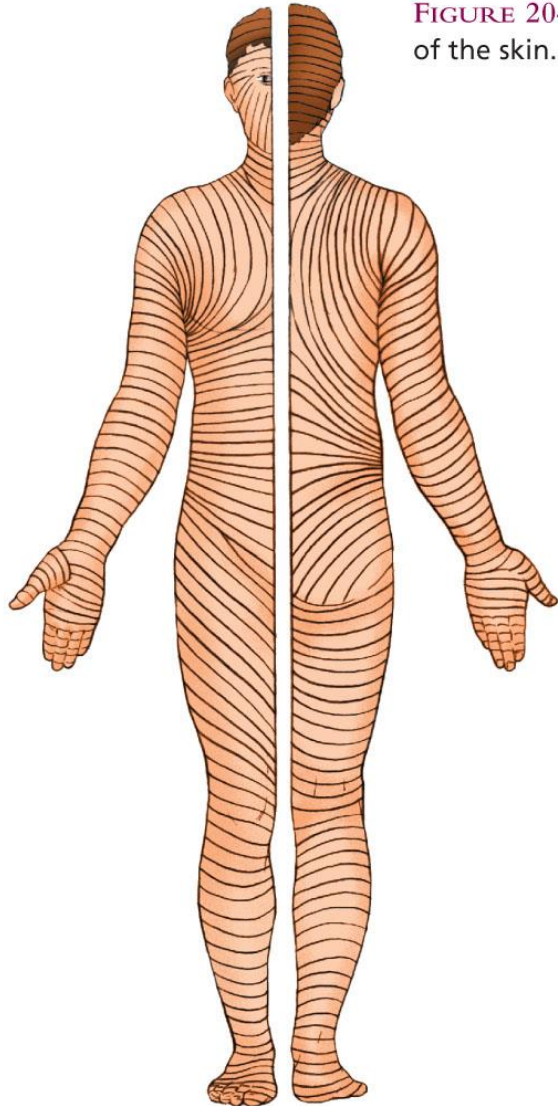


FIGURE 20-6 Tension lines of the skin.

- Tension lines may hold wound open or closed
  - Static (Langer's lines)
  - Dynamic

- Surgically smooth laceration
- Tends to bleed freely



- AKA pressure sore or bed sore
- Common in
  - Elderly
  - Disabled
  - Bed ridden
  - Fragile skin
- Often seen over boney areas
- Pressure over time causes skin to break down



- Small entrance wound with damage that extends into body interior



- High-pressure line bursts
- Injects fluid or other substance into skin and into subcutaneous tissue
- Body mechanisms unprepared to remove injected material
- Damage and infection may be severe



- Structural damage
- Local infection
- Disease transmission





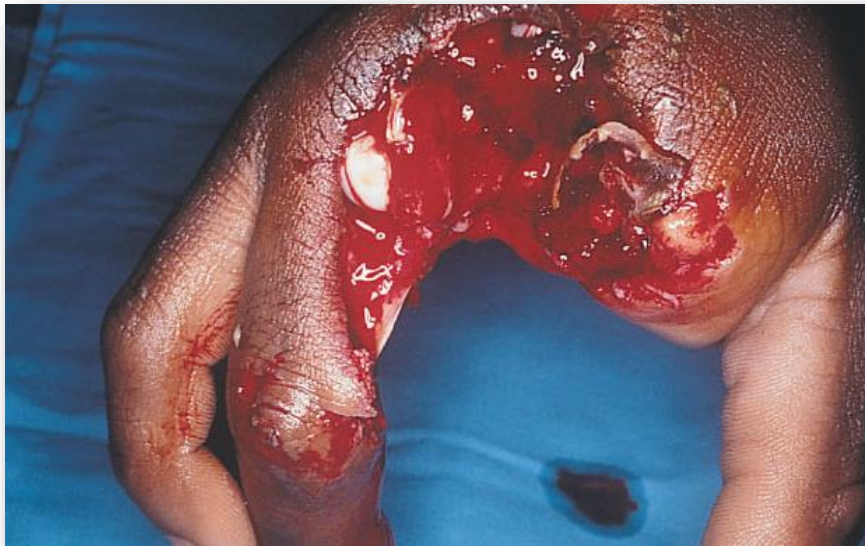
- Wound complication of a puncture or laceration
- Cause more damage if withdrawn



- Flap of skin not torn or cut completely from body
- Seriousness depends on
  - Area involved
  - Condition of circulation
  - Degree of contamination
- Degloving Injury
  - Injury tears skin off underlying muscle, connective tissue, blood vessels and bone



- Partial or complete severance of a digit or limb
- Bleeding may or may not be severe
- Occasionally can be surgically reattached



- Patient
  - Control bleeding by bulky dressing
  - Consider tourniquet proximal to wound
  - Do not delay transport to locate amputated part
  - Have a second unit transport the part
- Amputated Part
  - Dry cooling and rapid transport
  - Part in plastic bag (double bag)
  - Immerse in cold water
  - Avoid direct contact between tissue and cold water

- Blood loss may range from inconsequential to life threatening
- Nature of the injury more important than the size
  - Clean lacerations and amputations generally do not bleed as much

