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PIONEERS IN HERNIA SURGERY

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Wrapping the visceral sac into a bilateral mesh prosthesis in groin hernia repair

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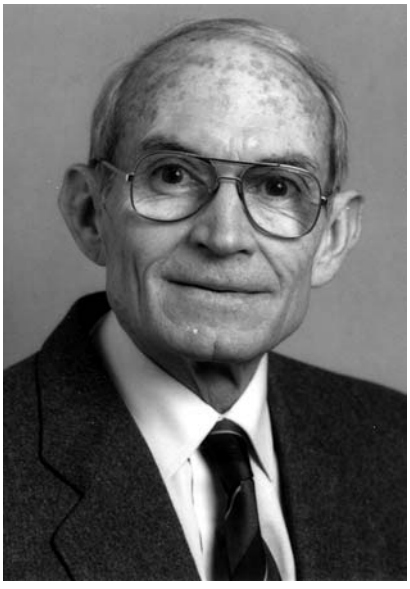

Professor René Stoppa

Born in Algeria, then an overseas French territory, Professor Stoppa attended primary and secondary schools in Oran. He started his medical studies at the Faculty of Medicine of Algiers in 1939. During Word War II, he volunteered in the French First Army for the campaigns of Italy, France and Germany, from 1942 to 1945, and received the war cross. After the war, he resumed his medical studies. He was appointed as a demonstrator in the Department of Anatomy of the University of Algiers from 1947 to 1954, and to a residency in 1950. He defended his medical thesis in 1954 and was qualified in General Surgery the same year. Further training in France and Europe completed his surgical education. In 1962, he became Chief of Surgery of the University Hospital of Algiers and was named "Professeur Agrégé" (Docent) of General Surgery. In 1965, he was appointed Chief of Surgery of the University Hospital in Amiens, France. In 1967, he was named Professor of Clinical Surgery at the Faculty of Medicine of Amiens, and, in 1992: Emeritus Professor and Honorary Chief of Surgery.

His interests have been in GI surgery and abdominal wall surgery which led to his important insights and influence on the evolution of hernia surgery. His publications have covered wound healing, chronic osteomyelitis, ischemic limbs, polytrauma; in GI surgery: dolichomegacolon, peptic ulcer, gastroesophageal reflux and diverse technical innovations in pancreatic and biliary surgery.

As a founder of the School of General Surgery of Jules Verne University of Picardy, Amiens, he directed the teaching of many French and foreign surgeons from the Middle East, Africa and Madagascar. He carried on university missions in Central Africa, Zaire, Madagascar, Bolivia, Peru, etc... .

Among his accomplishments he is a founding member of the GREPA-EHS (former President) and CICS (Collegium Internationale Chirurgiae Digestivae); a member of the French "Académie de Chirurgie" and "Académie de Médecine", of the "Association Française de Chirurgie" (former member of the first board), and a fellow of the ACS (American College of Surgeons), SIC (Societe Internationale de Chirurgie), ICS (International College of Surgeons).

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Abstract Almost 40 years of lucky existence is enough time for questioning and/or updating the Stoppa method for hernia repair. In this paper, the author reports the circumstances of the birth of this method more than 30 years ago, recalls its innovative principles, describes its technical aspects, and exposes its good results. Not simply approving old concepts, the author concludes with critical remarks with regard to a so-called political correctness of today's groin hernia repair, which gives great importance to reducing patient trauma arising from surgery. For belief without doubt can be wrong belief!

Keywords Groin hernia · Prosthetic repair · Preperitoneal route · Tension-free repair · Sutureless repair

Introduction

Let me at first briefly trace some historical marks surrounding the birth of this method. When, around the year 1965, hernia recurrences continued to plague patients and humiliate surgeons, I became convinced of a possible revolution for repairing even the worst cases. This led me to propose a method mixing some important concepts, the advent of which I had been a direct witness to. Henri Fruchaud [1] had described his "myopectineal hole," which expressed an evident structural weakness of the groin, due to the absence of voluntary striated muscle fibers in this area. Synthetic meshes had been used in France by Don Acquaviva since 1949 [2] and by one of my mentors, René Bourgeon (1955) [3], and then, in the United States, by Usher (1959) [4] and Koontz (1960) [5] for direct repair of hernia defects. My friend Jean Rives enthusiastically introduced the use of polyester (Dacron, Ethicon Ethnor) mesh in France [6, 7, 8]. I personally observed that the pieces of mesh used were of insufficient dimensions: whether by small patches of the same dimensions as those of the defect or by larger pieces covering the myopectineal hole. Moreover, synthetic fabrics, though well answering biologic tolerance criteria, could not thoroughly replace the anatomic living structures nor assume their tonic and motor functions. By eliminating the possibility of restoring the wall, I realized that a supple mesh could preferably be used only as an artificial fascia able to widely enwrap the visceral sac, as does the natural endoabdominal fascia. An interesting tactical advantage was provided when proceeding this way: instead of making the difficult attempts required to repair the defective wall, the surgeon could now render the parietal peritoneum inextensible so that herniation could no longer appear. The conflict between the intra-abdominal pressure and a more or less defective wall was abolished by the interposition of a wide mesh barrier. Such were the circumstances that led to the introduction of a virtually absolute weapon against recurrence of herniation in the groin region at first, and then in other locations in the abdominal wall (ventral and incisional hernias).

Anatomic background

Within the weak area of Fruchaud's myopectineal opening (Fig. 1), deprived of voluntary striated muscle fibers, the transversalis fascia (the inguinal portion of the endoabdominal fascia) and its analogs represent the only intra-abdominal pressure-tight layer of the wall. This is the best depth level for inguinal repairs in which the wall must be sutured or reinforced. Permanent tightness of the deep inguinal layer, in this weak area, can efficiently be ensured by a piece of synthetic mesh.

