



RESEARCH ARTICLE

OUTCOME OF AN OBSERVATIONAL STUDY TO ASSESS DIFFERENT TECHNIQUES
FOR THE LAPAROSCOPIC MANAGEMENT OF INCISIONAL HERNIAS

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ABSTRACT

Incisional hernia is one of the commonest surgical problems encountered in our day to day surgical practice. The laparoscopic technique for repairing ventral and incisional hernias (VIH) is now well established. Intra peritoneal on lay mesh hernioplasty without closure of defect (S-IPOM) has been the standard technique for a long time. However, concerns like seroma formation, mesh eventration, bulging and recurrence were of much concern. Intra peritoneal on lay mesh Hernioplasty with closure of defect (IPOM – PLUS) has shown promising results vis-à-vis these complications mentioned with S-IPOM. The theme of our study was to evaluate and observe the results with both the techniques for the repair of incisional hernia. Majority of the patients in our study were females in both groups and had undergone previous surgery through midline incision. Postoperative complications in terms of seroma formation, recurrence and mesh bulging were significantly less in IPOM-PLUS as compared to S-IPOM. We recommend that intraperitoneal on lay mesh hernioplasty with closure of defect is a better technique for the incisional hernias.

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INTRODUCTION

The word "hernia" is derived from Greek word -"hernios"- meaning "branching or offshoot". A hernia is defined as an abnormal protrusion of an organ or tissue through a defect in its surrounding walls. Although a hernia can occur at various sites of body but these defects most commonly involve abdominal wall particularly the inguinal region. Abdominal wall hernias occur only at sites where aponeurosis and fascia are not covered by striated muscles. These sites include the inguinal, femoral, umbilical sites, linea alba, lower portion of semilunar line and sites of prior incision. A hernia is reducible when its contents can be replaced within the surrounding musculature, and is irreducible or incarcerated when it cannot be reduced. A strangulated hernia has compromised blood supply to its contents, which is a serious and potentially fatal complication. A ventral hernia is defined by a protrusion through the anterior abdominal wall fascia.

These defects can be categorized as spontaneous or acquired or by their location on the abdominal wall. Epigastric hernias occur from xiphoid process to umbilicus, umbilical hernias occur at umbilicus, and hypogastric hernias are rare spontaneous hernias that occur below the umbilicus in the midline. Acquired hernias typically occur after surgical incisions and are therefore termed incisional hernias. A postoperative ventral abdominal wall hernia, more commonly termed incisional hernia, is the result of a failure of fascial tissues to heal and close following laparotomy. Such hernias can occur after any type of abdominal wall incision, although the highest incidence is seen with midline and transverse incisions (Bucknall, 1982). Postoperative ventral hernias following paramedian, subcostal, McBurney, Pfannenstiel and flank incisions have also been described in literature. Laparoscopic port sites may also develop hernia defects in the abdominal wall fascia. It is agreed that incisional hernias that develop between linea alba and linea semilunaris are laparoscopic suited hernias and the ones that develop outside the linea semilunaris towards flanks are laparoscopic unsuited hernias. The hernias that develop in the lateral part of the abdominal wall in the flanks need different techniques which include anterior component separation technique, posterior

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component separation technique, eTEP and TAR technique (Transversus abdominus release technique). These techniques are indicated in the incisional hernias beyond 8 cm defect. Incisional hernias have been reported in upto 20% of patients undergoing laparotomy. Modern rates of incisional hernia range from 2%-11% (Santora, 1993). It is estimated that approximately 100,000 ventral incisional hernia repairs are performed each year in the United States alone. The incidence seems to be lower in smaller incisions so that laparoscopic port site hernias are much less common than hernias following large midline abdominal incisions. The incidence of incisional hernia occurring at the port sites after laparoscopic surgery, lies between 0.02 to 3.6% (Yuen, 1995) and remains unreported, until the development of complications (Lamont, 1988). Approximately 50% of all incisional hernias develop or present within the first 2 years following surgery, and 74% occur within 3 years (Read, 1989). Multiple risk factors exist for the development of an incisional hernia. Some of these risk factors are under the control of surgeon at the time of initial operation, while many others are patient specific or related to postoperative complications.

Patient specific risks for postoperative ventral hernia include advanced age, malnutrition, presence of ascites, corticosteroid use, diabetes mellitus, cigarette smoking, and obesity (Gys, 1989). Emergency surgery is known to increase risk of incisional hernia formation. Wound infection is believed to be one of the most significant prognostic risk factors for the development of an incisional hernia (Carlson, 1995). Studies have shown that transverse incisions are associated with a reduced incidence of incisional hernia compared to midline vertical laparotomies, although the data are far from conclusive (Rucinski, 2001). Incisional hernias are twice as common in women as in men. There is no conclusive evidence that demonstrates the type of suture at the primary operation affects hernia operation (LeBlanc, 1993).

Whether the type of initial abdominal incision influences the incisional hernia rate remains controversial. As noted, the incidence of ventral herniation after mid line laparotomy ranges from 3% to 20% and doubles if the operation is associated with a surgical site infection. A meta- analysis of 11 studies examining the incidence of ventral hernia formation after various types of abdominal incisions has concluded that the risk is 10.5% for mid line, 7.5% for transverse, and 2.5% for paramedian incisions (Rucinski *et al.*, 2001). Diagnosis of a ventral hernia is typically made during the history and physical examination. Imaging studies including ultrasound, computed tomography (CT) with or without valsalva, and magnetic resonance imaging (MRI) can also be used for diagnosis. CT has been found to be useful in diagnosing occult hernias, multiple defects, abscess, and hematoma, as well as in differentiating incarcerated hernias from abdominal wall neoplasms.

Aims and Objectives: The aims and objectives of our study were to evaluate and assess different techniques (S.IPOM, IPOM-PLUS) in the laparoscopic management of incisional hernia. The following parameters were observed and studied.

- Operation Time
- Ileus
- Seroma Formation
- Mesh bulging / eventration.
- Hospital Stay

- Recurrence

MATERIALS AND METHODS

The study titled outcome of an observational study to assess different techniques for the laparoscopic management of incisional hernias was undertaken in the Post Graduate Department of General and Minimal Access Surgery, Government Medical College Srinagar, Jammu & Kashmir, India. The study was conducted on 40 patients admitted from our outpatient department. The study was conducted within a period of 3 years from Feb.2015 to Feb. 2018. Ethical clearance was granted after discussion of the topic in ethical clearance board of our college.

