GIANT PROSTHETIC REINFORCEMENT OF THE VISCERAL SAC

The Stoppa Groin Hernia Repair

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Giant prosthetic reinforcement of the visceral sac (GPRVS) is the descriptive term for Stoppa's revolutionary and innovative bilateral properitoneal prosthetic hernioplasty with the polyester Dacron. Since Stoppa's original description, his techniques for the procedure have been applied to a single groin for use with local anesthesia (Figs. 1 and 2). The procedures, although useful for the repair of all hernias of the groin, in practice are mainly used to manage complex hernias at high risk for recurrence and recurrent groin hernias. Herein is a report of the author's favorable experience with the GPRVS.

CONCEPT OF GIANT PROSTHETIC REINFORCEMENT OF THE VISCERAL SAC

The essential feature of GPRVS is the replacement of the transversalis fascia in the groin by a large prosthesis that extends far beyond the myopectineal orifice (MPO). The prosthesis envelops the visceral sac, held in place by intra-abdominal pressure and later by connective tissue ingrowth. The mesh adheres to the peritoneum and renders it inextensible so that it cannot protrude through the parietal defect. Parietal defects are not and, in fact, should not be closed. GPRVS differs from classic

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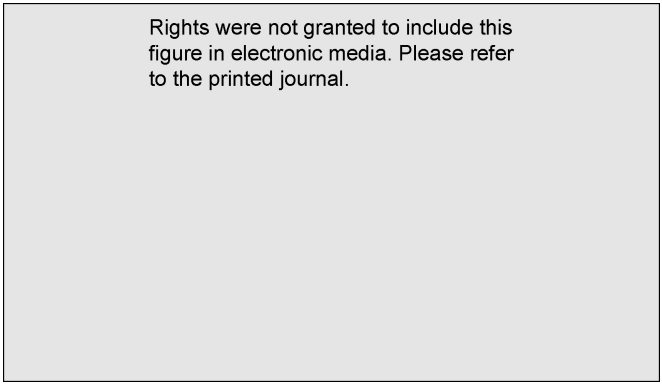


Figure 1. Bilateral giant prosthetic reinforcement of the visceral sac is the Stoppa operation. The mesh widely covers both myopectineal orifices (MPO) and may be implanted through a subumbilical midline or a Pfannenstiel incision. (*From* Wantz GE: Atlas of Hernia Surgery. New York, Raven Press, 1991; with permission.)

and patch prosthetic repairs by focusing on retaining the peritoneum rather than on repairing the abdominal wall defects. GPRVS is a sutureless and tension-free repair.

GPRVS via a transabdominal incision directly accesses the properitoneal space and the parietal defects of hernias without dissection of the inguinal canal, spermatic cord, and sensory nerves of the groin. It is especially suited for the repair of recurrent groin hernias because it minimizes the risk for complications, specifically testicular atrophy and chronic neuralgia.[16]

PARIETALIZATION

Parietalization of the vas deferens and the testicular vessels is an important feature of GPRVS that was first described by Stoppa (Fig. 3).[10] Normally, the vas deferens and the testicular vessels are tightly held to the mesothelial layer of the peritoneum by the transversalis fascia. They can be dissected away from the peritoneal mesothelial layer together with the intervening transversalis fascia, thereby permitting the elements of the cord to lie on the parietal surface of the pelvic wall and the mesh placement over the visceral surface to cover the MPO without a slit to accommodate the spermatic cord. The intervening transversalis fascia protects the iliac vessels from direct contact with the prosthesis.[9]

HERNIA SAC

Hernia sacs are dealt with in conventional ways. The sacs of direct, femoral, or other rare hernias, such as obturator hernias, are easily

