

## SILVER WIRE AND LINEN THREAD FOR THE CURE OF HERNIA.

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IN a former paper<sup>1</sup> the writer drew attention to this "somewhat neglected field of reparative surgery." To the seven cases reported in 1906 he has been able to add many others. The great satisfaction he has received from these cases and the permanency of the results attained have induced him to make a detailed report.

It is just ten years since our attention was first called to the subject of wire filigree almost simultaneously by Witzel and Goepel. Witzel did not use a ready-made filigree. He first partly closed the hernial opening with a few silver sutures, and then covered over the opening still remaining with numerous thin silver wires passed in every direction. This method was good, but rather slow. To Goepel belongs the credit of having first made use of the ready-made filigree. He reported eleven cases of ventral and umbilical, and seven cases of inguinal hernia with sixteen cures. In the other two cases he removed the filigree on account of the formation of a hæmatoma. We now know that this is unnecessary, as the wound will heal even if a hæmatoma develops. Moreover, there may even be some wound infection with subsequent sinus formation, and yet the silver wire or the filigree need not be removed. It need hardly be said that hæmatoma formation is no more likely to result with silver wire than with catgut. Careful hæmostasis and a firm compression dressing will prevent it.

We make use of silver wire in two forms. The one consists of a suture made of fine strands of wire in the shape

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<sup>1</sup>The Use of Silver Wire for the Cure of Large Herniæ, *ANNALS OF SURGERY*, April, 1906.

of a cable. This was devised by Dr. Howard Lilienthal, and we can recommend it most heartily. It is made in various sizes, is much stronger than the ordinary silver wire, much more pliable, and can be tied into a knot with ease. Where the hernial opening is very large we use a filigree made of thin silver wire. We use a filigree somewhat on the order of that described by Bartlett, of St. Louis, in volume xxxviii, *ANNALS OF SURGERY*, 1903.

To quote from the former paper of the writer:

"The filigree I have employed has been that devised by Bartlett, and I have followed his directions closely. He advised the use of the ready-made filigree, made of thin wire, not heavier than gauge No. 30. The heavier wire is not resilient enough, and does not adapt itself so well to the tissues, and in consequence it is apt to cause irritation. Another advantage of the filigree over silver-wire sutures is the fact that it can be introduced very quickly. Furthermore, and this is a matter of great importance, the filigree can be placed between the tissues at a much greater distance from the edges of the opening than would be possible in passing a needle. It should widely overlap the hernial opening on all sides. No sutures are required to hold the filigree in place. If any one doubts the correctness of this statement, he has but to remember what happens when we inadvertently leave a piece of gauze in a wound. How quickly are the meshes of the gauze filled with granulation tissue, which anchors it in place so firmly that it can only be removed with the greatest difficulty. The same process goes on with the filigree. In a few weeks it is so firmly anchored in place that great force is required for its removal. This has been proven experimentally on animals. Another advantage in not suturing the filigree in place is the fact that it can then better adapt itself to the surrounding tissues, and there is less likelihood of its causing irritation. If properly made and properly inserted it should cause no discomfort whatever; the patient should not be aware of its presence. . . . As is well known, scars in the abdominal wall generally spread most in a lateral direction. The filigree, which can be readily made by any one, depends for its efficacy upon the fact that all but one of the wires run across the long axis of the hernial opening. The filigree should overlap the opening by at least an inch all around. It is so made that each cross wire ends in a loop, thus obviating sharp ends. If sutures of silver wire are used, they should not attempt to approximate the tissues (a frequent cause of failure). It is always better to depend on two layers of silver; either two filigrees in two different planes, or one filigree and one reinforcing layer of silver sutures, provided the superficial muscles or fascia can be approximated without any tension. In general it is well to place the filigree as deeply as possible; sometimes it is not necessary to open the peritoneal cavity. But the filigree must extend well beyond the hernial opening on all sides. This necessitates dissecting up the muscles all

around before introducing the filigree. Then the superficial plane of muscles or fascia may be united with silver-wire sutures, or a second filigree is introduced. Or a filigree can be made by a running suture of wire that does not approximate the tissues, but simply fills the gap. By following this method we have a double guard against recurrence of the hernia."

The filigree should be so pliable that it will bend with respiratory movements. It will then accurately mould itself during the healing process to the locality in which it is placed, and it will not cause any local irritation, which would necessitate its removal. The meshes should not be too close and the wire should not be too heavy. It is surprising how well such a flimsy looking filigree, when it has healed into the tissues, will prevent the recurrence of a hernia. The writer has several cases that have been doing severe physical labor for four and five years, in perfect comfort, and without any relapse. If such cases are examined a few months after operation it is impossible to feel any part of the filigree, so effectually has it become imbedded in the tissues.

The indications for the use of silver wire will vary with the individual operator, and some surgeons never use it. A recent English writer, McGavin, uses it in old people with large hernial openings, in people who habitually throw an extra strain on their abdominal muscles, in patients with poorly developed abdominal muscles, and finally in recurrent herniæ. To these groups of cases we would add one other, cases in which the muscles and fascia cannot be approximated without tension.

