

Comparison of Prolene Versus Polydioxanone (PDS) for Midline Laparotomy Wound Closure: A Randomized Controlled Trial

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Abstract

Background: Closure of the abdominal wall after laparotomy is critical to minimize postoperative complications such as wound infections, burst abdomen, and incisional hernias. The choice of suture material is pivotal since an ideal suture should provide adequate strength, be tension free, minimize ischemia, and reduce the risk of infection. Traditionally, nonabsorbable sutures like Prolene have been used; however, their propensity to provoke foreign body reactions may predispose patients to higher infection rates. In contrast, absorbable materials such as Polydioxanone (PDS) offer prolonged tensile strength with gradual absorption, potentially reducing infection risks.

Objective: This study aimed to compare Prolene and PDS in terms of wound infection rates following midline abdominal wound closure in patients undergoing laparotomy.

Study Design and Setting: A randomized controlled trial was conducted at RMU and Allied Hospitals over a six-month period (April 2021 to September 2021).

Methods: A total of 140 patients meeting the inclusion criteria (ages 14–70 years, undergoing midline laparotomy for either elective or emergency indications) were enrolled. Patients with previous midline incisions, gynecological surgeries, diabetes, carcinoma, or immunocompromised status were excluded. Participants were randomized by lottery into two equal groups (n = 70 each). Group A underwent abdominal wall closure using nonabsorbable Prolene, while Group B received absorbable PDS. Closure was performed using a continuous single-layer mass closure technique incorporating both anterior and posterior rectus sheaths. Postoperatively, patients were managed with daily dressings and followed weekly for one month to evaluate for surgical site infection (SSI). Wound infections were defined as clinical evidence of deep tissue separation, erythema, or purulent/serous discharge confirmed by culture where applicable.

Results: Demographic characteristics were comparable between groups. The mean age in Group A was 38.16 ± 16.37 years and 39.69 ± 17.73 years in Group B, with similar gender distributions. Analysis revealed a statistically significant difference in wound infection rates: 54.3% (38/70) in the Prolene group versus 24.3% (17/70) in the PDS group ($p = 0.000$). Stratified analyses by age, gender, body mass index, duration of surgery, and whether the case was emergency versus elective further supported the lower infection rate with PDS.

Conclusion: The study demonstrated that closure with absorbable PDS results in a significantly lower rate of wound infection compared to nonabsorbable Prolene in midline laparotomy closures. These findings suggest that PDS may be the preferred suture material for reducing postoperative wound complications in this setting. Further multicenter trials are recommended to validate these results and explore long-term outcomes.

Introduction

Laparotomy via a midline incision is frequently performed because it allows rapid and extensive exposure of the abdominal cavity. However, complications such as wound infection, dehiscence (burst abdomen), and incisional hernia remain significant sources of morbidity. The selection of suture material plays a crucial role in the healing process. Prolene, a nonabsorbable suture, has been widely used since the 1970s for its ease of handling and tensile strength. Nonetheless, its nonabsorbable nature can trigger a persistent foreign body response, potentially increasing the risk of infection. On the other hand, PDS, an absorbable monofilament suture, maintains approximately 50% of its tensile strength for about one month and is absorbed over a six-month period. Its slower absorption and reduced inflammatory profile may lower the incidence of wound infections.

Several studies have compared absorbable and nonabsorbable suture materials for abdominal closure, with evidence suggesting that absorbable sutures may be advantageous in reducing SSI and other wound complications. This study was undertaken to provide a direct comparison between Prolene and PDS in a randomized controlled setting to inform surgical practice. [1-9]

Materials and Methods

Study Design:

A randomized controlled trial was designed to compare wound infection rates between two suture materials used for midline laparotomy closure.

Study Population:

A total of 140 patients aged between 14 and 70 years undergoing midline laparotomy (both elective and emergency cases) were included. Exclusion criteria comprised patients with a history of previous midline surgery, those undergoing gynecological procedures, diabetics (due to an inherently higher infection risk), patients with carcinoma, and immunocompromised individuals.

Randomization and Intervention:

Patients were randomized into two groups via a lottery method:

- Group A (n = 70): Closure with nonabsorbable Prolene sutures.
- Group B (n = 70): Closure with absorbable Polydioxanone (PDS) sutures.

Surgical Technique:

A continuous single-layer mass closure technique was employed in all cases. The technique involved taking 1–2 cm bites incorporating both the anterior and posterior rectus sheaths to ensure a secure, tension-free closure.

Postoperative Care and Follow-Up:

Patients received standard postoperative care with daily dressings using saline-soaked gauze until hospital discharge. Wound assessment for infection was performed throughout the hospital stay and at weekly intervals for one month post-discharge. In cases where infection was suspected, purulent discharge was sent for culture and sensitivity testing, and appropriate antibiotic therapy was initiated.

Data Collection and Analysis:

Demographic data (age, gender, BMI), duration of surgery, and wound type (clean, clean-contaminated, or contaminated) were recorded. Wound infections were classified according to established clinical criteria. Data were analyzed using chi-square tests to compare infection rates between the groups, with a p-value ≤ 0.05 considered statistically significant. Stratified analyses based on age, gender, BMI, surgical duration, and case urgency were also performed.

Results

Patient Demographics:

The mean age was 38.16 ± 16.37 years in Group A and 39.69 ± 17.73 years in Group B. Gender distribution was similar with approximately 70% males in Group A and 62.9% in Group B. Mean BMI and surgical times were also comparable between the groups.

Wound Infection Rates:

A significant difference was observed between the two groups. In the Prolene group, 54.3% (38 out of 70 patients) developed wound infections compared to 24.3% (17 out of 70 patients) in the PDS group ($p = 0.000$).

