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Comparison of Polypropylene (Prolene) Versus Polydioxanone(Pds) In Abdominal Wall Closure After Laparotomy

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ABSTRACT

Objective: To compare polypropylene (non-absorbable) versus polydioxanone (delayed absorbable) suture for abdominal wound closure after laparotomy

Study Design: Quasi-experimental study

Place and Duration of Study: Department of General Surgery Combined Military Hospital Quetta, Pakistan from May 2020 to June 2021.

Methodology: Total 140 patients (70 each Group) of elective laparotomy who met the inclusion criteria were included. Patients with complications, previous surgery or emergency surgery were excluded. In Group A mass closure of anterior abdominal wall was done with polypropylene while in Group B mass closure was done with polydioxanone. All patients were followed for six months post operatively for complications.

Results: Total 140 patients were included in the study. The mean age in Group A was 44.57±12.87 years and in Group B it was 48.47±11.45 years. There were 75(53.5%) males and 65(46.5%) females. Post operatively 29 patients (41.4%) in Group A and 20 patients (28.5%) in Group B developed surgical site infection. 10 patients (14.2%) of Group A and 8 patients (11.4%) of Group B developed incisional hernia. In Group A 5 patients (7.14%) had burst abdomen postoperatively while in Group B, 4 patients (5.71%) had burst abdomen.

Conclusion: We conclude that PDS (with antibacterial coating) has reduced inflammatory reaction and has better tissue regeneration. PDS is better as it has low surgical site infection, low wound dehiscence and incisional hernia formation when compared with prolene.

Keywords: mass closure abdomen, polypropylene, polydioxanone

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INTRODUCTION

Most frequently employed incision for abdominal access is midline.[1] The rectus sheath covering the abdominal muscles is made by abdominal muscles except the posterior layer which is absent below umbilicus. The choice of suture material and abdominal wall closure technique has always been a discussion topic among surgeons. An ideal closure should be easy, non-infective, tension free and should give enough strength to abdominal wall.[2] The effectiveness of a particular suture material used for closure can be related to early and late wound related complications like wound dehiscence, infections, and others which generally put a heavy economic burden on health-care systems. After surgery, 10% patients have high risk of developing ventral hernia after the major midline laparotomy.[3] It was observed in a study that short stitches are better than long stitches as this technique has fewer complications.[4] Permanent suture materials have greater tensile strength but absorbable sutures have low post-operative pain and complications.[5] Mass wound closure in a continuous fashion is better as compare to layered closure or interrupted as it has less wound dehiscence and other complications.[5] Wound dehiscence generally occurs because of poor technique, knot failure or premature weakening of suture material. Knot is the weakest point of suture and is inversely proportional to memory of suture material.[6] The ideal suture material is one which have long tensile strength, inert, and has least infection rate.[7] The pressure exerted by abdominal wall directly effects the suture material used which effect the results and complications in patients.[7] The use of long term absorbable sutures has been considered as safe as non-absorbable suture.[8] The suture material and closure technique is primarily

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selected by surgeon which is based on his own clinical experience and other evidence based learning.[9] Till today best material and technique although suggested in literature is not finalized worldwide.

Prolene is a non-absorbable polypropylene monofilament and PDS is a slowly absorbable monofilament suture material provides tissue support for 60 days (completely absorbed in 183-238days).[10]

We have conducted this study to compare the postoperative complications of prolene vs PDS like post-operative wound dehiscence, surgical site infection, burst abdomen and incisional hernia. There is a need to conduct the research to attain evidence for local practice, as the findings of both materials are still debatable.

METHODOLOGY

We conducted a quasi-experimental study in surgical unit of combined Military Hospital Quetta Pakistan from May 2020 to June 2021 after approval from ethical committee (CMH QTA-IRB/036). Sample size of 140 cases (70 each Group) was estimated by keeping 80% power of stud, 5% significance level and percentage of surgical site infection i.e. 23% with PDS and 45% with prolene.[2] Non probability consecutive sampling technique was used to include the patients. **Inclusion Criteria**: Patients of age (20-70 years) male or non-pregnant female with no previous history of abdominal surgery, non-smoker and no history of COPD were inlcuded.

Exclusion Criteria: Patients with debilitating illness, coagulopathy, mentally incapacitated, or pregnant ladies, and non-consenting individuals were also excluded from the study.

140 patients were allocated to Group A and B by lottery method. Group A patients underwent mass closure abdomen by continuous suturing with prolene while in Group B abdomen was closed with PDS by using the same technique. All patients were followed for post-operative wound dehiscence (burst abdomen), surgical site infection and incisional hernia for 6 months. Surgical site infection was declared using southampton classification of wound infection.[10] Incisional hernia was labeled if a patient complains of swelling in post-operative follow up which was later confirmed by examination and USG of swelling and CT Scan abdomen if required.

Data was collected on proforma and later on entered and analyzed in Statistical Package for the social sciences (SPSS) version 23:00. Mean±SD was calculated for continuous variable. Frequency and percentage was calculated for categorical variables. Chi square test was used. The p value ≤ 0.05 was considered significant.

RESULTS

We included total 140 patients (70 patients in each Group). The mean age of patients in Group A was 44.57±12.87 years while in Group B it was 48.47±11.45 years. In Group A, there were 39(55.7%) males and 31 (44.2%) females. In Group B, there were 36(51.4%) males and 34(48.5%) females (table I). Mean operative time in Group A was 3.24+1.34 hours while in Group B mean operative time is 3.59+1.44 hours. 27 patients (19.2%) were operated because of Periampullary mass which was the leading cause of laparotomy followed by stomach lesions due to which laparotomy was done in 25(17.8%) patients. Other indications of surgery are listed in Table II.

