

## Original Research Article

# Effectiveness of tissue adhesive versus conventional sutures in the closure of inguinal hernia skin incisions: a prospective randomized controlled trial

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### ABSTRACT

**Background:** Several surgical wound closure techniques are used including conventional sutures and skin adhesive compounds. However, tissue adhesives have evolved as an improved alternative to sutures. Few data are available on the tissue adhesives in the closure of inguinal hernia skin incisions. The aim of this study was to determine the effectiveness of tissue adhesive in the closure of inguinal hernia skin incisions compared to conventional sutures.

**Methods:** A 1-year randomized controlled trial was conducted including 60 patients with inguinal hernia. Based on closed envelope method, patients were randomly allocated into two groups: group A and B. Patients of group A underwent skin closure with cyanoacrylate glue and that of group B underwent skin closure with conventional sutures. Demographics and clinical characteristics of the patients were recorded. On postoperative day 3, the patients were evaluated for swelling, fever, redness and discharge from the wound. SPSS 20 was used to analyze the data. Chi-square test, Fisher's exact test, and independent sample t-test were employed in the analysis of data.

**Results:** All the patients included in the present study were men. The age of the patients ranged between 18 and 50 years in both the groups. All patients had chief complaint of swelling in the inguinal area. The clinical characteristics of the study population including sex, mean age, weight, pulse rate, systolic blood pressure, and diastolic blood pressure were comparable in group A and group B ( $P > 0.050$ ). The mean duration of surgery was significantly lower in group A ( $66.67 \pm 4.61$  min) compared to group B ( $71.21 \pm 6.90$  min;  $P = 0.004$ ). On Postoperative day 3, very few patients in group B had swelling (6.67% vs. 16.67%;  $P = 0.228$ ), fever (6.67% vs. 16.67%;  $P = 0.228$ ), discharge (6.67% vs. 16.67%;  $P = 0.228$ ), and redness (6.67% vs. 10.00%;  $P = 0.640$ ) than in group A.

**Conclusions:** Tissue adhesive is superior and equally safe as compared to conventional suture in terms of duration of surgery and postoperative surgical complications. However, large studies should be conducted focusing on infection, follow-up period, and cosmesis as the outcomes.

**Keywords:** Inguinal hernia, Skin closure, Subcuticular sutures, Tissue adhesive

### INTRODUCTION

Inguinal hernia is the most common type of hernia, which occurs due to the protrusion of abdominal contents into the inguinal canal through an abdominal wall defect.<sup>1</sup> Inguinal hernia occurs 20 times more in men than in

women.<sup>2</sup> The risk of inguinal hernia increases with age with a recurrence rate of 1% to 5%.<sup>1</sup>

Abdominal pain and lump at the groin area are the most common symptoms of inguinal hernia. Few inguinal hernias are asymptomatic, which are less dangerous and require an elective surgery to correct the defect.<sup>3</sup>

Surgical repair of inguinal hernia is the generally performed surgical procedure. The prime goal of this surgical repair includes repairing the hernia, resume the patient's normal activities, lessen the postsurgical discomfort, recurrence rate, and adverse effects of the surgery.<sup>1</sup> Conventional surgical suture, synthetic absorbable sutures, skin staplers, tapes, and adhesive compounds are the different techniques evolved from the earliest in the closure of surgical incisions. These materials maintain the closure until the wound is strong enough to endure daily tensile forces and enhance healing when the wound is vulnerable.<sup>4</sup>

Among the available closure techniques, tissue adhesives has been extensively studied for diverse applications including wound closure, hemostasis, tissue adhesion, vascular embolization, closure of cerebrospinal fluid leaks, and application of skin grafts.<sup>5</sup>

The advantages of tissue adhesive include less-time consuming procedure, no sutures to remove, no need for long follow-up period, rapid application, less need for nursing, sedation and monitoring, cost-effective, and improved cosmesis.<sup>6</sup> The tissue adhesives, such as cyanoacrylate, have been used in this study for surgical wound closure. This tissue adhesive acts by polymerizing and forming a strong bond when applied to moist skin.<sup>7</sup> However, till date, the data comparing on tissue adhesive and conventional sutures for skin closure in the settings of open inguinal hernia are scant. Hence, this prompted us to determine the effectiveness of tissue adhesive in the closure of inguinal hernia skin incisions compared to conventional sutures.

## METHODS

The present hospital-based randomized controlled study was carried out from January 2015 to December 2015 at the Department of General Surgery. A total of 60 patients divided into two groups of 30 each were considered for the study. The study was approved from the Institutional ethical and research committee. All the patients were informed about the study and the written informed consent was obtained prior to the study.

