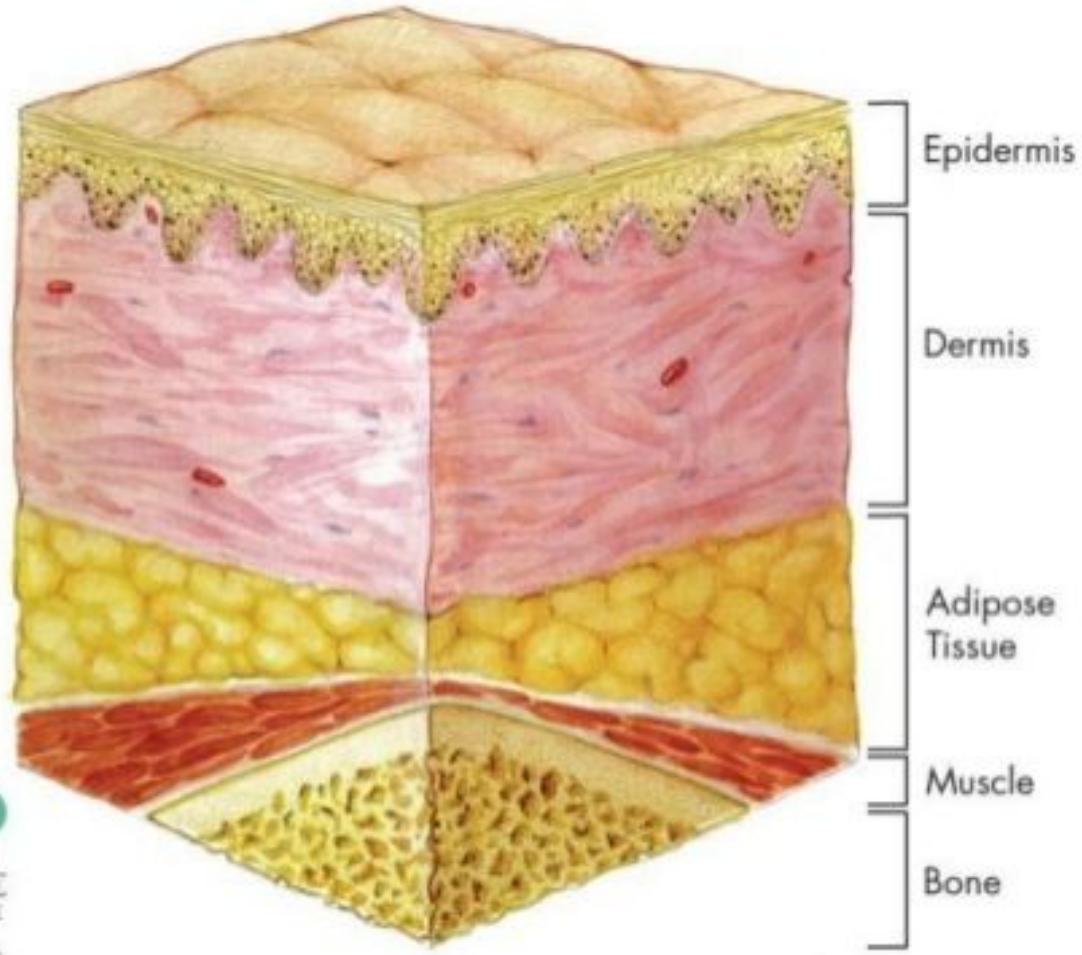
Wounds, wound healing & complications

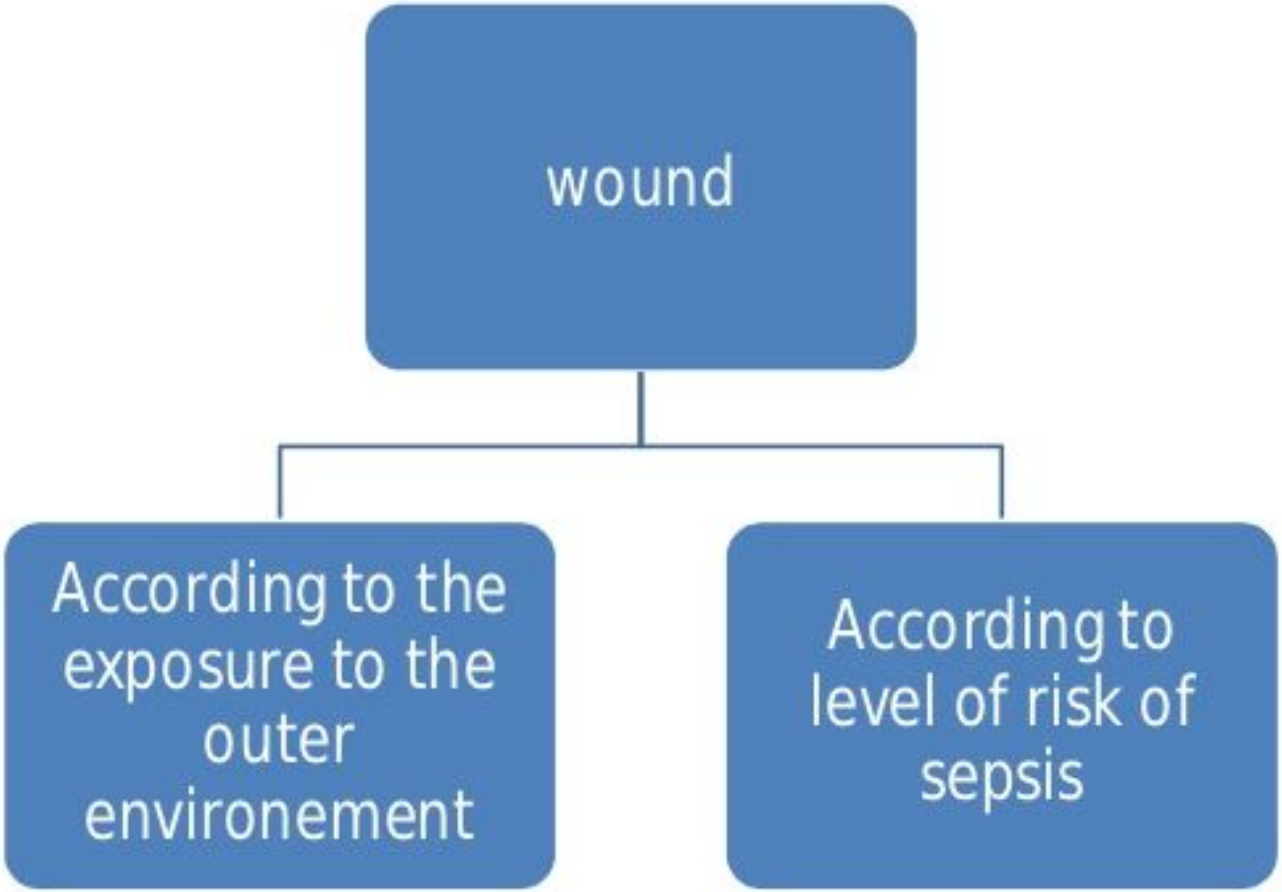
Definition

- Type of injury in which skin is torn, cut or punctured (an open wound), or where blunt force trauma causes a contusion (a closed wound)

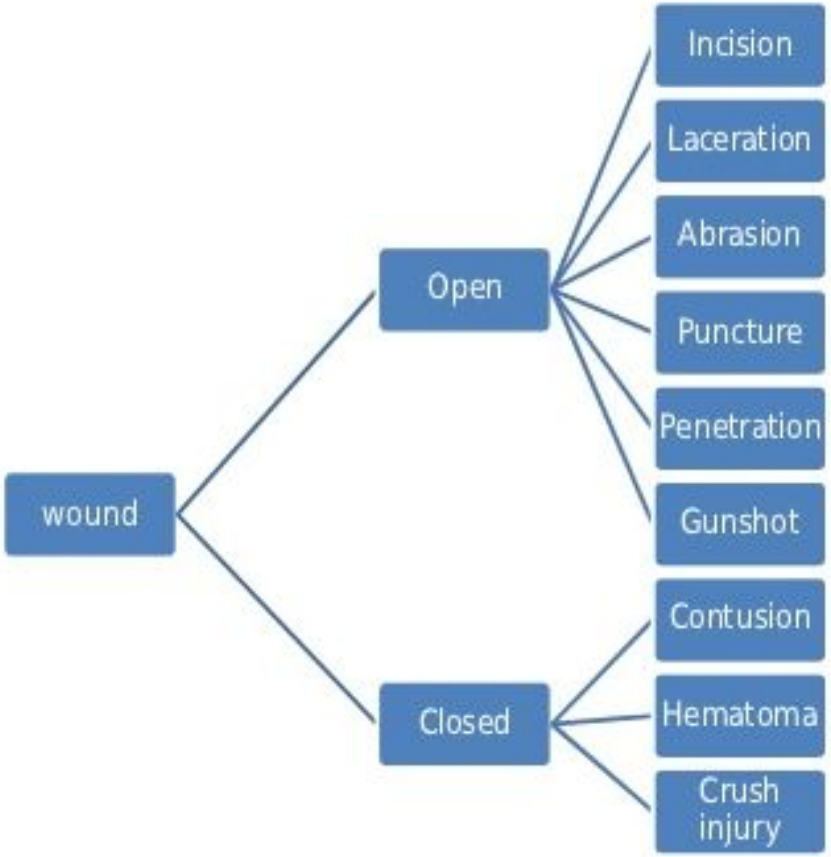
- In pathology: it specifically refers to a sharp injury which damages the dermis of the skin


Epidermis
Dermis
Adipose Tissue
Muscle
Bone
NATIONAL PRESSURE ULCER ADVISORY PANEL

Classifications of wounds



Classification according to the exposure to the outer environment



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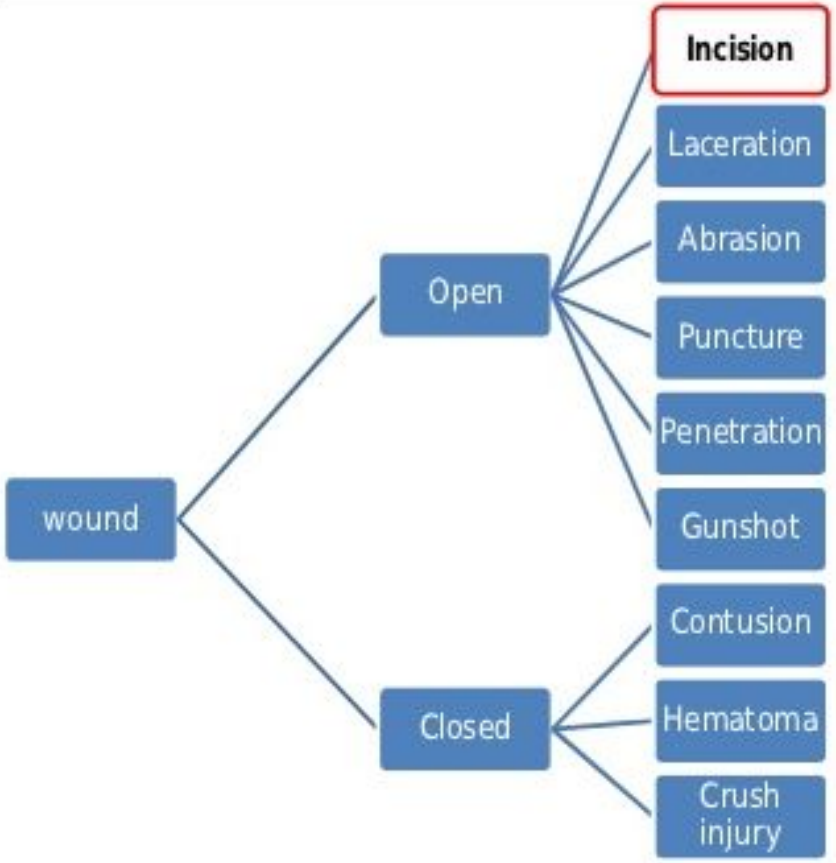

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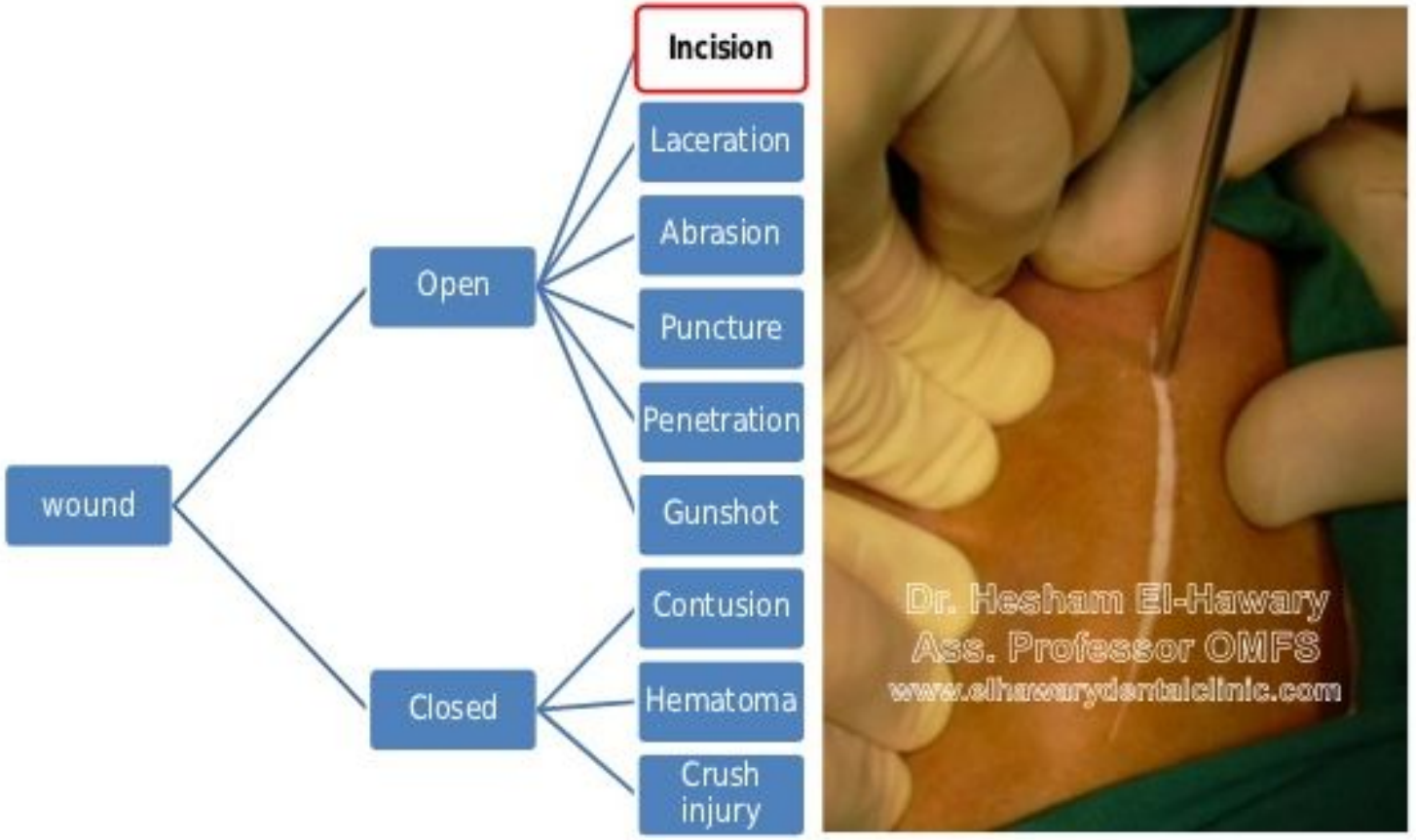

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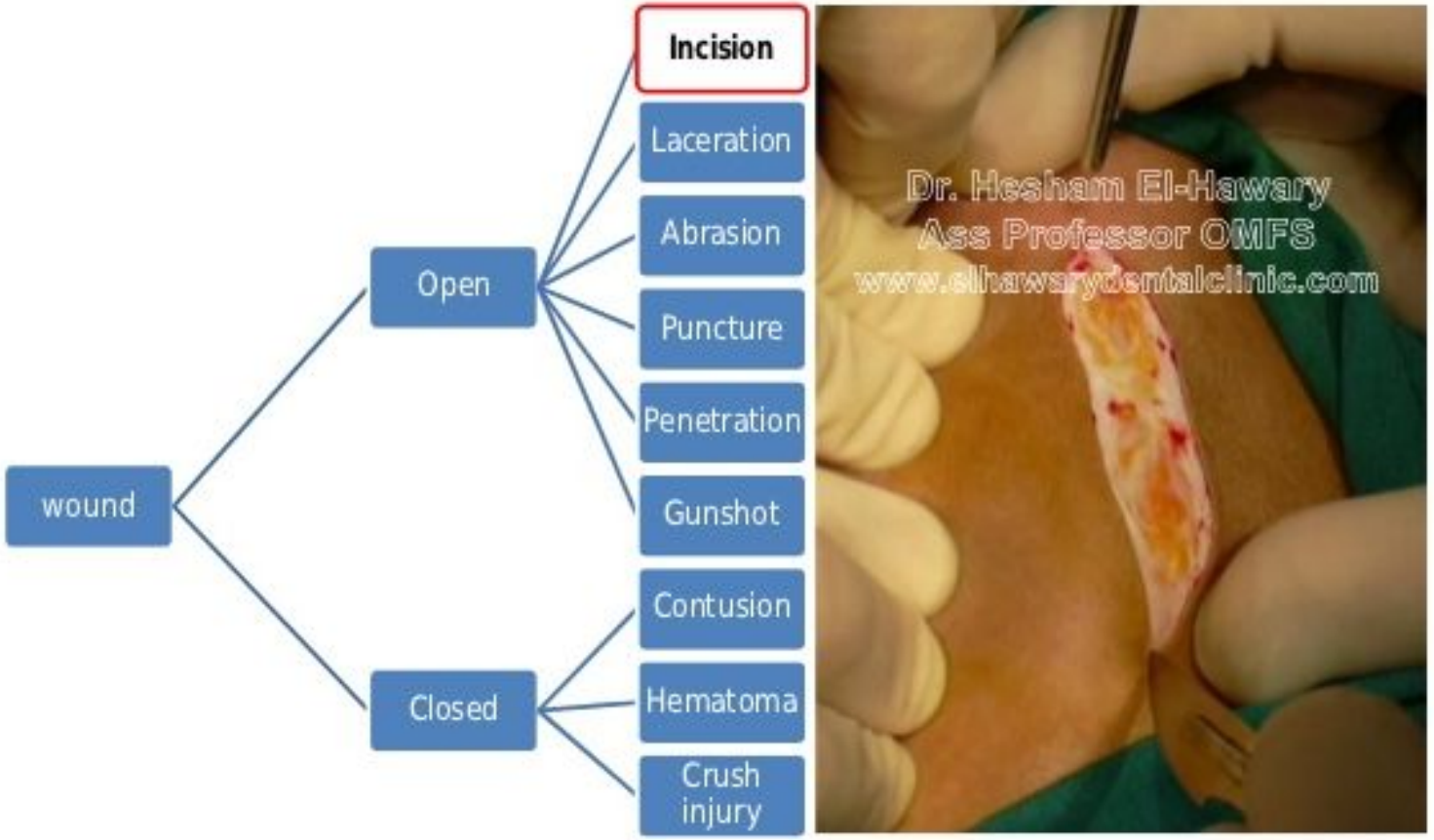

