



Journal of Minimal Access Surgery

Official Publication of Indian Association of Gastrointestinal Endo-Surgeons

ISSN 0972-9941

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The Journal is printed on acid free paper.

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E-mail: editor@journalofmas.com, Website: www.journalofmas.com

Published by

Medknow Publications

A-108/109, Kanara Business Center, Off Link Rd, Ghatkopar (E), Mumbai - 400075, India
Phone: 91-22-6649 1818/1816, Fax: 91-22-6649 1817 | Web: www.medknow.com

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July-September 2007 - Volume 3 - Issue 3

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Laparoscopic incisional and ventral hernia repair

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Abstract

Background: It has been more than a decade, since the introduction of laparoscopic management of ventral and incisional hernia. The purpose of this article was to systematically review the literature, analyze the results of Laparoscopic repair of ventral and incisional hernia and to ascertain its role. **Materials and Methods:** Pubmed was used for identifying the original articles. Both incisional and ventral hernia repair were included. Out of 145 articles extracted from Pubmed, 34 original studies were considered for review. More than three thousand patients were included in the review. Variables analyzed in the review were inpatient stay, defect size, mesh size, hematoma, seroma, wound infection, bowel perforation, obstruction, ileus, recurrence and pain. Qualitative analysis of the variables was carried out. **Results:** Seromas (5.45%) and post operative pain (2.75%) are the two common complications associated with this procedure. Recurrence rate was found to be 3.67%. Overall complication rate was 19.24%, with two deaths reported. **Conclusion:** The results suggest laparoscopic repair of ventral and incisional hernia as an effective procedure. Faster recovery and shorter in patient stay - makes it a feasible alternative to open repair.

Key words: Incisional hernia, laparoscopy, mesh, repair, ventral hernia

To review the literature from 1995 to 2006 in a systematic manner and to analyze the results of laparoscopic incisional and ventral hernia repair.

INTRODUCTION

Postoperative incisional hernia is one of the most common surgical procedure being performed in

General Surgery. The incidence of incisional hernia, as reported in literature is 3% to 20%.^[1-9] The principle of laparoscopic incisional hernia repair is based on Rives-Stoppa repair, first published in 1985.^[10] Original Rives-Stoppa repair involved extensive tissue dissection in a myofascial plane for placement of mesh. LeBlanc and Booth^[5] first described laparoscopic repair of incisional hernia in 1993. Since then, many authors have published reports of laparoscopic incisional and ventral hernia repair (LIVHR). This procedure is fast emerging as an alternative to open technique. The purpose of this study was to review and analyze the results of different authors and determine the clinical status of laparoscopic incisional and ventral hernia repair.

MATERIALS AND METHODS

English Language articles on Laparoscopic Incisional or Ventral hernia repair (LIVHR) from 1995 to 2006 were extracted from electronic databases. Pubmed and MEDLINE search was done using following terms “incisional hernia”, “ventral hernia”, “laparoscopy” and “repair” to find out relevant laparoscopic studies. Original prospective and retrospective observational studies and randomised control trials were included. Comparison studies between laparoscopic and open incisional/ventral hernia repair were also included. Laparoscopic repair data was extracted from comparison studies. In total 145 articles were found of interest. A cross-reference search was also carried out from the latter to include relevant manuscripts. Three different senior surgeons assessed these articles.

Review of literature or meta-analysis (only one found) was not included to avoid repetition bias. Studies that were excluded were animal experimental models, articles

containing combined abdominoplasty or autoplasty, case reports and primary repair using suture. The latter exclusions were done to make the review more specific and clinically-oriented. Articles with less than 10 reported cases were also excluded from the study, to avoid bias from authors being in the learning curve.

Thirty four articles were finally included into the study based on the above criteria (Quality of Reporting of Meta-Analysis, QUOROM, flow diagram [Figure 1]). The following parameters were studied including inpatient stay, defect size, mesh size, hematoma, seroma, wound infection, bowel perforation, ileus, obstruction, recurrence, chronic pain and other complications. Though quantitative analysis was not performed, qualitative assessment of parameters was done.

