

## Laparoscopic repair review article

### INTRODUCTION

New solutions to old problems begin with dissatisfaction with existing answers. High recurrence rates and morbidity, as well as prolonged recovery, have led to a gradual evolution in the way surgeons approach the problem of inguinal hernia repair. Bassini began the era of modern hernia repair 100 years ago by proposing an anatomical approach for the closure of inguinal hernias, radically reducing recurrence rates. Next, mesh-reinforced repairs were introduced to further decrease the incidence of failure. Lichtenstein championed an anterior approach, which incorporated a tension-free repair with mesh, while Nyhus and Stoppa introduced a posterior repair. Recently, laparoscopic surgeons have taken the posterior mesh repair one step further, utilizing modern laparoscopic instrumentation in an attempt to reduce morbidity and recurrence rates of previous hernioplasties. Each new approach comes about to reduce the complications seen with previous repairs. Unfortunately, with improvement comes a whole new set of problems, as well as some of the old ones. Only a complete understanding of the possible complications of a procedure and their causes will allow the surgeon to decrease postoperative morbidity and handle those complications that cannot be avoided.

Multi-institutional reviews and single-center studies have shown that complication rates after laparoscopic hernioplasty may vary from 8-13%, but what is included in each study as a complication differs widely. The incidence of major complications (approximately 1%), however, is consistent across these large studies with experienced surgeons and is similar to that reported from open hernia repairs. The purpose of the present review is not to give a detailed summary of the literature, but rather to explain why the most common and important complications occur and how they might be prevented or handled if they do develop.

### COMPLICATIONS RELATED TO ANATOMY

The performance of a laparoscopic hernioplasty is based upon a thorough knowledge of the anatomy of the pelvis and groin as viewed through the laparoscope. For many surgeons, this exposure is totally foreign. If the surgeon is ill-prepared to approach the groin laparoscopically, they may become lost and totally overlook an obvious hernia. The result is an immediate failure of the repair. Worse, however, is the situation in which the surgeon begins the dissection of the posterior floor, but is unable to properly identify the anatomical structures, which results in an injury to the iliac vein, bladder, cord structures or bowel. Complications such as these are avoidable in almost all cases by understanding the normal anatomy. This can be accomplished by reviewing tapes and slides of dissections performed by other experienced laparoscopic surgeons. Before undertaking one's first laparoscopic hernia repair, it is essential that the surgeon assist others as part of the educational process.

In some cases, the normal anatomy can be masked by complex, recurrent or incarcerated hernia. In these instances, the surgeon should begin dissecting from an area of normal anatomy and slowly dissect away the tissue so the landmarks can be identified. In the totally extraperitoneal approach, the pubis and Cooper's ligament will lead the surgeon to the iliac vein and inferior epigastric vessels, important guideposts to the repair. If there is an incarcerated femoral hernia, however, the iliac vein will be hidden behind the incarcerated sac, which must be reduced before the vein can be visualized. Knowing where the vein is located usually prevents inadvertent injury and sudden blood loss. If a direct hernia is incarcerated, the inferior epigastric vessels may not be visible until the sac is reduced. This sac, however, should not be ligated because the tip of the bladder may be part of the hernia and will be injured in the process. The indirect sac, if present, is lateral to the inferior epigastric vessels and identification of these vessels is essential. The surgeon must dissect this lateral tissue away from the abdominal wall to identify the peritoneum, as well as the cord structures. Unlike the TAPP (transabdominal preperitoneal)

approach, in which the indirect sac is obvious, in the totally extraperitoneal approach the indirect space must be dissected and identified by the surgeon in order not to overlook an indirect hernia.

In the transabdominal preperitoneal approach, the anatomy of the groin is usually more easily understood; but even in this approach, a complicated incarcerated or sliding hernia can cause confusion. By starting the dissection of the peritoneum above and lateral to the internal ring, manipulation of the bowel and cord structures can be avoided until the normal anatomy is identified. The indirect sac is lateral to the cord structures and can usually be peeled off the cord. If it is too long or adherent to the testicular vessels and vas deferens, it can be opened from lateral to medial, watching for the cord structures on the inferior medial aspect of the sac.