### *Inclusion and exclusion criteria*

The patients who were undergoing unilateral and/or bilateral inguinal hernia repair were included in the study and the patients with comorbid conditions such as renal failure, connective tissue disorders, peripheral vascular disease, infected wounds, substance abuse, malnourished and general debility and the patients with metabolic disorders, drugs impairing wound healing, coagulation disorders, steroids, chemotherapeutic drugs, radiotherapy immunocompromised status, collagen vascular disease, documented drug allergy, recurrent hernia strangulated hernia and obstructed hernia, and with local issues such as burns, keloids, urticarial, ulcers and history of trauma were excluded from the study.

### *Data collection and evaluation*

The information from the patients such as age, presenting complaints were recorded followed by the clinical examination and systemic examination. The patients were investigated for their complete blood count, Mini renal profile, liver function tests, chest x-ray, electrocardiogram, random blood sugar, human immunodeficiency virus, and hepatitis B surface antigen.

### *Study procedure*

Prior to the surgery, all the patients' abdomens were shaved their abdomen from the nipple to mid-thigh and 100 mL each of ciprofloxacin and metronidazole were administered intravenously.

Patients were also followed with standard analgesic and antibiotics protocol. Patients of the both groups underwent open abdominal surgeries using similar instruments and followed the general principles of the surgery. The wound closure was done by monolayer suturing technique. Patients in group A underwent skin closure with cyanoacrylate glue (Figure 1), while patients in group B underwent conventional skin closure for inguinal hernias.



**Figure 1: Application of cyanoacrylate glue.**

Postoperatively, the patients were administered with the 100 mL IV of ciprofloxacin twice a day and a 100 mL of metronidazole thrice a day, and were suggested to change the medications with higher antibiotics if indicated for the same.

The patients were then inspected and evaluated for outcome variables such as redness, swelling and pus formation from the wound, and fever if present on postoperative day 3.

The patients were finally evaluated with the presence or absence of postoperative surgical site infection. An incisional surgical site infection was positive if the surgical wound drained purulent material or if the surgeon judges it to be infected and opens it.<sup>8</sup>

### Statistical analysis

The data were analyzed using SPSS 20.0. Categorical data were compared using chi-square test or Fisher's exact test and continuous data were compared using independent sample t-test.  $P \leq 0.050$  at 95% confidence interval was statistically significant.

### RESULTS

The baseline characteristics of the study patients are given in Table 1. All the patients in the study were men. The mean age of the patients in group A was  $36.90 \pm 7.87$  years and in group B it was  $34.4 \pm 7.99$  years.

The mean weight of the patients in group A was  $69.73 \pm 10.76$  kg and in group B it was  $69.40 \pm 11.05$  years. The mean pulse rate in group A patients was  $80.07 \pm 6.16$  min vs.  $79.31 \pm 5.19$  min in group B. The mean systolic blood pressures in group A and group B patients were  $147.67 \pm 204.60$  and  $110.70 \pm 8.80$  mmHg, respectively. Whereas, diastolic pressure in both group A and B was  $98.00 \pm 0.00$  mmHg. However, no statistically significant difference was observed in these parameters of both groups ( $P > 0.005$ ).

The mean duration of surgery was significantly low in group A when compared to that of group B patients ( $66.67 \pm 4.61$  min vs.  $71.21 \pm 6.90$  min;  $P = 0.004$ ).

**Table 1: Baseline characteristics of the study patients.**

Variables	Group A, n (%)	Group B, n (%)
Sex distribution		
Male	30 (100)	30 (100)
Female	0	0
Age distribution (yrs.)		
18-30	10 (33.33)	10 (33.33)
31-40	9 (30)	11 (36.67)
41-50	11 (36.67)	9 (30)
Chief complaint		
Swelling in inguinal area	30 (100)	30 (100)
Diagnosis		
Left	10 (33.33)	12 (40)
Bilateral	6 (20)	4 (13.33)
Right	14 (46.67)	14 (46.67)
Type of hernia		
Direct	13 (43.33)	14 (46.67)
Indirect	17 (56.67)	16 (53.33)
Duration of surgery (min)		
61-70	28 (93.33)	20 (66.67)
71-80	2 (6.67)	10 (33.33)

The comparison of complications of patients occurred in both the groups is summarized in Table 2.

**Table 2: Comparison of post-operative complications of patients occurred in both the groups.**

	Group A, n (%)	Group B, n (%)	P-value
<b>Swelling</b>			
Present	2 (6.67)	5 (16.67)	0.228 <sup>a</sup>
Absent	28 (93.33)	25 (83.33)	
<b>Fever</b>			
Present	2 (6.67)	5 (16.67)	0.228 <sup>a</sup>
Absent	28 (93.33)	25 (83.33)	
<b>Redness</b>			
Present	2 (6.67)	3 (10)	0.640 <sup>a</sup>
Absent	28 (93.33)	27 (90)	
<b>Discharge</b>			
Present	2 (6.67)	5 (16.67)	0.228 <sup>a</sup>
Absent	28 (93.33)	25 (83.33)	

<sup>a</sup>Not significant

On postoperative 3, outcomes such as swelling, fever, redness, and discharge observed in group B patients were slightly higher than that of patients in group A. However, the difference observed was not statistically significant ( $P > 0.005$ ). The appearance of wound on post-operative day 3 in group A and B is depicted in Figure 2 and 3.