RESULTS

3266 patients were analysed from 34 studies with an average age of 55.34 years. One hundred and eighty extra procedures were performed while doing the primary operation. Further results are summarised in Tables 1-5 and [Figure 2].

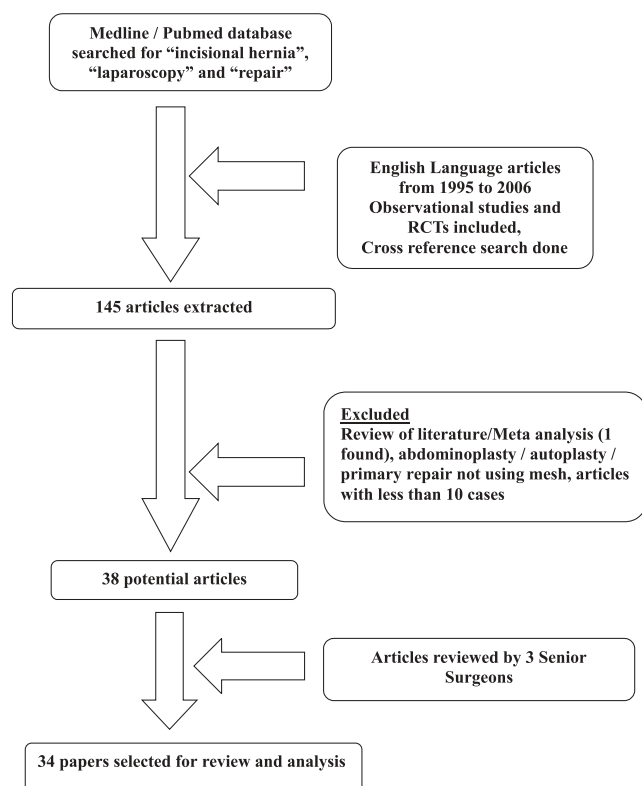


Figure 1: Quorom flow diagram

DISCUSSION

Technique

To gain intra abdominal access, peritoneal insufflation is done usually away from the hernia site.^[20,34,28] Left hypochondrium / subcoastal region has been found to be the preferred site for Verres needle insertion.^[18,28] Open Hassan technique^[22] and Visiport were other alternatives used for access.^[32,25] To obtain triangulation, working ports are placed away from defect or lateral to the rectus muscle.^[12,13,19,20,28,34]

Wherever possible, dissection with diathermy should be avoided or used sparingly because of concerns that energy transmission can cause delayed bowel perforation.^[24] Harmonic scalpel should be used with caution while doing adhesiolysis.^[16,18,25,34] Hydrodissection is another alternative to divide visceral adhesions with the parietes.^[11] However, sharp dissection with scissors remains the safest tool.^[18,28,34,45]

A 30 degree scope would provide a good panoramic view.^[13,24,28,32-35,46] Mizrahi *et al.*,^[27] have used 45 degree scope for surgery.^[22] In a series of 200 patients Le Blanc *et al.*,^[24] managed with a 0 degree scope.^[32]

Longstanding hernia with incarcerated bowel can pose technical challenge. These have a higher chance of enterotomy rate during dissection.^[15] Though they are not a contraindication for laparoscopic repair.^[24] Incisional hernias extending to suprapubic or xiphoid region^[17] are difficult to obtain a good overlap and fixation of mesh. Another demanding situation is

