CHALLENGING HERNIAS POSTGRADUATE COURSE

Philadelphia, PA
Wednesday, April 9, 2008
The Pennsylvania Convention Center

Program Chair	**Adrian Park, MD**
Course Chair	**Bruce Ramshaw, MD**
SAGES President	**Steve Eubanks, MD**

COURSE OUTLINE AND TABLE OF CONTENTS

Title: Challenging Hernias
Date: Wednesday, April 9, 2008
Time: 1:00 PM – 5:00 PM
Course Chair: Bruce Ramshaw, MD

Description:

The SAGES Postgraduate Challenging Hernias Cases Course is a half day course focusing on the management of difficult or atypical inguinal and abdominal wall hernias. Leading authorities will review preoperative planning and perioperative management, relevant anatomy, treatment options with an emphasis on complication prevention and management to improve outcomes for these challenging inguinal and ventral hernias. Management of patients with inguinodynia, infected mesh and enterotomies during laparoscopic ventral hernia repair will be discussed. An update on novel and evolving techniques in the repair of atypical abdominal wall hernia repairs will also be reviewed.

Objectives:

During this session, participants will be exposed to:

- Discuss the management and prevention of complications during laparoscopic TAPP and TEP inguinal hernia repair and the repair of large scrotal hernias
- Review the management algorithm for inguinodynia
- Communicate treatment options for patients with infected mesh or enterotomy during laparoscopic ventral hernia repair
- Understand novel techniques to repair parastomal, flank, suprapubic, subxiphoid hernias and large ventral hernias with loss of abdominal domain
- Review techniques to prevent and manage recurrence after ventral hernia repair

Table of Contents

TAPP-Complicated Cases: Managing and Preventing Complications and Recurrences.

Dr. O. N. M. Panton, MB, BS, FRCSC, FACS,
Clinical Professor,
Head, Division of General Surgery, Vancouver General Hospital,
Acting Head, Division of General Surgery,
University of British Columbia,
Vancouver, BC, Canada
Email: neely.panton@vch.ca

Introduction:

The primary indications for laparoscopic inguinal hernia repair are recurrent and bilateral hernias (1,2). Numerous reports and trials demonstrate the safety and efficacy of the trans-abdominal preperitoneal repair (TAPP), (3,4,5). Current level 1 evidence strongly endorses open mesh repair for primary inguinal hernias based on outcome data for complications and recurrences (6,7). In my opinion, the Lichtenstein repair with a reported recurrence rate of 0.12% remains the gold standard for comparison of open mesh repairs (8,9).

Absolute contra-indications for TAPP are similar for laparoscopy in general including cirrhosis of the liver with ascites, coagulopathy, pregnancy and inability to tolerate general anaesthesia.

Relative contraindications include previous lower abdominal and pelvic surgery, previous laparoscopic inguinal hernia repair with mesh, strangulated hernias, scrotal hernias, morbid obesity, prostatism and procedures resulting in scar formation of the preperitoneal space such as retropubic prostatectomy. There are reports of the feasibility of laparoscopic hernia repair after radical prostatectomy and vice versa (10,11).

Patient selection is key in preventing complications and recurrences.

Abdominal Access:

The open Hasson technique potentially prevents the complications of hollow viscus and major vessel injury. An optical trocar entry is also a good choice. The lateral trocars should be inserted under laparoscopic vision lateral to the inferior epigastric vessels.

Dissection of the Preperitoneal Space:

I begin the dissection laterally just medial to the anterior superior iliac spine (ASIS), extending medially slightly superficial to the neck of the indirect/direct sac. The peritoneum is elevated anteriorly to expose the transverses abdominal arch laterally and rectus muscle medially. The posterior leaf of the peritoneum is

reflected along with the sac/sacs off the iliopubic tract laterally, the external iliac vessels, spermatic cord structures and Cooper's ligament medially.

Prevention of Vascular Injury:

The vessels at risk for injury during TAPP are the inferior epigastric and external iliac vessels.

The inferior epigastric artery (IEA) usually arises from the external iliac artery (EIA) just proximal to the internal inguinal ring with the deep circumflex iliac artery (DCIA) arising just distal. The DCIA usually immediately penetrates the transversalis fascia and is deep to the preperitoneal space reducing injury risk. The two vessels may share a common origin.

The IEA gives off the pubic and cremasteric branches near its origin which are at risk during the dissection of the indirect sac.

There are usually two inferior epigastric veins running on either side of the artery joining at the femoral sheath sharing a common entry into the external iliac vein. Injury to the inferior epigastric vessels is avoided by meticulous dissection and can be controlled by electrosurgical cautery, application of haematostatic clips or other vascular sealing devices.

The external iliac vein is especially at risk during the exposure of Cooper's ligament, injury is prevented by gentle blunt dissection and use of low risk energy sources such as bipolar cautery.

Uncontrolled haemorrhage from the external iliac vessels is an indication for conversion to laparotomy for vascular control.

Prevention of Nerve Injury:

Nerve injury can occur during dissection or mesh fixation with staples. The genitofemoral nerve (GFN) and femoral nerve (FN) are at risk during the dissection of the indirect sac and posterior peritoneal leaf.

The genital branch of GFN nerve usually pierces the iliopubic tract just lateral to the deep inguinal ring. Injury is avoided by keeping the dissection immediately deep to the peritoneum. Some surgeons dissect circumferentially around the spermatic cord in order to place a slit mesh at the deep ring. This potentially predisposes to GFN injury.

The femoral branch usually passes deep to the inguinal ligament within the psoas fascia, but it may pierce the iliopsoas and transversalis fascia. Rarely it may accompany the femoral artery within its sheath. This nerve is not at high risk for injury.

GFN injury by staples is avoidable by placement high on the transverses abdominal arch and just lateral to the deep ring above iliopubic tract. The FN lying lateral to the external iliac artery and under the iliac fascia is usually out of harms way, staple placement as described above avoids injury. The lateral cutaneous nerve of the thigh runs below the inguinal ligament about 2.5 centimetres medial and below ASIS and avoiding this zone during staple placement is crucial. The ilioinguinal and iliohypogastric nerves pierce the internal oblique muscle just medial and superior to ASIS to lie deep to the external oblique aponeurosis. These nerves are not high risk for injury but are within the range of staples with deep tissue penetration.

Prevention of Bladder Injury:

The urinary bladder is at risk during the medial dissection of the preperitoneal space and staple placement in the rectus muscle and Cooper's ligament. It may form the medial wall of the direct sac. It imperative to ensure that the bladder is empty at the beginning of the procedure, older patients with a history difficulty with voiding should have an indwelling catheter placed in the bladder prior to surgery.

Recognised bladder injuries should be repaired primarily with postoperative catheter drainage.

Prevention of Bowel Injury:

Bowel injuries may be encountered beginning with laparoscopic access and throughout the procedure.

Incarcerated small bowel contents of the sac can usually be reduced safely but the large scrotal hernia with large bowel contents can pose a great challenge. Sliding hernias also pose difficulties with reduction.

Counter pressure on the groin region may facilitate reduction of contents, but if bowel contents cannot be reduced without excessive traction the procedure should be converted to an open repair.

It is feasible to repair recognized bowel injuries during TAPP depending on the surgeon's expertise, but conversion is always a safe option.

In the event of peritoneal contamination by bowel injury during TAPP serious consideration should be given to aborting the procedure and performing a staged open repair when the patient has recovered.

Closure of the peritoneal incision is important to prevent post-operative bowel obstruction.

Prevention of Recurrence:

Predictors for recurrence include recurrent hernias, scrotal hernias, prostatism and increased body mass index (12). Inadequate mesh size, mesh defects, inadequate mesh fixation and missed hernias are also causes of recurrence (13). It is imperative to expose all potential hernia defects during dissection of the inguinal region. En bloc dissection of the sac/sacs with the posterior peritoneal leaf is important for providing mesh coverage, but of greater importance is the reflection of this leaf off the structures posterior to the deep ring preventing recurrence in the bare area where the mesh rests on the iliac vessels and cord structures.

A large mesh measuring 10-12 x 12-14 centimetres is important for wide coverage. Heavy weight polypropylene mesh will shrink by as much as twenty five percent of its original surface area, current lightweight meshes may reduce recurrence because there is less shrinkage.

Staple fixation of the mesh is controversial, direct hernias repaired by the total extraperitoneal repair possibly do not require fixation. However with TAPP I fix the mesh to the transverses abdominal arch just lateral and above the deep ring, and medially to the rectus muscle, transverses abdominal arch and Cooper's ligament.

Difficult Cases:

The chronically strangulated primary or recurrent scrotal hernia poses challenges for a TAPP approach. The patient should be consented for a laparoscopic and open approach, have a urinary catheter inserted preoperatively and be skin prepared from the epigastric region down to the mid-thigh region. TAPP affords the distinct advantage of sac content evaluation for acute strangulations and may negate laparotomy to evaluate suspected infracted bowel which may have reduced spontaneously on induction of general anaesthesia.

I do not attempt to repair recurrences after laparoscopic repairs with a TAPP approach because dissecting a scarred preperitoneal space is an invitation to injury. Plugs are especially difficult to dissect and are virtually impossible to cut with scissors. If a plug has to be transacted then a hooked dissector with a high cautery setting is an option.

Dissecting to expose Cooper's ligament after radical retropubic prostatectomy can be an extremely challenging procedure putting the iliac vein at risk for injury.

Summary:

TAPP has been proven to be safe and efficacious, the key to prevention of complications is patient selection and deploying a meticulous surgical technique. Recurrences are also preventable by patient selection, adequate defect exposure and the use of a large mesh with limited shrinkage. The newer lightweight meshes are preferable to heavyweight meshes.

References.

1. Panton ON, Panton RJ. Laparoscopic hernia repair. Am J Surg 1994;167(5):535-7.
2. Mahon D et al. Prospective randomized trial of laparoscopic (transabdominal preperitoneal) vs open repair for bilateral and recurrent inguinal hernia. Surg Endosc 2003;17(9):1386-90.
3. Stylopoulos N et al. A cost-utility analysis of treatment options for inguinal hernia in 1,513,008 adult patients. Surg Endosc 2003;17(2):180-9.
4. Memon MA et al. Meta-analysis of randomized clinical trials comparing open and laparoscopic inguinal hernia repair. Br J Surg 2003;90(12):1479-92.
5. Corbitt JD. Transabdominal preperitoneal herniorrhaphy. Surg Laparosc Endosc 1993;3(4):323-32.
6. Neumayer L et al. N Engl J Med 2004;350(18):1819-27.
7. Voyles CR et al. Meta-analysis of laparoscopic inguinal hernia trials favours open hernia repair with preperitoneal mesh prosthesis. Am J Surg 2002;184(1):6-10.
8. Amid PK. Lichtenstein tension-free hernioplasty: Its inception, evolution and principles. Hernia 2004;8(1):1-7.
9. Amid PK et al. A critical evaluation of the Lichtenstein tension-free hernioplasty. Int Surg 1994;79(1):76-9.
10. Dulucq JL et al. Totally extraperitoneal (TEP) repair after radical prostatectomy or previous abdominal surgery: Is it safe? A prospective study. Surg Endosc 2006;20(3):473-6.
11. Laungani RG et al. Impact of previous inguinal hernia repair on transperitoneal robotic prostatectomy. Can J Surg 2007;14(4):3635-9.
12. Matthews RD et al. Factors associated with postoperative complications and hernia recurrence for patients undergoing inguinal hernia repair: a report from the VA Cooperative Hernia Study Group. Am J Surg 2007;194(5):611-7.
13. Felix E et al. Causes of recurrence after laparoscopic hernioplasty. A multicentre study. Surg Endosc 1998;12(3):226-31.

NOTES

TEP – MANAGING AND PREVENTING COMPLICATIONS AND RECURRENCES

Guy R. Voeller, MD, FACS
Professor of Surgery
University of Tennessee at Memphis
President, The American Hernia Society

When discussing complications from TEP repair for inguinal hernia repair it is best to learn how to prevent them and then the surgeon doesn't have to be concerned near as much about management of these complications. The focus of this 15-minute talk will thus be on the proper technique for TEP repair. Our basic technique is available on the SAGES Top 14 Procedures All Surgeons Should Know but it has evolved even more so the fine points and changes not seen in the DVD will be discussed. If the technique is followed and in the hands of a competent laparoscopic surgeon the TEP can be done with very few complications. The following is based on my own personal series of over 2800 TEP repairs done since 1992. These are my patients, not some public or resident's clinic and it is thus a method that works time and time again or I would have stopped TEP long ago. When properly done TEP leads to a happy patient time after time and this leads to low stress for the surgeon, which is what we all are after. I do many open Lichtenstein inguinal hernia repairs and these are done when the patient cannot tolerate general anesthesia, in scrotal hernias that cannot be reduced into the abdominal cavity and if the patient has had previous preperitoneal surgery like prostate or previous laparoscopic hernia repair that has failed. I try to avoid going through scar tissue and will choose the operation that will avoid scarring and thus decrease the chance of complications.

I believe it is time to stop trying to "prove" what repair is "best" when it comes to inguinal hernia repair. I believe the best repair is whatever the surgeon has learned to do well and does most often. There is a huge difference when one is talking about what results a busy herniologist who does 200-300 inguinal hernia repairs a year can achieve when compared to the busy general surgeon who does 20-30 repairs a year. This has been shown many times with all repairs that are technically demanding. The Shouldice Clinic has results with all autogenous repair for inguinal hernia that was never able to be reproduced as many European countries tried to make it the "gold standard" in their countries. The same can be said for the TEP repair. The first step in preventing complications is to not do TEP if you only do 20-30 hernias a year. The TEP is a very demanding repair on the surgeon and it takes a long time and a lot of dedication to develop a technique that works well and with a low complication rate. I believe that we should begin to look at TEP repair in the same way we look at bariatric surgery. We now have centers of excellence for bariatric surgery to prevent the complications that occur more frequently in less talented and/or experienced

hands. The same certification should be done for those who wish to do TEP. In addition, it is commonly said that TEP should only be done for bilateral or recurrent hernias. Nothing could be further from the truth. If you want to eliminate complications from TEP you must learn to do it properly in unilateral, first time hernias. The TEP repair can be done well in 30-60 minutes eventually, but initially it may take 1-3 hours to do and to then have to do the contralateral side for another 1-3 hours can only lead to bad results. The same can be said for recurrent hernias. There is distortion of the anatomy that makes the dissection more challenging and can lead to problems when done by the inexperienced surgeon.

The next step in preventing complications is to learn the technique of TEP from someone who does it all the time. As Robert Condon said, the high rate of complications from inguinal hernia repair are caused by failure of the surgeon to learn a method from those skilled in its application. This is one of the main problems with many of the randomized trials of laparoscopic versus open hernia repair. It is very difficult for experienced surgeons to be involved in these trials. Patients come to me for the laparoscopic repair and are not interested in being part of trials. For this reason, the trials done in Europe and in Asia usually involved residents in the “public” hospitals doing the TEP and often times are supervised by staff that may not be well versed in the TEP. This is one of the criticisms of the VA study done here in the USA. It was a multicenter trial wherein the majority of surgeries were done by residents supervised by staff that often did not do TEP on a high volume basis. The recurrence rates were high in this study for both the laparoscopic and open repairs, but when the results were analyzed for experience, it can be seen that those surgeons with a large experience in TEP had very low recurrence rates. The surgeon interested in TEP must invest a lot of time with a TEP expert to avoid the complications that are seen in inexperienced hands.

The next step to avoid complications in TEP is a first rate video-endoscopic system. The anatomy involved with TEP contains many critical structures compacted in a very small space. While you may be able to do a cholecystectomy with an older system, TEP should be done with the best light source and optics available. While some surgeons repair hernias laparoscopically using a zero degree scope, I prefer a 45° scope since it allows the surgeon to see both the retroperitoneum and the anterior abdominal wall. These areas are in two different planes and a zero degree scope does not let the surgeon appreciate this nearly as well as the 45° scope.