## ARTERIAL



- Spurting blood
- Pulsating flow
- Bright red color

## VENOUS



- Steady, slow flow
- Dark red color

## CAPILLARY



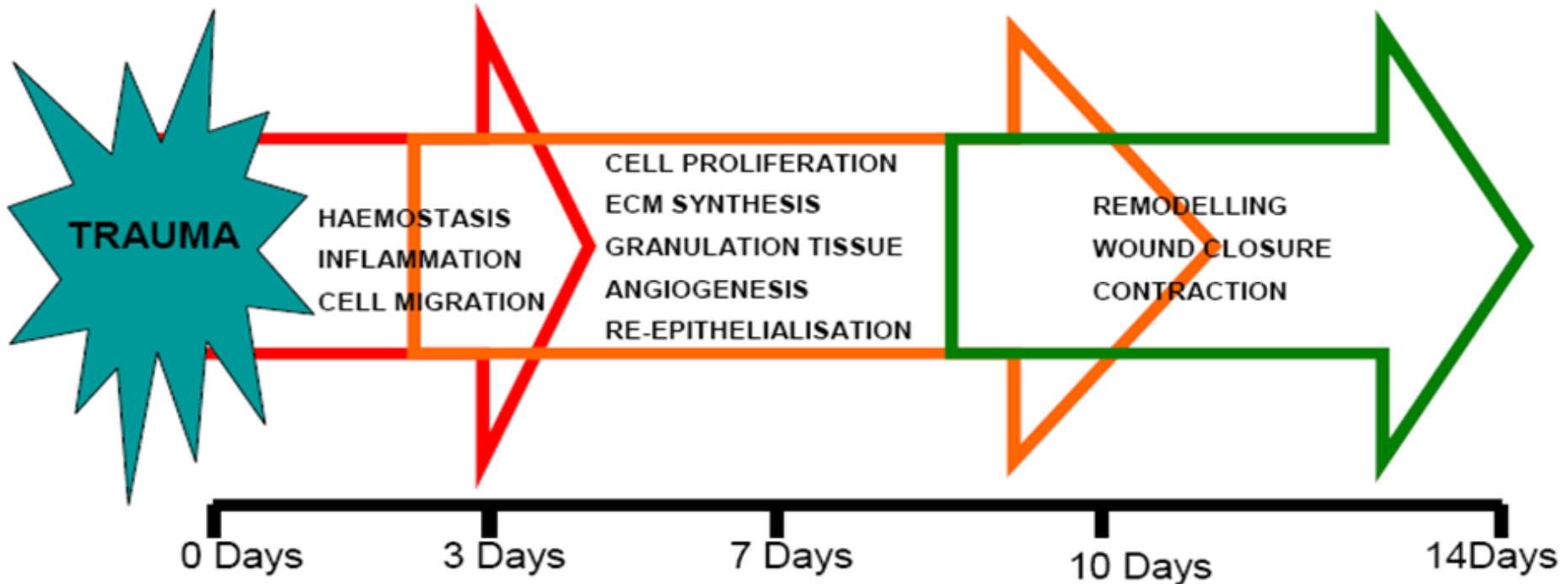
- Slow, even flow

- Complex process that may take up to several months to complete
- Phases of healing
  - Homeostasis – wound plug
  - Inflammatory response – Clean up
  - Proliferation – Scab formation
  - Remodelling – External closing
- Phases overlap and are physiologically intertwined

- Epithelialization
  - Epithelial cells migrate over surface of wound
- Neovascularization
  - New blood vessels generated to support healing
- Collagen synthesis
  - Main structural protein
  - Fibroblasts generate collagen to bind wound margins and strengthen healing

