

Open Mesh Plug Hernioplasty: The Less Invasive Procedure

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Surgical repair of inguinal hernia is among the oldest and most common operations performed by general surgeons. Currently, 700,000 procedures are performed annually in the United States.^{1,2} Regardless of the large volume of hernia surgery which is performed, the results are less than ideal. It is estimated that the recurrence rate of primary hernia repair remains at 10% to 15% with a higher rate following repair of recurrent hernia.³⁻⁶ Equally important, there is frequently a long period of disability and discomfort. Many surgeons still advise their patients to refrain from work, exercise, and heavy lifting for periods of 3 to 8 weeks. While it is common in the United States for hernia surgery to be performed on an ambulatory basis, it is still not unusual that patients are hospitalized for several days to a week in other parts of the world. It is readily apparent that unnecessary days spent in hospital add a great burden to every country's healthcare expenditures.

Over the past 100 years, since the advent of modern hernia surgery, various complex operative approaches have been developed, including multilayered repairs, fascial grafts, relaxing incisions, and tissue flaps. The suturing together of various layers of tissue has been advocated. These techniques all share the common disadvantage of tension on the suture line. This results in postoperative pain and discomfort. None of these methods fulfills the criteria of simplicity. Failure of these methods is evidenced by the large numbers of individuals with longstanding and untreated groin hernias.

EVOLUTION OF THE AUTHORS' METHODS

The authors' interest in open mesh plug concepts was encouraged by reports

of the "tension-free" concept of Lichtenstein and the "sutureless plug" method of Gilbert.⁷⁻¹⁰ In the "tension-free" repair, the mesh prosthesis is sutured as an onlay patch anterior to the hernia defect. No attempt is made to approximate weakened tissues with sutures. The mesh prosthesis is not used to buttress or support a previously sutured tissue repair. Weakened tissue is not approximated under tension.

Lichtenstein, in 1974, described the placement of a cylindrical rolled or "cigarette" mesh plug for the repair of femoral and recurrent hernias. Following dissection and reduction of a femoral or recurrent hernia sac, the rolled plug is placed within the fascial defect with the outer end lying flush with the fascial orifice. The mesh plug is then sutured in place with several interrupted sutures. It is of note

that he never described placement of the rolled plug within the internal ring for the repair of indirect hernia.

Beginning in 1987, Gilbert utilized a procedure which he referred to as the "sutureless repair" of inguinal hernias. He applied this technique to the repair of small to moderate-size indirect inguinal hernias, both primary and recurrent. A soft mesh plug is formed at the operating table from a flat piece of polypropylene mesh which is slit and folded into a cone-like or umbrella shaped configuration. The hernia sac is usually not opened, ligated, or excised. It is simply inverted through the internal ring. The mesh plug is then inserted, narrow end first, through the internal ring, holding the hernia sac in place. A second piece of flat mesh with a lateral slit is then placed over the intact

floor of the direct space. The spermatic cord is placed through the lateral slit and the tails of the mesh overlapped lateral to the cord. No suture is used to maintain either the polypropylene plug or the onlay patch to the tissues. The cord is placed anterior to the onlay patch. The external oblique aponeurosis is closed over the cord followed by routine wound closure.

The hallmark of this repair is simplicity, coupled with ease of performance. The normal anatomy of the inguinal canal is not disturbed. Needle and suture holes in tissue are avoided. Dissection is minimized. Possibility of nerve injury is diminished. The basic concept is that of putting a cork in a bottle.

OPERATIVE TECHNIQUE

From January 1989 to April 1993, we utilized an umbrella-shaped mesh plug fashioned from a 3-inch by 3-inch square of flat Marlex mesh. Subsequently, all repairs have been performed with the Marlex® mesh PerFix® hernia plug (Fig. 1), (Davol, Cranston, R.I.). The results have been reported in multiple articles,¹¹⁻¹⁵ and the authors have now performed over 3,000 mesh plug groin hernioplasties with these techniques. The PerFix plug consists of a pleated outer shell combined with a series of eight triangular internal mesh "petals." The pleated external configuration allows the plug to expand and contract in a flexible manner, permitting the plug to readily fit various size and shape hernia defects. The plug's internal petals prevent the plug from collapsing, thereby maintaining its configuration while ensuring a tension-free repair. This allows the PerFix plug to be utilized in the repair of all indirect, direct, and femoral hernias,

both primary and recurrent. Indeed, in well over 2,000 consecutive cases, we have used no other method of repair. Complications such as infection, urinary retention, ischemic orchitis, and long-term pain have been virtually nonexistent. Recurrence rate remains below 1%.

