Comparison of Antibiotic Coated Vicryl Vs Non-Coated Vicryl in Abdominal Fascial Closure After Laparotomy in Children

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Abstract

Objective: To compare the outcome of antibiotic-coated vicryl versus non-coated vicryl in abdominal fascial closure after laparotomy in children regarding surgical site infections in contaminated wounds.

Material and Method: This randomized control study (NCT06129773) was conducted for one year at The Children's Hospital and University of Child Health Sciences, Lahore. According to the operational criteria, 100 patients were included in the research and randomly divided into two groups (50 patients in each Group). All patients were assessed for surgical site infection on the 3rd, 7th, and 30th postoperative days using the Southampton wound grading system. The student's t-test and Chi-square tests were applied in SPSS version 24 to interpret the associations between different variables. A P-value of <0.05 was considered significant.

Results: Both groups have similar demographic parameters like age and weight distribution. The mean age of the children in abdominal fascial closure with antibiotic-coated vicryl was 64.09±50.14 months, while in non-coated vicryl was 64.26± 53.45 months (p-value of 0.164). There was a male predominance in the study population, with 70 % males and 30 % females. The total surgical site infection (SSI) incidence following laparotomy was 37%. Surgical site infections occurred in 22% of patients in abdominal fascial closure with antibiotic-coated vicryl and 52% in the non-coated vicryl Group (p-value: 0.002). The hospital stay in the antibiotic-coated vicryl Group was significantly shorter than non-coated group. (4.20 versus 8.24 days. P-value: 0.001).

Conclusion: The results of our study concluded that antibiotic-coated vicryl is superior to uncoated vicryl for abdominal fascial closure after laparotomy in contaminated wounds in children.

Keywords: Triclosan coated vicryl, Vicryl plus, surgical site infection, uncoated vicryl

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Introduction

Surgical site infections continue to be the most prevalent complication following laparotomy. Despite the availability of established preventative strategies, the global incidence of SSIs is estimated to range from 3 to 20%.[1,2] According to the Centers for Disease Control and Prevention (CDC), surgical site infections occur 30 days after surgery, except for implant procedures, which require a year of follow-up before being declared infection-free. The frequency of infected wounds after laparotomy ranges between 3% and 20 %.[3] SSI is also responsible for a longer hospital stay, more intensive care unit admissions, hospital readmissions following surgery, dramatically increased expenditures, and delays in adjuvant systemic therapy.[4] To reduce surgical site infection, problems with adequate antiseptic preparations and basic measures must be addressed. Two of the most important parts of surgical site infection prevention are intraoperative tissue handling and prophylactic antibiotics.[5]

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Effective and persistent antisepsis of the skin, meticulous surgical technique, appropriate antibiotic prophylaxis, and the development of techniques to reduce wound contamination appear to be the most important variables in minimizing the incidence of surgical site infection.[6] Type of suture material and its effect on wound infection is a long-debated topic among surgeons. Consequently, the type of suture used to close the incision substantially affects the incidence of SSI. Suture materials have been categorized according to their monofilament and poly filament compositions. One of the main contributors of wound infections is contaminated suture material. The occurrence of foreign substances in a wound amplifies its vulnerability to infection. Researchers have been researching an antibacterial suture for many years. To prevent bacteria from adhering to the suture material in surgical incisions, a triclosan-coated polyglactin 910 sutures with antibacterial activity was manufactured. Numerous animal studies have proven the antibacterial effectiveness of triclosan-coated polyglactin 910 sutures. Ford et al. reported that postoperative infection and pain is also reduced by triclosan-coated polyglactin sutures in pediatric age group.[7] Triclosan coated sutures successfully eliminate germs associated with surgical site infections and prevent the colonization of suture material in both in vitro and in vivo trials, with one research demonstrating a 66% reduction in bacterial colonization .[8]

Material and Methods

This randomized control trial (NCT06129773) was conducted at Pediatric Surgery Department, The Children's Hospital and University of Child Health Sciences, Lahore. After approval from the ethical review committee of the hospital, all patients who were recommended surgical procedures due to pneumoperitoneum or perforated organs were included in the study. The study was carried out between 1st September 2021 to 30th August 2022. Children of both genders having ages between 0 and 15 years and with Pneumoperitoneum / perforated viscus were included in this study. Malnourished children, aged above 15 years, clean surgeries, Low Hemoglobin level were excluded from the study. Each Group will have 50 patients. Group-A patients underwent antibiotic-coated vicryl, while Group-B patients experienced non-coated vicryl in abdominal fascial closure. The outcome of antibiotic-coated vicryl versus antibiotic non-coated vicryl in closure of abdominal fascia after laparotomy in children regarding surgical site infections were evaluated. According to the Southampton wound scoring system, all patients were examined on 3rd, 7th and 30th postoperative days for surgical site infection. The data was collected and was entered in SPSS software version 24.0, and data was analyzed statistically. Quantitative variables like age, hospital stay, etc were presented as a mean and standard deviation. Qualitative variables like surgical site infection were presented as frequency and percentages. The student t-test was applied for quantitative variables, and the Chi-square test was applied to estimate the relationship between qualitative variables. P-value of < 0.05 was considered significant.

