

Which method for the laparoscopic repair of inguinal hernia?; TAPP versus TEP

 Remzi Akturk¹,  Serdar Serinsoz²

¹Department of General Surgery, Istanbul Gelisim University, Istanbul, Turkey

²Department of Medical Imaging, Beykent University, Istanbul Turkey

Copyright@Author(s) - Available online at www.annalsmedres.org

Content of this journal is licensed under a Creative Commons Attribution-NonCommercial 4.0 International License



Abstract

Aim: The aim of this study is to prove that the total extraperitoneal patch plasty (TEP) method can be accepted as a standard method in elective and appropriate cases.

Materials and Methods: Six hundred sixty-five (665/678) patients with an uncomplicated primary inguinal hernia who consented to participate in the study were randomized into two groups: Group I transabdominal preperitoneal patch plasty (TAPP) repair and Group II TEP repair. Perioperative and postoperative complications and recurrence were detected with the help of radiology unit of our hospital and recorded. The patients were followed up for 1, 6, 12, 24 and 48 weeks.

Results: The difference between the number of Tackers and return to work was significant ($p < 0.05$). While complications related to bleeding and anaesthesia were more common in TAPP ($p < 0.05$), no difference was found between the two methods in terms of organ injury and conversion ($p > 0.05$). A significant difference was found between the two methods in terms of all complications except for chronic pain, seroma of inguinal area, subcutaneous emphysema and testicular ischemia ($p < 0.05$). No significant difference was found between obese patients and other groups when BMI groups were evaluated in terms of perioperative and postoperative complications ($p > 0.05$).

Conclusion: It is indisputable that the TEP method is less invasive than TAPP. TAPP should still remain method used in the laparoscopic hernia learning curve for the pushing forward of laparoscopic anatomy vision and used for very complicated inguinal hernias such as the undescended testis and giant inguinal hernias.

Keywords: Inguinal hernia; laparoscopy; TAPP; TEP

INTRODUCTION

With the development of medical technologies in recent years, interest in minimally invasive surgery has increased considerably. This increase is more prominent in inguinal hernia repair. The most important advantages of the techniques in the minimally invasive treatment of adult inguinal hernia are cosmetic results, low pain rate and rapid wound healing (1). The comparison of total extraperitoneal approach (TEP) and transabdominal preperitoneal approach (TAPP), which are laparoscopic repair methods of inguinal hernia, started 20 years ago (2). For many years, these methods have been compared with many conventional open surgery methods (3-7). Although studies comparing two laparoscopic methods, many of which are systematic reviews, have increased in recent years, the results are yet confusing (8-14). Because of these contradictory results, it has been shown that in all four systematic reviews and meta-analyses to compare TEP and TAPP approaches, the results were similar for

both methods and one method could not be superior to the other. As a result, it has been put forward that further studies were needed (8). Studies on TEP suggest advantages of faster recovery time, early return to work, and less postoperative pain. They also suggested that the TEP method was more convenient for repairing the bilateral inguinal hernia using three ports, diagnosing and repairing associated femoral and obturator hernias, and for the treatment of recurrent hernia after previous open repair (15). However, the view in the TEP method is quite complex and has a long learning curve (2). In conclusion, the European Hernia Society (EHS) highlight the necessity for an expert to supervise the TEP method in clinical practice in the learning process (1). Furthermore, the operative time of more than 100 minutes and a recurrence rate of 25% indicate that a surgeon has not yet completed the learning curve (8). The purpose of this study is to demonstrate that the TEP method can be accepted as a standard method in elective and appropriate cases.

Received: 24.04.2020 **Accepted:** 29.09.2020 **Available online:** 28.12.2020

Corresponding Author: Remzi Akturk, Department of General Surgery, Faculty of Medicine, Istanbul Gelisim University, Istanbul, Turkey

E-mail: dremzi@gmail.com

MATERIALS and METHODS

Between 2008 and 2017, patients who were operated on for laparoscopic inguinal hernia were retrospectively reviewed using digital hospital records. The operations were performed by two general surgeons.

Inclusion criteria were age 18 years and over, Simple uncomplicated inguinal hernia, Unilateral or bilateral, American Society of Anaesthesiologists (ASA) Score I/ II and no use of anticoagulants. Exclusion criteria for the study were age younger than 18 years, Significant comorbidities making patient unfit for general anaesthesia, Previous surgery to the inguinoscrotal region, Obstructed/strangulated inguinal hernia, ASA Score III / IV, Severe benign prostatic hyperplasia, cirrhotic ascites, acute incarcerated or strangulated hernia, and skin infection on the lower abdominal wall and use of anticoagulants.

Ultrasonography was routinely performed in the bilateral inguinal region to detect cryptorchidism, spermatic cord hydrocele and tumours with the help of radiology unit of our hospital. All patients underwent surgery were taken into operation after signing the consent form.

