# Extending indications of laparoscopic mesh repair of unilateral inguinal hernia in males, is it possible?

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**Background**
Inguinal hernia repair is one of the most commonly performed operations in general surgery departments. Open Lichtenstein procedure is the gold standard in managing such cases. Mini-invasive approaches have gained popularity in the recent few decades by achieving better cosmetic results, shorter hospital stay, less postoperative pain, and earlier return to normal activities. Transabdominal preperitoneal (TAPP) mesh repair is one of the most accepted procedures among surgeons and patients.
**Aim**
To compare open Lichtenstein with TAPP mesh repair techniques in unilateral inguinal hernia in male patients regarding perioperative outcome and complications.
**Patients and methods**
This is a randomized comparative prospective study conducted from October 2016 to February 2017 on 71 cases presented with unilateral inguinal hernia and divided randomly into two groups: laparoscopic group (28 cases) and open group (43 cases). Both groups were studied and followed up for 1 year postoperatively, detecting intraoperative and early and late postoperative outcomes.
**Results**
The mean age was 36±15 years, and comorbidities were present in 32.4% of cases. Left, oblique, and funicular type were the most frequent cases. Operation time was 111±22 min in TAPP group and 75±16 min in open group. Occult hernia was detected in five (17.9%) cases, indirect hernia in three cases, and direct hernia in the other two cases of TAPP group. Intraoperative and postoperative complications were encountered in 10.7 and 28.6% of TAPP group, respectively, and in 9.4 and 20.9% of open group, respectively. Postoperative hospital stay was 2±1 day in both groups.
**Conclusion**
TAPP procedure can be performed safely in unilateral inguinal hernia in males with no serious complications. Moreover, it increases the ability to detect and repair the occult hernia in the same session. Longer operation time is the only drawback.

**Keywords:**
groin, hernia, laparoscopic, Lichtenstein, preperitoneal

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## Introduction

The groin hernia has an incidence of 27–43% in the males during their lifetime, mostly presenting with symptoms, but still there is a minor percentage of asymptomatic cases. Surgical repair is the most accepted and effective treatment, and despite the presence of the conservative treatment option, most of these cases have to undergo surgical repair to avoid developing complications [1].

Hernia repair has many available alternatives, from Bassini, Shouldice, and Lichtenstein to variable laparoscopic procedures. Mesh-free techniques have a recurrence rate of 4.4–17% after 10 years compared with 1–1.4% in open mesh repair [2,3].

Laparoscopic hernia repair began in the early 1990s. The well-known approaches are transabdominal preperitoneal (TAPP) and total extraperitoneal (TEP) mesh hernioplasty. TAPP procedure consists of laparoscopic peritoneal entry and repair of the hernia followed by extraperitoneal insertion of the mesh. TEP consists of exploration of the myopectineal orifice and hernia repair followed by extraperitoneal mesh insertion without breeching the peritoneum at all [4,5].

Simultaneous presence of bilateral inguinal hernias was documented in adults up to 6%. The contralateral side is mostly asymptomatic or shows equivocal signs with no guidelines supporting exploration of the other side routinely except in pediatrics [4].

The evolution of laparoscopic era allowed the rise in occult contralateral inguinal hernia detection rate by 20% and diagnosing other hernias as femoral and Spigelian [4]. Minimally invasive repair of inguinal hernia has other advantages such as less postoperative pain, earlier return to work, and low incidence of chronic pain, but the main disadvantages are related to the longer learning curve time and higher costs [3,4].

TAPP hernioplasty is technically easier procedure than TEP and has been indicated in young males and females (18–30 years old) and in recurrent hernia, whereas it is contraindicated in huge scrotal hernia, in the presence of comorbidities that contraindicate general anesthesia, and in previous lower abdominal surgery with expected extensive adhesions [5].

The main aim of the present study is to compare TAPP versus open mesh hernioplasty in unilateral inguinal hernia concerning intraoperative and postoperative follow-up and complications, and also to evaluate the significance of TAPP in detection of occult contralateral inguinal hernia.

## Patients and methods

This study is a randomized comparative prospective study conducted on 71 male patients with unilateral inguinal hernia presenting to the general surgery department of Kasr Al-Aini Hospital during the period from October 2016 to February 2017. The manuscript gained the ethical committee approval before starting it. They were randomly divided into two groups: open group that included 43 cases and TAPP group that included 28 cases. They were followed up for 12 months.