Inclusion criteria

- Age >18 years
- Size of defect 2 to 10 cm

Exclusion criteria

- All irreducible hernias
- Size of defect >10 cm
- Patients not fit for general anaesthesia
- Recurrent ventral hernia after laparoscopic repair

The patients were evaluated and admitted for surgery. On admission a detailed history was taken from the patient including the presenting complaints, duration of complaints, past history especially with reference to previous surgery and any other associated conditions such as chronic ailment and any drug intake. General physical examination was done followed by systemic examination and a thorough abdominal and rectal examination. Each patient was fully investigated to confirm the diagnosis and to rule out associated syndromes. Each patient and his attendants were fully explained about the nature of the procedure in the language which they understood and a written consent was taken from the patient before surgery. Patient was also informed about the possible complications of the procedure.

The patient's age, sex, and other demographic features, anthropometry, underlying comorbid conditions, and relevant family history was recorded. Clinical data and parameters like systolic/diastolic BP, heart rate, body temperature, and respiratory rate were noted. The presenting clinical features of the incisional hernia and any treatment received for it prior to hospitalization were recorded. A complete blood count, microscopic examination of urine, blood chemistry including liver and kidney function tests, albumin, calcium, lactate dehydrogenase and random &/or fasting plasma glucose levels, chest radiograph, and 12 lead electrocardiogram were obtained in all patients at admission and at subsequent times as required.

Diagnosis of a ventral hernia was typically made during the history and physical examination. Imaging studies including ultrasound, computed tomography (CT) with or without valsalva were also used for diagnosis. Imaging studies were helpful to assess the anatomic details of a ventral hernia, augmenting the physical examination, especially when a hernia is likely reducible, and therefore the defect cannot be palpated and measured.

These situations commonly arise with small defects, obese patients, or incarceration (acute or chronic). CT was found to be useful in diagnosing occult hernias, multiple defects, abscess, and hematoma, as well as in differentiating incarcerated hernias from abdominal wall neoplasms.



Figure 1. Instruments



Figure 2. Port Position



Figure 3a & 3b. Preoperative Picture showing defect with laxity of skin and after pneumoperitoneum

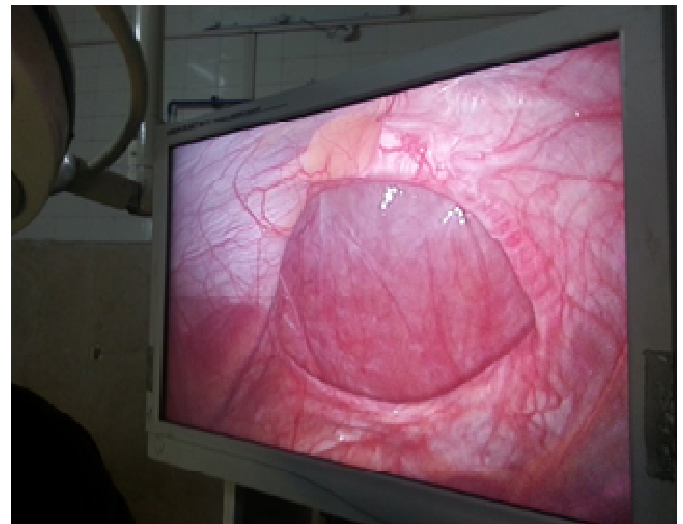


Figure 4. Endo view of Incisional hernia defect

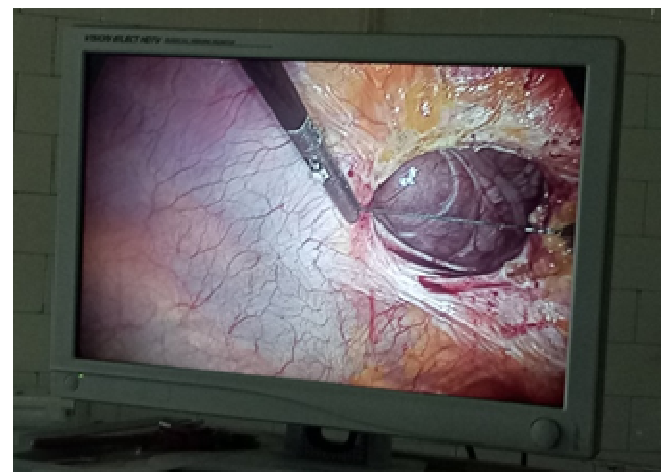


Figure 5. Intraoperative measurement of defect size

After preoperative preparation, patients were randomly assigned to a particular technique based on the surgeon's choice. One group of patients underwent Standard Intra Peritoneal Onlay Mesh Hernioplasty wherein the mesh was placed without closure of the defect and the other group had the suture closure of the defect with mesh placement.



Figure 6. Closure of the Defect



Figure 7. Fixation of Mesh with Tacker

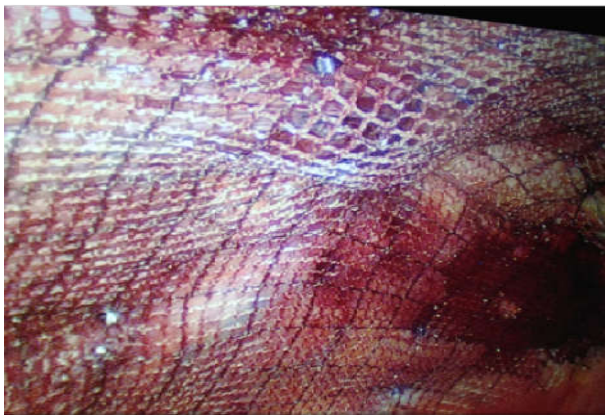


Figure 8. The completed Mesh Fixation



Figure 9: Post-operative picture of the defect site at 6 weeks

Operative Technique: The patient is laid supine on the operating table. The defect is marked with the marker. The instrument trolley (Figure 1) is kept ready and ports are marked. The size of the defect is measured on table using a sterile scale. Patient is anaesthetized and the procedure begins. The Veress technique was used to create pneumoperitoneum and demonstrate the defect by the pneumoperitoneum. The ports were placed diagonally opposite to the defect and made in the virgin area. Usually 3 ports were used, one 10mm optical port, one 10mm and one 5mm working ports (Figure 2). The abdominal cavity is insufflated to 12 to 15mmHg by Veress Needle. The diagnostic laparoscopy is performed and status of the hernia defect evaluated. The contents of the hernia are noted and defect size is measured intra-abdominally (Figure 3a, 3b, 4 & 5). Adhesiolysis is performed if needed. The fat is cleared surrounding the defect area. In standard IPOM mesh was directly put on the defect making sure to have an overlap of more than 5cm from all edges. The mesh is fixed with tacks using Double Crown technique. We used intra-corporeal suture fixation of the mesh at its four corners. The mesh fixation is done at a pressure of 5 to 6 mmHg. While as in IPOM PLUS the defect was closed with Prolene/ V-LOC sutures and then the mesh was placed and fixed (Figure 6, 7 & 8). Fascial defects due to trocars are closed with interrupted sutures. Skin is closed with single stitch. The patients were instructed to wear the binder continuously for seven days. The patients were first followed up on the seventh postoperative day for dressing and stitch removal. They were subsequently followed up upto three months post operatively, and at one year (Figure 9). During follow up visits, a clinical examination and ultrasound examination were performed to exclude recurrence of hernia or seromas.

