Basic Wound Closure & Knot Tying

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Objectives

- Provide basic information on commonly used suture materials
- Review general principles of wound closure
- Provide a general overview of basic surgical knot tying
Suture Material

- Generally categorized by three characteristics:
  - Absorbable vs. non-absorbable
  - Natural vs. synthetic
  - Monofilament vs. multifilament
Absorbable Suture

- Degraded and eventually eliminated in one of two ways:
  - Via inflammatory reaction utilizing tissue enzymes
  - Via hydrolysis

- Examples:
  - “Catgut”
  - Chromic
  - Vicryl
  - Monocryl
  - PDS (polydioxanone suture)

http://ecatalog.ethicon.com/sutures-absorbable
Non-absorbable Suture

- Not degraded, permanent
- Examples:
  - Prolene (polypropylene)
  - Ethibond (polyester/Dacron)
  - Nylon
  - Stainless steel
  - Silk*

(*not a truly permanent material; known to be broken down over a prolonged period of time—years)
Natural Suture

- Biological origin
- Cause intense inflammatory reaction
- Examples:
  - “Catgut” – purified collagen fibers from intestine of healthy sheep or cows
  - Chromic – coated “catgut”
  - Silk
Synthetic Suture

- Synthetic polymers
- Do not cause intense inflammatory reaction
- Examples:
  - Vicryl
  - Monocryl
  - PDS
  - Prolene
  - Nylon
Monofilament Suture

- Grossly appears as single strand of suture material; all fibers run parallel
- Minimal tissue trauma
- Resists harboring microorganisms
- Ties smoothly
- Requires more knots than multifilament suture
- Possesses memory
- Examples:
  - Monocryl, PDS, Prolene, Nylon
Multifilament Suture

- Fibers are twisted or **braided** together
- Greater resistance in tissue
- Provides good handling and ease of tying
- Fewer knots required

**Examples:**
- Vicryl (braided)
- Chromic (twisted)
- Silk (braided)
## Suture Degradation

<table>
<thead>
<tr>
<th>Suture Material</th>
<th>Method of Degradation</th>
<th>Time to Degradation</th>
</tr>
</thead>
<tbody>
<tr>
<td>“Catgut”</td>
<td>Proteolytic enzymes</td>
<td>Days</td>
</tr>
<tr>
<td>Vicryl, Monocryl</td>
<td>Hydrolysis</td>
<td>Weeks to months</td>
</tr>
<tr>
<td>PDS</td>
<td>Hydrolysis</td>
<td>Months</td>
</tr>
</tbody>
</table>
Suture Size

- Sized according to diameter with “0” as reference size
- Numbers alone indicate progressively larger sutures (“1”, “2”, etc)
- Numbers followed by a “0” indicate progressively smaller sutures (“2-0”, “4-0”, etc)

Smaller ←---------------------------------------------→ Larger

.....“3-0”...“2-0”...“1-0”...“0”...“1”...“2”...“3”.....
Needles

- Classified according to shape and type of point
  - Curved or straight (Keith needle)
  - Taper point, cutting, or reverse cutting
Needles

- **Curved**
  - Designed to be held with a needle holder
  - Used for most suturing

- **Straight**
  - Often hand held
  - Used to secure percutaneously placed devices (e.g. central and arterial lines)
Needles

- Taper-point needle
  - Round body
  - Used to suture soft tissue, excluding skin (e.g. GI tract, muscle, fascia, peritoneum)
Needles

- Cutting needle
  - Triangular body
  - Sharp edge toward inner circumference
  - Used to suture skin or tough tissue
Suture Packaging
Wound Closure

- Basic suturing techniques:
  - Simple sutures
  - Mattress sutures
  - Subcuticular sutures

- Goal: “approximate, not strangulate”
Simple Sutures

- **Simple Interrupted**
  - Single stitches, individually knotted (keep all knots on one side of wound)
  - Used for uncomplicated laceration repair and wound closure
Mattress Sutures

- **Horizontal Mattress**
  - Provides added strength in fascial closure; also used in calloused skin (e.g. palms and soles)

- **Two-step stitch:**
  - Simple stitch then,
  - Needle reversed and 2nd simple stitch made adjacent to first
  - Same size bite as first stitch
Mattress Sutures

- **Vertical Mattress**
  - Affords precise approximation of skin edges with eversion
  - Two-step stitch:
    - Simple stitch made – “far, far” relative to wound edge (large bite)
    - Needle reversed and 2nd simple stitch made inside first – “near, near” (small bite)
Subcuticular Sutures

- Usually a running stitch, but can be interrupted
- Intradermal horizontal bites
- Allow suture to remain for a longer period of time without development of crosshatch scarring
Steri-strips

- Sterile adhesive tapes
- Available in different widths
- Frequently used with subcuticular sutures
- Used following staple or suture removal
- Can be used for delayed closure
Staples

- Rapid closure of wound
- Easy to apply
- Evert tissue when placed properly
Two-Hand Square Knot

- Easiest and most reliable
- Used to tie most suture materials

(click image to start video)
Instrument Tie

- Useful when one or both ends of suture material are short
- Commonly used technique for laceration repair

(click image to start video)
References

  (More extensive overview of knot tying with photos for those interested in surgery)


- Edgerton, MT. The Art of Surgical Technique. Baltimore: Williams & Wilkins; 1988
  (Excellent resource for technical details of surgery)

  (Useful book for anyone doing clinical rotations!)

Special thanks to Drs. Thomas and Angelats for their assistance in the development of this presentation.