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Original Research Article

Comparing clinical outcomes between patients receiving non-absorbable and delayed absorbable sutures for abdominal wound closure after laparotomy

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ABSTRACT

Background: There is a lot of debate about the best suture for repairing the abdominal fascia post-laparotomy. This research compared the clinical results of patients who received non-absorbable versus delayed absorbable sutures for abdominal wound closure after laparotomy.
Methods: We conducted a prospective non-randomized clinical trial in the Department of General Surgery, Janaki Medical College and Teaching Hospital, Janakpur, Nepal. We included patients aged more than 18 years who underwent an elective laparotomy surgery with midline vertical incision for any indication between April 2020 till March 2022 in our department. Two study groups were formed: non-absorbable suture (polypropylene suture) and delayed absorbable suture (polydiaxanone suture).
Results: The two study groups were similar with respect to indication of surgery (p value = 0.52). Bowel was opened in 81% in non-absorbable group and in 85% in delayed absorbable suture group. Mean duration of surgery was found to be significantly lower in the delayed absorbable suture group as compared to non-absorbable suture group (185±21.8 vs. 232±27.3 minutes, p value < 0.05). Post-operative complications included surgical site infection, burst abdomen, incisional hernia and sinus formation. It was observed that surgical site infection rate was significantly higher among non-absorbable suture group patients as compared to delayed absorbable suture group (25% vs. 13%, p value <0.05).
Conclusions: Comparing early and late post-operative complications, there was no statistically significant difference between non-absorbable suture group and delayed absorbable suture group.

Keywords: Suture, Surgical site infection, Post-operative complications

INTRODUCTION

In the postoperative phase, wound dehiscence is an unpleasant condition that carries a significant risk of complications and may lead to morbidity and death.[1] Surgeons have long struggled to overcome postoperative difficulties related to wound closure using a variety of procedures and suturing materials.[2] Numerous investigations on sealing abdominal fascia with various sutures have been undertaken, but no definitive recommendations for improved results have been given.[3]

Numerous considerations must be made while selecting suture, including knot tying, suture handling, cost efficiency, strength, and susceptibility.[4] Durability of tensile strength is also a criterion that must be addressed, and it is the most crucial. It is possible to classify available sutures as non-absorbable or permanent sutures, slowly absorbable sutures, and fast absorbable sutures.[5] The best suture repair for repairing the abdominal fascia has been the subject of a number of studies, but no agreement has been achieved.[6] Though non-absorbable sutures (nylon and polypropylene) have generally been the favoured

option, the introduction of polydioxanone has sparked a surge in demand for absorbable sutures. This research compared the clinical results of patients who received non-absorbable versus delayed absorbable sutures for abdominal wound closure after laparotomy.

METHODS

Study design and sampling

We conducted a prospective non-randomized clinical trial in the department of general surgery, Janaki Medical College and Teaching Hospital, Janakpur, Nepal. We included patients aged more than 18 years who underwent an elective laparotomy surgery with midline vertical incision for any indication between April 2020 till March 2022 in our department. Patients who underwent emergency surgery, had a history of previous abdominal surgery, pregnant patients and those who could not be followed up post-operatively for 6 months were excluded. Those patients were also excluded who had raised intra-abdominal pressure which required tension suture closure, and those with frank purulent peritonitis. Two study groups were formed: non-absorbable suture (polypropylene suture) and delayed absorbable suture (polydiaxanone suture). Patients were not randomized to receive one type of suture material. Patients were explained the purpose of the study and an informed written consent was obtained from them before enrolment in the study.

Operative technique

Using No. 1 Polydiaxanone suture, interrupted X sutures were performed. Except for the skin and subcutaneous tissue, all layers of the abdominal wall were included in the single layer. Outside, a bite was taken 2 cm from the cut edge of the linea alba. The needle emerged through the other side diagonally, 2 cm from the edge and 4 cm above or below the first bite. This strand was crossed or looped around the free end of the suture and continued diagonally outside-in at 90 degrees to the initial diagonal. A bite was taken from the inside out, and the end was secured with a free end of suture to resemble the linea alba. This results in two 'X'-shaped crossings, one on the surface and one deep to linea alba.[7] The subsequent X suture is inserted 1 cm from the preceding one. Similar interrupted X sutures were applied using No.1 Polypropylene (prolene) suture to close the wound.

