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THE OPERATION OF BASSINI AS DESCRIBED BY ATTILIO CATTERINA

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Edoardo Bassini . . . found hernial surgery in the same state of development it had reached during the Dark Ages . . . ; he left it where it stands today (1).

THE BASSINI HERNIOPLASTY is performed differently in the United States than in Europe. American surgeons traditionally do not divide the posterior wall of the inguinal canal but merely strengthen it by plication (Fig. 1). The European surgeons, on the other hand, routinely divide the inguinal canal wall from the deep ring to the pubic tubercle before the repair (Figs. 2 and 3). Pondering this difference caused me to search the historical literature on hernias and led to the discovery of a remarkable book by Attilio Catterina (Fig. 4) entitled *L'operazione di Bassini per la Cura Radicale dell'Ernia Inguinale* (2).

This book describes and illustrates in color the details of the operation made famous by Edoardo Bassini. Leafing through this beautiful book reveals, quite astonishingly, that resection of the cremaster muscle and division of the wall of the posterior inguinal canal are essential steps of this surgical procedure. Furthermore, the text reveals that division of the posterior wall was an important step that was omitted by the majority of surgeons. Bassini, therefore, not only completely dissected the inguinal canal as well as isolated and ligated the hernia sac beyond its beginning, but also, like all modern day hernia surgeons, considered the deliberate, complete exposure and assay and survey of the anatomic parts to be sutured essential for good results. In recent years, the Shouldice hernioplasty has caught the fancy of surgeons in North America.

Central to this technique is the division of the cremaster muscle and posterior wall of the inguinal canal (3-6). The Shouldice and Bassini hernioplasties are, therefore, essentially the same. Apparently, the enthusiasts of the Shouldice hernioplasty, of whom the author is one, are unwittingly performing the operation of Bassini. One question that arises is whether or not the operation that passes for the operation of Bassini in North America is actually spurious. Another is whether or not the surgeons in this country are really unaware of how Bassini actually did his operation. A look at the contribution made by Attilio Catterina to the operation of Bassini and an inquiry into the Bassini hernioplasty as done in North America are necessary and appropriate.

CATTERINA'S OPERATION OF BASSINI

The most important contribution to the understanding of the Bassini hernioplasty was made by the publication of an article in Italy in 1932 by Catterina entitled, "The Operation of Bassini." This extraordinary atlas contains 16 life-sized colored drawings with legends that depict and describe the details of each step of the Bassini operation in its original, uncorrupted and pristine manner. Included also are topics on other types of inguinal hernias, such as sliding hernias, associated surgical conditions, complications and recurrences. The book was published in European countries as well as in England: Berlin, 1933 (7); Paris, 1934 (8); London, 1934 (9), and Madrid, 1935 (10). Obviously, it was a readily accessible reference for European surgeons who must have thumbed its pages frequently.

The surgeons of North America were not so fortunate because there is no evidence that this book was ever published here. It was not copyrighted in either the United States or Canada. It

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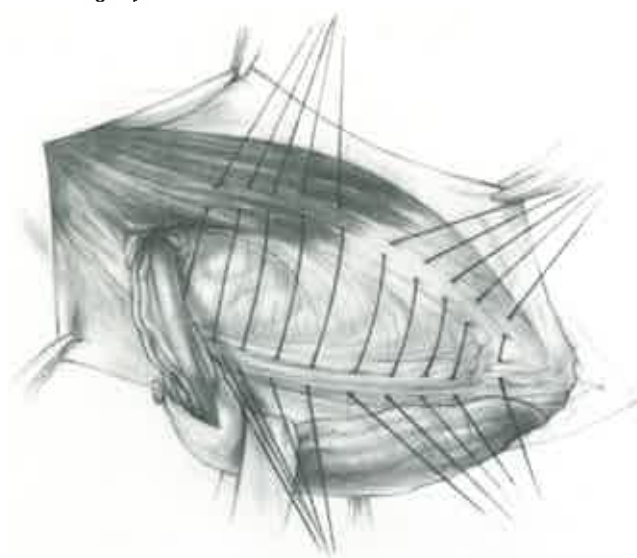


FIG. 1

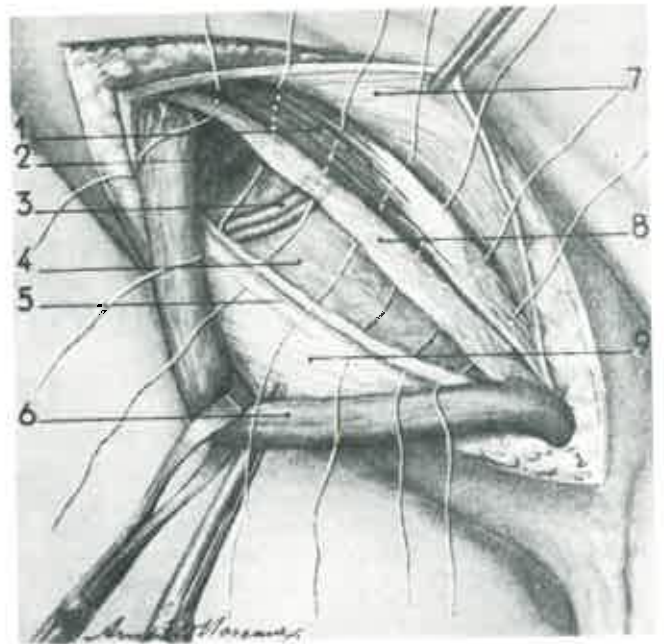
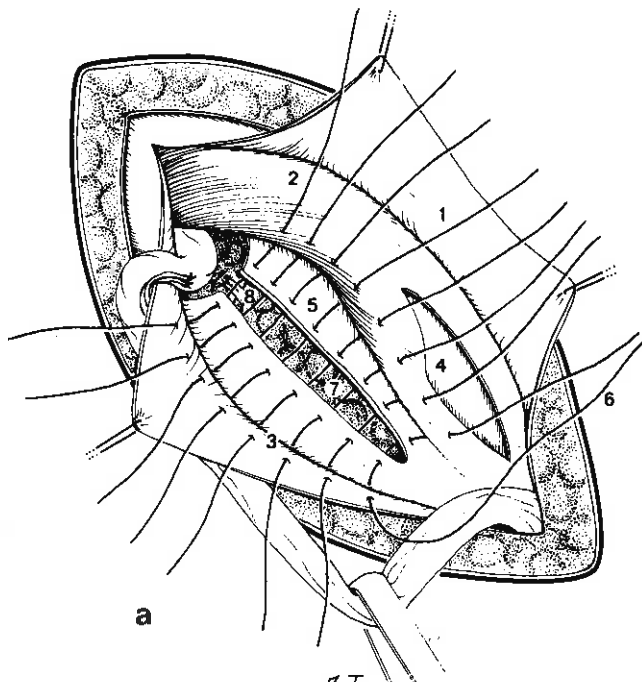


