

A COMPARATIVE STUDY OF CYANOACRYLATE GLUE AND PROLENE SUTURE FOR MESH HERNIOPLASTY IN INGUINAL HERNIA PATIENTS

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INTRODUCTION

Hernia is an abnormal protrusion of whole or part of a viscus or tissue through normal or abnormal opening in the walls of its containing cavity (1). The term "hernia" is derived from the Greek word "hernios", meaning "bud or offshoot," and the Latin word "Sacci hernialis", meaning "rupture". The earliest record of inguinal hernia dates back to the ancient Egyptians, Phoenicians, and Greeks (2). The writings of the Roman physician Celsus are some of the earliest accounts of the hernia and its repair, dating back to the first century, and contain more scientific information with details and complete descriptions (3).

Hernias are one of the most common problems seen in the surgical OPD. The most common type of hernia is an inguinal hernia, which makes up 75% of all abdominal hernias (4, 5). Both men and women can get inguinal hernias, and the lifetime risk is 27% for men and 3% for women (4). Inguinal hernia affects people of all ages, but the incidence rises with age. In women, inguinal hernias occur at a later age, with the peak age of presentation being 40 to 60 years, unlike that of men, which is 10 years earlier (5, 6). Inguinal hernias are twice as common on the right side as they are on the left. This could be because the right testicle comes down later and leaves the processus vaginalis open. Bilateral inguinal hernias affect up to 20% of adults (7, 8).

Inguinal hernias are classified as (a) direct or medial, (b) indirect or lateral, depending on their relationship to the inferior epigastric vessels. A direct inguinal hernia is less common and usually occurs in men over 40 years of age (9).

Indirect hernias follow the same route as the descending testes, which migrate from the abdomen into the scrotum during development. The larger size of their inguinal canal and deep ring, which transmitted the testicle and accommodated the structures of the spermatic cord, might be one reason why men are many times more likely to have an inguinal hernia than women (10).

Surgical methods for inguinal hernia repairs include tension-free mesh repairs, tension-free suture repairs, and the older method of tension suture repairs. Tension- or tissue-based repairs (such as Bassini, Cooper, McVay, and Shouldice repairs) were commonly performed surgeries throughout the majority of the 1980s (11). All the repairs, namely Bassini's, Shouldice's, and McVay's, regardless of modifications, have shared a common disadvantage of suture line tension leading to recurrences (12).

Usher introduced the idea of using a mesh in 1958 to reduce recurrence after hernia surgery. Lichtenstein tension-free hernia repair is the most commonly used technique due to its cost effectiveness, low recurrence rate, and better patient satisfaction (13). Lichtenstein repair involves suturing the prosthetic mesh to the posterior inguinal wall with a non-absorbable prolene suture (14).

Surgical Adhesives are becoming more important in clinical settings because they reduce the risk of needle-stick injuries to surgeons, shorten surgery times, reduce patient blood loss, reduce surgical complications and infections, and don't need removal after surgery (15). An adhesive exhibits characteristics that allow for in situ polymerization, making it adhere tissue-to-tissue or tissue-to-non-tissue surfaces(16). The tissue adhesives used specifically in hernia

repair have been fibrins (of biological origin) and cyanoacrylates (of synthetic origin) (17).

There has been a renewed interest in tissue adhesives because of the benefits of using them and the fact that their uses have grown in the field of surgery. For example, tissue adhesives are used to fix prosthetic materials in hernia surgery (18). Their use has been reported to result in better comfort and less postoperative pain after hernioplasty using tissue adhesives to fix the mesh (19).

Cyanoacrylate adhesives were first used for wound closure in 1959 and are now becoming a common treatment choice in many accident and emergency situations (20). Cyanoacrylates have the same tensile strength as absorbable sutures for closing wounds in the skin, and they can adhere to most tissue surfaces (21). Cyanoacrylate showed a lower seroma rate and similar collagenisation to sutures (21).

The chemical reaction that causes the curing of instant adhesives is referred to as an anionic polymerization, i.e., it causes a reaction to progress rapidly, with polymerization and curing taking place within seconds.

OBSERVATIONS AND RESULTS

The study was conducted at the general surgery department of G.G.S. medical college and hospital, Faridkot, Punjab. The comparative study was done between two groups on the use of cyanoacrylate glue and prolene suture for mesh fixation in mesh inguinal hernioplasty. The study included 60 patients who were divided into two groups of 30 patients each using a non-random convenient sampling technique.

