International Surgery JAuthorsnal
Gurung KB et al. Int Surg J. 2018 Nov;5(11):3719-3726
http://www.ijsurgery.com
pISSN 2349-3305 | eISSN 2349-2902

DOI: http://dx.doi.org/10.18203/2349-2902.isj20184651

Original Research Article

Laparoscopic inguinal hernia repairs: comparison between TAPP and TEP at a tertiary center of Nepal

Komal B. Gurung[1]*, Niroj Banepali[2], Rakesh R. Sthapit[2], Baikuntha Adhikari[3]

[1]Department of Clinical faculty, Trinity Medical Sciences University, Saint Vincent and the Grenadines, Caribbean
[2]Department of Surgery, National Academy of Medical Sciences (NAMS), Bir Hospital, Kahmandu, Nepal
[3]Department of Surgery, Consultant General Surgeon, Government of Nepal

Received: 06 September 2018
Accepted: 28 September 2018

***Correspondence:**
Dr. Komal B. Gurung,
E-mail: drkomalgurung@gmail.com

ABSTRACT

Background: Laparoscopic inguinal hernia repair has been proven to be a safe and effective procedure for groin hernias. In recent years, many of the tertiary centers in Nepal have started performing laparoscopic hernia repair. With the availability of resources and the facilities, the laparoscopic repairs for inguinal hernias are going to be more accessible in near future in Nepal. The aim of this study was to compare the intraoperative events and postoperative complications of transabdominal preperitoneal (TAPP) and totally extraperitoneal (TEP) techniques of laparoscopic inguinal hernia repairs.
Methods: Out of 56 patients, 30 underwent TAPP and 26 TEP repairs for primary unilateral inguinal hernias and were prospectively analyzed. Patient demographics, past medical and surgical history, intraoperative, and postoperative events were recorded. Patients were followed-up for two years.
Results: Demographic parameters were comparable in both the groups. The difference in mean operating time was statistically significant (longer in the TAPP group). Intraoperative events such as port-site bleeding and peritoneal tear were comparable in both groups. The immediate postoperative complications like skin ecchymosis, cord hematoma, and scrotal edema were comparable in both repairs. Immediate postoperative pain was significantly lesser in TEP repair whereas the hospital stays and time to return to the normal physical activity were comparable in both groups.
Conclusions: Both TAPP and TEP laparoscopic techniques are safe and effective for inguinal hernia repair. However, there are few advantages of TEP repair such as shorter duration of surgery and less postoperative pain.

Keywords: Inguinal hernia, Laparoscopic, TAPP, TEP, Comparison

INTRODUCTION

Though a common problem, the exact incidence of inguinal hernias is unknown.[1] Inguinal hernia repair is one of the most commonly performed operations, with about 20 million of hernia repairs annually.[2]

Minimally invasive inguinal hernia repairs are getting their recognition over the last two decades. Laparoscopic preperitoneal inguinal hernia repairs (TAPP and TEP) are other methods of tension-free mesh repair. Over the past few decades, there has been tremendous progress and improvisation in hernia repair techniques to reduce intraoperative and postoperative complications.

The principle of laparoscopic inguinal hernia surgery is tension-free repair. Transabdominal preperitoneal (TAPP) was described by Arregui and Doin whereas,

totally extraperitoneal repair was described by McKernan and Laws.

The current prospective, non-randomized study was conducted with the aim to study the safety and effectiveness as well as relative advantages of TAPP and TEP techniques for laparoscopic inguinal hernia repairs.

METHODS

This prospective, non-randomized study was conducted in a single unit of the Department of Surgery in between January 2015 to June 2016 at National Academy of Medical Sciences (NAMS), Bir Hospital, Kathmandu. All the repairs were performed by a single surgeon. Patients who were clinically diagnosed as uncomplicated, primary, unilateral inguinal hernia were included in the study.

Following patients were excluded from the study:

- Irreducible, obstructed, and strangulated inguinal hernia
- Recurrent inguinal hernia
- Previous lower abdominal surgery or surgeries; except for the previous surgery for the contralateral inguinal hernia
- Patients who are unfit for general anesthesia.

All the patients were admitted a night before the surgery. A single dose of prophylactic antibiotic, intravenous cefazolin, was given. All the patients were catheterized with 14 or 16 F Foley catheter after intubation.

