

Seroma and Recurrence in Laparoscopic Ventral Hernioplasty

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ABSTRACT

Background: Recurrence after laparoscopic ventral hernioplasty is a severe problem despite surgeons' increased experience in recent years. It is well known that the main reasons for recurrences are lack of experience, bad technique, infection, and seroma.

The aim of this study was to investigate the events, what caused recurrences, and the technique to prevent recurrence in laparoscopic ventral hernioplasty.

Methods: From May 1996 through December 2005, 78 patients who underwent 80 laparoscopic ventral hernioplasties (67 incisional hernias, 8 large epigastric, 5 large umbilical) were separated into 2 groups. Group A (n=28): ePTFE dual mesh patch secured intraperitoneally by full-thickness stitches and endoscopic tacks to cover the hernia defect and to overlap healthy margins by at least 2.5cm (n=17, subgroup A1) or 4cm (n=11, subgroup A2). In subgroup A2, a full-thickness suture was placed in the center of the hernia defect to reduce the "dead space." Group B (n=52): The same technique as in group A, but the hernia sac was cauterized by monopolar cautery (n=5) or Harmonic scalpel (n=47). The overlapping healthy margins were at least 2.5cm (n=16, subgroup B1) or 4cm (n=36, subgroup B2). In subgroup B2, a full-thickness suture was placed in the center of the hernia defect to reduce the dead space. Postoperatively, CT-scans were used to confirm complications or recurrences.

Results: In group A, 7 seromas [4 clinical (A1) and 3 subclinical (A1=1, A2=2)], 3 hematomas (A1=2, A2=1), 2 infections (A1), and 3 recurrences (10.7%) were observed (A1=2 or 11.8%, A2=1 or 9%). Two recurrences were observed in symptomatic seromas (subgroup A1) and 1 in a patient without seroma (subgroup A2). In group B, 1 subclinical seroma, 1 hematoma, and 1 recurrence (6.2%) were noted in subgroup B1. In subgroup B2, no recur-

rence was observed. Significantly fewer total seromas occurred in group B compared with group A (P=0.004). The total recurrence rate in group B was 1.95% (NS vs group A), but a significant difference was observed between subgroups A1 and B2 (P=0.036).

Conclusion: Cauterization of the hernia sac and a central full-thickness suture to reduce dead space seems to prevent seroma. This technique combined with a large patch to cover at least 4cm of healthy margins and the surgeon's experience may be sufficient to prevent recurrences in laparoscopic ventral hernioplasty.

Key Words: Epigastric hernia, Incisional hernia, Prosthetic material, Umbilical hernia.

INTRODUCTION

Repair of a large abdominal wall incisional hernia is a difficult surgical problem, with recurrence rates, even in the hands of experienced surgeons, between 30% and 50% after primary closure of the hernia defect without the use of prosthetic materials.¹⁻³ Favorable results have been reported after the use of synthetic meshes or skin for closure of the hernia defects, reducing the tension at the hernial margin.³⁻⁶

The laparoscopic repair of ventral incisional hernias (ventral hernioplasty) was first reported in 1993.⁷ Since then, sporadic case reports and small series have been published about this approach.⁸⁻¹² Today about 10 years after the first report, it is well known that laparoscopic ventral hernioplasty offers significant advantages and should be considered for repair of primary and incisional ventral hernias.¹³ Increased surgeon experience and improvement in biomaterials and instruments have led to fewer complications and recurrence rates,¹⁴ so that this procedure can be done as a highly efficient ambulatory procedure.¹⁵ However, recurrence rates are comparable to those for open mesh hernioplasty especially for larger hernias.¹⁶ However, reports have been published of significant complications and morbidity, which could be partly prevented by meticulous technique and liberal conversions.¹⁷

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The aim of this retrospective study was to investigate the events, what caused recurrences, and the technique to prevent morbidity and recurrences in laparoscopic ventral hernioplasty.

