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Surgery

COMPARATIVE STUDY OF MESH FIXATION BY CYANOACRYLATE GLUE VERSUS SUTURES IN LICHTENSTEIN OPEN INGUINAL HERNIA REPAIR

Dr Nikhil. Nataraju	Senior Resident, Department Of General Surgery, Rajarajeswari Medical College.
Dr Harish C	Junior Resident, Department Of General Surgery, Rajarajeswari Medical College.
Dr Deepthi R	Senior Resident, Department Of General Surgery, Rajarajeswari Medical College.
Dr Raksha R	Assistant Professor, Department Of General Surgery, Rajarajeswari Medical College.
Dr K S Hanumanthaiah	Professor & Hod, Department Of General Surgery, Rajarajeswari Medical College.

ABSTRACT

Background: Hernia is the atypical bulge/partial/complete viscus projection via normal/ abnormal cavity wall opening. Amongst the sites for hernia, the inguinal site accounts for the majority of the cases, approximating 70- 75% of cases. Management with sutures by the Lichtenstein technique is well-known. However, the advent of newer techniques, like the use of cyanoacrylate glue, is gaining popularity. **Objectives:** To assess the outcome of mesh fixation in terms of the duration of surgery (minutes), Hematoma/ seroma, Post-operative chronic groin pain persisting beyond 3-6 months postoperatively with cyanoacrylate glue and polypropylene sutures **Materials & Methods:** Our study included 50 hernia patients, divided equally into two groups - cyanoacrylate glue and Lichtenstein suture. We evaluated pain score (pre & post-operative), mean surgery duration, time to return to work, and complications like chronic groin pain, hematoma, wound infection, seroma, and sensation with foreign bodies over 2 years.Results: The study consisted of 38% of the patients in our study within the 60-69 years of age group, with 88% being male. 50% of the cases in our study were observed on the right side, 13 on the left side, and 12 patients were affected bilaterally. VAS score on Day 0 was negligible in groups A and B, reportedly 0.16 and 0.32. Complications such as chronic groin pain, hematoma as well and wound infection were observed in 8 patients, and other seromas and sensations with foreign bodies were noted in 9 patients. The mean duration of surgery in groups A and B was 43.4 ± 3.6 and 55 ± 4.7 minutes, which was highly significant. (p=0.0005). The time duration taken to return to work in groups A and B was found to be 3.9 ± 0.9 and 4.5 ± 1.0 days, which was statistically significant. (p=0.040) **Conclusion:** Lichtenstein mesh repair is a common way to manage inguinal hernia. However, cyanoacrylate glue is a viable alternative with similar or even better treatment outcomes in some cases. Glue requires less operative time, shorter hospital stays, and fewer complications, making it a superior option.

KEYWORDS : Hernia, Lichenstein, Cyanoacrylate, Glue, Recovery, Hernioplasty.

INTRODUCTION

A hernia is an abnormal protrusion of whole or part of a viscus through normal or abnormal opening in the walls of its containing cavity[1]. Amongst the sites for hernia, inguinal site accounts for the majority of the casesapproximating to 70- 75% cases.[2]

Inguinal hernioplasty has been known as the surgical treatment modality of choice Which is consisdered "gold standard" but amendments to protocol for management has been constantly been upgraded for benefit of the patient as well as the surgeon.[3]

Cyanoacrylic (CA) glue is an acrylic based resin which is purely synthetic with the capability to bind within 5 to 6 seconds in the presence of water in the form of a exothermic reaction within a minute.[4]

N-hexyl Cyanoacrylate is a well-known glue type material which adheres to the tissues and the mesh while reducing the complications which are most commonly encountered in case of sutures. It has also been deemed as a hybrid tissue sealant with the capability to provide hemostatic effect by mimicking the coagulation cascade pathway and paving the way for healing while harboring the defense cells.[5]

The most common complcation is chronic pain defined as pain which persists for 3 months or more .Chronic pain is hypothesized to be caused by inflammatory reaction due to grafts (mesh), nerve irritation, mutilation or entrapment caused by sutures[6] Incidence of chronic groin pain in the range of 0.7% to 62.9%.[7]