TAPP repair technique

After creating pneumoperitoneum, standard three ports were used: a supraumbilical 10 mm, ipsilateral 10 mm at the mid-clavicular line, 2.5 cm above the level of the umbilicus and contralateral 5 mm port, 2.5 cm below the level of the umbilicus at mid-clavicular line.

The peritoneal dissection was started at the level of the anterior superior iliac spine and continued medially about 1-1.5 cm above the hernial opening.

The dissection was continued medially by the medial umbilical ligament and 1-2 cm beyond the symphysis pubis to the contralateral side, cranially 3-4 cm above the transvarsalis arch or any direct hernia defect, laterally to the anterior superior iliac spine, caudally 4-5 cm below the iliopubic tract at the level of the psoas muscle and 2-3 cm below cooper's ligament at the level of the superior arch of the pubic bone.

The contents of an inguinal hernia (if any) were reduced. The peritoneal flap was raised. The anatomical landmarks (inferior epigastric vessels, rectus muscle, transversalis fascia, pubic bone) were defined. Vas deferens was seen to turn medially and the triangle of doom was clearly visualized. A polypropylene flat mesh (12×15 cm) was placed into the resulting preperitoneal space, without an opening or a slit for spermatic cord. The mesh was fixed at two places: medially at symphysis pubis and laterally above the iliopubic tract. The peritoneal flap was closed using 2.0 vicryl.

TEP repair technique

Three ports were created in the midline. An infraumbilical 10 mm port was created. Through it, a 30º telescope was used for blunt dissection to create the pre-peritoneal space; initially along midline down to pubic symphysis.

Two more 5 mm ports were made, one just above the symphysis pubis and another in the mid-point between the former two. A direct or an indirect hernia was reduced. The entire posterior floor was dissected. A 12 cm x 15 cm polypropylene mesh was introduced through the 10 mm port-site and placed over my pectineal orifice. CO_2 gas was released slowly under vision and port-site defects were closed.

Data collection

Intraoperative complications like a peritoneal tear, visceral injuries, and injuries to the vessels, nerves and vas deferens (if any) were documented. The total operative time was recorded. It was defined as the time from the skin incision to the beginning of skin closure. Conversion, if any, was recorded.

Post-operative pain in 1 hours, 6 hours, 18 hours, and 7 days after the TAPP and TEP repairs were recorded. Visual analogue scale (VAS) was used to score the pain; zero being no pain whereas 10 being the worst possible pain. Complications such as seroma formation, hematoma, scrotal swelling, and wound infection were recorded.

Patients were followed-up up to 24 months. It was done at one week, six weeks and then 3, 6, 12, and 24 months. Time to return to work or physical activity, any medical or surgical complications that led to medical attention was specifically asked. Follow-up after 6 months was done by telephone.

Statistical analysis

A descriptive statistical analysis was carried out. Mean and standard deviations were calculated for the results on continuous measurement, whereas number and percentage were represented for the results on categorical measurement.

A "p" value of ≤ 0.05 was considered statistically significant. Student t-test (two-tailed, independent) was used to calculate the statistical significance of study parameters on continuous scales between two groups.

Chi-square/Fischer exact test was used to calculate the statistical significance of the study parameters on categorical scales between two groups. Microsoft word was used for generating tables and excel was used for data analysis.

RESULTS

A total of 56 Patients with uncomplicated, primary, unilateral inguinal hernia were included in the study (Table 1).

Table 1: comparison of demographic and hernia characteristics.

Repair (technique)	Patient No.	Age (years) Mean±SD	Sex m/f	Hernia direct/ indirect
TAPP	30	43.93±15.42	29/1	4/24
TEP	26	41.42±12.55	26/0	6/20

TAPP repair was done in 30 patients with the age were ranging from 19-70 years. Likewise, 26 patients underwent TEP repairs who were 20-68 years of age. The two groups were comparable in terms of age, sex, and types of inguinal hernias. Eleven patients (19.6%) had the history of an open inguinal hernia repair on the contralateral side.

Intraoperative events

Minor port-site bleeding occurred in four TAPP patients and five patients with TEP repairs. There were minor peritoneal tears in seven TAPP cases and five TEP cases. These were small tears which did not require any further modifications to the procedure. There was no statistically significant difference in these intraoperative complications between the two groups (Table 2).

Table 2: Comparison of intraoperative events.