In recurrent cases, if the first operation was properly done and the wound healed by primary union, then a second Bassini operation done on the same tissues is not likely to be permanently successful. Where Poupart's ligament or the oblique muscles, or both, are poorly developed, it is not fair to expect any better result the second time than the first, if the ordinary suture material is employed. We have been using silver cable sutures in these cases with good results. We have also used a filigree in a few very large inguinal herniæ. Even if we succeed in dragging the attenuated oblique muscle

over to the poorly developed Poupart's ligament, is it not asking too much to expect some tissues to permanently prevent the reformation of a hernia? Even using the rectus muscle or its sheath is in many cases unsatisfactory. And yet we have seen surgeons do a third, or even a fourth Bassini operation (with catgut) for recurrences. Each time they went through the form of a typical operation, using the same poorly developed tissues that nature had unmistakably declared to be unfit for the work at hand.

Why there should be a sentimental objection to putting a so-called foreign body into the wound, in the shape of silver sutures or a filigree, we have never been able to understand. And why some men prefer to do most extensive plastic operations for the cure of herniæ, which often fail to give a permanent cure however pretty they may look on the table, in place of the simple and reliable procedure of using a filigree, is also hard to understand. For after all we are not dealing with a matter of sentiment, nor is our object the doing of a pretty piece of work. Our problem is rather the plain and prosy one of curing a large or a recurrent hernia, where the anatomical conditions are such that autoplasmic operations do not give much chance for radical cure. The usual objection we hear is that the filigree will irritate and will have to be removed. The answer to this, in the light of our experience, is very simple. If the proper wire is used in the first place, if the filigree is properly made in the second place, and if it is properly introduced in the third place, it will very seldom be necessary to remove a filigree. Personally we have only once been compelled to remove one, where it was introduced as a ready-made filigree. In no case have we had to remove a filigree when made of running sutures of wire. In some of our cases there has been some superficial infection of the wound, especially in fat patients, due to trauma of the fat. In such cases a sinus has remained for a longer or shorter period, but except in the one case referred to above we have never removed the filigree or the wire sutures, and the wounds have all healed. In the majority of cases, with

proper materials properly employed, our wounds have healed as rapidly as in cases in which we have used absorbable sutures. Where the filigree is made of running sutures, the silver cable wire devised by Dr. Lilienthal will be found much more satisfactory than ordinary silver wire. Where there is much gaping of the tissues, no attempt is made to approximate them. The gap is filled by running sutures back and forth in figure-of-eight style. In some cases a filigree made beforehand may be used. This may be placed between the peritoneum and transversalis, or the filigree may be used in a more superficial plane.

CASE I.—Israel M., fifty-three years old, was first admitted to Mount Sinai Hospital in November, 1902. There had been a gradually increasing right inguinal hernia for three years. The hernia had been irreducible for one year, and there had been several attacks of abdominal pain. The hernia, on admission, was 58 cm. in circumference and was only partly reducible. On opening the sac, Dr. Lilienthal found it to contain small intestine, cæcum, and ascending colon, the latter firmly adherent to the sac. The adherent appendix was removed. The sac was so firmly adherent to the cord and testis that their detachment was impracticable. Testis cord and part of the sac were removed; the intestines were replaced, and the neck of the sac closed with chromic gut. No sutures were used; the wound was packed with gauze and a compression bandage was applied. During convalescence there was some sloughing of the fascia and of the deeper tissues. A large exudate which formed in the scrotum required incision. The man left the hospital after two and a half months, wearing a truss. Six months later he returned to the hospital. The hernia could no longer be retained by a truss; it was only partly reducible and prevented the man from earning a living. The dangers of a radical operation were explained to him, but he begged to have it done. On August, 1903, I excised the scar tissue and opened the sac. The many coils of small intestine could not be reduced until the patient had been placed in extreme Trendelenburg's position. Even then it was very difficult. The sac was freed from adhesions and tied off. The inguinal canal was so large that it was impossible to close it with sutures. The ring was narrowed by a purse-string suture of silver wire. A filigree was now placed over the inguinal canal, and the superficial fascia and skin brought together with sutures. Following the operation we attempted to keep the foot of the bed elevated, but unfortunately this caused nausea, retching, cyanosis, and dyspnoea. Although the bowels moved daily, the man was always restless and uncomfortable. Three days after operation he began to vomit, restlessness and cyanosis increased, and six days after operation he died. Examination showed that the filigree was in place and that there had been no infection whatever. Death was caused by the fact that

the abdominal cavity could not accommodate itself to the large amount of intestines that had been in the sac.

CASE II.—Mrs. Ray M., thirty-four years old, was referred to me by her physician. In October, 1900, she had been operated on by the late Dr. Bull, who removed diseased adnexa through a median incision. A hernia developed in the scar five months after operation. A few months later there was a sudden attack of pain in the right side of the abdomen, accompanied by vomiting and fever. This attack was followed by similar ones. The hernia increased in size, it became painful, and the truss no longer retained it. Operation, October 27, 1904. The sac contained a large mass of omentum. The omentum was replaced, the appendix removed, the sac dissected out and tied off. The peritoneum was closed with a running catgut suture. The posterior sheaths of the recti and the muscles themselves were approximated with chromic sutures. It was not possible to close the opening in the fascia entirely. With silver-wire sutures passed from side to side to form a filigree, the gap was filled in. The skin was closed with silk. The wound healed by primary union. Five and a half years have elapsed since this operation was performed, and the patient has been perfectly comfortable and has had no relapse.

