

# Skin Adhesive vs Skin Sutures for Wound Closure in Hernia Repair: A Randomized Controlled Trial

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**Abstract:** *Background:* Wound closure is an important step in all sorts of surgeries, whether elective or emergency. Wound closure techniques vary from conventional skin suturing to natural glues, skin staples, and tapes. A good wound closure is one that ensures optimal healing. There are several aspects of wound closure technique that can render it either good or bad. This study is designed to investigate the outcomes of skin adhesives. The technique which leads to a better outcome is recommended moving forward so that we can reduce associated complications and costs in terms of post-surgical infection.

*Methods:* A randomized controlled trial was conducted in Surgical Unit-3, Civil Hospital Karachi from 9<sup>th</sup> Feb 2018 to 8<sup>th</sup> Aug 2018. A total of 130 patients undergoing open inguinal hernia mesh repair (i.e., hernioplasty) were randomly allocated to two groups. Patients in Group A were treated with skin adhesive, patients in and Group B were treated with subcuticular sutures. All patients were operated on in the usual manner using Lichtenstein's technique, and mesh was applied. In the post-operative period, all patients were observed for signs of wound infection according to the Southampton Score. Scar cosmesis was calculated using the Hollander Score at six weeks.

*Results:* The average age of the patients was 45.42±8.70 years. There were 105(80.8%) males and 25(19.2%) females. The rate of wound infection and dehiscence was not statistically significant between both groups. The mean application time of skin closure was significantly lower in Group A than Group B.

*Conclusion:* From this study, it can be concluded that the use of tissue adhesives has an advantage of saving time when compared to conventional suturing.

**Keywords:** Wound closure, Skin adhesive, Skin sutures, Hernia mesh repair incisions.

## INTRODUCTION

Wound closure is an important step in all sorts of surgeries, whether elective or emergency. Wound closure techniques vary from conventional skin suturing to natural glues, skin staples, and tapes. Recent modifications in wound closure technique have revolutionized wound closure both in terms of resources and results. A good wound closure is one that ensures optimal healing. There are several aspects of wound closure technique that can render it either good or bad. They may include time needed, cost of material, cosmetic results, asepsis, and patient and surgeon satisfaction.

The Skin adhesive Cyanoacrylate was first manufactured in 1949. In the 1970s, another recombinant was made which had minimal tissue toxicity. Skin adhesives have been in use for more than 20 years in bone and cartilage grafting, ophthalmology for corneal coating, repairing ossicles in

otolaryngology, and for embolization in neurovascular surgery [1-6]. Initially, skin adhesives were used in emergency rooms for superficial lacerations and clean wounds. Later, their use was extended to the laparoscopic incisions, maxillofacial incisions, head and neck surgeries, and breast surgeries with promising results [7-10].

A large number of studies have been conducted to compare the outcome of tissue adhesive to the conventional method of skin closure with variable results. A study comparing inguinal herniorrhaphy incision closure with the sub-cuticle method to skin adhesives found more wound complications in the latter group [11]. Some of the reported advantages of skin adhesives are lower infection rate, decreased application time, better cosmetic outcome, lower price, ease of use, better wound sealing, early return to activities, eliminating the risk of needle stick injury, and eliminating the need for post-operative suture removal [12]. Markus J *et al.* have reported a marked decrease in ventriculitis rate in patients with a 2-octyl cyanoacrylate dressing (3.54%) compared to standard bio-occlusive dressings and wound care (15.1%) for external ventricular drain sites [13]. In a trial of 900

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patients, Luca G reported lower rates of wound infection and wound dehiscence with skin adhesive, as compared to conventional methods of skin closure [14].

In 2014, the Cochrane meta-analysis analyzed 33 studies that investigated skin adhesives for wound closure. They concluded that skin adhesives are superior to conventional skin suturing in terms of time, safety (e.g., no risk of sharp injury), and no need of suture removal. However, wound dehiscence was minimal when sutures were used [15]. They also recommended that further studies are required to compare the outcomes of tissue adhesive to other alternative techniques of skin closure. This led us to compare skin adhesives to conventional skin suturing in hernia repair incisions.

## METHODS

This randomized control trial was conducted in Surgical Unit-3 of Civil Hospital Karachi, a tertiary care center, for the duration of six months, starting from 9<sup>th</sup> February 2018 and ending on 8<sup>th</sup> August 2018. Informed consent was taken from the patients after explaining the purpose and procedure, along with risks and benefits of the research in the language comprehensible to each patient. Ethical approval for the study was taken from the Institutional Review Board (IRB).

