Histopathology

Lecture 4

Inflammation

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Inflammation

The survival of all organisms requires that they eliminate foreign invaders, such as infectious agents, and damaged tissues. These functions are mediated by a complex host response called **inflammation.**

Inflammation represents a complex sequence of events that stimulates immune responses, it involves vascular and cellular components and a variety of soluble substances.

Tissue damage caused by a wound or by an invading pathogenic microorganism induces a complex sequence of events collectively known as the ***inflammatory response.***

- A molecular component of a microbe, such as Lipopolysaccharides LPS, may trigger an inflammatory response via interaction with cell surface receptors.
- The end result of inflammation may be the organizing of a specific immune response to the invasion or clearance of the invader by components of the innate immune system.
- The aim of inflammation is to bring more blood to the damaged area by acceleration of the blood stream.

- *Inflammation can be potentially harmful.*
- *Inflammation serves to:*

1- *Destroy, dilute or wall off the injurious agent.*
2- *Induces repair.*
3- *Protective response.*

The causes of inflammation (etiology).

1-Infections (bacterial, viral, fungal, parasitic) .

2-Trauma caused by various physical and chemical agents (e.g., thermal injury, such as burns or frostbite; irradiation; toxicity from certain environmental chemicals) injure host cells and elicit inflammatory reactions.

3- Tissue necrosis (from any cause), including ischemia and physical and chemical injury

4-Foreign bodies (splinters, dirt, sutures, crystal deposits)

5-Immunologic reactions: (also called *hypersensitivity reactions*) against environmental substances or against "self" tissues.

ACUTE INFLAMMATION

The external manifestations of acute inflammation, often called its cardinal signs :

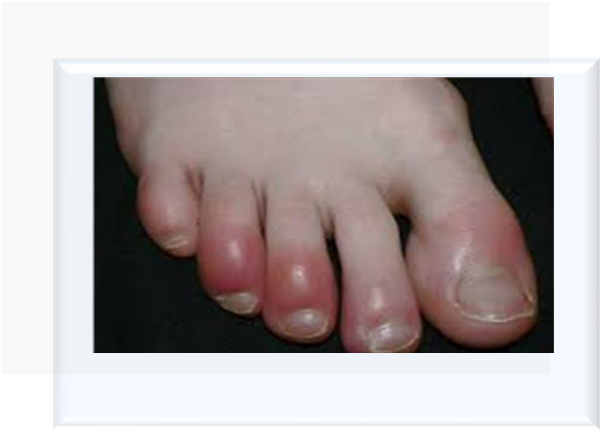
1- heat (calor),

2- redness (rubor),

3- swelling (tumor),

4- pain (dolor),

5- loss of function.

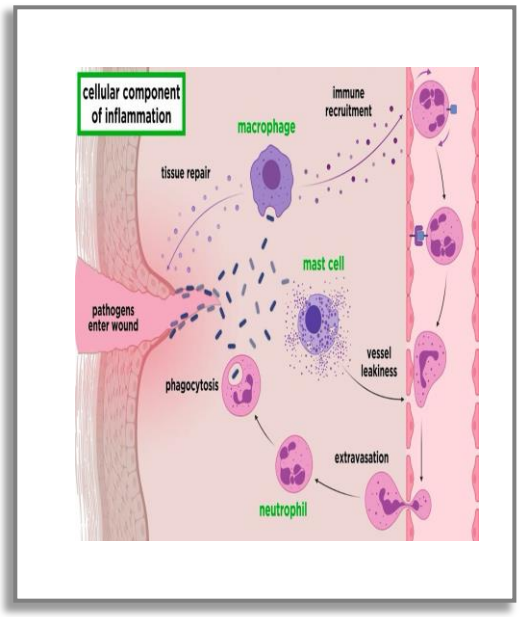


Causes of acute inflammation: Infection, trauma, physical and chemical agents, necrosis, foreign bodies, and immune reactions.