Results

In Group A, the average age of the children in abdominal fascial closure with antibiotic coated vicryl was 64.09 ± 50.14 months, while non-coated vicryl (Group B) had a mean age of 64.26± 53.45months, with a p-value of 0.164. This study has male predominance in the study population, with 70 % males and 30 % females. This pattern was also observed in both groups, with 35 males and 15 females in each Group. The p-value was 1.000, indicating that there was no significant difference between the two groups in terms of the distribution of gender. The study included facial abdominal closure after laparotomy for a variety of pediatric diseases. The most common diagnosis perforated appendix (66%), necrotizing enterocolitis (22%), traumatic perforation (5%), post reversal (3%) and Hirschsprung disease (2%). In terms of SSI after laparotomy, the overall rate was 37%. Group A had a 22% rate of surgical site infection while SSI occurred in 52 % of the cases in Group B, with a value of 0.002 as shown in Table 1. This reflects a decreased rate of SSI in group A, where the facial abdominal closure after laparotomy was done with the antibiotic-coated vicryl. Southampton score was used to assess the SSI and its severity of both groups of facial closure. Most SSIs were of 4A (16 patients) and 4B[(11)].

Table 1: *Shows surgical site infection.*

		SSI		Total	p-value
		Yes	No		
Group	Group A (Antibiotic coated vicryl)	11 22.0 %	39 78.0%	50 100.0%	
	Group B (non-coated vicryl)	26 52.0%	24 48.0%	50 100.0%	0.002
Total		37 37.0%	63 73.%	100 100.0%	

Table 2: *Shows comparison of SSI in Southampton score*

Southampton score	0	2A	3A	3B	4A	4B	5	P-value
Antibiotic coatedvicryl	39	0	1	1	3	5	1	
	78.0%	0.0%	2.0%	2.0%	6.0%	10.0%	2.0%	0.036
Non coated vicryl	23	1	3	1	13	6	3	
	46.0%	2.0%	6.0%	2.0%	26.0%	12.0%	6.0%	
Total	62	1	4	2	16	11	4	100
	62.0%	1.0%	4.0%	2.0%	16.0%	11.0%	4.0%	100.0%

When compared between the groups, the SSI was greater in Group A; only three patients had 4A compared to 13 patients in Group B. Similarly, grade 4B SSI was less in Group A (5 vs. 6). The fact that p-value of 0.036 indicated that antibiotic-coated vicryl had considerably less SSI than the non-coated vicryl. Burst abdomen (Southampton score 5) occurred in only one patient in the antibiotic coated vicryl Group compared to three burst abdomens with uncoated vicryl as shown in Table 2. Regarding postoperative hospital stay, Group A had a mean stay of 4.20± 4.11 days and Group B had a mean stay of 8.24±4.07 days, with a p-value of 0.001 indicating significant difference in the two groups in the term of postoperative hospital stay **(Table-3)**. Patients were examined and followed in the outpatient department after discharge. On the 30th postoperative day, SSI had resolved in most patients, except for one patient in the antibiotic-coated vicryl Group and two patients in the non-coated vicryl Group who had minor erythema and swelling around the wound (Southampton score 1A). These patients had Burst abdomen (Southampton score 5) which were managed successfully by closure via tension relieving sutures.

Discussion

SSI continues to be a big load for healthcare system; thus, more research is needed to develop new and novel strategies to reduce it. Our research aimed to see how efficiently antibiotic-coated vicryl prevented surgical site infection in contaminated wounds. Suture material, particularly braided stitches, serves as a nidus for several bacteria, which then form a biofilm layer over the sutures, which is resistant to the immunological response of host and is largely resistant to antibiotics. Therefore, sutures are coated with antibacterial substances like triclosan to avoid forming a biofilm on their surfaces.[9] Both groups shared similar demographic features in our study, including age and gender distribution. Contaminated wounds were only included in the study, and clean and clean contaminated wounds were excluded. The frequency of postoperative wound infections is mostly linked to the contaminated and filthy wound infection rate. We aim to analyze wound infection rates only in contaminated cases to assess SSI rates in high-risk patients with contaminated wounds and to compare SSI between antibiotic-coated vicryl to noncoated vicryl in Abdominal Fascial Closure after Laparotomy in Children. In the current study, the overall rate of SSI was 37%. The fact that only contaminated and dirty wounds were included in the study likely explains the high rate of SSI in our study. This SSI rate is consistent with the study of Luitel et al. study who reported a rate of SSI of up to 45.2 % in contaminated and dirty wounds.[10] Similarly, Naik and colleagues showed in their study that the rate of SSI in contaminated wounds was up to 13% to 20% and 40% in dirty wounds.[11] When the rate of SSI was compared between the groups in our study, we found that Group A had a 22% rate of surgical site infection, whereas Group B had a 52% rate of SSI (pvalue:0.002). This reflected a lower rate of SSI in group A when the facial and abdominal closure after laparotomy was performed with antibiotic-coated vicryl. It was noticed by Arslan et al. that the overall occurrence of SSI was 15.8% (n=28), out of which 9(10.5%) patients were from the antibiotic-coated Group (p=0.04419) whereas 19 (20.8%) patients were from the control group.[12] Rasi et al. noticed a considerably lower incidence of SSIs (4 patients; 4.3%) in the antibiotic-coated Vicryl group compared to the non-coated Vicryl group (12 patients; 13.2 percent). Therefore, they determined that antibiotic-coated sutures improve wound healing.

