THE INCISION IN ABDOMINAL SURGERY: METHODS AND RESULTS.

By J. HENRY CARSTENS, M.D.,
DETROIT.

When we hear and read so much about ventral hernia, and when we are told that last year Tiemann & Co. made to order six dozen trusses especially for the herniæ resulting from the operation for appendicitis, is it not well for us to pause and to consider if we are really properly closing the incision in the various operations for abdominal morbid conditions? Is it not time for us to devise ways and means to prevent herniæ after abdominal operations?

With some operators the occurrence of herniæ in the line of incision is very common, although they lay down emphatic rules about keeping patients in bed for six weeks, and make them wear strong, heavy bandages for a year or more in order to prevent the occurrence of ventral rupture; while other operators allow their patients to get up in ten or twelve days, leave the hospital in two weeks, do not ask the patients to wear bandages after a few weeks, and still they have seldom to record a case of ventral hernia. There certainly must be a very definite reason why in the track of one abdominal surgeon there follow a great number of ventral herniæ, while in the track of another surgeon it is a rare occurrence.

Is not the reason in the method of making the abdominal incision and closing the wound after the operation is finished?

It certainly seems so to me, and, therefore, I again bring this question up, which has been threshed over so frequently that I am getting tired of it myself. But as long as there are *abdominal* surgeons who stick to one definite way of closing the abdomen—that is, the *en masse* suture—so long will some of us bring up this subject and plead for the ideal, the esthetic surgery in closing the abdominal incision.

We are glad to admit that we are not infallible, and that cases will always occur where, as a result of an extensive adipose development, or as a natural result to be expected in stitch abscess and sepsis, a ventral hernia does occur; still we claim it should be a very rare occurrence. What I plead for is the buried aseptic animal suture, be it kangaroo tendon, squirrel tail, fascia lata, or catgut. I prefer the former, because it is naturally aseptic; it is very strong, and only fine threads are required; it is not absorbed quickly, hence it holds the parts in position for a longer time. There are exceptional cases where time is of prime importance, or for other reasons we may be allowed to use the *en masse* suture—silkworm-gut, silver, or silk—but they are very rare.

My usual procedure is as follows: Take the median incision as an example. I first decide how long an incision I will need, and, with a small, narrow-bladed knife (Fig. 1), with one sweep I make the cut of the desired length through the skin and fat. If the patient is exceptionally fat, I may have to make another sweep of the knife to get through it. I then, with another sweep of the knife, divide the tendinous insertion of the oblique muscles. I may strike the linea alba exactly, and, if not, I get very near to it. I can see by the way the fibres run on which side it is, and then push the rectus muscle to one side and cut through the remainder of all the tissues until I come to the loose cellular tissue beneath the peritoneum. I push my finger through the peritoneum, which I can do if it is thin, but if it has been subjected to repeated attacks of inflammation, and is thick, I lift it up with my forefinger and thumb (above the skin, if possible), so that I can see there is no omentum or intestine adherent to it; then I puncture it with a knife and increase the opening to the desired length, using one or two fingers as a director.

The skin incision is a little longer than all the rest, which are about the same length. If my operation is partly exploratory, I make only very short incisions, and then, finding it necessary to remove a large growth or to put the patient in the Trendelenburg position, I increase my incision to the desired length, using two fingers as a guide beneath the peritoneum, and with one sweep of the knife I cut through all the tissues at once.

The use of grooved directors or scissors may be allowed to beginners, but as they injure and bruise the tissues they are unworthy

Fig. 1.

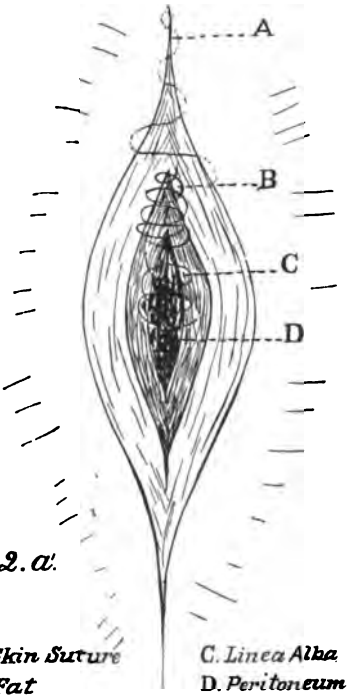

Fig 2. a.