The WHO sample size calculator (version 2.0) for sample size determination in health science was used to calculate the sample size, taking absolute precision as 0.05 (5%), confidence interval 95%, taking frequency of wound infection in skin adhesive group as 2.1%, and in suture closure group as 4.0%. The sample size was 65 in each group. The total sample size was calculated at 130. Non-probability consecutive sampling technique was used.

Patients undergoing open inguinal hernia mesh repair (i.e., inguinal hernia diagnosed as intermittent swelling presenting in inguinal region above and lateral to the pubic tubercle with a positive cough impulse, confirmed on ultrasound) with ages between 18-60 years were included in our study. Patients with diagnoses of diabetes mellitus, autoimmune disorders, blood clotting disorders, inadequate wound hemostasis, allergies to cyanoacrylate or formaldehyde, obstructed inguinal hernia, recurrent inguinal hernia were excluded from the study. Likewise, patients who were taking chemotherapy/radiotherapy, steroids, and immunosuppressive drugs were excluded

from the study. Additionally, those who refused to participate in study were excluded.

130 patients attending OPD with inguinal hernia were included in the research after assessment by senior residents and consultants. Patients were assigned to two groups: (1) Group A (i.e., skin adhesive); and (2) Group B (i.e., subcuticular sutures). They were randomly selected by the envelope method.

All patients were operated on in the usual manner, using Lichtenstein's technique, and mesh was applied. To avoid bias, all surgeries were performed by general surgeons with five years of post-fellowship experience. At the end of procedure, in Group A, wounds were closed by applying tissue adhesive after hemostasis was secured, while in Group B, wounds were closed using Prolene 2.0 in a subcuticular fashion. An independent observer recorded the time required to close the wound in both groups. In the post-operative period, all patients were observed for signs of wound infection according to the Southampton Score. Patients were called in for follow-up visits at seven days and at six weeks from the day of surgery. Scar cosmesis was calculated using the Hollander Score at six weeks. The data obtained from the patients was recorded on a pre-designed Proforma.

Data analysis was done using SPSS (version 21). Mean and standard deviations were calculated for quantitative data (e.g., age, application time, Hollander score). Frequency and percentages were calculated for qualitative data (e.g., gender, wound infection, wound dehiscence). The impact of final outcomes (i.e., mean application time) was compared in both groups by a student t-test, and the frequency of wound infection and wound dehiscence was compared between groups by a chi-square test. The stratification of data was done according to age and gender, and the outcome was compared between groups using a t-test and a chi-square test, taking p-value less than 0.05 as significant.

## RESULTS

A total of 130 patients undergoing open hernioplasty (inguinal hernia mesh repair) were randomly allocated to two groups. Patients in Group A were treated with skin adhesive and Group B were treated with subcuticular sutures. Age distribution of the patients is shown in Figure 1. The average age of the patients was 45.42±8.70 years. The mean age and the Hollander score of both groups is shown in Table 1. There were 105(80.8%) males and 25(19.2%) females. Gender distribution of both groups is shown in Figure 2.

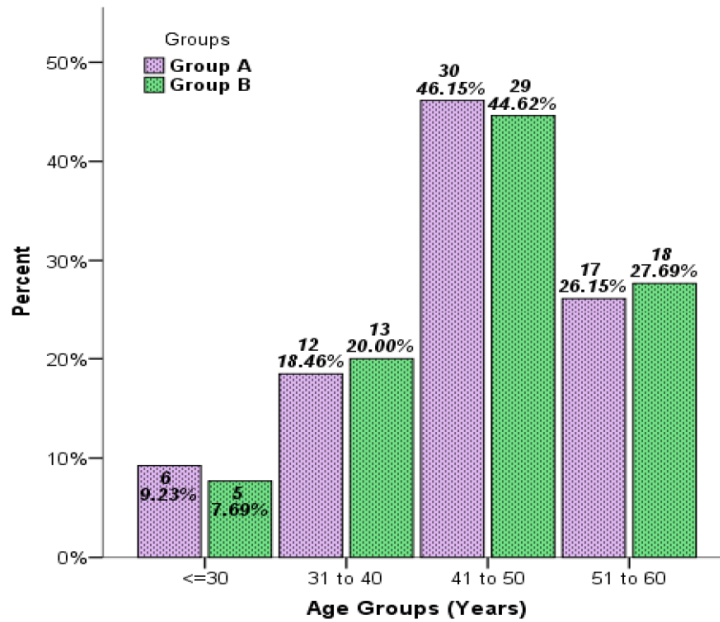


Figure 1: Age distribution of the patients with respect to groups (n=130).

