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2-octyl cyanoacrylate versus sutures for laparoscopic port-site closure

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Abstract:
Laparoscopic port-site closure requires secure wound approximation with minimal wound care burden and acceptable cosmetic outcomes. Therefore, it is of interest to compare the 2-octyl cyanoacrylate tissue adhesive with conventional sutures. Hence, 60 adults undergoing elective laparoscopic surgery were enrolled, with 30 patients in the tissue-adhesive group and 30 in the 3-0 polyamide suture group; closure time, dressing and follow-up requirements, surgical site infection, cosmetic outcome, patient satisfaction and Stony Brook Scar Evaluation Scale (SBSES) scores were assessed. Tissue adhesive reduced mean closure time (2.5 versus 4.5 minutes; $p<0.05$) and dressing and follow-up requirements ($p=0.001$) and was associated with better cosmetic outcome, patient satisfaction and SBSES distribution (median 4.0 (4.0-5.0) versus 4.0 (3.0-4.0); $p=0.006$), whereas surgical site infection did not differ significantly (3 versus 4 patients; $p=0.688$). Thus, 2-octyl cyanoacrylate provided faster laparoscopic port-site closure with reduced wound care requirements and favorable patient-centered cosmetic outcomes without a significant increase in infection.

Keywords: Laparoscopic surgery, tissue adhesive, 2-octyl cyanoacrylate, port-site closure, cosmetic outcome, sutures

Background:
Laparoscopic surgery is associated with reduced post-operative pain, shorter hospital stay, faster recovery and improved cosmetic outcomes compared with open surgery **[1].** Conventional sutures provide reliable tissue approximation but may be associated with tissue trauma, post-operative discomfort, needlestick injury, surgical site infection and visible suture marks **[2].** Cyanoacrylate based tissue adhesives, particularly 2-octyl cyanoacrylate **[3-5]**, permit rapid skin closure and have bacteriostatic properties **[6].** Tissue adhesives eliminate the need for suture removal and may reduce post-operative wound-care requirements **[7].** Cyanoacrylate adhesives have been used effectively for low-tension laparoscopic port-site incisions **[8].** Recent studies and meta-analyses published from 2021 to 2026 have continued to evaluate tissue adhesives for laparoscopic port-site closure, reporting consistently shorter closure times while showing variable findings for cosmetic and patient-reported outcomes **[9].** Therefore, it is of interest to compare the 2-octyl cyanoacrylate tissue adhesive with conventional sutures for laparoscopic port-site skin closure with respect to closure time, post-operative wound care, surgical site infection, cosmetic outcome and patient satisfaction.

Methodology:
This prospective comparative study was conducted in the Department of General Surgery at Sri Aurobindo Institute of Medical Sciences, Indore, Madhya Pradesh, India. Sixty adults undergoing elective laparoscopic surgery were consecutively enrolled after written informed consent and approval from the Institutional Ethics Committee. Patients aged >18 years undergoing elective laparoscopic procedures with clean, non-infected incision wounds were eligible. Patients with a history of keloid or hypertrophic scar formation, corticosteroid therapy, conversion to open surgery or repeat surgery before scar assessment were excluded. All patients received a single prophylactic dose of a third-generation cephalosporin at induction of anesthesia. Procedures were performed under standard aseptic precautions and fascial and subcutaneous layers at all port sites were closed with polyglactin sutures. Patients were enrolled consecutively and allocated to two groups of 30. Group I received 2-octyl cyanoacrylate tissue adhesive for skin closure, whereas Group II received 3-0 polyamide simple interrupted sutures. For tissue adhesive application, the wound was cleaned, the edges were approximated, a thin layer of adhesive was applied over the apposed edges without allowing adhesive to enter the wound and the adhesive was allowed to dry. Post-operative assessment included inflammation, surgical site infection, dressing and follow-up requirements, cosmetic appearance and patient satisfaction. Scar appearance was assessed using the Stony Brook Scar Evaluation Scale (SBSES) **[18]** on post-operative days 3, 7 and 14. Data were entered in Microsoft Excel and analyzed using SPSS software. Continuous variables were compared using an independent t-test or Mann-Whitney U test and categorical variables using the chi-square test or Fisher's exact test. A p-value <0.05 was considered statistically significant.

