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TEP or Lichtenstein for Inguinal Hernia Repair- A Comparative Analysis between Both the Techniques in a Tertiary Care Centre

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ABSTRACT

Objectives: The prospective study was conducted to find the intra-operative and post-operative outcomes of Lichtenstein over TEP repair in terms of duration of operation, Per-operative complications, conversion to open, Visual Analogue Scale (VAS), Wound complications, Duration of hospital stay and recurrence.

Material and Methods: 78 patients of inguinal hernia enrolled between November 2017 to November 2018 aged 18 years and above were included. It was non-randomised study and 50 patients were included in Lichtenstein while 28 patients in TEP group.

Results: Duration of surgery [p<0.0001], intensity of pain was significantly higher in Open (VAS) as compared to TEP during hospital stay at rest [p=0.0164] and on exertion after 1 week [p=0.0083] and 4 weeks of follow up [p=0.0470]. No significant difference observed in VAS between Lichtenstein and TEP during follow up- At Rest [1 week (p=0.3853), 4 weeks (p=0.4489), and 12 weeks (p=0.8933)], On Exertion [hospital stay (p=0.0675), and 12 weeks (p=0.2353)]. Both were comparable in Intra-operative and Post-operative complications {vascular injury (p=0.4230), seroma [hospital stay (p=0.8327), follow up {1 week (p=0.6507), 4 weeks (p=0.6406)}]; haematoma [hospital stay (p=0.4436), after 1 (p=0.1245)], 4 weeks follow up (p=0.4515); superficial infection [hospital stay (p=0.6740), 1 week (p=0.6406), 4 weeks (p=0.4515) follow up]. No deep wound/mesh infection occurred in either group. Duration of hospital stay was significantly more in Lichtenstein than TEP group [p=0.0304].

Conclusion: Our study supports that Extraperitoneal (TEP) mesh repair is the better modality of treatment as compared to Open Lichtenstein tension-free mesh repair for inguinal hernia repair.

Key Words: Hernioplasty, Inguinal hernia repair, Lichtenstein open hernia repair, Laparoscopic hernia repair, TEP

INTRODUCTION

A hernia is an abnormal protrusion of an organ or tissue through the defect in its surrounding wall.¹ From an aetiological point of view, there are two types of inguinal hernia- congenital and acquired. Congenital hernias imply to a persisting Processus Vaginalis with free communication between the abdominal cavity and the scrotum. In the newborn, the frequency of a patent Processus Vaginalis is 57-94% with 37-40% persisting up to two years of age and half of them may develop into an inguinal hernia later in life.^{2,3} Acquired inguinal hernias are generally not believed to be associated with a persistent Processus Vaginalis but it develops secondarily. Several risk factors for the development of acquired inguinal hernias have been suggested, among these various

connective tissue disorders like Marfan's and Ehlers- Danlos syndrome, cutis laxa and osteogenesis imperfect, all of which carry an increased hernia incidence, and the aetiological link to connective tissue disorders seems to be quite clear.⁴

In 1984, hernia surgery saw a big leap when Lichtenstein et al coined the term "Tension Free Hernioplasty" and broke the old dogma by routinely advocating the use of synthetic mesh in inguinal hernia repair.⁵ There was a significant decline in the recurrence rate and nowadays its rate is consistently reported as low as 1-4% which was earlier up to 50-60%.⁶⁻¹⁰

In 1990, Laparoscopic tension-free hernia repair technique was introduced and was propagated as a better alternative to Lichtenstein tension-free mesh repair in terms of outcome measures like less post-operative pain and shorter recovery

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time.¹¹ In 2009, the European Hernia Society (EHS) issued the guidelines as Grade A recommendation based on the 5 meta-analyses for the treatment of primary unilateral inguinal hernia repair. It recommended the open Lichtenstein and endoscopic inguinal hernia techniques as the best evidence-based options for the repair of primary unilateral inguinal hernia providing the surgeon was sufficiently experienced in a specific procedure.¹² EHS again in 2014 issued the same recommendations after excluding some of the Swedish Data.¹³

Since then, various studies and meta-analysis were done favouring either one of the studies or showing no difference in the outcome measures regarding postoperative pain, recurrence, duration of hospital stay, cost-effectiveness etc. This study is therefore undertaken to prospectively study the benefits and harm of the open and laparoscopic inguinal hernia repair techniques.

