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## RESEARCH ARTICLE

# Totally extraperitoneal versus transabdominal preperitoneal laparoscopic techniques for hernia inguinal repair using glue for mesh and peritoneal closure

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## ABSTRACT

**Background:** Totally extraperitoneal (TEP) and transabdominal preperitoneal repair (TAPP) are standard techniques of laparoscopic approach of groin hernia repair. Many studies compare clinical efficacy between TEP and TAPP technique. Which is the best approach? The choice of technique of hernia inguinal repair is still controversial.

**Aim:** To compare our result in last three years in laparoscopic hernia inguinal repair.

**Material and methods:** This study is retrospective-prospective analysis of patients database with TEP and TAPP hernia inguinal repair between January 2021 to September 2023. Patients demographic profile, hernia characteristic and clinical outcomes included in database. We performed two groups patients: TEP groups and TAPP groups. The primary endpoint included: mesh and peritoneum fixation, operative time, intra and postoperative complication, hospital stay and conversion rate. The secondary outcomes were recurrence rates, acute and chronic pain. The follow-up time was 12 months. The results were processed by the methods of classical statistic analysis. The significance level was 0,05.

**Results:** A total of 278 patients divide into two groups: TEP group had 128 patients and TAPP group had 150. There were 255 men and 23 women. The average age is 52.67 years. The American Society of Anesthesiologists Physical Status Classification System (ASA) had ASA I 157, ASA II 105 and ASA III 16 patients. There were 138 right and 140 left inguinal hernias. Bilateral hernias were 110, unilateral 168. There were 20,14% (56) recurrent hernias after Lichtenstein hernioplasty. The size of the hernia measured according to the criteria of the European Hernia Society (EHS) was L1/M1 106 or 38,1 %, L2/M2 114 or 41 % and L3/M3 58 or 20,9 %. There was no statistically significant difference by groups for age, ASA classification, hernia size, and location. We fixed the mesh in 87,3% (216) with glue, in 11% (30) we gave a self-fixing mesh and in 11,7% (32) cases we did not fix the mesh. We used lightweight titanium mesh in 89 % of cases and self gripping mesh in 11%. There was no statistically significant difference between TEP and TAPP groups in the method of mesh fixation and mesh type. In the TAPP group, we closed the peritoneum in 50,7% (76) cases with glue, in 38,7% (58) it was sutured and in 10,6% (16) suturing and gluing was done. Operative time of unilateral hernia surgery in the TEP group is 42 min, in the TAPP 60 min. In bilateral hernia, the operation time of TEP group is 74 min, TAPP group 105 min. The difference was statistically significant between the groups in both cases ( $p < 0.05$ ). The time of hospitalization is the same in both groups and is one day. Intraoperative complications were similarly distributed in both groups, without statistical significance (hemorrhage TEP 4, TAPP group 4, peritoneal lacerations TEP 12, TAPP 10). There was two conversion (0,72%) to another type of operation in both groups (TEP 1, TAPP 1). Postoperatively, we had groin seroma in 3,6 % (10) of cases (TEP group 5, TAPP 5), testicular hematoma in 3,6% (10) of patients (TEP 4, TAPP 6). There were two (0,72%) reinterventions, the first after the TAPP procedure due to postoperative ileus, and the second after TEP procedure due to iatrogenic perforation of the urinary bladder. Acute pain up to 30 days after surgery in 3,24% (9) patients (TEP 4, TAPP 5). There was no statistically significant difference in the occurrence of these postoperative complications ( $p > 0.05$ ). Chronic pain was present in TEP group 3 and in TAPP group 4 patients, a total of 7 or 2,52 %, with no statistically significant difference. Hernia recurrence was present in 5 patients or 1,8 %, without statistical difference by groups (TEP 2, TAPP 3).

**Conclusions:** Both laparoscopic techniques have similar complication, acute and chronic pain and recurrence rates. They are in excellent technique of laparoscopic inguinal hernia repair with acceptable complications. TEP has the advantage that the peritoneal cavity is not breached. However is more difficult to master when compared with TAPP. In conclusion, the choice of the technique should be based on the surgeon's skills, hospital practice, education and experience.

