Sutures and Suture Selection

Suture plays an important role in wound repair by providing hemostasis and support for healing tissue. Different tissues have differing requirements for suture support, and they heal at different rates; some tissues need support for only a few days (e.g., muscle, subcutaneous tissue, skin), whereas others require weeks (fascia) or even months (tendon) to heal.

Ideal suture
1. Easy to handle
2. Reacts minimally in tissue
3. Inhibits bacterial growth;
4. Holds securely when knotted;
5. Resists shrinking in tissue; is
6. Noncapillary,
7. Nonallergenic,
8. Noncarcinogenic, and
9. Nonferromagnetic; and absorbs with minimal reaction after the tissue has healed

Suture Characteristics
1. Suture size.
   a. The smallest diameter suture that will adequately hold the mending wounded tissue should be used to minimize trauma as the suture is passed through the tissue and to reduce the amount of foreign material left in the wound.
   b. The most commonly used standard for suture size is the USP (United States Pharmacopeia), which denotes dimensions from fine to coarse (with diameters in inches) according to a numeric scale, with 12-0 being the smallest and 7 the largest.

<table>
<thead>
<tr>
<th>Synthetic suture materials (usp)</th>
<th>Surgical gut (usp)</th>
<th>Brown and sharpe wire gauge</th>
<th>Metric gauge</th>
<th>Actual size (mm)</th>
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2. Flexibility.
The flexibility of a suture is determined by its torsional stiffness and diameter, which influence its handling and use.
3. **Surface characteristics and coating.**
The surface characteristics of a suture influence the ease with which it is pulled through tissue (i.e., the amount of friction or “drag”) and the amount of trauma caused.

4. **Capillarity.**
Capillarity is the process by which fluid and bacteria are carried into the interstices of multifilament fibers.

5. **Knot tensile strength.**
Knot tensile strength is measured by the force (in pounds) that the suture strand can withstand before it breaks when knotted.

### Specific Suturing Materials

**Absorbable Suture Materials**

Absorbable suture materials (e.g., surgical gut, polyglycolic acid [Dexon], polyglactin 910 [Vicryl], polydioxanone [PDS II], polyglyconate [Maxon], and poliglecaprone 25 [Monocryl]) lose most of their tensile strength within 60 days and eventually disappear from the tissue implantation site because they have been phagocytized or hydrolyzed.

**Catgut (surgical gut).**

The word *catgut* is derived from the term *kitgut* or *kitstring* (the string used on a kit, or fiddle). Misinterpretation of the word *kit* as referring to a young cat led to the use of the term catgut. Surgical gut actually is made from the submucosa of sheep intestine or the serosa of bovine
intestine and is approximately 90% collagen. It is broken down by phagocytosis and, compared with other suture materials, elicits a notable inflammatory reaction. Plain surgical gut loses strength rapidly after tissue implantation. “Tanning” (cross-linking of collagen fibers), which occurs by exposure to chrome or aldehyde, slows absorption. Surgical gut is available as plain, medium chromic, or chromic; increased tanning generally implies prolonged strength and reduced tissue reaction. Surgical gut is rapidly removed from infected sites or areas where it is exposed to digestive enzymes and is quickly degraded in catabolic patients. The knots may loosen when wet.

**Synthetic absorbable materials.**

Synthetic absorbable materials (e.g., polyglycolic acid, polyglactin 910, polydioxanone, polyglyconate generally are broken down by hydrolysis.

**Polyglycolic acid**

- Braided from filaments extracted from glycolic acid.
- It loses 35% of its tensile strength by 14 days and 65% by 21 days.
- Polyglycolic acid is available in both coated and uncoated forms.

**Polyglactin 910**

- Multifilament suture made of a copolymer of lactide and glycolide with polyglactin 370.
- It is coated with calcium stearate.
- Its rate of loss of tensile strength is similar to that of polyglycolic acid.

**Polydioxanone and polyglyconate**

- Monofilament sutures that retain their tensile strength longer than polyglycolic acid or polyglactin 910.
- Polydioxanone suture has a 14% loss of tensile strength in 14 days, 31% in 42 days, and complete absorption in 6 months.

**Nonabsorbable Suture Materials**

**Organic nonabsorbable materials.**

**Silk**

- Most common organic nonabsorbable suture material used.
- It is a braided multifilament suture made by a special type of silkworm and is marketed as uncoated or coated.
- Silk has excellent handling characteristics and often is used in cardiovascular procedures;
- It should also be avoided in contaminated sites

**Synthetic nonabsorbable materials**

Synthetic nonabsorbable suture materials are marketed as

- Braided multifilament threads (e.g., polyester or coated caprolactam) or
Monofilament threads (e.g., polypropylene, polyamide, polyolefins, or polybutester). They typically are strong and induce minimal tissue reaction.

