Open Lichtenstein Technique Versus Laparoscopic Intra-Peritoneal Onlay Mesh Technique For Inguinal Hernia Repair: A Comparative Study

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ABSTRACT

Objectives: *Inguinal hernia repair is one of the cornerstones of general surgery practice. This is a randomized non-controlled prospective study that aims to compare between the open Lichtenstein technique and the laparoscopic intra-peritoneal onlay mesh (IPOM) technique for inguinal hernia repair.* ***Patients and Methods:*** *Thirty adult males presenting with inguinal hernias were randomly allocated into one of two groups (A & B). Group A patients (n=15) underwent hernia repair using the open Lichtenstein technique, whereas Group B patients (n=15) underwent repair using the laparoscopic IPOM technique. All patients were followed up for 1 year and seven intra-operative / postoperative items were observed in both groups.* ***Results:*** *The operative time and length of hospital stay were significantly shorter in group B (P = 0.003 and 0.041, respectively). There was a higher rate of intra-operative complications in group A (P = 0.002). Postoperative pain scores were significantly lower in group B at 24 hours after the operation (P = 0.008). Group B patients also demonstrated better results in terms of patient satisfaction and time to return to work (P = 0.012 and 0.002 respectively).* ***Conclusion:*** *Both the open Lichtenstein and the laparoscopic IPOM techniques appear to be relatively safe and effective for inguinal hernia repair over the short term. However, the laparoscopic IPOM technique is associated with a shorter operative time, much less postoperative pain, a shorter hospital stay, an earlier return to work and a higher level of patient satisfaction.*

Key Words: *Inguinal hernia - Repair – Lichtenstein - Intra-peritoneal onlay mesh.*

INTRODUCTION

Groin hernias account for 75% of all abdominal wall hernias. Of all groin hernias, 95% are hernias of the inguinal canal with the remainder being femoral hernias [1]. Inguinal hernia repair is one of the most commonly performed operations, accounting for up to 10-15 % of general surgical procedures[2]. Worldwide, approximately 20 million groin hernia repairs are performed each year [3].

Strong recommendations now exist in favor of the open Lichtenstein repair for inguinal hernias. The American College of Surgeons considered this technique as the "gold standard"[4], while the National Institute of Clinical Excellence [NICE] in the UK[5], and the National Agency for Accreditation and Evaluation in Health [ANAES] in France[6] recommended it for inguinal hernia repair.

Laparoscopic repair of inguinal hernias is usually achieved by totally extraperitoneal (TEP) or transabdominal preperitoneal (TAPP) techniques. The intraperitoneal onlay mesh (IPOM) repair could be an interesting alternative as it is much easier to perform and faster to execute. This technique allows for a laparoscopic mesh repair without dissection of the preperitoneal space. However, it is still subject to correct selection of indications and to demonstration of its safety [7,8].

We hereby conducted a randomized non-controlled prospective study at the Department of General Surgery, Kasr Al-Aini hospital, Cairo University over a 15-months period, in order to compare between the open Lichtenstein technique and the intra-peritoneal onlay mesh (IPOM) technique for inguinal hernia repair.

PATIENTS AND METHODS

Thirty patients presenting with inguinal hernias to the outpatient clinic of the General Surgery department, Cairo University, between August 2014 and November 2014, were enrolled in the study. Inclusion criteria included adult

males with inguinal hernias (indirect or direct, unilateral or bilateral, primary or recurrent) who were fit for general anesthesia, whereas exclusion criteria included complicated hernias, previous lower abdominal surgery, serious concomitant disease and failure to complete a 1-year follow up.

Patients were randomly allocated into one of two groups (A and B), each including 15 patients. Randomization was carried out using 30 sequentially numbered, sealed, opaque envelopes, that were randomly distributed inside a box. Group A patients underwent inguinal hernia repair using the open Lichtenstein technique, whereas Group B patients underwent repair using the laparoscopic intra-peritoneal onlay mesh (IPOM) technique. All patients were followed up for a period of one year.

All patients underwent routine pre-operative evaluation through full history-taking, general and local examination, complete laboratory investigations, electrocardiography in patients ≥ 40 years, and other investigations as required (e.g. Chest X-ray, pelvi-abdominal ultrasonography), mainly to exclude factors that might predispose to hernia recurrence. Before surgery, informed consent was obtained from each patient after explaining the possible risks of the proposed procedure. The site of the hernia was marked, abdominal and groin hair was shaved and patients were asked to void urine. A prophylactic antibiotic (1 gram of a third generation cephalosporin) was given with induction of general anesthesia.