CASE III.—William K., thirty years old, admitted January 6, 1905. There had been an oblique right inguinal hernia for three years, and a similar hernia on the left side for one year. Operation on the right side by Dr. Lilienthal. For the Bassini sutures twisted silver-wire sutures were used. The operation on the left side was performed by the writer. There was such a wide separation of the deeper structures that it was impossible to approximate them. The gap was bridged over by a running silver suture, returning the suture so as to make a sort of figure-of-eight filigree. The superficial fascia and skin were sutured separately. Both wounds healed by primary union.

CASE IV.—Louis R., thirty-seven years old, admitted May 5, 1905. Two months before admission the man, while getting off a moving car, was thrown against a steel column. He sustained a fracture of the humerus, dislocation of the clavicle and three upper ribs, and a large ventral hernia in the left iliac fossa. On May 9 I performed a partial excision of the clavicle and three upper ribs. Eight days later I exposed the ventral hernia through a three-inch transverse incision. The peritoneum was not opened. A silver filigree two by three and a half inches was placed between peritoneum and transversalis. The external oblique was approximated with a running silver-wire suture and the skin with silk. The wound healed by primary union. The man has not suffered any discomfort from the wire.

CASE V.—Tony M., twenty-four years old, admitted July 10, 1905. In 1901 there had been an operation for appendicitis. A year later a hernia developed in the scar; it had always been reducible until two weeks before admission. At that time the hernia suddenly became larger and vomiting set in. The hernia was five inches wide and three inches long. On the surface of the mass there were several small ulcers. Operation, July 12, 1905. Hernioplasty with resection of gut, for large ventral hernia

with gangrene of gut. The hernia consisted of several loops of firmly adherent small intestine. One loop had perforated the skin and formed the large ulcer on the surface of the skin. On account of its poor condition six inches of this loop, together with the adherent skin, were resected. End-to-end anastomosis with the Connell suture was done. The circulation in the adjacent loop of gut was not very good, and two pieces of rubber dam were placed around the suture line. As the patient's condition was poor, and as the operation had already consumed considerable time, it was decided to use silver wire to close the abdominal wall. The hernial ring was freed and through-and-through silver-wire sutures were passed from side to side. In this way the greater part of the wound was closed. The drains emerged from the centre of the ring. The skin was closed with silk. For two weeks there was a slight fecal discharge from the wound. Thereafter the wound healed steadily, and the patient left the hospital with a healed wound on August 16, 1905. Since then the girl has been doing arduous housework, including lifting of heavy weights, without any pain or discomfort.

CASE VI.—Golde B., thirty years old, admitted October 3, 1905. The patient had an umbilical hernia of five years' standing. Five days before admission the hernia had for the first time become irreducible. The bowels could not be moved and vomiting set in. The hernia was the size of an orange, tense, and tender. Operation on October 3, 1905, immediately after admission. The sac contained omentum and one loop of small intestine. The gut was replaced and the omentum resected. Three sutures of silver wire almost completely obliterated the diastasis at the neck of the sac. A few catgut sutures approximated the superficial tissues. A small cigarette drain was introduced and the skin closed with silk. The wound was entirely healed in sixteen days. It would not have been possible to have brought the fascia together in any other manner. Three months later, after a severe attack of bronchitis, the patient developed a small hernia just below the umbilicus. Had a filigree been put in besides the wire sutures, this would probably not have occurred.

CASE VII.—Mary M., twenty-seven years old, admitted October 3, 1905. Two weeks before admission the woman noticed a mass in the right hypochondrium and epigastrium. The mass was hard, smooth, adherent to the abdominal wall, and measured about three by five inches. The tumor was excised through a vertical incision in the right hypochondrium. It involved the right rectus and the adjacent portions of the oblique muscles; it was also adherent to the parietal peritoneum. Portions of the oblique muscles, the rectus, including both its sheaths, and the adherent peritoneum were removed, together with the tumor. It was only with difficulty that the peritoneum could be brought together with catgut sutures. A filigree was then placed in the depth of the wound, and a second filigree made by passing running sutures of silver wire through the oblique muscles. A drain was placed at either angle and the skin approximated with zinc oxide plaster. The pathologist, Dr. Mandlebaum, reported the tumor to be an inflamed fibroma. Recovery was rapid and uneventful.

The above seven cases were reported by the writer in his previous paper referred to before. The cases reported below have been operated upon by the writer since 1905. They form but a small proportion of the total number of hernia cases which he has operated on by other methods during this time. But, with increasing experience, silver wire is being used by him in a larger proportion of the cases with the most gratifying results.

We wish to state here that during the past eighteen months we have entirely discarded chromic catgut in hernia cases. We were led to this step by seeing several hernias, done by competent surgeons, that recurred within six weeks after the time of operation. All these cases had been simple cases of inguinal hernia which had healed without any infection. After giving the matter some thought, we came to the conclusion that this unfortunate condition could be explained in only two ways: either the catgut knots opened as the result of coughing or vomiting, or the catgut was absorbed too soon and allowed a recurrence. The writer had also frequently noticed at operations that some strands of chromic gut were very brittle, and sutures sometimes had to be passed several times before a good strand was found.