Patient preparation also is important to decrease or eliminate complications. The bladder takes up a lot of room in the preperitoneal space when it is full of urine. When the surgeon is first learning TEP it will take 1-3 hours to accomplish properly and the bladder
will be in the way unless a catheter is in place. This makes the repair more difficult and increases the chance of complications. In addition, there have been

many reports of bladder injury in TEP. We have never had one bladder injury in over 2800 TEP repairs and I believe routine catheter drainage is the best way to AVOID the complication of bladder injury. Again, some surgeons have the patient urinate before the procedure but we have found that with anesthesia giving fluids as they do, the bladder is quickly in the way and this is not optimal for the novice to be sure. We always use an Ioban® protective drape so the mesh never encounters skin or gloves that have touched the skin. We have NEVER had one infection in over 2800 TEP repairs and this I believe is a wonderful aspect of the repair.

The next step is safe access to the preperitoneal space. While it is true that blunt dissection can be done I believe that using balloon dissection is safer and quicker. I have been part of live surgery sessions wherein surgeons doing blunt dissection were doing TEP repairs while I did balloon dissection to enter the preperitoneal space during a TEP repair. I have always been able to access the space and begin dissection of the structures much quicker than the surgeons doing blunt dissection to enter the space. When one is talking about cost-effective surgery, time must be included and while the balloon may cost more, it more than pays for itself when OR time is considered. I have always used the unilateral round, elastic balloon. I only want to gain access to the preperitoneal space and the round elastic balloon allows this to be done quickly and safely. The main complication I have seen with balloon use is small blood vessels being disrupted in 5-10 cases that had to be cauterized. I have never had disruption of the inferior epigastric vessels. I do not use the bilateral balloons since they are more prone to disrupt the epigastric vessels and in addition, if you are not doing a bilateral repair you have dissected a space that you may want to enter at a later date if a hernia develops.

Once access to the preperitoneal space has been safely gained, the medial and lateral areas (relative to the epigastric vessels) of the myopectineal orifice and their contents are reduced first and swept cephalad. The next step is to enter the space lateral to the epigastric vessels. The peritoneum must be dissected off of the cord, the anterior abdominal wall and the retroperitoneum and as Stoppa said, swept cephalad to the level of the umbilicus. To properly do this as described by Stoppa, I again recommend a 45° laparoscope. In sweeping the peritoneum off of the anterior abdominal wall the surgeon will find in some patients the insertion of the arcuate line is more caudad than usual and in the way and this will limit proper dissection and mesh placement. In these patients it is very simple to release this insertion with scissors and sweep it cephalad to get it out of the way. To prevent damage to the cord structures, it is best to pull the peritoneum or indirect sac on the cord medially while you sweep the cord structures laterally. The plane is between the blood vessels of the vas deferens and the peritoneum. If the sac is large and will not readily come out completely then one should transect the sac and leave the distal part in the groin and sweep the proximal peritoneum to the level of the umbilicus. This will prevent damage to the cord structures. If the cord structures are densely adherent to the sac then

the surgeon should enter the sac at 12 o'clock and cut the sac from the inside. As you cut the sac the cord structures will fall away safely. The medial border of dissection is the iliac vein or the fat overlying the vein. The lateral border is the psoas muscle. This peritoneum readily sweeps off of the psoas and the mesh must lay on the psoas to prevent a recurrence up under the mesh. The nerves run on the psoas and are readily avoided and not traumatized if the surgeon is well versed in the TEP technique. If a hole in the peritoneum occurs we never close the hole. It is only a gapping hole when CO2 is distending the peritoneal cavity. If all of the gas is released then the peritoneal edges coming together and seal within 24 hrs. We have had tears in hundreds of repairs that we never closed and never had a postop bowel obstruction in over 2800 TEP repairs. When the tear occurs I turn down the pressure to 10 from 12 mmHG. If my space is compromised we were the first to describe placing a Verress needle as a vent. If my space is not compromised, I place the Verress needle at the end of the case through the access incision into the peritoneal cavity to completely evacuate all CO2. However you choose to use the Verress, you must evacuate ALL CO2 and you will not have to worry about a bowel obstruction as a complication of a peritoneal tear.

Once the proper dissection has occurred, the next step in TEP is mesh placement. As in the open procedure described by Rives and Stoppa, we believe polyester mesh is the best mesh for TEP since it readily conforms to all the little curvatures of the preperitoneal space. Newer lower weight polypropylene meshes are more compliant and softer than the original heavy weight meshes and handle similarly to the polyester meshes and are probably just as good as the polyester mesh. I use the anatomic polyester mesh that is specifically designed for the TEP and meshodynia, as a complication has not occurred in my series. The key is to stay away from the heavyweight meshes that shrink and contract and stiffen and lead to meshodynia as a complication. The last step in TEP repair is fixation of the mesh. Many surgeons do not utilize fixation and I think this is fine with indirect hernias and smaller direct hernias however as Katkhouda demonstrated, the mesh does move in the first 24 hrs. so I have always utilized fixation for all but the smallest of hernias. We originally used the tacker and never have had to go back and remove a tack due to pain. The key to tacking is limited use and staying away from anything but Cooper's Ligament and the anterior abdominal wall. Several years ago we went to fibrin glue fixation and found even with the limited tacking that we did, the fibrin glue patients had less pain postop. This has been confirmed by several randomized trials.

Side effects of TEP repair are seroma and bruising. Most seromas will disappear over time but I have aspirated seromas if the patient desires or they do not resolve. We originally described tacking the transversalis fascia to Cooper's Ligament to help avoid seromas as George Wantz described for open preperitoneal hernia repair. We no longer do this however and seromas have not been a problem. Most studies show that TEP has less pain, quicker recovery

and less chronic pain than open repair when it is properly done. This is why patients seek out the repair. I however do the repair for the reason so well put by George Wantz when discussing open preperitoneal repair “when properly performed preperitoneal hernioplasty should prevent all hernias of the groin”.

REFERENCES

1. George S, Mangiante E, Voeller G. Preperitoneal herniorraphy for the acute incarcerated groin hernia. Am J Surg 1991; 57:139-41.
2. Voeller G, Mangiante E. Totally preperitoneal laparoscopic inguinal herniorraphy using balloon dissection. Scand J Gastroenteral 1995; 30 (suppl 208): 67-73.
3. Ramshaw B, Abiad F, Voeller G, Wilson R, Mason E. Polyester mesh for total laparoscopic inguinal hernia repair: initial experience in the USA. Surg Endosc 2003; 17(3): 498-501.
4. Shptiz B, Lansberg L, Bugayev N, et al. Should peritoneal tears be routinely closed during laparoscopic TEP repair of inguinal hernias? Surg Endosc 2004; 18:1771-1773.
5. Lovisetto F, Zonta S, Rota E, et al. Use of human fibrin glue versus staples for mesh fixation in laparoscopic Transabdominal preperitoneal hernioplasty. Ann of Surg 2007; 245:222-30.
6. Voeller G. Laparoscopic approach to inguinal hernia repair. Prob in Gen Surg 2002; 19(4): 42-50.

NOTES

The Large Scrotal Hernia

Gina L. Adrales MD, FACS
Assistant Professor
Dartmouth Medical School

Director of Hernia Surgery Center
Department of Surgery
Dartmouth-Hitchcock Medical Center
One Medical Center Drive
Lebanon, NH 03756

The large scrotal hernia is a challenge for both the patient and the surgeon. Fear or indifference may have deterred the patient from undergoing repair. Apart from the sizeable bulge, the hernia may be remarkably asymptomatic which makes postoperative expectations as well as any postoperative pain and swelling a challenge for the surgeon to address. Concomitant medical disease and/or lack of medical care may be the reason for delay in seeking repair. These are important considerations; comorbidities such as pulmonary disease should be optimized prior to repair.

A successful outcome is largely dictated by careful preparation and diligent postoperative care. Preoperatively, factors which may affect hernia recurrence should be discussed. Prostatism and constipation with associated abdominal straining should be controlled. Screening colonoscopy, if age and risk appropriate, should be recommended if there is no colon incarceration to pose an increased risk of perforation. As mentioned, pulmonary disease and particularly coughing and fitness for general anesthetic should be addressed. Smoking cessation at least two weeks prior to surgery is recommended. Discussion with the patient regarding the effect of smoking on wound healing, chronic cough, and hernia recurrence may be worthwhile. The patient should be questioned regarding symptoms of incarceration and strangulation, previous hernia repair, previous scrotal or abdominopelvic surgery, and previous wound infection. If the problem is a recurrent hernia, review of the previous operative note is critical in planning the appropriate repair. Obesity is a prevalent factor. Preoperative weight loss should be discussed with the patient, particularly if loss of domain is a potential risk.

A careful preoperative physical exam is of utmost importance. Attention should be paid to reducibility of the hernia and the presence of a contralateral defect which will weigh in the decision regarding surgical approach. One should conduct a careful evaluation and documentation of any nerve involvement including areas of anesthesia, hyperesthesia, and contact dysesthesia. The exam should include a scrotal examination taking note of any testicular or cord

masses, the testicular lie, and extent of the scrotal sac. Preoperative documentation of the degree of descent of the testes and any difference among them may become helpful information postoperatively. A meticulous skin exam is helpful to rule out a skin rash, eczema, or candidiasis which may increase the risk of wound and mesh infection. Cutaneous candidiasis should be treated with a full course of an antifungal and continued for a week after the rash is visibly cleared to facilitate full resolution. Chronic open sores raise suspicion for Staphylococcus infection and possible methicillin- resistant Staph infection. This should be addressed as well and if MRSA positive, eradication treatment may be beneficial.

Preoperative discussion and full informed consent should be conducted, including but not limited to a discussion of the potential risk of ischemic orchitis, vas deferens injury, nerve injury and chronic pain. [TABLE] The management algorithm should a bowel or bladder injury occur should be well formulated and discussed with the patient. Additionally, the handling of the cutaneous nerves should it be apparent that these are at risk for entrapment or neuroma should be discussed. If the nerve appears to abut the mesh in open repair or is at risk of entrapment, transection of the nerve and burying the ends away from the mesh may reduce the risk of post-herniorrhaphy inguinodynia. Chronic neuropathic pain is difficult to treat and prevention is key.

Perioperatively, a prophylactic antibiotic should be given with the appropriate timing before surgery (within an hour prior to incision, first generation cefazolin for most, Vancomycin if concern for MRSA, add fluconazole if recent history of candidiasis). Consider foley placement rather than just preoperative voiding as the procedure may take longer than usual. Alternatively, preoperative voiding but wide prep including the scrotal area allows intraoperative foley catheterization if it should become necessary. If open repair is the desired approach, local anesthetic with sedation may not be adequate due to peritoneal handling and the challenge of repair of the large scrotal hernia.

Postoperatively, measures such as an ice pack to the surgical site and NSAIDs can help reduce postoperative discomfort. Scrotal support and scrotal elevation while at rest may limit postoperative scrotal swelling. Opioid induced constipation may be addressed with a stool softener or bowel regimen. Again, thorough preoperative education makes for a more prepared and happier patient postoperatively.

Operative approach

For the laparoscopic repair, the transabdominal approach (TAPP) is preferred over the totally extraperitoneal repair (TEP). The comparatively blind or undirected TEP balloon dissection poses a risk to incarcerated viscera. There also may be limited working space with the large incarcerated hernia with the TEP approach. Alternatively, the transabdominal approach allows identification of the incarcerated contents and reduction from the peritoneal side. Via the

TAPP, the surgeon is able to approach the sac from the peritoneal cavity as well as the preperitoneal space.

Technical points

The prep should be wide to include the full inguinal area and scrotum. This permits external reduction of the hernia to aid in dissection and exposure. A dry field is imperative to allow identification of the peritoneal edge and hernia sac as well as the cord structures. Electrocautery should be used judiciously, though, due to the tight working space and the risk of coupling and direct bowel injury. Clips can be used for hemostasis but care should be exercised to avoid nerve entrapment. Hand over hand retraction with atraumatic graspers along with concomitant external compression of the hernia will facilitate hernia reduction. It is often advantageous to start medially to define Cooper's and the adjacent anatomy. Identify the edge of the hernia sac close to the peritoneal side to identify the cord structures and begin to separate them using a combination of blunt and careful sharp dissection. Sharp dissection should be limited until it is clear that the cord structures will be preserved. The testicular vessels are often thinned and the cord structure anatomy distorted in the presence of the large chronically incarcerated scrotal hernia. With sac reduction, one must be vigilant for adherence to the external iliac vessels. The peritoneal edge should be dissected away from cord structures well over psoas to allow wide mesh coverage. In the case of a thickened incarcerated sac tethered in the scrotum, the sac may be divided after ensuring that cord structures are fully separated and are lying posteriorly. Consider sac division when it is apparent that retraction of the sac is pulling up the tunica vaginalis and testicle. Once the dissection is completed, wide mesh coverage is performed. If the peritoneum has not been well preserved so that reperitonealization of the mesh may not be possible, an adhesion barrier mesh may be used.

Open mesh repair may be the preferred option for the patient with a history of multiple abdominal surgeries, severe pulmonary disease and suspected pneumoperitoneum intolerance, or the firmly or acutely incarcerated hernia with possible strangulation. Conversion from laparoscopy to open repair may be necessary when the working space is very limited or the incarcerated sac is severely thickened and adherent. Uncontrolled bleeding is also an indication to open. Once reduced, the large scrotal hernia is generally amenable to a Lichtenstein approach. For extensive hernias with floor disruption, this approach may not provide adequate coverage and giant prosthetic reinforcement as advocated by Wantz or the Stoppa repair should be considered.

CONCLUSION

With thoughtful patient selection and careful preparation, the laparoscopic approach to the large scrotal hernia is feasible. The ability to conduct the repair laparoscopically is dependent on the level of working space and degree of the chronic scarring where further laparoscopic dissection may pose a risk to adherent vascular and visceral structures. Regardless of the approach, a

successful outcome in terms of hernia recurrence relies on an adequate wide dissection and mesh coverage.

SUGGESTED READING

Wake BL, McCormack K, Fraser C, Vale L, Perez J, Grant AM.Transabdominal pre-peritoneal (TAPP) vs totally extraperitoneal (TEP) laparoscopic techniques for inguinal hernia repair.Cochrane Database Syst Rev. 2005 Jan 25;(1):CD004703.

McCormack K, Scott NW, Go PM, Ross S, Grant AM; EU Hernia Trialists Collaboration.Laparoscopic techniques versus open techniques for inguinal hernia repair.Cochrane Database Syst Rev. 2003;(1):CD001785.

Matthews RD, Anthony T, Kim LT, Wang J, Fitzgibbons RJ Jr, Giobbie-Hurder A, Reda DJ, Itani KM, Neumayer LA; Veterans Affairs Cooperative 456 Studies Program Investigators.Factors associated with postoperative complications and hernia recurrence for patients undergoing inguinal hernia repair: a report from the VA Cooperative Hernia Study Group.Am J Surg. 2007 Nov;194(5):611-7.

Wantz GE.Giant prosthetic reinforcement of the visceral sac. The Stoppa groin hernia repair.Surg Clin North Am. 1998 Dec;78(6):1075-87.

Rebuffat C, Galli A, Scalambra MS, Balsamo F.Laparoscopic repair of strangulated hernias.Surg Endosc. 2006 Jan;20(1):131-4. Epub 2005 Dec 7.

NOTES

Laparoscopic Approach for Multiple Recurrent Hernias or Previous Preperitoneal Surgery or Mesh in the Extraperitoneal Space

Archana Ramaswamy, MD, FACS
Assistant Professor of Clinical Surgery

University of Missouri
One Hospital Drive, DC075.00
Columbia, MO 65212

Total extraperitoneal (TEP) and Transabdominal preperitoneal (TAPP) repair of recurrent hernias, initially repaired by conventional open approaches, is often relatively straightforward as the preperitoneal space is untouched. Previous surgery in this space, or multiply recurrent hernias can necessitate different approaches to accomplish a safe and feasible repair.