The operative techniques were standardized in both study groups. In group A patients who underwent open Lichtenstein tension-free mesh repair, initial exposure was achieved using a 6-8 cm skin incision made over the inguinal region, 2 fingerbreadths above the inguinal ligament, and extending laterally to a point about 2 fingerbreadths below and medial to the anterior superior iliac spine (ASIS).

Electrocautry was used to divide the Camper's and Scarpa's fasciae. The external oblique aponeurosis was then incised by a scissors from the external inguinal ring to a point just lateral to the internal inguinal ring, 2 cm above the inguinal ligament.

The spermatic cord was dissected from the external oblique aponeurosis inferiorly to expose the inguinal ligament, and from the arching fibers of the internal oblique and transversus abdominis muscles superiorly. The surgeon's index finger and thumb were placed around the cord as it crosses the pubic tubercle. A penrose drain or a moist gauze was placed around the cord to raise it away from the posterior wall of the inguinal canal, thus allowing proper inspection of the inguinal floor for a possible direct hernia as well as subsequent dissection of the inguinal canal to create an ample space for mesh placement. In patients with indirect inguinal hernias, the cremasteric muscle and fascia as well as the internal spermatic fascia were incised to expose the hernial sac.

The cord structures were freed from the sac up to the level of the internal ring. Two or three hemostat clamps were then used to grasp the sac. In case of scrotal hernias, the sac was circumferentially divided at the middle of the inguinal canal and the distal sac was left open to prevent postoperative hematoma or hydrocele formation. The indirect sac was finally ligated and excised at the proper neck while directly visualizing the interior of the sac. In patients with direct inguinal hernias, the hernial sac was dissected free and its contents were reduced. The sac was then inverted and the floor of the inguinal canal was imbricated with stitches to reduce the sac. In our study, and as described by Lichtenstein[9], no attempt was made to do a formal repair of the inguinal floor, aiming at a tension-free repair.

Mesh hernioplasty was performed using a rectangular polypropylene mesh with a rounded edge at its apex corresponding to the medial margin of the mesh. At the other end (i.e. lateral margin), the mesh was split to accommodate the spermatic cord. A non-absorbable polypropylene suture was used to secure the mesh around the pubic tubercle.

The suture was then continued laterally in a running fashion to approximate the inferior margin of the mesh to the shelving edge of the inguinal ligament. The running suture was tied at the level of the internal ring.

The mesh prosthesis was tailored to fit around the spermatic cord at the internal ring. Few interrupted sutures were then used to fix the mesh borders. After meticulous haemostasis, the groin wound was closed in layers. No drains were placed in the study group.

In group B, patients underwent laparoscopic IPOM repair under general anesthesia. Patients were placed in the supine position, with both arms at the sides. The monitor and video equipment were placed at the foot of the operating table at the patient's midline, slightly towards the side of the hernia.

The operating surgeon stood opposite the hernia, while the assistant (camera operator) stood opposite the surgeon. Pneumoperitoneum was achieved in all patients using open Hasson technique through an infra-umbilical incision, and maintained at 12-15 mmHg. A 12-mm trocar and a 30-degree laparoscope were then inserted and a general inspection of the abdominal cavity was performed.

The patient was placed in the Trendelenburg position to allow the bowel to fall away from the pelvis. A 5-mm port was then placed at the side of the hernia and a similar port was placed on the contralateral side, both ports being slightly below or at the level of the umbilicus at the lateral edge of the rectus sheath, to avoid injury of the inferior epigastric vessels. Both inguinal regions were inspected and important landmarks (vas deferens, internal inguinal ring, spermatic vessels, inferior epigastric vessels and external iliac vessels) were identified. The site and type of the hernia were confirmed **(Fig. 1)**.

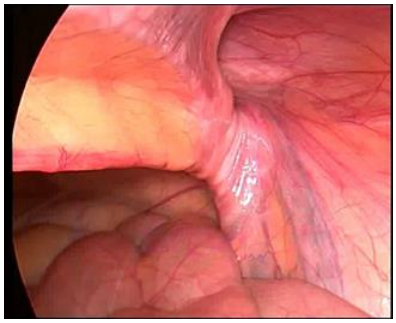

Fig. 1: Laparoscopic view of a right indirect inguinal hernia.