A. *Skin Suture*
B. *Fat*
C. *Linea Alba*
D. *Peritoneum*

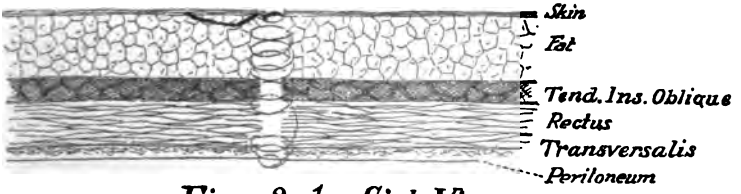

Fig. 2 b. Side View

Fig. 3 A.

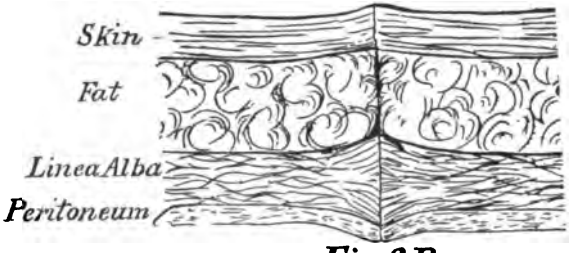

Fig. 3 B.

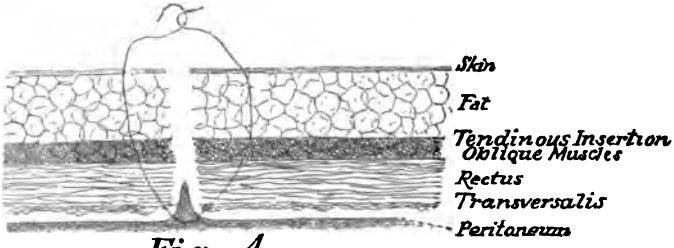

Fig 4

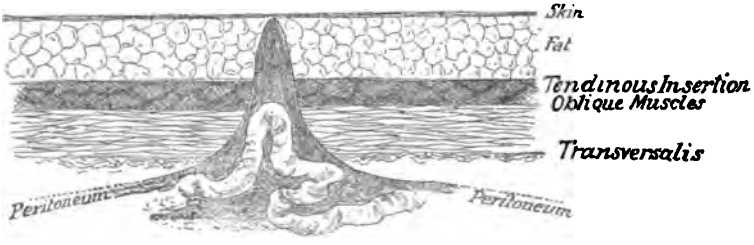

Fig. 5.

of the experienced abdominal surgeon. The bleeding is almost nothing, and such a thing as a catch forceps to an artery or to a bleeding point I rarely use. So that, in short, I would say, as far as the incision is concerned, diagnosticate your case properly in reference to the size and character of the growth and the amount of adhesions; thus you are able to judge how long an incision you need, and make it at once with a clean cut with a knife—no zigzagging or irregular wound, and no bruising of the tissues. The time required to enter the peritoneum should ordinarily not exceed half a minute.

When the operation is finished any aseptic animal tissue will do to sew up the wound; but I prefer kangaroo tendon, as it is stronger, consequently thinner ligatures can be used—that means less foreign substance is introduced, and therefore less danger of sepsis. I use it to tie the pedicle, as it disappears and there is no danger of pelvic abscess, which may continue for years as the result of the use of other ligatures. I use a long, medium-sized tendon, a half-curved Hagadorn needle, and my fingers—no needle-holder. I take the peritoneum and sew it together with a running stitch, putting my needle in a quarter of an inch from the incision. If I have gone through the rectus, with two or three stitches (over-and-over stitches), I bring that together, and then carefully, edge to edge, with the same ligature and the running stitch, bring together the tendinous insertion of the oblique or the linea alba. This, I think, must be done carefully, as nearly the whole strength of the abdominal wall depends upon accurate union of this part. The cellular tissues are then brought together, as they add so much to the strength of the abdominal wall; and the fat, which, if thick, requires two tiers. The skin is then brought together in the methods suggested by Marcy, the so-called cobbler's stitch. Before this time, however, my ligature is generally used up, and I then take a very fine ligature with a *straight* needle and sew up the skin, as I can do it quicker (Fig. 2).

