Surgical Techniques Used In Tissue Repair

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Surgical technic is first encountered when the surgeon picks up his first knife. From that time forward he strives to attain perfection in a field which knows no perfection. But, in so doing, he enhances the opportunity for recovery from many disease conditions found in man and animal life. The surgeon, in order to improve his technic, must have a profound knowledge of the materials with which he works, and employ that knowledge with sound judgment.

In the selection of a suture as well as in its placement, the purpose of the suture must be considered, whether it be closure, repair or reinforcement. At the same time, trauma and tissue reaction must be held to a minimum. All sutures, except the so-called living sutures, i.e. transfer of connective tissue in the same animal, will act as a foreign body in varying degrees. It is taken for granted that it is absolutely impossible to place a suture without inflicting some degree of trauma upon the tissues undergoing the surgery; therefore it is imperative that the suture be chosen and placed with careful forethought.

Through constant practice, suturing technics become second nature to the accomplished surgeon, but to the beginner it is cause for quite some anxiety as he embarks on his career as a repairman of the living body. A definite organized plan of procedure should be adopted in the beginning, and conscientiously followed until it becomes a firmly implanted habit.

The square knot is the basic knot used in surgery. It has the advantage over the granny knot of not slipping, and is less bulky than the surgeon’s knot. The technic of tying a square knot is described by Spivack.¹

The surgeon’s knot is employed when slippage of the first half-hitch is to be avoided while the second is being placed. The only difference in the technic of tying the square knot and the surgeon’s knot is that two turns are made in the first half-hitch and one turn made in the opposite direction in the second half-hitch.

Occasionally it is necessary to use forceps in the knot tying technic, due to inaccessibility of the part, or to shortness of the suture. In executing a forceps tie, the long end is held in the left hand and the forceps in the right. Place the jaws of the forceps against the long end on its right side, and with the left hand, wrap the long end around the jaws of the forceps a full 360 degrees. Open the jaws of the forceps, grasp the short end and pull it through the loop formed by the long end around the forceps. This completes the first half-hitch. The second half-hitch is performed in the same manner but in the reverse direction, i.e., the jaws of the forceps are held on the left side of the long end. In order to tie a surgeon’s knot, two wraps are taken around the jaws of the forceps in the first half-hitch.

It may, at times, be necessary to tie a knot with one hand. This is done by grasping the short end between the thumb and index finger of the left hand and allowing the free end to fall between the fourth and little fingers. The long end is then grasped in the right hand, brought over the dorsum of the left hand and passed between the third and little fingers.

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The second and third fingers are then flexed and the free short end picked up and returned through the loop, thus completing the first half-hitch. To begin the second half-hitch, the short end is passed over the dorsum of the left hand, between the third and little fingers and upwards over the palmar surface where it is held by the thumb and index finger. The long end is held in the right hand and brought downward between the index and second fingers. The second and third fingers are then flexed and the short end picked up and returned through the loop, thus completing the second half-hitch.

Two methods of tying a continuous suture are commonly employed. There is no apparent advantage of one over the other, so the operator may use whichever his choice may be. The first technic is described as follows: the last suture is placed and the free end retained on the side of entrance. This forms a single strand on one side and a double strand with the needle on the other. A square knot or surgeon's knot can now be tied. The second technic consists of placing the suture and pulling the free end through and removing the needle. The suture material running from the previous suture to the last suture is then caught up and is considered the second strand to be tied with the free end.

Of the general sutures now in use, the simple continuous, and interrupted sutures are most commonly used, however, the lockstitch suture and the Michel clip do have certain advantages and are not uncommonly used.

The simple continuous suture is applicable where speed is desired. It does, however, present the disadvantage that if it is broken at any one point the entire line of suture is relaxed. In placing the continuous suture the first stitch is placed and the knot tied. Subsequent stitches are then taken with the suture passing over the wound from the point where it emerges from one stitch to the point at which it enters in the next. Only enough tissue is included to approximate the tissues being sutured.

The simple interrupted suture is slow and tedious, but is valuable in situations where closure is to be retained. Several adjacent interrupted sutures must be broken or pulled out in order to relax the line. Sutures of this type are placed by entering the tissues on one side of the incision, crossing over at the depths of the wound, and emerging at a point opposite the entrance and tied.

The lockstitch suture has all the advantages of the simple continuous suture and offers an additional feature, it overcomes the puckering effect sometimes found in a line of continuous suturing. The technic is the same as that employed in placing the continuous suture, except the suture material is held taut in the left hand and the point of emergence of the stitch is between it and the wound edge.

Michel clips are small metal strips with a tooth on either end, and when in place are in the shape of a U. Special forceps are used in placing and removing the Michel clip. They involve a minimum of tissue and therefore, are able to withstand very little tension. They are usually used in conjunction with another type of suture as a means of closing the superficial wound.

Tension sutures are used in instances where a greater or lesser amount of stress and strain are placed upon the sutured tissues. In large animals the suturing of the ventral abdominal wall is usually done by one of the several methods in common use; the horizontal mattress, the vertical mattress, the quill suture, the button suture, and the cobbler's stitch.

