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Original Article

Comparative Study and Advantages of Laparoscopic Ventral Hernia Mesh Repair Versus Conventional Open Mesh Repair

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Abstract

Background: An incisional hernia develops in 7%–11% of laparotomy incisions. Laparoscopic repair was applied to the ventral hernias (VH), with the expectation of earlier recovery, fewer postoperative complications, and decreased recurrence rates. This prospective study was performed to compare the outcomes after open and laparoscopic VH repair (LVHR).

Materials and Methods: It is a prospective study involved 55 patients with VH, who were subjected either to repair by laparoscopy or to open repair. The open surgical operations were performed by onlay mesh repair, whereas the laparoscopic repairs were performed using the intraperitoneal dual mesh intraperitoneal onlay mesh repair technique.

Results: The mean surgery duration was significantly lower in the laparoscopic repair when compared to open repair ($P < 0.001$). The mean duration of post-operative analgesics used in laparoscopic group is 4.3±0.50 days as compared to open VH repair 6.48±0.15 days ($P < 0.001$) which is significant. The mean post-operative stay in the hospital was shorter for the laparoscopic group than for the open hernia group (6.3 vs. 11.06 days; $P < 0.001$). Antibiotics used in the laparoscopy group are 5.85±0.50 days as compared to open repair 6.48±0.50 days ($P < 0.001$). Return to the activity or normal daily work is significantly low in the laparoscopic group as compared to open repair of hernia (2.2 vs. 4.34 days; $P < 0.001$). There were fewer post-operative complications in laparoscopy.

Conclusion: The findings demonstrate that LVHR in our experience was safe and resulted in shorter operative time, fewer complications, shorter hospital stays, and earlier returns to daily activity. Hence, it should be considered as the procedure of choice for VH repair.

Key words: Hernia, Hospital, Repair

INTRODUCTION

Ventral hernias (VH) are occurring as a result of weakness in the musculofascial layer of the anterior abdominal wall. Unlike all other hernias that surgeon evaluates and repair, incisional hernias (IH) are unique in that the surgeon contributes to the source and cause of the disease incidence of 6–13%.[1-10]

The VH repair is based on the principle of Rives-Stoppa open tension-free mesh repair. In the laparoscopic technique, the mesh is placed in an intraperitoneal location and where the rise in the intra-abdominal pressures is totally diffused along each square inch and keeps mesh in place.

The laparoscopic approach helps complete visualization of the fascia underlying the previous incision allows for the identification of smaller Swiss cheese defects that may be missed in an open approach.[10-19]

Nevertheless, open hernia repair can be a major operation with considerable morbidity due to mesh-related infections. "An increasing interest in laparoscopic surgery and the availability of new materials have encouraged the adoption of laparoscopic techniques in VH repair."[19-24]

"Laparoscopic VH repair (LVHR) was first described by LeBlanc and Booth in 1991."

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MATERIALS AND METHODS

This study which is prospective involved 55 patients with VH that presented during the period of June 2016 year–August 2017 year, for a period of 15 months admitted to a single surgical unit at Government Rajaji Hospital, Madurai, India.

Patients were subjected to either repair by open or laparoscopy and were followed for a period of up to 1 year from the date of surgery.

In our study, out of 55 patients, 35 patients underwent open onlay mesh repair, and 20 patients underwent laparoscopic intraperitoneal mesh repair for various types of VH.

Patients in both groups were comparable with respect to age.

The objective of the study is to compare laparoscopic versus open VH repair with regard to post-operative pain, operative results, perioperative and post-operative complications, hospital admission and duration of stay, and return to work.

All patients underwent routine laboratory investigations (complete blood count, blood serum chemistries, chest X-ray, electrocardiogram, and high-resolution ultrasound of the anterior abdominal wall to know the defect size).

Surgical Technique

Open onlay mesh repair

After taking patients to operation theater and under general anesthesia, endotracheal intubation and close monitoring, the operation was done. Foleys catheter was put for patients with lower abdominal VH repair and nasogastric tube for the upper abdominal hernia repair with perioperative single dose antibiotic inj.cefotaxime 1 g IV administered.