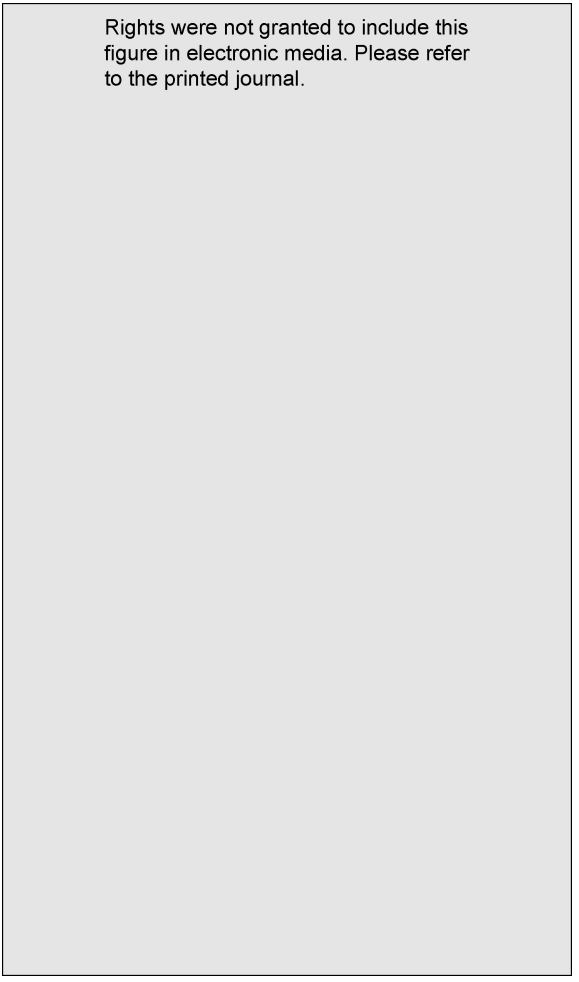


Figure 2. Unilateral giant prosthetic reinforcement of the visceral sac may be done through *(A)* a transverse lower quadrant abdominal incision or *(B)* an anterior groin incision. (*A, From* Wantz GE: Atlas of Hernia Surgery. New York, Raven Press, 1991; with permission. *B, From* Wantz GE: The technique of giant prosthetic reinforcement of the visceral sac performed through an anterior groin incision. Surg Gynecol Obstet 177:497, 1993; with permission.)

identified and teased from adjacent tissues. If the sacs are large, they are amputated or inverted beneath a purse-string suture to smooth the external surface of the visceral sac. The pedicle of simple, indirect inguinal hernias is divided and the proximal peritoneum oversewn. The distal peritoneal sac is left in place, undissected and attached to the cord. Of course, all sliding indirect hernia sacs require dissection from the cord. An incision in the anterior inguinal canal may be required to release voluminous incarcerated hernias.

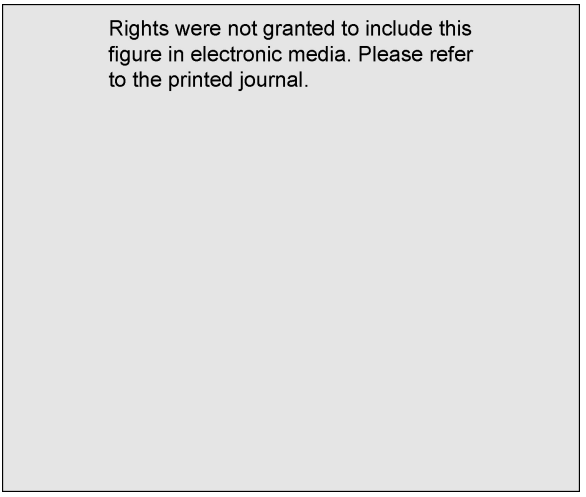


Figure 3. Parietalization of the vas deferens and the testicular vessels. The vas deferens and the testicular vessels are tightly bound to the peritoneum by the transversalis fascia. They, along with the intervening transversalis fascia, can be dissected away from the mesothelial component of the peritoneum. When liberated from the peritoneum they will lie against the parietal wall of the pelvis and the prosthesis enveloping the visceral sac will widely cover all of the myopectineal orifice (MPO) without a slit to accommodate the spermatic cord. (*From* Wantz GE: Atlas of Hernia Surgery. New York, Raven Press, 1991; with permission.)

