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ORIGINAL RESEARCH

Innovative hernia solutions: The two-port laparoscopic revolution in ventral hernia repair

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ABSTRACT
Recently, minimal access surgery for ventral hernias has gained popularity. However, there are still a number of problems that need to be addressed, such as ergonomics, longer learning curves, tactile feedback, seroma formation, recurrence, and postoperative pain.
The objective of the study is to analyse the ergonomics, outcomes, complications and patient compliance following surgery with two-port laparoscopic intra peritoneal onlay mesh repair using composite mesh.
The source of data for this study were patients admitted under the General Surgery, Department at SSIMS & RC Davangere from December 2022 to November 2024. A total of 32 patients diagnosed with ventral hernia are included in the study. Patients are posted for the laparoscopic IPOM or IPOM plus. For the methodology, the study employed a prospective observational design.
The mean age of the patients is 46 ± 15 years, 24 females (68.75%) & 10 males (31.25%) presented with ventral hernia. Out of 32 cases performed, with mean operating time of 50.3 ± 10.46 min. Among complications, post op mesh bulge (40%), seroma formation (30%), wound infection (10%), bowel perforation (0%) & conversion rate (0%) are noted. No new surgical complications noted in this technique.
On analysing this study, it is noted that two port technique had a better ergonomics, reduced mean operative time, reduced complications but difficult learning curve.
Key words: Two-port laparoscopic repair, ventral hernia surgery, ergonomics in laparoscopy, postoperative complications, composite mesh repair

INTRODUCTION

Recently, minimal access surgery for ventral hernias has gained popularity. However, there are still a number of problems that need to be addressed, such as ergonomics, seroma formation, pseudo bulge recurrence, and postoperative pain. Laparoscopic technique has lower recurrence (4.4-4.7%) and reduced postoperative complications compared to the open technique[6,7,8]. Suturing the defect is beneficial, as it decreases seroma formation and maintains the functionality of the abdominal wall[9].

Two port technique have been tried as solutions to the aforementioned problems.

AIMS & OBJECTIVES

To analyse the ergonomics, outcomes, complicationsandpatient compliance following surgery with two-port laparoscopic intra peritoneal onlay mesh repair using composite mesh.

MATERIALS AND METHODS

The source of data for this study were patients

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admitted under the General Surgery, Department at SSIMS & RC Davangere from December 2022 to November 2024. A total of 10 patients diagnosed with ventral hernia were included in the study. Patients were posted for the laparoscopic IPOM or IPOM plus.

For the methodology, the study employed a prospective observational, consecutive case series study.

INCLUSION CRITERIA

- Age >18 years.
- Sex-Both male and female.
- Diagnosed with ventral hernia.
- Hernia defect size <10 cm.
- Previous abdominal surgeries.

EXCLUSION CRITERIA

- Strangulated hernia.
- Gangrenous bowl.
- Peritonitis.
- Intra-abdominal Sepsis.
- Infection.
- Systemic condition like cirrhosis with caput medusae.
- Who had contraindications for laparoscopic surgery.

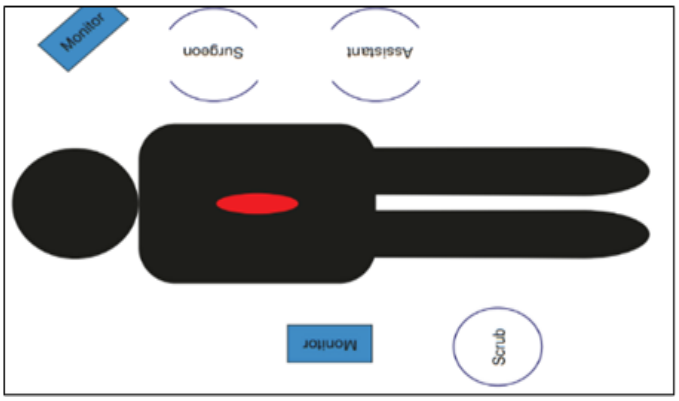
Patient data (age, sex, previous abdominal surgeries & defect size) were recorded.