Intraoperative events	TAPP	TEP	P value
Port-site bleeding	4 (13.3%)	5 (19.2%)	0.35
Peritoneal tear	7 (23.3%)	5 (19.2%)	0.98

Table 3: Comparison of operating time between TAPP and TEP repairs.

	TAPP group N= 30 Mean±SD	TEP group N=26 Mean±SD	P value
Operating time (Min)	65.5±10.60	56.5±08	0.003

Duration of surgery

The average operating time in TAPP and TEP groups were 65.5 minutes and 56.5 minutes respectively. The duration of surgery was statistically significantly longer in the TAPP group (Table 3).

Table 4: Comparison of post-operative pain on VAS score between TAPP and TEP repairs.

Pain score at	TAPP group N=30 Mean±SD	TEP group N=26 Mean±SD	P value
1 h	2.483±0.68	2.32±0.63	0.379
6 h	3.38±0.78	2.76±0.66	0.002
18 h	2.25±0.53	1.92±0.44	0.015
7 days	1.85±0.57	1.57±0.48	0.038

Conversion

There was no conversion from one group to another or to open repair.

Visceral or vascular injuries

No serious visceral and/ or vascular injuries were documented in both the groups.

Post-operative pain

Postoperative pain score was analyzed by using the visual analogue pain score scale (VAS). The pain score was comparable at one hours after the operation in both the groups. However, the pain scores were significantly higher in the TAPP patients at 6 hours, 18 hours, and 7 days after the operation (Table 4).

Persisting postoperative pain at 6 weeks

Five patients in the TAPP group complained of pain at 6 weeks following the operation. In the TEP group, four patients complained of inguinal pain or mild discomfort at 6 weeks (Table 5). The average pain scores at 6 weeks for TAPP and TEP groups were 1.3 ± 0.27 and 1.12 ± 0.25 respectively which was not statistically significant (P= 0.35).

Table 5: Persisting post-operative pain at 6 weeks.

Week 6		TAPP	TEP
		N	N
Pain	No	25	22
	Yes	5	4

Early postoperative complications

Skin ecchymosis, cord hematoma, and scrotal edema were reported as early postoperative complications in present study (Table 6). There was one patient with cord hematoma in the TAPP group that was managed with therapeutic aspiration. Rest of these complications were found to have resolved on subsequent follow-up. These

early postoperative complications were not statistically significantly different in the two groups.

Table 6: Comparison of postoperative complications between TAPP and TEP repairs.

Complications	TAPP N= 30	TEP N=26	P value
Skin ecchymosis	2 (6.6%)	2 (7.6%)	0.88
Cord hematoma	1 (3.3%)	0	0.32
Scrotal edema	6 (20%)	3 (11.5%)	0.24

Duration of hospital stay

Out of 30 patients in the TAPP group, 25 patients were discharged on the first postoperative day. Remaining five patients were discharged on the second postoperative day.

In the TEP group, 23 patients were discharged on day one and three patients were discharged on day 2 (Table 7). There was no statically significant difference in the length of hospital stay in both the groups (p= 0.58).

Table 7: Duration of hospital stay (days).

Duration of hospital stay		TAPP N=30 Count (%)	TEP N=26 Count (%)
	1 day	25 (83.33%)	23 (88.46%)
	2 days	5 (16.66%)	3 (11.53%)

P value: 0.58

Time to return to normal physical activity

The mean time to return to work or normal physical activities in the TAPP and the TEP groups were comparable (6 days and 5.6 days respectively). (Table 8)

Table 8: Comparison of time to return to work between TAPP and TEP repair.

Time to return to work of normal physical activity (days)	TAPP N=30 Mean±SD	TEP N=26 Mean±SD	P value
	6±2.61	5.6±2.40	0.56

Wound and mesh infection

None of the patients in both groups had superficial and/or deep infections.

Hernia recurrence

Recurrence was not reported during the study period.

DISCUSSION

Undoubtedly surgeons now believe that laparoscopic inguinal tension-free hernia repair has a mechanical advantage over the open tension-free method because a large mesh can be placed covering the entire myo pectineal orifice. The natural intra-abdominal pressure helps to support the large mesh in place as well. However, the surgeons seem to be divided into two groups regarding the validity of the laparoscopic approach over the open tension-free method. Surgeons who are performing laparoscopic inguinal hernia repair advocate that this method has a quicker recovery, the intraoperative anatomical field of vision is better, all the groin hernial defects can be dealt at once, and the postoperative pain is lesser. On the other hand, the critics are talking about the difficulty in learning the procedure, longer operating time, and the cost.[1]

Generally, surgeons are advised to learn TAPP before TEP repair to ascertain if the former has to be converted, especially when a large peritoneal tear obscures the potential working preperitoneal space. Numerous studies have been performed throughout the world comparing TAPP and TEP repairs but no obvious superiority of one technique over another has been validated as yet. The present study was conducted to recognize the better of the two methods (TAPP and TEP) of laparoscopic tension-free inguinal hernia repair techniques.