Table 1: Descriptive Statistics of Mean Age and Hollander Score with Respect to Groups

Variables	Group A n=65		Group B n=65	
	Mean	Std. Deviation	Mean	Std. Deviation
Age (Years)	44.54	8.90	46.31	8.47
Hollander Score	5.88	0.57	5.91	0.38

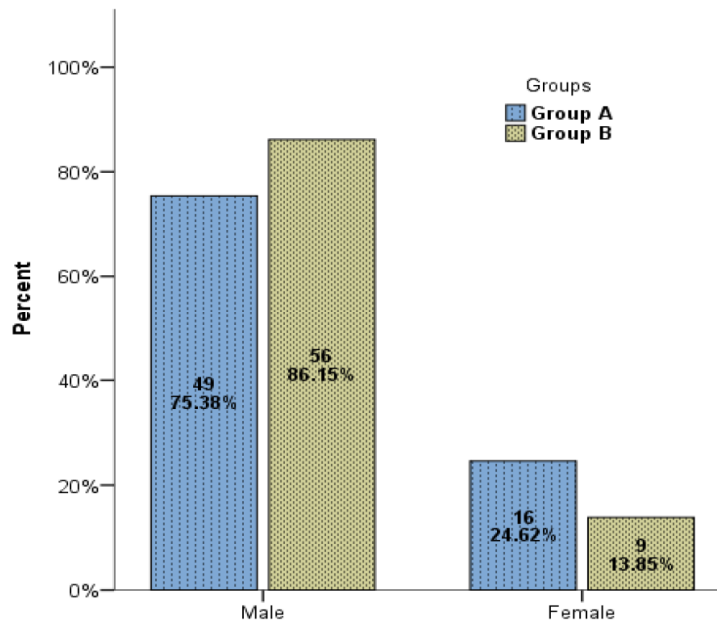


Figure 2: Gender distribution of the patients with respect to groups (n=130).

The overall rate of wound infection was eight (6.2%). The incidence of wound infection was more common in the control group, as compared to tissue

adhesive. However, the result was not statistically significant, as shown in Table 2. The total incidence of wound dehiscence was 7 (5.4%), but the result did not

**Table 2: Comparison of Wound Infection between Groups**

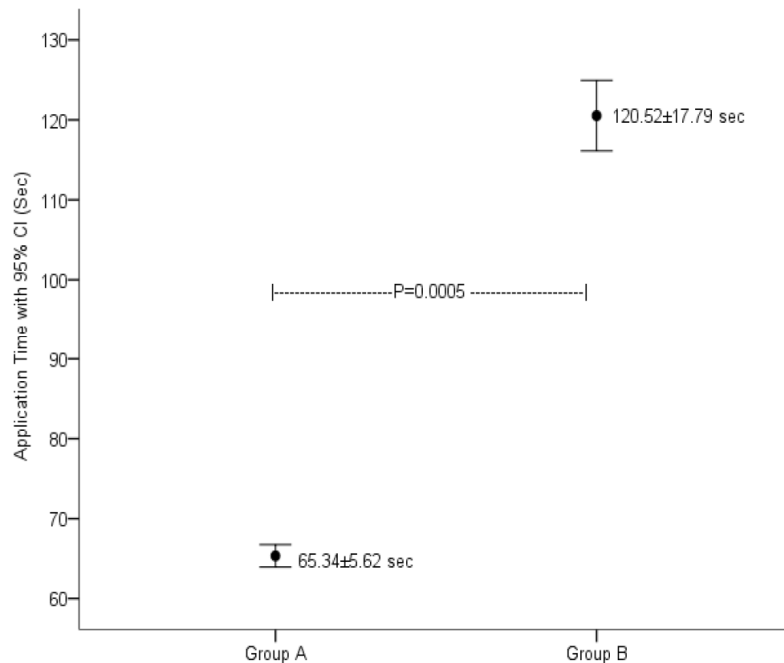
Wound Infection	Group A n=65	Group B n=65	Total	P-Value
Yes	3(4.6%)	5(7.7%)	8(6.2%)	0.465
No	62(95.4%)	60(92.3%)	122(93.8%)	

Chi-Square= 0.533.

**Table 3: Comparison of Wound Dehiscence between Groups**

Wound Dehiscence	Group A n=65	Group B n=65	Total	P-Value
Yes	3(4.6%)	4(6.2%)	7(5.4%)	0.698
No	62(95.4%)	61(93.8%)	123(94.6%)	

Chi-Square= 0.151.



