

# **SURGICAL INFECTIONS**

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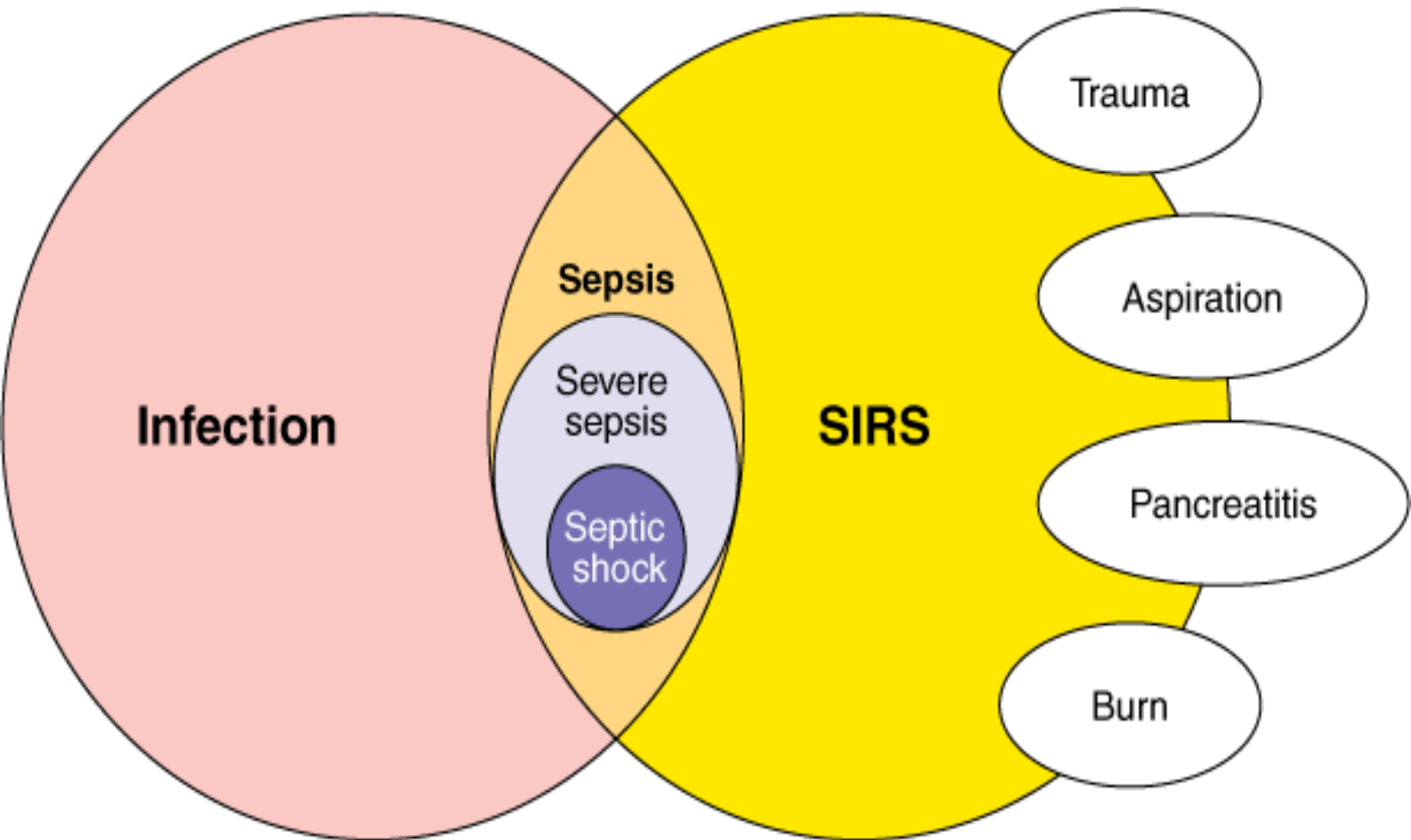
**MD, MSc, FRCSC**

# Infection

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**Infection is defined by:**

