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Compliments of the Author.

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Analysis of One Hundred and Thirty-Three Cases  
of Hernia Operated Upon for the Pur-  
pose of Radical Cure.

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Read before the Section of Surgery and Anatomy at the Forty-fourth  
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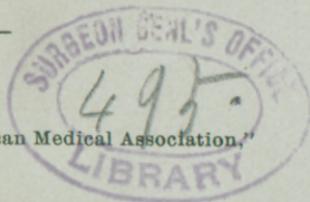
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ANALYSIS OF ONE HUNDRED AND THIRTY-  
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It may be possible that I owe the Surgical Section of the American Medical Association an apology for inviting their attention again, at so short an interval, to the subject of hernia. However, it is not for the purpose of repeating my views which I have so recently presented in extenso to the profession, but the rather that I may analyze a little more carefully the results of my personal experience, and also that of the distinguished surgeons who have made valuable contributions upon this subject since, and briefly draw therefrom the deductions thus afforded. In my work<sup>1</sup> published last summer, I gave a brief review of 112 operations with the history of seventy-eight cases which I had been able to keep under observation. Of these, there were reported four relapses, and of the four, three had returned within six months from the time of operation. I have re-operated upon two of these with a perfect result. Since this published report I have operated for hernia in twenty-one cases; thirteen were right inguinal, five left inguinal, two femoral, and one omental. In two cases there was a limited breaking down of the wound. Number 133 was evidently owing to infection, and is worthy of brief comment:

Mr. F., aged 23; a strong, vigorous man, but had suffered for years from an irreducible scrotal hernia, made much more painful from the attempt to wear a truss. Section revealed that it was of the congenital variety, and the omentum was firmly adherent

<sup>1</sup>The Anatomy and Surgical Treatment of Hernia. D. Appleton & Co.



to the testicle nearly its entire length. Separation proved impossible without injury to the testicle, and the omentum was sutured across and divided. The operation was conducted in the usual manner, a new tunica vaginalis testis being formed. I dissected the sac to its base, sutured across and resected; closed the parts as usual. Skin wound healed primarily, but ten days after operation there was a slight supuration at the upper portion of the wound. The testicle was not painful, no œdema of the scrotum, and the patient was almost entirely free from suffering. Otherwise, the recovery went on satisfactorily.

Number 122 is interesting in that the hernia was of long standing, and breaking down of the tissue followed from the greatly thinned and devitalized condition of the abdominal wall. It was of the irreducible scrotal variety, about the size of an infant's head, incapacitating the patient from active labor. The omentum was everywhere adherent to the sac, and the sac to the surrounding tissue. Little over one pound in weight of deformed omentum was removed. The sac was painstakingly dissected out and the injured, shreddy tissue was cut away. I closed the wound in three layers with the buried tendon suture, sealed with iodoform collodion as is my habit. The patient made seemingly a rapid recovery until quite two weeks later, when the superficial tissues softened in the upper portion of the wound with slight discharge of shreddy material. This was evidently owing to the defective vitality of the parts and not to infection. Rapid convalescence supervened and nearly six months later the report is that the parts are firm and strong.

Number 130 is also worthy of brief detail: A moderate-sized right scrotal hernia has long given suffering, being imperfectly retained by a truss. An undescended testicle is easily outlined on the left side at site of the internal ring. Otherwise the patient is a healthy man, aged 42, married, with a family. I made a new tunica vaginalis testis in the

scrotal tissue, having freed the testicle from its attachment at its former site and pulled down the cord. The transplanted testicle was stitched to the base of the scrotum with a tendon suture, passing through the connective tissue of the cord just above the testicle. Sutured the newly formed canal closely upon the cord and closed the hernial opening which was direct, admitting the tips of two fingers, from below upward. The reconstructed canal was of normal length, and the wound was sealed with iodoform collodion. Primary union supervened in both wounds except a slight opening at the base of the scrotal wound of the left side, from which in about two weeks a little broken down connective tissue was removed. Testicle gives no suffering in its new situation and the result is very satisfactory. The history of the other cases contained nothing noteworthy.

