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Original Article

Laparoscopic Intraperitoneal Onlay Mesh Plus Repair (IPOM Plus): Our Experience in 45 Patients

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Abstract:

Introduction: *Laparoscopic ventral hernia repair (LVHR) was first described in 1992 by Karl Leblanc and has increasingly gained popularity in this current era of minimal access surgery. Compared to the open technique, laparoscopic repair has low rates of complications and recurrence, greater patient acceptance, and shorter hospital stay.*

Objective: *This study aimed to assess the efficacy of the Laparoscopic intra-peritoneal onlay mesh with defect closure (IPOM PLUS) technique by using optimized composite mesh in ventral hernia repair.*

Methods: *This is an observational study, carried out on 45 patients who underwent Laparoscopic ventral hernia repair by IPOM Plus technique between January 2023 to December 2023 at BIRDEM General Hospital, Dhaka. Patient demographics, perioperative data, and postoperative outcomes were recorded and analyzed. Patients who had ventral hernia with a defect size> 2 cm but < 8 cm were included in this study. Intracorporeal suture closure of all ventral hernias with defect size >2 cm was done using PBT non absorbable wound closure device (V-Loc). Optimized composite mesh (Parietex™) with pre-placed sutures in four sites were used as prosthesis and fixed with non-absorbable tacking device. Follow up period was one year.*

Results: *A total of 45 patients underwent Laparoscopic IPOM Plus repair of ventral hernias. The mean operative time was 90 minutes, and the mean hospital stay was 3.5 days. Intraoperative and postoperative complications were negligible. No bulging of mesh, intestinal obstruction, mesh infection and recurrence observed in one year follow up time. Complications were minimal: seroma (2.2%), port site infection (4.4%).*

Conclusions: *The LIPOM Plus technique for ventral hernia repair demonstrated low complication and recurrence rate, high patient satisfaction, and a favorable recovery profile. These findings support LIPOM Plus as a viable and effective approach for ventral hernia management, warranting further investigation in diverse settings.*

Keywords: *Laparoscopic Ventral Hernia Repair (LVHR), Laparoscopic Intraperitoneal Onlay Mesh Plus (IPOM Plus) repair, Optimized composite mesh (Parietex™), Non-absorbable tacking device.*

Background:

Ventral abdominal wall hernia surgery is a common procedure in the armamentarium of surgeons. The commonest of these surgical procedures in adults are repair of incisional hernias and paraumbilical hernia. Incisional hernias have been reported to occur following 11%–20% of abdominal surgeries[1-3]. The overall incidence of primary ventral hernia is estimated to be between 4 and 5% in the literature, whereas ventral incisional hernia rates vary from 35 to 60% within 5 years after laparotomy[4,5]. About one in six patients undergoing hernia repair require reoperation within 10 years[6]. Ventral hernia and its recurrences are a huge burden to the health system and the nation's economy[7,8].

Since it was introduced by Karl Leblanc[9] in 1993, LVHR has gained increasing acceptance due to better postoperative outcomes compared to open ventral hernia repair (OVHR)[10-13] but there is considerable controversy regarding the optimal approach. Several issues related to LVHR are yet to be resolved, such as seroma formation, high recurrence rate of hernias among extremely obese patients and those with large fascial defects[14]. Standard LVHR involves bridging the defect from the peritoneal side followed by placement of a composite mesh, known as the "intraperitoneal onlay mesh (IPOM) repair," wherein the mesh is placed in an "underlay" position via the laparoscopic intraperitoneal approach. Bridging the hernial defect done by onlay composite mesh or by composite mesh with peritoneal bridging approach. IPOM repair is associated with a significant incidence of eventration of mesh, recurrence, and seroma formation and also cause incomplete restoration of abdominal muscle function[15]. To circumvent these problems, sutured closure of the defect in the fascia followed by intraperitoneal placement of a mesh, termed as the "IPOM plus repair,"[16] is now the recommended procedure

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in the guideline of the International Endohernia Society[17]. This study was conducted to assess the safety and efficacy of the IPOM plus repair of ventral hernias from January 2023 to December 2023 at BIRDEM General Hospital, Dhaka.