- 1. Microorganisms in host tissue or the bloodstream**
- 2. Inflammatory response to their presence.**



Source: Brunicaardi FC, Andersen DK, Billiar TR, Dunn DL, Hunter JG, Matthews JB, Pollock RE: *Schwartz's Principles of Surgery, 9th Edition*: <http://www.accessmedicine.com>

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# Inflammatory Response

## **Localized:**

- ▣ **Rubor, Calor, Dolor, Tumor, and functio laesa (loss of function)**

## **Systemic:**

- ▣ **Systemic Inflammatory Response Syndrome (SIRS)**

# S.I.R.S.

## Any Two of the Following Criteria

1. **Temperature:  $< 36.0, >38.0$**
2. **Heart Rate :  $>90$**
3. **Respiratory Rate:  $>20$**
4. **WBC:  $<4,000, >12,000$**

# Sepsis

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**Definition: SIRS plus evidence of local or systemic infection.**

## Septic Shock

**Definition: Sepsis plus end organ hypoperfusion. Mortality of up to 40%**

# SPREAD OF SURGICAL INFECTIONS

- NECROTIZING INFECTION
- ABSCESSSES
- PHLEGMONS AND SURPERFICIAL INFECTIONS
- SPREAD OF INFECTIONS VIA THE LYMPHATIC SYSTEM
- SPREAD OF INFECTION VIA BLOODSREAM

# Cellulitis

**Definition: Diffuse infection with severe inflammation of dermal and subcutaneous layers of the skin**

**Diagnosis: Pain, Warmth, Hyperesthesia**

**Treatment: Antibiotics.**

**Common Pathogens: Skin Flora  
(Streptococcus/Staphylococcus)**



# Cellulitis



# Cellulitis



Fig. 2



# FURUNCLES AND CARBUNCLES

- Furuncles and carbuncles are cutaneous abscess that begin in skin glands and hair follicles.
- If the pilosebaceous apparatus becomes obstructed at the skin level, the development of a furuncle can be anticipate
- A carbuncle is a deep –seated mass of fistulous tracts between infected hair follicles.
- Funruncles are the most common surgical infections, but carbuncles are rare

# Furuncle



# Carbuncle



# HIDRADENITIS

- Serious skin infection of the axillae or groin  
Consisting of multiple abscesses of the apocrine sweat glands.
- The condition often becomes chronic
- The cause is unknown but may involve a defect of terminal follicular epithelium

# Hiradenitis



# TREATMENT

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- The classic therapy of furuncle is drainage, not antibiotics.
- Invasive carbuncles must be treated by excision and antibiotics.
- Hidradenitis is usually treated by drainage of the individual abscess and followed by careful hygiene



# Abscess



# Abscess

**Definition: Infectious accumulation of purulent material (Neutrophils) in a closed cavity**

**Diagnosis: Fluctuant: Moveable and compressible**

**Treatment: Drainage**

# DIFFUSE NECROTIZING INFECTIONS

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- Particular dangerous
- Difficult to diagnose, extremely toxic, spread rapidly, often leading to limb amputation

# Pathogenic factors

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- Anaerobic
- wound Bacterial exotoxins
- Bacterial synergy
- Thrombosis of nutrient bridging vessels

# Classification of diffuse necrotizing infections

- **Clostridial**
  - ✓ Necrotizing cellulitis
  - ✓ Myositis
- **Nonclostridial**
  - ✓ Necrotizing fasciitis
  - ✓ Streptococcal gangrene

# Clostridial Infections

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- They are fastidious anaerobes
- On gram-stain they appear as relatively large, gram-positive, rod-shaped bacteria.
- A broad spectrum of disease is caused by clostridia

# Clinical Findings

- Crepitant abscess or cellulitis
- Invasion is usually superficial to the deep fascia and may spread very quickly, producing discoloration.
- Delayed debridement of injured tissue after devascularizing injury is the common setting.