Preoperative Routine

Patients are admitted to the authors' office-based surgical suite 1 hour before the procedure. In healthy patients under the age of 40, no preoperative laboratory tests are required. A CBC or chemistry profile is added on the basis of medical necessity. Coagulation studies are not routinely requested, nor are chest X-rays, barium enemas, or colonoscopy. An electrocardiogram is added for those over 40 years of age. A urine pregnancy test is requested on females of childbearing age. Medical consultation is obtained when needed.

Oral intake is stopped the night prior to surgery, except for cardiac or antihypertensive medication. No enemas or preadmission skin preparation are utilized.

Sensory epidural block is routinely administered; 3% chlorprocaine (Nesacaine) is the agent of choice. The patient is usually able to move the lower extremities while under a deep sensory block. Cardiac arrhythmias are usually not seen, even during traction on the spermatic cord or the peritoneal sac. The patient is usually fully ambulatory within 1 hour after completion of the procedure and able to be discharged within 2 hours.

A minimal shave is done by the surgeon immediately prior to the start of the procedure. Prophylactic antibiotics are not routinely administered. The mesh prosthetic is not soaked in an

antibiotic solution.

Indirect Hernia

An oblique 4- to 6-cm incision of the epidermis, overlying the inguinal canal, is made with a scalpel. The remainder of the incision and all sharp dissection is carried out with electrocautery, providing excellent hemostasis and diminished hematoma and seroma formation. Costly technology is avoided. Average blood loss is usually less than 5 mL.

The external oblique aponeurosis is opened from the external ring to the lateral margin of the internal ring. A Beckman self-retaining retractor with 2.5 x 2.5-cm blunt blades and a Goulet or U.S. Army retractor provide excellent exposure. If they are readily located, the ilioinguinal and genitofemoral nerves are preserved. If they are not readily identified, no effort is made to search for these nerves. A tissue plane anterior to and posterior to the aponeurosis is not dissected, avoiding the creation of tissue flaps. Dissection is, thus, kept to a minimum. Unnecessary tissue trauma is avoided. The spermatic cord is mobilized at the level of the pubic tubercle and a rubber drain is placed around the cord. The cord is opened in the direction of the cremasteric fibers. The indirect sac with any lipoma is separated from other cord structures to the level of the internal ring (Fig. 2). The neck of the sac is carefully separated from any adhesions. The sac is usually not opened. The sac and any lipoma are reduced through the internal ring. Routine pathologic examination is avoided. The key element in mesh plug repair for indirect hernia is high dissection, not high ligation. This allows visualization of the preperitoneal fat pad and creates a preperitoneal pocket to accommodate the plug.

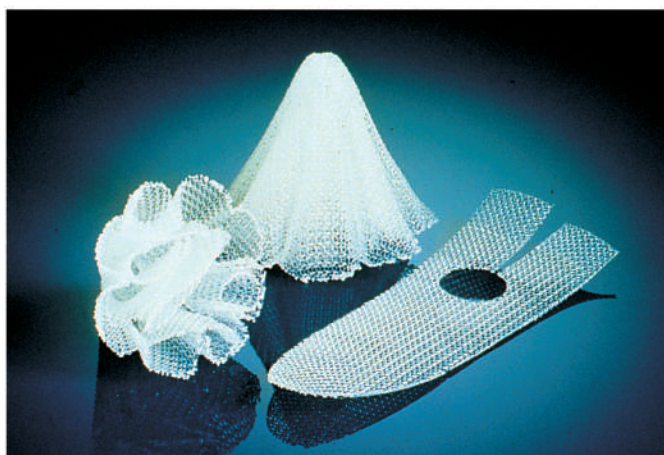


Figure 1. The Marlex® mesh PerFix® hernia plug.

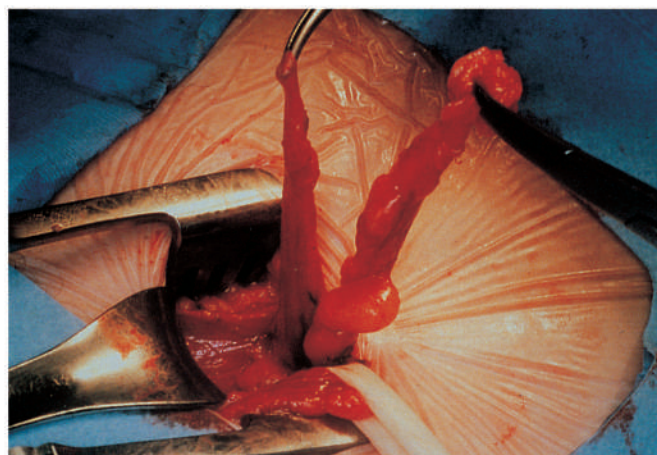


Figure 2. Indirect hernia, showing dissection of hernia sac and lipoma.

