

Original Research Article

Which suture is ideal for abdominal fascial closure: polydioxanone or polypropylene?

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Received: 08 February 2023

Revised: 07 March 2023

Accepted: 13 March 2023

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ABSTRACT

Background: A secured fascial closure with appropriate suture material is an integral step to prevent complications in laparotomy. A costly post-operative complication is wound dehiscence which manifests as incisional hernia as a delayed complication. The present study compared prolene and polydioxanone (PDS) sutures in patients undergoing midline closure after emergency exploratory laparotomy with the aim to evaluate wound outcome after the use of either of the sutures.

Methods: Sixty-six patients undergoing emergency laparotomy were randomly divided into two groups: group A (PDS) and B (prolene). Wound complications were evaluated for each patient in terms of wound pain, wound discharge, burst abdomen, stitch sinus, stitch granuloma and incisional hernia.

Results: Wound pain was observed more in prolene group, $p < 0.05$ till 3rd post-op day. Wound discharge, wound dehiscence and burst abdomen were more in prolene group, but the difference was statistically insignificant ($p > 0.05$). Six patients developed incisional hernia, out of which 5 had prolene, ($p > 0.05$). Similar statistically insignificant difference was found with stitch granuloma and stitch sinus.

Conclusions: Till date there is lack of agreement about the ideal suture for abdominal fascial closure. Present study concluded that any suture material is equally effective for abdominal fascial closure since there are many other factors contributing towards wound complications.

Keywords: Abdominal fascial closure, PDS, Polypropylene, Dehiscence, Incisional hernia

INTRODUCTION

Laparotomy is one of the most common surgical procedures performed globally.¹⁻⁴ An integral step to prevent complications in laparotomy is a secured fascial closure.⁵ Although the skill and technique of the surgeon is always detrimental to wound healing so is the choice of wound closure material. Sutures provide mechanical support for the closed wound during its initial healing.¹⁻⁴ Post-op wound complications occur because of multiple factors which can be patient related, intra-operative or post-operative. Patient related factors can be old age, co-

morbidities like diabetes mellitus, COPD, immunocompromised states, anemia, malnutrition, smoking, steroid use. Intraoperative factors may be like infected abdominal surgeries (like intestinal perforation peritonitis), length of operation, poor surgical technique, type of suture material used while post-operative factors are like prolonged ventilation, poor tissue perfusion, excessive patient coughing.⁶ An important factor out of all above may be selection of appropriate suture material.

Many different materials have been used in the closure of laparotomy wounds, but since last more than 3 decades

prolene and PDS have gained popularity. Non-absorbable materials like polypropylene (prolene) retain their mechanical strength in the process of healing to minimize the occurrence of incisional hernia. On the other hand, absorbable material like PDS provides prolonged wound support by retaining its tissue integrity.

The present study was undertaken with the aim to evaluate wound outcomes in the form of pain, wound discharge, dehiscence, suture sinus, stitch granuloma and incisional hernia formation using either prolene or PDS suture for abdominal fascial closure following exploratory laparotomy.

METHODS

The present study was a prospective randomised observational study. It was conducted from April 2021 to March 2022 in the department of general surgery at Pt. B. D. Sharma post graduate institute of medical sciences, Rohtak. Sixty-six patients were enrolled in study who qualified inclusion criteria after taking an informed consent.

Ethical approval was taken from institutional ethics committee before initiating the study.

Inclusion criteria

Patients older than 14 years, consent to participate in study and emergency laparotomies with vertical midline abdominal incision closures were included.

Exclusion criteria

Elective laparotomies, patients who take LAMA or expire during their hospital stay, patients who expire within follow up period (i.e., 3 months), patients with immunocompromised states like HIV and other co-morbidities like diabetes mellitus, chronic pulmonary disease, malnutrition, malignancy, severe renal and liver disease, history of steroid use, history of previous laparotomy, patients with raised intra-abdominal pressure, which may require tension suture closure, patients with pre- or post-operative diagnosis of malignant involvement of peritoneum, patients in whom there was a pre-existing cause of raised intra-abdominal pressure, ascites (due to medical causes) and patients requiring stoma formation after emergency laparotomy were excluded.

