

Our Results of Laparoscopic Totally Extraperitoneal Repair from a Single Center: The Learning Curve and Difficulties

Hacı Hasan Abuoğlu, Münip Ali Tolga Müftüoğlu, Ali Aktekin, Emre Günay, Bülent Kaya, Hakan Uzunoğlu

Department of General Surgery, Haydarpasa Numune Training and Research Hospital, Istanbul, Turkey

Abstract

Introduction: The number of laparoscopic hernia repair is increasing due to decreased post-operative pain and fast recovery. However, long learning curve and need of laparoscopic skills are important problems for common practice of laparoscopic hernia repair. In this study, we presented our experience with laparoscopic totally extraperitoneal (TEP) repair especially focusing on the learning curve.

Methods: The patients who underwent laparoscopic TEP repair in S.B.Ü Haydarpasa Numune Training and Research Hospital Department of General Surgery between January 2010 and December 2016 were included in the study. The patients who were operated between 2010–2013 and 2014–2016 consisted of Groups 1 and 2, respectively. All demographic data of patients were recorded. MedCalc Statistical Software version 12.7.7 (MedCalc Software bvba, Ostend, Belgium; 2013) was used in statistical analysis. $P < 0.05$ was accepted as statistically significant.

Results: There were a total of 600 patients and cases of 716 laparoscopic TEP repair during study period. There were 15 (4.8%) recurrences in Group 1 and 4 (1%) in Group 2. Complications in Groups 1 and 2 consisted of bleeding ($n=9:3.0\%$ vs. $7:1.7\%$) chronic pain ($n=5:1.6\%$ vs. $3:0.8\%$), hematoma ($n=9:3.0\%$ vs. $7:1.7\%$), wound infection ($n=4:1.3\%$ vs. $4:0.9\%$), and seroma ($n=11:3.5\%$ vs. $9:2.2\%$).

Discussion and Conclusion: Both the rates of complications (recurrence and other complications) as well as the duration of operation decreased with the increase of the surgeon's experience at the beginning and the following period in laparoscopic hernia repair. Early period operational insufficiency may play an important role in recurrent herniation.

Keywords: Inguinal hernia; Laparoscopic repair; recurrence; totally extraperitoneal.

The interest in laparoscopic methods (trans-abdominal preperitoneal [TAPP] and totally extraperitoneal [TEP]) increases rapidly in inguinal hernia repair [1]. Serious complications in laparoscopic TEP repairs are less common than TAPP repairs. However, laparoscopic repair of TEP is technically more difficult [1]. A long learning curve has been defined in laparoscopic hernia repair [3,4]. There are studies reporting the learning curve as 40 cases as well as 250 cases [1]. Fewer post-operative pain and faster wound healing are

the superiorities of laparoscopic hernia repairs over open repairs [4]. The aim of this study is to share our experiences related to laparoscopic repair of TEP and discuss it in the light of literature information.

Materials and Methods

This study includes laparoscopic TEP repairs performed by five different general surgeons in a single center. Between January 1, 2010, and December 31, 2016, patients who un-

Correspondence (İletişim): Hacı Hasan Abuoğlu, M.D. Haydarpasa Numune Eğitim ve Araştırma Hastanesi, Genel Cerrahi Kliniği, İstanbul, Turkey

Phone (Telefon): +90 216 322 12 72 **E-mail (E-posta):** abuoğlu@gmail.com

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derwent laparoscopic TEP repair for an inguinal hernia were evaluated using hospital data processing system and patient files. All patients had symptomatic unilateral or bilateral inguinal hernias. Laparoscopic TEP method was used in all patients and operations were performed using 1, 10mm, 2, 5 mm trocars, and laparoscopic hand tools, and also 10 cm×15 cm Prolene mesh was used for TEP repair in all patients.

The mesh was fixed with the help of a tucker. All patients were discharged on the post-operative 1st day. Patients were searched for information about recurrence and long-term complications. Patients who could not be contacted by phone were excluded from the study. The patients were examined in two groups according to their operation dates: As Group 1 (G1) (January 1, 2010–December 31, 2012); Group 2 (G2) (January 1, 2013–December 31, 2016). Demographic characteristics, operative findings, duration of operation (using intraoperative anesthesia follow-up forms), duration of hospitalization, and follow-up period, recurrence and other complications (bleeding, seroma, hematoma, wound infection, and chronic pain) were also recorded.