In all cases, the preperitoneal space was not entered and no dissection was carried out, apart from reduction of the hernia contents. Intra-peritoneal onlay mesh repair was performed using a 6 x 4 inches dual-facing Parietex™ Composite mesh, which was integrated on one side with a resorbable collagen film, in order to minimize visceral attachments. The Parietex™ mesh was rolled into a tubular shape and introduced into the abdomen via the 12-mm infra-umbilical port. It was then unfolded and placed over the myopectineal orifice of Fruchaud, with its collagen film facing inwards. The mesh was fixed in place using a tacker. In all cases, we fixed the superior edge of the mesh to the anterior abdominal wall (above the line of the iliopupic tract) by tacks. The inferior edge of the mesh was also fixed by a couple of stitches to the peritoneum after grasping the peritoneal edge, in order to avoid injury of the vessels and nerves in the triangles of doom and pain. No any dissection was carried out in those areas **(Fig. 2 a-d)**.

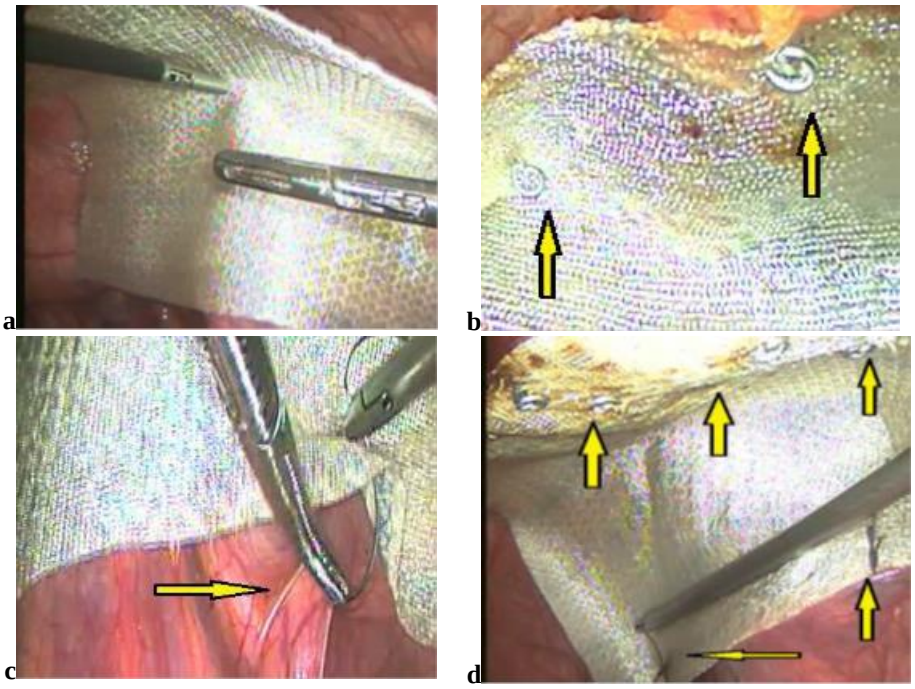

Fig. 2: (a) A dual-facing mesh was used to cover the myopectineal orifice. **(b)** The superior edge of the mesh was fixed to the abdominal wall by tacks. **(c)** The inferior edge of the mesh was fixed by sutures after grasping the peritoneal edge. **(d)** The mesh after fixation.

For postoperative pain control, patients were given intramuscular injections of 75 mg diclofenac sodium, only as needed, during their hospital stay. Early mobilization was encouraged. Postoperative examination of the abdomen, groins and scrotum was performed at least twice daily in all patients during the hospital stay to detect any early postoperative complications e.g. seroma, hematoma, neuralgia, wound infection. Upon discharge, all patients were prescribed oral diclofenac sodium 50 mg / 8 hours for 5 days. A proton pump inhibitor was added in some patients, if required. Patients were instructed to come to out-patient clinic for follow up at 1 week, 1, 3, 6 and 12 months after the operation. During those visits, patients were assessed for chronic groin pain as well as for any late postoperative complications e.g. hernia recurrence, port-site hernia, testicular problems, mesh complications, hydrocele of the distal hernia sac.

