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A comparative study of skin staples versus sutures for fixing mesh in tension-free mesh hernioplasty

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ABSTRACT

Background: In open anterior inguinal mesh hernioplasty, the commonly used method for mesh fixation is by polypropylene sutures which involves extensive mesh fixation and placement of sutures into periosteum of pubic symphysis, thereby increasing the operative time with attendant risk of infection of the prosthetic material. An alternative to sutures is the use of staples which are easy to use and quick to apply. We explored the use of staples in securing the mesh in inguinal hernioplasty.

Methodology: A prospective comparative study of 400 patients who underwent inguinal mesh hernioplasty with 200 patients selected randomly each in polypropylene suture (PPSG) and staple group (SG) was performed. Postoperatively patients were made ambulatory on the same day of surgery and discharged from hospital on 1st or 2nd day in both the groups. Follow-up was carried out in 1 week, 2 months, 6 months, 1 year, 2 years, and 3 years and the patients were assessed for wound infection, hematomas, local pain, return to work, recurrence if any, and other miscellaneous complications if any.

Results: The mean age of patients in our study in polypropylene suture group and staple group was 46.75 years and 46 years, respectively. 80% (160 patients) in polypropylene suture group and 75% (150 patients) in stapler group had indirect hernia. The mean operative time in PPSG and SG group was 59.25 minutes and 45 minutes, respectively (p value<0.05), while as the mean hospital stay in the two groups was 1.5 days and 1.28 days, respectively, the difference however was statistically insignificant (p value>0.05). Overall the complication rate was the same in the two groups with no statistically significant differences observed (P value >0.05). There was 0% recurrence rate in 6 months and 1 year of follow-up in both groups. However, in 3-year follow-up 20 patients (10%) in PPSG and 2 patients (1%) in SG had recurrence (P value=0.0001).

Conclusion: The technique of mesh fixation with skin staples is as effective as conventional fixation with polypropylene sutures, with an important added advantage of a significant reduction in the operative time and an early return to work. At the same time this technique does not have any additional complications compared to traditional Lichtenstein method. Good tissue penetrance and effective mesh anchorage are achieved when staples are utilized to secure the mesh.

Key words: *Polypropylene suture, staple, mesh fixation*

Introduction

Hernia repair is the most common elective procedure in general surgery [1]. Annually over 700,000 inguinal herniorrhaphies are performed in the United States [2], 100,000 in France [1], and 800,000 in UK [3]. The techniques include open suture, open mesh, and laparoscopic techniques. Traditionally, the most important measure of success of a hernia repair proce-

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dure was the recurrence rate of the hernia; newer measures focus on quality of life and return to normal activities as well. While the recurrence rates of tissue repairs vary according to the procedure, the introduction of Lichtenstein tension-free repair radically reduced recurrence rates to consistently low levels, 0.2% in one series [4] to 0.5% in another series up to 5-year follow-up. These low and easily reproducible recurrence rates led to the widespread acceptance of the tension-free repair as the gold standard for open anterior approaches [5]. Although a mesh can be placed both by an open approach and by laparoscopic approach and with more familiarity, advancement, and refinement in the laparoscopic techniques, recent studies have shown comparable recurrence rates with both open and laparoscopic repairs [6-8]. The laparoscopic technique however relies on advanced instrumentation and expertise and is more costly and has the potential for intra-abdominal complications not otherwise seen with the conventional open approach. A number of randomized controlled trials have demonstrated a significantly decreased incidence of chronic pain following laparoscopic repair and an increased incidence in open cohorts [9]. Possible explanations for the difference may pertain to mode of mesh fixation. In open tension-free repairs, an extensive mesh fixation is necessary, including placement of sutures into periosteum of pubic symphysis which also increases the operative time with attendant risk of infection of the prosthetic material. This led us to explore whether it was possible to anchor the mesh in position on open anterior approach with skin staples which are quick to use and reduce operating time, thereby minimising the risk of wound colonisation. We therefore explored the use of staples in securing the mesh to see if it is satisfactory.

Materials and Methods

This study is a prospective randomized study performed by the Department of Surgery, Government Medical College Srinagar, comprising 400 patients admitted for elective surgery for groin hernia between September 2008 and October 2015. The patients were selected unbiased from either sex and were above 18 years of age. After thorough evaluation of patients including history, physical examination, and all baseline investigations like complete hemogram, blood grouping, LFT, KFT, serum electrolytes, ECG, X-ray chest, and ultrasonography of abdomen and pelvis, patients were randomized into two groups: polypropylene suture group and stapler group. The surgery was then done as an elective procedure under spinal or general anesthesia.