During the year I have re-operated upon two cases which belong to the series reported last year as cured. There have been six recurrent herniæ in the 133 operations and no deaths. No truss has been advised with perhaps a single exception, where the abdominal wall was greatly thinned with slight bulging of the side, but without recurrence of the hernia. A considerable portion, quite one-third of the number have been under observation for ten years or more.

The recent literature of surgery has been exceptionally replete with reports of very many cases, almost without mortality. Perhaps the most noteworthy of the European contributions upon hernia is that of Professor Kocher of Berne.<sup>2</sup> In his first forty-two cases, covering the period from 1875 to 1886, the result showed a permanent cure in 83.4 per cent. with a recurrence of 16.6 per cent. Of the relapses the inference was that in four out of five of the cases, the hernial ring had not been securely closed. In his more recent report he was able to trace the his-

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<sup>2</sup> Annals of Surgery, Dec., 1892, p. 505.

tory of ninety-four patients from the 119 operated upon.

His method of operation briefly described is as follows: Isolation of the sac to its very base with as little damage to the external structures as possible. The cord is not displaced from the canal. The index finger of the left hand is introduced into the canal and a small opening is made laterally from the posterior inguinal ring through the aponeurosis of the external oblique muscle. A pair of slender artery-forceps is passed through this opening and out through the external inguinal ring. The hernial sac is grasped and drawn upward through this opening and energetically twisted. It is then carried down upon the anterior wall of the unopened inguinal canal and held thus twisted by the forceps. "The sutures are passed above the twisted sac, through the oblique fibers of the aponeurosis of the external oblique muscle and the underlying muscular fibers of the external oblique and transversalis through the hernial sac itself, including the ligament of Poupert beneath it. These sutures, five to seven or more, bring together also the pillars of the anterior ring, to which the lower end of the hernial sac is fastened." The modification of procedure peculiar to the author is yet another way of utilizing the peritoneal sac, not very unlike that of Dr. Bryant of New York, which he finds may be recommended in a limited number of cases.

Kocher assumes that it is safe to conclude that four-fifths of all patients operated upon may be radically cured, that the use of the truss after operation should be exceptional, that not the slightest excavation in the peritoneum about the internal ring should be permitted to remain. He writes: "We know positively enough from our statistics, how a method which in itself is technically perfect, in case of infection amounts to positively nothing." . . . "In this manner a firm and solid pad or roll is secured over the entire length of the inguinal canal, which forms a better dam against the pressure of the intes-

tines than an implanted patch of skin or peritoneum." He uses interrupted buried silk sutures. He emphasizes as of the first importance, the complete obliteration of the infundibulum depression of the peritoneum by the closure of the neck of the sac. It will, however, be seen that he makes no effort to reinforce the tissues posterior to the cord, or to close the deepened border of the internal ring, and thereby restore the obliquity of the canal.

Dr. G. R. Fowler of Brooklyn,<sup>3</sup> reviews carefully the subject of operative measures for the cure of hernia and gives the results in thirty-three operations, in which he has used a method of closing the wound of his own devising, "cross suturing" with silkworm gut.

He disposes of the sac by a free dissection quite to within the internal ring, and prefers to close it as the "ideal method" by a line of through and through sutures, in cobble-stitch fashion and resects it. The sac is held tense by an assistant and no portion of it is to be permitted to occupy the internal ring. Dr. Fowler strongly advises the method of Bassini, modified by Postempski in the disposition of the cord. This is to displace the cord towards the median line after having completely freed it from the canal, and attaching it by loose loops of catgut to the abdominal wall beneath the skin.

Dr. Fowler prefers to make a new internal ring by the dissection of the aponeurosis of the external oblique, for a distance towards the median line sufficient to permit the placing of the spermatic cord in this its new location, as far as its length will allow. In this he follows Dr. Halsted of Baltimore. The sutures are about three-eighths of an inch apart and a sufficient number are employed to close completely the wound, no drainage being used. The sutures are left in for at least three weeks. The advantages claimed for this method are forcibly put by the author as follows: "Under all circumstances in which a recurrence is favored or produced, the direc-

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<sup>3</sup> Annals of Surgery, May, 1893, p. 16-27.

tion of the force is from within forwards and downwards. When the cord is made to assume a course upwards and then inwards before making its descent in the direction of the scrotum, nothing short of the patient standing on his head will favor the entrance of a portion of intestine alongside of the cord and permit it to follow its course. It may be said that the weight of the testicle will tend to straighten the cord finally; this is true to a certain extent, but the manner of placing the sutures here described will prevent this for the reason that the cord is held away from the line of incision by being placed entirely outside of these, independently of the chromicized catgut loops which fasten the cord in its new position; second, the cross-suture secures in the approximation of the edges of the divided layers separately all the advantages of the buried catgut sutures; being removable at will, it presents none of the disadvantages arising from the uncertainty as to the length of time which the latter may be depended upon to hold securely."