METHODS

A retrospective chart review of 78 patients who underwent 80 laparoscopic ventral hernioplasties (67 incisional hernias, 8 large epigastric hernias, and 5 large umbilical hernias) from May 1996 to December 2005 was undertaken (2 of the patients had 2 hernias each). The abdominal wall defect was between 4cm² to 100cm² (mean 49±16 cm²). The average patient age was 61±12 years (range, 32 to 78). The 67 incisional hernias were 4 in McBurney incisions, 3 in right subcostal incisions, and 60 in midline incisions. There were 14 concomitant laparoscopic procedures including 3 TAPP procedures for inguinal hernia and 11 cholecystectomies for symptomatic gallstones.

All patients were operated on while under general anesthesia and received nasogastric intubation only during the procedure. Preoperative antibiotic prophylaxis was started at the induction of anesthesia and stopped 24 hours later (ampicillin plus sulbactam in 38 patients or piperacillin plus tazobactam in 40 patients).

The position of the trocars changed case by case according to hernia site, size, and concomitant procedures. Usually, hernioplasty requires 3 trocars, one 10-mm and two 5-mm. In our early experience, one 12-mm trocar was used to insert an Endo-clip applicator, but recently the use of tacks has required a 5-mm trocar. In large hernias, a 10-mm trocar and a 5-mm trocar are placed in one side and the second 5-mm trocar is placed in the other side of the abdominal wall, as sideways as possible, to facilitate patch fixation. Additional trocars were usually needed for the concomitant procedures. The first 10-mm trocar was inserted by using the open technique and the remaining trocars were inserted with guidance from the laparoscopic view after creation of a standard pneumoperitoneum.

A 30° scope was used in the first 36 patients, while a 45° scope was used in the last 34 patients for better visualization. The first step of the procedure was the lysis of the adhesions and the identification and dissection of the hernia defect. The concomitant procedure was performed first in all cases. The hernia sac was not excised, and no dissection of the peritoneum was required. The diameter of the hernia defect was measured with an endoscopic ruler. Then a drawing of this defect was painted on the

skin, corresponding to the internal locations of the defect margins determined by passing a thin needle through the abdominal wall around the defect. Around the painted skin line of the hernia defect, a second line was painted to show the line of the patch fixation (**Figure 1**). The distance between internal and external cyclic lines was measured, after reduction of pneumoperitoneum pressure to 7mm Hg to 8mm Hg, to be at least 3cm in the early experience and in later experience to be between 4cm to 5cm. The size of the patch was calculated on the cyclic lines of the abdominal wall, to overlap the margins of the defect by at least 2.5cm, in the early experience, and then at least 4cm on each side in the later experience.

In all cases, Gore-Tex Dual Mesh Biomaterial (W.L. Gore and Associates, Flagstaff, AZ, USA) was used. Nonabsorbable Gore-Tex sutures were put in the 4 corners of the patch. The patch with the tied, but not cut, sutures was then rolled and inserted into the abdominal cavity through an established port or through the 10-mm wound after taking away the port and, when necessary dilating the wound, for larger patches. Under laparoscopic vision, the patch was unrolled intraperitoneally, and after proper surface orientation¹¹ placed on the hernia defect. The fixation of the patch to the abdominal wall was started by passing the 4 sutures from inside through the full-thickness of the abdominal wall and out through 2-mm stab holes in the skin using a suture-passing instrument.^{9,11,12} The sutures were tied, after pneumoperitoneum pressure was reduced from 12 mm Hg to 7 mm Hg or 8 mm Hg, so that the knots came subcutaneously to lie on the outer

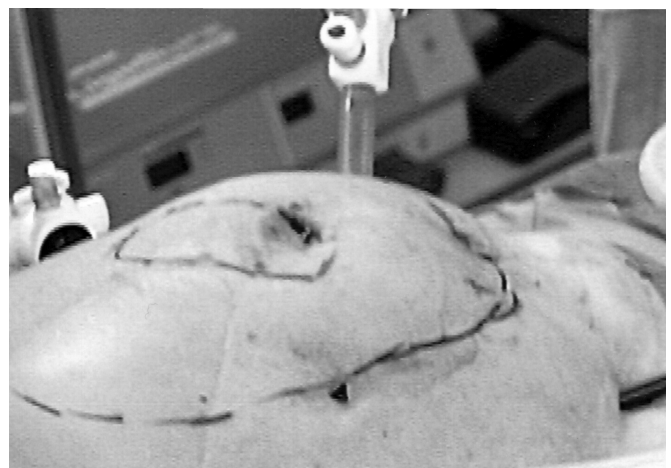


Figure 1. The corresponding internal location of the hernia defect is painted on the skin (internal cycle). The external cycle shows the line of patch fixation. The distance between the cycles is at least 4 cm.

