

Surgical infection

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Background Surgical infection, particularly surgical site infection (SSI), has always been a major complication of surgery and trauma and has been documented for 4000–5000 years. The Egyptians had some concepts about infection as they were able to prevent putrefaction, testified by mummification skills. The Hippocratic teachings described the use of antimicrobials, such as wine and vinegar, which were widely used to irrigate open, infected wounds before delayed primary or secondary wound closure. A belief common to all these civilisations, and indeed even later to the Romans, was that, whenever pus localised in an infected wound, it needed to be drained.

PHYSIOLOGY

Microorganisms are normally prevented from causing infection in tissues by intact epithelial surfaces, most notably the skin. These surfaces are broken down by trauma or surgery. In addition to these mechanical barriers, there are other protective mechanisms, which can be divided into:

- **chemical:** low gastric pH
- **humoral:** antibodies, complement and opsonins
- **cellular:** phagocytic cells, macrophages, polymorphonuclear cells and killer lymphocytes.

All these natural mechanisms may be compromised by surgical intervention and treatment.

Causes of reduced host resistance to infection

_ Metabolic: malnutrition (including obesity), diabetes, uraemia, jaundice

_ Disseminated disease: cancer and acquired immunodeficiency syndrome (AIDS)

_ Iatrogenic: radiotherapy, chemotherapy, steroids

Risk factors for increased risk of wound infection

_ Malnutrition (obesity, weight loss)

_ Metabolic disease (diabetes, uraemia, jaundice)

_ Immunosuppression (cancer, AIDS, steroids, chemotherapy and radiotherapy)

_ Colonisation and translocation in the gastrointestinal tract

_ Poor perfusion (systemic shock or local ischaemia)

_ Foreign body material

_ Poor surgical technique (dead space, haematoma)

Infection rate is proportionate to:

- Number of bacteria;
- Type of bacteria;
- Incisions involving mucus surfaces;
- Sites of existing infection in the body;
- The use of prosthetic implants.

Sources of bacteria:

1. Endogenous from the patient's viscera (98 per cent);
2. Endogenous from the patient's skin;
3. Exogenous sources

Note

- Nosocomial infections are acquired in hospital
- Community-acquired infections are acquired outside hospital

Factors affecting the occurrence of wound infection can be classified into:

- 1) Preoperative factors.
- 2) Operative factors
- 3) Postoperative factors.

Preoperative factors

Local factors include pre-existing infection e.g. perforated appendix or an infected compound fracture. General factors include being a nasal carrier of staphylococcus or having a skin infection e.g. crop of boils as well as malnourishment and immunosuppression.

Operative factors

These are lapses in theatre techniques e.g. failure of adequate sterilization of instruments, the surgeon's hands or dressings. There may be skin or nasal carriers of staphylococci among the nursing and surgical staff.

Wound infections are especially common when the alimentary, biliary or urinary tract is opened during surgery, allowing bacterial contamination to occur. Wounds placed in poorly vascularized tissue such as an amputation stump are also prone to infection in particular gas gangrene from anaerobic clostridial contamination, since necrotic tissue is a good medium for bacterial growth.

Postoperative factors:

- 1) Cross infection from elsewhere on the patient's body or from other infected cases in the ward during dressing changes or wound inspection.
- 2) New infection due to contamination of the wound from the nose or hands of the surgical or nursing staff.

The **infection of a wound** can be defined as the invasion of organisms through tissues following a breakdown of local and systemic host defences, leading to cellulitis, lymphangitis, abscess and bacteraemia. The infection of most surgical wounds is referred to as superficial surgical site infection (SSSI). The other categories include deep SSI (infection in the deeper musculofascial layers) and organ space infection (such as an abdominal abscess after an anastomotic leak).

MAJOR AND MINOR SURGICAL SITE INFECTIONS

A **major SSI** is defined as a wound that either discharges significant quantities of pus spontaneously or needs a secondary procedure to drain. The patient may have systemic signs, such as tachycardia, pyrexia and a raised white count. **Minor wound infections** may discharge pus or infected serous fluid but should not be associated with excessive discomfort, systemic signs or delay in return home.



Major wound infection with superficial skin dehiscence



Minor wound infection

Types of localised infection

Abscess

An abscess presents all the clinical features of acute inflammation originally described by Celsus: **calor** (heat), **rubor** (redness), **dolour** (pain) and **tumour** (swelling). To these can be added **functio laesa** (loss of function: if it hurts, the infected part is not used). Pyogenic organisms, predominantly *Staphylococcus aureus*, cause tissue necrosis and suppuration. **Pus** is composed of dead and dying white blood cells that release damaging cytokines, oxygen free radicals and other molecules. An abscess is surrounded by an acute inflammatory response composed of a fibrinous exudate, oedema and the cells of acute inflammation. **Granulation tissue** (macrophages, angiogenesis and fibroblasts) forms later around the suppurative process and leads to collagen deposition. If it is not drained

or resorbed completely, a chronic abscess may result. If it is partly sterilised with antibiotics, an **antibioma** may form.

Cellulitis and lymphangitis

This is the nonsuppurative invasive infection of tissues. In addition to the cardinal signs of inflammation, there is poor localisation. Spreading infection is typical of organisms such as Beta-haemolytic streptococci, staphylococci and *C. perfringens*. Tissue destruction and ulceration may follow, caused by release of streptokinase, hyaluronidase and other proteases. Lymphangitis is caused by similar processes but presents as painful red streaks in affected lymphatics.

The incidence of wound infection after surgical operations is related to the type of operation.

The common classification of risk groups is as follows:

- 1) ***Clean*** (e.g. hernia, thyroid, and breast mastectomy): an uninfected operative wound without inflammation and where no viscera are opened. Infection rate is 1% or less.
- 2) ***Clean contaminated***, where a viscus is opened under controlled circumstances & with little or no spillage. Infection rate is less than 10%.
- 3) ***Contaminated***, where there is obvious spillage or obvious inflammatory disease e.g. gangrenous appendix. Infection rate is 15-20%.
- 4) ***Dirty or infected***. Gunshot wound with devitalized tissue or in the presence of frank pus or gross soiling e.g. perforated large bowel. Infection rate is up to 40%.