Then, after proper cleaning, painting, draping of the abdomen, and the skin incision were made according to the site and size of defect, subcutaneous flaps raised up to 5 cm around the defect and after that hernia sac dissected and opened, the contents reduced into the abdominal cavity. The defect in the linea alba was closed with nonabsorbable 1–0 Prolene suture, and an appropriate size of monofilament polypropylene mesh (dolphin mesh) of Futura surgicare was placed over the anterior rectus sheath and fixed with 2–0 Prolene. Hemostasis was achieved and 16 fg Romo Vac suction drain placed. Skin closed with 2-0 Ethilon.

Laparoscopic repair of VH

In laparoscopic repair of ventral hernia in all cases bowel was prepared, bladder was catheterized with Foleys, nasogastric tube placed.

After proper cleaning, painting, and draping under general anesthesia, the surgeon stands to the left of the patient. The monitor was placed opposite to the surgeon, and the instrument trolley was toward the leg of the patient. In general, three trocars are adequate for small to moderate size hernias. Pneumoperitoneum created through palmers point, 2–3 cm below the left costal margin in the midclavicular line, using open Hasson's method. 10 mm trocars at the palmers point and other two 5 mm trocars at left lumbar and iliac fossa along the anterior axillary line. Adhesions of the abdominal contents to the hernia sac and the surrounding abdominal wall are lysed, and the contents of the hernia sac are reduced. Hernia sac is excised, as much as possible to avoid seroma formation. Transfascial sutures applied with polypropylene 1–0 sutures with the help of a cobbler needle to obliterate the defect after reducing pneumoperitoneum partially. Size of the defect measured and appropriate size of the defect measured and appropriate size of dual mesh (Symbotex composite mesh, covidien) composed of monofilament polyester with absorbable collagen film and preplaced sutures and marking covering 4–5 cm beyond the defect was selected.

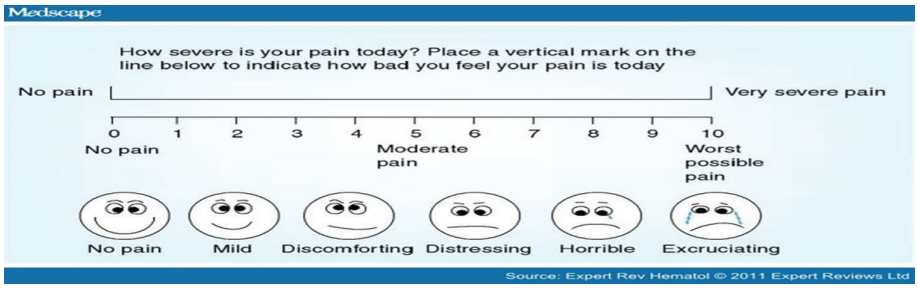
Mesh folded like banana leaf and introduced intraperitoneally through 10 mm trocar and mesh is unfolded so that white side polyester facing abdominal wall and marked site coated with absorbable collagen film facing viscera. Mesh is fixed transfascially in the middle with sutures provided along with mesh with the help of cobbler needle. Absorbable tackers (Absorba tack) 5 mm size used to fix the mesh all around and corners. Hemostasis was achieved before the removal of the trocars. All 10 mm trocar fascial defects were closed with 1–0 Vicryl and skin with 1–0 Vicryl. Catheter and ryles tube removed after extubating the patient.port sites sterile plaster dressing applied. Compressive dressing prepared from gauze is applied over the defect to prevent seroma formation for 5 days.

Patients were followed up 1 and 2 weeks after surgery and up to 1 year.

Statistical Analysis

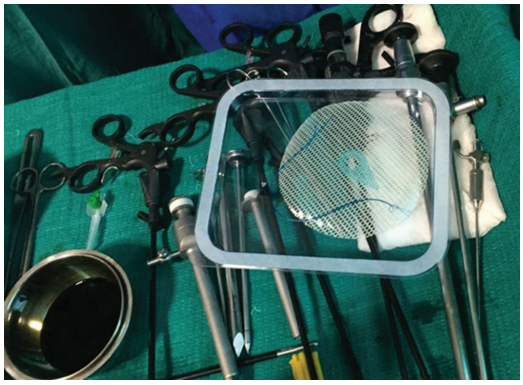
Unpaired Student's *t*-test and paired *t*-test were used to find out the statistical significance. $P < 0.005$ was taken as significant. SPSS Version 20 was used for statistical analysis, and the following parameters were calculated.