During the whole time every fifth, sixth, or eighth stitch is whip-corded, so as to make a knot and get additional strength. When the last stitch in the skin has been introduced, the needle is run beneath the skin for about an inch and then comes out; the ligature is cut short and retracts beneath the skin; everything is buried. A drainage-tube does not interfere at all.

For fear, however, of post-operative infection, the line of incision should be carefully cleansed and washed with a little ether and then sealed with collodion. The usual dressing is applied and the wound not looked at for ten days or more, unless special indication exists. When the dressing is removed we may expect to find the wound dry, perfectly healed, and no hernia will ever follow. The patient is allowed to sit up the tenth or eleventh day, to walk around by the twelfth, and the fourteenth or fifteenth day she is usually able to walk all around the hospital, and is then allowed to go home. In exceptional cases with a very long incision, or if stitch abscesses follow, the patient is kept a few days longer in bed, but is rarely kept in the hospital longer than three weeks.

This I consider the perfect, ideal method of suturing the abdominal incision. I doubt if it ever can be improved, and I have never seen hernia follow it. I use this for ordinary cases of hernia also, and find it very successful. In very severe cases of umbilical, ventral, or other hernia, I am afraid to trust that method alone, although it often will answer. Still, in such cases it seems to me safer to operate, as I have, by flap-splitting and burying interrupted silkworm-gut sutures. In my experience all cases of umbilical hernia occur in fat patients. If they are still young, there may be great stretching at the umbilicus during pregnancy. If abdominal section has been performed, and if the woman has a ventral hernia and is liable to become pregnant, I do not depend upon kangaroo tendon alone. My method then is about as follows:

I dissect the skin and fat down to the peritoneum, and remove the large hernial sac. The peritoneum is then carefully brought together with kangaroo tendon. The ring, which is generally hard and cartilaginous, I split all around, separate the split, and bring the raw surfaces carefully together in the region of the linea alba. I use interrupted silkworm-gut sutures for this purpose, putting them in a quarter of an inch apart.

In umbilical hernia the opening is circular, and we do not have much trouble in uniting it in the median line; but in ventral hernia the ring is sometimes very irregular, and we must adjust ourselves to the condition, sometimes putting in the suture transversely, sometimes horizontally—that is, in the direction of the linea alba, and in some cases we must put in part of the sutures one way and part in another way. The sutures are well tied and cut very short. The

cellular tissue and fat are now brought together in tiers with kangaroo tendon, and the skin with the same material. The cut is sealed with collodion and the proper dressing applied.

With this method of sewing we would have a union like that shown in the accompanying illustration (Fig. 3), where, at the line of incision, the wall is really a little thicker than at other places, instead of being thinner as in Fig. 4. When the *en masse* suture is used there we find a little depression where the peritoneum comes together, because the latter is generally pulled up a little so as to be brought in that position, and it results, as I have already shown on another occasion, in a development of hernia by the separation of the surfaces from within outward, as in Fig. 5. The least little starting-point will give the intestines an opportunity to act as a wedge, and hernia results.

The only exception I ever make is in some cases of tubercular peritonitis, where I use the *en masse* suture of silkworm-gut, as in my experience animal ligature is often infected by tubercular bacilli, and abscesses result.

