International Surgery Journal
Rambhia SU et al. Int Surg J. 2017 Feb;4(2):663-670
http://www.ijsurgery.com
pISSN 2349-3305 | eISSN 2349-2902

DOI: http://dx.doi.org/10.18203/2349-2902.isj20170210

Original Research Article

A comparative study between totally extraperitoneal and transabdominal preperitoneal laparoscopic inguinal hernia repair techniques

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Received: 13 November 2016
Accepted: 14 December 2016

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ABSTRACT

Background: Laparoscopic groin hernia repair can be done by trans-abdominal pre-peritoneal (TAPP) approach and also by total extra peritoneal (TEP) approach. The objective of this study was to compare the clinical effectiveness and relative efficiency of trans-abdominal pre-peritoneal (TAPP) versus totally extra peritoneal (TEP) techniques of laparoscopic inguinal hernia repair.
Methods: All the patients aged 18 years and above admitted in HBT Hospital undergoing laparoscopic inguinal hernia repair were included in this study from June 2014 to January 2016. 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.
Results: Total 56 patients were included in the study. It was a non-randomized study, where patients were allocated in TAPP and TEP group based on surgeon's preference. Hence, 29 patients were included in TAPP group while 27 patients were allocated to TEP group. 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 hematoma/seroma, wound/mesh infection, recurrence, port site hernia, persisting numbness. 2 patients in TAPP group and 3 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. Apart from statistically significant difference in pain at 24 hours, which was more in TAPP group than TEP group, we found no other significant difference between the two methods.
Conclusions: 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 port site and length of hospital stay, we had a follow up of 1 year which is adequate for most parameters except recurrence. Our follow up does not allow us to make any conclusion about recurrence. Though the patient numbers are small, our study resonates with the larger studies regarding most parameters. This study leaves us none the wiser as to the superiority of one technique and hence, it is the individual surgeon's preference and proficiency which dictates the choice of procedure.

Keywords: Laparoscopic hernia repair, TEP, TAPP, inguinal hernia

INTRODUCTION

Laparoscopic groin hernia repair can be done by trans-abdominal pre-peritoneal (TAPP) approach and also by total extra peritoneal (TEP) approach.[1] The choice of approach to the laparoscopic repair of inguinal hernia is controversial because of scarcity of data comparing the two approaches and some questions remain unanswered about their relative merits and risks.[2,3] TAPP requires access to the peritoneal cavity with placement of a mesh through a peritoneal incision. The mesh is placed in the pre-peritoneal space covering all potential hernia sites in the inguinal region. The peritoneum is then closed above the mesh.[2,3] TEP is different in that the peritoneal cavity is not entered and mesh is used to seal the hernia from outside the peritoneum. TEP is a technically more difficult procedure than TAPP but may lessen the risk of damaging intra-abdominal organs and of adhesion formation leading to intestinal obstruction (which has been linked to TAPP), and it may save operative time as it is not necessary to incise and close the peritoneum from the inside. TEP is also thought to reduce post-operative pain.[4,5] Indirect comparisons between TAPP and TEP have raised questions about whether the two procedures do perform differently for some outcomes such as recurrence.[2-4] Very large randomized controlled trails such as those conducted by the MRC laparoscopic groin hernia group and neumayer and colleagues, both of which compared a predominantly TEP arm with open repair, suggested that TEP has a higher risk of recurrence than open mesh repair. However, a systematic review comparing laparoscopic with open mesh repair found no evidence of a difference in recurrence rates between TAPP and open mesh repair.[2,4-6]

While any conclusions drawn on such indirect comparisons should be treated with caution, they do raise questions that can only be satisfactory addressed by well-designed studies and systematic reviews of such studies that directly compare TAPP with TEP.[5,7] Study purpose in this study is to compare the clinical effectiveness and relative efficiency of laparoscopic hernioplasty by totally extra-peritoneal (TEP) technique and laparoscopic trans abdominal pre-peritoneal (TAPP) technique.

METHODS

This study was carried out in HBT hospital, a Secondary referral healthcare centre in Jogeshwari, Mumbai, Maharashtra, India. This study was carried out from June 2014 to January 2016.

