Transfascial suture versus tack fixation of mesh in totally extraperitoneal repair of inguinal hernia: A prospective comparative study

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INTRODUCTION

Inguinal hernia is the most common abdominal wall hernia with its repair being the most commonly performed surgery worldwide.\(^1\,^2\) Laparoscopic repair of inguinal hernia after gaining popularity in 1990s now constitutes a large proportion of different types of inguinal hernia surgery. Totally extraperitoneal (TEP) repair has demonstrated favourable results in the reduction of post-operative pain and mean operative times (OTs) with early return to physical activity among laparoscopic procedures.\(^3\) In
laparoendoscopic repair, the subject of mesh fixation still draws a lot of debate, especially with regard to need of mesh fixation or ideal technique of mesh fixation. Although previous studies demonstrated the mesh fixation step to be irrational, recent studies have shown that there is a lack of strong evidence in support of non-fixation of mesh in laparoscopic inguinal hernia repair. Although both mesh fixation and non-fixation of mesh carry disadvantage of chronic groin pain and risk of hernia recurrence, respectively, the search for ideal/alternative technique of mesh fixation has gained momentum, and various studies have been done comparing various techniques of mesh fixation, including tack, sutures, fibrin glue and cyanoacrylate glue. Cost constraint is still applicable in developing countries with regard to use of tack or glue fixation of mesh, thereby leaving the option of using suture fixation of mesh still wide open. Suture fixation can be done by intracorporeal knotting or transfascial suture fixation techniques, but limited space in TEP repair causes hindrance to intracorporeal knotting and placement of transfascial sutures for mesh fixation can take precedence in this situation. This technique may be cost-effective but still requires further studies on post-operative complications, post-operative pain and recurrence rates in TEP repair.

For this reason, we planned to undertake this prospective non-randomised comparative study regarding two different techniques of mesh fixation (i.e. transfascial suture fixation vs. tack fixation).

MATERIALS AND METHODS

After approval from the Institutional Ethical Committee, a prospective non-randomised non-blinded study was done on 69 cases of inguinal hernia operated by TEP. All male patients between 18 and 65 years of age presenting to surgical outpatient clinic and diagnosed as inguinal hernia and planned for TEP inguinal hernia repair were enrolled in the study after obtaining informed consent. Patients with significant comorbidities, concurrent or past surgical illness, complicated inguinal hernias (irreducible/strangulated) and not fit for general anaesthesia or endoscopic hernia repair were excluded from the study. The present study was undertaken from October 2014 to September 2016 with minimum follow-up of 6 months for each patient. General anaesthesia was used in all TEP repairs done by the same operating surgeon with previous experience of independently performed more than 100 TEP repairs. Mesh fixation in TEP repair was done with either tack fixation (in those who afforded it or when it was present in hospital supply for poor patients) or transfascial sutures. All standard procedures of sterilisation of instruments were followed including the use of gas plasma sterilisation (STERRAD). Tacks or sutures were not reused in any of the patients. Randomisation could not be done in this study due to limited availability of tack fixation device. All patients received single intravenous dose of 1-g ceftriaxone at the time of induction of anaesthesia. Primary outcome parameters included any complications, post-operative pain and cost analysis.

After complete history and physical examination along with abdominal and scrotal ultrasound of the patient, the data were collected to include baseline demographics and peri-operative parameters such as previous inguinal hernia surgeries, laterality and type of hernia, length of operation (minutes), post-operative pain (both immediate and long term), post-operative complications (e.g. surgical site infections, seroma, haematoma and recurrence), length of hospital stay (days), time taken for return to normal activity and total costs incurred (including hospitalisation, surgery, prosthesis and special equipment costs). Alcohol abuse was defined as having >5 drinks per day and tobacco use as >5 cigarettes per day. Outcome parameters were recorded at 24 h, 1 week and 1, 3, 6 and 12 months after surgery. Visual analogue scale (VAS) with the scores from 0 (no pain) to 10 (worst pain) was used to assess pain intensity. The VAS is a subjective measure of pain. It consists of a 10-cm line with two endpoints representing ‘no pain’ and ‘worst pain imaginable’. Patients are asked to rate their pain by placing a mark on the line corresponding to their current level of pain.