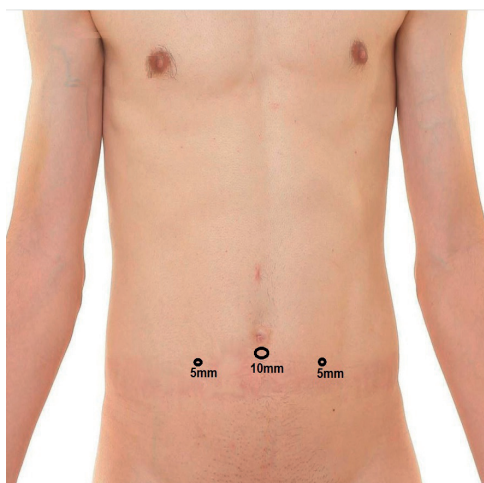


Figure 1. Trocars placement in one side hernia

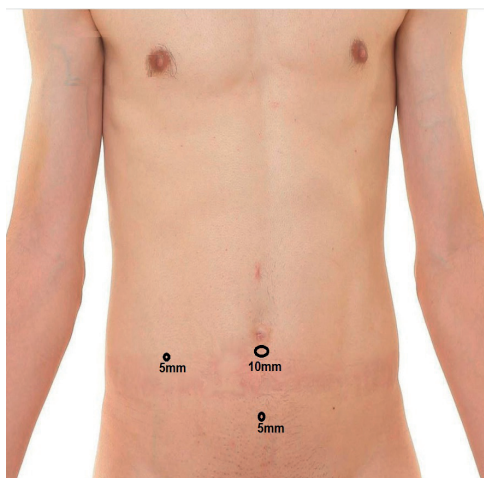


Figure 2. Trocars placement in bilateral hernia

The patient was placed on his back with both arms trapped and anaesthetized with general anaesthesia. The monitor was positioned on the foot side of the bed. In patients with bilateral inguinal hernia, the operation was started with the symptomatic side. A single injection Cefazolin 1000 mg dose was given intravenously as preoperative prophylaxis and the second dose was given 6-8 h after surgery. A 10-mm, 30-angle laparoscope was used to better perspective the groin anatomy. After placing the trocar, the patient is placed in the upright Trendelenburg position. Although laparoscopic port placements typically vary between two techniques, in the TEP method, one of 5 mm ports placed in the between the umbilicus and the Symphysis pubis, the other 5 mm port placed at the midclavicular line at the lateral of the umbilical port (Figure 2). In the TAPP technique, the three ports are placed at the umbilicus and the area of the midclavicular line at the level of the umbilicus on the left and right side of the abdomen (Figure 1). In our study, the same port placements were also used in the TEP method in bilateral inguinal hernia patients as same in the TAPP methods.

For both techniques, the standard method for dissection of the sac and mesh placement was used and balloon dissection was not used because it caused increased bleeding in the TEP procedure. In the TAPP method, the peritoneum closed with the tacks. An LW polypropylene mesh was used which has the properties included mono filamentous, non-absorbable, lightweight (<50 gm/m²), macroporous (>1 mm pore size), stable (16 N/cm) and elastic and sized 12cm × 15cm. Intraoperative details, operation time and complications were recorded.

20 mg intravenous tenoxicam was lead on postoperative day 1 for postoperative pain control. The patients were discharged with oral diclofenac sodium twice a day for the first 2 days of pain control and it was recommended to take it when needed.

1- Preoperative characteristics; age, BMI, gender, side of hernia, hernia type, ASA score

2- Perioperative variables; operative time, number of tacks,

3- Perioperative complications; conversion, bleeding, bowel or bladder damage, other (anaesthesia) complications

4- Postoperative outcomes; hospital stay, return to work,

5- Postoperative complications; oedema of the testis, reoperation, orchitis, chronic pain, seroma, ischemia of testis, recurrence, port side hernia postoperative complications were detected with the help of radiology unit of our hospital and recorded.

Operation time was recorded from the first port entry through the incision to the closure of the last port skin wound. the conversion was determined to switch an open approach or another laparoscopic method (Figure 3).

