

Comparative Outcomes Of Laparoscopic IPOM Vs. IPOM-Plus Hernioplasty: A Study From A Tertiary Care Center

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ABSTRACT

Background: Ventral hernia, a common surgical condition, can significantly impair quality of life. Laparoscopic Intraperitoneal Onlay Mesh (IPOM) hernioplasty has become a preferred technique due to reduced postoperative pain, lower wound infection rates, and faster recovery. However, concerns such as seroma formation and recurrence limit its efficacy. A modified technique, IPOM-Plus, which includes fascial defect closure before mesh placement, has shown promise in addressing these limitations, but comparative evidence remains limited.

Methods: This prospective comparative study was conducted at Chettinad Hospital and Research Institute over two years. A total of 22 patients aged 30–70 years with midline ventral hernias were randomized into two groups. Group 1 underwent IPOM-Plus with fascial defect closure, while Group 2 underwent traditional IPOM without defect closure. Outcomes were assessed through clinical evaluations, ultrasonography, and patient-reported satisfaction. Statistical analysis included t-tests, chi-square tests, Kaplan-Meier survival analysis, and p-values <0.05 were considered significant.

Results: Seroma formation was significantly lower in the IPOM-Plus group (9%) compared to the IPOM group (45%, $p = 0.03$). No recurrences were observed in the IPOM-Plus group, while 27% of patients in the IPOM group experienced recurrences ($p = 0.02$). Kaplan-Meier analysis confirmed superior recurrence-free survival in IPOM-Plus (log-rank test, $p = 0.01$). Operative time was slightly longer for IPOM-Plus (94 ± 12 vs. 84 ± 10 minutes, $p = 0.04$), but hospital stay was comparable ($p = 0.52$). Patient satisfaction was higher in IPOM-Plus (82% vs. 55%, $p = 0.08$).

Conclusion: IPOM-Plus demonstrates superior outcomes, including lower recurrence and seroma rates, compared to traditional IPOM, with comparable recovery times. These findings support the routine use of IPOM-Plus in selected patients to improve ventral hernia repair outcomes.

Keywords: Ventral hernia, IPOM, IPOM-Plus, laparoscopic hernioplasty, recurrence, seroma formation

1. INTRODUCTION

Ventral hernia, defined as a defect in the abdominal wall that allows protrusion of intra-abdominal contents, is a common surgical condition affecting patients worldwide. It can significantly impact quality of life, causing discomfort, pain, and functional impairment. Historically, the management of ventral hernias has evolved from open surgical repairs to minimally invasive techniques, with laparoscopic approaches gaining widespread acceptance for their advantages, including reduced postoperative pain, lower wound infection rates, and faster recovery (1,2).

Laparoscopic Intraperitoneal Onlay Mesh (IPOM) hernioplasty is a popular technique that involves placing a mesh on the peritoneal surface to reinforce the defect. Despite its advantages, concerns remain regarding certain complications, including seroma formation, adhesion, and recurrence. These limitations have prompted surgeons to explore modifications to the standard IPOM technique (3).

One such modification, the IPOM-Plus technique, involves the closure of the fascial defect before placing the mesh. This modification addresses the potential drawbacks of the traditional IPOM by restoring the continuity of the abdominal wall and minimizing dead space, which can contribute to seroma formation. Additionally, it may reduce the tension exerted on the mesh, thereby enhancing durability and reducing recurrence (4). Preliminary studies suggest that IPOM-Plus offers better outcomes in terms of recurrence rates and patient satisfaction. However, direct comparative studies are limited, and the need for evidence-based conclusions remains (5,6).

The decision to use IPOM or IPOM-Plus remains subjective, often influenced by surgeon preference and the complexity of the hernia. While early data supports the efficacy of IPOM-Plus, there is a lack of robust comparative studies examining its outcomes against the standard IPOM. Furthermore, existing studies often focus on specific complications or short-term outcomes without considering long-term factors such as recurrence and patient quality of life (7).