**Figure 2: Appearance of wound on post-operative day 3 in group A.**



**Figure 3: Appearance of wound on post-operative day 3 in group B.**

## DISCUSSION

Wounds and their closure modalities are a fundamental and challenging task for a surgeon. Although the expertise and technique of the surgeon are important, electing appropriate closure technique for wound closure ensures optimal healing.<sup>9</sup> This study was aimed to determine the effectiveness of tissue adhesive in the closure of inguinal hernia skin incisions when compared to conventional sutures.

In the present study, patients in both the groups were men. The risk factors include positive familial history of inguinal hernia, high work activity and total

activity index, and chronic obstructive disease.<sup>10</sup> Similar study conducted by Zendejas et al. in 332 patients with inguinal hernia, 91 % of the patients were men.<sup>11</sup> The demographic and clinical characteristics of the patients in both groups A and B were comparable, ruling out the possibility of bias.

The most extensively used tissue adhesives in recent days are cyanoacrylate derivatives. Among the different alkyl derivatives of cyanoacrylate, octyl-2-cyanoacrylate glue has been investigated as an ideal tissue adhesive. It slows down the degradation and by-product release into the surrounding tissues. In addition, plasticizer makes the adhesive bond even more stronger and durable but allows flexion of the skin.<sup>5</sup> Hence, octyl-2-cyanoacrylate glue was chosen as a tissue adhesive in the closure of inguinal hernial incisions.

Surgical time required for patients who underwent skin closure with cyanoacrylate was less compared to patients with conventional suturing. These findings suggest that cyanoacrylate glue did better than conventional suturing for skin closure of hernial incisions. However, the direct head to head comparison of present study was not possible due to lack of randomized controlled trials in the settings of inguinal hernia incision closure comparing cyanoacrylate glue with conventional suturing. Although, a prospective randomized study conducted by Brown et al.<sup>12</sup> reported a significantly shorter time in the skin adhesive group compared to subcuticular suture in the closure of pediatric inguinal hernia incisions ( $1.4 \pm 0.8$  min vs.  $2.4 \pm 1.1$  min;  $P = 0.001$ ). Similar study conducted by Maw et al.<sup>13</sup> on long wounds found an approximately 10-fold greater mean closure time for sutures compared to tissue adhesive. In contrast, a randomized trial conducted by Maniar et al.<sup>14</sup> reported that suture group fared better than the adhesive group in the closure of laparoscopic incisions, though it was not statistically significant (171.10 s vs. 198.40 s;  $P > 0.005$ ). However, results in the present study showed that the time required for closure of wound in the suture group was significantly higher than the tissue adhesive group.

In this study, the incidence of postoperative complications, such as swelling, fever, redness, and

discharge was slightly higher in patients of group A as compared to that of group B. Although, the incidence was less in group B patients, it was not statistically significant. It is difficult to comment on the findings of this study due to limited number of randomized controlled trials in the settings of inguinal hernia repair comparing skin closure with cyanoacrylate glue and with conventional suturing. However, in contrast, a study by Bansal et al reported significantly higher wound discharge rate in tissue adhesive patients than to subcuticular vicryl group (6 vs. 2;  $p < 0.001$ ).<sup>9</sup> Also, this study did not evaluate complications such as fever, redness and swelling.

Christopher et al, in a recent review study, stated that though cosmetic outcome of sutures and tissue adhesives are alike, tissue adhesive is the most preferred alternative wound closure technique in terms of quick, cost-effective and easy to use.<sup>15</sup> Several other randomized control trials conducted to date in different settings also reported effectiveness of tissue adhesive over conventional subcuticular sutures regarding infection, cosmetic outcome, cost, pain, and follow-up period.<sup>14,16</sup> However, as far as tensile strength is concerned both the tissue adhesives and sutures are equivalent.<sup>12</sup> Moreover, this kind of comparison between both the groups was not led in our study.

## CONCLUSION

Overall, the present study demonstrated that tissue adhesive when used for closure of skin incision in the settings of inguinal hernia repair seems to be a faster method when compared to suturing. Nevertheless, the frequency of complication using tissue adhesive is the same as that of subcuticular sutures. However, due to small sample size in this study, large multicentric should be conducted to illuminate these observations. Along with this, studies conducted in future should focus on other outcomes including infection rates, follow-up period, and cosmesis.

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