Dr. Fowler never permits a patient to sit up even in bed for the first six weeks following the operation, believing profit is often obtained by prolonging the stay in bed a fortnight longer. He considers an operation for the radical cure of hernia which requires a patient to wear a truss subsequently not worthy the name.

Dr. Halsted of Baltimore, in the May number of the *Annals of Surgery*, contributed a valuable article upon the radical cure of inguinal hernia in the male. His method is essentially that of Bassini and consists in a free dissection of the parts; lifting of the spermatic cord out of the canal and closure of the conjoined tendon to Poupart's ligament behind the cord, thus reënforsing the posterior border of the canal by the union of the parts by means of a double interrupted silk suture, "the mattress suture." He makes the incision sufficiently free to expose completely the parts, closes off the peritoneum by a line of interrupted silk sutures and forms a new internal

ring. In order that the ring may be made as small as possible, he isolates the vas deferens and blood vessels of the cord and excises all but one or two of the veins. He closes the skin with superficial sutures without drainage and very properly emphasizes the importance of approximating the tissues with as little constriction as possible. More recently he has closed the external wound by the use of a continuous buried skin suture of silk without knots, which is withdrawn after one or two weeks.

In advocating the advantages of his method, Dr. Halsted writes: "To reproduce the equivalent," anatomically and physiologically, of the inguinal canal is I believe impossible. Moreover, we do not know that nature has made the best possible provision against hernia in providing, as it does, for the passage of the cord through the abdominal wall. Bassini's operation, although essentially the same as my operation, is different in some respects. First, Bassini always brings the cord through the muscles at the internal abdominal ring. The point out to which I transplant the cord is determined, as I have said, by the condition of the muscles; second, Bassini does not excise the superfluens veins. I believe that it is advisable to reduce the size of the cord, as much as is practicable; third, in Bassini's operation the cord lies posterior to the aponeurosis of the external oblique muscle; in mine, between this aponeurosis and the skin. To secure for the cord the position which Bassini recommends, an additional row of stitches is required."

Dr. Halsted reports his experience in extenso in fifty-eight cases. His first operation is dated June 6, 1889. There has not been a single recurrence in his cases where primary union supervened. He mentions six recurrences due to imperfect conditions of the wound.

In the same number of the *Annals* is an extremely interesting paper, entitled, "Observations upon the Mechanical and Operative Treatment of Hernia, at the Hospital for Ruptured and Crippled," by Drs.

Bull and Coley. It includes the analysis of over 9,000 cases of hernia, or affections simulating hernia, up to Sept. 30, 1892. The portion of the article devoted to the mechanical treatment is worthy of especial study, but is of course foreign to the present discussion. The operative treatment is of exceptional interest, since it marks a radical change of methods hitherto employed at this hospital, and reverses in large measure the previous views of Dr. Bull which have been so widely quoted as demonstrating that operative measures, by whatsoever method attempted in order to effect a cure, usually resulted in failure. During fifteen months, forty cases were operated upon without a death, and in thirty-eight of these absolute primary union supervened. In reference to the suture material I quote: "The kangaroo tendon was also used in nearly all of the buried sutures in the Bassini operation and it has given the greatest satisfaction. The wounds have all healed by first intention, and there has been no tendency to the formation of sinuses as frequently occur when silk is used, and to a less extent with silk wormgut. The kangaroo tendon and the ox peritoneum seem to fulfill all the requirements of a buried suture in a hernial operation." . . . "The propriety of operation has been amply justified by its slight mortality and its incontestable benefit in cases of strangulated and irreducible hernia. Even after relapse the majority of these patients find themselves better than before the operation. The reappearing protrusion is smaller than the original rupture and a truss is worn with greater comfort. An exception is to be noticed only in a few cases of relapse after the open method, or in those where, after other procedures, prolonged suppuration has followed.