In statistical analysis, descriptive statistics were used to define continuous variables (mean, standard deviation, mini-

mum, median, and maximum). For the comparison of two independent continuous variables with normal distribution, Student's t-test, and for those with non-normal distribution Mann–Whitney U-test were used. Chi-square (or Fisher Exact test where appropriate) was used to examine the relationship between categorical variables. The level of statistical significance was determined as 0.05. The analyses were performed using the Med Calc Statistical Software version 12.7.7 (MedCalc Software bvba, Ostend, Belgium; <http://www.medcalc.org>; 2013).

Results

During the study period, 716 laparoscopic repair surgeries were performed in 600 patients consisting of 45 (8.1%) female and 555 (91.9%) male patients with an overall mean age of 49.21±14.54 (18–82 years) years. Recurrences occurred in 15 (4.8%) patients in Group1 and 4 (1%) patients in Group 2. The mean hospital stays were 1.14 (±0.35) days in Group 1 and 1.06 (±0.24) days in Group 2. 3. The follow-up periods were 55.28 (±11.47) days in Group 1 and 21.82 (±8.1) days in Group 2 (Table 1). Complications in Groups 1 and 2 consisted of bleeding [n=9:3.0% vs. 7:1.7%] ch-

Table 1. Demographic information and surgical findings of the groups

Demographics	Groups			P
	Total (n=600)	Group 1 (n=258)	Group 2 (n=342)	
Age				
Mean±SD	49.21±14.54	49.83±14.82	48.45±14.76	0.258*
Minimum-Maximum	18–82	18–82	18–82	
Gender				
Male (%)	555 (91.9)	241 (93.4)	314(91.8)	0.022**
Female (%)	45 (8.1)	17 (6.6)	28 (8.2)	
Localization				
Bilateral (%)	116 (19.3)	50 (19.4)	66 (19.3)	0.001**
Unilateral (%)	484 (80.7)	208 (80.6)	276 (80.7)	
Operation times (min)				
Bilateral±SS	86±30	92±32	80±28	<0.001*
Unilateral±SS	67±24	70±25	64±22	0.002*
Hospital stay (days)				
Mean±SD	1.09±0.29	1.14±0.35	1.06±0.24	0.001*
Complications				
Recurrence (%)	19 (2.6)	15 (4.8)	4 (1)	<0.001**
Other complications (bleeding, chronic pain, hematoma, wound infection, seroma)	68 (11.3)	38 (14.7)	30 (8.7)	0.030**
Follow-up period (mos)				
Mean±SD	36.16±19.21	55.28±11.47	21.82±8.1	<0.001*
Minimum-Maximum	6–72	36–72	6–36	

SD: Standard deviation; *Student t p; **Ki-Kare (Fisher's Exact) p.

ronic pain (n=5:1.6% vs. 3:0.8%), hematoma (n=9:3.0% vs. 7:1.7%), wound infection (n=4:1.3% vs. 4:0.9%), and seroma (n=11:3.5% vs. 9:2.2%) (Table 2). Recurrent hernias developed in 19 (2.6%) patients. When 19 patients had recurrent hernias (Group 1: 79%, and Group 2: 21%) were examined, 79% were in Group 1 and 21% in Group 2. While 3 of the recurrent hernias were different from the primary hernia type (primary hernia was of direct type, while the recurrent hernia of indirect type), 16 hernias were of the same type as the primary hernia. The distribution of recurrences is shown in Figure 1.

Discussion

The surgical method to be preferred in inguinal hernia repair is still controversial. The complex pelvic anatomy and narrow field of study encountered in laparoscopic hernia repair are important obstacles in the spread of the method. The concept of learning curve was first introduced in 1936 by T.P. It was used by Wright in the aircraft industry and was later used in many areas other than health [5]. It was a frequently used term in the 1980s with minimally invasive

surgery. The time required for the surgeon to learn a technique or to have full control of this technique is defined as the learning curve. In recent years, with the widespread use of laparoscopic methods in surgery, the opportunity to evaluate the effects of surgical experience on clinical outcomes in laparoscopic methods has emerged [6].

The learning curve of classical (open) inguinal hernia repair is not well defined [7]. Shouldice reported an initial recurrence rate of 17% in the anterior multiple repair technique described by him [8]. In >6000 cases, the recurrence rate was 0.6% in the follow-up period of at least 10 years [8]. Lal et al. [9] suggested that laparoscopic hernia repair may be like a copy of open procedures and that after 10 or more open stoppa procedures, laparoscopic repair of TEP may be attempted [3]. On the other hand, Haidenberg et al. [10] explained that laparoscopic repair of TEP is a simple, easy, understandable, reasonable method and that learning laparoscopic TEP repair can be easier than open procedures (Bassini, Lichtenstein or mesh plug methods).