The benefits of cyanoacrylate outweigh the disadvantages and at the same time are equal or sometimes superior to the results that are obtained with sutures. The benefits are decreased operating time, fast healing period, less chances of infection, less chances of complications like nerve entrapment, injury to blood vessels or periosteum in the pubic region, damage or chronic pain. Also, cosmetic healing is another added advantage.[5]

AIM AND OBJECTIVES

Aims

To assess the outcome of mesh fixation with cyanoacrylate glue and polypropylene suture

Objectives

To compare the outcome of cyanoacrylate glue versus polypropylene suture in terms of following observations

- Duration of surgery (minutes),
- Hematoma,
- Seroma,
- Post-operative chronic groin pain

Inclusion And Exclusion Criteria

Inclusion Criteria:

- Age more than 18 years
- Reducible inguinal hernia
- Patient willing to give consent to participate in study.

Exclusion criteria:

- Age less than18years
- Recurrent hernias
- Obstructed,Strangulated hernia
- Collagen/connective tissue disorder
- Refusal to take part in study.

MATERIALS AND METHODLOGY

Patient Selection: The study was conducted in the surgical wards of the Department of General Surgery at Rajarajeswari Medical College and Hospital, using a prospective comparative observational study design. The study period was 24 months, starting from December 2020 to December 2022, with a sample size of 50 patients divided equally into two groups - 25 with glue and 25 with suture. The study group underwent surgery using the modified method by Lichtenstein polypropylene mesh fixation with cyanoacrylate glue, while the control group underwent surgery using a conventional method of Lichtenstein hernia repair using polypropylene suture mesh fixation.

Methodlogy:

The methodology involves taking baseline demographic data and history, thoroughly examining the patient, and noting all points per proforma. All baseline investigations will be done, and equal cases will be included in each group. Randomization will be done by allotting random numbers to the patients coming with inguinal hernias that fit the inclusion criteria. Alternate subjects will be treated with Cyanoacrylate glue for mesh fixation (test group), and the remaining patients will be treated with polypropylene suture for mesh fixation. There are two groups - Group A / Test group includes patients undergoing surgery using the modified method by Lichtenstein polypropylene mesh fixation with Cyanoacrylate, and Group B / Control group includes patients undergoing surgery using the conventional method by using polypropylene suture mesh fixation.

Procedure:
Initial steps of Liechtenstein's hernia repair were conducted in conventional method till preparation of inguinal canal and the anatomical were identified (pubic tubercle, conjoined area, inguinal ligament). The hernia sac was identified and reduced. The mesh was shaped according to shape and size of the inguinal canal and placed.

In Control group/ Prolene group: The mesh was fixed with a key stitch placed on the tissue above the pubic tubercle avoiding the periosteum and with a 2 cm overlap of the mesh above the tubercle and two running sutures both starting from the key stitch passing on the conjoined area and the inguinal ligament. The two posterior wings of the mesh were sutured together with two single prolene stitches.

In Test group/ Cyanoacrylate glue group: The mesh was placed in position and fixed with cyanoacrylate glue on the pubic tubercle, along the inguinal ligament and the conjoined area. Glue was avoided on the nerves as much as possible. Only one vial of cyanoacrylate glue was used for each patient.

Figure 1: Polypropylene Mesh Fixation Done With Glue On The Pubic Tubercle, Along The Inguinal Ligament And The Conjoined Area Similar To Suture Fixation Irrespective of the fixation method, all the patients had the same polypropylene kind of mesh. The fascia was closed in both groups with a prolene 2-0 running suture. Skin was closed with a subcuticular vicryl 2-0 intermittent suture. All the Nerves were tried to preserve in either group. All operations were performed with subarachnoid block and no postoperative analgesic device was used.

Assessment tools:
Postoperatively patients were monitored for duration of operation (minutes), duration of mesh fixation Hematoma/ seroma. Wound/ mesh infection, Postoperative Recovery time to Daily activities (walking, driving, manual work) (days), Persistent numbness: numbness in the groin or testicle persisting beyond three months postoperatively, Chronic Groin pain :pain. persisting for or beyond three months postoperatively etc. Pain was assessed using visual analogue scale (VAS) and Inguinal Pain Questioneer (IPQ)

The collected data were analysed with IBM SPSS Statistics for Windows, Version 23.0.(Armonk, NY: IBM Corp).To describe about the data descriptive statistics frequency analysis, percentage analysis were used for categorical variables and the mean & S.D were used for continuous variables. To find the significant difference between the bivariate samples in Independent groups the Independent sample t-test and the Mann-Whitney U test was used. To find the significance in categorical data Chi-Square test was used similarly if the expected cell frequency is less than 5 in 2×2 tables then the Fisher's Exact was used. In all the above statistical tools the probability value .05 is considered as significant level.