Recurrence following laparoscopic hernia repair follows different patterns than after an open hernia repair. Following previous TEP, recurrences are more common early in surgeon's experience. Indirect recurrences are more common than direct recurrences. Indirect recurrences may be due to inadequate dissection of the deep ring and spreading of the mesh inferiorly and laterally, thus potentially leading to superior migration of the mesh (1). Other causes of recurrence may be due to small mesh size, missed hernia, and lack of fixation leading to migration or inadequate position. Following previous TAPP, recurrences have been related to the size of the mesh, recurrence along slit cut in mesh and mesh migration. This mesh migration has been seen either at its lateral, most inferior part in lateral hernias or medially at the Cooper's ligament in direct defects. (2)

Concerns with previous surgery in the preperitoneal space include the risks of bladder, vascular and bowel injury. Common surgeries which were considered as contraindications for repeat TEP include: TEP/TAPP, open appendectomy, c-section, prostatectomy, and lower midline incision for bowel surgery. Further complicating the situation are the reports that inguinal hernias are more frequent following prostatectomy, and potentially even following lower midline incision for non prostate urologic procedures (3).

Operative approach:

Is TEP possible following previous TEP?
Many authors feel the extraperitoneal space does not exist once previous dissection has been performed either with or without mesh placement. TAPP has been advocated in these instances. Repeat TEP has been described (4,5) focusing on avoidance of balloon dissection, using sharp dissection, ligating epigastric vessels if necessary and

identification of the pubis. Significant surgeon experience in primary TEP hernia repairs is probably necessary to proceed safely with TEP following previous TEP.

Is TEP possible following previous lower abdominal surgery?
Again as experience with TEP has increased, modifications in the technique have been described to proceed with TEP in these circumstances. Unilateral hernias may be approached by staying on the ispilateral side with the balloon dissector and avoiding the midline (lower midline incisions) or by staying on the contralateral side and performing limited balloon dissection and lateral dissection (appendectomy incisions). (6) Outcomes in comparative series demonstrate slightly longer operative times, but similar complication and recurrence rates. (7)

TAPP- special considerations:
The bladder may be difficult to identify due to scarring. 3–way Foley catheter can be beneficial in these situations if necessary to fill up the bladder with saline with or without methylene blue. Anatomy of the epigastric and femoral vessels may be distorted and dissection should proceed cautiously. If hernia repair needs to be performed, mesh for intraperitoneal placement should be used if the peritoneum cannot be closed over the mesh.

References:

1. Lamb, A D G. Robson, A J. Nixon, S J. Recurrence after totally extraperitoneal laparoscopic repair: implications for operative technique and surgical training. Surgeon Journal of the Royal Colleges of Surgeons of Edinburgh & Ireland. 4(5):299-307, 2006 Oct
2. Leibl BJ. Schmedt CG. Kraft K. Ulrich M. Bittner R. Recurrence after endoscopic transperitoneal hernia repair (TAPP): causes, reparative techniques, and results of the reoperation. Journal of the American College of Surgeons. 190(6):651-5, 2000 Jun
3. Stranne J. Hugosson J. Lodding P. Inguinal hernia is a common complication in lower midline incision surgery. Hernia 11(3): 247-52, 2007 Jun
4. Ferzli GS. Shapiro K. DeTurris SV. Sayad P. Patel S. Graham A. Chaudry G. Totally extraperitoneal (TEP) hernia repair after an original TEP Is it safe, and is it even possible?Surgical Endoscopy. 18(3):526-8, 2004 Mar
5. Ferzli GS, Khoury GE. Treating recurrence after a totally extraperitoneal approach. Hernia 10(4): 341-6, 2006 July
6. Schwab JR. Beaird DA. Ramshaw BJ. Franklin JS. Duncan TD. Wilson RA. Miller J. Mason EM. After 10 years and 1903 inguinal hernias, what is the outcome for the laparoscopic repair? Surgical Endoscopy. 16(8):1201-6, 2002 Aug.
7. Dulucq JL. Wintringer P. Mahajna A. Totally extraperitoneal (TEP) hernia repair after radical prostatectomy or previous lower abdominal surgery: is it safe? A prospective study. Surg Endosc 20(3): 473-6, 2006, Mar

NOTES

Inguinodynia – What to do?

Patricia L. Turner, MD

- Incidence of inguinodynia is likely higher than reported in the literature

- Review of anatomy
  - Nerves
    - Ilioinguinal
    - Iliohypogastric
    - Genitofemoral
    - Lateral femoral cutaneous
    - Femoral
  - Triangles
  - Dissection techniques

- Techniques for prevention of nerve entrapment, trauma

- Treatment
  - Analgesics
  - Local injection
  - Re-exploration
    - Removal of tacks
    - Removal of prosthetic
  - Neurectomy

NOTES

Management of Infected Mesh in Incisional and Inguinal Hernias

Eduardo Parra-Davila, MD, FACS, FASCRS
Boca Raton, FL

James R. Barron, Jr. MS3
University of Florida College of Medicine, Gainesville, FL

Prosthetic mesh is widely used in the repair of incisional and inguinal hernias. Mesh hernia repairs have lower failure rates (as defined by recurrence of the hernia) than do primary repairs.[1] This lower failure rate comes at the price of mesh-related complications, such as extrusion, infection and enterocutaneous fistula formation.[2,3] These infections may appear immediately in the postoperative period, but can also occur as late post-operative complications. Also, these infections may be caused by mesh extrusion or the presence of an enteric fistula. The treatment of infected mesh is a difficult surgical challenge, not only due to the procedure itself, but also due to the co-morbidities and suboptimal physical condition of this patient population. The clearest manner, and most common reflex reaction of physicians dealing with this problem, is removal of the infected mesh. However, the challenge of this procedure is removing the mesh, maintaining a competent and functioning abdominal wall, while avoiding postoperative evisceration.

Primary prevention of mesh infection can be managed by addressing pre-operative risk factors, the type of operation performed, the length of the operation, and the type of material used. Studies have also shown that cardiopulmonary disease, chronic steroid use, and low preoperative serum albumin levels are significant independent predictors of wound infection in these patients.[4] Therefore, consideration should be given to optimize these factors in patients before abdominal wall hernia repairs or treating their complications in order to reduce postoperative morbidity. Addressing the use of open versus laparoscopic operations, Yerdel et. al. has demonstrated that in open groin hernia repair with mesh, the infection rate can be as high as 9%,[5] whereas laparoscopic ventral hernia repair has a 0.7-2% incidence of mesh infection.[6] The open ventral repair is associated with a wound infection rate ranging from 7-18%.[7]. Studies have shown that patients with wound infection have significantly longer operative times, including surgeries with operative time greater than 4 hours, when compared to the overall population. Biological materials provide a number of potential benefits including an increased infection tolerance, host tissue ingrowth, vascularization, and decreased adhesion formation compared to synthetic prosthesis. However, the disadvantage of biomaterials includes the higher cost of these materials.

If infection does occur, the most traditional treatment for infected mesh is antibiotic therapy, open wound drains (as needed), and surgical removal of the mesh. This is followed by either immediate or delayed reconstruction of the abdominal wall. Most of the infected mesh is removed during an open procedure, although we have removed infected mesh via the laparoscope. Laparoscopic approaches are more challenging, especially if bowel is involved. Evisceration and/or injury to the bowel during this sometimes very lengthy intervention are the primary complications that the surgeon fears.

Almost all studies on abdominal wall implant infections report the presence of polymicrobial strains and treatment should be directed to address this finding.[8] However, cases of methicillin-resistant Staphylococcus aureus-infected prosthetic mesh have drawn notable attention. Patients have received negative pressure wound therapy to help facilitate healing without removing the prosthetic mesh. Following several weeks of this therapy, the wound is allowed to close by secondary intention.[9] The literature contains many case studies about the use of negative pressure wound therapy for a variety of wounds but information about its safety and effectiveness for managing methicillin-resistant Staphylococcus aureus-infected prosthetic mesh is limited and controlled clinical studies are warranted.

Replacing the mesh produces a clinical problem as placement of permanent mesh in heavily contaminated fields has been found to have infection rates as high as 50% to 90%.[10] Because of these high rates of infection, biological mesh is most commonly used in most of these situations. Although salvage of infected mesh has been reported, the feasibility, efficacy and long term outcomes of this practice are not totally clear. Mesh with extensive infection usually can not be salvaged, while limited mesh infections can be managed successfully with the use of percutaneous or open drainage, vacuum negative pressure wound therapy and prolonged antibiotic therapy.

Surgically implanted mesh is vulnerable to infection by a number of factors, including the local inflammatory environment, the structural properties of the mesh, and the pathologic features of the infecting bacteria. A sound understanding of these three factors will aid the clinician in anticipating and managing this complication.

Firstly, implanted mesh produces an intense inflammatory reaction that may impair the function of local host tissue defenses, such as polymorphonuclear lymphocytes, reducing the ability of the host to opsonize and phagocytize invading bacteria. Even with the use of a sterile technique and the administration of prophylactic antibiotics, mesh infection continue to complicate the use of biomaterials. Few investigators have addressed the ability of bacteria to proliferate on or attach to the surface of these biomaterials.[11] The ability of a biomaterial to resist infection has serious clinical significance. This resistance is

a function of bacterial attachment, the composition of the biomaterial, and the interaction with the host's local tissue defenses.

Secondly, the structure of the mesh can provide a suitable habit to foster the growth the bacteria. Klinge et al [12] demonstrated that because of their increased surface area, multifilamented biomaterials enable significantly more bacterial adherence than monofilamented biomaterials. Bellon et al [13] established, using electron microscopy, that alterations in the structure of the ePTFE were produced by Staphylococcus aureus colonies. By creating fissures in the structure of the ePTFE, such alterations allow the bacteria to have better adherence to the mesh. This situation is worsened by having micro pores of less than 10µm, known to be prone for infection by interfering with the migration of cells in the tissue to fight the infection. This is one of the reasons why most surgeons remove almost all the ePTFE mesh that has become infected.

Lastly, the production of a biofilm on synthetic mesh protects bacteria from the host's immune response and antibiotic therapies. This characteristic of certain organisms makes infection especially troublesome. Micro-organisms producing this biofilm are protected against the host immune response and antimicrobial defense.[14] In general, slime-producing micro-organisms survive better on synthetic surfaces than non-biofilm producing micro-organisms and this should be considered a clinically important pathogenic property of these bacterial strains.[15] Common biofilm producing organisms include S. aureus, S. epidermidis, E. coli and enteroccocal strains. When micro-organisms have adhered to a biomaterial surface, they are protected against phagocytosis, as the micro-organism and biomaterial together are too large to ingest. This infection generally must be treated by removal of the mesh, although negative pressure wound therapy may destroy the biofilm at the mesh and allow healthy granulation to occur. The knowledge of the mechanisms of bacterial adherence and biofilm formation is still in its infancy and requires further intensified research efforts to develop a clinically applicable mode of treatment, which is medically satisfactory and comforting for the individual patient. However, a number of recent publications seeking to characterize this mechanism describe the onset of mesh infection, involving abscess formation, with a striking delay of up to 39 months after implantation.[16]

The following principles/procedures are applied in the presence of infected wounds in hernia repair procedures in which mesh has been used to decrease recurrences:

A) Antibiotic therapy PO or IV. Culture wound.
B) Revision of wound (with probe)
C) Radiologic studies (US or CT scan abdomen and pelvis).Always look for collections not drained
D) Intact wound + drain placement
E) Open wound + surgical debridement + drain placement

F) Open wound + surgical debridement + vacuum negative pressure wound therapy
G) Open wound + surgical debridement + vacuum negative pressure wound therapy + delay split thickness skin graft
H) Open wound + surgical debridement + removal of mesh + vacuum negative pressure wound therapy + delay split thickness skin graft or component separation technique
I) Open wound + removal of mesh + immediate component separation technique
J) Open wound + removal of mesh + immediate component separation technique + biological mesh
K) Open wound + removal of mesh + biological mesh

Conclusion:
The use of a surgical mesh forces the clinician to choose between the risks of mesh-related complications versus a suboptimal treatment without a device and high recurrence. Infection of the mesh is a devastating complication resulting in long-term morbidity and possible removal of the implanted material.
The better knowledge of the mechanisms of infection, therapy modalities and the creation in the future of mesh resistant to infection will benefit this complex group of patients.

References
1. Luijendijk RW, et al.A comparison of suture repair with mesh repair for incisional hernia. N Engl J Med 2000; 343: 392-397
2. Leber GE, et al.Long term complications associated with prosthetic repair of incisional hernias. Arch Surg 1998; 133:378-382
3. White TH, et al.Factors affecting wound complications associated with prosthetic repair of incisional hernias. Am Surg 1998;133: 378-382
4. Dunne JR, et al.Abdominal wall hernias: risk factors for infection and resource utilization. J of Surg Res, 2003; 111, 78-84
5. Yerdel MA, et al.Effect of single-dose prophylactic ampicillin and sulbactam on wound infection after tension-free inguinal hernia repair with polypropylene mesh: the randomized, double blind, prospective trail. Ann Surg 233: 26-33
6. Heniford BT, et al.Laparoscopic repair of ventral hernias: nine years experience with 850 consecutive hernias. Ann Surg 238: 391-399.
7. Park A, et al.Laparoscopic and open incisional hernia repair: a comparison study. Surgery 1998; 124: 816-821
8. Engelsman AF, et al. The phenomenon of infection with abdominal wall reconstruction. Biomaterials 28 , 2007: 2314-2327
9. Steenvoorde P, et al. Negative pressure wound therapy to treat peri-prosthetic methicillin-resistant Staphylococcus aureus infection after incisional herniorrhaphy. A case study and literature review. Ostomy Wound Manage. 2006 Jan;52(1):52-4.

10. Dayton MT, et al.Use of an absorbable mesh to repair contaminated abdominal wall defects.Arch Surg. 1986; 121:954-690.
11. Carbonell AM, et al.The susceptibility of prosthetic biomaterials to infection. Surg Endosc, 2005;19: 430-435
12. Klinge U, et al.Do monofilament alloplastic meshes increase the infection rate? Analysis of the polymeric surface, the bacteria adherence, and the in vivo consequences in the rat model. J Biomed Mater Res 2002;63:765-771
13. Bellon JM, et al.In vitro interaction of bacteria with polypropylene/ePTFE prostheses.Biomaterials 2001; 22: 2021-2024
14. An YH, et al. Concise review of mechanisms of bacterial adhesion to biomaterial surfaces. J Biomed Mater Res 1998; 43 (3): 338-48
15. Gristina AG, et al. Infection from biomaterials and implants: a race for the surface. Med Prog Technol 1988; 14 (3-4): 205-24.
16. Coda A, et al.Reoperations for chronic infections following prosthetic hernia repair. Hernia 1998; 2: 163-7.

NOTES

LAPAROSCOPIC REPAIR OF SUPRAPUBIC VENTRAL HERNIAS

B. Todd Heniford, M.D.

Abstract

Introduction: The complexity of dissection and the close proximity of the hernias to bony, vascular, nerve, and urinary structures make the laparoscopic repair of suprapubic hernias (LRSPH) a formidable operation. This study prospectively evaluated the outcomes of patients undergoing LRSPH.

Methods: A prospective study of patients undergoing LRSPH from July 1996 to January 2004 was conducted. Patient demographics, hernia and mesh size, perioperative outcomes, and recurrences were documented. The repair has evolved to include transabdominal suture fixation to the pubic bone, Cooper's ligament and above the iliopubic tract.

Results: Thirty-six patients (26 F: 10 M), with a mean age of 55.9 yrs. (range, 33-76) and a mean BMI of 31.0 kg/m^2 (range, 22-67) underwent LRSPH. Twenty-two (61%) of the repairs were for recurrent hernias, with an average of 2.3 previously failed open repairs each (range, 1-11). The mean hernia size was 191.4 cm^2 (range, 20-768), with an average mesh size of 481.4 cm^2 (range, 193-1428). All repairs were performed with ePTFE. Mean OR time was 178.7 min (range, 95-290), with a mean blood loss of 40 cc (range, 20-100). One patient undergoing her fifth repair required conversion due to adhesions to a polypropylene mesh. Hospital stay averaged 2.4 days (range, 1-7). Mean follow up was 21.1 months (range, 1-70). Complications (16.6%) included: deep venous thrombosis (1), prolonged pain greater than 6 weeks (1), trocar site cellulitis (1),

ileus (1), prolonged seroma (1), Clostridium difficile colitis (1). Hernias recurred in 2 of our first 9 patients, for an overall recurrence rate of 5.5%. Since initiating the technique of applying multiple sutures directly to the pubis and Cooper's ligament (in the subsequent 27 patients), no recurrences have been documented.