MATERIAL AND METHODS

A total of 78 patients of inguinal hernia enrolled prospectively between November 2017 to December 2019 and patients aged 18 years and above admitted in JNMCH Hospital were included in this study. 50 patients were included in the open (Lichtenstein) group while 28 patients were allocated to Laparoscopic (TEP) group. The results were verified using the chi-square test and unpaired 't' test respectively.

Patients included were- Male patients, age ≥ 18 (Clinical Ethical Approval Number: 1023/FM) years, unilateral inguinal hernia, elective operation, patient giving consent. Patients excluded were- Female patient, age <18 years, bilateral inguinal hernia, previous lower abdominal surgery, coagulation defect, emergency operation. The patient was to be followed up- every day till discharge and follow up after 1 week, 4 weeks and 12 weeks. A detailed history and clinical examination were done in every case before surgery. Investigations before surgery included complete blood count, bleeding time, clotting time, kidney function test, serum electrolyte, blood sugar, X-ray chest and electrocardiogram. The patient was operated with spinal anaesthesia used for Lichtenstein repair patients and TEP patients were operated under general anaesthesia (Figure 1 and 2).

During the intra-operative period, duration of operation, intraoperative complications and conversion to open were noted in both Lichtenstein and TEP groups. Post-operatively all patients were evaluated for pain (based on VAS) in the immediate postoperative period (at 6 hrs) and also during the whole length of the hospital stay and in follow up after 1 week, 4 weeks and 3 months of surgery. They were also evaluated for any post-operative complications like seroma, hematoma, wound/mesh infection, length of hospital stay, recurrence. The patients underwent Open Lichtenstein repair

or laparoscopic TEP repair based on the surgeon's preference.

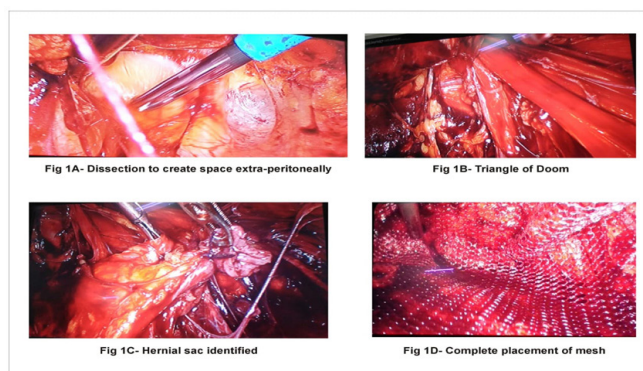


Figure 1: Extraperitoneal hernia repair.

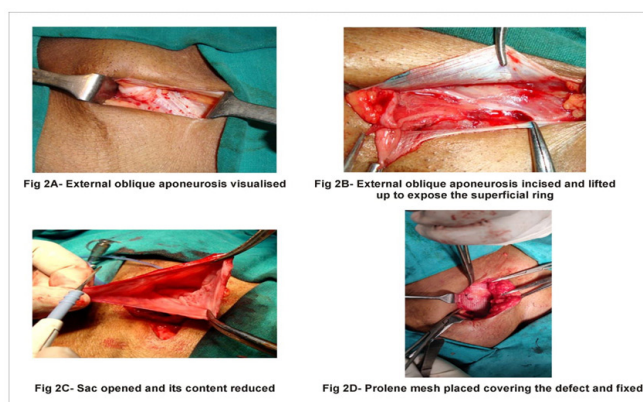


Figure 2: Lichtenstein "Tension free" hernia repair.