FIG. 2



A.T.
FIG. 3

FIG. 1. The Bassini repair of the posterior wall of the inguinal canal as performed traditionally in North America is illustrated. The posterior wall is plicated beneath sutures approximating the internal oblique muscle and conjoint tendon to Poupart's ligament (some surgeons today also include the iliopubic tract with Poupart's ligament). The deep ring is not dissected nor is the posterior inguinal wall and cremaster divided. Interstitial weakness cannot be ascertained nor the transverse aponeurotic arch assayed; the surgeon is never certain whether or not the suture encompasses strong, healthy transversalis fascia and transverse aponeurotic arch.

FIG. 2. This illustration of the European Bassini operation is from Doctor Fruchaud's book entitled *Le Traitement Chirurgical des Hernies de l'Aine Chez l'Adulte* published in 1956. It differs from the surgical procedure performed in North America and shows a completely divided posterior inguinal canal and a repair that includes the iliopubic tract and the inguinal ligament on one side and Bassini's triple layer on the other. It resembles the surgical procedure described and depicted by Catterina. Reproduced with permission from *Le Traitement Chirurgical des Hernies de l'Aine Chez l'Adulte* by Henri Fruchaud.

FIG. 3. This modern illustration of the European Bassini procedure, which also depicts a relaxing incision, is from R. Stoppa's chapter of a book originally published in French and later translated into English (1987). It differs very little from Figure 2. A completely dissected deep ring and a divided posterior wall of the inguinal canal permit a complete inventory of all the anatomic structures in the repair. Springer-Verlag. Reproduced with permission from *Hernias of the Abdominal Wall*, edited by J. P. Chevrel and from the author René Stoppa.

is, indeed, a rare book in any language. Searches through the various library reference systems located the German and Italian editions at the library of the New York Academy of Medicine, and copies of the London publication were located at the National Library of Medicine in Bethesda, Maryland; in the antique medical book collection of the library of the University of Kansas, and at the library of the Mayo Clinic. The latter is not surprising because the Mayo brothers wrote a preface to the London edition upon receiving a request to do so by Catterina.

Why the right to publish the book in the Unit-

ed States or Canada was not sold or bought is not known. L. Cappelli, in Bologna, was the original publisher but they did not respond to the inquiries and correspondence of the author. Perhaps interest waned as Catterina became involved with the fiftieth celebration of the Bassini hernio-

plasty and as the drums of war were becoming audible.

The book was reviewed in the United States; the German edition in the *New England Journal of Medicine* (11), the *Journal of the American Medical Association* (12) and the *American Journal of Surgery* (13). The French edition was also reviewed in the *Journal of the American Medical Association* (14). None of these reviews aroused much curiosity, however, even though one reviewer described the incision of the transversalis fascia as a departure of the original Bassini, and another said he had only rarely seen the incision of the transversalis fascia with exposure of the deep vessels. Finally, a reference to it in literature (past or present) in the United States has yet to be found. The only conclusion is that American surgeons were, and still are, entirely ignorant of the book and, quite probably, of Bassini's original technique. As a result, reproduced for the first time, as far as can be ascertained in North America, are the 16 plates illustrating the Bassini operation for the radical cure of inguinal hernia along with some of the relevant comments from the text (7).

The book is filled with fascinating information. Catterina dedicated his book "to the sacred memory of my great teacher Edoardo Bassini" (7) and began by announcing that the only intention of his modest book was to describe and illustrate Bassini's original hernia operation. This was necessary because the operation of his "Great Master" was being performed incorrectly, criticized unjustly, poorly described in surgical textbooks and even rejected by those who insisted on modifying it or substituting new procedures. There were even claims that the Bassini operation was particularly susceptible to infection.

Catterina conceded that Bassini was part of the problem because his descriptions were too short and meager, and the illustrations were insufficient in numbers and detail. Apparently, Bassini with his lofty mind imagined that everybody would grasp his ideas even though expressed succinctly. As a result of this widespread criticism and misunderstanding of the Bassini hernioplasty, Catterina considered it his duty to stand up against this unfair judgment and to set the record straight so that surgeons thereafter could correctly interpret and perform the technique.

No one was better qualified to do this than Catterina. He had assisted Bassini during the seven years of Bassini's greatest activity and had translated the Italian of Bassini into German for



FIG. 4. Attilio Catterina (1861-1944), who was born in Italy to a family of physicians and patriots. He received his medical education in Innsbruck and Vienna, learned surgical principles from Billroth, joined Bassini in Padua in 1887, and became Professor of Surgery in Genoa in 1904. He showed his unique friendship with Bassini by supporting and demonstrating the principles and unparalleled advantages of Bassini's original method of hernioplasty in the major hospitals throughout Europe. This work culminated in the publication of the atlas "The Operation of Bassini." His profound knowledge of anatomy, cheerful disposition, infectious style of expression, deep sense of duty, affection and concern for his staff are some of the traits for which he is remembered. Photograph courtesy of Professor R. Stoppa, Amiens, France and Professor G. M. Gazzaniga, Genoa, Italy. Biographical material by Professor Paolo Barco, Genoa, Italy.

the Langenback Archives. Catterina had also been entrusted by Bassini to teach the surgical technique and to give his lectures at the University of Padua. He became Bassini's teaching colleague during World War I and was the only

