Wound Care & Suture Techniques

- Michael Hazel, DNP, RN, FNP-BC
- Steve Branham, PhD, RN, FNP, ACNP

What to expect today.
- Discuss different types of wound healing techniques and assessments
- Identify different suture types and uses in the clinical setting
- Discuss several wound considerations and/or complications that can arise during healing process
- Practice - Practice - Practice

Model of Wound Healing
- (1) Hemostasis: within minutes post-injury; platelets aggregate at the injury site to form a fibrin clot.
- (2) Inflammatory: bacteria and debris are phagocytosed and antibodies and interferons are released that cause the migration and proliferation of cells
- (3) Proliferative: angiogenesis, collagen deposition, granulation tissue formation, epithelialization, and wound contraction
- (4) Remodeling: collagen is remodeled and realigned along tension lines and cells that are no longer needed are removed by apoptosis.
Factors Affecting Wound Healing

Local Factors
- Oxygenation
- Infection
- Foreign body
- Venous sufficiency

Systemic Factors
- Age and gender
- Sex hormones
- Illness
- Diabetes
- Chronic disease: DM, hepatitis, HIV, obesity, renal
- Obesity
- Medications: glucocorticoid steroids, NSAIDS, chemotherapeutic agents
- Alcoholism and smoking
- Immunocompromised conditions
- Nutrition

CDC Surgical Wound Classification

- **Contaminated:** (10-17% risk) open, fresh, accidental wounds, operations with major breaks in sterile technique or gross spillage from the gastrointestinal tract, and incisions in which acute, nonpurulent inflammation is encountered.

- **Dirty or infected:** (>27% risk) old traumatic wounds with retained devitalized tissue and those that involve existing clinical infection or perforated viscera. This definition suggests that the organisms causing postoperative infection were present in the operative field before the operation.

Wound Cleaning

- Consider...
  - Hand washing
  - Personnel precautions
  - Hair removal
  - Anesthesia
  - Foreign material
  - Wound soaking
Wound Cleaning

- “The solution to pollution is dilution”
- Scrubbing - controversial (be wary of too much on cosmetic areas)

Wound Preparation

- Most important step for reducing the risk of wound infection.
- Remove all contaminants and devitalized tissue before wound closure:
  - IRIGATE w/ NS or TAP WATER (AVOID H2O2, POVIDONE-IODINE)
  - CUT OUT DEAD, FRAGMENTED TISSUE
- If not, the risk of infection and of a cosmetically poor scar are greatly increased
- Personal Precautions

Anesthetic Solutions

- CAUTIONS: due to its vasoconstriction properties never use Lidocaine with epinephrine on:
  - Eyes, Ears, Nose
  - Fingers, Toes
  - Perine, Scrotum
Anesthetic Solutions

- Lidocaine (Xylocaine®)
  - Most commonly used
  - Rapid onset
  - Strength: 0.5%, 1.0%, & 2.0%
  - Maximum dose:
    - 5 mg/kg or
    - 200 mg
  - 1% Lidocaine = 1 g lidocaine / 100 cc
  - 0.5% lidocaine = 0.5 g lidocaine / 100 cc
  - 2% lidocaine = 0.05 g lidocaine / 100 cc

- Lidocaine (Xylocaine®) with epinephrine
  - Vasoconstriction
  - Decreased bleeding
  - Prolongs duration
  - Strength: 0.5% & 1.0%
  - Maximum individual dose:
    - 7 mg/kg or
    - 500 mg

BUPIVACAINE (MARCAINE):

- Slow onset
- Long duration
- Strength: 0.25% or 0.5%
- Dose: maximum individual dose 3 mg/kg

Local Anesthetics

```
<table>
<thead>
<tr>
<th>Agent</th>
<th>Concentration</th>
<th>Infusion</th>
<th>Duration of Block</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lidocaine</td>
<td>1%, 2%</td>
<td>Immediate</td>
<td>3-6 h max</td>
</tr>
<tr>
<td>Lidocaine w/ ep*</td>
<td>2%</td>
<td>Intermediate</td>
<td>6-20 min</td>
</tr>
<tr>
<td>Topical</td>
<td>A-100, A-0.5%</td>
<td>Slow</td>
<td>15-40 min</td>
</tr>
</tbody>
</table>

* As acepromazine in ears, paws, flanks, and tail
```
Injection Techniques
- 25, 27, or 30-gauge needle
- 6 or 10 cc syringe
- Check for allergies
- Insert the needle at the inner wound edge
  - Aspirate
  - Inject agent into tissue SLOWLY
  - Wait...
  - After anesthesia has taken effect, suturing may begin

