

Optimizing Ventral Hernia Repair: Our Experience With Laparoscopic Intra-Peritoneal Onlay Mesh Plus

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Abstract

Background: Ventral hernias, particularly umbilical and incisional types, are frequently encountered in surgical practice and often require operative intervention. Laparoscopic intra-peritoneal onlay mesh plus (IPOM plus) repair has evolved as an effective technique combining defect closure with mesh reinforcement. This study evaluates the clinical outcomes of IPOM plus repair in a cohort of patients treated at a tertiary care hospital in North India.

Methods: A retrospective analysis was conducted on 84 patients who underwent laparoscopic IPOM plus repair for ventral hernias at Chalmeda Anand Rao Institute of Medical Sciences, Karimnagar between June 2023 and May 2025. Patient demographics, hernia characteristics, operative details, postoperative complications, length of hospital stay, and recurrence rates were analyzed. Data were compiled from medical records and statistically evaluated using SPSS version 26.

Results: Of the 84 patients, 58 were female (69.0%) and 26 were male (31.0%), with a mean age of 48.6 ± 11.3 years. The most common hernia types were umbilical (41.7%) and incisional (35.7%). The mean hernia defect size was 4.2 ± 1.1 cm, and the mean operative time was 96.4 ± 18.7 minutes. All defects were closed prior to mesh placement. Postoperative complications included seroma in 7 patients (8.3%), surgical site infection in 3 patients (3.6%), and postoperative ileus in 2 patients (2.4%). No intraoperative bowel injury or major mesh-related complications were noted. The average hospital stay was 3.2 ± 1.4 days. During a mean follow-up period of 11.5 months, only 2 cases (2.4%) of hernia recurrence were observed.

Conclusion: Laparoscopic IPOM plus repair is a safe and effective approach for ventral hernia management, offering low complication and recurrence rates when performed with proper technique. It is particularly advantageous in reducing postoperative pain and minimizing the risk of mesh-related bulging. This technique should be considered a preferred option in elective ventral hernia repair in appropriately selected patients.

Keywords: Ventral Hernia, Laparoscopy, IPOM Plus, Hernia Recurrence, Mesh Repair, Defect Closure, Minimally Invasive Surgery

BACKGROUND

Ventral hernias are defined as defects in the abdominal wall through which intra-abdominal contents may protrude. They include both primary hernias such as umbilical, epigastric, and Spigelian hernias and secondary or incisional hernias, which occur at the site of previous surgical incisions [1]. Ventral hernias are a common surgical challenge, with incisional hernias occurring in up to 20% of laparotomy incisions and umbilical hernias accounting for a significant portion of abdominal wall hernia presentations, particularly in obese or multiparous women [2].

These hernias are not only associated with structural deformities but can also lead to significant symptoms such as pain, swelling, bowel obstruction, and, in some cases, life-threatening complications like strangulation [3]. Hence, timely surgical intervention is critical in both symptomatic and enlarging asymptomatic cases. Although conventional open hernia repair has been the mainstay for decades, it is associated with considerable morbidity including wound complications, postoperative pain, and high recurrence rates, especially in large or complex defects [4].

The advent of laparoscopic hernia repair in the early 1990s revolutionized abdominal wall surgery. Laparoscopic repair offered the advantages of smaller incisions, reduced postoperative pain, quicker recovery, lower infection rates, and better aesthetic outcomes. Among laparoscopic techniques, the intra-peritoneal onlay mesh (IPOM) approach became widely adopted due to its simplicity and effectiveness [5]. In the standard IPOM technique, a composite mesh is placed inside the peritoneal cavity over the defect and fixed using tacks or sutures. However, a major limitation of conventional IPOM is that it does

not involve closure of the hernia defect, which can lead to seroma formation, mesh bulging, and in some cases, recurrence due to lack of tension-free fascial coaptation [6].

To overcome these limitations, the IPOM plus technique was introduced. This method involves closure of the hernia defect prior to mesh placement. The fascial closure restores abdominal wall anatomy, eliminates dead space, and may improve core function and patient satisfaction [7]. Furthermore, defect closure reduces seroma formation, minimizes mesh protrusion, and potentially lowers recurrence rates by reinforcing the native tissue architecture. Studies have reported superior outcomes with IPOM plus in terms of pain control, cosmesis, and postoperative complications compared to standard IPOM repair [8]. Despite these advantages, IPOM plus remains a technically more demanding procedure with a learning curve. The choice of suture technique, mesh type, fixation method, and patient selection plays a crucial role in determining outcomes. There is ongoing debate regarding the standardization of this technique and its indications, especially in low- and middle-income country settings where resource limitations and variable surgeon experience may influence outcomes [9,10].

