

Research Article

A comparative study of outcome of the absorbable suture polydioxanone and nonabsorbable suture polypropylene in laparotomy wound closure

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ABSTRACT

Background: Abdominal wound closure is one of the common operations for a general surgeon. Prevention of complications is important to reduce post-operative morbidity and mortality. Post-operative wound pain, wound infection, wound dehiscence, suture sinus formation; palpable knots and incisional hernia are the parameters are to be studied. Therefore, the present study was undertaken to compare polydioxanone and polypropylene suture material for abdominal fascial closure regarding morbidity in terms of post-operative wound complications.

Methods: Patients admitted in the department of surgery, who undergo laparotomy operations, with midline abdominal incisions were included in the study. The recruited subjects were divided into Group-A, whom abdominal incisions are closed with non-absorbable suture material polypropylene and Group-B whom abdominal incisions are closed with absorbable suture material polydioxanone. Data was expressed as percentages.

Results: The incidence of wound pain was observed in all the patients in both immediate and delayed post-operative period in the polypropylene suture material compared to polydioxanone. The incidence of wound infection was higher in polypropylene (24%) compared to PDS (2%). There were 4% cases of wound dehiscence in the present study. The incidence of suture sinus formation was higher in the polypropylene suture material (9%) compared to the polydioxanone suture material (2%) in the delayed postoperative period. The incidence of palpable knots was higher in the polypropylene suture material (23%) compared to the polydioxanone suture material. No cases of incisional hernia were reported with polydioxanone suture material.

Conclusions: The overall morbidity from abdominal closure was considerably reduced in the Polydioxanone group. We encountered reduction in wound complications like burst abdomen, wound infection, wound pain, suture sinus formation, palpable knots and incisional hernia. Therefore, polydioxanone can be employed rewardingly in emergency situations where closure can be carried out safely and rapidly.

Keywords: Polypropylene suture material, Polydioxanone suture material, Wound infection, Wound pain, Suture sinus formation, Palpable knots, Incisional hernia

INTRODUCTION

Wound healing following abdominal closure is a complex and dynamic process with changing wound environment and changing health status of the individual.¹ Among several factors which affect the wound closure, a careful selection of proper suture material is one of the important

factors. The ideal suture material with the perspective of fast and comfortable recovery is yet to be ascertained. Surgeons always follow a primary wound closure because wound heals by primary intention with a minimal time period without gaping and minimal scarring. Absorbable sutures are required for a wound that heals quickly and needs temporary support. Polydioxanone

(PDS) a monofilament synthetic absorbable suture represents a significant advance in suturing options.

With its absorbability and extended wound support for up to 6 weeks, it is well suited for many types of soft tissue approximation. With the combinational property of retaining strength for considerable period and absorbability it is of significant value in laparotomy wound closure and has minimal post-operative complications.

Non absorbable sutures are required for the conditions where longer wound support is needed. Polypropylene is a synthetic non-absorbable suture material. It has a property of non-adherent to tissue and so a good suture material, but known to cause palpable knots, wound pain, wound sepsis, wound dehiscence, suture sinus formation, stitch granuloma and incisional hernia.²

However, studies comparing these two suture materials are scarce in rural tertiary care hospitals. Therefore, the present study has undertaken to compare the efficacy of these two suture materials for abdominal fascial closure.

METHODS

The present comparative observational clinical study was conducted after the institutional ethical clearance and informed consent from the patients admitted in the department of surgery, who undergo laparotomy operations, with midline abdominal incisions are included in the study.

Patients who have already undergone operations with midline abdominal incisions, Patients who require closure of abdominal wall with tension sutures and patients with malignant ascites were excluded.

By taking into account, the variables like suture sinus formation and wound granuloma, as estimated in previous studies, sample size of 120 cases were allotted in each group, a total of 240 patients were included in the study.

The age and sex matched patients are divided into group "A" and group "B" by giving odd and even numbers respectively. Group-A included the patients with odd numbers in whom abdominal incisions are closed with non-absorbable suture material polypropylene.

Group-B included the patients with even numbers in whom abdominal incisions are closed with absorbable suture material polydioxanone.

Detailed history of patient, investigations done, nature of operation performed was noted down in the standard study proforma.

In emergency operations, like peritonitis fluid from peritoneal cavity will be collected for culture and sensitivity. Appropriate antibiotics were administered after obtaining culture and sensitivity reports.

Wound was inspected in immediate post-operative period for evidence of infection. Discharge if any was sent for culture and sensitivity. Post-operative pain was recorded by using visual analog scale.

Subsequently patients were followed up regularly at intervals of 2 weeks, 4 weeks and once in 3 months up to 1 year. During subsequent follow up period wound pain, wound infection, wound dehiscence, suture sinus formation, stitch granuloma and incisional hernia were inspected and recorded for one year.