If necessary, the dead space created by the hernia sac can be eliminated by inverting the transversalis fascia that enveloped the peritoneal sac in the abdominal wall and suturing it to the abdominal wall. In this process, the spermatic cord should not be withdrawn.

Seromas in the dead space of the hernia sac can be expected when closed drains are not used. Large seromas may be aspirated to hasten their resolutions.

PROSTHESIS

The permanent prosthesis for GPRVS must conform to the complex curves of the pelvis and, therefore, should be soft, elastic, supple, and pliable. It also must become integrated rapidly, be tolerant of infection, have a surface texture that grips the tissues, and be available in large pieces. To date, the only prosthetic mesh meeting these criteria is Mersilene, which is composed of multifilamented fibers of the polyester Dacron.[13] Other materials used as meshes are not suitable substitutes. Polypropylene meshes are semirigid, buckle when bent in two directions, and are not conforming. Furthermore, intra-abdominal pressure is insufficient to hold the unfixed polypropylene mesh in place in the properito-

neal space. Gore-Tex is conforming but intolerant of early infection, and, rather than being rapidly integrated, is only slowly encapsulated in the tissues.

The Mersilene prosthesis in the forms of GPRVS described later is oriented so that the material stretches transversely.

BILATERAL GIANT PROSTHETIC REINFORCEMENT OF THE VISCERAL SAC

Bilateral GPRVS may be achieved through a subumbilical midline or a Pfannenstiel incision.[7, 8, 10, 12, 13] The properitoneal space is cleaved in all directions, exposing the space of Bogros and the space of Retzius, the superior ramus of the pubis, the obturator foramen, iliac vessels, and the iliopsoas muscle. The elements of the spermatic cord are parietalized.

The chevron-shaped mesh is tailored to the patient and should measure transversely 2 cm less than the distance between the anterior iliac spines and vertically should measure the distance between the umbilicus and the symphysis pubis. In obese patients, the mesh should be several centimeters wider than the interspinous dimensions. The superior edge of the chevron should slant downward 4 cm and the inferior edge 6 cm. The prosthesis is implanted by eight 30 cm Rochester-Pean clamps that grasp the corners and perimeter of the mesh (Fig. 4). Recurrences tend to be indirect, especially if the deep ring has been moved laterally as the result of repeated unsuccessful hernioplasties. To ensure success in these instances, the prosthesis may be made wider, and a split washer of polypropylene mesh 3 cm to 4 cm in diameter may be used to encircle the cord at the level of the deep ring. Closed suction drainage is necessary when hemostasis is incomplete.

UNILATERAL GIANT PROSTHETIC REINFORCEMENT OF THE VISCERAL SAC

Unilateral GPRVS is the Stoppa procedure applied to a single groin. It was developed for the treatment of complex unilateral hernias of the groin (e.g., recurrent and re-recurrent hernias) in an ambulatory setting with local anesthesia. The properitoneal mesh in unilateral GPRVS may be implanted through a lower-quadrant, transverse abdominal incision or through an anterior groin incision.[12-15]

Transverse Abdominal Incision

The properitoneal space is reached by a transverse incision extending from the midline laterally for 8 cm to 9 cm. It is made 2 cm or 3 cm below the level of the anterior superior iliac spine and should be well above the deep ring and any hernias that might present. The rectus