The cardinal signs of inflammation reflect the many events of an inflammatory response:

(1) ***Vasodilation***—an increase in the diameter of blood vessels—of nearby capillaries occurs as the vessels that carry blood away from the affected area constrict, resulting in distension of the capillary network. The puffy capillaries are responsible for tissue redness (*erythema*) and an increase in tissue temperature.

(2) ***increase in capillary permeability*** facilitates an influx of fluid and cells from the engorged capillaries into the tissue. The fluid that accumulates **(exudate)** has a much higher protein content than fluid normally released from the vasculature. Accumulation of exudate contributes to tissue swelling **(edema)**.



(3) ***Influx of phagocytes*** from the capillaries into the tissues is facilitated by the increased permeability of the capillaries.

- The emigration of phagocytes is a multistep process that includes adherence of the cells to the endothelial wall of the blood vessels **(margination)**, followed by their emigration between the capillary endothelial cells into the tissue **(extravasation)**, and, finally, their migration through the tissue to the site of the invasion **(chemotaxis)**.
- As phagocytic cells accumulate at the site and begin to phagocytose bacteria, they release lytic enzymes, which can damage nearby healthy cells.
- The accumulation of dead cells, digested material, and fluid forms a substance called pus.

Chemotaxis

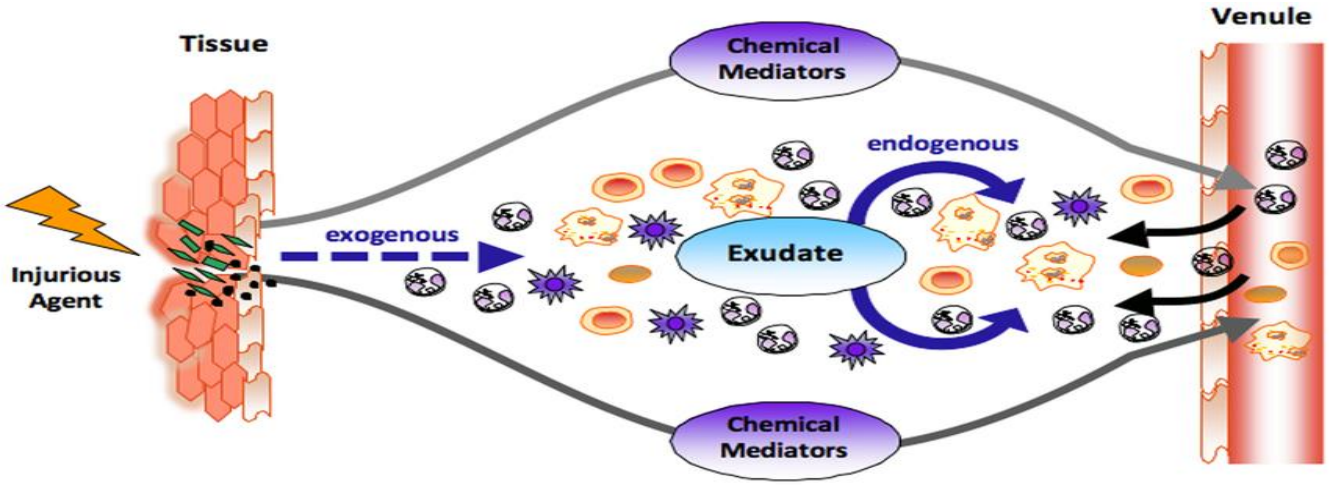
Basic description: Process by which white blood cells are drawn to the site of inflammation.

Mediators

Mediators : are the substances that initiate and regulate inflammatory reactions.

■ Exogenous mediators: Bacterial polysaccharides.

■ Endogenous mediators: C5a, leukotriene B4 (LTB4), and IL-8. The endogenous mediators act through various mechanisms.



OUTCOMES OF ACUTE INFLAMMATION

Overview: Outcomes of acute inflammation include resolution, abscess formation, ulcers, fistula formation, chronic inflammation, and scar formation.