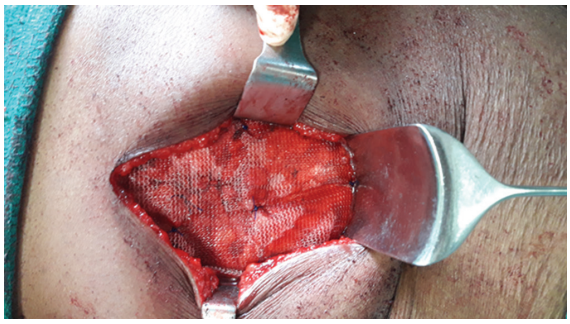
1. The operative time was calculated by measuring the time taken from skin incision to skin closure
2. Postoperative drainage fluid volume was calculated by Romo Vac suction drain for 1, 2, 3, 5, and 7 days
3. Post-operative pain was calculated using visual analog scale. We calculated pain during initial post-operative day 1 and day 3 and 5th day

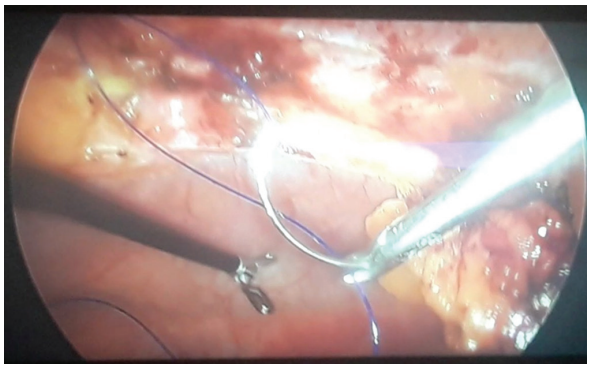


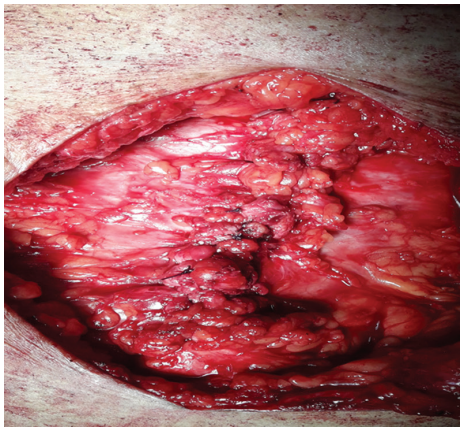
4. Eura HS quality of life scale calculated based on the following parameters and scoring calculated for the same, preoperatively and postoperatively on day 3 and 5 and day 7 and 4th week. Scoring of 0–10 given based on the condition of the patient evaluated
5. Intraoperative and post-operative outcomes were calculated for Seroma, wound infection, mesh infection, and bowel injury and recurrence rates.