Behind the transversalis fascia is a wide cleavable cellular space that spreads to the two sides of the infraumbilical midline the retrofascial preperitoneal and prevesical spaces, which widely overspread the Retzius' and Bogros' spaces. With Odimba [9], we have made precise measurement of its shape, dimensions, and variations by dissection and radioanatomic study. Thus, we have shown the practicing surgeon the shape and size of the retrofascial space, a natural site for large prostheses replacing or reinforcing the transversalis fascia and, at the same time, a fine route for placing them.

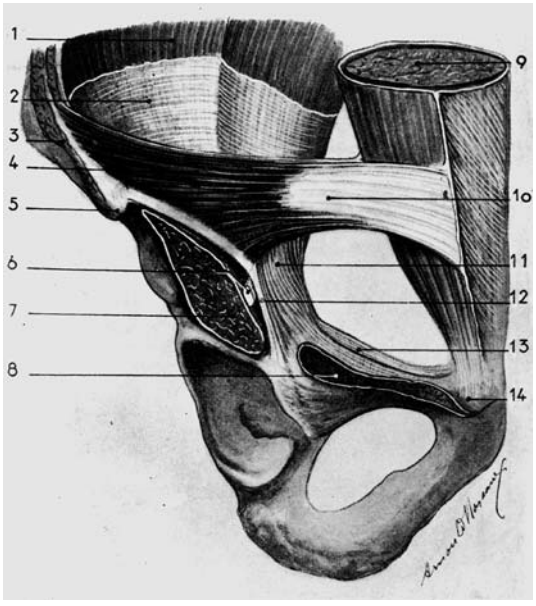

Fig. 1 Fruchaud's myopectineal hole. (10) internal oblique muscle; (13) Cooper ligament; (8) pectineus muscle; (7) iliopsoas muscle; (16) femoral nerve. [1] (with permission of Doin, Paris)

Every surgeon operating through a posterior route has observed that of the two pedicles that pass through the myopectineal opening, the iliofemoral vascular pedicle is a parietal element, whereas the spermatic pedicle, surrounded by its cellular sheath, traverses the Bogros' space when the preperitoneal cleavage has been performed. Yet the elements of the cord can be separated from the peritoneum and parietalized when a preperitoneal prosthesis is placed. Thus the zigzag course of the cord is transversely enlarged, and its deeper angle is transferred several centimeters more laterally. Consequently, the inguinal passage is better protected against a dangerous sudden increase in intra-abdominal pressure. Also the need to cut the mesh for passage of the spermatic cord is eliminated; the prosthesis can be easily placed in a retroparietal and retrofunicular location.

Pathologic bases

If herniorrhaphies, elective by nature, call for a precise study of hernia orifices, prosthetic repair accommodates itself to Fruchaud's singular remark: that all groin hernias, inguinal or femoral, pass through the musculopectineal opening. In addition to that anatomic

weakness of the groin wall, one hears more and more of a most probable biologic insufficiency of the groin structures (such as Peacock's "metabolic defect" and "Read's metastatic emphysema") a sort of "fascial diathesis" predisposing mostly to direct hernias. Prosthetic repair of the transversalis fascia is logical for weakness hernias caused by deterioration of the inguinal musculofascial layer, whatever their mechanical or metabolic nature.

On the preperitoneal approach

Among the abdominal or posterior approaches, the preperitoneal approach offers the richest well-known resources nicely exposed by Nyhus [10, 11, 12, 13]. Since 1965, I have used the preperitoneal subumbilical approach [14, 15]. The advantages of the approach are facility of cleavage of the retrofascial cellular space, direct access to the posterior inguinal structures, clear understanding of hernial lesions, and good exposure of the musculopectineal opening. The placing of a mesh prosthesis is easily carried out. This is most noticeable when one repairs multirecurrent hernias, while proceeding from normal anatomy (of the midline) toward abnormal anatomy (of the hernial lesions). There is no additional deterioration of the already-weakened inguinal structures and no risk of injury to the cord or the superficial nerves. The main interest in this approach is the ease of placing a large piece of synthetic mesh behind the weak groin area for widely wrapping the visceral sac, rendering it unextensible, at the same time tightening the wall, whatever the damage to its structural layers so that herniation can no longer occur. Proceeding this way is perfectly convenient for even the most difficult hernial repairs, such as those of multirecurrent, prevascular, sliding, enormous, and bilateral hernias.

In the preperitoneal approach, one avoids the regional nerves and cord dissection; thus, testicular atrophies and painful sequelae are exceptional [9, 16]. The median preperitoneal approach may induce the risk of incisional hernia, and I respond to this risk by using large bilateral pieces of prosthetic material, which tighten the weak inguinal areas of both sides and, at the same time, protect the subumbilical midline closure.

How to use prostheses in this method?

