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Soft Tissue Trauma



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Objectives

**At the conclusion of this presentation
the participant will be able to:**

- Identify various soft tissue injuries
- Define the major phases of wound healing
- Identify factors that contribute to wound healing
- Describe surgical and non-surgical treatments of soft tissue injuries

Incidence

- Wounds account for more than 10% of all ED visits.
- Skin is the first line of defense and, therefore, prone to injury.



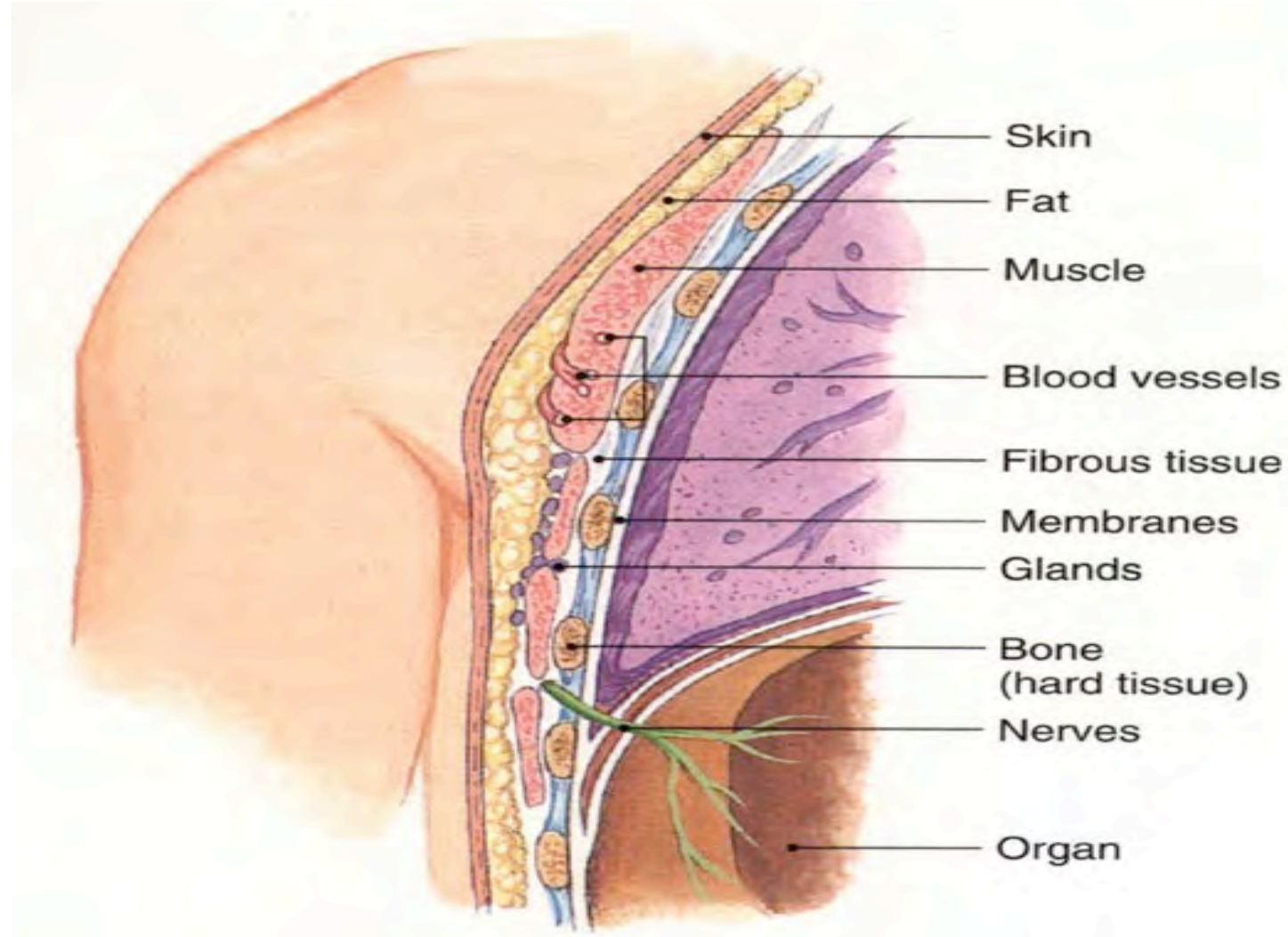


Mechanism of Injury

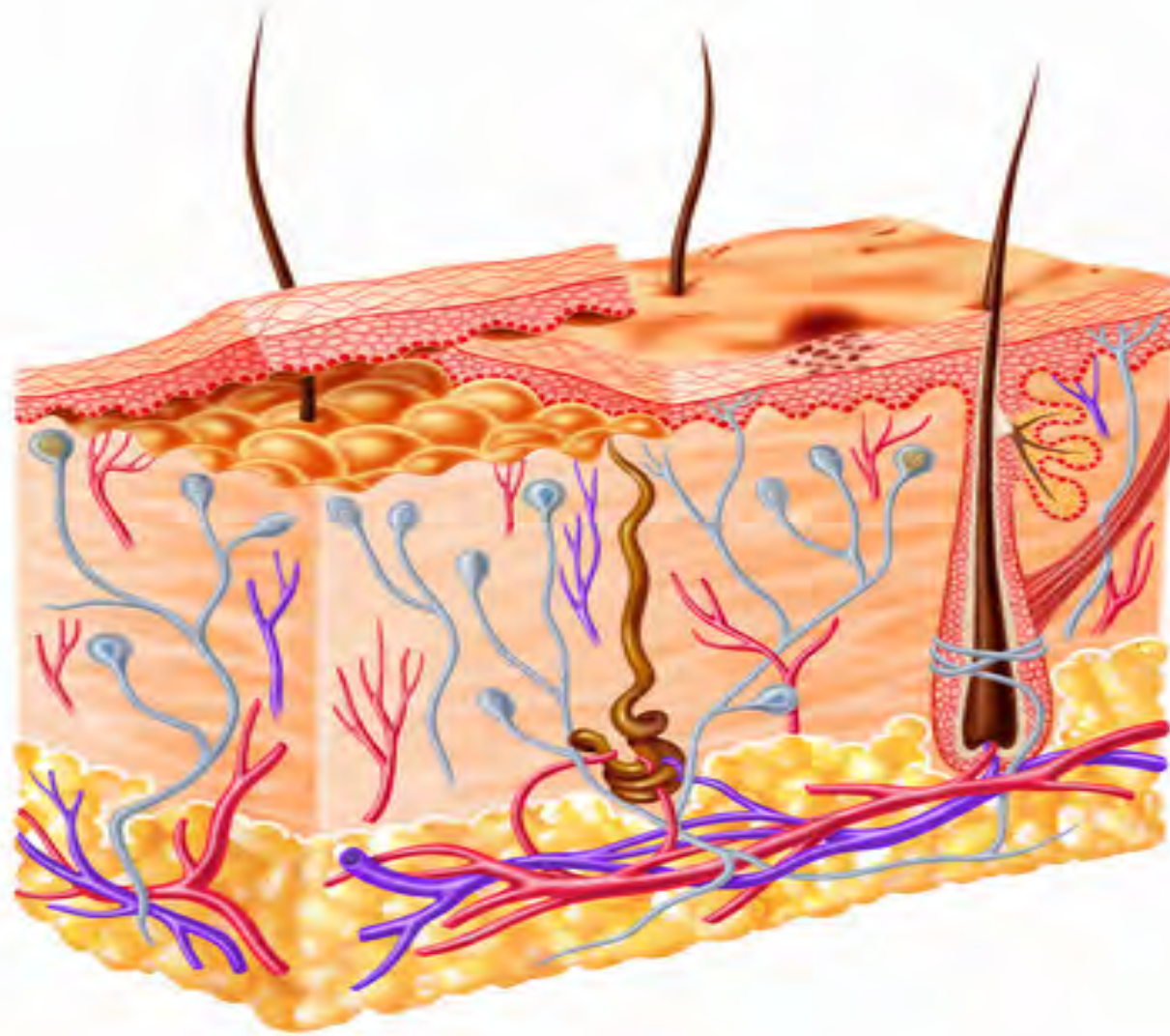
Special Considerations

- Common in both blunt and penetrating
- Environmental injury
- Occupational injury
- Foreign Body risk
- Bite injury
- Pressure Injection injury
- Compression injury