This paper is intended for experienced abdominal surgeons, not for general practitioners. For persons with little or no experience, who are obliged in an emergency to make an abdominal section, I think that silk is the best ligature, and the *en masse* suture is the most advisable. Silk and silkworm-gut can be easily kept or made aseptic, and for general practitioners are undoubtedly the best ligatures; but for surgeons who have made abdominal sections their lifework, who have the facilities of a hospital, trained nurses and assistants, it is not the ideal ligature, nor is the *en masse* suture the ideal suture. They should strive to make such a perfect incision and such perfect closures of the wound that, when the patient is well, he or she is well for good, and is not obliged to wear a cumbersome truss, or walk around with a ventral hernia which is sometimes more distressing than the original disease.

RÉSUMÉ.—1. With a small, narrow-bladed, sharp knife, make a clean incision through the skin of the necessary length, and with another sweep (or two) cut through the linea alba, muscle, etc. Lift the peritoneum with the fingers, open it, and enlarge the incision. The use of forceps to lift the tissues, or the grooved directors, is unnecessary.

2. In closing the abdominal incision use animal ligature, kan-

garoo tendon, or catgut. First carefully bring together the peritoneum in a running stitch, then the transversalis fascia, and the rectus if the incision is through the muscle. Then most carefully bring together—edge to edge—the tendinous insertion of the oblique muscles. The loose cellular tissue above and fat can be brought together in one or two tiers, according to thickness. Bring the skin together carefully with Marcy's cobbler's stitch, thus burying all your sutures.

3. Then seal with collodion, and, if everything connected with the operation has been perfectly aseptic, absolute primary union will take place, the different layers of the abdominal wall will have been brought together as nearly as possible as they were in the first place, and no hernia will result.

4. In cases of extensive umbilical, ventral, or other hernia it is best to bring the peritoneum together with an over-and-over stitch of kangoroo tendon or catgut; to make a flap-splitting operation of the ring, which is brought together with silkworm-gut or silver wire, which are buried, and then the fat and skin are united with the buried and animal suture.

DISCUSSION.

Dr. Willis G. Macdonald, of Albany.—Mr. President, I hardly expected to open the discussion on Dr. Carsten's paper, yet there were so many things in it that interested me, and still others that I cannot agree with, that I feel impelled to speak. In his introductory remarks the author spoke of the fact of ventral herniæ following operations for appendicitis. I can conceive very readily, in cases of relapsing appendicitis where we have not an active suppurative process, and where the demand for drainage is not great, that we may close the wound in the way the essayist has described; but there are other conditions in which we have localized abscesses, in which we open the peritoneum, where we find it necessary to drain not only with gauze, but with rubber. Sometimes we have to introduce into the wound a large iodoform tampon in cases of this sort. Dr. Carstens would not say that we could employ this method of procedure by stages. It is in those cases that ventral herniæ occur and in which trusses must be fitted. My experience in abdominal surgery is that by far the greater number

of herniæ have occurred in such cases as these, and I expect them to occur; I do not know of any way to avoid them. We have to tampon, *i. e.*, to pack carefully, if we have a cavity to drain, to prevent pocketing.

In Albany it is not the custom to close wounds by stages; surgeons there have been satisfied with the through-and-through suture. In coming to the meeting with Dr. Vander Veer, and in going over his (Vander Veer's) table of cases for some years back, I find Dr. Vander Veer has about 5 per cent. of herniæ following his operative work. This, I take it, is a relatively small per cent. The introduction of animal sutures in general surgery is not always so successful as it would seem. I have employed kangaroo tendon and the catgut suture in operations for the radical cure of hernia, and have seen a return of the hernia. It is not at all a certain method of preventing its return.

So far as buried silkworm-gut sutures are concerned, my experience has been equally unfortunate. I have removed them at the end of six months. In some operations done for umbilical herniæ I have spent more or less time in hunting for the sutures, getting them out one by one, and since then I have not introduced them buried. I always feel very glad to get them out. Then as to the question of time, it certainly takes considerable time to introduce this row of sutures. The author speaks of the sutures being made thicker, more dense, and I agree with him. This density is really the result of an inflammatory process; it may not be sufficieent to go on to the formation of an abscess or on to the suppurative stage, but we assuredly have a certain amount of infection. It is difficult so to sterilize animal material in the way of catgut and kangaroo tendon that one can feel perfectly comfortable. The abdominal surgeon in order to be sure of asepsis will continue to use silk and silkworm-gut in his operations.