Statistical analysis: The recorded data was compiled and entered in a spreadsheet (Microsoft Excel) and then exported to data editor of SPSS Version 20.0 (SPSS Inc., Chicago, Illinois, USA). Categorical variables were summarized as frequencies and percentages. Chi-square test was employed for correlating various categorical variables. A P-value of less than 0.05 was considered statistically significant.

Observation and Results: An observational study was carried out in department of general surgery at government medical college, Srinagar, J&K, India. A total of 40 patients were included in the study and distributed into two groups (Group A: IPOM PLUS-IPOM WITH CLOSURE OF DEFECT, Group B: Standard IPOM) and following observations were made.

Group a (Ipom plus- ipom with closure of defect): Comprised of 20 patients between the ages of 25 to 65 years (mean age: 42.5±11.18 years) maximum number of patients were in the age group of 35 to 45 years comprising 35% of group A.

Group B (s-ipom- ipom without closure of defect): Comprised of 20 patients in age range of 25 to 65 years (mean age: 42.5±10.94 years). Most of the patients were in age range of 35-45 years of age comprising 40 % each of group B. P-value was > 0.99.

Group A (ipom plus- ipom with closure of defect): 3 males were in group A comprising of 15% and 17 females comprising of 85 % of group A.

Table 1. Age distribution of study patients among two groups

Age (years)	Group A		Group B		P-value
	No.	%age	No.	%age	
25-35	06	30	05	25	>0.999
35-45	07	35	08	40	
45-55	03	15	04	20	
55-65	04	20	03	15	
MEAN±SD	42.5±11.18		42.5±10.94		

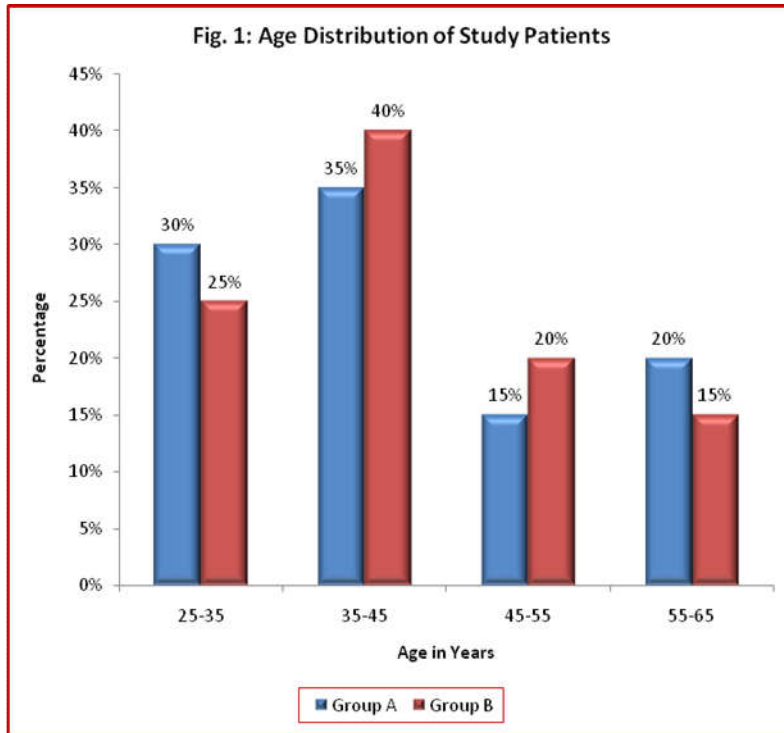


Table 2. Showing gender distribution among two groups

Gender	Group A		Group B		P-value
	No.	%age	No.	%age	
Male	3	15	4	20	0.6773
Female	17	85	16	80	
Total	20	100	20	100	

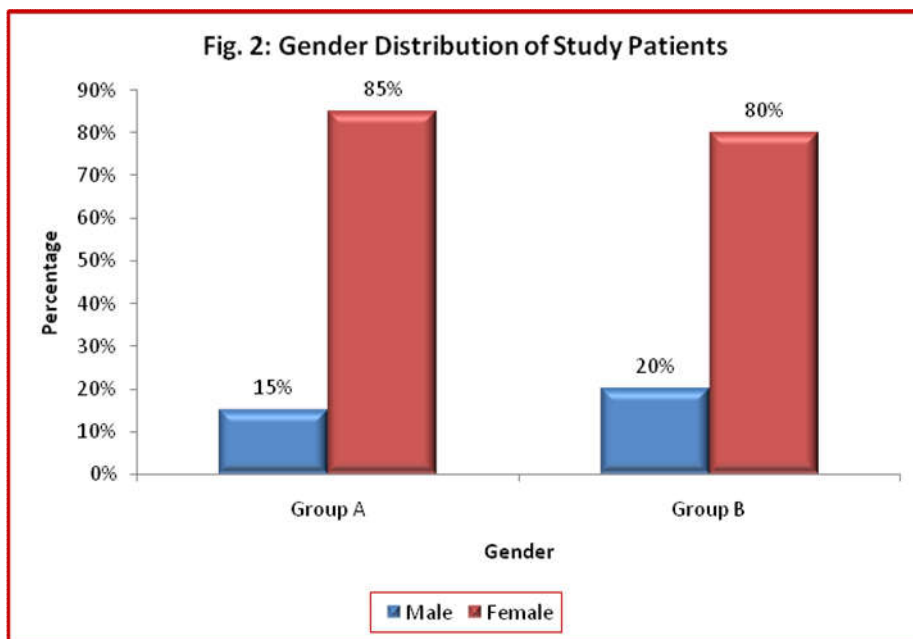


Table 3. Showing previous surgery done among two groups

Previous surgery	Group A		Group B		P value
	No.	%age	No.	%age	
LSCS	8	40	5	25	0.4177
Laparotomy	2	10	7	35	
Hysterectomy	3	15	3	15	
Cholecystectomy	2	10	1	5	
Others	5	25	4	20	

