LECTURE 4: SURGICAL INFECTION

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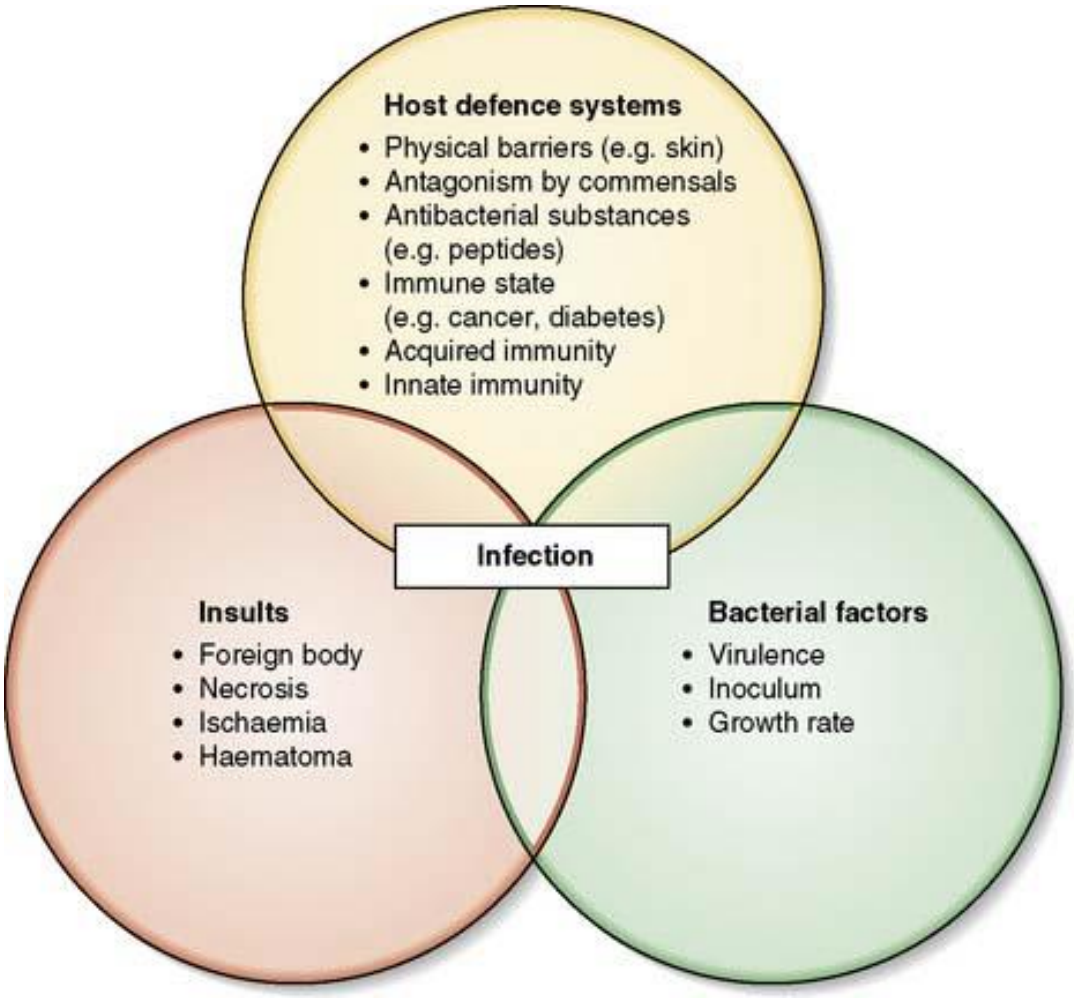
- **Biology of infection:**
  - Many body surfaces are colonised by a wide range of microorganisms, called commensals, with no ill effects.
  - However, once the normal defences are breached in the course of surgery, such as skin (e.g., Staphylococcus aureus) and bowel (e.g., Bacteroides spp. and Escherichia coli), commensals can then cause infection.

