Assessment of laparoscopic hernia repair in bubonocele

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Background
Inguinal hernias are one of the most common surgeries performed by a general surgeon. Repair of an inguinal hernia via surgery is the only treatment for inguinal hernias and can prevent incarceration and strangulation. Laparoscopic inguinal hernia repair has gained popularity with good results in terms of early return to work, reduced postoperative pain, decline in mesh infection and minimal recurrence. However, the routine use of laparoscopic inguinal hernia repair for the unilateral, uncomplicated hernia is a more controversial issue.

Objective
Assess the laparoscopic hernia repair in bubonocele in terms of risks, ease of technique, advantages and postoperative outcome including recovery time, postoperative complications, and short-term recurrence rate.

Patients and methods
This is a prospective cohort study was conducted from June 2022 till September 2022 and performed on a total of 20 patients who had inguinal hernia in bubonocele and were candidates for laparoscopic hernia repair.

Results
In the current study 20% of cases had bilateral inguinal hernia. As regards operative characteristics, our study results showed that the operative time ranged between 50 and 80 min in 75% of cases. There were no significant intraoperative complications, however, a mild bleeding was recorded only in one (5.0%) case and was easily managed intraoperatively, operating surgeons reported satisfaction and operation ease in 55% of cases. As regards postoperative characteristics, our study results revealed that almost all cases (100.0%) had stayed in the hospital 1 day only, majority of cases (85.0%) had resumed their daily activity and work within 2–4 days after the discharge date with no significant postoperative complications. mild seroma was reported in one (5.0%) case only, mild port site wound infection in one (5.0%) case only, pain was reported in one (5.0%) case only, and all these complications were managed conservatively and completely resolved during the follow up period. Ultimately, laparoscopic transabdominal preperitoneal repair showed good cosmetic outcome with good patient satisfaction in 80% of cases with no short-term recurrence.

Conclusion
We concluded that transabdominal preperitoneal repair of inguinal hernia was a safe, effective, feasible, and successful with the advantages of less hospital stay and less operative time. Moreover, it is associated with minimal intraoperative and postoperative complications.

Keywords:
bubonocele, laparoscopic hernia repair, transabdominal preperitoneal

Introduction

Inguinal hernias are one of the most common surgeries performed by a general surgeon [1].

Repair of an inguinal hernia via surgery is the only treatment for inguinal hernias and can prevent incarceration and strangulation. Health care providers recommend surgery for most people with inguinal hernias and especially for people with hernias that cause symptoms. Research suggests that men with hernias that cause few or no symptoms may be able to safely delay surgery until their symptoms increase. Men who delay surgery should watch for symptoms and see a health care provider regularly. Health care providers usually recommend surgery for infants and children to prevent incarceration [2].

Present-day hernia operations require that the surgeon more fully understand the functional anatomy and

pathophysiology of the abdominal wall and groin. Hernia surgeons must be familiar with different surgical techniques, ranging from the traditional tissue repairs with suture to the mesh-based 'tension-free' open and laparoscopic techniques [3]. The standard methods for inguinal hernia repair had few changes over a hundred years until the introduction of synthetic mesh. The next big change in hernia repair is the introduction of laparoscopic repair [4]. The laparoscope was first invented in the early 20th century. The first laparoscopic hernia repair was in 1990 [5]. Successful hernia treatment should offer high patient satisfaction, low cost, low recurrence rate, and rapid return to work [6]. Laparoscopy enables hernial orifices to be observed and tension-free mesh repair to be carried out effectively [7]. The anatomy is easier to identify when starting with a laparoscopy and the presence and type of hernia on the contralateral side can be identified before starting dissection [8]. Bilateral hernias are best repaired laparoscopically [9].

However, the question about the most appropriate technique still confuses the community of surgeons. Several studies have compared the laparoscopic and open techniques for inguinal hernia repair. The advantages of laparoscopic hernia repair over traditional open repair in terms of limited postoperative pain, shorter hospitalization, early resumption of activity, and improved cosmetic have been readily apparent and accepted [10].

Despite excellent long-term outcome after transabdominal preperitoneal (TAPP) repair, the use of laparoscopy in hernia repair is still limited [10].

Aim
The aim of this study is to assess the laparoscopic hernia repair in bubonocele in terms of advantages, risks, ease of technique, operative time and postoperative outcome including recovery time, possible postoperative complications and short-term recurrence rates.

Patients and methods
A cohort prospective study was conducted upon 20 patients with bubonocele and are candidates for laparoscopic hernia repair during a period of 6 months (from June 2022 to September 2022).

Patients who are fit for general anesthesia [American Society of Anesthetists (ASA) 1 or 2] and fit for laparoscopic surgeries, those with inguinal hernia; bubonocele type and uncomplicated hernias were included in the study. While, patients were excluded from the study if they do not meet any of the above criteria, patients with contraindications to laparoscopic surgeries in general (global heart failure, obstructive lung disease, chronic respiratory failure, advanced hepatocellular insufficiency, etc.), complicated inguinal hernia (obstructed, strangulated), inguinoscrotal hernia, recurrent inguinal hernia, and previous pelvic surgeries.