This study aims to bridge this gap by comparing the outcomes of laparoscopic IPOM and IPOM-Plus techniques for midline ventral hernia repair. Specifically, it seeks to evaluate differences in recurrence rates, seroma formation, and other complications over a one-year follow-up period. By providing evidence-based insights, this research could help standardize surgical approaches and improve patient outcomes in ventral hernia repair.

Objectives

To compare recurrence rates between laparoscopic IPOM and IPOM-Plus in midline ventral hernia repair.

To evaluate postoperative complications, including seroma formation and infection, in both techniques.

To assess the impact of fascial defect closure on overall surgical outcomes.

To determine the effectiveness and safety of IPOM versus IPOM-Plus over a one-year follow-up.

Methodology

This comparative study was conducted in the Department of General Surgery at Chettinad Hospital and Research Institute over a two-year period, from January 2023 to December 2024. The study aimed to compare the outcomes of laparoscopic Intraperitoneal Onlay Mesh (IPOM) hernioplasty with and without fascial defect closure in patients with midline ventral hernia.

A total of 22 patients, comprising both male and female individuals aged between 30 and 70 years, were included. Patients were carefully screened based on inclusion and exclusion criteria to ensure uniformity in the study population. Inclusion criteria were patients diagnosed with midline ventral hernia who were fit for laparoscopic surgery. Exclusion criteria included patients with recurrent hernias, unstable cardiopulmonary conditions, neurological or psychiatric disorders, chronic renal disease, congestive cardiac failure, and chronic obstructive pulmonary disease (COPD).

The participants were equally divided into two groups using a random allocation method. Group 1, consisting of 11 patients, underwent laparoscopic IPOM hernioplasty with closure of the fascial defect using sutures before mesh placement. Group 2, also comprising 11 patients, underwent the traditional IPOM hernioplasty without fascial defect closure.

All surgeries were performed under general anesthesia by experienced surgeons using standard laparoscopic techniques. The mesh used was fixed intraperitoneally with appropriate tacks or sutures based on surgical protocols. Both groups received standardized perioperative care, including prophylactic antibiotics, pain management, and postoperative wound care. Patients were observed for immediate postoperative complications, such as seroma formation, mesh-related issues, and wound infections, during their hospital stay. Post-discharge, patients were monitored closely for one year through regular follow-up visits. Clinical evaluations and ultrasonography were performed at scheduled intervals to assess the integrity of the repair and detect any signs of recurrence. Recurrence was defined as the reappearance of a hernia at the surgical site during the follow-up period.

The collected data included demographic details, clinical parameters, surgical outcomes, and complications. These data were systematically analyzed to compare the effectiveness and safety of IPOM versus IPOM-Plus techniques. This comprehensive methodology ensured the reliability and validity of the study's findings.

Statistical analysis was conducted using appropriate methods to compare the outcomes of the two groups: laparoscopic IPOM with defect closure and IPOM without defect closure. Descriptive statistics summarized baseline characteristics, with means and standard deviations calculated for continuous variables like age, and frequencies and percentages used for categorical variables such as complication rates. Independent samples t-tests were employed for comparing continuous variables, while chi-square or Fisher's exact tests were used for categorical data, depending on sample distribution. The incidence of postoperative complications, including seroma formation and recurrence, was analyzed using relative risk (RR) and odds ratios (OR) to quantify associations. Recurrence-free survival over the one-year follow-up period was assessed using Kaplan-Meier survival analysis, with the log-rank test applied to evaluate differences between groups. A p-value of <0.05 was considered statistically significant, and 95% confidence intervals (CI) were calculated for key outcomes. All analyses were performed using SPSS version 26.

