

# Suture Materials and Needles

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In all surgery, both animal and human, the suture plays a basic role. To obtain the best possible results the operator should have a profound knowledge of the materials he uses. He should thoroughly understand the effects of all sutures on the tissues in order to select the proper material in each individual instance.

In our recorded history there is evidence of the suture being in use some 4,000 years ago. The ancient Egyptian and Arab surgeons employed the use of adhesive plasters made of linen and the string of the "kit" or dance masters fiddle. The kitstring was made of sheep intestine and is now called catgut, probably due to its being confused with kitten string and later being changed to catgut. Early day surgeons, however, preferred the use of cautery and boiling oil to the ligature, and their adhesive plaster to the suture. It was not until the nineteenth century that the ligature came into popular usage, and only within the last 50 years has the suture become universally accepted.

It has been said that surgery improves with the choice and preparation of suture materials. It is an unpleasant truth that today many operators have allowed themselves to remain ignorant of one of the basic fundamentals of all surgery and in so doing have been unable to perform their best. If the operator can always remember that there is a vast distinction between sewing up a piece of cloth and uniting living, breathing, delicate cells,

the theoretical perfect can be much more closely attained. In order to make an intelligent selection, a thorough knowledge of the materials at hand must be had as well as the character and condition of the involved tissues.

All suture materials fall into two main categories: absorbable and non-absorbable. All absorbable sutures are of animal origin and are so called because they are absorbed by the body after they have served their purpose.

Of the absorbable sutures now in use, catgut is probably the most popular. Catgut is not a perfect suture by any means. Being of an animal origin it is naturally difficult to sterilize. Under heat and moisture it loses its tensile strength; therefore, it is, of necessity, sterilized chemically. Constant advancements are being made in the technic of its preparation, but still there is an occasional report of a complication due to contaminated gut. Catgut when buried in tissue causes leucocytosis, infiltration, weakening, and local necrosis. All of these factors are detrimental to good wound healing but, by and large, they are overcast by the ability of catgut to become resorbed, eliminating itself as a foreign body, whereas a non-absorbable suture remains as such.

Catgut is prepared in a number of different ways in order to delay its absorption. The first 24 feet posterior to the stomach of the sheep are used. The intestine is collected immediately after death of the animal and started through the com-

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plicated 24 step procedure of preparation. The submucous connective tissue is then thoroughly washed, dried and twisted, before its graduation into various sizes. Sizes range from No. 00000 to No. 5, each size being .003 in. larger than the previous size. No. 1 is .018 in. in diameter.

Plain catgut is, as the name indicates, the finished product without the incorporation of any of the "hardening" agents. It is more readily absorbed than "hardened" catgut; therefore, it can only be used in tissues that heal rapidly and require no great amount of reinforcement. In most cases it is the material of choice in closure of the peritoneum posterior to the umbilicus, and normal striated muscle. Normal striated muscle tissue is used in the standardization of absorption time. Plain catgut varies in absorption time from 5 days for No. 000 to 8 days for No. 2.

The most popular hardened catgut in use today is the so-called chromic catgut. It is plain catgut impregnated with chromic trioxide, which produces a "tanned" effect on the gut. It is the suture of choice when repairing fascia, peritoneum anterior to the umbilicus, intestine and tendons. Chromic catgut is available in sizes corresponding to those of plain catgut but is further classified as to absorption time, which may be 10 day, 20 day or 40 day. In the selection of chromic catgut it must be remembered that it will act as a foreign body until it is absorbed; therefore, the smallest size which will fulfill the requirements should be chosen.

In an attempt to avoid contamination of the tissue catgut has been subjected to an iodine solution and marketed as "iodized" catgut. Its main advantage lies in the fact that it exerts a germicidal action on the tissues. "Iodochromic" catgut is another of this type which is treated with iodine, potassium iodide, and potassium dichromate. Neither of these materials are very widely used.

Kangaroo tendon is made from the tail of the wallaby and is exceptionally strong. It is thought that the linear arrangement of its fibers makes it more slowly absorbed than the spirally arranged fibers of catgut. It finds its use where a considerable

amount of strength is needed for a prolonged length of time. It is classified as being fine, medium, or coarse. Its main disadvantage is that it can be obtained only in relatively short lengths—an average of 12 in.