Other data as comorbidities, operative time, and postoperative outcomes also were noted.

Patient is followed up on OPD basis for 1 month.

PROCEDURE

- All the patients diagnosed with ventral hernia, after applying inclusion and exclusion criteria are enrolled in the study.



Operative Setup

- Routine lab investigations & ultrasonography are done.
- Written and informed consent is taken for surgery. Anaesthesiologist fitness for surgery is taken. All the patients are administered cefoperazone & sulbactum along with proton pump inhibitor preoperatively.
- Patient is induced with general anaesthesia. After induction of anesthesia, Patient is catheterised under all aseptic precautions. abdominal wall is painted using antiseptic solution, and draped.
- Sterile Opsite transparent bandage is applied, covering the abdomen.
- Mesh placement markings are done over the abdominal wall.

Marking for Mesh Placement

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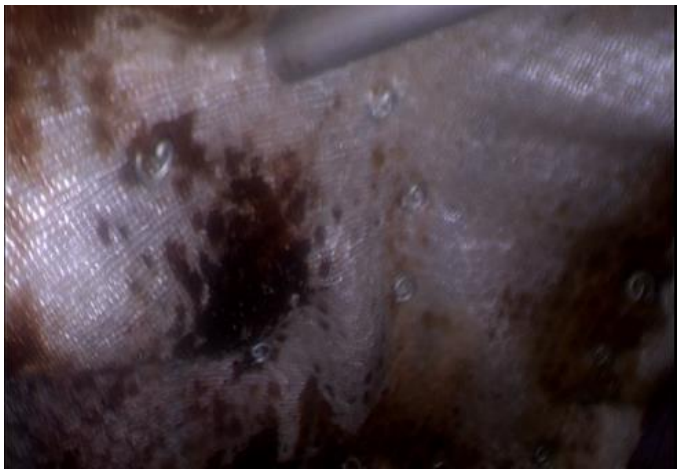
- In our study, 10 mm umbilical port is inserted by open technique at palmer's point & pneumoperitoneum is created using CO_2 with a flow rate of 6 L/min and at a pressure of 12mmhg. Another 10 mm working port is inserted in left flank region along the left midclavicular line under vision.
- 30° laparoscope is inserted into the camera port while 5 mm laparoscopic instruments inserted into 10 mm working port using reducers & Adhesiolysis is done.
- Hernial contents are reduced and plane is created for mesh placement.
- Defects closed with no.1 prolene.
- Composite mesh is held in position by using cardinal sutures at 4 corners.
- Intraabdominal pressure is reduced to 8 mm Hg and mesh is fixed.

IPOM Plus Closure

- **MESH FIXATION:** Using Spiral tackers by two innovative adaptive techniques.

1) Change to 75 ° camera.
2) Interchanging the camera and working ports.

Helps in fixing the mesh edge and corners adjacent to the ports.
Mesh is fixed in double crowning manner.



Double Crowning of Tackers

- Abdomen is inspected for any bleeding and bowel injuries.
- Ports are removed, gas desufflated. Ports closed. Intraop and immediate post op complications related to operating surgeons posture noted.

STATISTICAL ANALYSIS

Statistics were considered significant if $p \leq 0.05$. As AUC 0.7 was regarded as good, the ROC curve was also utilized to calculate the AUC, sensitivity, and specificity of all markers.

RESULTS

This prospective observational study involving 32 patients is conducted over a period of 12 months in the Department of General Surgery SSIMS & RC Davangere.

