…. Altered Inflammatory and Immunity

The body's inflammatory response is a reaction of the cell to injury. The primary focus of this response is to neutralize and minimize the effect of the injury so that healing and repair can happen. Early identification of the signs of inflammatory response and the implementation of appropriate interventions place the nurse in a uniquely important position to aid in the healing process for the client.
This lesson focuses on nursing care for inflammation. By completing this learning activity, you will gain the knowledge and skills needed to:

- Model Chamberlain Care® when communicating with clients, families, and other healthcare providers.
- Assess a client for inflammatory responses.
- Identify nursing diagnoses for clients who have inflammation.
- Develop and implement a plan of care to address and intervene in clients with inflammation.
- Evaluate a plan of care to determine the effectiveness and strategize changes that may be needed based on nursing assessment of clients with inflammation.

Inflammatory Response

Acute Inflammation

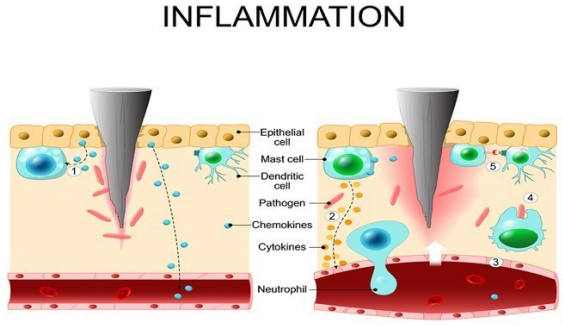
- Neutrophils are the main cell type at the site of inflammation.
- Healing occurs in 2–3 weeks.
- No residual damage occurs.
- Example: swelling at the site of a vaccine injection

Subacute Inflammation

- Falls between acute and chronic, lasting 2–6 weeks
- Example: infectious endocarditis

Chronic Inflammation

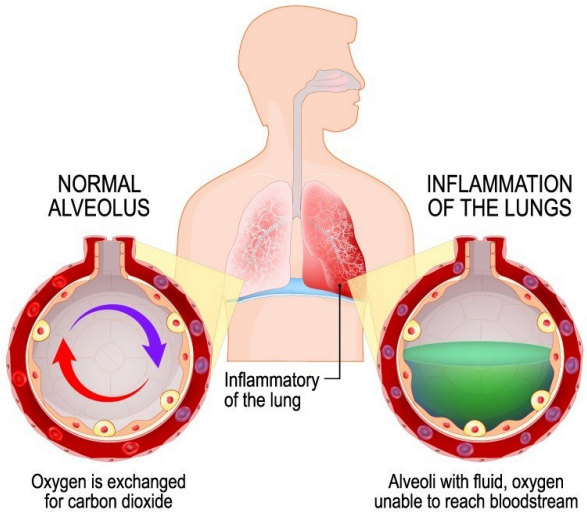
- Lymphocytes and macrophages are the main cells at the site of inflammation.
- Chronic inflammation can last weeks, months, or years.
- Residual damage occurs due to the frequency of inflammation or injury.
- Examples: rheumatoid arthritis, chronic inflammatory response syndrome (CIRS), obesity, allergies



Life Threatening Inflammation

A recent example of an acute inflammatory response is the COVID-19 global pandemic. The SARS-CoV-2 virus attacks the alveolar epithelial cells in the lungs, causing cellular damage and triggering an inflammatory response. The ongoing cellular injury causes a release of pro-inflammatory cytokines, which ultimately create a hyper-inflammatory reaction in multiple organs, including the lungs (Unudurthi et al., 2020).

Since the primary inflammation occurs in the respiratory system, the exudate that collects in the lungs fills the alveoli, decreasing the amount of gas exchange that can occur. Even if the inflammation remains within the lungs, the alteration in gas exchange can be life-threatening.



Clinical Manifestations of Inflammation

Whether occurring deep in the body (e.g., pyelonephritis) or on the surface (e.g., the palm of hands scraped during a fall), the clinical manifestations of inflammation are the same:

- heat (localized warmth or systemic fever)
- redness
- swelling
- pain
- eventual loss of function

Some of these responses can be beneficial in wound healing and infection control or pathological, as in many chronic disease states. Diseases in which inflammation plays a dominant pathological role have the suffix "-itis," such as appendicitis.