The horizontal mattress suture is placed by entering the tissues on one side of the incision, crossing over at the depths of the wound and coming out on the opposite side, as is done in the interrupted suture. The needle then re-enters the tissues on the same side, is crossed over and emerges on the side it entered on the first stitch. The knot is tied so that a square is formed with the sides parallel to the incision exposed and the other two are buried. This is a strong suture but can be criticized for causing an anemia of the wound edges which is not conducive to good wound healing. The horizontal mattress suture can also be used as a continuous suture.

The vertical mattress suture is placed
Fig. 1. Simple interrupted suture.

Fig. 2. Simple continuous suture.

Fig. 3. Horizontal mattress suture.

Fig. 4. Vertical mattress suture.
Fig. 5. Lembert suture.

Fig. 6. Interrupted Halsted suture.

Fig. 7. Continuous Halsted suture.

Fig. 8. Cushing suture.
Fig. 9. Blanket suture.
Fig. 10. Figure-of-8 suture.
Fig. 11. Cobbler's suture.
Fig. 12. Michel clips.
by entering the tissues a good distance back from the wound edge, crossing over and emerging at a corresponding point on the other side. Next the suture is introduced in the same plane on the same side about half way between its emergence and the wound edge, is crossed over, brought out at a corresponding point on the opposite side and the knot tied. This suture is as strong as the horizontal mattress and has the advantage of not causing an anemia of the wound edge.

The quill and button sutures are called upon when the horizontal and vertical mattress sutures are not able to withstand the tension placed upon them. They are always used as external sutures since the quills and buttons cannot be absorbed by the body. To place a quill or button suture a number, usually three or four, of vertical sutures are employed. Applicator sticks serve well as quills and are placed on either side of, and parallel to, the wound edge. The external portion of each suture passes around the quill, hence a considerable additional area can be brought to bear against the tension placed on the sutures. In the case of a button suture a button about the size of a 25 cent piece is used. The exposed portion of the vertical suture passes up through and back down through the holes of the button. Both of these sutures must be closely watched for the development of pressure necrosis which is likely to make an appearance when great exposure is encountered.

In suturing the hollow organs of the abdominal cavity, it is necessary to bring into contact the serous surfaces or the mucous surfaces, but never a mucous surface and a serous surface, to insure prompt and strong repair. Infolding sutures approximate the serous surfaces and are the last sutures employed in closing a wound of the hollow abdominal organs. They are all formed upon the same basis but different variations bear different names, among those most commonly used are the Lembert, the Cushing, the Connell, the Halstead and the purse string sutures.

The Lembert suture is placed by entering the serosa and muscularis of the wall
and emerging on the same side and about half way to the wound edge. The same procedure is carried out on the opposite side, except in the reverse manner, and the free ends tied. This may also be used as a continuous suture. The Cushing suture is placed just as a continuous Lembert suture, expecting the buried portion of the suture lies parallel to the wound edge instead of perpendicular to it. The Connell suture involves a greater amount of tissue and is, therefore, a stronger and more reliable suture. It is placed in the same manner as is the Cushing suture except that the lumen of the bowel is penetrated and the buried portion of the suture lies on the mucosa. The Halstead suture is, in reality, a double Lembert suture. When the first stitch is placed, as in the Lembert, instead of being tied the suture is returned in the same manner and the free ends tied. The purse string suture is employed when circular openings are being closed. A running basting stitch is taken into the serosa and muscularis around the opening and pulled tight with the stump of the organ inverted. It is always wise to use a double row of sutures, i.e., one placed on top of the other so that the first row is buried, when suturing the intestinal wall. A fibrin seal will be formed in from 30 to 60 minutes after the tissues are approximated, but to insure against any seepage the second row is considered necessary.

In instances where it is necessary to approximate the mucosa, an outfolding suture is used. The simple continuous, the interrupted and horizontal mattress sutures are the most commonly used. In order to prevent seepage of intestinal contents into the peritoneal cavity, one or two rows of the infolding or serosa approximating sutures are used.

In conclusion, may it again be emphasized that in all surgical work, millions of tiny viable cells are being manipulated, and gentleness and caution must constantly be practiced. Wise selection of the suture material and meticulous care in its placement will greatly enhance the wound healing processes as is the object of every conscientious operator.

References:

Grounding of Fowl

A new surgical solution to the problem of keeping expensive exhibition birds from flying away has been reported by Dr. W. A. Young, Chicago, Ill.

Dr. Young, who has performed the operation on hundreds of birds with "practically perfect success," described his method at a special session of zoo veterinarians during the 1947 convention of the American Veterinary Medical Association.

The oldest method, he recalled, was to clip off the feathers of one wing, so that the bird could fly only in a circle. This made the bird look ragged, and, when the feathers grew out again, the bird could again fly away.

Pinioning, the removal of a section of the large tendon in one wing, is another old method. Some of the wings drooped, however, and the severed tendon often healed again.

Dr. Young's procedure was developed in cooperation with the Lincoln Park Zoo, Chicago. It is a surgical amputation of the outer one-third of one wing.

"This is usually done under anesthesia, and the wound is closed immediately," he explained. "The bird can go on exhibition again almost immediately. As soon as the small feathers grow over the surgical area, the bird presents a perfectly satisfactory picture. He will never again be able to fly in a straight line, however, and thus it will be easy to keep him within bounds."

"The risk from surgery is extremely small. The bird's suffering is practically none during the operation, and very, very little during convalescence," Dr. Young concluded.

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