DR MANSOUR A

Surgical suture

Surgical suture is a wound closure technique known since ancient Egypt, several thousand years BC. It consists of bringing together the edges of a wound (skin wound closure) or a surgical incision (digestive surgery, orthopedic surgery, etc.).

Advantages: The main reasons are:

- Faster wound healing
- Reduced risk of infection by limiting access from the external environment to the interior of the wound
- Ensuring the most satisfactory aesthetic healing possible

Materials:

A set of basic instruments is necessary for suturing. They are used to manipulate the needle. All surgical instruments used for suturing must be sterile.

Basic suture instruments

Needle Holder

A needle holder is an instrument used to hold a needle. It is characterized by multi-stage ratchets that allow locking the handles. It provides a stable position for the needle fixed in the jaws. The tips of the jaws have gripping surfaces.

There are two types of holders: the **Hegar** holder (more popular and used by the majority of surgeons) and the **Mathieu** holder (less popular).

The **Hegar** holder should be held by the two handles with the thumb and ring finger (fourth finger) of the same hand. The index finger can be placed on the handle of the holder for stabilization.

The **Mathieu** holder should be held with the thumb on one side and the middle, ring, and little fingers on the other side. The index finger, as with the Hegar holder, can be placed on the handle.

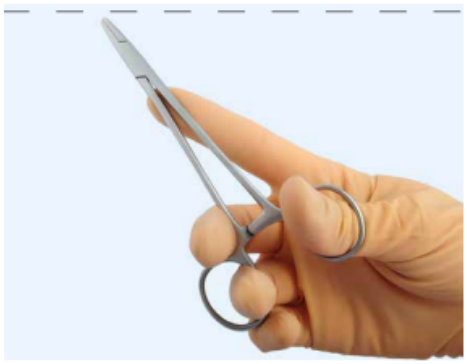


Image1: *Correct way to hold a Hegar needle holder*
Image2: *Correct way to hold a Mathieu needle holder*

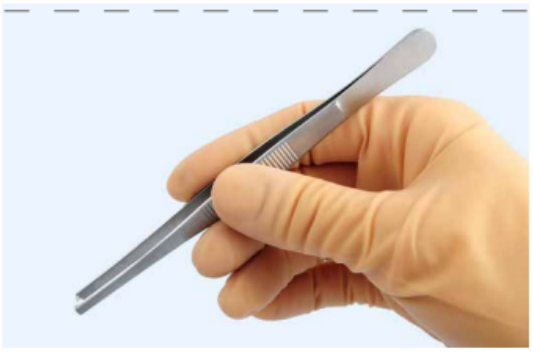
Grasping Forceps (Thumb Forceps)

Forceps are used to grasp tissues (skin, subcutaneous tissue, muscles, fascia), needles, or sutures to move them or hold them in a given position. Additionally, they are used for needle manipulation to reduce the risk of injury to the operator. There are two kinds of forceps: anatomical (smooth) and surgical (toothed).

Anatomical forceps are characterized by a flat gripping surface. They are most often used for coagulation, as well as for delicate, gentle grasping.

Surgical forceps are recognizable by their characteristic teeth on the end of the tips. They are a universal instrument for holding tissue with minimal effort. The pointed tips ensure that the tissue is held in the desired position.

To hold both types of forceps, use the pencil grip (between the thumb and index and middle fingers of the non-dominant hand – similar to holding a pencil).



Correct way to hold surgical forceps

Scissors

Scissors are used for tissue preparation and cutting sutures. The correct way to hold them is similar to the Hegar needle holder.

The Needle

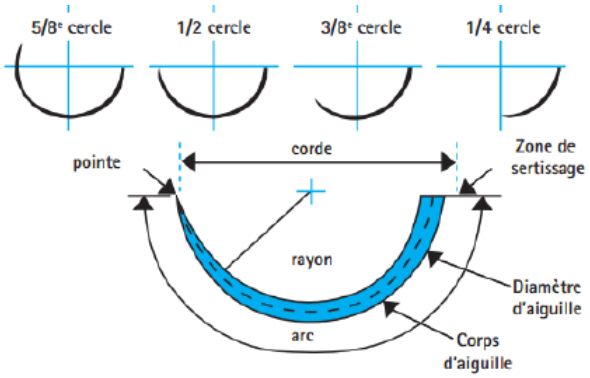
There is a wide variety of needles differing by eye, shape, point, curvature, length, diameter, and surface. The choice of needle type will be made based on:

- The surgical procedure
- The nature of the tissues to be sutured
- The operator's habit

Swaged (atraumatic) needles are increasingly used; they are ready to use: the suture is already attached to the needle. They are less traumatic than eyed needles.

- The needle should be grasped in the part farthest from the gripping surface of the holder (the ends of the holder should slightly protrude beyond the needle).
- It should be held perpendicular to the holder with the point pointing up and to the left (when viewed from the operator's side, assuming they are right-handed).

