|| ISSN(online): 2589-8698 || ISSN(print): 2589-868X ||
International Journal of Medical and Biomedical Studies
Available Online at www.ijmbs.info
NLM (National Library of Medicine ID: 101738825)
Index Copernicus Value 2019: 79.34
Original Research Article
Volume 4, Issue 11; November: 2020; Page No. 107-112

A COMPARATIVE STUDY BETWEEN THE INCIDENCE OF WOUND INFECTION AND BURST ABDOMEN BETWEEN DELAYED ABSORBABLE (VICRYL) AND MEDICATED VICRYL (VICRYL PLUS) SUTURE MATERIAL IN PATIENTS UNDERGOING MIDLINE INCISION LAPAROTOMY IN ACUTE ABDOMEN CASES IN THE EMERGENCY SETTINGS

Dr Abhishek Jina[1], Dr Abhinav Chaudhary[2], Dr U C Singh[3]
[1] Assistant Professor, Department of Surgery, BRD Medical College, Gorakhpur
[2] Assistant Professor, Department of Surgery, Maharshi Vashistha Autonomous State Medical College, Basti
[3] Professor, Department of Surgery, BRD Medical College, Gorakhpur

Article Info: Received 27 September 2020; Accepted 27 November 2020
DOI: https://doi.org/10.32553/ijmbs.v4i11.1535
Corresponding author: Dr Abhinav Chaudhary
Conflict of interest: No conflict of interest.

Abstract

Midline laparotomy is frequently done in the emergency setting of any hospital and type of suture material used for the fascial closure of the abdominal wall influences the incidence of the postoperative complications. The aim of this study was to compare the efficacy of the medicated Vicryl (Vicryl plus) suture material with plain Vicryl suture material in patients undergoing midline incision laparotomy in acute abdomen cases based on the postoperative complications. In addition, the effect of various risk factors on burst abdomen and wound infection was also evaluated.

Methods: 100 patients who have visited the emergency department of the hospital and underwent midline laparotomy were enrolled in this study.

Results: Patients were divided into two groups depending on whether they have an intestinal perforation (group A, n=60) or intestinal obstruction (Group B, n=40). These two groups were further divided into two groups depending on the type of suture material used (plain Vicryl: group A1, B1 and medicated Vicryl: group A2, B2). Both these groups had an equal number of patients. The analysis of the data showed that compared to the non medicated suture material the rate of wound infection is considerably less in the cases of medicated polyglactin suture material. In addition, older age, diabetes, anemia, and malnutrition are the significant risk factor for wound infection ($p<0.001$s) while Older age, malnutrition, and cough were found to be highly significant risk factors for burst abdomen.

Conclusion: The medicated suture material was proved to be more effective in preventing the burst abdomen and postoperative wound infections compared to the plain delayed absorbable Vicryl suture material.

Keywords: delayed absorbable Vicryl, medicated Vicryl, burst abdomen, wound infection, a midline laparotomy

Introduction

Abdominal wall closure is a complex and dynamic process. In the midline laparotomy procedure, the weak, tendinous zone called linea alba is opened. The weakness of the linea alba is increased when the fibers are vertically sectioned (1).

The manipulation or closure of linea alba by suture requires the fibers within it to be subjected to mechanical tension. This mechanical force is best created when the fibers are vertically sectioned. In this process, the weakness of linea alba is also increased and the access to the peritoneal cavity is eased. Different mechanical forces involved in the suturing process in combination with various biological factors play a determining role in the high incidence (16% to 20%) of postoperative incisional hernia (2).

The successful wound healing after a laparotomy process depends on various factors. Careful selection of the right suture material is one of them. It is every surgeon's dream to close the abdominal incisions securely so that no further complications arise. However, in spite of precautions taken, sometimes the procedure results in clinical complications including dehiscence, wound infection, suture sinuses, and incisional hernia (3).

Irrespective of the direction of the incision, abdominal wall closure procedure has changed significantly in the past two decades. In the past, the use of nonabsorbable suture was

practiced widely by the surgeons. One of the many reasons that absorbable sutures were not used in abdominal wall closure included dehiscence and chances of increased wound infection. Usually, absorbable sutures were used for a wound that heals quickly and required temporary support.