All the patients aged 18 years and above admitted in HBT hospital 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.

It is a prospective non-randomized study. The patients underwent laparoscopic TAPP or laparoscopic TEP repair of hernia based on Surgeon's preference.

Statistical analysis

Descriptive statistical analysis has been carried out to present the data in the present study. Results on continuous measurements are presented with Mean and standard deviation and results on categorical measurements are presented in number and percentages.

Significance is assessed at 5% level of significance. Student t test (two tailed, independent) has been used to find the significance of study parameters on continuous scale between two groups. Chi-square/ fisher exact test has been used to find the significance of study parameters on categorical scale between the two groups.

The statistical software SPSS version 17.0 was used for the analysis of the data and Microsoft word and Excel have been used to generate graphs and tables.

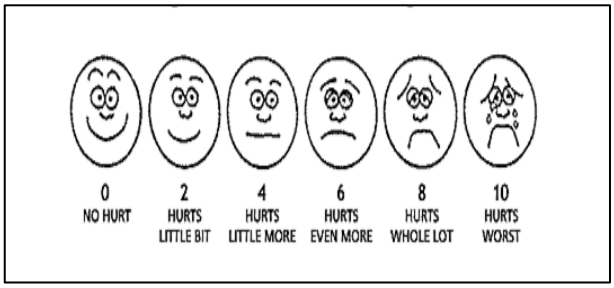

Figure 1: Wong-Baker faces pain rating scale.[13]

For each patient, the following demographic, perioperative and postoperative data were collected prospectively - age, presenting complaints, operating time, conversion, serious adverse events (including visceral injuries and vascular injuries), persisting post-operative pain, hematoma, seroma, wound/mesh infection, hernia recurrence, port site hernia, length of hospital stay, persisting numbness. All patients were evaluated preoperatively regarding fitness for surgery. Single dose of Cefuroxime 1.5 g was administered preoperatively as a prophylactic dose and in some cases therapeutic dose of Cefuroxime was used as per the surgeon's choice for 1-2 days. After discharge patients in both the groups were given three days of tablet Cefuroxime and analgesic tablet Paracetamol SOS for pain for three days. All patients undergoing laparoscopic inguinal hernioplasty had polypropylene mesh repair irrespective e of the procedure done i.e. TAPP or TEP. Patients were followed up at immediate post-operative period, 1 week, 1 month, 6 months and 1 year. Pain was assessed using Visual analogue score (VAS) ranging from the 0 to 10 score as shown in the figure below and VAS score was taken 6 hour, 12 hours, and 24 hours after surgery and 1 week, 1 month, 6 months and 1 year. The VAS was recorded through patient interview during

follow up visits. The hematoma, seroma, wound/mesh infection, hernia recurrences, port site hernia, numbness in patients were examined during their follow up visits at the prescribed interval.

The Wong-Baker visual analog score (VAS) pain scale was used to quantify the amount of pain. Seroma is the collection of fluid leading to bulge at the operation site observed by patient or surgeon. It is considered significant if it lasts more than six weeks without any intervention. Hematoma is the collection of blood underneath the operation site which appears as bulge at the operation site observed by patient or surgeon which was distinguished from seroma by discoloration of skin.

RESULTS

This was a prospective non randomized study carried out in HBT hospital, a secondary referral healthcare centre in Jogeshwari, Mumbai, Maharashtra, India. This study was done over a period of almost 2 years from June 2014 to January 2016. Total 56 patients were included in the study. It was a non-randomized study where patients were allocated in TAPP and TEP group based on surgeon's preference. Hence, 29 patients were included in TAPP group while 27 patients were allocated to TEP group.

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. 2 patients in TAPP group and 3 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.

Group comparison

The two groups were comparable with respect to the age and presenting complaints which included pain, swelling, and history of altered bowel habits and history of previous hernia repair if any.

Table 1: Age comparison between both groups.