Table 3: *Shows a comparison in terms of hospital stay*

Group	N	Mean	STD. deviation	P-value
Antibiotic coatedvicryl (group A)	50	4.20	4.11	0.001
Non coated vicryl (group B)	50	8.24	4.07	
Total	100	8.22	4.07	

Rasi et al. noticed a considerably lower incidence of SSIs (4 patients; 4.3%) in the antibiotic-coated Vicryl group compared to the non-coated Vicryl group (12 patients; 13.2 percent). Therefore, they determined that antibiotic-coated sutures improve wound healing.[13] In contrast, in a randomized controlled trial, Baracs et al. showed no significant difference in the incidence of infection between coated and uncoated vicryl sutures.[14] In our study, we only included cases of contaminated and dirty wounds and found a significant decrease in the rate of SSI with antibiotic-coated sutures. In contaminated and dirty wounds, antibiotic-coated sutures are effective in the prevention of SSI as antibiotic-coated sutures don't allow bacteria to adhere to the suture. Nakamura et al. also found a low rate of SSI with antibiotic-coated vicryl in the closure of 51 abdominal fascia after laparotomy. They concluded that abdominal fascial closure with antibiotic-coated vicryl is not only effective in the prevention of SSI in clean and clean contaminated wounds but also in contaminated and dirty wounds as well.[15] In severe cases of surgical site infection, wound dehiscence and burst abdomen can occur (Southampton score:5). The total rate of burst abdomen in our study was 8%. One patient (2%) in the antibiotic-coated Vicryl group and three patients (6%) in the non-coated Vicryl group had a burst abdomen. These cases were reexplored, and closure with tension sutures was done. Similarly, in the study of Arslan et al., wound dehiscence was seen in a total 7.3% of patients: from which 5.5% of cases were in the study(antibiotic) group, whereas 11.6% of cases were in the control group (p=0.116)[12]. This indicates that surgical site infections relate to prolonged treatment, re-exploration, and significant morbidity. To rescue patients from serious morbidities, every effort should be taken to limit the risk of SSI by addressing every modifiable factor (suture material, etc.)[13] SSIs are a major cause of patients' prolonged hospital stays. In our study, the hospital stay was considerably shorter in the antibiotics-coated Vicryl group than in the non-coated Group. (4.20 versus 8.24 days. P value 0.001). In the antibiotic-coated Group, the shorter stay was due to the decreased surgical site infection rate. It is a well-established fact that surgical site infections not only increase morbidity and mortality of the patient but also increase the length of the hospital stay and the expense of treatment. Agrawal et al. Found shorter hospital stay in the antibiotic-coated suture group. They emphasized that it is especially important in underdeveloped countries with a very high rate of surgical site infections. He noted that although the cost of the antibiotic-coated suture is higher than the non-coated sutures, but the shorter hospital stay due to the low incidence of the SSI will ultimately make up for the cost of the suture and result in an overall lower cost for the patient treatment.[16] When the patient developed an SSI, the stitches were removed for improved wound drainage, the wound culture was sent, antibiotics were started based on the culture, and a dry-to-wet gauze dressing was applied for better wound healing. After discharge, patients were examined and followed in the outpatient department. On the 30th postoperative day, the majority of patients' wound infections had resolved, except for one patient in the antibiotic-coated Vicryl group and two patients in the non-coated Vicryl group who had minor erythema and swelling around the wound.

Conclusion

Based on our findings from this study, it is concluded that antibiotic-coated vicryl is superior to non-coated vicryl in the surgical site infection prevention. Our study also shows that antibiotic-coated stitches have a role in reducing Surgical site infections in all types of wounds, including contaminated and dirty ones. It has also been noted that antibiotic-coated sutures result in shorter hospital stays due to a lower incidence of SSI. However, additional studies should be done to define clearly the role of antibiotic-coated sutures and its indications in surgery

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Authors Contribution

MAA,: Conceptualization of Project
MAA, GA, MAB: Data Collection
MAA, GA, MAB: Literature Search
MAA, GA, MAB: Statistical Analysis
AR, AA, AI : Drafting, Revision
MAA, GA: Writing of Manuscript