The ultimate measure of success of inguinal hernia repair is the rate of recurrence. Although other procedure-related complications are important and have been shown to affect health-related quality-of-life parameters, recurrence is more challenging for the patients and the surgeon. From the patients’ perspective, the initial physical and mental investment in the operation has failed. A new investment has to be made, with fewer guarantees for success, more risks for more serious complications, and more time off from work. For the surgeon, repair of a recurrent inguinal hernia is technically more demanding because scar tissue causes the inguinal canal to be obscured and distorted. In addition, the tissue tends to be weaker than at the time of primary repair, resulting in a substantially higher risk for complications or development of another recurrence. Although much has been published about primary repair of inguinal hernias, less is known about the best approach to address a recurrent hernia. In this review, we address the “pros and cons” of popular surgical approaches and watchful waiting for recurrent inguinal hernias and indications for each. In the absence of best evidence in this field, the authors present an opinion based on their experience and a review of the available literature primarily extracted from large trials and large cohorts for inguinal hernia repair in general.

**EXTENT OF THE PROBLEM**

Review of routine hernia practices within the community have shown recurrence rates of primary inguinal hernia repairs to vary between <1% and 17%. Despite recurrence rates being most accurate in prospective randomized trials, the limitation is that most trials follow patients for only 2 years, which is too short. In longterm observational studies, reoperation is used as a proxy for recurrence, with the accepted recurrence estimated at 1.7 to 2 times the reoperation rate. In a large observational study from Denmark, reoperation rate after a primary Lichtenstein repair was 2.4%, 6.2% after a primary nonmesh repair, 3.6% after primary mesh (non-Lichtenstein), and 3.3% after primary laparoscopic repair. In the same study, rate of reoperation after repair of a recurrence was higher, at 8.8%. In a similar observational study from Sweden, the cumulative incidence of reoperation at 24 months was 4.6% (95% CI, 2.5–5.8%) for recurrent repair and 1.7% (95% CI, 1.4–2.0%) for primary repair.

In the Danish observational study, 90.8% of the recurrences occurred in the inguinal canal and 9.2% of the recurrent hernias were found in the femoral area, raising the question of whether this was a recurrence in the first place or a missed hernia. Felix and colleagues found an occult femoral hernia incidence of 9% in their 1996 series of laparoscopic repair of recurrent inguinal hernia. Mikkelsen and colleagues found the risk of femoral hernia to be 15 times higher after inguinal hernia repair than in the general population, and Chan and Chan believe that a previous inguinal hernia repair can precipitate the occurrence of a femoral hernia. They found that 50.9% of their series of 225 femoral hernia repairs had concurrent inguinal hernia and 18.2% had previous groin hernia repair.

In this report, we describe the options available to the surgeon to address a recurrent hernia. Recommendations are given based on available literature, primary repair performed on the patient, and expertise and familiarity of the surgeon with various techniques.

**Is watchful waiting of a recurrent inguinal hernia an option?**

Inguinal hernias, even when recurrent, are often asymptomatic or minimally symptomatic at the time of diagnosis. The traditional recommendation has been to repair these hernias because of a perceived substantial risk of bowel obstruction or strangulation, or both. The recommendation is based on empiricism rather than scientific fact because there are no randomized controlled studies in the literature that specifically address the issue of observation of recurrent hernias. In addition, it is commonly believed...
that progression of a hernia is inevitable and that operations become more difficult the longer the hernia is left unrepaired.\textsuperscript{12} A prospective randomized multicenter trial of watchful waiting versus Lichtenstein repair with a minimum followup of 2 years was published in 2006.\textsuperscript{13} The rate of hernia accident (defined as a strangulation or bowel obstruction) for all patients (both primary and recurrent) was calculated at 0.0018 events/patient/year in that study, or one-fifth of 1% per year. Although the watchful waiting group had more pain interfering with activities (risk difference: 2.86, 95% CI, −0.04 to 5.77) and a slightly worse performance on the physical component of the SF-36 (difference: 0.16, 95% CI, −1.19 to 1.50), these differences were not statistically significant; the overall crossover rate from watchful waiting to operation in that study at 2 years was 23% and was mostly related to pain. A subset analysis was performed on 43 patients with recurrent hernia (33 unilateral and 10 bilateral) who were randomized to watchful waiting. By 2 years, 15 patients (35%) had crossed over and received an operation primarily because of increasing pain. There were no consequences for delaying operation and outcomes (ie, pain, quality of life as measured by the SF-36, and activity) were the same when compared with those who were randomized to immediate operation.\textsuperscript{14}

It is safe to conclude that watchful waiting of a recurrent hernia is acceptable and the recurrent hernia can be addressed when symptoms evolve.

