

# Laparoscopic Inguinal Hernia Repair: A Comparison of Totally Extra Peritoneal (TEP) versus Trans Abdominal Pre-peritoneal (TAPP) repair Techniques in a Tertiary Care Teaching Hospital

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## Abstract

**Background:** Inguinal hernia repair is one of the most common surgical procedures performed. The methods for inguinal hernia repair have remained mostly constant for over a century until the development of synthetic mesh. Francis Usher is the inventor of polypropylene. For laparoscopic groin hernia repair, both the trans-abdominal pre-peritoneal (TAPP) and total extra peritoneal (TEP) techniques can be employed. **Subjects and Methods:** The study comprised a total of 76 patients. It was a non-randomized research in which patients were divided into two groups based on the surgeon's preference: Group A (TAPP) and Group B (TEP). As a result, 40 patients were assigned to TAPP group A and 36 patients to TEP group B. All patients were assessed for pain at 6 hours, 12 hours, 24 hours, 1 week, 6 months, and 1 year after surgery. **Results:** The enlargement in the inguinal region was present in all of the individuals in the research, and it lasted anywhere from one week to six months. Pain was the presenting symptom in 16 of the TAPP patients and 11 of the TEP patients. In terms of pain as a presenting complaint, both groups were comparable, with a P value of 0.12 that was statistically insignificant. The mean VAS score for patients presenting with pain in the TAPP group was 4.02, whereas it was 3.87 for patients in the TEP group. Again, there was no statistically significant difference in the VAS scores between the two groups. Three patients in the TAPP group and two in the TEP group reported having changed bowel habits. Each group had one patient who had previously had an inguinal hernia repaired. Both groups were found to be comparable after statistical analysis. **Conclusion:** In this prospective non-randomized study, we compared laparoscopic TEP and TAPP repair for the standard parameters of surgery time, conversion, serious adverse event, post-operative pain, local complications, recurrence both locally and at the port site, and length of hospital stay over a one-year period. There was no other significant difference between the two treatments other than a statistically significant difference in pain at 24 hours, which was higher in the TAPP group than the TEP group.

**Keywords:** Inguinal Hernia, Extra Peritoneal (TEP) and Trans Abdominal Pre-peritoneal (TAPP) repair Techniques.

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## Introduction

In general, inguinal hernia repair is one of the most routinely done surgical procedures. Until the introduction of synthetic mesh, the methods for inguinal hernia repair had remained mostly unchanged for almost a century. Polypropylene was invented by Francis Usher.<sup>[1]</sup> Trans-abdominal pre-peritoneal (TAPP) and total extra peritoneal (TEP) approaches can both be used for laparoscopic groin hernia repair.<sup>[2]</sup> Because there is a lack of data comparing the two procedures, and some issues concerning their relative virtues and hazards remain unanswered, the choice of approach for laparoscopic inguinal hernia repair is contentious.<sup>[3]</sup> TAPP necessitates a peritoneal

incision to provide access to the peritoneal cavity and the insertion of a mesh. The mesh is implanted in the pre-peritoneal space in the inguinal region, encompassing all potential hernia sites. Above the mesh, the peritoneum is then closed.<sup>[4]</sup> TEP is distinct in that it does not enter the peritoneal cavity and instead uses mesh to seal the hernia from the outside. TEP is a more technically difficult procedure than TAPP, but it may reduce the risk of intra-abdominal organ damage and adhesion formation leading to intestinal obstruction (both of which have been linked to TAPP), as well as saving operative time because the peritoneum does not need to be incised and closed from the inside. TEP is also