# Gas Gangrene





# Clinical Findings

- Severe pain suggests extension into muscle compartments ( myositis).
- The disease progresses rapidly, with loss of blood supply to the infected tissue.
- Profound shock can appear early, rapidly leading to organ dysfunction.
- Air bubbles often visible on plain radiograph Crepitus may be present, but not reliable to differentiation .

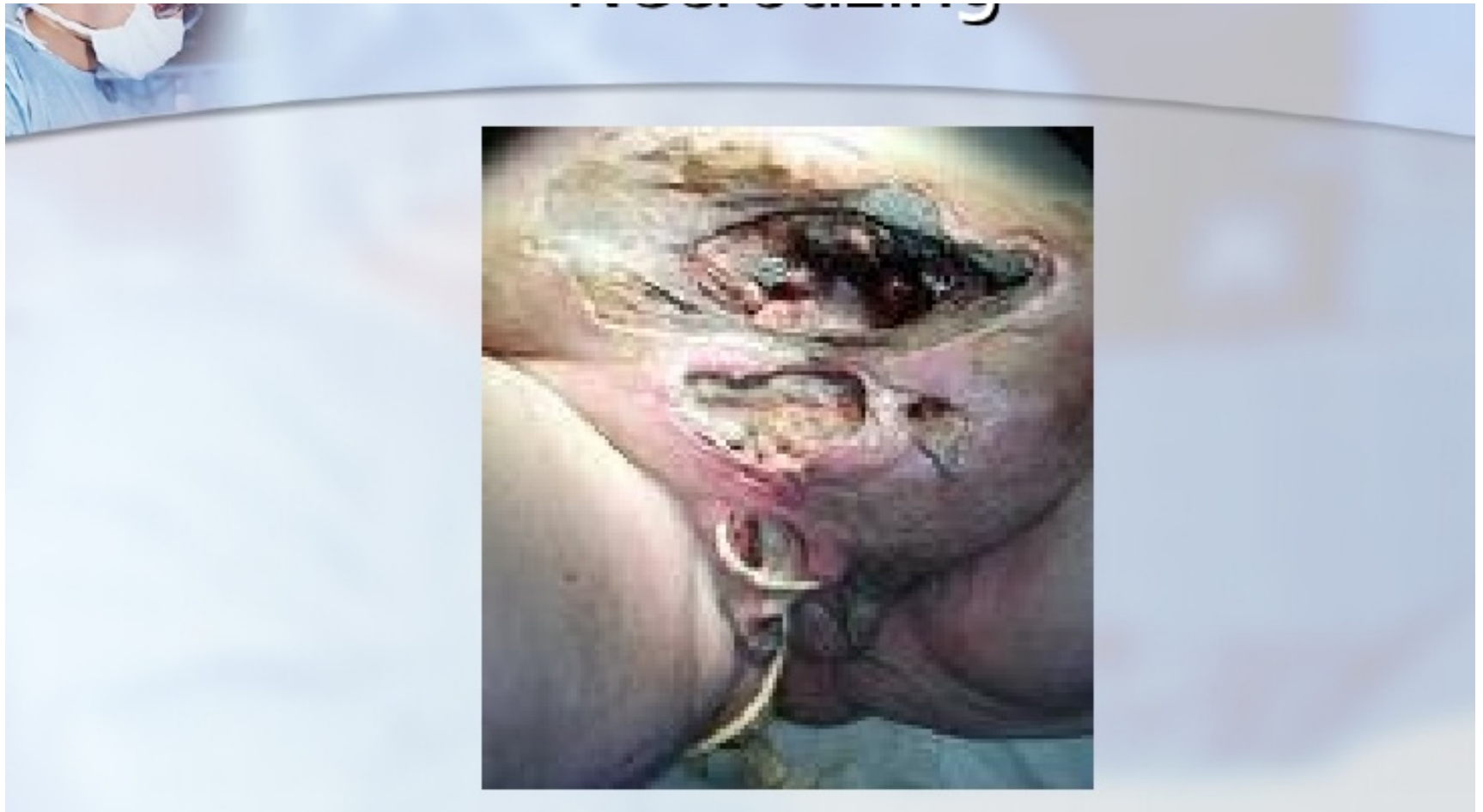
# Nonclostridial Infections

- Caused by multiple nonclostridial bacterial pathogens.
- Microaerophilic streptococci, staphylococci, aerobic gram-negative bacteria, and anaerobes, especially peptostreptococci and bacteroides.