RESULTS
Total 50 patients were enrolled on the study. They were divided equally into the study group(Group A) and the Control group (Group B). The majority of the patients were found to be within the 60-69 years age group, accounting for 38%, followed by 20% in the 50-59 years age group, 16% in the 40-49 years age group, 12% in the 30-39 years age group, 10% in the 20-29 years age group, with the least being 4% in the ≥ 70 years age range. The disease process accounted for 88% in males and 12% in females. Out of 50 patients, 12 were bilaterally affected, with 6 in each group. Furthermore, 13 patients were affected on the left side (5 in group A and 8 in group B), and 15 patients were affected on the right side (14 in group A and 11 in group B), which was found to be statistically insignificant when compared against both groups with the affected region of hernia. 9 patients in our study reported with pain with 4 patients in group A and 5 patients in group B. Statistical analysis by Fisher's exact test for pain between groups was found to be statistical insignificant (p=1.0) (p>.0.05). 8 patients in our study reported with haematoma with 2 patients in group A and 6 patients in group B. Statistical analysis by Fisher's exact test for haematoma between groups was found to be statistical insignificant (p=0.247) (p>.0.05).

Table 1 :Comparison of Haematoma between the Groups by Fisher's exact test

			Groups		Total	□ 2 - value	p-value
			Group A	Group B			
Haematoma	Present	Count	2	6	8	2.381	0.247 #
		%	8.0%	24.0%	16.0%		
	Absent	Count	23	19	42		
		%	92.0%	76.0%	84.0%		
Total		Count	25	25	50		
		%	100.0%	100.0%	100.0%		
# No Statistical Significance at p > 0.05 level							

9 patients in our study reported sensation with foreign bodies with 1 patients in group A and 8 patients in group B. Statistical analysis by Fisher's exact test for sensation with foreign bodies between groups was found to be **statistical significant (p=0.023)** (p>.0.05).

Table 2 Comparison of Sensation of Foreign body between the Groups by Fisher's exact test.

			Groups		Total	□ 2 - value	p-value
			Group A	Group B			
Sensation of Foreign body	Present	Count	1	8	9	6.640	0.023 *
		%	4.0%	32.0%	18.0%		
	Absent	Count	24	17	41		
		%	96.0%	68.0%	82.0%		
Total		Count	25	25	50		
		%	100.0%	100.0%	100.0%		
* Statistical Significance at p < 0.05 level							

9 patients in our study reported with seroma with 1 patients in group A and 8 patients in group B. Statistical analysis by Fisher's exact test for seroma between groups was found to be **statistical significant (p=0.023)** (p>.0.05).

Table 3: Comparison of Seroma between the Groups by Fisher's exact test

			Groups		Total	□ 2 - value	p-value
			Group A	Group B			
Seroma	Present	Count	1	8	9	6.640	0.023 *
		%	4.0%	32.0%	18.0%		
	Absent	Count	24	17	41		
		%	96.0%	68.0%	82.0%		
Total		Count	25	25	50		
		%	100.0%	100.0%	100.0%		
* Statistical Significance at p < 0.05 level							

8 patients in our study reported had wound infection with 3 patients in group A and 5 patients in group B. Statistical analysis by Fisher's exact test for patients with wound infection between groups was found to be statistical insignificant (p=0.702) (p>.0.05).

Table 4: Comparison of Wound Infection between the Groups by Fisher's exact test

			Groups		Total	□ 2 - value	p-value
			Group A	Group B			
Wound Infection	Present	Count	3	5	8	0.595	0.702 #
		%	12.0%	20.0%	16.0%		
	Absent	Count	22	20	42		
		%	88.0%	80.0%	84.0%		
Total		Count	25	25	50		
		%	100.0%	100.0%	100.0%		
# No Statistical Significance at p > 0.05 level							

8 patients in our study reported chronic groin pain, with 1 patients in group A and 7 patients in group B. Statistical analysis by Fisher's exact test for patients with chronic groin pain between groups was found to be **statistical significant** (p=0.049) (p>.0.05).

