Outcome of transabdominal preperitoneal versus open preperitoneal approach for treatment of recurrent inguinal hernia: a randomized control study

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Background
Up till now, there is a great concern about the optimal technique for repair of recurrent inguinal hernia. The aim of this study was to evaluate the outcome of transabdominal preperitoneal (TAPP) repair versus open preperitoneal approach for treatment of recurrent inguinal hernia.

Patients and methods
The present study included 72 male patients with recurrent inguinal hernia who were randomly allocated into two groups: group A (n=36) underwent TAPP, whereas group B (n=36) underwent open preperitoneal repair. For both groups, the operative time, intraoperative complications, postoperative complications, hospital stay, and return to normal activities were recorded. Follow-up was designed for 1 month for early postoperative complications and up to 2 years for recurrence.

Results
The mean age of the included patients was 42±15.2 and 44±11.9 years in groups A and B, respectively. There was no statistically significant difference between the mean operative time between both groups (P=0.064) and the mean hospital stay (0.34). The reported intraoperative complications showed no statistically difference between both groups. Seroma was reported in four (11.1%) cases in group B, and this was significantly higher than that reported in group A, where only one (2.8%) case was reported of postoperative seroma. There was no statistically significant difference in the 2-year follow-up recurrence in the two groups (P=0.092).

Conclusion
Both TAPP and open preperitoneal are reliable and applicable procedures for treatment of recurrent inguinal hernia with a low recurrence rate and minimal postoperative complications.

Keywords:
open preperitoneal repair, recurrent hernia, transabdominal preperitoneal

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Introduction

Inguinal hernia is well known as a protrusion of the intra-abdominal content fat through a defect in the inguinal area [1]. There is a direct proportion between the age and incidence of inguinal hernia; the chance of inguinal hernia occurrence increases with increasing age, especially in men from the fifth to the seventh decade of life [2,3]. The chance of a person having to undergo an inguinal hernia operation during his life is quite high, being 27% in men and 3% in women [4].

The possibility of complications from inguinal hernia is high, so inguinal hernia should be repaired surgically to avoid hernia complication, even if it was asymptomatic. Being one of the most frequently performed surgical procedures worldwide, inguinal hernia repair is regarded as a major economic burden on the health care sector [5,6].

Success of groin hernia repair can be considered primarily by the permanence of the operation, incidence of complications, minimal costs, and early return to normal activities. Recurrence is considered as the main factor in determining the success of inguinal hernia repair method. Before introduction of mesh technique in hernia repair, recurrence rates were accepted to be of over 15% for primary repair [7]. Nowadays after wider usage of nonabsorbable mesh implants, both in open and laparoscopic repairs, reduction of recurrence rates has been noticed but still recurrence occurs owing to various factors. Repair of a recurrent inguinal hernia is considered as

a high technical challenge for surgeons because of anatomical distortion caused by scar tissue of previous operation. This is beside the higher risk for complications or development of re-recurrence, as the tissue tends to be weaker than at the time of primary repair [8].

Although a lot has been published about primary repair of inguinal hernias, the best approach to repair a recurrent hernia is still a gray area. Most surgeons recommend using posterior mesh repair in recurrent hernias after previous anterior repair; this is due to the high risk associated with the repeated anterior repair, besides that surgeons will be offered the feasibility to explore virgin tissue planes with easier dissection during which the parietal peritoneum behind the posterior floor is nearly untouched. Posterior approach can be achieved by either laparoscopically or open technique [1].

The open posterior preperitoneal mesh repair popularized by Nyhus [9] is still a good choice for recurrent inguinal hernias repair. The main advantages of the open preperitoneal approach are mesh placement in the preperitoneal space where the hernia is produced and avoiding the disadvantage of reoperating through scar tissue especially with the limitations in financial capabilities and lack of enough experience in laparoscopic hernia repair [10].