Male patients older than 18 years with unilateral evident inguinal hernia were included in the study, whereas the following cases were excluded: female patients, patients less than 18 years old, recurrent hernia, bilateral hernia, complicated hernia, bleeding tendency, previous lower abdominal surgery, significant prostatic enlargement, medical disorders contraindicating general anesthesia, and cases associated with undescended testis or other clinically evident hernias in the same patient.

Proper history taking and full clinical examination were done focusing on local groin examination of the other side and other hernia orifices. The size of the hernia was considered small if bubonocele, moderate if funicular type reaching the neck of scrotum, and large size if reaching down to the bottom of scrotum. Full preoperative routine laboratory investigations and abdomino-pelvic sonography were done in all cases. Informed consents were signed by all cases after receiving information regarding the details of the procedure and the possible complications.

### Surgical technique

#### *Open Lichtenstein repair*

The patient lies supine, and induction of general or regional anesthesia is then done. Inguinal incision, reaching down to the cord, and dissection of hernia sac with preservation of related ilioinguinal and iliohypogastric nerves were performed followed by reduction of contents and excision of the sac. Closure of wide defect by interrupted nonabsorbable sutures and/or plication of the redundant posterior wall is then carried out if indicated. A 6×11 cm polypropylene mesh is fashioned and fixed to the inguinal ligament and rectus sheath with continuous and interrupted nonabsorbable sutures, correspondingly. Closure in layers over suction drain – if there is a need to place – after proper hemostasis was then done.

#### *Transabdominal preperitoneal mesh hernioplasty*

The patient is placed supine, and general anesthesia induction is started. Then the abdominal cavity is insufflated to 12–15 mmHg through umbilical incision followed by introduction of 10 mm, 30° scope through the umbilical port. The tower is positioned near the patient's leg, and the surgeon stands near the head of the patient at the reverse side of the hernia. The camera assistant stands on the same side of the surgeon, backwards. Tilting of the head downwards (Trendlenberg's position) was done to permit upward displacement of the bowel loops. Inspection of both inguinal regions was done to confirm the presence and type of the preoperatively detected hernia and for detection of any contralateral occult hernia. Insertion of two working ports, right 10 mm and left 5 mm, on midclavicular lines at, above, or slightly below umbilicus level according to the site of hernia, making proper triangulation, was done. The monopolar diathermy was used over scissor or hook to open preperitoneal space starting laterally above anterior superior iliac spine in an S-shaped manner reaching beyond medial umbilical fold, thus elevating a peritoneal flap, being so careful as to avoid its damage. Identification was done of the vas, gonadal vessels, and the sac, and then they were separated away from the cord. Any adhesions between the sac and contents must be freed at first. A polypropylene 15×12 cm mesh is fashioned and introduced through the 10-mm port, then laid in the preperitoneal plane covering the myopectineal orifice of Fruchaud and extending to symphysis pubis medially, Cooper's ligament

inferomedially, 3 cm above the defect covering conjoint tendon superiorly, reaching anterior superior iliac spine laterally and 2–3 cm from the defect inferiorly. Fixation of the mesh is then performed using tackers in the medial part avoiding triangles of pain and doom. Closure of the peritoneal flap is done using continuous polyglactin suture. After ensuring proper hemostasis, withdrawal of ports is done with no drain insertion. If the other side contains a hernia defect, it is repaired in the same setting by the same technique.

#### Postoperative care

Early ambulation and monitoring and documenting of any complications and drain time – if any – were recorded. Duration of hospital stay was recorded, and delayed complications were followed for 1 year postoperatively.

#### Statistical analysis

Data was entered and statistically analyzed using the Statistical Package of Social Science Software program (version 23, IBM SPSS Statistics for Windows; IBM Corp., Armonk, NY). Data were presented using range, mean, and SD for quantitative variables and frequency and percentage for qualitative ones. Comparison between groups was performed using independent sample *t* test (if normally distributed) or Mann–Whitney test (if not normally distributed) for quantitative variables and $\chi^2$ test or Fisher's exact test for qualitative variables. *P* values less than or equal to 0.05 were considered statistically significant.

