

# A Randomised Control Trial Comparing the Efficacy of Polydioxanone And Polypropylene Suture Material for Midline Vertical Abdominal Incision Using Interrupted X Sutures in Prevention of Burst Abdomen: A Hospital Based Study

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## ABSTRACT

**Background:** 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. So it is intended to study the closure of abdomen with Polypropylene (Prolene) versus Polydioxanone II (PDS II) in cases operated in Government medical setup in Churu, Rajasthan, regarding the effectiveness of two different suture materials in our setup.

**Materials & Methods:** The present study done on 60 patients underwent both elective and emergency laparotomies through midline vertical incisions in D.B. General Hospital, Churu (Raj.). Equal numbers of cases (30) were studied for closure with these two suture materials; Polydioxanone (PDS II) and Polypropylene (Prolene) suture material.

**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, but statistical no significant between two groups. Ratio of male to female was statistical significant (P=0.284). The incidence was higher in emergency cases in both group but polypropylene group was higher infected cases (25%) as compared to polydioxanone group (21%).

**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 sinus were considered.

**Keywords:** Polydioxanone (PDS II), Polypropylene (Prolene), Midline Incision, Burst Abdomen.

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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.<sup>1</sup> Numerous studies have been conducted evaluating a bewildering variety of suture materials and closure technique.<sup>2,3</sup> 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.<sup>4,5</sup> 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.<sup>6</sup> 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 dehiscence<sup>7</sup> 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.<sup>8</sup> 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) regarding the effectiveness of two different suture materials in our setup.

**MATERIALS & METHODS**

The present study done on 60 patients underwent both elective and emergency laparotomies through midline vertical incisions in D.B. General Hospital, Churu (Raj.). Equal numbers of cases (30) were studied for closure with these two suture materials; Polydioxanone (PDS II) and Polypropylene (Prolene) suture material.

**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.

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.

Various parameters were assessed during the course of healing of the suture line like,

- Burst abdomen partial/ total
- Wound infections
- Stitch sinus/ abscess formation

All cases were followed up for a period of 6 weeks after surgery. Patients were called for their first visit after one month and then after 6 weeks postoperatively.

**Table 1: Sociodemographic profile in present study**

Demographic	PDS II	PPL
Age (yrs) Mean±SD	45.7+/- 15.56	43.4+/-18.82
Male:female	17:13	21:9
Nature of operation	Elective	14
	Emergency	16

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

Type of closure	BA absent	BA present
Polydioxanone II	30	0
Polypropylene (PPL)	29	1
Total	59	1

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

Nature of operation	PDS II		PPL	
	No. of cases	Infected cases	No. of cases	Infected cases
Emergency	14	3 (21%)	16	4 (25%)
Elective	16	0 (0%)	14	1 (7.1%)
Total	30	3 (10%)	30	5 (16.6%)

**Table 4: Incidence of stitch abscess in Polydioxanone II and Polypropylene (PPL)**

Type of closure	SS absent	SS present
Polydioxanone II	29	1
Polypropylene (PPL)	27	3
Total	56	4

## 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, but statistical no significant between two groups. Ratio of male to female was statistical significant ( $P=0.284$ ). Nature of operation was 50% in both group (table 1). Burst abdomen present only one case in polypropylene group in our study (table 2). The incidence was higher in emergency cases in both group but polypropylene group was higher infected cases (25%) as compared to polydioxanone group (21%) (table 3). However, there is no statistical significance in the incidence of wound infection between the two closure techniques ( $p=0.704$ , chi-square with Yates's correction=0.144).

In Polydioxanone II group out of 30 cases, one developed suture sinus (3.3%). In Polypropylene (PPL), 3 patients developed suture sinus (10.0%), but no statistical significance ( $P<0.612$ ) (table 4).

## DISCUSSION

Majority of the operations performed by a general surgeon take place on the abdomen and consequently the incision and suturing of abdominal parities is one of the commonest exercises in operative surgery. A considerable number of different suturing techniques exist for closure of the abdomen and each has its pros and cons. Proper healing of the abdominal incisions so as to restore the structural integrity and strength of the wound has always been the most important factor in surgeons mind. In spite of the modern surgical technology and skills the morbidity associated with abdominal wounds is high. There are many factors which delay wound healing such as systemic and local factors.<sup>9-11</sup> Systemic factors include obesity, jaundice, diabetes, malnutrition, protein deficiency, elderly patients, patients on steroids and immunosuppressants. Local factors which delay wound healing after laparotomy is wound infection, hematoma, foreign body reaction. All these impose stress on the freshly sutured abdominal wound. 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.<sup>12</sup>

Partial burst abdomen is when either skin or peritoneum is intact with disruption of all layers of abdominal wall and complete burst abdomen when all layers of abdominal wall are disrupted exposing the viscera.<sup>13</sup> Clinically it is diagnosed when postoperatively there is pink discharge from the suture line and when observed carefully after removal of a stitch and inspecting the layers of abdomen, all layers give way all of a sudden, which may or may not cause evisceration of the abdominal contents. This may occur any day from 7-10th postoperative day.

Burst abdomen being a mechanical process no single cause can be held responsible for its disruption. Following factors are the main local factors responsible for disruption.<sup>14</sup>

1. The knot may break or undo, a technical error that should be avoided but is still seen from time to time.
2. The suture material may rupture either because it is too weak for the tensions placed upon it or because it is destroyed rapidly in the tissues. This can be avoided by correct selection of suture material.

3. The sutures may cut through the tissues, either because they are placed too close from the wound edge or because of excessive weakening of the tissues from such systemic factors like jaundice, uremia, protein depletion, neoplastic conditions or most important, sepsis and this will be compounded if the tension placed on the healing wound is increased by abdominal distension, coughing or straining.

In the normal healing fascial wound, the intrinsic strength in first four days is practically zero, therefore it is advisable to follow a good suturing technique and use ideal suture material.

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.

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%. Incidence of wound infection reported in previous studies is up to 37.5%. The rate of wound infection is higher after emergency surgery. The results of present study are consistent with previous studies. 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.<sup>13</sup> 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

Interrupted X suture technique using Polydioxanone (PDS II) for closure of midline laparotomy incision is superior to Polypropylene (Prolene) suture material when post-operative complication like burst abdomen wound infection & suture sinus were considered.

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