# Necrotizing Soft Tissue Infection



# Necrotizing



# Clinical Findings

- Usually begins in a localized area such as a puncture wound, leg ulcer, or surgical wound.
- Externally, hemorrhagic bullae are usually the first sign of skin death
- The skin is anesthetic and crepitus is occasionally present.
- The fascial necrosis is usually wider than the skin appearance indicates.
- At operation, the finding of edematous, dull-gray, and necrotic fascia and subcutaneous tissue confirm the diagnosis.

# Streptococcal gangrene Group A

- streptococcus is a bacterium frequently found in in the skin and throat.
- Streptococcal gangrene is uncommon The sudden onset of severe pain is the most common presenting symptom, usually in an extremity associated with a wound.
- Fever and other signs of systemic infection are frequently present at the time of presentation.
- Shock and renal dysfunction are usually present within 24 hours.

# TREATMENT

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- Complete debridement and depress tight fascial compartment. Amputation.

# TREATMENT

- Broad-spectrum antibiotic therapy
- Resuscitative therapy
- Treat diabetes mellitus aggressively
- Hyperbaric oxygenation inhibit bacterial invasion but does not eliminate the focus of infection.



# Post-Operative Infections

- **Fever After Surgery**
- **The “Five W’ s”**
  - ▣ **Wind: Atelectasis**
  - ▣ **Water: UTI**
  - ▣ **Walking: DVT**
  - ▣ **Wonder Drug: Medication Induced**
  - ▣ **Wound: Surgical Site Infection**

# Surgical Site Infections

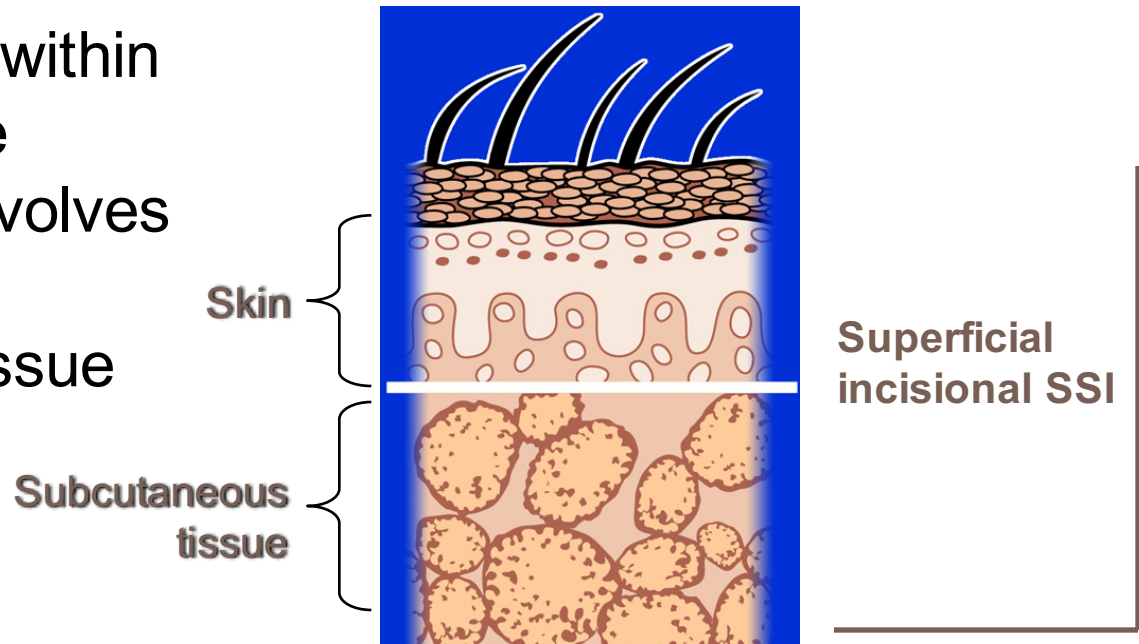
- **3rd most common hospital infection**
- **Incisional**
  - **Superficial**
  - **Deep**
- **Organ Space**
  - **Generalized (peritonitis)**
  - **Abscess**

