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Research Article

A comparative study on IPOM versus IPOM PLUS and their surgical outcomes in a Tertiary Health Care in Haryana

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Abstract

Background: Intra-peritoneal onlay mesh (IPOM) repair is a commonly performed technique for laparoscopic ventral hernia repair (LVHR), in which the fascial defect is bridged using a composite mesh. Recently, IPOM-Plus, which involves closure of the fascial defect prior to mesh placement, has been increasingly recommended to improve postoperative outcomes. **Materials and Methods:** This retrospective cohort study was conducted in the Department of General Surgery at NC Medical College, Israna, Panipat, Haryana, India. A total of 80 patients who underwent either IPOM (Group A) or IPOM-Plus (Group B) were included. Data on demographic characteristics, intraoperative findings, and postoperative outcomes were retrieved from medical records. All patients were followed up for 6 months. Statistical analysis was performed using SPSS version 29.0, with a *p*-value < 0.05 considered statistically significant. **Results:** Of the 80 patients, 40 underwent IPOM and 40 underwent IPOM-Plus repair. Both groups were comparable with respect to demographic and baseline clinical characteristics ($p > 0.05$). Umbilical hernia was the most common type in both groups. The mean operative time was significantly higher in the IPOM-Plus group ($p < 0.001$), while hernia defect size was comparable between the groups ($p = 0.36$). Seroma formation ($p = 0.03$) and pseudosac formation at first OPD visit ($p = 0.03$) were significantly higher in the IPOM group. Although pseudosac at 6 months was more frequent in the IPOM group, the difference was not statistically significant ($p = 0.15$). There was no significant difference between the groups in terms of postoperative pain, duration of opioid use, wound infection, or length of hospital stay. **Conclusions:** IPOM-Plus repair is a safe and effective technique with advantages over standard IPOM repair in reducing early postoperative complications such as seroma and pseudosac formation,

albeit with a longer operative time. Larger studies with longer follow-up are needed to assess long-term outcomes.

Keywords: Ventral hernia, IPOM, IPOM-Plus, laparoscopic repair

Introduction

Ventral abdominal wall hernia repair is one of the most commonly performed procedures in general surgical practice. Among these, incisional and para-umbilical hernias constitute a significant proportion in adults. Incisional hernias have been reported to occur in approximately 11–20% of patients following abdominal surgeries [1]. The overall incidence of primary ventral hernia ranges from 4% to 5%, while the incidence of incisional hernia may reach up to 35–60% within 5 years after laparotomy [2]. Furthermore, nearly one in six patients undergoing hernia repair require reoperation within 10 years [3]. Thus, ventral hernias and their recurrences pose a substantial burden on healthcare systems and the economy [4].

Since its introduction by Karl LeBlanc in 1993 [5], laparoscopic ventral hernia repair (LVHR) has gained widespread acceptance due to its advantages over open ventral hernia repair (OVHR), including reduced postoperative pain, shorter hospital stay, and lower wound-related complications [6]. However, despite these benefits, several challenges remain, such as seroma formation, postoperative bulging, and higher recurrence rates, particularly in patients with large fascial defects or obesity [7].

The conventional laparoscopic technique, intra-peritoneal onlay mesh (IPOM) repair, involves bridging the fascial defect with a composite mesh placed intraperitoneally. Although widely practiced, IPOM repair is associated with limitations, including seroma formation, mesh bulging, recurrence, and failure to restore normal abdominal wall dynamics [8]. To overcome these drawbacks, closure of the fascial defect prior to mesh placement—known as IPOM-Plus—has been introduced. This technique aims to reduce dead space, improve abdominal wall function, and minimize postoperative complications [9]. IPOM-Plus has also been recommended in guidelines by the International Endohernia Society (IEHS) [10].

Open onlay mesh repair, which involves placement of mesh over the anterior fascia, is technically simpler but is associated with a higher incidence of wound-related complications [11]. In contrast, laparoscopic IPOM-Plus combines the benefits of minimally invasive surgery with anatomical defect closure, potentially offering improved outcomes, albeit with increased technical complexity [12,13]. In this context, the present study was conducted to compare IPOM and IPOM-Plus techniques in the management of ventral hernias, with a focus on operative time, postoperative complications, recovery, and short-term outcomes.

Materials and Methods

This retrospective cohort study was conducted using data obtained from a prospectively maintained database of patients who underwent surgery for ventral hernia in the Department of General Surgery at NC Medical College, Israna, Panipat, Haryana, India. Patients who underwent either IPOM or IPOM-Plus repair during the study period and had a minimum follow-up of 6 months were included in the study.

Inclusion criteria: Patients undergoing laparoscopic ventral hernia repair by IPOM or IPOM-Plus technique.

Exclusion criteria: Patients with irreducible, obstructed, strangulated, or incarcerated hernias; defect size <2 cm or >5 cm; complete loss of abdominal domain; patients unfit for general anesthesia; and patients with recurrent ventral hernia following previous laparoscopic repair.