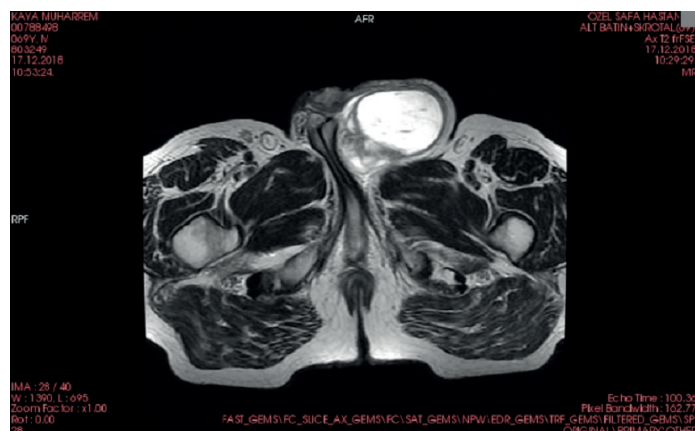


Figure 3. MRI imaging the seroma of the inguinal area

Statistical analysis

SPSS 2000 version was used for analysis. Our data were not normally distributed and therefore non-parametric tests were used. Mean Standard Deviation, Median & Range values were used as descriptive of continuous variables. Chi-Square test was used to compare group differences in medians. A frequency table was constructed to evaluate the proportion of patients in the respective categories in the groups, and data were analysed using the Chi-Square / Fischer Exact test as applicable. Repeated measures test was used to compare postoperative pain trends within-subject variation. The p-value of <0.05 was taken to be significant.

Follow up

The patients were followed up for 1, 6, 12, 24 and 48 weeks. All patients were examined for the presence of hematoma, testicular oedema, re-operation, orchitis, chronic pain, seroma, testicular ischemia, recurrence, port side hernia. The seroma that has no improvement after 4 weeks of follow-up was evacuated under ultrasound guidance. In the postoperative period, all patients were asked to walk, drive and continue their work, but they were warned to avoid heavy activities. Recurrence rates during a follow-up of 12 months and the complications such as chronic groin pain, wound infection, hematoma, seroma, neuralgia, numbness and other significant events were evaluated. Pain lasting more than 6 weeks was accepted as chronic.

RESULTS

678 patients were assessed for fitness for inclusion in the study. Thirteen (13/678) had to be excluded, as eight patients (8/13) didn't meet inclusion criteria, and five (5/13) patients refused to consent to participate in the study. Six hundred sixty-five (665/678) patients with an uncomplicated primary inguinal hernia who consented to participate in the study were randomized into two groups: Group I - TAPP repair and Group II - TEP repair.

As seen in Table 1, The difference between the two groups in terms of age, BMI, operation time and length of hospital stay was not statistically significant. The difference

Operation Type	Age	BMI	Operation Time (dk.)	Number of Tack	Return to Work (day)	Hospital Stay (day)
TAPP (n:309)	50.75±13.981 (18-81)	28.32±3.079 (22-38)	59.48±13.608 (31-88)	7.13±4.044 (3-10)	14.78±3.078 (7-23)	1.36±0.568 (1-3)
TEP (n:356)	50.12±14.171 (19-93)	27.73±2.886 (22-36)	63.1±14.583 (31-89)	0.6±0.674 (0-3)	8.18±2.125 (2-15)	1.07±0.251 (1-2)
Total (n:665)	50.41±14.076 (18-93)	28±2.99 (22-38)	61.42±14.243 (31-89)	3.63±4.294 (0-10)	11.25±4.2 (2-23)	1.20±0.453 (1-3)
P value	>0.05	>0.05	>0.05	<0.05	<0.05	>0.05

Operation Type	Preoperative Condition															
	Gender				Side Of Hernia				Hernia Type				Asa Score			
	Woman		Bilateral		Right		Left		Indirect		Direct		Asa I		Asa II	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
TAPP	16	5.2%	127	41.1%	111	35.9%	71	23.0%	150	48.5%	159	51.5%	148	47.9%	161	52.1%
TEP	23	6.5%	65	18.3%	153	43.0%	138	38.8%	199	55.9%	157	44.1%	168	47.2%	188	52.8%
Total	39	5.9%	192	28.9%	264	39.7%	209	31.4%	349	52.5%	316	47.5%	316	47.5%	49	52.5%
P value	0.483				P<0.05				0.058				0.856			

between the number of Tackers and return to work was significant ($p < 0.05$). The median age of the study population was 50.41 years, ranging from 18 to 93 years (Table 2).

The study population comprised of 626 males and 39 female. All patients included in the study were adults and had inguinal hernias. There was no significant difference between the two groups in terms of gender and ASA score ($p > 0.05$). Although there was no significant difference in terms of hernia type ($p = 0.058$), while direct hernias were in the majority in TAPP, indirect hernias were in majority in TEP.

There was a significant difference between the two groups in terms of hernia side ($p < 0.05$). TAPP was preferred in bilateral hernias, and TEP was preferred in the unilateral hernia, especially in left side hernias.

The perioperative complications were examined in Table 3. While complications related to bleeding and anaesthesia were more common in TAPP ($p < 0.05$), no difference was found between the two methods in terms of organ injury and conversion ($p > 0.05$).

Postoperative complications were evaluated in Table 4. A significant difference was found between the two methods in terms of all complications except for chronic pain, seroma of inguinal area, subcutaneous emphysema and testicular ischemia ($p < 0.05$).

