Suture

Abstract

This lecture for Vet Nurses takes a look at suturing and provides a good theoretical starting point for any VN who may be starting to suture in practice.

Learning Outcomes

- Theoretical knowledge of suturing - suture materials and patterns
- Confidence in understanding suturing.

Notes

Suture material

Suture material is available in many forms shapes and sizes. It is important to understand the terminology used when discussing suture to develop a good underpinning knowledge of what is available and in the selection of the appropriate material for the procedure being performed. With experience and knowledge the veterinary nurse becomes an invaluable member of the surgical team as they can anticipate the type of suture that may be requested.

Characteristics

- Tensile Strength: The amount of force that the suture can withstand before it breaks
- Memory: The ability or tendency of the suture to return to its original packaged form
- Flexibility: The ease with which the suture in manipulated, either by the surgeon or in the tissue. Flexibility is somewhat determined by the size (diameter) and the material used to make the suture e.g silk has better flexibility than stainless steel.
- Absorbability: Progressive loss of mass and/or volume of suture material. Suture can be classified as either non-absorbable or absorbable. Non-absorbable suture is not broken down by the body and can remain intact in the body for at least 2 years. Absorption of absorbable suture may begin as soon as 7 days after placement. Complete absorption may take up to 60 days to 2 years.
- Capillarity: Is the process by which fluid and bacteria are carried into the interstices of multifilament fibres.
- Structure: Two basic types of suture – Multifilament and monofilament.
- Knot security: The ability of the suture to hold the knot the surgeon has placed is imperative. Some types of suture material holds knots better than others. Usually braided material
- Colour: Some suture are dyed during the manufacturing processes for easier identification after placement in the tissue.

Origin of material

Suture material is also classified by the origin of material from which it is made

- Natural – made from fibres found in nature for example; silk, cotton and catgut
- Synthetic material – is other suture produced with manufactured products for example; nylon, polyglactin 910. Synthetic: Materials are usually chemical polymers and their absorption characteristics are generally more predictable
• Metallic suture – is limited to surgical stainless steel suture which includes; wire and staples

Classification
Sutures are generally classified into four main categories absorbable or non-absorbable, monofilament or multifilament.

- Absorbable suture materials provide temporary wound support, while the wound is still healing, and are then absorbed once the wound has sufficient strength to withstand normal stresses.
- Non-absorbable – generally intended for wound closure, where suture removal is later performed, or when extensive wound support is required.
- Monofilament – Suture materials are a single strand. This structure allows the suture material to pass through the tissues with less resistance and is less resistant to harbouring bacteria.
- Multifilament – Suture material is comprised of several filaments, which are twisted or braided together. These materials are less stiff to handle, but have higher coefficient of friction. Multi filament generally has higher tensile strength, flexibility, and more pliable with better handling and knot security. However, multifilament materials have increased capillarity, which results in the suture material absorbing fluid and may result in wicking of bacteria through the tissues.

Choosing the right material
At present there is no single material that can provide all of the characteristics listed. Under different situations and with differences in tissue composition throughout the body, the requirements for wound closure will require different suture material characteristics. Unfortunately, no perfect material exists for all surgical situations, so the surgeon must consider all suture the characteristics of the material when deciding whether to use it for a particular procedure - as this will influence healing of tissues, functional and cosmetic outcome.

Suture selection
A suture is only needed until the wound has healed. Once the suture material has lost its significant tensile strength, it should not persist in the wound.

Multifilament suture materials are a poor choice in contaminated or infected wounds, since the braid provide a haven for bacteria and blood serum soaked into the suture provide ideal medium for bacteria growth.

Advantages to choosing smaller gage suture – they are Less tissue trauma, have smaller knots, there is Greater knot security with small-diameter suture material, adherent bacteria is less viable on small-gauge suture material.

Advantages to swaged needle – available for immediate use, without need to attach material, Cause less tissue trauma as the needles/suture material junction is passed through tissue, they are Less likely to have the suture material become detached prematurely and Less handling of the suture material required, thus maintaining suture integrity. They are guaranteed to be sterile if used straight from the packet.

Suture attachment
Suture needles may be eyed, for threading, or have suture material swaged on Swaged-on needles;
• Channel-swage: have a channel into which the suture material is introduced before the channel is crimped over the suture material.
• Drill-swage: needles have metal removed from the end by drilling; the suture material is introduced and the end of the needle is crimped over the suture material.
Eyed needles: have a standard circumference ‘hole’ in the end of the needle or with a spring eye.
• A spring eye (French) needle has a slot at the end of the needle where the suture is attached.

