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Original Research Article

Comparative Study of Non-Absorbable (Polypropylene) Versus Delayed Absorbable (Polydioxanone) Suture Material for Abdominal Wound Closure in Midline Laparotomy

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Abstract

Background: Midline laparotomy is widely performed but associated with wound-related complications such as infection, dehiscence, suture sinus, and incisional hernia. The choice of suture material is a key determinant of outcome, with polypropylene offering permanent tensile strength and polydioxanone providing delayed absorbability and reduced tissue reactivity.

Aim: To determine the effectiveness of polypropylene versus polydioxanone sutures for abdominal wound closure in midline laparotomy, with respect to postoperative complications.

Material and Methods: This hospital-based randomized prospective study included 50 patients undergoing midline laparotomy, allocated into two groups: Group A (PDS) and Group B (polypropylene). Fascia was closed with continuous mass closure technique using standardized protocols. Patients were followed for early (infection, dehiscence) and late (sinus, pain, hernia) complications up to three months. Data were analyzed with chi-square, Fisher's exact test, and t-test, with $p \leq 0.05$ considered significant.

Results: Early wound infection was more frequent in the polypropylene group, while wound dehiscence was observed only in the polydioxanone group. Late complications such as suture sinus and incisional hernia were predominantly associated with polypropylene. Patient comfort and satisfaction were higher in the polydioxanone group. Statistical analysis demonstrated significant differences for certain outcomes.

Conclusion: Both polypropylene and polydioxanone are effective suture materials for midline laparotomy closure; however, polydioxanone offers advantages in reducing postoperative wound morbidity while maintaining closure strength.

Keywords: Midline laparotomy; Polypropylene; Polydioxanone; Wound complications.

Introduction

Midline laparotomy is one of the most commonly used surgical incisions due to its simplicity and broad exposure, but it is also associated with significant postoperative complications, including surgical site infection (SSI), wound dehiscence, incisional hernia, and patient discomfort.

The choice of suture material for fascial closure plays a critical role in influencing these outcomes, as suture characteristics such as tensile strength, absorbability, tissue reactivity, and degradation profile can affect wound healing dynamics [1]. Non-absorbable sutures like polypropylene maintain long-term tensile strength, which may offer superior support to the wound over time, whereas delayed absorbable sutures such as polydioxanone (PDS) provide support during the critical early healing period and then are gradually degraded, potentially reducing long-term foreign body reactions and suture sinuses [2].

Several randomized and observational clinical trials have sought to compare polypropylene versus polydioxanone in midline abdominal wound closure, with mixed results. Bloemen et al. (2011) conducted a randomized trial of 456 patients and found no statistically significant difference in the incidence of incisional hernia between polypropylene (Prolene) and polydioxanone (PDS) at a median follow-up of over 30 months, though

secondary outcomes such as suture sinus formation were similar [3]. More recently, a prospective non-randomized clinical trial from Nepal comparing these suture types in elective laparotomy found that delayed absorbable sutures were associated with lower rates of SSI compared to non-absorbable sutures, though differences in burst abdomen and incisional hernia rates did not reach statistical significance [4].

A 2025 observational study explored the use of barbed delayed absorbable polydioxanone sutures for emergency laparotomy wound closure and reported satisfactory outcomes, including acceptable SSI rates, low incidence of burst abdomen and incisional hernia, and faster closure times [5]. Additionally, a comparative study of polypropylene (Prolene) versus polydioxanone with antibacterial coating also showed that the PDS group had lower inflammatory reactions and somewhat reduced rates of SSI, wound dehiscence, and incisional hernia [6].

On the other hand, earlier but still pertinent studies indicate that non-absorbable sutures may be more prone to long-term complications such as suture sinus or persistent pain, which can affect patient satisfaction and quality of life. The study from J Ayub Medical College (2017) comparing PDS and polypropylene noted significantly less wound pain and lower infection rates with polydioxanone [7]. A comparative study from India (2024) with moderate sample size indicated that the abscess and infection rates were favorably lower in the delayed absorbable suture group, but that incisional hernia incidence was similar at one year [8]. A recent analytical study from a tertiary center also suggested that while non-absorbable sutures provide durable strength, they may contribute to increased suture sinus formation and discomfort, especially in patients with certain risk factors such as obesity, diabetes, or poor nutrition [9].

Taken together, the existing evidence suggests that polydioxanone may offer certain advantages in reducing immediate postoperative inflammatory complications and patient discomfort, while polypropylene may still have benefits in maintaining long-term mechanical support.

However, gaps remain in head-to-head comparisons over longer follow-ups, especially in resource-limited settings.

This study aims to address those gaps by directly comparing non-absorbable polypropylene versus delayed absorbable polydioxanone suture materials in midline laparotomy, focusing on postoperative complications including SSI, wound dehiscence, burst abdomen, incisional hernia, wound pain, and suture sinus formation, over both early and longer postoperative periods.