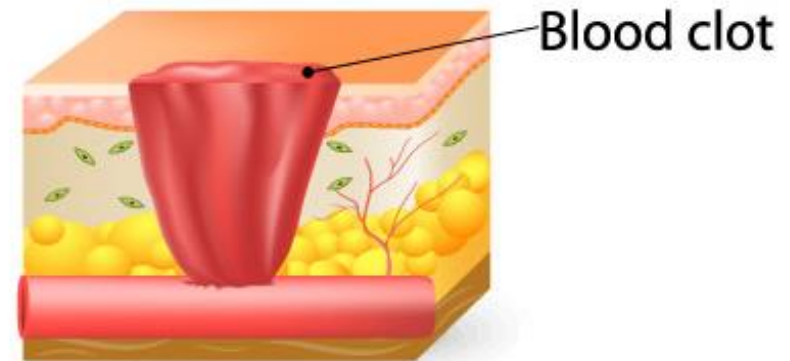


# Stages of Normal Cutaneous Wound Healing

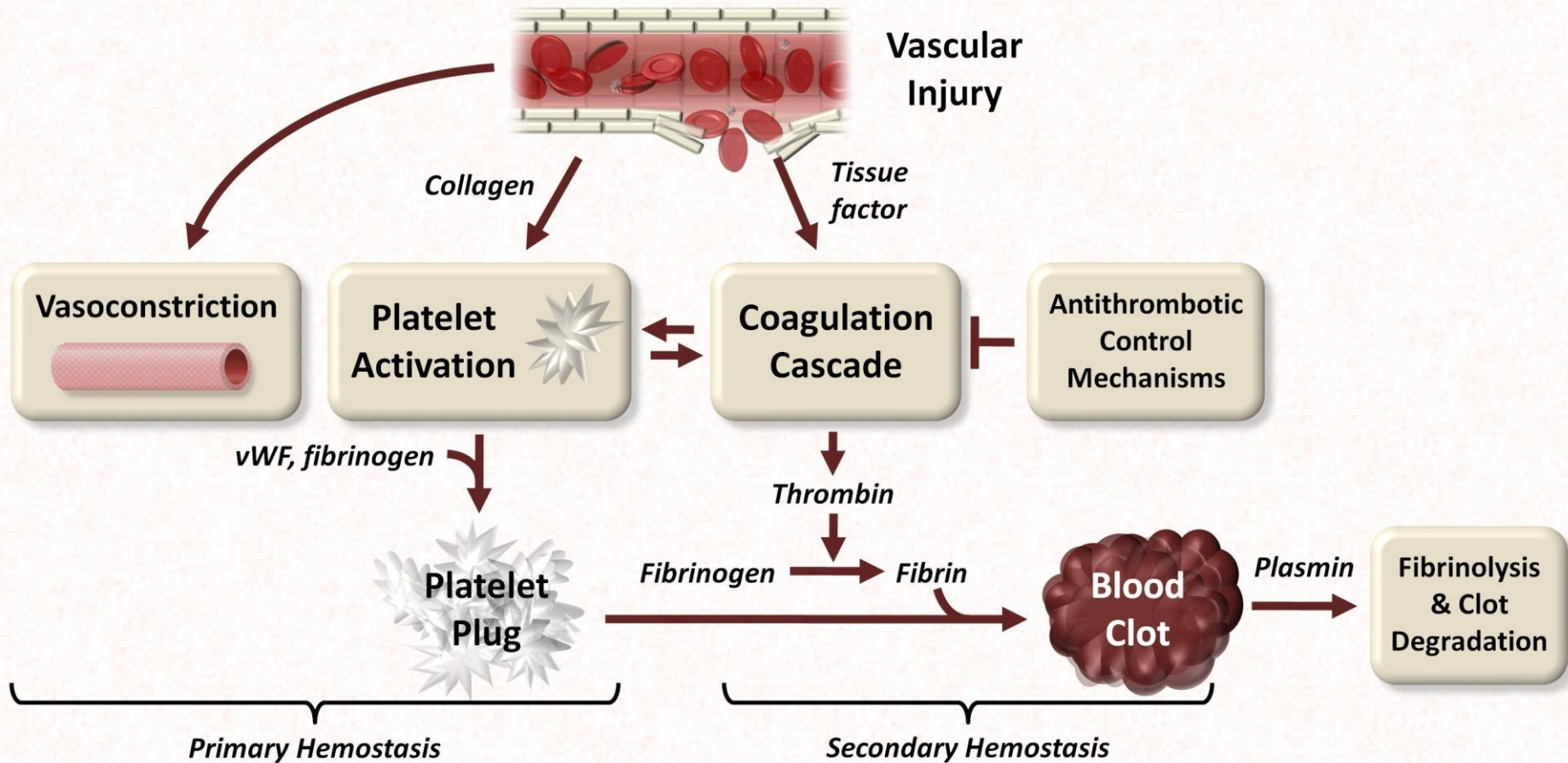


CELL TYPE	0 Days to 3 Days	3 Days to 10 Days	10 Days to 14 Days
	PLATELETS NEUTROPHILS LYMPHOCTYES MACROPHAGES EPCs	KERATINOCYTES ENDOTHELIAL CELLS FIBROBLASTS MACROPHAGES EPCS	MYOFIBROBLASTS MACROPHAGES

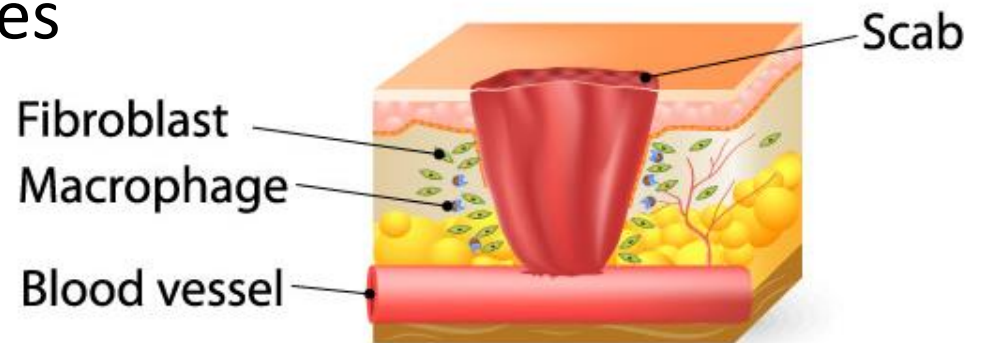
- Body's ability to stop bleeding on its own
  - Vasculature
    - Constricts in response to local injury
  - Platelets
    - Begin clotting process and form platelet plug
  - Clotting cascade
    - Collagen and other structural proteins exposed
    - Release enzymes that begin clotting cascade