The pain was calculated using a visual analogue score which is based on Wong-Baker facial pain rating scale¹⁴ and Visual analogue scale. Descriptive statistical analysis using SPSS statistical software score was used to present the data in the present study. Results on continuous measurements are presented with Mean and standard deviation while results on categorical measurements are presented in numbers and percentages. Pearson's chi (x²) square test and Unpaired 't' test were used for statistical analysis. A probability value of less than 0.05 ($p < 0.05$) was deemed statistically significant.

RESULTS

In both TEP and Lichtenstein groups, most of the patients were in the age group of 41 to 60 years. The mean age of patients in the TEP group was 40.39 ± 13.75 years and that in the Lichtenstein group was 43.88 ± 18.75 years. All the patients were male and the two groups were comparable concerning the age. No statistical difference was found between the mean age of the two groups ($p=0.3915$) (Table 1).

Table 1: Different patient outcomes between Lichtenstein and TEP repair-

		LICHTENSTEIN (n=50)	TEP (n=28)	p VALUE
Age		43.88 ± 18.75 years	40.39 ± 13.75 years	p=0.3915
Side of hernia	Right	30 (60%)	16 (57.1%)	p=0.8056
	Left	20 (40%)	12 (42.9%)	
Type of hernia	Indirect	38 (76%)	24 (85.7%)	p=0.4759
	Direct	12 (24%)	4 (14.3%)	
Operative Time		52.32 ± 12.93 min	79.00 ± 10.59 min	p<0.0001
Intra-operative complications	Visceral Injury	0	0	-
	Vascular Injury	0	1 (2%)	p=0.1785
	Conversion to open	0	4 (14.3%)	p=0.0061
Length of hospital stay		4.66 ± 2.57 Days	3.57 ± 0.57 Days	p=0.0304
Recurrence		0	0	-

Out of 78 patients in both the groups, the indirect hernia was present in 24 (85.7%) patients in TEP group and 38 (76%) patients in Lichtenstein group while direct hernial component was seen in 4 (14.3%) patients in TEP group and 12 (24%) patients in Lichtenstein group but the results were comparable (p=0.3078). In TEP group, 16 (57.1%) patients had right-sided hernia as compared to 30 (60%) patients in Lichtenstein group (p=0.8056) (Table 1).

The mean operative time was significantly lesser in Lichtenstein repair [52.32 ± 12.93 minutes, SD= 12.93, SEM=2.10] than in the TEP repair [79 ± 10.59 minutes, SD=10.59, SEM=2.16] (p<0.0001) (Table 1).

In our study, more intraoperative complications occurred in TEP group than in Lichtenstein group with vascular injury

occurring in 1 (2%) out of 28 patients (p=0.1785) in TEP group while there was no major vascular injury in Lichtenstein group, and in 4 (14.3%) out of 28 patients in TEP group, the procedure was abandoned midway and converted to open and the difference was significantly higher [p=0.0061] than Lichtenstein group. None of the patients had any visceral injury [Table 1]. The mean duration of hospital stay was found to be 3.57 days in the TEP group [SD=0.57, SEM=0.11] as compared to 4.66 days in the Lichtenstein group [SD=2.57, SEM=0.36], and the duration was found to be significantly higher in Open group as compared to TEP group [p=0.0304] [Table 1].

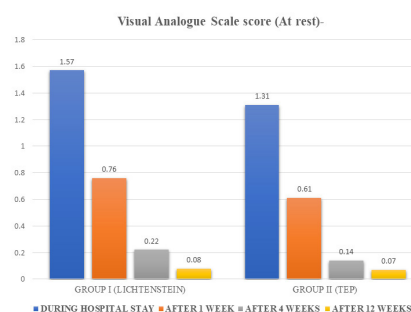
Till now, no recurrence of hernia is ever noted in either TEP or Lichtenstein group.