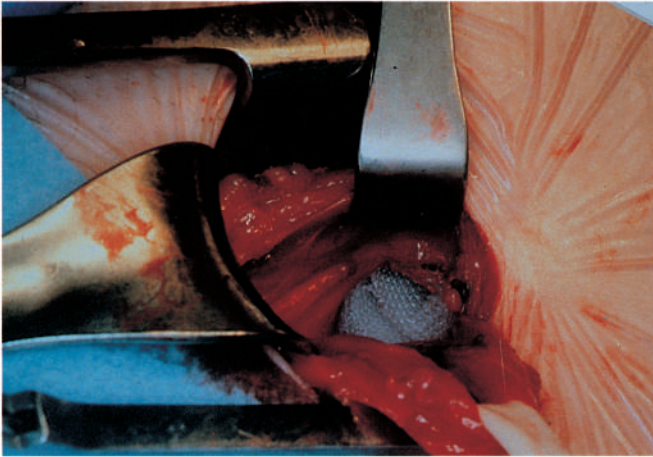


Figure 3. Indirect hernia, showing position of PerFix plug in internal ring.

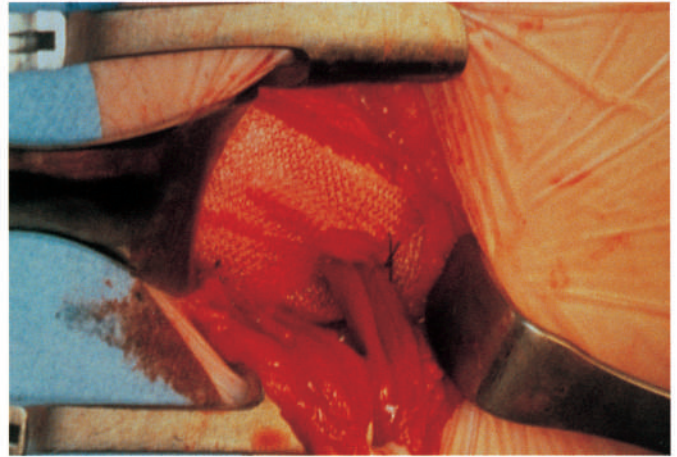


Figure 4. Indirect hernia, showing sutureless onlay patch overlying direct space.

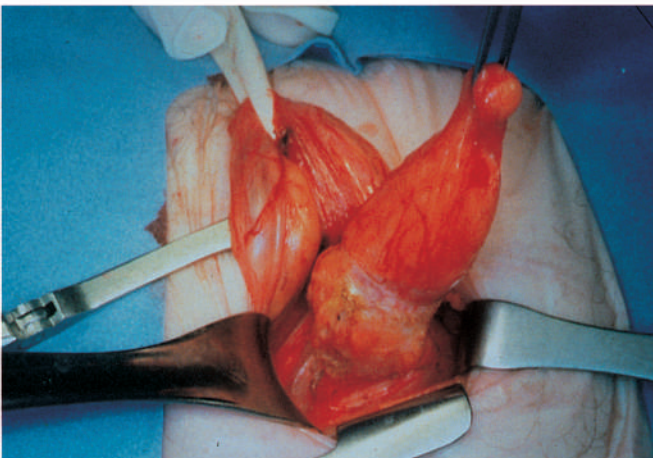


Figure 5. Direct hernia, showing incised fascia at base of hernia sac.

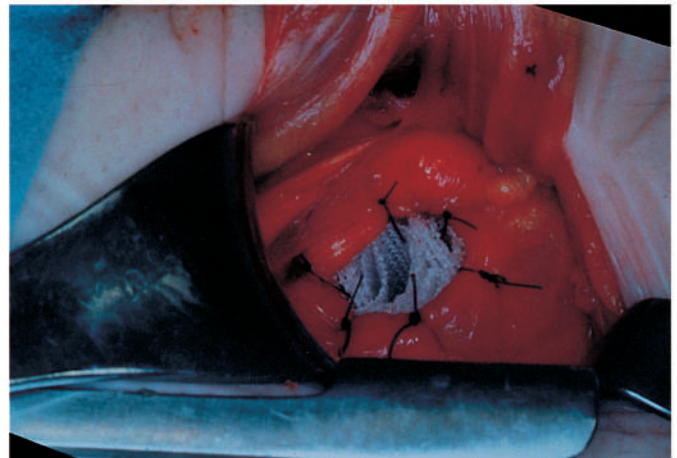


Figure 6. Direct hernia, showing sutured PerFix plug in hernia defect.