Table I: Demographics of patients

	Study Group	
	Group A (Prolene)	Group B (PDS)
No of patients	70	70
Age (years)	44.57±12.87	48.47±11.45
Gender		
Male	39(55.7%)	36(51.4%)
Female	31(44.2%)	34(48.5%)
Mean operative time(hours)	3.24+1.34	3.59+1.44

Table II: Indications of surgery

Indication of surgery	Study Group		n(%)
	Group A (Prolene)	Group B (PDS)	
Stomach carcinoma/lesions	12	13	25(17.8%)
Periampullary carcinoma/lesion	12	15	27(19.2%)
Small bowel diseases	10	8	18(12.8%)
Ileocecal junction diseases	9	8	17(12.1%)
Colon carcinoma/lesion	4	5	9(6.4%)
Rectal Carcinoma/lesions	7	5	12(8.5%)
Retroperitoneal lesions	9	5	14(10%)
Pelvic pathologies	1	4	5(3.5%)
Esophageal carcinoma/lesions	6	7	13(9.2%)

Post operatively 20 patients (60.6%) in Group A and 13 patients (39.3%) developed surgical site infection in which bowel was opened during laparotomy, while 9 patients (56.5) developed surgical site infection in Group A and 7 patients(43.5%) had post-operative surgical site infection in which bowel was not opened which was statistically significant. 10 patients (14.2%) of Group A developed incisional hernia post operatively when followed for six months while in Group B only 8(11.4%) patients developed incisional hernia post operatively which was statistically significant. In Group A 5 patients (7.14%) had burst abdomen postoperatively while in Group B 4 patients (5.71%) had burst abdomen which was statistically significant(Table III). It was observed that burst abdomen primarily occurred in those patients who had surgical site infection postoperatively.

Table-III: Comparison of both Groups

Variable	Study Group		*p* value
	Group A (Prolene)	Group B (PDS)	
SSI when bowel was opened	20(60.6%)	13(39.3%)	0.11
SSI when bowel was not opened	9(56.5)	7(43.5%)	0.04
Incisional hernia	10(14.2%)	8(11.4%)	0.04
Burst abdomen	5(7.14%)	4(5.71%)	0.02

DISCUSSION

Since15th century surgeons are looking for an ideal suture material which should have low complications and best post-operative results.[11] The discussion on an ideal is still present and many researches have presented different results.[2] Greenwald *et al.* found that PDS retains its maximum strength in the fresh state, followed by the Prolene. PDS has low inflammatory reaction and has better tissue regeneration when used for laparotomy wounds closure and anastomosis.[12] Jose Ignacio et al showed that slowly absorbable monofilament produces excellent results when used in small bites fashion with a ratio of 4:1 between suture and wound length.[7] Many patients related factor are known which causes incisional hernia like male sex, COPD, ascites, anemia and surgical site infection.[7] In our study 10 patients (14.2%) developed incisional hernia in Prolene Group while.[8] patients (11.4%) in PDS Group which were statistically significant. Similar results were shared by khan n et al in their study that PDS Groups has less incisional hernia formation as compare to Prolene Group.[13]

Surgical site infection is a common problem in postoperative period which often lead to wound dehiscence. In our study surgical site infection developed in 20 patients (60.6%) when bowel was opened and 9 patients (56.6%) when bowel was not opened in Prolene Group as compared to PDS Group in which 13 patients (39.3%) when bowel was opened and 7 patients(43.5%) when bowel was not opened which are statistically significant when bowel was not opened. Pai D *et al* found that 13 patients (23.2%) in the PDS Group and 20 patients (45.5%) in Prolene Group developed a surgical site infection which was statistically significant.[2] similarly weiland D *et al* shared that surgical site infection was statistically low in PDS Group.[14]

In our study 5 patients (7.14%) in Prolene Group and 4 patients (5.71%) in PDS Group developed burst abdomen in post-operative period which was statistically significant. Similar results were shared by Sajid M *et al* in their study that burst abdomen rate was low in PDS Group.[15] kushner BS *et al* found a significant low wound dehiscence and incisional hernia with PDS.[16] Vant Reit *et al* reported in their meta-analysis that PDS is better as it has least incisional hernia and wound dehiscence when compared with prolene.[17]

Chalya *et al* and Agarwal *et al* reported a higher incidence of stitch sinus formation in Prolene Group as compare to PDS Group.[18,19] Similarly khan N *et al* shared less incidence of stitch sinus formation with PDS.[13]

LIMITATION OF STUDY

This study doesn't include emergency cases which may have different results. In this study mass closure was done by differently experienced persons so depending on the expertise results may vary.

CONCLUSION

We conclude that PDS (with antibacterial coating) when used for laparotomy wounds closure has least inflammatory reaction and has better tissue regeneration. PDS is better as it has low surgical site infection, low wound dehiscence, lower stitch sinus formation and lower incidence of incisional hernia when compared with Prolene.

Conflict of Interest: None.

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Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

LR: & UM: Study design, drafting the manuscript, data interpretation, critical review, approval of the final version to be published.

AN: & RA: Data acquisition, data analysis, approval of the final version to be published.

A: & FL: Critical review, concept, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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