With the rapid advancement of laparoscopic technology, laparoscopic posterior repair techniques [transabdominal preperitoneal (TAPP) and totally extraperitoneal] have gained increasing popularity and have begun to replace open conventional techniques as a procedure of choice for recurrent inguinal hernia repair. This is attributed to their well-established advantages such as less postoperative pain, rapid recovery, and a lower incidence of infections, especially with highly experienced surgeon [11]. However, the costs and long learning curve are the two major disadvantages of the laparoscopic approach [12].

The debate about the most effective and feasible method for treatment of recurrent inguinal hernias using either laparoscopic or open posterior approach has motivated the authors to conduct this study.

Patients and methods

Study design and patients

This prospective randomized study was conducted following the ethical prospective of the World Medical Association Declaration of Helsinki where ethical approval was obtained from ethical and research committees of Benha University.

The current study was conducted at the Department of General Surgery of Benha University Hospital throughout the period from October 2018 till March 2022.

The present study included 72 adult male patients with recurrent inguinal hernia after conventional Lichtenstein hernia repair with BMI less than 35 kg/m^2.

Exclusion criteria included patients with BMI more than 35 kg/m^2 or American Society of Anesthesiologists score more than 3. Patients who refused to be included within the study were also excluded.

Eligible patients included in this study were randomly allocated into two groups: group A (n=36) underwent TAPP repair, whereas group B (n=36) underwent open preperitoneal repair.

A written informed consent was obtained from all patients included in the study.

After complete history taking and physical examination and investigations, both procedures were done under general anesthesia, which was induced with propofol and rocuronium and maintained with sevoflurane inhalation and intermittent injection of rocuronium or cisatracurium.

Randomization

Randomization of patients was done by specific software (random allocation software 1.0, 2011) into two equal groups.

Procedures

Group A

The established protocol was followed in all eligible patients, including intravenous antibiotics with induction of anesthesia and insertion of urinary catheter preoperatively. A 10-mm trocar was inserted above the umbilicus followed by insufflation of the abdomen with CO_2 with average pressure of 14. Another two 5-mm ports were inserted in the lateral side of both recti muscles. Exploration of the abdomen and both inguinal region was a mandatory step before any dissection to establish the diagnosis. A transverse incision in the peritoneum was done 5 cm above the hernia orifice and then upper and lower peritoneal flap

(Fig. 1a) were created by blunt dissection and using an energy source only for hemostasis. Dissection was continued medially to the pubic bone and 6-cm lathe edge of the defect to create a proper space for mesh insertion (Fig. 1b). The hernia sac was dissected from the spermatic cord (Fig. 1c) till its complete retraction or its cutting in large hernias. A 15×15 mesh was tailored and fixed to the pubic bone and abdominal wall using endotakers (Fig. 1d).

Group B

In this group, the protocol of repair was done following the original one described by Nyhus *et al.* [13]. A transverse lower abdominal incision was done including the anterior rectus sheath (Fig. 2a) and then proper retraction of the recti muscles was done for proper approach to the preperitoneal space using blunt dissection (Fig. 2b). Complete exposure of the myopectineal orifice was done where the hernia sac was dissected from the cord and reduced (Fig. 2c). A 15×15 cm mesh was tailored and fixed to cover the whole myopectineal orifice (Fig. 2d).

Evaluation and follow-up

For both groups, the operative time, intraoperative complications, postoperative complications, postoperative pain, thigh numbness, hospital stay, and return to normal activities were recorded.

Follow-up was designed for 1 month for early postoperative complications and up to 2 years for long-term complications, especially recurrence.