Conclusions: Although technically demanding and time-consuming, the LRSPH is safe, technically feasible, results in a low recurrence rate, and is applicable to large or multiply recurrent hernias. Transabdominal suture fixation to the bony and ligamentous structures yields a durable hernia repair.

Introduction

Incisional hernias may develop in 11-20% of patients undergoing laparotomy, and after a primary repair, these hernias may recur in up to 45% of patients.[4, 14, 20] With the development of laparoscopic techniques, the recurrence rate for ventral hernia repair is frequently reported to be below 4%.[2, 6, 16, 18] Based on the open, retrorectus, Stoppa[19] technique requiring wide coverage of the hernia defect, the laparoscopic approach is associated with few recurrences, rapid hospital discharge, improved cosmesis, a reduced risk of infection, and possibly less postoperative pain.[2, 6, 16, 18] Certain critical steps are required to ensure a reliable laparoscopic ventral hernia repair, such as a minimum of 4-5 centimeter mesh overlap of the hernia defect, and mesh fixation with both full-thickness abdominal sutures, and helical tacks.[8, 9] Although no randomized, prospective studies have been performed, a strong association has been made in the literature between hernia recurrences and the lack of mesh fixation with full-thickness abdominal sutures.[6, 8, 9]

The terms suprapubic and parapubic are often used interchangeably. When used to describe hernias, they refer to those located just above the symphysis pubis. They may occur as a result of low mid-line, Pfannenstiel, Maylard, and Cherney incisions used principally for gynecologic or rectal procedures, or radical prostatectomy.[1] These hernias have also been reported after suprapubic catheterization.[10]

The abdominal oblique aponeurosis, rectus abdominus musculature, and rectus sheath insert on the symphysis pubis. In the event an incision is placed in proximity to this musculotendinous insertion, a hernia may develop as a result of inadequate tissue purchase inferiorly when re-approximating the fascia. The complexity of dissection and the close proximity of these hernias to bony, vascular, and nerve structures make the repair of suprapubic hernias a formidable operation. Their is limited experience with the repair of these difficult hernias using the open[1, 3, 11, 15] and laparoscopic approach.[7, 13] We present our six-year experience with the laparoscopic repair of suprapubic hernias (LRSPH) and discuss in detail our operative approach.

Materials and Methods

A prospective study of patients undergoing LRSPH from July 1996 to January 2004 was conducted. Hernias that occurred within 3 cm of the pubis were counted as suprapubic due to the lack of usual or adequate tissue overlap, which is typically 4-5 cm in our series. Patient demographics, hernia size, mesh type and size, complications, and recurrences were documented.

Prior to the operative procedure, a three-way Foley catheter was placed, and as previously described,[6] a standard three or four-port technique for the repair was used. The hernia contents were reduced and adhesions were taken down sharply. To safely fixate the mesh to the abdominal wall and the posterior aspect of the pubic bone, a peritoneal flap was developed to allow direct visualization of the pubic bone, Cooper's ligaments, and the inferior epigastric and iliac vessels. The dissection plane mimics that for a laparoscopic, transabdominal, preperitoneal, inguinal hernia repair. Beginning at the median umbilical fold, the peritoneum was incised horizontally with cautery scissors for a length equal in size to the mesh to be placed, and the peritoneal flap was developed inferiorly. After filling it with 250-400 ml of saline, the tumescent bladder was mobilized bluntly off of the pubic bone, exposing Cooper's ligaments and the iliac vessels bilaterally (Fig 1). A distended bladder is easier to identify and allows visual confirmation that it is out of the surgical field. With retrograde instillation of methylene blue, it could also demonstrate an operative injury, if one were to occur.

The hernia defect was measured intracorporeally with a thin, plastic, metric ruler, and expanded polytetrafluoroethylene (ePTFE, DualMesh® Gore-Tex®, WL Gore & Associates, Flagstaff, AZ) mesh was cut to allow a 4-5 cm overlap of the defect. The overlap of the mesh inferiorly was calculated as the distance from the edge of the hernia to the pelvis plus 1-2 cm of overlap below the superior edge of the pubis. Pre-tied CV-0 ePTFE sutures were placed at the four corners of the mesh to serve as the initial transabdominal fixation sutures. The mesh was placed intraabdominally, and the

inferiormost transabdominal suture was then retrieved by using the suture passer to penetrate the periosteum of the pubis in the midline (Fig 2). The superior and lateral sutures were then retrieved with a suture passer and tied while the most inferior suture was held upward very tightly by an assistant without tying it. The superior and lateral portion of the mesh was then fixated to the abdominal wall with spiral tacks. While holding this inferiormost suture untied outside the body, two additional #1 polypropylene transabdominal sutures were passed through the periosteum of the pubis approximately 2 cm lateral to the first inferior midline suture. These sutures were not secured until all of the inferior sutures were placed (Fig 3). This allows the surgeon to hold the mesh upwards with a grasper to allow direct visualization of the suture passer safely traversing the abdominal wall. Further fixation was achieved with spiral tacks every 1 cm and transabdominal #1 polypropylene suture every 4-5 cm circumferentially around the mesh, avoiding placement of sutures or tacks below the iliopubic tract (Fig 4). Special attention was paid to tacks placed into the pubis and Cooper's ligament laterally because of their close proximity to neurovascular structures. Patients were admitted to the general surgical floor and discharged home after they were tolerating a diet with adequate pain control.

Results

Thirty-six patients, 26 females and 10 males, with a mean age of 55.9 yrs. (range, 33-76) and a mean BMI of 31.0 kg/m^2 (range, 22-67) underwent LRSPH. Twenty-two (61%) of the repairs were for recurrent hernias, with an average of 2.3 previously failed

open repairs each (range, 1-11). The mean hernia size was 191.4 cm^2 (range, 20-768), with an average mesh size of 481.4 cm^2 (range, 193-1428). All repairs were performed with ePTFE. Mean operating room time was 178.7 min (range, 95-290), with a mean blood loss of 40 cc (range, 20-100). One patient undergoing her fifth repair required conversion due to adhesions to previously placed polypropylene mesh. Hospital stay averaged 2.4 days (range, 1-7). Mean follow up was 21.1 months (range, 1-70). Complications (16.6%) included: deep venous thrombosis (1), prolonged pain greater than 6 weeks (1), trocar site cellulitis (1), ileus (1), prolonged seroma (1), and Clostridium difficile colitis (1). Hernias recurred in 2 of our first 9 patients, for an overall recurrence rate of 5.5%. Since initiating the technique of applying multiple sutures directly to the pubis and Cooper's ligament (in the subsequent 19 patients), no recurrences have been documented.

Discussion

Hermann Johann Pfannenstiel's first description of his eponymous incision in 51 patients in 1900, reported no incisional hernias after a 2-year follow up.[17] Recent authors cite a 0.04% to 2.1% incisional hernia rate after Pfannenstiel incision.[5, 12] There is a paucity of literature regarding the technical aspects of the repair of suprapubic ventral hernias. Bendavid[1] reported the Shouldice Clinic experience repairing parapubic hernias via an open technique in seven patients. All of his patients presented with a denuded pubis lacking fascia. He approached the defect preperitoneal through the space of Retzius, and placed a polypropylene mesh anchored to the pubis and Cooper's ligaments inferiorly, and full-thickness abdominal wall sutures superiorly.

Although recurrence was not reported, his results were favorable after a 5-48 month follow-up with no infections or seromas. Hirasa and colleagues[7] from Loyola University reported the first laparoscopic experience with the repair of suprapubic hernias. They employed a composite mesh with a 2-3 cm overlap, fixated only with spiral tacks and no transabdominal sutures in seven patients. After a 4-9 month follow up in six of the patients, one hernia (14.3%) recurred at eight months as a result of the mesh pulling off of the abdominal wall.

There is some evidence to support the use of full-thickness transabdominal sutures to ensure adequate mesh fixation.[6, 8, 9] Another important aspect of ventral hernia repair is an adequate overlap of mesh from the edge of the hernia defect.[6, 8] Obtaining adequate overlap to provide the necessary surface area for mesh-host tissue integration is difficult to achieve in hernias occurring just above the pubic bone. We develop a peritoneal flap inferiorly similar to the dissection plane for laparoscopic, transabdominal, preperitoneal, inguinal hernia repair to identify the critical pelvic structures and allow for the safe placement of fixation constructs directly to Cooper's ligaments and the pubic bone. This technique has not been described elsewhere.

We present the largest series to date of the LRSPH, and describe a unique approach to the problem of attaining adequate mesh overlap and fixation in an area with limited space. Our experience is similar to larger series of laparoscopic ventral hernia repair, with a minor complication rate of 16.6%.[2, 6, 16, 18] In our study, 61% of the patients were undergoing repair of a previously failed open repair (average 2.3 previous repairs

each). The two recurrences reported in this series occurred in the first nine patients (5.5% overall recurrence rate). The recurrences occurred just above the pubis before we began to employ full-thickness, transabdominal sutures incorporating the periosteum of the pubis. After this modification, no recurrences have been documented. This underscores the importance of adequate mesh fixation with sutures to the strong bony or ligamentous structures as opposed to the attenuated muscle at the hernia's border.

Although technically demanding, the LRSPH is technically feasible, safe, and results in a low recurrence rate. It can be performed with low morbidity in very large and recurrent hernias. Transabdominal suture fixation to the bony and ligamentous structures yields a durable hernia repair.

References

1. Bendavid R (1990) Incisional parapubic hernias. Surgery 108: 898-901.

2. DeMaria EJ, Moss JM and Sugerman HJ (2000) Laparoscopic intraperitoneal polytetrafluoroethylene (PTFE) prosthetic patch repair of ventral hernia. Prospective comparison to open prefascial polypropylene mesh repair. Surg Endosc 14: 326-9.

3. el Mairy AB (1974) A new procedure for the repair of suprapubic incisional hernia. J Med Liban 27: 713-8.

4. Gecim IE, Kocak S, Ersoz S, Bumin C and Aribal D (1996) Recurrence after incisional hernia repair: results and risk factors. Surg Today 26: 607-9.

5. Griffiths DA (1976) A reappraisal of the Pfannenstiel incision. Br J Urol 48: 469-74.

6. Heniford BT, Park A, Ramshaw BJ and Voeller G (2003) Laparoscopic repair of ventral hernias: nine years' experience with 850 consecutive hernias. Ann Surg 238: 391-9; discussion 399-400.

7. Hirasa T, Pickleman J and Shayani V (2001) Laparoscopic repair of parapubic hernia. Arch Surg 136: 1314-7.

8. Koehler RH and Voeller G (1999) Recurrences in laparoscopic incisional hernia repairs: a personal series and review of the literature. JSLS 3: 293-304.

9. LeBlanc KA (2001) The critical technical aspects of laparoscopic repair of ventral and incisional hernias. Am Surg 67: 809-12.

10. Lobel RW and Sand PK (1997) Incisional hernia after suprapubic catheterization. Obstet Gynecol 89: 844-6.

11. Losanoff JE, Richman BW and Jones JW (2002) Parapubic hernia: case report and review of the literature. Hernia 6: 82-5.

12. Luijendijk RW, Jeekel J, Storm RK, Schutte PJ, Hop WC, Drogendijk AC and Huikeshoven FJ (1997) The low transverse Pfannenstiel incision and the prevalence of incisional hernia and nerve entrapment. Ann Surg 225: 365-9.

13. Matuszewski M, Stanek A, Maruszak H and Krajka K (1999) Laparoscopic treatment of parapubic postprostatectomy hernia. Eur Urol 36: 418-20.

14. Mudge M and Hughes LE (1985) Incisional hernia: a 10 year prospective study of incidence and attitudes. Br J Surg 72: 70-1.

15. Norris JP, Flanigan RC and Pickleman J (1994) Parapubic hernia following radical retropubic prostatectomy. Urology 44: 922-3.

16. Park A, Birch DW and Lovrics P (1998) Laparoscopic and open incisional hernia repair: a comparison study. Surgery 124: 816-21; discussion 821-2.

17. Pfannenstiel H (1900) Ueber die vortheile des suprasymphysaren fascienquerschnitts fur die gynakologischen koliotomien. Samml Klin Vortr 268: 1735-56.

18. Ramshaw BJ, Esartia P, Schwab J, Mason EM, Wilson RA, Duncan TD, Miller J, Lucas GW and Promes J (1999) Comparison of laparoscopic and open ventral herniorrhaphy. Am Surg 65: 827-31; discussion 831-2.

19. Stoppa RE (1989) The treatment of complicated groin and incisional hernias. World J Surg 13: 545-54.

20. Sugerman HJ, Kellum JM, Jr., Reines HD, DeMaria EJ, Newsome HH and Lowry JW (1996) Greater risk of incisional hernia with morbidly obese than steroid-dependent patients and low recurrence with prefascial polypropylene mesh. Am J Surg 171: 80-4.

Figures Legend

Figure 1. The peritoneal flap has been developed inferiorly mobilizing the bladder and exposing the posterior aspect of the pubis and Cooper's ligaments bilaterally.

Figure 2. The suture passer is used to skive the pubis, penetrating the periosteum, for placement of a permanent suture

Figure 3. Additional transabdominal sutures are placed through the periosteum of the pubis to anchor the mesh inferiorly

Figure 4. The mesh is further fixed to the posterior pubis and Cooper's ligaments using a helical tacking device.

NOTES

Laparoscopic Parastomal Hernia Repair

Kristi L. Harold, MD, FACS
Associate Professor of Surgery
Mayo Clinic Arizona
5777 E. Mayo Blvd.
Phoenix, AZ 85054
480-342-2849

Introduction

Management of the parastomal hernia represents a common clinical dilemna, with some degree of herniation considered to be an almost inevitable consequence of ostomy formation.[1] Risk factors that may lead to an increased incidence of hernia formation include obesity, malnutrition, steroid use, malignancy, and infection.[2-4] Once established, these defects are notoriously difficult to treat. Although most parastomal hernias can be managed nonoperatively, approximately 30% will require intervention secondary to complications such as obstruction, pain, bleeding, poorly fitting appliances, or leakage.[5-7]

Traditional surgical management has consisted of local tissue repair, stoma relocation, or placement of a prosthetic mesh.[7-10] Recurrence rates for primary fascial closure are reported to range from 46 – 100%.[10-12] Stoma relocation is reported to have a recurrence rate of 36% (range 0 – 76%)[10, 11, 13, 14], but may require an additional laparotomy. Open repair with polypropylene mesh has improved on these outcomes, but it still associated with a failure rate of 26-29%. Over-all complication rates of up to 88%[9] , combined with a growing body

of literature citing decreased patient morbidity and improved outcomes with laparoscopic tension-free mesh repair of ventral hernias, have led many surgeons to apply these techniques to this difficult problem.

Surgical Technique for Laparoscopic Parastomal Hernia Repair

After induction of general anesthesia, the patient is positioned in the supine position and the arms tucked. A prophylactic antibiotic is given intravenously. The abdomen is prepped including the ostomy. A Foley balloon catheter is placed in the ostomy. and an Ioban drape is applied to the abdomen. Access to the peritoneal cavity is gained using a veress needle placed in the LUQ subcostal region at the midclavicular line. After adequate pneumoperitoneum is established, a 5 mm Optiview port is placed in the lateral position on the opposite side of the abdomen from the ostomy site. On the same side of the abdomen, two additional 5-mm trocars are placed low and lateral in the abdomen, and the entry 5-mm port is exchanged for a 12-mm balloon-tipped trocar.