The mean age of the patients is 46 ± 15 years, 10 males (31.25%) & 24 (68.75%) females, presented

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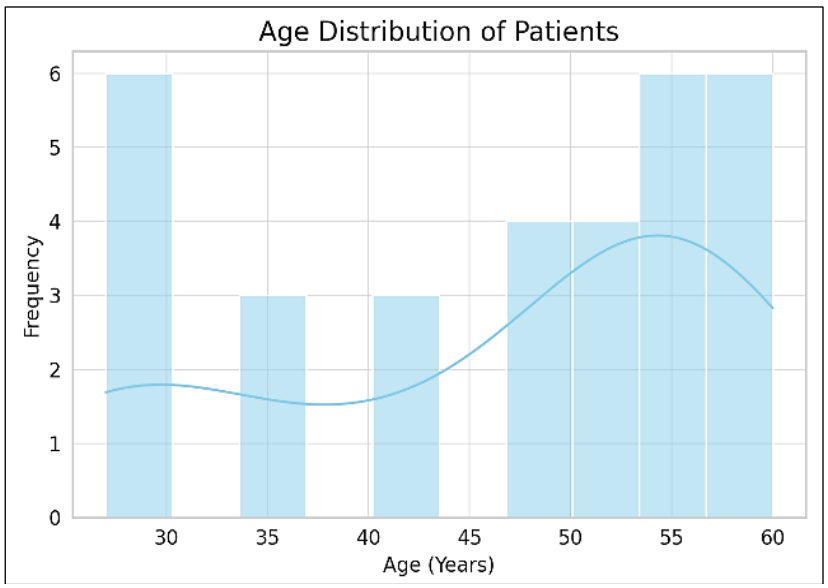
with Umbilical hernia 20 (60%), Paraumbilical hernia 2 (20%) & Recurrent incisional hernia 2 (20%). Average duration of surgery performed 119 ± 31 min. Among complications, post op mesh bulge (70%), seroma formation (50%), wound infection (15%), bowel perforation (0%) & conversion rate (0%). No new surgical complications noted in this technique.

Table 1: Showing statistical analysis

Patients	N=32
Age (Mean ± SD)	46 ± 15
Sex Male N (%) Female N (%)	 10 (31.25%) 24(68.75%)
Previous abdominal surgery Male N (%) Female N (%)	 0 (0%) 21 (87.5%)
Type of Ventral hernia Recurrent incisional hernia N (%) Umbilical hernia N (%) Infraumbilical hernia N (%) Both Paraumbilical and umbilical N (%)	 4(12.5%) 20(62.5%) 1(3.125%) 3(9.37%)
Defect size (cm) ≤3 3.1-5 >5	 16(50%) 11(34.37%) 5(15.62%)

Graph Showing Age Distribution



The histogram shows that most patients are in their 50s and 60s, with fewer younger or older patients undergoing surgery. The distribution is slightly skewed, indicating a concentration in middle-aged individuals.

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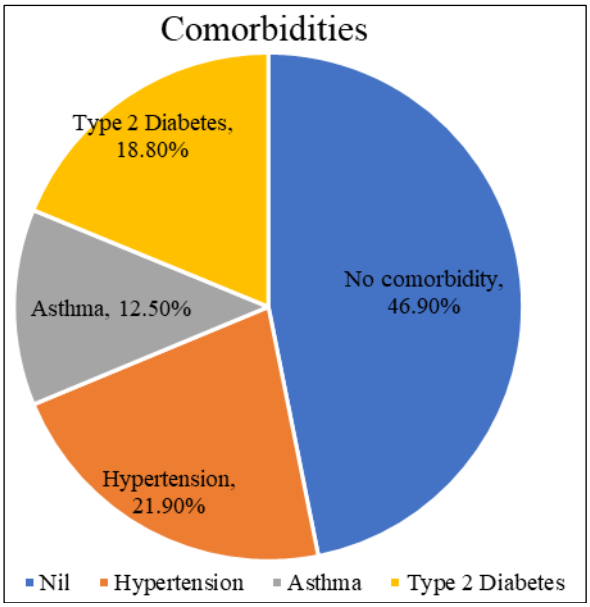