Choosing a good mesh

Convenient prostheses can replace or reinforce the tight inguinal layer (the transversalis fascia) and are a well-known modern therapeutic option. A good prosthetic material must provoke a moderate inflammatory reaction and have strong fibroblastic activity. Macroporous mesh must be preferred because of its fast invasion by the connective tissue and its good biologic tolerance of septic conditions. I routinely have used Dacron mesh, advocated in France by Rives and associates since 1965. Our experiments with Petit [16] and Soler [17] showed the good biologic tolerance of Dacron mesh. Arnaud and colleagues [18] stressed the quality of the fibroblastic-to-inflammatory cell ratio. Marlex (C.R. Bard, Inc. Murray Hill, NJ, USA) or Prolene (Ethicon Ethnor) mesh and Rhodergon 8000 (Rhone Poulenc, France) can be used, but they are less supple than Dacron and less convenient for groin hernia repair by giant prostheses, as assessed by Wantz [19]. Other materials, such as Vicryl (Ethicon Ethnor) mesh (low absorbency) offer only a temporary buttress, and silicone sheets (impervious) and Rhodergon velours (joining a sheet of Silastic and synthetic velvet) should never be used because they are badly tolerated by the body. I do not recommend microporous expanded polytetrafluoroethylene (ePTFE) mesh, which is not penetrated by fibrocytes but simply encapsulated, thus it does not fix and is responsible for frequent seromas.

Important principles of mesh use

I conceive the prosthetic repair of groin hernias, like that of eventrations, as the placement of synthetic nonabsorbable mesh between the deeper inguinal layer and the visceral sac in the retroparietal cleavable space. In so doing, I make a large interposition of prosthetic mesh, able to hold face to face with the neighboring layers and to support instantly and permanently the inguinal wall. For this purpose, the prosthesis must extend broadly beyond the weak inguinal area in all directions so that when the peritoneal sac is replaced, the prosthesis is pressed by intra-abdominal pressure against the inner face of the abdominal wall and quickly attached by the development of the connective tissue through the mesh. By this method, the surgeon uses the force that has created the hernia — the intra-abdominal pressure — to obtain its radical cure. In accordance with Pascal's hydrostatic principle, abdominal pressure procures a stability that exempts the surgeon from fixation of the prosthesis, provided it is large (Fig. 2). The larger the prosthesis, the more efficient the repair, with no need to suture the hernial orifice. This method is historically the first both tension-free and sutureless procedure, being used since 1965.

Technical aspects

Preoperative preparation

Operations for extremely large hernias necessitate respiratory preparations and, exceptionally, the use of the progressive pneumoperitoneum, as suggested by Goni-Moreno [20]. General anesthesia is usually used, as is spinal or peridural anesthesia in patients at respiratory risk. Some useful surgical instruments are: mounted swabs for the retroparietal cleavage, two straight

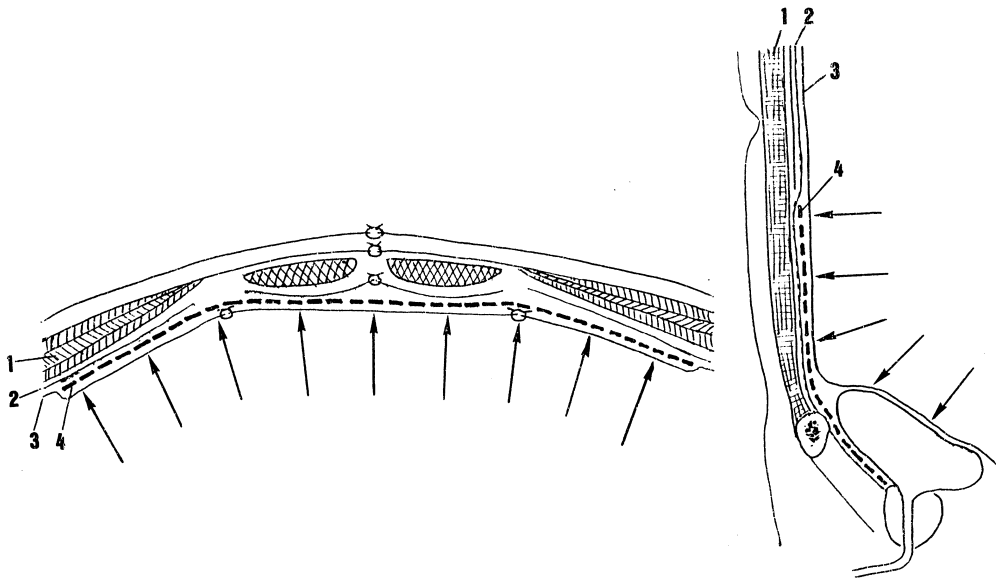

Fig. 2 Schematic representation of the action of Pascal's hydrostatic principle: the intraabdominal pressure (*arrows*) pushes the prosthesis (4) against the inguinal wall (1 = muscles, 2 = transversalis fascia); (3) parietal peritoneum. *Left*: horizontal section at the level of the groin regions; *right*: paramedian sagittal section

retractors (6- and 10-cm long) for the abdominal wall, Ombrédanne's forceps or tape for handling the cord, a sterilized scale and straight scissors for measuring and cutting the prosthesis, and long curved Rochester's clamps for no-touch handling and easy positioning of the prosthesis.

The operation

Medial preperitoneal approach

The patient is placed supine in a light Trendelenburg position. The surgeon is on the opposite side of the hernia. An adhesive field is applied as the usual protection against skin contamination. A median subumbilical incision is made (Fig. 3), and the endoabdominal fascia is cut with Mayo scissors. The preperitoneal cleavage starts from the lower portion on the median line in the median Retzius' space. It continues laterally, posteriorly to the rectus abdominis muscle on the far side of the operator and proceeds behind the epigastric vessels. The dissection advances downward in front of the bladder, up to the prostatic compartment and then outward behind the iliopubic ramus in Bogros' space. Thus is the hernial pedicle isolated, and the spermatic cord is either united to or distinct from the hernial sac, depending on the type of hernia (Fig. 4, Fig 5, Fig 6). This dissection does not necessitate a difficult search even in recurrent hernias, which is pleasing for all operators, regardless of their experience. The iliac vessels and crural nerve in their sheath do not incur any injury.

