**Principles of Laceration Repair**

- Cornerstones are cleaning, debridement, closure, and protection
- Objectives include:
  - Preserve tissue viability
  - Restore continuity
  - Optimize wound strength
  - Prevent excessive or prolonged inflammation
  - Avoid infection or impediments to healing
  - Minimize scar formation

**Steps in Laceration Repair**

- Hemostasis
- Anesthesia
- Wound irrigation
- Wound exploration
- Removal of devitalized tissue
- Tissue preservation
- Closure / tension
- Dressings
- Follow-up care
Assessment

- Patient safety: supine
- Initial hemostasis: simple pressure
- Jewelry removal for hand/finger repair
- Pain relief: Local anesthesia/sedation
- If closure delay, saline dressing
- Consider presence of other injuries

Laceration Evaluation and Documentation

- Focused history
  - Mechanism of injury: shearing (sharp), v. tension (blunt), v. compression (crushing)
    - Consider foreign body (x-ray, explore)
  - Age of wound
  - Associated s/s
    - Systemic
    - Numbness
    - Loss of function

Wound Evaluation and Documentation

- Past and Social History
  - Underlying disorders: diabetes, PVD
  - Allergies: drugs, anesthetics
  - Last tetanus
  - Current meds: anticoagulants, steroids
  - Vocation
  - Handedness
Wound Evaluation and Documentation

- Physical Exam
  - Vital signs
  - General systems as appropriate
- Wound description
  - Location
  - Length/extent/tissue depth
  - Condition: clean, contaminated, sharp, irregular, flap
  - Functional exam as appropriate

- Procedure
  - Anesthesia: type, amount
  - Wound cleansing: agent, irrigation
  - Exploration, debridement
  - Suture type, size, number
  - Dressing type
- Disposition
  - Wound care instructions
  - Interval for removal

Principles of Closure: Anatomy

- Align all layers
- Sutures anchored in the dermis
Simple Lacerations

Simple scalp laceration  Simple finger laceration

Complex Lacerations

Ear with cartilage involvement  Deep facial laceration

Complex Lacerations

Hand with tendon involvement ("No man's land")  Dog bite of the face
Complex Lacerations

- Facial laceration involving the vermilion border
- Careful alignment required

Skin Tension Lines: Dynamic

- Impact on scar formation
- Created by underlying pull of muscles (figure A,B)
- Scars parallel to these have better healing, less visible

Skin Tension Lines: Static

- Langer's lines
  - R/T arrangement, orientation, and dispensability of collagen: causing wound to retract open
  - Use lines for elective incisions
  - Result in gaping of wound in certain areas
    - Perform less debridement: may increase tension of wound
    - Increase scar width
Local Anesthetics

- Lidocaine (Xylocaine), Bupivacaine (Marcaine)
- Mechanism of blockade
  - Infiltrate tissues and diffuse across neural sheaths
  - Interfere with depolarization and transmission of impulse
  - Decrease NA influx → decrease polarization → dec. action potential → no nerve impulse

### Local Anesthetics

<table>
<thead>
<tr>
<th>Agent</th>
<th>Concentration</th>
<th>Infiltration</th>
<th>Onset of Action</th>
<th>Duration of Action</th>
<th>Max Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lidocaine</td>
<td>1%, 2%</td>
<td>Immediate</td>
<td>4-10</td>
<td>30-120</td>
<td>4.5mg/kg of 1% (30mL)</td>
</tr>
<tr>
<td>Lidocaine w/ epi</td>
<td>1%</td>
<td>Immediate</td>
<td>4-10</td>
<td>60-240</td>
<td>7mg/kg of 1% (50mL)</td>
</tr>
<tr>
<td>Mepivacaine</td>
<td>1%, 2%</td>
<td>Immediate</td>
<td>6-10</td>
<td>90-180</td>
<td>5mg/kg of 1% (40 mL)</td>
</tr>
<tr>
<td>Bupivacaine</td>
<td>0.25%, 0.5%</td>
<td>Slower</td>
<td>8-12</td>
<td>240-480</td>
<td>3mg/kg of 0.25% (50 mL)</td>
</tr>
<tr>
<td>Topical</td>
<td>5-15 min</td>
<td>-</td>
<td>20-30</td>
<td>2-5mL</td>
<td></td>
</tr>
</tbody>
</table>