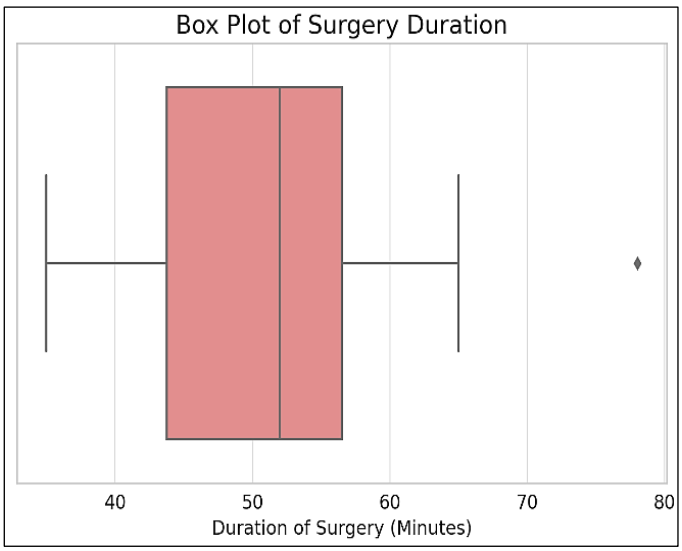
Among the patients 46.9% has no comorbidities, 21.9% has hypertension, 18.8% has diabetes & 12.5% has asthma.

Table 2: Showing ergonomics with their results

Ergonomics	Results
Operative duration Mean± SD	50.03 ± 10.46
Feasibility of procedureSmooth performance N (%) Struggling N (%)	25 (78.12%) 7 (21.87%)
Open conversion N (%)	0 (0%)

GRAPHS SHOWING TYPE OF SURGERY AND DURATION OF PROCEDURE

The box plot of surgery duration reveals that most procedures fall within a moderate timeframe, but a few outliers indicate longer surgeries in complex cases. The spread suggests variability, likely influenced by factors such as hernia type and patient-specific conditions.



IPOM plus is performed in 56.25% which is slightly higher than IPOM.

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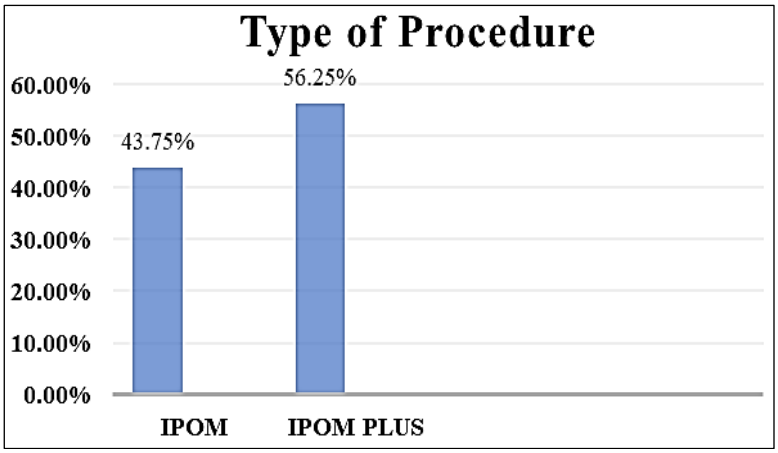
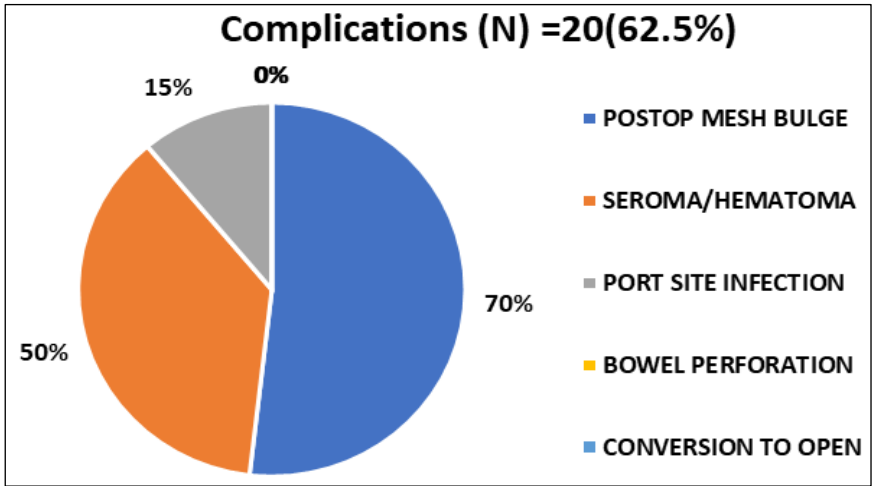


