

## Original Research Article

# A prospective randomized comparison of short-term outcome of laparoscopic, totally extra-peritoneal and trans-abdominal pre-peritoneal repairs for inguinal hernia

Saurabh Kumar<sup>1</sup>, Manmeet Kaur<sup>2\*</sup>

<sup>1</sup>Department of Surgery, Shri Guru Ram Rai Institute of Medical and Health Sciences, Dehradun, Uttarakhand, India

<sup>2</sup>Department of Surgery, Government Medical College, Kathua, Jammu and Kashmir, India

**Received:** 13 October 2020

**Revised:** 26 October 2020

**Accepted:** 27 October 2020

**\*Correspondence:**

Dr. Manmeet Kaur,

E-mail: [drmanmeetkaur79@gmail.com](mailto:drmanmeetkaur79@gmail.com)

**Copyright:** © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

### ABSTRACT

**Background:** Laparoscopic repair of inguinal hernia is steadily gaining popularity among general surgeons. Laparoscopically the preperitoneal space can be approached in two different ways, as a result of which two techniques of laparoscopic repair have emerged. We performed this study to compare the two techniques in a randomized setting in order to ascertain, if possible, which of these techniques is preferable when there is a choice.

**Methods:** This randomized, comparative study was conducted at Shri Mahant Indires hospital, Dehradun over a period of three years. Patients with unilateral, uncomplicated, inguinal hernia were randomized into two groups for undergoing surgery using either of these techniques. Patients' demography and both intraoperative and postoperative variables were compared between the two groups.

**Results:** Mean duration of surgery and mean pain scores in early postoperative period were found to be higher for transabdominal preperitoneal (TAPP) group as compared to totally extraperitoneal (TEP) group. Intraoperative and postoperative complications as well as hospital stay were not significantly different between the two groups.

**Conclusions:** In this study TEP has been found to have an edge over TAPP in some respect but as per the available evidence both techniques are safe and choice of procedure may be tailored according to individual cases.

**Keywords:** Totally extraperitoneal, Transabdominal preperitoneal, Inguinal hernia

### INTRODUCTION

Laparoscopic repair of inguinal hernia is steadily gaining popularity among general surgeons. Unlike other common laparoscopic procedures like cholecystectomy and appendicectomy the learning curve for laparoscopic hernia repair is long as it is technically more demanding.<sup>1</sup> It is not surprising therefore that open Lichtenstein's repair is still more popular among a majority of surgeons as compared to the laparoscopic repair.<sup>1,2</sup> To the beginners who are otherwise well versed in open surgery the procedure seems cumbersome but in experienced hands the procedure is as convenient and safe as open hernioplasty. Moreover, laparoscopic hernia repair has

distinct advantage in certain clinical situations like bilateral and recurrent hernias.<sup>3</sup> While open hernia repair usually approaches the hernia defect in abdominal wall from anterior aspect the laparoscopic repair involves approach from posterior side and entails familiarity with anatomy of preperitoneal region. This preperitoneal space has been used for mesh placement in many open procedures also described by stoppa, rives and nyhus.<sup>4</sup> Laparoscopically the preperitoneal space can be approached in two different ways, as a result of which two techniques of laparoscopic repair have emerged. In transabdominal preperitoneal (TAPP) repair the abdominal cavity is entered first and then the peritoneum is incised and a flap is raised to carry out preperitoneal

space dissection, while in totally extraperitoneal (TEP) repair the preperitoneal space is approached traversing the abdominal wall without entering the peritoneal cavity. Because of different anatomical approaches involved the outcome of surgery is expected to differ between the two techniques. More so, because in TAPP pneumoperitoneum is created and peritoneal cavity is entered while in TEP the peritoneal cavity per se remains untouched and dissection is done outside the peritoneum through the abdominal wall. So TAPP is likely to give rise to bowel adhesions in some cases which may lead to intestinal obstruction which is unlikely in case of TEP.<sup>5,6</sup> Several investigators have compared the two techniques in terms of various peri-operative variables and complications but the results are conflicting and the available data is insufficient to form any opinion.

We performed this study to compare the two techniques in a randomized setting in order to ascertain, if possible, which of these techniques is preferable when there is a choice.

## METHODS

This randomized, comparative study was conducted at Shri Mahant Indresh hospital Dehradun over a period of three years from May 2017 to April 2020.

### Inclusion criteria

Patients between the ages of 21 and 80 years undergoing laparoscopic inguinal hernia repair except those mentioned in the exclusion criteria.

