

# Comparative study between open and laparoscopic ventral hernia repair: A prospective non-randomized single institutional study

Anuroop Thota, K. S. Ravishankar, Krishna V. Rao, B. S. Ramesh, B. B. Ananda

Department of General Surgery, Dr B R Ambedkar Medical College, Bengaluru, Karnataka, India

## ABSTRACT

**Introduction:** In this modern era of surgery, laparoscopic surgery has gained paramount importance. There is continued debate on the role of laparoscopy in ventral hernia repair. Although laparoscopic repair has become increasingly popular, its outcomes need further evaluation. This is a prospective study designed to compare open ventral hernia repair with laparoscopic repair.

**Materials and Methods:** This study included patients who consented for midline ventral hernia operation at our institution from October 2013 to April 2015; data on relevant history, clinical examination, and appropriate investigations were collected. A total of 81 patients were operated after obtaining written consent. A total of 51 patients underwent open mesh repair whereas 31 underwent laparoscopic intra peritoneal mesh repair. The statistical software namely SPSS 15.0, MedCalc 9.0.1 were used.

**Results:** In the open group, majority were incisional hernias; in the laparoscopy group, majority were umbilical hernia. Age distribution and mean duration of surgery was comparable in both the groups. Significant decrease in postoperative pain, overall complication rate, length of hospital stay, and return to normal activity was noted in the laparoscopy group ( $P < 0.001$ ). There were no cases of mesh infection or recurrence with a mean follow-up of 12 months.

**Conclusion:** Laparoscopic ventral hernia repair holds a promising alternative to novel repair and the short-term results are encouraging. The technique is a little sophisticated and needs experience when compared to open repair.

**Key words:** Dual mesh, laparoscopic intraperitoneal mesh repair (IPOM), polypropylene mesh, polytetrafluoroethylene (PTFE), tackers, ventral hernia


## INTRODUCTION

Ventral hernia occurs through the anterior abdominal wall at any site other than groin.<sup>[1]</sup> They are classified into incisional, paraumbilical, umbilical, epigastric, and spigelian hernias.<sup>[2,3]</sup> Incisional hernias are a complication of open abdominal surgery. Surgical repair is demanding with the goal of tension free repair. The use

of prosthetic mesh has helped in reducing the recurrence rates. Paraumbilical hernias are usually acquired whereas umbilical hernias may be congenital. Epigastric hernia protrudes through linea alba above the umbilicus. Five percent of the population has epigastric hernias. There is a high chance of incarcerations and surgery remains the only cure.<sup>[4]</sup> Most of the spigelian hernias are acquired and require surgery as the chances of intestinal obstruction are high.

### Address for correspondence:

Dr. Anuroop Thota, 29-8-40/A, Chiluku Durgaiyah Street, Suryaraopet, Vijayawada, Andhra Pradesh, India.  
E-mail: anuroopt@gmail.com

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In this modern era of surgery, emphasis is on decreasing hospital stay and postoperative morbidity with importance given to cosmesis. Hence, laparoscopic surgery has gained paramount importance due to its minimally invasive technique, decreased hospital stay and better cosmesis. The trend toward minimal access surgery (MAS) has prompted general surgeons to scrutinize all operations towards laparoscopic techniques. Laparoscopic ventral hernia repair needs further evaluation of its long-term outcomes. In our study, we would like to share our experience with this procedure and compare it with traditional open repair.

## MATERIALS AND METHODS

### Study design

Prospective non-randomized study.

### Source and method of collection of data

This study included patients who consented to get operated for midline ventral hernia, with the help of relevant history, clinical examination, and appropriate investigations at our institution from October 2013 to April 2015.

### Inclusion criteria

Patients presenting with midline ventral hernias who were managed in our hospital with mesh repair were included after obtaining a written consent.

### Exclusion criteria

Nonmidline hernias such as

- Hernia after cesarean section
- Hernia after open appendicectomy
- Spigelian hernia
- Lumbar hernia
- Obstructed hernia.

### Objective of study

To compare open hernia repair with laparoscopic ventral hernia with regard to:

- Duration of surgery
- Postoperative pain
- Postoperative complications
- Postoperative hospital stay
- Return to normal activity
- Recurrence
- Cosmesis.

### Study groups

All consented patients were initially offered

laparoscopy surgery. Patients with financial constraints and in whom laparoscopy was contraindicated underwent open surgery whereas other patients underwent laparoscopic surgery. The patients undergoing open mesh repair were included in group 1, whereas those undergoing laparoscopic mesh repair were included in group 2 [Figure 1].