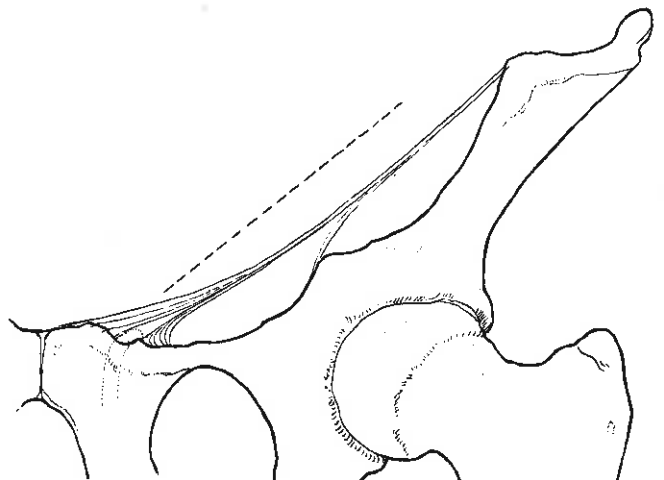


FIG. 5. The diagram of the cutaneous incision.



FIG. 6

FIG. 6. Incision of the external oblique muscle.

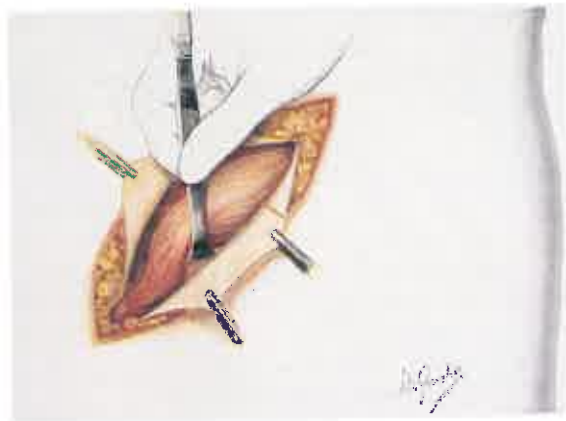


FIG. 7

FIG. 7. Separation of the block made with the handle of a scalpel.

student of Bassini's many famous pupils to have held a university chair, which was in Genoa.

Orazio Gaiger, of Cortina d'Ampezzo, was the artist that Catterina found to illustrate the hernioplasty. Catterina was pleased to have found him because he too was a surgeon who was already familiar with the Bassini hernioplasty as he had worked in the Nicoladoni Clinic in Innsbruck. Even the artist-surgeon became enlightened of technical nuances he had not previously appreciated until he began working on the drawings during operations and during dissections in the anatomy laboratories.

The beautiful illustrations are very specific, and explanations are not really needed to understand the procedure. Nevertheless, some of the text is pertinent and relevant and is presented more or less as written.

The diagram of the cutaneous incision. The incision is two to three inches in length and correctly placed, as illustrated, by referring to

important anatomic landmarks, such as the anterior superior iliac spine, the symphysis and the pubic tubercle, both of which can be identified by a finger invaginating a fold of the scrotum. The skin was incised in the middle of a fold of skin held by the surgeon and his assistant. Early in Bassini's experience, the incision was extended onto the scrotum (Fig. 5).

Incision of the external oblique muscle. The aponeurosis of the external oblique muscle is incised at the upper margin of the superficial inguinal ring so that, when reapproximated, the suture line will not overlap the deep sutures (Fig. 6).

Separation of the block made with the handle of a scalpel. The upper flap of the aponeurosis of the external oblique muscle is separated from the internal oblique muscle for more than an inch by blunt dissection with a finger or a handle of a scalpel directed against the aponeurosis rather than the muscle (Fig. 7). More important, how-



FIG. 8

FIG. 8. Isolation of the block at the external abdominal ring.



FIG. 9

FIG. 9. Isolation of the whole block.

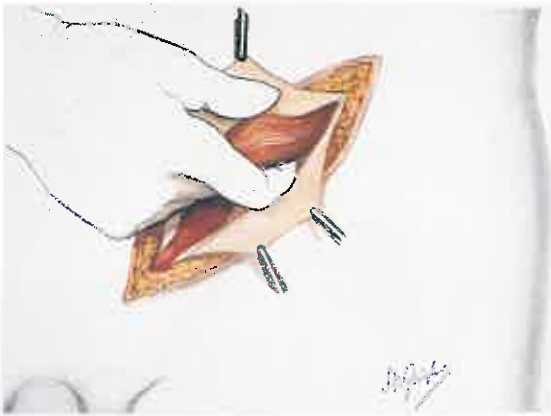


FIG. 10

FIG. 10. Separation of the cord performed by an assistant.



FIG. 11

FIG. 11. Disassociation of the cremaster muscle and other coverings from the sac and spermatic cord.

ever, is the correct separation of the block (cord and cremaster) from the lower flap and from the inner edge of the inguinal ligament because subsequent stages of the operation depend upon this step.

Isolation of the block at the external abdominal ring. The block of tissue consisting of the spermatic cord, cremaster muscle and other tissue is lifted "en masse" with the fingers of one hand exactly at the pubic tubercle so that the index finger of the other hand can be passed gently underneath to meet the fingers of the other hand (Fig. 8). This, Catterina said, is easy and only rarely is an instrument necessary.

Isolation of the whole block. The isolation of the whole block is completed by gently sliding the finger up toward the deep ring, as illustrated in Figure 9. It is good practice not to tear or hurt the tissues too much if a firmly healed wound is to be obtained.

Separation of the cord performed by an assistant. If the assistant is a "capable man" it may be easier for him to carry out the isolation of the whole block (Fig. 10). This was the custom by the surgeons at the Bassini Institute in Milan. Contact with the finger against the aponeurosis rather than the cord and cremaster muscle is again emphasized.

Disassociation of the cremaster muscle and other coverings from the sac and spermatic cord. The assistant lifts the block of tissue with his index finger, while the surgeon, with the index finger and thumb of each hand, separates the elements of the cord by kneading movements (Fig. 11). By this maneuver, the surgeon will succeed in gently separating the cremaster muscle and the spermatic cord with its vessels from the sac. Separating the cremaster muscle simplifies the isolation of the spermatic cord, and this separation should begin as close to the deep ring as is possi-



FIG. 12



FIG. 13

FIG. 12. Complete isolation of the cremaster muscle and other coverings.