Statistical analysis

The data was represented as Mean±SD and proportion. Comparison between the proportions was done by "chi-square test" and univariate analysis by using confident interval and odd's ratio.

RESULTS

In the present study, 200 patients undergoing laparotomy, both elective and emergency were included. The early and late wound complications encountered in both the suture material used were as follows.

The incidence of wound pain was observed in all the patients (out of 100) in both immediate (moderate pain) and delayed (mild pain) post-operative period in the polypropylene suture material compared to polydioxanone where in only 20% of patients (out of 100) had wound pain (Table 1 and 2).

The incidence of wound infection was higher in polypropylene (24% out of 100) compared to PDS (2% out of 100). The use of polydioxanone was better in emergency cases with low infection rate as compared to polypropylene suture material (Table 1 and 2).

There were 4 cases (out of 100) of wound dehiscence in the present study. All the cases of burst abdomen were noted in patients in whom midline closure done with polypropylene suture material. The incidence of suture sinus formation was higher in the polypropylene suture material (9% out of 100) compared to the polydioxanone suture material (2% out of 100) in the delayed postoperative period (Table 1 and 2).

The incidence of palpable knots was higher in the polypropylene suture material (23% out of 100) compared to the polydioxanone suture material in which no cases were reported in the follow up of patients in delayed post-operative period (Table 3).

Table 1: Immediate postoperative observations among polydioxonone and polypropylene group of laprotomy patients.

Immediate postoperative observations	Polydioxonone group (n=100)	Polypropylene group (n=100)	Total (n=200)	P value
Wound pain				
Mild	96	0	96	<0.001**
Moderate	4	100	104	
Wound sepsis				
Healthy	83	71	154	<0.001**
Purulent	2	16	18	
Serous	15	13	28	
Wound discharge				
Not sent	97	76	173	<0.001**
Gram +	0	7	7	0.012*
Klebsiella	1	0	1	1.000 NS
MSSA	1	5	6	0.111 NS
Pseudomonas	0	2	2	0.489 NS
Skin flora	0	6	6	0.013*
No growth	0	3	3	0.372 NS
Streptococci	0	1	1	0.489 NS
Acenetobacter	1	0	1	1.000 NS

Table2: Late postoperative observations among polydioxonone and polypropylene group of laprotomy patients.

Late postoperative observations	Polydioxanone group (n=100)	Polypropylene group (n=100)	Total (n=200)	P value
Wound pain				
No Pain	100 (100%)	0 (0%)	100 (100%)	<0.001**
Mild	0 (0%)	100 (100%)	100 (100%)	
Wound dehiscence				
Absent	100 (100%)	96 (96%)	196 (98%)	0.052
Present	0 (0%)	4 (4%)	4 (2%)	
Suture sinus formation				
Absent	98 (98%)	91 (91%)	189 (94.5%)	0.091
Present	2 (2%)	9 (9%)	11 (11%)	

Table 3: Occurrence of palpable knots among polydioxonone and polypropylene group of laprotomy patients.

Palpable Knots	Polydioxonone group (n=100)	Polypropylene group (n=100)	Total (n=200)
Absent	100 (100%)	77 (77%)	177 (88.5%)
Present	0 (0%)	23 (23%)	23 (11.5%)
Total	100 (100%)	100 (100%)	200 (100%)

Palpable knots is significantly more in prolene with p<0.001**

Table 4: Occurrence of incisional hernia among polydioxonone and polypropylene group of laprotomy patients.

Incisional hernia	Polydioxonone group (n=100)	Polypropylene group (n=100)	Total (n=200)
Absent	100 (100%)	98 (98%)	198 (99%)
Present	0 (0%)	2 (2%)	2 (1%)
Total	100 (100%)	100 (100%)	200 (100%)

Incidence of Incisional hernia is not statistically significant with P=0.232

The incidence of incisional hernia was noted in two cases in the polypropylene suture material and the cases were

operated on emergency basis (Table 4). Among two cases, one of the cases treated for wound infection. No

cases of incisional hernia were reported with polydioxanone suture material.