Dr. Charles A. L. Reed, of Cincinnati.—I have listened with a great deal of interest to the paper, but the method of closing the wound as outlined by its author is far from being a perfect one, in my opinion. There are some features of the paper which impressed me as rather confirmatory of the view which I desire to advance. For instance, the author has stated that he uses the buried animal suture by layers in his general run of abdominal cases, and yet in his cases of hernia in young subjects, in which the wound is subjected to intra-abdominal pressure, he deems it inexpedient to use it and fortifies his work with the interrupted *en masse* suture. I wish Dr. Carstens would state by what warrant he assumes, by virtue of the retching which follows

anesthesia, that his cases are not going to be subjected to precisely the same pressure, and, further, why he subjects his patients to the risk of a suture which he finds it necessary to fortify. It occurs to me that there are strange inconsistencies in the method. The paper itself does not enumerate, except by the slightest inference, what occurs to me to be the greatest danger—the most unsatisfactory result of the buried animal suture. The implication is not involved in the statement that the wound seems to be firmer. It is thicker, it is denser, and with my friend from Albany (Dr. Macdonald) I too grant that fact. I believe that the thickened cicatrix means not only a deposit of inflammatory exudate, but the presence of an unabsorbed suture; and if I had contemplated participating in this debate I could have presented specimens of cicatrices, painful in character, which I have been called upon to dissect out to afford relief to my patient. They contained unabsorbed sutures. One was applied in Boston, where it is presumed that this process has achieved its greatest perfection.

Dr. E. W. Cushing, of Boston.—I have long observed that there is a tendency for certain processes to come up and be used, fall into "innocuous desuetude," and then reappear. In regard to this matter of suturing by layers, I believe it was resorted to by Prof. Thomas as long ago as 1887. I do not know that it was new then, but it soon became very prevalent in New York, and seemed to promise a great deal. According to the method of Thomas, which Wylie also used, there were two stitches put through everything, in order to bring the wound together to prevent the formation of pockets. The peritoneum, fascia, fat, and skin were brought together in layers with continuous catgut suture. I published something about this running suture in 1887, and finally gave it up for certain reasons which seemed to me sufficient—namely, in spite of all the care I took I had a larger proportion of cases which did not heal well, especially where there was a large amount of buried suture. The reason is not far to seek. I think the use of the running suture constricts and strangulates the tissue in a way that the interrupted suture does not. You cannot apply a running suture in such a way that it is not liable to cut off the circulation from certain parts of tissue and cause them to necrose, and although there do not appear immediate symptoms of suppuration as would from an infected wound, yet in two or three weeks the wound had to be reopened, and under such circumstances it did not do so well when done in this way as under the old-fashioned way of interrupted sutures.

On the other hand, there is no doubt that in certain cases it is very proper to secure accurate coaptation of the layers; but if we will con-

sider how many needle punctures it involves, how much we wound the tissues, how much we delay the operation by so doing, and how much chance there is of extra infection where there has been pus in the abdominal cavity, I think you will agree with me that the fewer punctures in the abdominal wound we make the better, and the less liability there is for the running suture to constrict the tissues the better. In closing the wound in layers in the manner described, it seems to be admissible to shut off the peritoneum in a long wound, as it can be done rapidly. It is desirable to coapt the fascia accurately in subjects where it is necessary to go through two inches of fat, and in such cases I use the interrupted catgut suture. We want to be sure that the two edges of the fascia are coapted; therefore, it may be advisable to put a few interrupted stitches in the layer of fascia, to be sure that the layer of fascia on one side is not above that of the other. I do not think we can dispense with stitches running through and through everything if we would bring the wound firmly together and prevent pockets. The more surgery I do, the less I feel sure of asepsis, and, at any rate, we cannot afford to leave pockets anywhere for fluid to collect in. I prefer through-and-through sutures.