- **Group A (n = 30)**

Patients who underwent mesh hernioplasty with cyanoacrylate glue

- **Group B (n = 30)**

Patients who underwent mesh hernioplasty with prolene sutures The results of the study are as follows:

Table 1: Distribution of patients according to age group

Age (Years)	Group A (Cyanoacrylate glue) (n=30)		Group B (Prolene Suture) (n=30)		Total		Chi- square value	p- value
	No.	%age	No.	%age	No.	%age		
21-30	4	13.3%	4	13.3%	8	13.3%	1.66	0.645
31-40	7	23.3%	4	13.3%	11	18.3%		
41-50	8	26.7%	12	40.0%	20	33.3%		
51-60	11	36.7%	10	33.3%	21	35.0%		
Total	30	100.0%	30	100.0%	60			
Mean age ± SD	45.30±12.42		46.07±10.93					

Table 1 shows the distribution of patients according to age group. In the present study, the majority of the patients, i.e., 21 (35.0%), belonged to the age group 51–60 years. The mean age of the study group A was 45.30 ± 12.42 years, and the mean age of the study group B was 46.07 ± 10.93 years. Both groups were comparable to each other in terms of age distribution.

Table 2: Distribution of patients according to gender

Gender	Group A (Cyanoacrylate glue) (n=30)		Group B (Prolene Suture) (n=30)		Total	
	No.	%age	No.	%age	No.	%age
M	30	100.0%	30	100.0%	60	100.0%
Total	30	100.0%	30	100.0%	60	100.0%

Table 2 shows the distribution of the patients according to gender. In the present study, there were 60 (100%) male participants and no female participants, indicating a male predominance.

Table 3: Distribution of patients according to side of presentation of inguinal hernia

Side	Group A (Cyanoacrylate glue) (n=30)		Group B (Prolene Suture) (n=30)		Total		Chi- square value	p- value
	No.	%age	No.	%age	No.	%age		
Bilateral	3	10.0%	2	6.7%	5	8.3%	0.237	0.888
Left	14	46.7%	14	46.7%	28	46.7 %		
Right	13	43.3%	14	46.7%	27	45.0%		
Total	30	100.0%	30	100.0%	60	100.0%		

Table 3 shows the distribution of patients according to the side of presentation of the inguinal hernia. In Group A, there were 13 (43.3%) cases of right-sided hernias and 14 (46.7%) cases of left-sided hernias. In Group B, right and left- sided hernias were equally involved, with 14 (46.7%) cases each. 14 (46.7%) cases each of right- and left-sided hernias were present in Group B. There was no significant difference seen between the side distributions among either group.

Table 4: Distribution of patients according to type of inguinal hernia

Type of hernia	Group A (Cyanoacrylate glue) (n=30)		Group B (Prolene Suture) (n=30)		Total		Chi- square value	p- value
	No.	%age	No.	%age	No.	%age		
Direct Inguinal Hernia (DIH)	7	23.3%	11	36.7%	18	30.0%	1.863	0.394
Indirect Inguinal Hernia (IIH)	21	70.0%	17	56.7%	39	65.0%		
Pantaloon Hernia	1	3.3%	2	6.7%	3	5.0%		
Total	30	100.0%	30	100.0%	60	100.0%		

Table 4 shows the distribution of patients according to the type of inguinal hernia. In the present study, both groups had the maximum number of patients, i.e., 39 (65%) with indirect inguinal hernias. In group A, 21 (70%) patients had an indirect inguinal hernia, and 7 (23.3%) patients had a direct inguinal hernia. In group B, 17 (56.7%) patients had an indirect inguinal hernia, and 11 (36.7%) patients had a direct inguinal hernia. There was no significant difference seen between the distributions among the two groups.

Table 5: Distribution of patients according to demographic area

Demographic Area	Group A (Cyanoacrylate glue) (n=30)		Group B (Prolene Suture) (n=30)		Total		Chi- Square value	P value
	No.	%age	No.	%age	No.	%age		

Rural	21	70.0%	19	63.3%	40	66.7%	0.300	0.584
Urban	9	30.0%	11	36.7%	20	33.3%		
Total	30	100.0%	30	100.0%	60	100.0%		

Table 5 shows the distribution of patients according to demographic area. In the present study, the maximum number of patients belonged to the rural area (66.7%). In Group A, 21 (70%) patients, and in Group B, 19 (63.3%) patients were from rural areas. There was no significant difference in the distribution of the patients according to demographic area..

