

Sutures and needles

Sutures

A wide variety of material is available for suturing and ligating tissues. Sutures are selected for use according to the required function. For example, arteries are sutured together with non-absorbable polypropylene or polytetrafluoroethylene (PTFE) sutures which are nonthrombogenic, cause virtually no tissue reaction, and maintain their intrinsic strength indefinitely so that the anastomotic scar (which is under constant arterial pressure) does not stretch and become aneurysmal. Skin wounds, for example, are sutured with either **non-absorbable sutures**, which are removed after several days, or **absorbable sutures** hidden within the skin (subcuticular sutures) and which are not removed surgically but are absorbed after several weeks. Sutures are available in diameters ranging from 0.02–0.50 mm. The minimum calibre of suture should be used, compatible with its function. Non-absorbable sutures are avoided for suturing the luminal aspects of the gastrointestinal and urinary tracts because substances within the contained fluids (e.g. bile, urine) may precipitate on persisting sutures and produce calculi.

Choice of a suture

Choice of suture depends on:

- Properties of suture material
- Absorption rate
- Handling characteristics and knotting properties
- Size of suture
- Type of needle

The requirements of suture material are:

- ✚ **Tensile strength** – the suture must be strong enough to hold tissues in apposition for as long as required.
- ✚ **Durability** – the suture must remain until either healing is advanced or indefinitely if the healed tissue is under constant pressure.
- ✚ **Reactivity** – tissue reaction (i.e. an inflammatory response) allows absorbable sutures to be removed by phagocytosis but results in chronic inflammation if non-absorbable sutures remain *in situ*.
- ✚ **Handling characteristics** – sutures must be easy to grasp, handle and tie.
- ✚ **Knot security** – sutures must be able to be tied effectively so that knots do not come undone or slip.

Sutures are classified as:

- **Absorbable or non-absorbable.** The rate of absorption of absorbable sutures depends on what they are made of and their thickness. Disappearance of the suture occurs through **inflammatory reaction, hydrolysis or enzymatic degradation.**

Absorbable sutures tend to be used where the persistence of foreign material would cause unnecessary tissue reaction or increased risk of infection, e.g. bowel anastomoses, skin and subcutaneous tissues.

Non-absorbable sutures tend to be used where any loss of strength might compromise the future integrity of the tissues being joined, e.g. vascular anastomoses, hernia mesh fixation, tendon repairs, sternal wiring.

- ❖ **Synthetic or natural material.** Sutures of natural (animal) origin are being phased out of surgical practice because of the very minimal risk of disease transmission.

Wide varieties of synthetic suture materials are available:

Monofilament or multifilament.

- **Monofilament sutures** pass through tissues easily, are generally less reactive, and are more difficult to handle and knot securely.
- **Multifilament sutures** are braided or twisted thread, and are easier to handle and knot, but are more likely to harbour micro-organisms within the suture.

Natural suture materials

Absorbable

- Catgut - Plain or chromic

Non-Absorbable

- Silk
- Linen
- Stainless Steel Wire

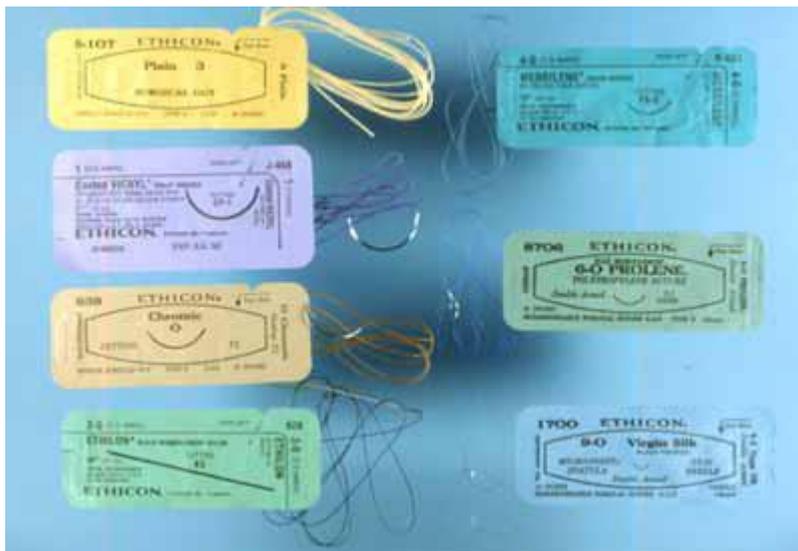
Synthetic suture materials

Absorbable

- Polyglycolic Acid (Dexon)
- Polyglactin (Vicryl)
- Polydioxone (PDS)
- Polyglyconate (Maxon)