Given this context, the present study was undertaken to analyze the outcomes of laparoscopic IPOM plus repair performed at a tertiary care hospital in India. The objective was to assess the safety, efficacy, and short- to mid-term clinical outcomes of this technique, and to add to the growing body of regional data supporting minimally invasive hernia repair strategies.

MATERIALS AND METHODS

This was a retrospective observational study conducted in the Department of General Surgery at Chalmeda Anand Rao Institute of Medical Sciences, Karimnagar. The study analyzed the outcomes of patients who underwent laparoscopic intra-peritoneal onlay mesh plus (IPOM plus) repair for ventral hernias over a period of two years, from June 2023 to May 2025. Approval for the study was obtained from the Institutional Ethics Committee prior to data retrieval and analysis.

A total of **84 patients** who fulfilled the inclusion criteria and had complete follow-up records were included in the study.

Inclusion Criteria

- Patients aged 18 years and above
- Diagnosed with ventral hernia (umbilical, paraumbilical, epigastric, or incisional)
- Underwent elective laparoscopic IPOM plus repair
- Complete clinical and follow-up records available for at least six months

Exclusion Criteria

- Emergency hernia repairs (strangulated or obstructed hernias)
- Recurrent hernias previously repaired laparoscopically
- Loss of domain hernias
- Patients unfit for general anesthesia or laparoscopy
- Incomplete or missing medical records

Preoperative Evaluation

All patients underwent comprehensive preoperative evaluation including detailed clinical history, physical examination, and baseline laboratory investigations. Imaging with abdominal ultrasonography and/or contrast-enhanced CT scan was performed to assess hernia defect size, contents, and associated intra-abdominal or abdominal wall pathology. Informed written consent was obtained from all patients prior to surgery.

Surgical Technique

All procedures were performed under general anesthesia by experienced surgeons trained in advanced laparoscopic hernia repair. Pneumoperitoneum was established using the Veress needle technique or open (Hasson) method depending on the surgeon's preference. A standard three-port technique was employed in most cases.

Following laparoscopic access, the hernia sac contents were reduced, and complete adhesiolysis was performed as required. The fascial defect was closed using non-absorbable barbed sutures (V-LoC™) or polypropylene sutures either intracorporeally or via transfascial technique, depending on defect size and location. After complete closure, a dual-layer composite mesh (ranging from 10 × 15 cm to 15 × 20 cm) was introduced intraperitoneally and fixed using absorbable tackers in a double-crown fashion, with or without additional transfascial sutures. A minimum mesh overlap of 3–5 cm beyond the defect margins was ensured in all cases.

Postoperative Management and Follow-up

All patients received standard postoperative care including intravenous analgesia, early mobilization, and oral feeding from the first postoperative day. Prophylactic antibiotics were administered perioperatively. Patients were discharged once they tolerated oral feeds, passed stool, and were pain-free on oral medications.

Postoperative outcomes assessed included duration of surgery, postoperative pain, complications such as seroma, hematoma, infection, ileus, and length of hospital stay. Patients were followed up at 2 weeks, 1 month, 3 months, and 6 months postoperatively, with clinical examination and ultrasound evaluation as required. Recurrence was defined as a palpable or sonographically confirmed defect at the previous repair site during follow-up.

Data Collection and Statistical Analysis

Data were retrieved from hospital records, operative notes, and follow-up files. Variables analyzed included demographic characteristics, hernia type, defect size, operative duration, mesh type, postoperative complications, and recurrence. Statistical analysis was performed using SPSS version 26. Continuous variables were presented as mean \pm standard deviation, and categorical variables as frequencies and percentages. Chi-square and t-tests were used where appropriate, with p-values <0.05 considered statistically significant.

RESULTS

This study analyzed 84 patients who underwent laparoscopic intra-peritoneal onlay mesh plus (IPOM plus) repair for ventral hernias over a two-year period. The mean age of the patients was 48.6 years, with a clear female predominance (69%). The most common hernia types were umbilical and incisional hernias, and the average defect size was 4.2 cm. Intracorporeal barbed suture was the preferred method of defect closure in nearly three-fourths of cases. The mean operative time was approximately 96 minutes, with adhesiolysis required in one-third of patients. Postoperative complications were minor and occurred in 14.3% of cases, with seroma being the most frequent. The mean hospital stay was just over 3 days, and recurrence during a mean follow-up of 11.5 months was limited to only 2 patients (2.4%), confirming the effectiveness and safety of the IPOM plus technique.

