

# Inflammation

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## OBJECTIVES/RATIONALE

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Inflammation is a normal response to infection or injury and is considered one of the body's defensive mechanisms. The student will define inflammation, state its purpose, and identify the phases of response to injury.

TEKS: 121.15 (c) 4(A-E), 5A-D), (A-D), 7 (A-D)

TAKS: ELA 1, 4  
Science 1, 2

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## KEY POINTS

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### I. The Cell

- A. Most signs of disease can be traced back to damage of individual cells and their attempts at repair - in order to understand what is happening when a person is ill, one must first comprehend the events at the basic level of the cell or sometimes in the area of biochemistry.
- B. The cell is the foundation of the structure of the human body. It is seen as a self-sustaining factory that carries on all processes of life
  - a. respiration
  - b. use & production of energy
  - c. reproduction
  - d. elimination
- large group of cells that join together for a specific activity is called *tissue*
- D. different tissues that join together for a specific function is called an *organ*
- E. organs that perform together for a specific function is called an *organ system*
- F. Cell Dysfunction = Organ Dysfunction = Clinical Disease

### II. Cellular Injury

#### A. Inflammation

- a. **Definition:** the body's response to injury
- b. **Purpose**  
**Goal**

Limiting factor of inflammation: cannot occur in tissue that does not have a blood supply

- a. This factor is important in forensic medicine because evidence of inflammation in tissue confirms that an injury occurred while the individual was alive.
  - b. If no evidence exists, the pathologist can be assured that the person was dead when the injury was inflicted.
- C. When Tissue is Destroyed by an Injury  
The inflammatory process will only occur along borders of injury where blood supply is maintained, i.e. gangrene
- D. Inflammation is Designed to be an Beneficial Protective Mechanism - in some instances reaction may become so intense that it becomes harmful to tissues.
- E. Inflammation vs. Infection
- a. Where as inflammation is a response to injury, infection is the invasion of living tissue by pathogens.
  - b. An infection causes inflammation, but tissue that is inflamed may not be infected. Therefore, inflammation may exist without the presence of microbial pathogens, i.e. sunburn

## F. Inflammatory Process

- a. The cells of the immune system are widely distributed throughout the body, but if infection or tissue damage occurs it is necessary to concentrate them and their products at the site of damage. Three major events occur during this response:

- 1) **Congestion** phase: Initially, the capillaries become engorged and dilated with blood. - this increases capillary permeability caused by the reaction of the endothelial cells.

- 1) **Leakage**

Leukocytes migrate

out of the capillaries into the surrounding tissues.

In the earliest stages of inflammation, neutrophils are particularly prevalent, but later monocytes and lymphocytes also migrate towards the site of infection.

- 2) **Phagocytosis**

## G. Two Major Categories of Inflammation: Acute and Chronic

- a. Acute inflammation– a condition of sudden onset; if resolved, lasts a relatively short time  
Characteristic Signs that Accompany Acute Inflammation (referred to as *cardinal signs*)

1. Redness
2. Swelling
3. Pain
4. Increased warmth or heat
5. Loss of movement or function

- b. Chronic inflammation– refers to a long duration (weeks, months, years, or even a lifetime)
  - i. Example of chronic diseases: asthma, allergy or hay fever, diabetes, etc.
  - ii. Chronic conditions often worsen (chronic progressive diseases) as result of aging process, environment, and cumulative damage of inflammation process

## H. Serous fluids associated with inflammation

- a. Serous Transudates - serum fluid that passes through membrane or tissue (very watery with low protein content)
  - i. Due to increased hydrostatic or decreased osmotic pressure in vascular system
  - ii. Example: pulmonary edema - fluid filling lungs during congestive heart failure (result of decreased osmotic pressure)
  - iii. Inflammatory reactions involving pleural, pericardial, and peritoneal cavities are associated with serous discharge
- b. Serous Exudates - serum fluid that is cloudy, thick, protein-rich fluid
  - i. created by decreased hydrostatic pressure and increased osmotic pressure
  - ii. Example: most common in acute inflammations such as minor burns (resulting in formation of blisters)
  - iii. Fibrinous exudate produces layer of fibrinogen, which forms a mesh of fibrin and becomes a scab.
- c. Purulent exudate – pus producing fluid
  - iv. referred to as pyogenic (*pyo*                      *genic*)
  - v.