Clinical studies have reported a higher incidence of dehiscence after abdominal wound closure with catgut. ***Mathur Sk*** has shown that using nonabsorbable suture material the incidence of burst abdomen can be reduced to 0 to 0.9% (4). Hence, the use of non-absorbable suture material is generally recommended for abdominal wall closure and polypropylene is widely used for this purpose (1). Polypropylene is a biocompatible and non-absorbable material that has been used for closure of laparotomy wounds widely.

However, interest in the use of absorbable sutures has been restored by the development of the synthetic absorbable materials polyglycolic acid, polyglactin and polydioxanone (PDS). The chemical structure of these sutures is rather similar, and they have greater tensile strength and a slower rate of absorption in vivo than surgical catgut (5).

There are many theoretical concerns over the use of absorbable suture material but recent studies have shown that the rate of wound infection and burst abdomen are almost equal in both cases. But the chances of stitch abscess and sinus formation are higher in case of nonabsorbable sutures (6).

In addition to the suture material selection, the health status of the individual undergoing the procedure and the wound environment also affects the wound healing process. Factors affecting laparotomy wound healing and complications are divided into controllable and uncontrollable factors. Controllable factors are wound infection, type of incision, nature of the operation, closure techniques, and suture material; postoperative hematoma, obesity etc. Uncontrollable factors include age, sex, sepsis, steroids etc.

In this present study the comparison between delayed absorbable suture polyglactin and medicated polyglactin was done in patients undergoing midline incision laparotomy in the emergency hospital setting and the incidence of wound infection and burst abdomen rate was also noted.

Material and Methods

This study was conducted in Baba Raghav Das Medical College, Gorakhpur. Patients who had visited this hospital from April 2019 to March 2020 for acute abdomen and have undergone midline incision laparotomy were included in this study. The study was conducted to compare the incidence of wound infection and burst abdomen between delayed absorbable (Vicryl) and medicated Vicryl (Vicryl plus) suture.

Total 100 patients were included in this study and were randomly one of the following types of closure

Continuous vicryl (polygalactin suture)

Continuous medicated vicryl (polygalactin suture medicated with Triclosan)

Inclusion criteria:

Patients with primary closure of a midline laparotomy in the region of the lower and/or upper abdomen were included in this study.

Exclusion criteria:

Patients were excluded depending on the following parameters:

- A patient who had undergone a previous laparotomy for any condition.
- A patient who had an incisional hernia or burst abdomen at presentation.

The patients were included in this study after written consent was signed and the complete history and physical examination were carried out. The relevant investigation including the hemoglobin concentration, total leukocyte count, differential leukocyte count, bleeding time, clotting time, urine routine examination, random blood sugar, blood urea, serum creatinine, serum electrolytes, serum albumin, total bilirubin, direct bilirubin, and chest x-ray was conducted. In addition, the patients were also evaluated for the presence of any high-risk factors that can affect the wound healing process and those factors were also recorded.

Initially, the patients were divided into two groups depending on whether they have an intestinal perforation or intestinal obstruction. In the first part, the incidence of wound infection and burst abdomen between the plain polyglactin (Group A1) and triclosan impregnated polyglactin suture material (Group A2) was studied in patients (n=60) of intestinal perforation in midline laparotomy wound incision. The patients were divided into two groups that comprise of 30 patients each.

Similarly, in the second part, the incidence of wound infection and burst abdomen between the plain polyglactin (Group B1) and triclosan impregnated polyglactin suture material (Group B2) was studied in patients (n=40) of intestinal perforation in midline laparotomy wound incision. The patients were divided into two groups that comprise of 20 patients each.

Results

The Age of patients in this study ranged from 16-80 years. In the intestinal perforation group, the majority of cases (in group Al 66.6% and in group A2 70%) were in between age group of 36-70 years. Overall, nearly 68% of the cases were in 36-70 years age group. No statistically significant difference was observed between mean ages of two groups (p> 0.05). In the intestinal obstruction group, 70% of cases both in group B1 and B2 were in age group of 36-70 years (Table 1A and Table 1B).