### Methodology

All patients were evaluated by obtaining proper history and performing detailed physical examination and routine blood investigations. All patients received antibiotic prophylaxis half an hour before surgery.

### Procedure for open surgery

All patients are operated under spinal anesthesia. Foleys catheterization and nasogastric tube were occasionally used. In onlay repair, polypropylene mesh was sutured over the anterior rectus sheath, whereas in inlay technique, the mesh was placed in the preperitoneal space. The mesh was fixed with nonabsorbable sutures. Anterior rectus sheath was closed over the mesh by nonabsorbable sutures. Suction drain was placed in few cases based on the surgeon's choice.

### Procedure for laparoscopic surgery

All the patients were operated under general anaesthesia. Nasogastric tube was placed for upper abdominal hernia and a Foleys catheter for lower abdominal hernias. Both were removed after the procedure on the operating table. The operating surgeon stands to the left of the patient with the camera man on his right or left depending on the location of

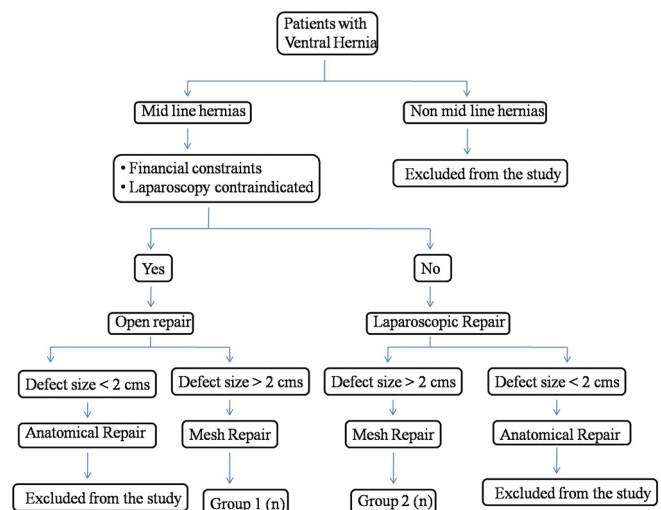


Figure 1: Study design

the hernia. Pneumoperitoneum established by veres needle in palmer's point. Adhesiolysis was done using sharp dissection or monopolar diathermy. Defect delineated and size was measured intracorporeally. The size of the mesh required was also assessed. The area to be covered by the mesh was marked after pneumoperitoneum was released and the sites for transfacial sutures were marked with the defect at its centre. The mesh was prepared, two nonabsorbable ethilon sutures were placed on either side at the upper end along with two polypropylene sutures at the opposite end. This was done for easy identification based on the color difference. Mesh was anchored with the use of a spinal or cobbler needle. In some cases, we also used tackers in a double crown fashion. A compression dressing was done over the defect.

### Mesh used

Open – Polypropylene mesh.

Laparoscopy – Composite or dual mesh.

### Postoperative management

During the postoperative period, all patients received intravenous aqueous diclofenac injections every 12 hours for 1 day unless contraindicated, and thereafter oral analgesics were given on the patient demand. All the patients were ambulated within 12 hours of surgery and were encouraged for oral feeds. Initially, we started with sips of liquids followed by normal diet after the resolution of postoperative ileus (indicated by passing of flatus, normal bowel sounds on auscultation, and return of appetite). In patients with persistent ileus, nasogastric tube was passed only to be removed after resolution. The wound was inspected for any seroma, hematoma, or infection. In the open group, drains were removed when the collection was less than 30 ml for 2 consecutive days. Patients were discharged after complete ambulation and tolerating normal diet.

### Follow-up evaluation

After discharge, patients were encouraged to return to their normal activities as early as possible. Follow-up was done at 1 week, 1 month, 3 months, and 6 months. In the initial follow-up, the patients were evaluated for short-term complications such as seroma, hematoma, wound infection, and wound dehiscence. During subsequent visits, chronic pain at the operated site, return to normal activity, and recurrence were noted.

### Postoperative assessment of pain

The pain in the postoperative period was graded according to the visual analogue scale (VAS) ranging from no pain to the worst possible pain on a scale of 0 to 10.

Cosmesis was assessed by a patient satisfaction score on a scale of 1 to 10, where 1 is the best possible result and 10 is the worst possible result.