Table 9: Comparison of operative time in between TAPP and TEP.

Study	TAPP; unilateral (min)	TEP; unilateral (min)	P value
Krishna et al[4]	72.3±25.9	61.6±27.4	0.343
Choksi D et al	87	72	<0.05
Abd Al-Rahman et al[6]	74.2±8.6	57.5±9.4	0.045
Bansal et al[7]	62.6±19.2	54.8±14	0.002
Gong et al[8]	76±16	79±13	0.258
More et al[9]	121±4.3	50.5±3.7	<0.0001
Günal et al[10]	104.49±8.1	57.37±3.8	<0.001
Feng et al[11]	29.9±11.2	27.7±10.1	<0.0001
Hamza et al[12]	96.12±22.5	77.40±43.21	< 0.001
Kumar et al[13]	97.11±12.72	116.60±13.27	< 0.0001
Zeineldin1[14]	43	57.3	<0.05
Rambhia et al[15]	68.28±22.33	73.89±14.76	0.276

Demographic characteristics

All the patients in this study were male except a 32-year-old lady who underwent TAPP repair. This reflects the gender-specific incidence of the inguinal hernias in general population. The age of the patients for TAPP repair ranged from 21 to 70 years, with a mean age of 43.93±15.52 years. Similarly, the age distribution for TEP repairs was 20-68 years, with the mean age of 41.42±12.15 years. Relatively younger patients could be explained by the selection of the unilateral, uncomplicated, primary inguinal hernia cases for the study.

Intraoperative events

Duration of surgery

In present study, the mean duration of surgery for TAPP and TEP repairs were 65.5 minutes and 56.5 minutes respectively, the difference of which was found to be statistically significant.

For TAPP repairs, after the placement of the mesh, we sutured the peritoneum intracorporeally using a routine 2.0 vicryl. On an average, it took about 8-10 minutes for the closure of the peritoneum. This explains a comparatively longer duration of surgery for TAPP repair. The duration of surgery in Authors study is similar to most series as shown below (Table 9).

Some of the studies have reported that the mean duration of surgery was higher for the TEP repair.[8,14,15] Zeineldin et al reported that the difference in the duration of surgery is significantly higher in the TEP repair.[14] They concluded that these results were due to difficulty in anatomical delineation and technical challenges of the TEP.

Table 10: Comparison of hematoma and cord edema in between TAPP and TEP repair in various studies.

Study	Hematoma (%) TAPP vs TEP (P value)	Scrotal edema (%) TAPP vs TEP (P value)
Rambhia et al[15]	6.8% vs 3.7% (P= 1.00)	none
Krishna et al[4]	none	34% vs 9.4% (P< 0.001)
Bansal et al[7]	none	29.6% vs 12.6% (P= 0.01)

Intraoperative complications

Proponents of laparoscopic inguinal hernia repair suggest beginning with the TAPP repair before TEP. In TAPP, there will be a better visualization of anatomical structures and larger working space than TEP. Therefore, chances of inadvertent intraoperative complications can be lower. Also, while performing TEP, if there occurs larger peritoneal tear causing loss of working apace, we can convert it to TAPP and proceed safely and efficiently.

In present study, there was no major vascular and visceral injury. However, we recorded minor port-site bleeding in four (13.3%) and five (19.2%) patients in TAPP and TEP respectively. This finding was not statistically significant in both repairs (P = 0.35). Bleedings were minimal and were dealt with either electrocautery immediately, or with simple pressure with the help of gauge piece. Another notable intraoperative complication was the peritoneal tear. We found peritoneal tears in seven (23.3%) and five (19.2%) patients in TAPP and TEP respectively. This finding was also comparable in both repairs (P =0.98). While performing TAPP, the peritoneal tear occurred exclusively during dissection of the hernial sac. For TEP, all the peritoneal tears were small that occurred while creating the working space after inserting all three ports and these tears did not affect the working space significantly. We proceeded the repairs successfully in all of them.