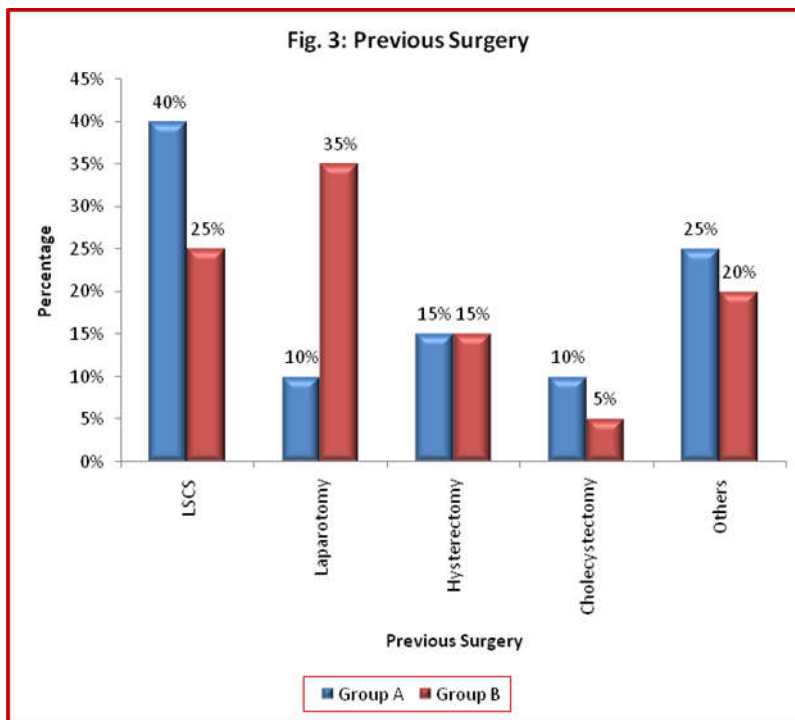


Table 4. Comparison based on operative time (minutes) among two groups

Operative Time (Minutes)	Group A		Group B		P-value
	No.	%age	No.	%age	
70-80	02	10	16	80	<0.0001
80-90	14	70	04	20	
90-100	4	20	0	0	
Mean±SD	86±5.5		77±4.10		

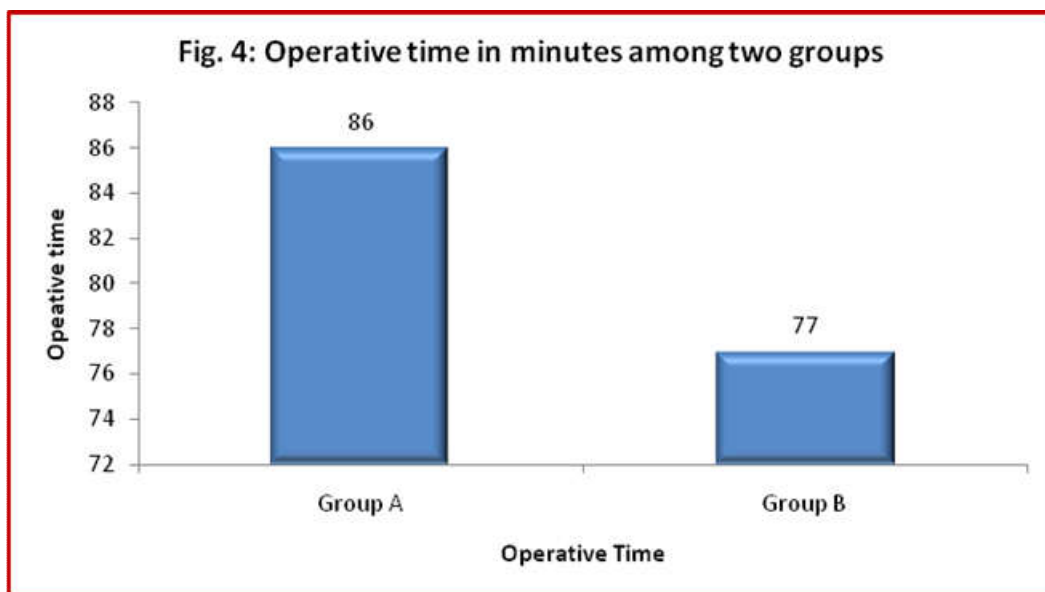


Table 5. Comparison based on Contents of hernia among two groups

Contents	Group A		Group B		P-value
	No.	%age	No.	%age	
Gut	02	10	03	15	0.6918
Omentum	13	65	14	70	
Nothing	05	25	03	15	

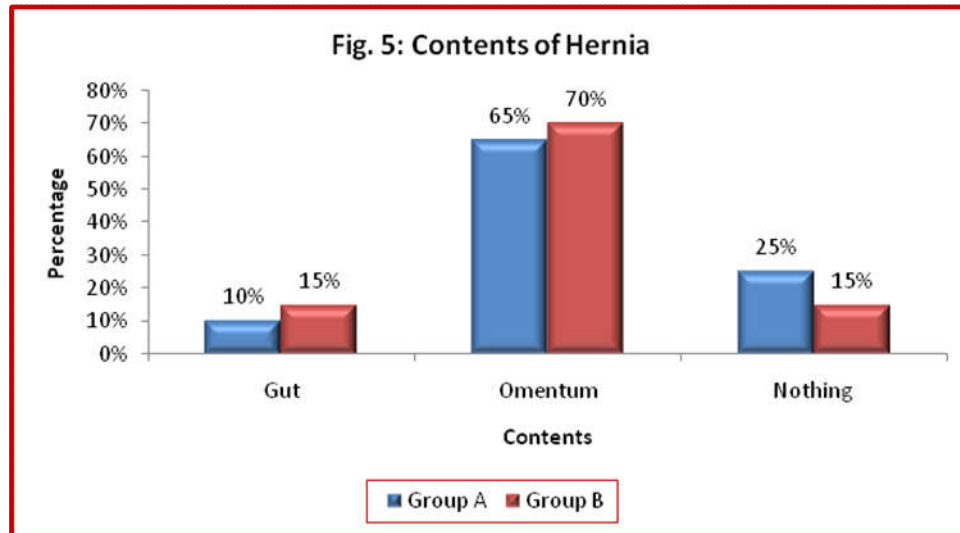


Table 6. Comparison based on size of dual mesh used among two groups

Size of dual mesh(cm)	Group A		Group B		P value
	No.	%age	No.	%age	
10×15 cm	3	15	4	20	0.7459
15×15 cm	11	55	12	60	
20×15cm	6	30	4	20	