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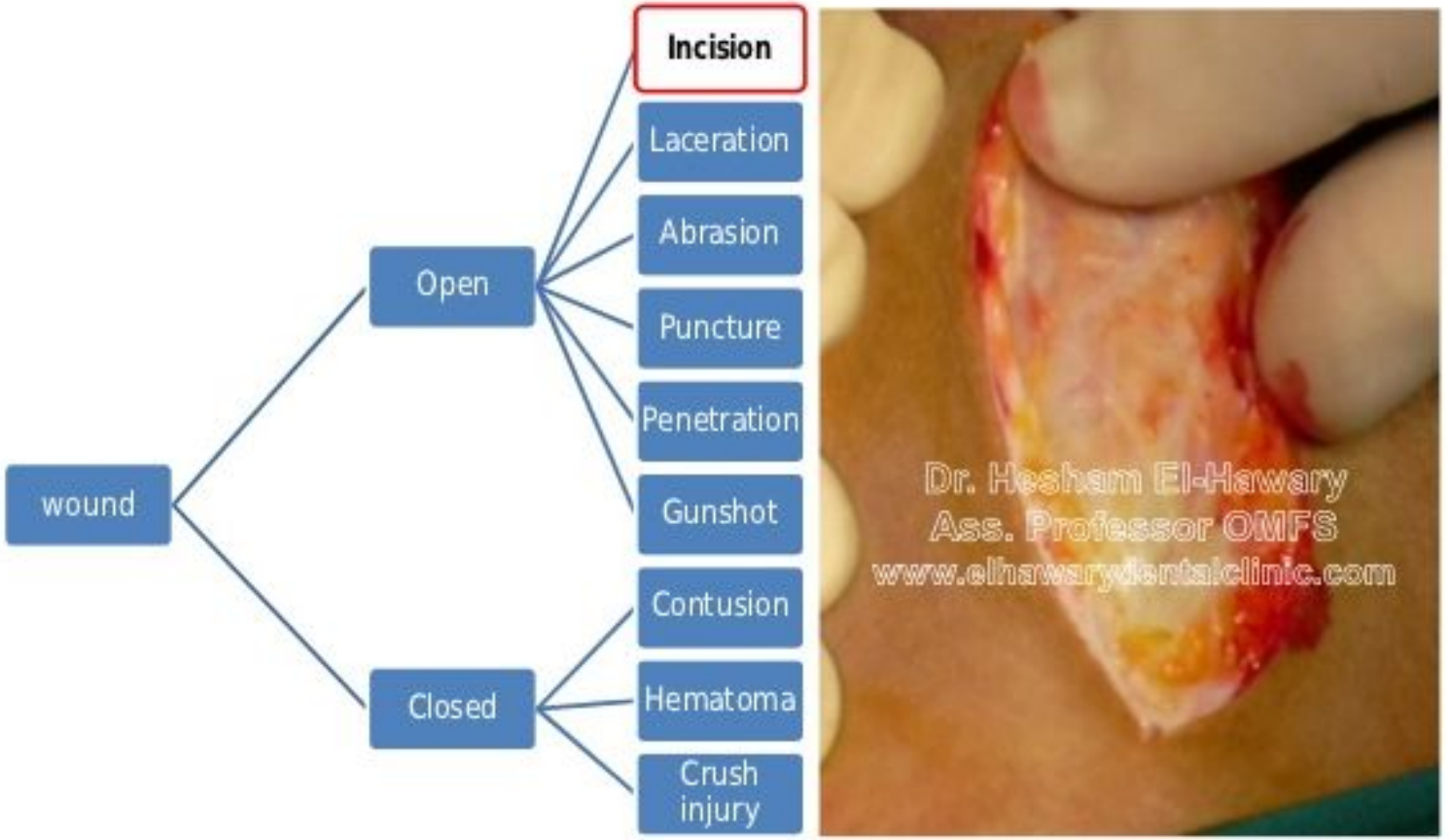
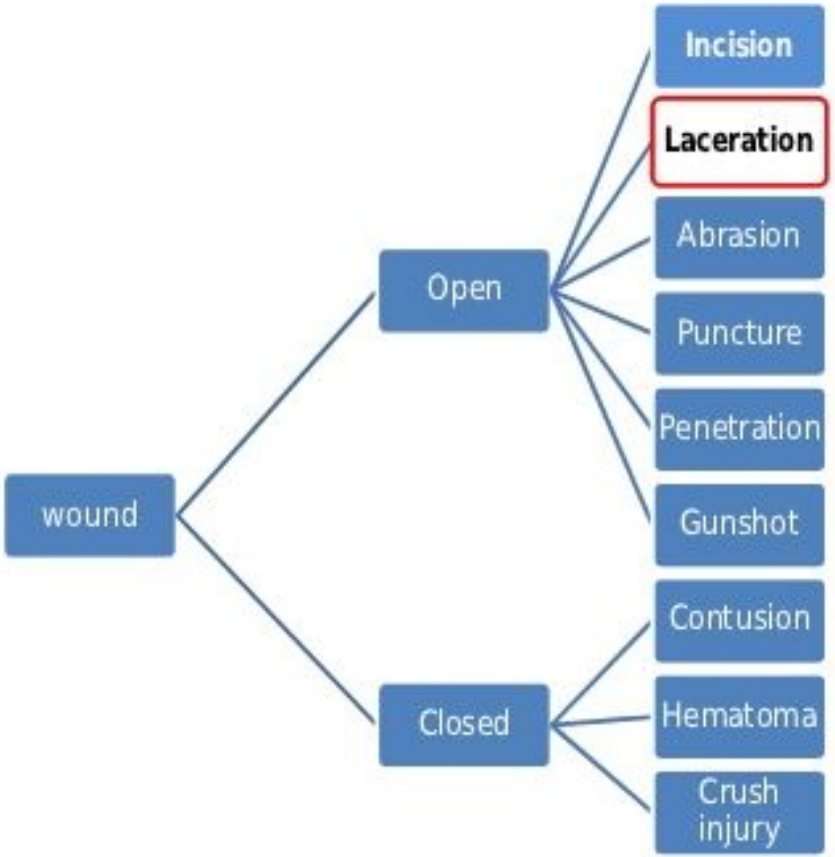


Tidy incised wound on the finger

Classification according to the exposure to the outer environment



Classification according to the exposure to the outer environment

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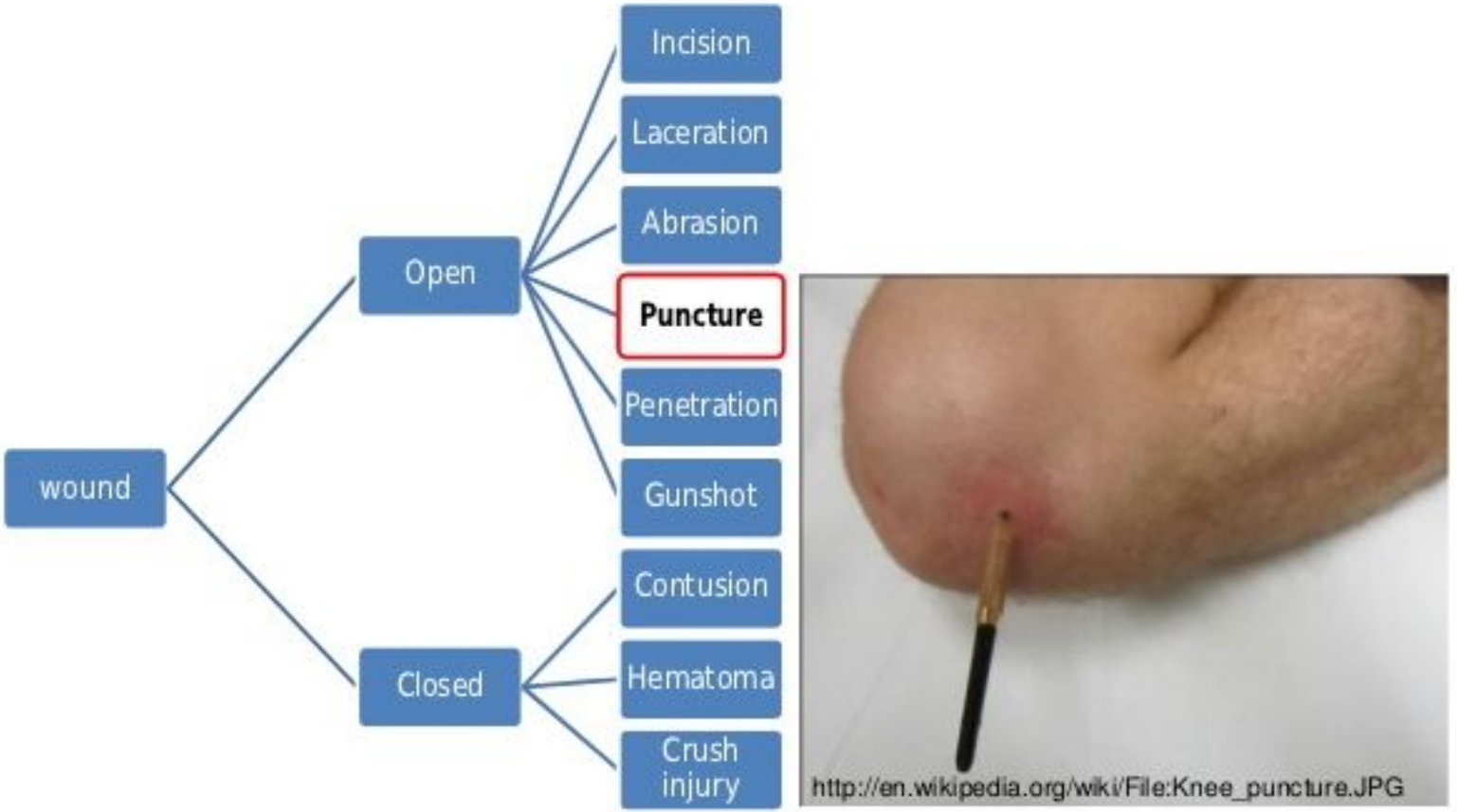

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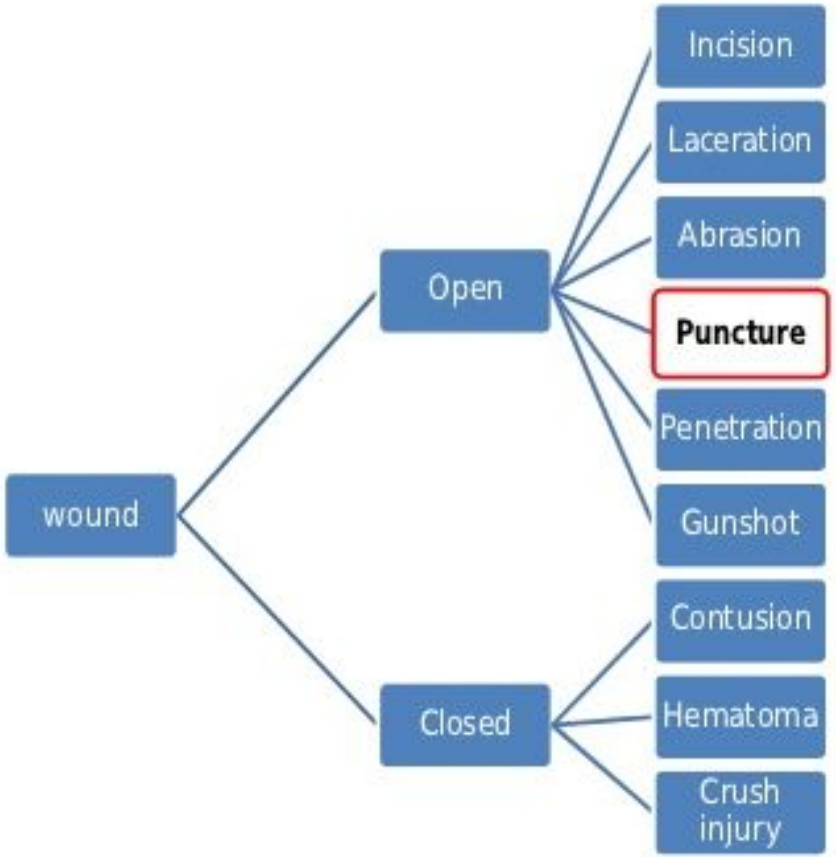

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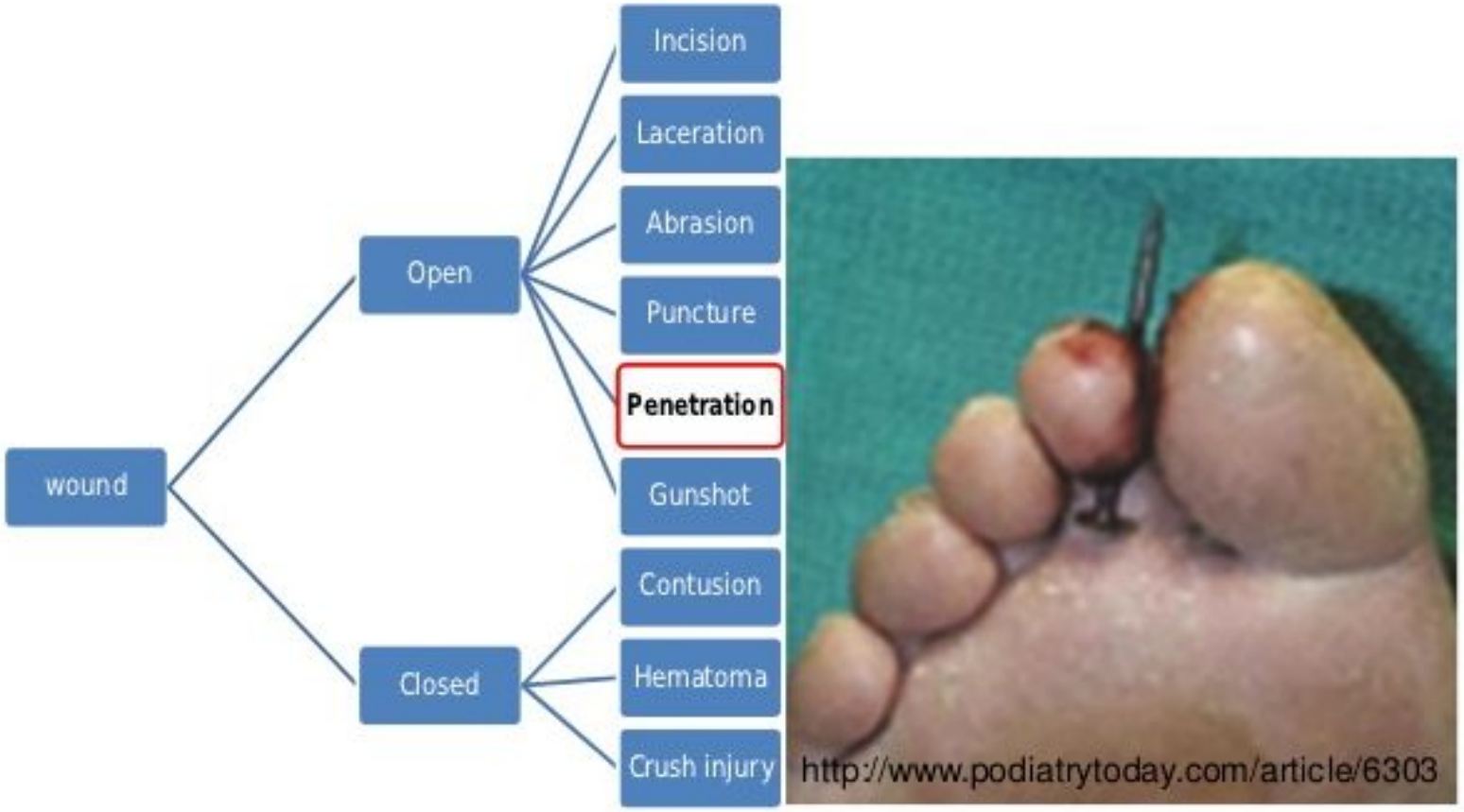