## I. Inflammatory Lesions - inflammatory reactions result in production of lesion - lesions vary according to level of severity

- b. Types of lesions:

localized spherical lesion filled with pus and pyogenic bacteria (usually staphylococci)

- i. usually found in many areas of body including: skin (boils: furuncles and carbuncles), teeth, appendix, bowel, breast, and lung
  - ii. empyema – pus that fills pleural cavity
2. cellulitis – spreading, diffuse infection most commonly involving streptococcal infection of subcutaneous tissues (body is unable to confine infection to localized area) - characterized by congestion and edema
3. ulcers – depressed or excavated lesions on skin or mucosa
  - i. may appear almost anywhere in body and may involve many types of organs
  - ii. stomach and duodenum may be ulcerated by gastric acids
  - iii. pressure sores (decubitus ulcers) result from wasting away of tissue in bedridden patients

J. Tissue Repair

- a. definition – body’s attempt to return to normal
- b. two primary types of repair: **regeneration**      **fibrous connective tissue regeneration**

**fibrous connective tissue repair**

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**ACTIVITIES**

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- I. Select an injury or inflammatory disease and present a multimedia presentation to the class showing the site of injury, the signs of inflammation and the healing response.
- II. Have students prepare a diagram on stages of tissue repair.

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**MATERIALS NEEDED**

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Key Terms.

<http://www.meddean.luc.edu/lumen/MedEd/medicine/dermatology/skinlsn/skini.htm> - site for reinforcement review of the skin; good slides and descriptions

Starter Sites for enrichment reports:

- <http://www.lightwarriorproducts.com/Silverlon%20case%20study.htm> - good case study page for reports of *Silverlon*

- [http://www.dermatologytimes.com/HMT\\_5/spot.html](http://www.dermatologytimes.com/HMT_5/spot.html) - nice site for hyperbarics and wound care,  
 - <http://www.dermatologytimes.com/dermatologytimes/article/articleDetail.jsp?id=39900> - very interesting article over low-level lasers which promote quicker healing

- <http://www.dermatologytimes.com/dermatologytimes/article/articleDetail.jsp?id=33184> - article that discusses possibilities of using *Creatine* to help prevent UV damage to skin

- <http://huntley.ucdavis.edu/tumors/wound.html> - starter site for steroid injections and healing

- <http://www.hopkinscme.org/woundmanagement/woundhealing.html> - wound healing and prenisone

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Successful completion of Inflammation Quiz.

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For reinforcement, the student will define Key Terms.

For enrichment, the student will research and write a report over one of the following: effects of vitamin E on wound repair, \_\_\_\_\_ for healing, steroid injections to reduce scarring, hyperbaric oxygen and wound healing, effects of prednisone on wound healing, low-level lasers for quicker healing, can *Creatine* prevent UV damage and repair skin tissue?

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## REFLECTIONS

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## KEY TERMS

1. gangrene -
2. pathogens -
3. microbe -
4. capillary -
5. permeability –
6. endothelial cells or endothelium -
7. leukocytes -
8. neutrophils -
9. monocytes -
10. lymphocytes -
11. serum fluid or serum -
12. hydrostatic -
13. osmotic pressure
14. pleural -
15. pericardial -
16. peritoneal -
17. transudates -
18. exudates -
19. purulent -
20. lesion -
21. pyogenic -
22. abscess -
23. cellulitis
24. empyema
25. edema -
26. decubitus ulcers -