Soft Tissue Layers



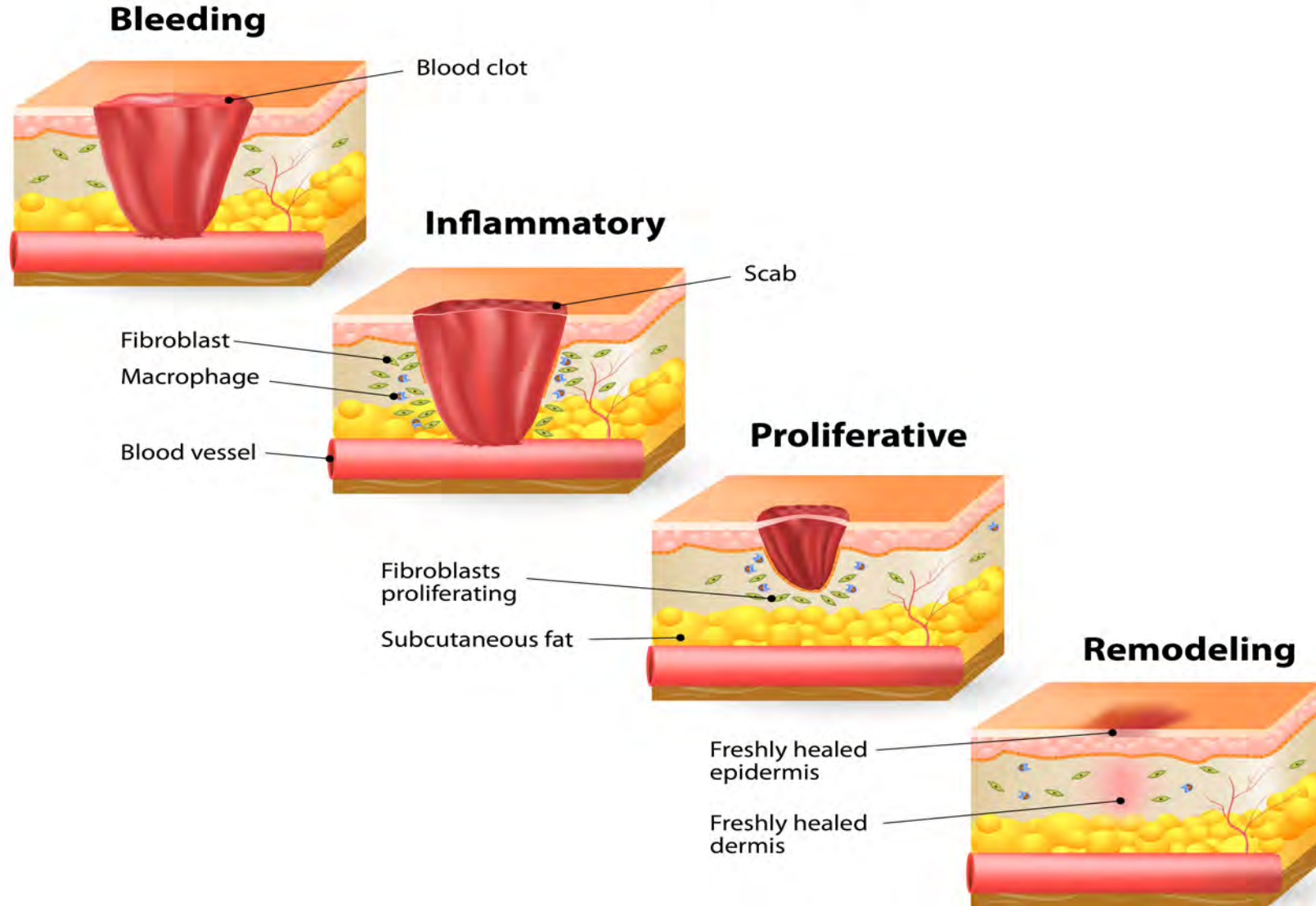
Soft Tissue Anatomy



Soft Tissue Functions

Skin	Barrier Homeostasis
Subcutaneous Tissue	Thermal regulation and shock absorption Wound healing
Muscles	Mobility Highly vascular High metabolism
Nerves	Afferent = sensation Efferent = action
Blood Vessels	Nutrient and gas exchange

Wound Healing



Wound Healing – By Intention

Primary Intention	<p>Clean wound with limited tissue loss Wound's edges easily approximated Classic surgical wound closure Sutures, staples, or adhesive tape used</p>
Secondary Intention	<p>Large tissue loss/heavy contamination Wound cleaned and left open to granulate Surgeon may pack and place drain Daily wound care promotes granulation</p>
Tertiary Intention	<p>Also known as delayed primary closure Often used with heavy bacteria counts Wound is cleaned, debrided, and left open 4-5 days Surgical closure afterward</p>



Determinants of Wound Healing

- Anemia
- Nutritional Status
- Age
- Perfusion
- Temperature
- Smoking
- Pain
- Stress
- Preexisting Disease
- Previous healing

Initial Assessment

- Rarely life-threatening alone
- Always start with ABCDEs
- Do not be distracted by the wound or injury before addressing the ABCDEs