Data was collected prospectively from cases candidate for laparoscopic inguinal hernia repair in Ain Shams Department of General Surgery.

The study was done according to approved ethical standards. Informed written consent was obtained from all the participants.

Study tools
All patients included in the study were candidates for:

(1) Clinical assessment.
   (a) Detailed medical, surgical, and family history.
   (b) Careful analysis of symptoms.
   (c) General examination.
   (d) Local examination.
(2) Investigations:
   (a) Routine preoperative investigations.
   (b) Pelviabdominal ultrasound.
   (c) Superficial ultrasound on groin region.
(3) Interventions:
   (a) Patients were subjected to laparoscopic inguinal hernia repair (TAPP repair).
(4) Procedure:
TAPP technique.

Preoperative preparation
The patient must be meticulously prepped for the procedure and told of the specifics of the surgery as well as its potential effects.

Evaluation of the operative risk
Making use of the ASA score. There are no 'absolute' contraindications for TAPP in terms of comorbidities. Low molecular weight heparins are used in place of the oral anticoagulant medication, and the surgery is typically carried out at least 12 h following the previous low molecular weight heparin dose.

Skin preparation
On the night before the intervention, a preparatory shower is conducted. Following induction of the anesthesia, the skin is prepped with disinfectants (povidone–iodine).

Urinary catheter
To make the Retzius space dissection easier and to prevent bladder damage, empty the bladder. A urinary catheter may be kept in place after surgery in some circumstances (such as bilateral hernias and recurring hernias).

Patient and surgical team position
The patient is positioned on the operating table with both arms fastened to the body and in the supine position. A Trendelenburg posture (15–20°) with lateral inclination across from the hernial defect is prescribed prior to surgery. The surgical team is set up to be on the side opposite to the hernia that has to be fixed, and the camera operator will be on the same side as the hernia or in its side. In front of the surgeon, close to the patient's feet, is the scrub nurse. After completing the first hernia in a case of bilateral inguinal hernioplasty, the surgical team switches places.

Anesthesia
The patient should have general anesthesia since the patient's muscles will be more relaxed during surgery. And a single dosage of 2 g of cefoperazone is administered as part of the preoperative antibiotic prophylaxis.

Laparoscopic instruments
Common laparoscopic instruments (monopolar scissor, monopolar hook, two atraumatic fenestrated graspers, needle holder, and 5 mm disposable absorbable screw type stapler device) as well as 'open surgery' instruments are required, along with three trocars: one of 10 mm (optical) and two of 5 mm (for the instruments) (two Kelly, two Halsted, Farabeuf retractors, scissors, and Hegar needle holder). It could also be essential to use a suction-irrigation device and a bipolar grasper. Though a 0° laparoscope is practical, we often utilize 30° models.

Surgical procedure
Pneumoperitoneum and trocar placement
Pneumoperitoneum can be created with a 10 mm Hasson trocar or a Verres needle through an upper horizontal paraumbilical incision. Two further 5 mm operative trocars are inserted into either sides of the umbilicus, in a horizontal plane with it, and under direct eyesight.

Abdominal exploration
The aim of the laparoscopic exploration is to identify the superficial anatomical landmarks (urachus, umbilical folds, epigastric vessels, spermatic vessels, vas deferens or uterine round ligament) and the site and type of hernia. The two 'dangerous triangles,' vascular and pain triangles, must be correctly identified. To perform the exploration and to ensure a good exposure of the inguinal region the position of the operating table is kept in 15° Trendelenburg with 15° lateral rotation to the side opposite the hernia (Fig. 1).

Peritoneal incision
The TAPP procedure starts with peritoneal cut 2 cm above and 1 cm medial from the anterior superior iliac spine and continue horizontally, in medial direction to the lateral umbilical ligament (umbilical artery), then the incision continues vertically along the umbilical ligament, using the monopolar hook or scissors This creates an 'L' shape incision. After the first peritoneal cut, the CO_2 pneumoperitoneum will enter into the preperitoneal space, facilitating the dissection.