Table 6: Distribution of patients according to presenting symptoms

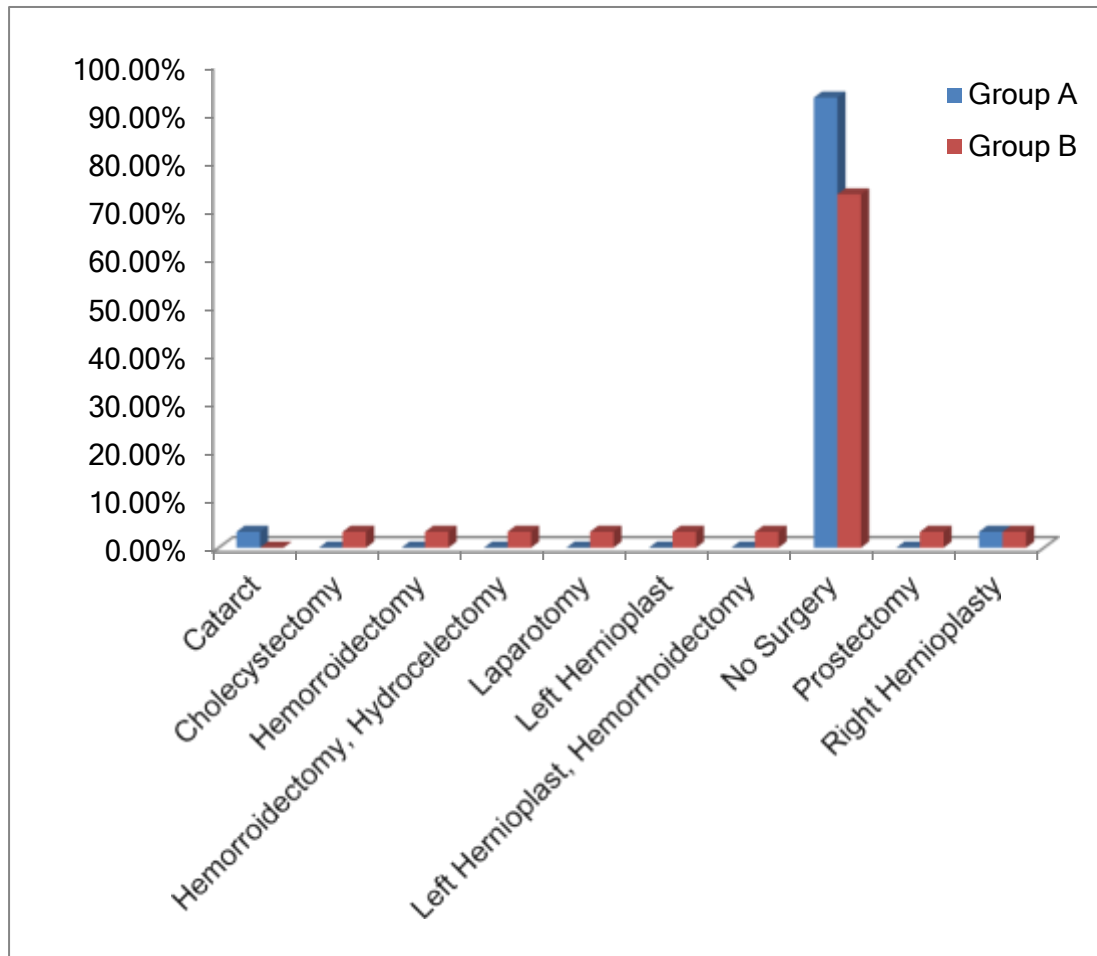
Presenting Symptoms	Group A (Cyanoacrylate glue) (n=30)		Group B (Prolene Suture) (n=30)		Total		Chi-square value	p-value
	No.	%age	No.	%age	No.	%age		
Swelling	18	60.0%	18	60.0%	36	60.0%	0.000	1.000
Swelling, Pain	12	40.0%	12	40.0%	24	40.0%		
Total	30	100.0%	30	100.0%	60	100.0%		

Table 6 shows the patient distribution based on their presenting symptoms. In the current study, the greatest number of patients (60.0%) presented with symptoms of swelling in the inguinoscrotal region. Swelling in the inguinoscrotal region was present in 18 (60%) of Group A patients and 18 (60%) of Group B patients. There was no significant difference between groups according to presenting symptoms.

Table 7: Distribution of patients according to risk factors for inguinal hernia

Risk Factors	Group A (Cyanoacrylate glue) (n=30)		Group B (Prolene Suture) (n=30)		Total		Chi-square value	p-value
	No.	% age	No.	%age	No.	%age		
BPH	4	13.30%	2	6.70%	6	10.0%	3.686	0.45
Chronic Cough	1	3.30%	0	0.00%	1	1.7%		
Constipation	0	0.00%	1	3.30%	1	1.7%		
COPD	0	0.00%	1	3.30%	1	1.7%		
Nil	25	83.30%	26	86.70%	51	85.0%		
otal	30	100.00%	30	100.00%	60	100.0%		

Table 7 shows the distribution of patients according to risk factors for hernia. In the current study, the majority of patients, 51 (86.7%), had no significant risk factors for developing an inguinal hernia. Some risk factors discovered in other study participants, such as BPH, COPD, and constipation, were statistically insignificant.