Inflammation Biomarkers

When inflammation is present in the body, there will be higher levels of substances known as biomarkers, which can be measured when assessing a client with suspected inflammation-related health alterations. C-reactive protein (CRP) is a biomarker that increases during acute inflammation.

Additional Measurable Mediators and Biomarkers of Inflammation

- acute-phase proteins (e.g., C-reactive protein or CRP)
- cyclooxygenase (COX)-related metabolites
- cytokines (e.g., IL-6 and TNF-alpha) and chemokines
- formation of DNA adducts
- inflammation-related growth factors and transcription factors (e.g., NF-kappaB)
- major immune cell types
- prostaglandins
- reactive oxygen and reactive nitrogen oxide species (ROS and RNOS)

Inflammation is “a local response to cellular injury that is marked by capillary dilatation, leukocytic infiltration (local swelling), redness, warmth, and pain and that serves as a mechanism initiating the elimination of noxious agents and of damaged

tissue" (Merriam-Webster, n.d.-b, Inflammation). Inflammation occurs each time cells are injured, such as when a person cuts a finger when chopping vegetables for dinner.

Infection is "the state produced by the establishment of one or more pathogenic agents (such as bacteria, protozoans, or viruses) in or on the body of a suitable host" (Merriam-Webster, n.d.-a, Infection). Infection occurs only after an infectious agent overwhelms the body's defenses, including inflammation. Signs of infection include warm skin, elevated temperature (fever), and generalized achiness

Inflammatory Exudate
As fluid and leukocytes surround the injury, swelling occurs. When the injury is near the surface of the body and the wound is closed (e.g., burn injury), fluid may collect under the skin in the form of a blister. If the surface injury is open (the skin is not intact), the fluid will leave the body as exudate. The consistency and amount of drainage vary by the severity of the injury, the tissues involved, and the degree of the immune response.

- Serous – Seen in the early stages of inflammation or when an injury is mild; watery looking fluid/discharge
- Serosanguineous – Composed of RBC's and serous fluid, which gives it an semi-clear pink color and may have red streaks
- Hemorrhagic – Frank Blood; results from rupture or necrosis of blood vessel walls
- Purulent (Pus) – Sign of infection; may have an odor; consists of debris (both dead and alive), liquefied dead cells, and white blood cells; can be yellowish-green/gray in color.

Nursing care of inflammation
Prevention –

- Eat a healthy diet.
- Exercise regularly.
- Take routine medical and dental care.
- Avoid injury when possible.
- Wear protective equipment during high-risk activities.

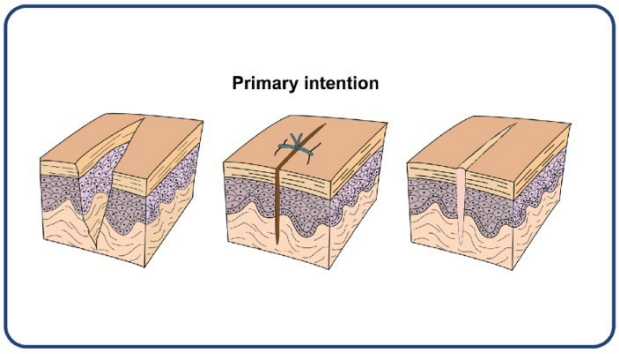
Acute Care –

- Fever
    - Fever is associated with infection but should not be treated if low to moderate (up to 103 °F [39.4 °C]) as it is part of the immune response.
    - Non-steroidal anti-inflammatory drugs (NSAID; e.g., aspirin and ibuprofen) and acetaminophen are used to lower fever, if needed.
    - Older adults and clients who are immunocompromised may not experience fever with inflammation, so other indicators should be assessed.
- Soft tissue injuries (e.g., sprains and strains) are treated using the acronym RICE (rest, ice, compression, and elevation).
- Reddened skin indicates altered blood flow to the injured area. To avoid injuring the tissue, do not massage reddened skin.