All patients who underwent exploratory laparotomy by a midline vertical incision were randomly divided into 2 groups. Group I: PDS no.1 (on loop) and group II: polypropylene no. 1 round body (RB). The fascia was closed in continuous manner by the respective suture mentioned in either of the groups. The skin was closed with ethilon (nylon) 2-0 reverse cutting. Post-operatively, patients were assessed for following parameters:

Early complications (from post-op day 1 till day 7)

Wound pain: This were assessed on 12 hourly basis using visual analogue scale (VAS) till post-op day 4. This visual analogue is a 10 cm line on which '0' represents no pain and '10' be the most severe pain.

Discharge: Serous / purulent.

Wound dehiscence: i) Superficial dehiscence and ii) Deep dehiscence / Burst abdomen.

Late complications (if persisted after 4 weeks post-op)

It included chronic wound infection, suture sinus formation, incisional hernia and stitch granuloma.

All the collected data was entered in Microsoft excel spreadsheet. Descriptive statistics was analyzed with SPSS software. Continuous variables have been presented as mean $\pm$ SD while categorical variables expressed as frequencies and percentages. A $p < 0.05$ has been considered statistically significant.

RESULTS

Majority of the patients in the present study were males (75.8%) with maximum number of patients (24.2%) in 40-50 years of age group.

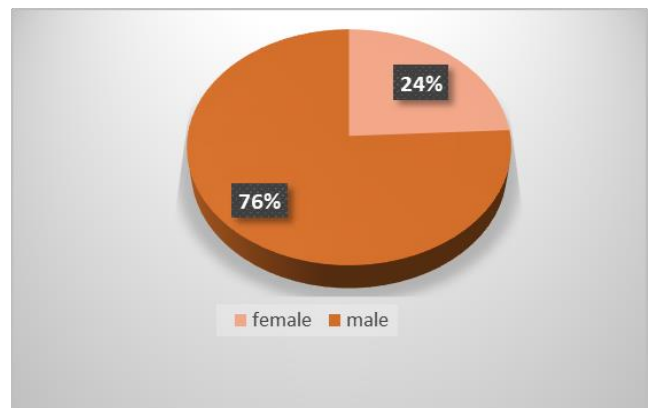


Figure 1: Gender distribution.

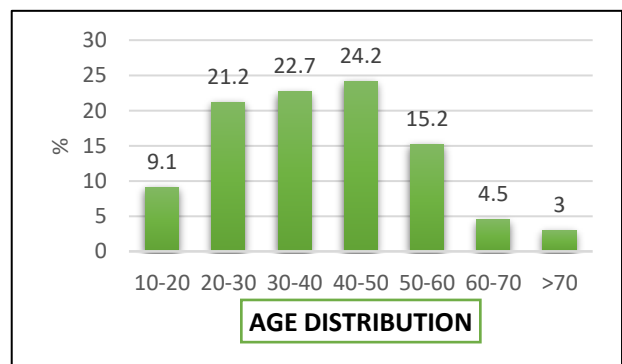


Figure 2: Age distribution.

Table 1: Blood investigations.

Variables		Frequency*	Percent (%)
Hb	≤ 10 gm/ dl	9	13.6
	>10 gm/dl	57	86.3
TLC	≤11000/mm ³	18	27.2
	>11000/mm ³	48	72.7
RBS	≤180 mg/dl	58	87.8
	>180 mg/dl	8	12.1
Serum albumin	≤3 gm/dl	29	43.9
	> 3 gm /dl	37	56.0
Blood urea	≤40 mg/dl	42	63.6
	>40 mg/dl	24	36.3
Serum creatinine	≤1.2 mg/dl	58	87.8
	>1.2 mg/dl	8	12.1

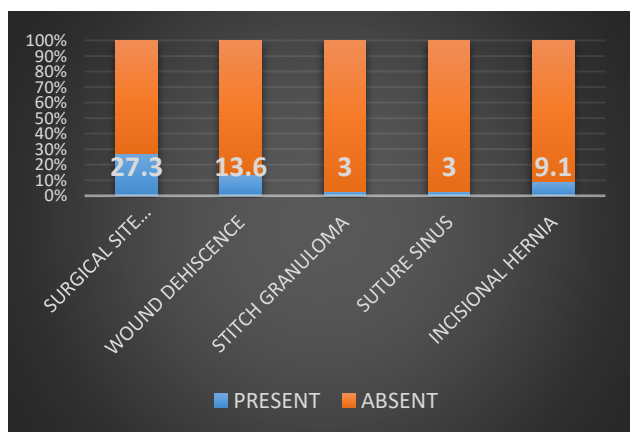
*Total patients=66

Patients in either group had many different types of deranged biochemical parameters like decreased serum albumin but increased blood urea along with raised differential WBC counts, which are independent markers for the wound complications.