The diagnosis of ventral hernia was made based on clinical history and physical examination. Imaging modalities such as ultrasonography and computed tomography (CT) were used when required to confirm the diagnosis and to assess defect size and hernia contents. Demographic, intraoperative, and postoperative variables were recorded and analyzed.

Surgical Technique

All procedures were performed under general anesthesia with the patient in the supine position. Pneumoperitoneum was established using a Veress needle at Palmer's point, maintaining intra-abdominal pressure at 12–15 mmHg. A 5-mm trocar was placed at the same site, along with an additional 5-mm trocar in the left iliac fossa and a 10-mm trocar at the level of the umbilicus along the anterior axillary line.

Adhesiolysis was performed as required. The hernia contents were reduced without excision of the hernia sac. The defect area was cleared of fatty tissue, and the falciform ligament was partially detached when necessary. The maximum defect size was measured at a reduced intraperitoneal pressure of 6–8 mmHg to guide mesh selection.

A composite mesh (Parietex) with at least a 5 cm overlap beyond the defect margins was placed intraperitoneally and fixed using transfascial sutures and tackers, with approximately 2 cm spacing between fixation points.

- **Group A (IPOM):** Mesh placement was performed without prior closure of the fascial defect.
- **Group B (IPOM-Plus):** The fascial defect was closed using 0 V-Loc sutures before mesh placement, incorporating all layers of the abdominal wall except the skin and subcutaneous tissue.

Trocar site fascial defects were closed using 2-0 Vicryl sutures, and the skin was closed with staples.

Postoperative Care and Follow-up

All patients were advised to wear an abdominal binder continuously for one month postoperatively. Follow-up was conducted on the 7th postoperative day for wound assessment and staple removal, and subsequently at 3 months and 6 months.

During follow-up visits, patients underwent clinical examination and ultrasonography to assess for seroma formation, pseudosac formation, mesh-related complications, and recurrence.

Statistical Analysis

Data were collected, coded, and analyzed using the Statistical Package for Social Sciences (SPSS) version 29.0. Descriptive statistics were expressed as mean ± standard deviation (SD) for continuous variables and as frequencies and percentages for categorical variables. Inferential analysis was performed using the Mann–Whitney U test for continuous variables and Pearson's Chi-square test or Fisher's exact test for categorical variables, as appropriate. A *p*-value of <0.05 was considered statistically significant.

Result

Table 1: Demographic, Clinical and Intra-Operative Parameters of Patients Who Underwent IPOM and IPOM Plus Procedure

Variable	Group A (n=40)	Group B (n=40)	p-value
Age (Mean ± SD)	48.4 ± 8.8	50.5 ± 9.1	0.28
Sex			0.65
Male	22 (55%)	20 (50%)	
Female	18 (45%)	20 (50%)	
BMI (Mean ± SD)	27.9 ± 3.1	27.6 ± 2.9	0.68
Duration of symptoms (days)	91.7 ± 5.3	96.2 ± 3.3	0.001*
Presenting symptoms			
Swelling	33 (82.5%)	36 (90%)	0.34
Pain	5 (12.5%)	6 (15%)	0.74
Irreducibility	5 (12.5%)	6 (15%)	0.74
Co-morbidity	9 (22.5%)	9 (22.5%)	1.00
Type of Hernia			
Epigastric	4 (10%)	4 (10%)	0.0081
Para-umbilical	10 (25%)	10 (25%)	
Umbilical	25 (62.5%)	30 (75%)	
Defect size (cm)	3.78 ± 0.97	3.6 ± 0.82	0.36
Operative time (min)	46.8 ± 7.1	54.1 ± 7.4	<0.001*

Demographic Profile and Intraoperative Findings

A total of 80 patients were included in this study, of whom 40 underwent IPOM (Group A) and 40 underwent IPOM-Plus (Group B). In Group A, there were 22 (55%) males and 18 (45%) females, while in Group B, 20 (50%) were males and 20 (50%) were females. There was no statistically significant difference between the two groups with respect to age, sex, body mass index (BMI), duration of symptoms, presenting complaints, irreducibility of hernia, and associated co-morbidities ($p > 0.05$ for all).

Umbilical hernia was the most common type in both groups, followed by para-umbilical and epigastric hernias; however, the distribution of hernia types between the groups was not statistically significant ($p > 0.05$). The mean defect size was comparable between the two groups (Group A: 3.78 ± 0.97 cm vs Group B: 3.6 ± 0.82 cm; $p = 0.36$). Since IPOM-Plus involves additional procedural steps, the mean operative time was significantly higher in Group B (54.1 ± 7.4 minutes) compared to Group A (46.8 ± 7.1 minutes) ($p < 0.001$) (Table 1).