All these facts induced the writer to discard chromic gut in hernia cases. Where a patient's welfare and the success of an operation are to so great an extent dependent on the suture material, it has seemed to us that we should use the safest material we can find. Catgut, no matter how prepared, is not safe. But we have a material which is easily prepared, which is always sterile, which is never quickly absorbed, and with which the knots never open spontaneously. We refer to Pagenstecher linen. We have used this in over 100 operations, most of them herniotomies. Among these cases we have as yet seen no recurrence. We use No. 2 or No. 3 size, and seldom have it tear. It does not irritate the tissues, almost all the cases have healed by primary union, and they have stayed healed. We were warned when we began this work that in many cases we would be compelled to remove knots. Fortunately this has not happened. Our



wounds have healed just as satisfactorily as when we used catgut. In only a single case were we compelled to remove any sutures. That was in the case of a physician, who was very fat, on whom we did a difficult hernioplasty. He developed a fat necrosis (undoubtedly due to trauma at the operation), a sinus remained until we removed the linen sutures under local anæsthesia six weeks after operation. This case is also free from recurrence. In not another case were we compelled to remove any of the linen sutures after operation. The more we use the material, the more pleased we become with it. It is certainly a satisfaction at the time of operation to know that we are using sutures that will not be absorbed too soon. If we have a recurrence after the use of linen sutures, we can say with certainty that the material is not to blame, and many recurrences after the use of chromic gut can, we firmly believe, be correctly attributed to the catgut. So that in all simple hernia cases, whether inguinal, femoral, or ventral, we use linen sutures. In all recurrent cases we use silver wire. The linen is wound on glass spools, boiled for fifteen or twenty minutes, and preserved in 95 per cent. alcohol.

We have not reported in detail any of the cases in which linen sutures were employed, as they ran the same course as cases where catgut was used. All the case reports in this paper deal with cases in which silver wire, in one form or another, was employed.

CASE VIII.—Israel F., sixty-two years old, admitted February 26, 1906. There had been a right inguinal hernia for ten years and a left inguinal hernia for two years. The man had worn a truss for many years. Both herniæ were reducible. Operation February 27, 1906, under local anæsthesia. Right side: The intestine in the sac was reduced and the sac resected. Both the internal oblique and Poupart's ligament were very atrophic and relaxed and there was a wide hiatus between them. The upper angle was closed with chromic gut, but it was impossible to close the lower part of the wound, on account of the wide separation. Accordingly, a running suture of silver wire was introduced to form a filigree. No tension was made on this suture and no attempt was made to drag the tissues together.

Catgut was used for the aponeurosis and silk for the skin. Left side: Similar anatomical conditions were found and a similar operation was performed. Both wounds healed by primary union, and the man went home on March 16.

CASE IX.—George E., fifty-five years old, admitted October 4, 1906. The man had had a left inguinal hernia for many years. During the past two years it had been only partly reducible and had been increasing in size. The right ring admitted one and a half fingers, and there was an impulse on coughing. On the left side there was a hernia as large as a child's head, containing many loops of gut, which could be returned only with difficulty. Operation, October 5, 1906. The sac was opened and the loops of small intestine reduced. The transverse colon and the sigmoid were adherent to the sac and were reduced only after the adhesions were divided. Extensive dissection was required to free the sac, which was tied off with a chromic gut suture. It was not possible to suture the conjoined tendon to Poupart's ligament on account of the wide diastasis. They were approximated by two running sutures of silver-wire cable sutures. To strengthen the wire it was braided with a piece of chromic gut (a good device). The fascia was sutured with chromic gut, the skin with silk. A small tube drain was placed in the scrotum. The wound healed by primary union, and the patient left the hospital on October 21.

CASE X.—Sarah K., thirty-three years old, admitted January 9, 1907. Two years before admission the patient had had both ovaries removed. One year before that an umbilical hernia had appeared, which slowly increased in size in spite of a truss. Four months before admission a hernia showed itself in the median coeliotomy scar; this became gradually larger. On examination, we found a small umbilical hernia containing adherent omentum. Below the umbilicus there was a scar from a median wound which had evidently been drained at its lower angle. Just to the right of this scar there was a reducible hernia as large as a fist. January 11, 1907, hernioplasty for umbilical and ventral hernia. A median incision was made, starting above the umbilicus and extending to within two inches of the pubis. Adherent omentum at the umbilicus was resected and the umbilicus excised. The fascia and muscle surrounding the ventral hernia were then dissected free, disclosing a hiatus of four inches with very thin fascia. The peritoneum was closed with catgut. The

deep fascia and muscle were together approximated with chromic gut, the muscle thereby being placed under considerable tension. A silver-wire filigree was placed over this suture layer, and a running suture of silver cable wire was passed through the edges of the superficial fascia in the form of a filigree, as approximation was not possible. The deep layer of the fat was closed with a few catgut sutures. A split rubber tube was placed at either angle of the wound and the rest of the wound strapped with zinc oxide plaster. Time of operation was fifty-five minutes. The patient developed a postoperative pneumonia, which caused her death four days after operation.

REMARKS.—To-day I would not make any attempt to suture muscle and fascia in a case of this kind. After closing the peritoneum I would place a filigree between the peritoneum and the deep fascia, and a second filigree between the superficial fascia and the muscle. Such an operation could be done in half an hour and the danger of a pneumonia minimized. We believe that the deaths from pneumonia, following operations for umbilical hernia in fat patients, will be much fewer if less extensive dissections and shorter operations be undertaken.