Toxicity of Local Anesthetics

- Cardiovascular
  - Hypotension and bradycardia
    - Sec. to inhibition of cardiac fibers
    - Often R/T direct injection veins or arteries or dose
  - Vasovagal reaction
    - Sec. to pain
    - All patients supine
  - CNS: seizures
    - Excitatory response
Special Considerations

- Epinephrine
  - Increases duration of anesthetic effect
  - Improved hemostasis at site r/t vasoconstriction
  - Contraindicated in terminal circulation: Ears, nose, fingers, toes, penis

- Topical solutions
  - Children
  - Small lacerations

Other Alternatives

- For true allergies: Most allergies implicate older ester solutions; procaine (Novocaine) and tetracaine; or preservative in solution (methylparaben)
  - No anesthesia for small lacerations
  - Ice
  - Preservative free (preps used for spinal, epidural)
  - Dephenhydramine (Benadryl): Dilute 1 mL (50 mg/mL) with 4 mL NS (1% soln)
    - More painful to inject
    - Duration of effect 30 min.

Anesthesia Techniques

- Topical
- Direct wound infiltration: For minimally contaminated wounds
- Parallel Margin Infiltration (field block): grossly contaminated wounds, closed skin
- Special techniques: Nerve Blocks
  - [http://emprocedures.com/anesthesia/infiltration.htm](http://emprocedures.com/anesthesia/infiltration.htm)
  - [http://www.youtube.com/watch?v=25kZWI_MYrg&feature=related](http://www.youtube.com/watch?v=25kZWI_MYrg&feature=related)
Reducing the Pain of Local Anesthetics

- Buffering
  - 1 mL bicarb per 9 mL 1% lidocaine
  - 0.1 mL bicarb per 20 mL bupivacaine
- Warming
- Needle selection
  - 27 G. To 30 G.
- Slow injection

Wound Cleansing and Irrigation

- Cleansing solutions (skin prep)
  - Providone-iodine
  - Chlorhexidine
- Hair removal
  - Never shave eyebrows!
- Wound soaking
- Irrigation: Saline “The solution to pollution is dilution”
  - 35 – 50 mL syringe with 19 G tip or splash shield
  - Amt. varies: irrigate until area looks clean (100 – x)
  - Manual scrub to remove excess debris as needed

Instruments and Suture Materials

- Instruments
  - Needle holder, forceps, skin hooks, scissors, hemostats, blades
- Suture material
  - Absorbable, non-absorbable
    - Select based on body part and strength
Types of Closure

- **Primary closure (intention)**
  - Optimum within 6-8 hours
  - May vary depending on body region, level of contamination, degree of tissue devitalization

- **Secondary closure (intention)**
  - No closure, left to heal via granulation
  - Prone to more scarring

- **Tertiary closure (intention)**
  - Leave open for 4 days
  - Close later

### Suture Material: Nonabsorbable

<table>
<thead>
<tr>
<th>Material</th>
<th>Structure</th>
<th>Tissue Reaction</th>
<th>Tensile Strength</th>
<th>Knot Security</th>
<th>Uses/Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silk</td>
<td>Braided</td>
<td>+++</td>
<td>+++</td>
<td>+++++</td>
<td>Inc. potential infection</td>
</tr>
<tr>
<td>Nylon (Ethilon, Dermalon)</td>
<td>Mono-filament</td>
<td>++</td>
<td>+++</td>
<td>+</td>
<td>Common, high memory</td>
</tr>
<tr>
<td>Polypropylene (Prolene)</td>
<td>Mono-filament</td>
<td>+</td>
<td>+++</td>
<td>+</td>
<td>High memory</td>
</tr>
<tr>
<td>Dacron (Mers bole)</td>
<td>Braided</td>
<td>+++</td>
<td>+</td>
<td>+++</td>
<td>Similar to silk, less inflammation</td>
</tr>
<tr>
<td>Polybutester (Novafill)</td>
<td>Mono-filament</td>
<td>+</td>
<td>+++</td>
<td>+++</td>
<td>Expands and contracts with tissue edema</td>
</tr>
</tbody>
</table>