Outcomes

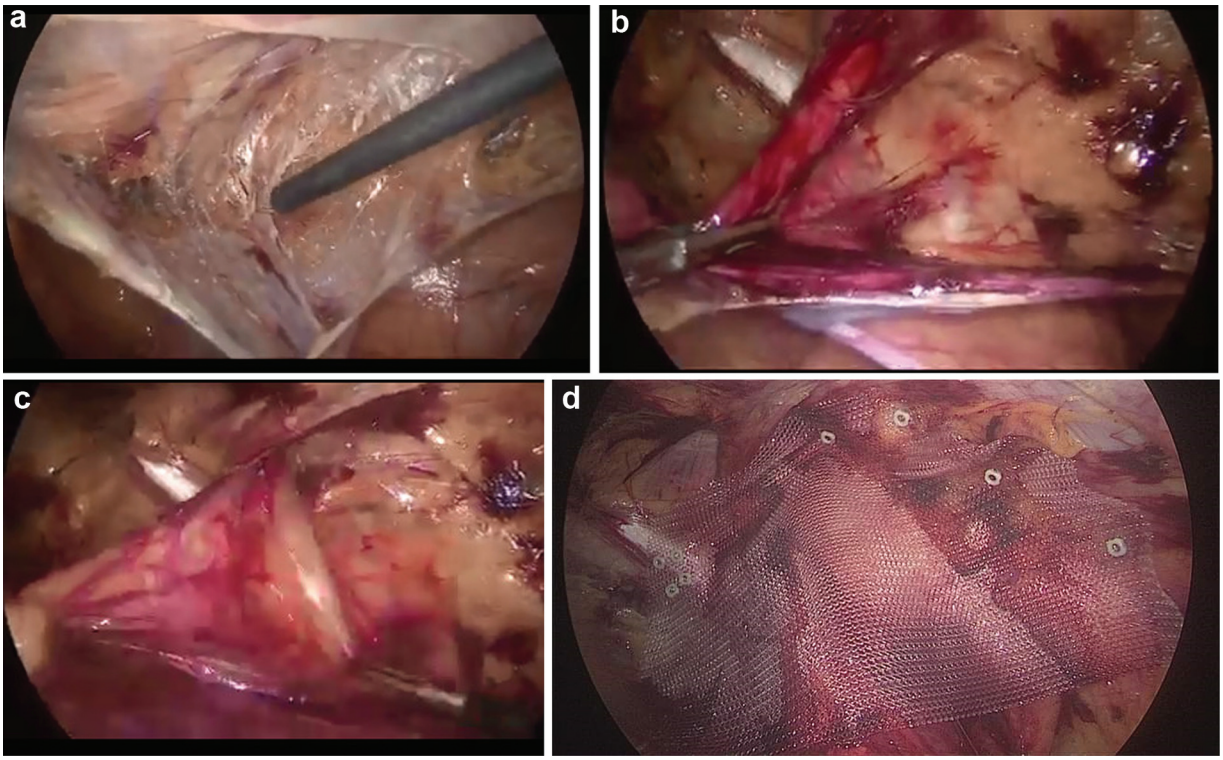
The primary outcome was successful repair of recurrent inguinal hernia with minimal short-term complications.

The secondary outcome was decrease of the hospital admission days and absence from work together with decreased incidence of recurrence.