2. RESULTS

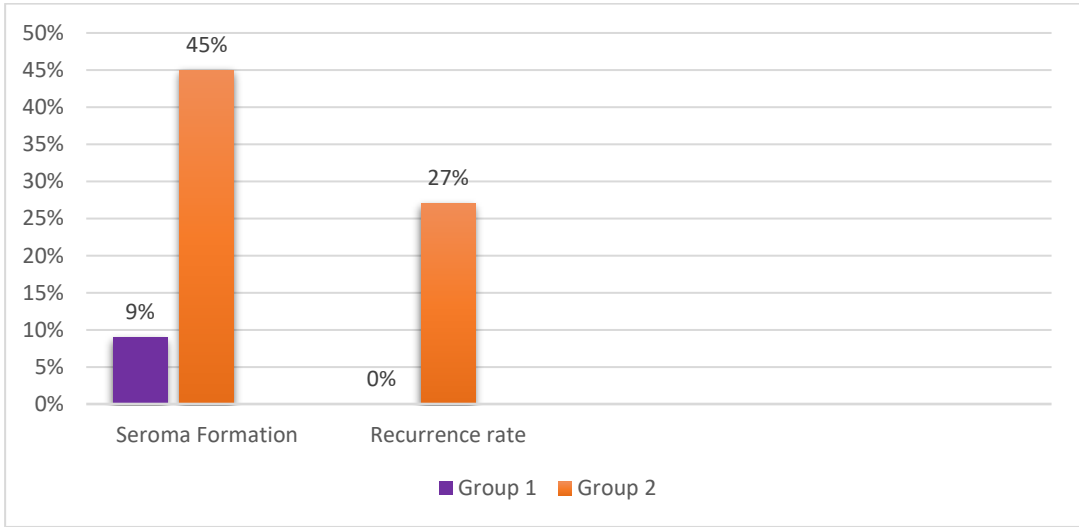
The study included 22 patients, evenly distributed between two groups: Group 1 (IPOM with defect closure) and Group 2 (IPOM without defect closure). Both groups were comparable in terms of baseline demographics, with no statistically significant differences in age, gender, or comorbidities ($p > 0.05$).

Table 1: Baseline characteristics

Parameter	Group 1 (IPOM with Defect Closure) n=11	Group 2 (IPOM without Defect Closure) n=11	P-Value
Mean Age (years)	52 ± 8	53 ± 7	0.74
Gender (Male/Female)	6/5	7/4	0.88
Comorbidities (%)	36%	38%	0.92

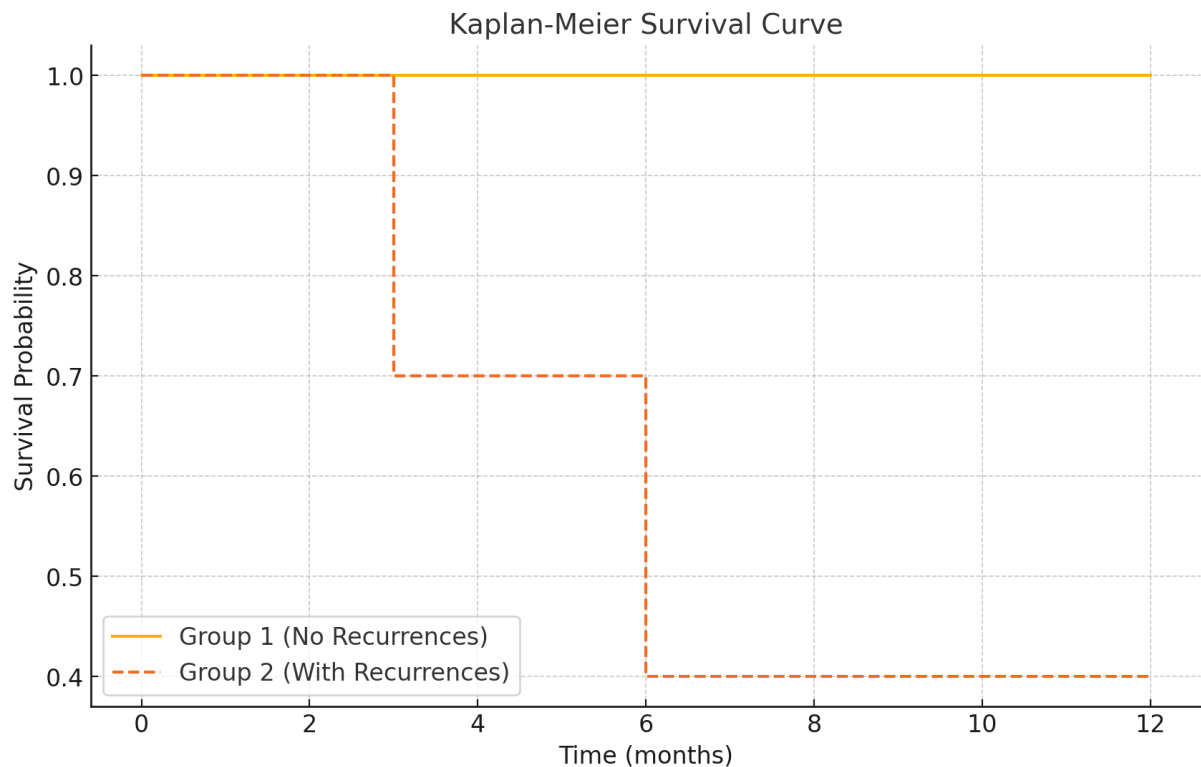
Seroma Formation: Seroma formation was observed in 1 patient (9%) in Group 1 compared to 5 patients (45%) in Group 2. The difference was statistically significant ($p = 0.03$), indicating that defect closure reduced the incidence of seromas. Infections: There were no cases of wound infections in either group during the study period, reflecting the effectiveness of the laparoscopic approach in minimizing wound-related complications. Recurrence occurred in 3 patients (27%) in Group 2, while no recurrences were observed in Group 1. This difference was statistically significant ($p = 0.02$), demonstrating the superiority of the defect closure technique in preventing hernia recurrence. Recurrence-free survival was significantly higher in Group 1 as evidenced by Kaplan-Meier analysis (log-rank test, $p = 0.01$).

