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Original Research Article

Abdominal Wall Closure after Laparotomy: Comparative Effectiveness of Polypropylene and Polydioxanone Sutures in a Tertiary Care Centre

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Abstract

Background: Abdominal wall closure after laparotomy is a crucial determinant of surgical outcomes. Inadequate closure may result in wound dehiscence, surgical site infection (SSI), suture sinus, and incisional hernia, leading to increased morbidity and healthcare costs. The choice of suture material remains debated, with non-absorbable polypropylene offering long-term strength but associated with foreign body reaction, and absorbable polydioxanone providing prolonged tensile support with potentially fewer chronic complications.

Methods: This prospective comparative study was conducted at F.M. Medical College and Hospital, Balasore, Odisha between October 2023 and October 2025, including 100 patients undergoing elective or emergency midline laparotomy. Patients were randomized into two groups: Group A underwent abdominal wall closure with No. 1 loop polypropylene (Prolene®) and Group B with No. 1 loop polydioxanone (PDS®). Patients were assessed for early complications (SSI, wound dehiscence, suture sinus) and late complications (incisional hernia) during a six-month follow-up. Data were analyzed using chi-square or Fisher's exact test, with $p<0.05$ considered statistically significant.

Results: Baseline characteristics, including age, sex, comorbidities, and diagnosis, were comparable between groups. Surgical site infection occurred in 18 patients (36%) in the polypropylene group versus 14 (28%) in the polydioxanone group. Wound dehiscence was noted in 6% of polypropylene and 4% of polydioxanone patients. Suture sinus occurred in 6% of polypropylene cases but in none with polydioxanone. At six months, incisional hernia rates were identical in both groups (4%).

Conclusion: Both polypropylene and polydioxanone are effective for abdominal wall closure following laparotomy. However, polydioxanone showed a trend toward fewer wound complications, particularly SSI and suture sinus, while long-term outcomes such as incisional hernia were similar. Polydioxanone may therefore represent a safer alternative in reducing early wound morbidity.

Keywords: Laparotomy, abdominal wall closure, polypropylene, polydioxanone, surgical site infection, incisional hernia.

Introduction

Abdominal wound closure following laparotomy is a critical step in surgery, as inadequate closure can result in severe complications such as wound dehiscence, burst abdomen, surgical site infection (SSI), and incisional hernia. These complications increase morbidity, prolong hospital stay, and add to healthcare costs. Reported rates of wound dehiscence range between 0.4% and 3.5%, while incisional hernia develops in up to 20% of cases depending on patient- and technique related factors [1,2]. The ideal closure method and suture material remain a subject of debate, with the aim of minimizing both early and late postoperative complications [3]. The choice of suture material plays a significant role in fascial healing. Non-absorbable sutures such as polypropylene provide durable tensile strength but are associated with foreign body reaction, suture sinus, and chronic wound pain [4]. In contrast, delayed absorbable sutures such as polydioxanone retain tensile strength for several weeks and are gradually absorbed, theoretically reducing chronic sinus formation while maintaining support during the critical healing phase [5]. Several randomized

controlled trials (RCTs) and observational studies have compared these two materials, but results remain conflicting. Some studies suggest fewer SSIs and wound complications with polydioxanone [6,7], while others report no significant differences [8]. Singla et al. reported more wound pain, burst abdomen, and incisional hernia in the polypropylene group compared to polydioxanone, although differences were not statistically significant [8]. Pai et al. found SSI significantly higher in polypropylene closures (45.5%) versus polydioxanone (23.2%) in elective laparotomies [6]. Similarly, Ansari et al. demonstrated significantly fewer wound infections and suture sinus with polydioxanone compared to polypropylene [7]. Cameron et al., in a landmark randomized trial, showed that dehiscence was significantly lower with polydioxanone (0.7% vs. 6.4%, p=0.018), while long-term incisional hernia rates were similar [9].

Despite substantial research, no universal consensus exists regarding the superior suture for abdominal fascial closure. Outcomes are influenced not only by suture choice but also by patient factors such as comorbidities, nutritional status, and wound contamination, as well as by surgical technique [1,3]. The present study was therefore conducted to compare No.1 loop polypropylene and No.1 loop polydioxanone sutures for midline abdominal wall closure in emergency and elective laparotomies, with the objective of evaluating their relative efficacy in preventing common postoperative wound complications.