Statistical analysis

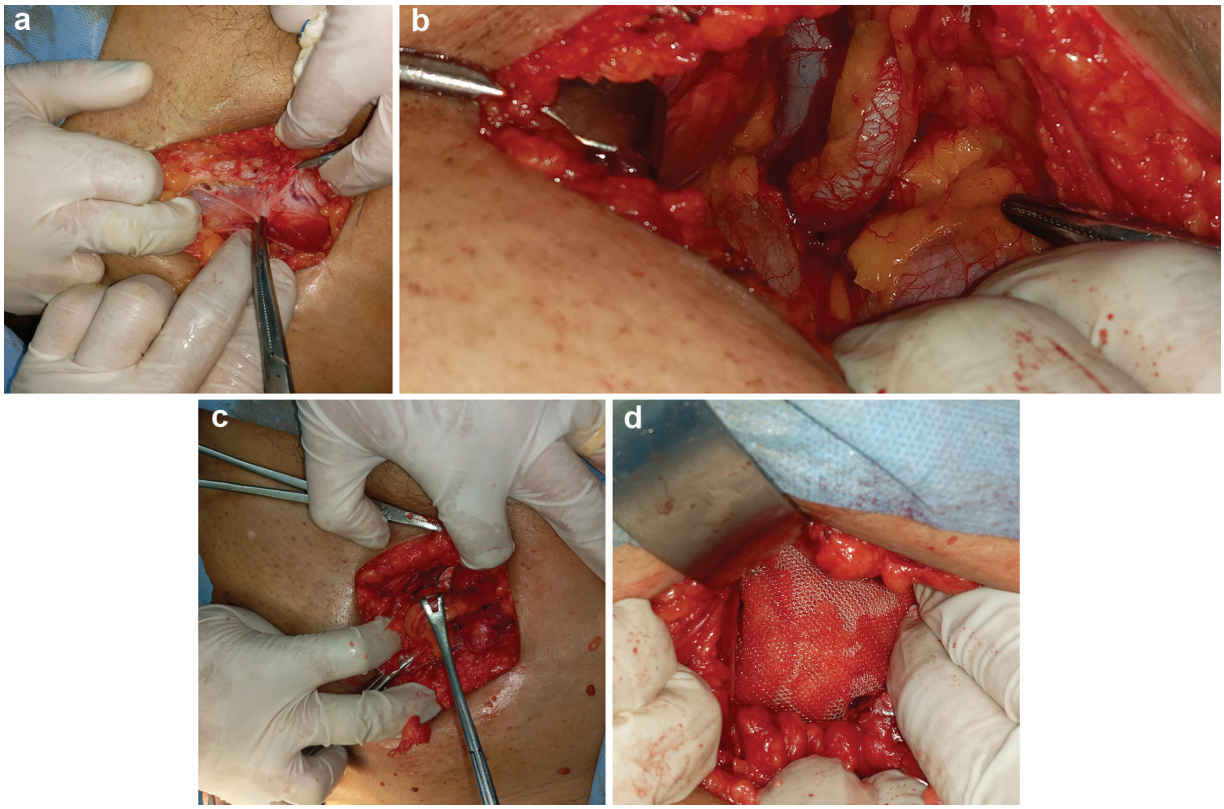
The sample size was calculated depending on the incidence of postoperative complications, which is the primary outcome of this study, and 2-year follow-up for recurrence with incidence of 10% loss in follow-up. A sample size of 36 in each group was considered with a power of 80%, *P* value of 0.05, and an effect size of 0.7 using G*power 3.1 software (Universities, Dusseldorf, Germany).

Figure 1



TAPP approach. (a) Peritoneal dissection and creation of peritoneal flap. (b) Identification of cord. (c) Dissection of sac. (d) Insertion and fixation of mesh. TAPP, transabdominal preperitoneal repair.

Figure 2



Open preperitoneal approach. (a) Transverse incision of the rectus sheath. (b) Proper preperitoneal dissection. (c) Identification of cord and dissection of sac. (d) Insertion and fixation of mesh.

SPSS, version 25 (IBM Corp., Armonk, New York, USA) was used for statistical analysis. Student *t* test was used for quantitative parameters that were described using mean and SD. The χ^2 test was used for qualitative parameters that were described as the frequency with percent. *P* values of less than 0.05 were considered significant.

Results

The current study included 72 patients with recurrent inguinal hernia who were randomly allocated into two groups: group A underwent the TAPP approach (n=36), with a mean age of 42±15.2 years, whereas group B underwent open preperitoneal repair (n=36), with a mean age of 44±11.9 years. There was no statistically significant difference between the two groups regarding age, comorbidities, or other sociodemographic data (Table 1). There was no statistically significant difference between the mean operative time between both groups (P=0.064) or the mean hospital stay (P=0.34) (Table 2). The reported intraoperative complications including hemorrhage or injury of important structures showed no statistically significant difference between both groups. Seroma was reported in four (11.1%) cases in group B, and this was significantly higher than that reported in group B, where there was only one (2.8%) case of postoperative seroma. There was no statistically significant difference in the 2-year follow-up recurrence in the two groups (P=0.092). Other postoperative complications are described in Table 2 and showed no statistically difference between the two groups. Early postoperative pain was assessed, and the present study shows no significant difference between groups A and B regarding pain reported via the visual analog scale score (mean 3.1 vs. 3.39, respectively; P=0.0823). There was statistically significant higher time off from work and return to daily activities in group B than that in group A (P<0.001) (Table 3).