Data collection and data analysis

We acquired demographic information about the patients from their medical records. All patients underwent detailed clinical examination. Using a pre-designed semi-structured study proforma, body mass index (BMI) and past medical history of the patients was noted. From the medical records, indication of surgery was noted. Opening of bowel and duration of surgery was obtained from operative notes. The patients were followed for 6 months post-operative to check for post-operative complications. Descriptive analysis of quantitative parameters was expressed as means and standard deviation. Qualitative data were expressed as absolute number and percentage. Cross tables were generated and chi square test was used for testing of associations. Independent t test was used for comparison of quantitative parameters. A p value <0.05 is considered statistically significant. All analysis were done using SPSS software, version 24.0.

RESULTS

During the study period, we included 112 patients, of which 52 received non-absorbable suture and 60 received delayed absorbable sutures. Mean age of the patients was 52.1 and 53.4 years in the non-absorbable suture and delayed absorbable suture group respectively (p value=0.14). Most of the patients were in the age group of 40 to 60 years (Table 1). Males comprised 65% of the non-absorbable suture group and 62% of the delayed absorbable suture group (p value=0.23). Mean BMI of the patients was 21.8 kg/m^2 and 22.4 kg/m^2 in the non-absorbable suture and delayed absorbable suture group respectively (p value=0.42). Majority of the patients had normal BMI. There were 8% diabetics in each group, three patients had COPD and total 5 patients were current smokers. Thus, both the study groups were similar with respect to age, gender, BMI and past medical history. The most common indication for laparotomy surgery was carcinoma colon (31% in non-absorbable suture group and 35% in delayed absorbable suture group) and carcinoma stomach (25% in non-absorbable suture group and 25% in delayed absorbable suture group). The two study groups were similar with respect to indication of surgery (p value=0.52). Bowel was opened in 81% in non-absorbable group and in 85% in delayed absorbable suture group. Mean duration of surgery was found to be significantly lower in the delayed absorbable suture group as compared to non-absorbable suture group (185±21.8 vs 232±27.3 minutes, p value <0.05). Post-operative complications included surgical site infection, burst abdomen, incisional hernia and sinus formation. It was observed that surgical site infection rate was significantly higher among non-absorbable suture group patients as compared to delayed absorbable suture group (25% vs 13%, p value <0.05). In the non-absorbable suture group, there was one case of burst abdomen and 4 cases of sinus formation. In the delayed absorbable group, there was one case of burst abdomen, incisional hernia and sinus formation.

DISCUSSION

The present study was done to compare the clinical outcomes in patients who received non-absorbable suture and those who received delayed absorbable suture for abdominal wound closure of laparotomy. The two study groups were similar with respect to age, gender, body mass index and past medical history. In addition, the indication for surgery was also similar, the most common being carcinoma colon.

Table 1: Comparison of baseline characteristics between the two study groups.

Parameters		Non absorbable suture (N=52)	Delayed absorbable suture (N=60)	P value*
Age group (years)				
20 to 40	N	10	14	0.14
	%	19	23	
40 to 60	N	28	30	
	%	54	50	
More than 60	N	14	16	
	%	27	27	
Gender				
Male	N	34	37	0.23
	%	65	62	
Female	N	18	23	
	%	35	38	
Body mass index				
Underweight	N	6	10	0.42
	%	12	17	
Normal	N	22	28	
	%	42	47	
Overweight	N	19	16	
	%	37	27	
Obese	N	5	6	
	%	10	10	
Past medical history				
Diabetes mellitus	N	4	5	0.99
	%	8	8	
COPD	N	3	3	0.91
	%	6	5	
Bronchial asthma	N	2	1	0.72
	%	4	2	
Smoking	N	2	3	0.82
	%	4	5	

*analzyed using Chi-square test

Table 2: Comparison of indications of laparotomy between the two study groups.

