Laparoscopic inguinal hernia repair: is dual-approach better than classic transabdominal preperitoneal repair?

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Received: 22 January 2020
Revised: 27 January 2020
Accepted: 30 January 2020
Published: 28 August 2020

The Egyptian Journal of Surgery 2020, 39:582–589

Background
Transabdominal preperitoneal repair (TAPP) and total extraperitoneal repair (TEP) are the two major types of laparoscopic repair for inguinal hernia. Although TAPP is easier, there is still some difficulty in sac and peritoneal dissection. As a result of this, a new modification of TAPP, under the name of 'dual approach' (DA), was introduced by inflating the preperitoneal space with CO_2 aiming to facilitate dissection and save time. The early reported results of this approach were encouraging.
Aim
The authors aimed to compare TAPP with the DA.
Patients and methods
In all, 40 consecutive patients with inguinal hernia were prospectively randomized into two equal groups; group I underwent TAPP and group II underwent DA. Preoperative, intraoperative, and postoperative data were collected and statistically analyzed.
Results
The mean age was 43±16 years and the mean BMI was 27.5±3.4. The mean operative time was 76.8±15.9 and 81.2±11.9 for TAPP and DA, respectively, with no significant difference. Within each group, the learning state of the operator affects the operative time significantly. Regarding the operative difficulty from the operator's perspective, there was no significant difference considering both procedures as a whole. However, the lateral and medial preperitoneal dissection was significantly easier for the DA. On the other hand, the difficulty in sac dissection did not significantly improve with the DA. There was no significant difference between both groups regarding hospital stay, intraoperative and postoperative complications, number of analgesic doses, postoperative pain, or recurrence.
Conclusion
DA offers easier dissection of the lateral and medial pre-peritoneal pockets but not the sac. However, this new approach does not offer advantages over the classic TAPP regarding operative time, hospital stay, complications, postoperative pain, or recurrence.

Keywords:
dual approach, inguinal hernioplasty, laparoscopy, pre-peritoneal gas dissection, TAPP

Egyptian J Surgery 39:582–589

1110-1121

Introduction

Inguinal hernia repair is the most common elective operative procedure done all over the world [1]. It represents about 75% of abdominal wall hernias. Overall, life incidence in men is 27% and in women is 3% [2].

Since 1887, when Bassini invented his technique, several techniques of open inguinal hernia repair have been used. Laparoscopic inguinal hernia repair started in 1990. Many techniques were proposed. However, only two laparoscopic techniques have stood the test of time; namely transabdominal preperitoneal repair (TAPP) and total extraperitoneal repair (TEP).

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 (by an experienced surgeon) than in open repair[3].

Comparing both TAPP and TEP, TAPP entails working in the large abdominal cavity, easier

handling of instruments, suitability for patients with previous prostatectomy or lower abdominal incisions, in addition to shorter learning curve. However, TEP advantages include absence of breaching of the abdominal cavity and less risk of abdominal visceral and vascular injuries.

Although TAPP is easier than TEP, there is some difficulty in sac and peritoneal dissection. In this regard, a new modification of TAPP repair under the name of 'dual approach' (DA) was introduced by Nasr in 2016. He used CO_2 insufflation in the pre-peritoneal space before peritoneal incision to facilitate dissection of the peritoneum and sac, decrease the operative time and improve intraoperative hemostasis. Early results of this new technique were published in Surgical Endoscopy and were highly encouraging [4]. In this study, we aimed at comparing this new modification; DA with the classic TAPP repair regarding operative time, difficulty of the procedure, intraoperative and postoperative complications.

Patients and methods

This is a prospective randomized study comparing two laparoscopic techniques for surgical repair of inguinal hernias.

The inclusion criteria were:

(1) Age more than 18 years.
(2) Males only.
(3) Indirect inguinal hernia.
(4) Patient is fit for general anesthesia.

The exclusion criteria were:

(1) Recurrent hernia.
(2) Complicated hernia.
(3) Previous lower abdominal incision.

The Institutional Board of Medicine has approved the research protocol. An informed consent was signed by each patient.

The recruited patients were divided by simple randomization into two equal groups: laparoscopic TAPP repair for patients in group I while laparoscopic DA for group II.

Preoperatively, all patients were fasting for 8 h. A single shot of Cephalosporin was administered with induction of anesthesia.

