Incidence of complications following laparoscopic hernioplasty

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Abstract. Smaller individual series on the outcome of laparoscopic hernioplasty techniques have been reported. This study reports on the complications of 3,229 laparoscopic hernia repairs performed by the authors in 2,559 patients. The TAPP (transabdominal preperitoneal) technique was the most frequently performed: 1,944 (60%). The totally preperitoneal technique was performed 578 (18%) times. The IPOM (intraperitoneal onlay mesh) repair was performed 345 (11%) times. The plug-and-patch technique was used 286 (9%) times and simple closure of the hernia defect without mesh was used in 76 (2%) repairs. Overall, there were 336 (10%) complications: 17 (0.5%) major and 265 (8%) minor. There were 54 (1.6%) recurrences, with a mean follow-up of 22 months. The TAPP technique had 19 (1%) recurrences and 141 (7%) complications. There were four bowel obstructions in this subgroup from herniation of small bowel through the peritoneal closure and trocar sites. The totally preperitoneal technique had no recurrence and 60 (10%) complications. The IPOM group had 7 (2%) recurrences and 47 (14%) complications. The plug-and-patch technique had 26 (9%) recurrences and 24 (8%) complications. The simple closure of the internal ring had 2 (3%) recurrences and 10 (13%) complications. Laparoscopic hernioplasty is not without complications. Training, experience, and attention to technique will prevent some of these complications.

Key words: Laparoscopy — Hernioplasty — Technique — Complications

Introduction

Laparoscopic hernioplasty is being performed in ever-greater numbers. Nevertheless, it has not been adopted as rapidly as was laparoscopic cholecystectomy. One of the most important reasons is that patient acceptance of traditional hernia repair is good, so patient demand for laparoscopic hernioplasty is less than that for laparoscopic cholecystectomy. Consequently, the operation must appeal to the surgeons who are performing it and/or the referring doctors who might recommend it. This will occur only if the procedure is easy to perform and the results are noticeably better. The surgeon recently enamored with therapeutic laparoscopy wants to add another operation to his/her armamentarium, while the surgeon reluctantly performing laparoscopic cholecystectomy does not want to have to learn yet another procedure. Nevertheless, even the most enthusiastic surgeon wants to perform the best operation for his patient and wants to tailor the best technique to the individual patient. A controversy exists as to which of at least five basic types of laparoscopic hernia repair is best. Because no comparative data is available to suggest which is best, and because prospective studies are not yet available, a large, multiinstitutional study of outcome data of the differing techniques of laparoscopic hernioplasty was undertaken.

Methods

No specific patient selection criteria were established. The authors individually selected their patients, though children, adolescents, and patients with known significant medical disease were not operated upon. The data regarding patient age, operative findings, type of operation performed, and outcome was collected concurrently. Complications were labeled "major" if they required intervention or readmission. Complication percentages were calculated by number of repairs unless they were single-organ complications, such as bladder injury, colon injury, or bowel obstruction, or organ-system complications such as myocardial infarction. These were calculated per patient so as not to underestimate them (though they were not more

Table 1. Laparoscopic hernia repairs by technique

Repair type	Number of patients	Number of repairs	% of repairs
TAPP	1,553	1,944	60
Preperitoneal	367	578	18
IPOM	295	345	11
Plug & patch	278	286	9
Closure of ring	66	76	2
Total	2,559	3,229	100

Table 2. Cumulative results of laparoscopic hernioplasty

	Number	%
Recurrence	54	2
Complication	282	9
Major	17	1
Minor	265	8

frequently seen in bilateral repairs). Pneumoscrotum and/or subcutaneous emphysema was not considered a complication unless it was remarkable or impacted the patient's recovery. Nausea and/or vomiting from anesthesia, even if it led to hospital admission, was not considered a complication for the purposes of this study. The data was collected and entered into a computer by the first author. The computer data output was then double-checked by the pertinent participant for accuracy. This process was continued until accuracy was assured.

The operations performed were defined as TAPP (transabdominal preperitoneal), Near or Total Preperitoneal, IPOM (intraperitoneal onlay mesh), Plug and Patch and Simple Closure.

TAPP is a technique that includes an incision in the peritoneum overlying the inguinal floor, fixation of mesh in an anatomic manner regardless of minor variations in fixation or mesh placement, and then peritoneal closure (even if a plug was placed beneath the mesh patch if the patch was secured with staples as in a TAPP).