The most commonly reported complication, which is due to a lack of understanding of the anatomy or respect for the location of the normal structures, is injury to the nerves: the femoral branch of the genito-femoral nerve, the lateral cutaneous nerve or the femoral nerve itself. Cauterization, transection, or entrapment of the nerves can be avoided if the surgeon is respectful of the tissue below the iliopubic tract. This line can be identified visually as a fibrous band at the lower edge of the internal ring or by placing one's hand on the abdominal wall and palpating an instrument placed laparoscopically at the level of the iliopubic tract. If the surgeon cannot feel the instrument, the point of contact of the probe is below the iliopubic tract. Because the nerves enter the thigh below this line, injury can be avoided by placing fixation staples or tacks only above the iliopubic tract.

If immediate severe pain is present after surgery in a distribution of the femoral, lateral cutaneous or femoral branch of the genito-femoral nerve, the surgeon should re-explore the posterior wall laparoscopically, looking for the offending staple in order to remove it. Pain presenting days or weeks after surgery is usually transient and due to irritation of the nerves rather than entrapment. Only on a rare occasion will surgical re-exploration be necessary for this situation and should only be suggested if time and other measures, such as anti-inflammatory medication, have not helped. We are aware of one such case of a superficial abdominal wall nerve being entrapped in a staple and being relieved as late as six months after surgery by re-exploration and removal of the staple, after all other conservative measures had failed.

#### **COMPLICATIONS RELATED TO TECHNIQUE**

Small bowel obstruction can occur after a laparoscopic hernia repair, either from inadequate coverage of the mesh and formation of adhesions, or from intestines being trapped in a defect left in the peritoneum which was inadequately re-approximated. Reports of adhesions to exposed mesh with either the TAPP or the TEP repair (totally extraperitoneal hernia repair) are almost nonexistent, because surgeons have been able to mobilize the peritoneum to fully cover the mesh. Internal hernias caused by a defect in the peritoneum, however, have been reported on several occasions with the TAPP repair and in one patient who had a TEP hernioplasty. Whether staples or suture are used to close the peritoneum, gaps cannot be left in the peritoneal closure. A potential space is created between the peritoneum and the abdominal wall by the dissection of the posterior floor and by the CO<sub>2</sub> gas. Bowel may become obstructed at the entrance to this space. Even a small hole in the peritoneum may result in obstruction of the small bowel. Another cause of bowel obstruction after laparoscopic hernioplasty has been trocar hernias. Richter, as well as typical incarcerated hernias causing bowel obstruction, have been reported in port incisions from trocars of size 10 mm or greater.

##### **Trocar Hernia**

Inadequate closure of trocar sites, especially during the TAPP approach, has led to a new complication of inguinal hernia repair-the late development of trocar hernias. The closure of lateral trocar sites is difficult, and a significant number of trocar hernias have been reported. Many new devices and techniques have been proposed to assist in closing the puncture sites. Most pass a suture through the fascia under laparoscopic guidance, and back out the opposing fascia. Only time will tell if the improved techniques reduce the incidence of trocar hernias. It has been suggested that the midline placement of trocars in a TEP approach will decrease the overall incidence of new hernia formation, but it is too early to say.

## Haemorrhage

Bleeding can occur during any operation, but it is especially troublesome during a laparoscopic hernioplasty. Because of limited access to the bleeding site and high flow rates of those vessels most likely to be injured, bleeding must be controlled quickly or avoided completely. The location of the inferior epigastric vessels, the most common cause of bleeding, may vary. Therefore, the surgeon must stay lateral to the rectus muscles in order to avoid injuring them when placing the lateral trocars in the TAPP approach. If haemorrhage results following trocar insertion, it should be controlled with a U-stitch, using a Grise needle, or by removing the trocar and placing a figure-of-eight stitch around the vessels before the trocar is reinserted. A surprisingly large amount of blood can be lost, if these vessels are not controlled immediately. In the TEP approach the expansion of the balloon dissector may pull the inferior epigastric vessels away from the abdominal wall, tearing small branches which fill the potential space with blood. If the surgeon is confronted with a darkened, bloody field when the camera is reinserted, the light intensity should be immediately increased and the two midline trocars placed so that the extraperitoneal space can be irrigated to allow the surgeon to find the source of bleeding. Hemoclips, endoloops or bipolar cautery will usually handle the problem once it is identified.