Surgical techniques

Group I: TAPP

(1) A 10 mm incision at the umbilical scar (upper crease) or 1 cm above according to the size of the abdomen.
(2) Veress needle insertion, CO_2 gas inflated after confirming its position inside the abdominal cavity.
(3) A 10 mm trocar insertion through the same incision, for a 30° telescope.
(4) Two working ports inserted according to the site of hernia (right, left, or bilateral).
(5) In right side hernia a (10 mm) port inserted at the midclavicular line 2 cm above the umbilical level and another (5 mm) port 2 cm at the left midclavicular line below the umbilical level.
(6) In the left side we insert a (10 mm) port at the midclavicular line 2 cm below the level of the umbilicus and a (5 mm) port at the left midclavicular line 2 cm below the umbilical level,
(7) In bilateral hernia the three ports are nearly at the same level, midclavicular line, the right side (10 mm), and the left (5 mm).)
(8) Peritoneal incision 4–6 cm above and lateral to the hernia defect and passing medially till the medial umbilical ligament (obliterated umbilical artery) with slight upward extension at the medial end.
(9) Lateral and medial dissection, till peritoneal reflection over the psoas muscle and appearance of Cooper's ligament, respectively.
(10) Sac dissection was done and separate the sac from the gonadal vessels laterally and vas deference medially.
(11) A 15×10 cm polypropylene mesh was inserted to cover the myopectineal orifice of Fruchaud.
(12) Fixation of the mesh was done either by tuckers, fibrin glue, or by simple stitches. Peritoneal flaps are closed by (Vicryl 00) continuous suturing.
(13) Deflation of abdominal cavity and closure of port sites was done.