Dissection of lower peritoneal flap
Starting with a medial dissection over the Retzius space, moving to a lateral dissection over the Bogros space, and finishing with a central dissection over the hernial sac and hernia's location. Typically, we begin by splitting the conjunctive fibers in touch with the rectus abdominal muscle during the medial dissection (Retzius gap), which separates the bladder from the rectus abdominal muscles. To reveal the Cooper's ligament, the pubis is dissected. Several fine veins from the corona mortis typically come into touch with the pubic bone. To avoid bleeding when doing the dissection or mesh stapling, we prefer to coagulate them. Then the peritoneum is pulled medially as the dissection is carried out laterally on the Bogros region. Traction-contra-traction techniques and fine

Figure 1
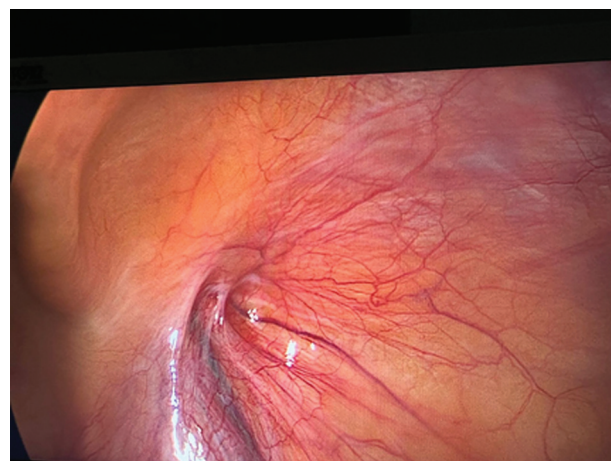
Laparoscopic view.

coagulation are used to complete the sac dissection. The sac is usually dissected anteriorly to prevent damage to the spermatic arteries and ductus deferens. We consistently do the literature-recommended hernia lipoma examination. When the previously mentioned anatomic markers are clearly visible and the two harmful triangles (of doom and of the pain) can be recognized, the preperitoneal dissection is complete. The transversalis fascia needs to be inverted and stapled to the Cooper ligament for significant parietal abnormalities (Fig. 2).

Mesh placement

The requirement to utilize a prosthetic mesh to completely cover the hernial defect and any potential herniation sites in the region is one of the most problematic aspects of the laparoscopic method to inguinal hernioplasty. The mesh need to extend at least medially to the pubic symphysis and laterally to the iliopsoas muscle. It should extend 3–4 cm beyond the hernial defect, inferiorly 1–2 cm below the pubis, and superiorly covering the anterior abdominal wall. We typically introduce a sizable (12×15 cm) polypropylene mesh through the optical trocar (Fig. 3). The prosthesis may be readily inserted via the Hasson trocar into the abdomen by rolling it upon

its long side and grabbing it with the grasper at the medial end. The prosthesis' medial end is brought over the Cooper. In order to avoid injuring the 'corona mortis vessels,' the prosthesis is then unrolled and the medial head is secured to the Cooper using the absorbable tacking staples (Fig. 4). The prosthesis may now be unrolled, placed in the preperitoneal pocket, and fixed with tacking staples on the upper and medial edges as well as at the level of the iliac spine thanks to this initial tack (Fig. 5). We employ two distinct meshes that cover the bilateral defects for bilateral hernia, which are then overlapped and stapled together on the median line.
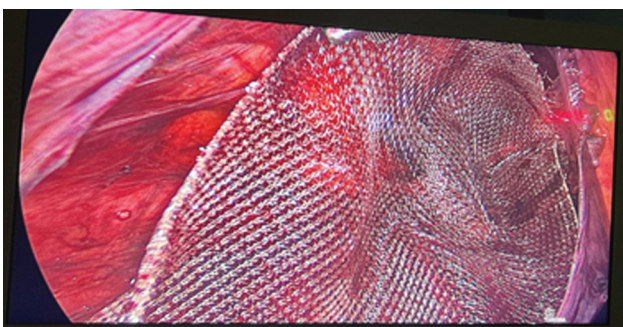
Drainage

As the release of carbon dioxide pressure is followed by capillary bleeding, several writers stress the function of suction-draining in reducing postoperative seroma and hematoma rates. Drainage is not something we frequently utilize.
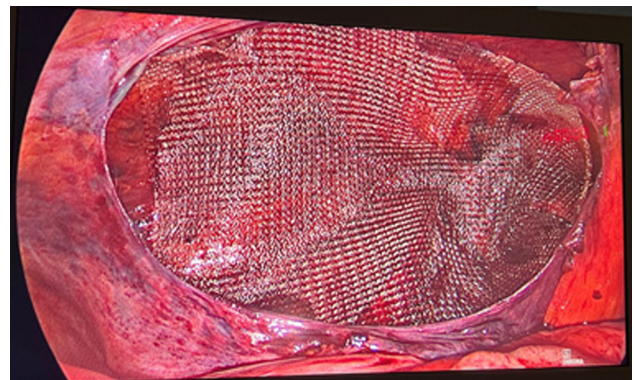
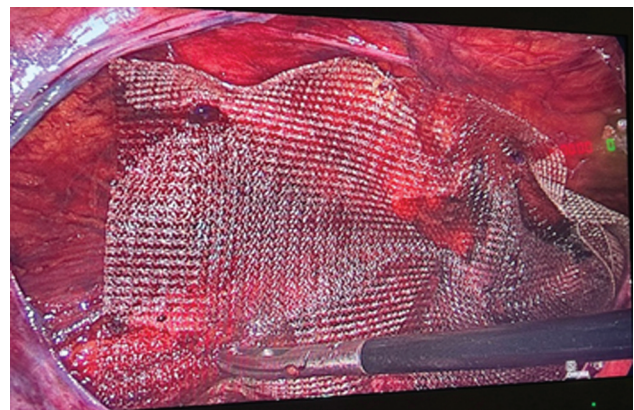**Figure 2**
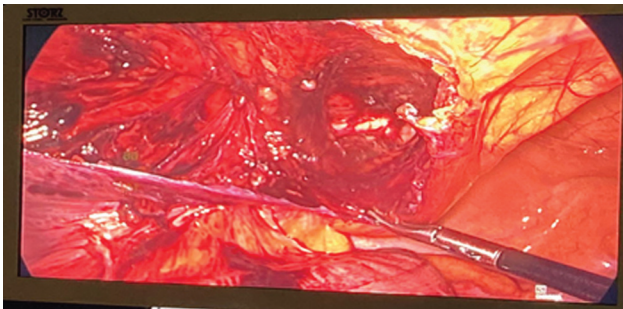
Flap and dissection.