Edward and Bailey reported that the surgeon's experience of a laparoscopic procedure, good pelvic anatomy knowledge, and the ability to use both hands skillfully during laparoscopic intervention may be factors affecting the learning curve [11]. They reported that the operation time was shorter and the complication rates could be lower in laparoscopic hernia repairs to be performed under the supervision of an experienced surgeon [12]. Considering the total number of cases of laparoscopic TEP repair performed by the surgery team in our study, we found that the recurrence and other complication rates, also operation time decreased significantly after 250 cases.

The complication rate in laparoscopic hernia repairs in a series of 867 cases was reported as 29% [13]. In another study, the rates of pre-operative and post-operative complications were reported as <1% and 7% in 3432 patients with laparoscopic TEP repair [14]. In our study, the total complication rate was 13.9%. In the first 3 years, this rate was 19.5% and in the next 3 years, it was 9.7%. The mean follow-up period was approximately 3 years. There is less post-operative pain in laparoscopic hernia repair than open repairs. Laparoscopic hernia repairs allow patients to return to their daily activities and working life earlier [15-18]. Furthermore, wound site infection develops less frequently and provides a better cosmetic appearance is provided [15, 19, 20].

A clear view of the femoral, inguinal, and obturator area during laparoscopic repair provides a great benefit in seeing the defect area. Very low recurrence rates have shown that laparoscopic TEP repair in experienced hands is an advantageous

Table 2. Distribution of post-operative complications among study groups

Complication (%)	Groups		
	Total n=87 (1.1)	Group 1 n=53 (17.2)	Group 2 n=34 (8.3)
Recurrence	19 (2.6)	15 (4.8)	4 (1)
Bleeding	16 (2.2)	9 (3.0)	7 (1.7)
Chronic pain	8 (1.1)	5 (1.6)	3 (0.8)
Hematoma	16 (2.2)	9 (3.0)	7 (1.7)
Wound site infections	8 (1.1)	4 (1.3)	4 (0.9)
Seroma	20 (2.8)	11 (3.5)	9 (2.2)

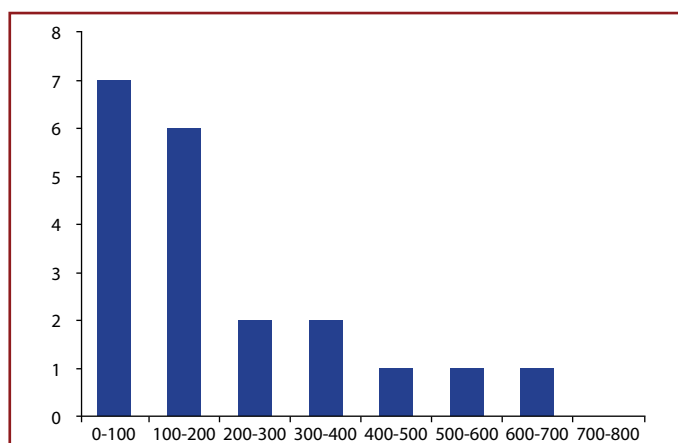


Figure 1. Number of laparoscopic totally extraperitoneal repairs, and recurrences.

method in the bilateral and recurrent hernia [15, 16, 18, 21].

In laparoscopic TEP repairs, vascular, bladder, and bowel injuries can be seen [15-17, 19]. However, these complications are very rare. Life-threatening iliac vascular injuries occurring during the introduction of Visiport and trocar were reported [19, 22]. The need for general anesthesia is another disadvantage of laparoscopic repair. In some studies, the long operation time is reported as a disadvantage of laparoscopic TEP repair compared to open hernia repair [15-17, 19]. On the other hand, there are studies reporting that the operation time is shortened as a result of the experience gained over time [20]. Very low rates of the major complications were reported after approximately 1000 laparoscopic TEP repairs and recurrence rates were very low in long-term follow-up [20]. In our series, vascular, bladder, and bowel injuries were not observed.

Recurrence rates were high in the first 3 years and the first 250 cases performed by all surgeons. In 10 recurrent cases which were of the same type as the primary herniation type, the Prolene patch was detached from the fixation points and slipped. In the other 6 cases, recurrence was observed after the inability to free the peritoneum sufficiently. We think that recurrence in the 1st year of laparoscopic repair is the result of our inexperience in this type of surgery.

Our study has some limitations. First, it is a retrospective study. Second, laparoscopic TEP repairs were performed by many surgeons with different skills, and surgical approaches, instead of using a single surgeon. Finally, the patients were contacted by phone and information about the patients was not based on examination findings.

In conclusion, laparoscopic (TEP) hernia repair should be used in the treatment of an inguinal hernia with low recurrence and post-operative complication rates. Experience and operational, technical skills in laparoscopic hernia repair can play an important role in reducing both complication rates and shortening the operation time.