Graph 1: Distribution of patients according to any previous surgery

Graph 1 shows the distribution of patients according to any previous surgery. In the present study, the majority of patients had no history of previous surgery in both groups, i.e., 50 (83.3%). 28 (93.3%) patients in Group A and 22 (73.30%) patients in Group B had no history of any previous surgery. This difference was statistically not significant.

Table 8: Distribution of patients according to content of inguinal hernia sac

Content of Inguinal Hernia Sac	Group A (Cyanoacrylate glue) (n=30)		Group B (Prolene Suture) (n=30)		Total		Chi-square value	p-value
	No.	%age	No.	%age	No.	%age		
Bowel	2	6.7%	5	16.7%	7	11.0%	9.943	0.269
Empty	0	0.0%	1	3.3%	1	1.7%		
Fat	1	3.3%	0	0.0%	1	1.7%		
Fluid	1	3.3%	0	0.0%	1	1.7%		
Omentum and Fluid	0	0.0%	1	3.3%	1	1.7%		
Omentum	24	80.0%	18	60.0%	42	70.0%		

Omentum and Bowel	1	3.3%	4	13.3%	5	8.3%
Omentun	1	3.3%	0	0.0%	1	1.7%
Urinary Bladder	0	0.0%	1	3.3%	1	1.7%
Total	30	100.0%	30	100.0%	60	100.0%

Table 8 shows the distribution of the patients according to the content of the inguinal hernia sac. The maximum number of cases, 42 (70%), had omentum as hernia sac content. Omentum was present in the hernia sac in 24 (80%) of group A patients and 18 (60%) of group B patients. The difference was statistically not significant..

Table 9: Distribution of patients according to operative time of mesh fixation

Operation Time of mesh fixation (Minutes)	Group A (Cyanoacrylate glue) (n=30)		Group B (Prolene Suture) (n=30)		t	p- value
	Mean	SD	Mean	SD		
	2.23	1.28	7.20	1.03		

Table 9 shows the distribution of patients according to the operative time of mesh fixation. It was found that the mean operative time of mesh fixation in Group A was 2.23 ±1.28 minutes, which was less than the mean operative time of mesh fixation in Group B, i.e., 7.20 ±1.03 minutes. With a p-value of.001, this difference was statistically significant.

Table 10: Distribution of patients according to early post operative complications

Early Post Operative Complications	Group A (Cyanoacrylate glue) (n=30)		Group B (Prolene Suture) (n=30)		Total		Chi-Square Value	P- value
	No.	% age	No.	% age	No.	%age		
Urinary retention	3	10.00%	3	10.00%	6	0	0	1
Seroma / Hematoma	1	3.30%	2	6.70%	3	0.351	0.351	0.554
Scrotal Swelling	1	3.30%	0	0.00%	1	1.017	1.017	0.313
Wound Infection	0	0.00%	1	3.30%	1	1.017	1.017	0.313
Mesh Infection	0	0.00%	0	0.00%	0	0	0	0
Nil	25	83.33%	24	80.00%	49	81.67%		

Table 0 shows the distribution of patients according to early post-operative complications. In the present study, the majority of patients did not experience any early post-operative complication, i.e., 49 (81.67%). Three (10%) patients in Group A and three (10%) patients in Group B experienced urinary retention. One patient in Group A was found to have scrotal swelling. Seroma developed in one (3.3%) patient in group A and in two (6.7%) patients in group B. A wound infection affected one patient in group B. All the findings were statistically not significant. All the complications were managed conservatively in both groups. The results were all statistically insignificant.



Figure 2: Showing Mesh Fixation done with cyanoacrylate Glue in Group A Patient



Figure 3: Showing mesh Fixation with Prolene suture in Group B Patient





Figure 4: Showing cyanoacrylate glue used in the present study in Group A patients

DISCUSSION

Inguinal hernia repair is one of the most common procedures in general surgical practices, and different types of repair have been described. In 1889, Bassini came up with the idea of "triple layer" tissue repair for inguinal hernias, which was associated with recurrence. In 1986, Lichtenstein described a tension-free inguinal hernia repair with mesh. This is now the most common open technique for fixing an inguinal hernia, and it has been shown to have less pain after surgery and a lower rate of recurrence than tissue-based hernia repair (31).