**Keywords:** Laparoscopic hernia inguinal repair, TEP, total extraperitoneal repair, TAPP, transabdominal preperitoneal repair, recurrent inguinal hernia, chronic pain.

## Introduction

Inguinal hernia repair is the most frequently performed operation in general surgery, with about one million procedures in the USA per year<sup>1</sup>. Hundreds of years have passed since the Bassini technique to modern laparoscopic hernioplasty. The first major change was the introduction of synthetic meshes in the Lichtenstein technique of open hernia repair. The next big challenge is the introduction of laparoscopic techniques in the early 1990s into routine operative procedures<sup>1,2</sup>. We know two standard techniques of laparoscopic hernioplasty and both were introduced into clinical practice in 1992<sup>3</sup>. Transabdominal preperitoneal (TAPP) inguinal hernia repair was introduced by Dion and Morion, it involves entering the abdominal cavity, opening the peritoneal flap and placing the mesh preperitoneally, and then closing the peritoneal flap<sup>3</sup>. Totally extraperitoneal repair (TEP) was introduced by McKernan, it is performed without opening the abdominal cavity<sup>4</sup>. Fixation of the mesh and closure of the peritoneum can be done with tissue-penetrating techniques such as tacker, suture, but this increases the percentage of vascular, nervous, muscular complications and increases acute and chronic pain after surgery<sup>14</sup>. Non-penetrating techniques of mesh fixation and peritoneum closure with N-2-butyl cyanoacrylate (nBCA) glue enable reduction of postoperative pain and intraoperative complications<sup>15</sup>. Unlike other adhesives that only have the capacity to fix the mesh, nBCA strongly seals the peritoneum<sup>16</sup>. The large number of laparoscopic hernia inguinal repair of surgical unit need a simple, practical, safe, non penetrating and shorting time technique for mesh and peritoneal fixation<sup>8</sup>.

## Study aims

To compare our result in last three years in laparoscopic hernia inguinal repair.

## Material and methods

This study is retrospective-prospective analysis of patients database with TEP and TAPP hernia inguinal repair between January 2021 to December 2023. The criteria for the inclusion of subjects in the analysis were the presence of unilateral or bilateral inguinal hernia, recurrent inguinal hernia, surgery under general anesthesia, and adults over 18 years of age. Patients with femoral hernia or other type of abdominal wall hernia were not included in the analysis. Patients demographic profile, hernia characteristic and clinical outcomes included in database. We performed two groups patients: TEP groups and TAPP groups. The primary endpoint included: mesh and peritoneum fixation, operative time, intra and postoperative complication, hospital stay and conversion rate. The secondary outcomes were recurrence rates, acute and chronic pain. The follow-up time was 12 months. After discharge from the hospital, patients were monitored by a surgeon after 1 and 6 months. 12 months after the operation, a telephone interview was conducted with the patient. We entered the data partly retrospectively (in the first year of the analysis) and then prospectively into a Microsoft Excel table. The description of numerical features was done using classic methods of descriptive statistics, namely arithmetic mean, median, standard deviation, minimum and maximum values. Student's T-test was used to compare average values of parametric features for two groups of data. In all applied analytical methods, the level of significance was 0.05.