A Marlex mesh PerFix hernia plug is placed, narrow end first, into the internal ring so that it lies just below the muscular crura of the ring (Fig. 3). Although the PerFix hernia plug is available in small, medium, and large sizes, we routinely use the large size for the repair of all indirect hernias. In the very tight internal ring, two to four of the triangular internal "petals" may be removed. In this manner the plug is made less bulky, avoiding any potential compression of the spermatic veins and any resultant testicular edema.

In the small to moderate size internal ring, one or two interrupted sutures are placed through the outer shell of the mesh and the muscular margin of the internal ring so as to prevent any possible migration of the plug. In a hernia with a patulous internal ring, additional sutures are placed so as to fix the periphery of the plug circumferentially to the margins of the hernia defect to maintain reduction of the hernia and any preperitoneal fat. The repair is then tested by requesting the patient to cough or strain.

A preshaped piece of flat Marlex mesh is then placed on the anterior surface of the posterior wall of the inguinal canal from the pubic tubercle to the internal ring (Fig. 4). If the supplied onlay patch is too wide for the exposed size of the inguinal canal, it may be trimmed to fit. The two lateral tails of the flat mesh are overlapped around the spermatic cord, fixed together with a single suture, and placed lateral to the cord. The onlay patch is not fixed to the tissues with sutures. The "Velcro-like" properties of Marlex assist in holding both the onlay patch and the plug in position. The principal component of the repair is the plug and not the onlay patch, which only serves as a reinforcement to the repair.

Cord structures are placed anterior to the onlay patch. The external oblique aponeurosis is reapproximated over the cord with a continuous suture. Scarpa's fascia is closed with interrupted sutures. Skin edges are brought together with a continuous subcuticular suture. A transparent plastic dressing is placed over the

incision. The typical operation is performed in 15 minutes.

Direct Hernia

Initial incision and dissection are performed as in the repair of indirect hernia repair. Following mobilization of the spermatic cord, and confirming the absence of an indirect hernia component, the fusiform or saccular direct hernia is elevated with an Allis clamp. The base or neck of the sac is inscribed by electrocautery to enter the preperitoneal plane and expose preperitoneal fat (Fig. 5). This is an essential step and ensures placement of the plug in the preperitoneal plane. The hernia sac is then inverted into the iliac fossa. The PerFix hernia plug is inserted into the fascial defect and securely sutured to its margins with multiple interrupted sutures to fix the plug securely in position and to maintain reduction of the hernia (Fig. 6). At least four sutures are required in the repair of a saccular hernia with a small defect, and an average of eight sutures in a fusiform hernia with a

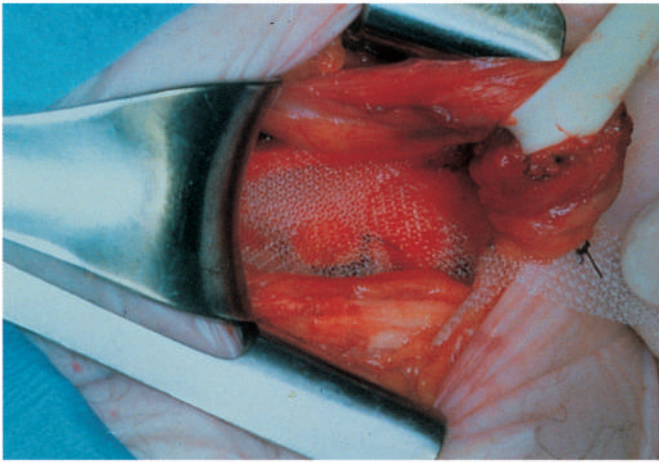


Figure 7. Direct hernia, showing sutureless onlay patch overlying sutured PerFix plug and direct space.