### Statistical methods

The statistical software namely SPSS 15.0, MedCalc 9.0.1 were used for data analysis. Descriptive and inferential statistical analysis was done. Variables on continuous measurements are presented on Mean  $\pm$  SD (Min–Max) and variables on categorical measurements are presented as number (%). Significance is assessed at 5% level of significance.

Chi-square/Fisher exact test was used to determine the significance of study parameters on categorical scale between two or more groups. A *P* value of  $<0.05$  was considered significance.<sup>[5-7]</sup>

## RESULTS

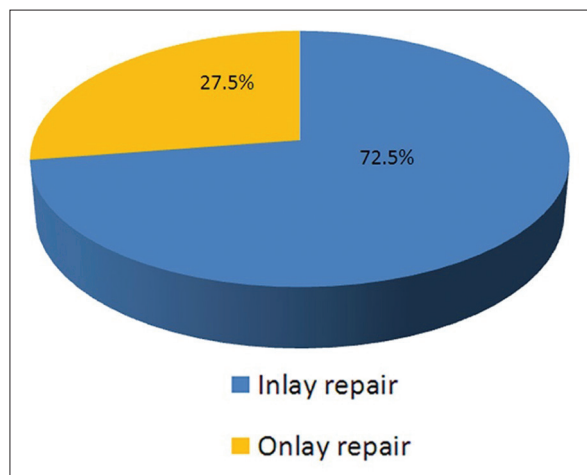
In our study, patients were grouped into two groups. Group 1: Patients undergoing open mesh repair. Group 2: Patients undergoing laparoscopic intraperitoneal mesh repair. The total number of patients was 82, of which 51 underwent open repair (group 1), among these 2 patients underwent abdominoplasty, and 31 patients underwent laparoscopic mesh repair (group 2) and 1 patient converted to open surgery due to dense adhesions. The mean age and defect size were comparable in both the groups, M:F ratio was 1:3 [Table 1]. The most common type of adhesions were omental followed by intestinal. One patient in the open group had transverse mesocolon adherent to the defect. In 2 patients of epigastric hernia, ligamentum teres was extending into the defect. In the open group, majority underwent inlay repair [Figure 2]. The mean duration of surgery was comparable in both the groups [Figure 3]. Intraoperatively, in the open group, 2 patients had enterotomy, whereas there was an accidental injury to the inferior epigastric artery in 1 patient in the laparoscopy group. Primary closure was done for enterotomy, and because there was no spillage, a mesh was placed. The arterial bleed was controlled by a transfacial suture. Drain

**TABLE 1: RESULTS**

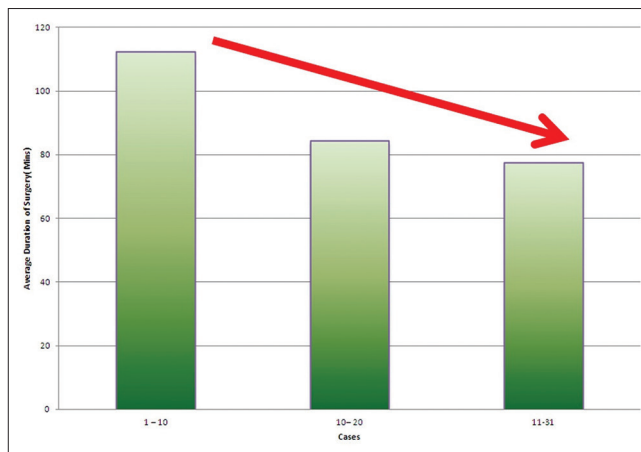
Variable	Open	Laparoscopy	P
Mean age	45.66 yrs	44.3 yrs	0.56
M:F	1:2.9	1:2.1	
Size of defect	2.65 cm <sup>2</sup>	3.45 cm <sup>2</sup>	0.212
Mesh	Polypropylene	Composite	
Duration of Surgery	92.65 min	94.35 min	0.443
Intraoperative complications			
Enterotomy <sup>*</sup>	2	0	
Bleeding <sup>#</sup>	0	1	
Mean duration of pain	6.9 days	2.35 days	<0.001*
Post-operative complications			
Overall complication rates	45.09%	19.4%	0.018*
Seroma	41.1%	6.4%	0.001**
Wound Infection	17.6%	3.2%	0.053
Post-operative ileus	7.8%	12.9%	0.454
Mesh Infection	-	-	-
Deep Vein Thrombosis	1.96%	-	0.433
Chronic pain	9.7%	3.2%	0.588
Mean hospital stay	15.17 days	4.64 days	<0.001*
Return to normal activity	29.7 days	3.61 days	<0.001*
Cosmesis score	4.99	1.71	<0.001*
Follow up	13.25 mon	10.55	0.14