One of the most common problems with herniorrhaphy is inguinodynia, which is pain that persists beyond three months after surgery for an inguinal hernia. Inguinodynia is caused by many factors, and studies have shown that it is related to how the surgery was done and to intrinsic factors in the patient that imply a greater predisposition to this phenomenon (32). Sutureless fixation of mesh in open inguinal hernia repair is being used to prevent inguinodynia after hernia surgery (33). Farouk et al. (1996) wrote the first papers about using a synthetic tissue adhesive in hernia surgery (34). So we conducted this study to compare the outcomes between mesh fixation with cyanoacrylate glue and mesh fixation with prolene suture.

In the present study, the majority of the patients belonged to the age group 51–60 years, which included 21 (35%) patients. The mean age of the patients in Group A, who underwent mesh fixation by cyanoacrylate glue was 45 ± 12.42 years, and the mean age of the patients in Group B who underwent mesh fixation by prolene suture was 46 ± 10.93 years. Both groups were comparable to each other. In the study by Tebala et al. (2015), the mean age of patients in the suture fixation group was 42.4 ± 12.0 years, and the mean age of patients in the glue fixation group was 47.6 ± 12.3 years (24). In a study by Fouda et al. (2020), the mean age of patients in the group with glue fixation was 48.2 ± 12.1 years, and the mean age of patients in the suture group was 49 ± 11.6 years (29).

In this study, both groups had only male patients. There were 60 male patients and no female patients. In a study by Fouda et al. (2020), the glue group included 19 (95% male) and 1 (5% female) patients, while the suture group included 20 (100% male) patients (29). Kalwaniya DS et al. (2020) did a study in which the male to female ratio was 29:1 in both the suture and glue groups (100).

The majority of patients in this study had left-sided inguinal hernias. Group A had 14 (46.7%) patients with a left-sided inguinal hernia and 13 (43.3%) patients with a right-sided hernia. In Group B, both right and left side hernias were present in 14 (46.7%) patients each. Arafa AS et al. (2019) did a study in which left-sided hernias were presented in both groups, with 63 (78.8%) patients in the glue group and 52 (65%) patients in the suture group. (28).

In the present study, indirect inguinal hernia was a common presentation. In group A, 21 (70%) patients had an indirect inguinal hernia, and 7 (23.3%) patients had a direct inguinal hernia. In group B, 17 (56.7%) patients had an indirect

inguinal hernia, and 11 (36.7%) patients had a direct inguinal hernia. Bilateral hernias were present in both groups, with one patient (3.3%) in group A and two (6.7%) in group B. A study by Jaiswal et al. (2018) had 11 (35.5%) patients with direct-type hernias and 20 (64.5%) patients with indirect-type hernias (93). Fouda et al. (2020) did a study in which indirect hernia cases were presented in both groups, with 49 (81.67%) patients in the glue group and 47 (78.33%) patients in the suture group (30).

In the current study, the most common type of hernia sac content (in 70% of cases) was omentum. It was present in 24 (80%) patients in group A and in 18 (60%) patients in group B. Bowel as the content of the hernia sac was present in 2 (6.7%) cases in group A and 7 (11.1%) cases in group B.

In our study, we found that the mean operative time to fix mesh in Group A was 2.23 ± 1.28 minutes, while the mean operative time in Group B was 7.20 ± 1.03 minutes. The difference between the mean operative time to fix mesh in both groups was found to be significant with a p value of 0.001. It was noted in our study that mesh fixation was easy and quick with cyanoacrylate glue. In a study by de Goede et al. (2013), the duration of operation was found to be shorter in mesh fixation with glue (84). A study by Moreno-Egea A et al. (2014) found that the use of glue significantly reduced the mean surgical time with a p value of 0.001 (23). In a meta-analysis done by Sun et al. (2017), it was found that mesh fixation with glue was superior to suture regarding duration of the operation (25). In a study by Jeyakumar et al. (2018), an average difference of 10.8 minutes was seen between the two methods of mesh fixation, with a comparatively longer time to complete the procedure when sutures were used. With $p = 0.009$, this difference was found to be statistically significant (26). Iyanahally et al. (2018) did a study in which the mean operating time required for the glue fixation was 36.52 ± 3.1 minutes and the suture fixation was 48.32 ± 5.9 minutes. There was a statistically significant difference between the two procedures for the mean operating time required, with a p value of 0.001 (27).

CONCLUSION

Techniques for inguinal mesh hernioplasty employing prolene mesh fixation with cyanoacrylate glue and prolene suture no. 3 produce results that are equivalent. However the usage of Cyanoacrylate adhesive in the mesh fixation showed promising results in terms of operating time, post-operative pain, and hospital stay.

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