27. furuncles -

28. carbuncles -

29. duodenum -

30. necrosis -

## ANSWERS: KEY TERMS

1. gangrene – local death and decay of soft tissues of body as a result of lack of blood to the areas
2. pathogens – something that can cause disease such as virus, bacterium, fungus, etc.; germs
3. microbe – a microscopic organism
4. capillary – an extremely narrow thin-walled blood vessel that connects small arteries with small veins to form a network throughout the body
5. permeability – the rate at which something such as a liquid passes through a membrane or other medium
6. endothelial cells or endothelium – a layer of cells that lines the inside of certain body cavities (e.g. blood vessels)
7. leukocytes – white blood cell which helps protect body against infection in the immune response
8. neutrophils – the most common type of white blood cell; engulf bacteria and cellular debris; an increase occurs in acute infections
9. monocytes – white blood cell that functions in gestation of bacteria and other foreign particles
10. lymphocytes – white blood cell that occur in two forms: B cells and T cells
11. serum fluid or serum – clear watery fluid exuded by serous membranes
12. hydrostatic – relating to fluids that are at rest and the forces and pressures they exert
13. osmotic pressure – pressure that must be applied to solution to stop the inward diffusion of solvent by osmosis through a semipermeable membrane
14. pleura – the thin transparent membrane that lines the chest wall and doubles back to cover lungs, thereby forming a continuous sac enclosing the narrow pleural cavity
15. pericardial – pertaining to the fibrous membrane that forms a sac surrounding the heart and attached portions of main blood vessels
16. peritoneal – pertaining to the smooth transparent membrane that lines the abdomen and doubles back over the surfaces of the internal organs to form a continuous sac
17. Transudates – fluid that passes through a membrane into intercellular space or capillary wall
18. Exudates – slow escape of fluids and cellular matter from blood vessels or cells through small pores or breaks in cell membranes (sometimes result of inflammation)
19. purulent – containing or consisting pus
20. lesion – general term used to describe any local abnormality of tissue
21. pyogenic – pus producing

22. abscess – puss-filled cavity resulting from inflammation and usually caused by bacterial infection
23. cellulitis – inflammation of tissue, especially that below the skin (subcutaneous tissue); characterized by redness, pain, and swelling; treated with antibiotics
24. empyema – pus in lung (or other cavity) usually due to bacterial infection; treatment with antibiotics and surgical drainage
25. edema – swelling due to an abnormal buildup of serous fluid between tissue cells
26. decubitus ulcers – inflammation or sore on skin over a bony prominence; “bed sore”
27. furuncles – a boil in the skin that has a core of dead tissue and surrounding inflammation; caused by bacterial infection through sweat glands or hair follicle
28. carbuncles – a multi-headed boil
29. duodenum – the first short section of the small intestine that comes off the stomach
30. necrosis – the death of cells in a tissue or organ caused by disease or injury

Name \_\_\_\_\_

Date \_\_\_\_\_

Period \_\_\_\_\_

### Quiz: Inflammation

- \_\_\_\_\_ 1. The process where leukocytes engulf & digest bacteria is called:  
a. leukocytosis  
b. pathogenolysis  
c. hydrostatic pressure  
d. phagocytosis
- \_\_\_\_\_ 2. Disease causing microorganisms are known as:  
a. pathogens  
b. bacteria  
c. microbes  
d. monocytes
- \_\_\_\_\_ 3. Inflammation is designed to be a protective defensive mechanism.  
a. true  
b. false
- \_\_\_\_\_ 4. Acute inflammation can be defined as:  
a. a purulent exudate  
b. a condition of long duration  
c. a condition of sudden onset  
d. an asthmatic incident
- \_\_\_\_/\_\_\_\_ 5. Two types of boils are:  
a. carbuncles  
b. furuncle  
c. abscess  
d. mynocyte
- \_\_\_\_\_ 6. Pus in the lung is called:  
a. emphysema  
b. empyema  
c. pyogenic  
d. endothelium
- \_\_\_\_\_ 7. Which of the following is a \_\_\_\_\_ ?  
a. boil  
b. burn  
c. cut  
d. all
- \_\_\_\_\_ 8. A decubitous ulcer can be described as:  
a. sublingual attrition  
b. a mucosal erosion  
c. a gastric lesion  
d. a bed sore
- \_\_\_\_\_ 9. The inflammatory process will only occur along borders of injury where blood supply.  
a. true  
b. false
- \_\_\_\_\_ 10. A localized spherical lesion filled with pus and pyogenic bacteria describes:  
a. cellulitis  
b. a pressure sore  
c. gangrene  
d. an abscess

Key: Inflammatory Process Quiz

1. **d**

2.

3.

4. **c**

5. , **b**

6.

7.

8.

9.

10.