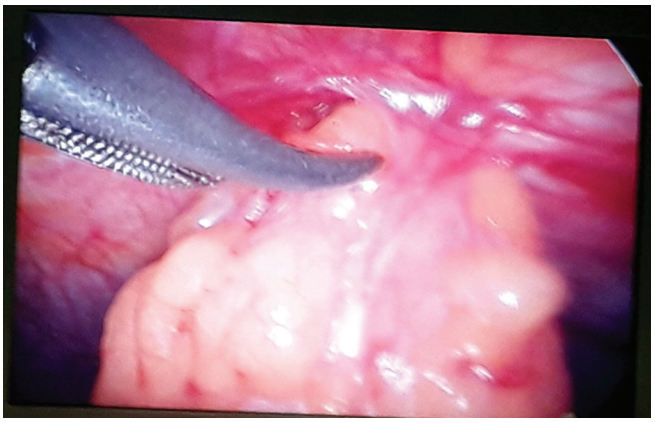
OPEN ONLAY MESH REPAIR

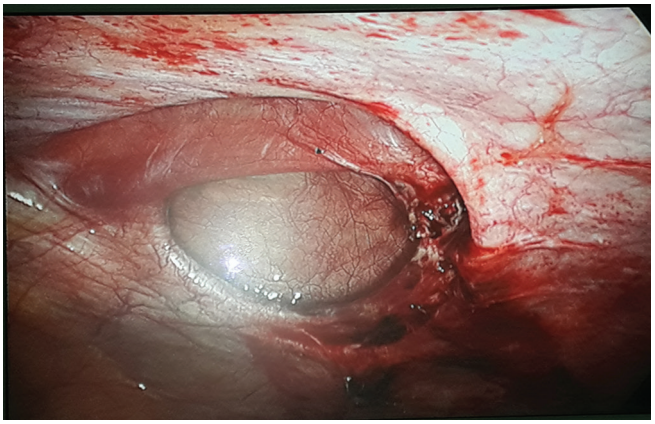


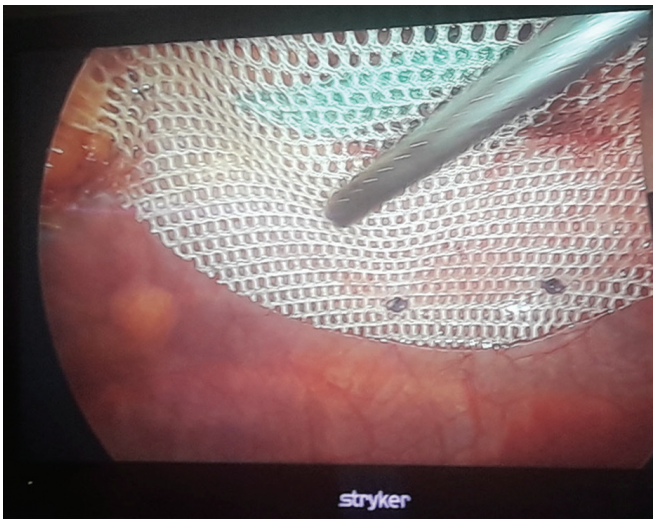












RESULTS

The patients in the groups were comparable at baseline in terms of age, presenting complaints, the type of hernia in both laparoscopic and open hernia repair.

The mean follow-up time was – 12 months.

The study group consisted of 20 patients in LVHR (14 women and six men) with a mean age of 41.1 years and 35 patients in open onlay mesh repair (26 women and nine men) with a mean age of 48.1 years.

The parameters used to compare the both groups show that patients in the laparoscopic group had defect size of 4.21 cm comparable with patients in open hernia repair with defect size of 5.71 cm ($P \leq 0.001$, significant).

The mean surgery duration was 76.95 min for the laparoscopic repair and 120.57 min for the open repair, as shown in figure ($P \leq 0.001$, significant difference).

The mean duration of post-operative analgesics used in the laparoscopic group is 4.3 days as compared to open VH repair 6.48 days, as shown in figure ($P \leq 0.001$), which is significant.

The mean post-operative stay in hospital was shorter for the laparoscopic group then for the open hernia group as depicted in figure (6.3 vs. 11.06 days; with $P - \leq 0.001$), which is significant.

Antibiotics used in the laparoscopy group are for 5.85 days as compared to open repair 8.51 days ($P \leq 0.001$), which is significant.

Return to the activity of normal daily work is significantly low in the laparoscopic group as compared to open repair of VH, as shown in figure (2.2 vs. 4.34 days; $P \leq 0.001$), which is significant.

There were fewer intraoperative and post-operative complications (seroma, wound infection, and enterotomy) among the patients who underwent laparoscopic repair then among the those who had open VH repair, as shown in Table 1.

Totally, 55 patients underwent laparoscopic and open VH repair and results analyzed, and the following conclusions were drawn.

In our study, totally 55 patients were studied, out of it, six patients are age <30 years, and 20 of them more than 50 years and others in between.

Out of 55 patients, 15 male and 40 female patients are selected for our study, as shown in Table 2.

Among <30 years, 4 patients underwent lap and 2 patients underwent open mesh repair. Among >50 years, 4 patients underwent lap and 16 patients underwent open mesh repair.

In between age group, 12 patients underwent lap and 17 patients underwent open repair, as shown in Table 3.