FIG. 13. Isolation of the spermatic cord from the sac.



FIG. 14

FIG. 14. Exposure and incision of the fascia transversalis.



FIG. 15

FIG. 15. Opening of the sac and attention to the contents.

ble, where the cord is not completely enwrapped by the cremaster. The cremaster and other coverings should be separated from the cord because separation of the sac will be easier and because they will atrophy once the cremaster and other coverings have been separated from the transverse abdominus muscle, the internal oblique muscle and Cooper's ligament. They should not be used to reinforce other layers as some surgeons propose because this intention would be frustrated by reabsorption and disappearance of the cremaster muscle. Bassini himself had demonstrated this, and it is also in accordance with the fundamental law of pathology that organs deprived of their proper function will in time atrophy. In young thin people who have small hernias, the cremaster muscle need not be separated from the cord or divided.

Complete isolation of the cremaster muscle and other coverings. The cremaster and other coverings are pulled aside from the spermatic cord and sac, clamped, divided and tied (Fig. 12) for the reasons explained in Figure 11. Lipomas of



FIG. 16. Twisting the sac and its removal.

the cord are removed at this stage of the procedure.

Catterina did not specifically address whether or not the genital nerve and the cremaster vessels are included with the division of the cremaster muscle. Indeed, nowhere in the text did he mention these structures, and they are not illustrated in the drawings, except perhaps in Figure 9. They are not seen in subsequent figures. The cremaster vessels arise from the deep epigastric artery and vein and, if mobilized with the cord, inhibit its mobility. The figures show the cord to be freely and even excessively mobile and also depict the deep epigastric vessels without branches. These observations suggest that the term "other coverings" must have meant also that the cremaster vessels (also known as the external spermatic artery and vein) and genital nerve were included in the division of the cremaster muscle.

Isolation of the spermatic cord from the sac. The separation of the sac from the cord should begin adjacent to the internal abdominal ring, as the sac becomes too entangled with the structures of the cord more distally (Fig. 13). Secondary gangrene of the testicle is common with very big indirect inguinal hernias. In these uncertain instances, it is better to warn the patient of the possibility of an orchiectomy. Orchiectomy will very much simplify repair in these large hernias. In congenital hernias, it is not advisable to remove the sac as it is difficult. In these patients, the sac should be divided at its neck and the proximal end ligated and allowed to retract. The distal sac may be left alone or may be slit in its entirety, exposing the inner surface so that the edges can be inverted around the cord and sutured in back of it as in the treatment of a hydrocele by the Winkelmann method. Otherwise, it may be possible to remove



FIG. 17

FIG. 17. First stitches in the deep layer.



FIG. 18

FIG. 18. Completing the sutures of the deep layer.

the sac partially or totally, together with the tunica vaginalis testis as in the Bergman operation for hydrocele of the testicle. Isolating the sac in direct inguinal hernias from the attenuated and thinned out transversalis fascia is an easy matter.

Exposure and incision of fascia transversalis. The transversalis fascia is exposed by gently drawing the cord downward and having the assistant draw the sac outward from the body to stretch the transversalis fascia covering the deep epigastric vessels near the neck of the sac (Fig. 14). The fascia must be cut lengthwise to loosen the transversus abdominus and the internal oblique muscle. The fascia should be cut from the deep ring down to the pubis. The surgeon grabs the free edge of the fascia transversalis, transversalis abdominus and the internal oblique muscle and pushes the thumb of his right hand between the fascia and the subperitoneal tissue to separate them for an inch in length and width.

Catterina simply and flatly stated this important

stage of the operation is frequently omitted by surgeons because they believe the thickness of the fascia is so insignificant, especially in small hernias, that the resistance it puts up is unimportant compared with the strength of the muscular wall made up of the transversalis abdominus and internal oblique muscles. Catterina agreed that, although this may be true, the surgeon should not forget to consider that cutting the fascia will expose deep epigastric vessels, which might otherwise be injured. Another consideration is that the deep layer must be made of a single wall and must, in consequence, contain fascia as well as muscles. Also, loosening fascia will allow easy reconstruction of the deep layer and complete control, avoiding injuries to the peritoneum, vessels or bladder. Finally, cutting fascia facilitates recognition of some special forms of inguinal hernia. In direct inguinal hernias, fascia must be cut from the end of the sac toward the mouth to expose the epigastric vessels.



FIG. 19

FIG. 19. Replacement of the cord.



FIG. 20

FIG. 20. Sewing up the aponeurosis and the subcutaneous tissues.

