

SILK, CATGUT, AND WOUND INFECTIONS*

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Whether absorbable or non-absorbable suture material should be used in the repair of wounds has long been a highly controversial subject. Popular favor has swung from one extreme to the other repeatedly in the last century. Lord Lister was responsible for the initial popularity of catgut, just as Kocher was one of the first to abandon its use in favor of a non-absorbable material, i.e., silk. Halsted is generally recognized as the first great proponent of the non-absorbable suture, and is rightfully considered the founder of the present-day silk technic.

The story of the changing trends in wound closure is a fascinating one. Most of the modern literature presents a very convincing brief for the use of a non-absorbable material, whether it be silk, cotton, alloy steel, or one of the newer synthetics. Howes, Jenkins, and Bower and his associates have been almost alone in the defense of catgut, though McKittrick, in a discussion of wound healing following amputation, showed results demonstrating fine catgut to be equal or superior to silk. Despite the paucity of literary support, it is safe to say that throughout the country catgut is used at least ten times as often as is the entire non-absorbable group. Habit and a sort of surgical superstition are probably more responsible for this state of affairs than is any rational approach to the problem. It must be admitted that the fear of burying a suture which will not be absorbed is still present in the minds of most surgeons. Not long ago the author heard a well-trained surgeon remark that the use of alloy steel wire for wound closure seemed like a return to the dark ages. Undoubtedly there is a natural reluctance to permit foreign bodies to become permanent guests of the human body. If and when an ideal material is developed, it will necessarily combine the best features of the materials in use today, possessing the absorbability of the one and providing the constant tensile strength and the minimal tissue reaction of the other.

Many papers have been published to demonstrate the superiority of silk, cotton, or steel wire over catgut and the results quoted can-

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not be summarily dismissed. Sound and highly valid reasons exist for preferring non-absorbable suture material. Briefly, there are three inherent factors possessed by this group: greater tensile strength per unit of diameter, lessened tissue reaction, and extremely low cost. Their use is not without danger or risk. MacCallum quotes Halsted: "A bad technique will get best results with catgut. A good technique best results without catgut, that is, with silk. Good and bad results are relative terms. Almost anyone can get pretty good results with catgut, but no one gets perfect results with catgut. To prevent even an occasional failure, the good technician resorts to silk. In the hands of a bad technician silk is disastrous." Howes' contention that similar results might be obtained if catgut were used with the "silk technic" is perhaps less prejudiced. Certainly, there is no reason to assume that improvements in manufacture may not eventually give us catgut with the best characteristics of the non-absorbable group. It is, however, unlikely that the price differential will ever be substantially reduced. Shambaugh has shown that this is a considerable item in the budget.

Careful analysis of the clinical material used to demonstrate the superiority of the non-absorbable group suggests that, except for McKittrick's series, a somewhat unfair comparison has been made. Almost invariably, wounds closed with interrupted sutures of fine silk or cotton are compared with wounds closed by running sutures of catgut whose diameter, and consequent volume, is many times greater. It is generally conceded that with other factors equal, body tissues can tolerate small foreign bodies in the presence of infection, whereas, larger foreign bodies will eventually be extruded, or will be responsible for abscess or sinus formation, and will require removal before healing is accomplished. Ives and Hirshfeld, among others, have demonstrated that no wound remains entirely sterile from the time of incision to skin closure. Despite these facts, the occurrence of more frequent clinically recognizable wound infections is regarded as evidence that catgut, per se, is an inferior suture material.

Impressed by the work of Harvey and his collaborators, we began, about five years ago, to use chromic catgut #00 for abdominal wound closure. The results were gratifying. Later this was replaced by fine silk and more recently by cotton. The transition was not due to any particular dissatisfaction with the results obtained from the use of #00 but rather because of the inherent advantages of silk.

Previous studies in this hospital had shown the usual findings that herniorrhaphy and thyroidectomy wounds in which silk had been used showed a definite decrease in wound infections when compared to those in which sizes 1 or 2 plain or chromic catgut were used. With a number of participating operators, both house and staff members, the results were as follows:

Herniorrhaphy:		Thyroidectomy:	
Wound infections	{ silk 2.8% catgut 7.7%	Wound infections	{ silk 0 catgut 5.9%

Howes' suggestion that silk technic applied to catgut might give similar results led the author to analyze his personal results with fine chromic as compared to silk. It must be admitted at the start that the comparison is not absolute. Chromic #00 is still considerably larger than #8 Champion twisted silk and furthermore it was used almost always as a running suture, whereas, the silk was always interrupted. However, the fact that all operations were performed by the same operator in one hospital adds a certain uniformity of technic.