**Open approach of a recurrent inguinal hernia**

Considerations for repairing a recurrent hernia from an open approach should take into account the native anatomy of the groin, namely the myopectineal orifice (MPO), which was originally described by Fruchaud.\textsuperscript{15} This anatomic hole located between the false pelvis and the ipsilateral lower extremity is quadrangular in shape and is divided into a superior and inferior level by the inguinal ligament. The myopectineal orifice allows passage of the spermatic cord structures superiorly (medial triangle) and the femoral vessels inferiorly (inferior triangle). (Reprinted from: Fagan SP. Abdominal wall anatomy: the key to a successful inguinal hernia repair. Am J Surg 2004;188[Suppl]:3S–8S, with permission.)

Figure 1. Myopectineal orifice. This anatomic hole located between the false pelvis and the ipsilateral lower extremity is quadrangular in shape and is divided into a superior and inferior level by the inguinal ligament. The myopectineal orifice allows passage of the spermatic cord structures superiorly (medial triangle) and the femoral vessels inferiorly (inferior triangle). (Reprinted from: Fagan SP. Abdominal wall anatomy: the key to a successful inguinal hernia repair. Am J Surg 2004;188[Suppl]:3S–8S, with permission.)

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1. Do not depend on fascial structures to close or reinforce the defect;
2. Reinforce the entire inguinal floor irrespective of the type of hernia;
3. Avoid all tension on suture lines;
4. Avoid use of scarred or devascularized tissue in the repair of recurrent hernias; and
5. Use a large prosthetic material to reinforce the entire inguinal floor permanently.

The choice of repair for the recurrent hernia will depend on the initial repair used. Initial repairs can include primary conventional tissue repair; primary anterior mesh repair, such as Lichtenstein onlay patch\textsuperscript{16}; plug and patch\textsuperscript{17}; Prolene Hernia System (Ethicon)\textsuperscript{18}; or primary posterior mesh repair, such as open posterior mesh repair (eg, Read, Rives, Stoppa, Kugel)\textsuperscript{19-21} or a laparoscopic repair.\textsuperscript{22} Primary repairs, such as Kugel patch, Prolene Hernia System, and plug, that place mesh in the preperitoneal space make subsequent laparoscopic repair more difficult. Recurrence rate after mesh repair differs with the type of repair and should

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**Abbreviations and Acronyms**

- MPO = myopectineal orifice
- TAPP = transabdominal preperitoneal
- TEP = totally extraperitoneal
be taken into consideration when performing subsequent repairs (Table 1).

The choice of anterior versus posterior open approach should be guided by the initial repair. A careful review of previous operative reports is paramount in guiding the subsequent repair. If the initial repair was a tissue repair, then either the anterior or posterior approaches can be used for repair of the recurrent hernia (Fig. 2A). If the initial repair was a mesh repair, then the recurrent repair should preferably employ an approach in the space in which the tissue planes have not been violated previously (Fig. 2B). An anterior approach is clearly the best choice after failed posterior repair, no matter if it was performed open or laparoscopically.

The choice of the procedure depends more on the personal experience of the surgeon than the specific operation. In an anterior approach, the cord structures have to be carefully dissected in order to avoid devascularization of the testicle and injury to the vas deferens and nerve structures. A mesh repair should be done in those patients with no previous mesh observing the Lichtenstein principles listed here. In cases where previous mesh was used, the mesh is usually severely adherent and fibrosed to the cord structures and surrounding tissues. Orchiectomy is rarely necessary but should be discussed with the patient before the operation and performed in case of devascularization of the testicle. Removal of the mesh is most often impossible and careful delineation of the anatomy and MPO are most important. Placement of a new additional mesh according to the principles listed here is practiced by many. Anchoring the mesh to healthy fascia and inguinal ligament is paramount for success of the new repair; anchoring the mesh to the previous mesh repair in areas where the mesh is well-incorporated to the inguinal ligament laterally and rectus fascia medially with no evidence of recurrence can prevent additional dissection and damage to underlying structures. With close to 9% of recurrences consisting of femoral hernias, the femoral canal should be carefully explored by dissecting the area medial to the inguinal ligament. In cases where femoral hernias are present, we would caution against use of a plug in that area and advocate for exposure of Cooper’s ligament and fixation of the new mesh to Cooper’s ligament laterally.

The plug repair favored by many in primary hernia repair has been used in recurrent hernias after tissue repair, with a 1.2% recurrence rate at 10-year followup and no major complications in one series. Similar results have been reported previously with plug repair for recurrences after mesh repair. With the plug repair, many complications are reported after primary inguinal hernia repair, such as chronic pain in approximately 6% of cases, scrotal and pelvic migration of the plug, and erosion of the plug into the intestine; bladder; and other structures.