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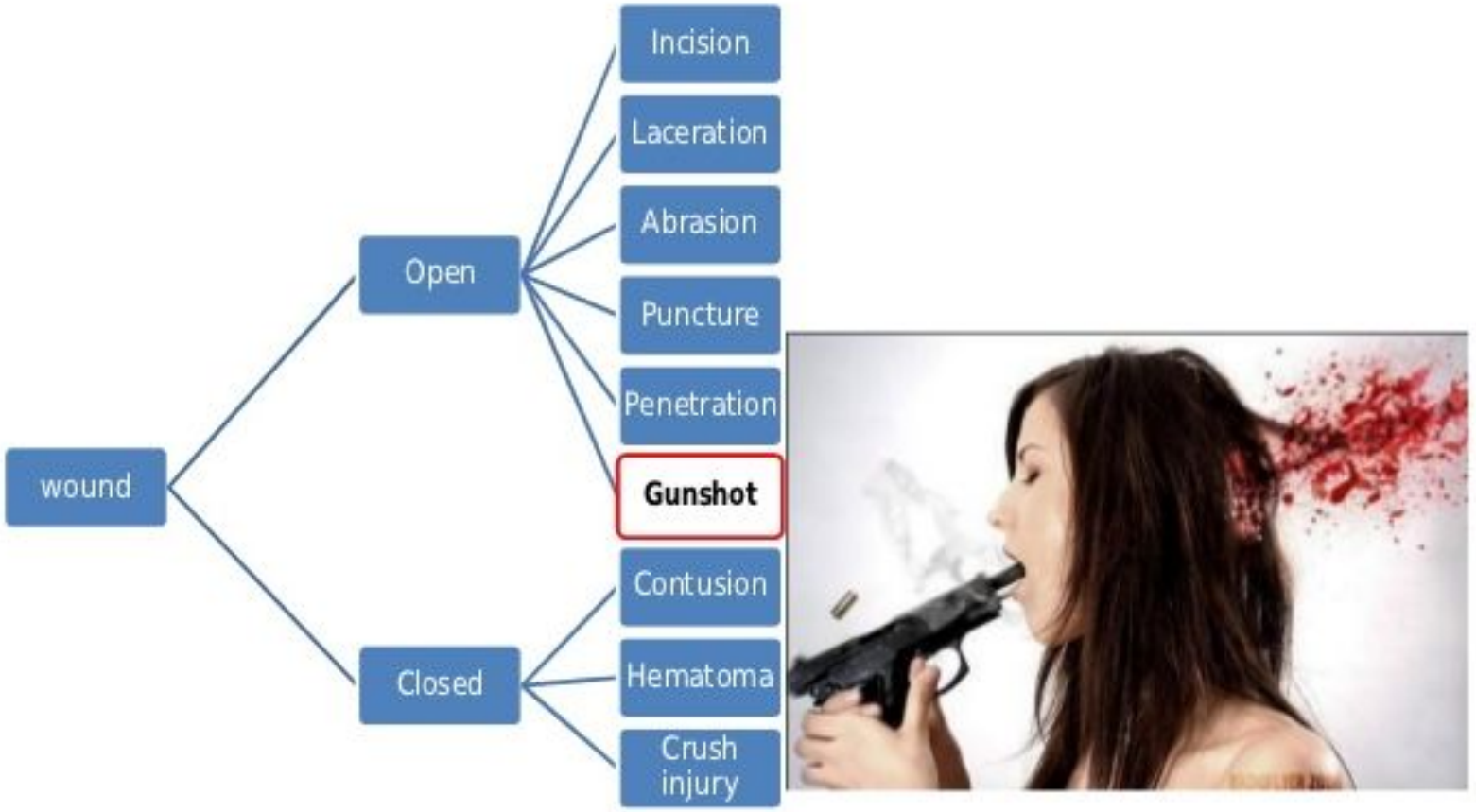
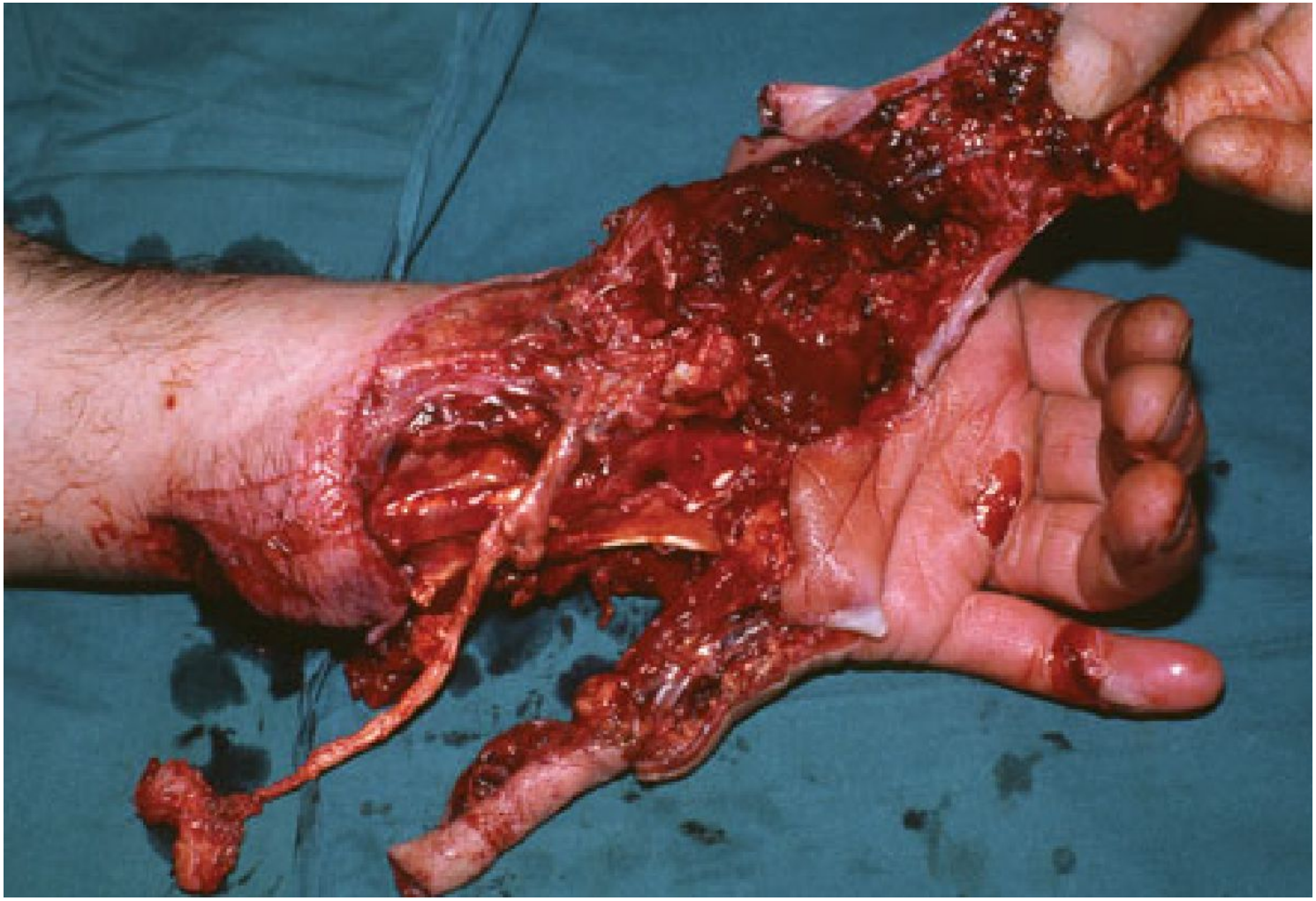
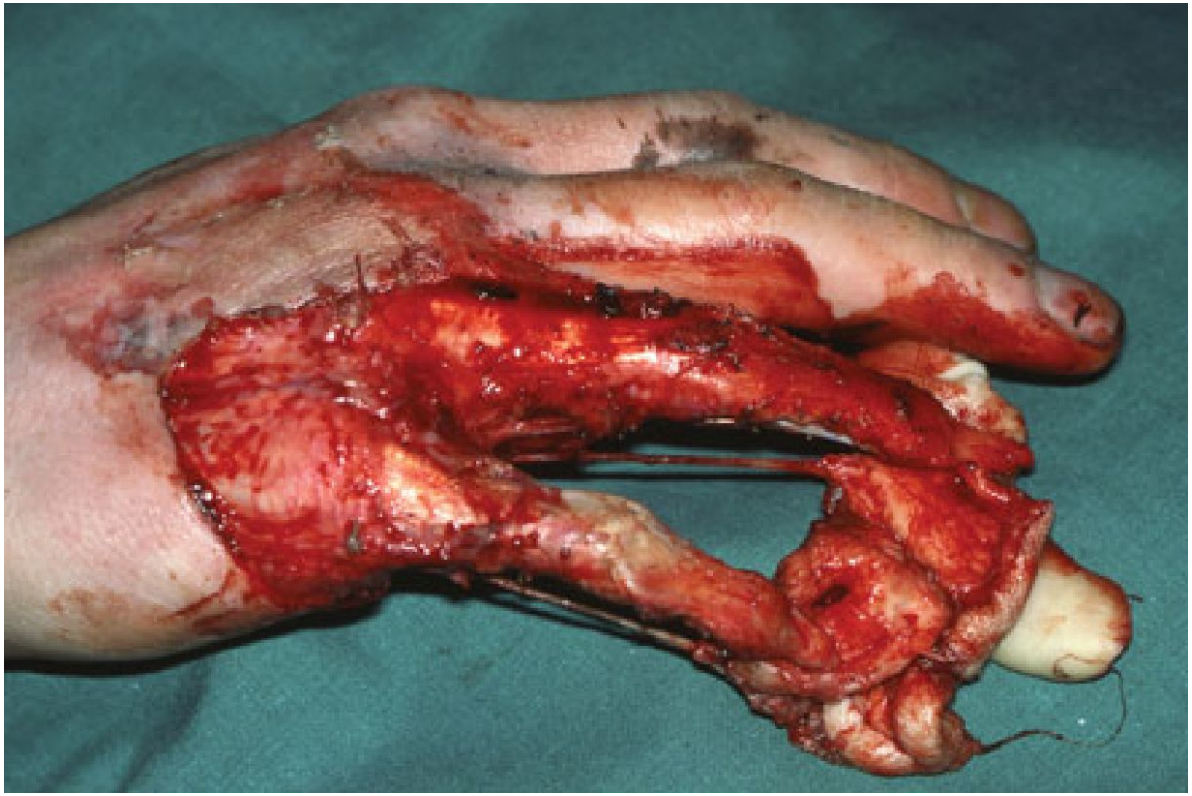


Untidy avulsed wound on the hand



Facial trauma – apparent tissue loss but none found after careful matching

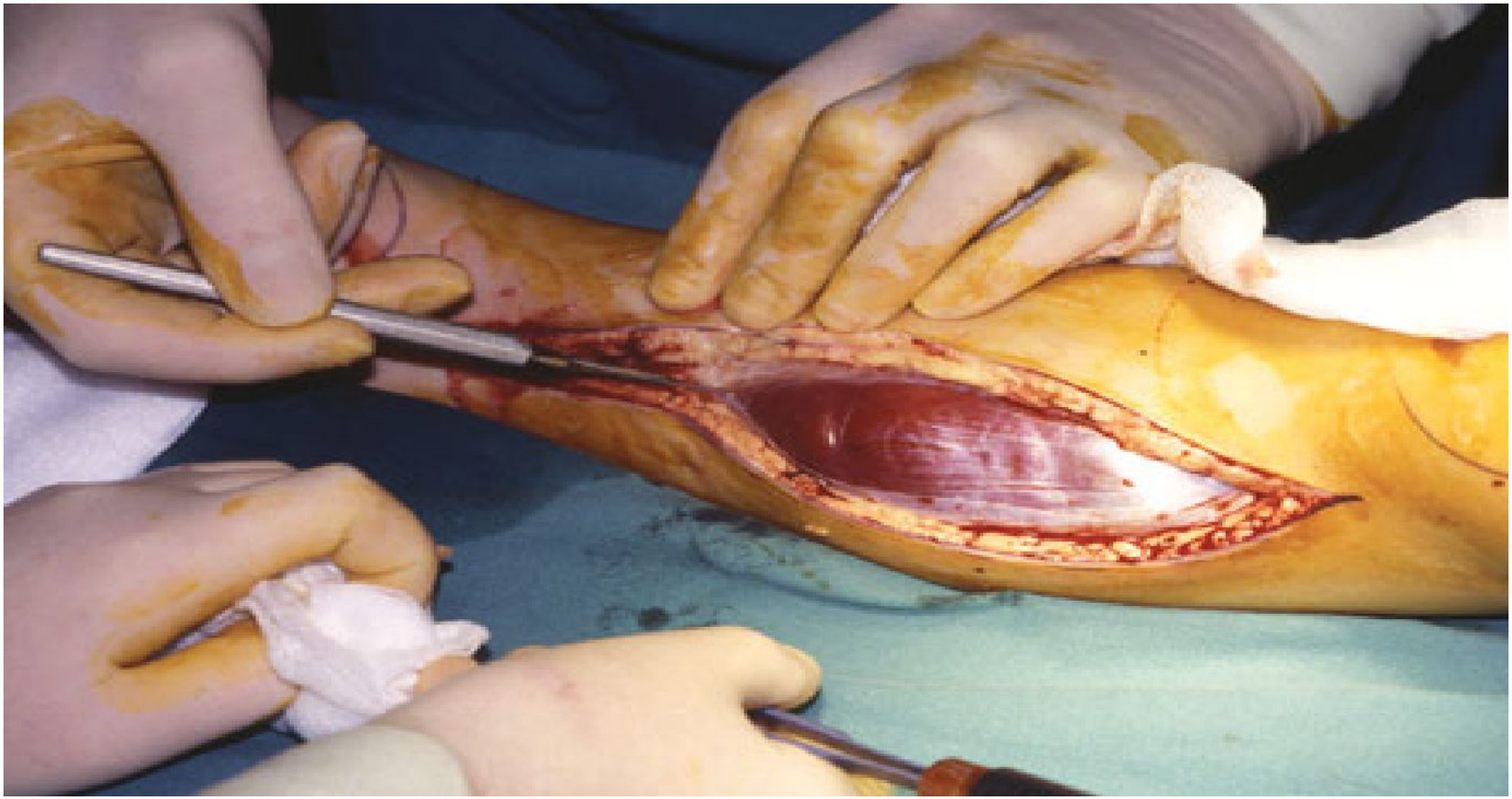
Degloving hand injury



Dog bite in a child

Degloving buttock injury

Fasciotomy of the lower leg



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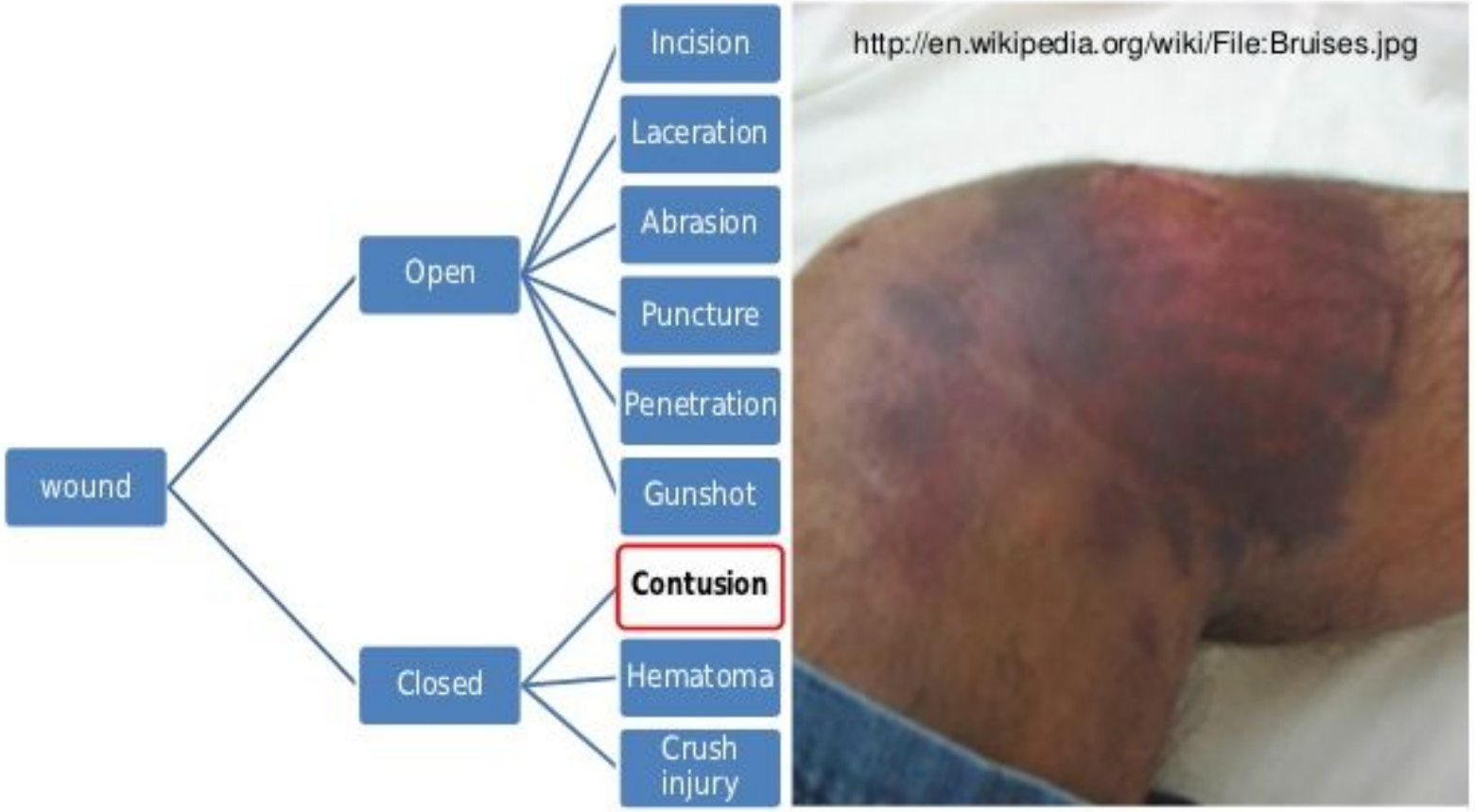

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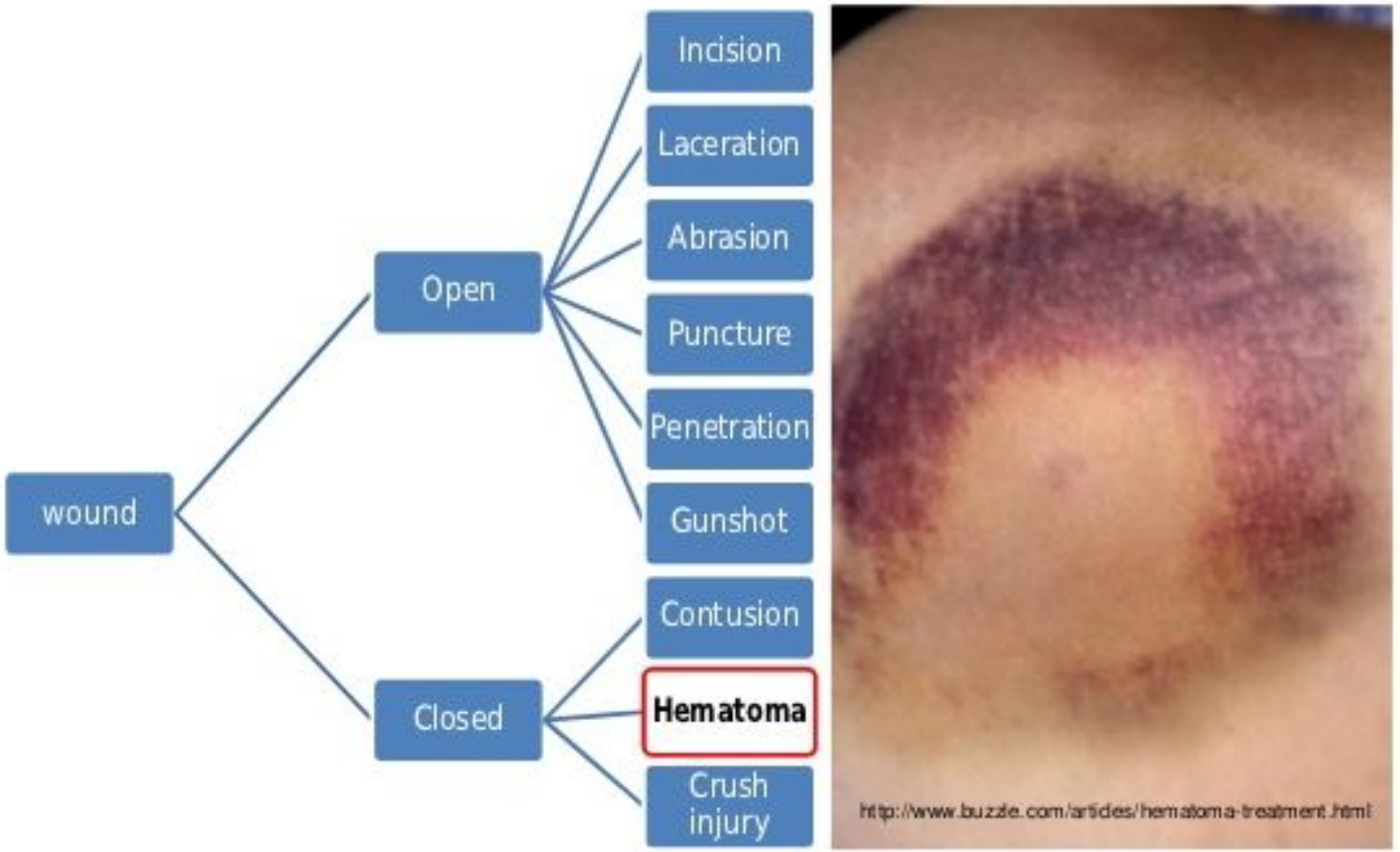