Figure 3

Mesh introduction.

Figure 4

Mesh in place.

Figure 5

Mesh fixation.

Peritoneal closure
Before beginning the peritoneal closure, we drop the capnoperitoneum pressure to 8 mmHg to make it easier for the peritoneal borders to approximate one another under less tension (Fig. 6).

Abdominal closure
The trocars are removed laparoscopically after the peritoneal closure has been carefully inspected. A purse-string or single simple stitch with absorbable suture is used to seal the aponeurosis at the umbilical site. Levobupivacaine, a long-acting anesthetic, is injected into the surgical incisions to help reduce postoperative discomfort. The laparoscopic TAP block is an alternative. Staples or inverted rapid absorbable sutures are used to seal the skin.

Postoperative management
Paracetamol 1000 mg three times day and ketorolac 30 mg intravenously twice daily make up the early postoperative analgesic regimen. If a urinary catheter was inserted, it is withdrawn 6 h following surgery. As soon as the patient's general health permits them, they are mobilized and encouraged to walk. A 24-h hospital stay is required (day surgery). Following surgery, 4 h later, a liquid diet is advised for every patient. For 4–6 weeks, we advise using a hernia support tensor. Patients continue to use oral analgesics at home as needed (paracetamol, ketoprofen). From the first day following surgery, light physical activity is advised (walking, slowly ascending one or two flights of stairs), regular physical activity (walks, resume of work requiring minimal physical effort) is permitted from days 7 or 10, and intense physical activity is only permitted from the fourth week following surgery.

Figure 6
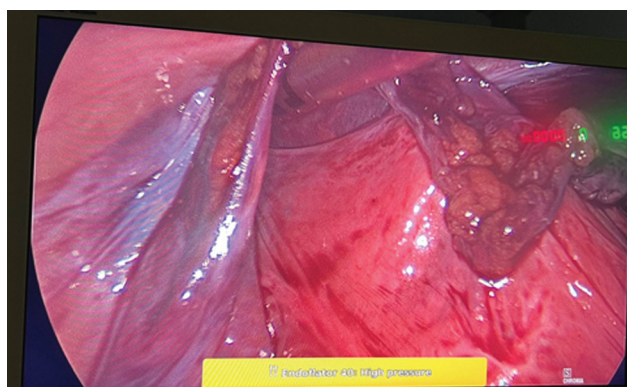
Flap closure.

Follow up
Patients were instructed to attend to outpatient clinics 1 week after the operation day, and then every 15 days for 3 months. Patients were asked whether if they are experiencing pain or numbness or any other complains, also about their return to work and daily activities, they were examined and assessed for seroma, hematoma, port site infection, numbness and recurrence. At the later follow up visits patients were asked to rate their surgical scars cosmetically as good, fair, or poor.

Statistical analysis
Appropriate descriptive statistical were used.

Statistical package
Data were collected tabulated and statistically analyzed, operating times were listed, surgical events were recorded, and operating surgeons were surveyed after surgery about their opinion regarding the ease of the surgery.

Results

Table 1 shows that demographic characteristics among the studied cases. Majority of the studied cases were 40.0–49.0 years (60.0%) (Fig. 7). All cases were males. About third of cases were obese (35.0%) (Fig. 8). Almost all cases were ASA I (80.0%). Few cases (20.0%) had bilateral hernia (Fig. 9). All cases underwent TAPP technique.