Healing

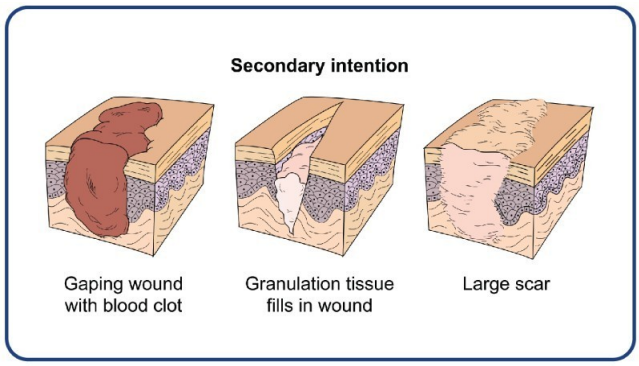
Primary Intention Healing

If an individual goes to the emergency department and has sutures placed, the injury will heal and result in a fine scar. This is primary intention healing.



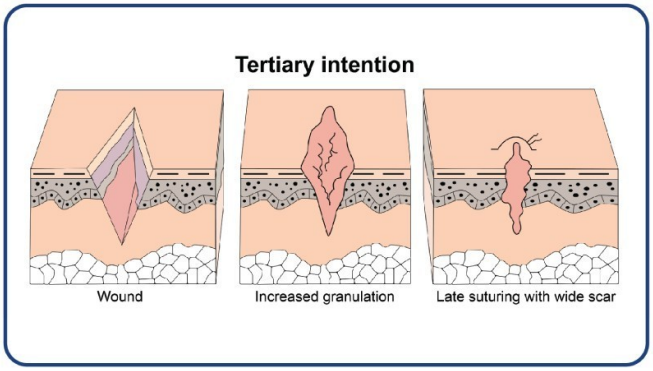
Secondary Intention Healing

If an individual leaves the injury alone and decides not to seek treatment, the body will create a blood clot to help heal itself. Granulation tissue will form on the bottom of the wound bed and heal itself from the inside out until the wound is filled in. The client may have a larger scar from this healing process. This is secondary intention healing.



Tertiary Intention Healing

The person forgets the injury is there and the wound becomes infected. (What type of exudate is likely to be present?) They then seek treatment and the infection is treated. Granulation tissue will form, just as in secondary intention healing, but then the wound is sutured closed to prevent further infection. This is tertiary intention healing and commonly results in a scar that is larger and deeper than primary or secondary intention.



As the inflammatory reaction ends, healing begins by either regeneration or repair. Healing by regeneration occurs as damaged cells and tissues are replaced with healthy cells of the same type.

Healing by repair, the most common form of healing, occurs when the lost cells and tissues are replaced with connective tissue. Repair usually results in the formation of scar tissue.

It is important to remember that scar tissue, while filling in the space and helping close the wound, will not function like the healthy tissue that was lost. Scar tissue is inflexible and will not stretch or maneuver in the way the original tissue did, so the client may have deficits or complications like a change in mobility or range of motion for external scar tissue or a decrease in function (after myocardial infarction [MI], inflexible scar tissue replaces the lost cardiac muscle cells causing the heart to pump less effectively).

Complications of Healing

Hypertrophic Scarring

Hypertrophic scarring comes from an overabundance of connective tissue and collagen trying to repair the wound bed. This scar is raised, but stays within the borders of the injury. Over time, hypertrophic scars will recede.

Keloid Scars

Keloid scars are an overproduction of collagen and scar tissue that extends beyond the edges of the wound. This is a permanent scar, with a chance of recurrence with all injuries. This occurs most often with dark-skinned clients, particularly African Americans.

Dehiscence

Dehiscence is the separation and disruption of previously joined wound edges. In this example, the suture line from the client's injury has separated. This is commonly paired with the concept of evisceration, or when the wound edges separate so much that organs actually protrude through the wound itself.

Emotional Response to Wounds

Several factors related to wounds can affect the client's emotional response, including:

- scarring or deformity
- strong or offensive odor of wound drainage
- amount of wound drainage and frequency of dressing changes
- fear of how others will react to the wound, odor, drainage, or scarring

While caring for a client with an extensive or non-healing wound, it is important for the nurse to remain calm and keep nonverbal behaviors consistent with professional standards. Facial expressions, like scrunching the nose or widening the eyes dramatically, may be interpreted by the client as disgust or a lack of care. While it is not always possible to control every reaction, the nurse should be open when communicating with the client and discuss how the client feels about the wound.

