RESEARCH ARTICLE

# Laparoscopic Ventral Hernia Repair: Intraperitoneal Onlay Mesh Repair vs Transabdominal Retromuscular Repair

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## Abstract

**Background:** Ventral hernia repair has changed over the past years by the introduction of laparoscopy and prosthetic materials. The laparoscopic approach is now broadly done because it offers its advantages for the patients. The broad acceptance of laparoscopic surgery has afforded an alternative to open repair of incisional hernia.

**Objective:** To compare the intraperitoneal onlay mesh (IPOM) repair vs the transabdominal retromuscular (TARM) repair as regards the periprocedural data.

**Patients and methods:** This prospective study was conducted on 60 patients with a ventral hernia in the period from May 2018 to August 2019. All eligible fit cases, who were 18-year-old and on with non-complicated ventral hernia (the size defect, ≤60 mm), were included. They were simply randomized between the two techniques to compare operative time, intraoperative complications, postoperative pain, postoperative hospital stay, postoperative complications, and cosmetic results.

**Results:** The IPOM repair (1st group) was done in 24 patients, while TARM repair was completed in 36 patients. The operative time of group I was significantly shorter than that of group II. The repair in group I was cheaper than that in the other one. There was no significant injury to viscera or vessel and no recurrence in either group. The hospital stay was shorter for both groups (28.0 ± 9.2 vs 26.0 ± 6.93 hours; $p = 0.527$) as well as return to normal daily activity. More wound infection occurred in group II (16.7%) than in the other group (8.3%) ($p = 0.511$). No important difference statistically was observed between the two groups regarding postoperative pain ($p = 0.885$).

**Conclusion:** Laparoscopic hernia repair by either of both techniques has less postoperative pain, shorter hospital stays, faster return to normal daily activity, a lower rate of postoperative complications as regard wound infection, and ileus. The TARM repair technique is more time-consuming than the other technique, but early results indicate that it can be performed as a cheaper alternative to the other one.

**Keywords:** Intraperitoneal onlay mesh, Laparoscopic, Transabdominal retromuscular, Ventral.

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## Introduction

Defects in the abdominal wall results in a ventral hernia. They are routinely identified and called by location and etiology. Ventral abdominal hernias can develop spontaneously or at a site of previous scar as an incisional hernia. Incisional hernias form the major group of ventral abdominal hernias and they are the most challenging to reconstruct. Trocars insertion for laparoscopic surgery may also cause defects in the abdominal wall fascia which is called port sites hernia.[1]

Abdominal wall hernias in adults are mostly acquired in origin. Postoperative incisional hernias, a long-term complication of abdominal incisions, are commonly seen with the incidence of 3–13% after laparotomy. The incidence can increase up to 20–40% if the case had considerable surgical site infection (SSI) postoperatively.[2–4]

The incidence of incisional hernias is lower in tiny slit incisions; therefore, it seems to be much less common following laparoscopic port sites than that following large midline abdominal surgeries. At least one-third of incisional hernias will appear within 5–10 years postoperatively. The surgical site infection and open abdomen are the most significant causative factors of the incisional hernia.[5,6] There are many nonsurgical possible causes like uncontrolled diabetes mellitus (DM), smoking, obesity, immunosuppressive therapy, malnutrition, use of steroids, and old age.[7]

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There is no definite clue that defines that the suture type at the index surgery causes hernia occurrence. Patient-associated risk factors contributed to the formation of ventral hernia involve male sex, older age, prostatism, obesity, emphysema, and sleep apnea, it has been claimed that all of these risk factors which are associated with collagen damage in the lung allied to diminish healing of the wound, with a rising incidence of hernia formation.[8]

The most common complications of abdominal ventral hernia are intestinal obstruction, strangulation, incarceration, in addition to frequent postoperative complications associated with hernia surgery such as wound infection, seroma formation, and hernia recurrence. These postoperative complications can frequently be revealed at physical examination.[9]