known to help with post-surgical pain.<sup>[5]</sup> Indirect comparisons of TAPP and TEP have raised concerns regarding whether the two techniques perform differently for certain outcomes like recurrence.<sup>[6]</sup> Large randomised controlled trials, such as those undertaken by the MRC laparoscopic groin hernia group by Neumayer and colleagues, which compared a primarily TEP arm to open mesh repair, revealed that TEP has a higher recurrence risk than open mesh repair. However, no indication of a difference in recurrence rates between TAPP and open mesh repair was discovered in a comprehensive review comparing laparoscopic and open mesh repair.<sup>[7]</sup> While any conclusions obtained from such indirect comparisons should be viewed with caution, they do raise problems that can only be answered satisfactorily through well-designed investigations and systematic reviews of such studies that directly compare TAPP with TEP.<sup>[8]</sup> The aim of this the present study is to assess the clinical effectiveness and relative efficiency of completely extra-peritoneal (TEP) and laparoscopic trans abdominal pre-peritoneal (TAPP) laparoscopic hernioplasty.

### Subjects and Methods

This prospective non-randomized study was carried out in the Department of General Surgery, World College of Medical Sciences Research and Hospital, Jhajjar Haryana, India during the period from October, 2016 to February, 2018. Total 76 patients were included in the study. It was a non-randomized study where patients were allocated in Group-A (TAPP) and Group-B (TEP) group based on surgeon’s preference. Hence, 40 patients were included in TAPP group- A while 36 patients were allocated to TEP group-B. Post-operatively all patients were evaluated for pain at 6 hours, 12 hours, 24 hours, 1week, 6 months and 1 year. They were also evaluated for length of hospital stay and any operative site complication like haematoma/seroma, wound/mesh infection, recurrence, port site hernia, persisting numbness. All the patients aged 20 years and above admitted in World College of Medical Sciences Research and Hospital, Jhajjar Haryana undergoing laparoscopic inguinal hernia repair were included in this study. Diagnosis was made based on history and clinical examination and ultrasound scan of the abdomen. Patients undergoing open hernia surgery and those having contra-indications to laparoscopic hernia repair were excluded from the study. The patients underwent laparoscopic TAPP or laparoscopic TEP repair of hernia based on Surgeon’s preference.

### Statistical analysis

In order to present the data in this study, descriptive statistical analysis was used. The mean and standard deviation of continuous measurements are displayed, while the number and percentages of categorical measurements are displayed. The significance is determined at a 5% level of significance. The significance of research parameters on a continuous scale

between two groups was determined using the Student t test (two-tailed, independent). The significance of research parameters on a categorical scale between the two groups was determined using the Chi-square/ Fisher exact test. The data was analysed using the statistical software SPSS version 22.0, and graphs and tables were created using Microsoft Word and Excel.

### Results

This current study was conducted at the World College of Medical Sciences Research and Hospital, Jhajjar Haryana, India, in the Department of General Surgery. Post-operatively all patients were evaluated for pain at 6 hours, 12 hours, 24 hours, 1week, 6 months and 1 year. They were also evaluated for length of hospital stay and any operative site complication like haematoma/seroma, wound/mesh infection, recurrence, port site hernia, persisting numbness. 3 patients in TAPP group and 4 in TEP group were lost to follow up at the end of 1 month. Further 4 patients in TAPP group and 1 patient in TEP group were also lost to follow up at 6 months. The two groups were similar in age and presenting complaints, which included pain, swelling, and a history of changed bowel habits, as well as any previous hernia repair. The majority of the patients in TAPP group-A were between the ages of 50 and 60, whereas the majority of the patients in TEP group were between the ages of 60 and 70. The TAPP group had a mean age of 59.37 years, while the TEP group had a mean age of 60.7 years. When it came to age distribution, both groups were comparable.