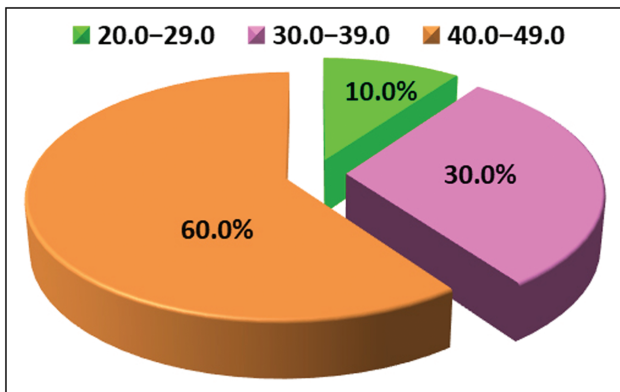**Table 1 Demographic characteristics of the studied cases**

Characteristics	Mean±SD	Range
Age (years)	39.2±7.0	24.0–49.0
BMI (kg/m^2)	27.9±3.1	22.4–32.4
	n (%)	
Age categories (years)		
20.0–29.0	2 (10.0)	
30.0–39.0	6 (30.0)	
40.0–49.0	12 (60.0)	
Sex		
Male	20 (100.0)	
Female	0	
BMI categories		
Lean	5 (25.0)	
Overweight	8 (40.0)	
Obese	7 (35.0)	
ASA		
I	16 (80.0)	
II	4 (20.0)	
Operation side		
Unilateral	16 (80.0)	
Bilateral	4 (20.0)	
Operative technique		
Transabdominatal preperitoneal	20 (100.0)	

Total=20. ASA, American Society of Anesthetists.

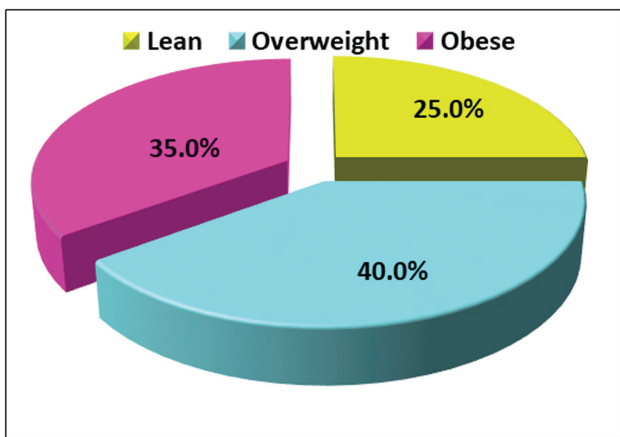Table 2 shows that: The most frequent operation time was 60.0–79.0 min (60.0%), the longest operation time
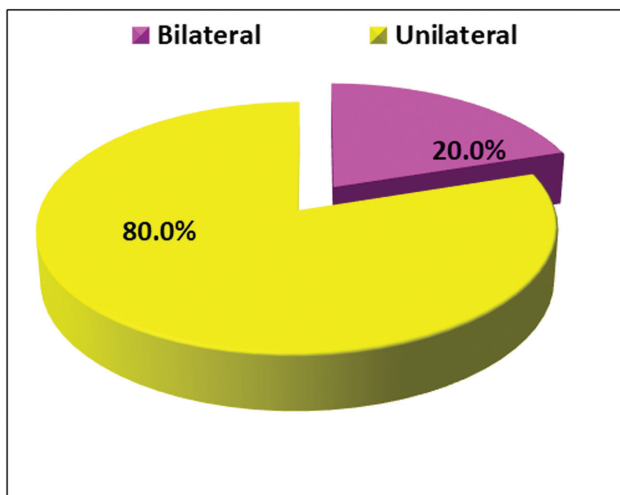
Figure 7

Age categories among the studied cases

Figure 8

BMI categories among the studied cases

Figure 9

Operation side among the studied cases

90.0–99.0 was only limited to the cases with bilateral hernia (Fig. 10).

Table 3 shows that bleeding recorded only in one (5.0%) case. No important structure or bowel injury was recorded (Fig. 11).

Table 4 shows that more than half of surgeries were considered easy by the performing surgeons (55.0%), about third was moderate (35.0%), minority was considered difficult (10.0%) (Fig. 12).
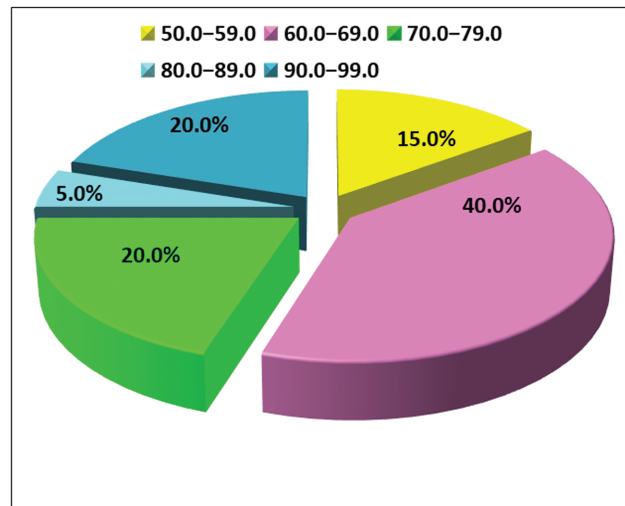
Table 5 shows that all cases had stayed 1 day only (100.0%).