\*There was no spillage and hence a mesh was placed. #Accidental injury to inferior epigastric artery, controlled by transfacial suture

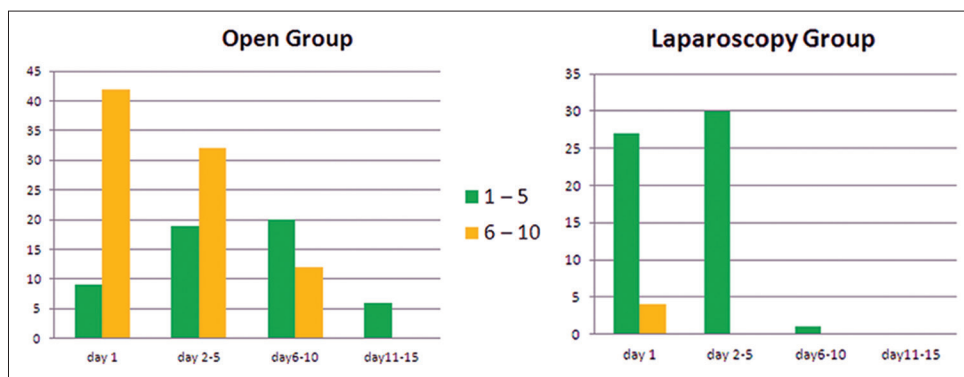
was placed and removed on postoperative day 2. Almost all the patients were pain free by 5 days in laparoscopy group, whereas 32 (62.7%) had pain in the open group [Figure 4]. Among the postoperative complications [Figure 5], seroma was the most common. In the 2 patients in the laparoscopy group, seroma reduced with conservative management in less than 2 weeks. In the open group, 16 patients were managed conservatively, whereas aspiration was done in 5 cases. Postoperative ileus was present in 4 patients in both the groups. In the open group, there was persistent ileus in 2 patients who recovered by conservative management. In the laparoscopy group, all the patients recovered in 3 days, nasogastric tube was placed in 1 patient and was removed in 1 day. None of the patients in both the groups had mesh infection. Deep vein thrombosis was seen in 1 (1.96%) patient in the open group and was managed conservatively. Chronic pain lasting for more than 6 months was present in 3 (9.7%) patients in the open group, whereas it was present in 1 (3.2%) patient in the laparoscopy group, which was managed by oral



**Figure 2:** Distribution of type of surgery in open group



**Figure 3:** Decrease in the average duration of surgery in laparoscopy group



**Figure 4:** Distribution of VAS scores in both the groups

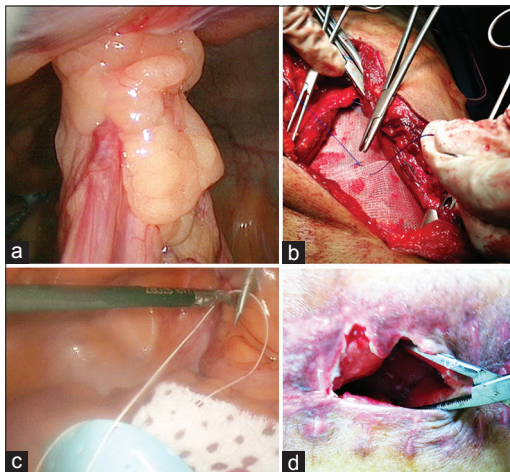
analgesics. The length of hospital stay, mean duration to return to normal activity, and cosmesis score based on patients' satisfactory score significantly favored laparoscopic repair. No recurrences were reported in this study.

