

Original Research Article

COMPARATIVE EVALUATION OF SUTURES AND SKIN ADHESIVES FOR LAPAROSCOPIC PORT SITE CLOSURE

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ABSTRACT

Background: Laparoscopic operations are prevalent owing to their minimum invasiveness, expedited recovery, and less postoperative discomfort. Nonetheless, the closure of port sites is essential to avert wound problems, including infection, dehiscence, seroma development, and unsatisfactory esthetic outcomes. Traditionally, sutures are utilized for skin closure, providing secure approximation but necessitating more operating time and technical proficiency. Skin adhesives represent a contemporary option, offering expedited closure, less risk of needle-stick injuries, and potentially enhanced aesthetic results. **Aims:** This study evaluates the comparative efficacy, safety, and patient satisfaction of laparoscopic port site closure using sutures versus skin adhesives.

Materials and Methods: A prospective, comparative study was conducted over 10 months involving 60 patients undergoing elective laparoscopic procedures. Patients were randomized into two groups: Group A (n=30) received conventional skin closure using absorbable sutures, and Group B (n=30) received closure with skin adhesives. Inclusion criteria comprised adult patients undergoing laparoscopic procedures requiring 5–12 mm ports. Postoperative outcomes were assessed for wound infection, dehiscence, hematoma, seroma, closure time, and cosmetic appearance using standardized scoring at days 3, 7, and 30. Patient satisfaction regarding scar appearance was also recorded.

Results: The mean port site closure duration was markedly reduced in the skin adhesive group (2.5 ± 0.4 minutes) relative to the suture cohort (6.8 ± 0.7 minutes, $p < 0.001$). The adhesive group exhibited somewhat fewer wound complications, reporting 1 case of mild infection and 1 hematoma, compared to 2 infections and 2 hematomas in the suture group; nevertheless, these differences lacked statistical significance. The cosmetic results, evaluated with the validated Patient and Observer Scar Assessment Scale (POSAS), indicated significantly higher scores in the adhesive group after 30 days (mean 8.2 ± 1.1) compared to the suture group (mean 10.5 ± 1.5 , $p = 0.02$). Patient satisfaction reflected these results, demonstrating greater acceptability of adhesive closure.

Conclusion: Skin adhesives provide a safe, effective, and cosmetically superior alternative to sutures. While sutures remain reliable, adhesives offer practical advantages, especially in day-care laparoscopic procedures or patients prioritizing cosmetic outcomes.

Keywords: Adhesives, Laparoscopic surgery, Port site closure, Sutures, Wound complications.

INTRODUCTION

Laparoscopic surgery has transformed contemporary surgical practice by offering minimally invasive options to traditional open surgery. Laparoscopic surgeries offer benefits such as less postoperative pain, abbreviated hospital stays, expedited healing, and enhanced cosmetic results.^[1,2]

Despite these advantages, the meticulous closure of port sites is an essential procedure in laparoscopic surgery to avert problems such wound infection, hematoma, seroma development, wound dehiscence, and hypertrophic scarring.^[3] Port sites, particularly those above 5 mm, are susceptible to difficulties if not properly closed, underscoring the necessity of choosing an appropriate closure method.^[4]

Historically, sutures have been employed for skin closure at port sites. Sutures, regardless of being absorbable or non-absorbable, ensure secure alignment of wound borders and facilitate effective wound healing.^[5] Nevertheless, suturing possesses specific limits. The process is labor-intensive, necessitates specialized knowledge, and poses a risk of needle-stick accidents. Furthermore, suture marks may result in inferior cosmetic results, which can be a worry for patients, especially in elective surgeries where aesthetics are paramount.^[6]

Skin adhesives, or tissue adhesives, have become a favored substitute for traditional suturing methods. These adhesives consist mostly of cyanoacrylate chemicals that polymerize upon exposure to moisture, creating a robust bond between wound edges.^[7] Skin adhesives provide numerous benefits: they are rapid and simple to apply, decrease surgical duration, obviate the need for needle manipulation, and furnish a bacterial barrier that may lower infection rates. Furthermore, tissue adhesives frequently yield superior cosmetic results, as they do not produce marks like sutures and facilitate accurate approximation of wound edges.^[8,9]