Shpitz et al did not observe any intra-or postoperative complications that could be attributed to peritoneal tear if left unrepaired.[16] Peritoneal tears have been reported (25.4 %) after TAAP repairs by Bansal et al without further complications.[17]

Immediate postoperative complications

Skin ecchymosis

Two of the patients in each of the repairs (TAPP= 6.6%, TEP=7.6%) had mild skin ecchymosis. This complication was comparable in both repairs (P= 0.88). None of them required further treatment. This complication was also reported by Krishna et al (TAPP= 2.1%, TEP 5.7%).[4]

Scrotal edema and cord hematoma

Scrotal, cord edema or hematoma are known complications of open as well as laparoscopic hernia surgery. Many factors are responsible for such complications such as hernia with a large sac, reoperation for a recurrent hernia, and the surgical proficiency as well.

In the current study, six patients (20%) developed scrotal edema in the TAPP group. The incidence of scrotal edema has been reported to be 12.8%.[18] In TEP group, three (11.5%) patients had scrotal edema. Though this complication was higher in the TAPP group, it was not statistically significant (P= 0.24).

We also reported one (3.3%) patient who had cord hematoma. This complication was not reported in the TEP group. The cord hematoma was treated with therapeutic needle aspiration; around 3 ml of dark-colored fluid was aspirated.

Similar complications reported by other studies are as follows (Table 10).

Postoperative pain

In the current study, we compared the post-operative pain at 1 hour, 6-hour, 18 hour, and 7 days after the TAPP and TEP repairs. We used the visual analogue scale (VAS) to score the pain. In one- hour, postoperative period, there was no significant difference in pain score in both groups. This may be due to the residual effect of general anesthesia in both the groups. However, the pain scores at

6 h, 18 h, and 7 days postoperatively were statistically significantly higher in the TAPP group.

The postoperative pain in various studies for laparoscopic TAPP and TEP repair is as follows (Table 11).

Table 11: Postoperative pain in various studies.

Study	Pain (VAS): TAPP vs TEP P value				
	1 hr	6 hrs	12 hrs	24 hrs	7days
Current	2.48 vs 2.32 p=0.37	3.38 vs 2.76 p=0.002	Not studied	2.25 vs 1.92* p=0.015*	1.85 vs 1.57 p=0.038
Bansal et al[7]	2.27 vs 2.16 P=0.1	2.39 vs 2.17 P=0.006	Not studied	1.93 vs 1.77 P=0.001	1.75 vs 1.44 p=0.002
Rambhia et al[15]	Not studied	3.72 vs 3.19 P=0.12	2.97 vs 2.44 P=0.078	2.28 vs 1.78 P=0.036	Not scored. P=0.77
Krishna et al[4]	2.79 vs 1.98 P=0.0001	1.47 vs 2.21 P=0.108	Not studied	1.83 vs 1.09 P=0.007	1.91 vs 1.13 p= 0.705

*pain score recorded at 18 hour postoperatively

During the follow-up at six weeks, five TAPP and four TEP patients complained mild inguinal pain. All of them had the pain score ≤ 1.5.

Mean pain scores of TAPP and TEP groups were 1.30 and 1.12 respectively. The difference in pain score in both groups was not statistically significant (p=0.25).

Table 12: Persisting pain in 6 weeks in various studies.

Study	Pain (VAS): TAPP vs TEP P value
Current	1.30 vs 1.12 P=0.25
Krishna et al[4]*	1.28 vs 1.09 P=0.001
Bansal et al[7]	1.46 vs 1.27 P=0.002
Rambhia et al[15]	No persisting pain in both groups

*persisting pain in four weeks

Pain score documented by other similar regional studies are as follows (Table 12).

Patients from both groups did not complain of inguinal pain in later follow-up periods. So, the patient did not suffer from chronic inguinal pain following TAPP and TEP repairs.

Duration of hospital stay

Since both TAPP and TEP repairs were performed under general anesthesia, all the patients were admitted after the operation. We were able to discharge majority of the patients (TAPP vs TEP: 83.33% vs 88.46%) safely in both the groups on the following morning or afternoon after recording the pain score (pain score at 18 hour).

Remaining patients were discharged on the second postoperative day (TAPP vs TEP: 16.66% vs 11.53%). The difference in the duration of hospital stay between TAPP and TEP repairs was not statistically significant (p=0.58). Majority patients were kept in the hospital on request.