Direct hernia sacs (inguinal, femoral, or, rarely, obturator) are inverted with a purse-string suture. An interesting detail of surgical anatomy of direct hernias is to be dealt with at this stage of the operation: after the management of the peritoneal sac, another fascial sac is visible, like a superficial lining of the reduced hernia's sac; turning

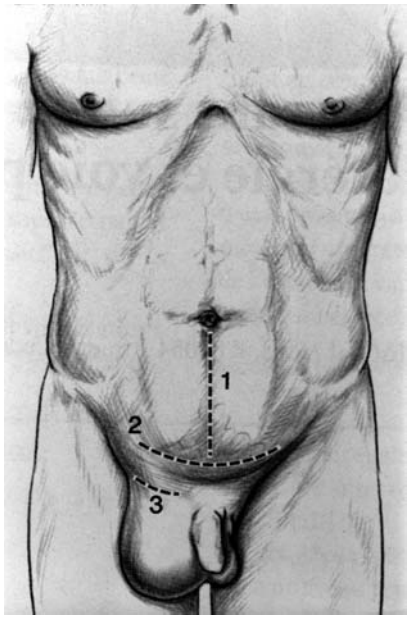

Fig. 3 (1) Usual median subumbilical incision; (2) horizontal low cosmetic incision; (3) complementary additional incision for freeing the adherent contents of a scrotal hernia (Reproduced with permission of Masson, Paris) [21]

inside out this fascial sac and fixing it to the inner surface of the abdominal wall eliminates the dead space and prevents serosanguineous collection, which may give the appearance of an early pseudorecurrence. *Indirect sacs* are opened for introducing a finger to simplify their dissection. Small sacs are managed by resection or invagination. After reduction of their contents, larger sacs should be preferably transected and closed at their proximal level, and their distal part left undisturbed in the scrotum, being careful not to dissect the sac below the level of the pubis, which carries the risk of ischemic orchitis due to the trauma of the distal spermatic vascularization. The

Fig. 4 Schematic postero-median intraoperative view of a right direct inguinal hernia sac during its reduction. (Reproduced with permission of Masson, Paris) [21]

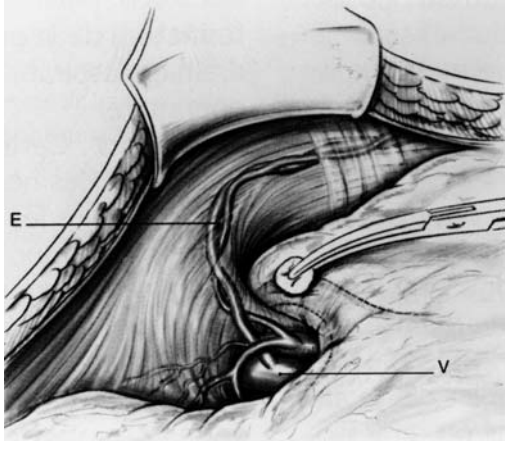

Fig. 5 Schematic postero-median intraoperative view of a right indirect inguinal hernia sac merged with the spermatic cord components (*dotted lines*). (Reproduced with permission of Masson, Paris) [21]

anterior aspect of the distal sac should be opened as widely as possible to promote drainage into the surrounding tissues, and a suction drain is placed within it at the end of the operation. The preperitoneal approach opens a large exposure of the whole region and uncovers other clinically nonapparent hernias (e.g., obturator hernias). The peritoneum is closed after eventual resection of the hernial sac, and the preperitoneal dissection continues rapidly and without difficulty under the external iliac vessels and laterally. It is not necessary to pursue the dissection above the Douglas linea arcuata, where the peritoneum is adherent or may tear. When an iliac appendectomy scar is present, dissection may become somewhat difficult but is easily overcome with scissors. On the whole, the surgeon can perform the dissection of the Bogros' and Retzius' spaces quickly and easily without bleeding, using a single

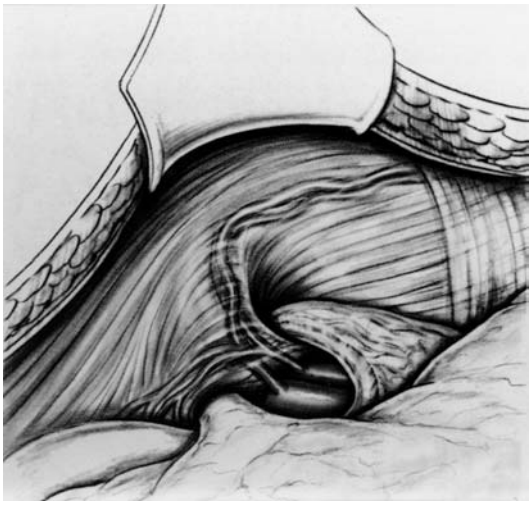

Fig. 6 Schematic postero-median intraoperative view of a right femoral hernia sac during its reduction. (Reproduced with permission of Masson, Paris) [21]

straight retractor under the inner wall while depressing the peritoneal sac with the left hand.

