Suture Selection: It does matter
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How do you make the right choice?

Suture material: Outline
• Purpose of suture
• Ideal suture
• Suture size and strength
• Suture type
• Needle selection

Purpose of Suture
• To optimize wound healing:
  – maintain tissue apposition or ligate vessels
• Suture is a foreign body
• Strike a balance

Role of sutures in infection
• In a human study, the number of Staphylococcus required to cause subcutaneous infection decreased by 10,000-fold by adding a single piece of silk to wound

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Short History of suture

- Ancient India used beetle mouths
- Plant fibers
  - Egyptians for mummies and living people
  - Irritating
  - Non-absorbable
- Cat gut
  - Galen of Pergamon 2nd century
  - Dissolvable
  - Unpredictable
  - Scarring noted

Ideal suture

- Adequate strength
- Easy to handle
- Minimal tissue reaction
- Resistant to infection
- Excellent knot security
- Dissolves when no longer needed
- Economical

Purpose of suture

- During the lag phase of healing, suture material provides the majority of wound strength
- Once the body takes over, it is no longer needed

Suture Selection

- Where is it going?
  - Tissue—strength required
- How long should it be there?
- Is tissue infected/contaminated?
- What kind of needle?

Suture size and strength

- "An ideal suture is one that will lose its tensile strength at a rate similar to that with which the tissue gains strength" (Fossum)
Suture size and strength

• Weak suture will break prematurely
• Overly strong suture will provide unnecessary presence resulting in a tissue reaction that may impede wound healing
• Match tissue strength with suture strength

Size and strength

Suture size correlates to suture strength

• USP pharmacopeia (USP):
  – small to large with diameter in inches
  – 12-0 to 7
  – Most common sizes are 0, 2-0, 3-0 and 4-0

Suture size and strength

• Strong tissues
  – Ligaments, tendons, fascia, skin
• Intermediate tissues
  – Stomach, intestines, bladder
• Weak tissues
  – Fat, liver, kidney, spleen

Suture Characteristics

• Flexibility
• Capillarity
• Relative knot security
• Tissue reaction
• Strength loss over time
• Ability to be absorbed
• Time to complete absorption

Suture material

Synthetic
  Absorbable
  Non-absorbable

Natural
  Absorbable
  Non-absorbable
Suture type

- Braided and non-braided
- Absorbable and Non-absorbable
- Natural and Synthetic

Braided v. Non-braided

- Braided
  - Greater strength and pliability
  - Knot less likely to slip
  - Less throws necessary for secure knot
  - Harbors infection
- Non-braided
  - Less pliable
  - More susceptible to crushing
  - More likely to slip
  - Requires more throws
  - Less prone to harboring infection

Suture Type

- Absorbable suture
  - Degradation and loss of strength within 60 days
- Non-absorbable suture
  - Retains tensile strength for 60 days or more after implantation

Natural versus Synthetic

- Natural – derived from plant or animal
  - Silk
  - Catgut
- Synthetic—polymers from man-made sources
  - Most commonly used sutures today

Natural suture

- Chromic gut
  - Submucosa of sheep intestine or bovine serosa
  - Formaldehyde treated collagen fibers
  - Stimulates significant foreign body reaction
  - "Virtually impossible to indicate exact designation of a consistent absorption time" (Covidien):
    - 3-7 days
  - Selection of chromic catgut suture for use in surgical procedures where adhesions are desired is unwarranted. (Rochat 1996, AJVR)
Natural Suture

- Silk
  - First non-absorbable suture material used
  - Multifilament
  - Loses strength in 6mos
  - Marked tissue reactivity
  - Avoid in infection
  - Good in vascular surgery: shunt, PDA, PRAA

Suture type

- Absorbable suture from strongest to weakest
  - Biosyn (glycomer)
  - Monocryl (poliglecaprone 25)
  - Maxon (polyglycolic acid)
  - PDS (polydioxanonone)
  - Vicryl (polyglactin 910)
  - Dexon (polyglycolide)
  - chromic gut

Synthetic absorbable

- Degraded by hydrolysis via esterase enzyme activity
- Significantly decreased inflammatory process
- Fairly constant rate of absorption
- Fairly constant loss of strength

Suture type

<table>
<thead>
<tr>
<th>Least reactive</th>
<th>Polidioxanone</th>
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<tr>
<td>Polyglyconate</td>
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<tr>
<td>Polyglactin 910</td>
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<tr>
<td>Polyglycolic acid</td>
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<tr>
<td>Poliglecaprone 25</td>
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<tr>
<td>Most reactive</td>
<td>Chromic gut</td>
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- Biosyn (Glycomer 631)
  - Synthetic, absorbable monofilament
  - Initially strongest
  - Lose of 60% by 21 days
  - Complete absorption by 90-100 days
  - Fascia, linea alba, joint capsule
Suture Type

- Maxon (polyglyconate)
  - Synthetic, absorbable monofilament
  - Loses 30% by 14 days
  - Loses 45% by 21 days
  - Totally absorbed 180 days
  - Good for linea

- PDS (polydioxanone):
  - Retains tensile strength the longest of all absorbable suture
  - 6 weeks to lose 50%
  - Linea closures, tendons, ligaments
  - Veterinary are no. 1 purchaser of PDS according to Ethicon
  - Minimum throws for secure knot is 4
  - Continuous 5/7

Polyglactin 910 (vicryl)