Resolution

Basic description: The inciting agent is removed, and all damage done by the inciting agent and inflammatory cells is repaired.

Requirements for resolution: The organ affected must be capable of regeneration, and the body must be capable of completely dealing with the inciting agent

Abscess (Figure 1- A and B)

Basic description: Walled off collection of pus (neutrophils and necrotic debris).

Location: Any organ in the body

Complications of an abscess: Pain, fever, rupture, and swelling.

Ulcer (Figure 2)

Basic description: Loss of the mucosa and deeper tissues. If only the mucosa is lost, the correct term is an erosion.

Location: Most commonly seen in the gastrointestinal tract.

Complications of an ulcer: Pain; hemorrhage.

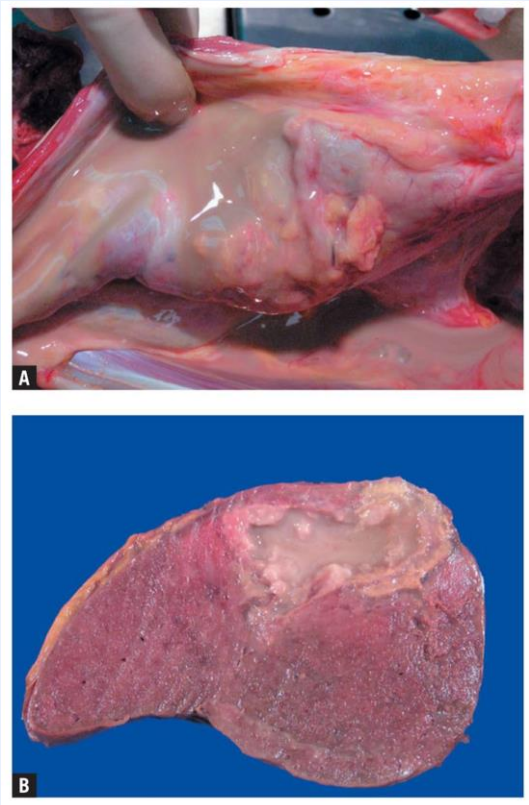


Figure 1. Abdominal wall and splenic abscesses. An abscess is a walled-off collection of pus. A, The abscess is in the right side of the abdominal wall. B, The abscess is in the spleen. Abscesses can rupture and release their contents (including bacteria) into body cavities and hollow organs, such as the gastrointestinal tract.

Fistula (Figure 3 A, B, and C)

Basic description: Anomalous patent connection between two organs; most commonly organs with a lumen.

Example: Enterocutaneous fistula (skin to colon, occurring in colon cancer or inflammatory bowel disease).

Complications: Depends upon the nature of the two organs involved.

Chronic inflammation

Scar formation

Basic description: Replacement of lost parenchyma with disorganized connective tissue .

Complications: Loss of function.

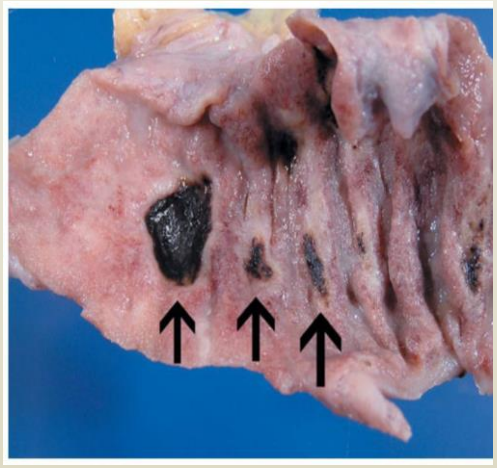


Figure 2. Duodenal ulcers. The arrows indicate superficial ulcers in the duodenum.

CHRONIC INFLAMMATION

Overview: Prolonged inflammation consisting of active inflammation and tissue destruction and repair. Chronic inflammation can follow acute inflammation.

Causes of chronic inflammation: Viral, persistent microbial infection, prolonged exposure to toxin, and autoimmune dysfunction.