Continuous data were summarised as mean ± standard error of the mean whereas discrete (categorical) in number and percentage (%). Continuous groups were compared by independent Student’s t-test. Categorical groups were compared by Chi-square test. A two-tailed \( P < 0.05 \) was considered statistically significant. Analyses were performed on SPSS Statistics for Windows, Version 17.0. (SPSS Inc., Chicago, IL, USA).

Surgical technique

Urinary catheterisation was performed for all patients before surgery. Under general anaesthesia, infraumbilical incision was given and anterior sheath of ipsilateral rectus muscle was opened. Without opening posterior sheath of rectus muscle, a space was created beneath rectus muscle with blunt dissection without using any balloon or balloon trocar, and this space was extended to pubic symphysis. With carbon dioxide insufflation at 8–10 mmHg, insertion of 0°optic camera was done through incision, and blunt dissection was maintained. After visualisation of pubic symphysis and inferior epigastric arteries, two trocars each with a diameter of 5 mm were
placed inside the preperitoneal space with one just above pubic symphysis and another between umbilicus and pubic symphysis. Hernial sac was dissected away from cord structures achieving their parietalisation [Figure 1] Sac of complete hernias was ligated proximally and then divided. Polypropylene mesh (Prolene; Ethicon, Inc., Somerville, NJ, USA) 10–15 cm in length was placed on the myopectineal orifice, with the coverage of medial and lateral borders of the defect.

Tack fixation of mesh [Figure 2] was done with application of four spiral tacks (Protack; Covidien–Medtronic, Dublin, Republic of Ireland), of which two were placed over Cooper's ligament and two were placed over lateral abdominal wall avoiding triangle of pain. Transfascial mesh fixation [Figure 3] was done by 2-0 polypropylene sutures by application of one suture 2 cm above the iliopubic tract and pubic tubercle medially with another suture applied about 2 cm above the iliopubic tract laterally just medial to anterior superior iliac spine (ASIS) taking help of hook through loop technique.

RESULTS

A total of 78 patients were diagnosed as inguinal hernia from the outpatient patient clinic, and all of them were planned for TEP hernia repair. Out of those, two patients did not gave consent for TEP repair, three patients had significant comorbidities (one had cardiac and two with respiratory illness) and three patients had history of previous laparotomy done (one for Koch’s abdomen and one for peptic ulcer perforation). After exclusion of these nine patients, 69 patients of inguinal hernia who were operated by TEP repair were included in the study after performing sequential convenience sampling with all patients presenting in outpatient visit on for TEP repair with tack fixation of mesh and transfascial suture fixation of the mesh depending on the availability tack fixation device in the hospital supply or the affordability of the patient to purchase. Thus, there were 44 patients in the tack group and 25 patients in the suture group.

Demographic and peri-operative characteristics

The mean age of the our patients was 34 ± 1.87 years in the tack group as compared to 38.64 ± 2.39 years in the suture group. Comparison of demographic characteristics and body mass index between two groups did not reveal any significant findings [Table 1]. In terms of history of the patient, prior inguinal hernia surgery with recurrence was present in one patient of tack group, whereas tobacco use and alcohol abuse were present in ten and seven patients out of 44 in tack group and five and four patients in suture group, respectively. Left-sided hernia was the predominant side present in 29 and 15 patients of tack group and suture group, respectively. Bilateral hernia was present in only two patients of tack group and one patient of suture group. Comparison of mean OT (78.2 min ± 6.1 vs. 75.9 ± 5.9 min) and length of hospital stay (48.2 ± 3.3 h vs. 50.3 ± 3.6 h) in tack group versus suture group did not reveal statistically significant results.

Complications (intra-operative and post-operative)

None of the patients in two groups had intra-operative complications (nerve or vessel injury). No significant difference was found in post-operative complication as no patient in each group had intra-operative or post-operative bleeding. Two (5%) of the patients in

Figure 1: Totally extraperitoneal repair. (a) Creation of pre-peritoneal space with vertical arrow showing suprapubic port inserted under vision. (b) Horizontal arrow showing hernia sac being separated from spermatic cord structures