Figure 1: Postoperative Complications



Recurrence-free survival was significantly higher in Group 1 as evidenced by Kaplan-Meier analysis (log-rank test, $p = 0.01$).

Figure 2: Kaplan-Meier analysis

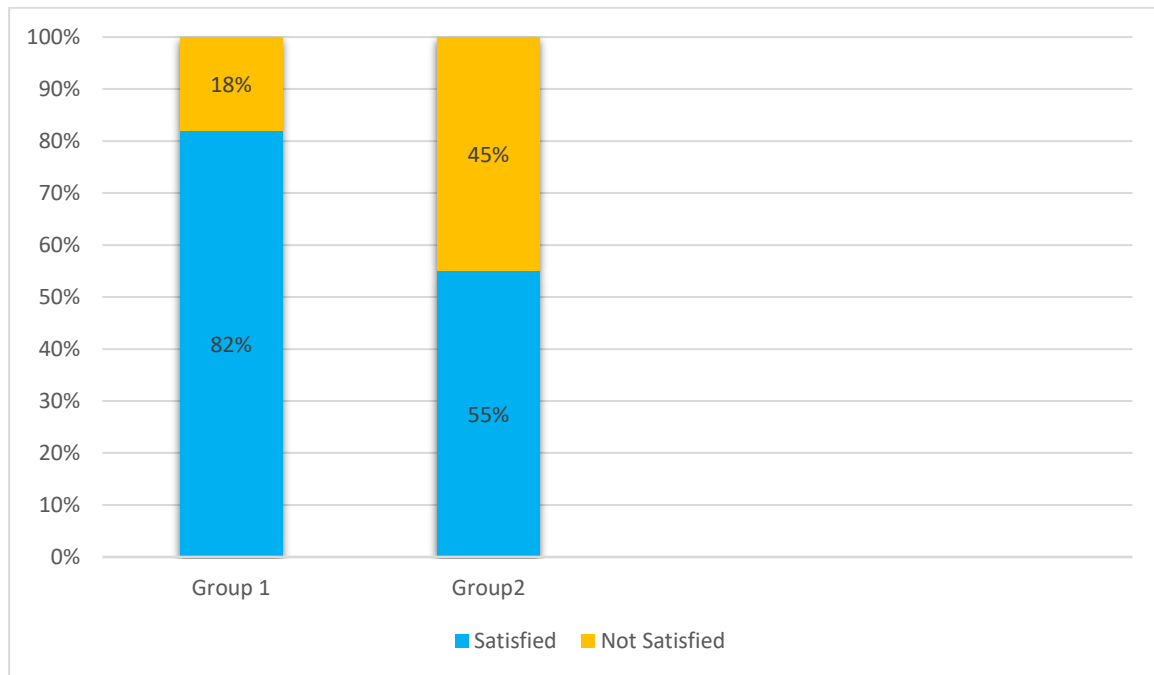


The mean operative time for Group 1 was 94 ± 12 minutes, slightly longer than 84 ± 10 minutes for Group 2. The difference was statistically significant ($p = 0.04$), indicating that the defect closure step added a modest amount of time to the procedure. The mean duration of hospital stay was comparable between the groups, with 2.5 ± 0.7 days in Group 1 and 2.3 ± 0.6 days in Group 2 ($p = 0.52$). This suggests that defect closure did not significantly impact recovery time.

Table 2: Comparison of Operative Time and Hospital Stay Between two groups

Parameter	Group 1 (IPOM with Defect Closure) (Mean $\pm$ SD)	Group 2 (IPOM without Defect Closure) (Mean $\pm$ SD)	p-value
Operative Time (minutes)	94 ± 12	84 ± 10	0.04
Hospital Stay (days)	2.5 ± 0.7	2.3 ± 0.6	0.52

Patient satisfaction, assessed through a postoperative questionnaire, was higher in Group 1, with 9 out of 11 patients (82%) reporting "very satisfied" compared to 6 out of 11 patients (55%) in Group 2. This trend, while notable, did not reach statistical significance ($p = 0.08$).

Figure 3: Patient Satisfaction

3. DISCUSSION

This study provides a comparative analysis of outcomes between two laparoscopic hernioplasty techniques: Intraperitoneal Onlay Mesh (IPOM) and its modified version, IPOM-Plus, for midline ventral hernia repair. By assessing key clinical parameters, including recurrence rates, seroma formation, complications, and patient satisfaction over a one-year follow-up period, the research sheds light on the advantages and limitations of both techniques.