According to Curvature Angle: Needles range from straight to curved (from 1/8 circle to 5/8 circle).



[Image: Needle curvature types]

- Curvature is conditioned by the depth of the tissue layer to be sutured (deep layer: 4/8 C – very deep layer: 5/8 C).
- Needle length varies from 2 mm (microsurgery, ophthalmology) to 10 cm.

According to Cross-Section: Cutting and non-cutting.

- Blunt section: round body with blunt point, round body with sharp point.
- Cutting section: triangular (cutting edge).

TYPE	Characteristics	Use
Blunt	Round shape, blunt tip	Liver, spleen, kidney
Taper point (round point)	Round shape, sharp tip	Muscles, gastrointestinal tract, subcutaneous tissue, fascia, blood vessels
Reverse cutting	Triangular shape, 3 cutting edges	Skin, dermis, fascia, ligaments

2. Suture Material

Characteristics

Absorbable Sutures: Material degraded by the body, used when temporary support is required.

- Examples: Catgut, Polyglycolic acid (Dexon®), polyglactin 910 (Vicryl®), glycomer, etc.

Resorption can occur by proteolysis (catgut) or hydrolysis (synthetic absorbable ligatures):

- Enzymatic proteolysis is irregular; it depends on the implantation site of the suture and the subject's condition (infectious state).
- Hydrolysis is more regular.

Non-Absorbable Sutures: Material not degraded by the body, used to be left permanently in the animal, to secure an implant, or to reinforce weak tissue.

- Silk. Linen thread. Surgical cotton thread. Nylon or synthetic polyamide monofilaments.
- Polypropylenes. Polyesters (e.g., Tergal®, Dacron®).
- Metallic wire, etc.

MATERIAL	Trade Name	Type	Absorption	Use
Glycolide and lactide	Velosorb™ Fast	Multifilament	Loss of 100% tensile strength in 14 days; Absorbable in 40–50 days	Intradermal, subcutaneous, muscular, and mucosal sutures where more than 7 days of support is not required
Polyglytone 6211	Caprosyn™	Monofilament	Loss of 50% tensile strength in 7 days;	Intradermal sutures, intestinal surgery, bladder, and other soft tissues

			Absorbable in 56 days	
Poliglecaprone 25	Monocryl®	Monofilament	Loss of 50% tensile strength in 7 days; Absorbable in 3 months	Intradermal sutures, intestinal surgery, and other soft tissues

Texture

1. Monofilament: Suture consisting of a single strand. The surface is very smooth and glides well through tissues; it is less prone to harboring bacteria. However, it is more difficult to handle (memory effect) and to tie, requiring several knots.

2. Polyfilament (Braided): Suture consisting of several strands braided together. It has better handling and good knot security. However, it glides less easily through tissues, can cause tissue trauma, and is more prone to bacterial contamination.

Size (Gauge):

According to the United States Pharmacopeia (USP), the gauge varies from 12-0 to 10: from finest to largest.

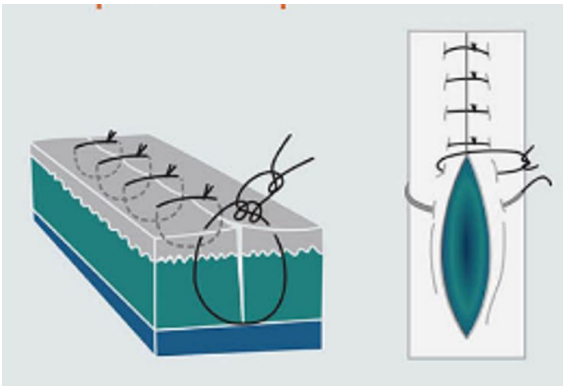
Species	Tissue to Suture	Choice of Suture Material
Cat	Muscles	Polyglactin, Polyglycolic acid, Glycomer 4-0
	Subcutaneous	Poliglecaprone, Polyglactin, Polyglytone 4-0
	Skin (cutaneous)	Nylon (polyamide) or Polypropylene 4-0
Dog (20 kg)	Blood vessels	Polypropylene, Nylon (polyamide) 10-0 / 8-0
	Intestine	Polydioxanone, Polyglyconate, Poliglecaprone 4-0 / 3-0
	Linea alba	Polydioxanone, Polyglyconate, Polypropylene 2-0 / 0
	Muscles	Polyglactin, Polyglycolic acid, Lactomer 3-0 / 2-0
	Subcutaneous	Poliglecaprone, Polyglactin, Lactomer 4-0 / 3-0
	Intradermal	Absorbable monofilament 4-0 / 3-0

Suturing Techniques

Simple Interrupted Sutures

The simple interrupted suture is the oldest and most widely used suture pattern. It is easy and relatively quick to perform. The insertion technique depends on the thickness of the tissue being apposed.