Table 2: Early Postoperative Outcomes of Patients Who Underwent IPOM and IPOM Plus Procedure

Parameters	Group A (n=40) (Mean±SD)	Group B (n=40) (Mean±SD)	P-value
Duration of opioid use (hours)	26.8 ± 3.3	26.2 ± 3.2	0.41
Pain score at 24 hours	6.7 ± 0.83	6.83 ± 0.78	0.48
Pain score at discharge	3.79 ± 0.86	3.63 ± 0.82	0.40
Pain score at first OPD	2.29 ± 0.86	2.31 ± 0.85	0.92

Parameters	Group A (n=40) (Mean±SD)	Group B (n=40) (Mean±SD)	P-value
visit			
Seroma, n (%)	10 (25%)	3 (7.5%)	0.03*
Wound infection, n (%)	0 (0%)	0 (0%)	—
Pseudosac at first OPD visit, n (%)	13 (32.5%)	5 (12.5%)	0.03*
Length of hospital stay (days)	2.02 ± 0.81	2.05 ± 0.80	0.87

Early postoperative outcomes: Seroma formation was significantly higher in Group A patients compared to Group B (25% vs 7.5%, $p = 0.03$). Similarly, a significant difference in pseudosac formation at the first OPD visit was observed between the groups (32.5% in Group A vs 12.5% in Group B, $p = 0.03$). There was no statistically significant difference between the two groups with respect to duration of opioid analgesia use, pain scores at 24 hours, at discharge, and at first OPD visit, wound infection, or length of hospital stay ($p > 0.05$ for all) (Table 2).

Table 3: Late Postoperative Outcomes of Patients Who Underwent IPOM and IPOM Plus Procedure

Parameters	Group A (n=40)		Group B (n=40)		P-value
	N	**%**	**N**	**%**	
Pseudosac at 6 months	7	17.5	2	5	0.15
Mesh infection	0	0	0	0	
Chronic pain	0	0	0	0	
Recurrence	0	0	0	0	

Late postoperative outcomes: Among the 80 patients, only 9 patients had persistent pseudosac at six months, of which 7 were from Group A. Although a higher proportion was observed in Group A compared to Group B, this difference between the two surgical procedures was **not statistically significant** *(p = 0.15)*. No evidence of mesh infection, chronic pain, or recurrence of hernia was observed in either group at 6 months (Table 3).

Discussion

The present study compared the outcomes of IPOM and IPOM-Plus techniques in the management of ventral hernias. With the increasing adoption of minimally invasive approaches, closure of the fascial defect (IPOM-Plus) has been proposed to improve postoperative outcomes and reduce complications such as seroma and pseudosac formation.

In our study, both groups were comparable with respect to baseline characteristics including age, sex, BMI, duration of symptoms, and co-morbidities, thereby minimizing selection bias. Umbilical hernia was the most common type observed in both groups, which is consistent with previous studies reporting it as the predominant form of ventral hernia.

Laparoscopic ventral hernia repair (LVHR) has gained widespread acceptance due to its advantages over open repair, including shorter hospital stay, reduced postoperative

complications, lower surgical site infection rates, and comparable recurrence rates [12]. However, certain challenges remain, such as seroma formation, mesh bulging or eventration, and lack of restoration of abdominal wall function when the defect is bridged without closure, as in conventional IPOM repair. These limitations have led to the development of IPOM-Plus, which incorporates fascial defect closure prior to mesh placement [13]. In the present study, the mean operative time was significantly higher in the IPOM-Plus group (54.1 ± 7.4 minutes) compared to the IPOM group (46.8 ± 7.1 minutes), which can be attributed to the additional step of defect closure. This finding is consistent with previous studies [14].

Seroma formation is one of the most common complications following LVHR and may lead to discomfort, pain, infection, and unsatisfactory cosmetic outcomes [15]. A meta-analysis of 16 studies reported significantly higher rates of seroma formation following IPOM compared to IPOM-Plus (12.2% vs 2.5%) [16]. In our study, seroma formation was significantly higher in the IPOM group (25%) compared to the IPOM-Plus group (7.5%) (p = 0.03), supporting the advantage of defect closure in reducing postoperative fluid collection. Similarly, pseudosac formation at the first postoperative visit was significantly higher in the IPOM group. At 6-month follow-up, pseudosac was more frequently observed in the IPOM group (17.5%) compared to the IPOM-Plus group (5%); however, this difference was not statistically significant (p = 0.15). This finding suggests a trend toward benefit with IPOM-Plus, although statistical significance was not achieved, possibly due to the limited sample size. No significant differences were observed between the two groups in terms of postoperative pain scores, duration of opioid analgesia use, wound infection, or length of hospital stay, indicating that IPOM-Plus does not adversely affect early postoperative recovery. The absence of recurrence, chronic pain, and mesh infection in both groups at 6 months suggests that both techniques are safe and effective in the short term. However, longer follow-up is required to evaluate long-term outcomes, particularly recurrence.

The limitations of this study include its retrospective design, relatively small sample size, and short duration of follow-up. As previous studies suggest that 66%–90% of ventral hernia recurrences occur within 2 years postoperatively [18], the present study may not fully capture long-term recurrence rates.

Conclusion

IPOM-Plus repair is a safe and effective technique with potential advantages over standard IPOM repair, particularly in reducing early postoperative complications such as seroma and pseudosac formation, albeit at the cost of increased operative time. Both techniques demonstrated comparable short-term outcomes in terms of pain, hospital stay, and recurrence. Larger prospective studies with longer follow-up are required to establish the long-term benefits of IPOM-Plus repair.

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