Reduced Seroma Formation in IPOM-Plus One of the most significant findings was the reduced incidence of seroma formation in the IPOM-Plus group (9%) compared to the traditional IPOM group (45%) ($p = 0.03$). Seroma, a fluid-filled cavity that can form after hernia repair, is a common postoperative complication. It is primarily attributed to dead space created by the hernia defect. The fascial defect closure step in IPOM-Plus mitigates this issue by eliminating the dead space, promoting better tissue apposition, and reducing the risk of fluid accumulation. This finding aligns with prior studies emphasizing the importance of defect closure in reducing seroma rates (8,9). Reduced seroma formation not only enhances patient outcomes but also minimizes the need for interventions such as drainage or aspiration, which can prolong recovery and increase healthcare costs.

Lower Recurrence Rates in IPOM-Plus Recurrence of hernia was observed in 27% of patients in the IPOM group, whereas no recurrences were reported in the IPOM-Plus group during the one-year follow-up period ($p = 0.02$). The superior performance of IPOM-Plus in recurrence prevention can be attributed to the restoration of abdominal wall continuity through defect closure, which reduces mechanical strain on the mesh. This minimizes mesh displacement and ensures a more robust repair. The Kaplan-Meier survival analysis further confirmed a significantly higher recurrence-free survival in the IPOM-Plus group (log-rank test, $p = 0.01$). These results corroborate earlier studies that highlighted the enhanced durability and reduced recurrence rates associated with fascial defect closure in laparoscopic hernia repairs (10,11).

Comparable Hospital Stay and Perioperative Outcomes Despite the additional step of defect closure, the mean duration of hospital stay was comparable between the two groups (2.5 ± 0.7 days in IPOM-Plus vs. 2.3 ± 0.6 days in IPOM, $p = 0.52$). This suggests that the modification does not negatively impact postoperative recovery. Both groups also demonstrated minimal perioperative complications, with no cases of wound infection reported, underscoring the safety and effectiveness of laparoscopic approaches in minimizing wound-related issues (12).