Cells involved in chronic inflammation: Macrophages and lymphocytes.

Important type of chronic inflammation: Granulomatous inflammation

■ **Basic description of granuloma**: Collection of epithelioid histiocytes.

■ **Morphology of granuloma**: Collection of activated macrophages (i.e., epithelioid histiocytes); can have multinucleated giant cells .

■ **Causes**: Mycobacteria, fungi, foreign material, and sarcoidosis.

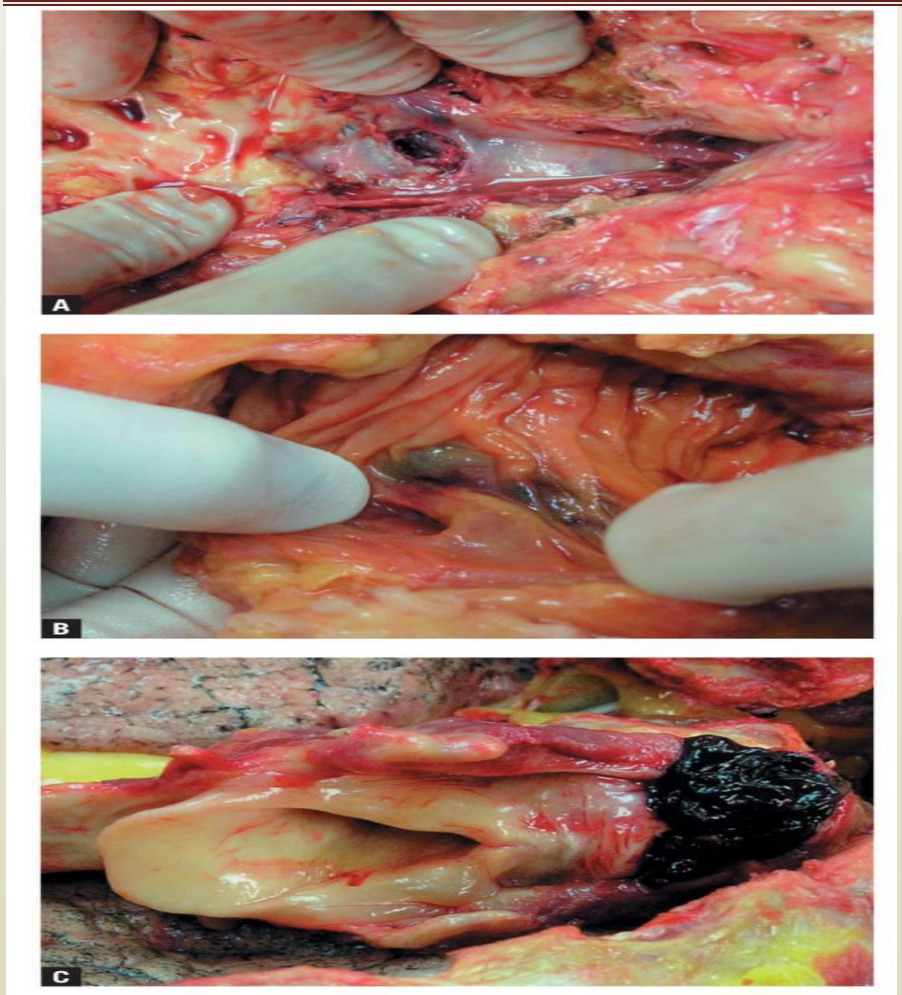


Figure 3. Aortoduodenal fistula. This patient had an abdominal aortic aneurysm, which was repaired with a graft. The graft became infected and was surgically replaced with a neointimal saphenous vein graft, which also became infected. A tract developed between the neointimal graft and the duodenum. There is a defect in the neointimal aortic graft (A) (center of the photograph), which communicated with the duodenum (B) through a fistula, resulting in a massive amount of blood entering the gastrointestinal tract, which is visible in the esophagus of the patient (C).