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References

- Lamb AD, Robson AJ, Nixon SJ. Recurrence after totally extraperitoneal laparoscopic re-pair: implications for operative technique and surgical training. *Surgeon* 2006;4:299–307.
- Wake BL, McCormack K, Fraser C, Vale L, Perez J, Grant AM. Transabdominal pre-peritoneal (TAPP) vs totally extraperitoneal (TEP) laparoscopic techniques for inguinal hernia repair. *Cochrane Database Syst Rev* 2005;CD004703. [CrossRef]
- Lal P, Kajla RK, Chander J, Ramteke VK. Laparoscopic total extraperitoneal (TEP) inguinal hernia repair: overcoming the learning curve. *Surg Endosc* 2004;18:642–5. [CrossRef]
- Technology Appraisal Guidance 83. Laparoscopic surgery for inguinal hernia repair. National Institute of Clinical Excellence. 2004.
- Subramonian K, Muir G. The learning curve in surgery: what is it, how do we measure it and can we influence it? *BJU Int* 2004;93:1173–4. [CrossRef]
- Buchmann P, Dinçler S. Learning curve calculation and value in laparoscopic surgery. *The Umsch* 2005;62:69–75. [CrossRef]
- 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. [CrossRef]
- Shouldice EE. The treatment of hernia. *Ont Med Rev* 1953;20:670–84.
- Stoppa RE, Warlaumont CR. The preperitoneal approach and prosthetic repair of groin hernia. *World J. Surg* 1999;23.
- Haidenberg J, Kendrick ML, Meile T. Totally extraperitoneal (TEP) approach for inguinal hernia: the favorable learning curve for trainees. *Curr Surg* 2003;60:65–8. [CrossRef]
- Edwards CC 2nd, Bailey RW. Laparoscopic hernia repair: the learning curve. *Surg Laparosc Endosc Percutan Tech* 2000;10:149–53. [CrossRef]
- Choi YY, Kim Z, Hur KY. Learning curve for laparoscopic totally extraperitoneal repair of inguinal hernia. *Can J Surg* 2012;55:33–6. [CrossRef]
- Gilbert AI, Graham MF. Technical and scientific objections to laparoscopic herniorrhaphy. *Probl Gen Surg* 1995;12:209–14.
- Schouten N, Simmermacher RK, van Dalen T, Smakman N, Clevers GJ, Davids PH, et al. Is there an end of the “learning curve” of endoscopic totally extraperitoneal (TEP) hernia repair? *Surg Endosc* 2013;27:789–94. [CrossRef]
- Memon MA, Cooper NJ, Memon B, Memon MI, Abrams KR. Meta-analysis of randomized clinical trials comparing open and laparoscopic inguinal hernia repair. *Br J Surg* 2003;90:1479–92.
- Schmedt CG, Sauerland S, Bittner R. Comparison of endoscopic procedures vs Lichtenstein and other open mesh techniques for inguinal hernia repair: a meta-analysis of randomized controlled trials. *Surg Endosc* 2007;19:188–99.
- Bowne WB, Morgenthal CB, Casto AE, Shah P, Ferzli GS. The role of endoscopic extraperitoneal herniorrhaphy: where do we stand in 2005? *Surg Endosc* 2007;5:707–12. [CrossRef]
- Knook MT, van Rosmalen AC, Yoder BE, Kleinrensink GJ, Snijders CJ, Looman CW, et al. Optimal mesh size for endoscopic inguinal repair: A study in a porcine model. *Surg Endosc* 2001;15:1471–7. [CrossRef]

19. Neumayer L, Giobbie-Hurder A, Jonasson O, Fitzgibbons R Jr, Dunlop D, Gibbs J, et al. Veteran's Affairs Cooperative Studies Program 456 Investigators Open mesh versus laparoscopic mesh repair of inguinal hernia. *N Engl J Med* 2004;350:1819–27. [\[CrossRef\]](#)
20. Thill C, Simoens C, Smets D, Ngongang C, da Costa PM. Long-Term Results of A Non-Randomized Prospective Mono-Centre Study of 1000 Laparoscopic Totally Extraperitoneal Hernia Repairs. *Acta Chir Belg* 2008;108:405–8. [\[CrossRef\]](#)
21. Richards SK, Vipond MN, Earnshaw JJ. Review of the management of recurrent inguinal hernia. *Hernia* 2004;8:144–8.
22. Sharp HT, Dodson MK, Draper ML, Watts DA, Doucette RC, Hurd WW. Complications Associated with Optical-Access Laparoscopic Trocars. *Obstet Gynecol* 2002;99:553–5. [\[CrossRef\]](#)