Numerous research have examined the effectiveness of skin adhesives in diverse surgical procedures, encompassing dermatologic, pediatric, and small general surgical interventions. Numerous studies have shown that adhesives offer similar wound strength and safety to sutures, while enhancing patient satisfaction through improved cosmetic outcomes. Nonetheless, information concerning their application specifically for laparoscopic port site closure is scarce.

Laparoscopic port sites, as small punctate wounds exposed to recurrent mechanical stress during instrument handling, necessitate closure procedures that guarantee both endurance and cosmetic appeal.^[10] Assessing traditional sutures against skin adhesives in this context is crucial for identifying the most successful and patient-friendly method. Considering the growing focus on minimally invasive surgery and patient-centered outcomes, it is essential to assess not only the therapeutic effectiveness of closure techniques but also

variables such as operative duration, complication rates, and patient satisfaction.

Aims and Objectives

- To compare the efficacy, safety, and cosmetic outcomes of laparoscopic port site skin closure using conventional sutures versus skin adhesives in patients undergoing elective laparoscopic procedures.

MATERIALS AND METHODS

This prospective, comparative study was conducted over a period of 10 months in the Department of General Surgery at SreeMookambika Institute of Medical Sciences. A total of 60 patients scheduled for elective laparoscopic procedures requiring port site incisions of 5–12 mm were enrolled in the study.

Patients were included irrespective of age or gender, provided they met the inclusion criteria. The inclusion criteria consisted of patients undergoing elective laparoscopic procedures, those with normal wound healing potential, and patients willing to provide informed consent. Patients with uncontrolled diabetes, immunocompromised status, previous port site infection, bleeding disorders, or known allergy to suture material or skin adhesive were excluded to avoid confounding factors affecting wound healing.

Patients were randomly allocated into two equal groups of 30 each. Group A underwent port site skin closure using conventional absorbable sutures, while Group B underwent closure using commercially available skin adhesive (cyanoacrylate-based). Standard aseptic precautions were observed for all procedures.

Laparoscopic procedures were performed under general anaesthesia following routine surgical protocols, and port sites were closed immediately after completion of the surgery. In Group A, closure was achieved using 3-0 or 4-0 absorbable sutures with simple interrupted technique ensuring adequate approximation of wound edges. In Group B, the skin adhesive was applied along the approximated wound edges after gently drying the area with sterile gauze, and the adhesive was allowed to polymerize naturally. No dressing was applied over adhesive-closed wounds unless clinically indicated.

Postoperative assessment was conducted at 24 hours, day 3, day 7, and day 30. Primary outcomes assessed included wound complications such as infection, hematoma, seroma, wound dehiscence, and allergic reactions. Infection was defined as erythema, warmth, pus discharge, or pain requiring antibiotic therapy. Hematoma or seroma formation was diagnosed clinically by palpation and visual inspection. Wound dehiscence was recorded if partial or complete separation of wound edges occurred.

Secondary outcomes included port site closure time, assessed from the start of skin approximation to

completion, cosmetic appearance evaluated using the Patient and Observer Scar Assessment Scale (POSAS) at 30 days, and patient satisfaction regarding scar appearance. Closure time was measured using a stopwatch by an independent observer to reduce bias.

All patients received standard postoperative care including analgesics and wound care instructions. Any adverse events or complications were documented and managed according to standard surgical protocols.

Data collected were entered into a predesigned proforma, and statistical analysis was performed using SPSS version 20.0. Continuous variables such as closure time and POSAS scores were expressed as mean $\pm$ standard deviation, while categorical

variables like infection, hematoma, and dehiscence were expressed as number and percentage. Comparative analysis between the two groups was performed using appropriate statistical tests, with a p-value of <0.05 considered statistically significant.