As shown in Table 5 and 6, no significant difference was found between obese patients and other groups when BMI groups were evaluated in terms of perioperative and postoperative complications ($p > 0.05$).

Table 3. Intraoperative complications distributions according to the operation type

Operation Type	Perioperative Complication							
	Bleeding		Bowel and Bladder Damage		Conversion		Other (Anaesthesia)	
	N	%	N	%	N	%	N	%
TAPP	16	5.2 %	3	1.0 %	3	1.0 %	9	2.9 %
TEP	4	1.1 %	1	0.3 %	7	2.0 %	3	0.8 %
Total	20	3 %	4	0.6 %	10	1.5 %	12	1.8 %
P value	P<0.05		0.251		0.293		P<0.05	

Table 4. Postoperative complications distributions according to the operation type

Operation Type	Preoperative Condition										
	Edema of Testis	Reoperation	Orchitis	Chronic Pain	Seroma of Inguinal Area	Subcutaneous Emphysema	Postoperative Pain	Testis Ischemia	Recurrence	Port Side Hernia	
TAPP	57 18.4 %	32 10.4 %	14 4.5 %	9 2.9 %	12 3.9 %	19 2.9 %	26 3.9 %	1 0.3 %	16 5.2 %	16 5.2 %	
TEP	30 8.4 %	9 2.5 %	6 1.7 %	7 2.0 %	7 2.0 %	16 2.4 %	8 1.2 %	2 0.6 %	7 2.0 %	2 0.6 %	
Total	87 13.1 %	41 6.2 %	20 3.0 %	16 2.4 %	19 2.9 %	35 5.3 %	34 5.1 %	3 0.5 %	23 3.5 %	18 2.7 %	
P value	P<0.05	P<0.05	P<0.05	0.427	0.139	0.633	P<0.05	0.648	P<0.05	P<0.05	

Table 5. Intraoperative complications distributions according to the BMI group

BMI Group	Perioperative Complication			
	Bleeding	Bowel and Bladder Damage	Conversion	Other (Anesthesia)
BMI <30	18 2.7%	3 0.5%	13 2.0%	9 1.4%
BMI =>30	2 0.3%	1 0.2%	7 1.1%	3 0.5%
Total	20 3.0%	4 0.6%	20 3.0%	12 1.8%
P value	0.085	0.936	0.398	0.889

Table 6. Postoperative complications distributions according to the BMI group

Operation Type	Preoperative Condition										
	Edema of Testis	Reoperation	Orchitis	Chronic Pain	Seroma of Inguinal Area	Subcutaneous Emphysema	Postoperative Pain	Testis Ischemia	Recurrence	Port Side Hernia	
BMI <30	65 9.8%	31 4.7%	18 2.7%	9 1.4%	15 2.3%	25 3.8%	22 3.3%	2 0.3%	13 2.0%	11 1.7%	
BMI =>30	22 3.3%	10 1.5%	2 0.3%	7 1.1%	4 0.6%	10 1.5%	12 1.8%	1 0.2%	10 1.5%	7 1.1%	
Total	87 13.1%	41 6.2%	20 3.0%	16 2.4%	19 2.9%	35 5.3%	34 5.1%	3 0.5%	23 3.5%	18 2.7%	
P value	0.738	0.723	0.085	0.120	0.568	0.804	0.249	0.797	0.065	0.239	

DISCUSSION

Because it is a better solution for detecting and treating femoral hernia European Hernia Society suggest that the laparoscopic approach has to preferred in women with groin hernia (10). Many studies have shown that laparoscopic inguinal hernia repair is safe and effective in the treatment of inguinal hernia and has advantages such as less pain, better cosmesis and faster recovery than open methods (16). The key to the efficacy of laparoscopic inguinal hernia surgery is the formation of an adequate study area. Since the most important difference between TAPP and TEP is the field creation approach, it emerges as an important point of differentiation in the comparative evaluation of these two procedures (13).

General anaesthesia is a major disadvantage of laparoscopic surgery, which requires the application of muscle relaxants to provide adequate working space (17-19). Absolute contraindication to laparoscopic inguinal hernia repair has not been reported except in the intolerability of general anaesthesia (19). Therefore, ASA 3 and 4 patients were excluded from the study. However, there are some studies that repair the laparoscopic hernia with epidural or spinal anaesthesia (20,21).

TEP and TAPP are more advantageous when they have compared to open repair, but it was not determined superiority between among both of them (1). However, there were some differences between the two methods. TEP is complicated and its mastery requires a long learning curve (2). Because of intra-abdominal space is larger than retroperitoneum and it provides the advantage in TAPP according to TEP especially in terms of spreading the graft. Since TEP is performed outside the peritoneal cavity, the incidence of abdominal visceral complications such as visceral injury, port side hernia and ileus is less than the TAPP method. Therefore, the European Hernia Society (EHS) recommends TEP primarily for laparoscopic inguinal hernia repair (18,22). In contrast, the Swiss Laparoscopic and Thoracoscopic Association showed that although both techniques had a low complication rate, TAPP had a relatively lower complication rate than the TEP method (23).

