Chapter 3
Inflammation and Repair

Learning Objectives

• List characteristics and clinical manifestations
  – Acute inflammation
  – Types of exudates: serous, purulent, fibrinous, hemorrhagic
• Describe possible outcomes of an inflammatory reaction and its harmful effects
• Explain chemical mediators of inflammation and role in intensifying the inflammatory process
• Compare inflammation and infection

Inflammatory Reactions

• A nonspecific response to any agent that causes cell injury
• Agents may be
  – Physical (heat or cold)
  – Chemical (concentrated acid)
  – Microbiologic (bacterium or virus)

Local and Systemic Effects of Inflammation

• Local effects
  – Capillary dilatation
    • Increased blood flow, increased warmth and redness
  – Increased capillary permeability, leading to extravasation of fluid, leading to swelling
  – Attraction of leukocytes
    • Migrate to site of injury
    • Adhere to endothelium of small blood vessels
• Systemic effects: fever, leukocytes

Characteristic Signs of Inflammation

• Heat and redness
  – Dilated blood vessels and slowing of blood through vessels
• Swelling
  – Accumulation of fluid and exudate due to extravasation of plasma
• Tenderness and pain
  – Irritation of nerve endings
Inflammatory Process (1 of 2)

• Acute inflammatory process
  – Polymorphonuclear leukocyte cell
    • Most important cell in acute inflammatory response; actively phagocytic cell
    • Mononuclear cells (monocytes, macrophages) follow later to clean up tissue debris

Inflammatory Process (2 of 2)

• Severe inflammatory process
  – Systemic effects become evident (feeling ill, fever)
  – Bone marrow accelerates production of leukocytes resulting in increased levels in bloodstream
  – Liver produces acute phase proteins such as C-reactive protein
• Mild inflammatory process
  – Self-limiting, subsides with tissue resolution

Outcome of Inflammation

• Depends on amount of tissue damage
  – Severe inflammatory process
    • Tissue damage → replacement of damage cells → heal with scarring
  – Mild inflammatory process
    • Self-limiting, subsides with tissue resolution

Outcome of Inflammation

• Outcomes
  – Resolution
  – Repair
  – Areas of destruction replaced by scar tissue
  – Mediators intensify inflammatory process
  – Mediators generate more mediators

Exudate

• Fluid mixture of protein, leukocytes, and tissue debris
• Proportion of protein and inflammatory cells vary
• Serous: primarily fluid, little protein
• Purulent: largely inflammatory cells (pus)
• Fibrinous: rich in fibrinogen; coagulates and forms fibrin; produces a sticky film on surface of inflamed tissue
• Adhesions: bands of fibrous tissue that bind adjacent tissue together
• Hemorrhagic: increased red blood cells
Chemical Mediators of Inflammation

1. Chemical agents that intensify the inflammatory process
2. Cell-derived mediators
   - Mast cells: specialized connective tissue cells with granules filled with histamine, a vasodilator
   - Histamine and serotonin: also in blood platelets
   - Prostaglandins
   - Leukotrienes: synthesized from arachidonic acid

Mediators from blood plasma
- Bradykinin
- Complement
  - Activated by antigen-antibody reaction
  - Series of proteins that interact in a regular sequence

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Lysosomal Enzymes and Antigen-Antibody Reaction

- Lysosomal enzymes
  - From cytoplasm of phagocytic cells neutrophils and monocytes that can digest protein material
- Antigen-antibody reaction
  - Activates complements generating mediators
- Harmful effects of inflammation
  - Tissue injury results in part from the injurious agent and the inflammatory reaction itself
  - Adrenal corticosteroids: used to suppress a persistent inflammatory

Infection

- Inflammatory process caused by disease-producing organisms
- “itis”: suffix indicates an infection or inflammatory process such as appendicitis, hepatitis, colitis
- Cellulitis: acute spreading infection at any site
- Abscess: infection associated with breakdown of tissues, formation of pus

Infection

- Septicemia: overwhelming infection where pathogenic bacteria gain access to bloodstream
- Pathogenic: capable of producing disease
- Virulence: a measure of severity of disease
- Host: affected individual or animal
Infection

- Factors influencing the outcome
  - Virulence of organism
  - Numbers of invading organisms
  - Host resistance

Chronic Infection

- State in which the pathogenic organism and the host are evenly matched
- Relatively quiet, smoldering inflammation, associated with repeated attempts of the body at healing
- Predominant cells: lymphocytes, plasma cells, and monocytes

Discussion

1. How do the mediators of inflammation function?
2. What are the possible outcomes of an inflammation?
3. An exudate high in fibrinogen can coagulate producing fibrin that causes a sticky film on tissues that causes normally separate tissues to adhere together. This results from the production of:
   - Serous exudate
   - Purulent exudate
   - Fibrinous exudate
   - Hemorrhagic exudate
   - None of the above