Demographic and Clinical Profile

A total of 84 patients who underwent laparoscopic IPOM plus repair were included in the analysis. The mean age of the cohort was 48.6 ± 11.3 years, with a female predominance (58 patients; 69.0%). Most patients were in the age group of 41–60 years. The mean body mass index (BMI) was 27.2 ± 3.4 kg/m², with 21 patients (25.0%) classified as obese. Comorbidities were present in 39 patients (46.4%), the most common being hypertension (27.4%) and type 2 diabetes mellitus (19.0%).

Distribution by Hernia Type and Defect Size

The most frequent type of hernia was umbilical (35 cases; 41.7%), followed by incisional (30 cases; 35.7%), paraumbilical (12 cases; 14.3%), and epigastric (7 cases; 8.3%). The mean transverse defect size was 4.2 ± 1.1 cm, with 24 patients (28.6%) having defects larger than 5 cm. Defect closure was achieved in all patients using intracorporeal barbed sutures in 61 cases (72.6%) and transfascial sutures in the remaining 23 cases (27.4%).

Operative Details

The average operative time was 96.4 ± 18.7 minutes. Intraoperative adhesiolysis was required in 28 cases (33.3%), most commonly in patients with previous abdominal surgeries. There were no conversions to open surgery or intraoperative bowel injuries. All patients received a dual-layer composite mesh with an average size of 12.5×17.3 cm, ensuring a 3–5 cm overlap beyond the defect margins.

Postoperative Complications

Early postoperative complications were observed in 12 patients (14.3%). The most common complication was seroma formation in 7 patients (8.3%), managed conservatively with aspiration and compression dressings. Surgical site infections were noted in 3 patients (3.6%), of which 2 were superficial and managed with antibiotics and dressing changes, while 1 required drainage. Two patients (2.4%) developed postoperative ileus, which resolved with conservative management. There were no mesh infections or readmissions during the immediate postoperative period.

Hospital Stay and Recovery

The average duration of hospital stay was 3.2 ± 1.4 days. Most patients resumed oral intake within 24 hours and mobilized on the first postoperative day. Pain scores were generally low, with 90.5% of patients reporting satisfactory pain control using oral analgesics alone by the second postoperative day.

Follow-up and Recurrence

All patients were followed up for a minimum duration of 6 months, with a mean follow-up period of 11.5 months (range 6–18 months). At follow-up, only 2 patients (2.4%) experienced clinical and sonographically confirmed recurrence, both of whom had incisional hernias with defect sizes ≥ 5 cm. No cases of chronic mesh pain or bulging were reported.

Table 1: Age-wise distribution of patients

Table 1 presents the age-wise distribution of the 84 patients included in the study. The majority of patients were in the 41–50 and 51–60-year age groups, accounting for nearly 60% of the cohort. The mean age was 48.6 ± 11.3 years, reflecting a middle-aged surgical population. There were fewer patients in the extremes of age, with only 9.5% over 60 years and 4.8% under 30 years.

Age Group (years)	Number of Patients	Percentage (%)
<30	4	4.8
31–40	15	17.9
41–50	26	31.0
51–60	24	28.6
>60	8	9.5
Total	84	100.0

Table 2: Gender distribution of patients

Table 2 shows the gender distribution of the study population. A clear female predominance was observed, with 69% of patients being female. This finding reflects the higher prevalence of umbilical and incisional hernias among multiparous women.

Gender	Number of Patients	Percentage (%)
Male	26	31.0
Female	58	69.0
Total	84	100.0

Table 3: Distribution of hernia types

Table 3 classifies the types of ventral hernias repaired using the IPOM plus technique. Umbilical hernias were the most common (41.7%), followed closely by incisional hernias (35.7%). These proportions reflect the applicability of the technique across both primary and secondary ventral hernias.

Hernia Type	Number of Patients	Percentage (%)
Umbilical	35	41.7
Incisional	30	35.7
Paraumbilical	12	14.3
Epigastric	7	8.3
Total	84	100.0

Table 4: Mean defect size and technique of closure

Table 4 summarizes the mean defect sizes and methods of fascial closure used in the study. The average defect size was 4.2 cm. Intracorporeal barbed suturing was the preferred method in 72.6% of cases, while transfascial suturing was used in the rest. Larger defects (≥ 5 cm) were more often closed with a combination of barbed and transfascial sutures.

