

## ORIGINAL ARTICLE

POLYDIOXANONE VERSUS POLYPROPYLENE CLOSURE FOR  
MIDLINE ABDOMINAL INCISIONS

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**Background:** Midline laparotomy is the most common technique of abdominal incisions because it is simple, provides adequate exposure to all four quadrants, and is rapid to open. A major problem after midline laparotomy remains the adequate technique of abdominal fascia closure. This study was conducted to see the role of Polydioxanone and Prolene for midline abdominal closure in terms of postoperative wound infection and wound pain. **Methods:** This study was carried out at surgical unit II, Federal Government Services Hospital Islamabad. Patients were equally divided in two groups, i.e., A and B. Groups A and B patients undergone midline abdominal closure with Polydioxanone number 1 and Polypropylene number 1 sutures respectively. **Results:** Total 620 patients were included in this study. Post-operative wound pain score according to Visual analogue scale (VAS) was compared in terms of no pain (0), mild pain (1–3), moderate pain (4–6), severe pain (7–9). In group A (Polydioxanone), the frequency and percentages of no, mild, moderate and severe pain were 101 (32.6%), 95 (30.6%), 81 (26.1%) and 33 (10.6%) respectively, where as in group B (polypropylene) it was 82 (26.5%), 43 (13.9%), 59 (19%) and 126 (40.6%) respectively. Similarly, the frequency and percentages of post-operative wound infection in group A (Polydioxanone) and group B (polypropylene) was 105 (33.9%) and 208 (67.1%) respectively. **Conclusion:** Polydioxanone results in less wound pain and wound infection when compared to Polypropylene.

**Keywords:** Abdominal wound closure; Midline laparotomy; Wound pain; Wound infection

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## INTRODUCTION

Laparotomy through midline abdominal incision is commonly used technique because it is easy, fast, and provides good exposure to all four quadrants. Selection of appropriate suture material for closure of abdominal layers is still big problem despite the advancement in surgical technique.<sup>1</sup> It is surgeon's personal choice and selection of suture material depends upon his experience and literature available. There are some qualities which are considered while using particular suture material like incidence of early and late wound complications. Early complications are partial and complete wound dehiscence, wound infection and pain.<sup>2</sup> The most significant early complication after laparotomy through midline incision is wound infection which occur in 3–21% of cases.<sup>3</sup>

The technique for midline abdominal wound closure is said to be better when it is simple, rapid and economical but does not develop complications. The selection of suture material depends upon the its characteristics like strength, durability, ease of handling, and resistance to infection.

There is no established technique generally considered as best and safe for closing the midline abdominal wound after laparotomy.<sup>3</sup> Polypropylene which is no absorbable suture material used since 1970's

for abdominal fascial closure but there is higher chance of wound infection with its use.<sup>2</sup> Absorbable sutures are made for closure of midline wound and will be absorbed after the facial layers are healed. These sutures are not associated with sinus and pain. Review of a literature shows that absorbable monofilament suture material is better than no absorbable monofilament for closure of midline laparotomy.<sup>2</sup>

Polydioxanone (PDS) and polypropylene (Prolene) are widely used suture materials. Polydioxanone is absorbed slowly over 6 months. It maintains fifty percent of their tensile for a month. Polydioxanone have 1.7 times tensile strength of prolene.

The aim of this study is to compare the development of wound pain and infection after midline laparotomy closure with polydioxanone and polypropylene. This study will help us in selection of better suture material.

## MATERIAL AND METHODS

It is a randomized control trial which was performed at department of surgery unit II, Federal Government Services Hospital Islamabad. The Sampling Technique was Consecutive Non-probability sampling.

All patients  $\geq 15$  years of age who underwent laparotomy through midline incision were selected. Both emergency and elective cases except

gynaecological surgeries were included in our study. Wound infection is common in diabetic patients so these are excluded from study.

This study was carried out after approval from hospital ethical committee. Consent was taken from all patients. Continuous single layer mass closure technique was used for closure of midline abdominal wounds. Surgery was done by a same team of surgeons. Lottery method was used to divide patients in two groups, i.e., A & B.

**Group A Patients:** Midline laparotomy closure done by PDS.

**Group B Patients:** Midline laparotomy closure done by polypropylene.

Prophylactic intravenous antibiotics were given to all patients to cover gram negative organisms and anaerobes at the time of induction and continued postoperatively for at least for 5 days. Intravenous analgesics also administered for same period. Wound infection was judged by wound examination till the wound heals (Daily for 7 days and then weekly for 4 weeks). Dressing of abdominal wound was done daily and pyodine followed by normal saline was used for cleaning till the wound heals. In case of wound infection pus was sent for culture and sensitivity. Postoperative wound pain was assessed by Visual Analog Scale (VAS) (0–10) and divided into different categories, i.e., no pain (0), mild pain (1–3), moderate pain (4–6), severe pain (7–10).