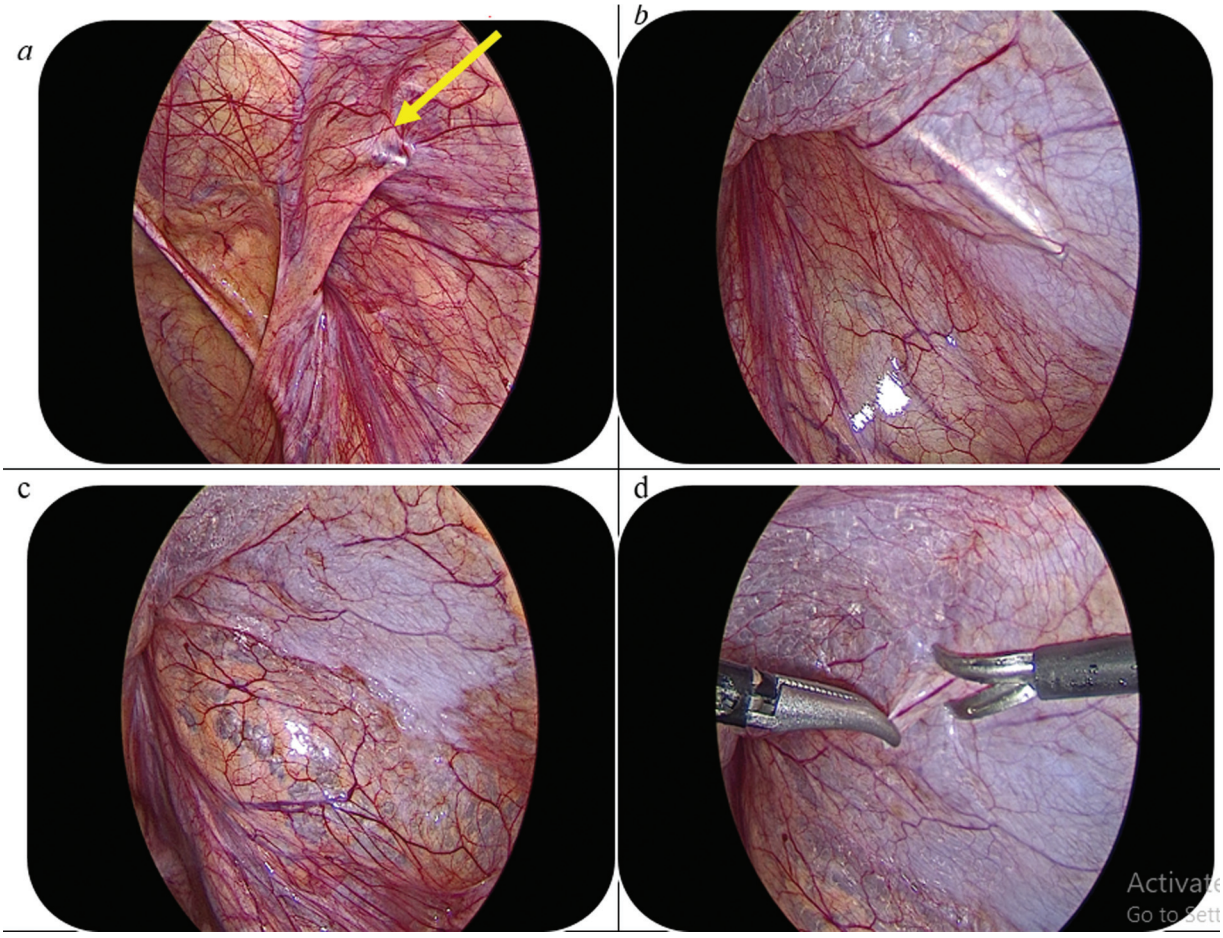
Group II: dual approach

As described by Nasr in 2016 in the *Journal Surgical Endoscopy* [4].

In this approach, before peritoneal incision as in TAPP, an additional step was done:

(1) A small snip is done at the site lateral to the pubic tubercle; the Veress needle is inserted till the preperitoneal space (under vision) (Fig. 1a).
(2) The insufflation gas connected to the Veress needle and the abdomen partially deflated to

Figure 1



One of our cases in (group II). (a) Veress needle insertion to the pre-peritoneal space under vision; (b) CO_2 inflation with Veress needle manipulation laterally and medially; (c) complete inflation; and (d) peritoneal incision as in classic transabdominal preperitoneal repair.

decrease the counter pressure and under vision the needle manipulated to inflate the areas medial and lateral to the cord and sac area (Fig. 1b and c).

(3) The pressure increased to 18–20 mmgh) for 3–5 min.
(4) Then complete the procedure as in group I (TAPP) repair (Fig. 1d).
(5) Preoperative, intraoperative, and postoperative data were prospectively collected including demographic data, characteristics of the hernia, operative time, difficulty of the procedure (subjective assessment of difficulty of the operative procedure by the operator with five grades), complications, and recurrence.

The procedures were performed by two operators: one was beyond the learning curve of laparoscopic hernia repair and the other was within the learning curve. Regarding postoperative pain, all patients were given a single injection of Ketorolac 30 mg at 6 h postoperatively. At 12 h, all patients were assessed by visual analog scale (VAS) and accordingly, they were given an additional dose every 6 h if needed till fulfilling the criteria of discharge. The number of analgesic doses was used as an additional indicator of pain severity.