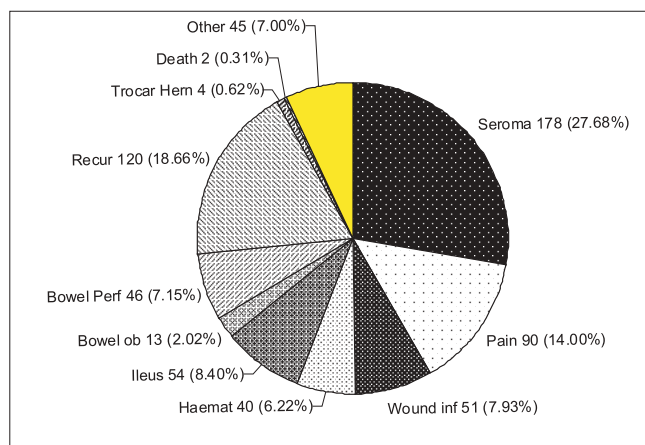


Figure 2: Pie chart showing percentage distribution of 643 complications

Table 1: Studies with more than 25 cases

Author	(Reference) year	Study type	Patients number	Follow up in (months)
Moreno Egea <i>et al.</i> ^[11]	2002	*prospective	55	18
Aura <i>et al.</i> ^[12]	2002	*prospective	86	37
B. Kua <i>et al.</i> ^[13]	2001	*retrospective	30	12
Bageacu <i>et al.</i> ^[14]	2002	*retrospective	159	49
Bamehriz <i>et al.</i> ^[15]	2004	*prospective	28	10.7
Ben-Haim <i>et al.</i> ^[16]	2002	*retrospective	100	19
Bower <i>et al.</i> ^[17]	2004	*retrospective	100	6.5
Chowbey <i>et al.</i> ^[18]	2003	*retrospective	34	median 16.5
Eid <i>et al.</i> ^[19]	2003	*retrospective	79	34
Franklin <i>et al.</i> ^[20]	2004	*retrospective	384	47.1
Franklin <i>et al.</i> ^[21]	1998	*retrospective	176	NR#
Heniford <i>et al.</i> ^[22]	2000	*retrospective	415	23
Koehler <i>et al.</i> ^[23]	1999	*retrospective	32	20
Le Blanc <i>et al.</i> ^[24]	2003	*retrospective	100	36
Le Blanc <i>et al.</i> ^[25]	2000	*retrospective	100	51
Mc Greevy <i>et al.</i> ^[26]	2003	**comparison	65	1
Mizrahi <i>et al.</i> ^[27]	2003	*retrospective	231	NR#
Muysoms <i>et al.</i> ^[28]	2004	*retrospective	50	14.3
Park <i>et al.</i> ^[29]	1998	**comparison	56	24.1
Park <i>et al.</i> ^[30]	1996	*retrospective	30	8
Parker <i>et al.</i> ^[31]	2002	*retrospective	50	41
Raftopoulos <i>et al.</i> ^[32]	2002	*retrospective	50	20.8
Riet <i>et al.</i> ^[33]	2002	**comparison	25	16
Olmi <i>et al.</i> ^[34]	2005	**comparison	50	median 9
Verbo <i>et al.</i> ^[35]	2004	*prospective	45	NR#
Misra <i>et al.</i> ^[41]	2006	*prospective	33	13.7
Lomanto <i>et al.</i> ^[42]	2006	*prospective	50	19.6
Earle <i>et al.</i> ^[43]	2006	*retrospective	469	NR#
Motson <i>et al.</i> ^[44]	2006	*prospective	117	median 42

*Observational, **Comparison study between laparoscopic and open repair, NR# not recorded in study

Table 2: Results

Results	Mean value	Comment
Defect size*	108.74 square cm	Defect average area from 15 studies; defect diameter as 7.05 cm in 5 studies
Mesh size*	268.61 square cm	Area evaluated in 10 studies
Operating time*	96.52 minutes	Evaluated in 29 studies, could not be evaluated in 2 studies, mentioned as median in another 3
Hospital stay*	54.85 hrs	Evaluated in 26 studies**
Follow up*	29.7 months	Follow up of 26 studies**

*All of included 34 studies did not mention this parameter, **Mentioned as median or range in other studies.

Table 3: Complications

Complication	Number (3266)#	Studies*	Percentage
Seroma	178	29	5.45
Postoperative pain	90	17	2.75
Wound infection and Trocar site cellulitis	44 + 7 = 51	25	1.56
Haematoma	40	13	1.2
Ileus	54	17	1.65
Bowel obstruction	13	9	0.39
Bowel Perforation	46	17	1.40
Recurrence	120	27	3.67
Trocar site hernia	4	3	0.12
Death	2	2	0.06
Other	45	12	1.37
Total	643		19.68

#Total number of cases in 34 studies, *Studies reporting this complication

repair of parastomal hernia where dissection and mesh placement is around hollow viscera.^[28]

In laparoscopic hernia repair mesh can be placed intraperitoneally^[13,14,20,42] or in preperitoneal / extraperitoneal space.^[13,18,22] At least 3 to 5 cm mesh overlap of the defect by the mesh has been recommended by different authors^[13,19,20,21,24,25,27,28,33,34]

to obtain good results.