## Major Components of Hemostasis



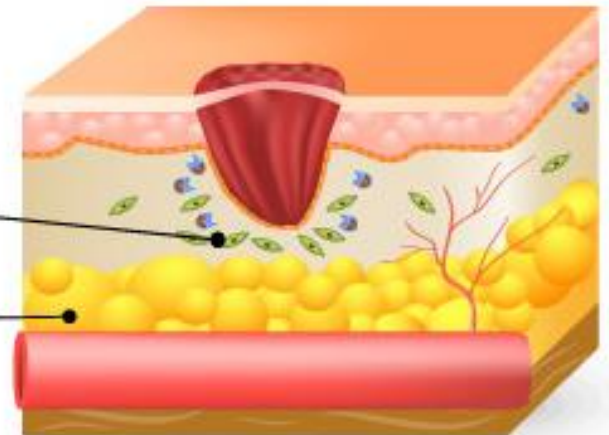
- Complex early stage of healing
- Damaged cells release chemotaxic factors
  - Attract phagocytes which engulf bacteria and debris
  - Lymphocytes attack invading pathogens
- Histamine released from damaged cells
  - Vasodilation increases blood flow to and through area



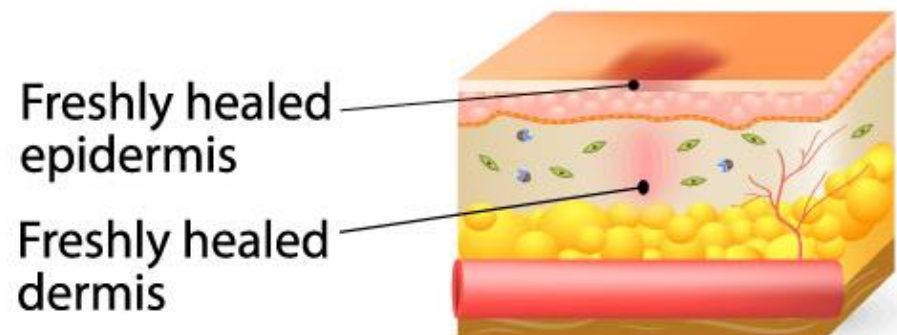
- Growth of new tissue begins
- Granulation tissue comprised of collagen and extracellular matrix into network of blood vessels develop.
- Resurfacing of epithelial cells (Epithelialization)

Fibroblasts  
proliferating

Subcutaneous fat



- Occurs once the wound is closed
- Involves remodelling of collagen
- Collagen is realigned along tension lines
- Cellular activity decreases and number of blood vessels in wounded area regress and decrease
- Wound tensile strength increases



- Infection
- Hemorrhage
- Compartment Syndrome
- Crush Syndrome
- Other Complications

- Most common complication of open wounds
  - 1:15 wounds seen in ED result in infection
  - Most serious complication after hemorrhage
- Usually caused by Staphylococcus or Streptococcus bacterial families
- Consequences
  - Delayed healing
  - Spread to adjacent tissues
  - Occasionally widespread systemic infection (sepsis)



- Pus:
  - WBC's, cellular debris, & dead bacteria
- Lymphangitis:
  - Visible red streaks due to inflammation of lymph channels
- Fever & Malaise
  - Especially if the infection has become systemic



- Host's health and pre-existing illnesses
- Medications (NSAID's)
- Wound type and location
- Associated contamination
- Treatment provided

- Antibiotics & keep wound clean
  - Occasionally a minor incision and wound drainage
- Gangrene
  - Deep space infection of anaerobic bacteria (Clostridium perfringens)
  - Bacterial gas and odour
  - May lead to death
- Tetanus
  - Caused by bacterium Clostridium tetani
  - Toxins create widespread, painful muscle contractions
  - Lockjaw

- Impaired Hemostasis
  - Medications
  - Anticoagulants
- Re-Bleeding
  - Caused by movement of underlying structures
  - Partially healed wounds also at risk
- Delayed Healing
  - Result of poor peripheral blood flow
  - Diabetics, elderly, chronically ill and malnourished

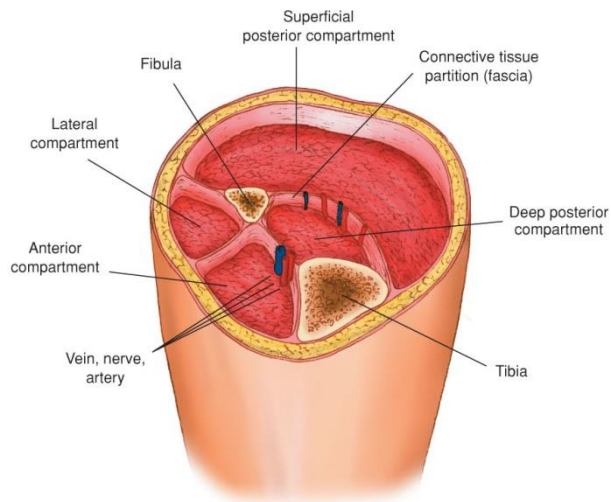
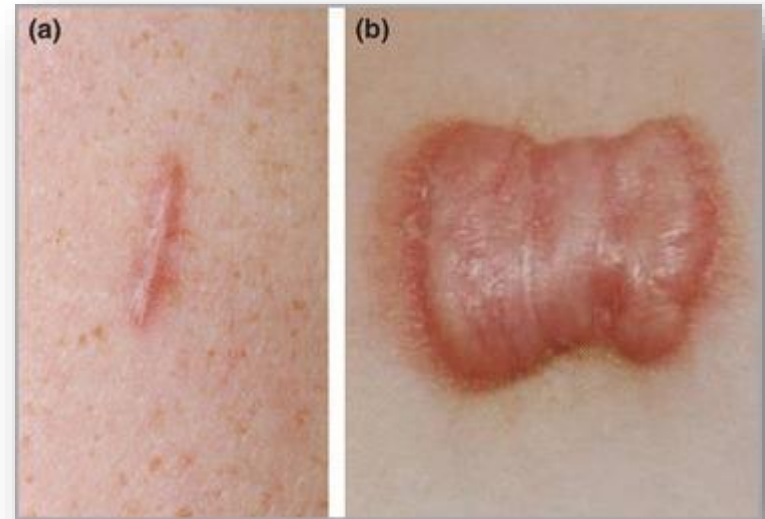