Cases with ventral abdominal hernia should have an appropriate preoperative preparation to get perfect surgical repair. Obesity or overweight is one of the most significant factors of ventral abdominal hernias. The ideal weight for surgery is the body mass index (BMI) of 18.5–25. Cases should be advised and promoted to cease smoking. Proper preoperative management of many comorbidities should be conducted as respiratory, cardiovascular, diabetes, renal conditions, hypertension, and other general illness. The candidates should be investigated for all of these preoperatively.[10–14]

The management of ventral hernia is surgical hernia repair. These procedures involve 1ry closure of the fascial defect, open hernia repair using a prosthetic mesh, and laparoscopic hernia repair. The concept of tension-free repair of any hernia using mesh has been standardized and customized as being the main technique for most of the hernias, whatever be the size of the defect.[5]

The different types of mesh with the different structure utilized as follows: Polypropylene (prolene) mesh and expanded polytetrafluoroethylene (PTFE) mesh. The prolene mesh is the most commonly used and it contains an inert, durable, non-absorbable, and knitted monofilaments that enhance rapid fibrotic incorporation into the surrounding tissues. The PTFE mesh is a durable, inert, and macrofilament that quickly becomes adherent to the tissues.[5]

Because of the high postoperative incidence of recurrence, repair of an incisional hernia is still one of the most challenging surgeries for general surgeons with high morbidities and rising costs. The frequent postoperative complications include wound infection, seroma formation, and hernia recurrence.[15]

In 1993, LeBlanc and William had started the repair of abdominal wall hernia using laparoscopy. Over many years, ventral hernioplasty using laparoscopy is standardized now and widely done. It may exhibit advantages for the cases from the use of the laparoscopic approach in which there is shorter hospital stay, less operative time, improved the surgical outcome of patients, and fewer morbidities. Deciding the surgical approach, the type of mesh to use, and the type of repair surgery are the principal challenges in hernia treatment, in addition to where to put the mesh to ensure the most powerful repair with the least probability of recurrence.[16–18]

In spite of the wide acceptance of laparoscopic hernioplasty as a standard procedure in elective hernia repair, there are still some concerns regarding challenging learning curve, higher costs, and risks of intestinal injuries from instruments and trocars or from operative manipulation intra-abdominally during the processing of the surgery of hernia repair.[19]

The role of laparoscopy in ventral hernia is still in progress to reach an ideal technique, one of the most accepted techniques is IPOM that include the use of a composite mesh that fixed to the peritoneum with tacks and transfacial sutures, but with IPOM technique, there is a limitation in its use due to the cost of the mesh and the tacks. So, the other alternative technique is the transcomposite mesh after creating a peritoneal flap and augmentation of the defect with vicryl suture, the usage of either technique still need further studies.[20,21]

The aim of this study was to compare two laparoscopic repair techniques the IPOM repair and TARM repair in non-complicated ventral abdominal hernia regarding operative observations and information, postoperative pain, and recurrence rate, intra and postoperative complications, cost-effectiveness, and return to normal daily activity.

## Patients and Methods

### Study Design and Recruitment of Population

It was a prospective clinical trial which had been conducted at the Department of General Surgery, Mansoura University Hospital, Egypt during the period from May 2018 till August 2019. This study involved 60 eligible candidates with uncomplicated ventral abdominal hernia (either primary or incisional), who were simply randomized between two groups: group I had 24 cases, with uncomplicated ventral hernia, for IPOM procedures were done and group II consisted of 36 cases, with abdominal ventral hernia, for whom the TARM procedures were achieved for them.

### Inclusion and Exclusion Criteria

All eligible cases, who were 18-year old and on with non-complicated ventral hernia were included. They should be fit for general anesthesia and accept to share in the research. The size of the hernia defect was less than or 60 mm in diameter to be suitable for the start of the learning curve. Complicated and recurrent ventral hernias were excluded. The patients with uncontrolled medical comorbidities, pregnancy, and psychological instability were also excluded.

All the eligible cases were carefully evaluated and were optimized preoperatively. All details of the techniques were explained to all patients. All patients provided informed consent to participate in the study and for the surgical procedure. The procedure was approved by the local health committee. All routine preoperative measures, such as fasting, administration of a single dose of IV antibiotic, anti-VTE measures, etc., were secured before the procedure for all cases. The study was conducted after securing the ethical approval from the local ethical committee, Institutional Research Board, Faculty of Medicine, Mansoura University.