Joining the constituting elements of the spermatic cord with the pelvic wall simplifies placement of the large prosthesis and eliminates the need to cut it for passage of the spermatic cord. I call this routine maneuver: "parietalization of the spermatic cord." The cord is seized in its retroparietal course with an Ombrédanne's forceps or tape, with moderate traction applied, so that the scissors and a blunt swab may dissociate the different elements of the cord, contained in their carefully preserved sheath, from the peritoneal sac (Fig. 7). At the end of the dissection, one finds a triangular cellular spread with a posterosuperior base, the sides of which contain the deferent canal, on its medial side, and the spermatic vascular pedicle, on its lateral side; When they are released, the elements of the spermatic cord join, by gravity, with the lateral wall so that

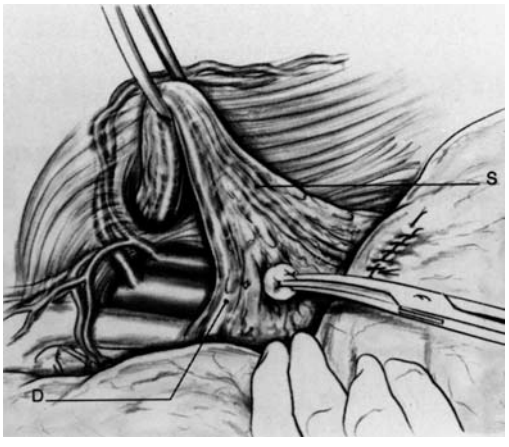

Fig. 7 Schematic postero-median intraoperative view of the preserved spermatic sheath at the end of the parietalization of the right spermatic cord. (Reproduced with permission of Masson, Paris) [21]

no element now crosses the preperitoneal prevesical space and the spermatic sheath covers the external iliac vessels. During this operative time, preperitoneal and cordal lipomas should be suppressed in the aim of avoiding the deceiving cough impulsion of a false recurrence. To perform the retroparietal dissection on the other side, the operator and assistant change sides and proceed in the same manner as for the first side.

Placement of the large bilateral prosthesis

The size of the prosthesis is measured on the patient. The correct transverse dimension is equal to the distance between both anterosuperior iliac spines minus 2 cm, the height of the prosthesis being equal to the distance between the umbilicus and the pubis. The mean values are 24 cm transversally and 16 cm vertically; the extreme values are 20–30 cm and 14–19 cm. The prosthesis is cut with straight scissors, using a no-touch technique, taking into account the main dimensions, which are chevron-shaped, so that its lateroinferior angles will later be placed far down behind the two pelvic obturator frames (Fig. 8) and its superior convex border will fit to the global concavity of the arcuate line of Douglas.

The patch is then seized by all angles and by the middle of the lateral borders with eight long Rochester's forceps that facilitate placement (Fig. 8). The patch is first placed on the opposite side of the operator. The assistant retracts the parietal wall up, as the operator depresses the peritoneal sac with his or her left hand, pulling it upward; this opens the parietoperitoneal cleavage space. The prosthesis is then pushed into this space with the Rochester's forceps. The inferior median forceps is first placed between the pubis and bladder, followed by the inferior angle forceps, median lateral forceps, and superior angle forceps, while pushing them as far back as possible. This maneuver unfolds the prosthesis on all points of the parietoperitoneal cleavage space, surrounding the part of the visceral sac opposite the operator. Every time one of the forceps is pushed into its correct place, the assistant immobilizes it until the operator releases the visceral sac with his or her left hand, which enables it to take its place. The valve is removed from under the parietal wall. The forceps used to place the prosthesis are then delicately removed at the same angle at which they were placed, while passing along the inner face of the parietal wall.

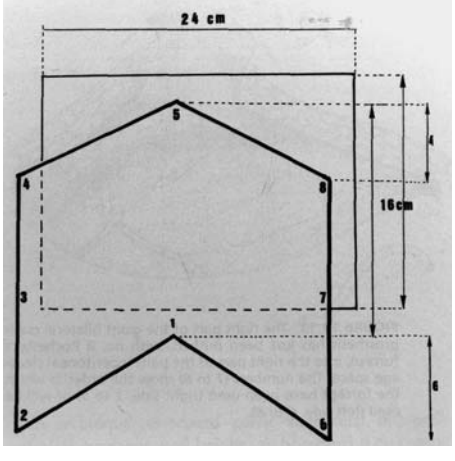

Fig. 8 The chevron-shaped prosthesis is cut with regard to the mean dimensions (in centimeters) of the rectangle measured on the patient. The numbered points (1 to 8) will be seized by eight long Rochester's clamps for easy placement of the mesh. The numbers also indicate the order of using the clamps for positioning the prosthesis. (Reproduced with permission of Lippincott, Williams & Wilkins) [22, 23]

The operator and the assistant again change sides and perform the same maneuvers on the opposite side. The Dacron mesh prosthesis is fully unfolded and inserted to surround the visceral sac, generously overlapping the hernial orifices and protecting the median subumbilical incision. Then the middle of the superior border of the prosthesis is fixed with a synthetic absorbable suture to the inferior border of the Richet's umbilical fascia. No other stitch is used for fixation of the prosthesis, simplifying the technique.

Closure and drainage

The parietal suture is made with a continuous slowly absorbing synthetic suture, the subcutaneous fat is padded with small sutures, and the skin is sewn with fine nylon. When suction drainage tubes are necessary, they are placed in front of the prosthesis.

Perioperative care

A prophylactic antibiotics preoperative bolus (2 g cefazoline) is routinely given. The patient is encouraged not to restrict activity. Recovery of activity is usually not a problem because postoperative discomfort is minimal. Nevertheless, slow-acting heparin is used for a few days. Eventual suction drainage and dressings are discontinued on the second postoperative day. Hospital discharge occurs between the third and fifth days.

Variations

Variations on the above technique include a low horizontal incision of the skin, which has cosmetic advantages. The Pfannenstiel's incision, reported by Cheatle [24] in his 1920 publication, has been periodically used in my experience and proposed for routine use by Rignault et al. [25]. The myoaponeurotic layers are divided vertically in the midline and will require multiple retractors for adequate exposure of the cleavage spaces and placement of the prosthesis. On occasion, an additional small incision at the neck of the scrotum may be required to free the adherent contents of a scrotal hernial sac. Pelvic pathologies can be dealt with at the same time as the hernia repair, provided that no septic procedure is involved. Occasionally, we carry out this operation on

patients with a unilateral hernia, as we have observed that 20% of contralateral hernias appear within 5 years of the repair for one-sided hernias.