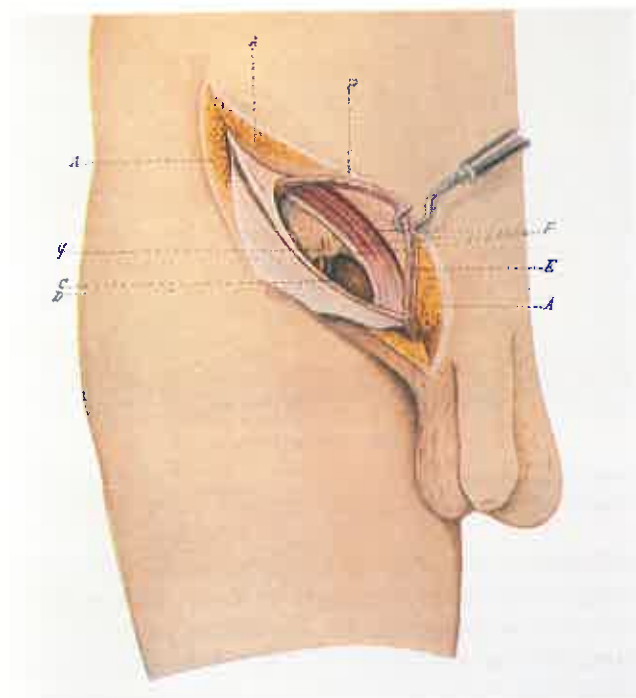


FIG. 21

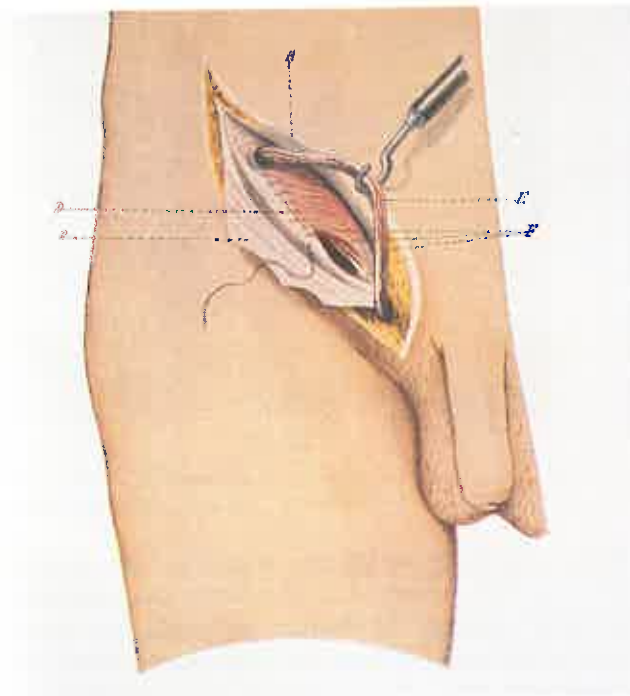


FIG. 22

FIG. 21. AAA, Subcutaneous fatty connective tissue; B, upper part of drawing—flaps of external oblique turned backward; C, lower flap of aponeurosis of external oblique; D, posterior border (shelf) of Poupart's ligament; E, displaced spermatic cord; F, three layers—internal oblique and transversalis muscle and vertical fascia of Cooper, and G, epigastric vessels.

FIG. 22. Suture of musculo-aponeurotic layer to the posterior border (shelf) of Poupart's ligament.

Opening the sac and attention to the contents.

In this legend, Catterina dwelled at length on dealing with an indirect inguinal hernia sac, both those that are empty and those that contain strangulated omentum and intestines (Fig. 15). Some of it is irrelevant to modern operations, such as leaving the strangulated small intestine exposed for 48 hours for observation or the creation of temporary colostomy by the exteriorization of gangrenous intestine in the groin.

Twisting the sac and its removal. Customarily, the empty indirect hernia sac was twisted, ligated, transfixed and divided, whereupon the neck of the sac retracts into the abdominal cavity, as illustrated in Figure 16. Sacs of direct hernias are merely inverted after incising the transversalis fascia with care so as to avoid injury to the bladder.

First stitches in the deep layer. The deep layer must be reconstructed with great care so it is necessary to completely expose the organs that are to be used for the reconstruction (Fig. 17). Catterina preferred to draw the cord downward and to tuck it behind the outer aponeurotic flap. This avoids the occasional need to mobilize the testicle when the cord is elevated upward as recommended by

Bassini. Traditionally, Bassini held the cord aside with a string but thought Catterina's modification suitable, saying to him, "all roads lead to Rome." Drawing the aponeurotic flaps downward has the advantage of displaying the whole free edge of the reflected portion of Poupart's ligament, which would also include the femoral sheath or iliopubic tract, although this structure was not specifically mentioned.

The first stitch includes the threefold layer and the external edge of the rectus abdominus muscle with or without the aponeurosis, while the forefinger of the surgeon protects the tissues under the loosened muscle and fascia transversalis. A threaded needle is passed through the elements about three-quarters of an inch from the edge of this layer going in and out twice, as one does a pursestring suture. Afterward, the needle passes through the periosteum of the pubis and Colles' ligament very close to the spine. At about one-third of an inch from the first stitch, the surgeon passes the second suture, including in it everything that has been included in the first. The third stitch includes only the threefold layer for about one inch and then the posterior fold of the reflected inguinal ligament.

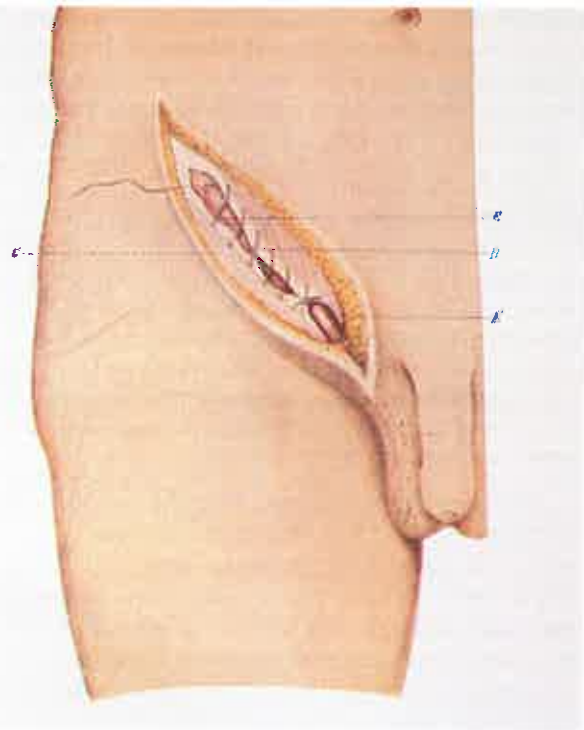


FIG. 23

FIG. 23. The fourth step of the operation. The spermatic cord is transplanted. The flaps of the external oblique are sutured.