Discussion

Up till now, there is a great concern about the optimal technique for repair of recurrent inguinal hernia owing to high risk of recurrence and complications [14].

Laparoscopic repair for recurrent inguinal hernia is highly suggested by Kockerling and Simons [15] after careful revision of updated hernia repair

Table 1 Sociodemographic data and patient comorbidities

Characteristic	Group A: TAPP (*N*=36)	Open preperitoneal approach (*N*=37)	*P* value
Sex (mean±SD)	42±15.2	44±11.9	0.324
ASA score (mean±SD)	1.5±62	1.4±83	0.421
HTN [*n* (%)]	3 (8.3)	4 (11.1)	0.725
DM [*n* (%)]	5 (13.9)	4 (11.1)	0.792
IHD [*n* (%)]	2 (5.6)	3 (8.3)	0.569
Smoking [*n* (%)]	9 (25)	10 (27.8)	0.07
BMI (mean±SD)	28±6.7	27±7.8	0.079
Employment [*n* (%)]			
Nonphysical	3 (8.3)	2 (5.6)	0.569
Light physical	11 (30.6)	12 (33.3)	0.469
Heavy physical	10 (27.8)	9 (25)	0.07
Retired	12 (33.3)	13 (36.1)	0.13

ASA, American Society of Anesthesiologists; DM, diabetes mellitus; HTN, hypertension; IHD, ischemic heart disease; TAPP, transabdominal preperitoneal.

Table 2 Intraoperative and postoperative complications

	Group A: TAPP (*N*=36)	Open preperitoneal approach (*N*=37)	*P* value
Intraoperative complications [*n* (%)]	0	0	1.00
Early postoperative complications [*n* (%)]			
Wound infection	1 (2.8)	1 (2.8)	1.00
Seroma	1 (2.8)	4 (11.1)	<0.001
Hematoma	1 (2.8)	2 (5.6)	0.072
Urine retention	2 (5.6)	3 (8.3)	0.559
Pain score (mean±SD)	3.1±1.2	3.39±1.9	0.7846
Late postoperative complications [*n* (%)]			
Recurrence	2 (5.6)	3 (8.3)	0.559
Loss or change in sensation	1 (2.8)	2 (5.6)	0.072
Abdominal wall stiffness	1 (2.8)	2 (5.6)	0.072
FB sensation	1 (2.8)	1 (2.8)	1.00
Testicular atrophy	0	0	1.00

FB, foreign body; TAPP, transabdominal preperitoneal repair.

Table 3 Operative time, hospital stay, and return to activities

	Group A: TAPP (*N*=36)	Open preperitoneal approach (*N*=37)	*P* value
Operative time (mean±SD)	62±13 min	68±9.8 min	0.064
Hospital stay (mean±SD)	2±1.2	2±1.7	0.34
Return to basic activity in days (mean±SD)	2±1.3	3±1.4	0.39
Return to home activity in days (mean±SD)	7±1.5	7±1.9	0.96
Return to work activity in days (mean±SD)	14±2.3	16±2.8	0.93

TAPP, transabdominal preperitoneal repair.

guidelines; however, this technique requires sufficient technical expertise and competency for dealing with recurrent hernia laparoscopically [16].

The distorted anatomy, fibrosis, and already weak tissue make the failure rate of classic open method higher up to 36%, which led to the evolution of posterior preperitoneal repair in such cases. The open preperitoneal mesh approach was described in 1988 by Nhyus [14] as a proper alternative for treatment of recurrent inguinal hernias with the great advantage of mesh placement in the preperitoneal space which is the site where the hernia is produced as well as avoiding the disadvantage of reoperating through scar tissue [17,18].

Success of the technical approach is measured by the incidence of postoperative complications and return to normal activities together with low incidence of recurrence. As documented before, totally extraperitoneal has more complications and is

technically difficult than TAPP. TAPP is currently suggested by many institutes to be the standard technique in recurrent inguinal hernia repair.

