

A Randomized Control Trial Comparing the Efficacy of Polydioxanone II and Polypropylene Suture Material for Midline Vertical Abdominal Incision Using Interrupted X Sutures in Prevention of Burst Abdomen

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ABSTRACT

Background: Abdominal wound dehiscence is a common complication of emergency laparotomy. Its prevention is important to reduce postoperative morbidity and mortality. The aim of this study to compare the incidence and risk of burst abdomen, wound infection and sinus formation with Polydioxanone (PDS II) versus Polypropylene (PPL) in midline laparotomy wounds.

Materials and Methods: 60 patients undergoing laparotomy through a midline vertical incision were randomized after informed consent, to either a Polydioxanone (PDS II) versus Polypropylene (PPL) suture material. The incidence and relative risk (RR) of burst abdomen, wound infection and sinus formation using Polypropylene (PPL) group as the reference category were calculated.

Results: There was 1 burst abdomen (out of 30 cases, 3.3%) in Polypropylene (PPL) group and none (out of 30) in Polydioxanone (PDS II). The RR of burst could not be calculated because of 0 in one arm. The incidence of wound infection was 16.6% in Polypropylene (PPL) (5 out of 30 cases) compared to 10% (3 out of 30 cases) in Polydioxanone (PDS II). The relative risk (RR) of wound infection was 0.60. The

incidence of suture sinus was 10% (3 out of 30 cases) in Polypropylene (PPL) as compared to 3.3% in Polydioxanone (PDSII) group.

Conclusion: The risk of burst abdomen, wound infection & suture sinuses is less with the use of Polydioxanone (PDS II).

Keywords: Burst Abdomen; Midline Vertical Incisions; Suture Technique; Suture Sinus; Abdominal Closure; Wound Infection.

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INTRODUCTION

Abdominal wound dehiscence is a common complication of emergency laparotomy in Indian setup. Wound dehiscence carries with it a substantial morbidity and mortality in addition to increase in cost of care. Its prevention is important to reduce postoperative morbidity and mortality. Many patients have a poor nutritional status and the presentation of patients is often delayed. This makes the problem of wound dehiscence more common and graver. Wound dehiscence is related to the technique of closure of abdomen and the suture used.¹ Numerous studies have been conducted evaluating a bewildering variety of suture materials and closure technique.²⁻⁴ The current opinion in the west centers around some form of running mass closure of abdomen in emergency and elective settings as there is no significant difference reported between the two, in most studies.^{5,6} A new interrupted X technique was introduced to circumvent the problem

of cutting out effect of continuous sutures which showed reduced incidence of wound dehiscence.⁷ While the choice may not be so important in elective patients who are nutritionally adequate, do not have any risk factor for dehiscence and are well prepared for surgery, however it may prove crucial in emergency patients who often have multiple risk factors for developing dehiscence⁸ and strangulation of sheath is the proverbial last straw in precipitating wound failure. A new suture material Polydioxanone (PDS II) was introduced to reduce the morbidity and mortality rate of laprotomies by its newer properties. Polydioxanone (PDS) is monofilament. It absorbs slowly and there is minimal absorption until about 90 days. However, its in vivo tensile strength reduces more quickly to 70% at 2 weeks, 50% at four weeks and 25% at six weeks. So it is intended to study the closure of abdomen with Polypropylene (Prolene) versus Polydioxanone II (PDS II).

MATERIALS & METHODS

The present study was carried out at SMS Medical College, Jaipur, where 60 patients underwent both elective and emergency laparotomies through midline vertical incisions. Equal number of cases (30) were studied for closure with these two suture materials; Polydioxanone (PDS II) and Polypropylene (Prolene) suture material. Patients were randomized to either procedure according to computer generated randomized list.

Inclusion Criteria

All patients undergoing laparotomy requiring vertical midline abdominal incisions which includes clean, clean contaminated, contaminated cases.

Exclusion Criteria

Patients who had undergone previous midline abdominal surgery for any condition (or had an incisional hernia or burst abdomen at presentation).

Closure of the abdominal incisions

Group 'A' Polydioxanone (PDS II):

An Interrupted X sutures were Performed using No.1 Polydioxanone (PDS II) suture. All layers of abdominal wall except skin and subcutaneous tissue were included in single layer .A bite was taken outside in 2 cm from cut edge of linea alba. The needle emerged on other side from inside out diagonally 2 cm from edge and 4 cm above or below first bite. This strand was crossed or looped around free end of suture and continued outside-in diagonally at 90° to first diagonal. A bite is taken inside out and the end is tied with free end of suture just tight enough to approximate linea alba. This creates two 'X' like crosses one on surface and another deep to linea alba. Next X suture is placed 1cm away from previous one.

Group 'B' Polypropylene (Prolene):

Similar interrupted X sutures were performed using No.1 Polypropylene (prolene) suture

Suture Technique

Interrupted X suture mass closure technique was used for fascial closure in both the groups.

In both the groups, skin was sutured with subcuticular sutures with no.3-0 Ethilon. Sterile dressings were placed after completion of closure.

Post operatively all patients received IV fluids and antibiotics as required. Blood transfusions were done wherever indicated.

Postoperatively, the laparotomy suture line were checked after 48 hours and assessed for any early wound complications. Thereafter the wound was examined on 5th, 7th and 9th post operative days.

RESULTS

In this series of 60 patients, PDS groups mean age was 45.7+/-15.56 (mean +/-SD) and in

PPL group mean age was 43.4+/-18.82 Statistical analysis shows no significant difference in distribution of age between two groups. Incidence of burst abdomen was 3.3% in PPL group and 0 in PDS II group. When only emergency cases were considered the incidence was 6.2% in PPL group. Statistical analysis shows no significant difference in the incidence of burst abdomen between the two groups (Fisher exact test, p-value =1.0). Relative risk could not be calculated due to ZERO value in one arm (table 2).