Near or total preperitoneal technique is one that does not have an incision in the peritoneal cavity except (in some instances) in the umbilical trocar site. Mesh is placed in the preperitoneal space and is sutured or stapled anatomically in place [5, 14, 19, 21, 22, 27].

IPOM is a technique that involves the placement of a prosthesis in the peritoneal cavity with or without the dissection of the hernia sac. Fixation is performed with staples or sutures [7, 9, 27].

The plug-and-patch technique involves the insertion of a plug into the hernia defect with or without a patch covering it. No fixation is employed [24]. Operations that some authors considered plug-and-patch techniques were counted as TAPP repairs if the overlying patch was stapled in place as in a TAPP repair.

Simple closure describes the closure of the hernia defect by suturing or stapling. No mesh is employed [11].

Results

There were 3,229 hernia repairs performed in 2,559 patients (Table 1). The TAPP technique was the most frequently performed. There were 1,944 (60%) repairs performed in 1,553 patients. Near or total preperitoneal technique was next in frequency. There were 578 (18%) repairs in 367 patients. IPOM was next with 345 (11%) repairs in 295 patients. The plug-and-patch technique was used for 286 (9%) repairs in 278 patients. Simple closure was only utilized for 76 (2%) repairs in 66 patients.

The authors performed the technique that they felt appropriate or the technique mandated by their research protocol. During the study period one author switched from IPOM to TAPP. Several changed from plug and patch to TAPP. Several utilized simple closure for small indirect hernias. One author switched from TAPP to near-total preperitoneal. No authors performing near or total preperitoneal changed to a different technique.

Overall there were 336 (10%) complications in 3,229 repairs—17 (0.5%) major and 265 (8%) minor.

There were 54 (1.6%) recurrences (mean follow-up 22 months). There were two (0.06%) deaths—one myocardial infarction and one hepatic failure (Tables 2, 3). Hematomas were the most common complication and occurred in 84 (2.6%) repairs. Neuralgias occurred in 53 (1.6%) repairs. Lateral femoral cutaneous neuropathies were present in one-third of these patients. All neuropathies were transient, but one required reoperation and removal of a staple. Urinary retention occurred in 37 (1.4%) patients. Testicular tenderness followed 31 (1%) repairs. All were transient and no cases of atrophy occurred. There were only four (0.1%) trocar-site infections and only one (0.03%) case of a mesh infection (IPOM repair). Three (0.1%) patients required transfusions.

Five (0.2%) patients developed small-bowel obstructions. Two (0.1%) patients developed trocar-site hernias. There were two patients (0.1%) with bladder injuries and one (0.04%) patient with a colon injury (Table 3).

TAPP

The TAPP technique was the most commonly performed laparoscopic hernioplasty. There were 1,994 repairs performed in 1,553 patients. It was associated with 141 (7%) complications—12 (0.6%) major. The most numerous complication was hematoma; there were 45 (2%). Neuralgias occurred in 35 (2%) repairs, and urinary retention occurred in 20 (1.3%) patients. There were four (0.3%) small-bowel obstructions in this group. Both deaths were in this group (Table 3).

Near or total preperitoneal

There were 578 repairs performed in 367 patients. There were more bilateral hernia repairs (1.6 per patient) in this group, which was due to the selection process of one of the authors, who performed it preferentially when bilateral hernias were suspected. Hematomas were the most frequently encountered problem, as in the other repairs, and occurred in 21 (4%) repairs. Neuralgias were associated with six (1%) repairs. This type of repair was remarkable in that there were no major complications or recurrences (Table 3).

IPOM

There were 345 repairs performed in 295 patients. Hematomas and neuralgias occurred in nine (3%) cases