When tying is done, the knot is placed on one edge rather than over the wound gap to avoid hindering healing.

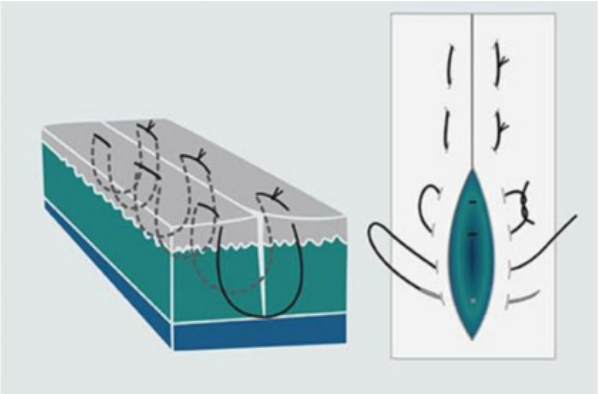


[Image: Simple interrupted suture]

- Sutures are generally placed about 5 to 7 mm apart and 1 to 2 mm from the wound edge.
- They are easy to place, possess greater tensile strength, and have less potential to cause wound edema and poor blood circulation.
- Their advantage is ensuring proper closure; thus, the wound does not open if one suture breaks or is removed.
- The disadvantage is that it is time-consuming, as each suture must be tied.

Vertical Mattress Suture

It is ischemic, resulting in a scar that is quickly strong, very thin, and aesthetic. It is the best stitch for skin suture in all species.

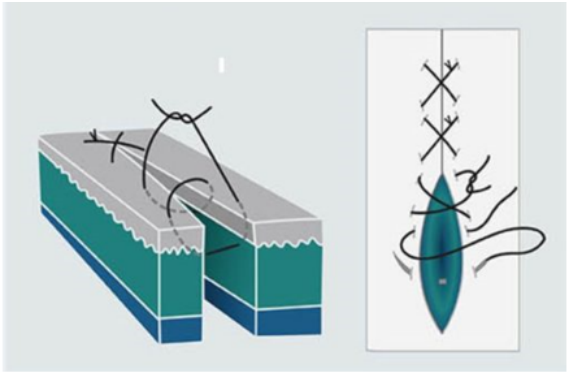


[Image: Vertical mattress suture]

Horizontal Mattress Suture

It is especially used for repairs of muscle walls. Indeed, it withstands mechanical forces better than the simple or vertical mattress suture. However, it is frankly more ischemic than the previous two.

At the muscle level, ischemia creates fewer drawbacks than at the level of the skin or deep organs.



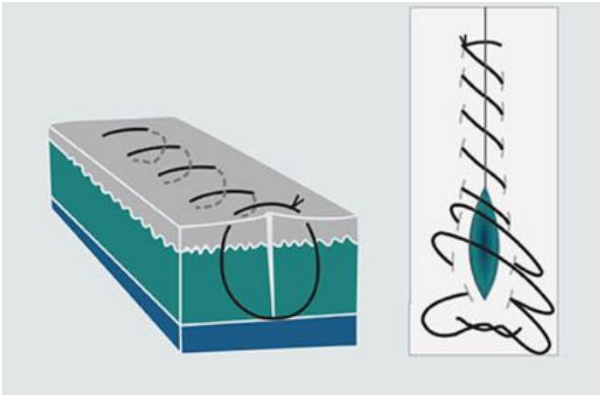
[Image: Horizontal mattress suture]

Continuous Sutures

Simple Continuous Suture (Running Suture)

It can be used on all types of tissues. For large wounds, the simple continuous suture has the advantage of:

- Being quick to perform.
- Distributing tension uniformly along the length of the suture.
- During the suture, the assistant must continuously maintain and guide the thread to prevent it from loosening.



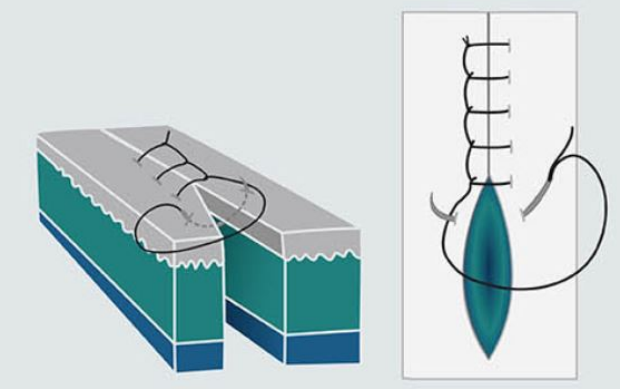
[Image: Simple continuous suture]

Note:

- This suture saves time but should not be too tight as it can cause ischemia of the tissue edges.
- This running suture is very commonly used in wall surgery to appose connective tissue layers.
- The simple continuous suture is recommended in areas of movement or tension. It provides hemostasis of the tissue edges, regularizes tension on the edges, and offers additional security by locking the thread at each pass.

