WOUNDS & HEALING
OBJECTIVES

- Identify the stages of wound healing
- Understand the classification of surgical wounds
- List variables in the OR that influence healing
TYPES OF WOUNDS

- Surgical
- Traumatic
- Chronic
HEMOSTATIS
ALL BLEEDING STOPS EVENTUALLY...RIGHT?

• While arterial pumping is more dramatic, venous “oozing” can cause negative outcomes if untreated.
• If hemostasis is incomplete, even if the wound is closed, a hematoma can form and impede healing or cause infection.
• When the body’s own ability to clot is not enough, we must rely on external factors...
COMMON HEMOSTATIC AGENTS

- Absorbable Gelatin (Gelfoam, Surgifoam)
- Microfibrillar Collagen (Avitene)
- Epinephrine (watch that concentration!)
- Silver nitrate - usually ENT, circumcisions
- Thrombin - Topical only last 3 hours once mixed.
- Electrocautery (Bovie)
- Good old direct pressure
- Ligation of blood vessels (hemoclips suture)
HOW DO WOUNDS HEAL?

Three phases of healing:
- Inflammatory
- Proliferative
- Remodeling

Phases of Wound Healing for Pilonidal Surgery

- **Inflammation**
  - 4 - 6 Days
  - The body sends fluids to the injury site to clean and prepare for healing

- **Proliferation**
  - 4 - 60 Days
  - The healing phase, the body works to mend the injured area and grow new tissue

- **Remodeling**
  - 60 Days - 2 Years
  - New nerve endings grow, tissue continues to rearrange, scar regains ability to stretch

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INFLAMMATORY

- 1-4 days after injury
- Blood flow increased, increased presence of leukocytes to fight off infection.
- Skin edges mildly red and swollen.
- Lymph and plasma exudate helps seal the wound but the seal is weak and easily corrupted.
PROLIFERATIVE

- Usually 2-4 weeks, up to a year or more.
- New epithelial cells are proliferating.
- Granulation tissue under wound edges feels like a hard ridge.
- Epidermal migration limited to 3 cm.
REMODELING

• Begins after proliferation.
• Scar tissue is formed, collagen replaced and re-arranged.
• Scar will never have more than about 80% of the tensile strength of skin.
FACTORS AFFECTING WOUND HEALING

WHAT CAN THE OR NURSE DO?

• Prevent infection!!! SSI is the most common cause of delayed wound healing.
• Monitor/regulate temperature. Use warm irrigation fluid when possible
• Oxygenation. Low SpO2 at wound site inhibits collagen formation
• Other things to be aware of: Pt nutritional status and post op return to ambulation have a big impact on healing.
SURGICAL WOUND CLASSIFICATION

Class I

- Considered Clean Wounds
- Area was prepped with surgical prep
- No contamination from respiratory, alimentary or genitourinary tracts
- No accidental contamination of surgical site
CLASS II

- “Clean Contaminated” Wounds
- Enters or crosses respiratory alimentary or genitourinary tract under controlled conditions and without gross spillage.
CLASS III

- Contaminated Wounds
- Involves spillage from alimentary or genitourinary tracts.
- Includes open, fresh accidental wounds and recent traumatic wounds that penetrate above mentioned tracts.
CLASS IV

• Dirty or Infected Wounds
• Old traumatic wounds with retained devitalized tissue
• Wounds with existing infection
• Includes delayed primary closure of class III wounds.
YOU TELL ME

Total hip replacement
Dental Implants
Tonsillectomy
Incision and drainage of breast abscess
Laceration repair of Dog bite on face
Removal of lung lobe
Hysterectomy
Open abdominal surgery with removal of 16” of lower intestine.
A WORD ABOUT ANTIBIOTIC PROPHYLAXIS

- Important for the prevention of SSI.
- Timing matters
- Use the appropriate antibiotic for expected pathogens
- Consider allergies
- May need to re-dose
- Total joint replacement, colon surgery, hysterectomy, neuro.
**Antibiotic Prophylaxis:**

1. Antibiotic received within one hour prior to surgical incision,
2. Antibiotic selection for surgical patients, and
3. Antibiotics discontinued within 24 hours after surgery end time. (48 hrs for cardiac surgery)