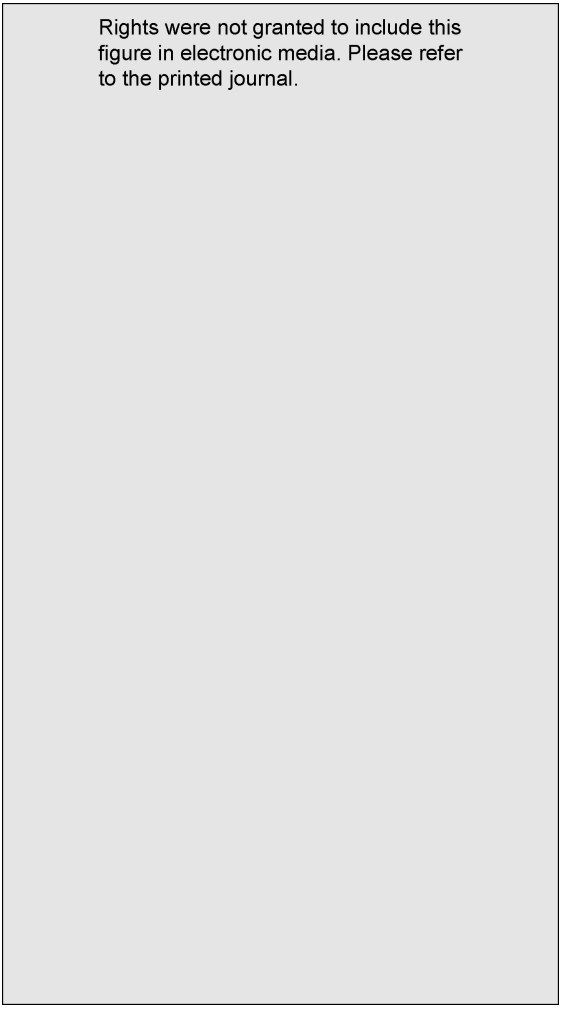


Figure 4. Long clamps *(A)* are used to implant the chevron-shaped mesh in the Stoppa operation. A single suture *(B)* attaches the mesh to the umbilical fascia to ensure that the prosthesis underlays the midline access incision. (*From* Wantz GE: Atlas of Hernia Surgery. New York, Raven Press, 1991; with permission.)

sheath and oblique abdominal muscles are incised the length of the skin incision. The rectus muscle is bluntly dissected from the rectus sheath and the lower abdominal wall retracted (Fig. 5*A*) The transversalis fascia is identified adjacent to the lateral border of the rectus muscle. It is thin, covers the inferior epigastric vessels and the yellow properitoneal fat, and passes deep to the rectus muscle. Incising the transversalis fascia along the border of the rectus muscle frees the muscle, permits entrance into the properitoneal space, and exposes the inferior epigastric vessels that do not necessarily require division. The dissection then proceeds as with bilateral GPRVS.

In the developmental stages of the operation, the Mersilene mesh was shaped as a rectangle and was considerably smaller than is used today. Experience (recurrence) showed that the mesh was incorrectly shaped and too small. Currently, the prosthesis is shaped like a diamond (Fig. 5*B*). It is important that the bottom edge is wider than the top and that the lateral side is longer than the medial side. The width of the superior edge of the prosthesis equals the distance from the midline to the anterior superior iliac spine minus 1 cm. The vertical distance medially is 14 cm. The inferior-lateral corner is extended 2 cm to 4 cm. This elongates the inferior-lateral corner of the mesh and ensures a solid prosthetic grip on the lateral visceral sac.

The prosthesis is drawn into place under the rectus muscle and the superior abdominal wall by three absorbable synthetic sutures appropriately placed along the upper border of the mesh. The sutures secure the mesh to the abdominal wall 2 cm to 3 cm above the incision (Fig. 5C). The medial corner suture is near the linea alba, the middle suture is in the semilunar line of Spiegel, and the lateral corner suture passes through the oblique abdominal muscles near the anterosuperior iliac spine. A Reverdin needle facilitates the placement of the sutures. Lacking this instrument, very large curved needles can be used.

The inferior portion of the mesh is implanted with the aid of three long clamps that grasp the two corners of the middle lower edge. Retracting the abdominal wall opens the properitoneal space, enabling the clamps to unfold the mesh and slide it into place (Fig. 5*D*). The clamp, grasping the medial corner, is placed into the space of Retzius and unfolds the mesh behind the rectus muscle and the symphysis pubis and in front of the bladder. It is steadied by an assistant. Next, the clamp that grasps the middle of the inferior edge is pushed deeply into the wound to unfold the mesh over the peritoneum facing the superior ramus of the pubis, the obturator foramen, and the iliac vessels. It is also steadied by an assistant. Finally, the clamp grasping the lateral corner of the mesh slides the prosthesis up into the iliac fossa and over the peritoneum facing the deep ring, the parietalized spermatic cord, and the iliopsoas muscle. This is steadied by the surgeon. The retractors are removed, and the clamps are released and carefully withdrawn. Wrinkling and folding of the mesh will occur with removal of the clamps if the properitoneal space is insufficiently cleaved. Closed-suction drainage is used when hemostasis is incomplete or when there remains