My late friend G. Wantz [19], following the same principles, adapted the operation for day surgery; he used a suprainguinal incision and then maneuvers similar to ours for positioning a 10×15-cm unilateral Dacron mesh prosthesis, without direct suture of the defect or direct fixation of the mesh, under local or general stand-by anesthesia. Ugahary places a mesh prosthesis of the same size via a 3- to 4-cm suprainguinal grid-iron incision [26].

Some corrupt variations

Destruction of the retroparietal segment of the spermatic sheath

This triangular sheath contains the vas deferens and the spermatic vessels, while the cord is separated from the peritoneum during its parietalization [27]. The preservation of this sheath is advisable for two reasons: (1) the preservation of the integrity of the vas deferens and its vessels, for the partial or complete obstruction of the vas, can, experimentally and clinically, lead to a hypoazoospermia by serum antibody elevation (2) the spermatic sheath protects the external iliac bundle from direct contact with the prosthesis. This is a wise precaution, as periprosthetic scarring would be a hindrance, should a subsequent intervention require dissection of the iliac vessels [28].

Resection of the distal part of a scrotal sac

In nonsliding hernia, disssection of the sac incurs the risk of testicular ischemia. In agreement with Fruchaud [1] and Wantz [19], we recommend that the distal sac be left undisturbed in the scrotum and drained. In scrotal sliding hernias, even a partial resection of the sac is not recommended; a reduction "en masse" after perisaccular dissection is a safer way to avoid injury of the mesenteric vascular supply and difficulties of peritoneal closure.

Suturing hernia(s) orifice(s)

Suturing hernia(s) orifice(s) is not recommended, particularly when the hernia gap is large and the suture, made under tension, may tear the tissues; if an early postoperative serohematoma occurs, this may favor a displacement of the unsutured prosthesis.

Use of too small a prosthesis

Ideal dimensions for sutureless prostheses were arrived at through research with my fellow, B.F.K. Odimba and his coworkers [9]. The use of smaller prostheses in unilateral procedures or two independent small prostheses for bilateral hernias, requires more or less blind fixation in the inferolateral area beneath the iliopubic tract, a neurological hazard. In addition, one small unilateral or two independent prostheses fail to protect the midline against a possible incisional hernia. Using our wide partial wrapping of the visceral sac in a single large prosthesis, we have not encountered a single case of incisional hernia in our series.

Splitting of the prosthesis to allow passage of the spermatic cord

Defenders of this procedure say that it promotes a central fixation of the prosthesis, but peripheral "instability" of the mesh is a greater risk. Furthermore, a split in the mesh is counterproductive, unnecessarily weakening the mesh and eliminating the interposition of the spermatic sheath between the prosthesis and external iliac vessels, a point that we consider important.

Choice of different material

The choice of a semirigid mesh (Marlex) results from misunderstanding of the essential principle of wrapping the visceral sac, which requires a sufficiently large and supple piece of mesh to carry out the task. Wantz [29], in his early experience with our method, attempted to use polypropylene (Marlex) mesh and soon after published his failures. He clearly advised against this less compliant material; its plastic memory tends to retract one edge of the prosthesis during the early postoperative period, leading to recurrence. Microporous or impervious materials cannot be infiltrated and, thus, do not become fixed. Absorbable meshes disappear by hydrolysis after a few weeks, and, of course, such fabrics cannot form a permanent artificial endoabdominal fascia.

Intraoperative pitfalls

Difficult retroparietal dissection

Previous intraperitoneal surgery through the midline does not represent a real obstacle, as the scarring is limited [27]. This is not the case with diffuse scarring following traumatic lesions of the pelvic rim, or suppuration, or in infrequent recurrences after a bilateral prosthesis. Thus, solutions vary. In the case of a clean nonpathological scar, excision of the scar allows entry to the paramedian preperitoneal space and then to the usual cleavage. Facing more extensive scarring of the spaces of Retzius and/or of Bogros, one must enter the peritoneal cavity and identify the limits of the scarred peritoneum, which should be circumscribed and left adherent to the wall, while the normal peritoneum can be dissected outward from the central area as extensively as possible and then securely

closed either by a running nonabsorbable suture or by a polyglactin mesh, as proposed by Trivellini et al. [30]; the final steps consist of wrapping the visceral sac in the usual wide bilateral prosthesis.

Inadvertent opening of the peritoneum

The inadvertent opening of the peritoneum may take place during the preperitoneal cleavage at sites where the peritoneum is adherent, as occurs normally at the level of the arcuate line of Douglas or at the scar of a previous incision. These openings require a tension-free closure, preferably by mattress suture. To avoid opening the peritoneum, a scalpel or scissors is preferred to the aggressive use of a mounted sponge to separate the peritoneum from a parietal scar.

Identifying the cord

Identifying the cord is usually easy but may be more difficult in the presence of a voluminous direct hernia or scarring associated with a recurrence. The external iliac vein and the inferior epigastric vessels – two important landmarks – form an obtuse angle, where the cord components converge, and can be found easily.