### Exclusion criteria

Exclusion criteria were complicated inguinal hernia, bilateral inguinal hernia, recurrent hernia, very large or irreducible hernia, hernias associated with undescended testis or hydrocele, patients with severe co-morbid conditions (ASA grade $\geq$ 3), patients requiring conversion from TEP to TAPP intra-operatively due to inadvertent leakage of gas inside peritoneal cavity

### Sampling technique

After admission each patient who was posted for laparoscopic inguinal hernia repair was explained in detail about the operative procedures and the purpose of study and an informed consent was taken. Then the patient was assigned to one of two study groups using "random number table". The patients with even numbers in random number table were posted for TAPP repair and those with odd numbers were posted for TEP repair.

Details of presenting symptoms & signs, co-morbidities, operative finding, duration of surgery and post-operative pain score were recorded for both the groups. Duration of stay in hospital as well as time to return to work were noted but later on time to return to work was omitted

from the study because of some confounding factors. Perioperative complications, if any, such as vascular or visceral injury, hematoma or seroma formation, subcutaneous emphysema, wound or mesh infection, recurrence of hernia or persistent pain were also recorded. All the surgeries were performed by surgeons having ample experience in either technique of laparoscopic hernia repair. A polypropylene mesh (15 cm $\times$ 12 cm) was used in all cases. Tacker was used for mesh fixation in all cases and also for closure of peritoneal incision in TAPP repairs. In TEP one infra-umbilical camera port (10 mm) and two midline 5 mm working ports were placed. In TAPP one 10 mm supra-umbilical camera port and two lateral 5mm working ports were used. All the patients were given one pre-operative and two post-operative injections of 1.2 grams of co-amoxycylav at eight hours intervals. Injection diclofenac Sodium was used for post-operative analgesia and the doses were administered at fixed intervals only after assessment of the pain scores. Data obtained from both the groups were tabulated. A comparative analysis was done using standard statistical methods and inference was drawn.

## RESULTS

A total of 96 patients underwent laparoscopic inguinal hernia repair during the study period, out of which 88 patients fulfilled the inclusion criteria initially. After randomization 41 patients fell into TAPP arm and 47 patients fell into TEP arm. But in two cases the procedure had to be converted from TEP to TAPP intraoperatively so these cases were excluded from the study. Thus, TEP arm eventually had 45 cases, TAPP arm had 41 cases and the study sample was restricted to 86 patients.

The two groups were comparable in terms of age distribution and the mean age was not significantly different. The proportion of indirect hernias was somewhat higher in the TAPP group but the difference was found to be statistically insignificant (Tables 1, 2).

**Table 1: Age distribution.**

Age group (in years)	Group			
	TAPP		TEP	
	N	%	N	%
21-30	4	9.7	2	4.4
31-40	6	14.6	7	15.5
41-50	9	21.9	12	26.6
51-60	11	26.8	12	26.6
61-70	8	19.5	10	22.2
71-80	3	7.3	2	4.4
<b>Total</b>	<b>41</b>		<b>45</b>	
<b>Mean age (SD)</b>	48.6 years (14.2)		51 years (12.5)	P value =0.20

The mean duration of surgery was found to be significantly higher in TAPP group. The mean duration of hospital stay was 1.95 days in TAPP group and 1.88

days in the TEP group. The difference was found to be statistically insignificant. One patient in the TAPP group had an extended duration of stay (eight days) because of formation of tender hematoma in the inguinal canal which responded to conservative management (Tables 3, 4).

**Table 2: Types of hernia.**

	Direct	Indirect	Proportion of indirect hernias	Significance (p value)
<b>TAPP</b>	15	26	63.4%	Not significant (0.2272)
<b>TEP</b>	20	25	55.5%	

**Table 3: Duration of surgery (minutes).**

Group	N	Mean (min)	SD (min)	Significance (p value)
<b>TAPP</b>	41	69.5	18.97	Significant (0.0052)
<b>TEP</b>	45	59.4	17.32	

**Table 4: Hospital stay (days).**

Group	N	Hospital stay (days)	Mean (days)	SD (days)	Significance of difference (p value)
<b>TAPP (n=41)</b>	14	1	1.95	1.24	Not Significant (0.753)
	22	2			
	3	3			
	1	5			
	1	8			
<b>TEP (n=45)</b>	12	1	1.88	0.74	
	28	2			
	4	3			
	1	5			

**Table 5: Vascular injury.**

Group	N	Vascular injury	Proportion	Significance (p value)
<b>TAPP</b>	41	1	2.4	Not significant (0.6062)
<b>TEP</b>	45	2	4.4	

There were no major intra-operative complications except injury to inferior epigastric artery in one patient in each group and hemorrhage from the corona mortis region in one patient in the TEP group. These complications were easily managed and did not require conversion to open surgery in any case. Post-operative complications have been depicted in table six. The incidence of none of these complications was significantly different in the two groups (Table 5, 6).