### Suture Material: Absorbable

<table>
<thead>
<tr>
<th>Material</th>
<th>Structure</th>
<th>Tissue Reaction</th>
<th>Tensile Strength</th>
<th>Tissue Half-Life</th>
<th>Use/Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chromic gut</td>
<td>Natural</td>
<td>+++</td>
<td>++</td>
<td>10-14d</td>
<td>Oral mucosa/ stiff</td>
</tr>
<tr>
<td>Polyglycolic acid (Dexon)</td>
<td>Braided</td>
<td>++</td>
<td>+++</td>
<td>25d</td>
<td>Subq</td>
</tr>
<tr>
<td>Polyglyconate (Maxon)</td>
<td>Braided</td>
<td>++</td>
<td>+++</td>
<td>28-36d</td>
<td>Subq, less reactive</td>
</tr>
<tr>
<td>Polydioxanone (PDS)</td>
<td>Mono-filament</td>
<td>+</td>
<td>+++</td>
<td>36-53d</td>
<td>Subq for high degree security</td>
</tr>
</tbody>
</table>
Guidelines for Suture Material and Size

<table>
<thead>
<tr>
<th>Anatomic Site</th>
<th>Percutaneous (Skin)</th>
<th>Deep (Dermal)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scalp</td>
<td>5-0/4-o monofilament</td>
<td>4-o absorbable</td>
</tr>
<tr>
<td>Ear</td>
<td>6-o monofilament</td>
<td>--------------</td>
</tr>
<tr>
<td>Eyelid</td>
<td>7-0/6-o monofilament</td>
<td>--------------</td>
</tr>
<tr>
<td>Face</td>
<td>6-o monofilament</td>
<td>5-o absorbable</td>
</tr>
<tr>
<td>Oral Mucosa</td>
<td>--------------</td>
<td>5-o absorbable</td>
</tr>
<tr>
<td>Trunk</td>
<td>5-0/4-o monofilament</td>
<td>3-o absorbable</td>
</tr>
<tr>
<td>Extremities</td>
<td>5-0/4-o monofilament</td>
<td>4-0/3-o absorbable</td>
</tr>
<tr>
<td>Hand</td>
<td>5-o monofilament</td>
<td>5-o absorbable</td>
</tr>
<tr>
<td>Foot</td>
<td>4-0/3-o monofilament</td>
<td>5-o absorbable</td>
</tr>
</tbody>
</table>

Simple Laceration

Complex Lacerations
Basic Principles and Techniques

- Basic Principles
  - Layer matching
  - Wound edge eversion
  - Reduce wound tension

- Simple Techniques
  - Simple interrupted
  - Vertical mattress
  - Horizontal mattress
  - Subq

Wound Dressings

- Uncomplicated face and scalp wounds: Open

- Other wounds
  - Antibiotic ointment
  - Non-adherent dressing
  - Gauze
  - Secure
- Immobilization over joints
- Neatness counts!!

Suture Removal

- Timing of removal

<table>
<thead>
<tr>
<th>Location</th>
<th>Days to Removal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scalp</td>
<td>6-8d</td>
</tr>
<tr>
<td>Face</td>
<td>4-5d</td>
</tr>
<tr>
<td>Ear</td>
<td>4-5d</td>
</tr>
<tr>
<td>Chest/abdomen</td>
<td>8-10d</td>
</tr>
<tr>
<td>Back</td>
<td>12-14d</td>
</tr>
<tr>
<td>Arms/Legs</td>
<td>8-10d</td>
</tr>
<tr>
<td>Hand</td>
<td>8-10d</td>
</tr>
<tr>
<td>Fingertip</td>
<td>10-12d</td>
</tr>
<tr>
<td>Foot</td>
<td>12-14d</td>
</tr>
</tbody>
</table>
References