These considerations lead to the conclusion that all open methods of operation, after which the wound is left to heal by granulation, should be discarded, and that *the feature* in every operation which is to give satisfaction should be *rapid primary union*. If

this latter statement be accepted, we should further discard all methods in which foreign bodies, even though aseptic, silk and silver wire for instance, are buried in the wound."

In a letter from Dr. Coley, assistant of Dr. Bull under date of May 23, he states: "I feel greatly indebted to you for the kangaroo tendon suture and your efforts to make known its virtues. It seems to be the ideal suture for hernia. I introduced it at the Hospital for Ruptured and Crippled, and afterwards persuaded Dr. Bull to use it in the New York hospital. I have operated upon forty-four cases in children, mostly during the last year. With my adult cases at the Post Graduate, I have operated nearly sixty times and have had more than fifty cases of primary union. In fact, have never failed to get primary union where I have used the kangaroo tendon."

The progress of modern surgery is emphasized upon every hand, and the prophesy which I made years ago that the cure of hernia was no exception, is being widely fulfilled. The older anatomists understood quite as well as ourselves that, in the normal relationship of the parts, the inguinal canal is always disposed in a direction at or near a right angle to the intra-abdominal pressure, and in the maintenance of this is the principal reason why all males are not subjects of hernia. It is quite probable that the primal predisposition to hernia is owing to an arrest of development, which finds its minor expression in the infundibulum process, in the attachment of the peritoneum to the spermatic cord about the internal ring.

When we remember the late period of intra-uterine life at which the testicle descends into the scrotum, and the closure of the peritoneum about the cord takes place, we can easily understand why the parietal peritoneum at the internal ring usually presents a depression. This is often very considerably pronounced in men who have never suffered from

hernia, the strong aponeurotic structures which close the internal ring having been sufficient to retain the intra-abdominal pressure at its normal angle. Change, however, the direction of pressure sufficiently to permit the wave-like impulses of the intestinal contents to impinge within the infundibulum, and little by little the barrier produced by the transversalis fascia yields; the internal ring enlarges by a depression of its lower border until gradually the line of intra-abdominal pressure becomes more or less parallel to that of the canal; the abdominal wall gives way under some sudden impulse and the patient recognizes that he is ruptured. That which seems to him a sudden accident is the result rather of a series of causes acting through a considerable period.

If we are correct as to causation, the study of which is of the greatest importance, it becomes us that we consider the essential factorage which must enter into the problem in any operation for cure. Although seemingly so simple, it will be found that the equation is a varying one, depending largely upon personal conditions which are ever subject to modifications. These may be grouped in a general way as follows:

First, intra-abdominal pressure; second, the condition of the abdominal wall; the development and tone of its muscles and connective tissue; the amount of fat; the size of the cord, which is oftentimes very greatly increased by enlarged veins; third, the pathological changes in the peritoneum; the sacs containing the hernial tumor which are most varied in character, demanding for the exhaustive treatment of this part of the subject a chapter longer than this entire paper; fourth, contents of the sac: the constituents of the hernial tumor, a condition of almost endless variety of detail which must be passed over without comment.

There is at the present time a general consensus of surgical opinion, that the contents of the hernial tumor having been disposed of, the sac itself must

be treated in great measure as a foreign pathological body. Nearly all operators agree that in pronounced hernia it should be dissected free quite within the internal ring and by some method closed so as to minimize as far as possible the infundibulum process. Mr. Macewen, by the use of the whole or a part, proposed to return it within the ring in a manner to press from without inward and forward; to buttress, so to speak, the weakened internal inguinal ring by it. This was a wise disposition of the parts before it was thought practicable to reënforce in any way the posterior border of the inguinal canal and close from below upward the internal ring. Other operators contented themselves with twisting, ligating, or suturing in order to make tense the peritoneum about the ring. Dr. Bryant of New York, advocated in addition to this, the division of the sac and interweaving it between portions of the abdominal wall, so to speak, using it as a vitalized suture. This, however, proved disastrous in a number of cases, because of the impairment of the vitality of the parts from cutting off the circulation at the base which caused sloughing, and it has been practically abandoned by its distinguished author.

