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Original Research Article

Is tissue adhesive a safe alternative to skin stapler for port site closure after laparoscopic surgery?

Tapan Sahu[1], Durgesh Goyal[1], Anand Rai Bansal[1]*, Harsha Kamalhans[1], Joy Bansal[2], Simon Lanah[1]

[1]Department of Surgery, PGIMS, Rohtak, Haryana, India
[2]Department of Surgery, MMU, Solan, Himachal Pradesh, India

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***Correspondence:**
Dr. Anand Rai Bansal,
E-mail: drarbansal@hotmail.com

ABSTRACT

Background: Wound management is fundamental to the practice of surgery. Different type of materials is available for wound closure like skin stapler, tissue glue, sutures and tapes etc. Surgical adhesives can simplify skin closure and problem inherent to suture use can be avoided. An attempt was thus made to compare tissue adhesive versus skin staplers in port site closure after laparoscopic surgery patients regarding efficacy, safety, postoperative wound complications and scar cosmesis.
Methods: The study was carried out on 150 patients who underwent laparoscopic surgery. The patients were divided into two groups and results were assessed on the basis of wound complication and cosmesis at 6 weeks.
Results: This study demonstrated that the use of tissue glue for skin closure prolonged the overall surgical time but wound related complications and wound cosmesis scores were comparable in both the groups.
Conclusions: Tissue adhesive can also be used as an acceptable alternative to skin staplers particularly for small incisions like port site closure.

Keywords: Skin stapler, Tissue adhesive, Wound complication, Wound cosmesis

INTRODUCTION

The management of wounds and their associated care is essential to the discipline of surgery. The process of wound closure constitutes a pivotal aspect of surgical intervention, directly affecting outcomes related to the healing process, the prevention of infection, the comfort of the patient, and the aesthetic results.[1] Numerous techniques for wound closure, including sutures, surgical staples, adhesive tapes, and tissue adhesives, are accessible for clinical application. The selection of wound closure methodologies must also take into account the distinctive characteristics of the specific tissue involved in the closure process.[2]

Surgical adhesives have the capacity to optimize the procedure of dermal closure, thereby mitigating the complications linked to the use of sutures. Various complications (e.g., reactivity, premature reabsorption) may arise from the application of sutures, potentially culminating in adverse outcomes, both from a cosmetic and functional perspective.[3] 2-octylcyanoacrylate is the sole cyanoacrylate tissue adhesive sanctioned by the U. S. food and drug administration for the purpose of superficial skin closure. The application of 2-octylcyanoacrylate is restricted solely to superficial skin closure and is contraindicated for subcutaneous implantation.[4] In the context of laparoscopic surgery, the effective closure of port sites is imperative for the reduction of complications and the enhancement of recovery outcomes in laparoscopic procedures. Tissue adhesives provide a needle-free alternative that is not only aesthetically advantageous but also prioritizes patient-centered wound management.[5]

Thus, the present study was structured to assess the relative efficacy, safety, postoperative wound complications, and cosmetic outcomes of scar formation between tissue adhesives and skin staplers in the closure of port sites following laparoscopic surgery in patients.

METHODS

Study setting

This prospective, randomized, controlled, institutional review board–approved study was carried out on 150 patients who underwent laparoscopic surgery from May 2023 to November 2024 admitted in the surgical ward of Pt. B. D. Sharma post graduate institute of medical sciences, Rohtak. The patients were divided into two groups based on computer randomisation, group A and B.

Group A comprised of 75 patients, in whom skin incision was closed by tissue adhesive (2-octylcyanoacrylate) after achieving haemostasis.

Group B comprised of 75 patients, in whom skin incision was closed by skin staplers.

Exclusion criteria

The patient with following criteria was excluded from the present study-Age <14 years, obese persons (BMI>35), diabetic person, malnourished person a malignant disease.

Tissue adhesive (2-octyl cyanoacrylate) is available in a sterile disposable blister pack. After opening the blister pack digital pressure was applied to the vial which breaks the internal capsule containing the monomer and a permeable tip facilitates topical application. The tissue adhesive was applied in multiple thin layers (3-4 layers) over the incision site with a few seconds delay between application of each layer. Surface tension could be created by distancing the applicator tip 1 to 2 mm away from skin surface during application of tissue adhesive. This small gap formed between the applicator tip and skin surface creates a surface tension effect that holds the adhesive between the applicator tip and skin surface.