Dr. C. C. Frederick, of Buffalo.—I rise for the purpose of saying a few words with reference to the point made by both Dr. Cushing and Dr. Reed. I wish to take positive grounds against the use of buried animal sutures or buried silkworm-gut sutures. I operated on a patient a week ago yesterday upon whom I first operated last November, it being one of a series of twenty-five cases in which I had been trying the buried catgut suture in uniting the peritoneum, fascia, and muscle. My experience has been that at least fifty per cent. of them had sizeable collections of pus along the incision with abscesses that I had to drain and wash out for a period of one, two, or three weeks, sometimes longer, after operation. I operated on the patient referred to a week ago yesterday for ventral hernia, and on another one about three or four weeks ago. Out of this series of twenty-five cases I used catgut in peritoneum, fascia, and abdominal muscles, and to give extra support used also silkworm-gut *en masse*. I believe the less the tissues are bruised the less necrosis there will be, and the better the union the better the results of the surgeon. All my cases of herniæ so far have occurred in those where I used the buried animal suture.

I know the cause was not in the catgut. It was sterile, I am certain, for it was of the same lot from which I tied pedicles and arteries within the peritoneal cavity, and had it not been sterile I should have had evidence of it there.

Dr. H. W. Longyear, of Detroit.—I am specially interested in this subject. You will doubtless remember that I read a paper before this Association last year at Detroit on a similar subject. I was particularly interested in the remarks of Dr. Frederick, as he makes an admission which accounts for his bad results in the use of the buried suture. In the use of this suture one of the prime objects is to prevent infection after it has been inserted. In the first place, you must have both the wound and the suture aseptic, and then the wound must be kept aseptic, and this cannot be done by reinforcing the buried suture with an *en masse* suture. My first experience with this method began about four years ago. Dr. Carstens and myself have been working together in this line at the Harper Hospital with the buried animal suture since that time. We began its application in the same manner that Dr. Frederick says that he uses it, *i. e.*, by closing the skin with the *en masse* suture instead of finishing the coaptation of this structure with the buried lacing stitch. Neither did we then seal the wound with collodion. Our results were not perfect, but we learned to do better, and, by experimenting with it since then, have found that when it is properly buried and the wound sealed with collodion, without the application of any external sutures whatever, the results become nearly perfect, and this, in my opinion, is the only way to avoid suppuration and obtain satisfactory results. You cannot put in dead-animal material absolutely foreign to the tissues and permit a track into it from the outside, and expect it to remain aseptic.

Dr. Reed.—What are the relative results in cases of hernia in which Dr. Carstens fortifies the buried animal suture with the interrupted *en masse* suture?

Dr. Longyear.—Dr. Carstens did not say anything about fortifying the buried animal suture with the interrupted *external* suture. You must have misunderstood him. He does not do it, to my knowledge. He says he uses the silkworm-gut suture *buried*. He fortifies the buried tendon suture by the insertion of a buried silkworm-gut suture, and seals the wound with collodion just the same afterward. That is the point I wish to make in the use of the buried suture. You cannot use it with an *en masse* suture and get good results. I would a great deal rather use the *en masse* suture alone than to mix them up in this way. You carry in the staphylococci, streptococci, and other suppurative germs from the skin, which we know lie there. The great point is to avoid wounding the external layer of the skin with the needle. By using this suture you avoid it; neither do you carry in these germs, nor leave a track for them to gain entrance. For this reason also,

after inserting the last stitch, I make the suture fast in the wound and drop the cut end back, covering it with the edges of skin, and do not pass the needle through the skin and allow the cut end to retract.

Another point I wish to make that has not been sufficiently touched upon is this: Dr. Cushing spoke of the importance of bringing the fascia together and having it in accurate apposition. As far as that goes it is correct, but to retain it in its place is of as much importance as simply to bring it together. It must also be retained for a sufficient length of time to have it unite strongly. The whole wound of the abdomen must be strongly united. The fascia itself does not unite in eight or ten days as skin or peritoneum will. It takes from four to six weeks to unite, and you will find this statement to be correct if you carefully look into the matter. Therefore, when you put in an *en masse* suture, and take it out at the end of eight or ten days, the wound is almost sure to give more or less. There is weak union. You have hernia as a consequence. It is not the peritoneum or skin that you are relying on, but it is the *fascia*. You cannot get this firm union with an *en masse* suture by holding it for simply ten days.

