



## Fourth Stage

### General Surgery

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### Lecture 3

## Surgical wound infection

Surgery predisposes to infection by affecting the body defenses at all levels...it also causes a breach in the protective barrier, allowing organisms a portal of entry. Wound infection is defined as a collection of pus in a wound. In the initial phase of bacterial penetration of the tissues, the body will host an inflammatory response against the invading organisms to try to contain them in the area and to destroy them. This inflammation will be apparent clinically as cellulitis, which is a tender redness of the tissues. However, a similar response may result from inflammation from other causes (e.g. hematoma, excess tissue handling or trauma during surgery). Because of this, the presence of cellulitis alone may not always indicate infection. For a wound infection to occur, there must be a sufficient number of organisms inoculated into the wound (>10<sup>7</sup> viable cocci must be injected into a wound in a normal person) to cause an abscess) and conditions within the wound area must be suitable for growth of the organisms. The presence of necrotic tissue, hematoma, seroma and foreign bodies all predispose to sepsis.

## Classification of wounds

**Clean wounds** These are wounds in which no viscus has been entered, no septic area has been encountered and there has been no break in aseptic technique. Such wounds should never become infected; infection rates with such wounds should be less than 3%.

**Clean contaminated wounds** In this situation, the operation enters a non-infected area but may encounter bacteria. Careful control of the area should result in minimal spillage of organisms. Examples of this include surgery on the upper gastrointestinal tract, biliary tree or respiratory tract. Infection rates for this type of surgery should be less than 10%.

**Contaminated wounds** This is surgery where there is gross spillage of organisms, where there is infection already present but without pus formation, where there is a major break in aseptic technique or where there is an open wound that has been exposed for less than 4 h (e.g. following major trauma). In this type of wound, sepsis frequently exceeds 30%.

**Dirty wounds** This is an operation through an infected area (e.g. perforated viscus, abscess or traumatic wound) that has been exposed for over 4 h. By definition, all these wounds are infected.

**Infecting organisms** Infecting organisms can be subdivided into two types.

**Exogenous organisms** Exogenous organisms are organisms introduced into a wound from an external source. The two main exogenous organisms responsible for wound sepsis are *Staphylococcus aureus* and *Streptococcus pyogenes*. These are encountered much less frequently than they used to be, with the exception of patients with trauma and/or burns, in whom they are as prevalent as ever. When wound sepsis occurs with these bacteria, it usually indicates a breakdown of sterile surgical technique. The longer an operative procedure, the more likely the procedure is to become infected by an exogenous organism.

**Endogenous organisms** Endogenous organisms are bacteria that are usually present in the body but are noninfective under normal circumstances. Such organisms are known as commensals. These organisms are encountered in clean-contaminated, contaminated and dirty wounds. Such organisms are common in gastrointestinal surgery, for example, *Escherichia coli*, enterococci and *Bacteroides* species. In clean-contaminated and contaminated wounds, where it is expected that a significant number of organisms may be encountered, the use of prophylactic antibiotics given from the time of surgery has been shown in many cases to significantly reduce the risk of wound infection. Such use of antibiotics, however, must not be seen to be an alternative to meticulous.

## A Prevention of wound Infection

1- **Environment** The design of a modern operating theatre with laminar air-flow and air-filtering systems has significantly reduced the number of organisms in the atmosphere. The longer the duration of surgery and the greater the number of personnel in theatre, the higher the wound sepsis rate.

2- **Theatre personnel, surgeon, theatre assistant(s) and nursing staff should wash/scrub their hands and forearms with an antimicrobial agent such as chlorhexidine** or povidone-iodine to reduce bacterial load on the skin. The initial scrub of the day should last at least 5 min. Thereafter, scrubbing for further operations requires only a 1 min careful wash and nail scrubbing is no longer necessary. This reduces the numbers of skin organisms but, after 30 min, the bacterial count on the skin starts to rise again and may exceed the pre-scrub levels after 2 h. Staff in intimate contact with an operation should therefore wear suitable sterile protective clothing with sterile gowns and gloves. Staff with a severe upper respiratory infection or sore throat should be excluded from theatre area.

3- **Patient preparation Prophylactic antibiotics** Patients who have been inpatients in hospital for a significant period prior to surgery tend to develop a skin contamination of 'hospital-acquired' organisms. These bacteria tend to be highly resistant to commonly used antibiotics. In such patients, bacterial scrub the night before surgery may be beneficial, although this is unproven. Shaving the skin in the area of the operation on the night before surgery has now been shown to increase wound sepsis rates if shaving is to be performed, this should be done in the anesthetic area immediately before surgery is about to take place.

4- **Operating technique Surgical technique** is most important in control of wound sepsis. Wound sepsis rates vary between surgeons and are almost certainly related to individual technique such as careful handling of tissues, removal of all foreign bodies or dead tissue, avoiding the use of excess diathermy and sutures, avoiding excessive suture tension, accurate placement of sutures, and avoiding the formation of haematoma. Monofilament sutures are probably associated with less wound sepsis than braided suture materials.

5- **Prophylactic antibiotics antibiotics** have been shown to reduce wound sepsis in clean/contaminated and contaminated wounds only. The use of antibiotics in clean wounds is of no value in careful atraumatic surgical technique. reducing wound sepsis but they should always be given if there is insertion of foreign material or if the patient has cardiac valvular disease. **Clinical features of wound Sepsis** Classically, wound sepsis produces a **tachycardia and pyrexia** approximately **2–4 days post-surgery**. The patient usually **complains of increasing pain in the wound**, perhaps exceeding that noted immediately after surgery. **The features of an infected wound usually develop very rapidly. The wound develops a cellulitis, perhaps with some purulent material oozing from the surface of the incision or from the suture sites.** The wound then becomes edematous and bronzed in appearance with marked swelling. At this point, **removal of some or all of the sutures results in release of pus** and the wound margins will then be noted to be lined with slough.

**Diagnosis** of wound sepsis This is usually made on clinical grounds alone. Bacteriology culture swabs may allow confirmation of the infecting organism(s) and their antibiotic sensitivity.

## Treatment

Initial treatment of a suspected wound infection is usually by antibiotics. The choice depends on the type of wound and the nature of the surgery. In contaminated and clean/contaminated wounds, antibiotic therapy may merely consist of continuing the prophylactic antibiotic originally used. Certainly, if there is severe or spreading cellulitis, antibiotic usage is essential and may be more effective if given intravenously. **Where there is obvious pus formation, sutures should be removed from the skin and the wound allowed to gape or, if necessary, probed. Any pus obtained should** be forwarded to the bacteriologist for culture. If there is no significant cellulitis, lymphangitis or lymphadenopathy, simple release of pus may be all that is indicated and antibiotics may not be necessary. After release of pus, the wound should be left open. It may be filled with antiseptic packs. These wounds re-heal rapidly without the need for re-suturing and, as soon as the wound has healed by granulation, it will rapidly re-epithelialize.