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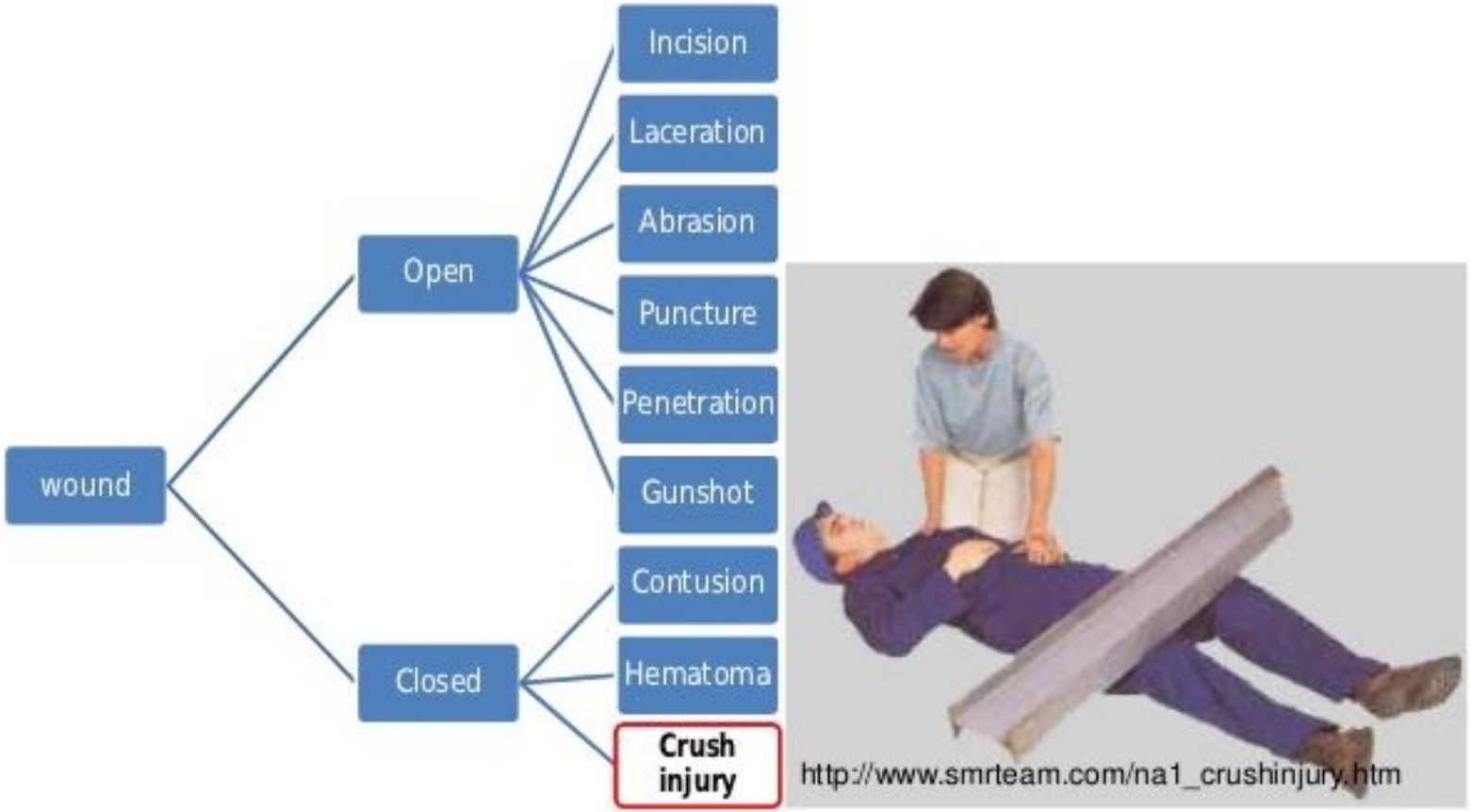

Classification According to level of risk of sepsis

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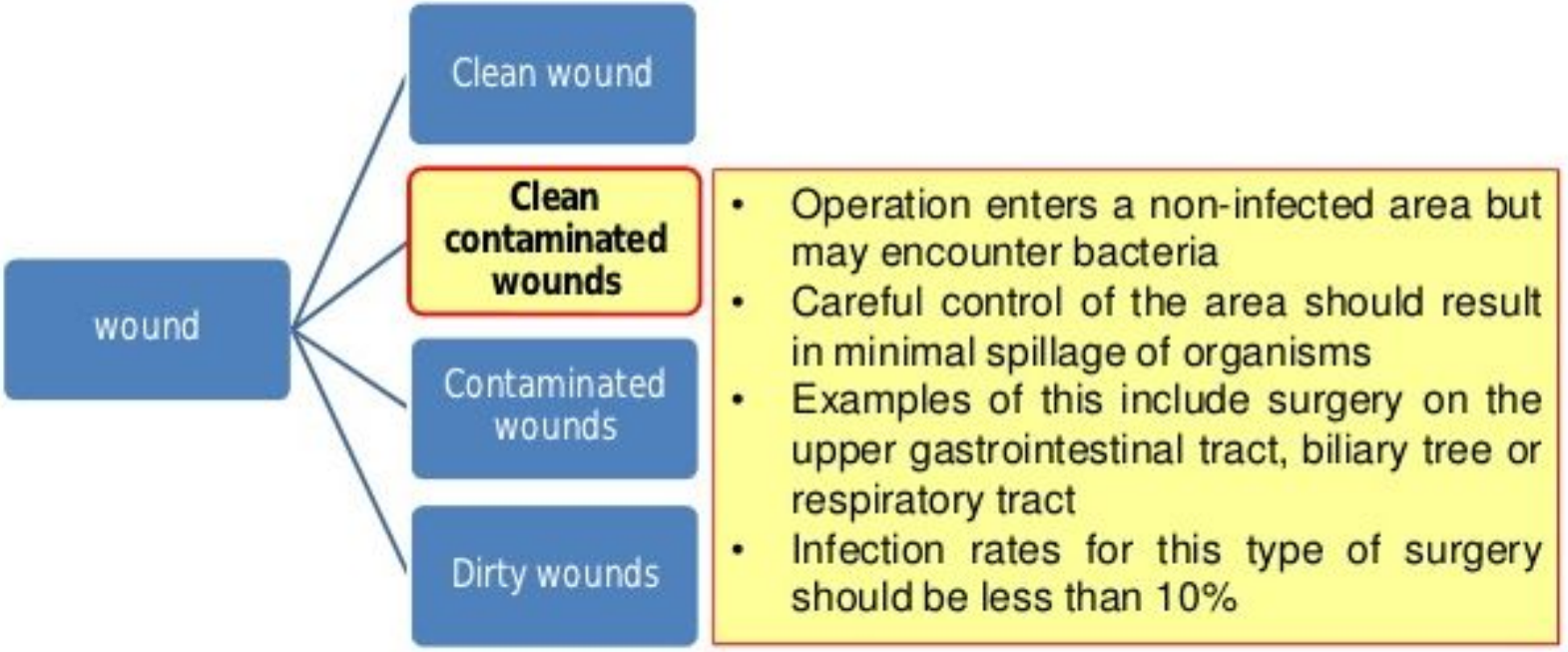


Classification According to level of risk of sepsis

Classification According to level of risk of sepsis

Wound Healing And Suturing

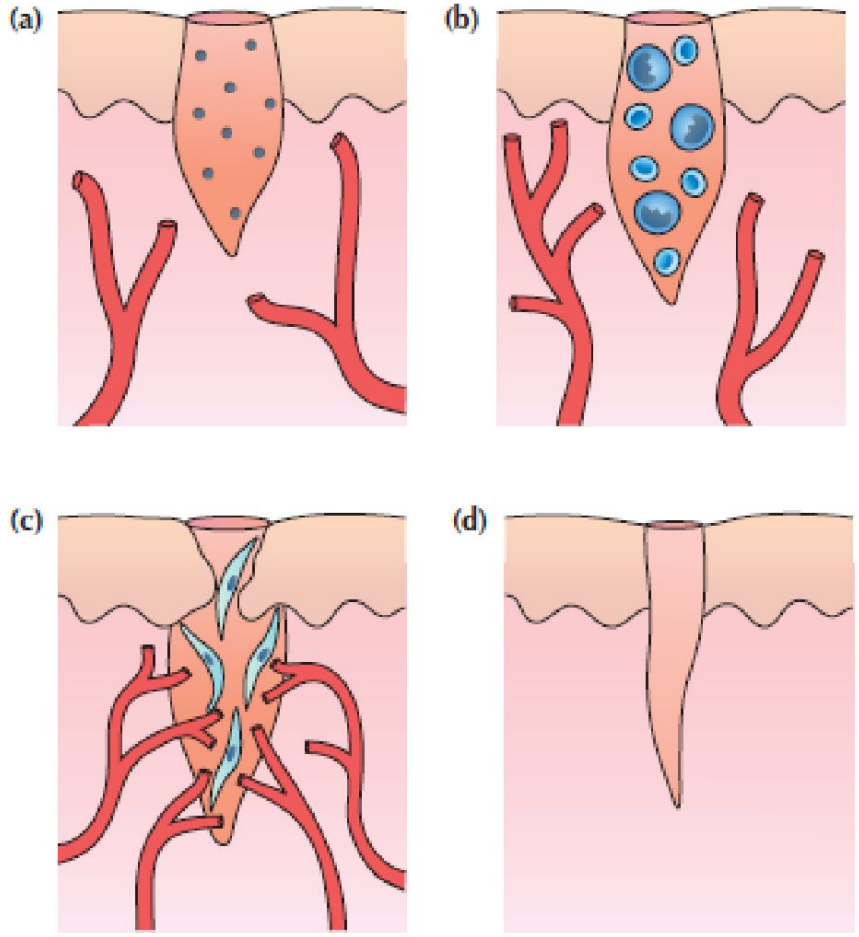
WOUND HEALING

Definition

- The **process** by which the body is trying to achieve **anatomical** integrity of the injured part and to restore full **function**

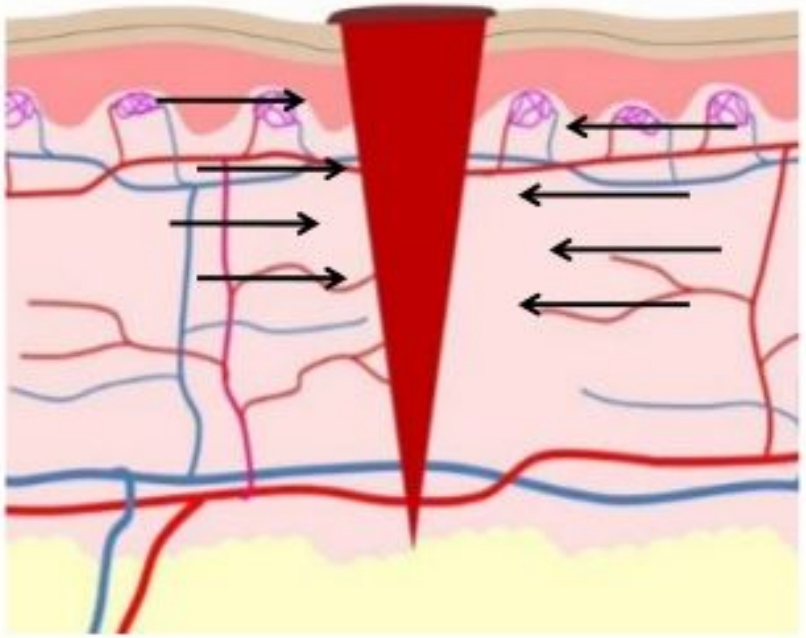
- As a secondary consideration, this should be combined with an attempt to produce as perfect a cosmetic result as possible

(a) Early inflammatory phase with platelet-enriched blood clot and dilated vessels. (b) Late inflammatory phase with increased vascularity and increase in polymorphonuclear lymphocytes (PMN) and lymphocytes (round cells). (c) Proliferative phase with capillary buds and fibroblasts. (d) Mature contracted

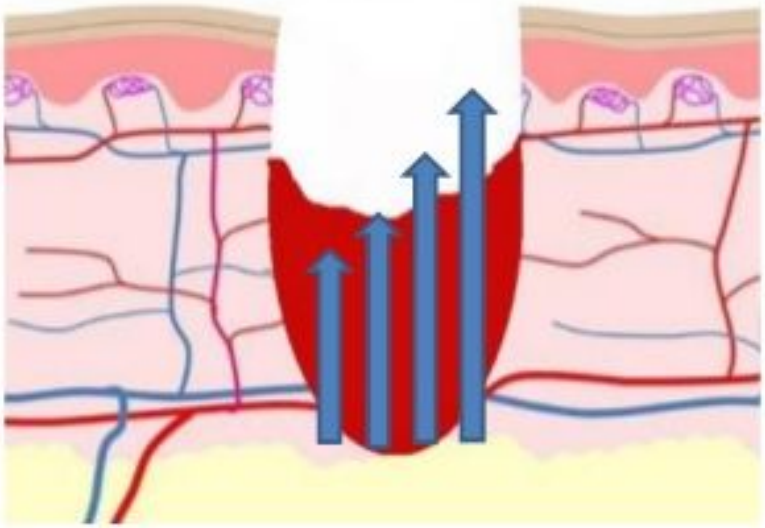


Classification of wound healing

- Primary Intention
- Occurs when:
  - The edges are clean and held together with ligatures
  - There is little gap to bridge Healing
- Healing properties (When uncomplicated)
  - Occurs quickly
  - Rapid ingrowth of wound healing cells (macrophages, fibroblasts, etc.)
  - Restoration of the gap by a small amount of scar tissue.
- soundly united within 2 weeks
- Dense scar tissue is laid down within 1 month



Classification of wound healing



- Secondary Intention
- Occurs when:
  - The edges are separated
  - The gap can not be directly bridged
  - Extensive epithelial loss
  - Severe contamination
  - Significant subepithelial tissue damage
- Healing properties
  - Occurs slowly
  - Granulation; healing from the bottom towards the surface
  - Restoration of the gap by a small amount of scar tissue.
- Scaring
- Wound contracture

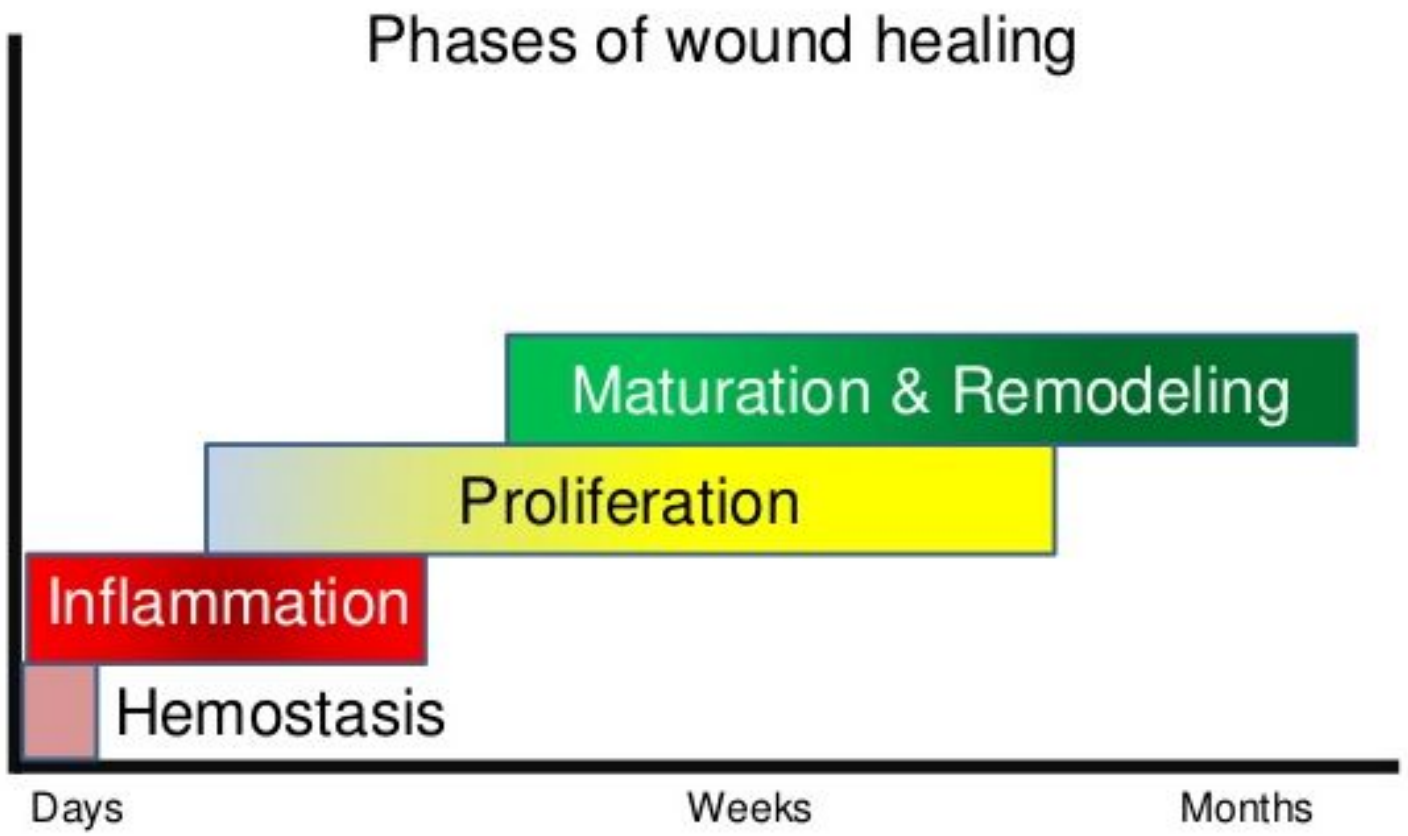
Differences between primary and secondary healing