## Results

This study included 71 male patients with unilateral inguinal hernia. Open Lichtenstein mesh hernioplasty was done in 43 cases, whereas TAPP was performed for the other 28 cases. Mean±SD age was 36±15 years. Overall, 32.4% of cases were associated with medical comorbidities, and 46.5% of patients presented with medium-sized hernia, with predominance of oblique type and left-side hernia. During TAPP procedure, occult contralateral small-sized hernias were detected in five (17.9%) cases. There was a statistically significant difference between both groups regarding the operation time and the size of the hernia. Intraoperative bleeding and postoperative seroma were the main encountered complications. Table 1 shows preoperative, intraoperative, and postoperative data of both groups.

There was no statistically significant difference regarding postoperative complications in relation to the performed procedure (*P*=0.461), age of patients (*P*=0.637), and characteristics of the hernia, that is, side, size, and type (*P*=0.956, 0.414, and 0.694, respectively). A significant relation was found in relation to the presence of medical comorbidities especially obesity with BMI more than or equal to 40 $kg/m^2$ (*P*=0.005). The presence of intraoperative complications was significantly related to the occurrence of postoperative complications (*P*=0.026). No significant relations were found between postoperative complications and the presence of occult hernia (*P*=0.606) or its type (*P*=0.6).

## Discussion

Repair of groin hernia is one of the commonest surgical procedures. Open mesh hernioplasty is the traditional way to repair such type of hernia with low rate of recurrence but with higher incidence of postoperative pain, prolonged hospital stay, and late return to the normal physical activities [3,6].

Multiple factors can be considered in detecting best surgical procedure, such as low rate of complications, reduced costs, permanent effect with low rate of recurrence, and early return to normal activity [6].

Endoscopic hernia repair emerged in the 1990s owing to the introduction of new operating techniques and facilities providing the advantages of reduced early and late postoperative pain, shorter hospital stay, and shorter periods of disability [6].

These laparoscopic procedures include TAPP repair, TEP repair, and intraperitoneal onlay mesh repair. They have totally different anatomical considerations and technical aspects [7].

In this study, we performed TAPP, as it does not require any special or expensive types of meshes as in intraperitoneal onlay mesh or need special skills with slower learning curve as in TEP. Open Lichtenstein operation was performed for the other group, being a familiar procedure and the most commonly used in our hospitals. The procedures were performed by the same surgeon to avoid bias in operation time and operative outcome.

Most of the previously reported studies were performed mainly or exclusively on males as documented by the meta-analysis done by Scheuermann *et al.* [8] with female comprising only 4.86% in open technique and 5.88% in TAPP.

In the present study, the mean operation time of TAPP procedures was 111±22 min, which was significantly

**Table 1 Comparison between both groups regarding preoperative, intraoperative, and postoperative data**

| | Groups [*N* (%)] | | *P* value* |
|---|---|---|---|
| | Laparoscopic (*n*=28) | Open (*n*=43) | |
| Age (mean±SD) (years) | 34±13 | 37±16 | 0.397 |
| Comorbidity | 10 (35.7) | 13 (30.2) | 0.630 |
| Hypertension | 5 (17.9) | 5 (11.6) | 0.501 |
| Diabetes mellitus | 3 (10.7) | 5 (11.6) | 0.905 |
| Obesity (BMI ≥40 kg/m$^2$) | 4 (14.3) | 5 (11.6) | 0.732 |
| Side | | | |
| Right | 16 (57.1) | 17 (39.5) | 0.146 |
| Left | 12 (42.9) | 26 (60.5) | – |
| Type | | | |
| Oblique | 24 (85.7) | 37 (86) | 0.969 |
| Direct | 4 (14.3) | 6 (14) | – |
| Size | | | |
| Small | 14 (50) | 10 (23.3) | 0.049 |
| Medium | 11 (39.3) | 22 (51.2) | – |
| Large | 3 (10.7) | 11 (25.6) | – |
| Operation time (mean±SD) (min) | 111±22 | 75±16 | <0.001 |
| Intraoperative findings | – | – | – |
| Other side occult hernia | 5 (17.9) | – | – |
| Same side pantaloon hernia | – | 2 (4.7) | – |
| Adhesions within the sac | – | 3 (7) | – |
| Intraoperative complications | 3 (10.7) | 4 (9.4) | 0.674 |
| Bleeding | 3 (10.7) | 2 (4.7) | 0.376 |
| Injuries | 0 (0) | 2 (4.7) | 0.515 |
| Conversion to open | 0 (0) | – | – |
| Postoperative complications | 8 (28.6) | 9 (20.9) | 0.461 |
| Seroma | 4 (14.3) | 3 (7) | 0.422 |
| Hematoma | 2 (7.1) | 2 (4.7) | 0.644 |
| Chronic pain | 2 (7.1) | 2 (4.7) | 0.644 |
| Recurrence | 1 (3.6) | 2 (4.7) | 0.825 |
| Wound infection | 0 (0) | 0 (0) | – |
| Port-site hernia | 1 (3.6) | – | – |
| Testicular atrophy | 0 (0) | 1 (2.3) | 0.735 |
| Drain | – | 29 (67.4) | – |
| Drain time range (days) | – | 1–6 | – |
| Mean±SD (days) | – | 2±1 | – |
| Hospital stay (mean±SD) (days) | 2±1 | 2±1 | 0.115 |