FIGURE 20-14 Musculoskeletal compartments segregated by fascia.

- Compartment Syndrome
  - Extremity injury causes significant edema and swelling in deep tissues
  - Swollen tissue is encapsulated within tough inflexible fascia
  - Blood flow compromised and ischemia ensues
  - Muscle mass may die and use of extremity lost
  - Lower extremities especially at risk

- Abnormal Scar Formation
  - Hypertrophic scar
  - Keloid scar
- Pressure Injuries
  - Similar to crush injury
  - May occur if patient is left on fracture board for too long



- Includes crush injury and crush syndrome
  - Crush injury
    - Deep injury to muscles, blood vessels and bones
    - Damage can be massive despite minimal signs on the skin
  - Crush syndrome
    - Refers to systemic effects
    - Accumulation and release of myoglobin, potassium, acids. etc



- Body tissues are subjected to severe compressive forces
  - Disrupts body's tissues
  - Skin may remain intact
  - Excellent growth medium for bacteria
- Hemorrhage may be difficult to control
  - Source of bleeding hard to identify
  - Large vessels may be damaged
  - Condition of limb may not support direct pressure



- Tamponading of distal tissue creates tissue hypoxia and acidosis
  - Muscle rigor
  - Buildup of byproducts of metabolism
  - “Wood-like” distal tissue
- Associated Injury
  - Related to mechanism
  - Fractures, open and closed injuries, etc

- Occurs when body is entrapped for >4 hours
  - Crushed muscle tissue becomes necrotic
- Traumatic Rhabdomyolysis
  - Skeletal muscle degradation
  - Release of toxins from break down of cells and anaerobic metabolism
    - Myoglobin
    - Phosphate
    - Potassium
    - Lactic Acid
    - Uric Acid



- When tissue is released, toxins move rapidly into systemic circulation
  - Impacts Cardiac Function
  - Impacts Kidney Function

- Often the result of prolonged entrapment
  - Anticipate problems
  - Can be identified before extrication takes place
- Scene safety
- Longer the entrapment , the greater the risk
- Once body freed, rush of metabolic wastes into circulation

- Fluid resuscitation
- Sodium bicarbonate
  - Combat systemic acidosis
- Calcium chloride
  - Counteract hyperkalemia
- Diuretics
  - Mannitol
  - Lasix

# Compartment Syndrome

- Extremity injury causes significant edema and swelling in deep tissues
- Swollen tissue is encapsulated within tough inflexible fascia
- Blood flow compromised and ischemia ensues
- Muscle mass may die and use of extremity lost
- Lower extremities especially at risk

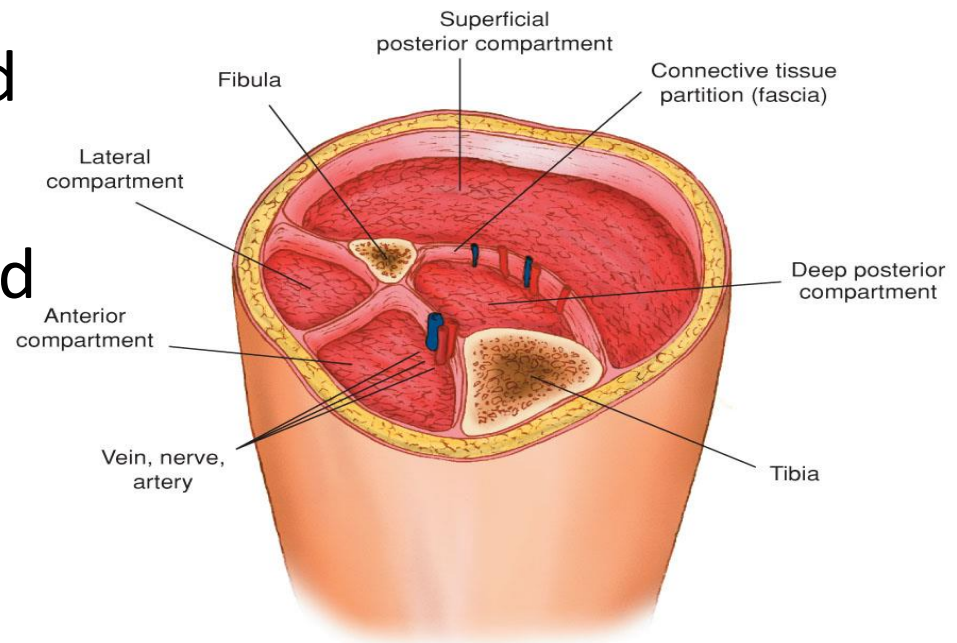


FIGURE 20-14 Musculoskeletal compartments segregated by fascia.