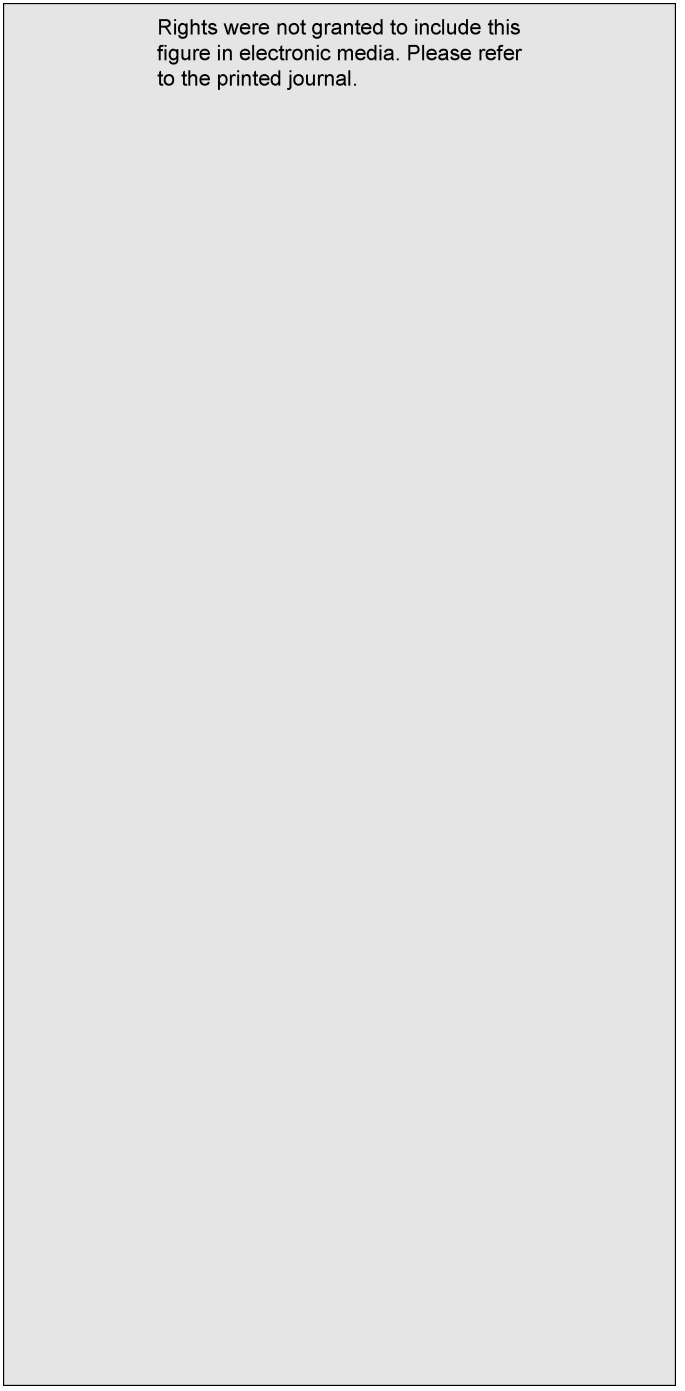


Figure 5. *See legend on opposite page*

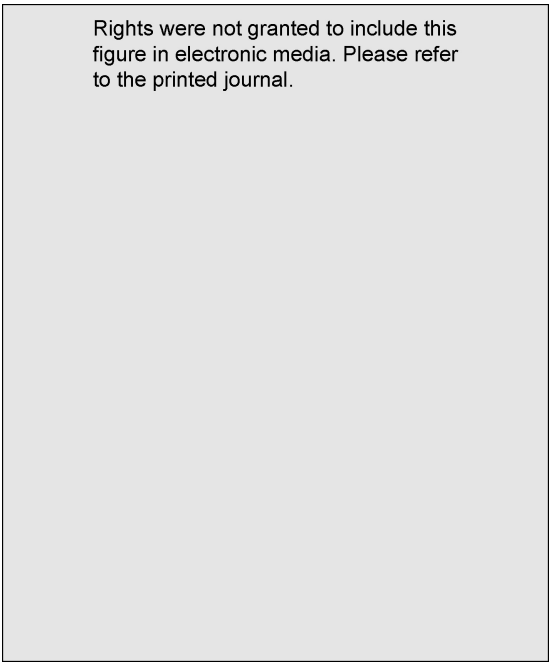


Figure 5 *(Continued).* After making a short transverse abdominal incision in a lower abdominal quadrant and incising the rectus sheath *(A)*, the abdominal wall is retracted to expose the transversalis fascia. Incising the transversalis fascia exposes the properitoneal space of Bogros. The shape and dimensions of the Mersilene are illustrated in *B.* The mesh is cephalad 3 cm under the abdominal wall and fixed with three absorbable sutures *(C)*. The distal mesh is implanted with three long curved clamps *(D)*. (*From* Wantz GE: Atlas of Hernia Surgery. New York, Raven Press, 1991; with permission.)

a large distal indirect hernia sac. The access incision is loosely closed with a continuous absorbable suture.

Another advantage of unilateral GPRVS is that in many cases the procedure can be done with local anesthesia. Anesthetizing the peritoneum adjacent to the pelvic wall, the vas deferens, and the testicular vessels may be difficult and incomplete. Supplementing the local anesthesia with sedation medication or analgesic medication is advisable. Drugs that may induce abdominal breathing, such as fentanyl, can severely restrict exposure and should not be administered.

Transinguinal Giant Prosthetic Reinforcement of Visceral Sac

Transinguinal GPRVS is similar to the Rives hernioplasty in that they both implant a polyester mesh in the properitoneal space via an anterior groin incision. It differs from it in that the mesh is not sutured

circumferentially and the vas deferens and testicular vessel are parietalized. Its main indication is for recurrent hernias in women and for unexpected complex hernias of the groin.