RESULTS

A total of 60 patients undergoing elective laparoscopic procedures were included, with 30 patients in the suture group (Group A) and 30 in the skin adhesive group (Group B). Age and sex distribution were comparable between the groups ($p=0.92$), providing baseline homogeneity. (Table 1)

Table 1: Age and Sex Distribution

Age Group (years)	Male n(%)	Female n(%)	Total n(%)	p-value
18–30	6 (20%)	9 (30%)	15 (25%)	0.92
31–45	11 (36.7%)	10 (33.3%)	21 (35%)	
46–60	7 (23.3%)	8 (26.7%)	15 (25%)	
>60	5 (16.7%)	4 (13.3%)	9 (15%)	
Total	29 (48.3%)	31 (51.7%)	60 (100%)	

Port number and size were similar across groups ($p=0.95$), ensuring fair comparison of closure techniques. (Table 2)

Table 2: Distribution of number and Size of Ports

Number/Size of Ports	Group A n(%)	Group B n(%)	p-value
1 port, 5 mm	5 (16.7%)	6 (20%)	0.95
2 ports, 5 mm	8 (26.7%)	7 (23.3%)	
3 ports, 5 mm	10 (33.3%)	9 (30%)	
1 port, 10–12 mm	7 (23.3%)	8 (26.7%)	
Total	30 (100%)	30 (100%)	

Both techniques were safe, with slightly lower complication rates in the adhesive group; however, differences were not statistically significant. (Table 3)

Table 3: Distribution of wound Complications

Complication	Group A n(%)	Group B n(%)	p-value
Infection	2 (6.7%)	1 (3.3%)	0.55
Hematoma	2 (6.7%)	1 (3.3%)	0.55
Seroma	1 (3.3%)	1 (3.3%)	1.00
Wound Dehiscence	1 (3.3%)	0 (0%)	0.31
Allergic Reaction	0 (0%)	1 (3.3%)	0.31

Closure with adhesives was significantly faster ($p<0.001$), highlighting their efficiency advantage in laparoscopic procedures. (Table 4)

Table 4: Mean port Site Closure Time

Group	Mean $\pm$ SD (minutes)	p-value
Sutures (Group A)	6.8 $\pm$ 0.7	<0.001
Adhesives (Group B)	2.5 $\pm$ 0.4	

Adhesive closure resulted in lower early postoperative pain (significant on Days 1 and 3), likely due to reduced tissue handling. (Table 5)

Table 5: Early Postoperative Pain (VAS Score)

Postoperative Day	Group A Mean $\pm$ SD	Group B Mean $\pm$ SD	p-value
Day 1	4.2 $\pm$ 0.8	3.5 $\pm$ 0.7	0.01*
Day 3	2.8 $\pm$ 0.6	2.2 $\pm$ 0.5	0.02*
Day 7	1.5 $\pm$ 0.5	1.2 $\pm$ 0.4	0.08

Cosmetic results were significantly better in the adhesive group ($p=0.02$), reflecting minimal scarring and superior wound edge approximation. (Table 6)

Table 6: Cosmetic Outcome (POSAS Score at 30 Days)

Group	Mean $\pm$ SD	p-value
Sutures (Group A)	10.5 $\pm$ 1.5	0.02
Adhesives (Group B)	8.2 $\pm$ 1.1	

Patient satisfaction was significantly higher in the adhesive group ($p=0.03$), consistent with improved cosmetic outcomes and reduced discomfort.(Table 7)

Table 7: Patient Satisfaction

Satisfaction Level	Group A n(%)	Group B n(%)	p-value
Very Satisfied	10 (33.3%)	18 (60%)	0.03*
Satisfied	12 (40%)	10 (33.3%)	
Neutral	6 (20%)	2 (6.7%)	
Dissatisfied	2 (6.7%)	0 (0%)	

DISCUSSION

This prospective study involved 60 patients undergoing various laparoscopic operations, comparing port site closure with traditional sutures (Group A, $n=30$) to skin adhesives (Group B, $n=30$). Both groups exhibited comparable baseline demographic and procedural features, including age and sex distribution, as well as an equivalent number of ports, so assuring that wound characteristics did not affect outcomes.