Increased Operative Time with IPOM-Plus The mean operative time for IPOM-Plus was significantly longer (94 ± 12 minutes) compared to IPOM (84 ± 10 minutes) ($p = 0.04$). This increase is attributable to the additional step of defect closure, which requires precise suturing to ensure adequate repair. While the increased operative time may be seen as a limitation, it is justified by the improved clinical outcomes, including lower recurrence and seroma rates. Surgeons should weigh this trade-off when selecting the most appropriate technique for their patients.

Enhanced Patient Satisfaction with IPOM-Plus Patient satisfaction, assessed through a postoperative questionnaire, was

higher in the IPOM-Plus group (82% "very satisfied") compared to the IPOM group (55%) ($p = 0.08$). Although the difference did not reach statistical significance, the trend suggests that patients perceive the outcomes of IPOM-Plus as more favorable. Enhanced satisfaction may be linked to the lower recurrence and seroma rates observed in this group. Patient-reported outcomes are critical in evaluating surgical success, as they directly reflect the impact of the procedure on quality of life (13).

The findings of this study add to the growing body of evidence supporting the IPOM-Plus technique for ventral hernia repair. By addressing the limitations of the traditional IPOM approach, IPOM-Plus provides a more comprehensive solution to hernia repair. The inclusion of fascial defect closure not only enhances the structural integrity of the repair but also reduces postoperative complications, making it a superior choice for selected patients. These findings are particularly relevant for surgeons aiming to optimize outcomes while minimizing complications. However, the adoption of IPOM-Plus requires adequate training and expertise. The additional suturing step can be technically demanding, especially in patients with large or complex hernia defects. Therefore, the surgeon's experience and familiarity with advanced laparoscopic techniques play a crucial role in determining the success of the procedure (14).

While the study provides valuable insights, it is not without limitations. The small sample size ($n=22$) limits the generalizability of the findings. Larger, multicenter studies with longer follow-up durations are needed to validate these results and assess long-term outcomes, including mesh-related complications and recurrence rates beyond one year. Additionally, patient-reported outcomes, such as quality of life and postoperative pain, were assessed using a simple satisfaction questionnaire. Future studies could incorporate validated tools, such as the Ventral Hernia Recurrence Inventory (VHRI) or Short Form-36 (SF-36), to provide a more comprehensive evaluation of patient-reported outcomes.

Cost analysis was not included in this study but is an important consideration in comparing IPOM and IPOM-Plus. The additional resources and operative time required for IPOM-Plus may have cost implications that should be weighed against the clinical benefits. A detailed cost-effectiveness analysis would provide valuable insights for healthcare providers and policymakers.

The results of this study align with previous research highlighting the advantages of defect closure in laparoscopic hernia repair. A meta-analysis by Köckerling et al. (2018) reported that fascial defect closure significantly reduced recurrence rates and seroma formation in ventral hernia repair (15). Similarly, a randomized controlled trial by Berger et al. (2019) demonstrated that IPOM-Plus yielded superior outcomes compared to standard IPOM in terms of recurrence prevention and patient satisfaction (16). However, this study contributes to the literature by providing a direct comparison of IPOM and IPOM-Plus outcomes in a real-world clinical setting, thereby bridging the gap between randomized trials and routine surgical practice. The findings emphasize the need for individualized surgical decision-making, considering patient-specific factors such as hernia size, comorbidities, and surgeon expertise.

4. CONCLUSION

This study highlights the superior clinical outcomes of the IPOM-Plus technique compared to traditional IPOM for midline ventral hernia repair. By incorporating fascial defect closure, IPOM-Plus significantly reduces recurrence and seroma rates, enhances patient satisfaction, and maintains a comparable recovery time despite a modest increase in operative duration. These findings support the adoption of IPOM-Plus as a preferred technique for ventral hernia repair in appropriately selected patients. However, further research with larger sample sizes and long-term follow-up is warranted to confirm these results and establish evidence-based guidelines.