Non-Absorbable

- Polyamide (Nylon)
- Polyester (Dacron)
- Polypropylene (Prolene)



Suture Removal Timing

1. Scalp: 6-8 days
2. Face, Eyelid, Eyebrow, Nose, Lip: 3-5 days
3. Ear: 10-14 days
4. Chest and abdomen: 8-10 days
5. Back: 12-14 days
6. Extremities: 12-14 days
7. Hand: 10-14 days
8. Foot and sole: 12-14 days
9. Penis: 8-10 days
10. Condition delaying Wound Healing: 14 to 21 days
 1. Chronic Corticosteroid use
 2. Diabetes Mellitus

Needles

Needle Qualities

Surgical needles are produced from stainless steel alloys, which have excellent resistance to corrosion. All true stainless steels contain a minimum of 12% chromium, which allows a thin, protective surface layer of chromium oxide to form when the steel is exposed to oxygen. Scientists have successfully used the concept of high nickel managing stainless steels to develop stainless steel wires with superior strength and ductility قابلية التطرق for use as surgical needles. Surgical needles made of a high nickel managing stainless steel have a greater resistance to bending and breakage than stainless steels without nickel.

Wound closure and healing is affected by the initial tissue injury caused by needle penetration and subsequent suture passage. Needle selection, surface

characteristics of the suture (eg, coefficient of friction), and suture-coating materials selected for wound closure are important factors that must be considered by the surgeon.

Ideal surgical needle characteristics

- High-quality stainless steel
- Smallest diameter possible
- Stable in the grasp of the needle holder
- Capable of implanting suture material through tissue with minimal trauma
- Sharp enough to penetrate tissue with minimal resistance
- Sterile and corrosion التآكل -resistant to prevent introduction of microorganisms or foreign materials into the wound

Anatomy of a Needle

Point

This portion of the needle extends from the tip to the maximum cross-section of the body.

Body

This part of the needle incorporates most of the needle length. The body of the needle is important for interaction with the needle holder and the ability to transmit the penetrating force to the point. The needle factors that affect this interaction include needle diameter and radius, body geometry, and stainless steel alloy السبيكة .

Swage

The suture attachment end creates a single, continuous unit of suture and needle. The swage may be designed to permit easy release of the needle and suture material.

Needle coating

The needle may be coated with silicone to permit easier tissue passage. The coating helps reduce the force needed to make initial tissue penetration and the frictional forces as the body of the needle passes through the tissue.

Point types

- **Cutting:** The needle has at least 2 opposing cutting edges (the point is usually triangular). This type is designed for penetration through dense, irregular, and relatively thick tissues. The point cuts a pathway through tissue and is ideal for skin sutures. Sharpness is due to the cutting edges.
- **Taper-point (round needle):** This type of needle penetrates and passes through tissues by stretching without cutting. A sharp tip at the point flattens to an oval/rectangular shape. The sharpness is determined by taper ratio (8-12:1) and tip angle (20-35°). The needle is

sharper if it has a higher taper ratio and lower tip angle. The taper-point needle is used for easily penetrated tissues (eg, subcutaneous layers, dura, peritoneum, abdominal viscera) and minimizes potential tearing of fascia.

- **Blunt-point:** This type of needle dissects friable tissue rather than cuts it. The point is rounded and blunt, ideal for suturing the liver and kidneys. Additionally, blunt needles are being developed for more conventional uses in an effort to reduce needlestick injuries.

Body types

- **Straight:** This body type is used to suture easily accessible tissue that can be manipulated directly by hand. The straight-body needle is also useful in microsurgery for nerve and vessel repair.
- **Curved:** The needle has a predictable path through tissue and requires less space for maneuvering than a straight needle. The semicircular path is the optimal course for sutures through tissue and provides an even distribution of tension. Body curvature is commonly a quarter-inch, three eighths-inch, half-inch, or five eighths-inch circle. The three eighths-inch circle is used most commonly for skin closure. The half-inch circle was designed for confined spaces, and more manipulation by the surgeon is required (ie, increased wrist motion is required).



- **Compound curved:** This needle curvature was originally designed for anterior segment ophthalmic surgery. The body has a tight 80° curvature at the tip, which becomes a 45° curvature throughout the remainder of the body. A microvascular compound curved needle also may facilitate vessel approximation in microvascular surgery.

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