Types of Sutures
- Absorbable or non-absorbable (natural or synthetic)
- Monofilament or multifilament (braided)
- Dyed or undyed
- Sizes 3 to 12-0 (numbers alone indicate progressively larger sutures, whereas numbers followed by 0 indicate progressively smaller)
- New antibacterial sutures
Suture

**Natural Suture**
- Biological
- Cause inflammatory reaction
  - Catgut (connective tissue from cow or sheep)
  - Silk (from silkworm fibers)
  - Chromic catgut

**Synthetic**
- Synthetic polymers
- Do not cause inflammatory response
  - Nylon
  - Vicryl
  - Monocryl
  - PDS
  - Prolene

---

**Monofilament**
- Single strand of suture material
- Minimal tissue trauma
- Smooth tying but more knots needed
- Harder to handle due to memory
- Examples: nylon, monocryl, prolene, PDS

**Multifilament (braided)**
- Fibers are braided or twisted together
- More tissue resistance
- Easier to handle
- Fewer knots needed
- Examples: vicryl, silk, chromic

---

**Suture**

<table>
<thead>
<tr>
<th>Non-Absorbable</th>
<th>Absorbable</th>
</tr>
</thead>
</table>
| - Not biodegradable and permanent
  - Nylon
  - Prolene
  - Stainless steel
  - Silk (natural, can break down over years) |
| - Degraded via inflammatory response
  - Vicryl
  - Monocryl
  - PDS
  - Chromic
  - Cat gut (natural) |
### Suture Materials

<table>
<thead>
<tr>
<th>Material</th>
<th>Structure</th>
<th>Tis. Use</th>
<th>Strength</th>
<th>Knot sec.</th>
<th>Uses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gut</td>
<td>Natural</td>
<td>++</td>
<td>5-0</td>
<td>***</td>
<td>Absorbable, gut</td>
</tr>
<tr>
<td>Chromic Gut</td>
<td>Natural</td>
<td>++</td>
<td>4-0-5</td>
<td>***</td>
<td>Non-absorbable, gut</td>
</tr>
<tr>
<td>Dexon</td>
<td>Braided</td>
<td>++</td>
<td>2-0</td>
<td>****</td>
<td>Soft-Q closures</td>
</tr>
<tr>
<td>Voseal</td>
<td>Braided</td>
<td>++</td>
<td>2-0</td>
<td>****</td>
<td>Meshed closures</td>
</tr>
<tr>
<td>Maxon</td>
<td>Monofil</td>
<td>+</td>
<td>2-0-3</td>
<td>****</td>
<td>Soft-Q closures</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Material</th>
<th>Structure</th>
<th>Tis. Use</th>
<th>Strength</th>
<th>Knot sec.</th>
<th>Uses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silk</td>
<td>Braided</td>
<td>++</td>
<td>5-0</td>
<td></td>
<td>Easy to handle</td>
</tr>
<tr>
<td>Nylon</td>
<td>Monofil</td>
<td>++</td>
<td>2-0</td>
<td></td>
<td>Common for skin</td>
</tr>
<tr>
<td>Polyfil</td>
<td>Monofil</td>
<td>+</td>
<td>3-0</td>
<td></td>
<td>High tenacity, Soft-Q suffix</td>
</tr>
<tr>
<td>Dacron</td>
<td>Braided</td>
<td>++</td>
<td>2-0</td>
<td></td>
<td>Good knot security</td>
</tr>
</tbody>
</table>

### Suture Sizes

<table>
<thead>
<tr>
<th>Location</th>
<th>Superfluous non-absorbable</th>
<th>Superfluous absorbable</th>
<th>Deep absorbable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scalp, nose (cheek, cheek)</td>
<td>3–0 to 5–0</td>
<td>7–0 to 9–0</td>
<td>10–0</td>
</tr>
<tr>
<td>Face, forehead, nose, lip</td>
<td>6–0</td>
<td>8–0</td>
<td>10–0</td>
</tr>
<tr>
<td>Ear, eyelid</td>
<td>6–0</td>
<td>8–0</td>
<td>10–0</td>
</tr>
<tr>
<td>Head*</td>
<td>6–0 to 5–0</td>
<td>8–0</td>
<td>10–0</td>
</tr>
<tr>
<td>Head and neck*</td>
<td>3–0 to 4–0</td>
<td>6–0</td>
<td>8–0</td>
</tr>
<tr>
<td>Neck</td>
<td>3–0 to 6–0</td>
<td>6–0</td>
<td>8–0</td>
</tr>
</tbody>
</table>

* Deep sutures are to be avoided in the head and neck unless being used to repair a wound, as they may increase the risk of wound infection.