However, the feasibility, availability, and the learning curve of laparoscopic hernia repair are still a crucial matter of concern in many institutes, so the open preperitoneal approach can be considered as an alternative technique with high success rate than the traditional Lichtenstein repair [19,20].

In the current study, there were no reported intraoperative complications, and this matched with the results of Yang *et al*. [21] and Abdelsamie *et al*. [19] and other studies [22,23], which reported no major intraoperative complications.

The current study reported no statistically significant difference in the early postoperative complications, including hematoma, urine retention, and wound infection, except for seroma, which was reported in only one (2.8%) case in patients who underwent TAPP, whereas it was reported in four (11.1%) cases in patients who underwent open preperitoneal repair ($P \leq 0.001$). These results were less than those reported by Abdelsamie *et al*. [19] who reported seroma in 9% of cases in TAPP repair, and this is assumed owing to inclusion of cases with previous multiple recurrence in their study.

Feliu *et al*. [10] described that the hospital stay after TAPP repair was shorter than that of the open preperitoneal approach, and this was similar to that reported in the current study, which showed slightly shorter hospital stay in patients who underwent TAPP but still statistically insignificant.

The posthernia repair chronic pain is one of the common complications in classical Lichtenstein repair because of the risk of injury of ilioinguinal and iliohypogastric nerves, and this is much reduced in the preperitoneal approach either laparoscopic or open. This is owing to proper anatomical exposure and dissection away from both nerves reducing the risk of the reported postoperative chronic pain and loss of sensation. In the current study, there was no statistically significant difference in the incidence or severity of chronic postoperative pain between both groups. This matched with the results reported by Yang *et al*. [21], and this is assumed to be owing to the proper dissection and careful fixation of the mesh.

In open repair, early recurrences are attributed to inappropriate operative technique and postoperative infection, whereas late recurrences are mainly due to patient factors like collagen defects, age, and medical morbidities. Finally, in laparoscopic repair, technical aspects of surgery like dissection, mesh size, placement, and fixation are the important factors that determine hernia recurrence [24,25].

The recurrence rate after open preperitoneal repair in the current study was 8.3% (three cases), and this was higher than that reported by Yang *et al*. [21], who reported 2.8% (two cases), and this assumed to be due to the small sample size of the current study.

The reported rate of recurrence after TAPP approach in the current study was 5.6%, and this was slightly lower than the results of Abdelsamie *et al*. [19] who reported 6% rate of recurrence. This may be owing to inclusion of recurrent cases after laparoscopic repair where the procedure is slightly difficult.

Conclusion

According to the current results, both TAPP and open preperitoneal are reliable, effective, and applicable procedures for treatment of recurrent inguinal hernia with a low recurrence rate and minimal postoperative complications.

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Recommendations: further study should be conducted to detect the long-term outcome of both techniques.

Authors contribution: Emad M. Abdelrahman: concept and designed the study, conducted procedure, analyzed data, and drafted the manuscript. Mohamed O. El-Shaer: study design, conducted procedure, and supervised cognitive and behavioral assessments. Mohamed M. Elfiky: collected the data, helped in data analysis, and drafted the manuscript. Mohamed A. Elbegawy: collected the data, conducted procedure, and drafting and final revision.

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Conflicts of interest

There are no conflicts of interest.

References

1 Simon MP, Aufenacker T, Bay-Nielsen M, *et al.* European Hernia Society guidelines on the treatment of inguinal hernia in adult patients. Hernia 2009; 13:343–403.

2 Ruhl CE, Everhart JE. Risk factors for inguinal hernia among adults in the US population. Am J Epidemiol 2007; 165:1154–1161.

3 De Goede B, Timmermans L, Van Kempen BH, *et al.* Risk factors for inguinal hernia in middle-aged and elderly men: results from the Rotterdam study. Surgery 2015; 157:540–546.

4 Primatesta P, Goldacre MJ. Inguinal hernia repair: incidence of elective and emergency surgery, readmission, and mortality. Int J Epidemiol 1996; 25:835–839.