Feature	Primary healing	Secondary healing
Cleanness	Clean	Unclean
Infection	Generally uninfected	May be infected
Margins	Surgically clean	Irregular
Healing	Scanty granulation tissue	Granulation tissue fill the gap
Healing period	Short	long
Healing direction	Direct healing	From the bottom to the edge
Outcome	Neat linear scar	Contracted irregular wound

Normal sequence of wound healing

Despite the differences in time taken and amount of scar tissue produced, the sequence of events in wound healing by primary and secondary intention is similar

Normal sequence of wound healing



Normal sequence of wound healing

- Inflammatory phase
- Proliferative Phase
- Remodeling Phase

Normal sequence of wound healing

- **Inflammatory phase**
- Proliferative Phase
- Remodeling Phase

Starts 1st day lasts from 3-5 days

- 1st vasoconstriction
- 2nd blood clot formation
- 3rd platelets aggregation
- 4th platelets degranulation
- 5th vasodilatation
- 6th chemotaxis
  - Leucocytes
  - Neutrophils
  - Macrophages

Normal sequence of wound healing

- Inflammatory phase
- **Proliferative Phase**
- Remodeling Phase

Starts 3rd day lasts for 3rd week

- 1st Angiogenesis
- 2nd fibroblasts migration
- 3rd formation of granulation tissue
- 4th reepithelialization

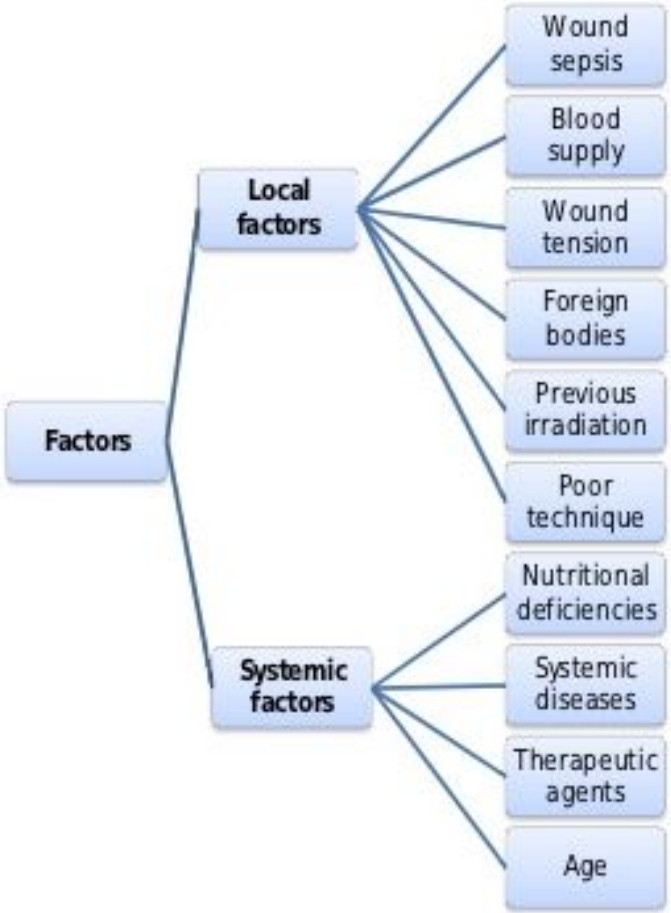
Normal sequence of wound healing

- Inflammatory phase
- Proliferative Phase
- **Remodeling Phase**

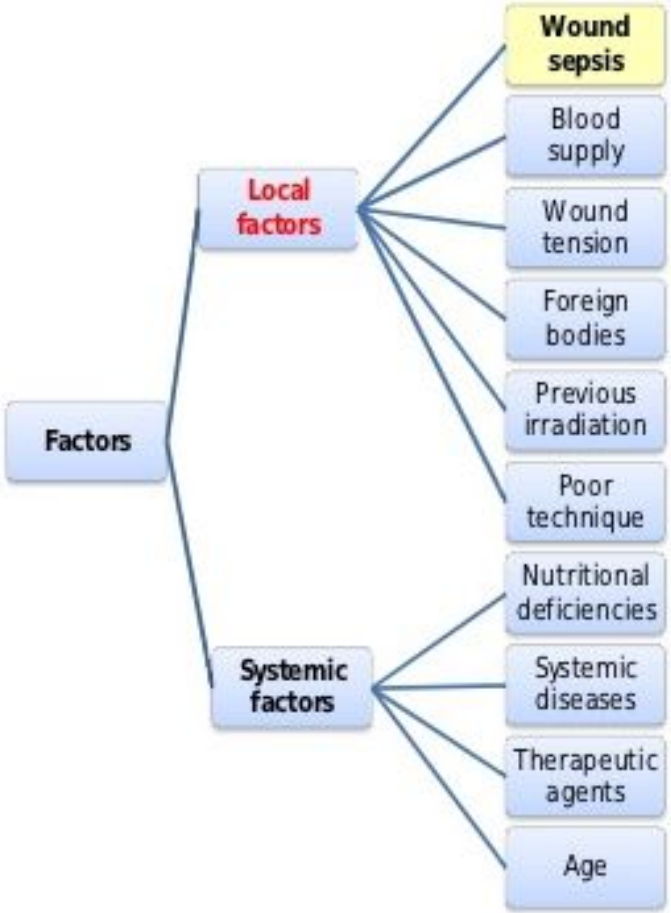
Starts from weeks to years

- The fibroblasts start to disappear
- Collagen type III is gradually replaced by stronger type I collagen
- The tensile strength of the scar tissue gradually increase

Factors affecting healing

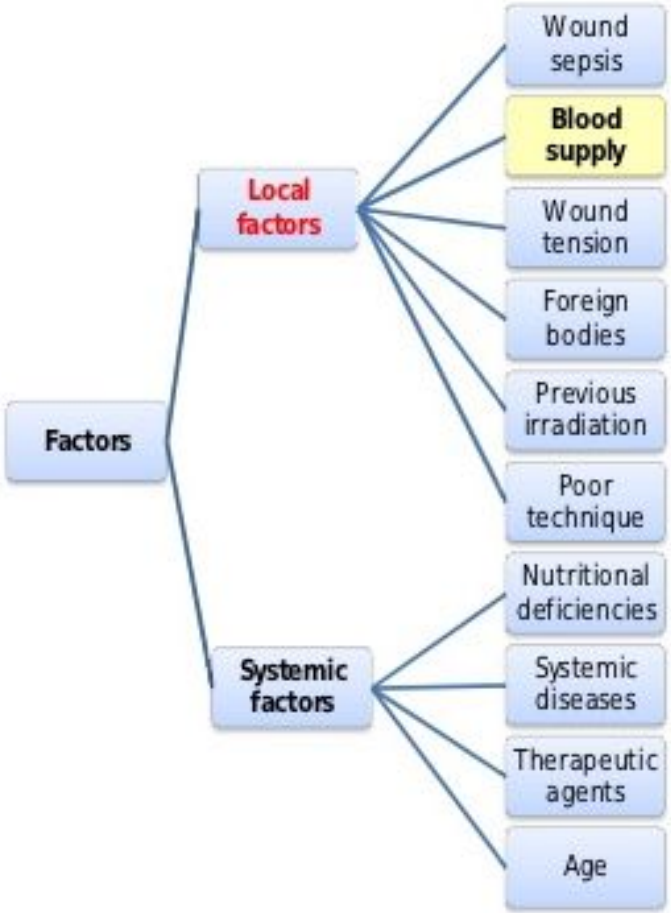


Factors affecting healing



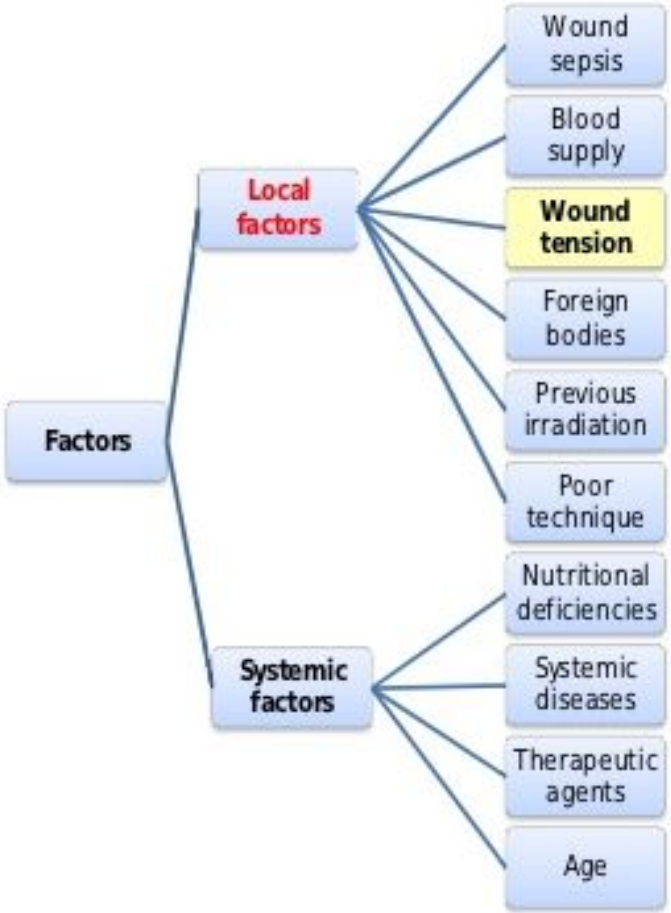
- Infection – delay healing & change type of healing
- To avoid infection:
  - Shave the skin immediate preoperatively
  - Scrub the operator hands with surgical scrub
  - Scrub the area with surgical antiseptic
  - Drape the body with sterile surgical drapes

Factors affecting healing

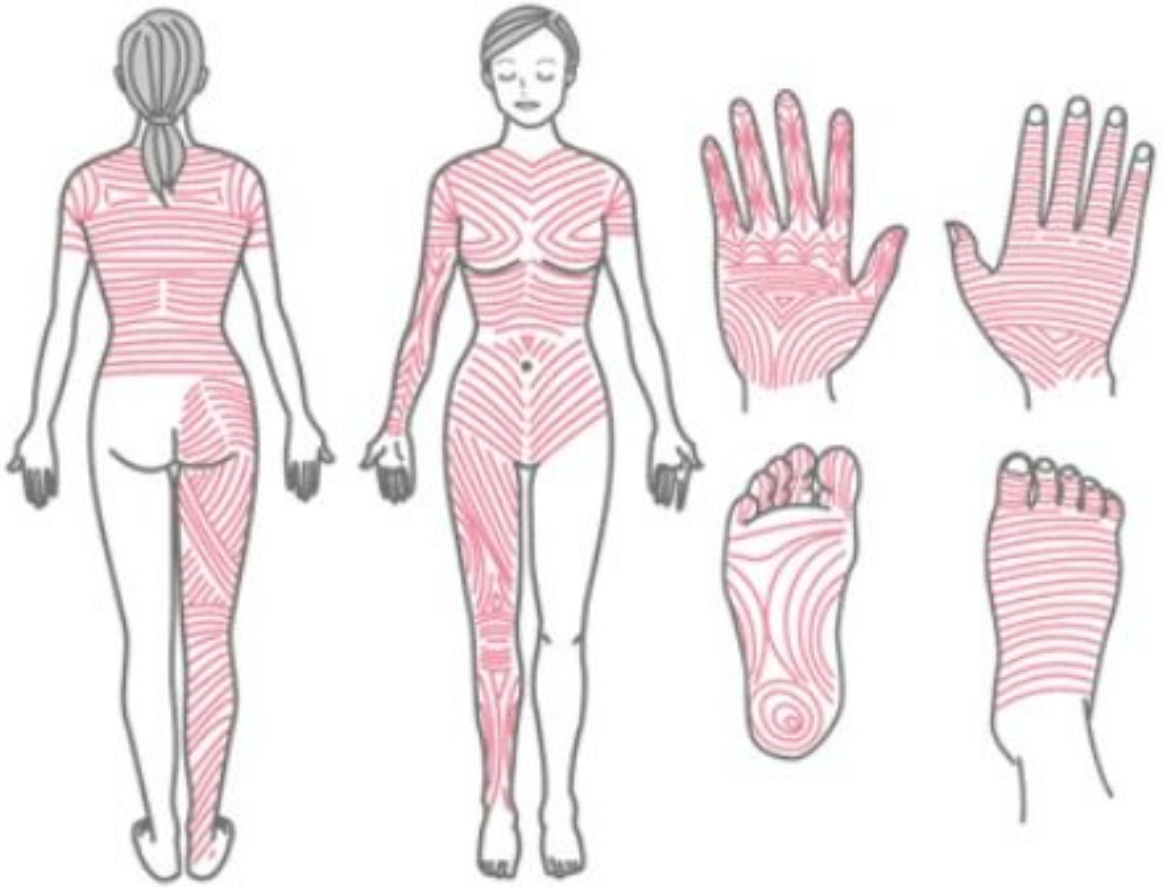


- Areas of good blood supply heal better than areas of poor blood supply
- Proper surgical technique

Factors affecting healing

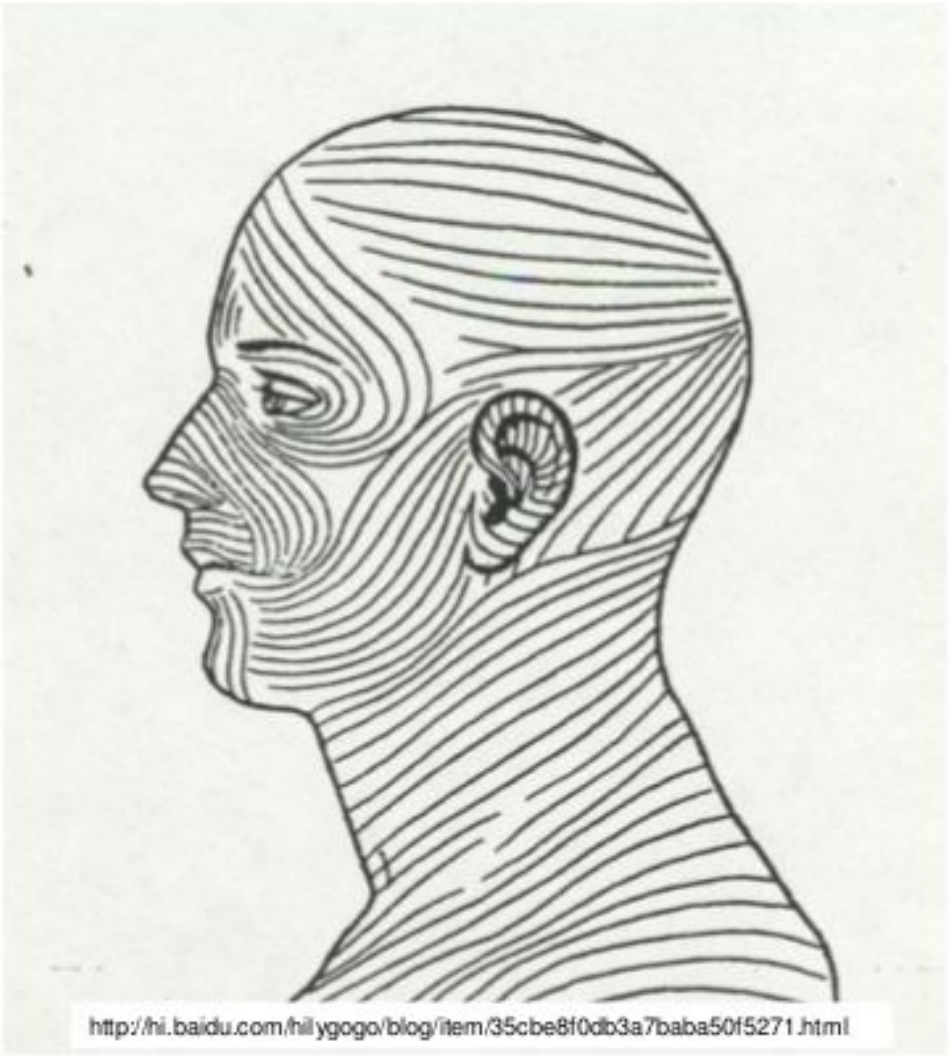


- Tension across a healing a healing wound
  - Separate wound edges
  - Impairs blood supply
  - Complicate wound healing
- Bridging a gap can be achieved by plastic surgery techniques rather than suturing under tension
- Incision along lines of collagen bundles (Langer's lines)
  - Skin creases
  - Transverse at the joints
  - Longitudinal on long parts (limbs)