The open posterior approach requires implantation of a mesh behind the transversalis fascia through a transinguinal method (Rives); a slit method made in the broad abdominal muscles (Wantz, Kugel); or a lower midline incision (Stoppa). During the Kugel operation, dissection to allow enough room to accommodate the patch in a completely flat position is extremely important. Inadequate dissection can lead to kinking of the patch, which can result in a kink in the expanding ring of the patch that might crack through the transversalis fascia into the inguinal canal, causing chronic pain, or into the peritoneal

Table 1. Rerecurrence Rates after Open Inguinal Hernia Repair Using Various Mesh Techniques

<table>
<thead>
<tr>
<th>Hernia repair</th>
<th>Rerecurrence rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lichtenstein onlay</td>
<td>1.3–8.46</td>
</tr>
<tr>
<td>Plug and patch</td>
<td>3.5–6.24</td>
</tr>
<tr>
<td>Prolene Hernia System</td>
<td>NA</td>
</tr>
<tr>
<td>Open posterior approach</td>
<td>5.9–9.74</td>
</tr>
<tr>
<td>Kugel</td>
<td>27.8</td>
</tr>
</tbody>
</table>

NA, not available.

![Figure 2. (A) Recommended approach when primary hernia was repaired without mesh. (B) Recommended approach when primary hernia was repaired with mesh.](image-url)
cavity with resulting bowel perforation.\textsuperscript{29,30} Although a softer/absorbable rim has been developed, there are no longterm studies about its use in the inguinal area.

The Prolene Hernia System placed through an anterior approach combines the placement of a mesh leaflet posterior to the transversalis fascia and an anterior mesh leaflet anterior to transversalis fascia. Both leaflets are held together by a connector. The Prolene Hernia System has not been studied in a large series of recurrent inguinal hernias. With a Prolene Hernia System, the surgeon will have to obtain access to the preperitoneal space, which is difficult in hernias repaired previously through the posterior approach (open or laparoscopic), and the surgeon will also face all the challenges described here in hernias repaired previously through the anterior approach.

**LAPAROSCOPIC REPAIR OF RECURRENT INGUINAL HERNIA**

From the discussion here, it is almost intuitive that a laparoscopic posterior repair, when expertise is available, is a preferable approach after failed anterior repair. A recent prospective randomized trial has shown that laparoscopic repair is superior to open Lichtenstein repair for recurrent inguinal hernia.\textsuperscript{31} In the large Danish observational study, the cumulative reoperation rate after primary Lichtenstein repair was substantially reduced after laparoscopic operation for recurrence (1.3%), compared with open repairs for recurrence (11.3%).\textsuperscript{32} The posterior laparoscopic approach for recurrent inguinal hernia not only provides the technical advantage of operating through unscarred tissue, but has the added benefits of other advantages of minimally invasive procedures, including less postoperative pain; earlier return to work and activity; and low incidence of wound and mesh infection, as demonstrated by a number of retrospective and randomized prospective studies.\textsuperscript{1,33-38} In athletes and obese patients, the laparoscopic approach also offers less dissection through thick layers of muscles or fat. In patients with testicular atrophy on the contralateral side of a recurrent hernia repaired with the anterior approach, the laparoscopic repair provides less chance of injuring the spermatic cord structures.

Laparoscopic inguinal hernia repair also provides the benefit of a panoramic view of all the potential hernia spaces, ie, direct and indirect; femoral; and obturator hernias, allowing identification of missed femoral and concomitant iliopectoral and contralateral hernias. All of these potential weakened areas can be addressed laparoscopically during the same setting.

The two most common types of laparoscopic repair are the transabdominal preperitoneal (TAPP) repair and the totally extraperitoneal (TEP) repair. These techniques have dissection of the preperitoneal space in common, to identify the inguinal anatomy; reduce the hernia sac; and place a mesh to cover the hernia defect. The TAPP repair starts with a standard intraperitoneal laparoscopy followed by incising the peritoneum to gain entry into the preperitoneal space. The TEP repair establishes the preperitoneal space without intentionally entering into the abdominal cavity.

Presence of prosthetic material in the preperitoneal space from a previous hernia repair results in a technical challenge if a laparoscopic repair is considered. This is usually encountered after previous repairs performed with a plug, Prolene Hernia System, and Kugel meshes. These devices result in scarring in the preperitoneal space, making dissection more difficult. They also create an obstacle to placing a new mesh and make the peritoneal closure in a TAPP repair more difficult. Removal of the plug or posterior leaflet of a Prolene Hernia System is not simple and cannot be easily accomplished with ENDO SHEARS (Covidien). It is our experience that the electrocautery cuts the protruding aspect of the mesh more effectively. With a Kugel mesh, if the ring has to be removed it should be done through a separate incision.