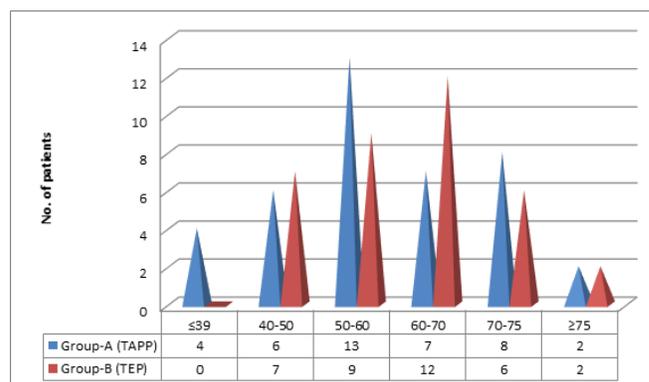


Figure 1: Shows the age comparison between both groups.

The enlargement in the inguinal region was present in all of the individuals in the research, and it lasted anywhere from one week to six months. Pain was the presenting symptom in 16 of the TAPP patients and 11 of the TEP patients. In terms of pain as a presenting complaint, both groups were comparable, with a P value of 0.12 that was statistically insignificant.

Table 1: VAS score between two groups.

VAS	Group	Pain	Mean ± S.D.	P- value
	Group A-TAPP	16	4.02 ± 1.27	0.52**
	Group B-TEP	11	3.87 ± 1.12	

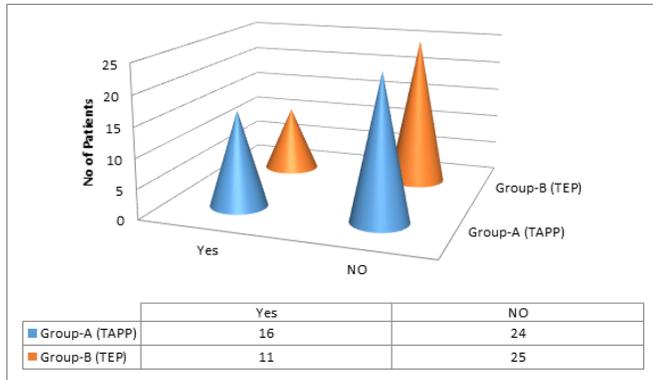


Figure 2: Shows the pain as presenting complaint.

The mean VAS score for patients presenting with pain in the TAPP group was 4.02, whereas it was 3.87 for patients in the TEP group. Again, there was no statistically significant difference in the VAS scores between the two groups. Three patients in the TAPP group and two in the TEP group reported having changed bowel habits. Each group had one patient who had previously had an inguinal hernia repaired. Both groups were found to be comparable after statistical analysis. One patient had a partially blocked right hernia that spontaneously decreased after pneumoperitoneum formation.

TAPP had a mean operating time of 67.24 minutes, whereas the TEP group had a time of 71.26 minutes. The length of the operation was not statistically significant (P value - 0.37). In the 76 patients who took part in the trial, no visceral damage were found. The inferior epigastric artery was injured in three TAPP patients and four TEP patients. The statistical analysis revealed no statistically significant differences (P value - 0.14). During the creation of the TEP plane, two patients in the TEP group inadvertently entered the peritoneum, necessitating TAPP repair. The intention to treat principle was used to keep these individuals in the TEP group.

Pain after the surgery was analyzed using VAS score at immediate post-operative period, 1 week, 1 month, 6 months and 1 year. At 6 hours, 12 hours, and 1 week, there was no statistically significant difference between the two groups. At 24 hours, however, there was a statistically significant difference in pain. Patients receiving TAPP repair experienced more pain (mean VAS - 2.23) than those undergoing TEP repair (mean VAS - 1.74).

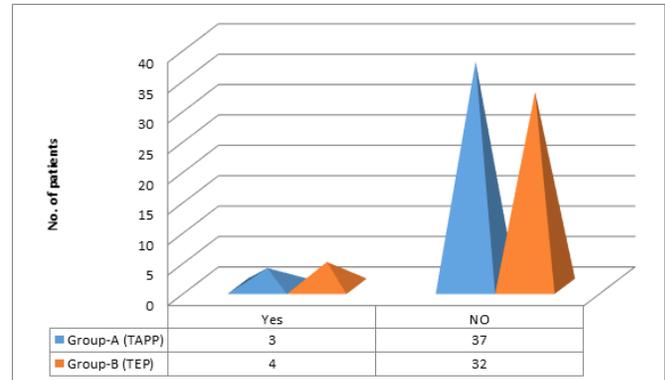


Figure 3: Shows the intra-operative complications in terms of visceral and vascular injury.