<table>
<thead>
<tr>
<th>Type of Surgery</th>
<th>Antimicrobial Recommendations</th>
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<tbody>
<tr>
<td>Cardiac or Vascular</td>
<td>Preferred: Cefazolin 1-2 gm IV. If B-Lactam Allergy: Clindamycin 600-900 mg IV or Vancomycin 1 g IV. If known history of MRSA: Vancomycin 1 g IV</td>
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<td>Colon</td>
<td>Preferred: Cefoxitin 1-2 g IV, or Ertaopenem 1 g IV. If B-Lactam Allergy: Metronidazole 500 mg IV and Ciprofloxacin 400 mg IV</td>
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<tr>
<td>General Surgery (gastroduodenal, hepatobiliary)</td>
<td>Preferred: Cefoxitin 1-2 g IV. If B-Lactam Allergy: Metronidazole 500 mg IV and Ciprofloxacin 400 mg IV</td>
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<td>Other General Surgical Procedures (e.g. hernia repair, breast)</td>
<td>Preferred: Cefazolin 1-2 g IV. If B-Lactam Allergy: Clindamycin 600-900 mg IV or Vancomycin 1 g IV. If known history of MRSA: Vancomycin 1 g IV</td>
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<tr>
<td>Gynecological Procedures (e.g. hysterectomy, C-section)</td>
<td>Preferred: Cefoxitin 1-2 g IV. If B-lactam allergy: Metronidazole 500 mg IV and Gentamicin 1.5mg/kg IV or Metronidazole 500 mg IV and Ciprofloxacin 400 mg IV</td>
</tr>
<tr>
<td>Neurosurgery</td>
<td>Preferred: Cefazolin 1-2 gm IV. If B-Lactam Allergy: Clindamycin 600-900 mg IV or Vancomycin 1 g IV. If known history of MRSA: Vancomycin 1 g IV</td>
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<tr>
<td>Orthopedic: Hip/Knee Arthroplasty ( infuse completely before tourniquet)</td>
<td>Preferred: Cefazolin 1-2 gm IV. If B-lactam allergy: Clindamycin 600-900 mg IV or Vancomycin 1 g IV.</td>
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Primary Intention

- Wounds created under aseptic conditions with minimal tissue destruction
- Closed with sutures, staples, glue or tape
- No tissue loss
- No dead space
- Edges well-approximated
SECONDARY INTENTION

- Wound allowed to heal from the inside of the body towards the surface.
- Usually involves packing a wound to prevent closing over and/or frequent dressing changes.
- Used for infected, dirty or chronic wounds and also traumatic wounds where large areas of tissue are lost.
TERTIARY INTENTION OR DELAYED PRIMARY CLOSURE

- Intentional delay of primary closure for a few days following injury
- May involve use of retention suture.
- Used after removal of inflamed organ, when the wound is heavily contaminated or when a trauma patient is very unstable.
WOUND VAC
NEGATIVE PRESSURE WOUND THERAPY

• For hard to manage wounds that do not respond to traditional methods
• Used in conjunction with surgical debridement of dead tissue.
• Acute traumatic wounds, chronic wounds, meshed skin grafts and skin flaps
HOW VACS WORK

• They suck! No really, they use suction to create a negative pressure environment for the wound
• Suction through the sponge drains exudate which suppresses bacterial proliferation
• Occlusive dressing prevents contamination
• Negative pressure promotes circulation and speeds up growth of new tissue.

That doesn’t suck at all...
VAC CONSIDERATIONS

- The coarse sponge should not be used over tendons.
- VAC therapy contraindicated for exposed bone, nerves, blood vessels and organs.
- Necrotic tissue must be debrided.
- Sponge can macerate intact skin.
- Suction can be discontinued briefly but works best when used at least 22 hours/day.
DRAINS

- Encourage the Elimination of serum, blood, bile, pus or intestinal secretions. Prevent hematoma formation
- Placed in the surgical wound usually during wound closure
- Usually sutured in place
- May or may not be attached to a suction reservoir
- Commonly used in: Chest Cases, Gallbladder, blunt trauma.
COMMON TYPES OF DRAINS
It's a good thing they make surgical masks. If they didn't,
everyone would know my face was like this the whole time.
SOURCES

- Berry & Kohn's Operating Room Technique. 11th edition, by N. Phillips
- Alexander’s Care of the Patient in Surgery 14th edition by Jane C. Rothrock
- Stanford Medicine Resources for Anesthesia Research and Education. The Antibiotic SCIP measures
  http://ether.stanford.edu/policies/re_dosing_guidelines.html