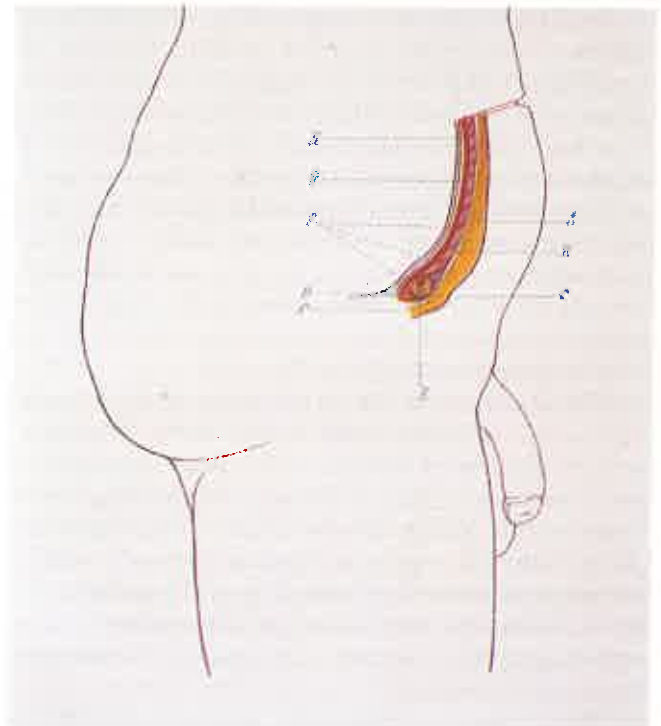


FIG. 24

FIG. 24. Schematic drawing of the inguinal region of vertical section—almost one-half the length. *a*, General coverings; *b*, aponeurosis of the external oblique; *c*, lower part of aponeurosis of external oblique and of Poupart's ligament; *d*, Shelf of Poupart's ligament to which the three layers of muscle and fascia are sutured; *e*, spermatic cord; *f*, preperitoneal fatty connective tissue, and *g*, peritoneum.

Completing the sutures of the deep layer. The surgeon deflects the preperitoneal fat and peritoneum and supports the threefold layer with the index finger of one hand. The sutures are placed in the threefold layer in several steps, as shown in Figure 18.

First, the needle passes through the elements of the threefold layer transversing about one and one-half inches and goes in and out twice as for a pursestring stitch. Then the surgeon raises the lower flap, which elevates Poupart's ligament and protects the underlying vessels from injury by the needle piercing a good portion of Poupart's ligament from beneath. Six to eight stitches are generally required to complete the suture. The last suture must be inserted one-third of an inch below where the cord arises. Catterina insisted that the elements of the threefold layer be made very loose and that the needle transfix it at a depth of at least one and one-half inches, especially in those patients who had thin muscular walls. Catterina bluntly concluded this stage of the operation with a fitting statement that, "One has no right to speak about a Bassini operation if one doesn't follow the fundamental rules; or to

attribute to the method recurrences due to mistakes of the surgeon."

In Figures 17 and 18, it is suggested that the pursestring suture in the triple layer did not go in and out twice but rather went in and out once and in and under in the triple layer. The illustrations also make clear that there is no distinction between the iliopubic tract and Poupart's ligament. As far as Bassini was concerned, the iliopubic tract or femoral sheath was part of the inguinal ligament and included in the sutures.

Replacement of the cord. Sutures are tied and the surgeon tests for looseness at the internal ring (Fig. 19). In women, the Bassini operation is much easier since the round ligament, having no importance, can be cut and ligated.

Sewing up the aponeurosis and subcutaneous tissues. The cord is placed on the newly reconstructed posterior wall of the inguinal canal, and the two flaps of the aponeurosis of the external oblique are approximated with both a continuous and some interrupted sutures down to the point where the external abdominal ring is reassembled (Fig. 20). Interrupted sutures are used to approximate the subcutaneous tissues.

Finally, Catterina emphasized Bassini's insistence on precise, accurate, careful surgical attention, the closure of all dead space and the execution of the hernioplasty without modifications because the procedure is based on invariable anatomic and physiologic basis. No other operation of importance can equal it in this point. All modifications, even the most recent, do not compare with the original technique of Bassini. If complaints of recurrence are voiced today, the reason must be looked for in a technique that does not conform to that taught by Bassini.

The description Catterina gave of the Bassini operation explains, why in the early 20th century, surgeons of Milan and Padua experienced recurrence rates that were much better than those reported by surgeons elsewhere. This also explains why European surgeons currently mobilize the spermatic cord completely at the deep ring by dividing the cremaster muscle, the cremaster vessels and the posterior inguinal wall when performing this repair.

The failure of the book to reach the North American market also explains why the surgeons of North America did not pick up on it and follow these steps. Surely, they would have done so had they had a chance to study the book. A look at what Bassini and others wrote is necessary if there is to be an explanation of the confusion concerning the Bassini operation and why it is performed as it is today.

BASSINI'S BASSINI

Bassini wrote only six articles about his operation and all are fundamentally the same (15–20). Three are in Italian and three are in German, with the German essentially a translation of the Italian. After the 1894 article, Bassini never wrote anything about his operation or hernias again.

In general, Bassini was specific about most of the steps of the procedure but he was, as Catterina pointed out, vague as to the repair and left out the excision of the cremaster muscle all together. Regarding the repair, Bassini said the following in his German treatise of 1890 (19) (which was translated for this article by Casper Henselman):

During the third stage I deflect the freed spermatic cord by pulling it gently upward onto the abdominal wall. I do the same with the testicle by pulling it out of the scrotal sac, if necessary. With sharp broad hooks I pull the lower edge of the aponeurosis of the oblique externus downward and the upper edge upward. This way it is easy to expose the channel formed by Poupart's ligament up to its posterior border and 1 cm.

past the emergence of the spermatic cord from the iliac fossa (internal ring). Then I separate the external edge of the rectus abdominus and the triple layer formed by the m. transversalis, the obliques internus and Cooper's vertical fascia from the aponeurosis of the oblique externus and the subserous adipose network, until the triple layer can be approximated easily to the freed posterior edge of Poupart's ligament.

This accomplished I suture the two parts with button stitches (interrupted sutures) for a distance of five to seven centimeters from the pubic tubercle outwardly toward the spermatic cord, which has been pushed about one centimeter towards the anterior superior iliac spine. This completes the third stage and the internal ring and posterior wall of the inguinal canal has been restored.

In the aforementioned, Bassini clearly made no mention of whether or not the posterior inguinal wall is to be deliberately incised to delineate the triple layer before repair. Division of the posterior wall of the canal, however, is implied because he instructed that the transversalis fascia was to be separated from the subserous (preperitoneal) fat. This step would be impossible unless the posterior inguinal canal wall was divided or unless the patient had a very large dilated deep ring.

Doctors Ravitch and Hitzrot (21) erroneously wrote subcutaneous adipose tissue for subserous fat in their article. Curiously, the author made the same mistake when first reading an English translation of Bassini's description of his operation. Perhaps preconceived notions mislead us.