Methods:

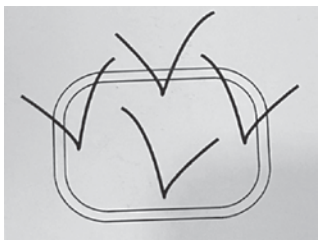
This is a descriptive observational study. The study was carried out at BIRDEM General Hospital, Dhaka from January 2023 to December 2023. A total of 45 adult patients of either sex, who had symptomatic ventral hernia, underwent laparoscopic IPOM plus repair, were studied. Patients were selected based on their diagnosis of ventral hernia and suitability for laparoscopic repair, with inclusion criteria covering both primary and incisional hernia cases with defect size >2 cm and <8 cm. Exclusion criteria included patients with contraindications to laparoscopic surgery, severe comorbidities preventing safe anesthesia, recurrent hernias after previous LIPOM, irreducible and/or obstructed hernia or prior intra-abdominal mesh placements. Detailed data on patient demographics, hernia type, hernia size, comorbid conditions, and prior surgical history were collected preoperatively. Informed written consent was taken for general anesthesia and intended surgical procedure for all patients. Perioperative data, including operative time, mesh size, and hospital length of stay, were documented, with intraoperative complications such as bleeding or bowel injury carefully noted. Postoperative outcomes were monitored and included assessment of seroma, port site infection and/or mesh infection and alongside the hernia recurrence rate. Patients were followed up for one year period. Follow up was done in the outpatient department and sometimes by cell phone at 1st month, 3rd month, 6th month and one year respectively. Data were analyzed using descriptive statistics to determine the frequency of outcomes, with results presented as means and percentages for categorical variables using SPSS software version 25.

Information recorded for data analysis

- Age
- Gender
- Body mass index (kg/m2)
- Hernia type
- Location
- Associated comorbidities
- Size of the defect
- Operative time
- Intraoperative Bowel injury
- Conversion to open
- Postoperative pain score
- Length of postoperative stay

Surgical Technique:

After written informed consent, patient was put under general anesthesia and placed in supine position. All patients were catheterized before the start of the procedure. Width of the defect was measured as the maximum distance between medial edges of the fascial gap of ventral hernia in the supine position. Palmer's point with veress needle was used to create pneumo peritoneum. This initial entry site was used for 10 mm camera port. Initial laparoscopy was done. Other conventional 2 lateral 10 mm and 5 mm ports for IPOM were made as required as per baseball diamond concept. In case of epigastric hernia initial palmer's point 10 mm port was used as working port. Hernia contents were reduced carefully by a combination of blunt, sharp and electrocautery dissection. When the hernial content was bowel, sharp cold scissor dissection was performed. Empty peritoneal hernial sac was left in situ. "Landing zone" was prepared with removing extra fatty tissue and adhesions around the defect, especially in the epigastric region, ligamentum teres was also separated so that crumpling could be avoided and mesh was placed. Intracorporeal primary sutures closure using PBT non absorbable wound closure device (V-Loc) for all hernias greater than 2 cm were done. After that an optimized composite mesh (Parietex™) of adequate size (15x10cm or 20x15cm), sufficient to ensure a minimal overlap of 5 cm all around over the edges of the defect, was introduced for intraperitoneal onlay placement covering the defect. The 20x15 cm optimized composite mesh was prepackaged with 4 site sutures at 4 places (Fig:1) using prolene 1-0 keeping both the ends of the knot long enough to hold easily with laparoscopic port closure system and introduced into the abdominal cavity through 10 mm port. In 15x10cm optimized composite mesh was prepackaged with 2 site sutures at 2 places and other 2 sites were prepared extracoporeally using prolene 1-0. Meshes were anchored with four site tension free extra corporeal subcutaneous transfascial suture. Meshes were than fixed as onlay pattern with nonabsorbable tacking device as double crowning fashion. In case of hypogastric/ incisional hernias arising following uterine/gynecological procedures, the preperitoneal fat and median umbilical ligament were brought down till the space of Retzius was reached, mesh was placed in a manner that the lower edge was in the preperitoneal space and tackers were applied on the pubic symphysis and pectineal line. Abdominal binders were given as anterior abdominal wall supports in all postoperative patients.