Table 3. Complications by technique

Repair type	TAPP (n = 1,944)	Preperitoneal (n = 578)	IPOM (n = 345)	Plug & patch (n = 286)	Closure of ring (n = 76)	Total (n = 3,229)
Recurrence	19 (1%)	0	7 (2%)	26 (9%)	2 (3%)	54 (2%)
Complications	141 (7%)	60 (10%)	47 (14%)	24 (8%)	10 (13%)	282 (9%)
Hematomas	45	21	9	3	6	84
Neuralgias	35	6	9	2	1	53
Urinary retention	20	5	7	5	0	37
Testicular pain	11	9	5	4	2	31
Chronic pain	6	2	1	0	0	9
SBO	4	0	0	1	0	5
Trocar site infection	3	1	0	0	0	4
Transfusion	2	0	1	0	0	3
Bladder injury	0	0	1	0	1	2
Colon injury	0	0	1	0	0	1
Vascular injury	1	0	0	0	0	1
Other	10	16	13	9	0	48
Trocar site hernia	2	0	0	0	0	2
Death[a]	2	0	0	0	0	2
Total	160	60	54	50	12	336

[a] Myocardial infarction 1; liver failure 1

each. This repair type was associated with one bladder injury and one colon injury. Recurrences occurred in seven (2%) repairs (Table 3).

Plug and patch

There were 286 repairs performed in 278 patients. This group experienced the greatest percentage of recurrences—26 (6%). Hematomas and neuralgias were low (1%), perhaps due to less dissection and lack of or limited suturing or stapling. This technique was discontinued during the study period (Table 3).

Simple closure

There were 76 repairs performed in 66 patients. These patients were selected in that they had moderate to small indirect inguinal hernias. Two (3%) recurred. Six (8%) had hematomas, and two (3%) experienced testicular pain (Table 3).

Conclusions

The efficacy and safety of laparoscopic hernioplasty have not been generally accepted despite the good early results published by individual investigators [6, 10, 12, 13, 21, 23, 24, 27]. Appropriate concerns have been raised about the violation of the abdominal cavity, the use of mesh in primary repairs, the use of general anesthesia, and the potential complication and recurrence rate of laparoscopic hernioplasty. This report addresses these important questions with the results of a large multicenter study of laparoscopic hernioplasties (LH).

Fitzgibbons et al. [8] and MacFadyen et al. [13] reported the results of differing techniques of LH from several centers and concluded that laparoscopic

hernioplasty was safe and effective. Fitzgibbons reported 736 repairs in 597 patients. There were 25 (3.4%) recurrences (IPOM had a 4.6% incidence) and an additional 267 complications (36%)—mostly minor. There was one (0.2%) death due to a myocardial infarction. MacFadyen reported 635 repairs in 563 patients. There were nine (1.4%) recurrences and 52 (8%) complications (only two major). Our results (which also include some of the same cases) involve 3,229 repairs in 2,234 patients. There were 54 (1.7%) recurrences and 282 (9%) complications—265 (8%) minor and 17 (1%) major.

Complications were assiduously searched for by all the authors included in this study and occurred in 9% of hernia repairs. Only 1% of patients had a major complication (Table 2) similar to reports of traditional anterior herniorrhaphy. No technique seemed to be associated with any specific complications though the simple closure of the internal ring had a 3% recurrence rate and there was a moderate incidence of hematomas and testicular pain. This is surprisingly high, given the simplicity of the approach and the fact that the technique was performed on only the most favorable patients.

To put these complications in perspective it is important to be aware of the results of traditional anterior repairs. For instance, many surgeons are unaware that vascular injuries can occur during any hernia technique. Reports by Barbier [1, 2] and Brown [4] showed vascular injuries occur more commonly during McVay repairs (0.35% and 1.6%, respectively). The incidence of vascular injuries was only 0.06% during laparoscopic hernioplasty.