Locking (Interlocking) Continuous Suture

It is mainly used when suturing layers under high tension (e.g., muscle suture for laparotomy) because it allows better distribution of tension along the entire length of the suture.



[Image: Locking continuous suture]

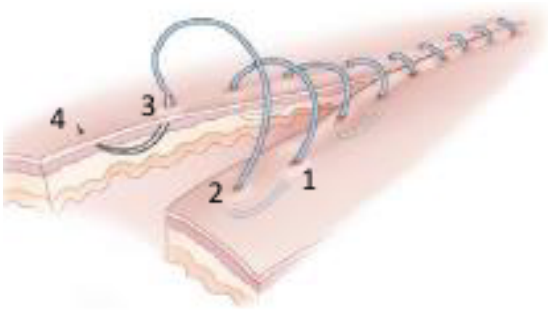
This suture is also called Reverdin's suture. The amount of suture material left is greater than when performing a simple continuous suture. It should be reserved for cases where the tension on the wound is such that the benefit provided by tension distribution outweighs the inflammatory risk caused by the additional material left.

For hollow organs, which generally have a septic internal face and an aseptic external face, there must be no communication between these two faces. In addition to perfect sealing, they are sutured in two layers: 2 continuous sutures.

- The first simple continuous suture to achieve apposition.
- The second non-perforating continuous suture (Cushing) for burying (inversion).

Cushing Suture

The Cushing continuous suture is generally used to suture hollow organs whose contents must not communicate with the exterior, more particularly to bury a first simple continuous suture.

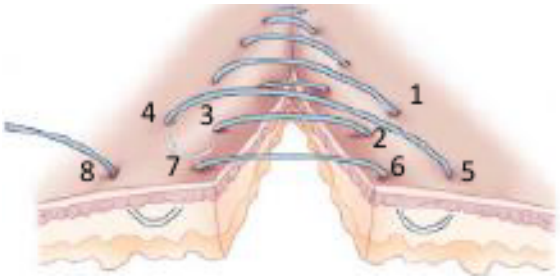


[Image: Cushing suture]

- It is important to note that one remains strictly within the thickness of the tissue concerned (non-perforating) during the different needle passes, and the thread never passes inside the hollow organ. This prevents leakage of the contents of the hollow organ (generally septic).
- It should be avoided on tubular structures, as its inverting nature naturally leads to narrowing of the lumen.

Lembert Suture

The Lembert continuous suture is used for suturing hollow organs. It can notably be used alone in place of a simple continuous suture covered by a Cushing suture. It then possesses the same resistance as these two associated sutures while generating less stenosis and being faster to perform.

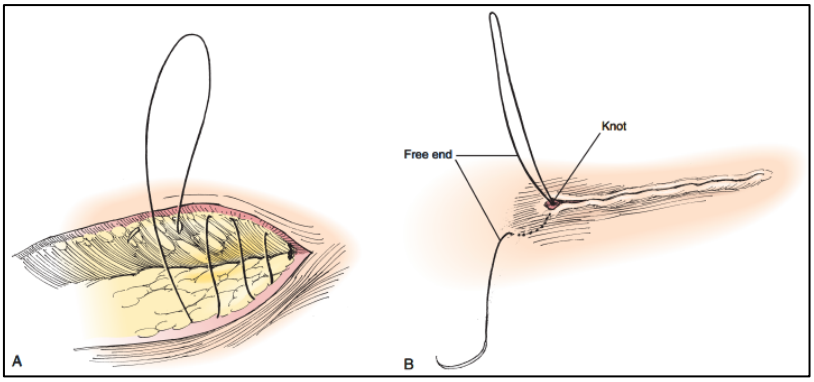


[Image: Lembert suture]

It is important to note that throughout the execution of the continuous suture, one remains well within the thickness of the tissue (including for the start and end points) to prevent communication between the organ contents and the external environment.

Intradermal (Subcuticular) Continuous Suture

The intradermal (subcuticular) continuous suture is a method of closing a skin wound without the suture being visible on the surface. Unlike conventional skin closure where a non-absorbable monofilament is often used, a smaller diameter absorbable material is chosen.



[Image: Intradermal suture]

The knots at the ends and the entire length of the suture are buried. There is a particular practical interest in performing such a suture: not having to remove the skin suture 12 to 15 days after its placement, and not risking the patient damaging its suture by scratching or licking.

The 4 Conditions for a Good Suture Are:

1. Good vascularization of the edges.
2. Absence of tension between the edges.
3. Good suturing technique.
4. Favorable environment.