# SSI – Definitions

- Infection
  - ▣ Systemic and local signs of inflammation
  - ▣ Bacterial counts  $\geq 10^5$  cfu/mL
  - ▣ Purulent versus nonpurulent
  - ▣ LOS effect
  - ▣ Economic effect
- Surgical wound infection is SSI

# Superficial Incisional SSI

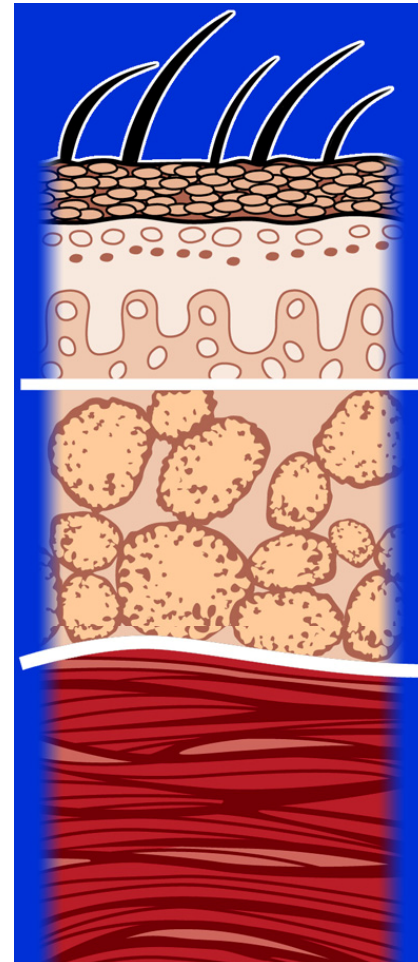
Infection occurs within 30 days after the operation and involves only skin or subcutaneous tissue of the incision



# Deep Incisional SSI

Infection occurs within 30 days after the operation if no implant is left in place or within 1 year if implant is in place and the infection appears to be related to the operation and the infection involves the deep soft tissue (e.g., fascia and muscle layers)

Deep soft tissue  
(fascia & muscle)