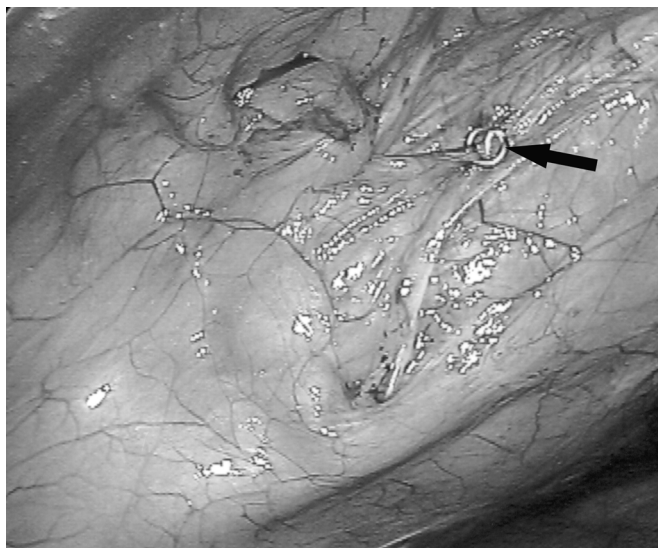


Figure 2. Primary (epigastric) ventral hernia. The sac is easily pulled and nailed down with a tack.

surface of the fascia. Between the sutures, the patch was stapled or tacked to the abdominal wall. In large patches, more full-thickness sutures were placed for better fixation by using the suture-passing instrument. In small patches (4 cases), to avoid the use of a tack applicator for economic reasons, we put only some full-thickness sutures around the patch.

Some modifications of the procedure were necessary, depending on the improvement in our experience. Thus, the patients were separated into 2 groups, and every group was separated into 2 subgroups. Group A (n=28):



Figure 3. Cauterization of the hernia sac using ultrasonically activated coagulating shears.

The patch was sized to cover the hernia defect and to overlap healthy margins by at least 2.5cm (subgroup A1: n=17), or 4cm (subgroup A2: n=11). In subgroup A2, a full-thickness suture was placed in the center of the hernia defect, approaching the patch to the hernia sac to reduce the “dead space” between hernia sac and patch. Group B (n=44): The hernia sac was easily pulled and nailed down in primary (n=8) ventral hernias (**Figure 2**) or cauterized (**Figure 3**) by monopolar cautery (n=3) or Harmonic scalpel (n=33). The overlapped healthy margins were at least 2.5cm (subgroup B1: n=16) or 4 cm (subgroup B2: n=28). In subgroup B2, a full-thickness suture was placed in the center of the hernia defect as in subgroup A2 plus some tacks, in large patches, to reduce the dead space between the hernia sac and patch (**Figure 4**). In the early experience, our technique was that of subgroup A1. Our first modification was the technique used in subgroup A2, then subgroup B1, and finally the technique used in subgroup B2.

Postoperatively, all patients underwent clinical examinations and imaging studies (ultrasonography or CT scan) to evaluate the position of the patch, the condition of the dead space, and to confirm complications or recurrences.

The statistical analysis was carried out using the chi-square and Spearman rank correlation tests. Statistical significance was considered as $P < 0.05$.

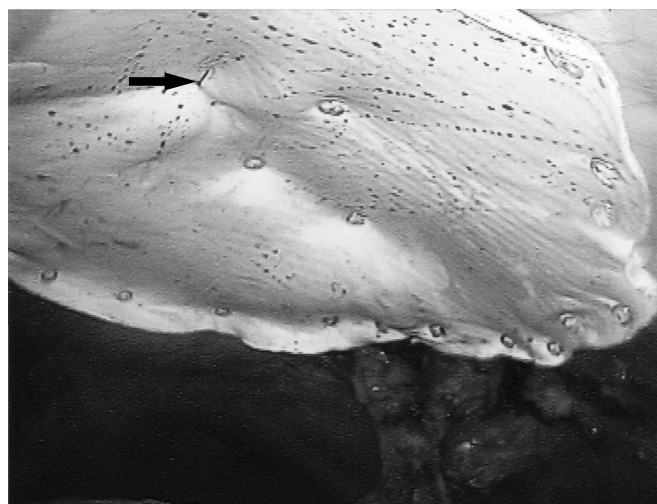


Figure 4. The fixation of the patch on the abdominal wall to cover the hernia defect. In the center of the patch, a full-thickness suture (arrow) and some tacks are placed to reduce the dead space between the hernia sac and the patch.