Statistical analysis

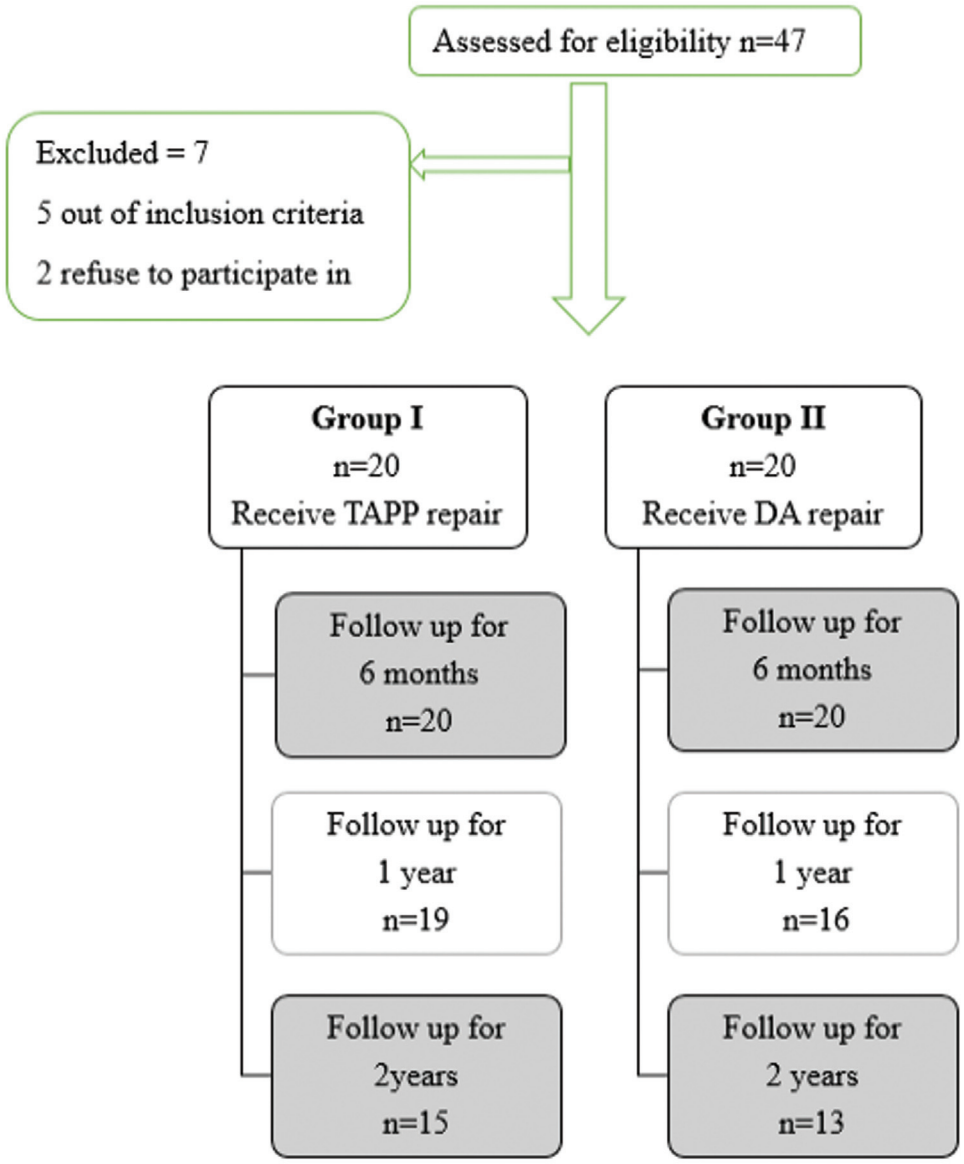
All data are collected in Excel file and by using SPSS version 20 (Statistical analysis was done using IBM SPSS statistics for windows, Version 20.0. Armonk, NY: IBM Corp.), different statistical tests were done (independent t test, Mann–Whitney U test, and χ^2-test). P value less than 5% is considered significant.

Results

In all, 47 patients were considered for this study, but only 40 patients were eligible for inclusion. Five patients were excluded and two refused to participate. Each of the two groups included 20 patients. All cases were followed up; however, the follow-up period affected according to the date of the procedure as shown in Figure 2.

Regarding the demographic data and hernia characteristics, both groups were comparable with no

Figure 2



Diagrammatic representation of the number of patients distributed in different groups and follow-up.

Table 1 Data on sociodemographic and hernia characteristics

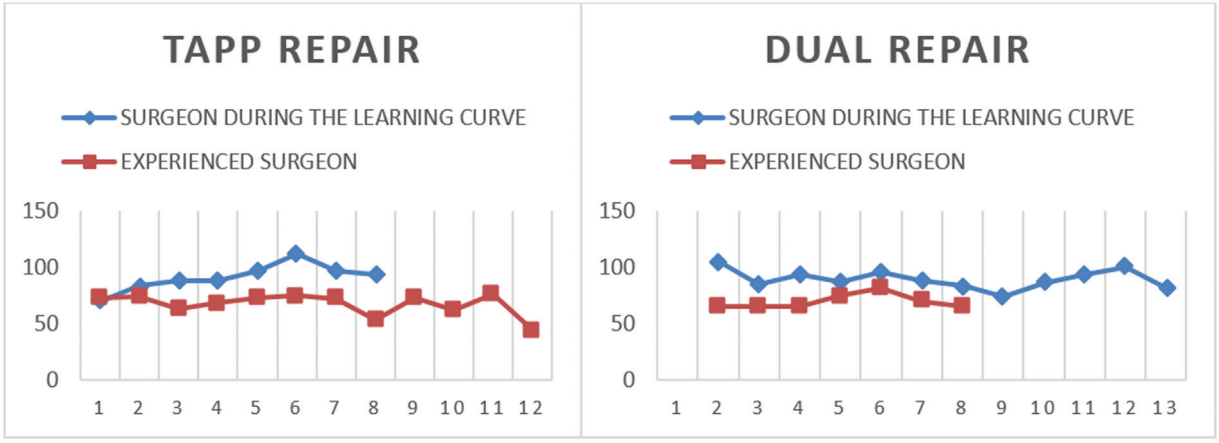
	Group I: TAPP	Group II: dual approach	Total	*P* value
Sociodemographic data				
N	20	20	40	
Age	45.5±17	40±15	43±16	0.28
BMI	27.5±3.3	27.6±3.6	27.5±3.4	0.89
Heavy weight lifting jobs	12	14	26	0.51
Smokers	13	13	26	1.0
Hernia characteristics				
Right/left side	12/8	12/8	24/16	1.0
Complete type	6/20	8/20	14/40	0.74