Controlling External Bleeding

- Direct pressure
- Pressure points
- Elevate the wound
- Tourniquets



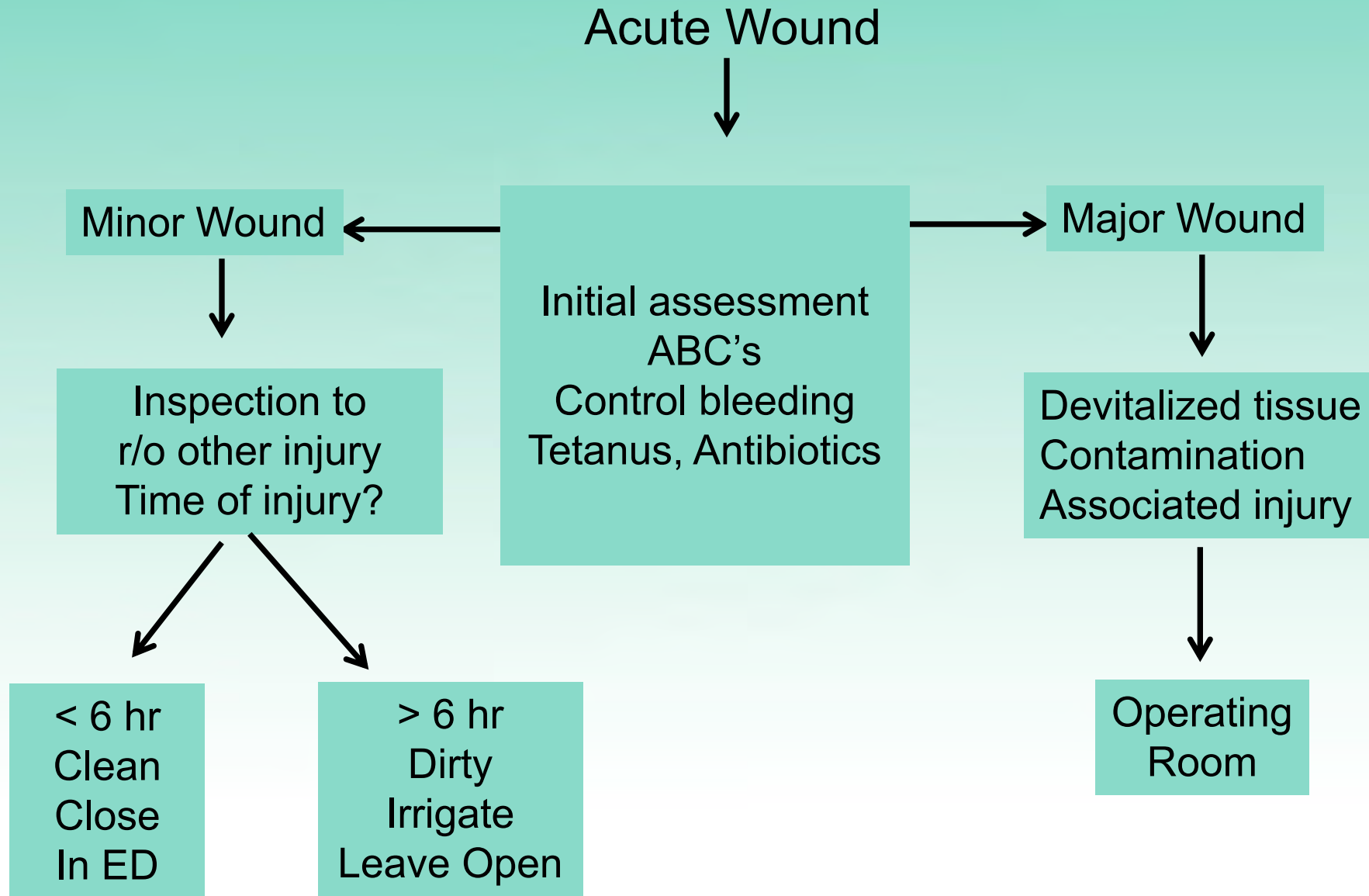
Tourniquets



<https://www.youtube.com/watch?v=y81aJ81In5Q>

Stop the Bleed

- Launched in 2015 by the federal government in collaboration with the American College of Surgeons and others, *Stop the Bleed* is a national awareness campaign and a call to action.
- *Stop the Bleed* is intended to cultivate grassroots efforts that encourage bystanders to become trained, equipped, and empowered to help in a bleeding emergency before EMS arrival.



Assessment

- Medical history
- Time of injury
- Allergy history
 - Antibiotics
 - Latex
 - Local anesthetics
- Tetanus history
- Occupation
- Hand dominance



Patient Symptoms

Paresthesia
Loss of sensation

Neurovascular injury

Severe Pain

Underlying fracture
Foreign body
Compartment syndrome
Necrotizing fasciitis

Physical Examination

- Hemostasis
- Local anesthesia
- Size/Depth
- Location
- Circulation
- Nerve function
- Motor function
- Injury to underlying structures



Time of Injury to Closure

- Wound at greater risk for infection with increased time from injury to repair
 - **6-8 hours** acceptable
- Clean face lacerations
 - Can close up to 24 hours after the injury



Henley, 2013

Injury Location Significance

Face and neck:

- Greater blood flow (lower infection risk)

Lower extremities:

- Less blood flow (higher infection risk)

Wounds involving tendons,
joints, bones:

- Increased infection risk



Anesthesia

Local

- Infiltration into wound

Field Block Method

- Inject through intact skin at edge of wound
- Preferred for grossly contaminated wounds

Regional Nerve Block

- Smaller volume required
- Less tissue distortion
- Used for digit lacerations



Topical Anesthetic For Wounds

- **LET (gold standard)**
 - Lidocaine 4%
 - Epinephrine 0.1%
 - Tetracaine 0.5%
- **Solution or Gel**
 - Saturated gauze on wound
 - 20-minute onset
- **Avoid**
 - Eyes and ears
 - Nose and mucous membranes
- **Ideal for lacerations:**
 - Small and superficial
 - Scalp and face
- **Advantages:**
 - No pain of injection
 - No tissue swelling
 - Minimize bleeding
 - Safe

Topical Anesthetics For Intact Skin

- **Uses:**

- Venipuncture
- Minor procedures

- **Forms:**

- Gels, sprays, creams, patches

- **Onset Time:**

- Varies by product
- Short as 5 minutes
- Long as 60 minutes

Some Examples:

- Eutectic Mixture of Local Anesthetics (EMLA)
 - Lidocaine and Prilocaine
 - 60-minute onset
- Liposomal Lidocaine
 - ELA-Max or LMX4
 - 30-minute onset
- Lidocaine/Tetracaine patch
 - Synera
 - 20-minute onset

Irrigation

- Highly effective cleaning
- Pressure more important than volume
- Sterile saline common
- Tap water as potential alternative
- Avoid povidone-iodine, hydrogen peroxide, or detergents



Initial Debridement

- Removing devitalized tissue
- Pressure irrigation preferred
- Mechanical debridement, if necessary
- Caution if extent of tissue devitalization unknown:
 - Watch and wait



Hair Removal

- Removal to ease wound closure
- Others advocate presence of hair to assist guiding edge approximation
- Avoid eyebrow removal
 - Potential for inconsistent regrowth

Foreign Body

- Retained foreign body
 - Inflammation and infection
 - Delayed wound healing
 - Loss of function
- Imaging helpful
- Most difficult to identify
 - Small glass
 - Plastic
 - Wood
- Litigation if missed



Closed Injuries (Skin Intact)

- **Contusion**

- Epidermis intact
- Swelling and pain



- **Hematoma**

- Blood collection under skin
- Larger tissue damage





Abrasion

Laceration

- Vary in depth:
 - Superficial
 - Deep tissue
- Vary in appearance:
 - Linear (regular)
 - Stellate (irregular)
- Assess:
 - Underlying damage
 - Contamination
 - Foreign bodies



Avulsion

- Tearing, stretching mechanism
- Full thickness loss of tissue; wound edges cannot be approximated
- Assess for degree of injury and underlying damage





Degloving

- Type of avulsion
- Shearing mechanism
- Assess for degree of tissue loss and underlying injury