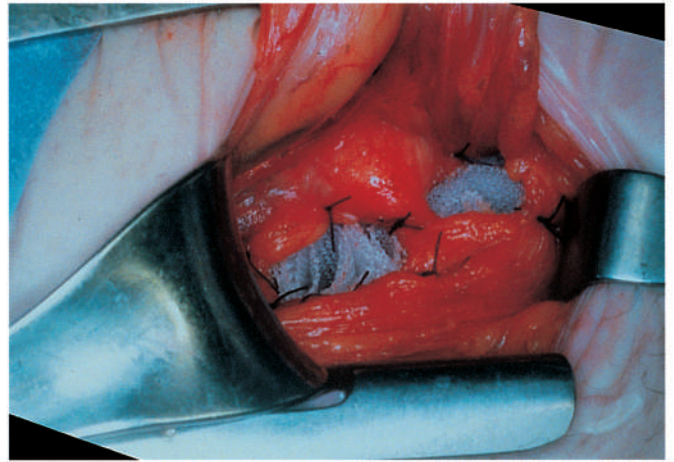


Figure 8. Pantaloon hernia, showing placement of two PerFix plugs.

large fascial defect. The repair is then tested by requesting the patient to cough or strain. Fusiform hernias of the largest type, occupying the entire floor of the direct space, may be repaired in this manner.

A sutureless onlay patch is placed in the same manner as in repair of an indirect hernia (Fig. 7). This is followed by routine wound closure. The usual operation is performed in 20 minutes.

Pantaloon Hernia

In the repair of combined indirect and direct defects, one or two plugs may be utilized, depending on the anatomic situation. In the case of a combined defect with no fascial bridge separating the two components, both the indirect sac and direct sac may be reduced, after scoring of their fascial margins, and fixed in place with a single large PerFix hernia plug. The plug is then securely sutured in place to the margins of the hernia defect. The inferior epigastric vessels are usually displaced posteriorly by the plug, avoiding ligation of these vessels. In some cases, a weak fascial bridge overlying the inferior epigastric vessels may require division to combine the defects. A sutureless onlay patch is placed in the same manner as in the repair of indirect or direct hernia. This is followed by routine wound closure.

In situations where there are two separate and distinct defects, two plugs are utilized (Fig. 8). When two plugs are placed adjacent to one another, they are frequently sutured together.

Femoral Hernia

In the repair of femoral hernia an infra-inguinal approach is utilized. The hernia sac is identified in a subcutaneous plane, dissected down to its base, freeing

the neck of the sac. The sac is then reduced. Due to the narrowness of the femoral canal, reduction may be difficult. Excision and ligation of the hernia sac or enlargement of the femoral canal by incision of the lacunar ligament may be required. A PerFix mesh plug (most commonly the medium size with the inner petals removed to narrow the diameter of the plug) is then placed within the defect (the femoral canal) and securely sutured in place with a minimum of four sutures. An onlay patch is not placed. This is followed by routine wound closure. Thrombophlebitis has not been observed following the tension-free procedure.

The authors have not encountered a single femoral hernia in association with

an indirect or direct hernia in this series. Nor has a femoral hernia in a patient following mesh plug repair of an inguinal hernia been noted in this series.

Recurrent Hernia

The repair of recurrent hernia is frequently easier and simpler with this procedure than repair of primary hernia. The most common recurrent inguinal hernia encountered has only one component which consists of a small suprapubic fascial defect. The hernia sac can usually be approached through a small incision and dissected down to its base through an intact external ring (Fig. 9). In this instance the external oblique aponeurosis is not opened. It is frequently necessary to

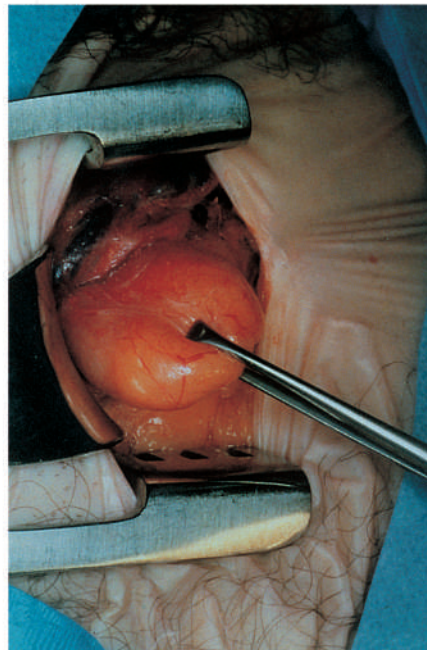


Figure 9. Recurrent hernia, showing suprapubic hernia sac.