Higher incidence of wound infection in emergency cases and amongst Polypropylene (PPL) and Polydioxanone II (PDS),

incidence of wound infection was higher in Polypropylene (PPL). However, there is no statistical significance in the incidence of wound infection between the two closure techniques (p=0.704, chi-square with tate's correction=0.144). Relative risk of wound infection was 0.60. (table 3).

The incidence of suture sinus was as follows. In Polydioxanone II group out of 30 cases, one developed suture sinus (3.3%). In Polypropylene (PPL), 3 patients developed suture sinus (10.0%). Fisher exact t test was used. There is no statistical significance in the incidence of suture sinus between two groups as the p value < 0.612.

Table 1: Gender wise Distribution of Cases

Sex	Male	Female	Total
PDS II	17	13	30
PPL	21	9	30
Total	38	22	60

Table 2: Incidence of Burst Abdomen in Relation to suture material

Type of closure	BA absent	BA present	Total
PDS II	30	0	30
PPL	29	1	30
Total	59	1	60

Table 3: Wound Infection in relation to suture material and nature of operation in Polydioxanone II

Type of operation	No. of cases	Infected cases	%
Emergency	14	3	21.00
Elective	16	0	0.00
Total	30	3	10

Table 4: Wound Infection in relation to suture material and nature of operation in Polypropylene (PPL)

Type of operation	No. of cases	Infected cases	%
Emergency	16	4	25.00
Elective	14	1	7.1
Total	30	5	16.6

Table 5: Incidence of stitch abscess in Polydioxanone II and Polypropylene (PPL)

Type of operation	SS absent	SS present	%
PDS II	29	1	30
PPL	27	3	30
Total	56	4	60

DISCUSSION

In both groups, the fascial closure technique used was interrupted X sutures. Polydioxanone (PDS II) sutures are strong, delayed absorbable, retain their strength after implantation, are inert and cause minimal tissue reaction. The only disadvantage is their slipping quality in handling and in tying. This can be overcome by using minimum 5 knots and better handling technically during the closure.⁹

The ideal method of wound closure would be one that provides adequate tensile strength to the tissues until the wound has healed, approximates the tissue in such a way that normal healing takes place under optimum conditions, and remains secure in presence of local and systemic factors.² Incidence of burst abdomen and associated mortality rate has not decreased during this century. Number of factors has been associated with dehiscence, most common cause being intraperitoneal sepsis.

The incidence of wound dehiscence has been reported to vary from 0.2% to 10% and mortality associated with dehiscence is considerably high at 10% to 44%. Indian authors have reported burst abdomen to occur in 10% to 30% of emergency cases. In our study, incidence of wound dehiscence for Polypropylene (PPL) use was 3.3% (1 out of 30 cases) when only emergency cases were considered the incidence was 6.2%

The risk for dehiscence from emergency operation may be related more to hemodynamic instability than to unscheduled procedure.

In Polydioxanone (PDS II) group, no case of burst abdomen occurred. The difference in both groups was not statistically significant, and p-value was 1.0. The low dehiscence in the elective laparotomy group can be explained by the fact that patients do not have any intraperitoneal sepsis, have less abdominal distension, their malnutrition and anemia are corrected prior to surgery and they are operated in a more controlled setting where errors of technique are minimal. Results indicate that our patients seem to do better with Polydioxanone (PDS II) suture material.

Postoperative wound infection was considered present when there was purulent discharge from wound. Superficial wound infection is the infection of superficial layers of abdomen like skin and subcutaneous tissue. Deep wound infection is the infection of deeper layers of abdomen, Linea alba and the peritoneum. In both cases, finding of seropurulent discharge from a stitch or from the incision, with signs of inflammation, with or without constitutional symptoms are present.¹⁰⁻¹²

Variety of factors are responsible for the wound infection to occur in a sutured incision like, closure technique, suture material, improper aseptic measures, tissue ischaemia, other factors which contribute to the wound infection are conditions of the viscera on opening the abdomen i.e. presence of peritonitis with collection, cases where infection due to breach in continuity of the bowel is present. Local factors like seroma, hematoma formation also increase the chances of wound infection.

In the present study the overall wound infection incidence was 13.3% (8 cases out of 60 cases). The percentage in Polypropylene was 16.6% while in Polydioxanone was 10%. Polydioxanone (PDS II) had a lower incidence of wound infection 10% (3 cases out of 30 cases) compared to Polypropylene (PPL) 16.6% (5 cases out of 30 cases). In Polydioxanone (PDS II) group, the incidence of wound infection was higher in emergency operations 21% (3 cases out of 14 cases) compared to elective operations in which there was no case of wound infection. In Polypropylene (PPL), in emergency situation 4 cases out of 16 (25%) developed wound infection while 1 out of 14 (7.1%) elective cases developed wound infection.

Suture sinus is blind ending tract leading from skin into surrounding tissue with presence of suture material in it. Incidence of suture sinus formation in previous studies is reported to be 2% - 25%. Frequency of suture sinus formation is directly related to the degree of contamination and suture material used.¹²

In the present study there was 1 case (3.3%) of suture sinus formation in Polydioxanone (PDS II) group and 3 cases (10%) in Polypropylene (PPL), so the risk of developing suture sinus was more with polypropylene. Our study is a smaller one for estimating any statistical difference between two suture materials but the results have been found superior with Polydioxanone as compared to Polypropylene suture material.

CONCLUSION

We concluded that interrupted X suture technique using no.1 Polydioxanone (PDS II) for closure of midline laparotomy incision is superior to no.1 Polypropylene (Prolene) suture material when post-operative complication like burst abdomen wound infection & suture sinuses were considered.

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