Lysis of any adhesions is performed using sharp dissection. Identification of the loop of bowel ending in the ostomy is facilitated by the use of the Foley balloon catheter within the bowel lumen. Once the entire anterior abdominal wall is cleared of adhesions and the stomal loop of bowel is identified, spinal needles are used to measure the extent of the hernia defect, including any co-existing ventral incisional hernias. ePTFE Dual Mesh extending 5 cm beyond all fascial defects is fashioned. Figures are drawn on the mesh as points of reference for orienting the mesh once placed intra-abdominally. A single Gore-Tex suture is

placed on three of the four sides. Two Gore-Tex sutures are placed on the fourth side to allow the mesh to encompass the stoma in a mesh underlay fashion. With the Keyhole technique, a 2-3 cm keyhole defect is created in the mesh to accommodate the ostomy. A 5 mm port is placed in the lateral abdominal wall contralateral to the three working ports. The mesh is rolled up, by rolling the superior and inferior edges together, to facilitate unrolling once in the abdomen. A grasper is placed in the port ipsilateral to the ostomy and pushed through the 12 mm port on the contralateral side to grab the mesh and bring it into the abdomen. The mesh is unrolled and oriented. The open jaws of a laparoscopic bowel grasper are used to measure a 5 cm overlap from the edge of the fascial defects. This area is marked with a spinal needle, and the transfascial sutures are passed through these sites with a suture passer. The mesh is then tacked circumferentially with spiral tacks using the ProTack device (Auto suture, US Surgical, Norwalk, CT, USA). For the Keyhole technique, interrupted sutures are placed intra- or extra-corporeally along the linear defect in the mesh leading away from the ostomy. Additional 0-Gore-Tex trans-abdominal sutures are placed every 4 - 5 cm circumferentially around the mesh.

Results

We have performed laparoscopic parastomal hernia repair on 21 patients. The average operative time was 210 (range 99-326) minutes. The average fascial defect size was 130 (range 25-416) cm^2. The average surface area of the mesh was 440 (range 240 – 780) cm^2. Of note, the mesh was placed with a 5 cm

overlap from the edges of the fascial defect circumfrentially. There were no intra-operative complications, and no patient required conversion to an open repair.

Mean length of stay was 6 (range 2 – 14) days. Post-operative complications included laparoscopic re-operation for obstruction of a urinary conduit (*n=1*), mesh removal for infection (*n=2*), *Clostridium Difficile* colitis (*n=1*), pneumonia (*n=2*), renal failure (*n=1*), surgical site infection (*n=1*), and bowel obstruction (*n=2*). After a mean follow up of 14 (range 1 – 36) months 1 patient had a recurrence.

Discussion

Parastomal hernias are a common occurrence following ostomy formation and present a dilema for both the patient and surgeon. Primary fascial repair has the advantages of being technically simple to perform, avoids an additional laparotomy, and is associated with low patient morbidity. However, the overall results are less than satisfactory, with recurrence rates of 46-100 percent. [10-12] Stoma relocation is generally considered to be superior to primary fascial repair, although only a single series has been published comparing the two. Rubin et al[10] demonstrated a lower recurrence with stoma relocation compared with primary fascia repair (33 versus 76 %, $p < 0.01$); their reported recurrence rate is in agreement with the mean of 36.3% reported in eight other available studies evaluating parastomal relocation. Despite a lower recurrence rate, this approach has several disadvantages. Relocation often requires a laparotomy with its attendant morbidity. Further, in one series, 52 percent of patients who underwent

stoma relocation subsequently developed an incisional hernia, effectively trading one surgical problem for another.[10]

Sugarbaker was the first to describe the placement of intraperitoneal mesh for the repair of parastomal hernias.[15] His technique involved placing a circular piece of mesh around the fascial defect and securing it circumfrentially, except laterally where the colon exited the abdominal cavity to create a mesh flap valve around the stoma to help prevent further herniation. He advocated laparotomy for placement of the mesh in order to avoid contact with the stoma bud and thus reduce infection. In his series of 6 patients, there were no recurrences or mesh-related complications after 4-7 years follow up.[15] In contrast, a subsequent series of 7 patients undergoing repair with polypropylene mesh described significant mesh-related complications after a mean follow-up of 81 months.[16] Steele et al reviewed the safety of parastomal hernia repair with polypropylene mesh in 58 patients with a mean follow-up of 50.6 months.[17] Their series revealed an over-all mesh-related complication rate of 36% (recurrence 26%, surgical bowel obstruction 9%, prolapse 3%, wound infection 3%, fistula 3%, and mesh erosion 2%). Overall, in published series of open mesh repair of parastomal hernias in which primary repairs and recurrences are clearly identified, 77 mesh repairs have been reported with 6 recurrences noted (7.8%).[7]

Currently, there appears to be an evolution in the operative management of parastomal hernia repairs mirroring the changing treatment paradigm for ventral hernias. Laparopscopic repair with prosthetic mesh is rapidly becoming the gold standard for treatment of incisional hernias, with large series reporting

recurrence rates of 4.7% compared to 16.5% for open repair after 9 years of follow-up.[18] Application of this approach to parastomal hernias has been promising, with early series demonstrating
decreased length of stay and earlier return to activities of daily living.[19-24] However, these early reports have involved small numbers of patients, with variable techniques of repair and types of mesh inserted with relatively short follow-up. Currently, there is no long-term data available regarding recurrence rates.

We have performed twenty-one laparoscopic parastomal hernia repairs (9 urostomy, 7 ileostomy, and 5 colostomy). Early in the experience we performed the Keyhole technique, but currently prefer the Sugarbaker technique. In our experience as well as others, the Sugarbaker technique was found to be technically less demanding, associated with decreased operative times and decreased recurrence rates.[20] A potential complication of this procedure is the mesh obstructing the enterostomy by creating too small a flap valve around the bowel. The surgeon needs to be cognizant of this while securing the mesh. Our experience agrees with a previous series that reported a recurrence with the keyhole technique for repair of an ileal stoma hernia; it is hyptohesized that the small caliber of this intestine may allow it to invaginate into the hole created in the mesh, making this particular approach unsuitable for ileal ostomies.[20]

In conclusion, the laparoscopic approach to parastomal hernias is a new technique that offers many potential advantages over conventional open repairs.

Based on our initial experience, this repair seems to be associated with a low recurrence rate. Long-term data is still needed to determine the durability of this technique.

References

1. **J. G. Surgery of the Anus, Colon, and Rectun. 5th ed. London: Bailliere Tindall, 1984.**
2. **Pearl RK. Parastomal hernias. World J Surg 1989; 13(5):569-72.**
3. **Leslie D. The parastomal hernia. Surg Clin North Am 1984; 64(2):407-15.**
4. **Rosin JD, Bonardi RA. Paracolostomy hernia repair with Marlex mesh: a new technique. Dis Colon Rectum 1977; 20(4):299-302.**
5. **Sjodahl R, Anderberg B, Bolin T. Parastomal hernia in relation to site of the abdominal stoma. Br J Surg 1988; 75(4):339-41.**
6. **P Burgess VM, HB Devlin. A review of terminal colostomy complications following abdominal perineal resection for carcinoma. Br J Surg 1984; 71:1004.**
7. **Carne PW, Robertson GM, Frizelle FA. Parastomal hernia. Br J Surg 2003; 90(7):784-93.**
8. **Sugarbaker PH. Peritoneal approach to prosthetic mesh repair of paraostomy hernias. Ann Surg 1985; 201(3):344-6.**
9. **Franks ME, Hrebinko RL, Jr. Technique of parastomal hernia repair using synthetic mesh. Urology 2001; 57(3):551-3.**
10. **Rubin MS, Schoetz DJ, Jr., Matthews JB. Parastomal hernia. Is stoma relocation superior to fascial repair? Arch Surg 1994; 129(4):413-8; discussion 418-9.**
11. **Allen-Mersh TG, Thomson JP. Surgical treatment of colostomy complications. Br J Surg 1988; 75(5):416-8.**
12. **Horgan K, Hughes LE. Para-ileostomy hernia: failure of a local repair technique. Br J Surg 1986; 73(6):439-40.**
13. **Williams JG, Etherington R, Hayward MW, Hughes LE. Paraileostomy hernia: a clinical and radiological study. Br J Surg 1990; 77(12):1355-7.**
14. **Prian GW, Sawyer RB, Sawyer KC. Repair of peristomal colostomy hernias. Am J Surg 1975; 130(6):694-6.**
15. **Sugarbaker PH. Prosthetic mesh repair of large hernias at the site of colonic stomas. Surg Gynecol Obstet 1980; 150(4):576-8.**
16. **Morris-Stiff G, Hughes LE. The continuing challenge of parastomal hernia: failure of a novel polypropylene mesh repair. Ann R Coll Surg Engl 1998; 80(3):184-7.**
17. **Steele SR, Lee P, Martin MJ, et al. Is parastomal hernia repair with polypropylene mesh safe? Am J Surg 2003; 185(5):436-40.**

18. **Heniford BT, Park A, Ramshaw BJ, Voeller G. Laparoscopic repair of ventral hernias: nine years' experience with 850 consecutive hernias. Ann Surg 2003; 238(3):391-9; discussion 399-400.**
19. **Deol ZK, Shayani V. Laparoscopic parastomal hernia repair. Arch Surg 2003; 138(2):203-5.**
20. **LeBlanc KA, Bellanger DE, Whitaker JM, Hausmann MG. Laparoscopic parastomal hernia repair. Hernia 2005; 9(2):140-4.**
21. **Porcheron J, Payan B, Balique JG. Mesh repair of paracolostomal hernia by laparoscopy. Surg Endosc 1998; 12(10):1281.**
22. **Kozlowski PM, Wang PC, Winfield HN. Laparoscopic repair of incisional and parastomal hernias after major genitourinary or abdominal surgery. J Endourol 2001; 15(2):175-9.**
23. **LeBlanc KA, Bellanger DE. Laparoscopic repair of paraostomy hernias: early results. J Am Coll Surg 2002; 194(2):232-9.**
24. **Gould JC, Ellison EC. Laparoscopic parastomal hernia repair. Surg Laparosc Endosc Percutan Tech 2003; 13(1):51-4.**
25. **Koehler RH, Begos D, Berger D, et al. Minimal adhesions to ePTFE mesh after laparoscopic ventral incisional hernia repair: reoperative findings in 65 cases. Jsls 2003; 7(4):335-40.**
26. **Hansson BM, de Hingh IH, Bleichrodt RP. Laparoscopic parastomal hernia repair is feasible and safe: early results of a prospective clinical study including 55 consecutive patients. Surg Endosc 2007.**
27. **Huguet KL, Harold KL. Laparoscopic parastomal hernia repair. In: Schuricht A, Koltun W (editors). Operative Techniques in General Surgery. Vol. 9(3). New York: Elsevier; 2007 Sep. p. 113-22.**

NOTES

Laparoscopic Approach for Giant Hernias/Loss of Domain

Bruce Ramshaw MD FACS
Associate Professor
Chief, Division of General Surgery
John A Growden Professorship in Surgery

The use of a laparoscopic approach for management of giant ventral hernias is controversial. Many surgeons would use large size of a hernia defect as a relative contraindication for a laparoscopic approach. However, since the main advantage of the laparoscopic approach is to minimize wound and mesh complications, it is the patient with a large ventral hernia who might benefit the most from a laparoscopic approach.

There are several technical issues that are particularly important when performing laparoscopic ventral hernia in a patient with a very large defect. The initial access may be challenging because of the limited options for a clear entry point for the initial trocar. Often, access just under the costal margin at either anterior axillary line can be a consistent and safe option. By using a finger aimed superiorly, the peritoneum is penetrated and the abdominal cavity can be palpated for any local adhesions. After initial access, one or two 5mm trocars can be placed inferior to the initial trocar and lysis of adhesions can begin. For the patient with a large hernia, it is often necessary to push the skin down to allow for adequate visualization of the adherent viscera. Sometimes, the laparoscope will need to be moved to other trocar positions to provide an adequate view for safe lysis of adhesions. For extremely large hernias, it is

common to need to move trocars more medially as the adhesions are taken down. For patients with loss of domain, it will require that trocars are actually placed through the skin within the areas of the hernia defect. During lysis of adhesions, it is also often necessary to use aggressive changes in table position to allow for better exposure in different areas of the abdominal cavity. This is especially helpful in patients who are obese.

After adhesions are taken down and the abdominal wall is cleared as needed (for example, dividing the falciform ligament), the next challenge is to accurately measure the hernia defect. Because of the large difference between the measurement of the defect at the skin compared to the level of the peritoneum, it is very common to overestimate the size of the defect. By deflating the abdominal cavity or pushing down on the skin, the defect can be measured more accurately. Measuring between spiral needles which are placed perpendicular to the edges of the defect and/or using a ruler, instrument or piece of suture placed laparoscopically to measure the defect from inside the abdominal cavity can increase the accuracy of defect size measurement.

The largest meshes available for laparscopic ventral hernia repair are about 35x30 cm's, so it is often necessary to sew two or more meshes together for very large defects. I recommend a permanent suture to prevent gaps in the mesh and multiple interrupted sutures to prevent recurrence if the running suture was to break. As the mesh is positioned, it will create a very small space between the

mesh and the viscera in most cases. Tenting up the mesh by placing point fixation more centrally, by the edge of the defect, will help to create more working space. In patients with loss of domain, there will be no space between the mesh and abdominal contents so the laparoscope and working ports will be above the mesh. For the large solitary defect, mesh overlap and full thickness abdominal wall fixation with permanent sutures is important. Because the mesh could easily eventrate out of a large defect, sutures are usually placed every 3-5cm around the periphery of the mesh.

Post operatively, these patients will be in considerable pain for the first few days. Pain management with PCA and epidural anesthesia can help control the pain. An abdominal binder is also placed to help stabilize the abdominal wall and help compress the large empty space that will fill with serosauguinous fluid. A large seroma is to be expected. In most cases, fluid drainage is not attempted because of the risk of mesh infection and because the fluid almost certainly returns to fill the empty space. Most large seromas do resolve over several months. These seromas and any residual fluid or capsule rarely cause symptoms.

There is ongoing debate about the use of laparoscopic repair for the large ventral hernia. One criticism is that the rectus muscles are typically not medialized and this may result in less than optimal abdominal wall function. However, one study has shown that the rectus muscles do medialized to some degree after

laparoscopic repair of large hernias. Whether this leads to optimal function is still debatable. The advantage of less wound and mesh complications for the laparscopic approach remains the major advantage for this technique over open mesh repair for large ventral hernias.

REFERENCES

1. Sickle KR, Baghia M, Mattar SG, Bowers SP, Ramaswamy A, Swafford V, Smith CD, Ramshaw BJ. What happens to the rectus abdominus fascia after laparoscopic ventral hernia repair? Hernia 2005 Dec;9(4):358-62. Epub 2005 Aug 5.
2. Gonzalez R, Rehnke RD, Ramaswamy A, Smith CD, Clarke JM, Ramshaw BJ. Components separation technique and laparoscopic approach: a review of two evolving strategies for ventral hernia repair. Am Surg. 2005 Jul;71(7):598-605.
3. Raftopoulos I, Courcoulas AP. Outcome of laparoscopic ventral hernia repair in morbidly obese patients with a body mass index exceeding 35kg/m2. Surg Endosc. 2007 Dec;21(12):2293-7. Epub 2007 May 24.
4. LeBlanc KA. Incisional hernia repair: laparoscopic techniques. World J Surg. 2005 Aug;29(8):1073-9.
5. Raftopoulos I, Vanuno D, Khorsand J, Kouraklis G, Lasky P. Comparison of open and laparoscopic prosthetic repair of large ventral hernias. JSLS. 2003 July-Sep;7(3):227.32.

6. Heniford BT, Park A, Ramshaw BJ, Voeller G. Laparoscopic repair of ventral hernias: nine years' experience with 850 consecutive hernias. Ann Surg. 2003 Sep;238(3):391-9; discussion 399-400.