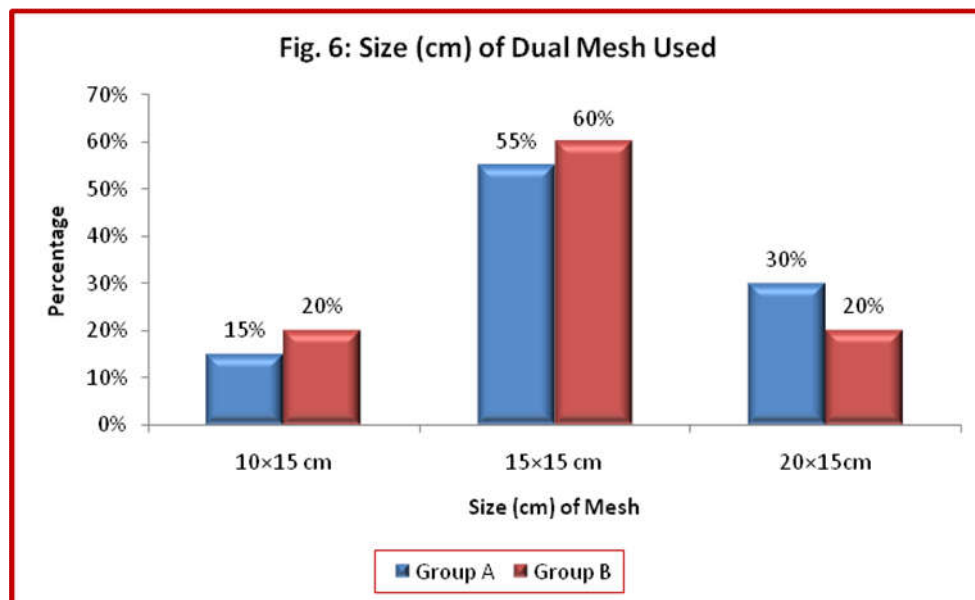


Table 7. Comparison based on post-operative hospital stay (days) among two groups

Hospital Stay (Days)	Group A		Group B		P-value
	No.	%age	No.	%age	
1 Day	4	20	03	15	0.9241
2Days	11	55	11	55	
3Days	4	20	4	20	
4 Days	1	05	2	10	
Median	2 days		2 days		

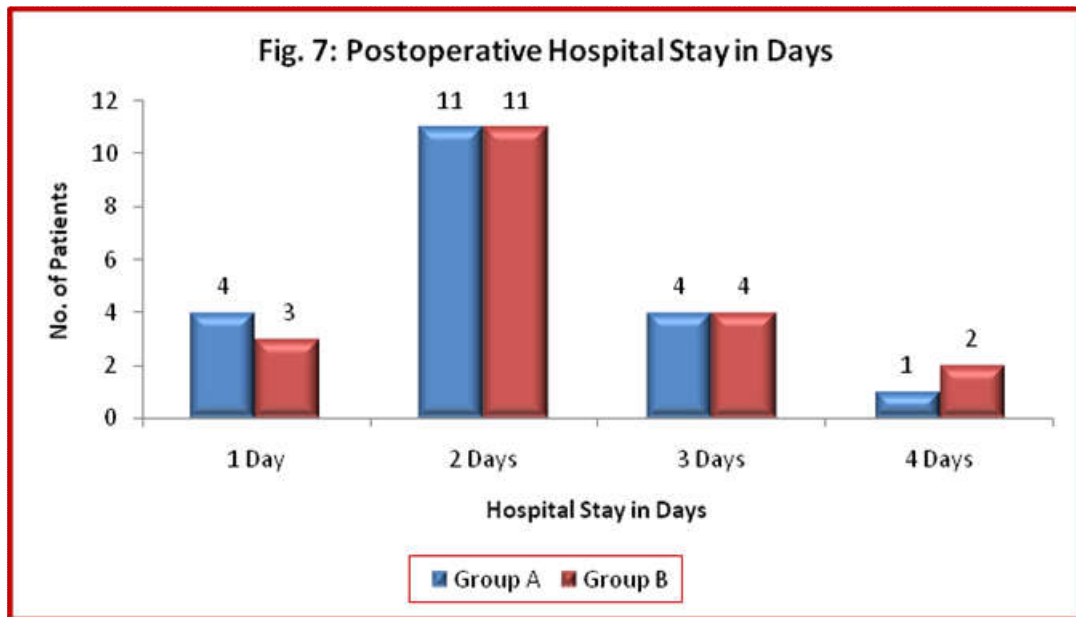


Table 8. Comparison based on Size of defect (cm) among two groups

Size of Defect (cm)	Group A		Group B		P-value
	No.	%age	No.	%age	
2-4	12	60	11	55	0.7565
4-6	08	40	09	45	
Mean±SD	3.8±1.01		3.9±1.02		

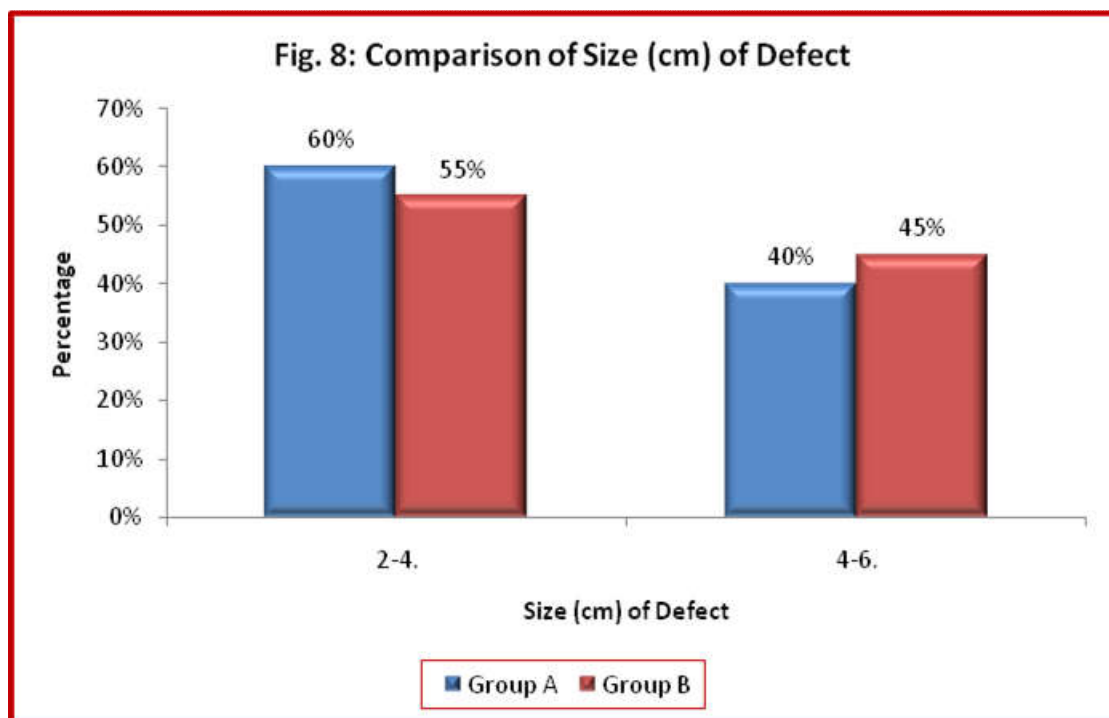


Table 9. Comparison based on resumption of orals among two groups

Resumption of Orals	Group A		Group B		P-value
	No.	%age	No.	%age	
1 ST POD	12	60	11	55	0.8807
2 ND POD	05	25	4	20	
3 RD POD	03	15	5	25	

