

ORIGINAL ARTICLE

A Comparative Study between Polyglactin 910 Versus Triclosan-Coated Polyglactin 910 Sutures on the Incidence of Surgical Site Infections

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Abstract

Background: Surgical site wound infection is one of the most common complications of surgery. It can result in delayed healing for sepsis. To investigate the effectiveness of anti-microbial coated sutures compared with non-coated sutures in reducing Surgical Site Infection (SSI).

Methods: This study was a prospective, cross control, comparative study conducted in the Department of General Surgery, Prathima Institute of Medical Sciences, Naganoor, Karimnagar. A total of 200 patients with 100 patients in each group based on the inclusion and exclusion criteria were included in the present study. The patients were operated with right lower quadrant incisions and appendectomy was done with a standard technique. Sutures were selected randomly to close the abdominal sheath. Post-operative follow up was done after 1 day, 3 days, one week, two weeks, one month and 6 months. **Results:** In a Group I 35% were between age groups 21-30, 28% were in age groups 31-40, 26% were in the age group 41-50 and 11% were in the age group 51-60 years. In group II polyglactin 910 with Triclosan (Vicryl Plus) 67% were male 33% were female. 32% were in between age group 21-30, 31% were in the age group 31-40, 29% were in age groups 41-50 and 8% were in the age group 51-60. The total number of SSIs in group I were 6 cases the incidence was 6%. Out of 6 cases, 4 cases were of superficial infection and 2 cases of deep infection. The total numbers of cases of SSIs in group II were 3 the incidence of SSI in group II was 3%. There were two cases of superficial infection and one case of deep infection. **Conclusion:** Within the limitations of the present study we found that triclosan-coated polyglactin 910 sutures (Vicryl Plus) were safer and reduced rates of SSIs were found in the patients using these sutures as compared to traditional polyglactin 910 (Vicryl).

Keywords: Polyglactin 910 (Vicryl), triclosan-coated polyglactin 910 (vicryl plus), surgical site infections

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Introduction

Surgical site suture infections are the most common nosocomial infections found in surgical patients and represent a significant cause of postoperative morbidity. [1] The risk of postoperative SSI in patients with contaminated or dirty wounds has been cited as being upwards of 20–30%. [2-4] The suture materials are used to close the wound edges and they are in contact with wound itself. Sutures may be organic (animal or vegetable origin) or synthetic. Sutures made of animal materials may be absorbable or non-absorbable. However, these

sutures sometimes can increase tissue inflammatory reaction in the early days, lengthen the exudative phase of wound healing, thus slowing the repair process. Yet, sutures made of plant materials can trigger a foreign body reaction, delaying fibroblast proliferation during the healing process. [5] Sutures with anti-bacterial activity have been developed to decrease microbial colonization of the suture material. Triclosan [5-chloro-2-(2, 4-dichlorophenoxy) phenol] is a broad-spectrum bacteriocidal agent that has been used for more than 40 years in various products, such as toothpaste and soaps. Higher concentrations of

triclosan work as a bactericide by attacking different structures in the bacterial cytoplasm and cell membrane. [6] At lower concentrations, triclosan acts as a bacteriostatic agent, binding to a product of the Fab-I gene called enoyl-acyl reductase and thus inhibiting fatty acid synthesis. [7, 8] Studies have been conducted involving polyglactin 910, an absorbable braided synthetic suture widely used in oral and maxillofacial surgery and trauma, and poliglecaprone 25, an absorbable monofilament suture featuring good flexibility and easy handling. [9, 10] Currently, some sutures are receiving a coating treatment that gives them new properties, including bioactive characteristics. [11-15] Polyglactin 910 sutures are being sold in two new formulations: triclosan-coated polyglactin 910 and irradiated polyglactin 910. Therefore we in the present study tried to investigate the effectiveness of anti-microbial coated sutures triclosan-coated polyglactin 910 sutures versus polyglactin 910 versus non-coated sutures on incidences of surgical site infections (SSIs).