Age	Group			
	TAPP		TEP	
	N	%	N	%
<=40	3	10.3	5	18.5
41-50	2	6.9	0	0.0
51-60	10	34.5	6	22.2
61-70	4	13.8	9	33.3
71-80	8	27.6	5	18.5
81+	2	6.9	2	7.4
Total	**29**	**100.0**	**27**	**100.0**
Mean(sd)	61.28 (15.41)		60.67 (14.19)	

Majority of the patients in TAPP group were between the age group of 51 years to 60 years, while in TEP group majority belong to 61 years to 70 years age group.

Mean age for TAPP group was 61.28 years while for TEP group it was 60.67 years. Both the groups were similar in comparison in terms of age distribution (P value - 0.88).

Comparison of presenting complaints (pain and swelling, altered bowel habits, previous repairs, complications).

All the patients included in the study had swelling in the inguinal region with duration varying from 1 week to 6 months. Pain as presenting complaint was seen in 12 patients in TAPP group and 7 in TEP group. Both the groups were comparable in terms of pain as presenting complaint with a P value of 0.222 (not significant statistically). Among the patients presenting with pain in TAPP group the mean VAS score was found to be 3.50 while it was 3.71 for patients in TEP group. Again the VAS score did not show any statistically significant difference in both the groups (P value - 0.762).

Table 2: Pain as presenting complaint.

		Group			
		TAPP		TEP	
		N	%	N	%
Pain	No	17	58.6%	20	74.1%
	Yes	12	41.4%	7	25.9%

P = 0.222 not significant.

Table 3: VAS score between two groups.

	Group	Pain	Mean	Std. deviation	Significance
VAS	TAPP	12	3.50	1.508	p = 0.762 Not significant
	TEP	7	3.71	1.380	

4 patients in TAPP group and 2 patients in TEP group gave history of altered bowel habits. One patient in each group had a history of previous inguinal hernia repair. On statistical analysis both groups were found to be comparable.

Table 4: Altered bowel habits and previous hernia repair.

		Group			
		TAPP		TEP	
		N	%	N	%
Altered bowel habits	No	25	86.2%	25	92.6%
	Yes	4	13.8%	2	7.4%
History or previous hernia repair	No	28	96.6%	26	96.3%
	Yes	1	3.4%	1	3.7%

Altered bowel habits p=0.671 (not significant); History of previous Hernia repair p=1.00(not significant).

One patient had right partially obstructed hernia which on pneumoperitoneum creation got reduced spontaneously.

Outcome analysis

Duration of operation (min)

The mean duration of operation in TAPP was 68.28 minutes while TEP group it was found to be 73.89 minutes. The duration of surgery was not statistically significant (P value - 0.276).

Table 5: Comparison of duration of surgery.

	Group	N	Mean	Std. deviation	Significance
Duration of surgery (mins)	TAPP	29	68.28	22.332	p = 0.276 Not significant
	TEP	27	73.89	14.763	

Conversion

In two patients in TEP group there was inadvertent entry into the peritoneum while creating the TEP plane and hence TAPP repair was done. These patients were retained in TEP group according to the intention to treat principle.

Serious adverse events (including visceral injuries and vascular injuries)

There were no visceral injuries in all the 56 patients included in the study. However, 2 patients in TAPP and 3 in TEP group had injury to the inferior epigastric artery.

The statistical analysis showed no significant statistical difference (P value - 0.664).

Table 6: Intra-operative complications in terms of visceral and vascular injury.

		Group			
		TAPP		TEP	
		Count	N%	Count	N%
Intraoperative complications	No	27	93.1%	24	88.9%
	Yes	2	6.9%	3	11.1%

p = 0.664 (Not significant).

Persisting post-operative pain

Pain after the surgery was analyzed using VAS score at immediate post-operative period, 1 week, 1 month, 6 months and 1 year.

There was statistically no significant difference between the two groups at 6 hours, 12 hours, 1 week. However, statistically significant difference was found in pain at 24 hours Pain was found to be more in patients undergoing TAPP repair (mean VAS - 2.28) as compared to patients in TEP repair (mean VAS - 1.78).

Table 7: Persisting post-operative pain.