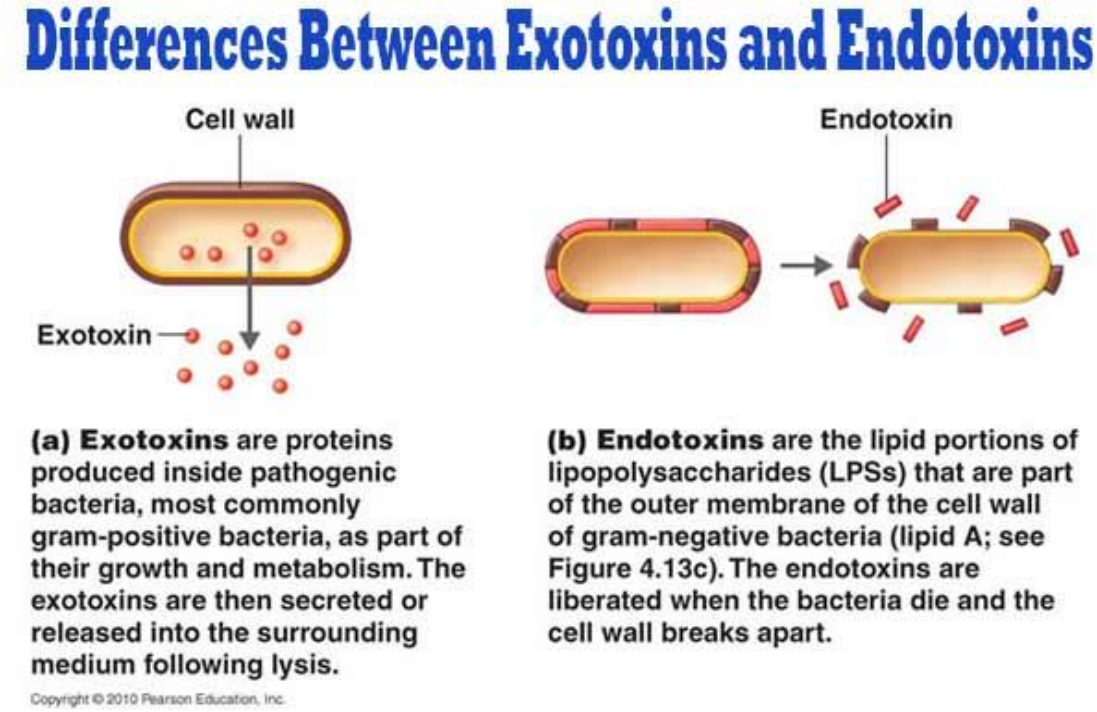
- **Infection** is defined as the proliferation of microorganisms in body tissue with adverse physiological consequences.

- The factors involved in the evolution of infection are



Bacterial factors:

- The size of the **inoculum**(dose of bacteria)
  smaller inoculum >>>easily removed by the host's immune response.
- Bacteria with greater pathogenic potential (**virulence**) in soft tissue (e.g., Streptococcus pyogenes versus Escherichia coli) will require a lower inoculum to establish infection.
- Pathogenic bacteria release
  1. Exotoxins that can act locally, regionally and systemically, having spread via the bloodstream, lymphatics and along nerves (e.g., tetanospasmin, which causes tetanus).
  2. Haemolysins, which destroy red blood cells, and damage connective tissues.
  3. Endotoxin: is liberated when gram-negative bacteria break up (lysis).



Host defence systems

- Commensals limit the potential virulence of pathogens by depriving them of nutrients, preventing their adherence and by producing various cell signalling substances that interfere with their activities.
- Administration of broad-spectrum antibiotics can lead to the replacement of commensals with a pathogen>
- Humans defences mechanism:
    1. **Skin** provides a dry, mechanical barrier to organisms and also secretes fatty acids in the sebum that kill or suppress potential pathogens.
    2. **Tears and saliva** contain a range of antibacterial substances such as lysozyme.
    3. **Gastric acids:** low pH of gastric secretions kills many ingested pathogenic bacteria.
    4. Mucosal membranes are secreted mucus, which both acts as a physical barrier and binds bacteria via specific receptors.
    5. Macrophages, neutrophils and complement provide innate immunity through phagocytosis and bacterial lysis.
- A number of host factors make infection more likely:
    1. Old age, obesity, malnutrition, cancer and immunosuppressive agents, and diabetes.
    2. The presence of dead tissue; e.g., burned flesh or haematoma.
    3. Poor vascularity; in the leg this is associated with peripheral arterial disease and diabetes.
    4. Foreign material .