- Feelings of tension within limb
- Loss of distal sensation
  - Especially in webs of fingers and toes
- Complaints of pain
- Condition more severe than mechanism of injury would indicate
- Pain on passive extension of extremity
- Pulse deficit (late sign)

# Compartment Syndrome





- Care of underlying injury
- Splint and immobilize all suspected fractures
- Cold packs to severe contusions
  - Most effective prehospital management
  - Reduces edema
  - Prevents ischemia

- Commonly known as flesh-eating disease or flesh-eating bacteria syndrome
- Rare infection of the deeper layers of skin and subcutaneous tissues, easily spreading across the fascial plane within the subcutaneous tissue.



- Quickly progressing, having greater risk of developing in the immunocompromised
- Sudden onset
  - Type I Polymicrobial infection
  - Type II Monomicrobial infection
- Many types of bacteria can cause necrotizing fasciitis



- Scene assessment
  - No mechanism can affect the human body without first going through the skin
- Primary assessment
- Focused history and secondary
  - Significant MOI: rapid trauma survey
  - No significant MOI: focused trauma
- Detailed secondary

**Soft Tissue Injuries are often  
grotesque and distracting**

But Remember

**A B C's first**



**This will not kill your patient**



**This will**



- Inquiry
- Inspection
  - Observed in such a way that it can be described to physician later
- Palpation
- Ongoing assessment

- Dressings
- Bandages
- Splints
- Ice Packs
- Tourniquets



- Material placed directly on wound to control bleeding and maintain cleanliness
  - Sterile/non-sterile dressings
  - Occlusive/non-occlusive
  - Adherent/non-adherent
  - Wet/dry
  - Hemostatic

# Sterile Dressings



# Abdominal Pad





# Non Sterile Dressings



# Occlusive Dressings



0398, 0312, 0304  
**ELONGATED 360-THRU™ PEDIATRIC  
NON-REBREATHING OXYGEN MASK  
WITH SAFETY VENT**  
Model 10100

**Directions for Use**  
NOTE: These dressings are primarily designed to be used by qualified medical personnel.  
Apply the dressing firmly, taking care to ensure the mask is fully seated on the patient's face. The oxygen mask should be placed over the patient's nose and mouth. The mask should be secured to the patient's face by the adhesive on the sides. The mask should be secured to the patient's face by the adhesive on the sides. The mask should be secured to the patient's face by the adhesive on the sides. The mask should be secured to the patient's face by the adhesive on the sides.

**CAUTION:** Federal law (USA) restricts this device to sale by or on the order of a physician.  
**HUDSON**  
Medical Products







- Material used to hold a dressing in place and to apply direct pressure
  - Roller
  - Gauze
  - Adhesive
  - Elastic
  - Triangular







# Triangular











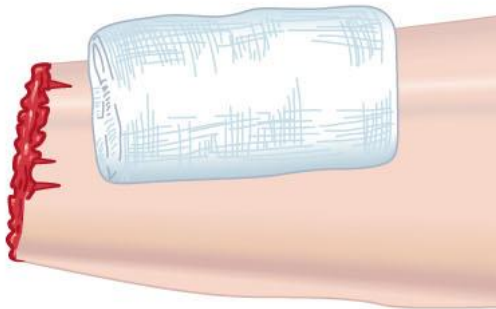
- Late priority in care unless there is significant bleeding
- Objectives of bandaging
  - Control hemorrhage
  - Keep wound clean
  - Immobilize the wound site

- Direct Pressure
  - Firm pressure for at least ten minutes
- Elevation
- Pressure Points
- Consider
  - Ice
  - Constricting Band
  - Tourniquet
- Consider a combination of techniques if bleeding is resistant
- TXA
- Immobilization

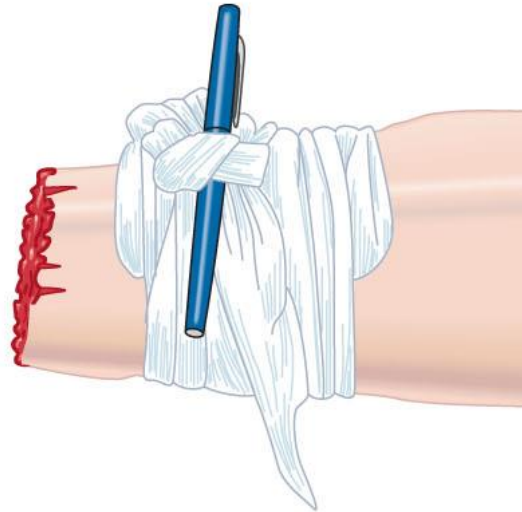
- Last option
- If pressure is insufficient
  - May halt venous return but not arterial flow
  - Increasing rate of blood loss
- Proper application
  - Entire limb distal becomes hypoxic, ischemic and potentially necrotic
- When circulation restored
  - Return of cellular waste products may cause profound systemic complications

# Tourniquet Application

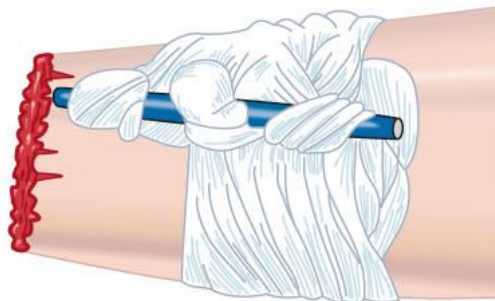
a. Place a bulky dressing over the distal artery.



b. Apply a pressure exceeding the systolic pressure.



c. Secure the tourniquet, and monitor the wound site for continuing hemorrhage.