Table 2A and 2B describe the gender distribution in the present study. Total male to female ratio was found to be 48:12 (4:1) in the study group indicating a male predominance in the study. In group A1 and in A2 80% of patients were male and 20% were female. There was no statistically significant difference was found between the sex distribution of the two groups (p > 0.05). In the intestinal obstruction group in B1 65% of the patients were male and 35% of the patients were female. While in group B2 there were 15 males (75%) and 5 females (25%). There was no statistically significant difference between the sex distributions of the two groups (p > 0.05).

Tables 3A and 3B summarize the distribution of risk factors such as diabetes mellitus, malnutrition, anemia, jaundice, sepsis, uremia, cough, and other pulmonary complications in both intestinal obstruction and intestinal perforation cases. The occurrence of these risk factors was identical (p>0.05) for the two groups in both intestinal perforation and intestinal obstruction patients and was attributed to an adequate randomization process. Moreover, in the term duration of the surgery the two groups A1 and A2 had an identical result (p>0.05).

In the wound complication in the suture material study such as wound infection (A1, 33.66% and A2 10%) and burst abdomen (A1, 10% and A2 6.66%) a statistically significant difference was observed (p < 0.05). This result indicates that both wound infection and burst abdomen incidence is less in medicated vicryl group.

The rate of wound complications found to be higher in old age (>55 yrs), male sex, anemia, diabetes, malnutrition, jaundice, uremia were found to be significant risk factors for developing a wound infection and burst abdomen (P >0.05). The rate of wound complications is higher in cases with a duration of surgery greater than 2 hours. But it is statistically non-significant (p>0.05). In addition, it was observed that the rate of burst abdomen is significantly higher in cases that had a cough (p<0.01) and patients with pulmonary complications (p>0.01).

Table 1 A: age distribution of patients in intestinal perforation study

Age (years)	Group Al Plain polyglactin		Group A2 Medicated polyglactin		Total	
	No.	%	No.	%	No.	%
16-35	10	33.33	9	30	19	31.66
36-45	5	16.66	6	20	11	18.33
46-65	12	40	13	43.33	25	41.66
65-80	3	10	2	6.66	5	8.66
Mean ± SD	44.25+ 15.89		44.16 ± 14.76		44.21 ±15 34	
TOTAL	30		30		60	

Table 1 B: Age distribution of patients in intestinal obstruction study

Age (years)	Group B1 Plain Polyglactin		Group B2 Medicated Polyglactin		Total	
	No.		No.	%	No.	%
16-35	6	30	6	30	12	30
36-45	4	20	3	15	7	17.5
46-65	5	25	7	35	12	30
65-80	5	25	4	20	9	22.5
Mean ±SD	47.37 ± 18.26		47.25 ± 17.47		47.31 ± 17.86	
TOTAL	20		20		40	

Table 2A: showing gender distribution in intestinal perforation study

Sex	Group Al		Group A2		Total	
	No.	%	No.	%	No.	%
Male	24	80	24	80	48	80
Female	6	20	6	20	12	20

Table 2B: showing sex distribution in intestinal obstruction acute abdomen study

Sex	Group B1		Group B2		Total	
	No.	%	No.	%	No.	%
Male	13	65	15	75	28	70
Female	7	35	5	25	12	30

Table 3A: Showing risk factors distribution in intestinal perforation study

Risk Factors	Group Al		Group A2		Total	
	No.	%	No.		No.	%
Diabetes Mellitus	3	10	2	06.66	5	8.33
Anemia	7	23.33	5	16.66	12	20
Malnutrition	10	33.33	10	33.33	20	33.33
Jaundice	2	06.66	3	10	5	8.33
Uremia	2	06.66	3	10	5	8.33
Cough	3	10	4	13.33	7	11.66
Pulmonary	6	20	8	26.66	14	23.33

Table 3B: Showing risk factors distribution in intestinal obstruction study

Risk Factors	Group B1		Group B2		Total	
	No.	%	No.	%	No.	%
Diabetes Mellitus	2	10	2	10	4	10
Anemia	5	25	5	25	10	25
Malnutrition	6	30	6	30	12	30
Jaundice	2	10	1	5	3	7.50
Uremia	2	10	2	10	4	10.00
Cough	3	15	4	20	7	17.5
Pulmonary Complications	5	25	5	25	10	25