Post-operative pain at rest

Table 2: Visual analogue scale score between Lichtenstein and TEP at rest-

S.No	Procedure	Average pain during the hospital stay	p-value	After 1 week	p-value	After 4 weeks	p-value	After 12 weeks	p-value
1.	OPEN	1.57	p=0.0164	0.76	p=0.3853	0.22	p=0.4489	0.08	p=0.8933
2.	TEP	1.31		0.61		0.14		0.07	

In our study, patients of Lichtenstein group had more pain at rest [Mean=1.57, SD=0.46, SEM=0.18] than those in TEP group [Mean=1.31, SD=0.41, SEM=0.14] during their entire hospital stay and the result was found to be statistically significant [p=0.0164] [Table 2]. However, the difference in VAS between the two procedures was found to be comparable after 1 week [p=0.3853], 4 weeks [p=0.4489] and 12 weeks [p=0.8933] of discharge at rest [Figure 3].

**Figure 3: Bar chart showing Visual analogue scale score (VAS) between Lichtenstein and TEP groups.**

Post-operative pain on exertion

Table 3: Visual analogue scale score between Lichtenstein and TEP on exertion-

S. No.	Procedure	Average pain during the hospital stay	p-value	After 1 week	p-value	After 4 weeks	p-value	After 12 weeks	p-value
1.	OPEN	2.33	p=0.0675	1.48	p=0.0083	0.82	p=0.0470	0.36	p=0.2353
2.	TEP	2.01		0.96		0.46		0.21	

In our study, patients of Lichtenstein group had more pain on exertion [Mean=1.48, SD=0.84, SEM=0.12] than those in TEP group [Mean=0.96, SD=0.74, SEM=0.14] which was found during follow up after 1 week of discharge and the result was found to be statistically significant [p=0.0083] [Table 3]. It was also found that patients of Lichtenstein group had more pain on exertion [Mean=0.82, SD=0.85, SEM=0.12] than those in TEP group [Mean=0.46, SD=0.51, SEM=0.10] which was found during follow up after 4 weeks of discharge and the result was found to be statistically significant [p=0.0470] [Table 3].

However, the difference in VAS between the two procedures was found to be comparable during hospital stay [p=0.0675], and 12 weeks [p=0.2353] of discharge on exertion [Figure 4].

Post-operative Chronic Pain

There was no reported chronic pain post-operatively in patients of both the groups after 12 weeks of follow up.

Post-Operative Complications:

In our study, out of 50 patients of Lichtenstein group, 8 (16%) developed seroma during the hospital stay as compared to 5 out of 28 (17.9%) patients of TEP group (p=0.8327). In 7 out of 50 patients (14%) of Lichtenstein group, seroma persisted even after discharge and was followed up after 1 week as compared to 5 patients out of 28 patients (17.9%) in TEP group (p= 0.6507). During follow up after 4 weeks, seroma was found in 3 out of 50 (6%) patients in Lichtenstein group while it subsided in 2 patients in TEP group and now it was seen in only 1 (3.6%) patient belonging to TEP group (p=0.6406). No occurrence of seroma was found in patients of both the groups during follow up after 12 weeks [Table 4].

Table 4: Postoperative complication rates between Lichtenstein and TEP repair

		LICHTENSTEIN (n=50)	TEP (n=28)	p VALUE
During Hospital Stay	Seroma	8 (16%)	5 (17.9%)	p=0.8327
	Haematoma	4 (8%)	1 (3.6%)	p=0.4436
	Superficial wound infection	1 (2%)	1 (3.6%)	p=0.6740
After 1 week	Seroma	7 (14%)	5 (17.9%)	p=0.6507
	Haematoma	4 (8%)	0	p=0.1245
	Superficial wound infection	3 (6%)	1 (2%)	p=0.6406
After 4 weeks	Seroma	3 (6%)	1 (2%)	p=0.6406
	Haematoma	1 (2%)	0	p=0.4515
	Superficial wound infection	1 (2%)	0	p=0.4515
After 12 weeks	Seroma	0	0	-
	Haematoma	0	0	-
	Superficial wound infection	0	0	-