In our study, among 15 male patients, six patients underwent lap and nine patients underwent open repair. Among 40 female patients, 14 patients underwent lap and 26 underwent open repair, as shown in Table 4.

Among 55 patients, 28 patients are IH, and ten patients had paraumbilical hernia, nine patients had umbilical hernia, six patients had epigastric hernia, and two patients had VH, as shown in Table 5.

Among 55 patients, 20 patients underwent lap and 35 patients underwent open mesh repair of which six lap incisional and 22 open IH mesh repair done, as shown in Table 6.

Mean defect size for lap mesh repair 4.21 and for open mesh repair 5.71, with SD value for open 1.77 and for lap 0.92 with $P < 0.001$, as shown in Table 7.

Mean duration for lap 76.95 min and for open mesh repair 120.57 min, which is shorter for the laparoscopic group with $P < 0.001$, as shown in Table 8.

Mean pain score was less in lap group 3.45 versus 5.34 in open group with significant $P < 0.001$ in lap group, Table 9.

Mean analgesic needed for lap group was lesser 4.3 days and 6.48 days for open group, Table 10.

Mean antibiotic needed are less for lap group than with open mesh repair, Table 11.

Lap patients had early oral intake compared to open mesh repair, Table 12.

Lap patients had stayed less in hospital compared to open mesh repair, Table 13.

Return to daily routine was earlier in lap group compared with open mesh repair, Table 14.

Post-operative complications were less in lap group compared with open onlay mesh repair group, Table 15.

Table 1: Age-wise distribution

Age in years	No. of cases
<30	6
31–40	16
41–50	13
>50	20
Total	55

Table 2: Gender-wise distribution

Sex	No. of cases
Male	15
Female	40
Total	55

Table 3: Age versus procedure

Age versus procedure	Lap onlay mesh repair	open onlay mesh repair
<30 (6)	4	2
31–40 (16)	8	8
41–50 (13)	4	9
>50 (20)	4	16
Total (55)	20	35

Table 4: Gender versus procedure

Gender versus procedure	Lap onlay mesh repair	open onlay mesh repair
Male (15)	6	9
Female (40)	14	26
Total (55)	20	35

Table 5: Diagnosis and distribution

Diagnosis	No. of cases
Epigastric hernia	6
Incisional hernia	28
Umbilical hernia	9
Paraumbilical hernia	10
Ventral hernia	2
Total	55

DISCUSSION

LVHR was started by LEBLANC in 1993 year, after that evaluations were done to make laparoscopic surgery easier and safest for VH repair, with the use of laparoscopic approach large incisions and drain placement can be avoided.

The results of our prospective study revealed that as compared to open repair, laparoscopic repair is associated with shorter duration of surgery, reduced post-operative analgesic requirement, and antibiotic requirement.

Duration of hospital stay and return to the normal activity are significantly shorter for laparoscopic repair, then for open hernia repair. The reason for this is because of extensive subcutaneous dissection to have 5 cm mesh cover beyond the hernia defect, which causes more pain, longer duration of surgery, requirement of suction drain for longer period of time, and late return of normal daily activity. The complication rate for laparoscopic repair was very low.

Table 6: Diagnosis versus procedure

Diagnosis	Lap onlay mesh repair	Open onlay mesh repair
Epigastric hernia	3	3
Incisional hernia	6	22
Umbilical hernia	4	5
Paraumbilical hernia	7	3
Ventral hernia	0	2
Total	20	35

Table 7: Defect size comparison

Defect size	Mean	SD	*P* value
Lap onlay mesh repair	4.21	0.92	<0.001
Open onlay mesh repair	5.71	1.77	Significant

Table 8: Operative duration comparison

Operative duration in minutes	Mean	SD	*P* value
Lap onlay mesh repair	76.95	10.16	<0.001
Open onlay mesh repair	120.57	18.54	Significant

Table 9: Pain score comparison

Pain score	Mean	SD	*P* value
Lap onlay mesh repair	3.45	0.83	<0.001
	5.34	0.68	Significant

Table 10: Mean analgesic days

Analgesic days	Mean	SD	*P* value
Lap onlay mesh repair	4.3	0.86	<0.001
Open onlay mesh repair	6.48	1.07	Significant