Table 2 Operation duration among the studied cases

Characteristics	Mean±SD	Range
Duration (min)	67.5±8.4	56.0–95.0
	n (%)	
Duration categories (min)		
50.0–59.0	3 (15.0)	
60.0–69.0	8 (40.0)	
70.0–79.0	4 (20.0)	
80.0–89.0	1 (5.0)	
90.0–99.0	4 (20.0)	

Total=20.

Figure 10

Operation duration among the studied cases

Table 3 Intraoperative complications among the studied cases

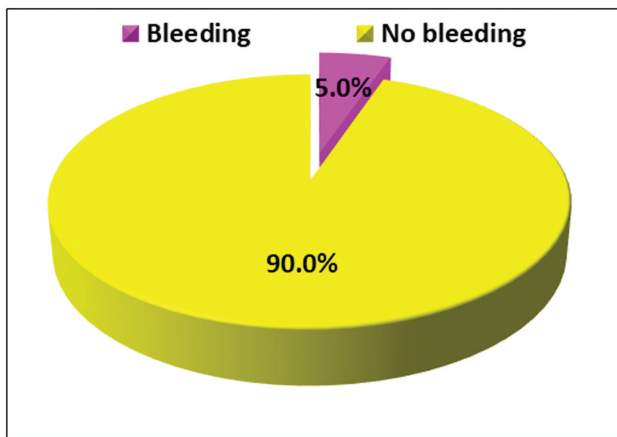| Complications	*n* (%)
Bleeding	1 (5.0)
Important structure or bowel injury	0

Total=20.

Table 6 shows that postoperative complications were uncommon; seroma (5.0%), surgical site infection (5.0%), and pain (5.0%) (Fig. 13).

Table 7 shows that majority of cases had resumed of activity and work within 2.0–4.0 days (85.0%) (Fig. 14).

Table 8 shows that more than three quarters of wounds considered by the patients as good (85.0%), the remaining was fair (15.0%) (Fig. 15).
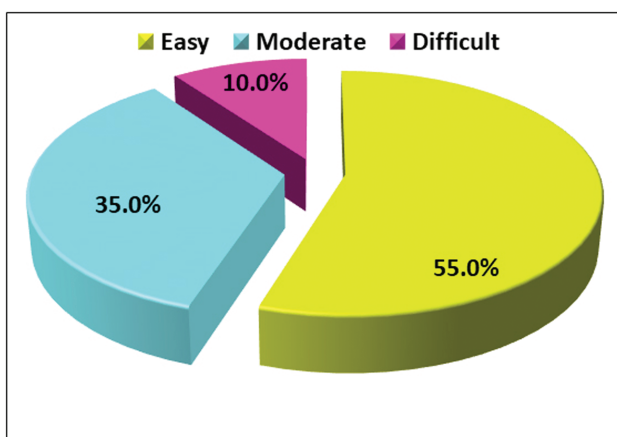
Table 9 shows that only one (5.0%) case was suspected clinically to have short-term recurrence, but radiology revealed no case had short-term recurrence (Fig. 16).

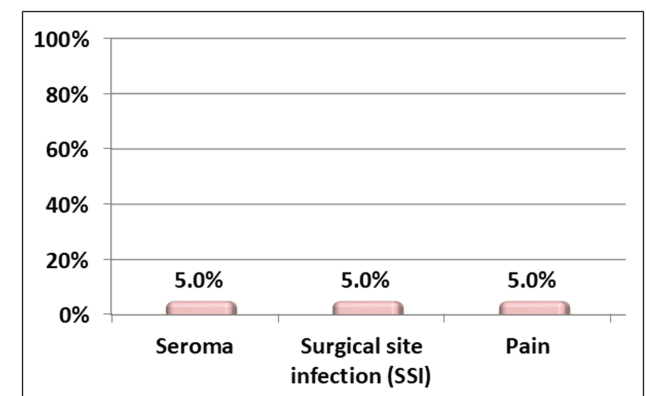**Table 5 Postoperative hospital stay among the studied cases**

Duration	n (%)
1 day	20 (100.0)
2 days	0
Total=20.	

Table 6 Postoperative complications among the studied cases

Complications	n (%)
Seroma	1 (5.0)
Surgical site infection	1 (5.0)
Pain	1 (5.0)
Numbness	0
Hematoma	0

Figure 11

Intraoperative bleeding among the studied cases.

Figure 13

Postoperative complications among the studied cases.

Table 4 Operation ease (surgeons' opinions) among the studied cases

Grades	n (%)
Easy	11 (55.0)
Moderate	7 (35.0)
Difficult	2 (10.0)
Total=20.	

Figure 12

Operation ease (surgeons' opinions) among the studied cases.

