Needles and sutures

Overview

In this module you will learn about the different types and properties of needles and sutures.

1 Suture needles

Many different types, sizes and shapes of needle are available. Most needles are curved, although straight needles are available. The choice of needle to be used depends on factors such as the nature of the tissue being sutured, the accessibility of the operative area, the gauge of suture material being used and the surgeon's particular preference.

1.1 Suture attachment

Almost all needles nowadays are atraumatic. A hole or channel is formed in the butt end of the needle and the suture is swaged or inserted into it. The suture will follow the needle's path without causing any further tissue damage and is therefore called 'atraumatic'.

Old fashioned needles had an eye and were threaded with a loop of suture. The suture caused more trauma than the needle alone, so the needle was called 'traumatic'.

1.2 Curved needles

The choice of needle shape is often determined by the accessibility of the tissue that requires suturing. Curved needles are most commonly used for suturing and usually, the more confined the operative site, the greater curvature of needle is required.

The curvature may be 1/4, 5/8, 1/2 or 3/8 circle.

A range of lengths is available for any particular curvature.

The mid portion of a curved needle is flattened to allow the needle holder to grip it firmly.

1/4 circle needle

- Applications:
  - eye
  - fascia
  - muscle
  - vascular
  - plastic
  - skin
  - subcuticular

3/8 circle needle

- Applications:
  - eye
  - fascia
  - muscle
  - vascular
  - plastic
  - skin
  - subcuticular

1/2 circle needle

- Applications:
  - gastrointestinal tract
  - pelvis
  - respiratory tract
  - peritoneum
  - muscle
  - urogenital tract

5/8 circle needle

- Applications:
  - urogenital tract
  - pelvis
  - oral cavity

J-shape needle

- Applications:
  - laparotomy closure
  - vagina
  - rectum

Compound curved needle

- Applications:
  - oral
  - eye
  - anterior segment

1.3 Cutting needles

Cutting needles have a triangular cross section. Each edge is extremely sharp, so the needle acts like three tiny scalpels slicing through tissue. This is effective for cutting skin but can cause damage in deeper parts of the body.

Every suture packet bears a symbol describing its needle's point.

Conventional cutting needles have the apex of the triangle on the inner, concave curvature (represented on the suture packet by an upward pointing triangle). This needle is suitable for most purposes. Typical applications are skin, ligament, nasal cavity, tendon and oral.

Reverse cutting needles have the apex of the triangle on the outer, convex curvature (represented on the suture packet by a downward pointing triangle). This places the flat part of the point nearest to the edge of the incision and is said to reduce the likelihood of the needle cutting outwards. Typical applications are skin, fascia, ligament, nasal cavity, tendon and oral.

Tapercut needles are like two needles in one. They combine the initial penetration of a cutting needle with the minimal trauma of a round bodied needle. The cutting tip is limited to the point of the needle.

Penetrating skin with a tapercut needle is difficult and can cause trauma because of the need to grasp the skin edge very tightly with forceps. Consequently, tapercut needles are not recommended for suturing skin. Typical applications are fascia, ligament, uterus and scar tissue.

1.4 Round-bodied needles

Round-bodied needles are conical, with a circular cross-section. This is represented on the suture packet by a circle.

A round bodied needle's conical shape lets it find the path of least resistance through tissue. These needles are best for inserting sutures deep in a wound. They bend or snap if you try to force them through skin or tough fascia.

1.5 Straight needles

A straight needle can be used without instruments, whereas a curved needle must be handled with dissecting forceps and a needle holder. However, the technique is cumbersome and there is a much higher risk of accidentally sticking yourself. For these reasons, suturing with a straight needle is not common and we recommend the use of curved needles.

A straight-body needle can be used to suture easily accessible tissue that can be manipulated directly by hand.

Examples of straight-body needles include the Keith needle, which is a straight cutting needle used for

skin closure of abdominal wounds, and the Bunnell needle, which is used for tendon/gastrointestinal tract repair.

2 Sutures

A suture is a strand of material used to approximate (sew) or to ligate (tie) tissues. Suture material is a foreign body implanted into human tissues and it elicits a foreign body tissue reaction.