	Group	N	Mean	Std. deviation	Significance
Pain at 6 hours	TAPP	29	3.72	1.486	t = 1.58, p = 0.12 NS
	TEP	27	3.19	1.001	
Pain at 12 hours	TAPP	29	2.97	1.267	t = 1.795, p = 0.078 NS
	TEP	27	2.44	0.847	
Pain at 24 hours	TAPP	29	2.28	1.032	t = 2.152, p = 0.036 NS
	TEP	27	1.78	0.641	

9 patients in TAPP group experienced pain after 1 week while in TEP group 7 patients had pain at the end of 1 week. This pain was found to be statistically insignificant (P value - 0.771).

Table 8: Persisting post-operative pain at 1 week.

Week 1		Group	
		TAPP	TEP
		N	N
Pain	No	20	20
	Yes	9	7

2 patients in TAPP group and 4 patients in TEP group were lost to follow up at 1 month, further 4 patients in TAPP and 1 patient in TEP were lost to follow up at 6 months. The pain was not found in any patients at 1 month, 6 months and 1 year.

Haematoma

Haematoma was seen in 2 patients in TAPP group and 1 patient in TEP group at the end of 1 week which got resolved spontaneously without the need for any intervention. No patients had haematoma at 1 month, 6 months, 1 year. Haematoma at the end of 1 week in both the groups was found to be statistically insignificant (P value - 1.00).

Table 9: Comparison of hematoma occurrence in two groups.

Week 1		Group	
		TAPP	TEP
		N	N
Hematoma	No	27	26
	Yes	2	1

p = 1.000 not significant.

Seroma

2 patients in each group complained of seroma at the end of 1 week, which was statistically not significant (P value - 0.605). Like haematoma, seroma also resolved spontaneously and no patients had seroma at 1 month, 6 months and 1 year.

Table 10: Comparison of seroma between two groups.

Week 1		GROUP	
		TAPP	TEP
		N	N
Seroma	No	27	25
	Yes	2	2

p = 0.605 not significant.

Wound/superficial infection and mesh/deep infection

None of our patients had wound infection or mesh infection.

Hernia recurrence

None of our patients had hernia recurrence till the duration of study (1 year).

Port site hernia

None of our patients had Port site hernia during the study period.

Lengths of hospital stay (days)

Table 11: Duration of hospital stay.

		Group			
		TAPP		TEP	
		Count	N%	Count	N%
Duration of hospital stay	1st day	25	86.2068	19	70.3703
	2nd day	4	13.7931	8	29.6296

p = 0.199 not significant.

In TAPP group out of 29 patients, 25 patients were discharged after a stay of 1 day while 4 patients were discharged after 2 days. In TEP 19 patients were discharged after a stay of 1 day while 8 patients after 2 days. The extra stay was not because of the complications of the surgery but at patient's request. The duration of stay in hospital in the two groups was statistically not significant, and the two groups were comparable in terms of duration of stay (P value- 0.199).

Persisting numbness

1 patient in TAPP group and 2 in TEP group had persisting numbness after 1 week but this was not found at 1 month and thereafter till 1 year of follow up. The persisting numbness between the two groups at 1week interval was not significant statistically.

Table 12: Persisting numbness.

		Group			
		TAPP		TEP	
		N	%	N	%
	No	28	96.6	25	92.6
	Yes	1	3.4	2	7.4

p=0.605 not significant.

DISCUSSION

There are two types of laparoscopic repair of inguinal hernia namely TEP repair and TAPP repair, both of which have evolved over a period of just two decades. Despite numerous studies there is no obvious superiority of one technique over the other.

The following study was undertaken in an effort to identify the better of the two methods of laparoscopic repair of inguinal hernia.

Studies have been performing both TAPP and TEP procedures for hernia repair regularly in our department. As there are only few articles on such comparative study in an Indian Setup, we decided to compare the two techniques of Laparoscopic Inguinal Hernia repair in our hospital.