After one week, 8 patients in the TAPP group had pain, while 7 patients in the TEP group had pain at the end of one week. This pain was shown to be statistically insignificant (P value - 0.26). At 1 month, 2 patients in the TAPP group and 3 patients in the TEP group were lost to follow up, and at 6 months, 4 patients in the TAPP group and 1 patient in the TEP group were lost to follow up. At one month, six months, and a year, no pain was found in any of the patients.

At the end of one week, haematoma was seen in two patients in the TAPP group and one patient in the TEP group, which cleared spontaneously without the need for intervention. At one month, six months, and one year, no patients experienced haematoma. At the end of one week, haematoma was statistically negligible in both groups (P value - 0.13).

At the end of one week, two patients in each group complained of seroma, which was statistically insignificant (P value - 0.24). Seroma, like haematoma, cured spontaneously, and no patients had seroma after one month, six months, or one year.

Out of 40 patients in the TAPP group, 35 were discharged after a one-day stay and 5 were discharged after two days. In TEP, 28 patients were discharged after a one-day stay and 8 patients were discharged after two days. The prolonged stay was requested by the patient, not because of the surgery's problems. The difference in hospital stay time between the two groups was not statistically significant, and the two groups were comparable in terms of stay time (P value- 0.21). There was no wound infection or mesh infection in any of our

**Table 2: Altered bowel habits and previous hernia repair.**

		Group A (TAPP) N=40 (%)	Group B (TEP) N=36 (%)
Altered bowel habits	Yes	3 (7.5%)	2 (5.6%)
	No	37 (92.5%)	34 (94.4%)
History or previous hernia repair	Yes	1 (2.5%)	1 (2.8%)
	No	39 (97.5%)	35 (97.2%)

**Table 3: Comparison of duration of surgery.**

	Group	N	Mean ± S.D.	P- value
Duration of surgery	Group A-TAPP	40	67.24 ± 27.54	0.37**
	Group B-TEP	36	71.26 ± 29.72	

**Table 4: Persisting post-operative pain.**

	Group	N	Mean ± S.D.	P- value
Pain at 6	Group-A(TAPP)	40	3.74 ± 1.36	0.24**
	Group-B (TEP)	36	3.21 ± 1.23	
Pain at 12	Group-A (TAPP)	40	2.97 ± 1.08	0.14**
	Group-B (TEP)	36	2.41 ± 0.97	
Pain at 24	Group-A (TAPP)	40	2.23 ± 0.87	0.05**
	Group-B (TEP)	36	1.74 ± 0.54	

**Table 5: Persisting post-operative pain at 1 week.**

Week 1		Group A (TAPP) N=40 (%)	Group B (TEP) N=36 (%)
Pain	Yes	8 (20.0%)	7 (19.4%)
	No	32 (80.0%)	29 (80.6%)

**Table 6: Comparison of hematoma occurrence in two groups.**

Week 1		Group A (TAPP) N=40 (%)	Group B (TEP) N=36 (%)
Hematoma	Yes	2 (5.0%)	1 (2.8%)
	No	38 (95.0%)	35 (97.2%)

**Table 7: Comparison of seroma between two groups.**

Week 1		Group A (TAPP) N=40 (%)	Group B (TEP) N=36 (%)
Seroma	Yes	2 (5.0%)	2 (5.6%)
	No	38 (95.0%)	35 (94.4%)

patients. None of our patients had hernia recurrence till the duration of study (1 year). During the study period, none of our patients developed a Port site hernia.

