Bangladesh Medical Res Counc Bull 2026;52(2): 91-96

DOI: 10.3329/bmrcb.v52i2.89095

RESEARCH PAPER

Efficacy of Tissue Glue in Comparison to Skin Staple for Skin Closure Following Elective Laparoscopic Surgery

Md. Nazmul Arefin[1], Afsana Begum[2], Md Ashraful Islam[3], Md Zillur Rahman[4], Md. Nadim Uddin[5], ABM Mir Mubinul Islam[4]

[1]Department of Casualty, Dhaka Medical College Hospital, Dhaka, [2]Department of Biochemistry, Mugda Medical College, Dhaka, [3]Department of General Surgery, Bangladesh Medical University (BMU), Dhaka, [4]Department of Surgery, Naogaon Medical College, Naogaon, [5]Department of General Surgery, Udayan Dental College, Rajshahi

Abstract

Background: The choice of skin closure technique influences closure time postoperative pain and wound cosmetic outcome following laparoscopic surgery. Tissue glue has emerged as an alternative to skin staples, but comparative evidence remains limited.

Objectives: To compare tissue glue and staples with respect to skin closure time, postoperative pain, and wound cosmesis in elective laparoscopic surgery.

Methods: This quasi-experimental study was conducted in the Department of General Surgery at Bangladesh Medical University, from October 2023 to September 2024. Sixty patients undergoing elective laparoscopic surgery were allocated in two groups: the experimental group (Group A-tissue glue; n=30) and the control group (Group B-skin staples; n=30). Skin closure time was recorded in minutes. Postoperative pain was assessed using the Visual Analog Scale at 12, 24, 48, and 72 hours and on postoperative day 7. Wound cosmesis was evaluated on postoperative day 7 and at 01 (one) month. Data were analyzed using SPSS version 27.

Results: The mean skin closure time was significantly shorter in the tissue glue group compared to the stapler group (3.90 ± 0.72 vs. 5.60 ± 1.46 minutes; p=0.001). Postoperative pain scores were significantly lower in the tissue glue group at 12, 24, 48, and 72 hours ($p<0.05$), with no significant difference on postoperative day 7 (p=0.087). Wound cosmesis scores were significantly better in the tissue glue group on postoperative day 7 and at 01 (one) month (p=0.001).

Conclusion: Tissue glue results in significantly better outcomes than skin staples for skin closure in elective laparoscopic surgery.

Key words: Tissue glue, Staples, Laparoscopic surgery.

Introduction

Wound closure is a fundamental step in any surgical procedure, directly influencing key postoperative outcomes such as healing time, infection rates, pain levels, and cosmetic appearance. The choice of closure technique is therefore a critical component of surgical planning, as it affects tissue approximation, scar formation, and complication rates.[1] Traditionally, sutures and staples have been the mainstay methods for skin closure; however, advances in biomaterials have introduced tissue adhesives—particularly cyanoacrylate-based glues—as a promising alternative.[2] In laparoscopic surgery, where small but precise incisions must be closed efficiently and with minimal tissue trauma, the selection of an optimal closure method becomes even more crucial.

Staples, typically made from stainless steel or absorbable polymers, are designed to provide rapid and consistent wound approximation. Deployed using a mechanical stapler, they allow for uniform placement, making them especially advantageous in surgeries requiring speed and efficiency.[3] This explains their widespread use in both laparoscopic and open procedures, particularly in sites requiring tension-free closure. One of their primary benefits is speed—skin closure with staples is reported to be 30–50% faster than with sutures.[3] Additionally, they offer consistent

***Correspondence:** Md. Nazmul Arefin, Department of Casualty, Dhaka Medical College Hospital, Dhaka.Email: narefin01@yahoo.com*

ORCID ID: 0009-0005-2470-7881

wound edge eversion and reduced tissue strangulation, potentially lowering local inflammatory responses. However, staples also present drawbacks. Their rigid metallic structure can increase postoperative pain and irritation, and their removal necessitates a specialized extractor, which may cause patient discomfort.[4] Furthermore, studies have suggested that staples may carry a higher risk of surgical site infection (SSI) than other closure methods, possibly due to the small gaps between staple insertion points where bacterial colonization can occur.[5]

Tissue glue, most commonly formulated from octyl-2-cyanoacrylate, offers a needle-free approach to skin closure. Upon application, the adhesive polymerizes rapidly, creating a waterproof and bacteriostatic barrier over the wound.[6] This method avoids skin penetration, thereby minimizing tissue trauma and eliminating the risk of needlestick injuries for surgical staff. One of the most appealing benefits of tissue glue is its cosmetic outcome—since there are no puncture marks or compressive metallic elements, the resulting scar is often smoother and less noticeable.[7] Moreover, postoperative pain tends to be lower, as there is no rigid foreign object applying continuous pressure to the wound.[5] The application process is also rapid, generally requiring only 2–3 minutes, compared to approximately 5–6 minutes for staples.[7]