Out of 50 patients in the Lichtenstein group, 4 (8%) developed haematoma during the hospital stay as compared to 1 out of 28 (3.6%) patients of the TEP group (p=0.4436). Dur-

ing follow up after 1 week, 4 out of 50 patients (8%) in Lichtenstein group, haematoma persisted even after discharge and was observed in follow up while it subsided in all the

patients in TEP group ($p=0.1245$). During follow up after 4 weeks, haematoma persisted in 1 out of 50 (2%) patients in the Lichtenstein group ($p=0.4515$). After 12 weeks, no haematoma was observed during follow up [Table 4]. One (2%) patient developed superficial wound infection during the hospital stay in Lichtenstein group as compared to 1 out of 28 (3.6%) patients who belonged to TEP group ($p=0.6740$). During follow up after 1 week, 3 out of 50 patients (6%) of Lichtenstein group had developed superficial wound infection as compared to only 1 out of 28 in patients who belonged to TEP group ($p=0.6406$). During follow up after 4 weeks, superficial wound infection was found in 1 out of 50 (2%) patients of Lichtenstein group while it subsided in all the patients of TEP group ($p=0.4515$). No occurrence of superficial wound infection was found in patients of both the groups during follow up after 12 weeks [Table 4]. None of the patients developed deep infection/ mesh infection in either of the two groups during follow up till now.

DISCUSSION

An inguinal hernia is a common surgical problem encountered worldwide. There are various methods for inguinal hernia repair, but 'Tension-free repair' is the procedure of choice. The tension-free repair procedures can be roughly categorized into two groups; laparoscopic and open approach¹⁵ but the ideal technique is still controversial. Although open tension-free mesh techniques of inguinal hernia repair offered good results the superiority of laparoscopic technique was reported for postoperative pain and lesser duration of hospital stay.¹⁶ In this study, most of the cases operated in both the Lichtenstein and TEP groups belonged to the age group of 41-60 years with the mean age of 45.32 ± 17.66 years in Lichtenstein group as compared to 39.88 ± 11.98 years in TEP group. Neumayer L et al.¹⁷ had reported the mean age of the patients in open mesh repair group and laparoscopic repair groups as 58.4 ± 12.7 years and 58.6 ± 12.8 years respectively and are in parallel to the current study. Hamza Y et al.¹⁸ noted no significant difference in age between the two groups indicating that the two groups are comparable and are similar to our study.

In our study, all the patients in both groups were males. Bringman S et al.¹⁹ and Sawarkar P et al.²⁰ included only males in their study which is similar to our study. But Govindaraj S et al.²¹ in their study had 98.3% of all the patients as males and 1.7% as females.

In our study, 38 (76%) out of 50 patients had indirect hernia who belonged to Lichtenstein group as compared to 24 (85.7%) out of 28 patients who were in TEP group while 12 (24%) out of 50 patients in Lichtenstein group had a direct hernia as compared to 4 (14.3%) out of 28 patients in TEP group and the results were comparable [$p=0.1859$]. Prasad

et al. reported 58% of patients having indirect hernia while 42% having a direct hernia.²² More occurrence of indirect hernia in a study with 186 out of 274 (60%) patients having indirect hernia as compared to 96 out of 274 (30%) patients having a direct hernia is also found.²³ So, the results in our study were found to be similar to both. However, Zhang X et al.²⁴ reported comparable results in the occurrence of indirect and direct hernia between both Open and TEP groups (32 out of 77 patients with an indirect hernia and 5 out of 77 patients with a direct hernia in Open group while 34 out of 77 patients with an indirect hernia and 6 out of 77 patients with a direct hernia in TEP group respectively) [$p=0.798$].