Ischemic orchitis is also an important but relatively uncommon complication of hernia repair. Wantz has published an incidence of 0.36% in primary repairs and 5% after repairs of recurrent herniae [28]. He also noted most cases occurred following the repair of large indirect inguinal hernias related to the extent of surgical trauma from dissecting the sac. Testicular atrophy
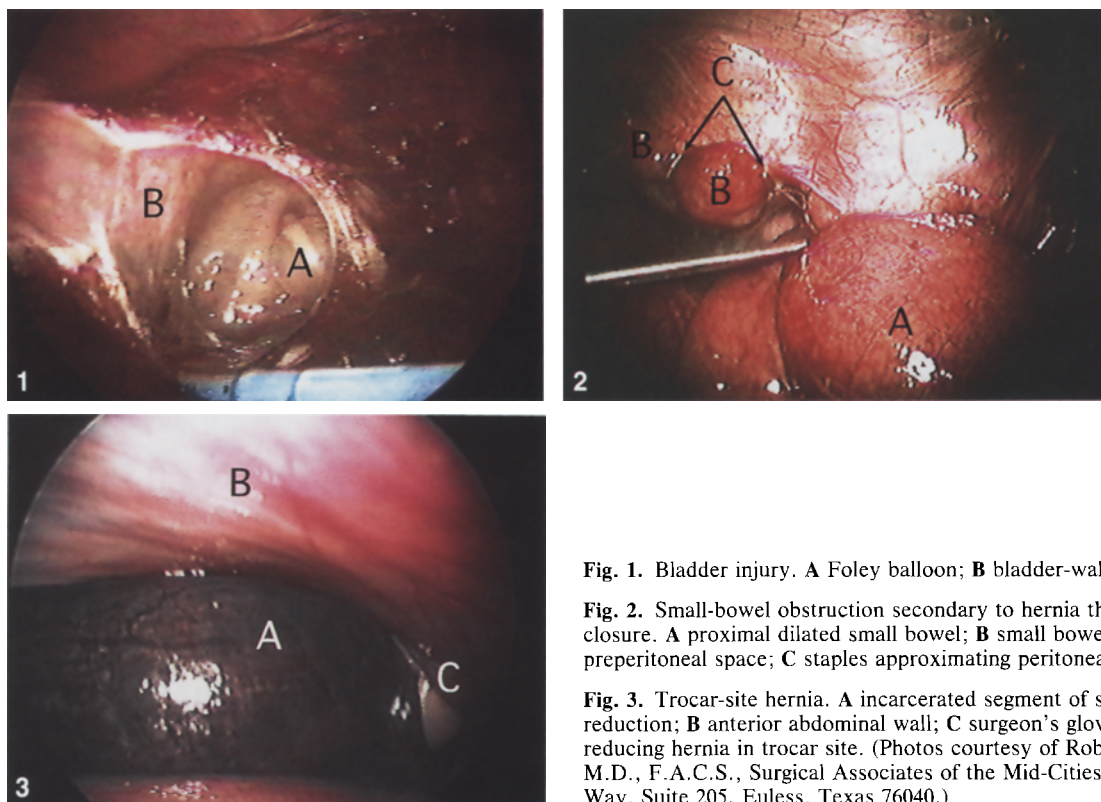
Fig. 1. Bladder injury. A Foley balloon; B bladder-wall mucosa.

Fig. 2. Small-bowel obstruction secondary to hernia through peritoneal closure. A proximal dilated small bowel; B small bowel in preperitoneal space; C staples approximating peritoneal edges.

Fig. 3. Trocar-site hernia. A incarcerated segment of small bowel after reduction; B anterior abdominal wall; C surgeon's gloved finger reducing hernia in trocar site. (Photos courtesy of Robert W. Sewell, M.D., F.A.C.S., Surgical Associates of the Mid-Cities, 350 Westpark Way, Suite 205, Euless, Texas 76040.)

is thought to occur less frequently when the cord is only mobilized proximally, as in Cheatle-Henry preperitoneal approaches, as there is less trauma to the blood supply to the testicle and less injury to the pampiniform plexus and collateral blood supply [16]. Postoperative testicular pain and tenderness was sought for in patients following laparoscopic approaches and was present transiently in 0.9%, but no cases of testicular atrophy were documented.

Seromas are thought to be relatively rare in traditional herniorrhaphy, but Ben-David [3] reported a 6.6% incidence when mesh was used in the repair. Seromas were noted in 1.4% of patients undergoing laparoscopic hernioplasty (listed in the "other" category in Table 3). Seromas were more frequent in totally preperitoneal repairs, presumably because the fluid could not readily drain into the peritoneum. Certainly, a seroma is not a significant problem when recognized as a seroma and the patient and doctors are reassured it is not a recurrence.

Hydroceles occur 0.9% of the time following anterior repair as reported by Obney [18] in 14,442 repairs. This probably represents an unrecognized patent process vaginalis that losses its drainage into the peritoneum when the indirect sac is ligated. This uncommon occurrence also occurs after preperitoneal approaches in 0.5% of cases [17, 25]. Hydroceles occurred in 0.2% with the laparoscopic technique.