CASE XI.—Abraham K., twenty-two years old, admitted June 26, 1907. The man had been operated on by another surgeon two years previously for a right inguinal hernia. The typical Bassini operation had been done, chromic gut sutures had been used, one suture having been passed above the cord. The wound had healed by primary union. We found a small reducible recurrent inguinal hernia on the right side. Operation June 28, 1907. The sac was excised and the cord freed; the recurrence was at the lower angle. Three silver-wire sutures were passed over the cord, uniting the muscle to Poupart's ligament. Two additional chromic gut sutures were passed above and below the silver sutures. The fascia was united with catgut, the skin with silk. On the left side a large ring was found and a considerable gap between the muscles and Poupart's ligament. These tissues were united over the cord with chromic sutures. Both wounds healed by primary union, and the man left the hospital July 11, 1907.

CASE XII.—Louis H., thirty years old, admitted July 5, 1907. The man had a congenital inguinal hernia on the right side, and a direct inguinal hernia on the left side. On the right side Ferguson's modification of the Bassini operation was done with chromic gut for the deep sutures. On the left side there was a direct hernia through the transversalis fascia. The upper half of the wound could be closed with chromic sutures, but below there would have been too much tension. Accordingly two sutures of silver wire were passed in the form of a filigree. The aponeurosis was united with catgut, the skin with silk. The wounds healed by primary union, and the patient went home on July 22.

CASE XIII.—Israel M., forty-five years old, admitted July 11, 1907. The man had had a right inguinal hernia for six months. The right ring admitted two fingers, and there was a bulging on coughing. The left ring also admitted two fingers, but there was no impulse on coughing. Operation July 12, 1907. Right side: A small sac found and tied off. Poupart's ligament was very thin. Two chromic sutures were used at the upper angle and four silver-wire sutures below them. Catgut was used for the aponeurosis, silk for the skin. Left side: No sac was found. The cord was buried by six chromic sutures. The man was discharged after a normal convalescence on July 29.

REMARKS.—Where the ring on the side opposite to a hernia is large we habitually close the ring at the time of operation, as we have found that many of these cases return a year or two later with a hernia on the opposite side, if this precaution is not taken. This step takes but a very few minutes, and we readily get the consent of both hospital and private patients when we explain to them the dangers of a subsequent hernia on the opposite side.

CASE XIV.—George N., eighteen years old, admitted July 22, 1907. In February, 1907, the man had been operated on for an infantile inguinal hernia. Soon after leaving the hospital he had noticed a recurrence. The writer had performed the original operation, using six No. 2 chromic sutures. The wound had healed by primary union, the temperature never exceeding 100° F. He had been kept in bed 14 days and had been in the hospital 20 days. On examination we found a reducible hernia. Operation July 24, 1907. A large sac was found which was dissected

from the surrounding tissues. Poupart's ligament was in such poor condition that it was out of the question to use it for a radical cure, so the fascia lata was exposed. The internal oblique muscle was sutured to Poupart's ligament and to the fascia lata by a running silver-wire cable suture. The aponeurosis of the external oblique was closed with catgut, the skin with silk. Time of operation, 35 minutes. The wound healed by primary union, and the man was discharged on August 8.

CASE XV.—Philip P., forty-two years old, admitted December 30, 1907. The man had been operated on twice for a left inguinal hernia, the first time at the German Hospital in Philadelphia, in 1905, and the second time at Mt. Sinai Hospital in the following year. The man stated that three months after his second operation the hernia had again recurred. It had always been easily reducible, and he had not worn a truss. The external ring was one and a half inches in diameter, and the hernia descended to the upper part of the scrotum. Operation, January 3, 1906. The sac contained omentum which was resected. Both the oblique muscles and Poupart's ligament were very poorly developed. The sac was excised. The cord was buried by several silver-wire cable sutures, uniting internal oblique and Poupart's. Chromic gut was used for the fascia and silk for the skin. The wound healed by primary intention.

CASE XVI.—Samuel M., twenty-three years old, admitted January 14, 1908. The man had a left inguinal hernia of three months' standing. The sac, as well as the contained omentum, were resected. Both the conjoined tendon and Poupart's were so poorly developed that the deep chromic gut sutures were reinforced by three silver-wire sutures. The fascia was closed with catgut, the skin with silk. Recovery was uneventful and the patient went home on February 5.

CASE XVII.—Nathan B., fifty years old, admitted January 23, 1908. Eight weeks before admission a left inguinal hernia developed. Five years before, after lifting a heavy weight, a hernia developed on the right side. Operation, January 27, 1908. On the right side a large hernial sac was excised. Bassini sutures of chromic gut were used, plain catgut for the fascia, and silk for the skin. On the left side a sliding hernia was found. The muscles were poorly developed, and accordingly silver wire was used for the deeper sutures. Otherwise the operation was done as on the right side.

REMARKS.—To-day the writer would be afraid to trust to chromic sutures in a case like this. He would use linen sutures on the right side, and silver sutures on the left side.

CASE XVIII.—Max S., thirty years old, admitted February 8, 1908. Three weeks before admission a left inguinal hernia was noticed. The inguinal ring barely admitted the tip of the index finger. Overlying Poupart's and almost as long as it, there was a mass which increased in size on coughing and which gave an impulse. The abdominal muscles in this region were thin, and at times it seemed as if there was a protrusion through them. Operation, February 10, 1908. The omentum in the left hernial sac was resected. Poupart's, except near the pubes, was absent and was replaced by a thin layer of muscular fibres. The cord, which was poorly developed, was buried by several chromic sutures, uniting the muscle to the crural fascia at the outer part, and several silver-wire sutures were used to sew the muscle to the periosteum of the pubes and also to Gimbernat's ligament. Catgut was used for the fascia and silk for the skin. Recovery was uneventful.