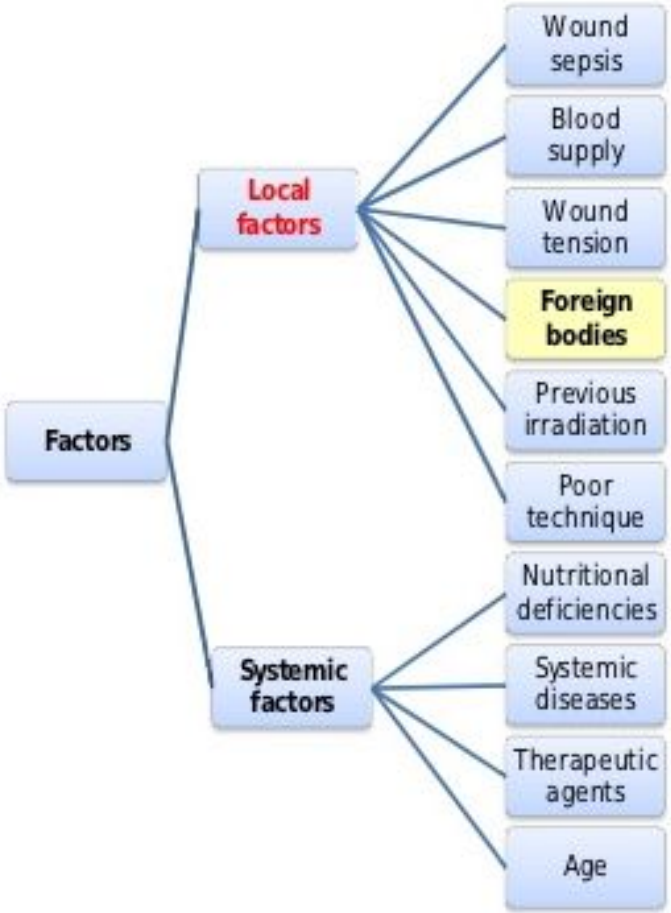
langer lines

http://www.beltina.org/health-dictionary/langers-lines-skin.html



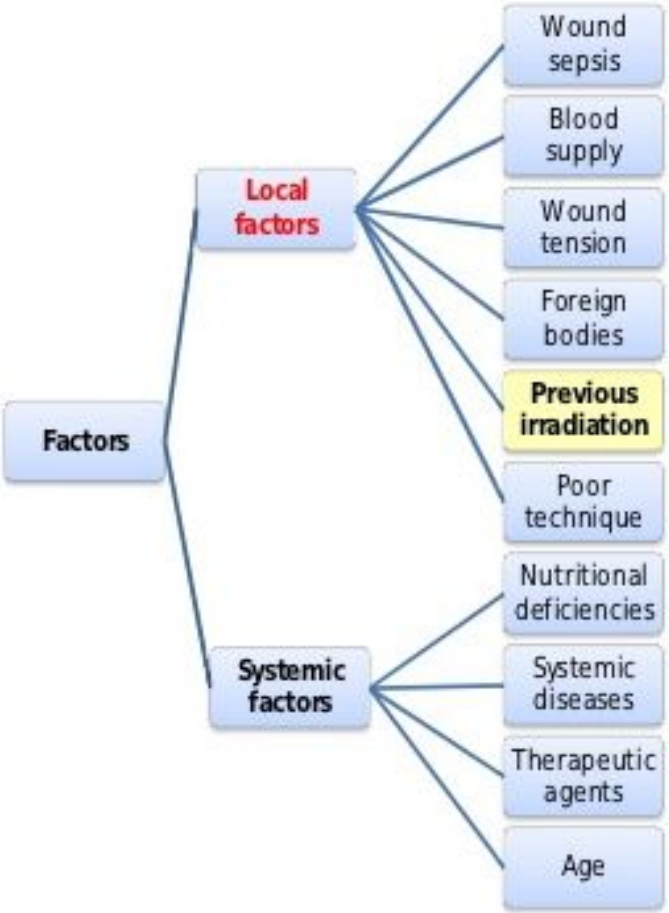
http://hi.baidu.com/hilygogo/blog/item/35cbe8f0db3a7baba50f5271.html

Factors affecting healing



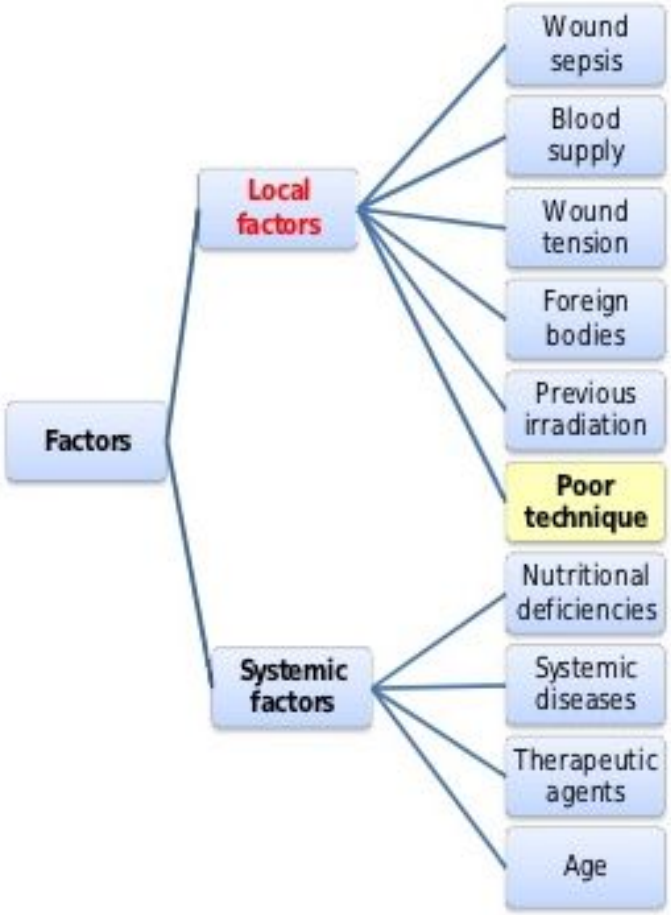
- If present leads to:
  - Infection
  - Prolong the inflammatory reaction
  - Predispose excess scar tissue formation
- Types
  - Exogenous: enter at time of injury
  - Endogenous: hair, fat, necrotic tissue, tooth fragment
- Requires: proper cleaning and disinfection before closure

Factors affecting healing



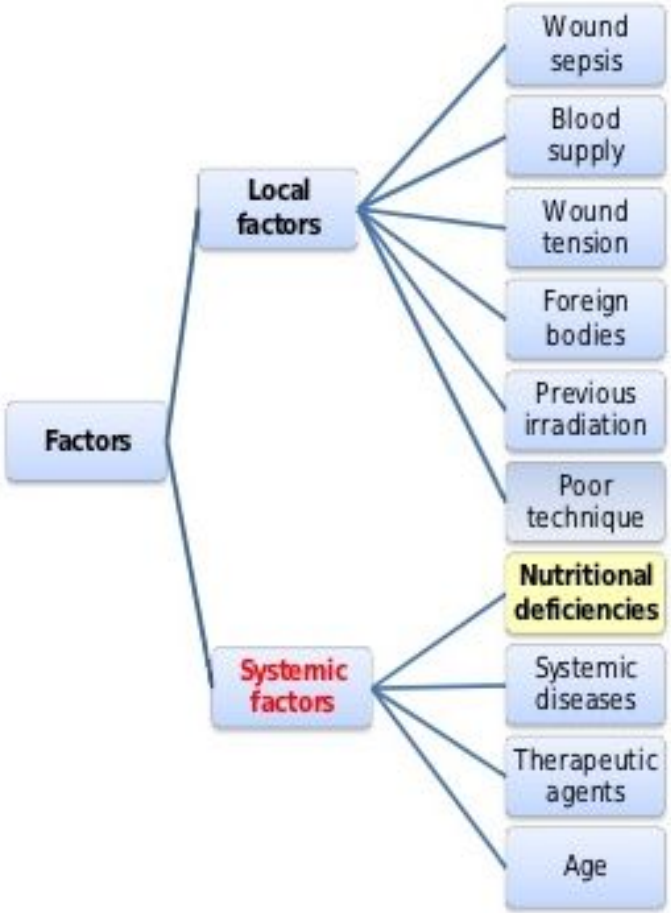
- Radiation effect
  - Hypovascularity
  - Hypocellularity
  - Hypoxia

Factors affecting healing



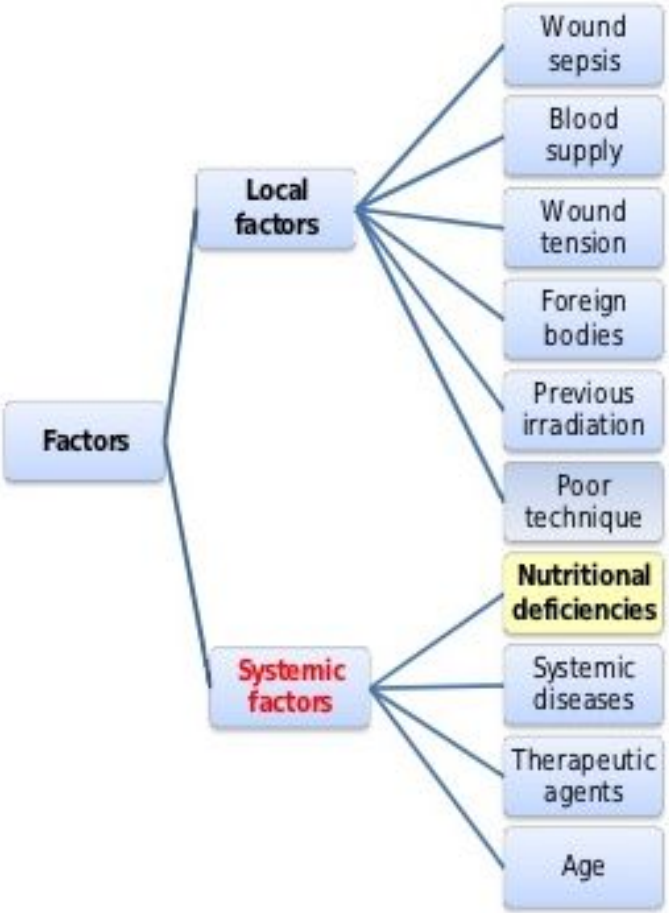
- Surgical technique affect the blood supply to area
  - Incision place: along lines of collagen bundles (Langer's lines)
  - Flap design
  - Sharp clean cut
  - Proper extension to prevent retraction pressure
  - Careful haemostasis
  - Proper suture material selection
  - Proper suturing technique

Factors affecting healing



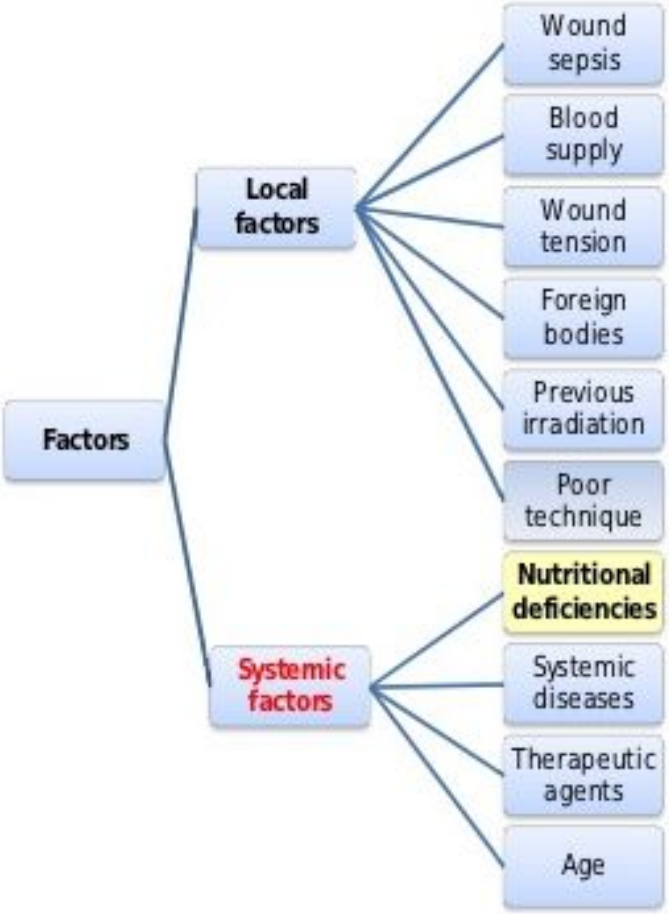
- Vitamins: A & C
  - vit. A: Involved in epithelialisation and collagen production
  - vit. C: Production and modification of collagen

Factors affecting healing



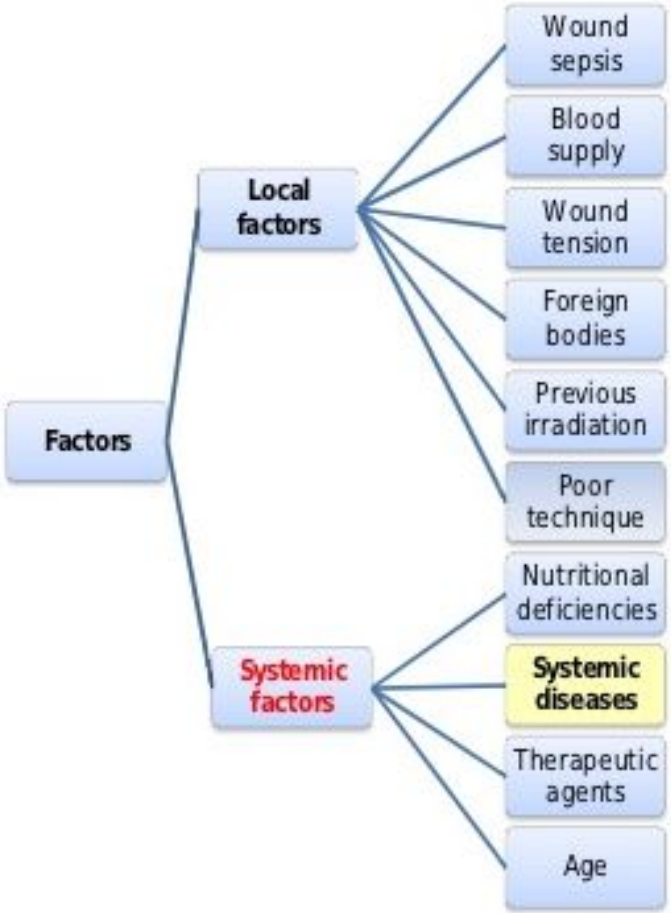
- Vitamins: A & C
- Minerals: Zinc
  - Acts as an enzyme cofactor
  - Has a role in cell proliferation
  - It accelerates wound healing in experimental models

Factors affecting healing



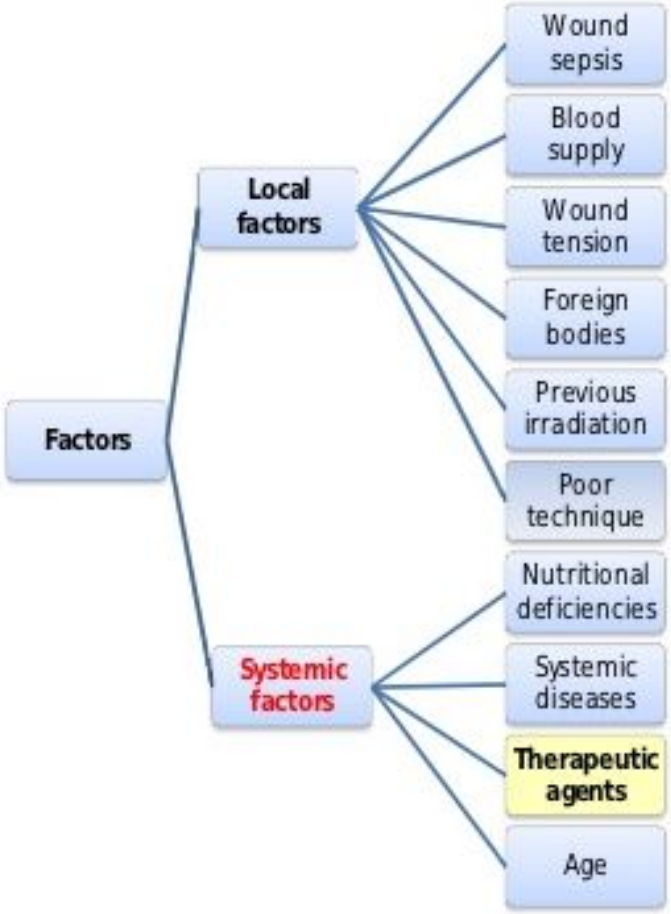
- Vitamins: A & C
- Minerals: Zinc
- Protein: The main building block in wound healing
  - A malnourished, hypoproteinaemic patient has impaired inflammatory and immune responses, vital for normal wound healing and prevention of wound infection.
  - Protein amino acids are essential for collagen production which is itself a protein.

Factors affecting healing



- Several diseases are known to impair wound healing via a number of mechanisms
- Important examples include diabetes, uraemia and jaundice

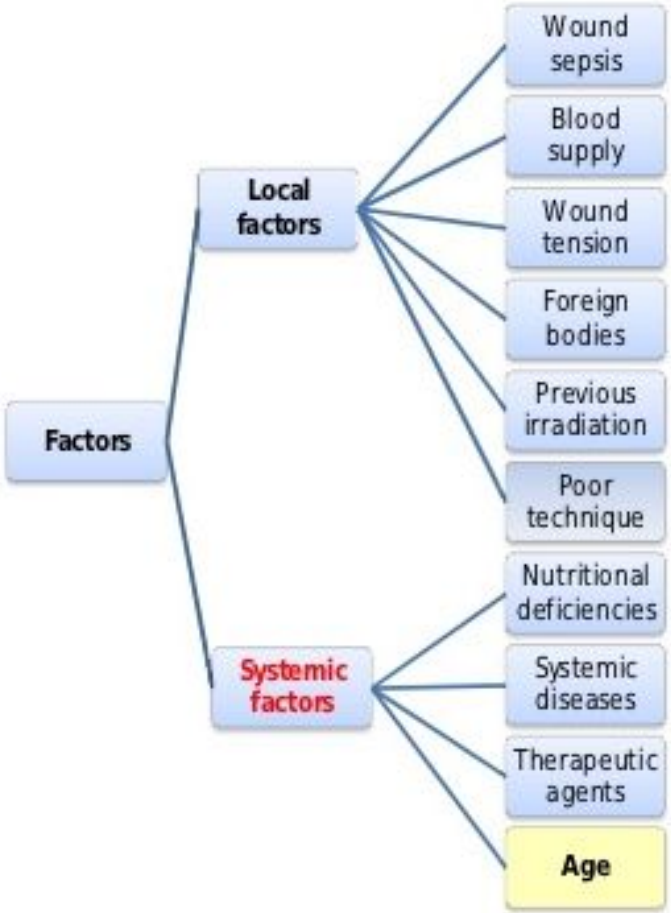
Factors affecting healing



- Immunosuppressive drugs dampen the inflammatory and immune responses, hence impairing wound healing
- Chemotherapeutic agents for malignancy
- Immunosuppressive and antiprostaglandin drugs used for inflammatory conditions such as rheumatoid disease; corticosteroid therapy