### Operative Techniques

#### *Intraperitoneal Onlay Mesh Repair*

Pneumoperitoneum creation was performed using the closed method, commonly at the umbilical area or palmer's point according to the location of the ventral hernia. Carbon dioxide gas insufflation was done till reaching a pressure of 14–17 mm Hg intra-abdominally which was a safe one during the performance of all laparoscopic procedures of the study. The telescope was introduced through a 10-mm port and 2 or 3.5-mm ports were put depending on the site of the ventral hernia.

The most common site used for the placement of ports is the left flank region. Adhesions of the omentum and bowel were released by the use of sharp dissection diathermy and reduced. A careful abdominal survey of the inner parietal side using laparoscopy was done to identify the defect of the hernia and to exclude other parietal defects. The defect size was measured by the use of a part of suture or a paper ruler. The ideal placement of the dual mesh of appropriate size was achieved by overlapping 3–5 cm beyond

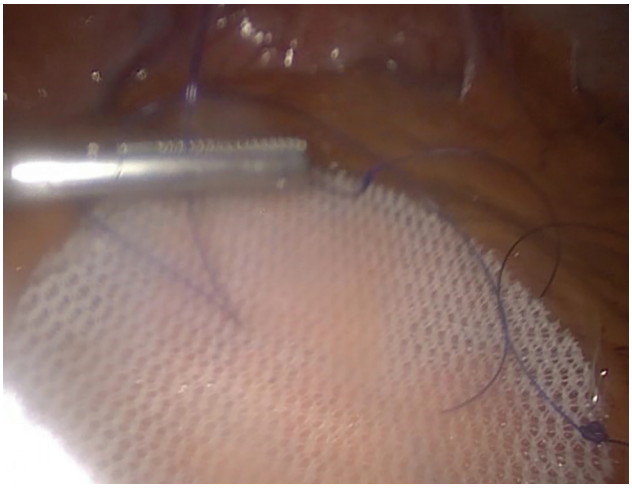

**Fig. 1:** Fixation of mesh by transfascial suture

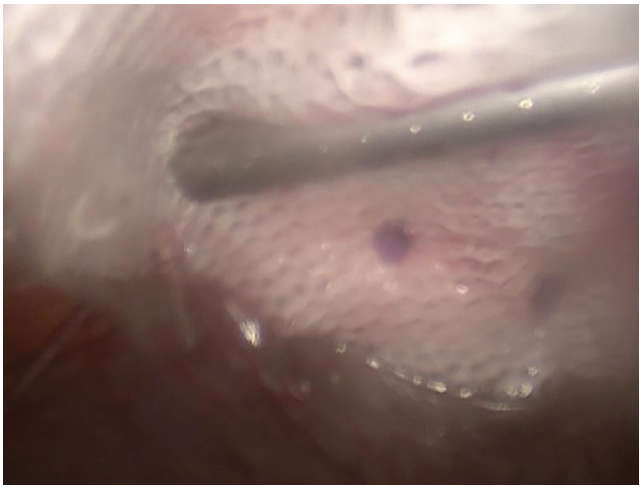

**Fig. 2:** Double crowning technique for mesh fixation

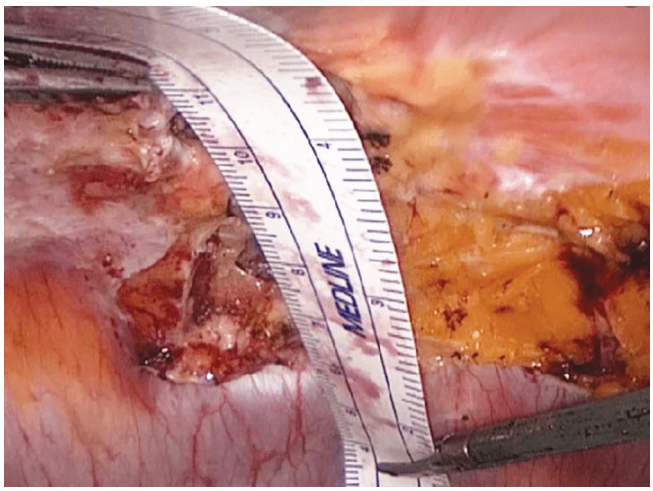


**Fig. 3:** Measurement of defect size by a paper ruler

the defect margins and anchored to the anterior parietal wall after lowering the pressure down to 6–8 mm Hg. Fixation was performed using transfascial sutures and double crown technique using absorbable tacks (Figs 1 and 2).