RESULTS

The demographic characteristics of the patients are shown in **Table 1**. All patients appeared to have mild pain during the first 1 to 2 postoperative days that was treated with mild analgesics or anti-inflammatory agents. All patients returned to full activity within 7 days to 3 weeks, except for 3 group A patients. Of these 3 patients, 2 had a persistent symptomatic seroma (**Figure 5**) and 1 a severe infection (abscess between the patch and the hernia sac). The symptomatic seromas were treated with multiple aspirations and the abscess with percutaneous drainage. The patient who developed the abscess had 4 aspirations of a recurrent seroma before the infection. One week after the percutaneous drainage, the patch was surgically removed because of the persistent infection. In all 3 of these patients, a recurrence was observed. The other clinical and subclinical seromas were resolved, without intervention, within the first 30 postoperative days (**Figure 6**). In group B (subgroup B1), a recurrence was observed without any evidence of seroma. There were no significant differences between the subgroups regarding recurrences except for subgroups A₁B₂ (P=0.036). Regarding seromas, there were significant differences between subgroups A₁B₂ (P=0.004) and A₂B₂ (P=0.009) (**Table 2**).

Technique and seromas were analyzed by using the



Figure 5. CT scan of the anterior abdominal wall. A seroma is revealed between the patch and the hernia sac (dead space). The arrow detects the seroma.



Figure 6. CT scan of the anterior abdominal wall 8 months after laparoscopic incisional hernia repair. An asymptomatic seroma was resolved without intervention. The arrow is shown the place of the resolved seroma.

Table 1. Demographic Characteristics of the Patients		
Patient Characteristics	GROUP A (n = 28)	GROUP B (n = 52)
Sex (male/female)	12/16	23/29
Age (years)	62 ± 11	59 ± 10
Type of Hernia		
Incisional	23	44
Midline	21	39
Right subcostal	1	2
Appendectomy	1	3
Epigastric	2	6
Umbilical	3	2
Defect size (cm ²)	47 ± 14	51 ± 16
Patch size (cm ²)	104 ± 39	116 ± 41
Operating time (min)	41 ± 11	43 ± 15
Mean Hospital stay (days)	3.4 ± 1.5	2.4 ± 1.2
Mean return to normal activity (days)	25 ± 46	12 ± 6
Mean follow up (months)	56 ± 21	48 ± 19

Spearman rank correlation test to assess the strength of the correlation with recurrences. The stronger association was with seromas between subgroups A₁A₂ (P=0.001), A₁B₁ (P=0.022), A₁B₂ (P<0.0001), A₂B₂ (P<0.0001), and with the technique between subgroups A₁B₂ (P=0.036), and groups A,B (P<0.0001) (**Table 3**).

In one patient, an intraperitoneal hemorrhage from adhesiolysis was observed. This patient was reoperated on with the open approach. All recurrences were laparoscopically operated on by the same group of surgeons. A transposition of the patch, which became wrinkled in the

Table 2.

Postoperative Complications

	A1 (n = 17)	A2 (n = 11)	B1 (n = 16)	B2 (n = 36)
Seroma	5	2	1	0*
Clinical	4	0	1	0
Subclinical	1	2	1	0
Hematoma	2	1	0	1
Infection	2	0	0	0
Recurrence	2	1	1	0†

*P = 0.004 vs A1, P = 0.009 vs A2.

†P = 0.036 vs A1.

Between groups A and B, seroma P < 0.004; recurrence P < 0.085 chi-square test.

Table 3.