The properitoneal space is reached by division of the posterior wall of the inguinal canal in exactly the same way as in classic hernioplasties. Division of the cremaster muscle, cremaster vessels, and genital nerve assists exposure but is not essential. Wide cleavage of the properitoneal space is easily accomplished bluntly with the index finger or sponge stick in all directions. Division of the inferior epigastric vessels facilitates this dissection and the implantation of the prosthesis but is not always necessary.

Parietalization of the elements of the spermatic cord is preferred; however, if parietalization is not done, the operation can be completed as Rives[10] does: A lateral slit is made in the mesh to accommodate the cord. The lateral bisected tails of the mesh are sutured around the cord and circumferentially to Cooper's ligament and the abdominal wall.

The Mersilene prosthesis should be as large as possible and not less than 10 × 10 cm. It should be arranged so that it stretches transversely. The prosthesis is drawn into the properitoneal space underneath the superior abdominal wall by three to five sutures of permanent or slowly absorbable synthetic suture. The sutures that suspend the prosthesis are placed medially, superiorly, and laterally far beyond the borders of the MPO. The sutures not only expedite the correct placement of the prosthesis superiorly but also they ensure its position during the manipulation required to insert the inferior portion of the prosthesis. The inferior border of the prosthesis is implanted with long, curved clamps (Wiley or Rochester Pean) that grasp the prosthesis on the corners and in the middle of the distal edge. The long, curved clamps push the prosthesis medially deep into the space of Retzius and laterally far up into the iliac fossa. The clamp in the middle edge aids implantation of the prosthesis over the peritoneum facing the obturator canal. The clamps are then carefully removed, and the position of the prosthesis is checked to make sure that it has not been dislodged. The posterior wall of the inguinal canal is closed without tension and with a permanent monofilament synthetic suture. A formal hernioplasty is not essential.