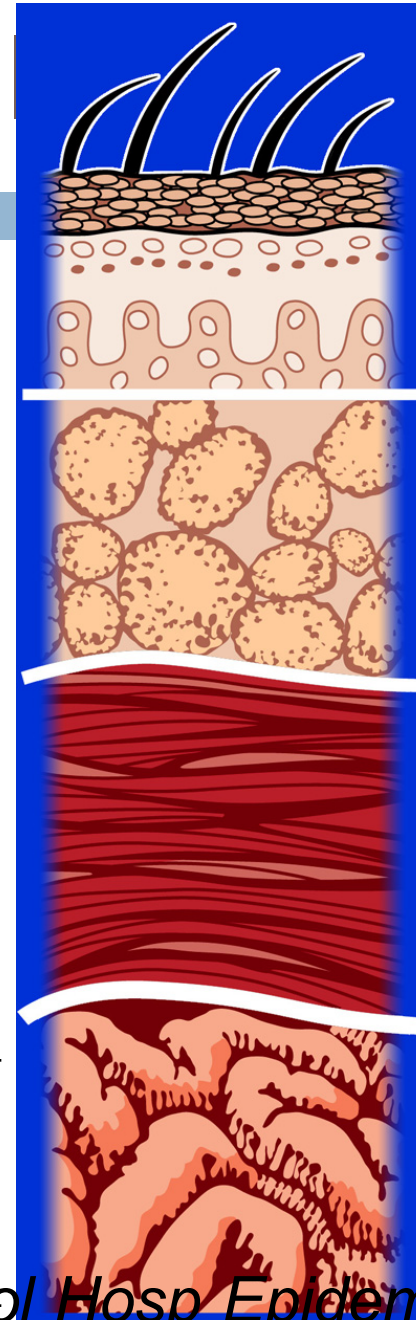


Deep incisional  
SSI

# Organ/Space SSI

Infection occurs within 30 days after the operation if no implant is left in place or within 1 year if implant is in place and the infection appears to be related to the operation and the infection involves any part of the anatomy, other than the incision, which was opened or manipulated during the operation

Organ/space



Deep incisional SSI

Organ/space SSI

# SSI – Risk Factors

## Operation Factors

- Duration of surgical scrub
- Maintain body temp
- Skin antiseptics
- Preoperative shaving
- Duration of operation
- Antimicrobial prophylaxis
- Operating room ventilation
- Inadequate sterilization of instruments
- Foreign material at surgical site
- Surgical drains
- Surgical technique
  - Poor hemostasis
  - Failure to obliterate dead space
  - Tissue trauma