Data was analysed through SPSS-20. Frequencies and percentages was computed for postoperative pain and wound infection. Mean and standard deviation was calculated for quantitative data, i.e., age. Statistical significance was taken at  $p \leq 0.05$ .

## RESULTS

Total 620 patients above 15 years of age were enrolled in our study according to our inclusion criteria of the study. Patients were randomly divided into two equal groups. Group A undergone PDS abdominal closure and Group B undergone Prolene abdominal closure. Frequency and percentages of both male and female patients, mean age and length of hospital stay are given in table-1.

Post-operative wound pain score according to VAS was also compared in both the groups using Chi-square test (Chi Square value was 79.420). As a whole Post-operative wound pain was statistically significant in both the groups ( $p$ -value  $< 0.05$ ), which showed that in midline abdominal closure with PDS there was decreased wound pain as compared to abdominal wound closure with Prolene, as shown in table-2.

Similarly, frequency and percentages of post-operative wound infection in group A (PDS) and

group B (Prolene) was observed as seen in table-2. Chi-square test was used to compare wound infection in both groups (Chi square value was 68.452). As a whole Post-operative wound infection was statistically significant in both the groups ( $p$ -value 0.05), which shows that in midline abdominal closure with PDS there was decreased wound pain infection as compared to abdominal wound closure with Prolene, as shown in table-2.

**Table-1: Gender, mean age and hospital stay of patients**

		Group A	Group B
		Polydioxanone (PDS)	Polypropylene (Prolene)
Gender of Patients	Male	168 (54.2%)	165 (53.2%)
	Female	142 (45.8%)	145 (46.8%)
<b>Total</b>		310 (100.0%)	310 (100.0%)
<b>Age (years) of patients</b>		31.81±14.378	33.99±14.86
<b>Length of hospital stay (days)</b>		6.47±5.33	7.39±1.81

**Table-2: Post-operative wound pain and wound infection in both the groups**

		Group A	Group B
		Polydioxanone (PDS)	Polypropylene (Prolene)
Post-operative wound pain	no pain (0)	101 32.6%	82 26.5%
	mild pain (1–3)	95 30.6%	43 13.9%
	moderate pain (4–6)	81 26.1%	59 19.0%
	severe pain (7–9)	33 10.6%	126 40.6%
	<b>Total</b>	310 100.0%	310 100.0%
Post-operative wound infection	Yes	105 33.9%	208 67.1%
	No	205 66.1%	102 32.9%
<b>Total</b>		310 100.0%	310 100.0%

$p$ -value  $< 0.05$ , Chi-square test was used to compare both groups

## DISCUSSION

Laparotomy through midline incision as compared to paramedian incision is considered to be standard technique because it is easy to perform and causes less bleeding. Substantial variation has been observed in repair of this incision and different suture materials are used for closure. Suture material plays a very important role so it should cause low wound pain, wound infection and formation of sinus.<sup>4-6</sup> In comparison to no absorbable sutures slowly absorbable sutures are preferred for closure of midline abdominal wound because it has comparable wound strength and lower prevalence of wound complications. This practice has been practiced since many years. Choice of suture material for abdominal facial closure depends on surgeon's preference depending upon his experience.<sup>7,8</sup>

It is established fact that randomized control trials has been unsuccessful for deciding Literature survey shows that different types of suture material has been well-tried for abdominal facial closure, some studies favour the use of no absorbable suture material while others recommend sutures which are slowly absorbed.<sup>4,7,11,12</sup> For this purpose we also conducted this study for observing the effectiveness of absorbable (Polydioxanone) and no absorbable (Prolene) in closure of midline abdominal wound. We tested both suture material in terms of postoperative wound pain and wound infection.

Prolene is associated with lower incidence of wound dehiscence and incisional hernia therefore used by many surgeons for midline facial closure.<sup>11,13</sup> Our study shows as per table-2, the pain has been demonstrated on visual analogue scale which shows that high incidence of mild and moderate pain is in group A (PDS) while high incidence of severe pain seen in group B (Prolene). Overall the incidence of pain is more in the group B (Prolene) as compared to group A (PDS) which is accordance with literature survey.<sup>9,14</sup>

In a study done by Chalye PL *et al* also shows that Prolene is associated with higher incidence of pain after midline fascial closure.<sup>1</sup> Prolene sutures needs 5–7 knots for adequate strength and these knots may cause pain. It also does not absorb as compared to PDS and elicits tissue reaction against foreign body which causes pain. A meta-analysis done by Van't Riet M *et al*<sup>16</sup> also favours our findings. It shows that there is statistical difference ( $p < 0.005$ ) in incidence of wound pain after midline abdominal facial closure. The incidence of wound pain is more with non-absorbable suture (Prolene) as compared to slowly absorbable suture material (PDS).