Puncture Wounds

- Small external opening, deep tissue penetration
- High risk for infection or contamination
- Check tetanus status



Gunshot Wounds



- Potential injury to multiple skin and tissue layers
- Severity determinants:
 - Speed
 - Bullet type
 - Cavitation
 - Injury Location

Bite Wounds

- Infection Risk:
 - Human > Animal
 - Cats > Dogs
- Assess:
 - Tetanus status
 - Rabies risk
- Treatment:
 - Elevate area
 - Incision & drainage
 - Antibiotics



High Pressure Injection Injuries



- Potentially devastating
 - Prompt surgical debridement
 - Extremity at risk for amputation
- Damage results from:
 - Impact
 - Ischemia due to swelling
 - Chemical inflammation
 - Secondary infection

Amputation

- Crush or cut injuries
- Potential causes:
 - Factory or farm accidents
 - Power tool accidents
 - Motor vehicle accidents
- Management
- Sometimes can be reattached





Wound Treatment

No single treatment for entire healing process

- Antibiotics
- Debridement
- Dressings
- Surgical closure
- Skin grafts
- Skin flaps
- Nutritional support

- Highly contaminated wounds
- Human and animal bites
- Crush injuries
- Stellate lacerations
- Puncture wounds
- Intraoral lacerations
- Wounds over open fractures, exposed joints, and tendons

Which Wounds Need Antibiotics?

Mechanical Debridement

- Wet-to-dry dressings
- Hydrotherapy
- Wound irrigation
- More painful than other methods
- May require specialized equipment
- Nonselective
- May cause trauma and bleeding



Surgical Debridement

- Use of scalpel, scissors, or lasers to remove dead tissue
- Gold standard of debridement
- May require serial treatments
- Dependent on practitioner expertise



Transparent Dressings

Advantages

- Transmits moisture vapor
- Semipermeable to gases
- Provides protection from friction
- Aids in autolytic debridement

Disadvantages

- No absorption capability



Hydrocolloid Dressings



- Impermeable to gases, water vapor
- Provides moist environment
- Increased granulation and maceration risk

Hydrogel Dressings

- Contains water in gel form
- Autolyzes and removes devitalized tissue
- Hydrates dry wound beds
- May require daily changes



Foam Dressings



- Highly absorbent
- Moisture-proof
- Uses:
 - Wounds with increased exudate
 - Infected wounds

Calcium Alginate Dressings

- Absorbent, non-adherent, biodegradable
- Soluble gel moistens wound bed
- Requires secondary dressing



Hydrofiber Dressings



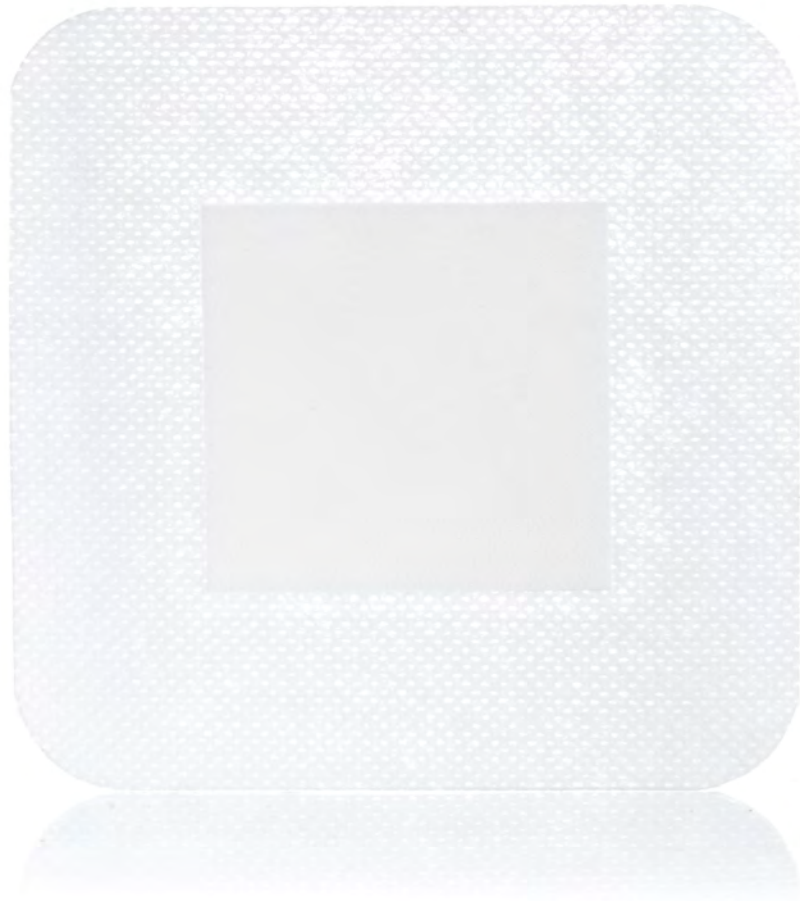
- Forms gel after contact with exudate
- Maintains moist environment
- Requires secondary dressing

Collagen Dressings

- Highly absorbent and hydrophilic
- Uses:
 - Granulating wounds
 - Necrotic wounds
- Changed every week
 - If infected, changed daily



Composite Dressings



- May adhere to wound bed
- Used on infected wounds
- Facilitates autolytic debridement

Contact Layer Dressings

- Low-adherence material of woven net
- Acts as a protective layer
- Used with topical ointments