Spiral tackers are placed in concentric pattern^[27,32,34] along the periphery of mesh in one or two rows. The depth of penetration for the spiral tackers is < 4 mm.^[47] In obese patients, the tackers may not reach up to the fascial layers. However, this should not be the reason for not offering laparoscopic incisional hernia repair to

Table 4: Complications as noted in different studies

Author	Seroma	Postoppain	Wound infection	Trocar cellul	Ileus	Obstrn	Recur
Moreno-egea ^[11]	5				1		1
Aura ^[12]	12	5			1		6
B. kua ^[13]		1	2			1	3
Bageacu ^[14]	22	31	4		6	2	19
Bamehriz ^[15]	9	2					1
Ben-Haim ^[16]	11				4	3	2
Bower CE ^[17]	1	3	2		2	2	2
Chari ^[36]		0	1	0			
Chowbey ^[18]	7		1				1
Eid ^[19]	3	3			1		4
Franklin ^[20]	12	12	3		5	1	11
Franklin ^[21]	2		4				2
Heniford ^[22]	8	8	4	5	9		14
Holzman ^[37]	1	4	1			1	2
Koehler ^[23]	2			2		1	3
Lau ^[38]	2		1				
Le Blanc ^[24]	7	2	2		9	1	4
LeBlanc ^[25]	7		1		2		9
Mc Greevey ^[26]	2	0	2	0	0		0
Mizrahi ^[27]	10						8
Muysoms ^[28]	2	4	0	0	2		1
Tagaya ^[39]	1		1(abscess)				2
Park ^[29]	2	2	2		3		6
Park ^[30]		1	1		3		1
Parker ^[31]	1	2					0
Raftopoulos ^[32]	7		2		3		1
Riet ^[33]	9		1		1		4
Stefano olmi ^[34]	6	1	1		0		1
Tsimoyiannis ^[40]	1		1				
Verbo ^[35]	3		0	0	1		0
Misra ^[41]	4	6	2				2
Lomanto ^[42]	5		2		1		1
Earle ^[43]							
Motson ^[44]	14	3	3			1	9
Total	178	90	44	7	54	13	120

Table 5: Type of mesh used in the 34 studies

Mesh type	Number of studies
ePTFE (expanded polytetrafluoroethylene)	15
Polypropylene	10
Dual mesh/composite	8
Goretex	4
Marlex	2

a population with raised BMI (body mass index).^[17,28,32] Transfascial sutures can be helpful in such a scenario.

Transfascial sutures are used for initial orientation, to fix the mesh and to prevent mesh migration.^[12,18,20,24,44,48] This technique can cause chronic postoperative pain. Sutures can be used to fix the mesh in centre or periphery. Some authors recommend transfascial sutures at the 12'o clock and the 6'o clock position.^[14,31] The 3'o clock and the 9'o clock position is optional.^[31]

The bowel lying underneath the mesh can be covered with omentum. This serves as a barrier. It also prevents adhesions^[20] and fistulization^[13,37,49] of bowel.

Pain

In this review, 90 patients had postoperative pain related to the wound site (2.75%).

Postoperative pain can lead to readmissions, hence increasing the morbidity and costs of laparoscopic procedure.^[11] This complication of laparoscopic incisional hernia repair has been found to be under reported.^[15] Godney *et al.*,^[50] have reported increased postoperative pain following laparoscopic ventral hernia repair when compared to open procedure. Different authors have used different period for defining chronic postoperative pain.