Polypropylene suture group comprised 200 patients in which Lichtenstein tension-free mesh herniaoplasty was done using a 7.5×15 cm mesh secured in place using interrupted sutures of 2/0 prolene. Stapler group again comprised 200 patients. The positioning of the mesh was identical to the other group but a proximate plus MD skin stapler containing 35 preloaded stainless steel staples was used to secure the mesh. The difference between the two groups was thus accounted for by the manner in which mesh was secured. In both the groups external oblique aponeurosis was closed with a continuous suture of 2/0 prolene. The subcutaneous tissues were then approximated with plain catgut. Skin closure in the polypropylene suture group was done using interrupted silk sutures (2/0). In the stapler group however skin closure was completed using stainless steel staple gun, as used for securing the mesh.

In the polypropylene suture group mesh was fixed in position by interrupted sutures of 2/0 prolene along the inguinal ligament, inferiorly from the pubic tubercle to the lateral edge of the mesh. Interrupted polypropylene sutures were then placed medially and superiorly into the internal oblique and transverse muscles. The spermatic cord was passed through a slit in the mesh and sutured together with two interrupted polypropylene sutures.

In the stapler group, the positioning of mesh was identical but a proximate plus MD multi-directional release skin stapler containing 35 preloaded stainless steel staples was used to secure it. A staple was placed into connective tissues overlying pubic tubercle with between seven and nine staples along the inguinal ligament placed 1-2 cm apart. A further four to five staples were placed in internal oblique and transverse abdominis medially and superiorly and the overlapping free edges of mesh were stapled together with two staples lateral to the cord.

Postoperatively patients were given intramuscu-

lar Diclofenac for pain and made ambulatory on the same day of surgery in both the groups. They were discharged from hospital on 1st or 2nd day in both the groups. After discharge patients were called for follow-up at 1 week, 2 months, 6 months, 1 year, 2 years, and 3 years. The follow-up examination included thorough clinical assessment for wound infection, hematomas, local pain, return to work, recurrence if any, and other miscellaneous complications if any.

Exclusion Criteria

High risk patients with coagulation disorders and irreducible, congenital, and massive scrotal or sliding hernias were excluded from study. Also the patients who presented in emergency with obstructed and strangulated inguinal hernias were excluded.

Statistical Analysis

Data was expressed as average and percentage. All the inferences for intergroup comparison were made by using non-parametric test measures. Yates' corrected Chi square, Mann–Whitney U test, and Student's t-test were applied for valid inferences as required. Statistical package for social sciences (SPSS) and minitab statistical package were used. A P value of <0.05 was considered as significant.

Results and Observations

The demographic distribution of patients in our study is summarised in Table 1.

The mean age of patients in our study in polypropylene suture group and staple group was 46.75 years and 46 years, respectively (Figure 1) with most of the patients in 41 to 50 years age group in both the groups.

Most of the patients in our study were having indirect hernia in both groups, 80% (160 patients) in polypropylene suture group and 75% (150 patients) in stapler group. Few patients had bilateral hernia in both groups and none of the patients in our study was with femoral or recurrent inguinal hernia (Figure 2).

Mean operative time and hospital stay of patients in the two groups are summarised in Table 3 (Figure 3).

Operative time was taken from the time of incision to skin closure. The mean operative time in PPSG and SG group was 59.25 minutes and 45 minutes, respectively (P value<0.05), and the mean hospital stay in the two groups was 1.5 days and 1.28 days, respectively, the difference however being statistically insignificant (P value>0.05).

The postoperative complications encountered in the two groups are summarised in Table 4.

Table 1. Demographic distribution of patients.

	Polypropylene suture group (PPSG)	Staple group (SG)
Mean age ± SD	46.75 ± 12.02	46 ± 12.10
Male : female ratio	19:1	19:1

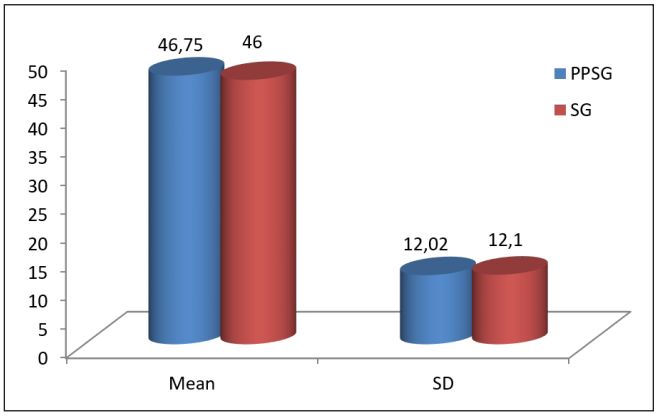

Figure 1. Mean and standard deviation of patients in polypropylene suture group and staple group in our study.