Indication for surgery		Non absorbable suture (N=52)	Delayed absorbable suture (N=60)	P value*
Carcinoma colon	N	16	21	0.52
	%	31	35	
Carcinoma stomach	N	13	15	
	%	25	25	
Carcinoma rectum	N	6	7	
	%	12	12	
Carcinoma esophagus	N	3	3	
	%	6	5	
Ileocecal tuberculosis	N	2	2	
	%	4	3	
Others	N	12	12	
	%	23	20	

*analzyed using Chi-square test

Pai et al also reported that overall, colorectal malignancies were the most common indications for surgery, followed by carcinoma stomach, carcinoma oesophagus and ileocaecal tuberculosis.[8] In our study, duration of surgery was significantly lower among in patients in the delayed suture group as compared to non-absorbable suture group patients. Pai et al found that the mean duration of the surgery in the prolene group was 4 hours, whereas in the PDS group it was 3 hours 10 minutes. The difference in the average duration of surgery between the two groups

was statistically significant with a p value of 0.020. Among complications, surgical site infection rate was significantly higher among non-absorbable suture group patients as compared to delayed absorbable suture group (25% vs. 13%, p value <0.05).

Table 3: Comparison of intra-operative variables between the two study groups.

Intra-operative variables		Non absorbable suture (N=52)	Delayed absorbable suture (N=60)	P value
Bowel opened				
Yes	N	42	51	0.33*
	%	81	85	
No	N	8	9	
	%	15	15	
Duration of surgery (min)		232±27.3	185±21.8	<0.05**

*analzyed using Chi-square test; **analyzed using independent t test

Table 4: Comparison of post-operative complications between the two study groups.

Post-operative complications		Non absorbable suture (N=52)	Delayed absorbable suture (N=60)	P value*
Surgical site infection	N	13	8	<0.05
	%	25	13	
Burst abdomen	N	1	1	0.99
	%	2	2	
Incisional hernia	N	0	1	NA
	%	0	2	
Sinus formation	N	4	1	0.13
	%	8	2	

*analzyed using Chi-square tes

The prolonged length of surgery in the non-absorbable group may have contributed to a greater incidence of wound infection. Kailas et al discovered that one occurrence of emergency abdominal rupture in polypropylene (prolene) was accompanied by wound infection.[9] The p value for the absence of abdominal rupture in the polydiaxanone (PDS II) group was 1.0. Ranjan et al discovered no statistical difference between suture material and suturing method and wound infection or abdominal rupture.[10] Since the presence of infection is related with a greater frequency of dehiscence, prevention of infection should be prioritised above methods of closure in order to limit dehiscence. Both closure techniques are fragile if an infection develops. Both suture material and suturing technique have been found to resist and delay infection growth. Due to the fact that Prolene is non-absorbable, it may function as a foreign body that maintains a superficial sinus tract until it is removed. In addition to suture material and surgical technique, other variables impact the incidence of a ruptured abdomen, such as the patient age, sex, anaemia, diabetes, nutrition status of the port, sepsis, cough, and pulmonary problems, among others.

The rate of wound infection was greater in Polypropylene (12%) than in Polydiaxanone (6%), according to Kadiya et al.[11] In emergency situations, the usage of Polydiaxanone suture material was superior than Polypropylene suture material, which had an infection rate of 12%. Suture sinus occurred in 2% of Polydiaxanone and 6% of Polypropylene sutured patients. In a different study by Pai et al the risk of surgical site infection was considerably greater in the Prolene group compared to the PDS group. Similarly, Chalya et al found a greater rate of sinus development when Prolene was used for abdominal fascial closure compared to PDS.[12] Agarwal et al similarly documented a greater incidence of stitch sinus development after using Prolene in their investigations (but they compared Prolene with Polyglactin for abdominal fascial closure).[13] Bucknall et al showed that non-absorbable (nylon) sutures were associated with a greater incidence of surgical site infection than absorbable (Polyglycolic acid) sutures.[14]

This research has a few drawbacks. We did not randomise or blind the allocation of patients in the research, which may have resulted in some selection bias. In addition, the included closures were done by a range of surgeons with varying degrees of experience and training, from residents to senior professors. Due to the fact that patients were collected from multiple units within the department of surgery, the perioperative antibiotic regimen was unable to be standardised.

CONCLUSION

Comparing early and late post-operative problems, there was no statistically significant difference between non-absorbable suture group and delayed absorbable suture group. It should be noted that duration of surgery was significantly lower in non-absorbable suture group. Consequently, based on the current study, any of the two suture materials may be used to close abdominal wounds

in elective midline laparotomies. However, future randomized studies are required to support our findings.

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