

## Pathology, Mechanisms of Pathogenicity and Disease-Causing Agents

### 1. Define:

**Pathology** – Pathos = suffering. Pathology may be defined as the science or study of disease that deals with the etiology, pathogenesis and structural and functional changes brought about by disease.

**Latent disease** – A disease is categorized as latent if the etiological agents exist for long periods of time (months or years) in an inactive state. When the disease-causing agents are activated (due to stress, the presence of another microbe, immune suppression, etc.) they often bring about acute disease symptoms.

**Septicemia** – Septicemia is a condition existing when bacteria (or fungi such as *Candida* or *Cryptococcus*) are reproducing within the bloodstream and are causing disease symptoms. The term sepsis (Greek, meaning putrefaction and decay) is a potentially fatal body-wide inflammation caused by severe infection.

**Leukocidin** – Leukocidin is a type of cytotoxin (exotoxin), produced by certain bacteria, and capable of causing the death of leukocytes, specifically phagocytic WBCs such as monocytes (macrophages) and neutrophils. One specific example is Panton-Valentine leukocidin, a toxin produced by most community-associated Methicillin-resistant *Staphylococcus aureus* (CA-MRSA) strains isolated.

**Tetanospasmin** – Tetanospasmin (also called spasmogenic toxin or Tetanus Neurotoxin (TeNT), is a protein exotoxin produced by *Clostridium tetani* that causes tetanus or lockjaw. This protein has a composition (amino acid sequence) very similar to the botulism toxins and is encoded by a viral genome, i.e., is the result of lysogenic conversion. The tetanus toxin causes spastic contraction of skeletal muscle by inhibiting the release of inhibitory neurotransmitters from inhibitory neurons.

2. Pathology
3. Infection/ disease
4. Communicable
5. Chronic/ acute
6. Bacteremia/ septicemia or sepsis
7. Septicemia or sepsis/ toxemia
8. Toxemia
9. Pathogen
10. Virulence
11. Infective dose or ID<sub>50</sub>/ lethal dose or LD<sub>50</sub>.

12. Parenteral/ reproduce themselves within the body
13. Microorganisms may produce substances that make them less likely to be recognized by phagocytic WBCs including capsules, M-proteins and A-proteins. Microorganisms may produce substances that kill phagocytic WBCs such as leukocidins, or they may cause the lysis of immune cells such as T4 lymphocytes (as does HIV). Sometimes pathogens are taken into WBCs via phagocytosis, but rather than being digested, they take up residence there. These cells may reproduce within the WBCs and be transported/distributed throughout the body by them.
14. Hemolysins/ collagenase
15. a) Tetanospasmin (tetanus toxin) is an exotoxin that inhibits the release of neurotransmitter substances from inhibitory neurons, and thus causes spastic and sustained muscle contraction in response to any excitatory signal from the motor cortex or reflex arcs. b) The botulism toxins are exotoxins that inhibit the release of the neurotransmitter substance acetylcholine from excitatory neurons, thus causing flaccid paralysis throughout the body. c) One exotoxin (enterotoxin) produced by *Staphylococcus aureus* acts on the medulla oblongata causing vomiting and diarrhea, another is a leukocidin that kills phagocytic WBCs by making holes in their cell membranes.
16. **Please note** – The toxins released by Gram-negative bacteria are endotoxins, not exotoxins. Lipopolysaccharide (LPS) released when the bacteria are killed or lysed/ fever, elevated heart and respiration rate, elevated neutrophil count, circulatory malfunction (septic shock) due to changes in capillary permeability and blood flow patterns (bodywide vasodilation) and abnormal clotting that can lead to organ failure and death. The effects of LPS seem to be linked to the release of cytokines from various WBCs which in turn stimulate the release of prostaglandins and leukotrienes. The LPS fragments also trigger the initiation of the complement cascade and abnormal coagulase activity. Blood vessel walls are damaged, circulation is impaired and death may occur.
17. M-proteins and A-proteins/ leukocidins/ bacterial kinases (streptokinase and staphylokinase)
18. The botulism toxins tend to cause flaccid paralysis of skeletal muscles. They act on excitatory neurons including motor neurons, and inhibit the release of acetylcholine, an excitatory neurotransmitter. The tetanus toxin (tetanospasmin) tends to cause spastic contraction of skeletal muscles (tetanus = sustained contraction). It acts on inhibitory neurons within the central nervous system. It inhibits the release of inhibitory neurotransmitter substances. **Note** - the botulism toxins and Tetanospasmin are very similar in structure and can have similar effects within the bodies of different individuals.
19. *Staphylococcus aureus*
20. *Escherichia coli*
21. *Escherichia coli*
22. *Pseudomonas aeruginosa*

23. Dental caries or cavities/ gingivitis or gum disease
24. a) the acids produced as a result of bacterial fermentation break down the enamel on teeth and cause the formation of dental caries or cavities. b) capsule-forming bacteria accumulate on the surfaces of teeth to form plaque. If calcium salts accumulate in this material they form calculus, a hard material that can cause damage to the gums. c) The activity of bacteria between the teeth or between the teeth and gums can cause inflammation of the gums or gingivitis. Bacteria can damage the tissues holding the teeth in place and cause periodontitis. If this is severe it can lead to tooth loss.
25. Symptoms/ inflammation within the fallopian tubes leading to sterility or can enter the body cavity to cause pelvic inflammatory disease/ HIV
26. In females these diseases often have no noticeable symptoms, so infections can go undetected for months or years. The bacteria responsible may continue to do damage during this time, causing sterility, lesions that increase the risk of contracting HIV and sometimes-severe neurological damage and death. If the female is pregnant the pathogens can cross the placenta and infect the fetus causing severe damage or death, or they may infect the infant during the birth process. The pathogens can also be transmitted to unsuspecting sexual partners, causing infections in them and a myriad of unforeseen problems.

**Bacterial Diseases and Agents (Matching)**

27. Matching letter sequence is – Ft, Sf, Dp, Ik, Tn, Qm, Cs, Kq, Oh, Be, Sd, Ci, Nj, Og, Jo, Gr, Pl, Ac, Hb, Ia