Table 5: Comparison of Chronic Groin Pain between the Groups by Fisher's exact test.

			Groups		Total	□ 2 - value	p-value
			Group A	Group B			
Chronic Groin Pain	Present	Count	1	7	8	5.357	0.049 *
		%	4.0%	28.0%	16.0%		
	Absent	Count	24	18	42		
		%	96.0%	72.0%	84.0%		
Total		Count	25	25	50		
		%	100.0%	100.0%	100.0%		
* Statistical Significance at p < 0.05 level							

VAS score on Day 0 was found to be negligible in group A & B reportedly 0.16 & 0.32, on Day 1 it was 4.28 & 5.04 and on Day 7 it was 1.52 & 2.08.

VAS score after a brief period of follow-up reportedly on the 1st month in group A & B was found to be 0.20 & 1.08, after 3 months it was 0.08 & 1.08 and at the 6th month it was 0.04 & 0.48. There was a definite statistical significance which was observed across both the groups during the long term follow-up period.

Table 6: Comparison of VAS between the Groups by Mann-Whitney U test.

VAS	Groups	N	Mean	SD	Z-value	p-value
Day 0	Group A	25	.16	.37	1.311	0.190 #
	Group B	25	.32	.48		
Day 1	Group A	25	4.28	.84	2.202	0.028 *
	Group B	25	5.04	1.24		
DAY 3	Group A	25	3.08	1.00	1.641	0.101 #
	Group B	25	3.76	1.39		
DAY 7	Group A	25	1.52	1.00	1.674	0.094 #
	Group B	25	2.08	1.22		
Month 1	Group A	25	.20	.50	3.901	0.0001 **
	Group B	25	1.08	.95		
Month 3	Group A	25	.08	.28	3.919	0.0001 **
	Group B	25	1.08	1.22		
Month 6	Group A	25	.04	.20	2.597	0.009 **
	Group B	25	.48	.77		
** Highly Statistical Significance at p < 0.01 ,* Significant at p < 0.05 and # No Statistical Significance at p > 0.05						

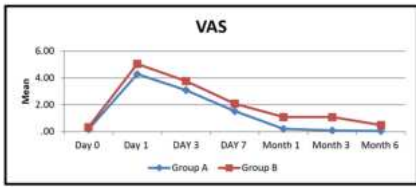

Figure 2: VAS graph.

The duration of surgery in group A & B was found to be 43.4 minutes (mean) 3.6 minutes (SD) & 55 minutes (mean) 4.7minutes(SD) , which was found to be highly statistical significance. (p=0.0005).

Table 7: Comparison of Duration of surgery (min) between the Groups by Independent sample t-test

Variable	Groups	N	Mean	SD	t-value	p-value
Duration of surgery(min)	Group A	25	43.4	3.6	9.758	0.0005 **
	Group B	25	55.0	4.7		
** Highly Statistical Significance at p < 0.01 level						

The duration taken for mesh fixation in group A & B was found to be 7.5 & 1.2 minutes & 13.4 & 1.6 minutes, which was found to be highly statistical significance.(p=0.0005)

Table 8: Comparison of Duration of mesh fixation (min) between the Groups by Independent sample t-test

Variable	Groups	N	Mean	SD	t-value	p-value
Duration of mesh fixation (min)	Group A	25	7.5	1.2	14.914	0.0005 **
	Group B	25	13.4	1.6		
** Highly Statistical Significance at p < 0.01 level						

The duration taken for the patients to return to work in group A & B was found to be 3.9 0.9 & 4.5 1.0 days, which was found to be statistical significance. (p=0.040).

Table 9: Comparison of Return to work (Days) between the Groups by Independent sample t-test

Variable	Groups	N	Mean	SD	t-value	p-value
Return to work(Days)	Group A	25	3.9	0.9	2.115	0.040 *
	Group B	25	4.5	1.0		
* Statistical Significance at p < 0.05 level						

DISCUSSION

Lichtenstein mesh repair of inguinal hernias is associated with a low risk of recurrence and other complications, chronic groin pain has become the most serious long-term complication [8]. which is due to nerves are injured or trapped when a mesh is fixed using sutures [9], which along with postoperative fibrosis, may be even disabling for the patient [10].