**Fig. 4:** The mesh placement after retromuscular flap creation

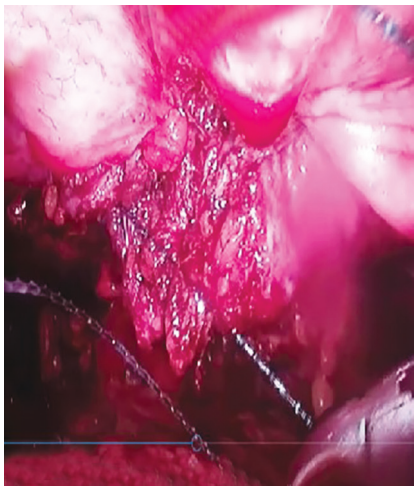

**Fig. 5:** Closure of peritoneum over the mesh

We imitated the technique of the previous studies.[20,21] The first row was put right at the defect or the hernia and the second one was placed at the mesh, 5 cm from the defect edge. To avoid adhesions between the mesh and the abdominal organs, created peritoneal flaps, or greater omentum were interfaced. Closure of the skin was completed using 3–0 sutures or skin stapler. A gauze ball was put over the area of the defect, with a gentle pressure dressing applied and kept for 2 weeks allowing its support, obliteration of any space between the mesh and parietal wall, and creation of adhesion in between.

## Transabdominal Retromuscular Repair

The same steps were followed as IPOM and the same technique of the previous studies was performed.[20,21] The measurement of the defect was done by the use of a paper ruler (Fig. 3). Then start to create a retromuscular flaps through the preperitoneal plane all around the defect, 5-cm distance from the defect edge to create roomy space for mesh placement (Fig. 4). After securing good hemostasis and closure of the fascial defect using non-absorbable suture, the polypropylene mesh placement in retromuscular space was done and fixed using some absorbable tacks with the closure of the peritoneal flaps over the mesh by interrupted sutures using Vicryl 3/0 (Fig. 5).

**Table 1:** Different types of included ventral hernias

| | *IPOM (N = 24) Group I* | | *TARM (N = 36) Group II* | | | |
|---|---|---|---|---|---|---|
| *Variables* | *No* | *%* | *No* | *%* | $\chi^2$ | *p* |
| Epigastric (1ry) | 8 | 30% | 18 | 50% | 1.970 | 0.961 |
| Paraumbilical (1ry) | 10 | 45% | 10 | 30% | | |
| Incisional | 6 | 25% | 8 | 20% | | |
| No complications | 18 | 75% | 20 | 55.6% | 4.013 | 0.404 |
| Minor bleeding | 3 | 12.5% | 6 | 16.7% | | |
| Tearing of the peritoneum | 0 | 0% | 6 | 16.7% | | |
| Serosal tear of small bowel | 0 | 0% | 2 | 5.6% | | |
| Retromuscular hematoma | 0 | 0% | 2 | 5.6% | | |
| Conversion of the technique | 0 | 0% | 3 | 8.3% | | |
| Operative time (min) (mean ± SD) | 82.17 ± 20.61 | | 115.83 ± 29.17 | | 3.456 | 0.002* |

### Postoperative Follow-up

The postoperative assessment of pain was achieved using the visual analog scale (VAS) in the first postoperative day and analgesia, as follows, was given accordingly: Intramuscular diclofenac 50 mg till resumption of oral intake. The clinical follow up of postoperative wounds were conducted with respection of SSI, hematoma, and seroma. Other complications, such as intestinal injury and internal bleeding, were looked for by clinical evaluation and follow-up ultrasound (US).