This was a comparative study consisting of 56 patients, with 29 patients in laparoscopic TAPP group and 27 patients in laparoscopic TEP group, conducted in HBT Hospital Jogeshwari Mumbai, Maharashtra, India from June 2014 to January 2016 which included a follow up of 1 year. 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.

Gender distribution

All the patients in our study were males. This represents the low incidence of inguinal hernia in female in general population.

Operative time

In this study the mean duration of operation in TAPP group was 68.28 minutes while it was 73.89 minutes in TEP group.

Hence the overall mean operative time was less in laparoscopic TAPP repair than in laparoscopic TEP repair.

The operative time in various studies for laparoscopic total extra-peritoneal and laparoscopic trans-abdominal pre-peritoneal repair is as follows;

Table 13: Operative time in various studies.

Study	TEP (minutes)	TAPP (minutes)
Hamza Y. et al[8]	96.12	77.4
Choksi D. et al[9]	72	87
Zeineldin A[7]	57.3	43

The TAPP is considered slightly easier since the operation is intra-peritoneal, which is considered a more familiar situation to the new comer.[10] TEP is different in that the peritoneal cavity is not entered and mesh is used to seal the hernia from outside the peritoneum. This approach is considered to be more difficult 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 (P value - 0.276).

Conversion

In two patients in TEP group there was inadvertent entry into the peritoneum while creating the TEP plane and hence TAPP repair was done. However, both the patients were included in TEP group based on the principle of intention to treat.

Study finding was supported by the study done by Zeineldin A who also had 2 cases of TEP being converted to TAPP because of entry into the peritoneum while creating the TEP plane.[7]

Serious adverse events (including visceral and vascular injuries)

Three comparative studies reported no vascular injuries, whilst one a small study of 120 patients reported a higher rate (3% versus 0%) in TEP.[3] In the three case series, one reported no vascular injuries in TAPP while the rates from the other two case series showed similar rates for TAPP (0.5%, based on 5707 cases) and TEP (0.47% based on 5203 cases).

Two comparative studies reported no visceral injuries whilst two reported a higher rate (0.9% versus 0% and 0.4% versus 0%) in TAPP than in TEP.[3] The combined number of cases in these studies was 1323. In the three case series, the two TAPP series3 reported similar rates of 0.64% and 0.60% with a combined number of cases of 8207, whilst the one TEP series reported a lower rate of 0.23% based on 5203 cases.

There were no visceral injuries in all the 56 patients included in the study. However, there were 2 cases in TAPP group and 3 cases in TEP group, where there was vascular injury.

The statistical analysis showed no significant statistical difference (P value - 0.664).

This was further supported by the study of Zeineldin A7 which showed 2 cases of vascular injury out of 68 patients in TAPP group while no patient had any vascular complication out of 59 patients included in TEP group.

Another study done by Wake BL et al showed no intra-operative complications in TAPP and TEP group. (TAPP - 28 patients and TEP - 24 patients).[3]

In a study done by Choksi D et al there were 8 patients with minor complications in laparoscopic TEP group (26.66%) compare to 6 patients in laparoscopic TAPP group (20%). It was not statistically significant (p = 0.54155).[9]

One study done by Cohen RV et al showed complication rate of 13.5% in laparoscopic TEP group compare 20.5% in laparoscopic TAPP group, which was also not significant statistically.[11]

Persisting post-operative pain

Pain after the surgery was analyzed using VAS score at immediate post-operative period, 1 week, 1 month, 6 months and 1 year.

There was statistically no significant difference between the two groups at 6 hours, 12 hours, and 1 week. However statistically significant difference (P value - 0.036) was found in pain at 24 hours. Pain was found to be more in patients undergoing TAPP repair (mean VAS - 2.28) as compared to patients subjected to TEP repair (mean VAS - 1.78).

9 patients in TAPP group experienced pain after 1 week while in TEP group 7 patients had pain at the end of 1 week. This difference in pain was found to be statistically insignificant (P value - 0.771).

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 ($p < 0.05$) as compared to TEP group.[12]

In this study also there was significant pain difference in TAPP and TEP group at 24 hour interval, with patients undergoing TAPP repair experiencing more pain at 24 hours than patients in TEP group (P value - 0.036).