The current study indicated that wound-related problems were limited and equivalent across the two groups. Skin adhesive closure had a markedly reduced duration (2.5 ± 0.4 min vs. 6.8 ± 0.7 min, $p < 0.001$) and yielded lower early postoperative discomfort on Days 1 and 3, with no significant difference observed by Day 7. The cosmetic outcomes, evaluated using the Patient and Observer Scar Assessment Scale (POSAS), were significantly better in the adhesive group (8.2 ± 1.1 vs. 10.5 ± 1.5 , $p = 0.02$).

Patient satisfaction was elevated with skin adhesives, as 60% of patients indicated they were "very satisfied," in contrast to 33.3% in the suture cohort. The findings indicate that skin adhesives offer a quicker, less painful, and aesthetically pleasing alternative for port site closure without elevating the risk of wound problems.

The current findings correspond with numerous prior research assessing the application of cyanoacrylate-based skin adhesives in laparoscopic port closure. Singh PK et al.^[11] noted similar wound outcomes across adhesive, subcuticular, and transcutaneous suture groups, indicating the shortest closure time with adhesive strips and greater patient satisfaction in the suture group, although the difference in wound healing scores was not statistically significant ($p = 0.86$).

Kim KE et al.^[12] indicated that patients in the skin adhesive cohort exhibited diminished scores in the "satisfaction with appearance" and "symptoms" subcategories of the PSAQ, yet showed no variation in the "appearance" and "consciousness" domains,

suggesting that aesthetic perception is affected by various factors beyond the closure method.

Ramjit SE et al.^[13] similarly discovered that the use of N-Butyl-2-Cyanoacrylate for closure markedly decreased closure time ($p < 0.0001$) and surgical site infection rates ($p < 0.021$) in comparison to sutures, resulting in a reduced hospital stay and no escalation in postoperative discomfort. Sharma T et al.^[14] showed significantly reduced closure times (143.4 ± 17.26 s vs. 227.1 ± 13.25 s) and diminished pain in the adhesive group, along with enhanced cosmetic satisfaction at two months. Ben Safta Y et al.^[15] exhibited comparable benefits, evidenced by markedly reduced closure durations ($p = 0.01$) and superior scar evaluations (median POSAS 9.45 vs. 11.43, $p = 0.005$) in the 2-octyl cyanoacrylate cohort, albeit an elevated incidence of early dehiscence in certain instances.

Moreover, Gandhi DR et al.^[16] validated the safety and efficacy of 2-octyl cyanoacrylate, demonstrating no significant differences in early problems such as film breaking, wound dehiscence, or infection compared to traditional suturing methods. The similar findings across trials underscore that tissue adhesives provide a dependable, efficient, and patient-centric alternative for skin closure in laparoscopic surgery.

Overall, the current study supports the existing evidence showing that skin adhesives improve esthetic results and patient satisfaction while dramatically reducing hospital stays, early postoperative discomfort, and port site closure times. The comparable complication rate further substantiates its application as a secure and effective alternative to traditional sutures.

CONCLUSION

Sutures and skin adhesives are both safe and effective for the closure of laparoscopic port sites. Skin adhesives offer numerous benefits, such as markedly expedited closure time, diminished early postoperative discomfort, enhanced aesthetic results, and elevated patient satisfaction, all without

exacerbating wound problems. These data underscore that adhesives represent a viable and patient-centric alternative to traditional sutures. Their application is especially advantageous in elective or outpatient laparoscopic surgeries, where reducing operational duration and enhancing aesthetic outcomes are crucial. The utilization of skin adhesives can enhance surgical efficiency and patient comfort while ensuring safety and efficacy.

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