Table 3: Showing complications with their results

Complications	Results N=20 (62.5%)
Postop mesh bulge	14(70%)
Seroma/hematoma	10(50%)
Port site infection	3(15%)
Bowel perforation	0(0%)
Conversion to open	0(0%)



62.5% patients had complications, with postop mesh bulge is the most common complication with 70% with no open to conversion and bowel perforation.

Table 6: Showing post operative pain (Visual Analogue Scale)

Post op duration (hours)	Moderate(Score 4)	Severe(Score 6)	Very severe(Score 7-9)
<6 hours	1 (3.12%)	9 (28.12%)	22 (68.75%)
7-12 hours	5 (15.62%)	14 (43.75%)	13(40.62%)
12-24 hours	15 (46.87%)	10 (31.25%)	7 (21.87%)
>24 hours	26 (81.25%)	4 (12.5%)	2(6.25%)

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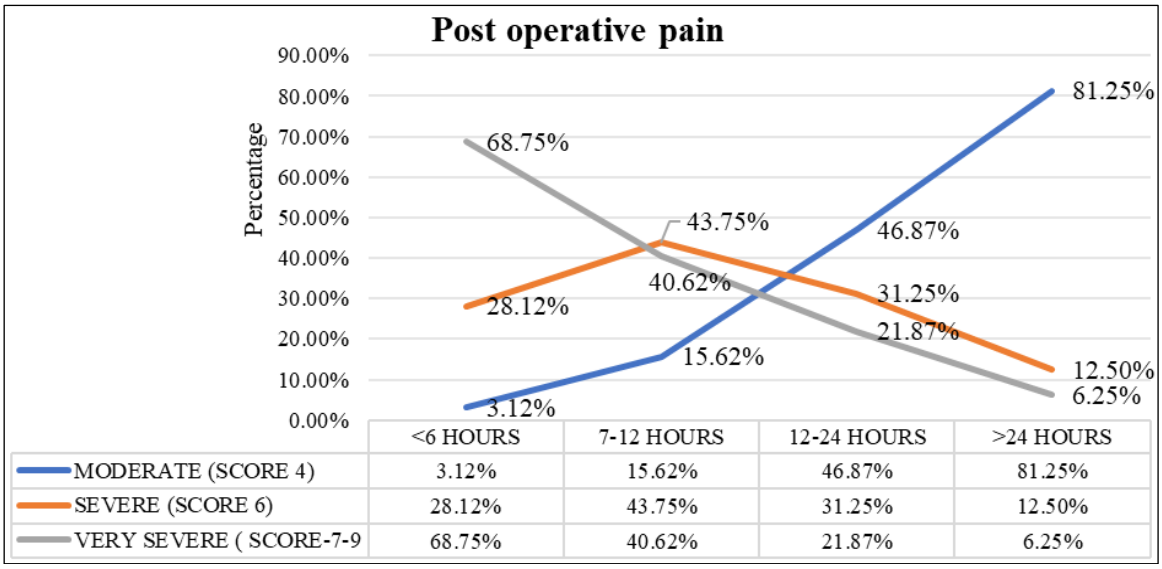

	<6 HOURS	7-12 HOURS	12-24 HOURS	>24 HOURS
MODERATE (SCORE 4)	3.12%	15.62%	46.87%	81.25%
SEVERE (SCORE 6)	28.12%	43.75%	31.25%	12.50%
VERY SEVERE (SCORE-7-9	68.75%	40.62%	21.87%	6.25%

68.75% patients experienced very severe pain in first 6 hours, while 28.12% experienced severe score. After 24 hours 81.25% experienced moderate pain. As the time progressed the severity decreased.