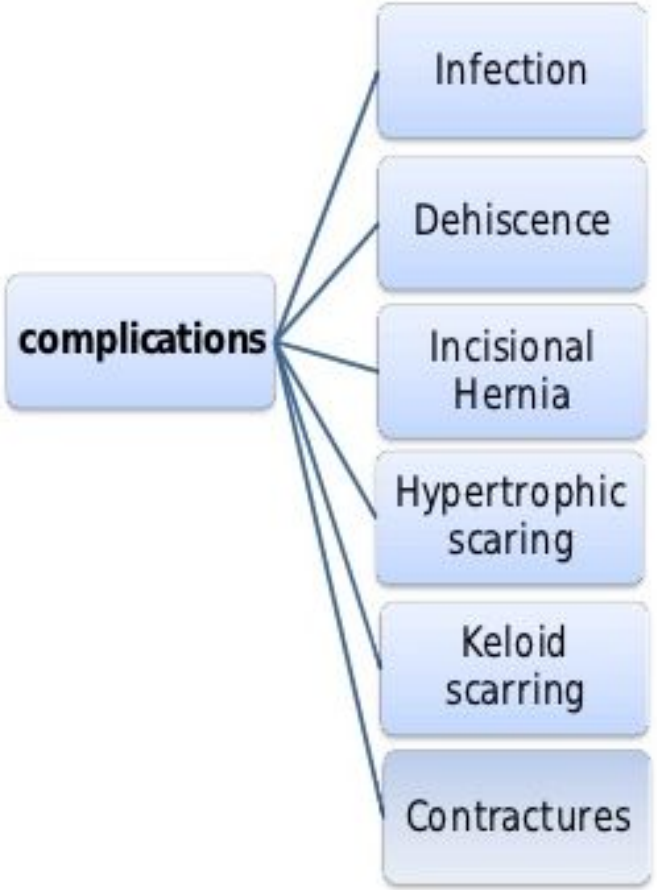
N.B. Steroids have the additional effect of increasing the fragility of small blood vessels

Factors affecting healing

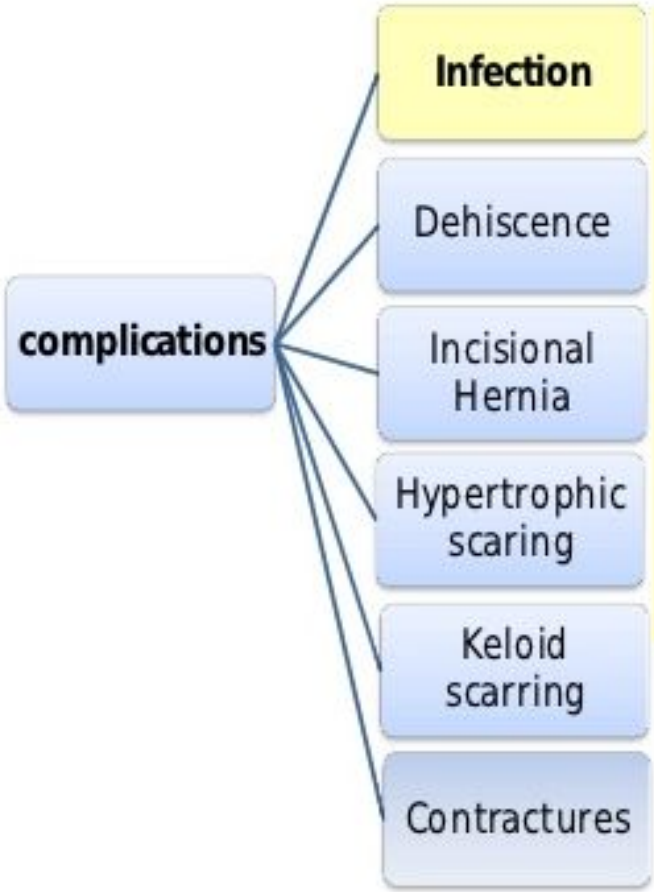


- Prior to puberty, the rate of wound healing is increased compared to postpuberty

Complications of wound healing

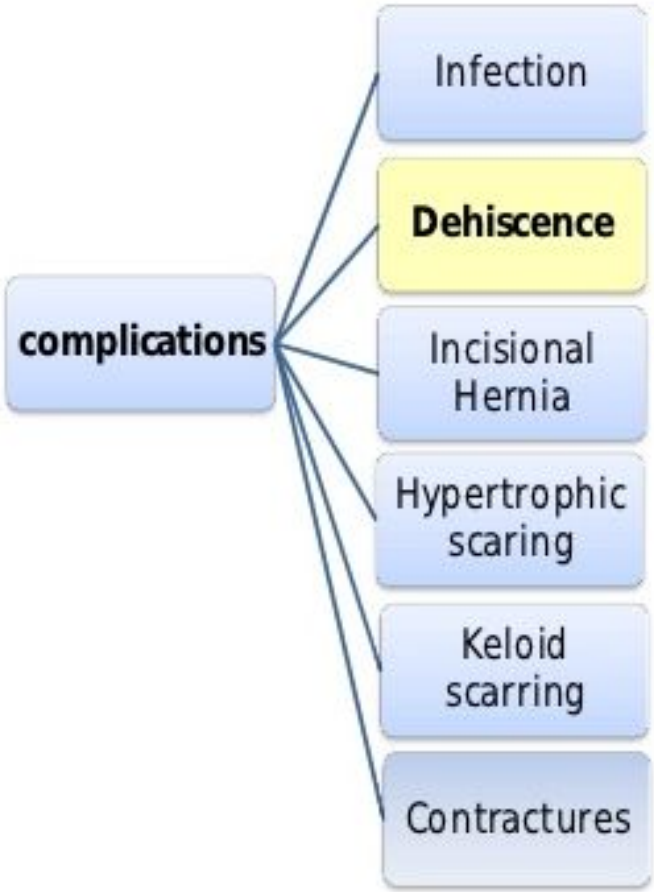


Complications of wound healing

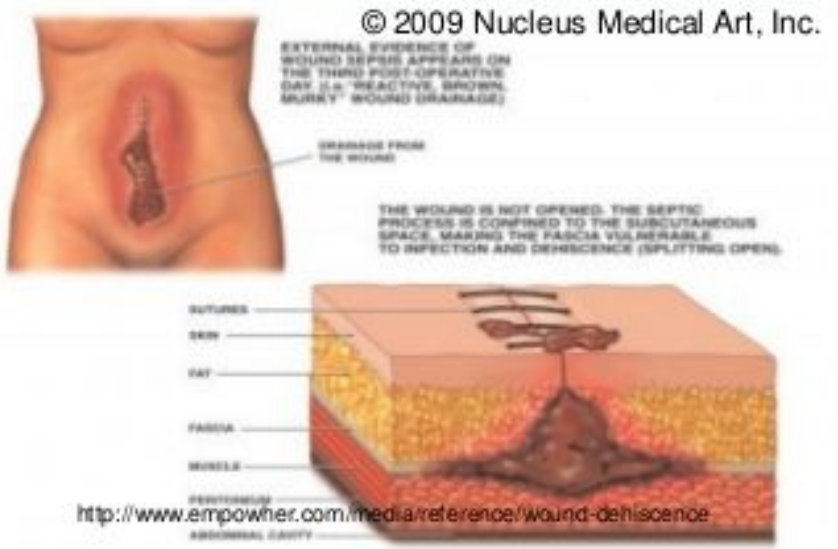


- **Classification of wounds according to risk of sepsis**
- **Prevention of wound infection**
  - Environment
  - Theatre personnel
  - Patient preparation
  - Operating technique
  - Prophylactic antibiotics
- **Treatment**
  - Prophylactic antibiotics
  - Empirical antibiotic
  - Therapeutic /specific antibiotics
  - I&D
  - Antiseptic packs

Complications of wound healing



- **Definition:** Total breakdown of all the layers of the surgical repair of a wound
- **Etiology / causes:**
  - Suture breakage
  - Knot slippage
  - Cutting out of sutures
  - Excess tension on the suture line

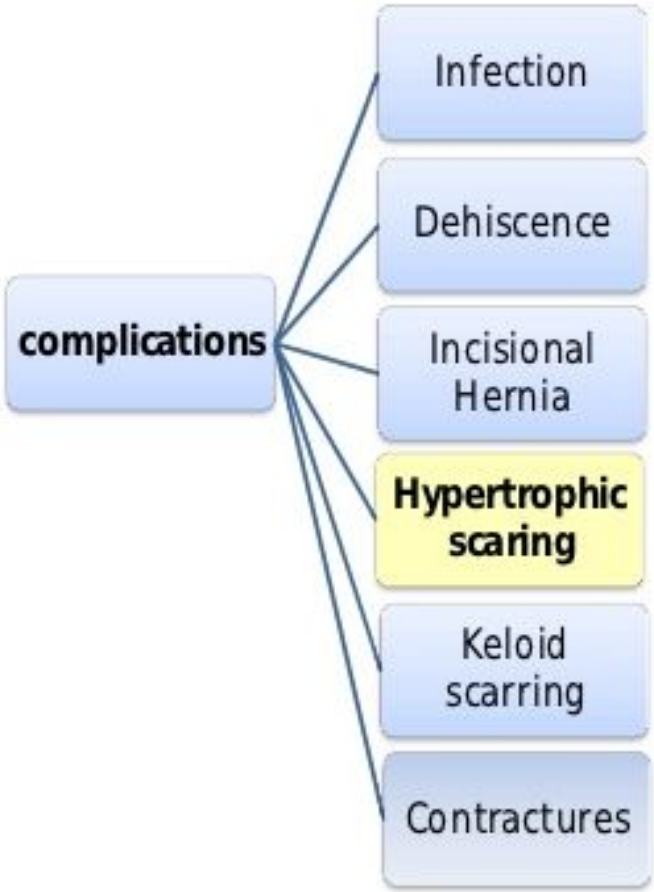


Complications of wound healing

- complications
  - Infection
  - Dehiscence
  - **Incisional Hernia**
  - Hypertrophic scaring
  - Keloid scarring
  - Contractures

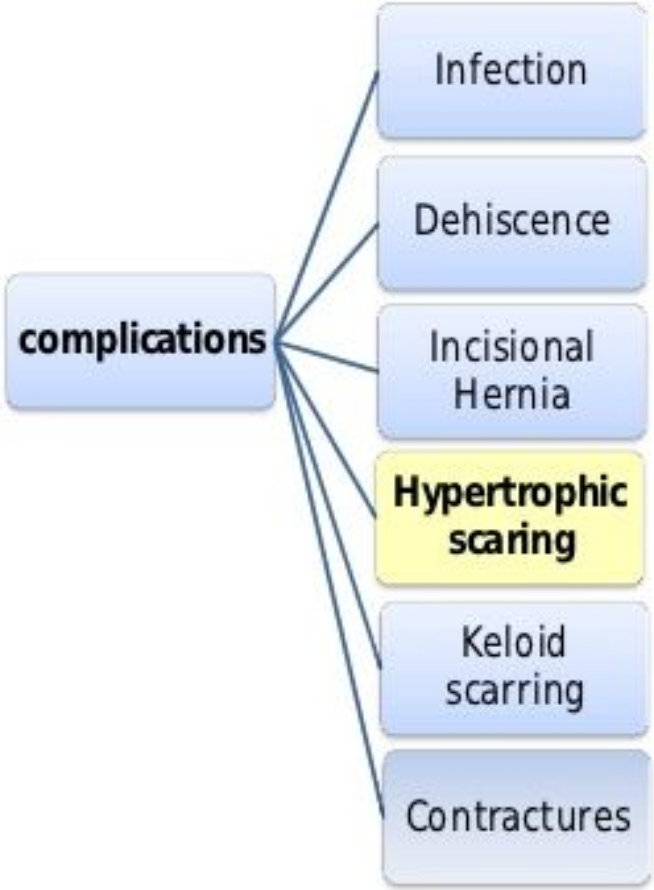
- **Definition:** Breakdown of the deeper layers of a wound in which the skin layer remains intact with protrusion of underlying structures through the deeper defect

Complications of wound healing



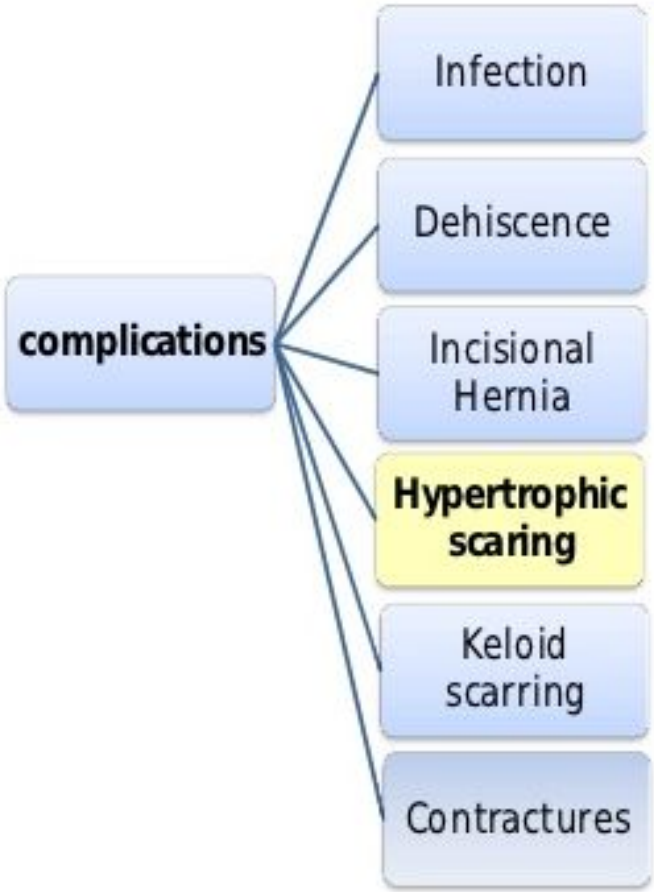
- **Definition:** Excess collagen scar tissue formation - almost an over healing of a wound

Complications of wound healing



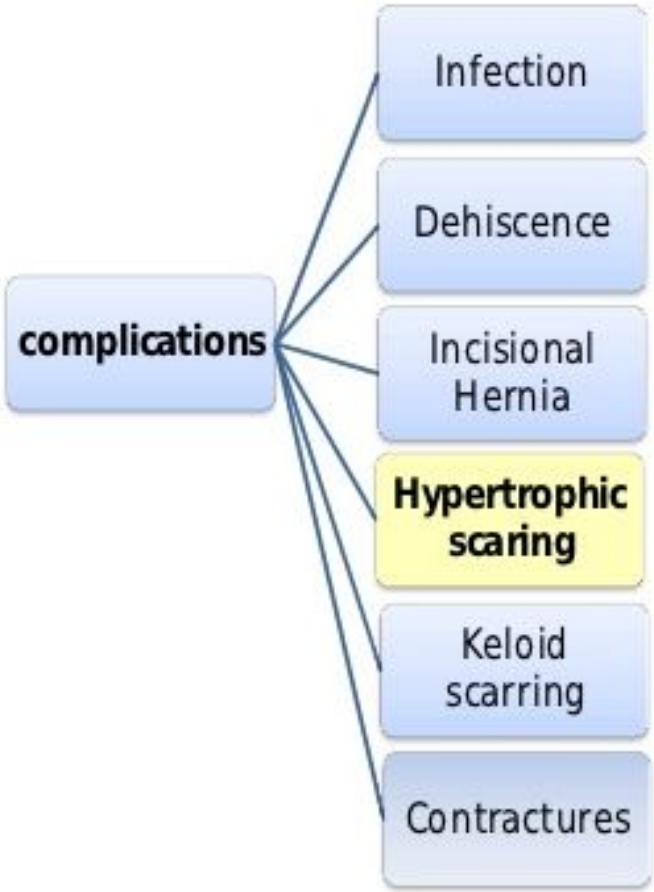
- **Definition**
- **Clinical features:**
  - It is non-progressive after 6 months
  - Does not extend beyond the edges of the wound.
  - It occurs most frequently around joints and where Langer's lines of tension are crossed by the incision

Complications of wound healing



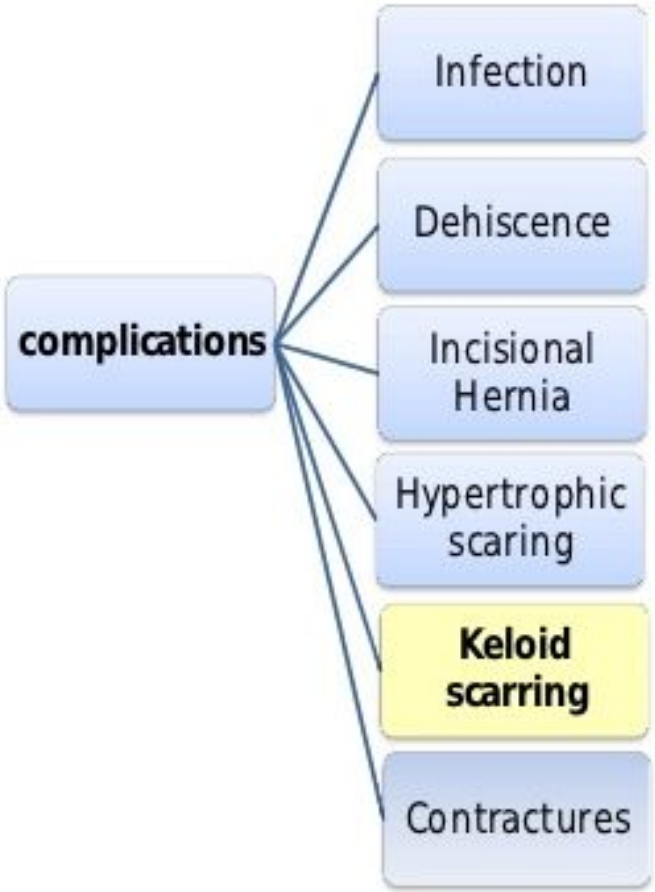
- **Definition**
- **Clinical features:**
- **Etiology:** Poor skin suturing
  - The edges of the skin are overlapping instead of being accurately apposed

Complications of wound healing



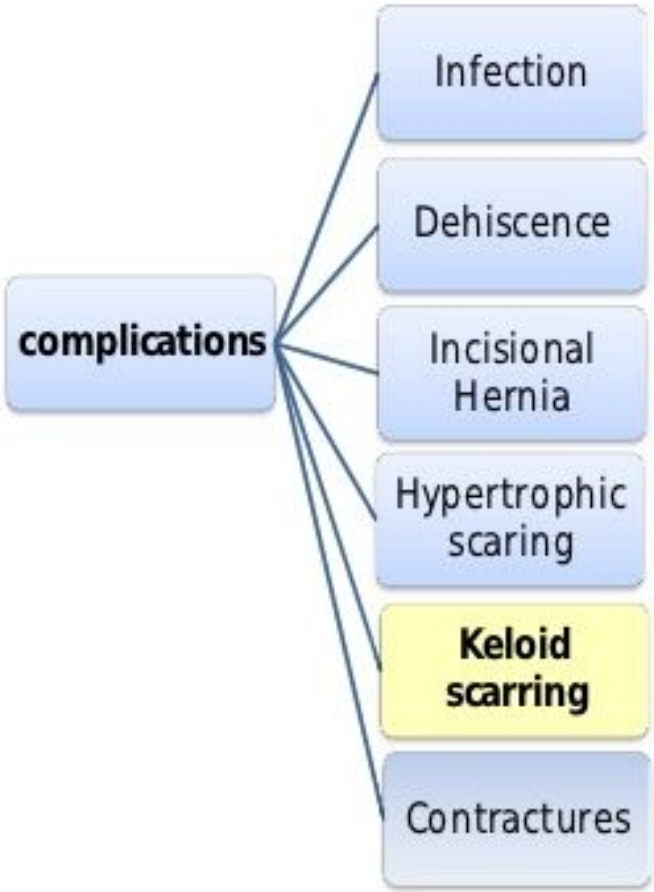
- **Definition**
- **Clinical features**
- **Treatment:**
  - Difficult
  - Further surgery should not be attempted for at least 6 months
  - Excision of the scar and re-suturing often has disappointing results, resulting in the same over healing
  - Radiotherapy used to be used but has now been abandoned
  - Some improvement can be achieved with local injection of corticosteroids directly into the scar, a process that might need repeating several times