I have already given a brief resumé of Professor Kocher's method, who endeavors to utilize the sac in a somewhat similar way by forcibly twisting it upon its base, and when thus twisted to its very end, attaching it by sutures to the undivided external abdominal wall. I have been unable to gather from his paper the number of his operations performed after this method which, although carefully illustrated by a series of drawings, is referred to as his more recent device. His results as tabulated are admirable and yet evidently not all performed in this way. It is clearly apparent that, in a very considerable class of hernia, for instance the large old direct-irreducible hernia, this method would be inapplicable. By it, it is impossible to re-enforce and strengthen the structures posterior to the inguinal canal; to reform the internal inguinal ring; to restore the

obliquity of the canal and change the line of intra-abdominal pressure.

Bassini's method is worthy of careful analysis and in all its essentials is not unlike that of mine. It is doubtless true that this distinguished Italian surgeon worked out the problem utterly independently, without knowledge of my labors in this direction, although my first publication upon this subject antedates his by quite fifteen years. By a free dissection the base of the sac is closed in an oblique line quite within the border of the internal ring, the cord is lifted from its canal and held upon the inner side by an assistant. The posterior border of the conjoined tendon is brought in apposition to Poupart's ligament by a line of continuous catgut sutures and closed from below upward quite upon the cord at its exit from the internal ring. The cord is then replaced and the strong aponeurotic fibers of the conjoined tendon and Poupart's ligament are closed down upon the cord by a similar line of continuous suturing, until the external ring is reformed. Suturing of the skin completes the operation.

Dr. Halsted's modification of Bassini's operation is different in that the cord is placed entirely external to the rejoined oblique muscle, re-enforcing posteriorly a new inguinal canal by all the strong structures that go to make up the abdominal wall. A new canal is constructed in the tissues just beneath the skin; although thus re-enforced Dr. Halsted thinks it is important to isolate and cut away all but one or two of the veins of the cord in order to reduce its size as much as possible.

Postempski has modified the Bassini method, apparently ignorant of Halsted's procedures, but differing from them in that he forms a new internal ring, one-half an inch or more above the upper border of its former site, and attaches the cord by loose catgut sutures to the connective tissue toward the median line external to the fascia of the great oblique muscle.

Dr. Fowler has still further modified this proce-

dure by carrying the site of the internal ring as far as the length of the cord will permit, an half inch or more, above its former location and reversing the direction of the cord through the abdominal wall in its entrance into the abdomen. Thus the cord is carried forward and inward and held by loose catgut sutures to the fascia of the external oblique muscle, while the abdominal opening, represented by its former inguinal canal, is obliterated in its entirety and closed by a double row of figure-of-eight silk worm gut sutures.

History is said to repeat itself. Heliodorus describes an operation essentially like these latter methods under discussion. After him the evolution of the problem went on little by little, until it was safely worked out by the elimination, not alone of the inguinal canal and the redundant veins of the cord, but also the entirety of this troublesome complication was removed, and cures were easily effected at wholesale; castration being first performed, although the operators were in blissful ignorance of our troublesome painstaking antiseptic technique. In tracing the results of these recent innovations it is an interesting, although I grant a subordinate question, to ascertain the integrity and usefulness of this organ oftentimes overestimated in its physiological value.

It is important to follow the deductions which should guide us in the safe solution of the problem, and this to most minds would seem answered in restoring the parts to their normal anatomical and physiological relationship and function. Thus I assume that the inguinal canal, normally developed is long enough to make the internal abdominal pressure at a right angle to its axis, and when this is effected little if anything further can be gained by the transplantation of the cord to a higher point through the abdominal wall. The upper border of the internal inguinal ring remains a sure and safe landmark for the fixation of the spermatic cord.

Sir Astley Cooper pointed out the extraordinary

reënförment of the transversalis fascia which normally circumscribes the internal ring and forms the posterior border of the inguinal canal. This is usually re-enforced also by a portion of the transversalis muscle. The great lateral protecting walls of the canal, as every anatomist knows, are made up, upon the inner border, by the conjoined tendon, and upon the outer, by Poupart's ligament. The thick fascia from the oblique muscles covers over the cord, making its external envelope. The lower edge of these reflecting fibers forms the external ring. Thus the cord lies easily movable in a fixed, firm canal, although its strong borders are subject to a considerable variety of changes.