Despite these advantages, tissue glue is not universally applicable. It is more expensive per unit than staples, which may limit its use in low-resource healthcare systems.[8] Its tensile strength is also lower, making it less suitable for wounds under high tension or in areas subject to significant mechanical stress.[5] Additionally, it requires a dry wound surface for optimal adhesion, which can be challenging to achieve in actively bleeding surgical fields.

When compared directly, several distinctions emerge. Tissue glue is generally faster to apply, offers better cosmetic results, and is associated with reduced postoperative pain and infection risk. It also eliminates the need for a follow-up visit for staple removal, improving patient convenience. On the other hand, staples provide greater tensile strength, are more reliable in high-tension or moist wound environments, and remain more cost-effective in terms of direct material costs. The balance between these factors depends on the surgical setting, patient profile, and available resources.

Given these contrasting characteristics, comparative research is needed to guide evidence-based decision-making. The present study was designed to evaluate tissue glue versus staples for skin closure in elective laparoscopic procedures, focusing on closure time, postoperative pain, and cosmetic outcomes, with additional consideration of cost-effectiveness. Special emphasis was placed on the relevance of these findings to Bangladesh and other resource-constrained environments, where both clinical outcomes and economic feasibility must be weighed. By addressing these variables, this research aims to contribute to clinical guidelines that can optimize wound closure strategies while enhancing patient care and operational efficiency.

Materials and Methods

This quasi-experimental study was conducted over a one-year period (October 2023 to September 2024) in the Department of General Surgery, Bangladesh Medical University (BMU), Bangladesh. The study aimed to compare the effectiveness of tissue glue (octyl-2-cyanoacrylate) and non-absorbable skin staples for skin closure following elective laparoscopic surgery (laparoscopic cholecystectomy, laparoscopic appendicectomy). Patients undergoing clean-contaminated elective laparoscopic procedures were assigned purposively. Inclusion criteria included patients receiving standardized perioperative antibiotic prophylaxis. Patients who were immunocompromised, had a history of keloid formation, or were unable to attend follow-up visits were excluded. The study population was divided into two groups based on the method of skin closure: the experimental group (Group-A) in which incisions were closed using tissue glue (octyl-2-cyanoacrylate) using propen. Octyl-2-cyanoacrylate was applied in a thin layer over the entire wound, extending 5-10 mm beyond wound edge using propen. The wound was allowed to dry for 20-30 s and the second and third layer was applied. No additional bandaging was done. The control group (Group-B) in which incisions were closed using non-absorbable skin staples. Once the procedure is finished ,the wound was dried and the time of start and finish of skin closure was noted using stopwatch timer.

The sample size was calculated using the formula for comparison of two means, considering a 95% confidence interval (Zá = 1.96), 80% study power (Zâ = 0.84), standard deviations derived from previous

studies, and an expected mean difference of 2.46. The calculated sample size was 30 patients in each group, yielding a total of 60 participants.

The primary independent variable was the method of skin closure using tissue glue. Outcome measures included skin closure time, postoperative pain, and wound cosmesis. The time taken for was recorded in minutes using a stopwatch. Postoperative pain was assessed using the Visual Analog Scale (VAS; 0–100) at 12 hours, 24 hours, 48 hours, 72 hours, and on the 7th postoperative day[9]. To ensure comparability of pain assessment, all patients received the same standardized postoperative analgesic regimen according to WHO Analgesic Ladder[10]. Early wound cosmesis was evaluated on postoperative day 7 using modified Hollander cosmesis scale[9] that assessed step-off at wound borders, contour irregularities, wound margin separation, wound edge inversion, excessive wound distortion, and overall appearance. Late wound cosmesis was assessed at one month postoperatively using the Visual Analog Cosmesis Scale (0–100), where higher scores indicated better appearance.

All patients received intravenous ceftriaxone (1 g) at induction of anesthesia as per institutional protocol. Data were collected using a structured questionnaire and analyzed using IBM SPSS Statistics (version 27). Continuous variables were expressed as mean ± standard deviation, and comparisons between the two groups were performed using Student's *t*-test. A p-value < 0.05 was considered statistically significant.