NOTES

Laparoscopic Component Separation in the Management of Complex Ventral Hernia Repair

Michael J. Rosen MD Assistant Professor of Surgery Director Case Comprehensive Hernia Center University Hospitals Case Medical Center

Laparoscopic Component Separation in the Management of Complex Ventral Hernia Repair

Michael J. Rosen MD, FACS
Chief, Division of General Surgery
Assistant Professor of Surgery
Director Case Comprehensive Hernia Center
University Hospitals Case Medical Center

Case Presentation

- 68 year old Obese Female
- 12 x 12 inches Prolene Mesh Intraperitoneal
- Enterocutaneous Fistula through mesh
- Multiple partial debridements

Single Staged Approach

Remove infectious source
Resect mesh, takedown fistula
Reconstruct abdominal wall
- Component separation
- Primary fascial repair
- Alloderm biologic mesh underlay repair
- Wide drainage
- Skin Closure

Single Staged Approach

CASE Surgery

Hernia
DOI 10.1007/s10029-006-0164-5

ORIGINAL ARTICLE

The single-staged approach to the surgical management of abdominal wall hernias in contaminated fields

D. I. Alaedeen · J. Lipman · D. Medalie · M. J. Rosen

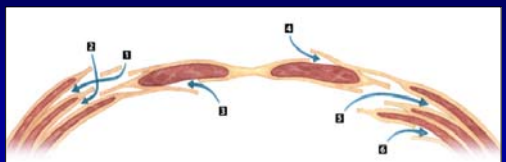
Patients	N=15	
Wound Infections	N=5	30%
Mortality	N=0	
LOS	16 Days (7-60)	
Follow up	N=14	93%
Mean Follow up	18 Months	
Recurrence Rate	N=0	

Outcomes Component Separation

Author	Year	N	Defect cm^2	Comps	Recurrence
Ramirez	1990	11	216	0%	0%
Dibello	1996	35	225	11%	9%
Girotto	1999	33	140	27%	6%
Lowe	2000	30	240	40%	10%
deVries	2003	43	234	35%	30%

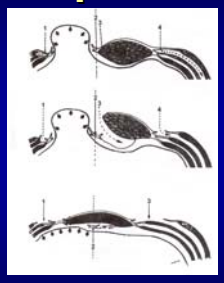
CASE Surgery

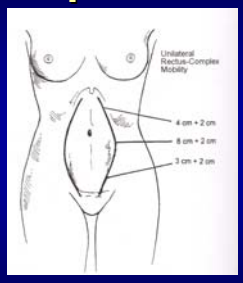
Component Separation



Technique	Author (Year)	Steps Involved
Components Separation Release	Ramirez (1990)	1 2
External Oblique Release	Shestak (2000)	1
External & Internal Oblique Release	Levine (2001)	1 2
"Sliding Door" Release	Kuzbari (1998)	1 2 3
External Oblique/Transversus Abdominis Release	Thomas (1993)	1 3
External Oblique/Anterior Rectus Release	Lucas (1998)	1 4
Anterior Rectus Fascia Release	Yeh (1996)	4
"Lateral" Release	Mathes (2000)	5
Modified Components Separation Release	Fabian (1994)	1 2 3

Component Separation

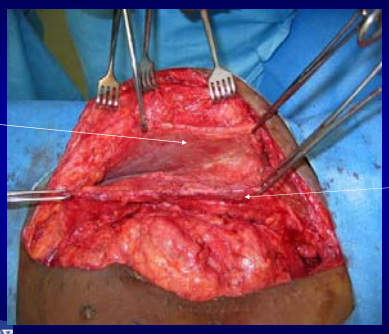




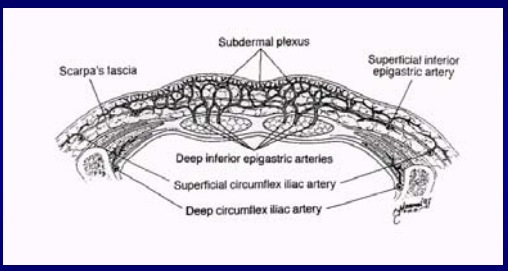
CASE Surgery

Ramirez OM, et al. PRS. 1990.

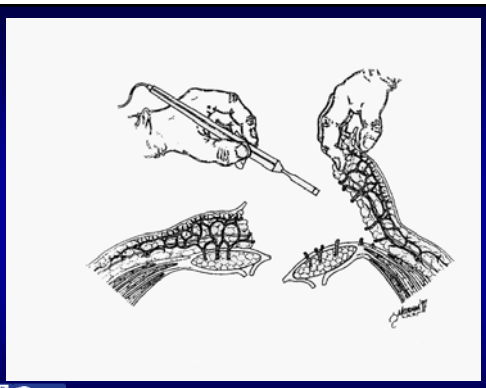
Separation of Parts



CASE Surgery



CASE Surgery

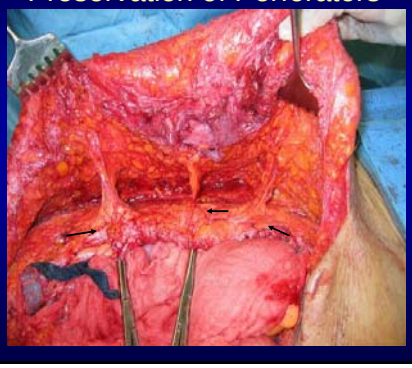


CASE Surgery

Skin Flap Necrosis

CASE Surgery

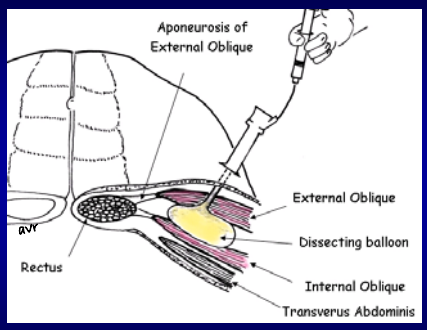
Separation of Component Parts with Preservation of Perforators



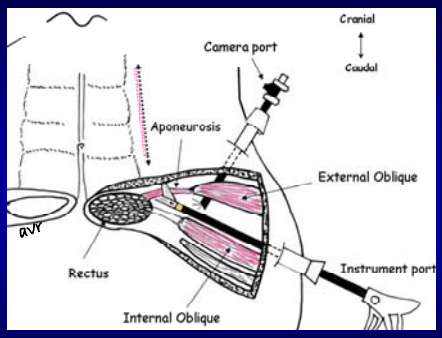
Minimally Invasive Component Separation

- Access the lateral compartment directly
- Avoids large subcutaneous flap dissection
- Avoids division of abdominal wall perforators
- Decreases complexity of postoperative wound infections

CASE Surgery



CASE Surgery

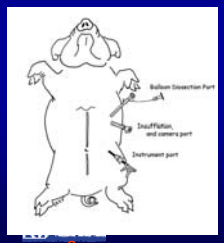


CASE Surgery

The American Journal of Surgery xx (2007) xxx

Laparoscopic versus open-component separation: a comparative analysis in a porcine model

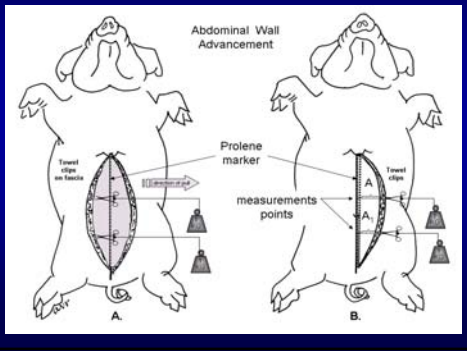
Michael J. Rosen, M.D.*, Christina Williams, M.D., Judy Jin, M.D.,
Michael F. McGee, M.D., Steve Schomisch, B.S., Jeffrey Marks, M.D., Jeffrey Ponsky, M.D.
Case Medical Center, University Hospitals of Cleveland, 11100 Euclid Ave., Cleveland, OH 44106, USA
Manuscript received December 19, 2006; revised manuscript March 20, 2007



Rosen et al. Am J Surg 2007

CASE Surgery

Porcine Model
Laparoscopic versus Open CSM



Porcine Model
Laparoscopic versus Open CSM

Laparoscopic	Open	% Release
5.3	5.6	95
3.1	4.1	76
4.0	5.3	75
6.8	7.2	94
4.0	5.5	73
6.0	6.5	92
5.3	6.0	88
4.0	4.4	91
6.2	7.5	83
4.7	5.3	89
Total Release		86%

Results

	Laparoscopic	Open	P value
Above umbo	3.84 cm ± 0.3	4.41 cm ±0.4	0.24
Below umbo	4.94 cm ± 0.4	5.74 cm ±0.4	0.13

CASE Surgery

Patient

- 53 year old male
- BMI 26
- Crohn's Disease
- Rheumatoid Arthritis
- Steroids, MTX
- Infected Goretex mesh
- Non-healing wound
- VAC 6 months

CASE Surgery

Surgery

Patient

- 65 year old female
- Crohn's disease
- s/p postoperative evisceration
- Multiple enterocutaneous fistulas
- 10 month recovery

Surgery

Operation

- Take down fistulas
- Re-establish GI continuity
- Proctectomy
- End sigmoid colostomy
- Definitive abdominal wall reconstruction

Surgery

Operation

- Take down fistulas
- Re-establish GI continuity
- Proctectomy
- End sigmoid colostomy
- Definitive abdominal wall reconstruction

CASE Surgery

Operation

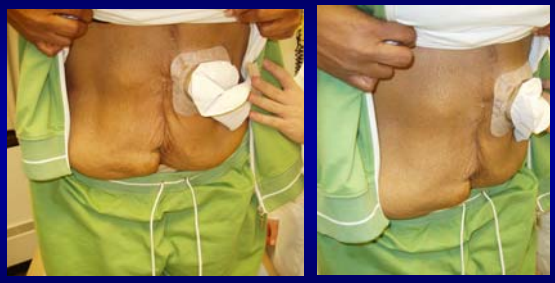
- Take down fistulas
- Re-establish GI continuity
- Proctectomy
- End sigmoid colostomy
- Definitive abdominal wall reconstruction

CASE Surgery

2 months follow up

CASE Surgery

6 months follow up



CASE Surgery

6 Months follow up

CASE Surgery

Hernia (2007) 11:435–440
DOI 10.1007/s10029-007-0255-y

ORIGINAL ARTICLE

Laparoscopic component separation in the single-stage treatment of infected abdominal wall prosthetic removal

M. J. Rosen · J. Jin · M. F. McGee · C. Williams · J. Marks · J. L. Ponsky

Rosen MJ et al Oct 2007 Hernia

CASE Surgery

Outcomes Lap CSM For Infected Prosthetic Removal

N=7		
M:F	3:4	
Mean Age (range)	54 yrs	(34-84)
ASA	3.21	(3-4)
BMI	37 kg/m^2	(30-45)
IDDM	n=3	
Morbid obesity (BMI>35)	n=4	
Prior abdominal procedures	4.6	(3-8)
Prior attempted hernia repairs	1.7	(1-3)

CASE Surgery

Patient Characteristics

Indications for Mesh removal
- Exposed Mesh n=6
- Infected seroma n=1

Prior Mesh
- Gore tex dual mesh n=3
- Composix mesh n=3
- Alloderm n=1

Time to referral 10 m (2-24 m)

CASE Surgery

Operative Details

OR time	185 min	(155-220)
Size of defect	338 cm2	(187-450)
Bilateral Lap CSM	52 min	(45-65)
Primary fascia reapproximated	100%	
Alloderm Underlay	n=7	

CASE Surgery

Postoperative Details

Complications	n=3
Midline wound infection	n=1
Resolved 27 days	
Lateral compartments not involved	
Hepatopulmonary Syndrome	n=1
Wound Hematoma	n=1
Responded to percutaneous drain	

CASE Surgery

Postoperative Details

Mortality	0%
Mean Length of Stay	5.4 days (4-6)
Follow up	n=7
Mean Follow up	12 months (3-16)
Recurrence	10%

CASE Surgery

Laparoscopic Versus Open CSM Patient Demographics

	Open	Lap	P
N	11	11	-
Age	66 yrs	56 yrs	0.09
BMI	37	36	0.80
# Prior Hernias	1.0	1.5	0.20
Albumin	3.1	3.4	0.45

CASE Surgery

Laparoscopic Versus Open CSM Peri-Operative Details

	Open	Lap	P
Defect Size	325 cm^2	425 cm^2	0.39
Wound Complication	82%	18%	0.03
Length of Stay	14 Days	6 Days	0.07
Recurrence	20%	20%	0.9

CASE Surgery

Economics of Ventral Hernia Repair

CPT	Procedure	Charges
49560	Repair Initial Ventral	$2704
49565	Repair Recurrent Ventral	$2715
49568	Mesh Implant	$1071
15330	Alloderm Implant	$993
15734	Abdomino-fascial Flap	$4834
Mod 59	Bilateral 15734	$9668

Conclusions

- ✓Laparoscopic Component separation is technically feasible.
- ✓ Results in comparable fascial advancement as open release.
- ✓ Results in minimal postoperative morbidity in these complex patients.
- ✓ May be the procedure of choice for complex abdominal reconstructions.

CASE Surgery

NOTES

Laparoscopic Component Separation in the Management of Complex Ventral Hernia Repair

Michael J. Rosen MD Assistant Professor of Surgery Director Case Comprehensive Hernia Center University Hospitals Case Medical Center

Laparoscopic Component Separation in the Management of Complex Ventral Hernia Repair

Michael J. Rosen MD, FACS
Chief, Division of General Surgery
Assistant Professor of Surgery
Director Case Comprehensive Hernia Center
University Hospitals Case Medical Center

Case Presentation

- 68 year old Obese Female
- 12 x 12 inches Prolene Mesh Intraperitoneal
- Enterocutaneous Fistula through mesh
- Multiple partial debridements

Single Staged Approach

Remove infectious source
Resect mesh, takedown fistula
Reconstruct abdominal wall
- Component separation
- Primary fascial repair
- Alloderm biologic mesh underlay repair
- Wide drainage
- Skin Closure

Single Staged Approach

CASE Surgery

Hernia
DOI 10.1007/s10029-006-0164-5

ORIGINAL ARTICLE

The single-staged approach to the surgical management of abdominal wall hernias in contaminated fields

D. I. Alaedeen · J. Lipman · D. Medalie · M. J. Rosen

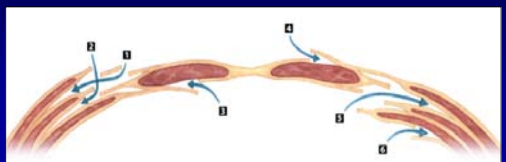
Patients	N=15	
Wound Infections	N=5	30%
Mortality	N=0	
LOS	16 Days (7-60)	
Follow up	N=14	93%
Mean Follow up	18 Months	
Recurrence Rate	N=0	

Outcomes Component Separation

Author	Year	N	Defect cm^2	Comps	Recurrence
Ramirez	1990	11	216	0%	0%
Dibello	1996	35	225	11%	9%
Girotto	1999	33	140	27%	6%
Lowe	2000	30	240	40%	10%
deVries	2003	43	234	35%	30%

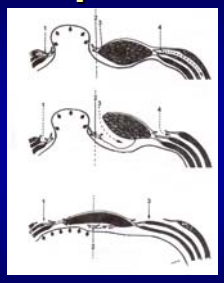
CASE Surgery

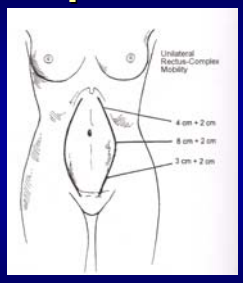
Component Separation



Technique	Author (Year)	Steps Involved
Components Separation Release	Ramirez (1990)	1 2
External Oblique Release	Shestak (2000)	1
External & Internal Oblique Release	Levine (2001)	1 2
"Sliding Door" Release	Kuzbari (1998)	1 2 3
External Oblique/Transversus Abdominis Release	Thomas (1993)	1 3
External Oblique/Anterior Rectus Release	Lucas (1998)	1 4
Anterior Rectus Fascia Release	Yeh (1996)	4
"Lateral" Release	Mathes (2000)	5
Modified Components Separation Release	Fabian (1994)	1 2 3

Component Separation

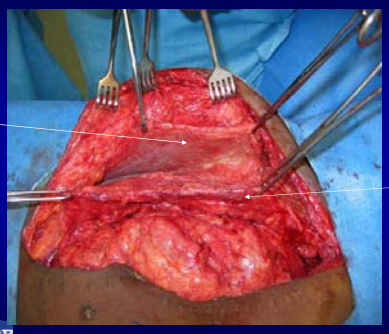




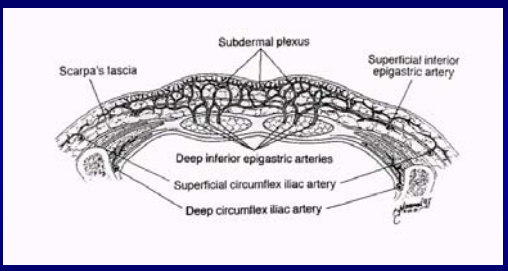
CASE Surgery

Ramirez OM, et al. PRS. 1990.