The recurrence of hernia was assessed by serial clinical evaluation in the inpatient ward and outpatient clinic. All patients were advised to avoid heavy duties and lifting heavy weights for at least 2 months, and then a gradual return to normal daily activity. Physical follow-up of the patient was performed once weekly during the first month, then once/month. A follow-up duration for 12 months at least was conducted for all cases. Evaluation of postoperative complications was performed regarding SSI, seroma formation, and hernia recurrence.

### Statistical Analysis

All of these data were collected in a special spreading datasheet then tabulated and coded. The data were fed to the computer and analyzed using IBM SPSS software package version 26.0. Qualitative data were described using the number and percent. Quantitative data were described using median (minimum and maximum) and interquartile range for non-parametric data and mean, the standard deviation for parametric data after testing normality using Kolmogorov–Smirnov test. The significance of the obtained results was judged at the 5% level.

## Results

Laparoscopic ventral hernia repair (LVHR) of IPOM technique was performed in 24 patients having a mean age of 38.58 ± 7.40 years; 75% were females, while LVHR was done by TARM technique repair was performed in 36 patients having mean age of 38.22 ± 9.33 years; 50% were females.

In this study, both types of ventral hernia were included (1ry and incisional). Incisional hernia accounted for 25% of the patients in IPOM group (three patients postexploratory, two cases postappendectomy, and one case of port site hernia) and 20% of patients in TARM group (five patients postexploratory, one postappendectomy, and two cases of port site hernia). The presentations of different ventral hernias were shown in Table 1. The defect size of all hernias was less than or 60 mm to facilitate the start of the learning curve with a mean of 39.31 ± 20.23 mm.

The intraoperative complications in both groups were recorded in Table 1; minor bleeding from adhesolysis were noticed in both groups, six patients in a group show tearing of peritoneum, small intestine serosal tear occur in group II in two patients that managed by vicryl suturing of the serosal tear, and retromuscular hematoma occurs in group II in two patients which were managed intraoperatively by aspiration and control of bleeder.

The operative time of laparoscopic repair in both techniques was shown in Table 1. There was a significant difference between the two groups regarding the operative time. It was statistically very significant as $p = 0.002$*.

The postoperative complications of the study population were recorded in Table 2. Postoperative seroma, wound infection, and mesh infection were a little higher in group I than group II. The recurrence rates of hernia were reported in the two techniques. One case, only in group II, presented with postoperative fever and pain. With investigation, there was a mesh infection which was managed by mesh removal, then it was managed like the cases of recurrence by open repair within 6–12 months postoperatively. No bowel injury or vascular injury was noticed in the population of this study.

The 60 cases were given postoperatively one dose of analgesic in the form of intramuscular (IM) injection of non-steroidal anti-inflammatory drugs (NSAIDs). Moreover, 12 cases from group I and 16 cases from group II received extra doses of analgesics with no important difference statistically (Table 3) between the 2 groups as concerning postoperative pain.

Most of the periods of hospital stay did not exceed 48 hours with few patients stayed in hospital for 72 hours (Table 3). The time of return to normal daily activity was shown in Table 3 with no significant difference statistically between the two groups regarding return to daily activity and hospital stay.

As far the analysis of hospital cost of the case of each technique is concerned, it was found that higher hospital costs were observed in IPOM ($3,080) than the costs of TARM ($2,210) as shown in Table 4.

**Table 2:** The postoperative complications of the study population

| | *IPOM (N = 24) Group I* | | *TARM (N = 36) Group II* | | | |
|---|---|---|---|---|---|---|
| | *No* | *%* | *No* | *%* | $\chi^2$ | *p* |
| Seroma | 8 | 33.3 | 15 | 41.6 | 0.201 | 0.654 |
| Wound infection | 2 | 8.3 | 3 | 8.3 | 0.433 | 0.511 |
| Mesh infection | 0 | 0.0 | 1 | 2.7 | 0.690 | 0.406 |
| Recurrence | 2 | 8.3 | 2 | 5.6 | 0.062 | 0.804 |
| Bowel injury | 0 | 0.0 | 0 | 0.0 | | |
| Ileus | 1 | 4.2 | 2 | 5.6 | 0.675 | 0.421 |
| Vascular complications | 0 | 0.0 | 0 | 0.0 | | |