Table 7 Time of resumption of activity and work among the studied cases

Characteristics	Mean±SD	Range
Time (days)	3.1±1.3	2.0–7.0
		n (%)
Time categories (days)		
2.0–4.0		17 (85.0)
5.0–7.0		3 (15.0)
Total=20.		

Table 8 Cosmetic outcome (patients' opinions) among the studied cases

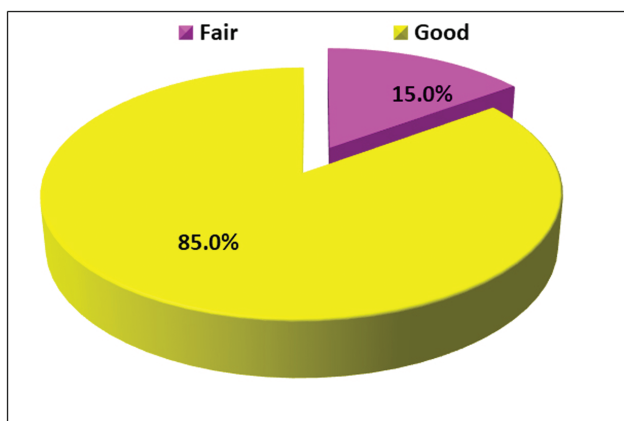| Grades	n (%)
Good	17 (85.0)
Fair	3 (15.0)
Poor	0
Total=20.	

Figure 14
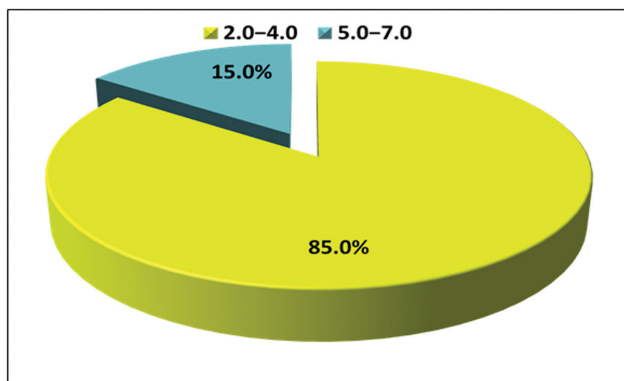
Time of resumption of activity and work among. the studied cases.

Figure 15

Cosmetic outcome (patients' opinions) among the studied cases.

Table 9 Short-term recurrence among the studied cases

Methods	*n* (%)
Clinical	1 (5.0)
Radiological	0
Total=20.	

Figure 16

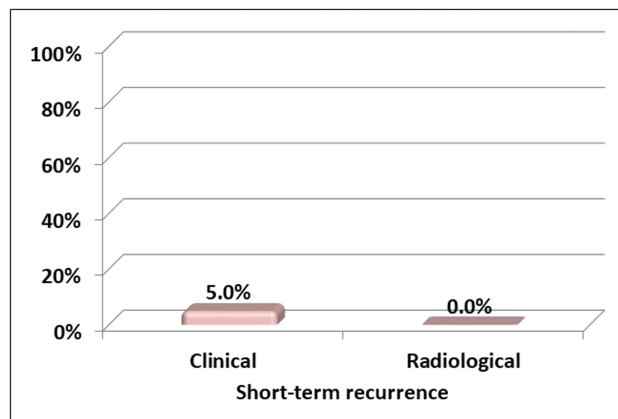Short-term recurrence among the studied cases.

Discussion

Inguinal hernia repair is the most common elective operative procedure done all over the world. It represents about 75% of abdominal wall hernias. Overall, life incidence in men is 27% and in women is 3% [11]. Laparoscopic repair has become the standard for bilateral inguinal hernia repair, recurrent hernia (postanterior approach), and unilateral uncomplicated inguinal hernia in women. Some studies have concluded less pain and recurrence in laparoscopic repair than in open repair [12]. Laparoscopic inguinal hernia repair started in 1990. Many techniques were proposed. However, only two laparoscopic techniques have stood the test of time; namely TAPP repair and total extraperitoneal repair [11]. Since various surgical approaches for management of inguinal hernia represents major conflict and may be associated with complications of pain and recurrence, evaluating the laparoscopic approaches for repair of inguinal hernia was highlighted as a main point of interest [11].

However, all cases in the current study underwent laparoscopic TAPP repair technique so, this study was conducted and aimed to assess the laparoscopic hernia repair in bubonocele in terms of risks, advantages, ease of technique, benefits, and postoperative outcome including recovery time and incidence of postoperative complications. This prospective cohort study was conducted from June 2022 till September 2022 and performed on a total of 20 patients who had inguinal hernia and candidate for laparoscopic hernia repair. During this study, 30 patients were assessed for eligibility and 20 patients were included in the study. Of all eligible patients, six patients were excluded from the study based on the inclusion criteria and four patients refused to participate in of the study. Ultimately, the analysis was based on the data of 20 patients who had inguinal hernia and candidate for laparoscopic hernia repair. In the current study all cases were males. Thirty-five percent of cases were obese and 60% of cases aged between 40.0 and 49.0 years. Twenty percent of cases had bilateral inguinal hernia. Bilateral hernias are best repaired laparoscopically. There is less postoperative pain, full recovery is better and return to work is faster [9].