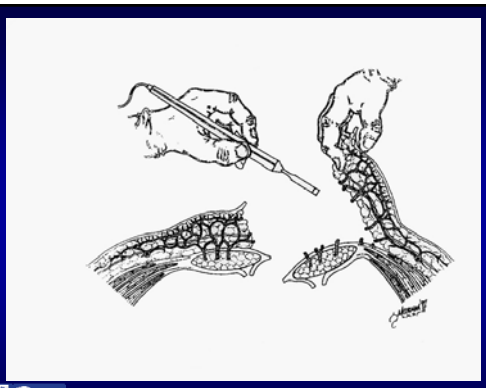
Separation of Parts



CASE Surgery



CASE Surgery

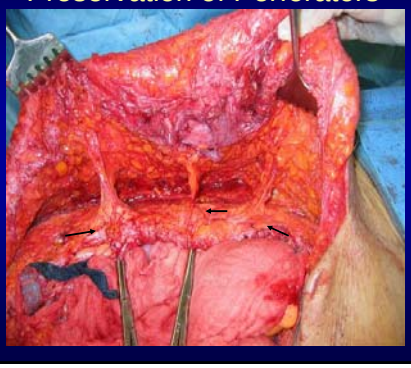


CASE Surgery

Skin Flap Necrosis

CASE Surgery

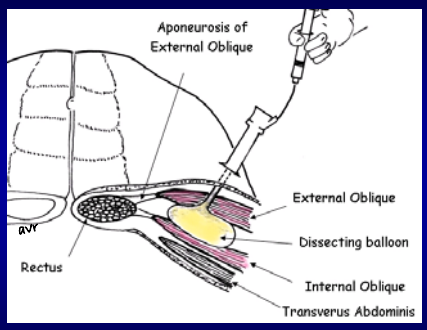
Separation of Component Parts with Preservation of Perforators



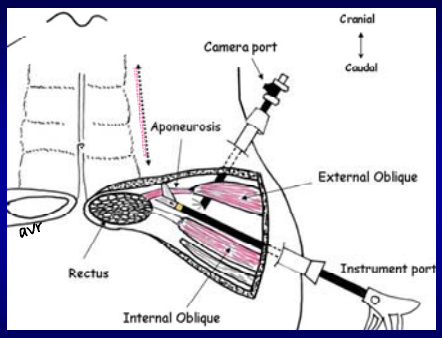
Minimally Invasive Component Separation

- Access the lateral compartment directly
- Avoids large subcutaneous flap dissection
- Avoids division of abdominal wall perforators
- Decreases complexity of postoperative wound infections

CASE Surgery



CASE Surgery



CASE Surgery

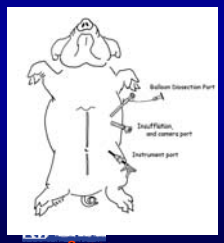
The American Journal of Surgery xx (2007) xxx

Laparoscopic versus open-component separation: a comparative analysis in a porcine model

Michael J. Rosen, M.D.*, Christina Williams, M.D., Judy Jin, M.D.,
Michael F. McGee, M.D., Steve Schomisch, B.S., Jeffrey Marks, M.D., Jeffrey Ponsky, M.D.

Case Medical Center, University Hospitals of Cleveland, 11100 Euclid Ave., Cleveland, OH 44106, USA

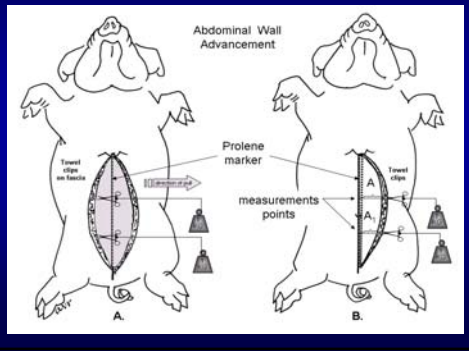
Manuscript received December 19, 2006; revised manuscript March 20, 2007



Rosen et al. Am J Surg 2007

CASE Surgery

Porcine Model
Laparoscopic versus Open CSM



Porcine Model
Laparoscopic versus Open CSM

Laparoscopic	Open	% Release
5.3	5.6	95
3.1	4.1	76
4.0	5.3	75
6.8	7.2	94
4.0	5.5	73
6.0	6.5	92
5.3	6.0	88
4.0	4.4	91
6.2	7.5	83
4.7	5.3	89
Total Release		86%

Results

	Laparoscopic	Open	P value
Above umbo	3.84 cm ± 0.3	4.41 cm ±0.4	0.24
Below umbo	4.94 cm ± 0.4	5.74 cm ±0.4	0.13

CASE Surgery

Patient

- 53 year old male
- BMI 26
- Crohn's Disease
- Rheumatoid Arthritis
- Steroids, MTX
- Infected Goretex mesh
- Non-healing wound
- VAC 6 months

CASE Surgery

Patient

- 65 year old female
- Crohn's disease
- s/p postoperative evisceration
- Multiple enterocutaneous fistulas
- 10 month recovery

Operation

- Take down fistulas
- Re-establish GI continuity
- Proctectomy
- End sigmoid colostomy
- Definitive abdominal wall reconstruction

Operation

- Take down fistulas
- Re-establish GI continuity
- Proctectomy
- End sigmoid colostomy
- Definitive abdominal wall reconstruction

CASE Surgery

Operation

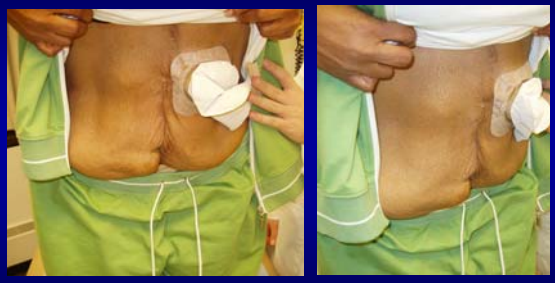
- Take down fistulas
- Re-establish GI continuity
- Proctectomy
- End sigmoid colostomy
- Definitive abdominal wall reconstruction

CASE Surgery

2 months follow up

CASE Surgery

6 months follow up



CASE Surgery

6 Months follow up

CASE Surgery

Hernia (2007) 11:435–440
DOI 10.1007/s10029-007-0255-y

ORIGINAL ARTICLE

Laparoscopic component separation in the single-stage treatment of infected abdominal wall prosthetic removal

M. J. Rosen · J. Jin · M. F. McGee · C. Williams · J. Marks · J. L. Ponsky

Rosen MJ et al Oct 2007 Hernia

CASE Surgery

Outcomes Lap CSM For Infected Prosthetic Removal

N=7		
M:F	3:4	
Mean Age (range)	54 yrs	(34-84)
ASA	3.21	(3-4)
BMI	37 kg/m^2	(30-45)
IDDM	n=3	
Morbid obesity (BMI>35)	n=4	
Prior abdominal procedures	4.6	(3-8)
Prior attempted hernia repairs	1.7	(1-3)

CASE Surgery

Patient Characteristics

Indications for Mesh removal

- Exposed Mesh n=6
- Infected seroma n=1

Prior Mesh

- Gore tex dual mesh n=3
- Composix mesh n=3
- Alloderm n=1

Time to referral 10 m (2-24 m)

CASE Surgery

Operative Details

OR time	185 min	(155-220)
Size of defect	338 cm2	(187-450)
Bilateral Lap CSM	52 min	(45-65)
Primary fascia reapproximated	100%	
Alloderm Underlay	n=7	

CASE Surgery

Postoperative Details

Complications	n=3
Midline wound infection	n=1
Resolved 27 days	
Lateral compartments not involved	
Hepatopulmonary Syndrome	n=1
Wound Hematoma	n=1
Responded to percutaneous drain	

CASE Surgery

Postoperative Details

Mortality	0%
Mean Length of Stay	5.4 days (4-6)
Follow up	n=7
Mean Follow up	12 months (3-16)
Recurrence	10%

CASE Surgery

Laparoscopic Versus Open CSM Patient Demographics

	Open	Lap	P
N	11	11	-
Age	66 yrs	56 yrs	0.09
BMI	37	36	0.80
# Prior Hernias	1.0	1.5	0.20
Albumin	3.1	3.4	0.45

CASE Surgery

Laparoscopic Versus Open CSM Peri-Operative Details

	Open	Lap	P
Defect Size	325 cm^2	425 cm^2	0.39
Wound Complication	82%	18%	0.03
Length of Stay	14 Days	6 Days	0.07
Recurrence	20%	20%	0.9

CASE Surgery

Economics of Ventral Hernia Repair

CPT	Procedure	Charges
49560	Repair Initial Ventral	$2704
49565	Repair Recurrent Ventral	$2715
49568	Mesh Implant	$1071
15330	Alloderm Implant	$993
15734	Abdomino-fascial Flap	$4834
Mod 59	Bilateral 15734	$9668

Conclusions

- ✓Laparoscopic Component separation is technically feasible.
- ✓ Results in comparable fascial advancement as open release.
- ✓ Results in minimal postoperative morbidity in these complex patients.
- ✓ May be the procedure of choice for complex abdominal reconstructions.

CASE Surgery

NOTES

Managing and Preventing Recurrence in Ventral Hernia Repair

Brent D. Matthews, MD

Chief, Section of Minimally Invasive Surgery
Associate Professor, Department of Surgery
Washington University School of Medicine
St. Louis, Missouri

Managing and Preventing Recurrence in Ventral Hernia Repair

Society of American Gastrointestinal and Endoscopic Surgeons Annual Scientific Session, Philadelphia, PA, April 9, 2008

Washington University in St.Louis

Brent D. Matthews, MD

Chief, Section of Minimally Invasive Surgery
Associate Professor, Department of Surgery
Washington University School of Medicine
St. Louis, Missouri

SAGES 2008 April 9 - 12, 2008
Postgraduate Course and Scientific Session
Pennsylvania Convention Center, Philadelphia, PA

Brent D. Matthews, MD

Associate Professor, Department of Surgery
Washington University School of Medicine
St. Louis, Missouri

Presenter Disclosures

Atrium Medical	- Consulting; Honorarium
Ethicon EndoSurgery	- Research support; Honorarium
Ethicon, Inc.	- Consulting
Karl Storz Endoscopy	- Equipment support
Stryker Endoscopy	- Research, Equipment support
W.L. Gore	- Research support; Honorarium

Managing and Preventing Recurrence in Ventral Hernia Repair

Society of American Gastrointestinal and Endoscopic Surgeons Annual Scientific Session, Philadelphia, PA, April 9, 2008

SAGES 2008 April 9 - 12, 2008
Postgraduate Course and Scientific Session
Pennsylvania Convention Center, Philadelphia, PA

INTRODUCTION

Recurrence rates in long-term follow-up after ventral hernia repair remain unacceptably high due to:

- lack of standardization of operative techniques
- failure to recognize factors contributing to ventral hernia recurrence
- patient co-morbidities
- inability to alter inherent collagen metabolism / acute wound healing deficiencies

Managing and Preventing Recurrence in Ventral Hernia Repair

Society of American Gastrointestinal and Endoscopic Surgeons Annual Scientific Session, Philadelphia, PA, April 9, 2008

Long-term Follow-up of a Randomized Controlled Trial of Suture Versus Mesh Repair of Incisional Hernia

Jacobus W. A. Burger, MD,* Roland W. Luijendijk, PhD,† Wim C. J. Hop, PhD,‡ Jens A. Halm, MD,* Emiel G. G. Verdaasdonk, MD,* and Johannes Jeekel, PhD*

Ann Surg 240:578-85, 2004

10 year cumulative recurrence rate
~ 32% recurrence - prosthetic repair
~ 63% recurrence – primary repair

Recurrence rate hernia ≤ 10 cm^2
~ 17% recurrence - prosthetic repair
~ 67% recurrence – primary repair

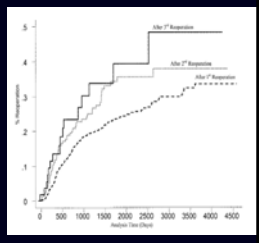
Have Outcomes of Incisional Hernia Repair Improved With Time?
A Population-Based Analysis

David R. Flum, MD, MPH,*†‖ Karen Horvath, MD,† and Thomas Koepsell, MD, MPH*‖

*Robert Wood Johnson Clinical Scholars Program and Departments of †Surgery, ‡Epidemiology, and §Health Services, University of Washington, Seattle, Washington

Ann Surg 237:129-135, 2003

"controlling for age, sex, comorbidity index of the patient, year of the initial procedure, and hospital descriptors (rural location, nonprofit and teaching status), recurrence was 24.1% higher if no mesh was used"



Randomized clinical trial comparing suture and mesh repair of umbilical hernia in adults

A. Arroyo, P. García, F. Pérez, J. Andreu, F. Candela and R. Calpena

Ambulatory Surgery Unit, Department of Surgery, University Hospital of Elche, Elche, Spain
Correspondence to: Dr A. Arroyo, Avenida Oscar Esplá 35-E4-6°D, CP 03007, Alicante, Spain (e-mail: arroyocir@hotmail.com)

Br J Surg 2001;88, 1321-1323

mean postoperative follow-up – 64 months

	Sutures (n = 100)	Mesh (n = 100)
Seroma	5	6
Haematoma	1	1
Wound infection	3	2
Other	2	1
Recurrence	11	1*

*P = 0·0015 *versus* sutures (χ^2 test with Yates' correction)

mean pain scores (ns)

recurrence rates (ns):
8% - > 3 cm
5% - < 3 cm

"recurrence rates lower after mesh repair regardless of size"

Table 2 Analysis[a] of risk factors for recurrence after incisional herniorrhaphy

Risk factors	*n*	Odds ratio	95% confidence interval	*p*
Age	297	1.017	0.997–1.018	0.1032
Gender	297	1.355	0.813–2.2590	0.2430
Body mass index	297	1.410	1.299–1.5310	0.0000
Type of repair				
Tissue	297	2.339	1.281–4.273	0.0058
Mesh	297	0.427	0.234–0.781	0.0058
Hernia size (cm)				
<5	297	0.153	0.075–0.313	0.0000
5–10	297	0.285	0.142–0.572	0.0005
>10	297	12.600	6.921–22.940	0.0000
Chronic illnesses				
No	297	0.439	0.260–0.741	0.0022
Any	297	2.279	1.350–3.850	0.0022
Chronic pulmonary Disease	297	2.098	0.734–5.998	0.1662
Cardiac disease	297	0.886	0.355–2.209	0.7938
Prostatic hyperplasia	124	4.279	1.681–10.896	0.0026
Diabetes mellitus	297	1.738	0.672–4.497	0.2531
Cirrhosis/Ascites	297	9.581	1.046–87.769	0.0456
Wound healing disorders				
No	297	0.248	0.137–0.451	0.0000
Any	297	4.030	2.220–7.317	0.0000
Hematoma	297	3.571	1.308–9.749	0.0132
Seroma	297	3.464	1.338–8.967	0.0106
Infection	297	4.188	1.467–11.955	0.0076

Hernia (2006) 10: 322–325

Laparoscopic Versus Open Gastric Bypass in the Treatment of Morbid Obesity

A Randomized Prospective Study

Juan A. Luján, MD, PhD, M. Dolores Frutos, MD, Quiteria Hernández, MD, Ramón Liron, MD, PhD, Jose R. Cuenca, MD, Graciela Valero, MD, and Pascual Parrilla, MD, PhD

Ann Surg 2004;239: 433–437

TABLE 2. Complications

Results	Laparoscopy	Open
Early complications (>30 days)	22.6%	29.4%
	3 intestinal subocclusions	4 subphrenic abscesses
	2 asymptomatic leaks	3 UGIH
	2 Intra-abdominal bleeding	4 wound infections
	2 UGIH	3 respiratory infections
	1 LGIH	1 evisceration (death)
	1 thrombophlebitis	
	1 stenosis of the gastro-entero-anastomosis	
Late complications (>30 days)	11%	24%
	3 intestinal obstructions	10 eventrations
	Conservative (6th month)	1 subphrenic abscess
	Death	1 intestinal obstruction
	Re-operation (2.5 months)	Re-operation (9th month)
	2 pancreatitis/cholecystectomy	
	1 sudden death	