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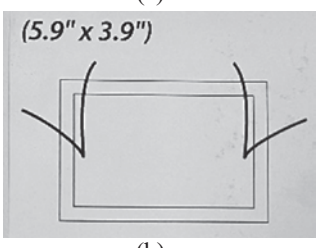

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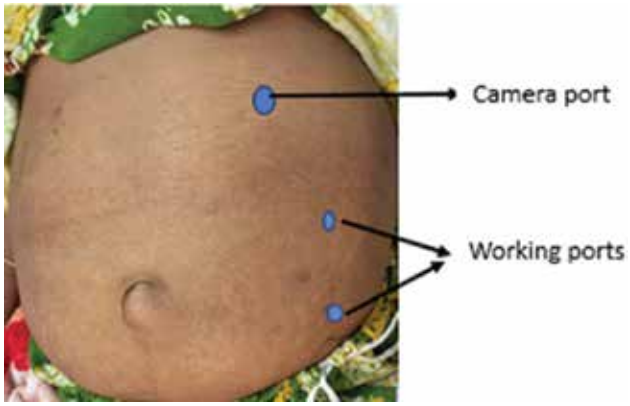
Fig. 1: (a) Diagrammatic picture of mesh (20×20cm) prepackaged with 4 site sutures at 4 places
(b) Diagrammatic picture of mesh (20×15cm) prepackaged with 2 site sutures at 2 places



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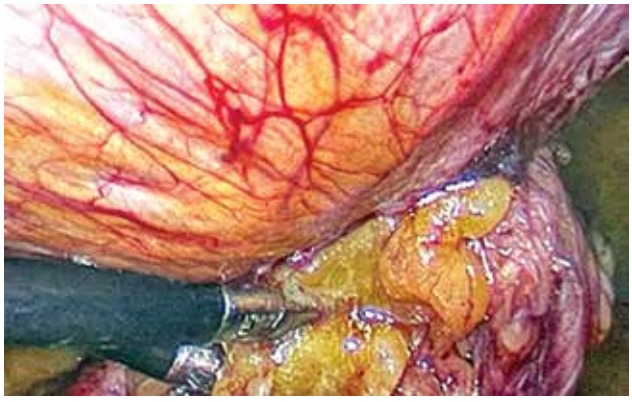

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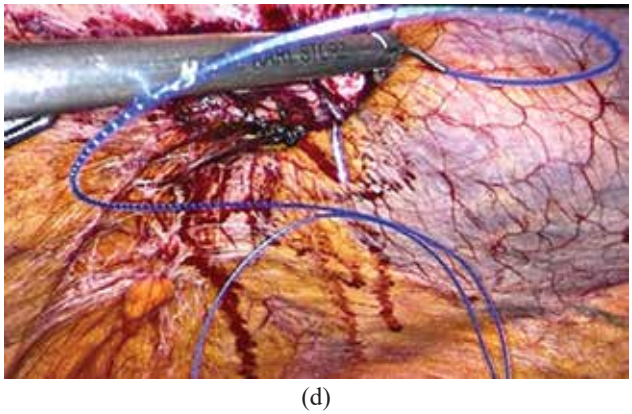