5 Fitzgibbons RJ, Ramanan B, Arya S, *et al.* Long-term results of a randomized controlled trial of a nonoperative strategy (watchful waiting) for men with minimally symptomatic inguinal hernias. Ann Surg 2013; 258: 508–514.

6 Lange JF, Bosch JL, Hop WCJ, *et al.* Operation compared with watchful waiting in elderly male inguinal hernia patients: a review and data analysis INCA Trialists Collaboration. J Am Coll Surg 2011; 212:251–259.

7 Schumpelick V, Treutner KH, Arlt G. Inguinal hernia repair in adults. Lancet 1994; 344:375–379.

8 Van den Heuvel BJ, Wijsmuller AR, Fitzgibbons RJ. International guidelines for groin hernia management. Hernia 2018; 22:1–165.

9 Nyhus LM. Iliopubic tract repair of inguinal and femoral hernia. The posterior (preperitoneal) approach. Surg Clin North Am 1993; 73:487–499.

10 Feliu X, Torres G, Viñas X, Martınez F, *et al.* Preperitoneal repair for recurrent inguinal hernia: laparoscopic and open approach. Hernia 2004; 8:113–116.

11 Langeveld HR, Van't Riet M, Weidema WF, *et al.* Total extraperitoneal inguinal hernia repair compared with lichtenstein (the level-trial): a randomized controlled trial. Ann Surg 2010; 251:819–824.

12 Ramshaw B, Abiad F, Voeller G, Wilson R, Mason E. Polyester (Parietex) mesh for total extraperitoneal laparoscopic inguinal hernia repair. Initial experience in the United States. Surg Endosc 2003; 17:498–501.

13 Nyhus LM, Pollak R, Bombeck CT, Donahue PE. The preperitoneal approach and prosthetic buttress repair for recurrent hernia. The evolution of a technique. Ann Surg 1988; 208:733–737.

14 Yang B, Zhou S, Li Y, Tan J, Chen S, Han F. A comparison of outcomes between lichtenstein and laparoscopic transabdominal preperitoneal hernioplasty for recurrent inguinal hernia. Am Surg 2018; 84:1774–1780.

15 Kockerling F, Simons MP. Current concepts of inguinal hernia repair. Visc Med 2018; 34:145–150.

16 Bansal VK, Krishna A, Misra MC, Kumar S. Learning curve in laparoscopic inguinal hernia repair: experience at a tertiary care centre. Indian J Surg 2016; 78:197–202.

17 Saber A, Ellabban GM, Gad MA, Elsayem K. Open preperitoneal versus anteriorapproach for recurrent inguinal hernia: a randomized study. BMC Surg 2012; 12:22.

18 Campanelli G, Pettinari D, Nicolosi FM, Cavalli M, Avesani EC. Inguinal hernia recurrence: classification and approach. Hernia 2006; 10:159–161.

19 Abdelsamie M, Zeineldin AA, Balbaa MA. Laparoscopic repair for recurrent inguinal hernia after previous laparoscopic approach. Egypt J Surg 2020; 39:1014–1019.

20 Gopal SV, Warrier A. Recurrence after groin hernia repair-revisited. Int J Surg 2013; 11:374–377.

21 Yang B, Zhi-peng J, Ying-ru L, Zong Z, Chen S. Long-term outcome for open preperitoneal mesh repair of recurrent inguinal hernia. Int J Surg 2015; 19:134–136.

22 Millat B. Inguinal hernia repair. A randomized multicentric study comparing laparoscopic and open surgical repair. J Chir (Paris) 2007; 144:119–124.

23 Farooq O, Rehman B. Recurrent inguinal hernia repair by open preperitoneal approach. J Coll Physicians Surg Pak 2005; 15:261–265.

24 Robson AJ, Wallace CG, Sharma AK, Nixon SJ, Paterson S. Effects of training and supervision on recurrence rate after inguinal hernia repair. Br J Surg 2004; 91:774–777.

25 Kukleta JF. Causes of recurrence in laparoscopic inguinal hernia repair. J Minim Access Surg 2006; 2:187–191.

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