Table 2. Type of hernia in our patients in the two groups.

Type of hernia	Polypropylene suture group				Stapler group			
	Frequency		% age		Frequency		% age	
	Right	Left	Right	Left	Right	Left	Right	Left
Indirect	160		80%		150		75%	
	105	55	52.5%	27.5%	110	40	55%	20%
Direct	25		12.5%		45		22.5%	
	20	5	10%	2.5%	25	20	12.5%	10%
Bilateral	15		7.5%		5		2.5%	
	5	10	2.5%	5%	5	0	2.5%	0%
Total	200		100%		200		100%	

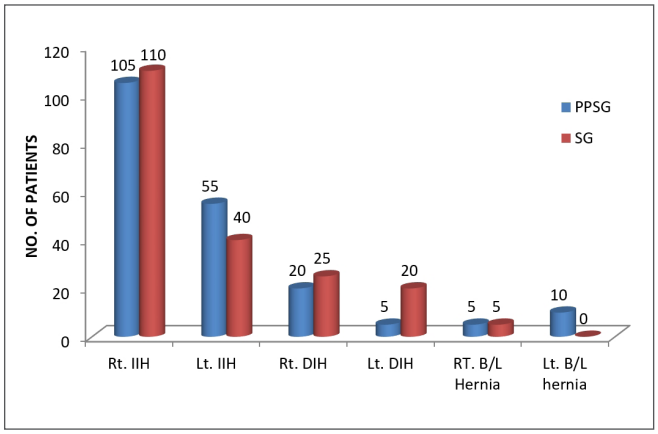

Figure 2. Distribution of cases with respect to type of hernia in polypropylene suture group (PPSG) and stapler group (SG) in our study.

Table 3. Mean operative time and mean hospital stay of patients.

	Polypropylene suture group (PPSG)	Staple group (SG)
Mean operative time	59.25 ± 8.07 minutes	45 ± 11.31 minutes
Range of operative time	31 – 80 minutes	31 – 80 minutes
Mean hospital stay	1.5 ± 0.78 days	1.28 ± 0.73 days
Range of hospital stay	1-4 days	1-4 days

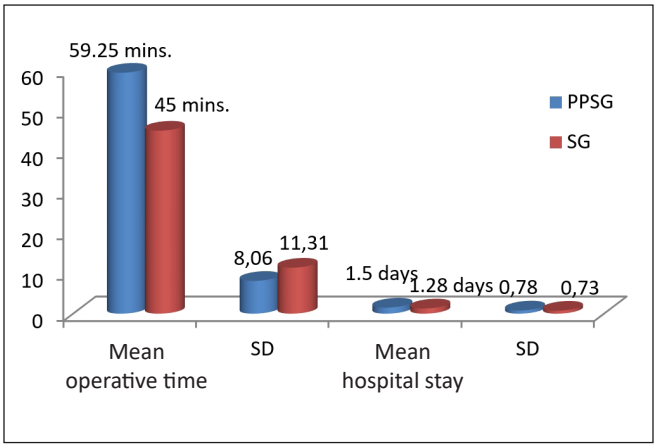

Figure 3. Mean operative time and hospital stay.

Table 4. Postoperative complications encountered.

Group	Staple group (No.)	% age	Suture group (No.)	% age
Hematoma	5	2.5%	5	2.5%
Seroma	15	7.5%	20	10%
Chronic groin pain	5	2.5%	0	0%
Urinary retention	5	2.5%	10	5%
Wound infection	15	7.5%	15	7.5%
Hernia recurrence	Nil	Nil	Nil	Nil
Total	45	22.5%	50	25%

Discussion

The treatment of inguinal hernias is integral to the history and evolution in the treatment of inguinal hernias has paralleled technologic developments in the field. Initially the tissue based repairs were in vogue which were supplanted by tension- free repairs with the widespread acceptance of prosthetic materials, introduced by Lichtenstein, for inguinal floor reconstruction. Lichtenstein tension-free hernioplasty takes account of important factors identified in successful outcome of inguinal hernia operations, supplementing the strength of transversalis fascia and a tension-free repair. In our study we compared a study group (stapler group) in which skin staples were utilized for fixing the mesh with the control group (polypropylene suture group). This modification of Lichtenstein's technique was investigated to establish whether it provides an effective anchorage of the mesh. A prolene mesh (7.5×15 cm) was used in both the groups and it was tailored according to groin anatomy. A proximate MD skin stapler (35w) was utilized in our study for securing the mesh and closure of skin. The length of the prongs on the staples is 3.9 mm, providing good penetration into the tissues.