Majority of patients (35%) operated in this study were of burst appendix and the rest being of intestinal perforation peritonitis (25%), gut gangrene (15%), blunt trauma abdomen (15%) and stab injury abdomen (10%).

Post- operative complications

At 24 hours after surgery it was observed that patient suffered wound pain equally in both PDS (46.9%) and prolene (44.1%) group with maximum number of cases showing score of 6 ($p>0.05$). But pain lasted longer (upto day 3) in more patients of prolene group (44.1%). The difference was significant at post-op day 3 in case of patients who underwent abdominal wall closure with prolene suture ($p<0.05$). Wound discharge was observed in 28.1% of patients with PDS while 26.5% in those with prolene ($p>0.05$). A total of 18 patients developed superficial dehiscence (21.9% of the patients with PDS while 32.4% of those with prolene, ($p>0.05$).

**Figure 3: Overall incidence of wound complications.**

Burst abdomen is a fearsome complication which causes increased morbidity and mortality. Nine patients developed burst abdomen out of which 6 patients were from prolene group. This can be probably due to higher wound infection rate observed with prolene.

At 3 months, 6 patients developed incisional hernia of which 5 patients were from prolene group ($p>0.05$). Other late complications like suture sinus and stitch granuloma were comparable in both the groups.

DISCUSSION

After any exploratory laparotomy an important step to prevent complications is a secured fascial closure. Laparotomy incision needs mechanical support by suture material which helps in stable scar tissue by collagen formation and maturation. The ideal suture should prevent incisional hernia and wound dehiscence, without increasing wound infection, wound pain or the formation of suture sinus.⁷

Uptil now numerous randomized controlled trials of abdominal fascial closure have failed to determine the ideal suture material with finality. Various deranged biochemical parameters were recorded in many patients in this study. But Gaikwad et al noted that no patient related factors influenced wound complications ($p>0.05$).⁷

In the present study, patients undergoing closure with non absorbable prolene showed more pain (VAS score 8) and it lasted for around 72 hours in majority of cases (44.1%) as compared to PDS where average VAS score was 4 and pain lasted maximally till 48 hours. Studies conducted by Israelsson et al and Van't et al also found similar results.^{8,9} The wound discharge rate was 28.1% in PDS group while 26.5% in the prolene group ($p>0.05$) This was consistent with the results of the studies conducted by Singal et al, Bloeman et al and Gaikwad et al.^{7,10,11}

More number of patients suffered from abdominal wound dehiscence in the PDS group but this was found to be statistically insignificant. But Gaikwad et al reported contrary findings with the PDS group, which showed a very high incidence of wound dehiscence, which has not been reported in any previously performed study.^{7,8,12-15}

It is quite evident that suture sinus formation frequently occurs with non- absorbable sutures like nylon/ prolene because of its long memory, stiff nature and tissue reactivity. The present study observed that suture sinus formation is more prevalent with prolene (5.9%) and this was consistent with findings of the studies conducted by Singal et al, Bloeman et al and Gaikwad et al.^{7,10,11} Present study demonstrated the incisional hernia rate as 3.1% in PDS group and 14.7% in prolene group ($p>0.05$). This is not in consonance to study done by Bloeman et al which showed the rate of incisional hernia to be more

with PDS. Khan et al also observed higher rate of incisional hernia with prolene ($p>0.05$).

Limitations

One potential drawback in the current study is a single location data collection and small sample size. Similar studies are required with larger sample size to make the results representative and conclusive.

CONCLUSION

There is still a lack of agreement within the surgical fraternity about the ideal abdominal fascial closure technique. The present study also demonstrated that whether PDS or prolene, all are equally effective for abdominal fascial closure. Risk of incisional hernia, wound dehiscence, peri-operative complications, suture sinus formation, and surgical site infection do not differ significantly for different suture materials. But more research needs to be directed towards newer suture materials and use of prophylactic biosynthetic meshes particularly in high risk patients with obesity, chronic obstructive pulmonary disease, diabetes, malnutrition, anemia and smokers.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Singla A, Bansal AR, Chopra V, Chopra D, Bansal J. Which suture is ideal for abdominal fascial closure: polydioxanone or polypropylene? Int Surg J 2023;10:647-50.