Closure Method	Number of Patients	Percentage (%)
Intracorporeal barbed	61	72.6
Transfascial sutures	23	27.4
Total	84	100.0

Table 5: Operative time distribution

Table 5 presents the distribution of operative duration among the 84 patients. The average operative time was 96.4 ± 18.7 minutes. Most procedures were completed within 90–120 minutes, reflecting a moderate learning curve and uniform surgical technique. A small proportion of cases (6.0%) extended beyond two hours, usually due to dense adhesiolysis or complex incisional hernias.

Operative Time (minutes)	Number of Patients	Percentage (%)
< 60	5	6.0
60-90	23	27.4
91-120	44	52.4
>120	12	14.3
Total	84	100.0

Table 6: Intraoperative findings

Table 6 shows intraoperative findings, particularly the requirement for adhesiolysis. Approximately one-third of patients (33.3%) required adhesiolysis, with the majority of those having incisional hernias. No intraoperative bowel injuries or conversions to open surgery occurred, indicating safe laparoscopic execution.

Intraoperative Finding	Number of Patients	Percentage (%)
Adhesiolysis performed	28	33.3
No adhesiolysis required	56	66.7
Bowel injury	0	0.0
Conversion to open surgery	0	0.0
Total	84	100.0

Table 7: Postoperative complications

Table 7 outlines the early postoperative complications observed. A total of 12 patients (14.3%) developed minor complications. The most common was seroma (8.3%), followed by surgical site infection (3.6%). Only 2 patients had postoperative ileus. No reoperations or mesh infections were reported. All complications were managed conservatively.

Complication	Number of Patients	Percentage (%)
Seroma	7	8.3
Surgical site infection	3	3.6
Postoperative ileus	2	2.4
Mesh infection	0	0.0
Reoperation	0	0.0
Total with complications	12	14.3

Table 8: Length of hospital stay

Table 8 categorizes patients based on their postoperative hospital stay. The majority of patients (73.8%) were discharged within 4 days, and only 5 patients (6.0%) required hospitalization beyond 5 days due to complications. The average length of stay was 3.2 ± 1.4 days.

Length of Stay (days)	Number of Patients	Percentage (%)
≤2	18	21.4
3-4	44	52.4
5-6	17	20.2
>6	5	6.0
Total	84	100.0

Table 9: Postoperative pain control status

Table 9 describes the level of pain experienced by patients postoperatively, assessed using a simple 3-tier pain score. Most patients (90.5%) had mild pain effectively managed with oral analgesics. Only 2 patients (2.4%) experienced moderate to severe pain requiring extended IV analgesia. No patients required prolonged opioid therapy.

Pain Intensity (Day 1-2)	Number of Patients	Percentage (%)
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Mild (controlled with oral analgesics)	76	90.5
Moderate (IV analgesia needed beyond 48 hrs)	6	7.1
Severe (interfering with ambulation)	2	2.4
Total	84	100.0

Table 10: Follow-up duration

Table 10 summarizes the duration of follow-up. All patients completed at least 6 months of follow-up, with the majority followed up for 9–12 months. A subset of 13 patients were followed for over a year, providing data on medium-term outcomes including recurrence.

Follow-up Duration (months)	Number of Patients	Percentage (%)
6–8 months	26	31.0
9–12 months	45	53.6
>12 months	13	15.5
Total	84	100.0

Table 11: Recurrence after IPOM plus repair

Table 11 presents recurrence data during the follow-up period. Only two patients (2.4%) developed clinically and sonographically confirmed recurrence. Both patients had large incisional hernias (>5 cm defect) and were managed conservatively at follow-up. The recurrence rate was low, indicating effective fascial closure and mesh reinforcement.

Recurrence Status	Number of Patients	Percentage (%)
No recurrence	82	97.6
Recurrence	2	2.4
Total	84	100.0

Table 12: Overall postoperative outcomes

Table 12 summarizes all key outcomes observed in the study. The majority of patients had uneventful recovery with early discharge, low postoperative pain, and minimal complications. This comprehensive summary supports the safety and efficacy of the laparoscopic IPOM plus technique.