- Vicryl
  - Braided, synthetic suture
  - Soft for mouths
  - Vessel ligation and subcutaneous sutures
  - Avoid in urinary, biliary tract and infection
  - Good knot security
  - Loses about 1/3 of strength at 14 days
  - 2/3rd by 21 days
  - Fully absorbed by 90 days

Nonabsorbable synthetics

- Maintain full strength for > 60 days
  - Walled off or encapsulated by fibroblasts
- Stainless steel
- Polyester (mersilene, ethibond)
- Polymerized caprolactum (vetafil, braunamid)
- Nylon (ethilon)
- Polypropylene (prolene)
Synthetic non-absorbable

- Polypropylene (prolene)
  - Lower initial strength than nylon but retains strength longer
  - Awkward to handle
  - Least likely to potentiate infection in contaminated wounds
  - Non-thrombogenic
  - Uses
    - Skin sutures
    - Vascular surgery
    - Fascia, ligament, tendons, cavity closures in immune compromised

Synthetic Non-absorbable

- Nylon
  - Loses 30% within 2 years
  - Minimal tissue reaction
  - Good choice for skin

WHICH ONE DO YOU CHOOSE?

Suture Type

- Short-lived suture
  - Ideal for rapidly healing tissues
    - Bladder
    - Mucosa
    - Oral surgery
    - Intradermal sutures
    - Monocryl, Dexon

Linea closures

- Longer lasting absorbables
  - PDS, Maxon
  - 0-big dogs, 2.0 medium, 3.0 small dogs and cats
- Non-absorbable if delayed wound healing
  - Diabetes, cushings, hypothyroidism, chemotherapy
  - Polypropylene (prolene)
Thoracic surgery

- PDA, PRAA—silk
- Lung lobectomy – PDS, maxon
- Circumcostal closure—PDS or polypropylene
- Muscle layer—PDS
- Subcutaneous/intradermal—monocryl
- +/- Skin sutures (nylon, polypropylene) or staples

Gastrointestinal surgery

- Absorbable suture that retains strength through 14 days is recommended
  - PDS, Maxon, etc
  - 3.0, 4.0
  - Monocryl?
- Enterotomies
- Gastrotomies
- Gastropexies
- Resection and anastomoses

Subcutaneous and intradermal tissue

- Weak tissue does not need strong suture
- Quick absorption suture
  - Monocryl, vicryl, dixon
  - 3.0/4.0
  - Continuous pattern

Oral surgery

- Absorbable
- Braided soft sutures
  - Vicryl, 3.0
- Short lived sutures
  - Monocryl, 3.0

Antibiotic impregnated suture?

- Effect of using triclosan-impregnated suture for incisional closure on surgical site infection and inflammation following tibial plateau leveling osteotomy in dogs
- Sean W. Etter et al 2013 JAVMA
NEEDLE SELECTION

Needle Selection

• Ideal needle
  – High quality stainless steel
  – Small diameter but strong
  – Stable in needle holder
  – Cause minimal trauma
  – Rigid
  – Corrosion resistant

Swaged v. Eyed

• Swaged
  – Suture and needle are approximately same size
    – Ideal
    – Minimal trauma
    – Saves times
    – More expensive

Swaged v. Eyed

• Eyed:
  – Feed suture through eye
  – More traumatic
  – Two strands must pass through suture
  – Time consuming

Suture Needle Selection

• Most needles are curved
• Typical sizes include
  – ¼, 3/8, ½, 5/8
• 3/8 has the “friendliest” curve
• Cutting v. taper

Taper Needle

• Taper needle
  – Round, less traumatic
  – Less likely to cut tissue
  – Good for delicate tissue such as viscera, connective tissue, vessels
  – Laryngeal tie-back surgery
• Good for most things
Cutting Needle

- **Purpose**
  - Reduce trauma getting through tough tissues
  - Skin sutures
  - Intradermal sutures

Suture common sense

- Use least amount of suture material necessary to accomplish successful healing of tissue

Suture: Common sense

- It is better to increase number of sutures than to increase size of suture material
  - Each added suture decreases the stress on the rest
- Proper spacing
  - to avoid tissue necrosis or dehiscence

Suture: Common sense

- Placing a knot weakens suture material
  - The knot is the weakest part of the suture loop
  - #1 reason for dehiscence improperly tied knots
  - Knots (foreign material) should be minimized
Suture Common Sense

• When performing a continuous suture pattern, the ending knot requires more throws because loop makes knot weaker
• Larger sutures sizes are less secure and require more throws, more foreign material

Examples

• Skin wound with potential for contamination
  – Highly dissolvable in subcutaneous region
  – Nonabsorbable in the skin
    • Remove when appropriate

Case examples

• Diabetic, Cushingoid 10 yr bishon frisee OHE (25lbs)
  – Linea – 2.0/3.0 polypropylene
  – Subcutaneous region—4.0 monocryl
  – Skin—3.0 nylon

Case examples

• Gastropexy in 90lb lean M german shepherd
  – Incisional gastropexy: 3.0 PDS
  – Linea: 0 PDS
  – SQ/intradermal: 3.0 monocryl

Case Examples

• Cystotomy in diabetic 13 yo FS toy poodle 9lbs
  – Cystotomy: 3.0 PDS (non diabetic—monocryl)
  – Linea: 3.0 polypropylene (non DM-3.0 pds)
  – SQ: 4.0 monocryl
  – Skin: 3.0 nylon
Conclusions

- Match suture to tissue
- Remember suture material is a foreign material
- When in doubt use a taper needle
- Less is more

Questions?