Although the duration of operation was dependent on the surgeon's experience, while in TEP, the spreading the graft due to narrow space longed the time, in TAPP, the closing the peritoneum with tacker (the mesh fixation material) shorted the time, but this relatively increased the cost and chronic pain ($p = 0.427$). Although the TEP methods cost was slightly higher than the open method, it is found to be less costly than TAPP method (24). Ferzli et al showed that non-fixation of mesh resulted in savings of \$120 per operation (25). We can see that when we keep tacker usage to a minimum in the TEP method, it would be more beneficial in terms of cost and benefit than also the open method. Värcauş F. et al. suggests that stapling the peritoneum with the staple accelerates the study time

but surgeons prefer the use of more time-consuming but less damaging sutures because of the risk of accidental damage to the arteries and nerves of the abdominal wall. Some suggest that fibrin glue can be used to fix the mesh in place, while at the same time closing the peritoneum by it will result in less chronic pain and less bleeding (10).

Gass M. et al. show that average age, BMI and ASA score were similar in both groups (11). In the literature, the mean BMI of patients selected for TEP was around 23.5 (15). In patients with a BMI above 25 kg / m², laparoscopic TEP approach during the learning period only encountered in difficulties in inserting the umbilical port because of the thick subcutaneous fatty tissue, but other stages of the operation progressed in its natural course. On the other hand, BMI was not a factor in technical difficulties during the experience. The learning curve was shorter when BMI low groin hernia patients were selected (26). In our study, BMI > 30 patients were not different from other patients in terms of both perioperative and postoperative complications ($p > 0.05$). In these patients, especially in patients who underwent TEP, we had difficulty in starting the operation because of the high amount of subcutaneous fatty tissue. Dissection was easier than open surgery because of the wide field of view.

In both methods, the dissection time was dependent on the size of the hernia rather than the procedure type. Recent meta-analyses recommend fixation of mesh routinely, especially in large hernias (>3 cm)(4). In our study, no significant difference was found between the two methods in terms of mean operative time ($p = > 0,05$). Studies comparing two methods showed no difference between the two methods in terms of operative time (1,9,12,13). There are also studies that find the operation time longer in TEP method (11,14). Otherwise, other authors have reported a shorter time for TEP as compared to TAPP (27,28). All studies that reported less working time in TEP repair compared to TAPP repair were performed on unilateral hernias and used a balloon dissector or indigenous glove finger balloon for the initial site (medial area) of the TEP (14). Dissection during umbilical port placement is the most important factor to eliminate the risk of peritoneal injury, which is currently the most common cause for conversion, as it causes gas leakage into the intraabdominal region, causing loss of operating space (16), this may result in prolonged working time or make a repair impossible and ultimately result in conversion to another method, especially in obese patients.

There have been many studies on how to complete the learning curve in laparoscopic inguinal hernia repair, and this process resulted in numbers ranging from 13 to 250 cases (2,16,18,19,23,29). In many studies, the learning curve in laparoscopic hernia surgeries has been reported to be between 50-100 cases to reduce the 60-minute duration (16,23,29), but this number has been reported over 100 in TEP (23,29). Zendejas et al. reported the specific curriculum for surgical residents to improve their operative

outcomes for TEP, demonstrating the effectiveness of simulation-based learning for the mastery of TEP (30). The establishment of a training system is essential for the promotion of TEP.

The difference in perioperative outcome between TEP and TAPP should be held accountable for indication rather than surgical technique. Accordingly, in some studies, the differences between operation time, hospital stay and return to work were associated with differences in patient selection (8). While there is no difference in the length of hospital stay between the two methods (12-14,18), there are also studies that find the TEP method more advantageous (9,11). In many studies, laparoscopic hernia surgery is referred to as patients who are discharged within 24 hours of daily care (27). The time of hospital stay depends in fact on many factors other than surgical techniques or outcomes, such as trends in medical dependence, local traditions, health care financing, and patient factors such as reliable healthcare and travel to or from the hospital (27).

The difference between the number of tacks used and the time of return to work was significant ($P < 0.05$). We think that the time to return to work and postoperative chronic pain may be related to the number of tacks used. There was no difference between the two methods in terms of return to daily activities (9,12-14,18).

Although there was no significant difference in terms of hernia type ($p = 0.058$), while Direct hernias were predominant in TAPP, Indirect hernias were predominant in TEP. While the surgeons especially preferred direct hernias in TEP in terms of the ease of dissection, in our study we encountered a different result.