The study revealed that 38% of patients were in the 60-69 age group, followed by 20% in the 50-59 age group, 16% in the 40-49 age group, 12% in the 30-39 age group, 10% in the 20-29 age group, and 4% in the 70 and above age range. A similar study conducted by Tofigh AM. indicated mean patient ages of 53.1 ± 10.9 and 55.8 ± 6.9 years in the suture and N-Hexyl Cyanoacrylate glue groups, respectively, both found to be statistically insignificant (P < 0.05).[11]

Patients treated with glue reported less pain and showed quicker recovery within one month, with a VAS score similar to that recorded on Day 0. Conversely, patients managed with sutures experienced high levels of pain, comparable to Day 0, even after 6 months. Shukla A et al.[12] study recorded mean pain scores at various durations in the suture and glue groups after 1 week, 1 month, 3 months, and 6 months, as per the NRS (Numeric Rating Scale), with scores of 2.88 ± 1.22 & 5.2 ± 0.953, 0.317 ± 0.725 & 2.47 ± 1.05, 0 & 0.933, 0 & 0.75 ± 0.704, respectively.

Analysis of results from various researchers such as Negro P et al[13]., Matikainen et al[14]., Quyn et al.[15], and Sun P et al[16]. indicated that patients treated with glue reported less post-operative pain compared to those treated with sutures. Additionally, patients managed with glue required less operative time and experienced accelerated recovery periods. Losi P et al.[17] demonstrated in their study that the use of glue led to a reduced inflammatory response at the site.

8 patients in our study reported with haematoma with 2 patients in group A and 6 patients in group B, which was found to be statistical insignificant (p=0.247) (p>.0.05). Our study results were in agreement with Tofigh AM et al., and Hayder et al., where they found that hematoma was observed more commonly in suture group against that in the glue group.

8 patients in our study reported chronic groin pain, with 1 patients in group A and 7 patients in group B, which was found to be statistical significant (p=0.049) (p>.0.05), However, most of the studies suggested that patients with glue treatment suffered from chronic groin pain in comparison to the patients who were treated with sutures. Likewise Arslani et al.,[18] also recorded chronic pain in 0 (52) suture patients & 3 (45) glue treatment patients. Campanelli et al.,84 showed that early & late chronic pain was suffered by only 9 (147) patients who underwent sutures & 18 (154) patients with glue treatment Kim-Fuchs et al.,[19] found that early chronic pain was suffered by only 13 (131) patients who underwent sutures & 21 (133) patients with glue treatment Shen et al.,[AS94] found that early chronic pain was suffered by only 0 (55) patients who underwent sutures & 6 (55) patients with glue treatment We recorded the mean duration of surgery in group A & B to be 43.4 ± 3.6 & 55 ± 4.7 minutes, which was found to be highly significant. (p=0.0005).

We recorded the mean duration of surgery in group A & B to be 43.4 ± 3.6 & 55 ± 4.7 minutes, which was found to be highly significant. (p=0.0005).Likewise Torcivia et al.,[20] recorded the fastest mean duration of surgery in glue & sutures to be 18 & 38.8 mins, with Kim-Fuchs et al.,[21] having the mean duration of surgery in glue& sutures was found to be 73 & 79 mins.

As the procedure is slightly less invasive with the use of glue, we can expect a faster recovery period along with the reduced operative time, the time taken in stabilizing the structures during each suture placement is eliminated and a single time use of glue fastens the procedure and reduces the damages.

Our study adds evidence to the existing data on the techniques for management of hernia, however our sample size is minimal and a larger sample size would be preferable to reduce the bias that would inadvertently be present in any study.

Our study clearly showed the dominance of the cyanoacrylate glue as a superior material in terms of operative time, wound infection, hospital stay, hematoma, seroma and recovery period. However the use of cyanoacrylate glue may not be possible in all situations and may require a switch back to the conventional lichen stein mesh repair technique. The supremacy of the glue material is highly appreciable and can serve as an alternative for management of hernia cases Further, the biocompatibility of the glue with it being inexpensive whilst being easy to store and use is quite attractive for the surgeon in contrast to sutures.

CONCLUSION

Lichtenstein mesh repair is used as a landmark to manage the inguinal hernia which occurs most commonly however the use of cyanoacrylate glue which shows similar treatment outcome and sometimes have even scored even better cannot be ignored and should remain an option for the treating surgeon.

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