In our study, 30 (60%) out of 50 patients who belonged to Lichtenstein group presented with right-sided hernia as compared to 16 (57.1%) out of 28 patients in TEP group while 20 (40%) out of 50 patients in Lichtenstein group had a left-sided hernia as compared to 12 (42.9%) out of 28 patients in TEP group but the results were comparable [$p=0.7708$]. Prasad KT et al.²⁶ in their study found 62 % of patients of having right-sided hernias as compared to 38% of patients left-sided hernias. Pooraneson K et al.²⁵ found 14 out of 25 (56%) patients as having a right-sided inguinal hernia in Open group as compared to 10 out of 25 (40%) patients in TEP group with more occurrence of right-sided hernia in Open group while more occurrence of left-sided hernia in TEP group. So, our results were in concordance with other studies

The duration of surgery among the study participants in TEP group (79 ± 10.59 mins) was significantly higher as compared to the Lichtenstein group (52.32 ± 12.93 mins) group [$p<0.0001$]. Shah et al.²⁶ reported average duration of 84.25 minutes taken for Laparoscopic (TEP) hernia repair as compared to open (Lichtenstein) hernia repair which was about 71.5 minutes and the duration was significantly higher [$p=0.016$]. Schmidt et al.²⁷, McCormack et al.²⁸ [$p<0.0001$], Bringman S et al.¹⁹ [$p<0.0001$], also reported the duration of surgery to be significantly higher in TEP group as compared to Lichtenstein hernia repair group which is similar to our study. In our study, the vascular injury occurred in 1 out of 28 patients of TEP group ($p=0.1785$), and in 4 out of 28 cases in TEP group, the procedure was abandoned midway and was converted to open and the difference was significantly higher [$p=0.0061$] than in Lichtenstein group. None of the patients had any visceral injury in either group. Schmidt et al.²⁷, McCormack et al.²⁸ [visceral (Overall 8/2315 versus 1/2599) and vascular (Overall 7/2498 versus 5/2758) injuries], Grant et al.²⁹ [visceral (4.7 per 1000) and vascular injuries (1.1 per 1000)] found visceral and vascular injury to be more in Laparoscopic (TEP) group as compared to Open group in their study.

Patients who underwent Lichtenstein repair had significantly more pain [Mean=1.57, SD=0.46, SEM=0.18] than those undergoing TEP repair [Mean=1.31, SD=0.41, SEM=0.14]

during their entire hospital stay [$p=0.0164$] at rest. However, the difference in VAS between the two procedures at rest was not found to be statistically significant during follow up after 1 week [$p=0.3853$], 4 weeks [$p=0.4489$] and 12 weeks [$p=0.8933$]. On exertion also, patients who underwent Lichtenstein repair experienced more pain [Mean=1.48, SD=0.84, SEM=0.12] than those undergoing TEP repair [Mean=0.96, SD=0.74, SEM=0.14] during follow up after 1 week [$p=0.0083$]. Also, after 4 weeks of follow up, patients of Lichtenstein repair had significantly more pain [Mean=0.82, SD=0.85, SEM=0.12] on exertion than those undergoing TEP repair [Mean=0.46, SD=0.51, SEM=0.10] [$p=0.0470$]. However, no difference in VAS between the two procedures on exertion was found to be statistically significant during the hospital stay [$p=0.0675$] and after 12 weeks follow up [$p=0.2353$]. Mc Cormack et al.²⁸ in their study showed the lesser occurrence of pain [Overall 290/2101 versus 459/2399; Peto OR 0.54, 95% CI 0.46 to 0.64; $p<0.0001$] in the laparoscopic group which is similar to our study. Sawarkar P et al.²⁰ in their study found 13.4% of patients in the Lichtenstein group had severe pain as compared to 8.0% patients in the laparoscopic group, ($p=0.29$). While 9.3% of patient had moderate pain in the laparoscopic group as compared to 36.0% in the Lichtenstein group ($p<0.001$) after 1 week of operation. After that, severe pain occurred in 2 patients (2.6%) of the Lichtenstein group, while none of the patients in the laparoscopic group complained of any pain and the findings were similar to our study. Kochia ST et al.³⁰ found chronic pain to be more prevalent in the Lichtenstein group as compared to the TEP group. There was no reported chronic pain in the patients of both the groups after 12 weeks of follow up in our study. Bringman S et al.¹⁹ and Sawarkar P et al.²⁰ also reported the absence of chronic pain in their study which was similar to the findings of our study.