Post-operative pain was assessed using visual analogue scale with a range of one (no pain) to ten (worst pain) at six and 24 hours after surgery. Mean pain scores were significantly higher for the TAPP group at both of these in post-operative intervals (Table 7).

**Table 6: Post-operative complications.**

Group	TAPP (n=41) N (%)	TEP (n=45) N (%)	Significance (p value)
<b>Seroma</b>	2 (4.88)	3 (6.67)	NS (0.36)
<b>Hematoma</b>	0	1 (2.22)	NS (0.16)
<b>Scrotal Oedema</b>	2 (4.88)	1 (2.22)	NS (0.25)
<b>Subcutaneous emphysema</b>	1(2.44)	2 (4.44)	NS (0.30)
<b>Chronic groin pain</b>	1 (2.44)	0	NS (0.16)
<b>Total</b>	6 (14.63)	7 (15.56)	NS (0.45)

**Table 7: Post-operative pain score.**

Pain	Procedure	N	Mean VAS score	SD	Significance (p value)
<b>At 6 hours</b>	TAPP	41	4.44	1.06	Significant (0.0053)
	TEP	45	3.76	1.21	
<b>At 24 hours</b>	TAPP	41	2.78	0.98	Significant (0.0046)
	TEP	45	2.18	0.99	

**Table 8: Persistent postoperative pain.**

Pain	Procedure	N	Patients with persistent pain	Proportion (%)	Significance (p value)
<b>At one week</b>	TAPP	41	6	14.6	Not significant (0.31)
	TEP	45	5	11.1	
<b>At six weeks</b>	TAPP	None			
	TEP	None			

**Table 9: Mean VAS scores in patients with persistent pain at one week.**

Pain	Procedure	N	Patients with persistent pain	Mean VAS score	Significance (p value)
<b>At one week</b>	TAPP	41	6	2.83	Not significant (0.29)
	TEP	45	5	2.6	
<b>At six weeks</b>	TAPP	41	1	-	-
	TEP	45	0	-	

Pain was again assessed at follow up visits at one and six weeks to look for persistence of pain. Six patients (14.6%) in TAPP group and five patients (11.1%) in the TEP group had persistent pain at one week although with milder intensities as compared to that found at 24 hours after surgery. The proportion of patients with persistent pain was not significantly different in the two groups. Among the patients with persistent pain at one week the mean pain scores were also comparable in the two groups (Table 8 and 9).

Only one patient in TAPP group had persistent pain at the time of six week follow up visit. Other complications like wound infection, mesh suppuration, port site hernia and chronic neuralgia did not occur in any patient during study period. None of the patients presented with a recurrence of hernia within a period of three years from the commencement of the study but admittedly the patients were not actively followed up after six months to look for recurrence, as we had to study the short-term outcome only.

## DISCUSSION

A number of studies have been performed till date to compare the two techniques of laparoscopic inguinal hernia repair viz., TAPP and TEP but only a fraction of them are randomized.<sup>7-16</sup> This single center study compares the two techniques of laparoscopic inguinal hernia repair for short-term outcome in a randomized setting. The age-wise distribution of patients in the two groups was comparable. In TAPP group maximum number of patients belonged to the age group of 51 to 60 years whereas in TEP group the peak frequency of 12 patients was seen both in 41 to 50 and 51 to 60 years age groups. Still the mean age of patients was not significantly different for the two groups at 95% confidence interval.

Kockerling et al have used EHS classification for stratification of patients in their large study including 17,587 patients from Herniated registry.<sup>17</sup> They have categorized patients into groups with medial, lateral, scrotal and femoral hernias. They observed that the duration of surgery was significantly shorter for the medial type of hernias. Our study included only inguinal hernias and not the femoral hernias. Moreover, even the large scrotal hernias were among the exclusion criteria so we divided the groups only into direct and indirect hernias. The proportion of indirect hernias was calculated in each group for comparison as it may have a bearing on the duration of surgery. It was 63.4% in TAPP group and 55.5 in the TEP group. The difference was not statistically significant. Despite this observation the mean duration of surgery was significantly higher in the TAPP group as compared to TEP group. This finding was consistent with those of the studies by Krishna A. et al and Kockerling et al.<sup>10,17</sup>