TAPP, transabdominal preperitoneal repair.

statistically significant difference as illustrated in Table 1.

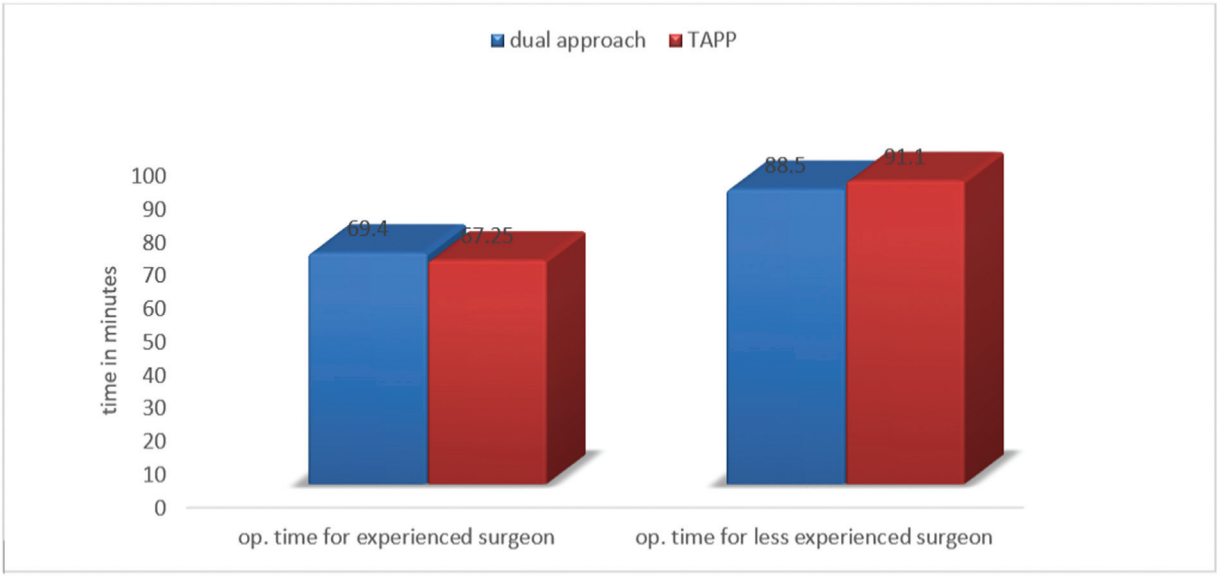
Regarding the experience of the surgeon, 19 cases (12 in group I and seven in group II) were performed by the surgeon beyond the learning curve, while 21 cases (eight in group I and 13 in group II) were done by the other surgeon within the learning curve. The two groups were comparable regarding the

Figure 3



Operative time difference between the surgeons in both groups.

Figure 4



Comparing the operative time between the two groups as regards the experience of the surgeon.

distribution of cases with surgeon's experience (*P*=0.11) (Fig. 3).

Regarding operative time, there was no statistically significant difference between the two groups (*P*=0.32).

However, comparing both operators with different experience, the operative time was significantly shorter for the more experienced surgeon (*P*=0.001) as shown in the linear chart.

Within the cases performed by the same surgeon, there was no statistical difference in operative time between both groups (*P*=0.898**)** in comparing the cases done by an experienced surgeon, and (*P*=0.45) in comparing the cases of two groups done by the surgeon during the learning curve as shown in Fig. 4.

