

SURGICAL AIDS

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These are referred to a wide range of materials used for dressing of wounds or injured or diseased tissues (Surgical dressings); some are used to hold wound edges closely during healing (sutures and ligatures). All these materials are collectively called surgical aids.

SURGICAL DRESSINGS

Definition Surgical dressing is a term applied to a wide range of materials used for the dressing of wounds or injured or diseased tissues.

Dressings may serve to :

- i) Provide an environment for moist wound healing.
[N.B. Drying of the wound is a major factor in retarding wound healing and increasing scarring. Dressings which prevent drying (or desiccation) provide an optimal environment for autolysis, cell migration, granulation and re-epithelialization.]
- ii) Prevent maceration by permitting evaporation or absorption.
[N.B. In highly exudative wounds, excessive moisture and autolytic enzymes will damage repairing tissue, and will provide a perfect culture medium for microbes.]
- iii) Promote haemostasis (i.e. stops bleeding)
- iv) Protect the wound from further damage [e.g. mechanical damage, microbial invasion, dehydration, maceration, chemical damage, alteration in pH.]
- v) Reduce heat loss.
- vi) Control microbial growth by incorporation of antimicrobial drugs.
- vii) Promote healing.
- viii) Provide compression, promoting haemostasis and reducing oedema.
- ix) Reduce pain, increase patient comfort and improve functional use for wound site.
- x) Reduce odour.
- xi) Improve appearance of the wound site.
- xii) Reduce overall costs associated with wound treatment.

SUTURES AND LIGATURES

- A surgical suture is a strand or fiber used to hold wound edges in application during healing.
- A ligature is a thread or string without a needle which is used to tie blood vessels and other tissues together.

CLASSIFICATION OF SUTURES

- (i) Absorbable and (ii) Non-absorbable

ABSORBABLE SUTURES

Surgical gut / Catgut

Catgut is prepared from the intestine of the sheep.

N.B. The name is said to be derived from the word “kit-gut” (a ‘kit’ being a small violin used in olden times)

- (i) Raw material: When sheep are slaughtered the intestines are roughly washed and placed in cold brine for transport.
- (ii) Washing: The intestines are washed thoroughly with water.
- (iii) Splitting: The intestinal tube is fitted over the end of a flat curved peg and then splitted longitudinally with a knife into “smooth” ribbons.
- (iv) Mechanical processing: Mechanical processing remove the innermost mucosa and the outer muscularis and serosal layers, essentially leaving only the submucosa. This appears as a thin, strong network consisting chiefly of collagen.
- (v) Chemical processing: At this stage the ribbons may be tanned or hardened by soaking in solution of chromic salts. This causes delay in the absorption depending on the strength of solutions used. Such

products formerly were designed as 10, 20, or 40 days catgut, on the assumption that these sutures would remain for such periods in normal tissues. The variations in catgut depends on the variations in patients and on the sites of implantation. Two varieties of catgut, as distinguished by their resistance to absorptive action by tissue enzymes are described in the USP as Type - plain or untreated and

Type C - medium treatment.

In other terms they may be called as 'plain', 'chromic' or 'extra chromic'.

- (vii) Spinning: The ribbons are next tied at the ends in groups of two, three or more, depending on the gauge of thread to be prepared, pulled to an even tension and spun. Hardening and chromicising may be done at this stage, but here it produces a case-hardened effect, the center of the string being unaffected by the chromic solution.
- (viii) Drying: This is done in an atmosphere conditioned with regard to temperature and humidity, the strings being kept under a suitable tension.
- (ix) Finishing: The dried strings are 'polished' by mechanical means. This is really a smoothing process, in which the strings are rubbed against an abrasive surface to produce a smooth, uniform string of circular section.
- (x) Sterilization of catgut: The sheep intestine is normally infected with bacteria and is likely to contain pathogenic organisms such as the sporing anaerobic bacteria responsible for tetanus and gas gangrene.

The gut may be sterilized by chemicals, heat or ionizing radiations.

Chemical process: In this process the guts are sterilized by immersing them in iodine solution for a prolonged period. The disadvantage with this method is the variable increase in absorption time in the body.

The heat process:

Tubing: Suitable lengths of gut are coiled on a heat-resistant fibre card and placed in glass tubes along with a label of heat-resisting material, printed with heat-resistant ink.

Drying: The tubes are placed in baskets and dried in a drying oven in which the temperature is raised slowly to avoid damaging the gut. When thoroughly dried it is ready for the sterilization process which may be done in one of two ways.

1. The baskets of tubes are placed in an autoclave containing an anhydrous fluid such as toluene or xylol. A temperature of 160°C is maintained for several hours. [N.B. The catgut consists of collagen, which is converted into gelatin if heated in presence of moisture hence the anhydrous solvents are used.]
2. Alternatively, the heating may be done in a non-pressure vessel using an anhydrous liquid of high boiling point so that a temperature of 160°C can be readily maintained.

The tubes are then filled with sterile tubing fluid and sealed by fusion of the glass. This part of the process must be done under stringent aseptic conditions.