Materials and Methods

This study was a prospective, cross control, comparative study conducted in the Department of General Surgery, Prathima Institute of Medical Sciences, Naganoor, Karimnagar. Institutional ethical committee permission was obtained for the study. We in the present study evaluated SSIs using traditional polyglactin 910 (Vicryl) in Group I and Group II consisting of patients sutured with polyglactin 910 with Triclosan (Vicryl Plus). A total of 200 patients with 100 patients in each group based on the inclusion and exclusion criteria were included in the present study. The inclusion criteria were patients aged 21 to 60 years of both sexes undergoing appendectomy without any significant Medical disorders that can affect the

outcome. The exclusion criteria were morbid medical conditions like diabetes mellitus, patients with HIV, Malignancy, and history of allergy to this substance. The study protocol was explained to the patients in their local language and a written consent was obtained. The patients were diagnosed with appendicitis and prophylactic antibiotic ceftriaxone 1gm/IV were started 30 minutes before the operation. The patients were operated with right lower quadrant incisions and appendectomy was done with a standard technique. Sutures were selected randomly to close the abdominal sheath. Post-operative follow up was done after 1 day, 3 days, one week, two weeks, one month and 6 months. The surgical infection rate and wound type according to the National Nosocomial Infections Surveillance risk factor, and mean duration of hospital stay was recorded in both the groups. The data were analyzed using SPSS software version 17 for windows.

Results

Two hundred patients were included in the study divided into two groups (n=100) each. Of the 100 patients included in the group I traditional polyglactin 910 (Vicryl) 62% of patients were male and 38% of patients were female. In group I 35% were between age groups 21-30, 28% were in age groups 31-40, 26% were in the age group 41-50 and 11% were in the age group 51-60 years. In group II polyglactin 910 with Triclosan (Vicryl Plus) 67% were male 33% were female. 32% were in between age group 21-30, 31% were in the age group 31-40, 29% were in age groups 41-50 and 8% were in the age group 51-60. There was no statistical significance in relation to age and sex distribution in the cases as none of the p values calculated were found to be significantly shown in table 1.

Table 1: Demographic profile of the patients involved in the study

Age group	Group I [Vicryl]	Male/ Female	Group II Vicryl plus	Male/ Female	Total	P value
21 – 30	35	20/15	32	19/13	67	0.458
31 – 40	28	15/13	31	24/7	59	0.721
41 – 50	26	20/6	29	19/10	55	0.861
51 - 60	11	7/4	8	5/3	19	0.218
Total	100	62/38	100	67/33	200	---

The National Nosocomial Infection Surveillance Risk Factors was assessed in both the groups to find the percentage of SSI in both groups based on NNIS criteria. [16] It was found that in both the groups those with NNIS criteria as 0 were having nil rates of surgical site infections. These are the patients with no risk for surgical site infections. In the Group I 25 patients have included in NNIS 1 category out of which 4

(16%) patients were having SSIs. Those with NNIS 2 category were 4 patients out of which 2 (50%) had SSI. None were reported in NNIS category 3 in both the groups. In group II 25 patients were in NNIS 1 category out of which 2 (8%) had SSIs, in NNIS 2 category 10 patients were present out of which 1 (10%) had SSIs given in table 2.

Table 2: wound type National Nosocomial Infections Surveillance risk factor [16]

National Nosocomial Infections Surveillance risk factor	Group I	SSI cases	SSI %	Group II	SSI cases	SSI %
0	71	0	0	65	0	0
1	25	4	16	25	2	8
2	4	2	50	10	1	10
3	0	0	0	0	0	0

The mean pre-operative preparation time in group I was 280 minutes and in group II it was 240 minutes. The operation time including suturing was 65 minutes in group I and 56 minutes in group II. The type of appendicitis diagnosed in group I was Acute in 65%, suppurative in 25% and ruptured in 10% of cases. In group II 60% had acute appendicitis, suppurative in 35% of cases and ruptured in 5% of cases.

Table 3: Surgical profile of patients included in the study

Surgical profile	Group I	Group II
Pre-operative (min)	280	240
Operation Time	65	56
Type of Appendicitis		
Acute	65	60
Suppurative	25	35
Ruptured	10	5

The total number of SSI in group I were 6 cases the incidence of SSI in group I was 6%. Out of 6 cases, 4 cases were of superficial infection and 2 cases of deep infection. The total numbers of cases of SSI in group II were 3 the incidence of SSIs in group II was 3%. Superficial infection was found in 2 cases and deep infection was found in 1 case. The mean duration of hospital stay in Group I was 4.5 days and the mean duration of hospital stay in group II was 3.5 days (table 4).