In cases where a laparoscopic approach is undertaken for a previous flat mesh placed through a posterior open or laparoscopic repair, it is best to leave it in place to avoid risk of injury to the iliac vein or bladder. The new mesh can be laid on top of the old, correcting any technical failure from a slipped or misplaced prior mesh. This approach should be reserved for surgeons with advanced laparoscopic expertise in this field.

**TEP versus TAPP**

There are no multicenter prospective randomized studies comparing TEP and TAPP repairs for recurrent inguinal hernia. Most nonrandomized studies find equivalent rates of recurrence and complications between TEP and TAPP repair.\textsuperscript{39} A recent Cochrane review looking at TEP versus TEF for inguinal hernia repair suggests that TAPP is associated with higher rates of port-site hernias and visceral injuries, and there appear to be more conversions with TEP. Vascular injuries and deep or mesh infections were found to be rare, with no obvious difference between the groups.\textsuperscript{40}

A number of studies have looked at TAPP repair for recurrence after TEP or TAPP as the primary repair modality (TAPP after TEP or TAPP). Most of these studies have shown excellent results but were done by experts in that field.\textsuperscript{37,40,41}

**Relative contraindications for laparoscopic repair**

As in other laparoscopic operations, TEP and TAPP performed for recurrent hernias have some relative contrain-
dications that are similar to those performed for primary hernia, ie, repair requires general anesthesia and muscle relaxation. Patients with severe cardiac or pulmonary diseases are better treated with open repair with local anesthesia. The extensive preperitoneal space is usually created by blunt dissection in the case of TEP and by peeling the peritoneum in the case of TAPP, so patients who are anticoagulated or are at risk for bleeding should have open repair. It is also more difficult to create the preperitoneal space if the patient had previous preperitoneal dissection, such as for a prostatectomy, or operations involving the iliac vessels or a preperitoneally located transplanted kidney. For these patients, the advantage of laparoscopic repair is outweighed by the disadvantage of technical difficulty in creating the preperitoneal space to place the mesh. Patients with large scrotal hernias or ascites are also better treated with open hernia repair.

**Problems with laparoscopic repair**

There are two main reasons why laparoscopic primary and recurrent inguinal hernia repair has not gained full acceptance. Injuries to bowel, bladder, and major vessels are very rare but potentially life-threatening complications that occur more frequently in laparoscopic repair than in open hernia repair. A long learning curve also poses an obstacle. Although 250 cases is frequently quoted as distinguishing an experienced versus inexperienced surgeon for laparoscopic hernia repair, the Veterans Affairs’ study was not specifically designed to determine the learning curve of the surgeons. In retrospect, the Veterans Affairs study’s requirement that surgeons had already performed 25 laparoscopic hernia repairs before joining the study was an underestimation. A recent study from Edinburgh showed that recurrence rate after TEP repair plateaus to about 2% after 80 cases. Cost of laparoscopic repair can be in the same range as open repair if the surgeon avoids using expensive disposable instruments.

**Reccurrent inguinal hernias in women**

Most of the discussion here relates to the repair of inguinal hernias in men. Very little is published on groin hernias in women and most of our knowledge in this area comes from the large Swedish hernia registry, where 6,895 women with inguinal hernias were followed prospectively. In 267 repairs for recurrent hernias, 41.6% of women diagnosed with a direct or indirect inguinal hernia at the primary operation were found to have a femoral hernia at the time of reoperation. In a multivariate analyses of relative risks for reoperation, the risk was reduced when transabdominal preperitoneal laparoscopic repair was performed at the time of primary repair. After adjusting for all other factors (eg, mode of admission, reoperation, suture material, hernia type, methods of repair, postoperative complications, methods of anesthesia), women were found to have a higher risk of reoperation for recurrence than men.

This study points to considerable differences that need to be taken into consideration when addressing recurrent hernias in women as compared with men. Although the principles delineated here for men apply to women, surgeons must be aware of the very high incidence of recurrence in the form of a femoral hernia in women.

The higher rerecurrence rate of inguinal hernia after a previous recurrence results from distortion of the normal anatomy and from replacement of the fascial strength layer with weaker scar tissue. Although watchful waiting is acceptable in asymptomatic patients and does not represent greater risks than in patients with primary hernia, many patients will ultimately require rerepair. For recurrent inguinal hernias, it is now accepted that a laparoscopic posterior repair is a preferable approach after failed anterior repair; an anterior approach would seem to be the best choice after failed posterior laparoscopic or open repair.

It is imperative that the surgeon caring for patients with recurrent inguinal hernias make every effort to obtain the previous operative report in order to anticipate any potential difficulties in the rerepair and to help guide the choice as to the best reoperative approach. In the final analysis, it is the surgeon’s training and experience with a particular anterior or posterior technique that determines what the best and safest repair is for the patient.

**REFERENCES**