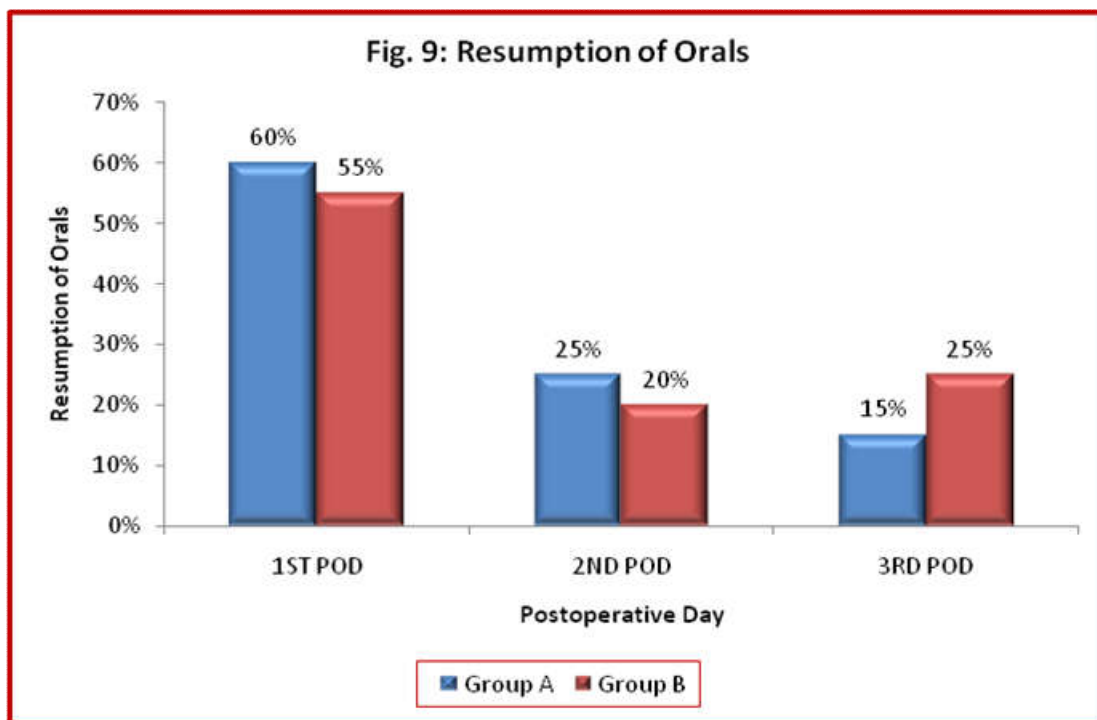
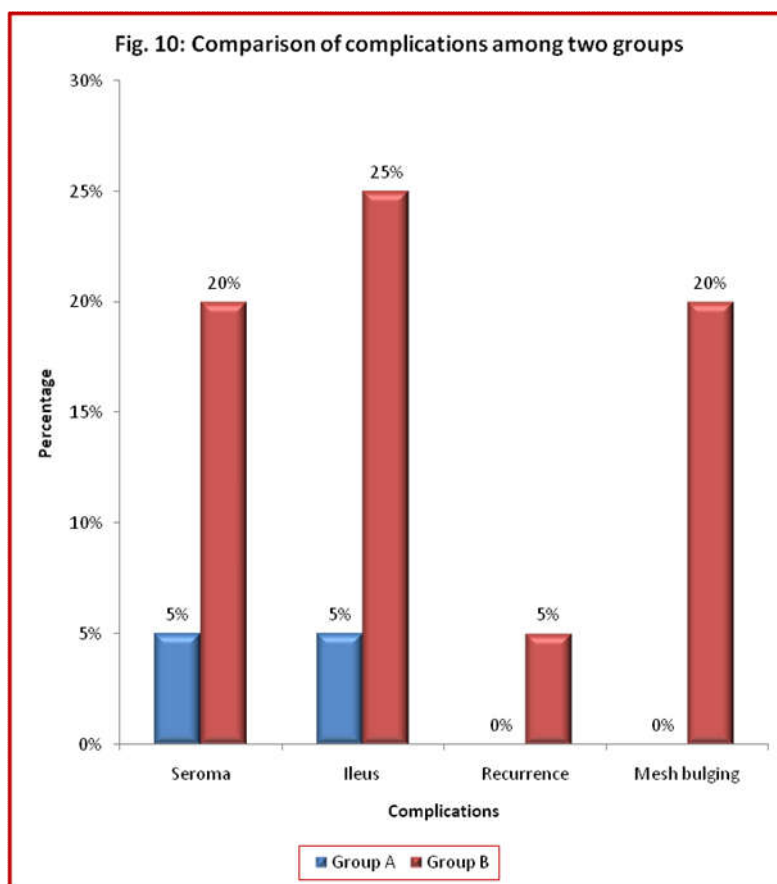


Table 10. Complications among two groups

Complications	Group A		Group B		P-value
	No.	%age	No.	%age	
Seroma	01	05	04	20	0.1516
Ileus	01	05	05	25	0.07653
Recurrence	00	00	01	05	0.3132
Mesh bulging	00	00	04	20	0.03502
Total	02		14		0.0001



Group B (Ipom without closure of defect): 4 males were in group B, comprising 20% and 16 females comprising 80 % of group B.

GROUP A (IPOM PLUS-IPOM with defect closure) comprised of 20 patients with LSCS as previous surgery in 8 (40%) patients, Laparotomy in 2 (10%) patients, Hysterectomy in 3 (15%) patients, cholecystectomy in 2(10%) patients, others which included tubal ligation, appendicectomy and diagnostic laparoscopy comprised 5(25%) patients. One case of umbilical port site hernia post cholecystectomy was also reported. Thus Mid-line incisions comprised about 13(65%) patients out of 20 patients.

Group B (s-ipom- ipom without closure of defect): comprised of 20 patients with LSCS as previous surgery in 5(25%) patients, laparotomy in 7(35%) patients, Hysterectomy in 3 (15%) patients, cholecystectomy in 1 (5%) patient, others in 4 (20%) patient. Thus mid-line incisions comprised about 15(75%) patients.

Group A (ipom plus- ipom with defect closure): The mean operative time in group A was 86 ± 5.5 . For majority of the patients in group A, total operative time ranges from 80-90 (14 patients).

Group B (s-ipom-ipom without closure of defect): The mean operative time in group B was 77 ± 4.10 . For majority of the patients in group B, total operative time ranges from 70-80 (16 patients).