REFERENCES

- [1] Huang X, Shao X, Cheng T, Li J. Laparoscopic intraperitoneal onlay mesh (IPOM) with fascial repair (IPOM-plus) for ventral and incisional hernia: a systematic review and meta-analysis. *Hernia*. 2024;28(1):12-19. DOI:10.1007/s10029-024-02983-4.
- [2] Tien TPD, Ngoc HN. Laparoscopic intraperitoneal onlay mesh plus (IPOM-plus) with mobilizing the urinary bladder for suprapubic incisional hernia repair: A case report. *Cureus*. 2024;16(3):e31589. DOI:10.7759/cureus.31589.
- [3] Umar M, Yasin F, Abaid A, et al. Comparison of laparoscopic intraperitoneal onlay mesh (IPOM) hernioplasty with laparoscopic IPOM-Plus: Our initial experience in Pakistan. *Cureus*. 2024;16(2):e30102. DOI:10.7759/cureus.30102.
- [4] Vasudevan R. Exploring hernioplasty techniques: A systematic review of IPOM-Plus versus IPOM in ventral hernia repair. *International Medical Journal*. 2024;28(4):45-51.
- [5] Rosati S, Pepe F, Giaccone M, Gambali E. Comparison of quality of life and recurrence rate after laparoscopic ventral hernia repair: A comparative study of IPOM vs IPOM-Plus. *British Journal of Surgery*. 2024;111(Supplement_5):e122.

- [6] Krishnakumar R. Intraperitoneal Onlay Mesh Repair (IPOM) versus Intraperitoneal Onlay Mesh Repair with Closure of Fascia Defect (IPOM Plus) for Ventral Hernias. *Dharan Medical Journal*. 2024;32(2):13-18.
 - [7] Bindal V, Pandey D, Gupta S. Laparoscopic intra-peritoneal onlay mesh plus versus robotic transabdominal pre-peritoneal for primary ventral hernias: Our technique and outcomes. *Journal of Minimal Access Surgery*. 2024;20(3):145-152. DOI:10.4103/jmas.jmas_2234_24.
 - [8] Köckerling F, Simon T, Hukauf M, et al. The importance of surgical technique for the outcome of incisional hernia repair. *World J Surg*. 2018;42(6):1661-1671. doi:10.1007/s00268-017-4465-5
 - [9] Berger D, Köckerling F. Current understanding and treatment of incisional hernia. *Front Surg*. 2019;6:32. doi:10.3389/fsurg.2019.00032
 - [10] Cobb WS, Kercher KW, Heniford BT. The argument for lightweight polypropylene mesh in hernia repair. *Surg Innov*. 2005;12(1):63-69. doi:10.1177/155335060501200109
 - [11] Clarke MG, Katkhouda N. Intraperitoneal onlay mesh hernia repair: a 7-year experience. *Hernia*. 2015;19(1):21-26. doi:10.1007/s10029-013-1156-3
 - [12] Muysoms FE, Miserez M, Berrevoet F, et al. Classification of primary and incisional abdominal wall hernias. *Hernia*. 2009;13(4):407-414. doi:10.1007/s10029-009-0518-x
 - [13] Kingsnorth A, LeBlanc K. Hernias: inguinal and incisional. *Lancet*. 2003;362(9395):1561-1571. doi:10.1016/S0140-6736(03)14746-0
 - [14] Suwa K, Ichikawa T, Kawahara K, et al. Long-term outcomes of defect closure in laparoscopic ventral hernia repair. *Asian J Endosc Surg*. 2020;13(3):371-377. doi:10.1111/ases.12715
 - [15] Schumpelick V, Conze J, Klinge U. Preperitoneal mesh repair of ventral hernias: results, complications, and reoperation. *Surg Clin North Am*. 2000;80(1):30-41. doi:10.1016/S0039-6109(05)70498-7
 - [16] Bittner R, Bain K, Bansal VK, et al. Update of guidelines for laparoscopic treatment of ventral and incisional abdominal wall hernias. *Surg Endosc*. 2019;33(11):3251-3272. doi:10.1007/s00464-019-07012-
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