## Results:

A total of 278 patients divide into two groups: TEP group had 128 patients and TAPP group had 150. There were 255 men and 23 women. The average age is 52.67 years. The American Society of Anesthesiologists Physical Status Classification System (ASA) had ASA I 157, ASA II 105 and ASA III 16 patients. There were 140 right and 132 left inguinal hernias. Bilateral hernias were 75, unilateral 113. There were 20,14% (56) recurrent hernias after Lichtenstein hernioplasty (table1). The size of the hernia measured according to the criteria of the European Hernia Society (EHS) was L1/M1 106 or 38,1 %, L2/M2 114 or 41 % and L3/M3 58 or 17,6% (table 2). There was no statistically significant difference by groups for age, ASA classification, hernia size, and location. We fixed the mesh in 87,3% (216) with glue, in 11% (30) we gave a self-fixing mesh and in 11,7% (32) cases we did not fix the mesh. We used lightweight titanium mesh in 89 % of cases. There was no statistically significant difference between TEP and TAPP groups in the method of mesh fixation and mesh type. In the TAPP group, we closed the peritoneum in 60.2% (90) cases with glue, in 33,8% (51) it was sutured and in 6% (9) suturing and gluing was done. Operative time of unilateral hernia surgery in the TEP group is 42 min, in the TAPP 60 min. In bilateral hernia, the operation time of TEP group is 74 min, TAPP group 105 min (figure 1). The difference was statistically significant between the groups in both cases ( $p < 0.05$ ). The time of hospitalization is the same in both groups and is one day. Intraoperative complications were similarly distributed in both groups, without statistical significance, hemorrhage TEP 4, TAPP group 4 all 8 (2,9%), peritoneal

lacerations TEP 12, TAPP 10, all 22 (7,9%). There was two (0,72%) conversion to another type of operation in both groups (TEP 1, TAPP 1) (table 3). Postoperatively, we had groin seroma in 3,7% (10) of cases (TEP group 5, TAPP 5), testicular hematoma in 3,7% (10) of patients (TEP 4, TAPP 6). There were two reinterventions (0.72%) in the first three days after surgery. Ileus after the TAPP procedure because perforation of the peritoneal flap, an internal hernia developed where the small intestines entered the space between the peritoneum and the abdominal wall, reintervention was performed laparoscopically. Another serious complication (after TEP) was iatrogenic perforation of the urinary bladder with leakage of urine into the preperitoneal space and then into the abdomen. Reoperation is performed laparoscopically on the third postoperative day. Acute pain up to 30 days after surgery in 3,24% (9) patients (TEP 4, TAPP 5). There was no statistically significant difference in the occurrence of these postoperative complications ( $p > 0.05$ ). Chronic pain was present in TEP group 3 and in TAPP group 4 patients, a total of 7 or 2,52%, with no statistically significant difference. Hernia recurrence was present in 5(1,8 %) patients, without statistical difference by groups (TEP 2, TAPP 3) (table 4).

Table 1. Patient's demografis data

parametar	value
Total number of patients	278
TAPP group	150 (54 %)
TEP group	128 (46 %)
age	52,67+/- 15,1
Sex male	255 (91,7 %)
Sex female	23 (8,3%)
ASA score I	157 (56,5 %)
ASA score II	105 (37,8 %)
ASA score III	16 (5,7%)
Hernia left side	140 ( 50,36%)
Hernia right side	138 (49,64%)
Hernia recurrence	56 (20,14%)
Hernia unilaterals	168 (60,4%)
Hernia bilateral	110 (39,%)

Table 2. The size of the hernia- European Hernia Society (EHS)

Size of hernia (EHS)	value
L1+M1	106 (38,1%)
L2+M2	114 (41%)
L3+M3	58 (17,60%)