Table 13: Comparison of the length of hospital stay in various studies.

Study	TAPP Mean ± SD	TEP Mean ± SD	P value
Gong et al[8]	3.4±1.7 days	3.6±1.6 days	0.614
Krishna et al[4]	25.2±5.1 hrs	24.4±3.2 hrs	0.056
Choski et al[5]	2.76±1.0 days	2.8±1.3 days	0.70
Abd Al-Rahman et al[6]	24.53±4.64 hrs	13.67±5.48 hrs	<0.05
Wake et al[19]	3.7 days	4.4 days	<0.05

Various studies demonstrate that the length of hospital stay after a laparoscopic inguinal repair is less than two days. Rambhia et al reported that 86.20% and 70.37% of the patients who underwent TAPP and TEP repairs respectively were discharged on the first postoperative day.[15] Remaining patients were discharged on the second postoperative day. The difference in the length of hospital stay in their study was not statistically significant (p=0.199).

The duration of hospital stays after laparoscopic TAPP and TEP repairs in other studies are shown below (Table 13).

Return to normal physical activity

In the current study, the average time to return to normal physical activity after laparoscopic TAPP and TEP repairs was 6.0±2.61 days and 5.6±2.40 days

respectively. The difference in the time to return to the normal activity of daily life or work in between TAPP and TEP repairs was not statistically significant (p=0.56). However, patients who underwent TEP repair were able to return to their normal physical activity earlier than the patients who had TAPP repair. This difference may be because of the longer operative period of TAPP repairs and more anatomical intraoperative disruption such as an incision in the peritoneum and intracorporal suture. Longer duration general anesthesia taken by the patients for TAPP repairs can also be another factor. These confounding factors can be the matter of discussion and research in the future.

Various studies have shown comparable time to return to normal physical activities. Gurung et al on their unilateral TAPP repairs reported that the time to return to normal work ranged from 3-15 days (mean: 6 days).[18] However, in terms of statistical significance, we can observe mixed reports which are shown in Table 14.

Table 14: other studies on return to normal physical activity.

Study	TAPP (days) Mean±SD	TEP (days) Mean±SD	P value
Verma et al[20]	7.2±2.31	6.43±2.76	>0.05
Hamza et al[12]	9.8±5.97	7.53±3.65	0.001
Abd Al-Rahman et al[6]	12±1.46	9.06±1.58	0.038

We did not find any surgical site infection, both superficial as well as deep, in present study. Recurrence is considered as one of the most important complications after hernia surgery.[21] It is also related to the quality of hernia repair.[4]

There was no recurrence in both TAPP and TEP repairs until two years of follow-up. No recurrence has been reported by other recent studies as well.[4,21] Decrease or absence of recurrence of laparoscopic inguinal hernia repair signifies the improvement in the quality of the techniques and growing expertise and proficiency of the surgeons.

CONCLUSION

From the current study, it is difficult to recommend one method over another for laparoscopic inguinal hernia repairs. Small sample size and limited follow-up period are the limitations. However, we have concluded that,

- Both TAPP and TEP techniques are equally safer and effective laparoscopic techniques for inguinal hernia repair.
- Operative time is significantly lesser in TEP repair as compared to TAPP technique.
- Immediate postoperative pain is significantly lesser in TEP repair than TAPP.
- Intraoperative minor complications, postoperative hospital stays, and time to return to normal physical activity are comparable in both techniques.