The mean duration of stay in the hospital was not significantly different in the two groups and the median was 2 days in both the groups. This finding differed from that of some prominent studies where the hospital stay has been found to be more for TAPP.<sup>12,17</sup> Duration of hospital stay can affect the cost effectiveness of the techniques if calculated. However, we haven't included cost-effectiveness of the techniques as a variable in our study owing to some practical concerns. No intra-operative complications like bowel injury or severe hemorrhage was encountered in any group. Injury to inferior epigastric artery occurred in one patient in each group and in one patient in TEP group hemorrhage occurred while fixing the mesh using tacker near pubic symphysis. All these complications were managed laparoscopically and did not require conversion to open surgery in any case. The overall rate of complications was not significantly different in the two groups. Many other studies have also shown similar results in terms of intra-operative complications.<sup>7,9,17</sup> But Markus Gass et al have made a different observation in their large cohort study, based on prospective data of the Swiss association of laparoscopic and thoracoscopic surgery, wherein they have found a higher incidence of both intraoperative as well as postoperative complications in the TEP group.<sup>11</sup>

The common post-operative complications after laparoscopic hernia repair are urinary retention, bleeding, seroma or hematoma formation, scrotal oedema, subcutaneous emphysema, wound infection, chronic neuralgia.<sup>18</sup> Intestinal obstruction and recurrence of hernia are seen less commonly. Most of the post-operative complications observed in either group were non-serious in nature. Overall proportion of cases with post-operative complications was not significantly different in the two groups. When considered individually also none of these complications differed significantly between the two groups. The most frequent post-operative complication was formation of seroma seen in 6.67% cases in TEP and in 4.88% cases in TAPP group. One patient in TAPP group developed chronic groin pain suggestive of nerve irritation syndrome. The pain responded to medical management over a three months period.

Postoperative pain scores were compared for the two groups at six and 24 hours using visual analogue scale. The mean pain scores were significantly higher for the TAPP groups at both the intervals. Similar results have emerged in other studies also.<sup>10,14,19</sup> The reason for this finding are not clearly understood but one explanation may be the use of greater numbers of tacks for fixation of mesh as well as for the closure of peritoneal incision. More extensive dissection may be another factor because of the availability of wider view and a greater degree of freedom of movement of hand instruments. According to Tolver et al, the pain in early post-operative period is most severe in younger patients and can be predicted by pre-operative high pain response to experimental heat stimulation.<sup>20</sup> Bansal et al have concluded in their study



that although there was significantly higher acute pain after TAPP the chronic postoperative pain is comparable in the two groups.<sup>19</sup> In our study also the pain at follow up visits were comparable between the two groups. Chronic pain was seen in one patient only belonging to TAPP group.

### Limitations

The chief limitation of our study is that we have chosen only simple, uncomplicated and unilateral hernias. The findings of this study cannot be applied universally to all laparoscopic inguinal hernia repairs. In addition, we have studied only short-term outcome which does not suffice to comment upon 'recurrence' after surgery which is an important complication of hernia repair.

### CONCLUSION

In the light of above findings, we can conclude that both the techniques are being used fairly commonly by the surgeons all over the world and appear to be relatively safe. In terms of both intraoperative and postoperative complications both the techniques have fared similarly in our study but there is indeed some difference in the parameters of duration of surgery and early postoperative pain scores. This makes TEP a preferable option when the surgeon is well versed in the either of these techniques. However, as per the evidence-based recommendations TAPP is better preferred in case of less experienced surgeons whereas in other cases a tailor-made choice of procedure according to the prevailing circumstances in individual cases shall be in order.

### ACKNOWLEDGEMENTS

We would like to express our sincere thanks to the institute's management for providing a conducive environment for this research project.