Results Assessed by Spearman Rank Correlation Test.
Correlation Between Seromas and Techniques Regarding
Recurrences, Between Subgroups

Subgroups	Spearman Rank Correlation Coefficient	P Value
A₁A₂		
Seroma	0.600	0.001
Technique	0.42	0.831
A₁B₁		
Seroma	0.398	0.022
Technique	0.096	0.596
A₁B₂		
Seroma	0.614	<0.0001
Technique	0.288	0.036
A₂B₁		
Seroma	0.350	0.074
Technique	0.053	0.792
A₂B₂		
Seroma	0.699	<0.0001
Technique	0.267	0.070
B₁B₂		
Seroma	0.210	0.135
Technique	0.020	0.890

side of the recurrence, was found. The fixation with sutures and tacks, lengthwise on this side, was completely broken. Three out of 4 recurrences were observed in patients with overlapped healthy margins of 2.5cm. In the

fourth patient with overlapped 4cm of healthy margins, a severe infection occurred after the first procedure and patch removal during the early postoperative period. All recurrences developed during the first 9 postoperative months and were confirmed clinically and by CT-scan images (**Figure 7**). Three of these patients were reoperated on laparoscopically without removal of the previous patch (**Figure 8**). The fourth patient was reoperated on by using the open approach 6 months after removal of the infected patch.

All hematomas were resolved uneventfully. These hematomas were created in the abdominal wall around the passage of the full-thickness suture to fix the patch. Of the 2 cases of infection, the first is mentioned above (abscess percutaneously drained). In the second case, an infection of a full-thickness suture occurred, the suture was removed 2 months later, and the infection healed after local wound care and antibiotic therapy without any evidence of recurrence in a follow-up period of 71 months.

Our technique was first used in subgroup A1. Two early recurrences prompted us to increase the overlap of healthy margins (subgroup A2). The high incidence of seromas led us to the evolution of the technique. Thus, a full-thickness suture was placed in the center of the hernia defect to reduce the dead space. The seromas were reduced, but still existed. Consequently, the hernia sac was cauterized and the seromas significantly reduced. The combination of cauterization of the hernia sac, using a large patch to overlap healthy margins by at least 4 cm,



Figure 7. CT scan of the anterior abdominal wall. The right fixation side of the patch is completely broken, the patch has become wrinkled and transposed to the left side of the hernia defect (arrow).

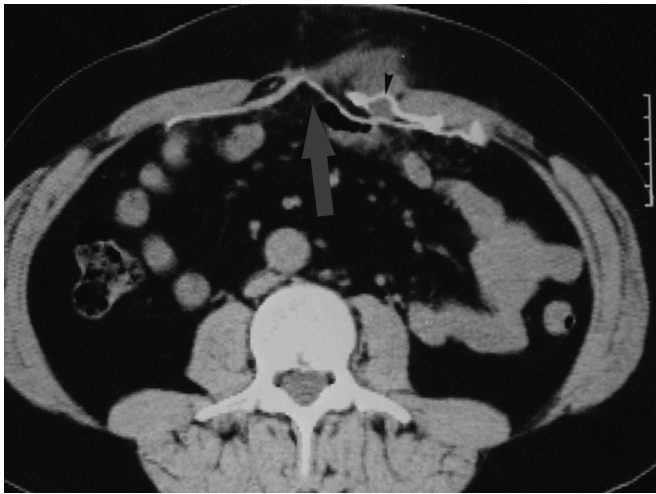


Figure 8. CT scan of the anterior abdominal wall shows a second patch placed laparoscopically on a recurrent incisional hernia repair without removal of the previous laparoscopically placed patch.

and placing a full-thickness suture in the center of the hernia defect to secure the patch to the hernia sac reducing the dead space have provided the best results, as in subgroup B2. The surgeons' increased experience led in the evolution of this technique and improvement in the results.

DISCUSSION

In this retrospective study of 72 laparoscopic ventral hernia repairs, we found that¹ recurrences are fewer if a Gore-Tex Dual mesh patch was sized to overlap the healthy margins of the defect by at least 4cm on each side rather than just 2.5cm.² The cauterization of the hernia sac and a full-thickness suture placed in the center of the hernia defect plus some tacks in large patches to reduce the dead space minimize the incidence of seroma and probably of recurrence.