Figure 2: Totally extraperitoneal repair – tack fixation of mesh. (a) Tack fixation at Cooper’s ligament with horizontal arrow showing tack fixation device and vertical arrow showing non-absorbable spiral tacks. (b) Tack fixation at lateral abdominal wall (right vertical arrow) avoiding triangle of pain shown by vertical arrow
tack group developed seroma (one at post-operative day 3 and another at post-operative day 6) and surgical site infection (one at post-operative day 4 and another at post-operative day 7) as compared to 1 (4%) of the patients in suture group [Table 2]. These complications were managed safely by conservative means only. The two groups were also comparable in terms of return to normal activity (17.08 ± 0.39 days in tack group vs. 16.36 ± 0.30 days in suture group, respectively). Although early post-operative pain was present in more (15) patients in suture group as compared to tack group (14) at 24 h [Table 3], chronic pain (>6 months) was present in 4 (9%) versus 1 (4%) patients in tack group versus suture group, respectively. Although mean VAS scores in patients having post-operative pain were not having statistically significant difference in the tack group versus suture group being 2.42 ± 0.24 versus 2.2 ± 0.24 at 24 h, their comparative (tack group vs. suture group) VAS scores in the follow-up period at 1 week, 1, 3 and 6 months were 1.14 ± 0.33 versus 0.67 ± 0.27; 0.78 ± 0.24 versus 0.07 ± 0.06; 0.42 ± 0.17 versus 0.07 ± 0.06 and 0.5 ± 0.11 versus 0.07 ± 0.06, respectively [Table 4 and Figure 4]. None of the patients in each group had hernia recurrence during our study follow-up.

Cost analysis
Mean hospitalisation costs (bed charges, surgery charges and investigation charges) in tack group and suture group [Table 5] were 5450.326 ± 208.86 INR and 5650.28 ± 164.68 INR, respectively. The mean charges for the technique of fixation, i.e., tack versus suture, was 15674 ± 33.38 INR versus 564 ± 24.8 INR ($P$ < 0.05) were

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**Figure 3**: Totally extraperitoneal repair – transfascial fixation of mesh. (a) Horizontal arrow showing the technique of inserting polypropylene suture for mesh fixation. (b) Vertical arrow showing taking out the suture by Hook with in a loop technique.
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Discuss the importance of mesh fixation in TEP, especially in developing countries where economic burden on patients is a concern. Our study suggests that transfascial suture fixation of mesh can be a cost-effective alternative to tack fixation of mesh in TEP, and it can be used in the peri-operative outcomes and complication rates.

In our study, there was no significant difference in mean peri-operative characteristics such as laterality (bilateral, unilateral right or unilateral left), type of hernia (indirect, direct, mixed and femoral), mean OT and total length of hospital stay (LOS), intra-operative and post-operative complication rates, post-operative pain scores and recurrence rates in tack group and suture group. Various studies done on various techniques of mesh fixation in TEP have reported outcomes similar to our study, but none of them had included transfascial suture technique in their study. Moreover, only a few studies have commented on the cost-effectiveness of mesh fixation technique.

Our study also assumes importance as there are a few studies on transfascial suture fixation of mesh in TEP repair. Our results suggest that transfascial suture fixation of mesh can be a cost-effective alternative to tack fixation of mesh in TEP, especially in developing countries where other techniques (tack, staplers or glue) can add to economic burden of the procedure on the patient. Besides prospective in nature, our study comprised a sample size of 69 patients, which is comparable to various other prospective studies done on a debatable topic of mesh fixation in TEP repair of inguinal hernia. The main limitation of our study is its non-randomised nature which was expected due to limited availability of tack fixation devices to affordable patients only. Another limitation of our study is that we have not done quantitative assessment of analgesic medication required for pain alleviation in the post-operative period after TEP. There is also lack of including hernia-related quality of life parameters (e.g. Carolinas comfort scale) and long-term follow-up in our study. These limitations can be dealt in the future well-designed prospective studies.
CONCLUSION

Transfascial suture fixation of mesh in TEP repair of inguinal hernia is cost-effective as compared to tack fixation. The results in our study also suggest that there is possibly higher incidence of post-operative pain on medium-term follow-up of 6 months along with lower cost in use of transfascial suture fixation. Although there is no recurrence in our study, long-term follow-up (at least 5 years) is needed to confirm these results. There is still lack of strong evidence to support routine use of transfascial suture fixation in TEP, but it can be safely adopted in low-resource settings. These results require further validation by future well-designed prospective multi-institutional randomised controlled trials.

Financial support and sponsorship
Nil.

Conflicts of interest
There are no conflicts of interest.