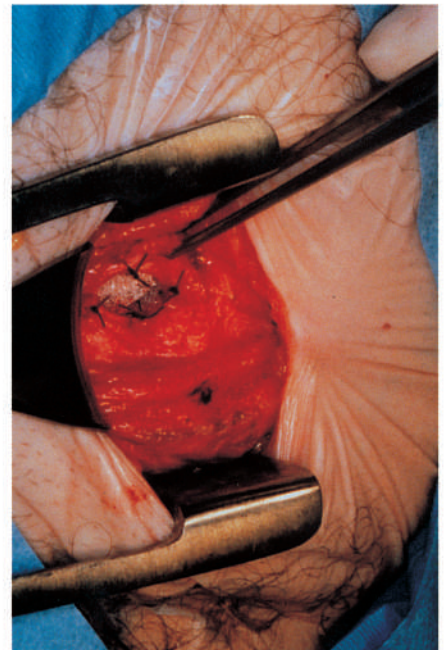


Figure 10. Recurrent hernia, showing sutured PerFix plug in suprapubic hernia defect.

dissect cord structures off the sac. Thus, mobilization of the cord may be avoided, diminishing the incidence of post-operative testicular ischemia. The sac is reduced followed by insertion of a PerFix mesh plug, tapered end first, so that the outer circumference lies flush with the fascia. The plug is then securely sutured to the fascial margins of the defect with a minimum of four sutures (Fig. 10). An onlay patch is not utilized unless the external oblique aponeurosis has been opened. This is followed by routine wound closure.

In operating on recurrent hernias, every attempt is made to minimize dissection. Routine attempts to identify fused and distorted anatomic layers are avoided. The basic principal involved is the same as applies to the repair of all groin hernias with mesh plug techniques. That concept is to dissect and reduce the herniated object through its muscular-fascial defect and to place the plug securely within that defect.

COMMENTS

The economic realities of the various laparoscopic approaches to groin hernia repair have been previously presented.¹⁶⁻¹⁹ There is little question that if the laparoscopic approach, using very conservative cost factors, yields a minimal additional expenditure of \$400 in addition to the costs of an open hernia repair, these costs must be justified. Certainly the economic stresses on the healthcare expenditures of every developed country demand this degree of fiscal responsibility.

A recent prospective study²⁰ of an equal number of patients treated with mesh plug and laparoscopic techniques concluded that the mesh plug procedure yielded superior results and diminished complications. That author now advocates plug procedures for the majority of his patients.²¹

The simplistic nature of mesh plug hernia repair cannot be overemphasized. In comparison with laparoscopic hernia repair, (1) the learning curve is shorter, (2) operative time is markedly diminished, (3) general anesthesia is not required, and (4) the peritoneal cavity is not entered. The laparoscopic procedure continues to be plagued with the complication of (1) intestinal and vascular injury and (2) with instances of mortality. From a cosmetic viewpoint, the length of the 4- to 6-cm

incision of the mesh plug operation is comparable with the length of the combined trocar sites; yet the incision is completely located within the bikini line, avoiding scars that are visible in a bathing suit. Trocar-site hernias are eliminated. Overall recurrence rate is lower (<1% in the authors' series).¹¹⁻¹⁵ Nausea and vomiting, which have been a problem in several laparoscopic series^{20,22} resulting in failure to discharge on the day of surgery, are rarely seen with plug repair. The great majority of hernia repairs in this country are already being performed on an ambulatory basis. This is in contradistinction to the advantages of other types of laparoscopic surgery such as cholecystectomy, bowel resection, and hiatal hernia surgery. Our opinions appear to be supported by Fitzgibbons:²²

"This (herniorrhaphy) is perhaps the most controversial of the newer laparoscopic procedures because the conventional procedures currently being performed are reasonably effective, and therefore the benefit of a laparoscopic approach is not immediately self-evident. Furthermore, most current conventional herniorrhaphies are totally extraperitoneal. A laparoscopic approach, by definition, presumes an intra-abdominal approach to the hernia, exposing the patient to potential intra-abdominal complications in addition to the local complications already known to be associated with conventional herniorrhaphy."

The extraperitoneal technique may seem to be the savior of the endoscopic approach. General anesthesia and invasion of the peritoneal cavity can be avoided. The amount of instrumentation is, however, increased, as are the cost, degree of technical difficulty, and complexity—all of this to justify the use of high-tech instrumentation. This needs to be compared with open mesh plug hernioplasty, the most simplistic approach to hernia surgery.

There seems to be little question, comparing the various options available in 1996, that open mesh plug hernioplasty should be considered the minimally invasive procedure of choice. **STI**

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