Haematoma/seroma

Haematoma was seen in 2 patients in TAPP group while 1 patient in TEP group had haematoma at the end of 1 week. Difference in the incidence of haematoma at the end of 1 week in both the groups was found to be statistically insignificant (P value - 1.00).

2 patients in each group developed seroma in the inguinal region post hernioplasty at the end of 1 week, which was statistically not significant (P value - 0.605).

The haematoma and seroma resolved spontaneously without the need for any intervention in all the cases.

No patients had haematoma/ seroma at 1 month, 6 months and 1 year.

Our finding was supported by the study of Zeineldin A which showed 2 cases of seroma in TAPP and 4 in TEP, which was insignificant statistically.[7]

Wake BL et al had only one case of haematoma out of 28 patients who underwent TAPP repair while no patient had haematoma in TEP group which comprised of 24 patients.[3]

Wound/superficial infection and mesh/deep infection

Deep infections, primarily mesh infections, are potentially more serious than superficial infections and can result in removal of the mesh.

In our study none of our patient had superficial or deep wound infection and also none of them had mesh infection.

Our finding was supported by the study of Wake BL et al3 who showed that in the comparative studies, three reported no deep infections, whilst one reported rates of 0.2% and 0% for TAPP and TEP respectively.[3] Reported rates were also low for the case series and did not indicate a difference between TAPP and TEP. The two TAPP case series had rates of 0% and 0.1%, while the corresponding rate for the TEP case series was 0.02%.[3]

Hernia recurrence

None of our patient had hernia recurrence till 1 year of the study period.

Wake BL et al assessed Hernia recurrence up to three months. Within this time there was one recurrence in the TAPP group.[3]

Zeineldin A found that the recurrence rate was higher in TEP than TAPP (3.4% versus 1.5%) where the mean follow up period was 38.5 months in the TAPP and 40 in the TEP group.[7]

Hamza Y et al found recurrence in 1 patient in TAPP and 1 patient in TEP group which was not significant statistically.[8]

Port site hernia

None of our patient had port site hernia. Our finding was in contrast to findings of Wake BL et al who found that the incidence of port-site hernia was higher in TAPP group than TEP.[3]

Lengths of hospital stay (days)

In this study in the TAPP group out of 29 patients the duration of stay was 1 day for 25 patients and 2 days for 4 patients. In TEP 19 patients were discharged after 1 day while 8 patients after 2 days.

The extra stay was not due to the complications of the surgery but at the request of the patient. The duration of stay in hospital in the two groups was not significant statistically, and the two groups were comparable in terms of duration of stay (P value - 0.199).

Similar result was shown by Zeineldin A7 in which the mean duration of stay in TAPP group was 32 hours and in TEP it was 30 hours.

Choksi D et al in their study found that the mean duration of post-operative hospital stay was 2.8±1.3 days for laparoscopic TEP repair hernia repair and 2.76±1.0 days for laparoscopic TAPP repair.[9]

Wake BL et al found a longer duration of stay in TEP group (mean duration of stay of 3.7 days in TAPP group and 4.4 days in TEP group).This was found to be statistically significant.[3]

Persisting numbness

1 patient in TAPP group and 2 in TEP group had persisting numbness after 1 week but this was not found at 1 month, 6 months and 1 year. The persisting numbness between the two groups at 1-week interval was not significant statistically (P value - 0.605).

CONCLUSION

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 port site and length of hospital stay, we had a follow up of 1 year which is adequate for most parameters except recurrence.

Apart from statistically significant difference in pain at 24 hours, which was more in TAPP group than TEP group, we found no other significant difference between the two methods.

Longer duration studies with more volume and a longer period of follow up is required to justify the use of one procedure over the other.

In the current scenario we conclude that TAPP or TEP can be both performed for any inguinal hernia depending on the surgeon preference.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: Not required

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Cite this article as: Rambhia SU, Modi R. A comparative study between totally extraperitoneal and transabdominal preperitoneal laparoscopic inguinal hernia repair techniques. Int Surg J 2017;4:663-70.