Results and Discussion:

Table 1: Consolidated baseline characteristics and comparative outcomes

Variable	Group I (n=30)	Group II (n=30)	p-value
Baseline characteristics / procedure			
Mean age (years)	42.5	45.0	>0.05
Male	13 (43.3%)	25 (83.3%)	
Female	17 (56.7%)	5 (16.7%)	
Laparoscopic cholecystectomy	17	16	
Laparoscopic appendicectomy	8	8	
Laparoscopic inguinal hernia repair	4	6	
Laparoscopic hydatid cyst surgery	1	0	
Closure and wound care			
Mean closure time (minutes)	2.5	4.5	<0.05
One dressing	27 (90%)	0	
Two or more dressings	3 (10%)	30 (100%)	0.001
Two follow-up visits	27 (90%)	0	
Three follow-up visits	3 (10%)	26 (86.7%)	
Five follow-up visits	0	4 (13.3%)	0.001
Surgical site infection present	3 (10%)	4 (13.3%)	0.688
Cosmetic outcome and satisfaction			
Excellent cosmetic outcome	25 (83.3%)	0	
Good cosmetic outcome	2 (6.7%)	26 (86.7%)	
Fair cosmetic outcome	1 (3.3%)	1 (3.3%)	
Poor cosmetic outcome	2 (6.7%)	3 (10%)	0.001

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Excellent patient satisfaction	25 (83.3%)	0	
Good patient satisfaction	2 (6.7%)	26 (86.7%)	
Fair patient satisfaction	1 (3.3%)	1 (3.3%)	
Poor patient satisfaction	2 (6.7%)	3 (10%)	0.001
SBSES score 0	1 (3.3%)	1 (3.3%)	
SBSES score 1	1 (3.3%)	3 (10%)	
SBSES score 3	1 (3.3%)	9 (30%)	
SBSES score 4	13 (43.3%)	14 (46.7%)	
SBSES score 5	14 (46.7%)	3 (10%)	
Median SBSES (IQR)	4.0 (4.0-5.0)	4.0 (3.0-4.0)	0.006

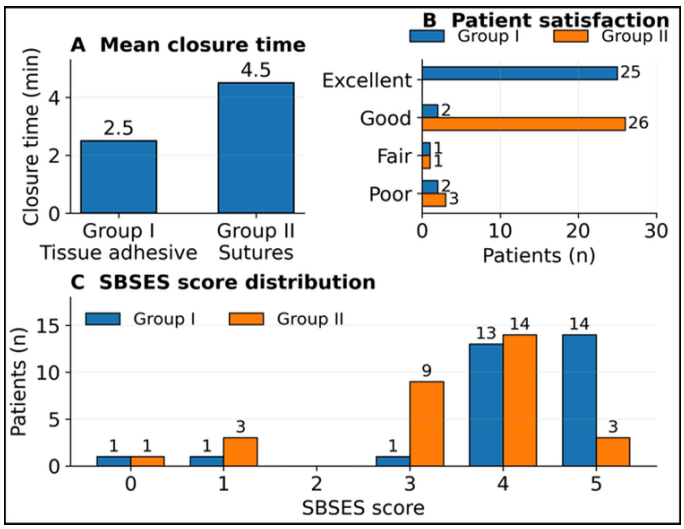


Figure 1: (A) Time required for wound closure in Group I and Group II; (B) patient satisfaction by category; (C) Stony Brook Scar Evaluation Scale score distribution. Group I, tissue adhesive; Group II, sutures