**FIGURE 20-20** The steps of tourniquet application.

- Keep the wound as sterile as possible
  - Field conditions may necessitate keeping wound as clean as possible
- If wound is grossly contaminated consider cleansing
  - Irrigate with IV fluids

- Adhesive
  - Butter fly closures
  - Steri-Strips
  - Cyanoacrylate (Skin glue)
- Sutures
- Staples









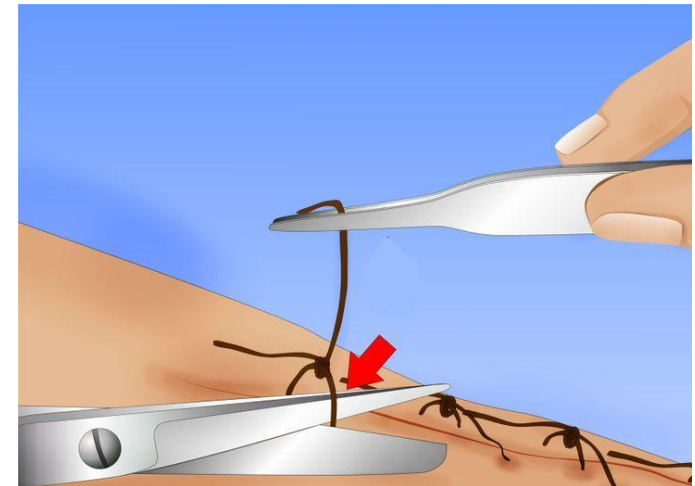
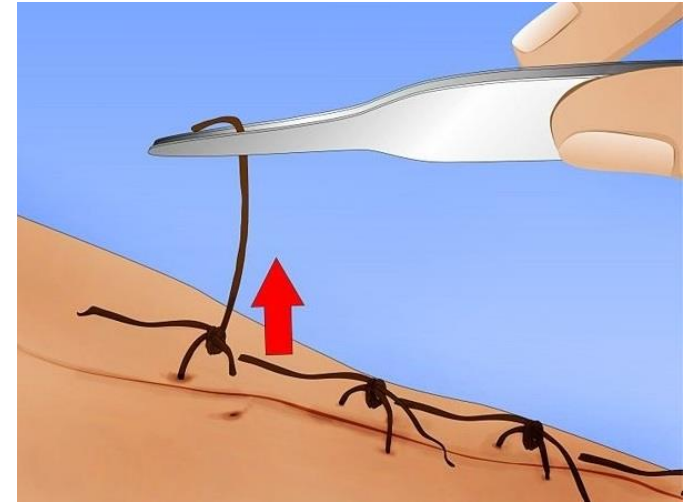
- The aim to bring together the edges of a wound to facilitate healing





- When To Remove Stitches:
  - 5 days for face
  - 7 days for scalp
  - 7 - 10 days for other sites
- Assemble supplies:
  - Toothed forceps
  - Povidone–iodine swabs
  - Gauze pads
  - Small pointed scissors  
OR stitch cutter OR  
scalpel

- Remove stitches:
  - Swab area with povidone-iodine.
  - Use forceps to grasp one end of stitch and lift off skin.
  - Insert cutter under suture and cut away from skin or snip with scissors.
  - Use forceps to pull thread out gently.



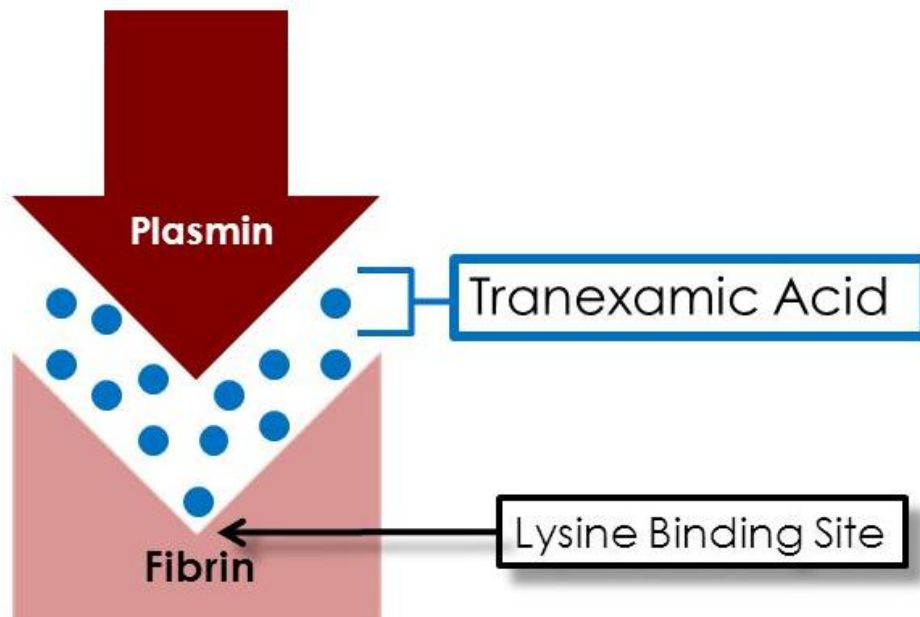
- Alternative to stitching with needle and thread.