We determined that the TAPP approach was preferred in bilateral hernias, whereas TEPP approach was preferred in unilateral hernias (especially in left side hernias) ($p < 0.05$). This may be due to the need for a wider field of view due to the larger area to be dissected in bilateral inguinal hernias in the TEP approach. Studies report the incidence of bilateral hernia up to 6% only when the clinical examination is used for diagnosis. Laparoscopic procedures, especially the TAPP approach, lead to an increase in the detection of firstly diagnosed contralateral hernias (10).

In our study, bleeding and complications of anaesthesia were more common in TAPP ($p < 0.05$), but no difference was found between the two methods in terms of organ injury and conversion. Some studies have not found a difference in the rate of intraoperative complications between TEP and TAPP (14,18). It is absolutely necessary for proper space creation, identification of anatomic structures during surgery and comfortable operation. In laparoscopic surgery, as in general surgery, exposure is everything. It also provides significant advantages for the management of problems such as lower epigastric artery tear or mesh placement problems (14). Therefore, we avoided balloon dissection in the TEP method. Capillary tears in TEP repair

have been reported to occur in approximately 11% cases. Lack of experience, the use of sharp instruments and previous adhesions have been proposed as preventive factors for capillary tears (14). In laparoscopic hernia repair, vascular and intra-abdominal organ injuries are a nightmare for both patient and surgeon. It has been reported that vascular injuries, especially inferior epigastric artery damage, are common in the TEP approach. Previous studies have reported the incidence of inferior epigastric artery injury in TEP as 0-4% (14). Gass M. et al. Claims that intraoperative complications and conversion in TEP are significantly higher (11). In addition, secondary bleeding occurred significantly more frequently after TEP than TAPP (8). These results may be valid throughout the learning curve. On the contrary, in our series, we found that hemorrhagia was minimal in TEP method which was performed the self-dissection compared to balloon and blunt dissection. The conversion rate was similar at both group in our study, which corresponds with results of previously published series (20). However, other authors report higher conversion rate after TEP to TAPP (14). In addition, some authors argue that the rate of conversion to TAPP after TEP is high. Preperitoneal surgery, such as pre-prostatectomy, can cause adhesions and increase the chance of peritoneal rent (14). In the TEP approach, the operating space is extraperitoneal does not prevent any visceral damage, but the visceral injury rate is relatively lower in TEP (0.11%) than TAPP (0.21%) (14,18). There are also studies determined that postoperative narcotic analgesic requirement of patients undergoing TEP is less than the TAPP approach (9).

We detected a statistically significant difference between the two methods In terms of postoperative complications other than testicular ischemia and chronic pain ($p < 0.05$). TAPP method in the use of tack is more because of the chronic pain is relatively higher than the TEP method was found ($p = 0.427$). In some studies, the significant difference in the postoperative complication rates, which were higher for TAPP, was due to a significantly higher seroma rate (8,18). In multivariate analysis, postoperative complications, especially seroma formation, have been reported in large hernia defects and scrotal hernias (8). Studies comparing laparoscopic and open methods have shown a significant decrease in rates of chronic pain and numbness, wound infection, seroma and hematoma (15,24). Moreover, both the TAPP and TEP potentially allow the surgeon to refrain from an inguinal nerve injury that unavoidably causes chronic pain, which makes the patient's quality of life unbearable (1,31). Postoperative groin pain remains an important complication that is often associated with the type of mesh used or the technique of fixation used (1,15,31). When discussing network fixation, the risk of recurrence and chronic pain should be carefully considered (19). Cristaudo A et al. demonstrated that the TEP procedure was independent of the mesh type or fixation method related to low CCS scores up to 12 weeks postoperatively (15). Some authors report that mesh fixation is not necessary for TEP repair (9,20). The risk of neurological complications and cost are the major

disadvantages of mesh fixation. We prefer to use a few tacks at safe points for mesh fixation in both TAPP and TEP such as Sharma D et al. (14). Especially, we have never used any takers in the small indirect hernia that underwent TEP method. Recent guidelines recommend atraumatic fixation or non-fixation in most cases, except for patients with a large direct hernia (19). Many articles argue that the TAPP approach increases postoperative pain incidence mainly due to the use of nails when compared with TEP (20). Some trials could not detect a difference in recurrence rates and postoperative pain after non-fixation versus fixation. They put forward that fixation may not be necessary and also causes chronic pain (18).

Lau et al. pointed to important preoperative characteristics related to seroma formation such as old age, large hernia defects, the spread of hernia to scrotum and presence of residual distal indirect sac (31). It is recommended from plication or ligation of the distal hernia sac to prevent seroma formation (14). Nonetheless, the significant difference in postoperative complication rates did not cause a significant difference in the rates of reoperation due to complications between TEP and TAPP (8,9,11). Some studies claim that local complications such as hematoma, hydrocele, seroma, subcutaneous emphysema are common after TEP (14).