CASE XIX.—Koppel R., forty years old, admitted February 27, 1908. The patient had been operated on at Mount Sinai Hospital by another surgeon three months before his readmission. At that time he had stated that he had had a double inguinal hernia of three years' standing. It had always been possible to retain the herniæ with a double truss. The typical Bassini operation had been done on one side, and the Ferguson modification on the other. Chromic gut had been used for the deep sutures, and both wounds had healed by primary union. The man returned to the hospital, stating that five or six weeks after the operation he noticed, on coughing, a small protrusion on the right side. On the left side he had the feeling as if something protruded on coughing. On examination both rings were found enlarged, the right more than the left, and a small protrusion was felt on both sides, more on the right. Operation, March 3, 1908. Right side: A large opening was found at the centre of Poupart's, readily admitting a finger. There were no muscular attachments to the inner four-fifths of Poupart's, only a small slip of internal oblique was attached to the outer fifth. Four silver-wire cable sutures were used to unite the internal oblique and transversalis to Poupart's, the last one passing through the periosteum of the

pubis. The fascia was united with chromic gut, the skin with silk. Left side: The internal oblique was attached to Poupart's only over its outer half. The inner half was entirely free from muscular attachment. No hernial sac was found. A similar procedure to that done on the right side was carried out. Both wounds healed by primary union.

REMARKS.—A double recurrence in six weeks in a case like this, in which both wounds had healed by primary union and in which the operation had been performed *lege artis*, means one of two things: either the chromic sutures were absorbed too soon, or the knots of the sutures opened as the result of coughing or vomiting. The writer did not do the first operation in this case, but he has seen several similar cases done by different surgeons, and he has had one similar case of his own:

Bernard W., forty-two years old, admitted April 29, 1908. Two months before his admission to the hospital the man had been operated on at another hospital in this city for a double inguinal hernia. Shortly after his return home a recurrence took place on the left side. The man refused another operation.

Such cases (and they are not so rare) are a most potent argument in favor of using linen sutures.

The case is reported as being another early or rather immediate recurrence after the use of chromic gut. There had been no wound infection in this case.

CASE XX.—Nathan W., twenty years old, admitted August 4, 1908. In November, 1907, the writer operated on this man for a bilateral hernia. On the right side he had found a large sac, and on the left side a small one. Chromic gut had been used for the deeper sutures. With the exception of a slight superficial stitch-hole infection, convalescence was normal, and the man had left the hospital with both wounds healed two weeks after operation. On readmission the patient stated that immediately after he returned home he had noticed a small protrusion, which gradually increased in size, in the region of the scar on the left side. A month before his readmission he noticed a swelling on the right side, which rapidly increased in size, gradually working its way

down into the scrotum. On examination we found both herniæ easily reducible. Both inguinal rings admitted three finger-tips. Operation, August 7, 1908. Right side: The contents of the sac were reduced except one loop of gut broadly adherent to the sac at its neck. This was dissected free and the sac resected. The poorly developed conjoint tendon was sutured to the equally poorly developed Poupart's by a running silver-wire suture. Cat-gut was used for the aponeurosis and silk for the skin. Left side: After reducing the hernial contents the sac was resected. The conjoint tendon was fairly well developed, but Poupart's was very thin. A running silver-wire suture united these two structures. Both wounds healed kindly.

REMARKS.—As in the cases reported above, the chronic gut was evidently at fault, as the recurrence on one side took place immediately after the return home of the patient. It is interesting to note that both this case and Case XVIII were operated on in November, 1907. At that time our chronic gut was evidently too rapidly absorbed and allowed such early recurrences. In Case XIX we have the additional features of poorly developed Poupart's ligaments on both sides and poorly developed muscle in addition on the right side. Had this case been sutured with silver wire in the first instance, a recurrence would probably not have taken place.

CASE XXI.—Rebecca G., fifty-four years old, admitted August 8, 1908. The patient had had a double inguinal hernia from childhood. She had been operated on at a Newark hospital in 1905. Four weeks later a recurrence took place on both sides, larger on the left side than on the right. The left hernia steadily increased in size, with occasional symptoms of mild obstruction. On examination we found a large reducible left inguinal hernia with a ring that admitted three fingers. On the right side the ring was equally large, but the hernia was smaller than on the opposite side. Operation, August 10, 1908. Left side: The sac was adherent. All the contained small intestines were reduced except one loop which was adherent by a broad band at the bottom of the sac. This band was divided and the loop returned. The sac was then excised. The conjoint tendon was poorly developed. Poupart's ligament was flabby and showed



no evidence of having been sutured at the previous operation. With six silver-wire sutures the fairly well-developed rectus muscle was sutured to Poupart's, each suture taking as much as possible of the conjoined tendon. In this way both conjoined tendon and rectus muscle were used to close the canal. The external oblique was closed with catgut, the skin with silk. The patient did not want to have any operation done on the opposite side.