The statistical analysis of the dataset provides valuable insights into patient demographics and surgical details. The average age of patients undergoing IPOM and IPOM PLUS procedures is approximately mid-50s, with a standard deviation indicating moderate variability in age distribution. This suggests that patients across a wide age range undergo these surgeries.

In our study, the average duration of surgery was found to be moderate, with IPOM PLUS generally taking slightly longer than IPOM. The standard deviation in surgery duration indicates that while most procedures follow a predictable timeframe, some cases require significantly longer times due to complexity or patient-specific factors.

The correlation analysis between age and surgery duration suggests a weak or negligible relationship, implying that patient age does not significantly influence the time taken for the procedure. This aligns with expectations, as surgery duration is more likely impacted by factors such as hernia size, complexity, and comorbidities rather than patient age alone.

These findings highlight key aspects of patient profiles and surgical efficiency, providing valuable information for optimizing treatment strategies and predicting patient outcomes.

DISCUSSION

There are different types and techniques of hernia surgery. Minimally invasive surgeries like laparoscopic surgeries have ramped up these days. Many surgeons have tried their innovative techniques due to ergonomics and to reduce complications. The International Endohernia Society recommends the procedure for IVH with defects up to 10 cm in diameter[8].

In such an attempt, two port technique for laparoscopic ventral hernia repair is considered. In this study to overcome the difficulty of handling the mesh intraperitoneally, the surgeon initially oriented the mesh with 4 sutures at the periphery and used full-thickness fixation of the mesh to position and anchor it correctly.

No new intraoperative complication noted during the study. 68.75% patients had severe pain in 24 hours of post op period and we strongly believe that it is due to helical tackers.

Despite being safe, the method employed here has certain drawbacks. For instance, patients with extensive peritoneal adhesions or those with blocked or strangulated umbilical hernias should not employ the two-port approach if technical issues are expected or will arise. Therefore, it is recommended to do a feasibility evaluation prior to using the two-port technique. In circumstances that are problematic, the conventional technique or the three-or four-port method should be used. Proper mesh fixation, choice of mesh material, and meticulous surgical technique play crucial roles in preventing mesh bulging[10].

A number of studies have examined two-port minimally invasive umbilical hernia repair techniques.

1. Abir *et al.*[1]reported the first laparoscopic hernia repair using a two-port technique in three cases in 2005.
2. Mehrotra *et al.*[2]reported the largest series involving 162 cases, in which technical success was 100% with no conversions to the open or the three-port procedure.
3. Abhishek *et al.*[3]examined a series of 32 patients treated with two access ports but, in contrast to our technique, mesh fixation was accomplished with a transabdominal suture alone to reduce procedural costs.
4. Some comparative studies have reported favourable cost analyses of laparoscopic versus open umbilical hernia repair, with laparoscopic umbilical hernia repair significantly reducing

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costs compared to open mesh repair[4] albeit with the type of mesh used and fixation device having a considerable impact on cost calculations.

5. The preferred mesh fixation method used during laparoscopic umbilical hernia remains controversial; some surgeons prefer to use tacks in order to reduce the surgical time and postoperative pain[5], while others prefer to use a transabdominal suture alone in order to reduce the costs and to reduce recurrence rates due to the higher tensile holding strengths of sutures compared to tacks.

To achieve the best results from two-port laparoscopic umbilical hernia surgery, proper patient selection is crucial. Achieving outstanding outcomes free of complications also heavily depends on experience and skill in performing laparoscopic hernia repair.

LIMITATIONS OF THE STUDY

1. Single institute study.
2. Duration of the surgery is for 2 years.

CONCLUSION

On analysing this study, it was noted that two port technique had a better ergonomics, reduced mean operative time, reduced complications.

Hence it allows a safe, efficient repair of ventral and incisional hernias.

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