The two groups comprised 30 patients each. Mean age was 42.5 years in Group I and 45.0 years in Group II. Laparoscopic cholecystectomy was the most common procedure (17 versus 16 patients), followed by appendicectomy (8 versus 8) and inguinal hernia repair (4 versus 6). Baseline and outcome data are summarized in **Table 1.** Port-site closure was significantly faster with tissue adhesive, with mean closure times of 2.5 minutes in Group I and 4.5 minutes in Group II ($p<0.05$). This is consistent with reports of reduced closure time with cyanoacrylate-based methods **[8, 19 and 20].** Faster closure may be useful when several port sites require skin approximation. More recent evidence is concordant: a 2021 prospective study, meta-analyses published in 2022 and 2023, a 2024 randomized study and a 2026 randomized trial all reported faster port-site skin closure with cyanoacrylate or tissue adhesive compared with suturing **[9-12, 14 and 15].** Post-operative wound-care requirements were lower with tissue adhesive. Twenty-seven patients (90%) in Group I required only one dressing, whereas all patients in Group II required two or more dressings ($p=0.001$). Similarly, 27 patients (90%) in Group I required only two follow-up visits, compared with none in Group II; the overall distribution of follow-up visits differed significantly ($p=0.001$). Tissue adhesives form a protective surface barrier and eliminate suture removal, which may reduce subsequent wound-care requirements **[7].** A recent Indian prospective cohort also described efficient laparoscopic trocar-site closure with cyanoacrylate and low rates of wound complications **[21].** Surgical site infection occurred in 3 patients (10%) in Group I and 4 patients (13.3%) in Group II, with no significant difference ($p=0.688$). Thus, the faster closure achieved with tissue adhesive was not associated with an evident increase in infection in this sample; cyanoacrylate adhesives have also been described as bacteriostatic **[6].** Recent meta-analyses similarly found no significant difference in overall wound complications between tissue adhesive and suture closure **[10, 11].** The 2025 multicenter STILS trial and the 2026 randomized trial also found no statistically significant difference in wound complication rates between closure methods **[13, 14].** Cosmetic outcome and patient satisfaction favored tissue adhesive ($p=0.001$ for both). Excellent cosmetic outcome and excellent satisfaction were each reported in 25 patients (83.3%) in Group I, whereas most Group II patients had good rather than excellent outcomes. SBSES scores also favored Group I: 14 patients (46.7%) scored 5 compared with 3 (10%) in Group II and median SBSES was 4.0 (4.0-5.0) versus 4.0 (3.0-4.0) ($p=0.006$). Reduced tissue handling and absence of suture marks may contribute to this cosmetic advantage, consistent with previous comparisons of adhesive and suture closure **[22].** Recent evidence regarding cosmesis is mixed **[15-17]**. The 2023 meta-analysis reported comparable cosmetic outcomes and patient satisfaction between skin adhesives and absorbable sutures **[11],** the 2025 STILS trial favored sutures on scar scores **[13],** whereas the 2026 randomized trial found comparable objective cosmesis but better patient-reported cosmetic ratings with adhesive glue **[14].** Differences in closure material, outcome scales and follow-up duration may explain some of the variation between studies. The study is limited by the small sample size and short follow-up, which precluded assessment of long-term scar maturation. Larger multicenter studies with longer follow-up are required to determine the durability of the cosmetic and patient-satisfaction benefits observed here. **Figure 1** summarizes closure time, patient satisfaction and SBSES findings.

Conclusion:

2-Octyl cyanoacrylate tissue adhesive was a safe and effective alternative to conventional sutures for laparoscopic port-site skin closure in this cohort. It reduced closure time, dressing requirements and follow-up visits and was associated with better cosmetic outcome, patient satisfaction and SBSES scores, while surgical site infection did not differ significantly between groups. These findings support tissue adhesive as a practical option for appropriately selected low-tension laparoscopic port-site wounds.

Conflict of interest:

The authors have no relevant financial or non-financial interests to disclose.

Source of funding:

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Ethical approval:
The study was conducted after approval from the Institutional Ethics Committee of Sri Aurobindo Institute of Medical Sciences, Indore. Written informed consent was obtained from all study participants.

Consent for publication: Not applicable

Data availability:
All data relevant to the study are included in the article. The datasets generated and/or analyzed during the current study are available from the corresponding author on reasonable request.

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Author Contribution and Abbreviations:
Shantanu Yadav: data collection, manuscript preparation and final approval of the manuscript. Pervej Sharik Khan: study conception and design, data collection, analysis and interpretation of data, manuscript drafting and final approval of the manuscript. Parmanand Tiwari: preparation of tables, assistance in drafting the Results section and final approval of the manuscript. Advait Prakash: study supervision, critical revision of the manuscript and final approval of the manuscript. SBSES, Stony Brook Scar Evaluation Scale; IQR, interquartile range. Group I, 2-octyl cyanoacrylate tissue adhesive; Group II, 3-0 polyamide sutures.

Advancement to knowledge:
This study adds prospective comparative evidence that 2-octyl cyanoacrylate tissue adhesive can provide faster laparoscopic port-site skin closure and reduce post-operative dressing and follow-up requirements compared with conventional sutures, without increasing surgical site infection. It also demonstrates favorable patient satisfaction, cosmetic outcomes and Stony Brook Scar Evaluation Scale scores with tissue adhesive.

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