~ 20%

mean f/u 23 months

Laparoscopic ventral hernia repair (LVHR) in morbidly obese patients

Z. Tsereteli · B. A. Pryor · B. T. Heniford · A. Park · G. Voeller · B. J. Ramshaw

American Hernia Society Scientific Meeting 2007 March, Hollywood, FL

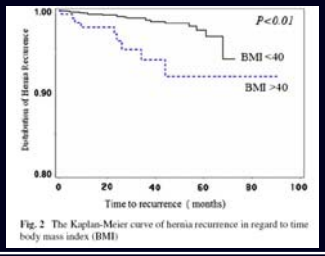


Fig. 2 The Kaplan-Meier curve of hernia recurrence in regard to time body mass index (BMI)

The use of polypropylene mesh in midline incision closure following gastric by-pass surgery reduces the risk of postoperative hernia

Langenbecks Arch Surg (2002) 387:294–297

Table 2 Characteristics of the studied groups of patients

	Group 1 (*n*=12)		Group 2 (*n*=9)		Group 3 (*n*=39)	
	Mean±SD	Range	Mean±SD	Range	Mean±SD	Range
Age (years)	41.2±12.8	22–58	42.3±9.4	23–57	35.2±10.8	18–63
Body weight (kg)	163.6±26.0	136–220	138.6±27.2	98–180	122.8±21.2	90–190
Height (m)	1.70±0.1	1.58–1.9	1.70±0.08	1.6–1.85	1.70±0.08	1.52–1.91
Body mass index	52.9±6.1	44.6–61.3	48.0±8.3	34.7–60.8	42.6±5.6	32.8–58.1
Waist circumference (cm)	149.1±9.9	136–170	135.2±15.0	117–165	128.1±16.2	98–165
Hip circumference (cm)	151.3±18.3	130–186	140.7±16.6	111–155	133.7±11.2	108–152
Waist-to-hip ratio	1.0±0.1	0.8–1.1	1.0±0.1	0.9–1.1	1.0±0.1	0.8–1.2
Hospital stay (days)	14.4±5.7	8–23	27.8±25.1	11–88	11.9±3.8	7–25

ventral incisional hernia rate – 0%

ventral incisional hernia rate – 20%

Randomized clinical trial of postoperative hernia prophylaxis in open bariatric surgery

J. M. Strzelczyk[1], D. Szymański[1], M. E. Nowicki[1], W. Wilczyński[1], T. Gaszyński[2] and L. Czupryniak[3]

Departments of [1]General and Transplant Surgery, [2]Anesthesiology and Intensive Care and [3]Metabolic Disorders, Barlicki University Hospital, Medical University of Lodz, Lodz, Poland

Correspondence to: Dr J. M. Strzelczyk, Department of General and Transplant Surgery, Barlicki Hospital, Kopcinskiego 22, 90-153 Lodz, Poland (e-mail: janusze@noya.nes.pl)

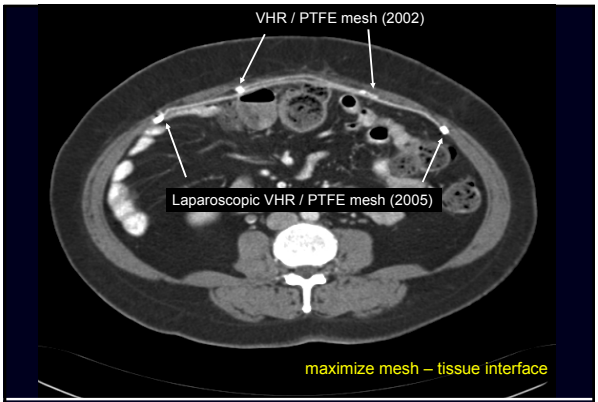
Br J Surg 2006; 93: 1347–1350

Table 1 Patient characteristics

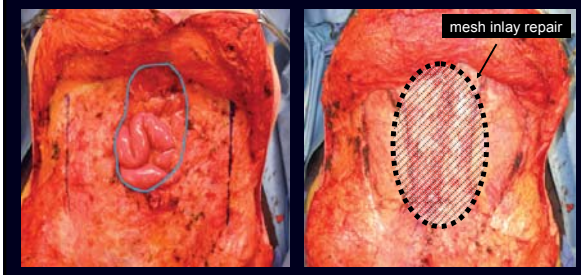
	Mesh (*n* = 36)	No mesh (*n* = 38)
Sex ratio (M:F)	24:12	23:15
Age (years)	39·4(12·3)	38·9(11·8)
Body mass (kg)	137·3(24·5)	139·0(24·9)
Body mass index (kg/m^2)	46·2(7·1)	46·8(7·6)
Waist circumference (cm)	137·8(16·3)	138·4(17·0)
Hip circumference (cm)	139·4(18·7)	140·1(22·1)
Waist-to-hip ratio	1·0(0·1)	1·0(0·1)

Values are mean(s.d.).

Results: Patients were followed for at least 6 months (range 6–38). An incisional hernia developed in 8 patients in the non-mesh group and none in the mesh group. The duration of hospital stay was similar in both groups (p = 0·092). There were no serious complications in either group.



Component Separation Technique



eliminate “bridging” of ventral hernia defect

Plast Reconstr Surg 119: 1792, 2007

Managing and Preventing Recurrence in Ventral Hernia Repair

Society of American Gastrointestinal and Endoscopic Surgeons Annual Scientific Session, Philadelphia, PA, April 9, 2008

Outcomes Analysis of Laparoscopic Ventral Hernia Repair

3rd International Hernia Congress, Boston, MA 2006

Spitler et. al., Dept of Surgery, Washington University, St. Louis, MO and Mayo Clinic, Scottsdale, AZ

Laparoscopic Ventral Hernia Repair
January 2000 – December 2005; n=327 patients

Results:
n=327 patients underwent LVHR (152 male, 175 female)
mean age of 58.7 ± 14 years
mean body mass index of 33.1 ± 8 kg/m2

n=112 recurrent ventral hernias (34.3%)
mean 1.9 previous repairs (range, 1-12)
9 cases (2.8%) converted to open operation
mean defect size - 145.7 ± 140 cm2; mean mesh size - 439.7 ± 243 cm2

mean operating time - 186.0 ± 80 minutes
mean postoperative hospital stay averaged 4.3 ± 3 days

perioperative complications - 110 cases (34.5%)
[2 (0.6%) enterotomies / 3 (0.9%) mesh infections / 10 (3.1%) wound infections]

recurrence rate was 2.8% (n=9)

Intraperitoneal Polypropylene Mesh Hernia Repair Complicates Subsequent Abdominal Surgery

J. A. Halm, MD,[1*] L. L. de Wall, MD,[1*] E. W. Steyerberg, MD,[2] J. Jeekel, MD,[1] J. F. Lange, MD[1,3]

World J Surg (2007) 31: 423–429

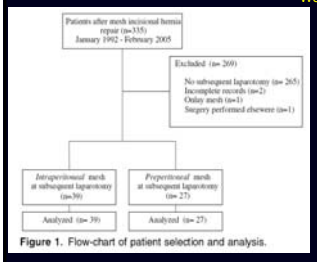


Figure 1. Flow-chart of patient selection and analysis.

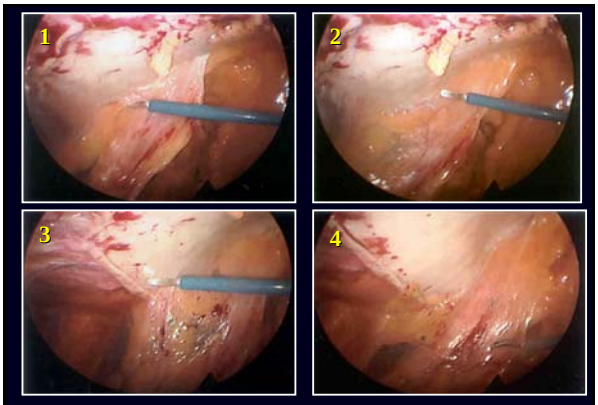
perioperative complications (p<0.001):
intraperitoneal mesh 76% (30/39)
preperitoneal mesh 29% (8/27)

SB resections:
intraperitoneal mesh - 21%
preperitoneal mesh – 0%

surgical site infection:
intraperitoneal mesh – 26%
preperitoneal mesh - 4%

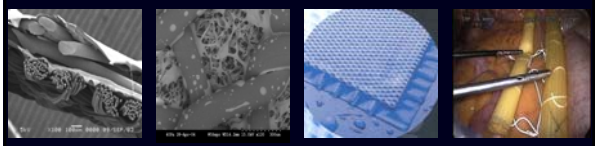
Managing and Preventing Recurrence in Ventral Hernia Repair

Society of American Gastrointestinal and Endoscopic Surgeons Annual Scientific Session, Philadelphia, PA, April 9, 2008



Koehler RH, et al. Minimal adhesions to ePTFE mesh after laparoscopic ventral incisional hernia repair: re-operative findings in 65 cases. JSLS 2003; 7:335-340

Absorbable Barrier Coated Meshes



PROCEED™ Sepramesh™ Parietex®Composite™ C-Qur™

PROCEED™ - oxidized regenerated cellulose

Sepramesh™ - hyaluronic acid / carboxymethocellulose

Parietex®Composite™ - type I atelocollagen / polyethylene glycol / glycerol

C-Qur™ - omega-3 fatty acid cross-linked gel

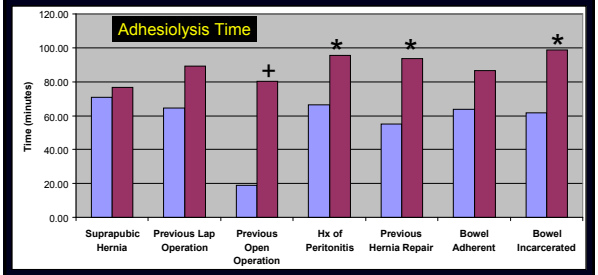
Managing and Preventing Recurrence in Ventral Hernia Repair

Society of American Gastrointestinal and Endoscopic Surgeons Annual Scientific Session, Philadelphia, PA, April 9, 2008

Clinical Predictors of Operative Complexity in Laparoscopic Ventral Hernia Repair

American Hernia Society Annual Congress, March 10, 2007, Hollywood, Florida

Pierce RA, Matthews BD

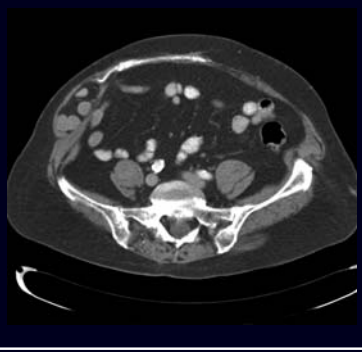


* p<0.05 + p<0.0001

Managing and Preventing Recurrence in Ventral Hernia Repair

Society of American Gastrointestinal and Endoscopic Surgeons Annual Scientific Session, Philadelphia, PA, April 9, 2008

Laparoscopic Ventral Hernia Repair : Mesh Fixation



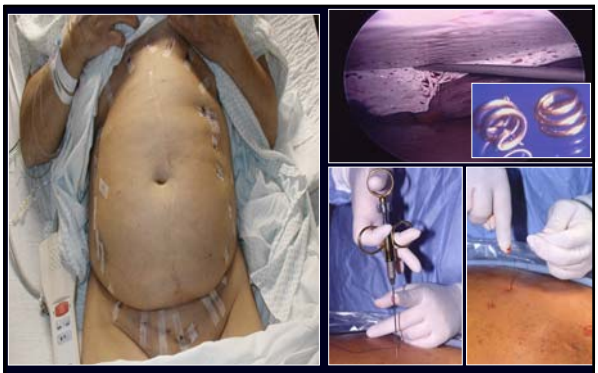
mean burst load polypropylene (95 g/m2) mesh = 1218 N

mean burst strength porcine abdominal wall fascia = 232 N

Textile Analysis of Polypropylene Mesh in a Porcine Ventral Hernia Model
Cobb WS, Matthews BD et al. J Surg Res 136:1-7, 2006

Laparoscopic Ventral Hernia Repair : Mesh Fixation

Time	Titanium Spiral Tacks	Nitinol Anchors	Polypropylene Suture	Polyglactin 910 Suture
Control	15.4 N	7.4 N	39.1 N	40.0 N
Week 8	17.5 N	15.3 N	25.7 N	11.4 N
Week 16	19.1 N	13.8 N	21.4 N	12.8 N



mesh fixation –metallic or absorbable fixation devices and transabdominal sutures

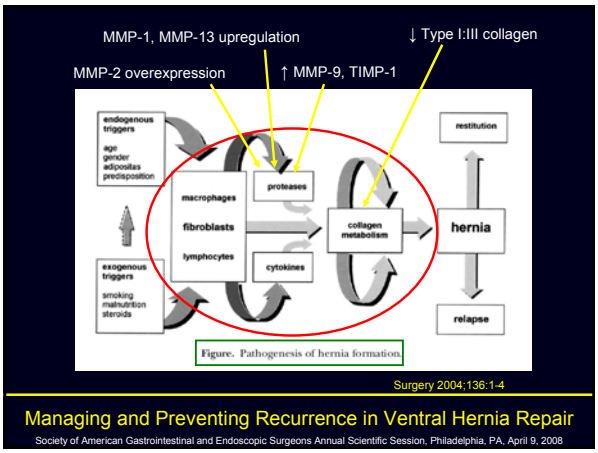


Figure. Pathogenesis of hernia formation.

Surgery 2004;136:1-4

Indications for incisional hernia repair: an international questionnaire among hernia surgeons

J. Nieuwenhuizen · G. J. Kleinrensink · W. C. J. Hop · J. Jeekel · J. F. Lange

Table 2 Indications for repair

Indication	Average	Pain	Limitations of daily activities	(Possible) period of incarceration	Progressive enlargement	Risk of incarceration	Respiratory dysfunction	Discomfort (no pain or limitation)	Young age	Only cosmetic complaints
Pain	1.4	–	NS	NS	NS	NS	$P < 0.05$	$P < 0.05$	$P < 0.05$	$P < 0.05$
Limitations of daily activities	1.4	NS	–	NS	NS	NS	$P < 0.05$	$P < 0.05$	$P < 0.05$	$P < 0.05$
(Possible) period of incarceration	1.6	NS	NS	–	NS	NS	NS	NS	$P < 0.05$	$P < 0.05$
Progressive enlargement	1.7	NS	NS	NS	–	NS	NS	NS	NS	$P < 0.05$
Risk of incarceration	1.7	NS	NS	NS	NS	–	NS	NS	NS	$P < 0.05$
Respiratory dysfunction*	2.0	$P < 0.05$	$P < 0.05$	NS	NS	NS	–	NS	NS	$P < 0.05$
Discomfort (no pain or limitation)	2.1	$P < 0.05$	$P < 0.05$	NS	NS	NS	$P < 0.05$	–	$P < 0.05$	$P < 0.05$
Young age	2.1	$P < 0.05$	$P < 0.05$	$P < 0.05$	NS	NS	NS	NS	–	$P < 0.05$
Only cosmetic complaints	2.7	$P < 0.05$	$P < 0.05$	$P < 0.05$	$P < 0.05$	$P < 0.05$	$P < 0.05$	$P < 0.05$	$P < 0.05$	–

NS not significant

Rate indication for repair (1-5); 1 (most), 5 (least)

Indications for incisional hernia repair: an international questionnaire among hernia surgeons

J. Nieuwenhuizen · G. J. Kleinrensink · W. C. J. Hop · J. Jeekel · J. F. Lange

Table 3 Reasons not to operate

Reasons	Times mentioned
Comorbidity, high operation risk	19
Asymptomatic	10
High body mass index or obesity	5
High age	3
Large size	2
Smoking	1
No progression	1
Loss of abdominal wall tissue	1
Small hernia	1

"The absence of symptoms was most often mentioned as a primary reason not to operate. On average, more than 20% of patients did not receive surgical repair of their incisional hernia. This would mean that many patients with incisional hernia are presumably monitored, although data about the natural course of incisional hernia has not been sufficiently recorded or published. This internationally posted questionnaire shows that there is quite a uniform opinion about indications for repair and, more importantly, indications not to intervene surgically."

NOTES