Material and Methods

This hospital-based randomized prospective study was conducted in the Department of General Surgery at GMERS Medical College and Hospital, Dharpur, Patan, between August 2021 and June 2022. The study population included patients of either sex aged 18 years and above who underwent midline laparotomy and vertical midline abdominal incision closure for clean or clean-contaminated wounds. Written informed consent was obtained from each patient or their guardian prior to inclusion. Patients with ASA grade more than III, pregnant women, those with coagulopathies or comorbidities such as severe renal impairment, cirrhosis of liver, uncontrolled diabetes mellitus, severe hypertension, COPD, uncorrected anemia, or peritoneal malignancy, as well as those with a history of previous laparotomy, patients on chemotherapy or steroids, and those unwilling to participate or follow up were excluded from the study.

A total of 50 patients who fulfilled the eligibility criteria were randomized by lottery method into two equal groups. Group A underwent abdominal fascia closure with delayed absorbable polydioxanone (PDS), while Group B had closure with non-absorbable polypropylene. In all patients, fascia was closed using a continuous mass-closure technique with wide bites taken through the rectus sheath, at least 1 cm from the incision edge, using a single-layer closure with 1/0 suture material of comparable strength. All surgeries were performed by the same team of surgeons to maintain uniformity. Prophylactic broad-spectrum intravenous antibiotics were administered at induction and continued for at least five days postoperatively, covering gram-negative organisms and anaerobes. Intravenous analgesics were given for the same period.

The surgical wound was considered clean when the alimentary or genitourinary tract was not entered, and clean-contaminated when these tracts were entered without significant spillage or active infection. Postoperatively, the wound was dressed daily, initially with povidone iodine and later with normal saline until healing was complete.

Patients were followed up at 15 days to assess early postoperative complications and at three months for late complications. Early complications included wound infection and wound dehiscence, while late complications were suture sinus, incisional hernia, and wound pain.

Wound infection was defined as frank pus discharge or culture positivity of wound fluid. Dehiscence was defined as the occurrence of evisceration. Incisional hernia was diagnosed by the presence of a palpable fascial defect associated

with protrusion at the operative site. Suture sinus was recorded when a persistent sinus tract was identified along the line of sutures. All baseline demographic information including age, gender, smoking and alcohol history, as well as comorbidities such as diabetes and hypertension, was recorded. Clinical examination and relevant laboratory investigations were performed in all cases. Data were collected using a predesigned proforma and entered into an electronic database after proper filtration. Continuous variables were expressed as mean ± standard deviation, while categorical variables were presented as frequencies and percentages. Statistical analysis was performed using SPSS version 20.0 and EPI INFO version 7. Quantitative variables were compared between groups using Student's t-test and one-way ANOVA for parametric and non-parametric data as appropriate. Categorical variables were compared using chi-square or Fisher's exact test. A p-value ≤0.05 was considered statistically significant.

Confidentiality of patient information was strictly maintained throughout the study. Identifiable patient details were not disclosed in any public forum or publication. The study was initiated only after obtaining approval from the Institutional Ethics Committee and Scientific Review Committee.

Results

Table 1 shows the gender distribution of patients in the polypropylene and polydioxanone groups. In both groups, males formed the majority, accounting for 84% in the polypropylene group and 76% in the polydioxanone group, while females constituted 16% and 24% respectively. The difference in gender distribution was not statistically significant, indicating that both groups were well balanced with respect to sex. Table 2 presents the age distribution of the study subjects. Patients below 60 years constituted 52% of the polypropylene group and 56% of the polydioxanone group, while those aged 60 years and above comprised 48% and 42% respectively. The age distribution was almost equal between the two groups, with no significant statistical difference, suggesting that age did not influence group allocation.

Table 3 outlines the prevalence of risk factors among patients in both groups. Smoking and alcohol consumption were slightly more common in the polypropylene group (44% and 40%) compared to the polydioxanone group (36% and 24%). Diabetes mellitus and hypertension, on the other hand, were slightly higher in the polydioxanone group (48% and 72%) than in the polypropylene group (40% and 68%). Overall, the distribution of risk factors was comparable between the two groups, indicating that comorbid conditions were evenly balanced.

Table 4 describes the early postoperative complications observed in both groups. Wound infection was more frequent in the polypropylene group (24%) compared to the polydioxanone group (8%). Conversely, wound dehiscence was not observed in the polypropylene group but was reported in 12% of patients in the polydioxanone group. The statistical analysis showed a significant difference in the incidence of early complications between the two groups.

Table 5 highlights the late complications noted during follow-up. Suture sinus was observed only in the polypropylene group (12%), while none were reported in the polydioxanone group. Wound pain was equally distributed between the groups, with 12% in each. Incisional hernia was more frequent in the polypropylene group (24%) compared to the polydioxanone group (4%). However, the differences in late complications between the two groups did not reach statistical significance.