As regards the difficulty of the procedure, three main steps were assessed for each procedure; namely dissection of the sac, lateral side of the preperitoneal pocket, and the medial side of preperitoneal pocket. From the point of view of the surgeons, the DA was significantly easier than TAPP regarding the lateral and medial side dissection, (*P*=0.016 and 0.017, respectively). On the other hand, the difficulty of sac dissection was not significantly different between the two groups (*P*=0.464**)**.

Table 2 Complications in both groups

Complications	Group I	Group II	*P* value
Hematoma	0	0	
Seroma op. site scrotal<	0	1	
	2	0	
Surgical site infection	0	1[a]	
Chronic pain	1[b]	0	
Urine retention	0	1	
Dysejaculation	1[b]	0	
Emphysema	0	1	
Recurrence	0	0	
Total [*n* (%)]	3 (15)	4 (20)	0.681

[a]Developed on top of seroma at the operative site after aspiration.
[b]Complications happened in the same case at the same time.

Assessed by VAS, postoperative pain was not significantly different between the two groups (2.15 and 1.90 for groups I and II, respectively and (*P*=0.348). Also, the average analgesic doses were not different (1.55 and 1.4 for groups I and II, respectively, *P*=0.675).

Three postoperative complications (as shown in Table 2) were reported (15%) in group I in the form of two cases of seroma and one case of chronic pain with a burning sensation during ejaculation. In group II, four complications (20%) were reported in the form of seroma, scrotal emphysema, urinary retention, and surgical site infection. There was no statistically significant difference between both groups regarding the complication rate (*P*=0.681).

The average hospital stay in hours was 14.2 and 13.1 for groups I and II, respectively. There was no significant difference between both groups (*P*=0.678).

No recurrence was reported during the period of the study with a mean follow-up period of 23 months ranging from 8 to 45 months.

Discussion

Laparoscopic repair started in 1990. TAPP repair and TEP repair are the two major types of laparoscopic repair. TAPP has advantages over TEP in the form of working in the large abdominal cavity, easy to handle instruments, suitable for patients with previous prostatectomy or lower abdominal incisions, and shorter learning curve. However, TEP has the advantages of not breaching the abdominal cavity, less risk of visceral or vascular injuries, and less operative time.

Although TAPP is easier than TEP, there is some difficulty in the sac and peritoneal dissection. As a result of this, a new modification of TAPP repair known as DA was introduced by Nasr by injecting CO_2 at the preperitoneal space before peritoneal incision. This additional step is expected to facilitate dissection, decreases the operative time, and improves intraoperative hemostasis. The early results of this study were published in Surgical Endoscopy in 2016 and were encouraging [4]. Our study aimed to compare the new modification (DA) with standard TAPP repair as regards operative time, difficulty of the procedure, and intra and postoperative complications.

Data on demographic and hernia characteristics show no statistically significant difference between both groups.

This study suggested no difference in operative time between TAPP repair and DA repair as regards the operative time, difficulty of the whole procedure, intra- and postoperative complications. However, there was statistically significant difference between the two groups as regards the difficulty assessment of individual steps (lateral and medial preperitoneal pocket dissection).

As regards operative time, there was no statistically significant difference between the two groups (*P*=0.567**)**. The mean operative time was 76.8 ±15.9 min group I and 82.3±11.9 min in group II.

In 2018, 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 [3,5], which is the same in our study. In a previous report on early results of the DA repair [4], the mean operative time was 39±2 min, which is much less than in our study for a DA group (82.3 min). This could be explained due to patient selection, in the published results only patients with bubonoceles were operated upon; in contrast to our randomized study, 40% of cases of group III (DA) were of complete type, and more cases (65%) were operated by the surgeon during the learning curve.

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 previously shown in a study comparing the operative time, morbidity, and recurrence between the expert surgeons and trainee surgeons [6].

Evaluating the whole operative procedure difficulty according to the subjective assessment by the

operator on a scale ranging from 1 to 5 (1 is the easiest and 5 is the most difficult), both procedures were not significantly different. However, if different steps of the DA (sac dissection, lateral side, and medial side of preperitoneal pocket) were individually assessed and compared with the same operative step in TAPP. The lateral and medial dissection were significantly easier in DA compared with TAPP. On the other hand, the difficulty of sac dissection appeared to be similar in both procedures; this difference could be explained by the distribution of the CO_2 gas dissected into the preperitoneal space on both sides of the sac but not within the spermatic cord surrounding the sac.