REFERENCES

1. Kingsnorth A, LeBlanc K. Hernias: Inguinal and incisional. Lancet 2003;362:1561-71.
2. Devlin HB. Trends in hernia surgery in the land of Astley Cooper. In: Soper NJ, editor. Problems in General Surgery. Vol. 12. Philadelphia, PA: Lippincott-Raven; 1995. p. 85-92.
3. Winslow ER, Quasebarth M, Brunt LM. Perioperative outcomes and complications of open vs. laparoscopic extraperitoneal inguinal hernia repair in a mature surgical practice. Surg Endosc 2004;18:221-7.
4. Beattie GC, Kumar S, Nixon SJ. Laparoscopic total extraperitoneal hernia repair: Mesh fixation is unnecessary. J Laparoendosc Adv Surg Tech A 2000;10:71-3.
5. Sajid MS, Ladwa N, Kalra I, Hutson K, Sains P, Baig MK. A meta-analysis examining the use of tacker fixation versus no-fixation of mesh in laparoscopic inguinal hernia repair. Int J Surg 2012;10:224-31.
6. Heise CP, Starling JR. Mesh inguinodynia: A new clinical syndrome after inguinal herniorrhaphy? J Am Coll Surg 1998;187:514-8.
7. Lantis JC, Schwaitzberg SD. Tack entrapment of the ilioinguinal nerve during laparoscopic hernia repair. J Laparoendosc Adv Surg Tech A 1999;9:285-9.
8. Felix E, Scott S, Crafton B, Geis P, Duncan T, Sewell R, et al. Causes of recurrence after laparoscopic hernioplasty. A multicenter study. Surg Endosc 1998;12:226-31.
9. Lowham AS, Filipi C, Fitzgibbons RJ Jr., Stoppa R, Wantz GE, Felix EL, et al. Mechanisms of hernia recurrence after preperitoneal mesh repair. Traditional and laparoscopic. Ann Surg 1997;225:422-31.
10. Khajanheuree YS, Urbach DR, Swanstrom LL, Hansen PD. Outcomes of laparoscopic herniorrhaphy without fixation of mesh to the abdominal wall. Surg Endosc 2001;15:1102-7.
11. Kaul A, Hutless S, Le H, Hamed SA, Tymitz K, Nguyen H, et al. Staple versus fibrin glue fixation in laparoscopic total extraperitoneal repair of inguinal hernia: A systematic review and meta-analysis. Surg Endosc 2012;26:1269-78.
12. Ladwa N, Sajid MS, Sains P, Baig MK. Suture mesh fixation versus glue mesh fixation in open inguinal hernia repair: A systematic review and meta-analysis. Int J Surg 2013;11:128-35.
13. Kukleta JF, Freytag C, Weber M. Efficiency and safety of mesh fixation in laparoscopic inguinal hernia repair using n-butyl cyanoacrylate: Long-term biocompatibility in over 1,300 mesh fixations. Hernia 2012;16:153-62.
14. McKernan JB, Laws HL. Laparoscopic repair of inguinal hernias using a totally extraperitoneal prosthetic approach. Surg Endosc 1993;7:26-8.
15. Bobo Z, Nan W, Qin Q, Tao W, Jianguo I, Xianli H, et al. Meta-analysis of randomized controlled trials comparing lichtenstein and totally extraperitoneal laparoscopic hernioplasty in treatment of inguinal hernias. J Surg Res 2014;192:409-20.
16. McCormack K, Wake B, Perez J, Fraser C, Cook J, McIntosh E, et al. Laparoscopic surgery for inguinal hernia repair: Systematic review of effectiveness and economic evaluation. Health Technol Assess 2005;9:1-203, iii-iv.
17. Nienujhis S, Staal E, Strobbe L, Rosman C, Groenewoud H, Bleichrodt R, et al. Chronic pain after mesh repair of inguinal hernia: A systematic review. Am J Surg 2007;194:394-400.
18. Moreno-Egea A, Torralba Martinez JA, Morales Cuenc a G, Aguayo Albasini JL. Randomized clinical trial of fixation vs. nonfixation of mesh in total extraperitoneal inguinal hernioplasty. Arch Surg 2004;139:1376-9.
19. Jani K. Randomised controlled trial of n-butyl cyanoacrylate glue fixation versus suture fixation of mesh in laparoscopic totally extraperitoneal hernia repair. J Minim Access Surg 2016;12:118-23.