The solution of the problem for the cure of hernia must be the restoration of the parts to their normal standard if possible. This was the problem which I set before me for solution quite twenty years ago. In order to accomplish it, it is clearly evident that the peritoneal sac must be entirely removed. Since the hernia has its origin in the deformation and shortening of the posterior wall of the canal, it seemed equally clear that some method must be devised for its reconstruction and restoration. This demanded a free dissection; first to deal properly with the contents of the sac; second, to free quite within the ring and eliminate this deformed peritoneal pouch. This having been effected it was a natural deduction that the posterior wall of the inguinal canal must be reformed, but to accomplish this, suture material must be used which could be buried in the tissues and there remain undisturbed. If arteries could be ligated with catgut, and the subsequent intervening processes show the constricted vessel surrounded by a newly-formed connective-tissue band, replacing the ligature, the inference was that this material might serve a similar purpose when applied for closing the internal ring and reconstructing the posterior wall of the inguinal canal. This I put in practice in 1870, and published the results, being the first to advocate the

advantages derived from the use of buried animal sutures.<sup>4</sup>

Having reformed the internal ring and the posterior border of the canal, there only remained the closure of the wound in order to effect the complete restoration of the parts to their normal relationship. This I have long believed is best effected by approximating the tissues in an even layer by means of the double continuous tendon suture.

To master the problem as thus outlined, the technique of the operation must be conducted with the most careful antiseptic measures, since otherwise primary union is the exception rather than the rule, and when suppuration ensues, the operation is followed not only by an almost necessary failure, but with a possible risk of life. But in these precautions I happily found safety owing to the early personal training received from the great master of antiseptic surgery. Ambitious operators very properly desire to improve upon previous measures, and probably to this more than any other cause, the profession is indebted for a great variety of detail, worked out with much enthusiasm, and a vast amount of clinical experience by which the subject has been greatly enriched.

If the essential factors are as above outlined, and the experience of a multitude of workers under improved methods is accepted as testimony, conservatively the verdict may be rendered; that inguinal hernia in the male can be safely and permanently cured; so safely that the collated experiences which within a year I have myself made of over 3,000 cases of hernia, operated upon, shows less than 1 per cent. of mortality. The results in the hands of these operators have been satisfactory, so satisfactory that from 80 to 90 per cent. are declared cured.

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<sup>4</sup> I made careful histological studies, by burying sutures in different animals, and making sections from the parts at varying periods; and demonstrated not only that the sutures were more or less slowly absorbed, dependent upon a variety of conditions, but that they were in a large measure replaced by a *band of vitalized connective-tissue*. These observations have since been abundantly confirmed by Bolling & Co. and Edwards.

The surgical measures are not severe; the later operators declare that under modern aseptic precautions not more than 5 per cent. of the wounds fail of primary union. Even where cure has not been effected, in a great majority of the cases the condition of the patient has been much improved. The essential factor in addition to those above stated is, a wound in *aseptic* tissues, *aseptically* made and maintained. For reasons which I have emphasized elsewhere, there is great advantage in the use of buried animal sutures, preferably tendon, because aseptic and very much more slowly absorbed, but whatever the material employed, the tissues must not be over-constricted, since approximation and retention at rest of the structures as little devitalized as possible are important factors in securing primary union in even an aseptic wound. The only dressing which seems entirely adequate and which also approaches the ideal, is the iodoform collodion seal which necessarily prevents infection entering the wound, while drainage is dispensed with and no sutures have to be removed.

I have no hesitancy in commending to the profession these measures, which generally are applicable to all wounds aseptically made, as the really essential factors which pertain as fundamental in the cure of hernia.

In reviewing the recent literature of the subject it has given me intense satisfaction to find that the fundamental principles of the operation, for which I have so long contended, have been finally accepted and carried into practice by many of the most distinguished surgeons of Europe and America. It is with the utmost confidence that I contemplate the surgical relief which will be given to the great army of truss-bearing sufferers in a not distant future.