In our study, most recurrences developed in the first three weeks. In recurrence development, factors such as severe exercise, chronic constipation and chronic cough were effective in the first postoperative period of 1 month. Dissection difficulties during operation are another factor effective in relapses. It has been determined that patients with recurrence have long operating times. Recurrences in laparoscopic hernia repair usually occur in the early postoperative period. The main cause of early recurrence is that the dissection cannot be performed efficiently and the graft cannot be disseminated adequately. In laparoscopic inguinal hernia repair, preoperative characteristics such as learning curve, obese patients, recurrent hernias, scrotal wide defects, the method applied (especially TEP approach), narrow the operating space even more and cause insufficient dissection or improper spreading of the mesh and increase early recurrence (16). Many surgeons hesitate to perform laparoscopic inguinal hernia repair because they are not familiar with the pelvic anatomy and the study area is narrow (16). Early recurrence of the disease occurs in 1 of 4 patients, especially during the learning curve (1). Significantly, more medial and scrotal hernias, as well as larger defects, were seen in the TAPP group in a study on the basis of prospective data from the German hernia registry Herniamed collected for a very large patient group data in everyday routine practice (8). In this type of patients, it is more appropriate to select the TAPP method, especially in the learning curve because the probability of recurrence is more than in other patients. Laparoscopic inguinal hernia repair, especially for the

TEP method, has a very steep learning curve and the technique is extremely complex (16). Edwards and Bailey argue that surgeon-related factors, such as experience with laparoscopic procedures, mastery of pelvic anatomy, and the ability to use two hands synchronously, may affect the learning curve (2). The long learning curve was one of the main reasons why some of the surgeons avoid using the TEP procedure and prefer TAPP (10). In some studies, recurrence rates were found between 1-2% after the learning curve was completed (1,9,14,16). While Khoury N. argued that the recurrence rate is higher in TAPP compared to TEP (9), the recurrence rate was found to be equal in some studies (1,12-14,18,24). After the first learning phase, positive improvements in complication and recurrence rates and better patient satisfaction can be expected (2,16,23). A complete lack of prior experience with laparoscopic herniorrhaphy is associated with a higher rate of conversion and significant increases in complications and hernia recurrences (2).

CONCLUSION

Laparoscopic repair is more advantageous in terms of return to work than the open method, likewise, the TEP method is more advantageous in terms of return to work than TAPP method. Although TAPP and TEP differ only in terms of the access pathway, the surgical technique is similar. It is indisputable that the TEP method is less invasive than TAPP. TAPP should still remain the method used in the laparoscopic hernia learning curve for the pushing forward of laparoscopic anatomy vision and used for very complicated inguinal hernias such as the undescended testis and giant inguinal hernias.

Acknowledgements: I would like to thank everyone who contributed to this study, especially my family, author friends and Serdar Serinsoz MD., responsible for our radiology department.

Conflict of interest :The authors declare that they have no competing interest.

Financial Disclosure: There are no financial supports.

Ethical approval: Istanbul Education Research Hospital Clinical Research Ethics Committee, no: 2164.

REFERENCES

1. Toma H, Eguchi T, Toyoda S, et al. 10-year experience of totally extraperitoneal endoscopic repair for adult inguinal hernia. *Surg Toda* 2015;45:1417-20.
2. Edwards CC 2nd, Bailey RW. Laparoscopic hernia repair: the learning curve. *Surg Laparosc Endosc Percutan Tech* 2000;10:149-53.
3. Fujita F, Lahmann B, Otsuka K, Lyass S, Hiatt JR, Phillips EH. Quantification of pain and satisfaction following laparoscopic and open hernia repair. *Arch Surg*. 2004;139:596-600; discussion 600-2.
4. Bowling K, El-Badawy S, Massri E, et al. Laparoscopic and open inguinal hernia repair: Patient reported outcomes in the elderly from a single centre - A prospective cohort study. *Ann Med Surg (Lond)*. 2017;22:12-5. Published 2017 Aug 29.