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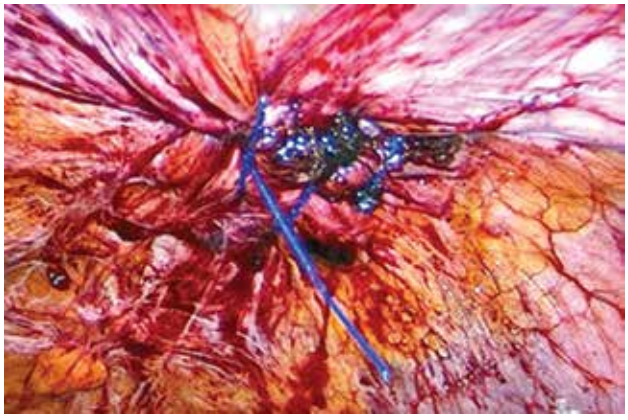

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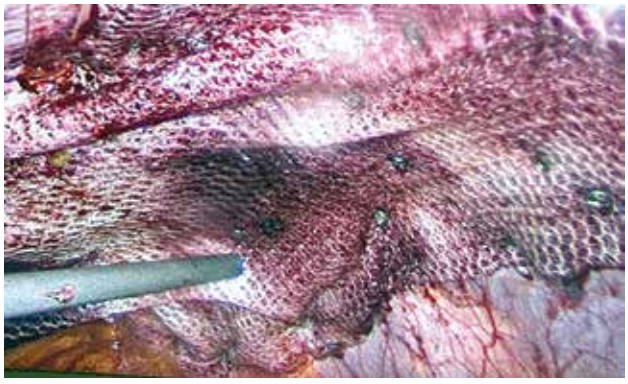

(f)

Fig. 2: (a) Port position. (b) Reduction of hernia content. (c) Hernia content reduced. (d)(e) Hernia defect closed by intracorporial sutures by V-Loc (f) Composite Mesh placed over the closed hernia defect and fixed with nonabsorbable tackers

Post Operative Pain:

Postoperative pain was quantified by asking patients to level their pain with Visual Analog scale (VAS) and recorded as VAS score (0-10). Pain was recorded in the hospital at the 4th hour after operation. After that pain was recorded as VAS scores 8 hourly during hospital stay. Then daily for one week. Then once a week for the next 12 weeks postoperatively.

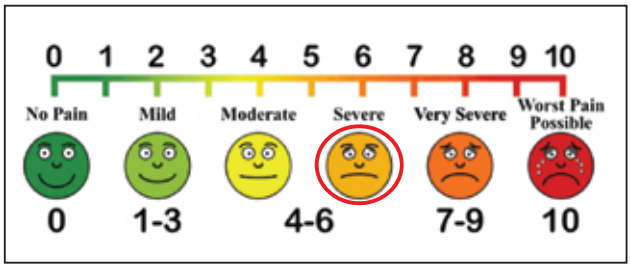

Fig 3: Visual Analog Scale (VAS)

Fig 3 showed Visual analog scale (VAS) used to quantify the post operative pain. Mean post operative pain score (VAS score) was 6 at the 4th hour after operation (Range 4-8).

Results:

A total of 45 patients underwent Laparoscopic IPOM Plus repair of ventral hernia in a span of 1 year.

Table I: Patient Demographics (N=45)

Demographics	Frequency
Total number of patients in the study	45
Male: female	1:2
Average body mass index	22.5
Mean age	45.58 (30 -70)

Table I showed age and sex distribution of patients in this study. Mean age of the patients was 45.58 years (range 30-70). Study population comprises 30 female (55%) and 15 male (45%). Average body mass index was 22.5.

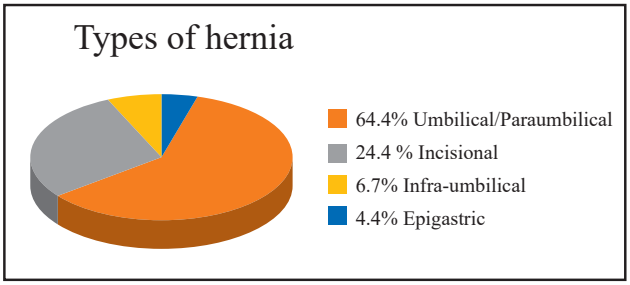

Fig 4: Types of Hernia

Fig 4 showed types of hernia in this series. Maximum cases were umbilical/paraumbilical hernia (n=29, 64.4%) followed by incisional hernia (n=11, 24.4%), infraumbilical hernia (n=3, 6.7%) and epigastric hernia (n=2, 4.4%).