Figure 1. Operative time

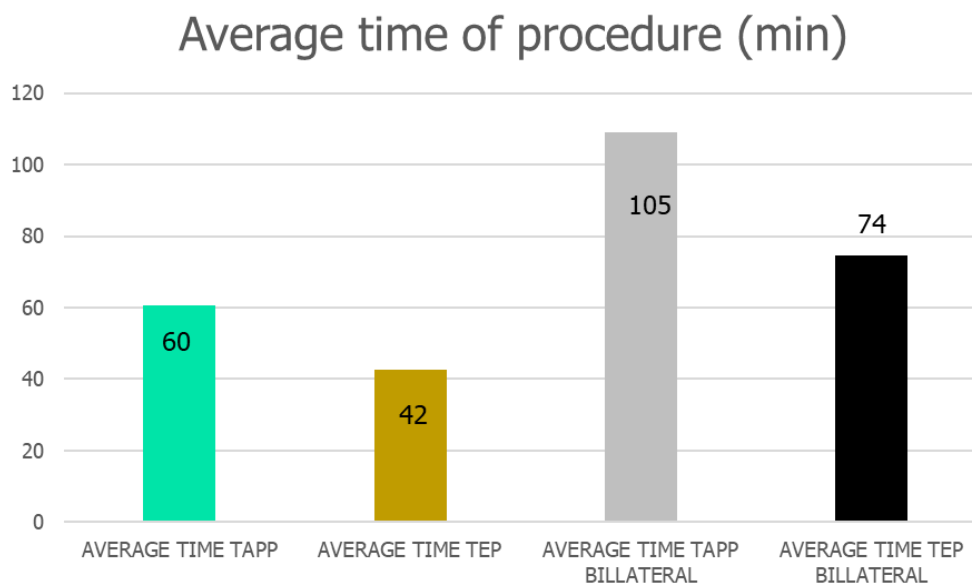


Table 3. Intraoperative and postoperative complications, conversion, early reintervention

	Intraoperative complication	Intraoperative complications	Intraoperative complication	Postoperative complications	Postoperative complications	Reintervention
	hemorrhagia	Peritoneal laceration	Conversion	seroma	hemathoma	Ileus, laesio urinary bladder
TEP	4	12	1	5	4	1
TAPP	4	10	1	5	6	1
all	8 (2,9%)	22 (7,9%)	2 (0,72%)	10 (3,6%)	10 (3,6%)	2 (0,72%)

Table 4. postoperative complications, pain and hernia recurrence

parametar	Value $\Sigma$	TAPP vs TAPP
Acute pain	3,24 % (9)	5 vs 4
Chronic pain	2,52 % (7)	4 vs 3
Hernia recurrence	1,8 % (5)	3 vs 2

## Discussion

The majority of operated patients are male, which correlates with the lifetime risk of developing inguinal hernia in the population (men 27%, women 3%)<sup>5</sup>. Patients undergoing laparoscopic hernioplasty must be operated under general endotracheal anesthesia, which determines a better ASA score in laparoscopic in correlation with open hernioplasty (spinal and local anesthesia is possible with a higher ASA coefficient)<sup>6</sup>. In Germany 60% of all hernia operations are performed laparoscopically, and the dominant technique is TEP with 65%, while TAPP accounts for 35%<sup>7</sup>. In Slovenia, TAPP is the dominant technique and more than 90% of procedures in Slovenian hospitals are performed using the TAPP technique. At General Hospital Murska Sobota, we routinely perform both types of laparoscopic surgery. In this paper, the percentage of TEP techniques is 46%, while TAPP is represented by 54%. We use glue to fix the mesh in both laparoscopic techniques. Recommendations are to fix all hernias larger than L2/M2 or combined

hernias<sup>7,8</sup>. In our papers, 87% of the meshes were fixed with an atraumatic technique-glue, which correlates with published works in the literature<sup>8,19</sup>. Kukleta et al reported major series of about 1300 operation with mesh fixation with n-butyl-cyanoacrylate, and demonstrated precise fixation, with smaller volume of glue, excellent mesh integrity and biocompatibility<sup>17</sup>. Mechanical fixation with taks used to fix mesh and peritoneal flab but there is a high risk to damage nerves, blood vessels and significant increasing acute and chronic postoperative pain and complications<sup>18,19,20</sup>. The percentage of fixation of the peritoneal flap with the TAPP technique is as follows: in 60,2%, the fixation was done with glue (N-butyl cyanoacrylate), in 38,7% it was the suture was performed with a stich and in 10,6% a combination of both techniques was used. The percentage of fixation of the peritoneal flap with glue is lower compared to published works where it ranges up to 90%, the reason is that some surgeons do not use glue but primarily sew