Further stratification demonstrated that among younger patients (aged 14–40), the infection rate was markedly higher in the Prolene group. Similarly, when analyzed by gender, BMI, emergency case status, and duration of surgery, the PDS group consistently showed lower infection rates.

Summary of Study on Suture Material

Table 1. Wound Infection Rate.

Group	Infection Rate (%)
Prolene	54.3
PDS	24.3

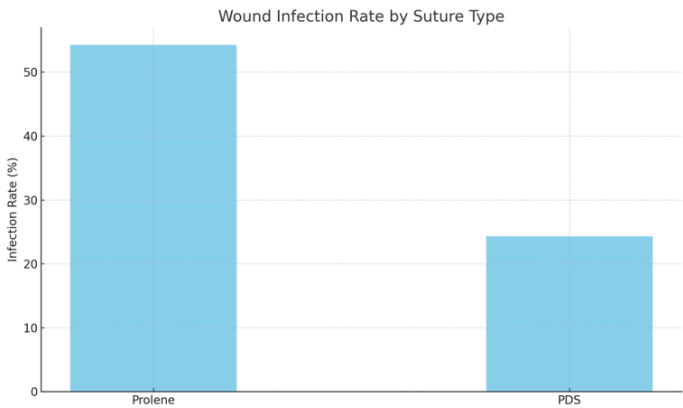


Table 2. Gender Distribution

Group	Male (%)	Female (%)
Prolene	70.0	30.0
PDS	62.9	37.1

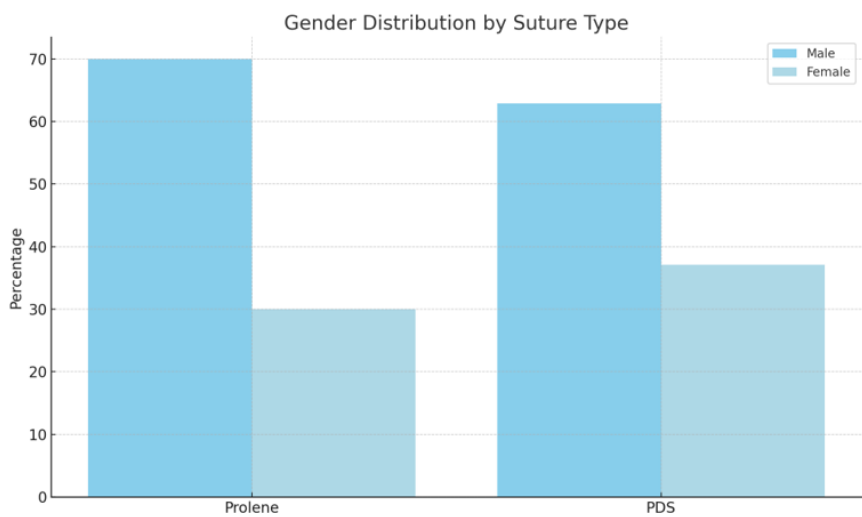
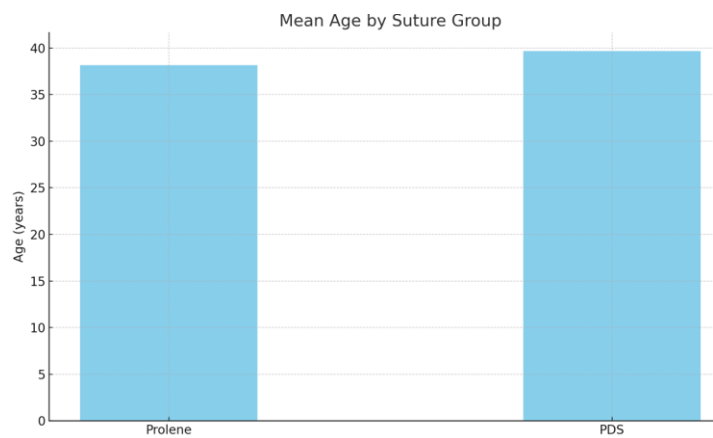


Table 3. Mean Age

Group	Mean Age
Prolene	38.16
PDS	39.69



Discussion

The findings of this study clearly indicate that the absorbable PDS suture material is superior to nonabsorbable Prolene for midline laparotomy wound closure in terms of reducing postoperative wound infection rates. The lower infection rate associated with PDS may be attributed to its absorbable nature, which minimizes prolonged foreign body reactions. In contrast, the persistent presence of Prolene in the tissue can elicit a sustained inflammatory response, thereby increasing susceptibility to bacterial colonization and subsequent infection.

These results are in agreement with previous literature where absorbable monofilament sutures have been shown to be beneficial in reducing wound-related complications. Although some studies have noted comparable outcomes between different suture materials when other factors (such as surgical technique and operative time) are optimized, the present study highlights the importance of suture selection as an independent variable influencing wound healing.

Moreover, stratified analyses reinforced that even when adjusting for patient age, gender, BMI, and operative factors, the use of PDS consistently resulted in a lower incidence of wound infection. This suggests that the intrinsic properties of the suture material play a critical role in postoperative outcomes.

Despite these promising results, the study is limited by its single-center design and the relatively short follow-up period. Future multicenter trials with extended follow-up are recommended to assess long-term outcomes, including incisional hernia formation and overall patient satisfaction. [1-9]

Conclusion

This randomized controlled trial demonstrates that midline abdominal wound closure using absorbable PDS is associated with a significantly lower rate of wound infection compared to nonabsorbable Prolene. These findings support the preferential use of PDS in midline laparotomy closures to improve postoperative outcomes. Further large-scale, multicenter studies are warranted to confirm these results and to evaluate the long-term benefits of using absorbable sutures in abdominal surgery.

Competing Interests

The authors declare that they have no competing interests.

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