*Funding: No funding sources*

*Conflict of interest: None declared*

*Ethical approval: The study was approved by the Institutional Ethics Committee*

### REFERENCES

- Bansal VK, Krishna A, Misra MC, Kumar S. Learning Curve in Laparoscopic Inguinal Hernia Repair: Experience at a Tertiary Care Centre. *Ind J Surg.* 2016;78(3):197-202.
- Light D, Stephenson BM, Sanders DL; British Hernia Society. Management of the uncomplicated primary inguinal hernia in 2019: the practice amongst members of the British Hernia Society. *Ann R Coll Surg Engl.* 2020;102(3):191-3.
- Köckerling F, Simons MP. Current Concepts of Inguinal Hernia Repair. *Visc Med.* 2018;34(2):14550.
- Soler, M. The minimal open preperitoneal (MOPP) approach to treat the groin hernias, with the history of the preperitoneal approach. *Ann Laparosc Endosc Surg.* 2017;2(8).
- Cueto J, Vázquez JA, Solís MA, Valdéz G, Valencia S, Weber A. Bowel obstruction in the postoperative period of laparoscopic inguinal hernia repair (TAPP): review of the literature. *J Soc Laparosc.* 1998;2(3):277-80.
- Köhler G, Mayer F, Lechner M. Small bowel obstruction after TAPP repair caused by a self-anchoring barbed suture device for peritoneal closure: Case report and review of the literature. *Hern.* 2015;19(3):389-94.
- Rambhia SU, Modi R. A comparative study between totally extraperitoneal and transabdominal preperitoneal laparoscopic inguinal hernia repair techniques. *Int Surg J.* 2017;4(2):663-70.
- Vărcuș F, Duță C, Dobrescu A, Lazăr F, Papurica M, Tarta C. Laparoscopic Repair of Inguinal Hernia TEP versus TAPP. *Chirurgia (Bucur)* 2016;111(4):308-12.
- More MP, Nasta AM, More RM, Shedge R. Comparison of Laparoscopic TAPP (Transabdominal Preperitoneal) and Laparoscopic TEP (Totally Extra peritoneal) Techniques for Inguinal Hernia Repair- An Observational Study of 60 Cases. *J Dent Medic Sci.* 2016;15(7):90-3.
- Krishna A, Misra MC, Bansal VK, Kumar S, Rajeshwari S, Chabra A. Laparoscopic inguinal hernia repair: transabdominal preperitoneal (TAPP) versus totally extraperitoneal (TEP) approach: a prospective randomized controlled trial. *Surg Endosc.* 2012;26(3):639-49.
- Gass M, Banz VM, Rosella L, Adamina M, Candinas D, Güller U. TAPP or TEP? Population-based analysis of prospective data on 4,552 patients undergoing endoscopic inguinal hernia repair. *World J Surg.* 2012;36(12):2782-6.
- Bracale U, Melillo P, Pignata G, Di Salvo E, Rovani M, Merola 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(12):3355-66.
- 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(10):2348-52.
- Chen LS, Chen WC, Kang YN, Wu CC, Tsai LW, Liu MZ. Effects of transabdominal preperitoneal and totally extraperitoneal inguinal hernia repair: an update systematic review and meta-analysis of randomized controlled trials. *Surg Endosc.* 2019;33(2):418-28.
- Wei FX, Zhang YC, Han W, Zhang YL, Shao Y, Ni R. Transabdominal Preperitoneal (TAPP) Versus Totally Extraperitoneal (TEP) for Laparoscopic

- Hernia Repair: A Meta-Analysis. *Surg Laparosc Endosc Percutan Tech.* 2015;25(5):375-83.
16. Aiolfi A, Cavalli M, Micheletto G, Lombardo F, Bonitta G et al. Primary inguinal hernia: systematic review and Bayesian network meta-analysis comparing open, laparoscopic transabdominal preperitoneal, totally extraperitoneal, and robotic preperitoneal repair. *Hern.* 2019;23(3):473-84.
  17. Köckerling F, Bittner R, Jacob DA, Seidelmann L, Keller T, Adolf D, et al. TEP versus TAPP: comparison of the perioperative outcome in 17,587 patients with a primary unilateral inguinal hernia. *Surg Endosc.* 2015;29(12):3750-60.
  18. Chowbey PK, Pithawala M, Khullar R, Sharma A, Soni V, Baijal M. Complications in groin hernia surgery and the way out. *J Minim Access Surg.* 2006;2(3):174-7.
  19. Tolver MA, Rosenberg J, Bisgaard T. Early pain after laparoscopic inguinal hernia repair. A qualitative systematic review. *Acta Anaesthesiol Scand.* 2012;56(5):549-57.
  20. Bansal VK, Misra MC, Babu D, Victor J, Kumar S, Sagar R et al. A prospective, randomized comparison of long-term outcomes: chronic groin pain and quality of life following totally extraperitoneal (TEP) and transabdominal preperitoneal (TAPP) laparoscopic inguinal hernia repair. *Surg Endosc.* 2013;27(7):2373-82.

**Cite this article as:** Kumar S, Kaur M. A prospective randomized comparison of short-term outcome of laparoscopic, totally extra-peritoneal and trans-abdominal pre-peritoneal repairs for inguinal hernia. *Int Surg J* 2020;7:3945-50.