Sutures for mesh fixation may cause ischemic injuries to anterior abdominal wall musculature or neurovascular bundle which results in pain. Nerve entrapment in tacker is another possible explanation to the postoperative pain.^[20,38] Heniford *et al.*, have reported chronic pain along the dermatomal^[22] distributions. This on occasion has called for the extraction of tackers^[14,28] or division of transfascial sutures.^[24] Moreno-egea *et al.*,^[11] found laterally placed transfixation sutures are likely to be associated with postoperative pain outside the midline. Patients tend to tolerate the mid-line transfascial fixation sutures better.^[14,31] Marcaine injections, NSAIDs and narcotics have been tried to treat this complication.^[22] Seromas have also been associated with chronic postoperative pain.^[12] Kua *et al.*,^[13] had to remove the mesh in a patient with persistent postoperative pain.

Seromas

178 (5.45%) seromas were noted. Thirty seven of these seromas were aspirated (20.7 %). In laparoscopic hernia repair, the hernia sac is not excised.^[12,15,19,22,33-35] This effectively leaves behind a potential space for seroma formation. It happens to be one of the complications inherent to this procedure.^[20,22,25,51,52] Most seromas resolve with time, some requiring eight to 12 weeks for complete resolution.^[15,17,19,20,22,25,27] Majority of the authors considered the seromas for conservative management. Occasionally it will give an ominous appearance of recurrence.^[38,41] In such cases ultrasound of abdomen can be an useful diagnostic tool.^[17,49] If followed-up using ultrasound, seromas have been reported to be ubiquitous.^[53] Some surgeons^[25,31,41] have advocated using dressing or abdominal binder to cause compression on abdominal wall to occlude the potential dead space. Rarely, they would require aspiration when persistent^[12] or symptomatic.^[16,22,24,26,33,34,54] No long-term complications have been noticed following seromas.^[22] Though infection of hematoma has been noted in literature.^[34]

Recurrence

One of the most important outcome measurements of hernia repair is recurrence. On analysis, in our study we found a recurrence rate 3.67%. Some authors feel using just the tackers, without suture, increases the chances of recurrence.^[14,20,33] Transfascial sutures for

mesh orientation and fixation has been shown to reduce recurrence.^[18,22,33] Franklin *et al.*,^[20] found 73% of recurrence occurred in patients in whom transfascial sutures were not used. In these cases, only staples were relied upon to keep the mesh in place.^[20] Transfascial sutures prevent the migration of prosthesis and hence recurrence.^[20]

Recurrence rate is likely to improve with experience^[24] and improved techniques of adequate mesh overlap at the periphery of hernia.^[24] Breakdown of transfascial sutures has been attributed as one of the causes of recurrence.^[24] Eid *et al.*,^[19] on their long term follow-up (mean 34 months) found a recurrence rate of 5%. A rare complication is herniation of bowel between the mesh and abdominal wall.^[16] Widely spaced tacks can cause bowel herniation between the tacks.^[12,16] Delayed recurrence is known to occur and Le Blanc *et al.*,^[25] suggest at least three-year follow-up.

Wound infection / trocar site cellulitis

Wound infection is lower in laparoscopic hernia repair compared to open, as there is decreased extent of tissue dissection in the former.^[22,55] Trocar site cellulitis seen in laparoscopic repair resolves with antibiotics.^[22]

Mesh, wherever possible, should not be brought in touch with skin to avoid contamination by skin flora.^[35] Leber *et al.*,^[4] along with others^[10,29,56-59] found polyester meshes to have highest incidence of infection, fistulisation and recurrence. Mesh infection required extraction in certain cases.^[17-20,26,27] Thirty one meshes had to be extracted in 16 studies. Porcine small intestine mucosa derivative has been used in infected environment^[9,60] with good results as an alternative to mesh.

Intra-abdominal complications

Laparoscopic hernia repair causes decreased incidence of ileus.^[19] This is because of less handling of the intestines and lesser tissue dissection. Ileus usually settles down spontaneously. However, mechanical obstruction should be ruled out if it tends to persist beyond 72h.^[61] Ben -Haim *et al.*,^[16] have reported prolonged ileus beyond five days.