**Table 3:** Postoperative follow-up data of both groups

| *(mean ± SD)* | *IPOM (N = 24) Group I* | *TARM (N = 36) Group II* | *T* | *p* |
|---|---|---|---|---|
| Postoperative pain | 3.42 ± 0.51 | 3.44 ± 0.51 | 0.145 | 0.885 |
| Hospital stay (hours) | 26.0 ± 6.93 | 28.0 ± 9.2 | 0.640 | 0.527 |
| Return to normal activity (days) | 3.08 ± 1.0 | 3.39 ± 1.61 | 0.584 | 0.564 |

**Table 4:** Analysis of hospital cost of the case of each procedure

| *Variables* | *IPOM ($)* | *TARM ($)* | *p* |
|---|---|---|---|
| Equipment cost | 1,900 | 1,000 | 0.001 |
| Theater cost | 250 | 250 | – |
| Ward cost/night | 650 | 650 | – |
| Cost of anesthesia | 280 | 310 | 0.23 |
| The mean cost of the inpatient | 3,080 | 2,210 | 0.041 |

## Discussion

The ventral hernias are a group of hernias affecting the abdominal. Repair surgeries of these hernias stay one of the most frequently performed operations with more than 350,000 achieved/year in the US. These hernias carry the risk of bowel ischemia and strangulation, which can lead to serious consequences, In addition to the aesthetic detriment of the hernia.[22]

Laparoscopic ventral hernia repair has many advantages over the open approach mainly due to reduced wound complication rates and faster recovery. Laparoscopic ventral hernia repair uses different prosthetic meshes, which are put either intraperitoneally IPOM or in retromuscular space TARM. Laparoscopic ventral hernia repair is growing rapidly to be a standard technique worldwide due to the low rate of recurrence and all the advantages of laparoscopic surgery.[23,24]

In spite of the marvelous results of LVHR, many experimental and clinical researches have noticed complications resulting from the procedure of IPOM when using prolene mesh. It had a rising rate of complications which were a statistically significant issue. They included formation of adhesions, small intestinal obstruction, and fistula formation.[25,26]

The omental interface can diminish or prevent the adhesion of viscera to prolene mesh. However, in the case series of reoperated patients, they revealed that one-third of the cases had dense adhesion to prolene mesh. Depending on the results of experimental and clinical researches, it was concluded that TARM placement of prolene mesh is a cost-effective available option and has a reduced rate of postoperative formation of adhesions.[27,28]

This current study was conducted to assess and compare the outcomes of two laparoscopic procedures of LVHR composing of TARM and IPOM placement of mesh. The cases were randomly divided into two groups; group I patients were operated by IPOM procedure and group II patients were operated by TARM placement of mesh.

In this study, the ventral hernia with defect size 39.31 ± 20.23 mm represented in the cases of both groups. Epigastric hernias were true hernias with defect size in the range of 20–60 mm in diameter with no significant difference statistically between the two groups.

Prasad et al. reported that there was no difference in the mean fascial defect size (30.8 cm ± 24.4 cm vs 29.9 cm ± 22.0 cm, $p = 0.78$) and the mean size of mesh (237.8 cm ± 66.8 c, vs 240.3 cm ± 98.2 cm, $p = 0.84$) used in both techniques.[29]

In the study between our hands, the mean operative time of LVHR by IPOM was (82 minutes) which was significantly shorter than that of laparoscopic TARM repair (115 minutes) ($p = 0.002$, statistically significant). The explanation for the longer duration associated with TARM is the need for the creation of peritoneal flaps in the retromuscular space and closure over the mesh by resuturing of the flaps after mesh fixation. Inspite of higher operating time, TARM procedure is economical because of the use of cheap prolene mesh, but IPOM procedure involves the use of expensive composite meshes.