- AKA Vacuum Assisted Closure
- Promotes healing through negative pressure
  - Increased blood flow
  - Enhanced granulation tissue formation
  - Reduction in bacterial colonization
- Indications
  - Burn patients
  - Chronic wounds
  - Slow healers



- Class: Anti-fibrinolytic
- MOA: A synthetic derivative of lysine that inhibits fibrinolysis by blocking the lysine binding sites on plasminogen





- Indications:
  - Hemorrhagic shock not responding to IV fluids
  - Trauma with all of the following:
    - < 3 hours since time of injury
    - Systolic BP < 90 mmHg OR HR > 110
    - Suspicion of hemorrhagic blood loss



- Contraindications:
  - < 16 y/o
  - Hypersensitivity
  - Active thrombotic disease (PE, DVT, CVA)
  - Unable to initiate bolus within 3 hrs of injury
- Dose:
  - Adult
    - 1 g in 100 ml NS over 10 minutes
      - ED will add 1 g in 500 ml over 8 hrs



- Frequently overlooked
- Prevents movement and aggravation of wound
- Avoid elastic bandages
  - Tourniquet effect
- Monitor distal pulse, motor, and sensation

- Cold packs
  - Reduces inflammation and local edema
- Moderate pressure over wound
- Consider analgesic if approved by medical control

- Scalp
  - Rich supply of blood vessels
  - Rarely account for shock
  - Can be severe and difficult to control
  - With skull fracture
    - Gentle digital pressure around the wound
    - Pressure on local arteries
  - Without skull fracture
    - Direct pressure

- Face
  - Often involve heavy bleeding
  - Aware of potential airway complications
  - Blood is a gastric irritant
    - Be alert for nausea and vomiting
- Ear or Mastoid
  - Easily bandaged
  - Cover and collect bleeding
  - Fluid may contain ICF
  - Halting flow may increase ICP

- Neck
  - Be aware of airway complications caused by bandages
  - Sever wounds may require direct pressure to hospital
  - Consider c-collar and dressing
  - Occlusive dressing if lacerated vessel
- Shoulder
  - Care to avoid pressure on anterior neck and trachea

- Trunk
  - Minor wounds may only require dressing
  - Major wounds may require circumferential wrap
  - May risk worsening injury unnecessarily
- Groin & Hip
  - Bandage by following contours of body
  - Movement can increase tightness of bandage



- Elbow and Knee
  - Circumferential wrap and splint
  - Splinting reduces movement
  - Position of function/half flexion half extension
- Hand and Finger
  - Bulky dressing
  - Position of function
- Ankle and Foot
  - Circumferential bandage

- Developing ischemia
  - Pain
  - Pallor
  - Paraesthesia (tingling)
  - Pulselessness
  - Decreased capillary refill
- Assess
  - Distal pulse, sensation and mobility
  - Pressure beneath dressing
  - Match dressing size appropriate to injury

- Potential for airway obstruction or compromise
  - Blood and tissue debris in airway
  - Pooled secretions and tissue edema
- Aggressive suctioning and oxygenation
- Consider intubation
- If anatomical distortions prevent intubation
  - Needle or surgical cricothyroidotomy

- Superficial injury can be deep
  - Always suspect the worst due to underlying organs
- Alert for subtle early presentations of
  - Subcutaneous emphysema
  - Pneumothorax or hemothorax
  - Tension pneumothorax
- Consider
  - Occlusive dressing sealed on 3 sides
  - Needle decompression

- Injuries between the level of the 5th and 9th rib
  - Always suspect injury to ribs or thoracic organs
- Damage to hollow or solid organs from blunt or penetrating trauma
- Signs of symptoms of internal injury may be subtle and slow to progress
  - Supportive treatment unless aggressive care is warranted

- Nerves
- Blood vessels
- Ligaments
- Tendons
- Muscles
- Significantly contaminated
- Impaled object
- Likely cosmetic injury

- Patient & care giver should monitor wound daily for healing progress.
- Inspect the wound for signs & symptoms of infection following acronym S-H-A-R-P
  - **S**welling, edema in tissue around wound.
  - **H**ot, surrounding tissue hot or noticeably warm.
  - **A**che, pain, but slight tenderness is normal.
  - **R**ed, surrounding tissue is red and inflamed.
  - **P**us, or odour is not normal, but slight discharge of clear fluid (plasma) may be normal, scab may form.

- Typically requires online medical control
- Evaluate and dress wound
- Inform the patient about:
  - Preventing infection
  - Follow-up care with a physician
  - Inquire about tetanus and inform of risks
- Document treatment, referral and teaching.