5. Barbaro A, Kanhere H, Bessell J, et al. Laparoscopic extraperitoneal repair versus open inguinal hernia repair: 20-year follow-up of a randomized controlled trial. *Hernia* 2017;21:723-7.
6. Zhu X, Cao H, Ma Y, et al. Totally extraperitoneal laparoscopic hernioplasty versus open extraperitoneal approach for inguinal hernia repair: a meta-analysis of outcomes of our current knowledge. *Surgeon*. 2014;12:94-105.
7. Scheuermann U, Niebisch S, Lyros O, et al. Transabdominal Preperitoneal (TAPP) versus Lichtenstein operation for primary inguinal hernia repair - A systematic review and meta-analysis of randomized controlled trials. *BMC Surg*. 2017;17:55. Published 2017 May 10.
8. Kockerling F, Bittner R, Jacob DA, et al. TEP versus TAPP: comparison of the perioperative outcome in 17,587 patients with a primary unilateral inguinal hernia. *Surg Endosc* 2015 ;29:3750-60.
9. Khoury N. A comparative study of laparoscopic extraperitoneal and transabdominal preperitoneal herniorrhaphy. *J Laparoendosc Surg* 1995;5:349-55.
10. Vărcuș F, Duță C, Dobrescu A, et al. Laparoscopic Repair of Inguinal Hernia TEP versus TAPP. *Chirurgia (Bucur)* 2016;111:308-12.
11. Gass M, Scheiwiller A, Sykora M, Metzger J. TAPP or TEP for Recurrent Inguinal Hernia? Population-Based Analysis of Prospective Data on 1309 Patients Undergoing Endoscopic Repair for Recurrent Inguinal Hernia. *World J Surg* 2016;40:2348-52.
12. McCormack K, Wake BL, Fraser C, et al. Transabdominal preperitoneal(TAPP) versus totally extraperitoneal (TEP) laparoscopic techniques for inguinal hernia repair: a systematic review. *Hernia*. 2005;9:109-14.
13. Wake BL, McCormack K, Fraser C, et al. Transabdominal preperitoneal (TAPP) vs totally extraperitoneal (TEP) laparoscopic techniques for inguinal vhernia repair. *Cochrane Database Syst Rev* 2005.
14. Sharma D, Yadav K, Hazrah P, et al. Prospective randomized trial comparing laparoscopic transabdominal preperitoneal (TAPP) and laparoscopic totally extraperitoneal (TEP) approach for bilateral inguinal hernias. *Int J Surg*. 2015;22:110-7.
15. Cristaudo A, Nayak A, Martin S, Adib R, Martin I. A prospective randomised trial comparing mesh types and fixation in totally extraperitoneal inguinal hernia repairs. *Int J Surg* 2015;17:79-82.
16. Bansal VK, Krishna A, Misra MC, et al. Learning Curve in Laparoscopic Inguinal Hernia Repair: Experience at a Tertiary Care Centre. *Indian J Surg*. 2016;78:197-202.
17. Yang XF, Liu JL. Laparoscopic repair of inguinal hernia in adults. *Ann Transl Med*. 2016;4:402.
18. Carter J, Duh QY. Laparoscopic repair of inguinal hernias. *World J Surg*. 2011;35:1519-25.
19. William W. Hope; Christopher Pfeifer. *Laparoscopic Inguinal Hernia Repair*. StatPearls Publishing.
20. Lal P, Philips P, Saxena KN, et al. Laparoscopic total extraperitoneal (TEP) inguinal hernia repair under epidural anesthesia: a detailed evaluation. *Surg Endosc*. 2007;21:595-601.
21. Yildirim D, Hut A, Uzman S, et al. Spinal anesthesia is safe in laparoscopic total extraperitoneal inguinal hernia repair. A retrospective clinical trial. *Wideochir Inne Tech Maloinwazyjne* 2017;12:417-27.
22. Simons 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.
23. Aeberhard P, Klaiber C, Meyenberg A, et al. Prospective audit of laparoscopic totally extraperitoneal inguinal hernia repair: a multicenter study of the Swiss Association for Laparoscopic and Thoracoscopic Surgery (SALTC). *Surg Endosc* 1999;13:1115-20.
24. McCormack K, Wake B, Perez J, et al. Laparoscopic surgery for inguinal hernia repair : systematic review of effectiveness and economic evaluation. *Health Technology Assessment* 2005.
25. Ferzli GS, Frezza EE, Pecoraro AM Jr, et al. Prospective randomized study of stapled vs. unstapled mesh in laparoscopic preperitoneal inguinal hernia repair. *J Am Coll Surg* 1999;188: 461-5.
26. Park BS, Ryu DY, Son GM, et al. Factors influencing on difficulty with laparoscopic total extraperitoneal repair according to learning period. *Ann Surg Treat Res* 2014;87:203-8.
27. Bracale U, Melillo P, Pignata G, et al. Which is the best laparoscopic approach for inguinal hernia repair: TEP or TAPP? A systematic review of the literature with a network meta-analysis, *Surg Endosc* 2012;26:3355-66.
28. Gunal O, Ozer S, Gurleyik E, et al. Does the approach to the groin make a difference in hernia repair? *Hernia* 2007;11:429-34.
29. Ramshaw B, Shuler FW, Jones HB, et al. Laparoscopic inguinal hernia repair: lessons learned after 1224 consecutive cases. *Surg Endosc* 2001;15: 50-4.
30. Zendejas B, Cook DA, Bingener J, et al. Simulation-based mastery learning improves patient outcomes in laparoscopic inguinal hernia repair. *Ann Surg* 2011;254:502-11.
31. Lau H, Lee F. Seroma following endoscopic extraperitoneal inguinal hernioplasty. *Surg Endosc*. 2003;17:1773-7.