Gauze Dressings



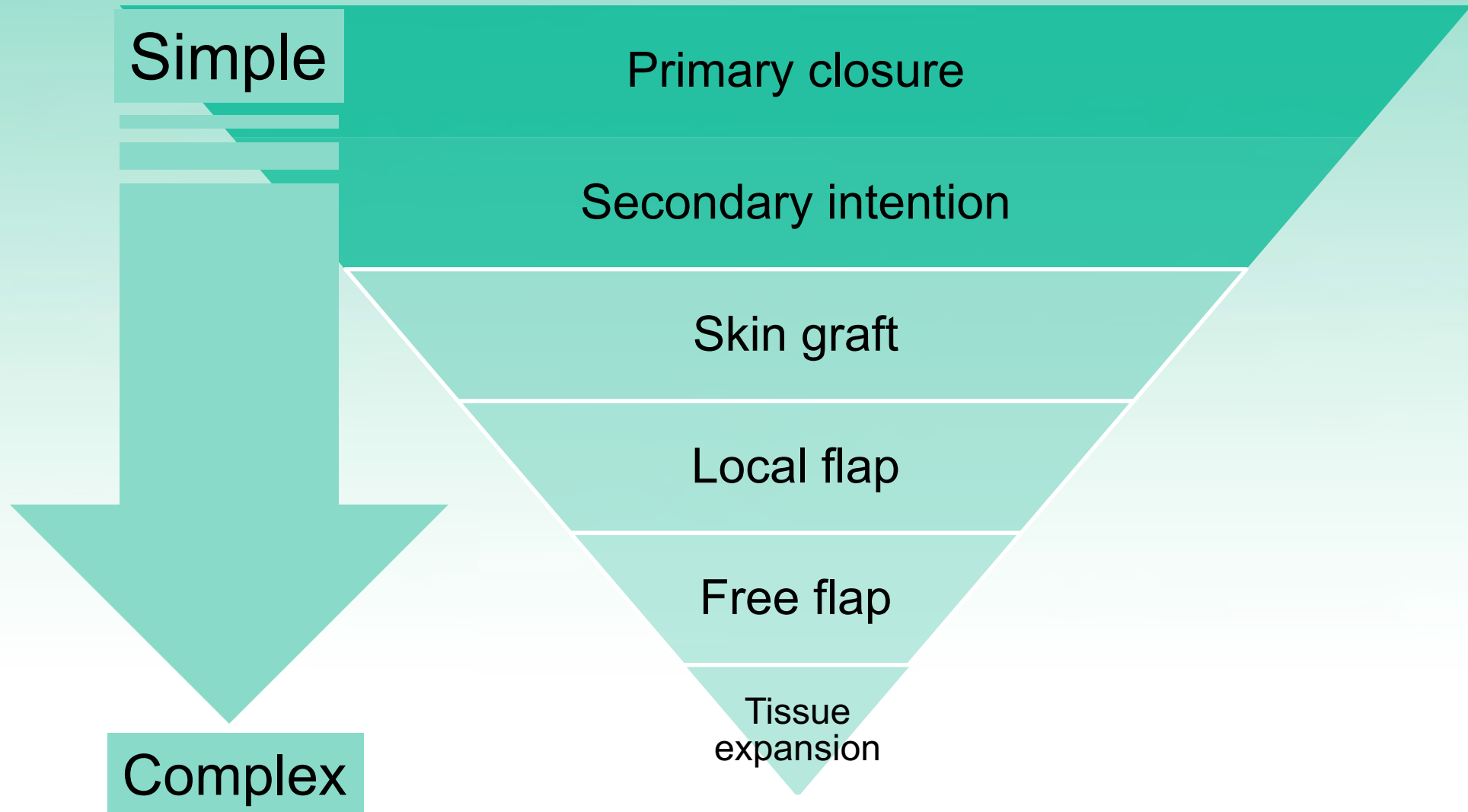
- Does not moisten wound environment
- Removal may cause wound trauma
- Uses:
 - Wound packing
 - Primary or secondary dressing
- Requires frequent changes

Antimicrobial Dressings

- Added antimicrobial effects
- Available in variety of forms
 - Transparent, foam, or fillers
- Use with systemic antibiotics