I think some one spoke of catgut being a more dangerous suture to use than kangaroo tendon. I think it is a well-known fact that catgut is very much more difficult to make aseptic than kangaroo tendon. I formerly used catgut in my practice, and was not at all pleased with it. It would absorb too soon, and there was a tendency to the formation of abscesses; but I did not have them result to any great degree. I will say that in the use of the kangaroo tendon in a few cases I have had small superficial abscesses in the wound which discharged only a few drops of a watery-looking material, and that these healed very readily under the ordinary methods of keeping the parts aseptic for three or four days. Generally, I used peroxide of hydrogen, followed by some stimulating wash, and they have healed up in a short time, so that they were not half so much trouble as is usually experienced in ordinary cases of stitch abscess, which we see so frequently with the *en masse* suture.

Dr. Macdonald says that Dr. Vander Veer has about 5 per cent. of herniæ. My experience is that we cannot follow up all of our cases, and that hernia cases especially are liable to go to somebody else. You doubtless remember that last year I tried to obtain some statistics upon this subject, and with this end in view I wrote to twenty or thirty prominent operators both in this country and in Europe, and Dr. Joseph Price was the only one that tried to give me statistics. The other operators wrote me stating that they could not give me statistics, for the reason that they could not keep track of their patients. Dr.

Price gave me what he knew of his patients that staid by him, and the percentage of herniæ was about the same as Dr. Vander Veer's.

Dr. Macdonald.—How do you prepare your kangaroo tendon?

Dr. Longyear.—I do not prepare it myself; I get it from Dr. Marcy, of Boston. In our earlier experience Dr. Carstens and myself each had a little unpleasant experience in improperly preserving the kangaroo tendon, and discovered after using it that the suture had been contaminated in some way. That is one trouble we have to guard against in using it. You must be extremely careful to have everything pertaining to the operation aseptic if you are to get the best results. Strict attention to detail, accurate apposition of like structures, an aseptic suture in an aseptic wound that is held aseptic by sealing until Nature has closed all channels of entrance, will give perfect results with the buried suture, and produce an operation that is artistic as well as being the most useful for its purpose in preventing post-operative hernia.

Dr. Donald Maclean, of Detroit.—I am sorry, indeed, that I did not get here early enough this morning to hear Dr. Carstens's paper read; but I have listened with great interest and profit to the divergent opinions expressed on this very important question of the treatment of the abdominal incision, and my own conviction is, after all—and I have seen a great many different operators and have had some personal experience myself—that what is most essential is carefulness and cleanliness of the method. I do not believe there is such a fundamental difference between the two sides in this debate as there seems to be. I do not believe it matters very much which way or how the incision is closed, so long as the operation on the whole has been carefully, thoroughly, and skilfully done, and the wound likewise carefully and skilfully closed and kept clean. I operated for a great many years before I ever thought of closing the wound in layers, as is now so commonly done, by using the *en masse* suture. I have seen this suture used very extensively on both sides of the Atlantic, and, so far as I am able to judge, just as good results have been obtained in that way as by the other method, although the other method seems to possess some characteristics of precision and nicety, and perhaps there may be some anatomical arguments in favor of it—namely, bringing together in an accurate manner simultaneous tissues, so to speak, tendon to tendon, and fascia to fascia.

After all, I doubt very much if we could obtain really exhaustive and reliable statistics which would show a decided difference between the two methods. There is always danger in connection with the use

of the buried animal suture, no matter how careful one may be, and that danger is sepsis, more so than in the case of the other method. When the latter method was first introduced and applied, it struck me as being a very great improvement, and I was glad enough to adopt it; but from my own personal experience and from the observations that have been made today by the several speakers, it is to me questionable whether it is, after all, of so great importance as it has been considered to be. At all events, whether that is so or not, the fact remains that today there is an immense amount of abdominal surgery being done successfully all over the world, and my candid conviction is that, whether it is by one method or another, the steady evolution of this department of modern surgery must eventually give us better methods, and that with our lofty ideals of success the limit of scientific precision must be very nearly within our grasp. I hope to live long enough to witness its complete attainment.