ACKNOWLEDGEMENTS

Authors would like to express special appreciation and thanks to all the patients who participated in the study. Authors sincere thanks and gratitude to their teachers, hospital staff, and the department of surgery for their help and support.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Mark AM, Michael JR. Hernias. In: Townsend CM, Beauchamp RD, Evers BM, eds: Sabiston textbook of Surgery, 20th ed. Philadelphia: Elsvier;2017:1092-1119.
2. Kingsnorth A, LeBlanc K. hernias: inguinal and incisional. Lancet. 2003;362:1561-71.
3. Davis CJ, Arregui ME. Laparoscopic repair for groin hernias. Surg. Clin. North. Am. 200;83:1141-61.
4. Krishna A, Mishra MC, Bansal VK, Kumar S, Rajeshwari S, Chabra A. Laparoscopic inguinal hernia repair: transabdominal preprotoneal (TAPP) versus totally extraperitoneal (TEP) approach: a prospective randomized controlled trial. Surg Endosc. 2012;26:639-49.
5. Choksi D, Parmar A, Raiyani G, Prasad G. Comparative prospective study of laparoscopic TEP repair versus laparoscopic TAPP repair for inguinal hernioplasty conducted at tertiary level hospital, Vadodara. Int J Res Med. 2014;3(1):17-9.
6. Abd Al-Rahman MHN, Abd El-Latif TE, Wael El said L. Transabdominal preperitoneal and totally extraperitoneal laparoscopic inguinal hernia repair: a comparative study. ZUMJ. 2016:22(1):48-61.
7. Bansal VK, Krishna A, Mishra MC, Kumar S. Learning curve in laparoscopic inguinal hernia repair: experience at a tertiary care center. Indian J Surg. 2016;78(3):197-202.
8. Gong K, Zhang N, Lu Y, Zhu B, Zhang Z, Du D, et al. Comparison of the open tension-free mesh-plug, transabdominal preperitoneal (TAPP), and totally extraperitoneal hernia repair: a prospective randomized controlled trial. Surg Endosc. 2011;25:234-9.
9. More MP, Nasta AM, More RM, Shedge R. Comparison of laparoscopic TAPP (transabdominal preperitoneal) and laparoscopic TEP (totally extraperitoneal) techniques for inguinal hernia repair: an observational study of 60 cases. ISOR-JDMS. 2016;15(7):90-3.

10. Günal Ö, Özer Ş, Gürleyik E, Bahçebaşi T. Does the approach to the groin make a difference in hernia repair? Hernia. 2007;11:429-34.
11. Feng B, He Z-R, Li J-W, Ling T-L, Zhang Y, Chen Z, et al. Feasibility of incremental laparoscopic inguinal hernia repair development in China: An 11-year experience. J Am Coll Surg. 2013;216:258-65.
12. Hamza Y, Gabr E, Hammadi H, Khalil RF. Authors arm randomized trial comparing laparoscopic and open hernia repairs. Egypt J Surg. 2009;28(3):110-7.
13. Kumar P, Kumar N. Transabdominal preperitoneal versus totally extraperitoneal laparoscopic techniques for inguinal hernia repair: a comparative study. Int Surg J. 2017;4:162-5.
14. Zeineldin A. Transabdominal (TAPP) versus total extraperitoneal (TEP) laparoscopic inguinal hernia repair: a prospective comparative study. Minut Med J. 2008;21:147-54.
15. Rambhia SU, Modi R. A comparative study between totally extraperitoneal and transabdominal preperitoneal laparoscopic inguinal hernia techniques. Int Surg J. 2017;4:663-70.
16. Shpitz B. Lansberg L, Bujayev N, TiomkinV, Klein E. Should peritoneal tears be routinely closed during laparoscopic totally extraperitoneal repair of inguinal hernias? A reappraisal. Surg Endosc. 2004;18:1771-3.
17. Bansal VK, Krishna A, Mishra MC, Kumar S. Learning curve in laparoscopic inguinal hernia repair: experience at a tertiary care center. Indian J Surg. 2016;78:197-202.
18. Gurung KB, Adhikari B, Thapa GS, Upadhyay P. Laparoscopic inguinal hernia repair (TAPP): early and medium-term results. Int J Health Sci Res. 2017;7(12):68-74.
19. Wake BL, McCormack K, Fraser C, Vale L, Perez J, Grant A. Transabdominal preperitoneal (TAPP) versus totally extraperitoneal (TEP) laparoscopic techniques for inguinal hernia repair. The Cochrane Library. 2008;4:1-25.
20. Verma N, Prajapati K, Mistry S. A comparative study between total extraperitoneal (TEP) repair and transabdominal preperitoneal (TAPP) repair in management of inguinal hernia. Nation J Med Res. 2015;5:64-6.
21. Bringman S, Ek A, Haglind E, Heikkinen T, Kald A,Kylberg F. Is a dissection ballon beneficial in totally extraperitoneal endoscopic hernioplasty (TEP)? a randomized prospective multicenter study. Surg Endosc. 2001;15:266-70.

Cite this article as: Gurung KB, Banepali N, Sthapit RR, Adhikari B. Laparoscopic inguinal hernia repairs: comparison between TAPP and TEP at a tertiary center of Nepal. Int Surg J 2018;5:3719-26.