As regards operative characteristics, our study results revealed that the operative time ranged between 50 and

80 min in 75% of cases, the most frequent operation time was 60.0–79.0 min (60.0%) operative time more than 90 min were limited to cases with bilateral hernia. Inguinal hernia repair guidelines reviewed the results of 22 previous studies and found that the mean operative time for TAPP was 57 min which ranged from 34.5 to 104.5 min [4]. The previously published studies that compared the operation time between open and laparoscopic procedures confirmed the shorter operation time in open procedure as mentioned by Abbas *et al.* [13] (46.3±8.92 min in TAPP vs. 45.3 ±9.85 min in open), Pokorny *et al.* [14] (66±183.52 in TAPP vs. 48±73.4 in open), and Schmedt *et al.* [15] (mean time, 65.7 min with range, 40–109 in TAPP vs. 55.5 min with range, 34–99 in open Lichtenstein repair). The operative time could be affected by the surgeon experience, comparing the experienced surgeon with the surgeon during the learning curve, the operative time was significantly shorter with the more experienced surgeon with a *P* value less than 0.001. This was shown in a study comparing the operative time, morbidity, and recurrence between the expert surgeons and trainee surgeons [16].

In our study there were no significant intraoperative complications. Bleeding recorded only in one (5.0%) case, which was mild and was managed intraoperatively with cautery and clipping with no need for blood transfusion. Pokorny *et al.* [14] 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 [14]. Through the surveys filled by the operating surgeons in our study, 55% of the cases were considered to be technically easy by the operating surgeons.

As regards postoperative characteristics, our study results revealed that almost all cases (100.0%) had stayed in the hospital 1 day only and they were discharged next morning. majority of cases (85.0%) had resumed their daily activity and work within 2–4 days after the discharge date. Seroma was reported in one (5.0%) case which was a mild seroma, measured 7 ml as measured by the ultrasound and were managed conservatively and resolved in 10 days. Postoperative complications in form of seroma, hematoma, and wound infections were documented in some studies done by Abbas *et al.* [13], Pokorny *et al.* [14] 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. In our study surgical site infection

was reported in one (5.0%) case, which was a mild infection of the paraumbilical port site and was managed conservatively. pain was reported in one (5.0%) case during follow up and was controlled by oral analgesics, resolved by the second week. In a meta-analysis done by Schmedt *et al.* [15]. On 34 randomized control trials, laparoendoscopic repairs were associated with fewer incidences of complications of chronic pain syndrome compared with open Lichtenstein repair. The same was reported Salma *et al.* [17] in a small volume study in 2015. Also on 2018 after analyzing data of more than 20 000 patients but with persisting pain in 2–5% of cases treated laparoscopically and the hospital stay ranged between 2 and 4 days in both groups with no significant relation with the performed procedure (*P*=0.115) [18].Ultimately, laparoscopic TAPP repair showed good cosmetic outcome when patients were surveyed in their follow up sessions 85% of cases showed satisfaction about wounds. No short-term recurrence. One case was suspected to have recurrence of the hernia by clinical examination but ultrasound with superficial probing on the inguinal region revealed no defect and no recurrence.

Similar to our study Hussein conducted a randomized comparative prospective study that included 71 cases presented with unilateral inguinal hernia to compare open Lichtenstein with TAPP mesh repair techniques in unilateral inguinal hernia in male patients regarding perioperative outcome and complications and revealed that operation time was 111±22 min in TAPP group and 75±16 min in open 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 and 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) [19].

The strength points of this study are that it is prospective study design, its setting at a single tertiary care center with the same surgical team and the same anesthetic protocol and having no patients lost to follow-up during the study period. It provided information about feasible and successful laparoscopic approach of hernia repair with less intraoperative and postoperative complications.

The limitations of the study are worthy of mention including relatively smaller sample size relative to the

previous studies, not being a multicentric study and this represents a significant risk of publication bias. Another limitation is the lack of comparison with other laparoscopic approach of total extraperitoneal repair or open hernia repair which may underestimate the results of our study. Presence of pandemic COVID-19 which limited the availability of patients.

Conclusion

As evident from current study, TAPP repair of inguinal hernia was a safe, effective, feasible and successful with the advantages of less hospital stay and less operative time Moreover, it is associated with minimal intraoperative and postoperative complications. The present study can burden the knowledge and shed some light on future prospective studies with larger sample sizes demonstrating the long-term outcomes of TAPP repair of inguinal hernia in comparison with other laparoscopic approach or open approach.

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Nil.

Conflicts of interest
There are no conflicts of interest.

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