Problems with reduction of sac contents

Large and sliding hernias are difficult to reduce, whatever the surgical approach. In all irreducible hernias, it is important to open the peritoneal cavity to assess the viability of the herniated viscera and whether they adhere to the neck of the hernial sac. It is also important to avoid forceful traction on the adherent viscera in adhesive or sliding hernias. When necessary, a small transverse incision on the neck of the scrotum will facilitate the reduction of irreducible contents of the sac, often with surprising efficiency, by freeing the intrasaccular adhesions or carrying out a perisaccular dissection of a sliding scrotal sac.

Postoperative complications

Early complications

Serohematomas

There were 72 clinically detectable serohematomas out of 1,438 patients (4.5%) in our 1982 series. Two sites are clinically important. Preperitoneal hematomas may be exceptionally large and give rise to symptoms of functional obstruction and urinary retention; they may also displace the sutureless prosthesis. Echography will confirm the diagnosis and assist in the follow-up. Prognosis is usually favorable; only one preperitoneal hematoma needed reoperation in our experience. Scrotal hematomas following surgery in large scrotal hernias are also of interest. After drainage, they may recur or become infected. In intractable cases of chronic infected serohematomas, it may be necessary to perform a partial resection of the scrotum. Careful hemostasis should be carried out, together with suction drainage when justified; in difficult hemostasis, fibrin suspension spray can be helpful.

Suppuration

In a series of 1,223 patients reviewed up to 1990, we reported 26 septic complications (2.1%). One must differentiate between superficial and deep suppuration. Early diagnosis is essential; the dressing is removed on the second postoperative day for this reason. Echography is of help in the early diagnosis of deep sepsis. Management of suppurations includes early reopening of the wound, irrigation, and allowing healing by secondary intention. This is to be carried out without removing the macroporous mesh, which will be, slowly but surely, incorporated into the scar tissue. Prophylaxis must include the precepts of all good, clean surgery: local preparation, adequate operating room, team discipline, aseptic operative technique, and postoperative observation. We recommend the use of a broad-spectrum antibiotic as soon as the septic risk appears.

Hydroceles of the tunica vaginalis

Hydroceles of the tunica vaginalis are rare in our experience (0.5%), although Houdelette and Dumotier report several bilateral hydroceles; they are caused by disturbances of microcirculatory lymphatic and venous drainage of the tunica vaginalis. They are treated simply by drainage and eventual resection of the tunica. Prevention lies in minimizing manipulation of the spermatic cord.

Delayed complications

In our 1982 and 1990 series, there were no cases of testicular atrophy and no chronic neuralgia: an established advantage of the posterior approach.

Delayed suppurations (fistulas)

We have observed 14 fistulas in cases treated at other centers. They appeared between the third and 18th postoperative months. They were caused by either suppuration of an unsuspected, mildly infected deep serohematoma or by delayed reactivation of an attenuated deep sepsis. A fistulogram is required to locate the fistulous tract and the abscess that maintains it. The tract

must be completely excised; instilling a small quantity of methylene blue solution helps to define the tract. A small part of the mesh may have to be excised along with the deep abscess, but no attempt should be made to remove the entire prosthesis, as this would be difficult, risky, needless, and illogical.

Recurrences

Recurrences must be considered complications. Review of our most recent series (1998) yields the following recurrence rates: global, 1%; in primary repair, 0.56%; and in recurrent hernia repair 1.1%. These recurrences all appeared during the first postoperative year; this rather short interval points to intraoperative error. The mechanism was displacement of the inferior margin of the mesh, more often than its lateral margin, resulting in a direct hernia with a solid prosthetic edge. This observation and the expected difficulties of reintervention through the midline lead one logically to consider a different approach from that of the primary repair. For a recurrence on the lateral border of the mesh, a suprainguinal preperitoneal approach allows easy access to anchor the prosthesis beneath the lateral abdominal wall near the anterior superior iliac spine with full-thickness sutures. If the recurrence is at the lower border of the mesh, an inguinal incision allows fixation of the prosthesis to the ligament of Cooper. Wherever difficulties are expected, it is best to use a suprainguinal approach and insert an additional preperitoneal piece of mesh.

Problems of reoperation

After a bilateral preperitoneal prosthesis, various situations may arise [26]. *An intraperitoneal procedure* may be carried out without any technical modifications on account of the presence of the preperitoneal Dacron prosthesis, which can be cut with a scalpel and is seldom noticed. *In surgery for benign prostatic hypertrophy,* the transvesical approach need not be technically modified. The retropubic approach (Millin) is hampered by the retropubic sclerosis, which can be freed only by the use of a scaler through the retropubic subperiosteal space. *Surgery for cancer of the prostate or malignant bladder pathology* must use a combined transperitoneal and retropubic subperiosteal route. With respect to an eventual associated lymph node dissection, one may envisage the following modalities. *In surgery of the external iliac vascular bundle,* for lymph node dissections, the real obstacle may be the distal perivenous sclerosis, and dissection should begin around the proximal part of the vessels and progress distally. For vascular procedures on the external iliac artery (arteriotomy, bypass, heterotopic organ transplantation), careful dissection beneath its sheath can usually be carried out, as the artery is more mobile and pulsatile than the vein and can be rather easily separated from its fibrotic external sheath. The prevention of these potential difficulties is based on two points: (1) preoperative identification of prostate and bladder pathology in the group of patients at risk for whom our method is relatively contraindicated and (2) careful preservation of the spermatic sheath during the parietalization of the cord, as this sheath then lies between the iliac vessels and the prosthesis; moreover, the latter must not be divided for passage of the cord, as has already been pointed out and illustrated [31].

Long-term results

The review of my latest personal series (1998) shows the following data: Number of patients = 1,209; follow-up duration = 4–13 years; recurrence rates: global = 1%, in primary repairs = 0.56%, in recurrent hernias repairs = 1%.