Table 4: Type of infection and mean duration of hospital stay

	Group I	Group II	P value
Total SSI cases	6	3	<0.05 *
Superficial infection	4	2	< 0.05 *
Deep infection	2	1	>0.5
Mean Duration of Hospital stay	4.5	3.5	<0.304

* Significant

In the present study, we found the rate of SSI in group I [traditional polyglactin 910 (Vicryl)] based on National Nosocomial Infection Surveillance (NNIS) Risk Factor [16] category 1 had SSIs of 16% and NNIS 2 category had SSIs 50%. In group II [polyglactin 910 with Triclosan (Vicryl Plus)] with NNIS 1 category had 8% SSIs and 10% of SSIs in NNIS 2 category. We in the present study found lower incidences of SSI in Group II [polyglactin 910 with Triclosan (Vicryl Plus)]. In vitro studies, have shown that triclosan-coated sutures have antibacterial efficacy against Staphylococcus aureus, Staphylococcus epidermis, methicillin-resistant S. aureus (MRSA), Pseudomonas aeruginosa, and Escherichia coli. [17, 18] Ford et al; evaluated the intra-operative handling and wound healing characteristics of coated vicryl polyglactin 910 Suture compared with other sutures in a total of 147 patients. They reported excellent score (59%) for overall intra-operative

handling and placid wound healing parameters with Coated Vicryl Polyglactin 910 Suture. ^[19] In a study by Justinger C et al; Patients were randomized to have the fascia closed with either a 2-0 polydioxanone loop or a triclosan impregnated 2-0 polydioxanone loop of the total 856 patients 42 (11.3%) patients with wound infections were detected. The number of patients with wound infections decreased significantly to 31 when the PDS plus for abdominal wall closure was used (6.4%, $P < .05$). ^[20] Several other studies were performed to evaluate the Coated Vicryl Polyglactin 910 Sutures in a study in Switzerland with 856 patients undergoing abdominal wall closure, the proportional of SSIs decreased from 11% to 6% ^[20] In a multicentre trial in Egypt studying 450 patients with various operations classified as clean SSIs decreased from 15% to 7% by the use of triclosan-containing sutures. ^[21] C Mingmalairak et al; ^[22] studying vicryl plus and vicryl in appendectomy patients with clean-contaminated patients found that SSI rates were 10% in vicryl plus and 8% in vicryl group of patients. We in the present study found 6% overall SSI in the vicryl group and 3% in Vicryl plus Group patients. We in the present study also found that the SSI's were more found in the patients with ruptured appendicitis probably because rupture of appendix causing contamination subsequent bacterial colonization of the sutures. The average operating time in our study did not vary significantly between the two groups. There were no significant problems between the two groups in relation to tensile strength, knot characteristic and other physical properties between the two sutures. In a study by Marjo Renko et al; ^[23] found SSIs in 3% of 778 patients sutured with Triclosan containing sutures as compared to 5% of 779 patients given ordinary absorbing sutures in children. Ford HR et al; ^[19] also found that that in children with various operations vicryl plus was better in pediatric patients and incidence of postoperative pain was significantly less in patients using Vicryl plus (triclosan-coated). It has been shown that triclosan use in sutures inhibits bacterial colonization of the sutures. Micro-organisms adhere to non-shredding surfaces of the sutures and form biofilms. ^[24] The presence of foreign material enhances the patient's susceptibility to infection. One study has found that resorption

related properties of suture materials affect macrophage function in vitro and impair the secretion of cytokines and bactericidal elements. It, therefore, appears that the triclosan impregnated sutures are the safer alternative to regular sutures to prevent SSIs and reduce the complications of fascial closures after abdominal surgeries.

Conclusion

Within the limitations of the present study, we found that triclosan-coated polyglactin 910 sutures (vicryl Plus) were safer and reduced rates of SSIs were found in the patients using these sutures as compared to traditional polyglactin 910 (vicryl).

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