Results

A total of 60 patients undergoing elective laparoscopic surgery were included in this quasi-experimental study, with 30 patients in each skin-closure group (tissue glue and skin staples). The demographic profile of the study population is presented in Table I. The age of the patients ranged from 22 to 78 years, with a mean (±SD) age of 44.85 ± 12.20 years. The largest proportion of patients (25%) belonged to the 31–40-year age group, followed by the 22–30 years and 41–50 years age groups (20% each). Male patients constituted 55% (n=33) of the study population, while females accounted for 45% (n=27). The comparison of mean time required for skin closure between the two groups is shown in Table II. The mean skin closure time was significantly shorter in the tissue glue group (3.90 ± 0.72 minutes) compared to the stapler group (5.60 ± 1.47 minutes). The difference between the two groups was statistically significant (p=0.001) as determined by unpaired Student's *t* test. Post-operative pain was assessed using the Visual Analogue Scale (VAS) at different time intervals, and the results are summarized in Table III. At 12, 24, 48, and 72 hours post-operatively, the mean VAS scores were significantly lower in the glue group compared to the stapler group (p<0.05). However, on postoperative day 7, although the glue group demonstrated a lower mean pain score (22.00 ± 4.10) than the stapler group (27.00 ± 9.23), the difference was not statistically significant (p=0.087). Post-operative wound cosmesis scores at different follow-up intervals are presented in Table IV. On postoperative day 7, the mean wound cosmesis score was significantly higher in the glue group (6.00 ± 0.00) compared to the stapler group (5.20 ± 0.41) (p=0.001). Similarly, at one-month follow-up, the glue group demonstrated significantly better cosmetic outcomes (86.15 ± 6.00) than the stapler group (71.00 ± 4.93), with the difference being statistically significant (p=0.001).

Table I: *Patients Demography (n=60)*

Demographic Profile	Number	Percentage
Age (in years)		
22-30	12	20
31-40	15	25
41-50	12	20
51-60	9	15
61-70	3	5
71-78	9	15
Mean±SD	44.85 ± 12.20	
Range (min,max)	22, 78	
Gender		
Female	27	45
Male	33	55

Table-II: *Mean time of skin closure in experimental and control group (n=60)*

Group	N	Mean Time (minute)	Std. Deviation	p value
Group-A (Tissue Glue)	30	3.90	0.72	0.001
Group-B (Skin Stapler)	30	5.60	1.46	

Unpaired Student's t test was performed to calculate statistical difference between groups. p-value of < 0.05 was taken as level of significance. The Table II showed statistically significant difference in mean skin closure time between the two groups.

Table III: *Post-operative pain score using VAS at specific time interval in each study group (n=60).*

VAS (mean±SD)	Group-A	Group-B	p value
12h	31.00±05.52	44.00±10.46	0.004
24h	25.00±05.12	33.00±06.56	0.001
48h	23.00±04.70	29.00±8.52	0.033
72h	22.00±04.10	29.00±8.52	0.007
POD-7	22.00±04.10	27.00±9.23	0.087

Unpaired Student's t test was performed to calculate statistical difference among groups. p-value of < 0.05 was taken as level of significance. The Table III showed that the mean Post-operative pain score different time interval with standard deviation. Data expressed as mean ± SD.

Table IV: *Post-operative wound cosmesis score at specific time interval in each study group (n=60).*

Wound Cosmesis (mean±SD)	Group-A	Group-B	p value
7-POD (Modified Hollander cosmesis scale)	6.00±0.00	05.20±0.41	0.001
1 Month (Visual Analog Scale)	86.15±6.00	71.00±4.93	0.001

Unpaired Student's t test was performed to calculate statistical difference among groups. p-value of < 0.05 was taken as level of significance. The Table IV showed the mean post-operative wound cosmesis score different time interval with standard deviation. Data expressed as mean ± SD. WCs-wound cosmesis score ; POD-post operative day.

Discussion

In this quasi-experimental study, the effectiveness of octyl-2-cyanoacrylate tissue adhesive and skin staples for laparoscopic incision closure was evaluated in patients undergoing elective abdominal surgery. Sixty patients were equally allocated to the tissue glue group and the staple group. Primary outcomes included wound closure time, postoperative pain, and cosmetic appearance, while cost-effectiveness was assessed as a secondary outcome.