Post procedure adhesive bowel obstruction increases

the morbidity and may require reoperation.^[13,16] Bageacu *et al.*,^[14] had to perform resection anastomosis for bowel obstruction presenting more than one year after primary procedure. Obstruction was secondary to mesh complication. Dual mesh using smooth surface towards peritoneal cavity decreases the chances of adhesions. Smooth surfaced side has ePTFE, which has less postoperative visceral adhesions.^[22,25,30,62-65]

Enterotomies have been reported to occur in up to 6% of patients undergoing laparoscopic ventral hernia repair.^[20,23-25,43] Enterotomy during the surgery may not necessarily mean conversion to open procedure. This depends upon the expertise of the operating surgeon. Although, it does increase the rate of mesh infection.^[20] Hernia repair by some surgeons was deferred in cases of recognized enterotomy.^[24,31] Missed bowel perforation can have disastrous consequences. Delayed diagnosis of bowel perforation would result in mesh infection and ultimately extraction.^[11,16,66] Clinical parameters need to be monitored and should be supplemented by radiological evidence if such kind of complication is suspected. Intracorporeal knotting^[12,24,34] can be done to manage serosal tear of bowel, if required.

Other complications

Postoperative fever of unknown origin prolongs the hospital stay and overall has financial bearings.^[16] It has been reported in four studies.^[12,16,22,27] Heniford *et al.*, performed diagnostic laparoscopy in patients with unexplained postoperative fever to exclude abdominal pathology, with negative results.^[22]

In 40 (1.2 %) patients, a wound hematoma or significant bleeding at wound/trocar site was noted.^[11-14,22,27,32] This is a well known complication in laparoscopic surgery. Intraabdominal pressure during laparoscopy causes tamponade effect on vessels and hence the bleeding, arterial or venous, may manifest after surgery.^[67]

Enterocutaneous fistula was reported in two cases in a study by Bageacu *et al.*,^[14] Both the cases required surgical intervention for treatment. There have only been two deaths reported in the review^[23,44] (0.06%).

Conversion to open

Seventy four (2.26%) cases required to be converted to open procedure. Technical difficulties in dissection and defining the right plane can result in conversion.^[22] Surgeons experience is also an important factor towards conversion to open repair. Malignancy,^[28] dense adhesions^[16,20,24,25,28,32] and incarcerated hernia^[22,35] remain common contributory factors towards conversion. Bowel injury^[16,19,24,25] which cannot be dealt with laparoscopically^[20] is another cause for conversion. Spillage of enteral contents increases the chances of wound infection.

CONCLUSION

Laparoscopic repair of incisional hernia has a learning curve and increased operative time.^[14,32] This form of surgery requires advanced laparoscopic skills.^[16,32] It has been recommended for incisional and ventral hernia greater than 3 cm in diameter.^[11,17,22,24,32,35,60,61,68]

LIVHR has shown promising results and is being widely accepted. It results in shorter hospital stay and lower short-term complications when compared to open repair.^[26] Less incidence of wound infection, early return of bowel activity and faster resumption of normal activities^[22,34,37,60,69] favor LIVHR. Shorter hospital stay is translated into lesser overall cost of procedure.^[34] It is also feasible to perform this procedure as day case surgery.^[11,25,31,32] Monro-Egea *et al.*,^[11] performed 76% of cases as day care.

Laparoscopic repair allows viewing of hernia defects, which are not apparent clinically and treat multiple hernias located in different quadrants of abdomen through same incision.^[13,35] It also allows dissection in the right anatomical plane.^[35]

Seromas tend to be a common complication with LIVHR, which tends to settle down conservatively. Placing tacks and transfascial sutures judiciously can avoid recurrence and chronic postoperative pain. Meticulous tissue plane dissection can avoid bowel perforation. Hernias included in this study are clinically a heterogeneous group. We feel this provides strength to the study as a greater cross-section of incisional and ventral hernia

was studied. The data from the observational studies has not been combined statistically but essentially summarized and this makes it a qualitative review. The evidence provided by this study would be 2++ according to grading system of “Levels of evidence”. More prospective randomized controlled trials are required to establish the role of Laparoscopic incisional and ventral hernia repair.

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Cite this article as: Bedi APS, Bhatti T, Amin A, Zuberi J. Laparoscopic incisional and ventral hernia repair. *J Min Access Surg* 2007;3:83-90.

Date of submission: 16/07/07, **Date of acceptance:** 17/09/07

Source of Support: Nil, **Conflict of Interest:** None declared.