After 1 week, 1 patient in the TAPP group and 2 in the TEP group had persistent numbness, however this was not discovered at 1 month or subsequently until 1 year of follow up. The difference in persistent numbness between the two groups after a one-week delay was not statistically significant.

## Discussion

TEP and TAPP repair of inguinal hernias are two techniques of laparoscopic inguinal hernia repair that have emerged during the last two decades. Despite various studies, there is no clear evidence that one procedure is preferable to the other. The following research was conducted in order to determine which of the two laparoscopic inguinal hernia repair meth-

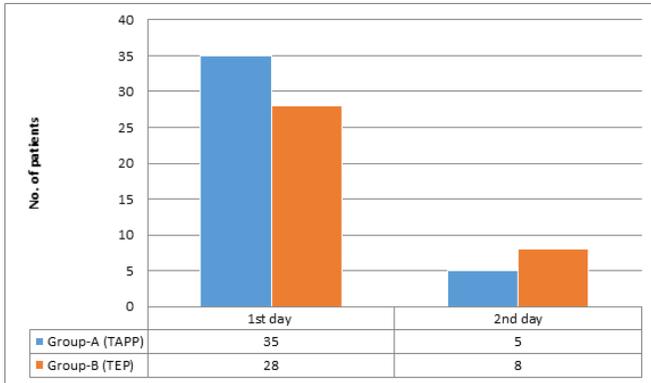


Figure 4: Shows the duration of hospital stay.

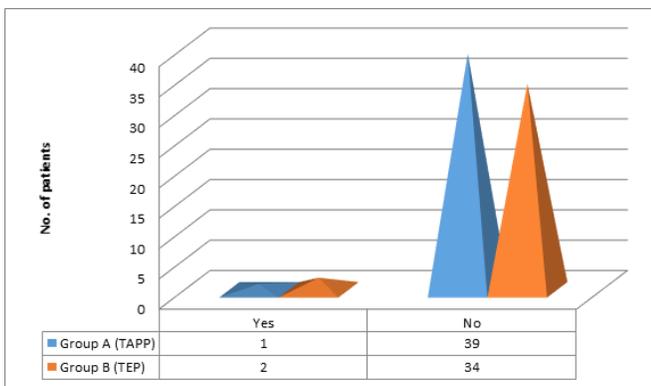


Figure 5: Shows the persisting numbness.

ods was superior. The Department of General Surgery, World College of Medical Sciences Research and Hospital, Jhajjar Haryana has been doing both TAPP and TEP procedures for hernia repair on a regular basis. We opted to evaluate the two approaches of laparoscopic inguinal hernia repair in this institute because there are few literature on such comparative studies in an Indian setting. This was a 76-patient comparative study, with 40 patients in the laparoscopic TAPP group and 36 patients in the laparoscopic TEP group, conducted in the Department of General Surgery, World College of Medical Sciences Research and Hospital October, 2016 to February, 2018, with a one-year follow-up. A comparative study with regard to following parameters was made: duration of operation (min), conversion, serious adverse events (including visceral injuries and vascular injuries), persisting post-operative pain, haematoma, seroma, wound/superficial infection, mesh/deep infection, hernia recurrence, port site hernia, length of hospital stay (days), persisting numbness. In this study, all of the patients were males. This reflects the uncommon occurrence of inguinal hernia in female. In this study, the mean operation time in the TAPP group was 67.24 min-