Bleeding from the inferior epigastric vessels may also result from dissection of the hernia sac, but can usually be easily controlled by utilizing a two-handed technique, one instrument to compress the vessel and the other to ligate, clip or coagulate it. In contrast, haemorrhage from the iliac vein is a life-threatening complication if it occurs. If there is bleeding from the vein, the vein must be immediately compressed to control the haemorrhage and prevent a CO<sub>2</sub> embolus. While compressing the vein, a third port can be added in order to suture ligate the hole, or the procedure can be converted to an open repair for the suture ligation of the bleeding point.

## Spermatic Cord Injury

Injury to the vas deferens and testicular vessels are well known complications of open hernia repair. Although uncommon after laparoscopic hernioplasty, when these complications do develop, they are quite disturbing to the patient and the surgeon. Complications can usually be avoided by proper identification of the cord structures before any longitudinal structures are cut and by proper handling of the vas deferens and testicular vessels with atraumatic instruments. Pain in the scrotum from irritation of the genital branch of the genito-femoral nerve is seen in a small percentage of patients after laparoscopic dissection of the posterior floor. It has also been reported as a delayed complication in some patients, possibly due to compression or irritation of the nerve secondary to fibrosis around the cord. Fortunately, in most cases, this scrotal discomfort disappears with time. Ischemic orchitis, which has been reported to occur with open hernia repair in from 3-5% of repairs, has so far not been reported with the laparoscopic technique.

## COMPLICATIONS INHERENT TO REPAIR

Some complications of surgery are inherent in the procedures themselves and the surgeons must be able to recognize them. Seromas or hematomas, for example, are not unusual after the repair of large direct or scrotal hernias using the laparoscopic technique. Fluid accumulates in the dead space left by the hernia in from 2 to 10% of patients. If left alone, the seroma spontaneously resolves in 90% of the patients. If, however, the seroma is large or symptomatic, a single aspiration usually eliminates the problem. In an occasional patient, repeated aspirations are necessary, or even the use of an external drainage catheter. Although the seroma may at first appear to be an immediate recurrence of the hernia, by careful examination one is able to recognize the problem as a fluid collection. If there is any question, an ultrasound can be performed, but it is not usually necessary because of the classic characteristics of the seroma.

From months to years after a laparoscopic hernioplasty, a hydrocele may form in the scrotum. The incidence of hydrocele after laparoscopic hernioplasty is approximately equal to that of the open hernia repair (<1%) and may be related to lymphatic obstruction. It does not appear to be correlated with the incidence of previous seroma.

Urinary retention is seen in approximately 2% of patients after open or laparoscopic hernioplasty and is probably related to the group of patients undergoing the procedure as well as the technique itself. In our experience, preoperative placement of a catheter does not appear to influence the incidence of retention and has been

avoided. In the small number of patients that have developed the complication, outpatient management has been possible.

#### SUMMARY

Unfortunately, it is impossible to eliminate every complication which may occur after a laparoscopic hernioplasty, but it is possible to reduce their incidence. A thorough knowledge of the anatomy and the operative approach, along with advanced laparoscopic skills, will reduce the chance of a significant complication to less than one in a hundred. When complications do develop, the well-trained surgical laparoscopist should be prepared to reduce their morbidity by taking appropriate measures. In any new operation the learning curve plays an important role in the outcome of the procedure. To reduce its deleterious effects, surgeons should make every effort to work with others experienced in the procedure before venturing out on their own. In several large series with surgeons experienced in performing laparoscopic hernioplasties, morbidity, recovery time, and recurrence rates are extremely low. There is no reason why these results cannot be extended to a larger group of surgeons with proper education.

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