Materials and Methods

This prospective comparative study was conducted in the Department of General Surgery at F.M. Medical College and Hospital, Balasore, Odisha between October 2023 and October 2025 over a period of two years. A total of 100 patients undergoing midline laparotomy, either elective or emergency, were included after obtaining institutional ethics committee approval and informed consent. Patients aged above 18 years undergoing primary laparotomy were eligible, while those with previous midline laparotomy, immunocompromised status, malignant peritoneal involvement, or requiring stoma formation were excluded.

Patients were randomized into two groups: Group A underwent mass closure of the abdominal fascia with No.1 loop polypropylene (Prolene®), and Group B with No.1 loop polydioxanone (PDS®). Closure was performed using continuous mass closure technique, maintaining a suture-to-wound length ratio of approximately 4:1. Skin was closed with nylon. Patients were monitored for early postoperative complications, including surgical site infection (SSI), wound dehiscence, and burst abdomen, during their hospital stay and up to four weeks postoperatively. Late complications such as suture sinus and incisional hernia were assessed during follow-up visits at 3 and 6 months. Data were collected using a predesigned proforma, and statistical analysis was performed using SPSS software (version XX), applying chi-square test or Fisher's exact test for categorical variables and independent t-test for continuous variables, with $p<0.05$ considered statistically significant.

Results

A total of 100 patients undergoing midline laparotomy were included in the study, with 50 patients randomized to polypropylene and 50 to polydioxanone. The demographic distribution was comparable between the two groups. The mean age was 44.96 ± 16.6 years in the polypropylene group and 44.1 ± 16.52 years in the polydioxanone group. Patients were well distributed across age groups, with no statistically significant difference (p=0.816). Both groups demonstrated a male predominance, with 66% males in the polypropylene group and 74% in the polydioxanone group; the gender difference was not significant (p=0.346).

Table 1: Demographic Characteristics of Patients

Characteristic	Poplypropylene (n=50)	Polydioxanone (n=50)
Mean Age in years	44.96 ± 16.66	44.1 ± 16.52
≤ 20	2 (4%)	4(8%)
21-40	22(44%)	18(36%)
41-60	13(26%)	19(38%)
≥ 60	13(26%)	9(18%)
Male : Female	33 : 17	37 : 13

The clinical diagnoses were varied, with intestinal perforation (22%) and peptic perforation (18%) being the most frequent indications for laparotomy in the polypropylene group, while carcinoma colon (24%) and peptic perforation (14%) predominated in the polydioxanone group. Other common indications included ileocaecal tuberculosis, abdominal trauma, retroperitoneal tumors, and carcinoma stomach.

Between-group comparisons of clinical diagnoses did not reveal any significant differences (p>0.05), suggesting both groups had comparable case mixes.

Comorbidities such as anemia, diabetes mellitus, and hypertension were prevalent in both groups, with no significant intergroup differences.

Table 2: Distribution of Clinical Diagnoses

Clinical Diagnosis	Poplypropylene (n=50)	Polydioxanone (n=50)
Intestinal Perforation	11(%)	5(10%)
Peptic Perforation	9(%)	7(14%)
Ca Colon	7(%)	12(24%)
Ca Stomach	2(%)	4(8%)
Intestinal Obstruction	7(%)	2(4%)
Ileocaecal Tb	5(%)	6(12%)
Retroperitoneal Tumor	5(%)	3(6%)
Abdominal Trauma	4(%)	6(12%)
Pancreatic Pseudocyst		5(10%)

With regard to intraoperative findings, gastrointestinal tract opening occurred in 58% of patients in the polypropylene group and 56% in the polydioxanone group, which was not statistically different (p=0.842). Early postoperative complications demonstrated a trend favoring polydioxanone. Surgical site infection was observed in 18 patients (36%) with polypropylene and 14 patients (28%) with polydioxanone. Wound dehiscence was reported in 6% of the polypropylene group compared to 4% in the polydioxanone group, while suture sinus occurred in 6% of patients in the polypropylene group but was absent in the polydioxanone group. Although these outcomes were not statistically significant in between-group comparison, the absence of suture sinus with polydioxanone suggests a possible advantage.