Sutures may be:

- absorbable or non-absorbable
- naturally occurring (biological) or synthetic
- monofilament (made out of one strand of material) or multifilament (made by twisting or braiding several smaller filaments into a single structure).

In general, monofilament sutures elicit less tissue reaction than braided (multifilament) sutures, and non-absorbable sutures elicit less tissue reaction than absorbable sutures.

Each suture type comes in a range of sizes. This leads to a bewildering array of possibilities, so it is worth getting to know a small number of sutures well. Your choice of suture will depend on the area of the body, the patient's age and health and the type of closure.

All suture packets have a two part outer covering made of a paper backing bonded to a transparent cover. Information about a suture and its needle is summarised on the suture packet and these details can be seen through the covering before opening. The suture is guaranteed sterile only if this outer covering is unbroken.

2.1 Monofilament sutures

Because of their simple structure, monofilament sutures typically encounter less resistance than multifilament sutures as they pass through tissue. The simple structure also means they are less likely to harbour bacteria that could result in infection. For these reasons, monofilament sutures are highly suitable for vascular surgery.

However, their simple structure means they must be handled very carefully to avoid damage and weakening of the strand.

A monofilament suture can also be springy and resistant to being straightened after being coiled up in its packet. This is because it has what is referred to as 'memory': an inherent capability to return to or maintain its original gross shape.

2.2 Multifilament sutures

Multifilament sutures have greater tensile strength achieved by twisting or braiding several strands

together. They are more pliable and flexible. They have less memory than monofilament sutures, so stretching them will permanently removed most coils and zig zags.

Coated multifilament sutures are available to assist passage through tissue and minimise the risk of bacterial growth amongst strands. These are often the suture of choice for intestinal procedures.

2.3 Absorbable sutures

Absorbable sutures allow temporary wound support until the wound heals well enough to withstand normal stress, and thereafter are gradually absorbed. Because they do not need to be removed, they are mainly used internally for continuous subcuticular closures, for suturing deep to the skin and for tying blood vessels.

Absorbable sutures may support a wound for only a very short period, but they may be present as a foreign body for a long time.

Absorbable sutures can be made of natural or synthetic material.

2.3.1 Natural absorbable sutures

Natural absorbable sutures are absorbed through a process of enzymic reaction. In other words, they are digested by enzymes that attack and break down the suture strand. These enzymes are brought to the wound site by white blood cells.

Catgut is an example of a natural monofilament, made from beef or sheep intestine. Note however that it has been withdrawn in many countries and that in most of Europe only non-absorbable natural sutures are available.

Plain catgut loses its tensile strength after 7-10 days. It can produce a marked tissue reaction and has largely been replaced by synthetic absorbable sutures.

Chromic catgut is treated with chromium salt to slow absorption and retains tensile strength for longer. It can also produce a marked tissue reaction and has largely been replaced by synthetic absorbable sutures.

2.3.2 Synthetic absorbable sutures

Synthetic absorbable sutures are absorbed through a process of hydrolysis, which means that water penetrates the suture filaments and causes the polymer chain to break down.

Synthetic multifilament sutures, such as Vicryl (polyglactin) and Dexon (polyglycolic acid), last longer than the natural alternative, catgut, and produce less tissue reaction. They are also stronger and more predictable in terms of strength retention and absorption than catgut.

Vicryl 2 metric (3-0) is recommended for subcuticular closures and is also useful for deep haemostatic

sutures.

Vicryl 1.5 metric (4-0) is recommended for more delicate subcuticular closure or deep sutures.

Multifilament Dexon sutures are recommended for use as absorbable sutures in general soft tissue approximation and/or ligation, including use in ophthalmic procedures. They are not recommended for use in cardiovascular or neural tissue.

Monocryl is used for general soft tissue suturing and/or ligation. It is not suitable for use in cardiovascular or neurological tissues, ophthalmic and microsurgery, or where extended support is required.

2.4 Non-absorbable sutures

Non-absorbable sutures are materials which are not broken down by the body, Some will lose tensile strength over time, but the mass of the material is not absorbed by the body. They can be removed once the wound has healed, or left in a wound indefinitely.