MATERIAL AND RESULTS

The author's experience was less than satisfactory before Mersilene became the routine prosthesis for bilateral GPRVS and before the correct shape the Mersilene was determined for unilateral GPRVS via a transverse abdominal incision.

The author's experience with GPRVS consists of 646 patients with 766 groin hernias, of which 63 were primary and 703 were recurrent. Sixteen recurrences occurred, for an overall recurrence rate of 1.9%. After Mersilene became routine for bilateral GPRVS and was correctly sized in unilateral GPRVS, the recurrence rate fell to 0.8% (592 repairs and 5

recurrences). These errors in the technique have been reported so that others could benefit from the author's experience.[13, 14]

No deaths, life threatening complications, testicular atrophies, or neuropathies occurred. No deep infections occurred in the patients who had Mersilene prostheses implanted, and no Mersilene prostheses had to be removed. Unilateral GPRVS and currently bilateral GPRVS are performed in the ambulatory surgical center.

Bilateral GPRVS was used in 191 patients to repair 311 hernias, of which 247 were recurrent and 63 primary groin hernias. The first 40 patients presented with 43 recurrent hernias. In patients in whom polypropylene mesh was implanted, five recurrences occurred, for a disappointing rate of 11.6%. Polypropylene mesh and Gore-Tex are not suitable prostheses for GPRVS. When Mersilene was used in the subsequent 141 patients who had 264 hernias, five recurrences occurred, for a rate of 1.9%.

Unilateral GPRVS via a transverse abdominal incision has been used to manage 455 complex and recurrent hernias of the groin, with an overall recurrence rate of 1.8% in 1986 to 1997. It was not recognized until six recurrences became apparent among the first 127 repairs that the rectangular-shaped mesh did not insure against recurrence. Draping the mesh in the properitoneal space of Bogrus in a cadaver revealed that inadequate coverage of the MPO occurred as a result of twisting of the mesh as it accommodated to the curves of the pelvis. When the mesh was elongated at the inferior-lateral corner to correct this fault, no recurrences occurred in the subsequent 328 repairs.

DISCUSSION

In theory, recurrences after GPRVS are inconceivable. Nevertheless, they occur. Although other factors may be at play, most recurrence can be attributed to technical errors, most often related to the size and placement of the mesh. The author's results compare favorably with those of others (Table 1). No other hernioplasty produces better results for recurrent and especially re-recurrent groin hernias.

For excellent results, the mesh must be Mersilene that is correctly sized, shaped, and placed. The surgeon should never skimp on the size of the prosthesis. To ensure proper placement, the properitoneal space needs wide cleavage. When placing the mesh, it is important for the surgeon to envision that the mesh envelops the visceral sac rather the mesh being applied to the pelvic wall. Wrinkled mesh may result if the mesh is too large but also it may indicate inadequate cleavage of the space or inappropriate prosthesis placement. No attempt should be made to close the hernia defects, no matter how large they are. Although they may be easy to close when the access incision is open, they will inevitably be under tension when the access incision is closed. Disruption of the defect will then dislodge the mesh and cause a recurrence.

Table 1. RECURRENCE RATE WITH GIANT PROSTHETIC REINFORCEMENT OF THE VISCERAL SAC

Author (Reference)	No. Hernias	Recurrences (%)
Beets et al (1)	300	0.3
Cubertafond and Gainant (2)	399	1.6
Mathonnet et al (3)	1049	1.6
Rignault (4)	568	4.0
Salinier (5)	309	2.9
Stoppa (3, 9)	604	1.4
Van Damme (11)	100	0.0
Wantz (12)	766	1.9

Closed suction drainage eliminates seromas and hematomas and is not necessarily an indication for hospital admission.

SUMMARY

GPRVS is a properitoneal hernioplasty with a prosthesis composed of the polyester Dacron. The repair is anatomic, sutureless, tension-free, and the absolute weapon to eliminate all types of groin hernias. No other technique produces better results for the repair of recurrent and re-recurrent groin hernias. It also is a joy to perform.

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