Seven intra-operative/postoperative items (outcomes) were observed and recorded in both groups. These included 2 intra-operative items; operative time, defined as the time from the first incision to the last suture (in minutes), and intra-operative complications e.g. conversion of one technique to another, vascular / visceral injury, complications of pneumoperitoneum/general anesthesia. The remaining 5 items were observed postoperatively and included the degree of postoperative pain, postoperative complications (early/late), length of hospital stay (in days), time to return to work (in days) and patient satisfaction. The latter was evaluated one week postoperatively by asking each patient a single question; "*Are you completely satisfied, satisfied or unsatisfied regarding your condition after the operation, compared to your condition before?*".

Guided by Coll et al [10], postoperative pain assessment was carried out in all patients using a "*Visual Analogue Scale"* (VAS)**.** This VAS scale consists of a line 100 mm in length. Each end of the line indicates an extreme of the pain sensation being measured, with the left end representing *"no pain"* and the right end representing *"unbearable pain"*. Each patient was asked to mark a point on the line that indicates his current degree of pain sensation and

the VAS score was determined by measuring the distance in millimeters from the left end of the line to the point that the patient marked. VAS scores were obtained at 24 hours after the operation and then on the 7th postoperative day (POD). Generally speaking, scores from 0 to 3 correspond to mild pain, for which patients do not seek analgesia. Scores from 4 to 6 represent moderate pain whereas scores from 7 to 10 represent severe pain [10].

Values in our study were expressed as means and standard deviations (mean ± SD), or as frequencies [number of cases (n)] and percentages (%) when appropriate. Values of different numerical variables in both study groups were compared using the Student *t* test for independent samples, whereas categorical variables were compared using the Chi square test. Fisher's exact test was used instead when the expected frequency was less than 5. A *P* value ≤0.05 was considered statistically significant. Data was analyzed using SPSS (Statistical Package for the Social Science; SPSS Inc., Chicago, IL, USA) for Microsoft Windows Version 18.

RESULTS

The study patients ranged in age from 16 to 59 years **(Fig. 3 a,b)**. All were male patients who presented with unilateral inguinal hernias. In only 3 patients (10%), the hernias were recurrent. In 6 patients (20%), the inguinal hernias were of the direct type and in 24 patients (80%), they were indirect hernias, 4 of which were extending down to the scrotum (i.e. complete scrotal hernias). Following inguinal hernia repair, our study groups were compared in terms of seven intra-operative / postoperative items **(Table 1).** All patients managed to complete a 1-year follow-up.

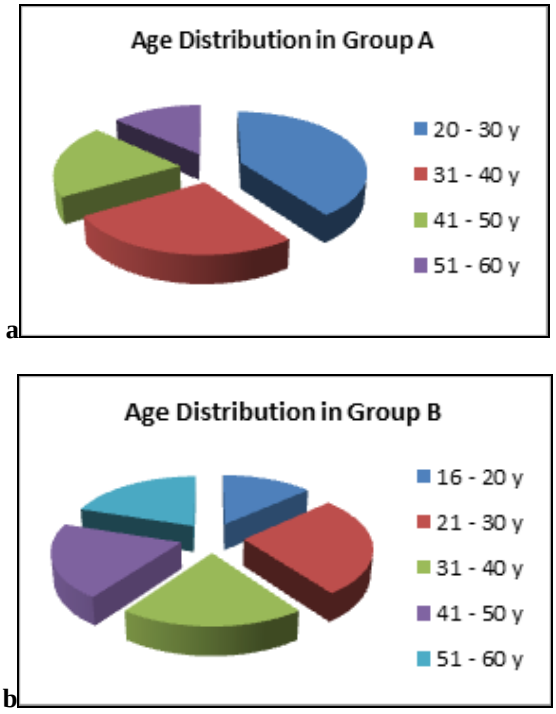

Fig. 3: (a&b) Pie charts of age distribution in the study groups (y = years).