Before and after application of tissue adhesive, the skin edges were closely apposed with forceps, which prevent skin edge eversion and penetration of tissue adhesive to deeper layers of wound. Tissue adhesive acts as occlusive dressing in itself, dressing was not done after cyanoacrylate polymer dried completely. During this procedure, with the help of stop watch, the total time required to apply the tissue adhesive to all the 4 ports, was also calculated.

In group B, skin stapler was used for skin closure of port sites. During this procedure, with the help of stop watch, the total time required to apply the skin staplers to all the 4 ports, was also calculated.

In both the groups the following parameters were evaluated: A. Wound closure time. B. Postoperative complication like, wound disruption, wound discharge and wound infection.

Patients in both the groups were given usual instructions with regard to wound care at the time of discharge. Follow-up was done after one week. Thereafter follow up of all patients after six weeks was done. The condition of the wound was assessed in both the groups at 7th postoperative day and cosmesis at six weeks. Cosmesis was analysed by visual analogue score, in which photographs were taken at six weeks, and rated by two surgeons blinded to the method of closure. Each incision was assigned a score ranging from one (poor result) to six (excellent result). Six considerations were evaluated while assigning the score: step off border, contour irregularities, wound margin separation, edge inversion, excessive distortion and overall appearance.

In both the groups all the parameters/observations were tabulated and statistically analysed using the standard student's' test to assess the routine functional utility of tissue adhesive/ skin staplers in port site closure after laparoscopic surgery. P<0.05 was taken as significant.

RESULTS

Wound closure time

The table presents the mean duration of wound closure in seconds for the stapler and glue groups. In the stapler group, the mean duration was 30.26 seconds with a standard deviation of 1.87, while in the glue group, the mean duration was 316.57 seconds with a standard deviation of 3.98. The p value of less than 0.001 indicates a statistically significant difference in the duration of wound closure between the two groups, with the glue group taking considerably longer than the stapler group (Table 1).

Postoperative wound complications

A total of three patients had wound disruption in group A while none of the patients in group B had wound disruption. The patients in group A who had wound disruption (Epigastric port site), had it on the day of surgery. The patients were taken to minor OT and local anaesthesia infiltrated at the wound site and suturing with ethilon 2-0 RC done. These three patients were then not included in the assessment of scar cosmesis at 6 weeks.

The table presents the occurrence of wound-related complications in the stapler and glue groups. There were no cases of wound disruption in the stapler group (0%), while 3 cases (4%) of wound disruption were observed in the glue group, with a p=0.077, indicating no statistically significant difference between the two groups (Table 2). There were no instances of wound discharge or wound infection in either group.

Wound cosmesis at 6 weeks

Each incision received a score of "0" or "1" depending upon the cosmetic deficiencies in the individual wound. All the scores were then summed and depending upon the score the incisions were categorised as follows: 1. Excellent: if optimal total cosmesis score is 6, 2. Acceptable: if optimal total cosmesis score is 5 and 3. Unacceptable: if optimal total cosmesis score is <4.

In group A, five out of 75 (6.66%) patients never attended the OPD at sixth week follow-up while six out of 75 (8%) patients in group B were lost in follow-up at the sixth week. Subsequently the wound cosmesis for these patients could not be evaluated. For remaining patients wound cosmesis is as being evident from the (Table 3).

The table presents the wound cosmesis scores for two groups: the stapler group and the glue group. The mean score for the Stapler group is 5.80 with a standard deviation of 0.41, while the glue group has a mean score of 5.96 and a standard deviation of 0.19. The p value for the comparison between the two groups is 0.063, indicating that there is no statistically significant difference in the wound cosmesis scores between the two groups (Table 4).

Table 1: Comparison of mean age between the two groups, (n=150).

	Mean (SD)		P value
Age of the patient in years	Stapler group (%)	Glue group (%)	
	48.86 (11.95)	45.34 (12.06)	>0.05

Table 2: Distribution of cases according to sex in the two groups, (n=150).

Sex of the patient	Stapler group (%)	Glue group (%)	P value
Male	17 (22.85)	13 (17.14)	>0.05
Female	58 (77.14)	62 (82.85)	

Table 3: Mean closure time.