**Figure 3:** Comparison of mean application time for skin closure between groups (n=130).

reach statistical significance, as shown in Table 3. Additionally, the mean time of skin closure was significantly lower in Group A than Group B, as shown in Figure 3.

The effects of age and gender were controlled through stratification, and it was observed that the rate of wound infection and dehiscence was not statistically significant between groups.

**DISCUSSION**

The number of surgical procedures performed throughout the world are increasing day-by-day. For the majority of surgical wounds, the edges are

reapproximated and held together with the help of sutures to facilitate tissue healing by primary intention. The traditional method of wound closure with needle and thread (i.e., sutures) for surgical incision was the only option in the past, but recently, other alternatives like staples, adhesive tapes, and tissue adhesive have entered surgical practice. The suture method for surgical site wounds allows diligent closure, but skin reaction to suturing material can occur, and often, stitches removal is required. The advantages of tissue adhesive (i.e., glue) over sutures is that there is no need to remove stitches after a few days, and the risk of needle stick injury to healthcare professionals like surgeons and assistants has been eliminated. Tissue

adhesive for surgical wound closure results in better cosmetic appearance of the scar, equivalent tensile strength, and a decrease in the rate of wound infections, as compared to sutures, staples, and adhesive tapes. Additionally, tissue adhesive for surgical wound closure eliminates many of the disadvantages and risks of the aforementioned alternative techniques; thus, the introduction of this method has been accepted vigorously [16]. The incidence of hernia among males and females at some time in their life is about 27% and 3%, respectively [17]. The incidence of inguinal hernia is eight times higher in men than women [18]. This is in accordance with our observations, as in our study, out of 130 patients, there were 80.8% males and 19.2% females with a mean age  $45.42 \pm 8.70$  years.

In our study, we found that the overall rate of wound infection was eight (6.2%). 4.6% of patients in the adhesive group and 7.7% patients in the control group had infected wounds. However, the difference has no statistical significance. Sebesta MJ, in his study, reported no significant difference in rates of complication between tissue adhesive and control groups [19]. In addition to this, a recent Cochrane review reported that there was no difference in the rate of wound infection between high viscosity octyl cyanoacrylate adhesives and sutures [20]. Maartense *et al.* reported that fewer wound infections were associated with tissue adhesions, as compared to sutures [21]. Souza *et al.* demonstrated that, for cardiovascular surgery patients, the use of tropical tissue adhesive as an add-on method to conventional suturing for surgical wound closure resulted in significantly reduced rates of wound infection [22].

In our study, we observed that the overall rate of wound dehiscence was seven (5.2%), which was not statistically significant between groups. Our results are supported by many other authors, who compared tissue adhesives to sutures. YL Yang reported no wound dehiscence or infection in skin closure for thyroid surgery with tissue adhesive [23]. However, on the contrary, in one recent prospective study, wound dehiscence of about 26% in tissue adhesive was found, compared to 0% in subcuticular suture for inguinal incision closure in children [24]. Finally, the Cochrane review of eight RCTs (i.e., 630 patients) compared tissue adhesives to sutures and found no statistically significant difference in dehiscence, infection, or cosmetic appearance [25].

Our study demonstrates that the mean time for skin closure was significantly lower in Group A than Group

B, showing decreased time required for the application of tissue adhesives. Our results are supported by many studies. According to the Maartense *et al.* study, laparoscopic trocar site wound closure with tissue adhesive reduces operating room time [21]. In Sebesta's study, he found that skin closure with tissue adhesive is cheaper and faster by more than nine minutes per case [19]. Matin S *et al.* found that in laparoscopic surgeries involving three or more port sites and cases with the total length of incision more than 4 cm, the time required for closure was significantly less, as compared to conventional suturing [26]. In contrast, in the prospective by Maniar N and his colleague, interventional randomized controlled trials reported that, with regards to time required for closure, the control group (i.e., suture) fared better than the adhesive group, with a mean closure time of 171.1 seconds. However, the difference in the mean closure time was only 27.3 seconds, which is not statistically significant [27].

## CONCLUSION

From this study, it can be concluded that the use of tissue adhesives has the advantage of saving time, as compared to conventional suturing. However, there are no differences in the early complications between tissue adhesive and suturing. There is no difference in complications, such as breaking the film, wound dehiscence, and wound infection rate, as compared to traditional suturing. Tissue adhesives can be recommended for skin closure so that we can reduce associated complications and cost in terms of post-surgical infection.

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