Group A:- Out of 20 patients, 2 patients (10%) had gut as contents of hernia, 13 patients (65%) had omentum as hernial contents and there were no contents in 5 patients (25%).

Group B:- Out of 20 patients, 3 patients (15%) had gut as contents of hernia, 14 patients (70%) had omentum as hernia contents and there were no contents in 3 patients (15%).

Group A:- Out of 20 patients, 10x15 cm size mesh was used in 3 (15%) patients, 15x15 cm mesh was used in 11(55%) patients, 20x15 cm mesh was used in 6 (30%) patients.

Group B:- Out of 20 patients, 10x15 cm size mesh was used in 4 (20%) patients, 15x15 cm mesh was used in 12(60%) patients, 20x15 cm mesh was used in 4 (20%) patients.

Group A (IPOM PLUS- IPOM WITH DEFECT CLOSURE): Majority of the patients in group A had a hospital stay of 2 days(55%). The hospital stay ranged from 1 day to 4 days.

Group B (S-ipom- ipom without closure of defect): Majority of the patients in group A had a hospital stay of 2 days(55%). The hospital stay ranged from 1 day to 4 days. The p-value was 0.9241.

Group A (Ipom Plus):- Out of 20 patients, 12 (60%) patients had defect size of 2 to 4 cm, while as 8 (40%) patients had defect size of 4 to 6 cm. mean defect size was 3.8 ± 1.005 .

Group B(S-IPOM):- Out of 20 patients, 11(55%) patients had defect size of 2 to 4 cm, while as 9 (45%) patients had defect size of 4 to 6 cm. Mean defect size was 3.9 ± 1.02 . P value was 0.7565.

Group A(IPOM PLUS):- Out of 20 patients, in 12(60%) patients, orals were started on 1stPOD, in 5(25%) patients, orals were started on 2nd POD, in 3(15%) patients, orals were started on 3rd POD.

Group B(S-IOPM):- Out of 20 patients, in 11(55%) patients, orals were started on 1stPOD, in 4 (20%) patients, orals were started on 2nd POD, in 5(25%) patients, orals were started on 3rd POD.

Group A (ipom plus- ipom with closure of defect):- This group comprised of 20 patients. Out of 20 patients who underwent IPOM PLUS, only 1 (5%) patient developed seroma postoperatively, Postoperative ileus was observed in only 1(5%) patient, none of the patient who underwent IPOM PLUS showed recurrence. Mesh bulging was also seen in none of the cases of IPOM PLUS.

Group B (s-ipom- ipom without closure of defect):- This group also comprised of 20 patients. Out of 20 patients who underwent S-IPOM, 4 (20%) patients developed seroma formation, Postoperative ileus was seen in 5 (25%) patients, 1 (5%) patient developed recurrence, Mesh bulging was seen in 4 (20%) patients.

DISCUSSION

Incisional hernia is a common surgical disease and is a global problem. Most of our emergency surgeries warrant unplanned laparotomies performed in emergency surgical theatres without proper optimization of the patient. It is an observation that most of these laparotomies usually in developing countries result in future incisional hernias either due to patient factors, surgeon factors or the suture factors and technical problems. Wound infection is apt to occur especially in laparotomies on unplanned bowel surgery. The evolution of incisional hernia repair has advanced from open primary repair to the application of mesh repair to the laparoscopic approach. The primary repair of incisional hernia enjoyed a good amount of freedom as procedures of choice wherein primary tissue repair was done without application of mesh. Subsequently all along the follow up showed majority of patients relapsing with hernia.

The mesh repair of incisional hernia became Gold Standard owing to the recurrences with the primary tissue repair. The recurrences with mesh Hernioplasty showed a decline in its occurrence. However with the advent of minimal access surgery many other advantages were achieved like less pain, less hospital stay, less time to recover, early mobilization to work in addition to the recurrence coming down to 0.3 to 5%. The Laparoscopic incisional hernia repair was first described by leBlance and Booth in 1993. Although the laparoscopic technique for repairing incisional hernias is well established. However, several issues related to laparoscopic repair of incisional hernia such as the high recurrence rate for hernias with large fascial defects and in extremely obese patients are yet to be resolved. Additional problems include seroma formation, mesh bulging/ eventration, and non-restoration of the abdominal wall rigidity/ function with only bridging of the hernial orifice using standard laparoscopic intraperitoneal onlay mesh repair (s-IPOM). To solve these problems, laparoscopic fascial defect closure with IPOM reinforcement (IPOM PLUS) have been introduced. With IPOM-PLUS, not only the recurrence but also seroma formation has reduced.

The problem of non-restoration of abdominal wall rigidity/function has also been solved. We took up a study to observe the results of standard IPOM over IPOM PLUS in our medical college. The patients were divided into two groups, in Group A mesh was placed after closure of the defect and in Group B mesh was placed without the closure of the defect. The study comprised of a total of 40 patients with a mean follow up of 18 months

- **Group A:-Intraperitoneal onlay mesh and closure of gap:** In this group, The hernia gap was sutured with Prolene/V-LOC. All the layers of abdominal wall except the skin and subcutis are incorporated into the stitches. After closure of defect, mesh is placed intraperitoneally.
- **Group B:- Intraperitoneal onlay mesh and non-closure of gap**

The results were analyzed and compared with published literature both in India and abroad. In our study Group A (IPOM PLUS- IPOM with closure of defect) comprised of 20 patients between the ages of 25 to 65 years (mean age: 42.5±11.18 years) maximum number of patients were in the age group of 35 to 45 years comprising 35% of group A. While in Group B (S-IPOM- IPOM without closure of defect) comprised of 20 patients in age range of 25 to 65 years (mean age: 42.5±10.94 years). Most of the patients were in age range of 35-45 years of age comprising 40 % of group B. P-value was > 0.999. Study done by Agbakwuru *et al.* (2016) showed that patients who had incisional hernia were mostly of the reproductive age group. Ages ranged from 25-70 years with median of 35 years. Study conducted by Chandra Kant Paliwal (1993) showed that peak incidence of incisional hernia was in 31-50 years of age. In Group A (IPOM PLUS- IPOM WITH CLOSURE OF DEFECT), there were 3 males (15%) and 17 females (85 %). While in Group B (IPOM without closure of defect): there were 4 males (20%) and 16 females (80 %). P value was 0.6773.