Laparoscopic ventral hernioplasty is an effective procedure with low rates of morbidity and recurrence.¹²⁻¹⁷ This procedure is indicated for a large number of cases, in the hands of experienced surgeons. The only real medical contraindication for this procedure is the inability for the patient to undergo general anesthesia or the inability to tolerate the insufflation pressures necessary for the operation.¹⁴

Conversion to an open procedure is required in the presence of dense adhesions in small or large bowel injury or in some cases of hernia strangulation.^{14,17}

The presence of seroma is common, especially after repair of a large hernia defect. In general, small asymptomatic seromas are not considered a complication, because most of them resolve without therapy within 6 weeks to 8 weeks.¹⁷ Very large seromas can take several months to resolve. It is important to explain to the patient that the "bulge" is not a recurrent hernia. Rarely, a symptomatic or persistent seroma is aspirated, and a sterile technique is essential to avoid secondary mesh infection.¹⁷ Aspiration of the contents has the risk of introducing bacteria, resulting in infection and the recurrence of the hernia.¹⁸ In a large series of 850 patients,¹⁹ seroma in most of the patients did not cause any long-term problems because they were either aspirated under sterile conditions or allowed to resolve.

Cauterization of the hernia sac destroys the serosal surface of the hernial subcutaneous cavity and creates adhesions immediately in the burned sac close to the dead space. The full-thickness suture in the center of the defect leads to better contact with the burned serosal surfaces and between these surfaces and the patch, supporting adhesion formation in the dead space.¹² This mechanism seems to prevent seroma, which infected or not probably causes rupture of the patch fixation and hernia recurrence.

In our early experience, the patch was sized to overlap the margins of the hernia defect by at least 2 cm⁸ or 2.5 cm¹¹ on each side. This technique led to a recurrence rate of about 10%.^{12,14} A larger patch, which must cover all the old incision, together with more experience, decreases the incidence of recurrence.¹⁴ In the initial technique of ventral hernioplasty, the patch was only stapled without suture fixation.⁸ The staples usually fix the patch only on the parietal peritoneum, so that patch slippage is easy, and hernia recurrence is obvious. The fixation of the patch to the abdominal wall with standard 4 full-thickness sutures in each of its corners stabilizes the patch and prevents patch slippage. In large patches, more sutures may give better fixation.¹² The staples, or better, the tacks between the sutures are used to improve the fixation and mainly to close the openings between the patch and the parietal peritoneum to prevent bowel entrance and possible strangulation. It is known that none of the staplers consistently and adequately secured a 1-mm PTFE patch to a depth beyond the peritoneum.⁹ The tacks succeed better than staple fixation but are not as safe. For this reason, the full-thickness sutures tied subcutaneously ensure patch fixation preventing recurrences.

The overall complication rate that occurred in the largest

multicenter series evaluation to be published was 13%.²⁰ The most frequent complications were ileus in 2.2%, seroma in 2%, and pain in 2%. In another single institution series, the incidence of ileus was 8%, seroma 7.5%, and pain 4.5%.¹⁴ In the present study, no ileus occurred, but the incidence of seroma was 11%. We believe that the higher incidence of seroma found in the present study was because of the highly sensitive image studies of all cases, which better visualized clinical and subclinical seromas. The incidence of hematomas and infections is low, and as the surgeon's experience increases hematomas and infections decrease.

CONCLUSION

The laparoscopic repair of ventral hernias is a safe and effective procedure. Cauterization of the hernia sac and the application of a central full-thickness suture to reduce the dead space between the hernia sac and the patch significantly decrease the incidence of seroma, hematoma, and infection. The use of a large patch to cover at least 4cm of healthy margins and the fixation of the patch with at least 4 full-thickness sutures and tacks between these sutures significantly decrease the incidence of recurrence. From the strong association between seromas and recurrences, it is apparent that the techniques must be intended to eliminate postoperative seromas. Above all, the techniques in which the hernia sac is cauterized are preferred for the prevention of postoperative seromas and recurrences. The combination of the above technical parameters with the adequate experience of the surgical team may be the gold standard to minimize morbidity and recurrences in laparoscopic ventral hernioplasty. More clinical studies with a larger number of patients and longer follow-up periods are needed to confirm these data.

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