the peritoneum, which led to a decrease in the percentage of glued peritoneum with the TAPP technique. Peritoneal flap closure using nBCA and in 90% of cases is possible<sup>11</sup>. So we can talk about the influence of surgical experience on the success of closing the peritoneum with glue? The definition of an experienced laparoscopic surgeons reporting that an experience of more than 100 procedures show that operative time drops below 60 min and closing peritoneal flap with glue in more than 80% cases. The percentage of intraoperative and postoperative complications is similar in both examined groups and correlates with those published in the literature<sup>7,8,9</sup>. Hernia recurrence in this paper is 1,8%, in the literature this percentage ranges from 1% to 3%<sup>7,8,9</sup>. There is no difference in hernia recurrence between the groups. The operative time required for the performed TEP and TAPP procedures is without statistically significant difference in the groups of Bracala, Ortenzi, Krishna and Varcusa<sup>10,12,13</sup>. A statistically significant difference in the duration of the operation in this paper exists between TEP and TAPP procedures in unilateral and bilateral hernias. This can be explained by different surgical techniques, different performers of the procedures, and the use of balloon preparation in TEP hernioplasty. The percentage of conversions is lower here than in literature data<sup>7,8,9,10,12,13</sup>.

## Conclusion

Both laparoscopic techniques have similar complication, acute and chronic pain and recurrence rates. Application of the glue mesh and peritoneal fixation is standard procedure in laparoscopic inguinal hernia repair, is safe

and can lower the incidence of pain, reduce complications and recurrence rate. They are is exelent technique of laparoscopic inguinal hernia repair with acceptable complications. TEP has the advantage that the peritoneal cavity is not breached. However is more difficult to master when compared with TAPP. In conclusion, the choice of the technique should be based on the surgeon"s skills, hospital practice, education and experience.

## Conflict of Interest:

The authors have nothing to disclose.

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## Authors contribution

Radenko Koprivica- MD, PhD, surgeon, Surgical Department General Hospital Murska Sobota, Slovenia-contribute to the design, acquisition of data, writing and reviewing the manuscript, approved the final form of the manuscript.

Sanjanin Perišić- MD, surgeon, Surgical Department General Hospital Murska Sobota, Slovenia-performs laparoscopic procedures.

Jelko Čopi- MD, surgeon, Surgical Department General Hospital Murska Sobota, Slovenia-performs laparoscopic procedures.

Jernej Šadl- MD, surgical resident, Surgical Department General Hospital Murska Sobota, Slovenia- assistance, care for the database.