utes, while in the TEP group it was 71.26 minutes. As a result, the overall mean operation time for laparoscopic TAPP repair was less than for laparoscopic TEP repair. The surgical time for laparoscopic total extraperitoneal and laparoscopic trans-abdominal pre-peritoneal repair has been reported to be 43, 77.4, 87.0 minutes in TAPP and 57.3, 96.12, 72.0 minutes by Zeineldin A,<sup>[8]</sup> Hamza Y. et al,<sup>[9]</sup> and Choksi D. et al,<sup>[10]</sup> in various studies. The TAPP is seen to be a little easier because it is performed intra-peritoneally, which is a more familiar environment for the newcomer.<sup>[11]</sup> TEP is distinct in that it does not enter the peritoneal cavity and instead uses mesh to seal the hernia from the outside. This method is regarded as more complicated than TAPP. Study found that TEP approach is more difficult and is taking longer time to perform than TAPP mainly because of unfamiliar anatomy, however in our study the duration of surgery was statistically not significant. During the creation of the TEP plane, two patients in the TEP group inadvertently entered the peritoneum, necessitating TAPP repair. However, based on the concept of intent to treat, both patients were assigned to the TEP group. The findings of the investigation were backed up by a study by Zeineldin A, who found two examples of TEP being changed to TAPP due to penetration into the peritoneum when constructing the TEP plane.<sup>[8]</sup> Three comparison studies found no vascular damage, whereas one small research of 120 patients found a greater prevalence of TEP (3 percent versus 0%). One of the three case series found no vascular damage in TAPP, whereas the other two case series found identical rates for TAPP (0.5 percent, based on 5707 cases) and TEP (0.5 percent, based on 5707 instances) (0.47 percent based on 5203 cases). Two comparative studies found no visceral injuries, while two others found a greater rate (0.9% compared 0 percent and 0.4 percent versus 0 percent) in TAPP than in TEP (0.9 percent versus 0 percent and 0.4 percent versus 0 percent, respectively).<sup>[4]</sup> There were a total of 1323 instances in these investigations. With a total of 8207 instances, the two TAPP series 3 revealed identical rates of 0.64 percent and 0.60 percent, respectively, however the one TEP series reported a lower rate of 0.23 percent based on 5203 cases. In the 76 patients who took part in the trial, no visceral damage were found. There were three incidences of vascular damage in the TAPP group and four cases in the TEP group. The statistical analysis revealed no statistically significant differences. This was supported by a study by Zeineldin A,<sup>[8]</sup> which found two occurrences of vascular injury out of 68 patients in the TAPP group, but no vascular complications in the 59 patients in the TEP group. Wake BL et colleagues found no intra-operative problems in the TAPP and TEP groups in another investigation. (There were 28 TAPP patients and 24 TEP patients in this study.<sup>[4]</sup> In a research by Choksi D et al, 8 patients in the laparoscopic TEP group (26.66%) had minor problems compared to 6 patients in the laparoscopic TAPP group (20%). The difference, however, was not statistically significant.<sup>[10]</sup> Cohen RV et colleagues found a 13.5 percent