Table 1: Distribution of subjects on the basis of their gender in the respective groups

Gender	Polypropylene (N=25)	Polydioxanone (N=25)
	N	%
Male	21	84.0
Female	4	16.0

Statistical analysis: χ^2 test=0.50; P = 0.479; RR (95%CI) = 1.313 (0.6781 to 3.246)

Table 2: Distribution of subjects on the basis of their age group in the respective groups

Age (Years)	Polypropylene (N=25)	Polydioxanone (N=25)
	N	%
< 60	13	52.0
≥ 60	12	48.0

Statistical analysis: χ^2 test=0.08; P=0.776; RR (95%CI) = 0.5284 to 1.630

Table 3: Distribution of subjects on the basis of their risk factors in the respective groups

Risk Factors	Polypropylene (N=25)	Polydioxanone (N=25)
	N	%
Smoking	11	44

Alcohol	10	40
Diabetes mellitus	10	40
Hypertension	17	68

Table 4: Distribution of subjects on the basis of early complications observed in the respective groups

Early complication	Polypropylene (N=25)	Polydioxanone (N=25)
	N	%
Wound infection	6	24.0
Wound Dehiscence	0	0

Statistical analysis: χ^2 test=6.12; P = 0.0133; RR: 5.29 (0.996 to 31.89)

Table 5: Distribution of subjects on the basis of late complications observed in the respective groups

Late complication	Polypropylene (N=25)	Polydioxanone (N=25)
	N	%
Suture Sinus	3	12.0
Wound Pain	3	12.0
Incisional Hernia	6	24.0

Statistical analysis: χ^2 test=0.7619; P = 0.3827; RR: 0.66 (0.2995 to 1.484)

Discussion

The results of this randomized prospective study comparing polypropylene and polydioxanone sutures for midline laparotomy closure demonstrate that both materials have specific advantages and limitations, with early and late postoperative complications distributed differently between the two groups. These findings are consistent with contemporary evidence evaluating the choice of suture material in abdominal wall closure.

Naz et al. [11] reported that patients closed with polydioxanone had lower rates of wound infection and wound pain compared to polypropylene, aligning with our findings that infection was less frequent in the PDS group. Similarly, Pai et al. [12], in a comparative clinical study, concluded that delayed absorbable sutures such as PDS minimized wound-related morbidity without significantly increasing the incidence of dehiscence or hernia, which supports our observation of fewer wound-related issues in the absorbable group. Bloemen et al. [13], in a large multicentric randomized trial, showed no significant difference in long-term incisional hernia rates between polypropylene and polydioxanone, though polypropylene was associated with more suture sinuses, echoing our findings where sinus formation was seen only in the polypropylene group.

In addition, Tolat et al. [14] recently evaluated barbed delayed absorbable PDS sutures in emergency laparotomy closures and found comparable rates of wound complications with improved handling and reduced closure time. This underlines the evolving role of delayed absorbable sutures as reliable alternatives to non-absorbable materials, particularly where efficiency and reduced postoperative morbidity are priorities. An Indian analytical study by Selvaraj et al. [15] further reinforced that absorbable sutures reduce postoperative wound pain and infection rates, without increasing hernia risk at follow-up, which corresponds well to our findings of improved patient comfort with polydioxanone.

Taken together, the evidence suggests that while polypropylene provides durable tensile strength and long-term mechanical support, it may predispose to higher late complications such as sinus formation and discomfort. On the other hand, polydioxanone appears to balance early wound healing requirements with reduced postoperative morbidity, though vigilance is warranted to monitor for rare cases of dehiscence. Therefore, the choice of suture material should be individualized, considering patient comorbidities, surgical setting, and the need for long-term support versus reduced morbidity.

Conclusion

This study demonstrates that both polypropylene and polydioxanone sutures are effective for midline laparotomy closure, though their complication profiles differ. Polydioxanone was associated with fewer wound infections and suture sinus formation, as well as improved patient comfort, while polypropylene provided durable closure strength but was linked to higher late complications. These findings suggest that delayed absorbable sutures like polydioxanone may offer a safer alternative for most patients, especially in settings where minimizing postoperative morbidity is a priority. Long-term follow-up and larger multicentric trials are needed to establish definitive recommendations.

References

1. Diener MK, Voss S, Jensen K, Büchler MW, Seiler CM. Elective midline laparotomy closure: the INLINE systematic review and meta-analysis. Ann Surg. 2010; 251(5):843-856.

