



### Understanding Wound Infection

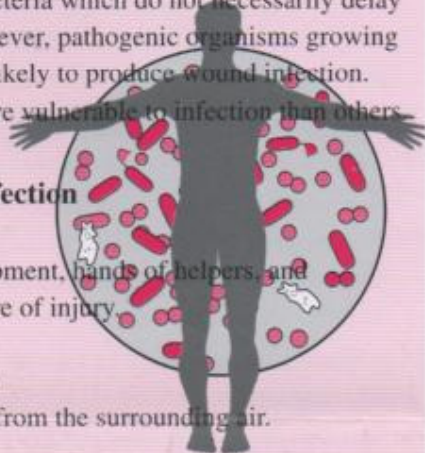
#### Understanding Wound Infection

Bacteria are distributed throughout the environment and a variety of species are also carried by most living creatures particularly on the skin and in the gastro-intestinal tract. Colonization of bacteria on body surfaces, in the gut and damaged tissues can have no ill effect to their host. Infection occurs if normal tissues is invaded by bacteria and cause destruction of cells.

Wound infection can occur at any time during the healing phase, and all types of wound can be infected. All wounds are colonized with bacteria which do not necessarily delay or affect healing; however, pathogenic organisms growing in large numbers are likely to produce wound infection. Some patients are more vulnerable to infection than others.

#### Route of wound infection

1. Direct contact :  
Transfer from equipment, hands of helpers, and sometimes by nature of injury.
2. Airbrone dispersal :  
Bacteria deposited from the surrounding air.
3. Self-contamination :  
Physical transfer or migration from the patient's skin or gastro-intestinal tract.



#### What is infection & what is colonisation

**Infection** can be defined as the growth of an organism in a wound with associated tissue reaction and depends on the number of pathogenic organisms, their virulence and host's resistance.

**Number of organisms x Virulence / Host resistance**

**Colonisation** means the states that the growth of the bacteria in the wound does not stimulate any tissue response.

An infection is confirmed when at least one of the following requirement presence :

- \* purulent drainage
- \* organism isolated
- \* one of pain/ tenderness, swelling redness, heat, fever > 38°
- \* incision dehisces or is opened by surgeon
- \* evidence of infection or abscess on direct examination
- \* diagnosis by a medical officer

Some criteria also help to indenfy infection of a granulating wound :

- \* Abscess
- \* Cellulitis
- \* Discharge -- serous, pus, heamopurulent
- \* Delayed healing
- \* Discoloration
- \* Friable granulation tissue which bleeds easily
- \* Unexpected pain and tenderness
- \* Pocketing at the base of the wound
- \* Bridging at the base of the wound
- \* Abnormal smell
- \* Wound breakdown



#### Factors affecting wound infections

##### Local factors

##### pH

Most bacteria grow best in a medium that is neutral or slightly alkaline (i.e. > pH 7)

##### Temperature

Most bacteria have an optimal growth temperature. For those living in or on the human host this is 37°C.

##### Oxygenation

Some bacteria only grow in the presence of free



atmospheric oxygen, e.g. *Pseudomonas*. Some bacteria will not grow in the presence of oxygen e.g. *Bacteroides* spp., *Clostridia* spp and anaerobic streptococci.


### **Systemic factors**

Patients who are immunocompromised or with severe debilitating diseases, patients with poor blood supply to the wound, incontinence and elderly.

### **Wound Factor**

Such as the presence of necrotic or devitalised tissue. If necrotic tissue is present in a chronic wound, it provides an excellent culture medium for bacteria. Acute wounds, are frequently not colonized to the same extent as chronic wounds, but infection can be a complication until the wound has healed.

\* Clean wound : No pathogenic organisms. Asepsis maintained. Gastro-intestinal tract intact.

\* Clean contaminated wound : Gastro-intestinal tract opened but with minimal spillage. 


\* Contaminated wound : Gastro-intestinal tract opened with gross spillage. Acute inflammation without pus formation. Traumatic wound less than 4 hours old.

\* Dirty wound : Pus encountered. Perforated intestinal tract. Traumatic wound more than 4 hours old.

### **Managing Wound Infection**



**Prevention of wound infection in hospital environment may be achieved by:**

1. Ensure adequate bed spacing.
2. Reduce the time between admission and operation to a minimum.
3. Perform skin preparation in theatre.
4. Reduce operating time as much as possible. 
5. Avoid contamination during operation.
6. Avoid using of drains as this increases the risk of wound infection.
7. Good hand-washing techniques before procedure.

**The general aim of intervention for infected wounds are :**

- \* To maintain a clean environment for healing.
- \* Control exudate by using absorbent dressing materials

(e.g. alginates and hydrophilic foams) and by frequent dressing changes.