Bassini's beautiful illustrations with their original legends (Figures 21–24) are as ambiguous as the text. In Figure 21, the completed dissection is depicted. The inguinal ligament is seen laterally, and the preperitoneal fat and the inferior epigastric vessels are visible in the dark central area of Hesselbach's triangle. But whether the exposure of these structures was accomplished by division of the posterior inguinal canal or it was coincidental to the dissection of the neck of a hugely dilated indirect sac from the deep ring is not discernible. Although the illustrations may be subjected to different interpretations, the author concludes that the posterior inguinal canal was not completely incised because the falx inguinalis is unmistakably present next to the triple layer pointed out by the letter F in Figure 21.

ANDREWS'S BASSINI

E. Willys Andrews visited Padua three times and watched Bassini operate both in his home and at the hospital and wrote about what he saw in great detail in 1899 (22). His authentic and detailed description of the Bassini operation was

and still is the best available to the English speaking surgeons of North America.

Andrews said he observed the Bassini operation many times both in Europe and America, sometimes performed poorly and sometimes skillfully, but nowhere was it done as well as it was in Padua. His description is remarkably similar to Catterina's with one exception—he, like Bassini, did not say specifically that the transversalis fascia of the floor of the inguinal canal was incised and divided from the deep ring to the pubic tubercle. The next few illuminating excerpts are from Andrews's article (22).

The cord mass, containing the cremaster, hernial sac, and spermatic cord, is now raised by a blunt dissection and any lobules of loose fat stripped away as high up as possible. The cremaster muscle, when developed into large strings, is removed in the same way, often between ligatures.

The neck of the sac is now detached from the internal ring by loosening the parietal peritoneum for 2 cm. all around.

The sac is now cut off. . . . The elastic peritoneum draws the stump well inside the abdomen, and, of course, the subsequent work is purely extraperitoneal.

Now the dissection of the peritoneum away from the internal ring, which has already been mentioned, has also had the effect of loosening the transversalis fascia and internal oblique muscle so that the margins of the internal ring are free and even undermined. These, as everyone knows, are the structures to be included in the Bassini operation in the first or deep line of suture, intended to restore the enlarged ring to its normal size. To facilitate the insertion of these stitches a forceps is made to grasp the transversalis and internal oblique, pointing from the internal ring inward, one blade being just outside the peritoneum, i.e., the blades grasp the whole of the posterior wall except the peritoneum. This gives a ready means of handling and raising the structures in placing the deep stitches. *A flat director is also used in some cases at this stage, thrust into the internal ring to push the posterior wall forward, and to steady it as the needle enters its substance* (italics added). I attach some value to this little step in the technique, since it is obviously difficult without it to know the exact depth to which the needle enters the muscle, and whether it gets any of the transversalis fascia, unless one goes deep enough to risk puncturing the peritoneal cavity.

The deep stitches are placed beginning very close to the pubic bone. The first one or two may, in some cases, include part of the rectus muscle and sheath. Each stitch enters the transversalis and internal oblique 1.5 cm. from their lower margin, and makes exit at that margin.

Their effect is not only to restore the length and obliquity of the canal, but to invert the upper or muscular segment like a Lembert suture, and to draw it

somewhat behind the ligament and not merely against it. In other words, we have a sort of overlapping or imbrication here, giving broad surfaces of union.

It is obviously very clear that, at least in the beginning, Bassini did not intentionally divide the floor of the inguinal canal to facilitate exposure of the transversalis fascia underneath the transverse abdominal muscle, rather he freed the triple layer through a dilated but deliberately exposed deep ring from which the cord was completely detached. This dissection renders the triple layer clearly exposed so that preperitoneal fat could be dissected from beneath it and the external oblique aponeurosis separated from the front.

The deliberate incision of the floor of the canal down to the pubic tubercle must have been a development that occurred after 1899. The division of the floor would have become a necessity as the popularity of the operation increased and patients with small inguinal hernias in whom the floor was only minimally attenuated undertook to have their hernias corrected.

Neither Bassini nor Andrews described the dissection for direct inguinal hernias. Perhaps Andrews only saw large indirect and direct inguinal hernias repaired, both in which the transversalis fascia of the floor would have been so attenuated as to be nonexistent and placement of a flat bladed instrument in the internal ring was all that was necessary to facilitate the dissection of the preperitoneal fat from the transversalis fascia and rectus muscle.

The method that Andrews described of the placement of the sutures in the triple layer is still done today and is not unlike that of Catterina. In the description Catterina gave, the sutures are placed in and out of the triple layers twice, whereas Andrews described it as passing in and out of the triple layer only once. In the method of Andrews, the suture would pick up the shelving edge of the Poupart's ligament and perhaps the femoral sheath, whereas Catterina's sutures would have unavoidably included the femoral sheath. Approximating these sutures, placed as described by either Catterina or Andrews, had the effect of imbricating or overlapping the triple layer, which are the very same words Andrews used in his description.

NORTH AMERICAN BASSINI

From the aforementioned, neither imagination nor explanation is needed to understand why the surgeons of North America, and perhaps those of Europe also, prior to the publication of Catterina's atlas, did not include the division of the in-

guinal floor and cremaster muscle in the dissection, and for the repair merely imbricated the posterior wall, just as some textbooks and atlases of surgery, in this country, currently depict and describe (23) (Fig. 1). It is not all clear why the division of cremaster was abandoned, because this part of the dissection enormously facilitates exposure of the deep ring. Similarly, it is not known precisely why complete definition of the triple layer was de-emphasized, eliminated and forgotten. By omitting this part of the dissection, which Bassini initially described and then later extended to the pubic tubercle, a surgeon could never be certain as to what structures the sutures were encompassing except for the internal oblique abdominal muscle.

The popularity of the Ferguson hernioplasty, also known as the Halsted II, may have influenced surgeons of the day. Prior to World War II, the Ferguson procedure was very popular throughout the United States—especially at institutions that had been influenced by the Halsted school of surgical techniques. In the Ferguson or Halsted II hernioplasty, the cremaster muscle is preserved, and the repair consists of suturing the internal oblique muscle and transverse abdominal muscle to the inguinal ligament over the top of the cord, unmobilized and in its normal anatomic position. Not surprisingly, the repair was frequently referred to in North America as the anatomic hernioplasty. Surgeons of the day considered the only important difference between the Ferguson and Bassini operations to be that the cord was mobilized and transposed in the Bassini, whereas in the Ferguson, it was not; in both, the oblique cord was preserved.