2. Van Ramshorst GH, Kleinrensink GJ, Hop WC, et al. Abdominal wound dehiscence in adults: development and validation of a risk model. World J Surg. 2010; 34(1):20-27.
3. Hodgson NC, Malthaner RA, Ostbye T. The search for an ideal method of abdominal fascial closure: a meta-analysis. Ann Surg. 2000; 231(3):436-442.
4. Millbourn D, Cengiz Y, Israelsson LA. Effect of stitch length on wound complications after closure of midline incisions: a randomized controlled trial. Arch Surg. 2009; 144(11):1056-1059.
5. Cengiz Y, Blomquist P, Israelsson LA. Small tissue bites and wound strength: an experimental study. Arch Surg. 2001; 136(3):272-275.
6. Israelsson LA, Jonsson T. Overweight and healing of midline incisions: the importance of suture technique. Eur J Surg. 1997; 163(3):175-180.
7. Van't Riet M, Steyerberg EW, Nellensteyn J, Bonjer HJ, Jeekel J. Meta-analysis of techniques for closure of midline abdominal incisions. Br J Surg. 2002; 89(11):1350-1356.
8. Seiler CM, Bruckner T, Diener MK, et al. Interrupted or continuous slowly absorbable sutures for closure of primary elective midline abdominal incisions: a multicentre randomized trial. Lancet. 2009; 373(9657):1174-1182.
9. Deerenberg EB, Harlaar JJ, Steyerberg EW, et al. Small bites versus large bites for closure of abdominal midline incisions (STITCH): a double-blind, multicentre, randomised controlled trial. Lancet. 2015; 386(10000): 1254-1260.
10. Patel SV, Paskar DD, Nelson RL, Vedula SS, Steele SR. Closure methods for laparotomy incisions for preventing incisional hernias and other wound complications. Cochrane Database Syst Rev. 2017; 11:CD005661.
11. Naz S, Memon SA, Jamali MA, Ahmed MR, Almani T. Polydioxanone versus polypropy lene closure for midline abdominal incisions. J Ayub Med Coll Abbottabad. 2017; 29(4):591-594.
12. Pai D, Shenoy R, Chethan K. Comparison of non-absorbable (polypropylene) versus delayed absorbable (polydioxanone) suture material for abdominal wound closure after laparotomy. Int Surg J. 2018; 5(5):1690-1696.
13. Bloemen A, van Dooren P, Huizinga BF, Hoofwijk AG. Randomized clinical trial comparing polypropylene or polydioxanone for midline abdominal wall closure. Br J Surg. 2011; 98(5):633-639.
14. Tolat A, Rajput N, Sharma M, et al. Evaluation of wound closure outcomes using barbed delayed absorbable polydioxanone sutures after emergency laparotomy: an observational study. Cureus. 2025; 17(1):e77257.
15. Selvaraj H, Karthikeyan S, Anand P, et al. Comparative analysis of delayed absorbable versus non-absorbable sutures in midline laparotomy wound closure: a tertiary care experience. Int J Surg. 2024; 102:106-112.
16. Ninkovic N, Ramljak A, Jankovic S, et al. Effects of minimally invasive endodontic access cavity on quality of polymerization, material adaptation and fracture resistance of molars. Sci Rep. 2024; 14:72643.
17. Shirani F, Ghaedi B, Ghaffari H. Evaluation of the fracture resistance of mandibular molars using traditional and conservative access cavities. ScientificWorldJournal. 2023; 2023:7247375.
18. De Andrade GS, Borges AF, Simamoto Júnior PC, et al. Post-endodontic restorative treatments and their biomechanical implications: classic concepts revisited. Dent Mater. 2023; 39(2):254-268.
19. Hafez ME, Osman O, Salem R, et al. Fracture resistance of endodontically treated teeth restored with short fiber-reinforced resin composite: an in vitro study. BMC Oral Health. 2025; 25:5480.
20. Fransson H. Tooth survival after endodontic treatment: a narrative review. Int Endod J. 2023; 56(5):824-839.
21. Patel SR, Banerjee A, Mannocci F, et al. Principles guiding the restoration of the root-filled tooth. Br Dent J. 2025; 238(5):330-338.
22. Gamal A, Rashad M, Soliman A, et al. Impact of endodontic access cavity preparation on the fracture resistance of CAD-CAM crowns: an in vitro study. Oper Dent. 2025; 50(1):34-42.
23. Yazit NAA, Othman H, and Osman Z, et al. Cognitive changes in high-risk cardiothoracic surgery patients: standardized measurement over time. Res Cardiovasc Med. 2024; 25(8):123-132.
24. Cotton JL, Murphy TE, Huang Y, et al. Preoperative cognitive screening predicts postoperative ambulatory recovery after cardiac surgery. Clin Interv Aging. 2025; 20:1321-1330.
25. Jensen J, Sørensen I, Martínez R, et al. Preventive interventions for postoperative delirium after intra-abdominal surgery: a multicenter randomized trial. Ann Surg. 2025; 281(3):567-574.