Table 4 A: Showing distribution of cases according to the duration of surgery in intestinal perforation study

Duration of surgery	Group Al		Group A2		Total	
	No.	%	No.	%	No.	%
< 2 hours	22	73.33	16	53.33	38	63.33
> 2 hours	8	26.66	14	46.66	22	36.66

Table 5 A: Showing rate of wound complications in intestinal perforation study

Wound Complications	Group Al		Group A2		Total	
	No.	%	No.	%	No.	%
Wound infection	11	36.66	3	10	14	23.33
Burst Abdomen	3	10	2	6.66	5	8.33
Sinus Formation	0.0	0.0	0.0	0.0	0.0	0.0
Nil	16	53.33	25	83.33	41	80
Total	30	100	30	100	60	100

Table 6: Showing relation of age with a wound complication

Age (yrs)	Total	Wound Infection		Burst Abdomen	
		No.	%age	No.	%age
< 55	67	9	13.43	5	7.46
>55	33	15	45.45	5	15.15
p-value		<0.05s		<0.05s	

Table 7: showing the relation of sex with a wound complication

Sex	Total	Wound Infection		Burst Abdomen	
		No.	%age	No.	%age
Male	76	19	25.67	8	10.52
Female	24	5	20.83	2	8.33
p value		>0.05s		>0.05s	

Table 8: Showing the effect of anemia on wound complications

Anemia	Total No.	Wound infection		Burst abdomen	
	No.	No.	%	No.	
Present	22	11	50	5	22.72
Absent	78	13	16.66	5	6.41
p-value		<0.05s		<0.05s	

Table 9: Showing effect of malnutrition on wound complication

Malnutrition	Total No.	Wound infection		Burst abdomen	
	No.	No.	%	No.	%
Present	32	13	40.62	6	18.75
Absent	68	11	16.17	4	5.88
p value		< 0.05s		< 0.05s	

Table 10: Showing effect of diabetes mellitus on wound complication

Diabetes Mellitus	Total No.	Wound infection		Burst abdomen	
	No.	No.	%	No.	%
Present	9	6	66.66	3	33.33
Absent	91	18	19.78	7	7.69
p value		< 0.05s		<0.05s	

Table 11: Showing effect of uremia on wound complication

	Total No.	Wound infection		Burst abdomen	
	No.	No.		No.	%
Present	9	5	55.55	4	44.44
Absent	91	19	20.87	6	6.59
p-value		>0.05s		>0.05s	

Table 12: Showing effect of jaundice on wound complication

Jaundice	Total No.	Wound infection		Burst abdomen	
	No.	No.	%	No.	%
Present	8	6	75	2	25
Absent	92	18	19.56	8	8.69
p value		<0.05s		<0.05s	

Table 13: Showing relation of duration of surgery with wound complication

Duration Surgery	Total No.	Wound infection		Burst abdomen	
	No.	No.	%	No.	%
<2 hours	51	10	19.60	4	7.84
> 2 hours	49	14	28.57	6	12.24
p-value		>0.05s		>0.05s	

Table 14: Showing effect of cough on wound complication

Cough	Total No.	Burst abdomen	
	No.	No.	%
Present	14	5	35.71
Absent	86	5	5.81
p-value		< 0.01s	

Table 15: Showing effect of other pulmonary complications on wound complication

Pulmonary Complications	Total No.	Burst abdomen	
	No.	No.	%
Present	24	7	29.16
Absent	76	3	3.94
p-value		< 0.01s	

Discussion

Midline laparotomy whether elective or done in emergency condition is a frequently performed procedure in any surgical unit worldwide. The method of closure of the abdominal wall following a laparotomy incision and the choice of the suture material remains an important aspect of the operation procedure. However, in a majority of the instances choice of the suture material often reflects the surgeon's personal choice, preferences and anecdotal experience (7,8).