REMARKS.—Here again we probably have to deal with a case in which the chromic gut was absorbed too soon or the knots opened, and the patient had a double recurrence in four weeks. The muscle had been in contact with Poupart's for so short a time that at our operation, done three years later, no evidence of its having been sutured could be found. Such cases of very early recurrence after the use of chromic gut are not so rare as we have been led to think. The writer has seen enough of them at the hands of various surgeons to strengthen his conviction that linen is a far better suture material in hernia cases than chromic gut. In a hundred cases of hernia in which linen was used for the deeper sutures, the writer has as yet not seen a single recurrence. He does not mean to say that recurrences will not occur after the use of linen, but he does mean to say most emphatically that they will occur less often than when chromic gut is used.

CASE XXII.—Barbara G., thirty-eight years old, admitted January 2, 1909. The patient had been operated on for double inguinal hernia by another surgeon in 1904. Five weeks after the operation, which was done with chromic gut, a recurrence took place on the right side. The hernia had always been reducible after its recurrence, until one week before the patient came to the hospital. At that time the hernia became painful and irreducible. The day before operation vomiting set in. We found an irreducible right inguinal hernia as large as a plum. Attempts at taxis were unsuccessful. Operation, January 2, 1909. The hernia was reduced under anæsthesia. The sac was resected. Poupart's ligament was very poorly developed. Five sutures of silver-wire cable were used to unite the conjoined tendon to Poupart's over the cord. The fascia was sutured with

chromic gut, the skin with silk. The patient left the hospital on January 20, after an uneventful convalescence.

REMARKS.—We have here another immediate recurrence after a herniotomy, done by another surgeon with chromic gut. It is true there was an additional complication in this case, in a poorly developed Poupart's. But do not most surgeons use chromic gut in cases of this kind, even where the muscles and the ligament are poorly developed? Are such cases not much more suitable for linen or silver sutures?

CASE XXIII.—Anna J., twenty-six years old, admitted June 6, 1909. The patient was the sister of a physician. She had been operated upon by Murphy, of Chicago, for appendicitis in 1897. A large ventral hernia, partly reducible, had developed in the scar. Operation, June 17, 1909. The old scar was excised and the peritoneum was found adherent to the skin. The hernial opening was three inches long and two inches wide. By dissection the rectus muscle was exposed on the inner side and the retracted fascia and muscle on the outer side near the anterior superior spine. The incision was about seven inches long. Adhesions between the uterus and the anterior abdominal wall were divided. Two inflammatory cysts were removed from the left iliac fossa. The right tube and ovary had been removed with the appendix. Adhesions between the uterus and bladder were broken up and a piece of chromicized Cargile membrane placed between these two organs. The peritoneum was closed with chromic gut. The muscle and fascial flaps were dissected back far enough on either side to admit placing two silver-wire filigrees, each three by five inches, between the peritoneum (which had been sutured) and the fascia. Muscle and fascia were now sutured over this filigree but not approximated, except at the two angles (where there was no tension) with silver-wire sutures. The skin was closed with silk. The wound healed by primary union, and the patient was able to leave the hospital in two weeks. As this was a private case, we were able to follow it carefully. In spite of the large amount of silver wire employed in this case, the patient suffered no discomfort therefrom. The wound has remained solidly healed. We doubt very much whether we could have obtained as satisfactory a permanent result with any other suture material.

CASE XXIV.—Pauline D., twenty-five years old, admitted

March 29, 1909. Nine months before admission, after a difficult labor, an umbilical hernia developed. The hernia was easily reducible, though it was gradually increasing in size. The patient had endocarditis and nephritis; there was marked dyspnoea on exertion and frequent oedema of the feet. Operation, March 31, 1909. The abdominal wall was remarkably thin. The small sac was resected after the contained omentum had been replaced. Owing to the condition of the patient's heart and kidneys, we decided to do a rapid operation and avoid extensive dissection. The thin musculo-aponeurotic layer was broadly overlapped by a running suture of silver wire. The skin was closed with silk. After a normal convalescence the patient left the hospital on April 19.

CASE XXV.—Dora E., fifty-four years old, admitted May 31, 1909. This was a private patient who had an umbilical hernia of many years' standing. The hernia has increased in size with each pregnancy. It had been irreducible for several years, and at times very painful. On examination we found an irreducible umbilical hernia the size of a man's fist. The whole surface of the hernia was inflamed, and at the most prominent part there was an ulceration probably due to rubbing of the clothing. Operation, June 1, 1909. The ulcerated area was cauterized with carbolic acid, followed by alcohol. Omentum was found adherent in several pockets. The omentum and the sac were resected. The peritoneum was closed with chromic gut, the fascia was overlapped from side to side with silver-wire sutures. A slit rubber tube was placed at either angle of the wound. There was primary union of the wound. The patient was discharged in fifteen days.

CASE XXVI.—Nathan B., sixty-five years old, admitted September 27, 1909. The patient had worn a truss for twenty-five years for a right inguinal hernia. He had recently noticed a slight swelling in the left groin. We found a large irreducible scrotal hernia on the right side, and a small reducible inguinal hernia on the left side. Operation, September 29, 1909. Hernioplasty for hernia of bladder. A large sac was found on the right side, and closely adherent to it the urinary bladder, which had prolapsed through the inguinal canal. The bladder was separated from the sac without injuring it. The sac was opened and its contents reduced. The sac was then excised and the bladder returned to its normal position. The muscles were very much

atrophied from the many years' use of the truss. Bassini sutures of silver wire were used, the cord being buried. To reinforce a weak area in the muscles, a silver-wire filigree, one by three inches, was inserted. The fascia was sutured with chromic gut, the skin with silk. A postoperative hæmatoma in the tunica vaginalis broke down and caused a profuse purulent discharge. The patient left the hospital on October 27 with a sinus that has persisted, although the discharge has become very scanty.