Other absorbable sutures used mainly in human surgery include carnofil, nerves, and "living sutures." Carnofil is prepared from muscle tissue of the horse, is wiry and flexible, and is used for tension suturing. Nerves, prepared in a 20 percent acetic acid solution are used as tension sutures and are absorbed in 12 to 14 days. "Living sutures" consist of transplanted fascia, aponeurosis or tendons which act as a reinforcement and are the least irritating of all sutures.

### Non-absorbable Sutures

Non-absorbable suture material is subdivided into those of an inorganic nature and those of an organic nature.

Inorganic sutures are all metallic and are mostly used in orthopedic surgery, however, they do find some application in other tissues.

Silver wire, which is an alloy of silver and copper, has heretofore been most widely used in bone surgery. It has a considerable amount of tensile strength, but is rather brittle and its knots are none to reliable. Some who use it contend that it exerts an antiseptic action on the tissue in which it is imbedded. In time it degenerates and disappears. In veterinary surgery it has been used in repair of teat wounds in the cow.

Stainless steel wire has recently become quite popular as a skin and tension suture. It is found to be flexible, strong, smooth, and non-irritating; all of which are conducive to good wound repair, particularly where considerable tension is required of the suture.

Other metallic sutures include gold, alloys and nickeline. Gold is impractical because of the cost. The Michel clip and the Murphy button are both alloys and are used to a limited degree. Michel clips are quite practical as an external suture in the closure of wounds. Nickeline is oc-

asionally used in human surgery in suturing the abdominal wall.

The most widely used organic suture materials of a vegetable origin are linen and cotton. Linen has been used as a suture material since the days of the ancient Egyptians. It remains to be quite popular as a suture because of its strength, but it does present some disadvantages. Linen has a capillary action which is undesirable in any external suture. This has been overcome by the development of Pagenstecher's linen which is linen thread impregnated with a celluloid-like preparation. Another of the objections to linen as a suture material is that it causes more cellular activity and subsequent edema and inflammation of the part.

In recent years considerable attention has been paid to cotton as a suture material. It presents several attractive features in its pliability, its satisfactory tension strength, its stability to heat and moisture, its relatively non-irritating effect on the tissues and its low cost. It is true that it requires more deftness to manipulate, but certainly that cannot conscientiously be called a deterrent. Cotton suture material can be more safely used in contaminated and infected wounds. It has been shown that infection has occurred in from four to 11 percent of the clean wounds sutured with catgut while only one third as many occurred with the use of cotton (7). It is not a perfect suture by any means but it appears to be as desirable as any we have at the present time.

Non-absorbable suture materials of an animal origin include silk, silkworm gut, horsehair, dermal and Kal-dermic.

Silk is a product of the silkworm and is available in the braided and twisted forms. It is readily sterilized without deterioration. It is strong but has the undesirable characteristic of capillarity. When used for skin closure there is danger of its introducing infection into the healing tissues. When silk is selected as a skin suture the dermal or Kal-dermic forms are usually chosen. Dermal suture material is a twisted silk thread of considerable strength and is used largely in cosmetic surgery. Kal-dermic sutures are

silk thread encased in a modified protein to overcome the capillarity.

Silkworm gut is essentially unspun silk. It is very strong and is used as a tension suture almost altogether. Its undesirability lies in its flat, short strands (about 12 in.) and the difficulty in standardizing it.

Horsehair is light, flexible, elastic, and relatively non-capillary but has very little strength. It finds its use mostly in human cosmetic surgery.

It is to be understood that surgery is as much of an art as it is a science, and, as it is in all art, great individual differences are encountered. For that reason no hard and fast rule can be laid down for the selection of a proper suture material. Each individual situation must be treated as such which calls for a thorough knowledge of the materials and good judgment based on this knowledge by the operator.