Table II: Associated co-morbidities

Associated comorbidities	Incidence	Percentage
Diabetes mellitus	28	62.2
Bronchial Asthma	4	8.9
Hypertension	5	11.1

Table II showed comorbidities were common among the study population: 62.2% of patients had diabetes, 11.1% had hypertension and 8.9% had bronchial asthma.

Table III: Major perioperative parameters

Variables	Value	
	Mean	Range
Defect size	5.2 cm	2 -8 cm
Operative time	90 minutes	70-120 minutes
Post operative pain (VAS) score	6	4-8
Post operative hospital stays	3.5 days	3- 6 days

Table III presents the perioperative data for patients who underwent ventral hernia repair using the LIPOM Plus technique. The mean operative time was 90 minutes with a range of 70-120 minutes, reflecting a moderate duration for the laparoscopic procedure. Mean post operative pain score (VAS score) was 6 at the 4th hour after operation (Range 4-8). The average length of hospital stay was 3.5days.

Table IV: Intraoperative complications (N=45)

Variables	Frequency	Percentage
Intraoperative visceral injury	nil	
Omental laceration	2	4.4
Intraoperative vascular injury	nil	
Conversion to open	nil	

Table IV presents the intraoperative complication such as minor omental laceration occurs in 2 cases and there was no visceral or vascular injury. In this series no patient needed conversion to open procedure.

Table V: Postoperative complications (N=45)

	Variables	Frequency	Percentage
Immediate	Seroma formation	1	2.2
Short-term	Port site infection	2	4.4
	Mesh infection	nil	
	Bulging or eventration of mesh	nil	
	Persistent pain (taking analgesics at 2 months)	1	2.2
	Intestinal obstruction	nil	
	Mortality	nil	
Late	Recurrence	nil	
	Port site hernia	nil	

Table V outlines the postoperative complications among the patients who underwent ventral hernia repair with the LIPOM Plus technique. Overall, postoperative complications were relatively low, with seroma occurring in 2.2% of patients (1 case), port site infection in 4.4% (2 cases). Hernia recurrence and port site hernia was nil.

Discussion:

This paper summarizes our experience in laparoscopic repair of ventral abdominal hernias with the intention of carrying out an IPOM plus repair - closure of the fascial defect with reinforcement from the peritoneal side with a composite mesh. The closure of the fascial defect has been described by various techniques - interrupted or continuous, intracorporeal or extracorporeal[18]. The extracorporeal technique consists of placing multiple stab wounds on either side of the defect to pass the suture material and take interrupted stitches[19]. This may increase the risk of suture granuloma, infection or cosmetic dissatisfaction[20]. We prefer to suture the defect intracorporeally with PBT non absorbable wound closure device (V-Loc). Measuring the defect preoperatively in the resting supine position allows us to select an adequately sized mesh for placement, allowing a minimum of 5 cm overlap of the edges of defect. Literature on the subject reveals that different centers select the mesh size depending on the original defect or the closed defect[19]. However, the consensus is that whichever way the defect is measured, there should be an overlap over the fascial edges of the defect of at least 5 cm in all directions. Co-morbidities like diabetes mellitus (DM)