### Surgical Needles

- Wide variety with different company’s naming systems
- 2 basic configurations for curved needles

- Cutting: cutting edge can cut through tough tissue, such as skin
- Tapered: no cutting edge. For softer tissue inside the body
Surgical Needles

Surgical Instruments

Scalpel Blades

Commonly used in the blades: A, no. 11 blade; B, no. 15 blade; C, no. 10 blade.

Table 1. Choosing Which Blade to Use

<table>
<thead>
<tr>
<th>Blade Size</th>
<th>Optimal Cutting for Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 11</td>
<td>Cutting on a variety of tissues, perforating a plane tissue</td>
</tr>
<tr>
<td>No. 15, 20</td>
<td>Cutting, perforating, and incising tissues</td>
</tr>
</tbody>
</table>

*This table describes the optimal blade to use. If you have a choice of blades, if you do not have the variety of tissues, any blade can be used for almost any situation.*
Wound Evaluation
- Time of incident
- Size of wound
- Depth of wound
- Tendon / nerve involvement
- Bleeding at site

When to Refer
- Deep wounds of hands or feet, or unknown depth of penetration
- Full thickness lacerations of eyelids, lips or ears
- Injuries involving nerves, larger arteries, bones, joints or tendons
- Crush injuries
- Markedly contaminated wounds requiring drainage
- Concern about cosmesis
Contraindications to Suturing
• Redness
• Edema of the wound margins
• Infection
• Fever
• Puncture wounds
• Animal bites
• Tendon, nerve, or vessel involvement
• Wound more than 12 hours old (body) and 24 hrs (face)

Closure Types
• Primary closure (primary intention)
  – Wound edges are brought together so that they are adjacent to each other (re-approximated)
  – Examples: well-repaired lacerations, well reduced bone fractures, healing after flap surgery
• Secondary closure (secondary intention)
  – Wound is left open and closes naturally (granulation)
  – Examples: gingivectomy, gingivoplasty, tooth extraction sockets, poorly reduced fractures
• Tertiary closure (delayed primary closure)
  – Wound is left open for a number of days and then closed if it is found to be clean
  – Examples: healing of wounds by use of tissue grafts.

Basic Laceration Repair
Principles And Techniques
Principles And Techniques

• Minimize trauma in skin handling
• Gentle apposition with slight eversion of wound edges
  – Visualize an Erlenmeyer flask
• Make yourself comfortable
  – Adjust the chair and the light
• Change the laceration
  – Debride crushed tissue

Types of Closures

● Simple interrupted closure – most commonly used, good for shallow wounds without edge tension
● Continuous closure (running sutures) – good for hemostasis (scalp wounds) and long wounds with minimal tension
● Subcuticular – good for cosmetic results
● Vertical mattress – useful in maximizing wound eversion, reducing dead space, and minimizing tension across the wound
● Horizontal mattress – good for fragile skin and high tension wounds
● Percutaneous (deep) closure – good to close dead space and decrease wound tension

Simple Interrupted Suturing

• Apply the needle to the needle driver
  – Clasp needle 1/2 to 2/3 back from tip
• Rule of halves:
  – Matches wound edges better, avoids dog ears
  – Vary from rule when too much tension across wound
Suturing

- The needle enters the skin with a 1/4-inch bite from the wound edge at 90 degrees.
  - Visualize Erlenmeyer flask
  - Evert wound edges
  - Because scars contract over time

- Release the needle from the needle driver, reach into the wound and grasp the needle with the needle driver. Pull it free to give enough suture material to enter the opposite side of the wound.
- Use the forceps and lightly grasp the skin edge and arc the needle through the opposite edge inside the wound edge taking equal bites.
- Rotate your wrist to follow the arc of the needle.
- Principle: minimize trauma to the skin, and don’t bend the needle. Follow the path of least resistance.

- Release the needle and grasp the portion of the needle protruding from the skin with the needle driver. Pull the needle through the skin until you have approximately 1 to 1/2-inch suture strand protruding form the bites site.
- Release the needle from the needle driver and wrap the suture around the needle driver two times.
Simple Interrupted Suturing
Rule of halves

Simple Interrupted Suturing
Rule of halves

Simple, Interrupted

http://www.youtube.com/watch?v=PFQ5tquFqY
Placing a Simple Suture

Instrument Ties

Running Simple Sutures
Suturing
Examples

Thanks
Practice, Practice, Practice