In our study, we reported two intraoperative complications, one for each group. Both were injury to the inferior epigastric vein during its dissection from the peritoneal membrane. Both cases occurred with the operator during the learning curve. The published data for the early results of DA [4] reported no intraoperative complications.

Regarding acute postoperative pain, both groups showed no significant difference using the VAS scale as an indicator. In our study VAS was 2.10 and 1.9 for group I and group II, respectively. The mean postoperative pain in TAPP as reported in a study was 1.83±0.433 [7], which is the same as in our study.

In our study, TAPP did not significantly differ from DA regarding post-operative complications with rates of 15 and 20%, respectively. In 2018, inguinal hernia repair guidelines reviewed 24 comparison studies and found that TAPP complication rates ranged from 1.23 to 49% (median of 11.4%) [5].

There was one case of chronic pain (5%) in group I; this was a dull aching pain with no specific dermatomal distribution for more than 6 months which increased with strenuous activity. However, it was tolerated with time and relieved by a small dose of oral analgesia. A meta-analysis and systemic review revealed 8% of chronic pain in TAPP repair [8], which is comparable to our study results. A previous report on early results of DA revealed no chronic pain with a follow up of 27 months [4]

As regards seroma; 4 out of 40 (10%) were complicated by seroma. There was one case of surgical site seroma in group II in the preperitoneal space which was complicated by surgical site infection. After failure of conservative treatment, ultrasound-guided aspiration was done which revealed a clear serous fluid; however, after 1 week the patient presented with tender swelling for which he underwent another ultrasound-guided aspiration, and frank pus was revealed. Pigtail drainage was performed with culture and sensitivity and antibiotic treatment (both IV and irrigation through pigtail three times with gentamycin). The patient improved with removal of the drain within 3 weeks. There were three cases of scrotal seroma, two in group I and one in group II. This could be explained by leaving the distal part of the sac in some cases which leads to fluid collection postoperatively. Only one case in group I underwent complete aspiration while the other two cases had expectant treatment with complete resolution. Comparable to our study results (10% of seroma and 2.5% of infection), a meta-analysis revealed that the rate of infection in TAPP was 2.1%, and the rate of seroma was 15.3% [9]. A previous report on early results of DA revealed no infection or seroma in 212 cases [4].

Regarding urinary retention, we reported a single case (5%) in group II, which underwent temporary catheterization once. This was comparable to the percentage of urinary retention in TAPP meta-analysis which was 5.4% [10–13].

In our study, we reported one case (5%) of scrotal emphysema in the DA group. This could be explained by inflation of the pre-peritoneal space by CO_2, which passes through the tissues to the scrotum and subcutaneous tissues. Scrotal emphysema resolved spontaneously after 24 h, which prolonged the hospital stay but does not require additional analgesic doses. A previous assessment of DA reported that nine cases out of 212 (4.25%) developed emphysema [4].

We reported a single case of dysejaculation (5%), in the TAPP group, which was described as discomfort and mild burning pain at the time of ejaculation. It was reported that 1–2% of dysejaculation occurred in postlaparoscopic hernioplasty due to the traction of the vas by fibrosis or mesh shrinkage [14].In our study, hospital stay did not significantly differ between both groups. In a previous report on early results of DA, hospital stay ranged from 10 to 14 h [4] which is comparable to our results. However, in a meta-analysis about TAPP, hospital stay varied from 1 to 2.4 days [9].

In our study, the recurrence rate was 0% in both groups with the total follow-up duration being 23 months which ranged from 8 to 45 months. This is a relatively short duration of follow-up and is required to be extended for a stronger evidence about recurrence.

The recurrence rate in the meta-analysis (which extended follow ≥70 months) was 3.5 for TAPP [15]. In a previous report on early results of DA, there was no recurrence in the first 212 cases operated upon with a follow up of 27 months which ranged from 24 to 32 months [4].

Conclusion

There was no significant difference between TAPP repair and DA repair regarding operative time, intraoperative and postoperative complications, or hernia recurrence. However, regarding the difficulty of dissection, DA did not facilitate sac dissection in spite of facilitating lateral and medial pocket dissections. Consequently, in our study, DA was not generally superior to TAPP for laparoscopic inguinal hernia repair.

Acknowledgements

The authors acknowledge the surgical and the nursing team for the clinical care of the patients included in this study.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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