The "clean" case, herniorrhaphy or thyroidectomy, has been commonly used for the study of the incidence of wound infection. Cutler and Dunphy have recently reviewed their experiences with silk in what they call the "potentially contaminated" case, wherein a hollow viscus had been incised as in appendectomy, cholecystectomy, gastrectomy, etc. Believing that our operative technic in cholecystectomy and appendectomy was reasonably well standardized, we selected these cases for study.

Appendectomy:

The appendectomies have been separated into two groups: 1. acute, chronic, and "interval" appendicitis, but without peritonitis, 2. acute appendicitis with peritonitis. The latter group is not subdivided into general or localized peritonitis because that differentiation cannot always be safely and accurately made except at autopsy. The McBurney incision was used almost invariably and no cases were drained. Skin preparation was predominantly ether, iodine, and alcohol, and skin closure was carried out by means of clips or non-absorbable sutures. Dressings were not changed before the

fifth or sixth postoperative day except in the event of obvious infection. Wounds were considered infected if pus or serum were discharged or could be expressed from them.

Appendicitis without peritonitis:

Silk, 53 cases	Wound infections, 2 (3.1%)
Chromic, 43 cases	Wound infections, 2 (4.7%)

Appendicitis with peritonitis:

Silk, 10 cases	Wound infections, 3
Chromic, 9 cases	Wound infections, 5

Cholecystectomy:

The skin preparation was identical with that used in the preceding group. The Kocher, or right sub-costal, incision was used in most instances. The conventional right split-rectus incision was used only when the configuration of the costal arch indicated that better exposure could be so obtained. All cases were drained with an oil-silk drain to the region of the cystic duct stump which was brought out at the lateral angle of the Kocher incision or the upper part of the right rectus incision. Common duct drains were brought out at the same site. Ten cases had common duct drainage in addition to cholecystectomy, but as this did not seem to interfere with wound healing, they are not listed separately. There is always a slight local infection at the site of drainage if the drain is left in place for more than 48 hours, and for the purpose of this study the area immediately surrounding the drain was disregarded. Otherwise, the same criteria for wound infection were employed.

Silk, 36 cases	Wound infections, 1
Chromic, 16 cases	Wound infections, 5

Summary

A study of the incidence of wound infection in appendectomy and in cholecystectomy contrasting the use of fine silk and #00 chromic catgut has been presented. With the admission that the silk has an initial advantage because of its lesser bulk, the conclusion is submitted that under these circumstances better results may be obtained with the use of interrupted fine silk. It is noticeable that where the wound surfaces are relatively small, as in the case of the

McBurney incision, and the surface contamination is slight, as in the non-peritonitic cases of appendicitis, the difference in the incidence of wound infection is insignificant. As the possibilities for wound contamination increase, whether due to an increased wound surface, as in cholecystectomy, or to increased wound contamination, as in peritonitis, the use of interrupted fine silk sutures is attended by a decrease in the incidence of wound infection. It is entirely probable that similar results might be obtained with catgut, if equally fine sutures could be used.

REFERENCES

- Bates, R. R.: Studies on the absorbability of catgut. *Am. J. Surg.*, 1939, 43, 702-09.
- Bower, J. O., Burns, J. C., and Mengle, H. A.: The superiority of very fine catgut in gastro-intestinal surgery. *Am. J. Surg.*, 1940, 47, 20-32.
- Cutler, E. C., and Dunphy, J. E.: The use of silk in infected wounds. *New England J. Med.*, 1941, 224, 101-07.
- Harvey, S. C.: Concerning the suture. *Surg., Gynec., & Obst.*, 1934, 58, 791-92.
- Howes, E. L.: The immediate strength of the sutured wound. *Surgery*, 1940, 7, 24-31.
- Howes, E. L.: A renaissance of suture technic needed. *Am. J. Surg.*, 1940, 48, 548-52.
- Howes, E. L.: How to use catgut. *Surg., Gynec., & Obst.*, 1941, 73, 319-23.
- Howes, E. L., and Harvey, S. C.: The strength of the healing wound in relation to the holding strength of catgut sutures. *New England J. Med.*, 1929, 200, 1285-91.
- Howes, E. L., and Harvey, S. C.: Clinical significance of experimental studies in wound healing. *Ann. Surg.*, 1935, 102, 941-46.
- Ives, H. R. Jr., and Hirshfeld, J. W.: The bacterial flora of clean surgical wounds. *Ann. Surg.*, 1938, 107, 607-17.
- Jenkins, H. P. Jr.: A clinical study of catgut in relation to abdominal wound disruption. *Surg., Gynec., & Obst.*, 1937, 64, 648-62.
- MacCallum, W. G.: *William Stewart Halstead, Surgeon*. Johns Hopkins Press, Baltimore, Maryland, 1930.
- McKittrick, L. S.: Diabetic gangrene. *Arch. Surg.*, 1940, 40, 352-63.
- Shambaugh, P.: Post-operative wound complications. *Surg., Gynec., & Obst.*, 1937, 64, 765-71.