Table 11: Mean antibiotic days

Antibiotic days	Mean	SD	*P* value
Lap onlay mesh repair	5.85	0.93	<0.001
Open onlay mesh repair	8.51	1.56	Significant

Table 12: Mean postop nil by mouth days

Post-operative nil by mouth days	Mean	SD	*P* value
Lap onlay mesh repair	2.05	0.61	<0.001
Open onlay mesh repair	3.63	0.49	Significant

Table 13: Hospital stay in days

Hospital stay in days	Mean	SD	*P* value
Lap onlay mesh repair	6.3	1.49	<0.001
Open onlay mesh repair	11.06	1.64	Significant

Table 14: Return to normal activity

Return to normal activity in days	Mean	SD	*P* value
Lap onlay mesh repair	2.2	0.62	<0.001
Open onlay mesh repair	4.34	0.8	Significant

Table 15: Post-operative complications

Post-operative complications	Seroma	Wound infections	Bowel injury	Mesh infection	Recurrence
Lap onlay mesh repair	8	1	0	0	0
Open onlay mesh repair	16	16	0	0	0
P value	0.898 NS	0.005 Sig.			

The laparoscopic procedure was associated with potentially less wound infection and seroma formation as compared with open repair. Recent analysis also suggested minimal post-operative morbidity, a shorter convalescence period, and an acceptable recurrence rates.[25-46]

The results of our study are quite comparable with studies done by Park *et al.*, Carbaja *et al.*, and Rameshaw *et al.*, and the following points were analyzed, Table 16.

1. Mean duration of surgery (minutes)
   - Park *et al.* lap-95, open – 78
   - Carbaja *et al.* lap – 87, open – 112
   - Rameshaw *et al.* lap – 56, open – 82
   - In our study lap – 76.95, open – 120.57

   with SD value for lap – 10.16 and for open – 18.54 with $P < 0.001$, which is significant.
2. Mean length of stay (days)
   - Park *et al.* lap – 3.4, open - 6.5
   - Carbaja *et al.* lap – 2.2, open – 9.1
   - Rameshaw *et al.* lap – 1.7, open – 2.8
   - In our study lap – 6.3, open – 11.06
3. Mean infection rate (%)
   - Park *et al.* lap – 00, open - 02
   - Carbaja *et al.* lap – 00, open – 18
   - Rameshaw *et al.* lap – 00, open – 03
   - In our study lap - 1, open – 16
4. Mean seroma rate (%)
   - Park *et al.* lap – 04, open - 02
   - Carbaja *et al.* lap – 13, open – 67
   - Rameshaw *et al.* lap – 00, open – 00
   - In our study lap - 8, open – 16

The results of our study strongly recommend that LVHR is the procedure of choice in an trained laparoscopic surgeons hands.

Table 16: Comparison similar studies

Observation	Park 11		Carbaja 12		Rameshaw 13		Our study	
	Lap	Open	Lap	Open	Lap	Open	Lap	Open
Operating time (min)	95	78	87	112	56	82	76.95	120.57
Length of stay (day)	3,4	6.5	2.2	9.1	1.7	2.8	6.3	11.06
Infection rate (%)	00	02	00	18	00	03	01	16
Seroma rate (%)	04	02	13	67	00	00	08	16
Patients	56	49	30	30	79	174	50	50

CONCLUSION

The present analytical study of comparative analysis and advantages of LVHR versus open VH repair was carried out at Government Rajaji Hospital, Madurai, during the period of June 2016–August 2017

Based on the data and results obtained in the present study, the following parameters were drawn

1. The average total duration of surgery is less using laparoscopic intraperitoneal mesh placement
2. The post-operative drainage is nil in the laparoscopic approach
3. The post-operative pain is less in the laparoscopic approach
4. The post-operative complications are less in the laparoscopic approach (seroma, wound infection, and recurrence)
5. The shorter hospital stay in the laparoscopic approach
6. Early return to normal work
7. Early mobilization
8. It is even possible to reduce post-operative time, because of standardized techniques, surgeons getting more skill, and use of mesh fixation devices, and newer mesh implantation.

Hence, LVHR is considered as the first line of choice in VH repair.

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