Ionizing radiation process: In this process the prepared gut is packed in aluminum foil envelopes containing 90 percent isopropyl alcohol as a preservative. The packets are then passed through a gamma irradiation area on a conveyor system. Thus catgut is sterilised when sealed in final container and the process is a rapid one. Each suture receives a minimum dose of 2.5 megarads (unit of radiation).

BOILABLE AND NON-BOILABLE CATGUT

If the tubing fluid is anhydrous the tubes may be boiled before opening it for use; this type of catgut is called "boilable catgut".

If the tubing fluid contains water the tubes of the catguts are labeled 'Non-boilable'. This is a warning to avoid the use of heat in sterilizing the outside of the tube prior to opening it for use.

Non-boilable guts are more popular because the water in the tube keeps it pliable and immediately ready for use. The non-boilable tubes are filled with alcohol containing a small quantity of water.

SYNTHETIC ABSORBABLE SUTURES

Polymers derived from

- i) condensing the cyclic derivative of glycolic acid (glycolide),
 - ii) mixtures of glycolide and lactide (derived by cyclizing lactic acid)
 - iii) dioxanone and glycolide with tetramethylene carbonate
- have shown to possess high tensile strength and absorbability.

The first two polyesters mentioned are melt-extruded into multifilament yarns which then are braided into various sizes of sutures.

The second two polyesters are provided as pliable monofilaments.

Sterilization: They are packaged without fluid and sterilized with ethylene oxide to avoid degradation.

Synthetic absorbable sutures do not undergo the enzymatically mediated absorption process that is well-known for catgut. Rather, the suture is broken down completely by simple hydrolysis as it resides in the tissue. Tissue reaction is minimum since scavenger leukocytes are not involved significantly in the absorption process.

Quality control tests for catgut:

The following tests are given in the *British Pharmaceutical Codex*.

Sterility tests: The tests for sterility are intended for detecting the presence of viable forms of microorganisms on the surgical suture materials.

Method I: The suture materials are washed with a sterile fluid, the fluid is then passed through a filter membrane (for filtering bacteria), the filter membrane is then incubated in sterile medium and observed for minimum of 7 day. If any viable form of microorganisms were present in the suture material they will grow.

Method-II: The suture materials are incubated in culture medium for not less than 14 days. If microorganisms are present they will render the medium turbid.

Gauge: This is measured by means of a dial reading micrometer at several points along the strand.

Tensile strength: This is done by means of a machine in which the load necessary to rupture the gut is measured, the tests being performed on 'straight' and 'knotted' samples.

NON-ABSORBABLE SUTURES

This group of sutures are relatively resistant to attack by normal tissue fluids.

When non-absorbable sutures are used for skin closure, they usually are removed after the wound has healed to the point where suture support is no longer necessary.

Generally silk, linen, cotton, metallic wire, nylon and dacron are given in USP.

Silk:

Degummed commercial silk fibres consists chiefly of the protein fibroin as extruded by the silk-worm. Many such fibers are twisted into a single strand of various diameters as specified in USP, and sold in the natural colour or after dyeing.

Silk sutures are handled easily, and tolerated well by body tissue, although they may cause significant tissue reaction. The microorganisms can remain concealed in the interstices of silk strand and may protect them from antimicrobial agents. So chronic wound may not heal unless the suture is removed.

Silk occasionally migrates from the site of implantation and comes to the surface.

In certain sites the knots may produce irritation and may remain encapsulated in the tissue.

Dermal Silk

These sutures consists of natural twisted silk encased in an insoluble coating of tanned gelatin of other protein. This coating must withstand autoclaving without stripping.

Its purpose is to prevent the in-growth of tissue cells which would interfere with its removal after use as a skin or dermal suture.

Cotton and Linen

Sutures derived from cellulose, they are twisted from fiber staple, have moderately high tensile strength and are stable to heat sterilization.

Synthetic non-absorbable sutures:

Nylon is a polyamide obtained from the condensation of adipic acid and hexamethylenediamine or from the polymerization of caprolactum.

It is strong, water-resistant and can be used for all suturing and ligating.

Polyester fibres are multifilament synthetic fibres. They are prepared by melt-extruding polyethylene terephthalate into fine filaments which are then braided into various sizes.

The polyester sutures do not lose strength in contact with water or body fluids, for this reason they are used for permanent reinforcement as, for example, in installation of artificial heart valves.

They have the advantage of excellent knot holding characteristics and are available in the natural colour or dyed to enhance visibility in the surgical field.

Polyoelfin fibres : Examples are polyethylene and polypropylene.

Polypropylene sutures compared to monofilament nylon, tie more secure knots and have a very low order of tissue reactivity. Because of the smoothness, they slip through tissue in-growth, they may be removed easily when necessary. They are widely used in cardiovascular and other surgical specialties.

Metallic sutures:

Silver: Among the older materials which are still used to some extent are silver wire, foil and other forms. Silver though has some antiseptic action but in some tissues it produce irritation.

Stainless steel is a ferrous alloy is resistant to chemical attack has been used widely in the form of wire sutures, fixation plates, screws and other items.

Stainless steel sutures are available both as twisted and monofilament strands and presents the strongest available material. However, they are relatively difficult to use and are employed most commonly in areas where great strength is required, such as in the repair of the sternum after chest surgery.

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