The demographic characteristics of the study population were comparable between the two groups. Most patients were aged between 31 and 40 years, followed by the 41–50-year age group, with a mean age of 44.85 years. Male patients constituted 55% of the cohort, a distribution consistent with previously published studies.[9,11,12]

The mean skin closure time was significantly lower in the tissue glue group than in the stapler group (3.9 ± 0.72 minutes vs. 5.6 ± 1.46 minutes; p = 0.001), indicating superior procedural efficiency with tissue adhesive. Similar findings have been documented in previous studies.[12,13]

Postoperative pain assessment using the Visual Analog Scale demonstrated consistently lower pain scores in the tissue glue group during the early postoperative period (12–72 hours), with statistically significant differences compared with the stapler group. No significant difference in pain scores was observed on postoperative day 7. Additional discomfort related to staple presence and removal may have contributed to higher pain scores in the stapler group. Similar findings of increased postoperative pain associated with staple closure have been reported previously.[14-17]

Cosmetic outcomes favored tissue glue at both early and late assessments. Although early wound evaluation on POD-7 demonstrated a modest but statistically significant difference, the advantage of tissue adhesive became more pronounced at 01(one) month, suggesting improved scar maturation. Similar cosmetic benefits of cyanoacrylate adhesives have been reported previously.[18,19] However, some studies involving laparoscopic port-site closures have shown no significant cosmetic differences between closure techniques, indicating that factors such as incision size, wound tension, and patient characteristics may influence cosmetic results.[20,21]

From an economic perspective, skin staples were associated with lower initial material costs, whereas tissue adhesive demonstrated potential overall cost-effectiveness. Reduced operative time and shorter hospital stay contributed to this advantage. Greater cost efficiency with adhesive use and significant per-patient cost savings attributable to improved operative efficiency have been reported in laparoscopic procedures.[18,22] These findings suggest that the higher initial cost of tissue adhesive may be compensated by subsequent economic benefits.

Overall, tissue adhesive appears to be a favorable option for laparoscopic wound closure, offering advantages in operative efficiency, postoperative comfort, and cosmetic outcomes, with potential cost savings. Skin staples remain useful in situations requiring greater tensile strength or in moist surgical fields. The choice of wound closure technique should be individualized based on clinical requirements, patient characteristics, and economic considerations, particularly in resource-limited healthcare settings.

There were several limitations of the study. The procedures in the experimental and control groups were not performed by the same surgeon. Therefore, differences in operative technique, tissue handling, and experience with skin closure may have influenced the outcomes. Although standardized operative and postoperative protocols were followed, the potential effect of inter-surgeon variability cannot be completely excluded. Furthermore, cosmetic outcomes were assessed only at 1 month postoperatively due to time constraints.

Conclusion

In this study, skin closure with tissue glue after elective laparoscopic abdominal surgery resulted in significantly better outcomes than skin stapler closure in terms of reduced postoperative pain, shorter skin closure time, and improved cosmetic results. Although the cost of tissue glue remains a concern, it may be considered a safe and effective alternative to skin staples. Further randomized controlled trials with larger sample sizes and longer follow-up are needed to confirm these findings and provide more robust evidence.

Conflict of Interest: There are no conflicts of interest.

Funding Source: Bangladesh Medical Research Council (BMRC)

Ethical Clearance: The institutional Review Board of Bangladesh Medical University.