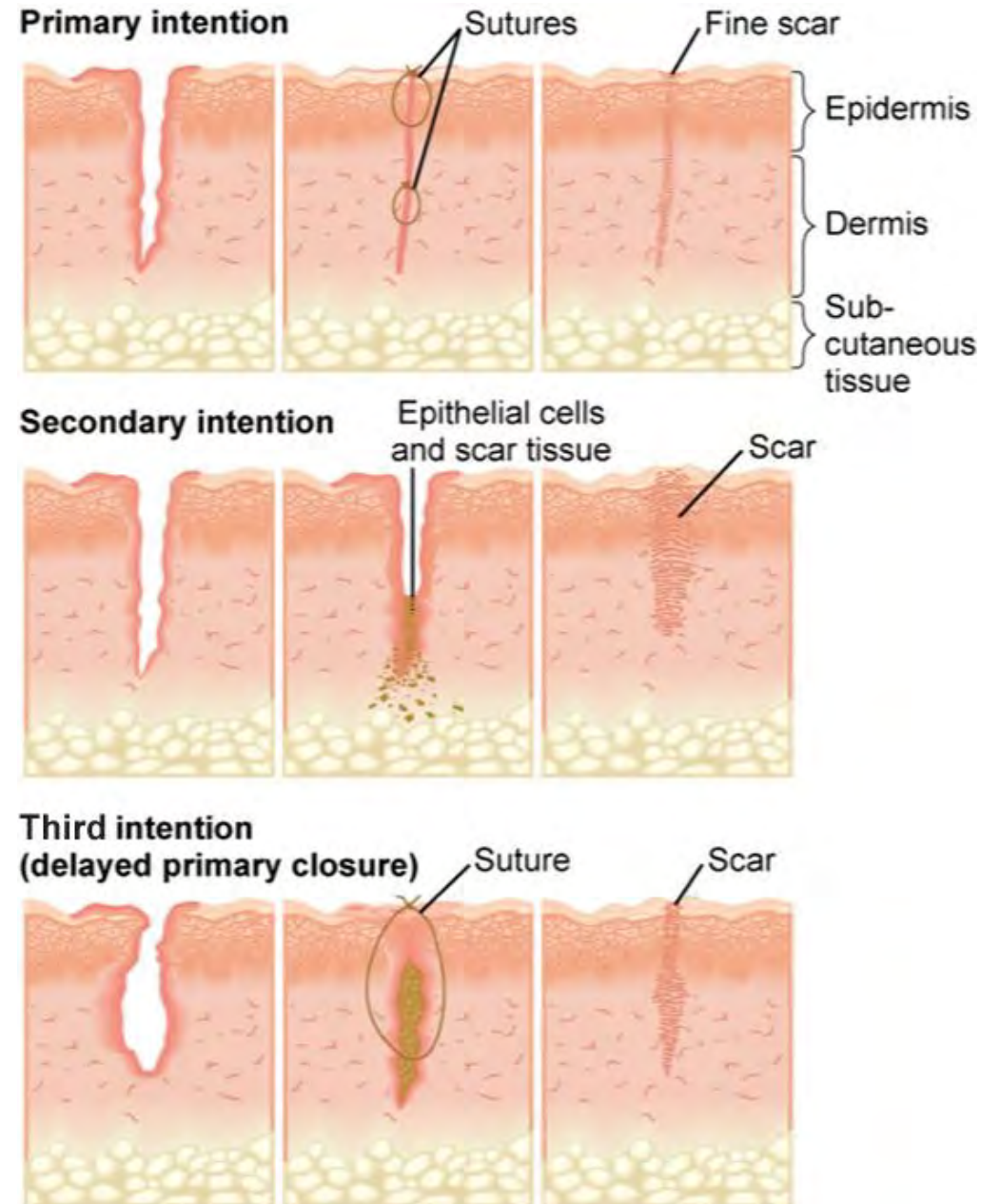
Reconstructive Ladder: Surgical Wound Coverage



Surgical Interventions

Wound Closure

- Primary
 - Minimal tissue loss
 - Edges well approximated
- Secondary
 - Wound granulates and closes on its own
 - Larger scar
- Tertiary
 - Used with contaminated wounds



Skin Graft

Indications

- Permanent replacement for missing or damaged skin
- Temporary wound covering to protect against infection
- Reconstruction for extensive wounds
- Closure of extensive wounds



Full Thickness Grafts for Extensive Tissue Loss



Flaps

Local Flap:

- Tissue is rotated to an adjacent area but retains its original blood supply
- Used when tissue “bulk” is needed to fill contour defects

Free flap:

- Tissue from one area is detached and transplanted to another area
- Blood supply then surgically reconnected to blood vessels adjacent to the wound

Flap Coverage of the Elbow: Latissimus Dorsi Local Transfer Flap



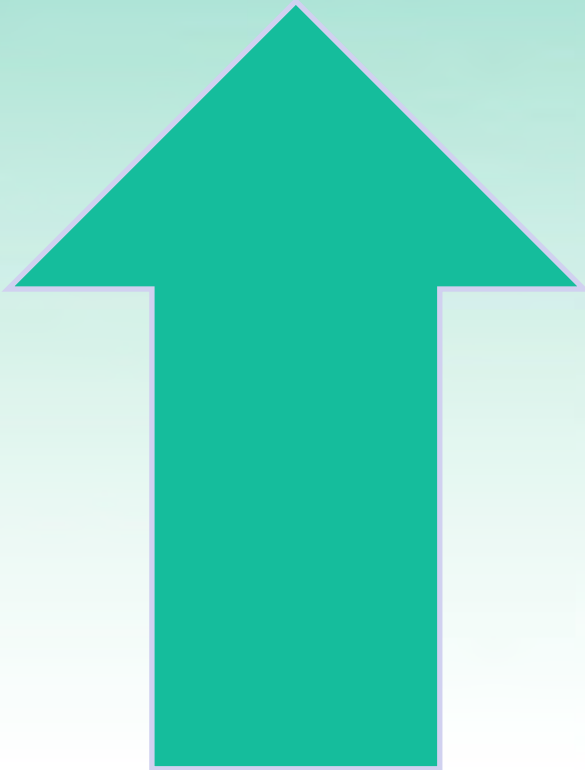
Negative Pressure Wound Therapy

Wound VAC

- Temporary management
- Removes fluid from extravascular space
- Reduced edema
- Improves microcirculation
- Enhances proliferation of granulation tissue
- Open cell polyurethane foam dressing ensures an even distribution



Injury Impact on Nutrition



- Energy Expenditure
- Protein & Amino Acid Requirements
- Metabolic Demand

Essential Nutrients for Wound Healing

- Calories
- Carbohydrates
- Proteins
- Fats
- Vitamin A
- Vitamin C
- Zinc
- Water



Summary

- Meticulous care of soft tissue injuries can have a tremendous impact on patient outcomes.
- Utilizing appropriate measures during each phase of the healing process can prevent complications and promote adequate healing of soft tissue injuries.