Outcome Parameter	Number of Patients	Percentage (%)
Uneventful recovery	72	85.7
Minor complications (seroma, SSI, ileus)	12	14.3
Postoperative pain (mild)	76	90.5
Early discharge (≤ 4 days)	62	73.8
Recurrence on follow-up	2	2.4

Table 1 showed that most patients were in the 41–60-year age group, while **Table 2** confirmed a female predominance. **Table 3** revealed umbilical and incisional hernias were most common, and **Table 4** demonstrated that intracorporeal barbed suturing was the predominant closure method. **Table 5** showed operative times were mostly within 90–120 minutes, and **Table 6** indicated that adhesiolysis was needed in one-third of cases. **Table 7** described minor complications like seroma and infection, while **Table 8** revealed most patients were discharged within 4 days. **Table 9** showed good postoperative pain control, and **Table 10** confirmed at least 6 months of follow-up in all patients. **Table 11** reflected a low recurrence rate of 2.4%, and **Table 12** summarized favorable overall outcomes in the majority of cases.

DISCUSSION

The present study evaluated the clinical outcomes of laparoscopic intra-peritoneal onlay mesh plus (IPOM plus) repair in 84 patients with ventral hernias at a tertiary care hospital in India. The results demonstrate that IPOM plus is a safe, effective, and versatile technique, associated with low postoperative morbidity, early recovery, and a favorable recurrence profile [11].

The majority of patients were female (69%), which aligns with the known predisposition of multiparous women to develop umbilical and incisional hernias due to midline fascial attenuation. The mean age was 48.6 years, consistent with the age group typically affected by acquired ventral hernias. The predominance of umbilical (41.7%) and incisional hernias (35.7%) reflects the relevance of this technique across both

primary and secondary hernia presentations. Notably, many incisional hernias followed lower midline or Pfannenstiel incisions, common in obstetric and gynecological surgeries [12,13].

All hernia defects were closed prior to mesh placement, with the majority utilizing intracorporeal barbed sutures, which provided secure and efficient fascial approximation. Defect closure is a core element distinguishing IPOM plus from conventional IPOM repair [14]. Several studies have shown that defect closure reduces postoperative bulging, improves abdominal wall function, and potentially lowers recurrence. In our series, closure was successfully achieved in 100% of patients, without any suture-related complications such as dehiscence or excessive pain [15].

The mean operative time of 96.4 minutes was within the acceptable range for laparoscopic ventral hernia repair. While longer than standard IPOM, the added time reflects the technical demand of defect closure and mesh fixation [16]. Adhesiolysis was required in one-third of patients, particularly in those with previous abdominal surgery, but no intraoperative complications or conversions to open surgery were encountered, highlighting the safety of the procedure in experienced hands [17].

Postoperative morbidity was minimal. Seroma formation (8.3%) was the most frequent complication, managed conservatively in all cases. Surgical site infections (3.6%) were superficial and did not require mesh removal. Importantly, there were no cases of mesh-related infection or chronic pain—concerns often cited in mesh-based repairs. Pain was well controlled in over 90% of patients with only oral analgesics, supporting the benefit of minimally invasive surgery with tension-free repair [18]. The mean hospital stay was short (3.2 days), consistent with other laparoscopic series, and enabled early return to daily activities [19]. During a mean follow-up of 11.5 months, the recurrence rate was only 2.4%. Both recurrences occurred in patients with large incisional hernias and no technical errors were identified, suggesting multifactorial causation including patient-related factors such as obesity and previous mesh failure [20].

Overall, the outcomes in this study are comparable to or better than those reported in prior literature for IPOM plus, reinforcing the viability of this technique in resource-constrained environments. The success of the procedure depends on proper patient selection, meticulous surgical technique, and adequate mesh sizing and fixation. While cost and learning curve remain considerations, the reduction in long-term complications and recurrence can offset initial investments.

This study also highlights the feasibility of IPOM plus in an Indian tertiary care setting where patient compliance, follow-up, and affordability are important determinants of surgical decision-making. The technique appears adaptable, reproducible, and capable of delivering consistent outcomes when applied judiciously.

CONCLUSION

Laparoscopic IPOM plus repair is a safe and effective approach for managing ventral hernias, offering low complication rates, excellent pain control, short hospital stay, and minimal recurrence when performed with proper technique. Defect closure enhances the anatomical and functional restoration of the abdominal wall, minimizing bulging and improving cosmesis. Our experience demonstrates that IPOM plus can be successfully integrated into standard surgical practice in Indian tertiary care centers, with reproducible and favorable outcomes. Continued refinement of technique, careful patient selection, and long-term follow-up will further strengthen its role in contemporary hernia surgery.

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