were seen in 62.2%, bronchial asthma were seen in 8.9%. COPD is a relative contra-indication for laparoscopic repair due to the possibility of retention of carbon dioxide during surgery. However, all our patients with bronchial asthma were well controlled with pre-operative bronchodilators and nebulization to minimize the risks during the immediate post-operative period. Smoking, DM and COPD are also considered as risk factors for postoperative infection and recurrence[21-23]. However, other authors do not consider them as contributory factors in recurrence after umbilical hernia repair[24]. In this series, mean operating time was 90 minutes (range 70-120 minutes), which is more than the study carried out by Gupta *et al* (45 minutes) but less than the study carried out by Palanivelu *et al* which was 95 minutes[25,26]. There was no intraoperative visceral and vascular injury encountered in this study. Palanivelu *et al* reported 0.3% bowel injury in his study and all bowel injuries occurred while separating the adherent small intestine from the previous scar site[26]. In Palanivelu *et al* study, they included recurrent incisional hernias, especially when a polypropylene mesh was used for the previous repair, adhesion was much denser. In our study recurrent incisional hernias were excluded. No patient needed conversion to open procedure in this study in contrast to other study carried out by Sieda Bassem M *et al* study, there were three conversions in group I (4.3%) owing to large nonreducible hernia containing the small bowel[27]. There was no incidence of mesh infection in this study compared to other studies[27]. Loh *et al* observed that laparoscopic repairs generally result in shorter hospital stays and faster recovery compared to open repairs, an advantage that we also noted in our study with an average hospital stay of just 3.5 days[28].

International Endohernia Society stated that defect closure followed by IPOM repair (IPOM plus) was associated with decreased incidence of seroma formation and decreased incidence of chronic pain[15]. In this study, mean post operative VAS pain score was 6 at the 4th hour after operation (range 4-8) requiring opioid analgesic. After that all patients were managed with NSAID analgesics. One patient (2.2%) had persistent pain requiring analgesics for 2 months comparable to other studies done by Palanivelu *et al* (5%) and Jitendra T Sankpal *et al* (6.67%)[26,29].

In this study, the hernia defect size more than 2 cm was closed with Intracorporeal primary sutures closure using PBT non absorbable wound closure device (V-Loc) sutures and there was seroma formation in one case observed. Palanivelu *et al* and Sieda Bassem M *et al* reported 7.6% and 14.5% seroma formation in their studies respectively[26,27]. Several comparative studies between IPOM and IPOM plus concluded that IPOM plus was associated with more favorable surgical outcomes[30,31]. In this study we also observed very negligible intra and postoperative complications with favorable surgical outcome. No bulging or eventration of mesh was observed in this study comparable to other studies[27]. We agree that fascial closure has been recommended to prevent the bulging of the abdominal wall and seromas after bridging repair in laparoscopic IPOM repair[32,33]. No recurrence reported in the one year follow up time compared to other studies done by Gupta *et al* (0.4%) and Palanivelu *et al* (0.55%)[25,26].

However, while the LIPOM Plus technique has demonstrated significant benefits, it is essential to recognize potential limitations. For instance, Tsimoyiannis *et al* highlighted the learning curve associated with laparoscopic IPOM repairs, which applies to LIPOM Plus as well. Surgeons require proficiency in advanced laparoscopic techniques to perform LIPOM Plus effectively, which may limit its availability in centers with limited resources[34]. The cost of composite mesh with anti-adhesive properties could also be a constraint in low-resource settings. Nevertheless, studies like Muysoms *et al* suggest that the long-term savings from reduced complications and recurrences may offset initial costs, especially in high-risk populations where recurrence would otherwise require additional surgeries[35].

Limitations:

This study has several limitations. Firstly, it was conducted at a single center with a relatively small sample size of 45 patients, which may limit the applicability of the findings to broader populations. Secondly, short period of follow up. This study lacks long-term follow-up, which is critical to fully assess recurrence rates, mesh durability, and the potential for late-onset complications. More studies incorporating large number of patients in the study sample and long period of follow up are recommended to reach a consensus regarding safety and efficacy of Laparoscopic IPOM plus repair of ventral hernias. Finally, the cost of the LIPOM Plus technique, particularly the composite mesh, could be prohibitive in low-resource settings and warrants economic evaluation.

Conclusion:

IPOM plus repair is safe and may be used for routine laparoscopic ventral and incisional hernia repair. Closure of fascial defect appears to give decrease postoperative morbidity. This technique appears to offer significant advantages over traditional open and standard IPOM repairs, particularly in terms of patient recovery and recurrence prevention. However, larger-scale studies are essential

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