Generally, two types of suture material are used in the abdominal wall closure: absorbable or nonabsorbable. Historically, absorbable sutures (especially catgut) were thought to be more tissue reactive and had limited tensile strength. Although this material was more superior than the non-absorbable one in term of tying characteristics and handling, strength and security were doubtful. After World War II synthetic nonabsorbable sutures were advocated, and more recently long-term absorbable sutures (Dexon and Vicryl) have received considerable attention. Vicryl is an absorbable suture material that maintains its strength for a relatively long period and can be used even in sepsis patients.

The present study was carried out on 100 patients of acute abdomen with either intestinal perforation or intestinal obstruction who had visited the emergency department of the Baba Raghav Das Medical College, Gorakhpur and in whom midline incision laparotomy was performed.

Suture material

The most common complication that causes a higher number of morbidity in patients after laparotomy surgery is abdominal fascial dehiscence. In the early postoperative period this complication is termed as the burst abdomen, and in the later part of the operational complications, it referred as an incisional hernia. Both these conditions are highly complicated and these patients usually undergo a second surgery for secondary fascial closure. This operation is associated with increased morbidity and up to 45% of the higher recurrence rates (9).

In the intestinal perforation cases the rate of wound infection was, 36.66% in group A1 and in group A2 it was 10%. Similarly, in cases of intestinal obstruction the rate of wound infection was 40% in group B1 and in group B2 it was 10%. Moreover, the rate of burst abdomen was also lower in the A2 and B2 group where medicated suture material was used. Thus this result signifies that with the use of medicated polyglactin suture decreases the rate of burst abdomen and wound infection.

Justinger et al have observed that use of antibiotic-coated loop suture decreases the chances of infection in patients undergoing abdominal surgery. They have used triclosan-coated polyglactin 910 suture materials with antibacterial activity (Vicryl plus) and compared its efficacy with the polydioxanone suture (PDS II) material. The result of this study showed that when the PDS II suture material was used 10.8% of the patients were diagnosed with the wound infection whereas; when the medicated vicryl plus suture was used only 4.9% patients had wound infection (10).

Other Risk factors

Studies have also shown that nutritional status of the patients also affects the cases of burst abdomen or wound infection. Serum albumin is the most commonly used indicator that can denote whether any patient has malnutrition or not. In addition, ***Mullen et al (1979)*** found that the incidence of surgical complications was double in those patients whose serum albumin was less than 3.0 gm/dl as compared to those above 3.0gm/d1.

In the present study, it was found that the rate of wound infection is higher in a malnourished patient (40.62%) as compared to well-nourished patients (16.17%) and in an anemic patient (50%). In a similar study by ***Verma et al (2018)*** have shown that malnutrition, is a significant risk factor for the development of wound infection after laparotomy procedure (11).

In our study rate of burst abdomen was found to be higher in malnourished patients (18.75%) as compared to well nourish patient (5.88%) and in anemic patients (22.72%) as compare to nonanemic patients (6.41%).

In the present study among cases of intestinal perforation cases, the rate of burst abdomen was found to be 8.33% and among intestinal obstruction acute abdomen cases it was 12.5%. ***Rehman et al*** (2018) have reported a burst abdomen in 8.13% of cases in patients undergoing emergency laparotomy. In a study from Allahabad 30% burst abdomen was reported in patients with infected cases (9).

Studies have shown that older age and male sex have a positive association with increased incidence of burst abdomen and wound infection. In the present study, the rate of wound infection was found to be more in males (25.67%) as compared to females (20.83%) and in old patients (45.45%) as compared to young patients (13.43%). Similarly, the incidence of burst abdomen was higher in males (10.52%). These findings are consistent with studies of ***Verma et al (2018), Singh (2015) and Sharma et al (2015)*** (11–13).

Studies by several groups have demonstrated delayed wound healing, poor collagen formation and poor tensile strength of deep surgical wound in diabetic patients. Animals that have been made insulin deficient and given a

skin incision demonstrate 25 to 35% less wound tensile strength during the first several weeks of healing than controls. In our study, the rate of wound infection was found to be higher in diabetic patients (66.66%). In our study rate of burst abdomen found to be higher in diabetic patients (33.33%) as compared to non-diabetic patients (7.69%). Riou et al (1992) found a higher rate of burst abdomen in diabetic patients (19%) as compared to control (8%).