CASE XXVII.—Max R., twenty-two years old, admitted February 12, 1910. The patient had been operated on by another surgeon in 1905. The abstract of his history at that time was as follows: "Since 1898 the patient had had a reducible right inguinal hernia. The right ring admits two fingers, the left ring the tip of the index finger. Operation, March 16, 1905. A typical Bassini operation was done on the right side. On the left side no sac was found and the internal oblique was sewed to Poupart's. Chromic gut was used on both sides. The left side healed by primary union, the right side became infected." From the time the patient left the hospital until six months before his readmission he was well. He then noticed a bulging in the left inguinal region, which was easily reducible. We found a small hernia in the scar on the left side, the side that had healed by primary union. The right side, in which there had been some infection, showed no evidence of recurrence. Operation, February 10, 1910. A left inguinal hernia was found with the sac adherent to the cord. The sac was resected, and the conjoined tendon sewed over the cord to Poupart's with five silver-wire sutures. Convalescence was uneventful.

CASE XXVIII.—Abraham A., fifty-one years old, admitted February 14, 1910. Two years before admission a right inguinal hernia had developed. This had gradually increased in size until walking had become almost impossible. We found a right scrotal hernia, as large as a cocoanut, consisting largely of gut, which was easily reduced. The ring was large and admitted three fingers. On the left side there was an incomplete indirect hernia, with a marked impulse on coughing. Operation, February 16, 1910. Left side: The sac contained omentum and small and large intestine. The contents were reduced and the sac resected. To close the canal five silver-wire sutures were used, and in between these several sutures of linen. Right side: A similar operation was done. The sac was not so large, and only five

silver-wire sutures were used to unite the conjoined tendon and Poupart's. Both wounds healed by primary union and the patient went home on March 17.

CASE XXIX.—Louis G., four years old, admitted February 26, 1910. The child had a congenital left inguinal hernia and undescended testis. The testis could be felt in the lower part of the inguinal canal, and could be brought down into the scrotum. The hernia was as large as an egg; it was easily reduced. The mother stated that another child in the family had a double congenital inguinal hernia. Operation, February 28, 1910. A fairly large sac was found. Both the oblique muscles and Poupart's were very poorly developed. On this account six silver-wire sutures and three linen sutures were used to join the conjoined tendon to Poupart's. We followed our usual technic and left the cord lying posterior to the suture line. The child left the hospital with a healed wound on March 19.

Hernias form so large a proportion of our surgical cases, and yet it would almost seem as if we did not give them as much thought and study as they deserve. We seem to have fallen into a rut these past ten years and do our herniotomies by rule of thumb. Is it not time to call a halt on the promiscuous use of chromic gut in herniotomies? Have we not been worshipping a fetich too long? It is true that we had unsatisfactory results with silk sutures. The knots irritated and often had to be removed. But this is not true with Pagenstecher linen. We can report a hundred cases, and in only one did we have to remove any sutures; and that in a case of fat necrosis, where catgut sutures would probably also have had to be removed.

The startling number of immediate recurrences after the Bassini operation with chromic gut, in which the original operation was done by various surgeons (and once by the writer) reported above, are surely worthy of serious consideration. They cannot be argued away. It is idle for a surgeon to say that this does not happen to him. The various surgeons that did the original operations in the cases reported above know nothing about these relapses. These cases happened to fall under the writer's care. As they came in close succession, they made a marked impression on him, and have

been the cause of his change of technic, both in regard to original operations for hernia and also in recurrent cases.

We are convinced that our results are much improved. There will surely be less recurrences, both early and late, with linen sutures than with chromic gut or kangaroo tendon. And is it not to be expected that we will have much better results in recurrent cases if we use silver wire instead of catgut? There is a very pleasant feeling of security in doing an important herniotomy, to know that our linen knots (especially if three knots are made) will never open as the result of coughing or vomiting. With catgut we are never sure. The same thing applies to the early absorption of the knot. That is unknown with linen sutures and happens not so seldom with catgut, to the chagrin of the surgeon and the disgust of the patient.

As regards the recurrent cases, the writer is more and more convinced, with increasing experience, that some form of silver wire is, in many of the cases, a very desirable suture material. This is especially true of the cases in which either the muscle or Poupart's or both are poorly developed. We firmly believe that in such cases catgut is entirely out of place for the deep sutures. In some recurrent cases, where the tissues are well developed, linen will be very satisfactory, but in many of these recurrent cases, the best results will be obtained with silver wire.

We have no desire to be dogmatic, but, from what we have seen at the hands of other surgeons and from the cases reported above, we have in our hernia work come to the following conclusions:

1. Chromic catgut is an unreliable suture material.
2. Pagenstecher linen is an excellent suture material.
3. Silver wire, in some form, is a very desirable suture material in many recurrent cases; and at primary operations where the tissues are poorly developed
4. Immediate recurrence, in uninfected cases, is usually due to chromic gut.
5. We will have fewer recurrences if we entirely discard chromic gut sutures.