## References:

1. Scott NW, McCormack K, Graham P, Go PM, Ross SJ, Grant AM. Open versus non mesh for repair of femoral and inguinal hernia. *Cochrane Database Syst rev.* 2002;(4): CD002197.
2. Sains PS, Tilney HS, Purkayastha S, Darzi AW, Athanasiou T, Tekkis PP, et al. Outcomes following laparoscopic versus open repair of incisional hernia. *World J Surg.* 2006; 30(11): 2056-64.
3. Neumayer L, Giobbie-Hurder A, Jonasson O, Fitzgibbons R Jr, Dunlop D, Gibbs J, et al. Open mesh versus laparoscopic mesh repair of inguinal hernia. *N Engl J Med.* 2004; 350 (18): 1819-27. Epub 2004 apr 25.
4. McKernan JB, Laws HL. Laparoscopic repair of inguinal hernias using totally extraperitoneal prosthetic approach. *Surg Endosc.* 1993, 7(1): 26-28.
5. Simons MP, Aufenacker T, Bay-Nielsen M, Bouillot JL, Campanelli G, Conze J et al. European hernia Society guidelines on the treatment of inguinal hernia in adult patients. *Hernia.* 2009, 13 (4): 343-403. Doi:10.1007/s10029-009-0529-7. Epub 2009 Jul 28.
6. Lal P, Philips P, Saxena KN, Kajla RK, Chander j, Ramteke VK. Laparoscopic total extraperitoneal (TEP) inguinal hernia repair under epidural anesthesia: a detailed evaluation. *Surg Endosc.* 2007; 21 (49):595-601. Epub 2006 Dec 16.
7. Kockerling F, Bittner R, Jacob DA, Seidelmann L, Killer T, Adolf D, Kroft A, Kulle A. TEP versus TAPP: comparasion of the perioperative outcame in 17587 patients with a primary unilateral inguinal hernia. *Surg Endosc.* 2015; 29: 3750-3760.
8. Wilson P, Hickey L. Laparoscopic transabdominal preperitoneal (TAPP) groin hernia repair using n-butyl-2-cyanoacrylate (Liquiband Fix 8) for mesh fixation and peritoneal closure: learning experience during introduction into clinical practice. *Hernia.* 2019; 23:601-613
9. Ortenzi M, Williams S. at all. Laparoscopic repair of inguinal hernia: retrospective comparison of TEP and TAPP procedures in a tertiary referral center; *Minerva Chir.* 2020 okt;75(5):279-285
10. Bracale U, Melillo P, Pignata G, Di Salvo at all. Wich is the best laparoscopic approach for inguinal hernia repair: TEP or TAPP? Systematic review of the literature with a network meta-analysis. *Surg Ednosc.* 2012 dec; 26(12): 355-366.
11. Koprivica R, Perišić S, Kuhar Makoter M. Adhesive techniques for mesh and peritoneum fixation in laparoscopic inguinal hernia repair. *Surgery and Surgical Endoscopy.* 2020 oct; vol 2, No 2: 11-16.
12. Krishna A, Bansal VK at all. Totally extraperitoneal reapir in inguinal hernia: more than decades experience at a tertiary care hospital. *Surg Laparosc Endosc Percut Tech.* 2019 avg; 29(4): 247-251
13. Varcus F, Duta C at all. Laparoscopic repair of inguinal hernia TEP versus TAPP. *Chirurgia* 2016.111;308-312
14. Liew W, Wai YY, Kosai NR, Gendeh HS. Tackers versus glue mesh fixation: an objective assessment of postoperative acute and chronic pain using inflammatory markers. *Hernia.* 2017; 21(4): 549-554.
15. Mittermair R, Jenic G, Kolenik R, Sorre C. TAPP surgery with mesh fixation and peritoneal closure using n-butyl-2-cyanoacrylate

- (LiquiBand§FIX8™ )-initial experience. Eur Surg.2016; 49(1): 27-31.
16. Dauser B, Szyszkowitz A, Seitinger G, Fortelny RH, Herbst F. A novel glue device for fixation of mesh an peritoneal closure during laparoscopic inguinal hernia repair: short and medium term results. Eur Surg. 2017; 49(1): 27-31.
17. Kukleta JF, Freytag C, Weber M, et al. Efficiency and safety of mesh fixation in laparoscopic inguinal hernia repair using n-butyl.cyanoacrilate: long-term biocompatibility in over 1300 mesh fixation. Herni. 2012; 16: 153-62.
18. Katkhouda N, Mavor E, Friedlander MH, et al. Use of fibrin sealant for prosthetic mesh fixation in laparoscopic extraperitoneal inguinal hernia repair. Ann Surg. 2001,233: 18-25.
19. Niebuhr H, Wegner F, Hukauf M,et al. What are the influencing factors for chronic pain following TAPP inguinal hernia repair: an analysis of 20004 patients fron the herniamed regurstry. Surg Endosc. 2018; 32: 1971-1983.
20. Nan H, Hong X, Deng-Chao W, Yue-Hua L, et al. Efficacy and safety of glue mesh fixation for laparoscopic inguinal hernia: A meta-analysis of randomized controlled trials. Asian Jornal of Surgery. 2023; 46: 3417-3425.
21. Vidovic D, Kirac I, Glavan E, Filipovic-Cugara J, Ledinsky M, bekavac-Beslin M. Laparoscopic totally extraperitoneal hernia repair versus open Lichtenstein hernia repair: results and complications. J Laparoendosc Adv Surg Tech A. 2007; 17(5): 585-90.
22. Ramshaw B, Shuler FW, Jones HB, Duncan TD, White J, Wilson R,et al. Laparoscopic inguinal hernia repair: lessons learned after 1224 consecutive cases. Surg Endosc. 2001, 15(1): 50-4.