Groups	No. of patient	Mean time seconds	P value
A	75	188.57±2.67	<0.001
B	75	30.26±1.87	

Table 4: Wound disruption.

Variables	Group A	Group B
Total no. of patients	75	75
Wound disruption	3	0
Percentage (%)	4	0

Table 5: Wound cosmesis.

Variables	Group A	Group B
No. of step-off border	0	0
No. of contour irregularities	0	0
No. of margin separation	0	0
No. of edge inversion	0	0
No. of excessive distortion	0	0
No. of poor overall appearance	0	0

Table 6: Wound cosmesis score at 6 weeks.

Wound cosmesis score	Mean±SD		P value
	Stapler group	Glue group	
	5.80±0.41	5.96±0.19	>0.05

DISCUSSION

Wound closure techniques have evolved from the earliest development of suturing materials to comprise resources that include synthetic sutures, staples, tapes and adhesive compound. Aesthetic closure is based on knowledge of healing mechanism and skin anatomy and closure technique. Choosing the proper materials and wound closure technique ensure optimal healing. Topical adhesive has been used quite successful for minor incisions, thus sparing the patient the need for injection of local anesthesia for traumatic lacerations, a benefit of considerable importance especially for pediatric patients.[6]

Various studies conducted on the use of tissue adhesive (2-octylcyanoacrylate) concluded that the only complication of tissue adhesive is a small increased risk of wound disruption with no statistically difference in cosmesis. A recent Cochrane database systematic review of eight randomised control trials concluded that tissue adhesive is an acceptable alternative to standard wound closure for repairing simple traumatic laceration, there was no significant difference in cosmetic outcome between tissue adhesive and standard wound closure, or between different tissue adhesive. Tissue adhesive was advocated to decrease procedure time and pain, albeit with a small, but statistically significant, increased rate of dehiscence.[7]

The present study showed that the time required for closure of wound in the tissue adhesive group was significantly higher than the skin stapler group and this was in consonance to various other studies wherein wound closure time was higher in tissue adhesive group. In different study average time taken for closure of incision in surgeries with glue was much more than with skin staplers.[8-11]

But a study conducted by Chibbaro et al observed no significant difference between surgical adhesive glue and skin staples for closure of neurosurgical scalp incisions.[12]

The present study was not in consonance to the study conducted by Ando et al, which showed that wound closure time in tissue adhesive group was significantly shorter than in skin stapler group in patient undergoing spinal surgery and with wound length of 10 cm.[13]

The present study was in consonance to the study conducted by Bae et al, wherein wound complication rates were comparable in both the groups undergoing elective minimally invasive colorectal surgeries.[11]

Also, Eggers et al in a randomised series of 75 patients whose operation involved a knee incision for total knee arthroplasty found that there is no statistical significance between both the groups in terms of wound related complication.[14]

Similar studies conducted by Pronio et al showed that wound related complications in both the groups undergoing thyroid surgery were comparable.[15]

The ideal method of surgical incision closure should be time saving without complication and optimal cosmetic outcome. Cosmetic outcome is the ultimate parameter by which we measure the quality of surgical incision repair. In the present study there was no statistically significant difference in the wound cosmesis scores between the two groups.

A number of prospective randomized controlled trials have been done for comparison of cosmetic outcome between tissue adhesive and skin staplers.[8,10]Earlier studies by Ridgway et al, had compared the cosmesis score using VAS scale at 6 weeks and found that tissue adhesive group had better cosmesis than the stapler group but had failed to prove statistical significance.[8] Another study done between groups undergoing total hip and total knee arthroplasty by Khan et al had no significant difference as regards to cosmesis (assessed by Hollander wound evaluation score at 6 weeks.[10]

Limitations

The limited sample size restricts the generalizability of the findings, as the results may not be representative of the broader population.

CONCLUSION

Present study demonstrated that although the use of tissue glue for skin closure prolonged the overall surgical time but wound related complications and wound cosmesis scores were comparable in both the groups. Tissue adhesive can also be a practical solution for patient living a long distance from health facilities or those with limited mobility. Tissue adhesive may be considered an alternative for skin incision closure having the added advantage that it doesn't require wound dressing and also avoids any anxiety and pain associated with stapler removal. Therefore, it may be suggested that tissue adhesive can also be used as an acceptable alternative to skin staplers particularly for small incisions like port site closure.

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