In the postoperative period, 8 (16%) patients had developed seroma during the hospital stay, persisting in 7 (14%) patients after 1 week and in 3 (6%) patients after 4 weeks during follow up in the Lichtenstein group while it was seen in 5 (17.9%) patients during the hospital stay and persisting in all 5 (17.9%) patients after 1 week and in 1 (3.6%) patient after 4 weeks during follow up TEP group respectively. No occurrence of seroma occurred in both the groups during follow up after 12 weeks. The occurrence of haematoma was seen in 4 (8%) patients during the hospital stay persisting in all 4 (8%) patients after 1 week and later subsiding in 3 patients and after that, it was seen in 1 (2%) patient after 4 weeks during follow up Lichtenstein group while in the TEP group, haematoma occurred in 1 (3.6%) patient and later it was absent during follow up after 1 week, 4 weeks and 12 weeks. Superficial wound infection was seen in 1 (2%) patient in the Lichtenstein group during the hospital stay, while it was seen in 3 (6%) patients after 1 week and in 1 (2%)

patient after 4 weeks of follow up. No superficial wound infection was seen after 12 weeks in the Lichtenstein group. In the TEP group, superficial wound infection was seen in 1 (2%) patient during the hospital stay and in 1 (2%) patient after 1 week of follow up. No occurrence of superficial wound infection was seen during follow up after 4 and 12 weeks in TEP group. None of the patients developed deep infection/ mesh infection in either of the two groups during follow up till now. Shah et al.²⁶ [2 cases of seroma & haematoma ($p=0.510$), 4 cases of wound infection ($p=0.636$) in the open group versus 0 case of seroma/haematoma and 1 case of wound infection in Laparoscopic group], Prasad KT et al.²² [3 cases each of Seroma & Hematoma, 1 case of wound infection were found in Lichtenstein group and none (seroma, haematoma or superficial wound infection) in the TEP group], and Athmaram A et al.³¹ also found no difference in the postoperative complication rates between either Open or Laparoscopic groups.

The mean duration of postoperative hospital stay was found to be significantly lesser in TEP group [Mean=3.57 days, SD=2.57, SEM=0.36] as compared to Lichtenstein group [Mean=4.66 days, SD=0.57, SEM=0.11] [$p=0.0304$]. Prasad KT et al.²² [3.84 days for the Open (Lichtenstein) group compared to 3.44 days for the Laparoscopic TEP group ($p=0.004$)], Pooraneson et al.²⁵ [(3.08+0.4 days) TEP group compared to 5 days in the open group ($p<0.001$)] in their study found the duration of hospital stay to be more in Lichtenstein as compared to TEP group. While Shah et al.²⁶ [3.23 days for Open group and 3.50 days for the Laparoscopic group [$p=0.352$], Mc Cormack et al.²⁸ [$p=0.05$], Grant et al.²⁹ [$p=0.50$] did not find any difference in hospital stay between the two groups.

CONCLUSION

Though the procedure of totally extraperitoneal repair for inguinal hernia takes a little longer time and complications of general anaesthesia cannot be ruled out, it is a better procedure in parameters like lesser post-operative pain scores and less duration of hospital stay, with no recorded intra-operative or post-operative complications. Thus, TEP can be considered as the procedure of choice for the inguinal hernia repair in the hands of the experienced surgeons.

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