## DISCUSSION

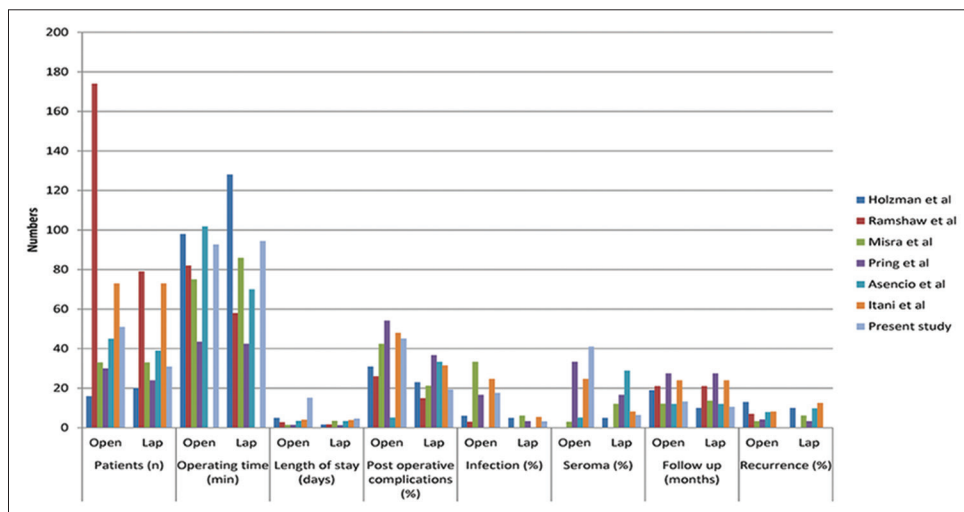
Prosthetic mesh repair is the gold standard for hernia surgery and plays a pivotal role in reducing the recurrence rates. The worldwide acceptance of laparoscopic surgery has paved the way for an alternative. Ever since the first laparoscopic ventral hernia surgery by Le Blanc<sup>[8]</sup> in 1993, the procedure has faced many challenges and underwent many modifications. There are more than a dozen randomized controlled trials (RCTs) reported in the

last 20 years, comparing both the repairs [Table 2, Figure 6]. The suggested advantages of laparoscopic repair are avoidance of large incisions and extensive dissections, low incidence of wound infections, reduced analgesic requirements, and hospital stay.

Ramshaw *et al.*<sup>[9]</sup> conducted a large single institutional study with a total of 253 patients. In a recent RCT by Itani *et al.*<sup>[10]</sup> in 2010, a total of 146 patients were randomized such that 73 patients underwent conventional repair and 73 underwent laparoscopic repair. In a study by Misra *et al.*<sup>[11]</sup> in 2006, the mean age of the patients in both the groups was comparable. The size of the defect does not hold the criteria for selecting the procedure. Hernias less than 2–3 cm are better repaired by conventional methods without using a mesh. During an incisional hernia repair, effort should be made to cover the entire length of incision with the mesh. This helps in preventing recurrence at a new site along the previous scar. The area to be covered by the mesh is a matter of substantial debate. The present general recommendation is a minimum of 5 cm overlap from the fascial defect. The main reason is the probability of mesh shrinkage. In our study, we ensured a minimum of 5 cm covering in all cases. Few surgeons suggest that a minimum of 3-cm overlap (in all directions) of the prosthetic biomaterial is mandatory.<sup>[12,13]</sup> Another debatable step is the method of fixation of mesh. Initial series established a direct correlation between recurrence and the absence of transfascial sutures. However, many authors argue that the earlier series did not consider several factors which were potentially



**Figure 5:** (a) Omental adhesions in laparoscopic surgery. (b) open ventral hernia repair. (c) Transfascial suturing with a cobbler needle. (d) Wound infections in open surgery



**Figure 6:** Comparison of present study with other similar studies

**TABLE 2: COMPARISON OF PRESENT STUDY WITH OTHER SIMILAR STUDIES**

Reference	Patients (n)		Operating time (min)		Length of stay (days)		Post-operative complications (%)		Infection (%)		Seroma (%)		Follow up (months)		Recurrence (%)	
	Open	Lap	Open	Lap	Open	Lap	Open	Lap	Open	Lap	Open	Lap	Open	Lap	Open	Lap
Holzman <i>et al.</i>	16	20	98	128	5	1.6	31	23	6	5	0	5	19	10	13	10
Ramshaw <i>et al.</i>	174	79	82	58	2.8	1.7	26	15	3	0	-	-	21	21	7	0
Misra <i>et al.</i>	33	33	75	86	1.47	3.43	42.4	21.2	33.3	6.06	3.03	12.1	12.17	13.73	3.3	6.2
Pring <i>et al.</i>	30	24	43.5	42.5	1.47	1.33	54.17	36.67	16.67	3.3	33.3	16.67	27.5	27.5	4.16	3.3
Asencio <i>et al.</i>	45	39	101.88	70	3.46	3.33	5.12	33.3	0	0	5.12	28.89	12	12	7.9	9.8
Itani <i>et al.</i>	73	73	-	-	4	3.9	47.95	31.5	24.66	5.47	24.66	8.2	24	24	8.2	12.5
Present study	51	31	92.65	94.35	15.17	4.64	45.09	19.4	17.6	3.2	41.1	6.4	13.25	10.55	0	0