Non-absorbable sutures can be made of natural or synthetic material.

Most skin wounds are best closed with synthetic, non-absorbable sutures because they are likely to produce a better cosmetic outcome.

Non-absorbable sutures are also used in stressful internal environments where absorbable sutures are not sufficient. Examples would include the heart (with its constant pressure and movement), or the bladder.

2.4.1 Natural non-absorbable sutures

Black silk is a braided, naturally-occurring material. It is made of raw silk spun by silkworms. It handles well and is easy to tie, but tends to excite a tissue reaction which can result in an unsightly scar. Silk should generally be avoided because the synthetic alternatives produce much better results.

Surgical cotton is made of twisted, long, staple cotton fibres. Tensile strength is 50% within 6 months and 30-40% by 2 years.

Another example of a natural non-absorbable suture is surgical steel which has low tissue reactivity and holds knots well. However, it can be difficult to handle because of kinking, fragmentation, and barbing. The cutting, tearing, or pulling of other patient tissues is also a risk.

2.4.2 Synthetic non-absorbable sutures

There is a wide range of synthetic non-absorbable sutures. Polyester and polypropylene lose neither mass nor strength, whereas nylon can lose strength and gradually fragment over time.

Monofilament sutures in this category are excellent for skin closure. They glide smoothly through the tissues and excite very little reaction.

However, they are more difficult to tie than silk and knots can tend to come undone. There are various knot tying techniques for overcoming this problem.

Prolene is a monofilament, synthetic non-absorbable suture made from polypropylene. It retains its tensile strength for up to 2 years. Prolene holds knots better than other monofilament synthetic materials. 1.5 metric (4-0) is recommended for interrupted sutures in most sites. Prolene 2 metric (3-0) is recommended for non-absorbable subcuticular closures. It is also useful for interrupted sutures in thick skin such as the back. Prolene 0.7 (6-0) is recommended for fine facial sutures and in children.

Ethilon is a good alternative to Prolene. 1.5 metric (4-0) is recommended for interrupted sutures in most sites. Ethilon 2 metric (3-0) is recommended for non-absorbable subcuticular closures. It is also useful for interrupted sutures in thick skin such as the back. Ethilon 0.7 (6-0) is recommended for fine facial sutures and in children.

Ethibond is a braided polyester suture with indefinite tensile strength retention. It is recommended for cardio vascular and general surgery where permanent retention is important. Ethibond has a highly adherent coating which acts as a lubricant and improves handling qualities.

Nurolon and Surgilon are braided sutures made from nylon-polyamide polymers. They lose tensile strength at a rate of 15-20% per year and degrade at the same rate. These sutures are suitable for suturing and ligating most body tissues.

2.5 Suture sizes

There are two systems for describing the thickness of a suture - metric and traditional.

In the metric system, the number given to a suture is equivalent to its diameter in tenths of a millimetre. The number 1.5 suture shown here, for example, is 0.15 mm in diameter.

The traditional system is less rational but widely used. Suture thickness is expressed by a number followed by a zero, or by an equivalent number of zeroes. e.g. 3-0, 3/0 or 000, 4-0, 4/0 or 0000, etc. The larger the number, the finer the suture.

- 6-0 is about the thickness of a human hair
- 4-0 is commonly used for skin closure.
- 3-0 is suitable for tough skin (e.g. on the back)
- 0-0 is about the size of a large fishing line. A typical application would be closure of the abdominal wall

You generally will use sizes in the middle range: 3-0 to 5-0. On areas where cosmetic concerns are not

of the utmost importance, 3-0 or 4-0 sutures are best, because the larger size makes the technique easier and the thicker sutures are stronger.

It is best to use small sutures on the face, such as 5-0 or 6-0 as this is likely to result in decreased scarrings. The tendency is also to use smaller sutures on children because of their more delicate skin.

2.6 Practise opening a suture packet

To open a suture, peel apart the outer covering and deposit the inner packet onto a sterile field.

Pick up the inner packet and lift the card tab to reveal the needle with its attached suture neatly coiled. Grasp the needle with the needle holder (avoiding the needle's point) and gently pull in a straight line. This allows the suture to uncoil without becoming tangled.