*Significant *P* value if less than 0.05.

longer than that of open surgery (75±16 min), with highly statistically significant difference (*P* value less than 0.001).

The previously published studies that compare the operation time between both procedures confirmed the shorter operation time in open procedure as mentioned by Abbas *et al.* [9] (46.3±8.92 min in TAPP vs. 45.3±9.85 min in open), Pokorny *et al.* [10] (66±183.52 in TAPP vs. 48±73.4 in open), and Schmedt *et al.* [11] (mean time, 65.7 min with range, 40–109 in TAPP vs. 55.5 min with range, 34–99 in open Lichtenstein repair) [1,8].

In this study, despite the presence of statistically significant relation between open and laparoscopic groups regarding the size of the hernia (*P*=0.049), there was no clinical or statistical significance with the occurrence of intraoperative complications, drain time, or duration of hospital stay, with *P* values of 0.231, 0.06, and 0.875, respectively.

The occult hernia is defined as an asymptomatic hernia undetectable by clinical examination. It includes patients with actual mild protrusion of intra-abdominal contents, a beginning hernia or just a processus vaginalis patency with no hernia. In patients with symptomatic unilateral inguinal hernia, 50% of them may have an evident contralateral hernia or will develop it along their lifetime, ranging from 0 to 12 years, with a median of 3.7 years [1].

In this study, occult hernia was diagnosed during TAPP procedure in five cases representing 17.9% of

cases done laparoscopically. On the contrary, contralateral hernia was detected in one patient after 1 year of follow-up after open Lichtenstein repair.

Many other studies were concerned about this issue and the possibility of diagnosing the contralateral hernia during TAPP. van den Heuvel *et al.* [12] and Thumbe [13] found that occult hernia was detected in 13–22% of cases, and if left untreated, 29% of them could manifested within the first year postoperatively. Nevertheless, another study was conducted by van Veen *et al.* [14] on patients who underwent open mesh repair surgery and found that 25% of patients developed contralateral hernia in a follow-up period of 11 years.

In the present study, intraoperative complications were encountered in a total of seven cases, with three (10.7%) in the TAPP group and the other four (9.4%) were in open group, which was found to be of a nonsignificant statistical value. In the TAPP group, bleeding was the encountered complication in the three cases owing to troublesome dissection in vascular planes which was controlled rapidly using monopolar cauterization, whereas no other complications occurred or conversion to open. In open group, two cases were complicated by bleeding owing to the presence of extensive vessels over a large hernias but was controlled successfully during the procedure. The other two cases were complicated by injuries to the ilioinguinal nerve in one of them and to inferior epigastric vessels in the other one, which was ligated and controlled. No major visceral or vascular complications were detected in both groups.

Intraoperative complications during hernia repair range from simple to serious events whether in open or TAPP procedures. These complications infrequently occur in hernia repair except in patients presented with complications or associated with comorbidities that endanger patient's life [1]. Nerve injuries in open hernia repair were reported in a large volume study done by Chow *et al.* [15] to reach up to 14.5%. Serious complications like bowel, bladder, or vascular injuries were reported as being uncommon events that occurs more frequently with TAPP than open Lichtenstein repair with an incidence that may reach 0.4% [16,17].

Pokorny *et al.* [10] reported intraoperative hemorrhage in 2.03% of TAPP group compared with 0.26% in open hernioplasty group. Bowel injury was encountered in 0.5% of TAPP cases. Conversion to open was performed in 1% of these cases as a result of intraoperative complications. The occurrence of these complications was not correlated with the experience of the surgeon [10].