At the Hospital for the Ruptured and Crippled in New York, now known as the Hospital for Special Surgery, thousands upon thousands of Bassini hernioplasties were done. William B. Coley (24) simply described the procedure:

Slitting up the aponeurosis of the external oblique from the external ring to an inch or more beyond the internal ring.

Isolation of the sac and ligation well beyond the internal ring with no fanicular process left to favor a recurrence.

Reconstruction of the inguinal canal by suturing the internal oblique muscle to Poupart's ligament underneath the cord from the internal ring to the pubic bone.

The cord is then placed upon the new floor of the inguinal canal and the aponeurosis of the external oblique is sutured from above, below leaving only sufficient space for the cord to emerge at the external ring. By this method of reconstruction the obliquity of the

inguinal canal is restored and exaggerated and the chances of recurrence greatly diminished.

In the late 1940s, just before the Hospital for Special Surgery moved uptown adjacent to the New York Hospital-Cornell Medical Center, the author spent a couple of months of his surgical training performing hernias (as many as 15 a day were performed) under the supervision of Bradley Coley, William Coley's son, in the exact manner as his father described.

At about this time, renewed interest in hernias and the anatomy of the groin was stimulated by the work of such surgeons and anatomists as Anson, Clark, Condon, Griffith, Harkins, Hashimoto, McVay, Madden, Nyhus, Ponka, Ravitch and Zimmerman, to name a few, and the Bassini procedure again came under severe criticism. The deficiencies of the Bassini hernioplasty as practiced in North America were elucidated and denounced, and emphasis was placed upon the importance of the repair of the posterior wall of the inguinal canal with either Cooper's ligament or the iliopubic tract, and transverse aponeurotic arch. Little did these surgeons know that this was also a central feature of Bassini's repair.

Despite this voluminous literature describing the essentials of a successful repair, many and perhaps most surgeons still perform an adulterated Bassini hernioplasty and fail to appreciate the importance of the complete exposure of the most posterior aspect of the inguinal canal for a long lasting hernial repair. Some even perform McVay's Cooper ligament repair without division of the floor and excision of the medial portion of the iliopubic tract to expose Cooper's ligament and to define the medial edges of the femoral sheath, which are important structures to which the transverse aponeurotic arch is to be sutured (25). Failure to do this part of the dissection gave the Cooper ligament repair a poor reputation and was the principle cause of the disastrous complications with the femoral vessels that surgeons reported after this procedure.

Nevertheless, some surgeons were aware that Bassini actually did divide the cremaster and the posterior wall of the inguinal canal. Zimmerman (26) realized Bassini's intentions and wrote in 1953 that one of the more salient features of the Bassini procedure was the intentional division of the fascial floor and that the traditional Bassini hernioplasty as performed here was a departure from the original. Recently, Read likened the Bassini hernioplasty to the Shouldice repair (27).

Finally, a collection of papers about hernias was published in Padua on the occasion of the

50th celebration of the Bassini hernioplasty in 1937 (28). Many surgeons from around the world including the United States (A. D. Bevan, J. J. Buchanan, W. B. Coley, D. Lewis, C. H. Mayo, L. M. Zimmerman and K. E. Heller) contributed to the two volumes edited by Fasiani and Catterina, and Catterina's illustrations were reproduced in black and white for all to see. Unfortunately, the book was published only in Italy and nearly all of the contributions were in Italian; consequently, the two volumes exerted little influence on those not fluent in the language and unable to get the book.

SHOULDICE BASSINI

After World War II, Nicholas Obney and Ernest A. Ryan were working with Earle Shouldice in his hernia clinic in Toronto where they were performing a modified Bassini operation and began to change the technique to improve their disappointing results. Beginning a little at a time, they started to divide the cremaster muscle and the cremaster vessels for better exposure of the internal ring, then they divided the entire floor of the posterior wall of the inguinal canal. According to Obney, the procedure was established by 1951 but the division of the cremaster vessels were not routine until 1953. For the repair, they used the identical structures used by Bassini, that is, the iliopubic tract or femoral sheath and the inguinal ligament on one side and on the other, Bassini's triple layer. Instead of approximating these sides in one layer with interrupted sutures, they imbricated the layers with four continuous wire suture lines. The dissection of the Shouldice hernioplasty is identical to the dissection of Bassini's hernioplasty. The repair is also essentially the same although the re-approximation of the divided floor is refined and a lot more precise. Obney modestly downplays his role in the development of the Shouldice hernioplasty and credits the development mainly to the gifted Ryan. The Shouldice hernioplasty is enjoying enormous popularity in North America, as it rightly should, because it produces exceptionally good results (3-6). Bassini would be proud and pleased but certainly not surprised. Nicholas Obney has stated that he and Ryan were unaware of Catterina's book. Like the reinvention of the wheel, Obney and Ryan of the Shouldice Hospital have reinvented the Bassini hernioplasty. The recognition of the Shouldice hernioplasty as a modern equivalent of the Bassini hernioplasty is well known to the hernia surgeons of Europe (29, 30). It will be a surprise to many American surgeons, however,

especially those who have been critical of the Shouldice repair and to those who have adopted the Shouldice technique to replace the adulterated Bassini procedure that they were taught was the authentic hernial operation.

SUMMARY

The book entitled, "The Operation of Bassini" by A. Catterina made the greatest contribution to the understanding of the details and technique of the Bassini hernioplasty. The 16 colored figures are reproduced for the first time as far as can be ascertained in North America. For unknown reasons, the book was never published in North America, leaving the surgeons of North America ignorant of Bassini's intentions. Bassini's own descriptions were brief and subject to misinterpretation and his illustrations were not detailed enough. The description given by Andrews of his personal observation of Bassini operating should have, but did not, enlighten North American surgeons. The inguinal hernioplasty of the Shouldice Hospital evolved de novo but is, in fact, the modern equivalent of the Bassini procedure.

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