This came in agreement with a study[29] who reported that the operative time is longer in TARM group was statistically significant longer than in IPOM group ($p = 0.001$). This also came in accordance with Shetty et al. who showed that the mean operative time in the TARM group was 105 ± 19.8 minutes vs 89.5 ± 26.4 minutes in the IPOM group with statistically significant difference between the two groups.[30]

On the other hand, Gokcal et al. showed that there was no difference in terms of operative times in their cohort studies

between IPOM and TARM techniques. This likely stems from the distribution of cases who required extensive adhesolysis (>30 minutes) (7.7% in IPOM vs 3.8 in TARM).[31]

In this study, intraoperative complications in both groups, minor bleeding from adhesolysis accounted for 12.5% in group I and 16.7 % in group II, six cases in group II (16.7%) show tearing of peritoneum, small intestine serosal tear occur in group II in two patients that managed by vicryl suturing of the serosal tear, also retromuscular hematoma occurs in group II in two patients and managed intraoperatively by aspiration and control of bleeders. Three cases in TARM repair were converted to IPOM technique due to tearing of the peritoneum, Neither vascular injuries nor intestinal injuries were observed in both groups.

In a previous research, two cases in TARM procedures had an omental bleed while doing adhesolysis, which was controlled laparoscopically with the placement of a drain for one postoperative day. One case in the IPOM group had an inferior epigastric vessel injury that was managed by clip application. None had any intraoperative complications in IPOM.[30] Prasad et al. reported that bleeding occurred in only one patient (1.4%) with TARM while serosal injury occurred in two patients (2.9%) in TARM group, and five patients (2.3%) in the IPOM group.[29]

Hematomas were more frequent in the IPOM group of another research as well. One possible explanation for this may be stemmed from the more extensive mesh fixation in IPOM repairs, increasing the likelihood of inadvertently injuring perforating vessels.[31]

Regarding the postoperative complications of the cases within the two groups, 12 cases (50%) had complications in the IPOM repair group while in the TARM group, postoperative complications appeared in 21 cases (58.3%). seroma formation was the most commonly reported complication in IPOM and TARM groups (33.3% vs 41.6%, respectively) with no significant difference. All cases of seroma were managed conservatively with no need for surgical interference.

It has been reported that the most commonly noticed complication of LVHR is the formation of seroma. The majority of the seromas occur anterior to the mesh and within retained hernial sac.[32,33] This came in agreement with a previous study which stated that seroma was the most frequent complication in both groups underwent LVHR enrolled in their research (5.8% in the TARM group and 8.3% in the IPOM group) with no significant difference between the two groups.[29]

The fundamental principles of the retromuscular (preperitoneal) repair, described by Stoppa and Rives, that entail placing the mesh in this preperitoneal planes have many advantages. It is a highly vascular plane; hence, it is protective against infection, and, moreover, any SSI occurring in the subcutaneous planes does not reach the mesh, as the mesh is retromuscular in a different deeper plane.[34]

This coincided with our results where mesh infection in the studied patients was only one case in the second group. Five patients developed wound infection—two in the IPOM group and three in the TARM repair group. The minimal surgical interference was needed without the need for mesh removal. One case in the IPOM group and two cases in the TARM group had postoperative paralytic ileus and they were managed conservatively.

On the contrary, Gokcal et al. showed that the rate of development of seromas, hematomas, and SSI, was significantly higher in the IPOM group, though when taken individually, these complications did not reach significance.[31]

In this study, only two patients in the IPOM group and two patients in the TARM group showed postoperative recurrence of the ventral hernia with no significant difference between the two groups. All of those four cases were repaired within 6–12 months postoperatively by open approach.

The previous studies reported that the total recurrence rate of LVHR (IPOM) is 3.8–5.6%.[35,36] Chowbey et al. observed in their series of 34 cases who underwent LVHR with TARM approach that the recurrence rate was 2.5%.[37] However, other study reported no recurrence rates in the two groups of cases included in their study either those underwent IPOM or TARM.[38]

In this study, there is no significant difference between the periods of hospital stay of the two groups. Most of the hospital stay durations in both groups did not exceed 48 hours and only a few cases stayed in the hospital for 72 hours. Return to normal daily activity with a short period for both techniques with no significant difference between both of them.