In this study, postoperative complications were encountered in eight (28.6%) cases of the TAPP group and in nine (20.9%) cases of open group. No statistical significance was present in relation to type of procedure; age of patients; characteristics of the hernia, that is, type, size and side; presence of occult hernia; or hospital stay period.

The occurrence of postoperative complications was significantly related to the presence of medical comorbid factors ($P$=0.038), especially obesity with BMI more than or equal to 40 $kg/m^2$ ($P$=0.005) and also with the operation time ($P$=0.009). Another significant relations were found with the presence of intraoperative complications ($P$=0.026) and with drain time in open group ($P$=0.037).

Postoperative seroma was the main frequent complication as encountered in four (14.3%) cases of TAPP group and three (7%) cases of open group but with no statistical significance ($P$=0.422). Hematoma was the second most common complication as reported in two (7.1%) cases of TAPP group and two (4.7%) cases in open group, without any statistical significance ($P$=0.644). No wound infections in both groups were observed.

Postoperative complications in form of seroma, hematoma, and wound infections were documented in studies done by Abbas *et al.* [9] and Pokorny *et al.* [10] to be of no significance in relation to the type of surgery, being less frequent in TAPP, except for seroma, which was more in the latter study. The same was reported by Schmedt *et al.* [11] indicating that open Lichtenstein repair has the advantage of less seroma formation over TAPP [9,10]. According to the study done by Köckerling *et al.* [18], the most common risk factors for higher incidence of seroma formation in TAPP are the fixation of the mesh, larger size of the defect, and the medial type of inguinal hernia.

Chronic pain is defined by the International Association for the Study of Pain as the pain that persists for 3 months or more, but recent studies consider it chronic if exceeded 6 months, respecting the nature of the inflammatory process of the mesh. The incidence of chronic pain was reported in the literature to range between 0.7 and 75% with an upper limit average of 17% in open repair and 13% in TAPP [1,19].

Risk factors of chronic pain include young age, medial hernia, female sex, the presence of preoperative pain, recurrent hernia, open hernia repair, mesh fixation, and the type of the mesh itself [19,20].

In the present study, chronic pain was found in two (7.1%) cases of the TAPP group with decreasing amplitude over time for both cases and in another two (4.7%) cases in open group with one of them improved by time and the other required referral to pain clinic with significant improvement. No significant relation between both groups was detected ($P$=0.644).

In a meta-analysis done by Schmedt *et al.* [11], on 34 randomized control trials, laparoendoscopic repairs were associated with fewer incidences of chronic pain syndrome compared with open Lichtenstein repair. The same was reported by Salma *et al.* [6] in a small volume study in 2015 and by Niebuhr *et al.* [20] on 2018 after analyzing data of more than 20 000 patients but with persisting pain in 2–5% of cases treated laparoscopically.In this study, hospital stay ranged between 2 and 4 days in both groups with no significant relation with the performed procedure ($P$=0.115), encountered intraoperative or postoperative complications ($P$=0.886) or with the presence of drain in open group.

Hospital stay and early return to normal activities were documented by most of the studies to be significantly earlier in TAPP than in open repair [1,6].

In the present study, recurrence occurred in two (4.7%) cases of open repair after 9 and 11 months, postoperatively, and in one (3.6%) case of TAPP after 7 months of surgery, with no statistical significance between both groups ($P$=0.825). Port-site hernia occurred in one (3.6%) case of TAPP group after 9 months.

Simons *et al.* [1] conducted a review study and guidelines update for inguinal hernia and found that the incidence of port-site hernia after TAPP operations may reach up to 3.7%, so they recommended closure of port sites.

The recurrence rate, as reported by Scheuermann *et al.* [8] and Butters *et al.* [21], was the same between open and TAPP repairs with no significant difference between both techniques. Schmedt *et al.* [11] in their meta-analysis documented higher rate of recurrence in TAPP procedure, and the same was found by Pokorny *et al.* [10] so Simons *et al.* [1] recommended the significance of surgeon skills of TAPP to achieve better results.

In this study, no mortalities were documented. In the literature, the mortality rate in elective hernia repair is not exceeding 0.2%, which is related to the present comorbidities [1].

In this study, we can conclude that TAPP repair of unilateral nonrecurrent inguinal hernia in males was feasible and successful with the advantages of diagnosis of occult hernia and the same perioperative parameters as in open repair. A more learning curve is required to overcome the longer operative time than that in open Lichtenstein repair.

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There are no conflicts of interest.

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