Soft Tissue Injuries

1. Skin is critical to survival because it provides what major function related to immunity?
 - A. Retains body heat
 - B. Secretes enzymes that digest proteins, carbohydrates, and fats
 - C. Prevents loss of proteins and assists with regulation of fluids and electrolytes
 - D. Serves as a barrier to invasion by microorganisms and chemicals
2. Abrasion injuries:
 - A. Involve only the epidermis
 - B. Involve only the dermis
 - C. May involve both the epidermis and the dermis
 - D. Never involve the epidermis or the dermis
3. Puncture wounds carry a heightened risk of infection primarily because:
 - A. They result from a stretching or tearing away of the soft tissue.
 - B. They deliver bacteria or foreign inoculum deep into the body.
 - C. They cause widespread tissue destruction.
 - D. They are always closed by primary intention.
4. Local wound anesthesia is:
 - A. Used for repair of digit lacerations
 - B. Used for contaminated wounds
 - C. Is infiltrated directly into the wound
 - D. Injected through intact skin at the wound's edge
5. External hemorrhage is initially treated with:
 - A. Direct pressure on the bleeding site
 - B. Occlusion of the pulses distal to the bleeding site
 - C. Application of a tourniquet
 - D. Administration of blood products
6. The Reconstructive Ladder describes wound closure techniques. What is the simplest technique for wound closure?
 - A. Local flap
 - B. Skin graft
 - C. Free flap
 - D. Primary closure

7. What are the three major phases of wound healing?
 - A. Infection, proliferation, and remodeling
 - B. Bleeding, bruising, and inflammation
 - C. Inflammation, proliferation, and remodeling
 - D. Inflammation, infection, and remodeling

8. Which of the following is a potential cause of traumatic amputation?
 - A. Motor vehicle accidents
 - B. Factory or farm accidents
 - C. Power tool accidents
 - D. All of the above

9. Why are wounds from cat bites at higher risk of infection than wounds from dog bites?
 - A. They are small wounds that trap bacteria inside the skin barrier.
 - B. They are large wounds that provide a larger opening for bacteria to enter the body.
 - C. They are large wounds that provide a larger opening for bacteria to exit the body.
 - D. There is no risk for infection with these wounds.

10. Which essential nutrient promotes healthy DNA structure, cell division, and protein synthesis?
 - A. Proteins
 - B. Vitamin A
 - C. Zinc
 - D. Vitamin C

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References

Soft Tissue Trauma

5th Edition

4X4 Gauze 200 pk. [Wound care dressings]. (n.d.). Spa Source. <https://spasource.com/4x4-gauze-200-pk/>

American College of Surgeons. (2016). *The Hartford Consensus: How to use a tourniquet* [Video]. Youtube. <https://www.youtube.com/watch?v=y81aJ81ln5Q>

American Skin Association. (2020). *Healthy skin*. Retrieved from <https://www.americanskin.org/resource/>

Convatec aquacel ag hydrofiber dressing 1x45 cm 5 pieces. [Wound care dressings]. (n.d.). Optiphar Online Pharmacy. Retrieved from <https://optiphar.com/en/online-pharmacy/convatec-aquacel-ag-hydrofiber-dressing-1-x-45-cm>

Gabriel, A. (2021). *Wound irrigation*. Medscape. Retrieved from <https://emedicine.medscape.com/article/1895071-overview#a1>

Heller, J. L. (2020). *Gunshot wounds – aftercare*. MedlinePlus Medical Encyclopedia. Retrieved from <https://medlineplus.gov/ency/patientinstructions/000737.htm>

Henley, J., Brewer, J. (2013). Newer hemostatic agents used in the practice of dermatologic surgery. *Dermatology research and practice* https://www.researchgate.net/publication/256334052_Newer_Hemostatic_Agents_Used_in_the_Practice_of_Dermatologic_Surgery.

Kaye, A., Abubshair, L. (2020). Trick of the trade: DIY squirt bottle wound irrigation. *Orthopedic, Trauma, Tricks of the Trade*. Retrieved from <https://www.aliem.com/trick-trade-diy-squirt-bottle-wound-irrigation/>

Ma, C. B. (2020). *Traumatic amputation*. MedlinePlus Medical. Retrieved from <https://medlineplus.gov/ency/article/000006.htm>

Stevenson, T., Carr, D. J., Harrison, K., Critchley, R., Gibb, I. E., & Stapley, S. A. (2020). Ballistic research techniques: Visualizing gunshot wounding patterns. *International Journal of Legal Medicine*. <https://doi.org/10.1007/s00414-020-02265-5>

Trauma Nurse Specialist Course Book. (2016). Manuscript, Illinois Department of Public Health.

Wallace, H. A., Basehore, B. M., & Zito, P. M. (2021). Wound healing phases. *StatPearls*.
<https://www.ncbi.nlm.nih.gov/books/NBK470443/>

[Wound care dressings]. (n.d.). DermaRite. Retrieved from <https://dermarite.com/product-category/wound-care/>

Zbrueva, J. V., & Bogomolov, D. V. (2020). Clinical and morphological characteristics of gunshot wound in soft tissues. *Systematic Reviews in Pharmacy*, 11(12).
<https://www.sysrevpharm.org/articles/clinical-and-morphological-characteristics-of-gunshot-wound-of-soft-tissues.pdf>