Use of absorbable monofilament suture material is increasing because it is very effective in abdominal wound closure.<sup>17</sup> It is associated with lower chances of wound infection and also maintain its strength for about 6 months which is necessary for healing of wound especially where blood supply is not good. In group A (Polydioxanone) incidence of wound infection is low while it is high in group B (Prolene). It has been observed in different studies that low incidence of wound infection is experienced in polydioxanone group.<sup>4,8,18</sup> In a study done by Rucinski J *et al* shows that there is same incidence of wound pain after closure with either Prolene or PDS.<sup>7</sup> PDS is monofilament and slowly absorbable suture. It causes less inflammatory response and has less chances of wound infection.<sup>19</sup>

## CONCLUSION

Our study concluded that Polydioxanone is better choice than Polypropylene in midline abdominal wound closure because it causes less post-operative wound infection and pain.

## AUTHORS' CONTRIBUTION

SN: Conceived, Designed, data collection. SAM: Manuscript writing, editing and literature research. MAJ: Statistical analysis. MRA & TA: Critical revision.

## REFERENCES

1. Knaebel HP, Koch M, Sauerland S, Diener MK, Buchler MW, Seiler CM. Interrupted or continuous slowly absorbable sutures – Design of a multi-centre randomized trial to evaluate abdominal closure techniques INSECT-Trial [ISRCTN24023541]. *BMC Surg* 2005;5:3.
2. Ceydeli A, Rucinski J, Wise L. Finding the Best Abdominal Closure: An Evidence-based Review of the literature. *Curr Surg* 2005;62(2):220–5.
3. Fischer L, Baumann P, Hüsing J, Seidlmayer C, Albertsmeier M, Franck A, *et al*. A historically controlled, single-arm, multi-centre, prospective trial to evaluate the safety and efficacy of MonoMax® suture material for abdominal wall closure after primary midline laparotomy. ISSAAC-Trial [NCT005725079]. *BMC Surg* 2008;8:12.
4. Weiland DE, Bay RC, Del Sordi S. Choosing the best abdominal closure by meta-analysis. *Am J Surg* 1998;176(6):666–70.
5. Gaikwad V, Kapoor R, Thambudorai R. An ideal suture for midline closure? *Indian J surg* 2009;71(3):128–32.
6. Pavlidis TE, Galatianos IN, Papaziosog BT, Lazaridis CN, Atmatzidis KS, Makris JG, *et al*. Complete dehiscence of the abdominal wound and incriminating factors. *Eur J Surg* 2001;167(5):351–4.
7. Rucinski J, Margolis M, Panagopoulos G, Wise L. Closure of the abdominal midline fascia: meta-analysis delineates the optimal technique. *Am Surg* 2001;67(5):421–6.
8. Leaper DJ, Pollock AV, Evans M. Abdominal wound closure: a trial of nylon, polyglycolic acid and steel sutures. *Br J Surg* 1977;64(8):603–6.
9. Gys T, Hubens A. A prospective comparative clinical study between monofilament absorbable and non-absorb-able sutures for abdominal wall closure. *Acta Chir Belg* 1989;89(5):265–70.
10. Korenkov M, Sauerland S, Arndt M, Bograd L, Neugebauer EA, Troidl H. Randomized clinical trial of suture repair, polypropylene mesh or autodermal hernioplasty for incisional hernia. *Br J Surg* 2002;89(1):50–6.
11. Hodgson NC, Malthaner RA, Ostbye T. The search for an ideal method of abdominal fascial closure: a meta-analysis. *Ann Surg* 2000;231(3):436–42.
12. 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):1350–6.
13. Pandey S, Singh M, Singh K, Sandhu S. A prospective randomized study comparing non-absorbable polypropylene (Prolene®) and delayed absorbable polyglactin 910 (Vicryl®) suture material in mass closure of vertical laparotomy wounds. *Indian J Surg* 2013;75(4):306–10.
14. Carlson MA, Condon RE. Polyglyconate (Maxon) versus nylon suture in midline abdominal incision closure: a prospective randomized trial. *Am Surg* 1995;61(11):980–3.
15. Chalya PL, Massinde AN, Kihunrwa A, Mabula JB. Abdominal fascia closure following elective midline

- laparotomy: a surgical experience at a tertiary care hospital in Tanzania. BMC Res Notes 2015;8(1):281.
16. Van't Riet M, Steyerberg EW, Nellensteyn J, Bonjer HJ, Jeekel J. Meta - analysis of techniques for closure of midline abdominal incisions. British journal of surgery. 2002 Nov 1;89(11):1350-6.
  17. Sahlin S, Ahlberg J, Granström L, Ljungström KG. Monofilament versus multifilament absorbable sutures for abdominal closure. Br J Surg 1993;80(3):322-4.
  18. Leaper DJ, Allan A, May RE, Corfield AP, Kennedy RH. Abdominal wound closure: a controlled trial of polyamide (nylon) and polydioxanone suture (PDS). Ann R Coll Surg Engl 1985;67(5):273-5.
  19. Bucknall TE, Teare L, Ellis H. The choice of a suture to close abdominal incisions. Eur Surg Res 1983;15(2):59-66.

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