Among other risk factors uremia, jaundice, cough, and other pulmonary complication was found to significantly affect the wound infection and burst abdomen in patients undergoing laparotomy procedures. Studies have shown that pulmonary disease and postoperative pulmonary complications (atelectasis, Bronchitis, and pneumonia) are important systemic risk factors for increased incidence of wound infection and burst abdomen. ***Singh et al (2015)*** have also shown that other than the suture material several other risk factors such as age, sex, anemia, cough, and other pulmonary complications also influence the occurrence of burst abdomen (12).

Risk of wound infection has been repeatedly shown to be proportional to the length of operative procedure (12). In our study, the rate of burst abdomen (12.24% versus 7.84%) was found to be higher in cases with a long duration of surgery as compared to cases with a short duration of surgery. So this higher rate of burst abdomen seen in longer cases may be due to increased wound infection in these cases.

Conclusion:

The present study showed that compared to the non medicated suture material the rate of wound infection is considerably less in the cases of medicated polyglactin suture material. Previous reports have also shown that Medicated polyglactin was especially effective over gram-positive cocci group (S aureus, S epidermidis, MRSA and MRSE). On further analysis, it was also found that older age, diabetes, anemia, and malnutrition are significant risk factors for wound infection ($p<0.001$s) while Older age, malnutrition, and cough were found to be highly significant risk factors for burst abdomen.

References

1. Bellón JM, Pérez-López P, Simón-Allue R, Sotomayor S, Pérez-Köhler B, Peña E, et al. New suture materials for midline laparotomy closure: an experimental study. BMC Surg. 2014 Sep 17;14:70.
2. Diener MK, Voss S, Jensen K, Büchler MW, Seiler CM. Elective midline laparotomy closure: the INLINE systematic review and meta-analysis. Ann Surg. 2010 May;251(5):843–56.
3. T. K, G. C. A randomized control trial comparing the efficacy between delayed-absorbable polydioxanone and non-absorbable suture material in abdominal wound closure. Int Surg J [Internet]. 2017 [cited 2018 Dec 18]; Available from: http://www.ijsurgery.com /index.php/isj/article/view/632
4. Mathur SK. Burst abdomen. A preventable complication, monolayer closure of the abdominal incision with monofilament nylon. J Postgrad Med. 1983 Oct 1;29(4):223.
5. Khiste SV, Ranganath V, Nichani AS. Evaluation of the tensile strength of surgical synthetic absorbable suture materials: an in vitro study. J Periodontal Implant Sci. 2013 Jun;43(3):130–5.
6. H. K. A comparative study of outcome of the absorbable suture polydioxanone and nonabsorbable suture polypropylene in laparotomy wound closure. Int J Res Med Sci. 2016;2084–8.
7. Ceydeli A, Rucinski J, Wise L. Finding the best abdominal closure: an evidence-based review of the literature. Curr Surg. 2005 Apr;62(2):220–5.
8. Knaebel H-P, Koch M, Sauerland S, Diener MK, Büchler MW, Seiler CM, et al. Interrupted or continuous slowly absorbable sutures - design of a multi-centre randomised trial to evaluate abdominal closure techniques INSECT-trial [ISRCTN24023541]. BMC Surg. 2005 Mar 8;5:3.
9. Rehman Z. Comparison of Wound Dehiscence in Interrupted with Continuous Closure of Laparotomy. :6.
10. Justinger C, Moussavian MR, Schlueter C, Kopp B, Kollmar O, Schilling MK. Antibacterial [corrected] coating of abdominal closure sutures and wound infection. Surgery. 2009 Mar;145(3):330–4.
11. Verma S, Patil SM, Bhardwaj A. Study of risk factors in post-laparotomy wound dehiscence. Int Surg J. 2018 Jun 25;5(7):2513.
12. Singh S, Singh V. Comparative study of non-absorbable versus delayed absorbable suture material and suturing technique in midline abdominal closure. Int J Med Health Res. 2015;2:19–22.
13. Sharma AC, Mamta S, Mohammad S, Spandan K. Evaluation of Wound Complications in Elective Abdominal Surgery. group. 20(8):7–3.