\* Manage granulation tissue. As epithelium will not cover over-granulated tissue, intervention is required to flatten the wound surface and so facilitate re-epithelialization.

e.g. silver nitrate sticks (75%)

corticosteroid cream.

flat foam dressing



### **Infected Sutured wounds**

\* To remove one or two sutures to facilitate complete drainage.

\* Pus can be sent for culture and sensitivity.

\* Once the pus has been drained a packing material such as an alginate rope / NaCl impregnated gauze can be inserted to maintain drainage.

\* When drainage of the abscess is not clear, surgical incision may be required.

\* A dressing is used to ensure healing from the base of the wound.

### **Infected Open Granulating Wounds**



\* Surgical toilet, debriding and cleansing should be done to remove source of infection.

\* Frequent wound cleansing to reduce bacterial count.

\* **Topical antiseptics agents appear to have very little therapeutic effects.**

\* Cleaning is best carried out by irrigation, as swabbing the wound only results in organisms being redistributed around the wound.

\* Reducing the spread of bacteria by the non-touch technique

\* Wearing gloves should never replace scrupulous hand-washing, but is an essential precaution when the skin is broken.


### **Wound with MRSA-positive Wound Swabs**

1. Abide to the infection control policy of contact isolation.

2. Swab at weekly intervals following treatment. The patient is considered clear when three consecutive negative swabs have been obtained.

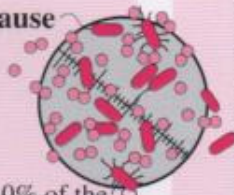
3. Where patients have a serious infection, antibiotics will be administered intravenously.

### **Antibiotics are indicated for :**

- \* Badly contaminated wounds
  - \* Human or animal bites
- 

\* Diabetic or immunocompromised patients

## Pathogenic organisms that commonly cause wound infection



### Aerobic bacteria

\* *Staphylococcus aureus* is carried by around 30% of the population and causes many hospital-acquired wound infections.

\* *Staphylococcus epidermidis* is found in large quantities on the intact skin of individuals. It is present in the air and in dust, being constantly shed by the skin.

\* **Methicillin-resistant *Staphylococcus aureus* (MRSA)** has been a cause of hospital-acquired infection. It developed resistance to penicillin quickly.

\* *Beta-haemolytic streptococci* In burns and plastic surgery units this bacteria causes infection under skin grafts and can lead to the death of the graft.

\* *Escherichia coli* and *Proteus* are normal bowel flora. These bacteria can be spread by hand contamination or by local approximation of the perineum to the wound.

\* *Klebsiella* and *Pseudomonas* are found in moist conditions. These bacteria can easily contaminate lotions and antiseptics. It is also common in sinks and sluices.

### Anaerobic bacteria

Anaerobic bacteria thrive in the absence of oxygen. Therefore, they always found in the bowel and in soil.

\* *Bacteroides* is present in the bowels of healthy individuals. In pilonidal sinus excisions these micro-organisms are present, because the wound close to the anus.



\* *Clostridium welchii* is a potentially fatal organism because it can cause gas gangrene. Amputation stumps or deep contaminated traumatic cavities are especially at risk.

\* *Clostridium tetani* infects wounds exposed to dirt or soil and cause tetanus in the unprotected individual.

Incidence of bacteria detected in infected wounds. Based on information published by Meers et al but excludes the incidence of infection in chronic ulcers.

Species	%
1. <i>Staphylococcus aureus</i>	33
2. Other staphylococci	5
3. <i>Streptococcus faecalis</i>	6
4. Other streptococci	6
5. <i>Escherichia coli</i>	19
6. <i>Proteus</i> spp.	10
7. <i>Klebsiella</i> spp.	4
8. Other Gram negative bacteria	6
9. <i>Bacteroides</i> spp. and other anaerobic bacteria	6

### Examples of Common normal flora

Organs	Bacteria
Nose	<i>Staphylococcus aureus</i>
Mouth & throat	<i>Staphylococcus viridans</i> <i>Neisseria catarrhalis</i>
Skin	<i>Staphylococcus albus</i>
G I tract	<i>Escherichia coli</i> <i>Proteus</i> spp. <i>Klebsiella</i> spp. <i>Bacteroides</i> spp. Faecal streptococci
Vagina	Lactobacilli

By: Pang Chak Hau

Nurse Specialist, YCH

## HKCET Wound Care Course

FULL ! Thank you for your support!



### Conference / Seminar information

#### 1st International Congress of the Asia Pacific Society of Infection Control

Date : 9-11th, August, 1999

Venue : Hong Kong Convention and Exhibition Centre, Hong Kong

For information, please contact Congress Secretariat  
Telephone No. : 2735 8118

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E-mail: hkcet@hongkong.com