Table 3: Early Postoperative Complications

Complication	Poplypropylene (n=50)	Polydioxanone (n=50)
SSI	18(36%)	14(28%)
Wound Dehiscence	3(6%)	2(4%)
Suture Sinus	3(6%)	0(0%)
GI Tract Opened	29(58%)	28(56%)

At six months follow-up, late complications were noted.

Incisional hernia developed in 2 patients (4%) each in both groups, indicating no difference in long-term wound integrity. Persistent SSI was reported in 4% of polypropylene cases versus 2% of polydioxanone cases. Suture sinus persisted only in the polypropylene group (6%). Overall, polydioxanone demonstrated a trend toward fewer wound-related complications, especially suture sinus, whereas both sutures were comparable in terms of incisional hernia prevention.

Table 4: Late Complications At 6-month Follow-up

Complication	Poplypropylene (n=50)	Polydioxanone (n=50)
Incisional Hernia	2(4%)	2(4%)
Persistent SSI	2(4%)	1(2%)
Suture Sinus	3(6%)	0(0%)

Discussion

The present study compared No. 1 loop polypropylene and No. 1 loop polydioxanone sutures for midline abdominal closure in patients undergoing elective and emergency laparotomy.

The findings demonstrated that while both materials were effective in achieving secure fascial closure, polydioxanone was associated with fewer postoperative complications, particularly surgical site infection (SSI) and suture sinus, although the difference was not statistically significant. These observations support the view that suture choice influences wound outcomes, particularly in the early postoperative period. Our results are consistent with several published studies. Ansari et al. reported significantly lower rates of wound infection (15.2% vs. 27.2%) and suture sinus (3.2% vs. 19.2%) in patients closed with polydioxanone compared to polypropylene [4].

Similarly, Pai et al. observed that SSI was significantly higher with polypropylene (45.5%) compared to polydioxanone (23.2%) in elective laparotomy, though there was no difference in incisional hernia rates [6].

In our study, while the reduction in SSI with polydioxanone did not reach statistical significance,

the complete absence of suture sinus mirrors these findings and highlights the advantage of using absorbable monofilament sutures in minimizing chronic inflammatory response. Cameron et al., in a landmark randomized controlled trial, found that dehiscence rates were significantly lower with polydioxanone (0.7%) compared to polypropylene (6.4%), while incisional hernia rates were similar at one year [5]. Our results are in agreement with this observation, as wound dehiscence was less frequent with polydioxanone, and incisional hernia rates were comparable between groups at six months. More recently, Singla et al. reported that polypropylene was associated with longer-lasting wound pain and higher rates of burst abdomen and incisional hernia, although the differences were not statistically significant [7]. These consistent trends across studies suggest that the benefits of polydioxanone may lie in better early wound healing and lower incidence of suture-related complications, while long-term outcomes such as hernia remain unaffected by suture type.

Despite these encouraging findings, it is important to recognize that patient-related factors such as nutritional status, comorbidities, and contamination of the surgical field also play a crucial role in wound outcomes [1,3]. Meta-analyses, including the INLINE systematic review, emphasize that while suture material contributes to outcomes, surgical technique and adherence to the small-bite continuous closure principle are equally, if not more, important in reducing incisional hernia and wound dehiscence [2]. Our study is limited by a relatively short follow-up period of six months and a modest sample size, which may underestimate the true incidence of late complications such as incisional hernia. Larger randomized trials with long-term follow-up are needed to confirm the superiority of one suture material over the other.

Conclusion

Both polypropylene and polydioxanone are effective suture materials for abdominal wall closure following laparotomy. However, polydioxanone demonstrated a trend toward fewer postoperative complications, particularly surgical site infection and suture sinus, while long-term outcomes such as incisional hernia were comparable between the groups. These findings suggest that polydioxanone may offer a safer alternative in reducing early wound morbidity without compromising long-term closure integrity.

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