Most of the patients in our study were in 41-50 years age group in both the polypropylene suture and the stapler group with majority of the patients being males. Ira M. Rutkow and Alan W. Robbins et al. (1993) [10] also had the majority of cases in the age group of 46-65 years and most of the patients were males. The mean age of patients in polypropylene suture group (PPSG) and stapler group (SG) in our study was 46.75 years and 46 years, respectively, with the minimum and maximum age of patients being 20 and 80 years, respectively.

Our study comprising 400 patients demonstrated that majority of patients (310; 77.5%) had indirect hernia and (70; 17.5%) had direct inguinal hernia. All the bilateral hernias were direct. I. W. Mills et al. (1998) [11] in a group of fifty patients reported an incidence of 70% of indirect inguinal hernia and 30% of direct inguinal hernia. Parviz Amid et al. (1995) [12] in a study group of 4000 patients showed that 44% had indirect hernias, 43.1% had direct hernia, and 12.5% had both direct and indirect components.

We observed a striking difference between the

mean operating time of polypropylene suture and the staple group. The range of operating time in the stapler group was 30 to 75 minutes with a mean of 45 minutes while in polypropylene suture group the range and mean were 41 to 75 minutes and 59.25, respectively. The difference is statistically significant (P<0.05). Garg Chaitanya P. et al. (2004) [13] in their study of 54 patients reported a 12 minute shorter median length of operation when staples were used. Anand Munghate et al. (2014) [14] in their study also noted a statistically significant difference in the mean operative time when staples were used for mesh fixation (P=0.0001).

The patients were discharged from the hospital as soon as they became ambulant, voided urine, and tolerated orals. In our study the mean postoperative stay in days was 1.5 days (range 1-3 days) for the PPSG and 1.28 days (range 1-4 days) for SG, the difference being statistically insignificant. Also, the patients belonging to SG returned to work earlier as compared to patients in suture group (PPSG).The average time to return to work was 10 days in the SG and 11.95 days in the PPSG. The difference is statistically significant (P value <0.05). Garg Chitanya P. et al. (2004) [13] in their study of 54 patients reported 12 days as the medium time taken to return to work in the SG and 14 days as the time to return to routine work in the polypropylene suture group.

Overall the complication rates in our study were more or less same in the two groups with no statistically significant differences observed (P value >0.05). Overall complication rates of 23.75% with 25% in PPSG group and 22.5% in SG were observed with wound infection (7.5%) in the PPSG group and 7.5% in SG and seroma formation (10%) in the PPSG group and 7.5% in the SG. Hematoma formation was 2.5% in the PPSG and 2.5% in the SG with chronic groin pain of 2.5% in the SG. We did not encounter any case of vascular injury. These results we have compared with the study of George Sakorafas et al. (2001) [15] of 540 patients where seroma and hematoma formation were seen in 6 and 2 patients, respectively, and Mills et al. (1998) [11] who in a prospective study involving 50 patients (25 in staple group) reported minor complications in 3 patients, hematoma in 2 patients, urinary retention in 1 patient, and no case of recurrence.

We noted a 0% recurrence rate at 6 months and 1 year of follow-up in our study. However, 20 patients (10%) in PPSG and 2 patients (1%) in SG in our study had recurrence at 3-year follow-up. The difference is statistically significant (P value 0.0001). Van der Zwaal et al. [16] in their study on mesh fixation using staples in Lichtenstein's hernioplasty also reported 11 and 1% recurrence at a median follow-up of 30 months in the suture and staple groups, respectively.

Conclusion

The results of this study comprising 400 patients followed for a period of one year and the observations made therein suggest that the technique of mesh fixation with skin staples in Lichtenstein inguinal hernia repair is as effective as conventional fixation with polypropylene sutures, with an important added advantage of a significant reduction in the operative time and an early return to work. A reduced operative time in turn comes with its inherent benefits like

- less exposure to anesthesia,
- minimisation of risk of wound colonisation,
- an option to include hernia cases in day care operative lists,
- reduction in backlog of hernia cases.

At the same time this technique does not have any additional complications compared to traditional Lichtenstein method. Good tissue penetrance and effective mesh anchorage are achieved when staples are utilized to secure the mesh.

Conflict of interest statement

The authors have no conflicts of interest to declare.

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