In study by Chandrakant Paliwal (1993) there is a female preponderance noticed with 81.1%. In Bhutia *et al.* (1993) study, the female: male ratio was 3:1.5 with female preponderance 84%. GROUP A (IPOM PLUS-IPOM with defect closure) comprised of 20 patients in total, with LSCS as previous surgery in 8 (40%) patients, laparotomy in 2 (10%) patients, Hysterectomy in 3 (15%) patients, cholecystectomy in 2 (10%) patients, others which included tubal ligation, appendectomy and diagnostic lap comprised 5 (25%) patients including one case of umbilical port site hernia post cholecystectomy. Mid-line incisions comprised about 13 (65%) patients out of 20 patients. GROUP B (S-IPOM- IPOM without closure of defect) comprised of 20 patients in total, with LSCS as previous surgery in 5 (25%) patients, laparotomy in 7 (35%) patients, Hysterectomy in 3 (15%) patients, cholecystectomy in 1 (5%) patient, others in 4 (20%) patient. Mid-line incisions comprised about 15 (75%) patients.

Becknell *et al.* in his study noticed highest incidence with mid-line incisions. Carlson MA reported that transverse incisions are associated with a reduced incidence of incisional hernia compared to midline vertical laparotomies. In Study done by EA. Agbakwuru, 63% patients with incisional hernia had undergone LSCS previously. LeHuu Nho, (2012) in his study observed that the incidence of incisional hernia was significantly higher for midline incisions compared with

transverse incisions (11% v/s 4.7%, p =0.006). Study done by Lawrence Lee, (2016) revealed that out of a total of 99 patients who participated in the study, the overall incidence of incisional hernia was 21%. Being 29% after midline as compared with 14% after transverse incision. The mean operative time in group A was 86±5.5. Majority of the patients in group A, total operative time ranges from 80-90 (14 patients). The mean operative time in group B was 77±4.10. Majority of the patients had operative time in the range of 70-80 (16 patients).

Study done by Chandra Kant R Kesari, (2016) revealed that Operative time for hernia repair with closure of defect was 80 to 100 min and without closure of defect was 50 to 70 min. In study done by Chelala *et al.* (2017), the mean operative time was 70 min. In GROUP A, out of 20 patients, 2 patients (10%) had gut as contents of hernia, 13 patients (65%) had omentum as hernial contents and there were no contents in 5 patients (25%). In GROUP B, out of 20 patients, 3 patients (15%) had gut as contents of hernia, 14 patients (70%) had omentum as hernia contents and there were no contents in 3 patients (15%). In Group A, out of 20 patients, 10x15 cm size mesh was used in 3 (15%) patients, 15x15 cm mesh was used in 11 (55%) patients, 20x15 cm mesh was used in 6 (30%) patients. In Group B, out of 20 patients, 10x15 cm size mesh was used in 4 (20%) patients, 15x15 cm mesh was used in 12 (60%) patients, 20x15 cm mesh was used in 4 (20%) patients.

In Group A (**Ipom Plus- Ipom with defect closure**): The mean postoperative hospital stay in days of group A was 2.1±0.78, with majority of the patients having hospital stay of 2 days (55%). The hospital stay ranged from 1 day to 4 days. In Group B (S-IPOM- IPOM without closure of defect): The mean hospital stay in days of group B was 2.25±0.86 with majority of the patients having hospital stay of 2 days (55%). The p-value was 0.067. In GROUP A (IPOM PLUS):- Out of 20 patients, 12 (60%) patients had defect size of 2 to 4 cm, while as 8 (40%) patients had defect size of 4 to 6 cm. mean defect size was 3.8±1.005. In GROUP B (S-IPOM):- Out of 20 patients, 11 (55%) patients had defect size of 2 to 4 cm, while as 9 (45%) patients had defect size of 4 to 6 cm. Mean defect size was 3.9±1.02.

Out of 20 patients who underwent IPOM PLUS, only 1 (5%) patient developed seroma postoperatively, while in those who underwent S-IPOM, 4 (20%) patients developed seroma formation. P value was 0.1516. Postoperative ileus was observed in only 1 (5%) patient in group A (IPOM PLUS) while in group B (S-IPOM), 5 (25%) patients developed postoperative ileus. p value was 0.076. None of the patient who underwent IPOM PLUS showed recurrence. While as 1 (5%) patient in S-IPOM group showed recurrence. p value was 0.313. Mesh bulging was also seen in none of the cases of IPOM PLUS. While as it was observed in 4 (20%) patients in S-IPOM group value was 0.0001. Chandrakant R Kesari *et al.* in his study found that Seroma, pain, ileus and recurrence incidence are less in closure of defect in comparison to non-closure of defect. Suwa *et al.* in his study reviewed the literature on IPOM-Plus in the PubMed database and identified several comparison studies between sIPOM and IPOM-Plus which suggested that IPOM-Plus is associated with more favorable surgical outcomes in terms of recurrence, seroma, mesh bulging. Chelala *et al.* on his study in 1326 patients who underwent LIVHR found that on the overall early complications of 5.78%, over time the elimination of the dead space by routine closure of the defect

was achieved, thus reducing seroma formation to 2.56%. Mitura *et al.* (2014) conducted a study on Outcomes of bridging versus mesh augmentation in laparoscopic repair of small and medium midline ventral hernia. Between 2011 and 2014 we performed 82 hernia repairs using the laparoscopic technique with Physiomesh. Between 2011 and 2014 we performed 82 hernia repairs using the laparoscopic technique with Physiomesh. Four cases of hernia recurrence were confirmed in sIPOM group (10 %) and none in IPOM-plus group ($p = 0.018$). Non-closure of fascial defects with only bridging of the hernia defect (sIPOM) causes more frequent recurrence and bulging. As a result, patient satisfaction with treatment is lower, and they are concerned about hernia recurrence.

Nguyen DH *et al.* reviewed various studies and suggested that primary fascial closure compared to non-closure in LVHR resulted in lower recurrence rates (0-5.7 vs 4.8-16.7%) and seroma formation rates (5.6-11.4 vs 4.3-27.8%). The above data indicates that IPOM PLUS has got certain advantages over S-IPOM in terms of recurrence, mesh bulging, seroma formation. However larger studies are required to confirm the obtained results.

Summary

This prospective study was observational and was aimed to observe the outcomes of intraperitoneal onlay mesh with closure of defect (IPOM-PLUS) and standard IPOM (S-IPOM).

- There was no significant difference between the two groups in terms of age.
- Majority of the patients in our study were females in both groups.
- Total operative time was significantly less in standard IPOM (S-IPOM) than intraperitoneal onlay mesh with closure of defect (IPOM-PLUS).
- Majority of the patients had undergone previous surgery through midline incision.
- Postoperative complications in terms of seroma formation, recurrence and mesh bulging were significantly less in IPOM-PLUS as compared to S-IPOM.

Conclusion

- Closure of defect in laparoscopic management of incisional hernia has more advantages than non-closure of defect.
- Closure of defect in laparoscopic management of incisional hernias decreases incidence of seroma formation, mesh bulging and recurrence.

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