There are only rare reports of bowel or bladder injuries during traditional hernia repairs (Fig. 1). These usually occur during the repair of sliding hernias [28]. The IPOM technique was associated with a bladder injury and a colon injury, due either to the learning curve or to the lack of dissection that is a feature of the IPOM repair.

Unique to the laparoscopic technique, small-bowel obstructions occurred in 0.2% of patients (Fig. 2). Four of the five obstructions occurred in the TAPP group due to herniation through inadequately closed peritoneum (the so-called "shower-curtain effect"). One obstruction occurred from a trocar-site hernia (Fig. 3). All obstructions occurred in the first postoperative week. No obstructions occurred in the IPOM group (Table 3). Longer follow-up will be needed to fully evaluate this serious potential complication.

Nerve injuries, paresthesias, and chronic pain were hoped to be less frequent following laparoscopic hernioplasty. Unfortunately, injuries to the ilioinguinal nerve have occurred from stapling the mesh inferior to the lateral portion of the ilioinguinal ligament. In fact, injuries to the lateral femoral cutaneous nerve have also occurred, and are also a unique complication of the laparoscopic approach. In all, 1.6% of patients experienced neuralgias, which is similar in incidence to that seen following traditional anterior approaches [15].

Early recurrence and the so-called "retained" hernia (those hernias that are still present immediately after the operation) are not unique to laparoscopic surgery. Obney reported a 13% incidence of preoperatively unappreciated additional hernias [18]. If not detected intraoperatively because of inexperience or lack of dissection they result in early recurrence. This phenomenon is more common during the learning period (just as in traditional approaches). As experience is gained these problems should not occur. Also, recur-

rent herniae and direct herniae are more likely to recur after repair. Unfortunately, the type of hernia repaired is not available in the present study. Still, the overall recurrence rate of 1.7% (just 1% if nonstapled early plug repairs are excluded) compares well with the 1–10% incidence reported following modified Bassini, McVay, and Nyhus repairs [3]. Reports from the Shouldice Hospital show long-term recurrence rates of 1.5% [3]. Because mesh is used in nearly all laparoscopic techniques, all recurrences are the result of technical errors, shifting of the mesh, not covering the hernia, or failure of the fixation method [20]. It must be stressed that the long-term recurrence rates of the different laparoscopic techniques are not known, although, as in the Stoppa repair, the long-term results should be similar to the early results because of the use of large sheets of mesh that either cover the floor or do not. Careful follow-up studies are still needed to establish the long-term results.

The authors are in agreement that the laparoscopic approach seems preferable in patients with complicated recurrent hernia (especially hernias that would otherwise be approached preperitoneally with midline incision) and in patients in good health with bilateral hernia [19]. There is some evidence that patients with unilateral hernia do better following laparoscopic repair than after traditional anterior repair performed with local anesthesia [29, 30].

This study shows that if patients are properly selected and surgeons are adequately trained and proctored, laparoscopic hernioplasty can be performed with an acceptably low incidence of complications. This study did not attempt to determine whether the patients experienced less pain than that associated with traditional repairs or whether patients returned to work or full activity sooner. However, the authors are uniform in their belief that their patients with bilateral hernioplasties experience less pain and return to full activity sooner than patients undergoing traditional anterior repairs. Most of the authors feel that their patients with unilateral repairs also experience less pain.

The results of the present report not only reflect the early experience of surgeons' learning and perfecting laparoscopic hernioplasty technique but also reflect the results that can be expected after considerable experience has been gained. That is why the results of this larger survey are better than those reported by Fitzgibbons. This difference shows the need for caution and proper training before embarking on these operations. Serious complications can occur and can be avoided. Prospective randomized trials of the different laparoscopic techniques of hernioplasty compared with the different traditional anterior repairs will be needed to determine which repairs should be performed in specific situations and which repairs offer patients the least pain, disability, and risk.

Summary

Laparoscopic hernioplasty techniques are not without complications. Hopes that the laparoscopic approach could avoid nerve injuries and chronic pain have not

been realized. Nevertheless, the results of the early experience of the authors show that complications can be avoided with proper attention to anatomy and the technique of hernioplasty. Recurrences in the first two years were few and were invariably failures of technique. Inadequate fixation of mesh, small patch size, and failure to cover both the direct and indirect portions of the floor were the reasons for early recurrence. Proper training, knowledge of complications, experience, and attention to technique are important to the safe and successful outcome of laparoscopic hernioplasty.

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