Table 1: Clinical features of Inguinal Hernia Repair in the study groups

Variables	**Group A (n=15)**	**Group B (n=15)**	**P value**
Demographic data			
Age, year (mean ± SD)	36.07 ± 9.06	37 ± 8.22	0.546
Side of hernia (n, %)			
Right	9 (60%)	10 (66.7%)	0.716
Left	6 (40%)	5 (33.3%)	
Type of hernia (n, %)			
Indirect	11 (73.3%)	13 (86.6%)	0.379
Direct	4 (26.6%)	2 (13.3%)	
Recurrent hernia	1 (6.6%)	2 (13.4%)	0.559
Intra-operative data			
Operative time, minutes (mean ± SD)	67.93 ± 20.06	38.8 ± 15.22	0.003*
Intra-operative complications (n, %)	2 (13.3%)	0 (0%)	0.002*
Inferior epigastric vessels injury	1 (6.6%)	0 (0%)	0.040*
Conversion to another technique	0 (0%)	0 (0%)	-
Bowel / bladder injury	1 (6.6%)	0 (0%)	0.040*
Post-operative data			
Degree of postoperative pain (VAS Score)			
At 24 hours (n, %)			
2	2 (13.4%)	13 (86.6%)	
3	6 (40%)	1 (6.6%)	0.008*
4	5 (33.3%)	1 (6.6%)	
5	2 (13.4%)	0 (0%)	
On 7th postoperative day			
0	11 (73.3%)	15 (100%)	
1	2 (13.3%)	0 (0%)	0.099
2	2 (13.3%)	0 (0%)	
Early postoperative complications (n, %)	4 (26.6%)	3 (20%)	0.409
Urinary retention	0 (0%)	1 (6.6%)	0.040*
Scrotal edema	4 (26.6%)	2 (13.3%)	0.075
Late postoperative complications (n, %)	1 (6.6%)	0 (0%)	0.040*
Mesh infection	1 (6.6%)	0 (0%)	0.040*
Recurrence	0 (0%)	0 (0%)	
Length of hospital stay, days (mean ± SD)	1.87 ± 2.114	1.07 ± 0.258	0.041*
• 1 day (n, %)	12 (80%)	14 (93.3%)	
• 2 days (n, %)	2 (13.3%)	1 (6.6%)	
• 12 days (n, %)	1 (6.6%)	0 (0%)	
Patient satisfaction (n, %)			
Completely satisfied	9 (60%)	10 (66.7%)	
Satisfied	3 (20%)	5 (33.3%)	0.012*
Not satisfied	3 (20%)	0 (0%)	
Time to return to work (n, %)			
One week	0 (0%)	15 (100%)	
Two weeks	13 (86.7%)	0 (0%)	0.002*
Two months	2 (13.3%)	0 (0%)	

Values are expressed as mean ± standard deviation (SD) or number (%); *$P \leq 0.05$ = significant

We found that the operative time was remarkably shorter in group B (38.8 ± 15.22 min) versus group A patients (67.93 ± 20.06 min), and this was statistically significant (P = 0.003). We also noticed a higher rate of intra-operative complications in group A [2 (13.3%)], compared to no complications in group B (P = 0.002). The 2 reported complications in group A included an inferior epigastric artery injury in one case, which was managed by suture-ligation to control the bleeding, and a urinary bladder injury in another case where a sliding hernia was encountered. This was managed by primary repair of the injured bladder in two layers using a continuous absorbable suture, together with the insertion of a urinary catheter. As there was no more than minor contamination of the operative field, the decision was made to thoroughly irrigate the wound and proceed with a Lichtenstein mesh repair.

Postoperatively, group B patients generally experienced much less postoperative pain and their "*Visual Analogue Scale*" (VAS) scores were significantly lower than in group A patients at 24 hours after the operation (P = 0.008). However, on POD7, and although 100% of patients in group B had VAS scores of 0, compared to 73.3% in group A, the difference in the degree of pain between both groups was not statistically significant (P= 0.099).

All the study patients had a smooth postoperative course so far, with no major complications. The rate of hernia recurrence at 1-year follow up was 0% in both groups. However, eight minor postoperative complications were encountered in our study, 7 of which occurred in the early postoperative period (i.e. in the 1st month after surgery). These included mild to moderate scrotal oedema in 6 cases (4 in group A and 2 in group B) which resolved in all cases within an average period of 2 weeks by scrotal elevation and medical treatment; as well as 1 case of urinary retention in group B which was managed with conservative measures without the need for urinary catheterization. In the late postoperative period, only 1 case of mesh infection was reported in group A. This was first observed in the 2nd postoperative month, and was successfully managed by repeated dressings and antibiotics. The patient who sustained a bladder injury in group A had no early or late postoperative complications. Overall, there was no significant difference between both groups in terms of postoperative complication rates.