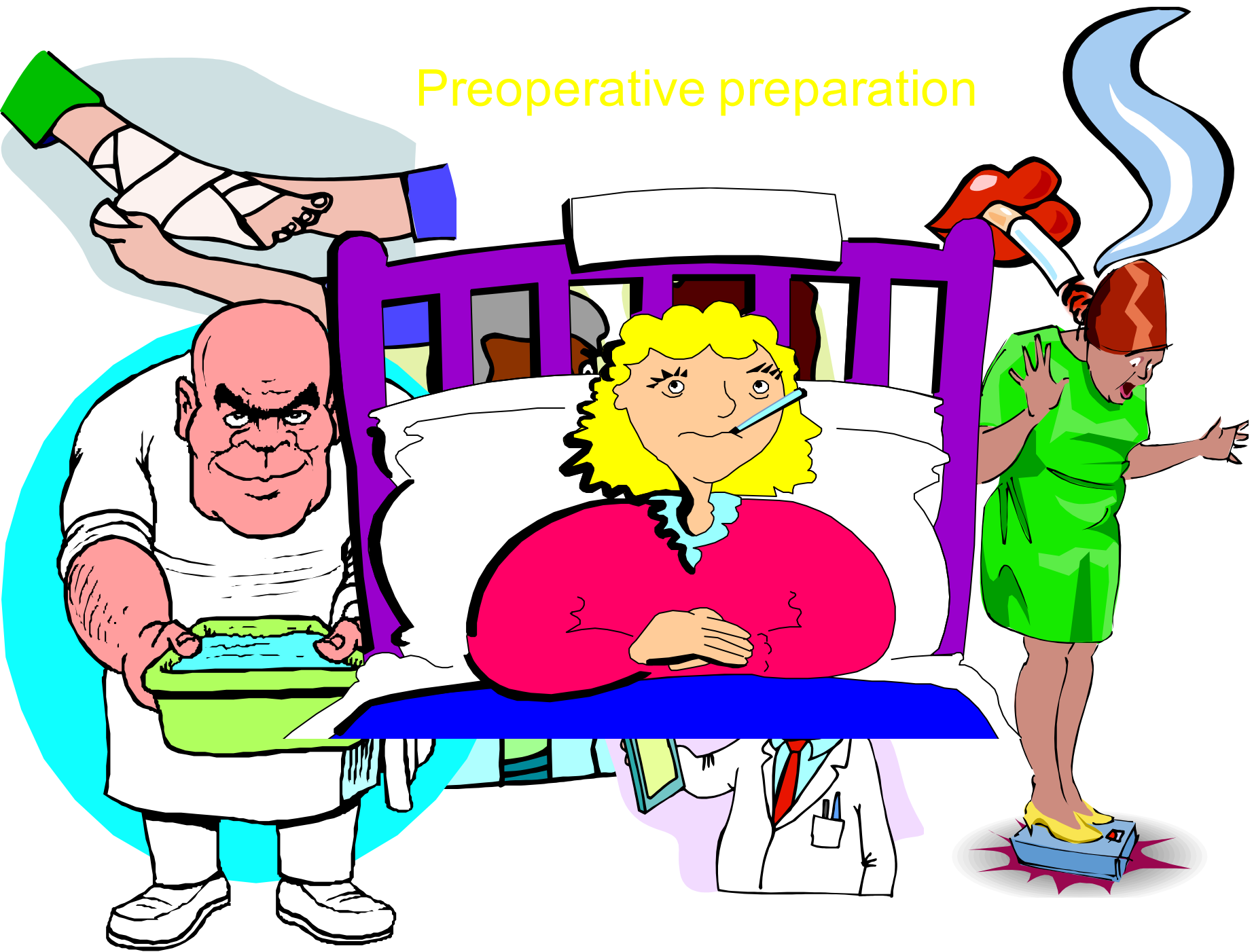
# SSI – Risk Factors

## Patient Characteristics

- Age
- Diabetes
  - ▣ HbA<sub>1c</sub> and SSI
  - ▣ Glucose > 200 mg/dL postoperative period (<48 hours)
- Nicotine use: delays primary wound healing
- Steroid use: controversial
- Malnutrition: no epidemiological association
- Obesity: 20% over ideal body weight
- Prolonged preoperative stay: surrogate of the severity of illness and comorbid conditions
- Preoperative nares colonization with *Staphylococcus aureus*: significant association
- Perioperative transfusion: controversial
- Coexistent infections at a remote body site
- Altered immune response



# Preoperative preparation



# PRE-OPERATIVE SHAVING



# Pre-operative shaving

- Shaving the surgical site with a razor induces small skin lacerations
  - ▣ potential sites for infection
  - ▣ disturbs hair follicles which are often colonized with *S. aureus*
  - ▣ Risk greatest when done the night before
  - ▣ Patient education
    - *be sure patients know that they should not do you a favor and shave before they come to the hospital!*

# Influence of Shaving on SSI

<u>Group</u>	<u>No Hair Removal</u>	<u>Depilatory</u>	<u>Shaved</u>
Number	155	153	246
Infection rate	0.6%	0.6%	5.6%

# Prophylactic Antibiotics

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*Antibiotics given for the purpose of preventing infection when infection is **not** present but the risk of postoperative infection **is** present*

# Prophylactic Antibiotics

## *Questions*

- Which cases benefit?
- Which drug should you use?
- When should you start?
- How much should you give?
- How long should antibiotics be continued?

# Surgical site prevention

Use antibiotics  
appropriately

Avoid shaving  
Site

Maintain normal  
Body temp

Optimize oxygen  
tension

Maintain normal  
Blood glucose

# Treatment

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- **Incisional: open surgical wound, antibiotics for cellulitis or sepsis**
- **Deep/Organ space: Source control, antibiotics for sepsis**



# Types of Surgery

<b>Clean</b>	<b>Hernia repair breast biopsy</b>	<b>1.5%</b>
<b>Clean- Contaminated</b>	<b>Cholecystectomy planned bowel resection</b>	<b>2-5%</b>
<b>Contaminated</b>	<b>Non-preped bowel resection</b>	<b>5-30%</b>
<b>Dirty/infected</b>	<b>perforation, abscess</b>	<b>5-30%</b>

# Occupational Blood Borne Virus Infections

	<b>HBV</b>	<b>HCV</b>	<b>HIV</b>
<b>Risk from Needle stick</b>	<b>30%</b>	<b>2%</b>	<b>0.3%</b>
<b>Chemoprophylaxis</b>	<b>Yes</b>	<b>No</b>	<b>Yes</b>
<b>Vaccine</b>	<b>Yes</b>	<b>No</b>	<b>No</b>

Q