The mostatraumatic and therefore most common method of suture attachment is with the swaged needle, or eyeless needle. When the suture is manufactured, the needle and suture are attached to each other. With this type of attachment, the tissues undergo minimal damage because the point and diameter of the needle create the hole, and the suture simply follows along without causing further trauma. The ease of use and limited trauma of the eyeless needle make it the first choice of almost all veterinary surgeons.

Needle Shapes
There is arrange of needle shapes is available
• Curved – are used in deep wounds with restricted access
• Straight – used in the skin; passed through the tissue with the hands rather than using instruments
• Half-Curved – have a straight shaft, with a curve at the point. These needles are difficult to handle, as the flat portion of the needle does not follow the curved point
• Compound curved needles – have a different radius of curvature along the shaft of the needle. Designed for anterior segment ophthalmic surgery and vessel anastomosis

Needle points
The needle point helps to determine the type of tissue in which the needle should be used.
Round bodied needles: are generally less traumatic to the tissues than cutting needles. Non-cutting round-bodied needles are used in parenchymatous organs, fat and muscle.
Any tissue that should not be traumatised or is not difficult to pass a needle through will tolerate a taper needle.
Cutting needles are used in tissues with a higher collagen content e.g. fascia, skin.
• Tapercut: compromise between round bodied and cutting. This type of needle is easily used with tough fibrous tissue and some cardiovascular procedures.
• Conventional cutting: has cutting edge along the concave aspect of a curved needle
• Reverse cutting: needle has cutting edge along the convex side The rev-cut needle has stronger construction and minimises suture cut through, since the suture material abuts the flat side of the triangular hole in the tissue rather than the point apex
• Spatula cutting: needles are used for very small-gauge suture material for ophthalmic surgery

Packaging
• Most suture material is packaged as single-use items sterilised at the factory by ethylene oxide. When stored in this manner it has a long shelf-life – which is indicated by an expiration date on the box
• Individual suture packs are opened on an as-needed basis, aseptically, onto the surgical field.
• Exposed but unused suture should not be resterilised.
• Cassette – long lengths of suture placed on a reel by the manufacturer. Economically a good idea, this method of storing suture material has a greater potential for contamination than individually packaged products.

Common suture patterns
• The selection of suture pattern is important to successful outcome of surgery.
• Choose a suture pattern that will close the incision and give maximum mechanical support with minimal tissue reaction, restore anatomical alignment of tissues, obliterate dead space, preserve blood supply to the tissues.
• The vital component of the suture pattern is the surgical knot. Tying a secure knot will provide anchor for the pattern to stay intact and perform its purpose

Surgical knots

The surgical knot has three compartments

• The Loop – The part of the suture material within the opposed or ligated tissue
• The Knot – Made from a number of throws
• The Ears – The cut end of the suture that prevents the knot from being untied

Alternative to suture

Specific soft tissue cases may benefit from the use of internal stainless steel staples. Internal staples may be most advantageous in certain thoracic cases (e.g. pulmonary resection, excision of tumours). Thoracoabdominal (TA) staples are designed to place multiple rows of staples in tissue. Gastrointestinal procedures use (GA) staples such as gastrointestinal anastomosis (GIA) and end-to-end anastomosis (EEA). A number usually follows the initials of the staple type to indicate the length of the row of staples e.g. TA 90 is a row of staples 90mm in length with TA design. Although expensive, these staples can save time in critical cases and reduce tissue trauma/manipulation. They provide easy and secure closure of large vessels vascular pedicles and gastrointestinal, lung, liver and splenic tissue. Although, the benefit must be weighed against the cost.

External we use Skin staples they are stainless steel and placed perpendicular to the incision to close the wound. If a patient has a history of postsurgical incisional, licking or tissue reaction to other suture material, external staples may be a good option. Self-contained in a disposable stapling device, the staples can be quickly placed, significantly decreasing anaesthesia time. Once placed in the skin the staples take on a unique shape to inhibit accidental removal. A special staple removal device is required to remove the staples safely and comfortably from the patient at the appropriate time.

Therefore, the use of stapling equipment may decrease the morbidity associated with a procedure in certain circumstances. Reduction in surgical time is most beneficial for critically ill patients. Using a stapler does not compensate for inadequate surgical technique and may introduce additional complications if not used correctly.

Tissue adhesive have been used effectively in oral surgery, intestinal anastomosis, management of corneal ulceration, control of haemorrhage, attachment of feeding tubes, in surgical incisions in patients likely to chew at suture or who will not tolerate a collar restraint etc. Tissue glue may be used to ensure apposition of edges in wounds that are under tension, but only if tension is managed using alternative technique e.g. tension sutures.

Ligating clips – may be used for vessel ligation, particularly useful when vessel is difficult to reach/when several vessels must be ligated.