Basics of Wound Care

For proper healing, a wound needs to be clean, moist, and have the nutrients required to heal. Priority goals for wound care include the following:

- Protect a clean wound from trauma and infection so that it can heal normally.
- Remove dirt and debris from a contaminated wound using clean water and mild soap, then pat dry with a clean cloth.
- Cover the wound to retain moisture and promote healing, as a wound that is too dry or too wet will not heal well.
- If large amounts of drainage are present, use an absorbent dressing and change it frequently to prevent an over-wet wound bed.
- Treat infection to prepare an infected wound for healing.
- Promote rest, hydration, and optimal nutritional intake during healing.

Superficial Wounds

Superficial wounds, such as scrapes and cuts, should be cleansed with water and mild soap, patted dry, and covered to keep the surface clean and moist. The bandage should be removed daily (or as needed) to cleanse the wound, inspect for signs of infection or delayed healing, and covered until it is closed.

Deep Wounds

Deeper wounds, or those that will not stop bleeding, should be assessed and treated by a healthcare provider. Treatments can include:

- medications to ease pain (both from the wound itself and treatment provided)
- deep clean of the wound
- closing the wound using sutures, skin glue, or adhesive strips
- covering the wound with specialty dressings

Contaminated Wound Care

A wound that remains contaminated (or "dirty") after cleansing, as well as one that becomes infected while healing, needs to be cleaned before healing can naturally occur. Debridement is one method to clean a contaminated wound.

Surgical Debridement

Surgical debridement is a surgical procedure that can be done in an office, treatment center, or surgical suite. The procedure is a quick way to clean the wound bed by

removing large foreign objects (e.g., gravel or splinters), nonviable tissue, or infected tissue to leave a clean wound bed for natural healing.

Mechanical Debridement

Mechanical debridement is used to remove contamination over time and can be done in several ways.

Wet-to-dry dressings use sterile dressing material soaked in a sterile liquid (such as normal saline), placed into the wound, and allowed to dry. When the dry dressing is removed, the contamination is removed.

Wound irrigation uses a sterile liquid (such as normal saline) or solution (e.g., Dakin's solution or antibiotic solution) to wash contaminants from the wound bed.

Managing Excessive Wound Drainage

Many specialty dressings, such as alginates and foams, can absorb large amounts of exudate from a wound. For wounds with a large amount of drainage, negative pressure can be used to remove excess wound exudate to decrease excess moisture while leaving the wound bed moist enough to heal properly. Both low- and high-tech options are available to remove the fluid.

Compression drains, such as a Jackson-Pratt (JP) drain, are low-tech means to apply negative pressure. Using a compressible bulb connected to the wound by tubing, the JP drain is placed in the wound during a surgical procedure. The bulb should remain compressed and be emptied as needed. After emptying, compress the bulb before closing the drainage port. The bulb should always remain compressed to be effective.

Negative pressure wound therapy (NPWT), often called a "wound vac," creates continuous or intermittent negative pressure inside the wound bed to remove fluid, exudate, and infectious debris so the wound can heal and close. The negative pressure also increases blood flow to the wound bed, increasing the nutrients and oxygen needed for healing.

With this intervention, thick foam is cut to the size of the wound. Next, it is inserted into the wound bed and a sizeable occlusive dressing is placed tightly over it. Next, a small opening is made in the occlusive dressing to attach the drainage tubing to the vacuum pump. Once turned on, the pump creates negative pressure in the wound bed, causing the foam and occlusive dressing to shrink—like vacuum-sealed food.

It is imperative that the occlusive dressing is sealed on all sides. If the dressing is not occlusive, the vacuum pump of the NPWT cannot create appropriate negative pressure in the wound, rendering the therapy useless. In addition, it is essential to monitor the client's protein levels and electrolyte and fluid balance due to the potential loss from the wound.

Nutrition, Oxygen, and Wound Healing

Nutrients for Healing

- Water loss occurs through perspiration, exudate formation, and increased metabolism rate, so care must be taken to maintain optimal hydration. If the client is unable to maintain hydration and nutrition through oral intake, enteral or parenteral options should be considered.
- A diet high in protein, carbohydrates, and vitamins is needed to promote wound healing.