Dr. E. T. Tappey, of Detroit.—I have listened with a great deal of pleasure to this very interesting discussion, and I have had more or less experience with the different methods. My own preference is for the tier method of suturing. It strikes me as being a very much more exact and thorough method of closing the abdominal incision, and I have practised it for a number of years. I am not prepared to say, however, that I have not had abscesses following its use. I have sometimes been disappointed with the material we have been speaking of —namely, the kangaroo tendon, for I have found in one or two cases that the wound has been infected by it, at least I supposed it was the material that was at fault. I sent the specimen to Dr. Marcy, of whom I bought it, and he was very glad to receive it, and looked it over, but I have not heard just what he found to be the matter. I think we cannot be too careful in the use of this material. We must see that it is entirely clean. Lately I have boiled the material in alcohol, and afterward immersed it in a bichloride solution. I think, however, it is perhaps the most useful material we have, if we are only sure of its being aseptic and in a proper condition to use, for in the manipulation of this material it is certainly very much easier to use than catgut. You tie your knot, and you know that the knot does not slip, besides it is not the stiff, irritating material that the silkworm-gut is. I speak here of silkworm-gut only as a material for buried sutures.

Dr. Carstens (closing the discussion).—I use the buried silkworm-gut suture in exceptional cases, where it is not apt to be broken down on account of vomiting. Like Dr. Reed, I am afraid of vomiting. But it is in cases where pregnancy may occur, producing a gradual distention of the abdomen, that we should use silkworm-gut, for if we use

either catgut or the kangaroo tendon I think the parts will gradually stretch, and the patient will not be liable to have either umbilical or ventral hernia after she becomes pregnant. If there is any liability to pregnancy, I do not use the buried silkworm-gut. I use it in exceptional cases only.

Speaking of pus, we will let this represent the incision (illustrating). If I had a very bad case of pus in which I thought there would be suppuration and I used a drainage-tube, I am afraid that I might get infection along the track of the drainage-tube, and in such a case I would use the buried suture from both sides up to about here (illustrating), and from this side up to here, and then, on each side, I would use one silkworm-gut suture, an *en masse* suture on each side of the drainage-tube, allowing the kangaroo tendon or catgut only to come up about the point you see, and be sure that it does not come in contact with the drainage-tube, so that no infection can take place. It seems to me reasonable that when you use the *en masse* suture, which you have to pull tight in order to bring the parts into apposition, you constrict the parts, causing them to die and slough; whereas, if I take but a little bit of the tissue and just sew it gently together with a little stitch, I do not constrict the tissues so much. The buried suture brings the parts into apposition; and when our patient is well she is not in danger of hernia in the future. I can show you any number of cases where I did not think of having such a thing as suppuration. Of course, I will admit that we have it once in a while, but I think it is largely due to carelessness. If we have a perfectly aseptic condition and perfect union, we will have no further trouble. I do not know what hernia is. I do not see any cases of it out of hundreds of operations that I have done. They will not average one per cent. of herniæ. The only cases in which I have had hernia were those in which I performed abdominal hysterectomy with the clamp method, and where I used the *en masse* suture. I do not do it any more. It is certainly a great deal more difficult to use and keep aseptic.

As Dr. Longyear says, you have the buried animal suture, then on the outside you reinforce it with the silkworm-gut suture, and then you take the ligature and cut it off, pull it through the wound, and the staphylococci which you find on the skin are pulled down, brought in contact with the suture, and as a result you have post-operative infection. You have abscesses a week or two after operation. What I desire to plead for is a more ideal method. I admit it is more difficult to keep the wound aseptic, but still we ought to try to have it so. That is what we should strive to do. Our success in abdominal surgery resolves itself simply into asepsis.