DISCUSSION

Abdominal surgeries are the most commonly done procedures. There by incision and closure (suturing) of abdominal wall is one of the commonest exercises in surgery. There are number of techniques of closure of abdominal wall with its own advantages and disadvantages.³ Regarding the healing of abdominal wound however meticulously closed, the healing takes place en-mass, even when closures done in layered technique because of formation of dense fibrous block of tissue. This is evident from the scar of previous surgeries when it is opened. While suturing, bites should be taken at a minimum distance of 1 cm from wound edge and the interval between two sutures should be 1 cm. The material taken for suturing in the present study was four times the wound length as reported earlier.⁴⁻⁷

There are many factors which delay the wound healing both systemic and local factors. In spite of improved surgical skills, the morbidity associated with abdominal wound is still high. So surgeons give maximum importance for the wound closure and care. Systemic factors include obesity, jaundice, diabetes, malnutrition, protein deficiency, elderly patients, patients on steroids and immune-suppressants. Local factors which delay wound healing after laparotomies are wound infection, hematoma, foreign body reaction. All these impose stress on the freshly sutured abdominal wound.⁸⁻¹⁰

In both groups, the closure of abdominal wound was done in a continuous en-mass. Polydioxanone sutures are strong, delayed absorbable, retain their strength after implantation, are inert, cause minimal tissue reaction and technically has a better handling during the closure. The only disadvantage is their slipping quality in handling and in tying. This can be overcome by using minimum five knots as reported by others.¹¹ The wound complications are wound pain, wound infection, wound dehiscence, suture sinus formation, palpable knots and incisional hernia.

Wound pain is the subjective feeling of pain in the postoperative wound site. Wound pain is graded according to the visual analogue scoring. Wound pain depends on the suture material. If suture material stays for a prolonged period without getting absorbed, it itself is a factor for wound pain. Because it causes irritation and causes pain. Polypropylene which is a nonabsorbable suture material is more irritant to the tissue and causes moderate wound pain. Polydioxanone which is a delayed absorbable suture material which is less irritant to the tissue causes mild wound pain.

In the present study sample involving 200 cases 100 cases were studied under group A, we observed that all the patients experienced moderate degree of wound pain

in the immediate post-operative period. Even in the delayed post-operative period all the patients continued to experience mild degree of wound pain and required analgesics for a prolonged period. In group B involving 100 patients pain was of mild degree in 96 % of cases and moderate in 4% of cases in the immediate post-operative period and none of the patients experienced wound pain in the delayed post-operative period hence required analgesics for a lesser duration. In both the groups, the patients were treated with same group of analgesics.

Wound infection

In our study we observed wound infection (purulent discharge) among 16 patients (out of 100) in group A (16%) and among 2 patients (out of 100) in group B (2%). Also group- A patients had a maximum infection rate even in emergency laparotomy as compared to group B. In comparison to the earlier report our study showed that polydioxanone sutures had a lesser incidence of wound infection.¹² From this, it is evident that chances of wound infection in both emergency and elective operations is observed to be higher in Polypropylene (PPL) suture material compared to Polydioxanone (PDS) and thus Polydioxanone suture is considered preferable in emergency and elective surgery.

Wound dehiscence

In group A, mid-line mass closure was done with polypropylene, the incidence of wound dehiscence was 4%. Whereas in group B, the mid-line mass closure done with polydioxanone, no cases were reported with wound dehiscence. In a prospective study conducted, wound dehiscence was noted in 7.8% patients among 30 belonging to polydioxanone group and none of the patients had this complication among 34 patients of polypropylene group.¹⁴ In comparison to the previous study, we observed that Polydioxanone suture material has lesser incidence of wound dehiscence in the post-operative period when compared to polypropylene suture material.¹²

Incisional hernia

In our study 2 out of 100 patients of group A developed incisional hernia, no such complication was observed in group B. patients who developed hernia were reported to us in subsequent follow up period of 6 months and another at 1 year. In a prospective study conducted, 6 out of 141 patients developed incisional hernia in the polydioxanone group, while 5 patients developed incisional hernia in polypropylene group (P=0.981). This finding was found to be statistically insignificant as concluded in the other study as well.

Suture sinus formation

In our study group A, 9 (9%) patients developed suture sinus formation whereas 2 (2%) patients in group B

developed suture sinus formation. So this observation is not statistically significant. In a study conducted 1 patient out of 30 in the polypropylene group developed this complication, and none of the patients in the polydioxanone group developed this complication.¹³ In comparison with the above study, polydioxanone had lesser incidence of suture sinus formation as observed in present study.

Palpable knots

Polypropylene suture material which is non-absorbable has tendency to stay permanently even after the wound is healed completely. So this property leads to formation of palpable knots in the region where the knots are secured while performing a mass closure of a laparotomy wound. Polydioxanone suture material which is delayed absorbable stays till the wound achieves the maximum tensile strength, so the wound cannot have the palpable knots in the delayed postoperative period. In our study, 23 (23%) patients reported palpable knots in group A, whereas no patients reported with complaints of palpable knots in group B. So, this part of study showed statistical significance ($p < 0.001$).

CONCLUSION

Based on the observations made in this study, it has been concluded that continuous mass closure technique using no.1 Polydioxanone (PDS) for closure of midline laparotomy incision is superior to no.1 Polypropylene (PPL) suture material in preventing the wound complications like post-operative wound dehiscence, wound pain, wound infection, suture sinus formation, palpable knots and incisional hernia.

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