responsible for recurrences. The main disadvantages of transfascial sutures are longer surgery time, more incisions, poor cosmetic rates, greater infection rates, pain during early postoperative period, and chronic pain. With the advent of tacking devices and double-crowning technique,<sup>[14]</sup> the concept of transfascial sutures came under scrutiny. In a randomized study, three methods of mesh fixation were studied for 4 years – absorbable transfascial sutures, nonabsorbable transfascial sutures, and double crown technique of tacker fixation; none of the technique has pain reduction advantage over others. Bansal *et al.*,<sup>[15]</sup> concluded that suture fixation is cost effective and has statistically less significant postoperative pain. In recent times, studies are emerging with double crown technique using tacking devices resulting in similar if not less recurrence rates.<sup>[14]</sup> The main reason for this is better understanding on the conditions responsible for recurrence such as area of coverage and type of mesh. Some surgeons believe that tacking devices are equally effective, reduce operating time, and less postoperative discomfort. In our study, we employed transfascial sutures in all the patients and sutures with tackers in 24 patients. The operating time is the detrimental factors in assessing the effectiveness of the procedure. In our study, mean operating time was comparable in both groups. Studies by Ramshaw<sup>[9]</sup> and Asencio<sup>[16]</sup> reported lesser operating times in laparoscopy group, whereas those by Mishra<sup>[11]</sup> and Pring<sup>[17]</sup> did not show any significant difference between the two procedures. Studies by Olmi *et al.*<sup>[18]</sup> and Carbajo *et al.*<sup>[19]</sup> showed significant reduced time in laparoscopic surgery. In our study, two enterotomies were reported in the open group when compared to none in laparoscopy. Carbajo *et al.*<sup>[19]</sup> in 1999 in his RCT reported similar results. Asencio *et al.*<sup>[16]</sup> 2009 and Barbaro *et al.*<sup>[20]</sup> 2006 reported one event of enterotomy each in the laparoscopy group when compared to none in the open group. In one

patient in the laparoscopy group, there was accidental bleeding from the inferior epigastric artery, which was controlled by transfascial sutures. Laparoscopic surgery is generally associated with reduced pain as reinstated by our study. Four RCTs (Asencio 2009,<sup>[16]</sup> Barbaros 2006,<sup>[20]</sup> Misra 2006,<sup>[11]</sup> and Pring 2008<sup>[17]</sup>) reported equal incidence of postoperative pain scores in both the groups. Almost all the RCTs except Asencio<sup>[16]</sup> reported decreased wound-related complications with laparoscopy. Among all, the most common complications are seroma and wound infection. Seroma rates are higher in laparoscopy in earlier studies, whereas Itani<sup>[10]</sup> reported lower seroma rates in laparoscopy. Wound infection is higher in open group in all the studies. In the study by Heinford *et al.*<sup>[12]</sup> with 850 cases, postoperative ileus was reported in 3% cases undergoing laparoscopic surgery. In the meta-analysis by Sains *et al.*,<sup>[21]</sup> there was no significant difference in both groups with regard to postoperative ileus. In our study, we had 3 cases of ileus in both the groups. The INCH trail<sup>[22]</sup> reported that difference in time to full recovery between the two treatment strategies favors laparoscopy group and hence is a more cost-effective approach. The present study reported decreased hospital stay in laparoscopy group. Two RCTs by Holzman *et al.*<sup>[23]</sup> and Ramshaw *et al.*<sup>[9]</sup> showed significant difference between the two groups and favored laparoscopy, whereas most of the other studies did not show much difference between the two groups. All the recent studies showed decreased recurrence rates with laparoscopic repair. Laparoscopic repair has also shown clear advantage in obese patients.<sup>[24,25]</sup> All recent studies favored laparoscopic repair for ventral hernia.<sup>[10,24-26]</sup>

#### Drawbacks of the study

- Single institutional study
- Non-randomized study
- Small sample size

- Selection bias
- Period for assessment of recurrence rates is short.

## CONCLUSION

Laparoscopic ventral hernia repair has shown promising results and a clear advantage over open repair in regard with:

- Reduced postoperative pain,
- Decreased postoperative complications,
- Reduced length of hospital stay,
- Less time for return to normal activity
- Better cosmesis
- Lower recurrence.

Hence, laparoscopic ventral hernia repair is a safe and feasible alternative to open repair.

## Financial support and sponsorship

None.

## Conflicts of interest

There are no conflicts of interest.

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