Preventing infection in surgical patients:

- All hospitals should have infection prevention programs that include measures to minimize risks to patients and staff from infections which may be acquired during and after surgery.

- Most healthcare-associated infections can be prevented by adherence to good hand hygiene.
- The WHO five moments of hand hygiene defines the five moments when healthcare workers should clean their hands, i.e.:
  1. Before touching a patient.
  2. Before clean/aseptic procedure.
  3. After body fluid exposure risk.
  4. After touching a patient.
  5. After touching patient surrounding.

- **Prevention of infection in theatre:**
  1. **Preoperative screening of patients for MRSA**.
  2. The routine practices of hand washing, surgical scrub, skin preparation of the patient and maintaining a sterile field (**aseptic technique**).
  3. Maintaining normothermia before, during and after surgery lowers the risk of postoperative wound infection.
  4. Sterility of surgical instruments is critical to preventing cross-infection.

Prophylactic antibiotics:

- Antibiotic prophylaxis in surgical practice aims to prevent infection by achieving high concentrations of antibiotic at the incision and site of operation during surgery.
- The choice of antibiotic must cover the likely pathogens for the operation site.
- A single dose of antibiotic is usually adequate for prophylaxis, although during prolonged procedures or where there is excessive blood loss, a second dose may be required.
- In some circumstances, e.g., colonization with multi-resistant bacteria or immunocompromised patients, the antibiotic choice may need to be modified and expert advice should be sought.

Management of surgical infections

- Surgical infections are of two types; those that occur in patients who:
  1. Have undergone a surgical procedure.
  2. Present with sepsis and require surgery as part of their management.

- **Diagnosis**
  - Infections in the early postoperative period (>48 hours) are most likely to be respiratory or urinary, with wound infections usually becoming evident later. Implant-related infections may not be evident for weeks, months or even years.
  - Leakage of a gastrointestinal anastomosis usually presents after 5–6 days with low grade pyrexia and abdominal symptoms and signs; there may also be leakage of bowel content from surgical drains.
  - Ask about: Cough, dysuria, abdominal pain.
  - Look for: **signs**
    - Tachycardia, tachypnoea, pyrexia
    - Tenderness at or around the surgical wound.
    - Signs of peritonitis in post abdominal surgery patients.
    - Signs of shock – hypotension, pallor, sweating, rigors.
    - confusion – and if present contact the critical care outreach team for urgent resuscitation. Identify the focus of infection:
  - Investigations:
    - Urine for dipstick test and culture.
    - Sputum culture

  - Pus from wound or deep aspiration for Gram staining and culture.
  - Blood culture in febrile/septic patients.
- Computed tomography (CT) or magnetic resonance imaging (MRI), preferably with contrast, should be performed to detect peritoneal leaks and collections of pus, and can be life-saving.

Antibiotic therapy

- Antibiotics are almost always needed in addition to surgical treatment in surgical infections, e.g., drainage of abscesses, debridement, excision of infected tissue or lavage of a serous cavity.
- Antibiotic policies: each hospital has its own antibiotic formulary and this should be consulted.
- Specimens for culture and sensitivity testing should always be obtained if possible and then specific antibiotics used.
- It is not always possible to await these results if the patient is seriously ill, and empirical therapy should be started.
- When using some antibiotics such as gentamicin and vancomycin, therapeutic drug monitoring is needed to (i) establish adequate serum concentrations and (ii) identify toxic concentrations before renal or neurological damage develops. Specific protocols are available from microbiology/ pharmacy departments at individual hospitals.
- Advice should be sought early about antibiotic treatment regimens from microbiologists/infectious diseases specialists, particularly when the diagnosis is not certain and/ or the patient is critically ill.