Nonabsorbable suture materials, which consist of an inner core and an outer sheath (e.g., Supramid), should not be buried in tissue because they may predispose to infection and fistulation. The outer sheath frequently is broken, which allows bacteria to reside under it.

**Metallic sutures.**

- Stainless steel is the metallic suture most commonly used.
- It is available as a monofilament or multifilament twisted wire.
- Tissue reaction to stainless steel generally is minimal, but the knot ends evoke an inflammatory reaction.
- Stainless steel has a tendency to cut tissue and may fragment and migrate.
- It is stable in contaminated wounds and is the standard for judging knot security and tissue reaction to suture materials.

**Surgical Needles**

A variety of needle shapes and sizes are available

**Selection of a needle depends on:**

- Type of tissue to be sutured (e.g., penetrability, density, elasticity, and thickness),
- Topography of the wound (e.g., deep or narrow), and
- Characteristics of the needle (i.e., type of eye, length, and diameter). Needle strength, ductility, and sharpness are important factors in determining the handling characteristics and use of a needle.

**The three basic components of a needle are**

- Attachment end (i.e., swaged or eyed end),
- Body
- Point

Eyed needles may be

- closed (i.e., round, oblong, or square) or
- French (i.e., with a slit from the inside of the eye to the end of the needle for ease of threading). Eyed needles are threaded from the inside curvature.
Swaged sutures, the needle and suture are a continuous unit, which minimizes tissue trauma and increases ease of use.

**Body**

- The needle body comes in a variety of shapes. The tissue type and depth and the size of the wound determine the appropriate needle shape.
  1. Straight (Keith) needles generally are used in accessible places where the needle can be manipulated directly with the fingers (e.g., placement of purse-string sutures in the anus).
  2. Curved needles are manipulated with needle holders. The depth and diameter of a wound are important when selecting the most appropriate curved needle.
  3. One-fourth (¼) circle needles are primarily used in ophthalmic procedures.
  4. Three-eighths (⅜) and one-half (½) circle needles are the most commonly used surgical needles in veterinary medicine (e.g., for abdominal closure). Three-eighths circle needles are more easily manipulated than one-half circle needles because they require less pronation and supination of the wrist. However, because of the larger arc of manipulation required, they are awkward to use in deep or inaccessible locations.
  5. A one-half circle or five-eighths (⅝) circle needle, despite requiring more pronation and supination of the wrist, is easier to use in confined locations.

**Needle point**
- cutting,
- taper,
- reverse cutting, or
- side cutting.

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※ Fourth (⅘) circle needles are primarily used in ophthalmic procedures.
Cutting needles generally have two or three opposing cutting edges. They are designed to be used in tissues that are difficult to penetrate, such as skin. With conventional cutting needles, the third cutting edge is on the inside (i.e., concave) curvature of the needle. The location of the inside cutting edge may promote “cut out” of tissue because it cuts toward the edges of the wound or incision.

Reverse cutting needles have a third cutting edge on the outer (i.e., convex) curvature of the needle; this makes them stronger than similarly sized conventional cutting needles and reduces the risk of tissue cut out.

Side cutting needles (i.e., spatula needles) are flat on the top and bottom. They generally are used in ophthalmic procedures.

Taper needles (i.e., round needles) have a sharp tip that pierces and spreads tissues without cutting them. They generally are used in easily penetrated tissues, such as the intestine, subcutaneous tissue, or fascia.
- Tapercut needles, which are a combination of a reverse cutting edge tip and a taperpoint body, generally are used for suturing dense, tough fibrous tissue, such as a tendon.

- Bluntpoint needles have a rounded, blunt point that can dissect through friable tissue without cutting. They occasionally are used for suturing soft, parenchymal organs, such as the liver or kidney.

**Tissue Adhesives**

- Cyanoacrylates (e.g., N-butyl and isobutyl-2-cyanoacrylate) are commonly used for tissue adhesion during some procedures, such as declawing, tail docking, and ear cropping.
- Products advocated for use in veterinary patients include Tissueglue, Vetbond, and Nexabond. These adhesives rapidly polymerize in the presence of moisture and produce a strong, flexible bond.