Unsurprisingly, the length of hospital stay was shorter in the "laparoscopy group [group B]" (1.07±0.258 days) versus the "open group [group A]" (1.87±2.114 days), and the difference was statistically significant (P=0.041). Furthermore, group B patients clearly demonstrated better results in terms of patient satisfaction and time to return to work, compared to group A patients (P= 0.012 and 0.002 respectively), where 100% of patients were able to return to work after one week in the "laparoscopy group", whereas 86.7% of patients were able to return to work after two weeks in the "open group".

DISCUSSION

The ideal method of inguinal hernia repair should not cause more than minimal discomfort to the patient, both during the surgical procedure and in the postoperative period. It should be technically simple to perform and easy to learn, should have low rates of complications and recurrence, and should require only a short period of convalescence [11].

The use of tension-free mesh repairs, regardless of the approach, for treatment of inguinal hernias, has proved to produce results superior to those of conventional tissue-based repairs [12]. Different mesh techniques have been described to date. However, the EHS (European Hernia Society) guidelines have clearly stated that none of the mesh techniques except for the Lichtenstein and laparoscopic techniques has received sufficient scientific evaluation to be recommended [13].

Since the introduction of laparoscopic inguinal hernia repair in the early 1990s, most of the ongoing discussion has focused on the choice between open and laparoscopic approaches. Many reports have demonstrated that laparoscopic inguinal hernia repair is associated with much less postoperative pain, and that it permits more rapid recovery of normal physical activity than conventional repair [14,15]. However, it still has the disadvantages of increased cost, longer operative time, steeper learning curve, as well as higher recurrence and complication rates early in a surgeon's experience[16].

Furthermore, with time, the techniques of laparoscopic hernia repair have become significantly more sophisticated [17].

The rise in the popularity of open mesh and laparoscopic inguinal hernia repairs in the recent years has provided an abundance of investigational studies that aimed to compare between these two techniques[18]. Hereby, we conducted a study that aimed to compare between the open Lichtenstein technique and the laparoscopic IPOM technique for inguinal hernia repair.

In our study, the finding that the operative time was significantly shorter in group B (*P*= 0.003) was attributed to the relative ease of the laparoscopic IPOM procedure, clearly because it required no preperitoneal dissection. Similar findings were previously revealed by some studies[7,8,19]. Regarding postoperative pain, several authors have used the Visual Analogue Scale (VAS) for postoperative pain assessment in order to compare different inguinal hernia repair techniques[20-22].

Most studies comparing laparoscopic to open mesh repair found that pain in the postoperative period was significantly less following laparoscopic inguinal hernia repair, which is one of the major advantages of most laparoscopic procedures in general [18]. In our study, VAS scores were significantly lower in group B patients at 24 hours after the operation (*P*= 0.008), but on POD7, the difference between both groups was not statistically significant (*P*= 0.099). These findings are nearly consistent with previous studies [8,19]. Catani et al [8] reported that 92.9% of patients who underwent inguinal hernia repair using the laparoscopic IPOM technique had no or mild pain at 24 hours postoperatively.

Complications of laparoscopic inguinal hernia repair have not been uniformly reported in the literature. The lack of standardization plays a large role in the variability of available evidence. However, generally speaking, laparoscopic hernia repair has a history of unique and potentially serious intra-operative complications that are not seen with open hernia repair. Most of those complications were encountered when the laparoscopic techniques were still relatively new and the experience was limited [18].

Several postoperative complications have also been reported following both laparoscopic and open hernia repairs. These include urinary retention, groin hematoma, neuralgia, groin pain, testicular problems, scrotal oedema, wound infection, and mesh complications [23].

In our study, no major complications were reported in either group. However, the rate of intra-operative complications was higher in group A (*P*=0.002). One of the 2 intra-operative complications that were reported in group A was a bladder injury. This iatrogenic injury, that was primarily repaired, has led to an increase in the operative time to about 2 hours, together with an increase in the length of hospital stay, as the patient was discharged on POD12 after performing an ascending cystogram on POD10 that revealed no evidence of leakage. This complication might thus have contributed, at least to some extent, to the statistical difference between both study groups in terms of operative time and length of hospital stay. Urinary bladder injury during inguinal hernia repair was previously reported by some studies [16,24].

All study patients had a smooth postoperative course so far. However, eight minor complications were encountered [scrotal oedema (n=6), urinary retention (n=1), mesh infection (n=1)]. The slightly higher incidence of postoperative scrotal oedema following the open Lichtenstein technique was attribured to the dissection of the inguinal canal, an operative step that was not part of the laparoscopic IPOM technique in which no preperitoneal dissection was carried out. Overall, there was no significant difference between both groups in terms of postoperative complication rates.