### Surgical Needles

The selection of the surgical needle is by no means of minor importance. If it can always be borne in mind that the gentlest handling of tissues cannot fail to do tremendous damage to delicate living cells and that every effort should be bent in developing a technic to minimize this detrimental effect much better end results can be obtained. The surgical needle should be of prime consideration in eliminating such trauma.

In soft tissues, particularly of the abdominal cavity the heavy cutting edge needle should seldom, if ever, be used. The round shank, atraumatic needle—the suture material being attached to the heel of the needle instead of being doubled back upon itself—is the most ideal. A needle of this design merely shoves aside the tissue as it passes through whereas the cutting edge needle cuts its way through. Both the straight and curved types of intestinal needles are widely used.

The French needle is a very small curved needle which is quite adaptable to suturing at depths.

The Ferguson, Bloodgood and cervical

needles are all of the same general design, being curved, rather heavy shanked and suited for suturing the more dense tissues. The Ferguson needle is probably most widely used in veterinary surgery because of its adaptability in so many instances.

The Hagedorn needle is particularly heavy shanked and has a large eye. It finds its use in suturing tendons and similar tissues where heavy materials such as kangaroo tendon are used.

The Reverdin needle is a large needle with a handle and an eye in the point. When in use it is passed through the tissues, threaded and returned through the tissues carrying the suture. It is used in placing setons among other limited uses.

In veterinary surgery the need for a very heavy cutting edge needle is occasionally encountered. The so-called spay needle, which was originally designed for use in oophorectomies in the bovine, is probably the most widely used. It is about 4 in. in length and of an elongated S-shape. It is easily manipulated, but because of its size, inflicts a considerable amount of trauma.

### Conclusions

In conclusion it can be said that in the selection of a suture material the first consideration should be the accomplishment of the object of the suture, whether it be closure, repair or reinforcement; secondly, the character and condition of the tissues to be sutured should be taken into account; and thirdly, the suture should accomplish its purpose with a minimum of tissue reaction. The selection of the most adaptable material available is based on a thorough understanding of the reaction of the tissues being sutured.

### References

1. Spivack, J. L.: *The Surgical Technic of Abdominal Surgery*. Charles C. Thomas, 1946.
2. Frank, E. R.: *Veterinary Surgery Notes*. Burgess Pub. Co., 1944.
3. Waltman, Walters: *The Practice of Surgery*. W. F. Prior Co. 1(1945)27-33.
4. Kilmer, et al: *Ligature and Sutures*.

5. *Manual of Surgical Sutures and Ligatures*. Davis and Geck Inc.
6. Floyd, J. R., and Brockland, M. J.: Spool cotton as a suture material. *Surgery*. 16 (1944) 403-406.
7. Hyde, T. L.: Cotton surgical suture material. *Surgery*. 16(1944)407-415.
8. Mahoney, L. E.: Suture materials. *Am. Jour. Surg.* 61 (1943) 414-417.
9. Babcock, W. W.: Catgut allergy. *Am. Jour. Surg.* 27 (1935) 67-70.
10. Meade, W. H., and Long, C. H.: The use of cotton as a suture material. *Jour. AMA.* 117 (1941) 2140-2143.

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## Brucellosis a Serious Swine Disease

The American Veterinary Medical Association has condemned swine brucellosis as one of the 3 most serious disease problems in the nation's swine herds.

Dr. C. A. Manthei, veterinary scientist at the federal government's animal disease station, Beltsville, Md., has cited 7 characteristics making brucellosis difficult to control.

(1) Infection invades the body in various ways: through the mouth, eyes, reproductive organs and skin.

(2) Swine of both sexes and all ages are susceptible.

(3) Symptoms are different in different cases; abortions, stillborn or weak pigs, sterility and partial paralysis.

(4) The trouble may localize in any of the body tissues.

(5) Infection persists in the animal's system for as long as 3 years.

(6) Blood-testing, although it is highly effective in detecting brucellosis in a herd, is not a reliable means of diagnosing individual cases.

(7) Vaccination is effective for only a limited period, producing a serviceable resistance for 9 months but wholly ineffective after 24 months.

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### Nervous Dogs

Dogs develop nearly all of the nervous ailments that are found in man, according to Dr. F. C. Schlotthauer, Rochester, Minn.