Prasad et al. showed that the mean of the hospital stay was 1.5–0.6 days in TARM group and 1.4–0.7 days in the IPOM group with no significant difference between the two groups.[29] In another study, the mean postoperative hospital stay was 2.8 ± 1.02 days in the TARM group vs 3.4 ± 1.3 days in the IPOM group.[38] Gokcal et al. showed that the median length of postoperative hospital stay was 0 days (IQR = 0–0) for both groups (range, 0–7 days in IPOM vs 0–4 days in TARM). They reported that a very large majority of patients are discharged on the same day of the surgery.[31]

In this current study, the 60 cases were given postoperatively one dose of analgesic in the form of IM injection of NSAIDs. Moreover, 12 cases from group I and 16 cases from group II received extra doses of analgesics with no important difference statistically. The mean postoperative pain score in the IPOM repair group was 3.42 ± 0.51 vs 3.44 ± 0.51 in the TARM group. There was no significant difference between the two groups regarding the postoperative pain.

Similar results were reported by previous research. There was no statistically significant difference in the pain VAS score between the cases who underwent IPOM or TARM hernia repair at 12 and 24 hours.[38] This came in agreement with Prasad et al. (2011) who revealed by comparison of the VAS pain score in both of the groups included in their study that there was no statistically significant difference between the two groups either in the first day postoperatively or after 30 days.[29] The recent research conducted by Gockal et al. who did not find a difference in early postoperative pain scores between the two groups.[31]

From our initial experience of these 36 cases done by TARM repair, we feel it may be better to reduce mesh size to 12 cm × 15 cm with 12 cm placed laterally so that lateral nerves are not unduly irritated and to reduce postoperative pain.

Transfascial sutures used in IPOM may result in increased postoperative pain.[29] Another a possible contributing factor to a difference in the perception of pain or discomfort in IPOM cases relates to a potential inflammatory reaction which resulted from the placement of a foreign body within the peritoneal cavity.[39]

However, although shortened operation time due to minimal dissection with IPOM repair, the economic calculation including mesh costs is significantly higher.[40] In regard to the analysis of hospital cost of the case of each technique, it was found also that higher hospital costs were observed in IPOM ($3,080) than the costs of TARM ($2,210).The difference was statistically so significant due

to the high cost of composite mesh used in IPOM vs a traditional cheap one used in the TARM approach.

## Limitations

Transabdominal retromuscular is a feasible procedure for midline ventral hernias. We found that the best approach for epigastric hernias is a three-port suprapubic approach, in lateral three-port placement, we found it ergonomically difficult to suture midline defects in the epigastric region. There was no difficulty in suturing defects in umbilical and infraumbilical regions by the lateral approach. Subxiphoidal port placement is also recommended for an umbilical and infraumbilical hernia.

Difficulties we encountered with this approach were in suturing anterior defects because of interference by breast tissue in female patients and by a costal margin in male patients which interfered to some extent with hand movements. There was also the problem access because of the falciform ligament in 10-mm port subxiphoidal access. Therefore, we gained initial access by 5-mm port with 5-mm telescope in the left subcostal region after pneumoperitoneum by a Veress needle. We then dissected down the falciform ligament distally to proximally and then inserted 10-mm subxiphoidal port under vision.

Of all these approaches, we found the suprapubic approach versatile for epigastric hernias and the lateral approach for umbilical and infraumbilical hernias. The subxiphoidal approach is ergonomically difficult in our experience. Further studies are needed to establish this procedure as the preferred method for the treatment of ventral hernias.

The medium-sized hernias (≤60 mm) only were included and it should be extended to include larger sized hernias.

## Conclusion

Laparoscopic hernia repair either IPOM or TARM repair techniques had less postoperative pain, shorter hospital stay, faster return to normal daily activity, a lower rate of postoperative complications as regard wound infection and ileus, and better cosmetic appearance. However, we found that TARM repair technique was more time consuming in comparison to the IPOM technique, but early results indicated that TARM could be performed as a cheaper alternative to IPOM mesh repair.

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