Table 1 presents the recurrence rates reported in diverse published experiences with preperitoneal

Table 1 Recurrence rates after preperitoneal prosthetic repair

Author	Technique	No of Hernias operated on	Control rate (%)	Follow-up Duration (yr)	Recurrence Rate (%)
Blondiaux et al. (1979) [32]	Teflon, mid. ap	91	52.7	0.5–3.5	0.0
Brismoutier [33]	Silicone, mid. ap.	101		4	6.0
Calne (1967) [32]	Dacron, Pfannenstiel	30		1–7.5	13.3
Champault (1999) [34]	Polypropylene, mid. ap.	49	93	3	2.0
Detrie [33]	Nylon, mid. ap.	50	100	0.5–4	0.0
Fagot [33]	Dacron, mid. ap.	29	100	0.5–3	1–3
Gosset (1972) [32]	Rhodergon, mid. ap.	7	100	2	0.0
Mathonnet (1998) [35]	Dacron, mid. ap.	198		2–6	1.6
Read (1975) [32]	Marlex, mid. ap.	83		4	7
Rignault et al. (1983) [32]	Dacron, Pfannenstiel	658	86.3	4	4.6
Saint Julien [36]	Dacron, mid. ap.	309	63.0	0.5–6	2.9
Stoppa et al. (1973) [32]	Dacron, mid. ap.	168	88.1	1–7	3.3
Stoppa (1995) [27]	Dacron, mid. ap.	529		1–12	1.1
Warlaumont (1982) [32]	Dacron, mid. ap.	285	91.3	1–10	1.2

Mid. ap. = midline approach.

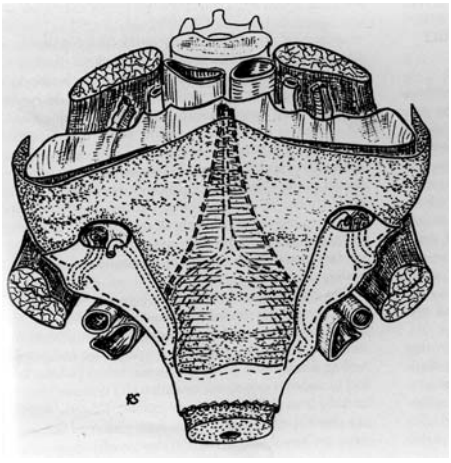

Fig. 9 Schematic anterior bird's eye view of the giant bilateral Dacron mesh prosthesis enwrapping the inferior part of the visceral sac. (Reproduced with permission of Lippincott, Williams & Wilkins) [23]

prosthetic repair of groin hernias. including two of my former series.

Indications

Hernias are diverse and, therefore, call for diverse methods of repair. For simple hernias (Nyhus type I or II), nonprosthetic repairs should be sufficient. We started using our method to repair multirecurrent hernias in which Poupart's and/or Cooper's ligaments were destroyed. Then we extended its use to primary treatment of all complex and difficult hernias — giant, sliding, multiple, prevascular, femoral — and also to treat patients with special risks — obesity, ascites, chronic bronchitis, collagenosis, heavy physical labor. We no longer distinguish between inguinal and femoral hernias or between unilateral and bilateral hernias. Because it avoids the superficial inguinal nerves and the distal testicular vessels, it is recommended when there is a special risk for neuralgia or testicular sequelae. At present, we use this method in around 10% of groin hernias. Contraindications to the use of this method are primarily septic risks: dermatoses, granulomas in recurrent hernias, and emergency surgery. The presence of a midline subumbilical scar or a history of iliocaval thrombosis is not an absolute contraindication for trained surgeons.

Conclusions

The method described and commented on above has popularized the following important principles: the first one is the key-purpose of the operation: a wide enwrapment of the visceral sac inferior part into a bilateral piece of macroporous Dacron mesh, rendering the parietal peritoneum inextensible and, thus, definitively unable to herniate (Fig. 9). Pascal's hydrostatic principle provides the surgeon with the cooperation of physics; it makes the intra-abdominal pressure pushing the mesh against the inner face of the abdominal wall. This turns the main force, which creates hernia, into a force for impeaching reherniation. Thus, fixation of the mesh and closure of the hernia hole are not necessary, and, historically, this method proposed the first both tension-free and sutureless procedure for hernia repair, used since 1965.

Now, in light of today's political correctness in hernia surgery, one may criticize this virtually absolute weapon against recurrence as being too invasive. Let me underline some points for responding to that. When this method appeared, nearly 40 years ago, it did not seem excessive to take up the challenge of radically treating recurrent and multirecurrent hernias. Especially as the outcomes of the method were effective, its principles were judged correct by the surgical community. The preperitoneal approach through the subumbilical midline raphe was accepted as being the simplest way offered to general surgeons for applying the successful principles of the procedure. Today main potential critics mostly regard the midline route, which is a technical detail of the operation. Yet a method must be considered as prevailing upon technical details, which can be modified and improved, providing principles are safely maintained. Besides, the ease and satisfaction felt by the operator, whatever the level of his or her skill when performing this "blue flame" procedure, have certainly led to excessive indications, yet surgery must conform to the patient and not the reverse; and selective indications were recommended since the first introduction of this method.

On the whole, I think this method is still worth teaching within the hernia-repair surgical arsenal for several reasons. It has been a revolutionary historical step in hernia surgery tactics. Several interesting procedures at least partly derive from it, namely the operations proposed by Wantz, Kugel, Ugahary, and laparoscopic repairs, among others. It fits the treatment of the most difficult and complex groin hernias, and, out of the groin region, of other locations hernias (ventral and incisional ones).

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