Complications of wound healing



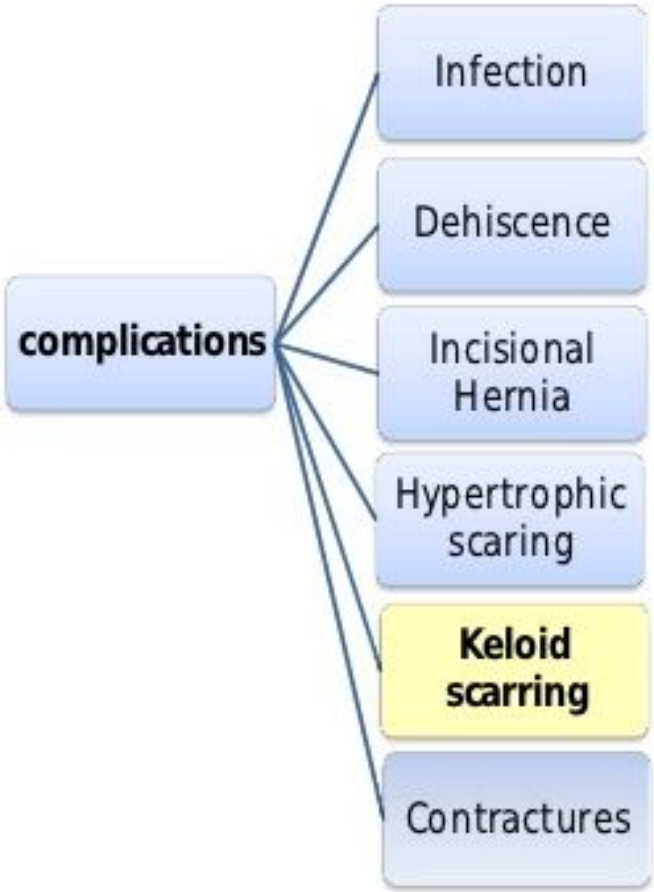
- **Definition:** Overhealing with excess collagen scar formation due to abnormality in collagen metabolism

Complications of wound healing



- **Definition**
- **Clinical features:**
  - Excess scar tissue
  - Extends out beyond the wound edges
  - Continue to enlarge after 6 months
  - Prevalence is higher in
    - Patients with dark skin
    - young patients
    - Burn wounds

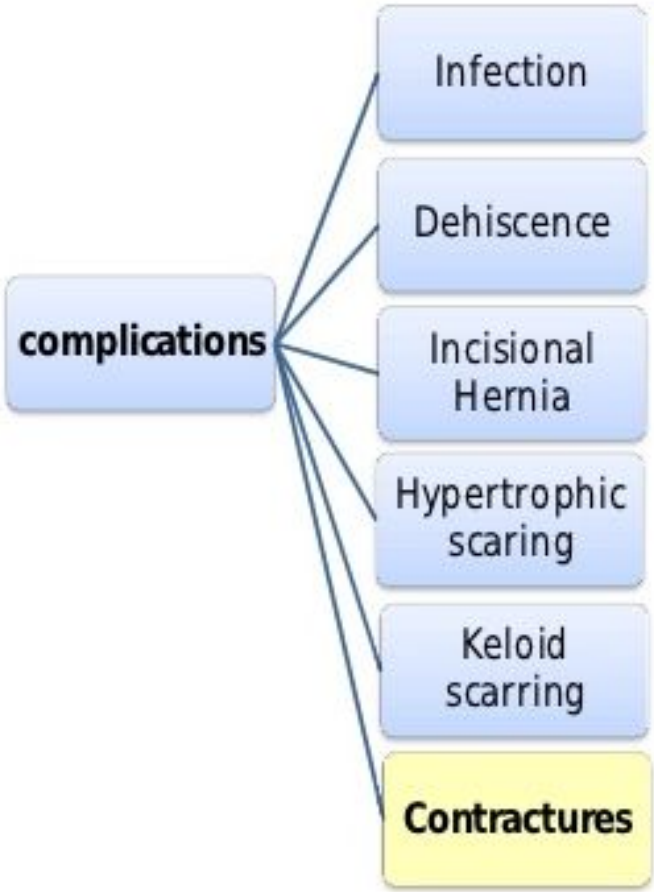
Complications of wound healing



- **Definition**
- **Clinical features**
- **Treatment:**
  - Excision generally results in a larger recurrence
  - Although excision followed by compression bandaging can have slightly better results
  - Corticosteroid injections give some improvement

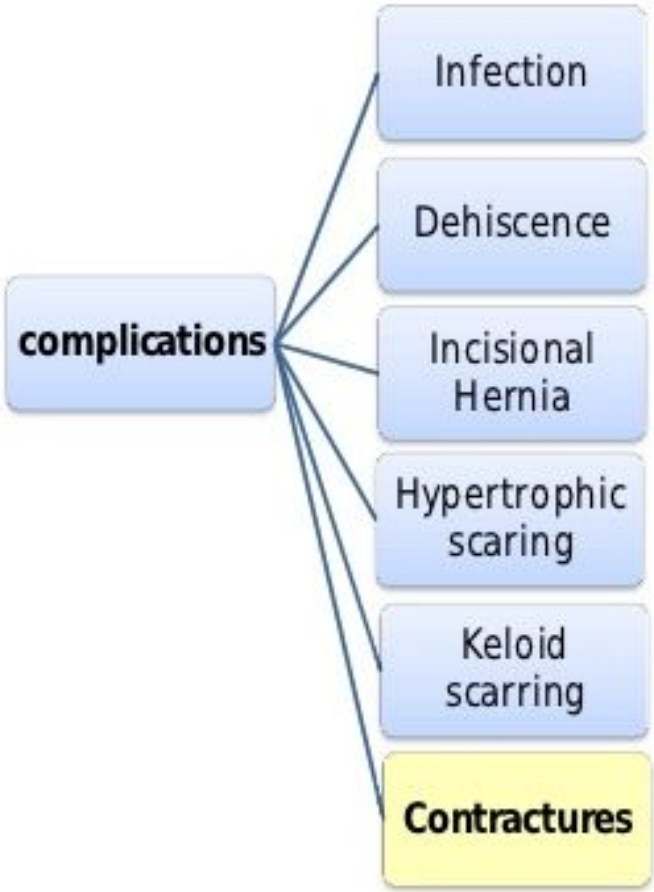
Multiple keloid scars

Complications of wound healing



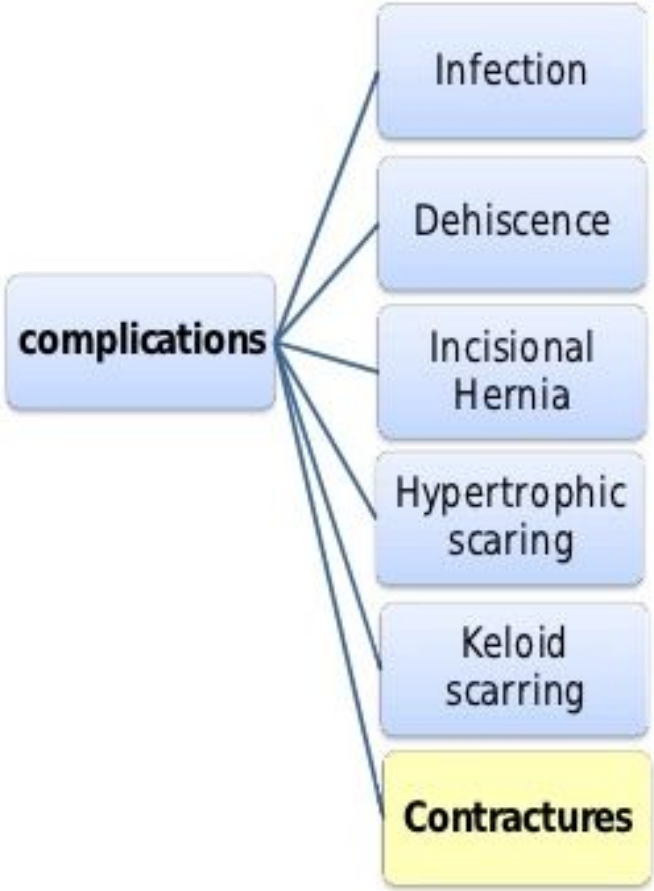
- Wound Contractures can occur with any wounds
- More commonly with delayed healing wounds
  - Infection
  - Burns
  - Incision crosses Langer's lines

Complications of wound healing



- Wound Contractures can occur with any wounds
- More commonly with delayed healing wounds
- Contracture of a scar across a joint can result in marked limitation of movement
- It is therefore essential to avoid vertical incisions across a joint if possible

Complications of wound healing

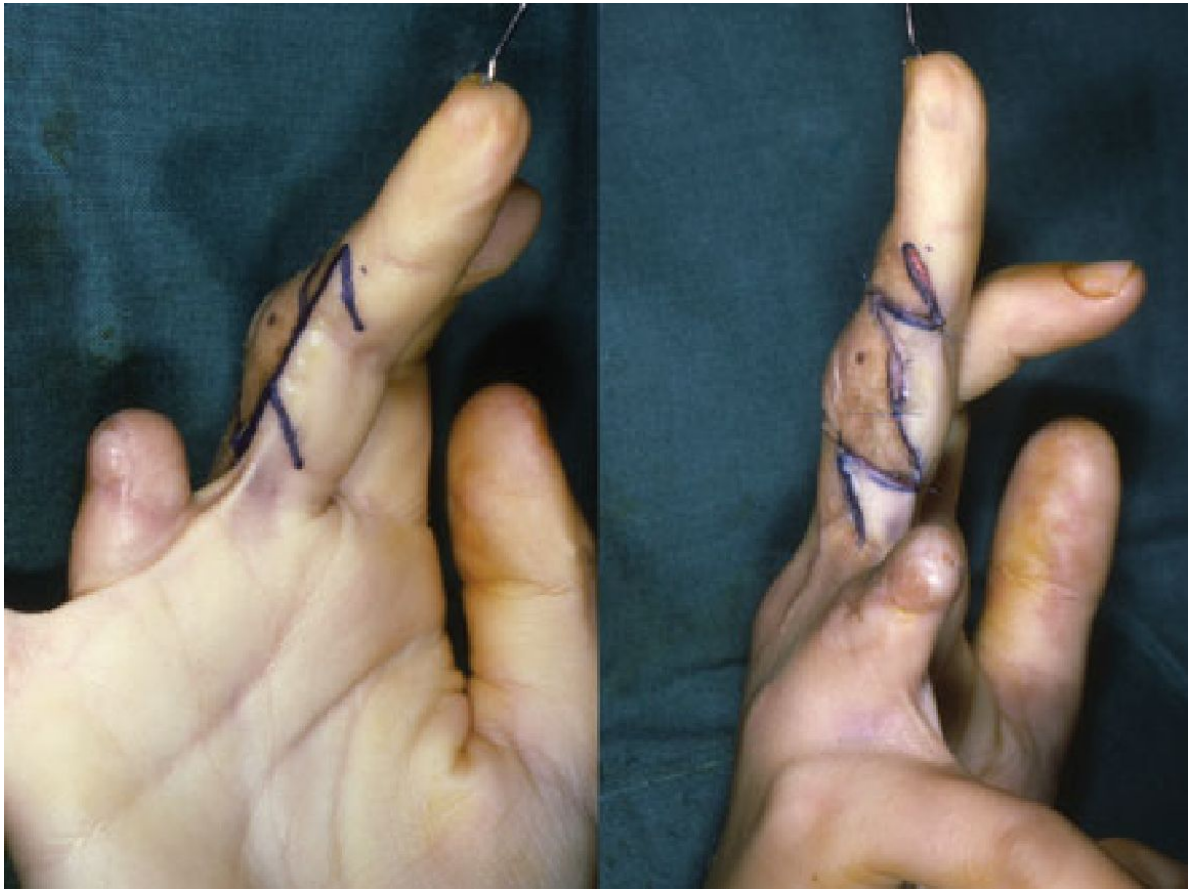


- Wound Contractures can occur with any wounds
- More commonly with delayed healing wounds
- Contracture of a scar across a joint can result in marked limitation of movement
- Surgical treatment include
  - Skin grafting
  - local flaps
  - wound Z-plasty

Burn contractures showing hyperextended fingers and hyperflexed elbow.

Post-traumatic (chainsaw) midline neck contracture

Multiple Z-plasty release of finger contracture



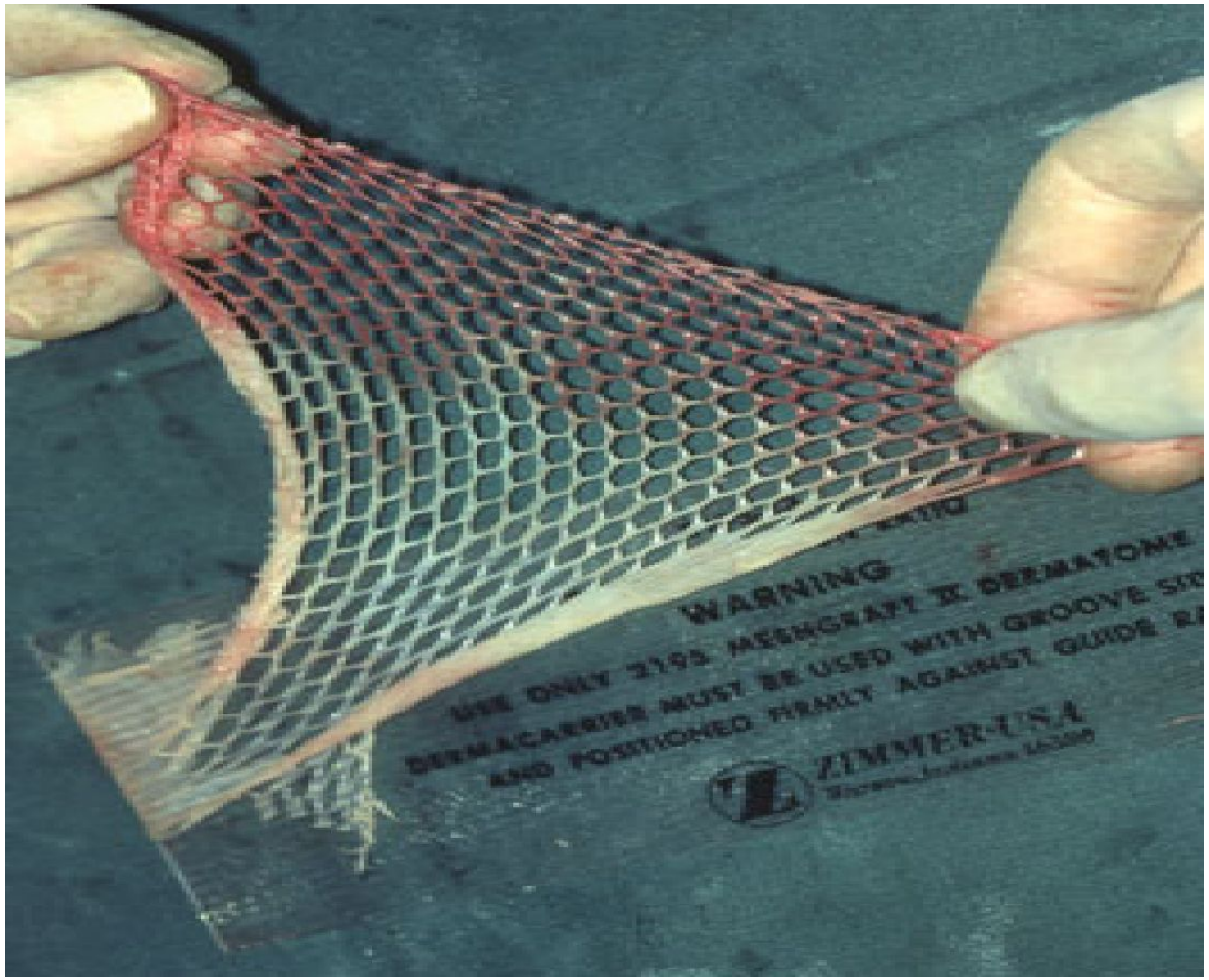
Treatment of hypertrophic and keloid scars

- Pressure – local moulds or elasticated garments
- Silicone gel sheeting (mechanism unknown)
- Intralesional steroid injection (triamcinolone)
- Excision and steroid injectiona
- Excision and postoperative radiation (external beam or brachytherapy)a
- Intralesional excision (keloids only)
- Laser – to reduce redness (which may resolve in any event)
- Vitamin E or palm oil massage (unproven)

MANAGING THE ACUTE WOUND

- The surgeon must remember to examine the whole patient
- A bleeding wound should be elevated and a pressure
- Clamps should not be put on vessels blindly as nerve damage is likely and vascular anastomosis is rendered impossible
- Devitalised tissue must be excised until bleeding occurs with the obvious exception of nerves, vessels and tendons
- Muscle viability is judged by the colour, bleeding pattern and contractility
- In a tidy wound, repair of all damaged structures may be attempted

Meshed split-skin graft



Managing the acute wound

- Cleansing
- Exploration and diagnosis
- Debridement
- Repair of structures
- Replacement of lost tissues where indicated
- Skin cover if required
- Skin closure without tension
- All of the above with careful tissue handling and meticulous technique

CHRONIC WOUNDS

1.Leg ulcers

Aetiology of leg ulcers

- Venous disease leading to local venous hypertension (e.g. varicose veins)
- Arterial disease, either large vessel (atherosclerosis) or small vessel (diabetes)
- Arteritis associated with autoimmune disease (rheumatoid
- arthritis, lupus, etc.)

2.

THANK YOU!