Submit Date: 18 February 2026

Accepted: 08 July 2026

Final Revision Received: 13 August 2026

Publication: 20 August 2026

References

1. Chandrashkhar N, Nayak V, Prabhakar S. A comparative study between staples and silk sutures in closure of scalp wounds. *J Clin Diagn Res.* 2013;7:1413–1415. DOI:10.7860/JCDR/2013/6523.3210.
2. Kolarsick PA, Kolarsick MA. Dermabond: surgical adhesive. *Dermatol Nurs.* 2011;23:336–338. Available from: https://pubmed.ncbi.nlm.nih.gov/33903846/.
3. Al-Mubarak L, Al-Haddab M. Cutaneous wound closure materials: an overview and update. *J Cutan Aesthet Surg.* 2013;6:178–188. DOI:10.4103/0974-2077.123411.
4. Cochetti G, Cottini E, Del Zingaro M, Boni A, Tiezzi A, Mearini E. Use of skin staples in urological surgery: quick and safe method for wound closure. *Urol Int.* 2020;104:630–636. DOI:10.1159/000507593.
5. Cheadle WG. Risk factors for surgical site infection. *Surg Infect (Larchmt).* 2006;7(Suppl 1)–S11. DOI:10.1089/sur.2006.7.s1-07.
6. Murugananth V, Muthukumaravel N, Ramasamy S. A prospective comparative study of tissue adhesive and suture in skin closure following laparoscopic surgery. *Int Surg J.* 2023;10:845–850. DOI:10.18203/2349-2902.isj20230532.
7. McGrath JA. The biology of wound healing. In: Burns T, Breathnach S, Cox N, Griffiths C, editors. *Rook's Textbook of Dermatology.* 7th ed. Oxford: Blackwell Publishing; 2004. p. 47.1–47.18.
8. Jones Jr SM, Lacey SR, Fellabaum JE. Cost-effectiveness of cyanoacrylate tissue adhesives in closing surgical incisions. *Arch Surg.* 1993;128:410–413. DOI:10.1001/archsurg.1993.01420160052008.
9. Ananda P, Kumar G, Lakshmaiah V. Comparative study of tissue adhesives and skin staples in laparoscopic incision closure. *Int J Res Med Sci.* 2019;7:1645–1649. DOI:10.18203/2320-6012.ijrms20191825.
10. *Revisiting the WHO Analgesic Ladder for Surgical Management of Pain. Laura Stone McGuire, MD and Konstantin Slavin, MD AMA J Ethics.* 2020;22(8):E695-701. DOI: 10.1001/amajethics.2020.695.
11. Varghese A, Sharma D, Gupta V. Comparative study of octylcyanoacrylate tissue adhesive and conventional skin closure in laparoscopic incisions. *Int Surg J.* 2017;4:2563–2567. DOI:10.18203/2349-2902.isj20173559.
12. Pandove P, Gupta V, Kumar R. Study of skin closure techniques: tissue glue vs staples in laparoscopic surgeries. *Int J Contemp Med Res.* 2017;4:1211–1214. Available from: https://www.ijcmr.com/uploads/7/7/4/6/77464738/ijcmr_1484_v1.pdf.
13. Ridgway PF, Mahmood A, Moore M, Mullett H, Hill AD, Redmond HP. A prospective randomized study comparing skin closure techniques in neck surgery. *Arch Surg.* 2005;140:1106–1108. DOI:10.1001/archsurg.140.11.1106.
14. Kochar R, Jain A, Soni R. Evaluation of octylcyanoacrylate tissue adhesive versus skin staples for skin closure in orthopedic procedures. *Indian J Orthop Surg.* 2016;2:119–124. Available from: https://indianjos.org.
15. Gaertner WB, Bonsack ME, Delaney CP. A prospective, randomized, controlled trial of stapled versus tissue

adhesive skin closure after ileostomy closure. *Dis Colon Rectum.* 2008;51:886–890. DOI:10.1007/s10350-007-9253-0.

16. Singh BI, Arora M, Jindal M, Grover D. Comparative study of skin closure by staples and tissue adhesive in abdominal surgeries. *Surg J (N Y).* 2020;6–e190. DOI:10.1055/s-0040-1716733.
17. Arunachalam PS, Dutt SN, George M, Shaikh S, Darwish H, Saleh HA. A prospective randomised trial comparing octylcyanoacrylate tissue adhesive and suture for skin closure after neck surgery. *J Laryngol Otol.* 2002;116:443–445. DOI:10.1258/002221502320520957.
18. Zempsky WT, Parrotti D, Grem C, Nichols J. Randomized controlled comparison of cosmetic outcomes of sutures, tissue adhesives, staples, and adhesive strips for traumatic lacerations. *Pediatrics.* 2004;113:1219–1223. DOI:10.1542/peds.113.4.1219.
19. Jones SM, O'Donohoe MK, Pereira JL. Randomized trial comparing skin closure techniques following groin surgery. *Ann R Coll Surg Engl.* 2017;99:539–543. DOI:10.1308/rcsann.2016.0234.
20. Chitrambalam TG, Govindarajan T, Krishnasamy R. Evaluation of cyanoacrylate adhesive in laparoscopic port site closure. *J Clin Diagn Res.* 2016;10–RD03. DOI:10.7860/JCDR/2016/18867.7838.
21. Maartense S, Bemelman WA, Dunker MS, Slors JF, van Duijvendijk P, Pierik EG, et al. Randomized clinical trial of the effect of surgical adhesive on wound healing after laparoscopic surgery. *Br J Surg.* 2002;89:1255–1259. DOI:10.1046/j.1365-2168.2002.02183.x.
22. Dowson HM, Sweinstein AP, Tiernan JP, et al. A randomized controlled trial comparing skin adhesives to subcuticular sutures for closure of laparoscopic port sites. *Colorectal Dis.* 2006;8:375–378. DOI:10.1111/j.1463-1318.2006.01049.x.
23. Keng L, Prystowsky JB, Lewis JL. Economic comparison of skin closure methods in laparoscopic surgery. *Surg Laparosc Endosc.* 1989;1:105–109. Available from: https://pubmed.ncbi.nlm.nih.gov/2482727/.