complication rate in the laparoscopic TEP group against 20.5 percent in the laparoscopic TAPP group, which was not statistically significant.<sup>[12]</sup> The VAS score was used to assess pain in the immediate post-operative period, one week, one month, six months, and one year after surgery. At 6 hours, 12 hours, and 1 week, there was no statistically significant difference between the two groups. At 24 hours, however, there was a statistically significant difference in pain. Pain was observed to be higher in patients receiving TAPP repair (mean VAS - 2.23) than in those undergoing TEP repair (mean VAS - 1.74). 8 patients in TAPP group experienced pain after 1 week while in TEP group seven patients had pain at the end of 1 week. This difference in pain was found to be statistically insignificant. 2 patients were lost to follow up at 1 month and 4 were lost at 6 months in TAPP group while in TEP group, 3 patients were lost to follow up at 1 month and 1 at 6-month interval. No patient in both the groups complained of pain at 1 month, 6 months and 1 year. One study done by Krishnan A et al showed that pain scores at 1 hour and 24 hours after surgery and at 3-month follow-up were significantly higher in the TAPP group as compared to TEP group.<sup>[13]</sup> There was also a substantial pain difference between the TAPP and TEP groups at the 24-hour mark in this trial, with patients receiving TAPP repair suffering more pain than patients in the TEP group. At the end of one week, two patients in the TAPP group developed haematoma, while one patient in the TEP group had haematoma. The difference in haematoma incidence between the two groups at the end of one week was determined to be statistically insignificant. At the end of one week, two patients in each group developed seroma in the inguinal region following hernioplasty, which was statistically insignificant. In every case, the haematoma and seroma cleared spontaneously without the need for intervention. At 1 month, 6 months, and 1 year, no patients experienced haematoma/seroma. Our findings were supported by a research by Zeineldin A, which found two cases of seroma in TAPP and four in TEP, both of which were statistically insignificant.<sup>[8]</sup> Out of 28 patients who underwent TAPP repair, Wake BL et colleagues found only one case of haematoma, whereas none of the 24 patients in the TEP group had a haematoma.<sup>[3]</sup> Deep infections, particularly mesh infections, can be more severe than surface infections and lead to mesh removal. No one in our study had a superficial or deep wound infection, and none of the patients had a mesh infection. Wake BL et al,<sup>[4]</sup> found that three of the comparison investigations found no deep infections, whereas one found rates of 0.2 percent and 0 percent for TAPP and TEP, respectively. The case series' reported rates were also modest, with no discernible difference between TAPP and TEP. The TAPP case series had rates of 0% and 0.1 percent, respectively, whereas the TEP case series had a rate of 0.02 percent. No one in our research experienced a hernia recurrence after the first year. Hernia recurrence was assessed by Wake BL et al for up

to three months. There was one recurrence in the TAPP group during this time.<sup>[4]</sup> Zeineldin A discovered that the recurrence rate in TEP was higher than TAPP (3.4 percent versus 1.5 percent), with a mean follow-up length of 38.5 months in TAPP and 40 months in TEP.<sup>[8]</sup> Hamza Y et colleagues discovered recurrence in one patient in the TAPP group and one patient in the TEP group, although it was not statistically significant.<sup>[9]</sup> No one in our group had a hernia at the port. In contrast to our findings, Wake BL et colleagues reported that the incidence of port-site hernia was higher in the TAPP group than in the TEP group.<sup>[4]</sup> The duration of stay in the TAPP group was one day for 35 patients and two days for five participants in this study. In the TEP, 28 patients were discharged after one day and 8 patients were discharged after two days. The prolonged stay was not owing to operation problems, but rather at the patient's decision. The difference in hospital stay time between the two groups was not statistically significant, and the two groups were comparable in terms of stay time. Zeineldin A,<sup>[8]</sup> found a similar outcome, with the mean duration of stay in the TAPP group being 32 hours and the TEP group being 30 hours. In their study, Choksi D et al discovered that the average length of post-operative hospital stay for laparoscopic TEP repair hernia repair was 2.81.3 days and 2.761.0 days for laparoscopic TAPP repair.<sup>[10]</sup> The TEP group had a lengthier stay, according to Wake BL et al (mean duration of stay of 3.7 days in TAPP group and 4.4 days in TEP group). It was discovered that this was statistically significant.<sup>[4]</sup> After one week, one patient in the TAPP group and two in the TEP group exhibited persistent numbness, but this was not seen after one month, six months, or one year. The difference in persistent numbness between the two groups after a one-week delay was not statistically significant.

## Conclusion

In conclusion, We had a one-year follow-up in this prospective non-randomized study comparing laparoscopic TEP and TAPP repair for the standard parameters of duration of surgery, conversion, serious adverse event, post-operative pain, local complications, recurrence both locally and at the port site, and length of hospital stay. Apart from a statistically significant difference in pain at 24 hours, which was higher in the TAPP group than the TEP group, no other meaningful difference between the two treatments was detected. To justify the use of one procedure over another, lengthier studies with more volume and a longer time of follow up are required. In the current scenario, we conclude that, depending on the surgeon's preference, TAPP or TEP can be used to treat any inguinal hernia.

postoperative quality of life in TEP, TAPP, and modified lichtenstein repairs.

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