Recurrence after inguinal hernia repair is also one of the most important measurable outcomes. It is largely determined by the technique used, and can only be accurately assessed with long-term follow up [18].

Amid et al [25] reported a recurrence rate of 0.1% in a prospective study that included 4000 patients who underwent open Lichtenstein technique for inguinal hernia repair and were followed for up to 11 years by clinical examination. On the other hand, Catani et al [8] reported a recurrence rate of 3.3% following laparoscopic IPOM repair at an average 18-months follow-up, whereas another study[7] reported a 0% recurrence rate in 61 patients following IPOM repair at an average 24-months follow-up. Unfortunately, although the recurrence rates were 0% in both of our study groups, the

relatively short follow-up period of only 1 year would not allow us to draw any definitive conclusions on the rates of such complication following the open Lichtenstein and laparoscopic IPOM techniques. A study with a larger sample size and a longer follow-up is still required in order to accurately evaluate the recurrence rates associated with both techniques.

Unsurprisingly, we found that the length of hospital stay was significantly shorter in group B (P= 0.041). This is consistent with two previous studies[7,8] which reported mean lengths of hospital stay of 36 hours and 24 hours, respectively, following laparoscopic IPOM inguinal hernia repairs. Furthermore, group B patients clearly demonstrated better results in terms of patient satisfaction and time to return to work (P= 0.012 and 0.002 respectively).

In our study, we have not had the chance to re-explore any of the patients who underwent laparoscopic IPOM repair and thus to identify any sequalae that could have possibly resulted from the use of the dual-facing Parietex™ Composite mesh. This fact, besides the relatively short follow-up period, did not allow us to evaluate the long-term safety of this dual-facing mesh and the possible sequalae of its intra-peritoneal placement.

Finally, one of the major criticisms of laparoscopic hernia repair is the higher cost compared to open repair, and this has been consistently demonstrated by many studies. It has been shown that most of the increased cost is attributed to longer operative times and more expensive equipment [26].

On the contrary, Fegade and Mishra[27] emphasized that laparoscopic hernia repair may not be more expensive than open repair in terms of direct hospital costs or where a difference exists, it is relatively small. In fact, cost analysis comparing laparoscopic and open hernia repair is a complex task, and accurate evaluation of cost should involve an integration of all operative, hidden, and indirect costs. Other factors that affect cost and should be taken into consideration include postoperative pain, recurrence rates, and surgeon's experience[20]. In our study, in spite of the higher cost of the laparoscopic equipment (including the tacker) and the dual-facing composite mesh that were used in the laparoscopic IPOM technique, compared to the cost of the polypropylene mesh used in the Lichtenstein technique, some of those expenses were compensated for by the significantly shorter operative time and hospital stay as well as the earlier return to work in patients who underwent laparoscopic IPOM repair.

In conclusion, both the open Lichtenstein and the laparoscopic IPOM techniques appear mto be relatively safe and effective for inguinal hernia repair over the short term. However, the laparoscopic IPOM technique is associated with a shorter operative time, much less postoperative pain, a shorter hospital stay, an earlier return to work and a higher level of patient satisfaction. It is relatively easy and thus, faster to execute than the open Lichtenstein technique, clearly because it requires no preperitoneal dissection. It might also be associated with a slightly lower incidence of intra-operative complications, if performed by an experienced laparoscopic surgeon. However, the relatively higher cost, the questionable long-term efficacy and safety, as well as the possible long-term sequalae of intra-peritoneal mesh placement remain the main concerns of this attractive procedure, despite the aforementioned potential advantages. Unfortunately, the limited number of cases and the relatively short follow-up period in this study did not allow us to properly evaluate the recurrence rates and the long-term efficacy of both the open Lichtenstein and the laparoscopic IPOM techniques. Hence, further randomized prospective long-term studies are still required in order to accurately evaluate such outcomes.

Conflict of Interest Statement

The authors of this manuscript have no conflicts of interest to disclose. They have no financial or personal relationships with other people or organizations that could inappropriately influence or bias their work. There was no corporate involvement or patent holdings for the study. All authors have contributed significantly to this work and are in agreement with the content of the manuscript. Neither the authors nor participants were funded by any foundation or non-governmental sources.

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