

Original Research Article

A comparative study to test the effectiveness of triclosan coated polyglactin 910 in reduction of surgical site infection in clean wounds

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ABSTRACT

Background: Surgical site infection (SSI) has been pointed out as the 2nd most common nosocomial infection. Since suture materials have been proven to be a contributor to SSI, they have been the focus of research and development centered on making them less conducive to bacterial overgrowth. The Triclosan coated suture slowly releases Triclosan, which is an antibacterial agent that inhibits bacterial colonization of the suture and wound site and thus, promises prevention of surgical site infection.

Methods: Total of 100 patients undergoing excision of uninfected subcutaneous benign lumps and cutaneous swellings were randomized in two groups: group A in which triclosan coated polyglactin 910 suture was used for wound closure (50 patients) and Group B in whom conventional uncoated Polyglactin 910 suture was used for wound closure (50 patients).

Results: In this study, maximum number of patients was in the age group of 46-60 years. Mean age of subjects in triclosan- coated suture group was 45.03 years while it was 47.32 in conventional uncoated suture group. Among 100 subjects in triclosan- coated suture group, 26 (52%) were males and 24 (48%) were females. In comparison to it, male and female subjects in conventional uncoated suture group were 25 (50%) each. Among 50 subjects in triclosan-coated suture group, only 2 (4.0%) had surgical site infection while in conventional uncoated suture group, 8 (16.0%) had surgical site infection. Incidence of surgical site infection with use of triclosan- coated suture was significantly lower compared to conventional uncoated suture group. (p 0.04).

Conclusions: Triclosan coated suture surely, helps in preventing surgical site infection which, not only increases the morbidity of the patient but also has long-term implications.

Keywords: Polyglactin 910, SSI, Triclosan

INTRODUCTION

Surgical site infections (SSIs) are infections of tissues, organs, or spaces exposed by surgeons during performance of an invasive procedure. SSIs are the second most frequent nosocomial infection, after urinary tract infection.^{1,2} Global incidence rates of SSIs vary from 4.5% to 20%, depending on the region and facilities available and 12.5% to 17.7% in India according to one study.^{3,4}

Suture materials used for treating wounds were originally natural materials, such as animal tendons and cotton fibres. Usage of these materials often resulted in severe infections. Sterilisation reduced these complications significantly. However, sutures are still foreign materials, which tend to attract bacteria. Postoperative wound infections are still the second most common perioperative complication. In view of this risk of infection, much recent academic and industrial research in this area has focused on avoiding bacterial colonisation of medical

materials from the beginning, especially by the use of antibacterial coating.⁵

Since suture materials have been proven to be a contributor to SSIs, they have been the focus of research and development centered on making them less conducive to bacterial overgrowth. Recently a new antimicrobial suture polyglactin 910 coated with triclosan has been introduced. Triclosan is a broad spectrum antiseptic that has been widely used for over 30 years in humans.

Triclosan is an antibacterial phenol derivative that has in vitro activity against Gram-positive and, to a lesser extent, Gram-negative bacteria.”

With this background, the present research was aimed to compare antiseptic coated suture material (triclosan coated polyglactin 910) with the conventional uncoated suture material (polyglactin 910) with respect to reduction in surgical site infections in clean wounds.

METHODS

This study was a randomised control trial conducted from July 2016 to September 2018. Participation in the study was purely voluntary. All eligible cases were informed about the study in depth and all benefits and potential risks were also conveyed to the cases. After that those who had given written approval was included in the study.

The study protocol was approved by Institute Ethics Committee before start of study.

The patients requiring excision of benign uninfected subcutaneous lumps and cutaneous swellings like Lipoma, uninfected sebaceous cyst, dermoid cyst, mole, calcinosis cutis between ages 15-60, were included in the study. Patients with Immunocompromised states like HIV/Malignancy, patients on steroids and dirty wounds were excluded from the study.

The triclosan-coated sutures and conventional uncoated sutures were used in these patients during the procedure for suturing purpose.

The sample size was 100 in the present study. The subjects were randomly divided into two groups by lottery method - group A and group B.

- Group A- surgical site receiving triclosan-coated suture (test group) - 50
- Group B- surgical site receiving conventional uncoated suture (control group) - 50

Postoperative evaluation was done on the 3rd post-operative day, 7th post-operative day and 30th post-operative day.

Procedure

Standardized skin preparation was done. There was not any shaving done preoperatively; clipping of hairs was done wherever necessary and skin was cleaned with three swabs of povidone iodine solution followed by spirit followed by dry gauze. After the incision was made, a sterile swab was taken from skin and subcutaneous tissue and sent to Microbiology for microbial culture. Meticulous hemostatic control was encouraged. All wounds were closed by interrupted subcutaneous suturing followed by subcuticular suturing. No antibiotics were used pre and post operatively.

Wound was opened on the third postoperative day and patients were examined for SSIs. Postoperative wound care was done with transparent and quick drying film not containing any antiseptic as a form of dressing for all the patients.

Subsequently the patients were examined on day 3rd, 7th and 30th post operatively for signs of SSIs, however the patients were also instructed to come back to hospital immediately and contact the principal investigator in case they developed wound infection. The criteria for making the diagnosis of superficial SSIs were.

- Erythema around suture line
- Purulent discharge from wound
- Local rise of temperature
- Unusual pain at incision site

All the patients who developed SSIs were subjected for Microbiological studies for microbial culture and sensitivity through sterile swab stick and were treated accordingly for SSIs.

Statistical analysis

All study data was entered in Microsoft excel sheet and analysed using EpiInfo software. Outcome of the intervention was assessed by incidence of SSIs. Chi square test and t test were used to compare qualitative and quantitative data respectively. Statistical significance was assessed at 95% confidence interval at p value of 0.05.

RESULTS

In this study maximum numbers of patients were in the age group of 16-40 years. Mean age of subjects in triclosan- coated suture group was 45.03 years while it was 47.32 in conventional uncoated suture group (Table 1). There was no significant difference of age among both the groups (p 0.056).

Among 100 subjects in triclosan- coated Suture group, 26 (52%) were males and 24 (48%) were females. In comparison to it, male and female subjects in Conventional Uncoated Suture group were 25 (50%) each

(Figure 1). There was no significant difference of gender distribution among both the groups (p 0.841).

Table 1: Comparison of age distribution of subjects in both groups.

Age in years	Group A triclosan- coated suture		Group B conventional uncoated suture		P value
	Subjects (N=50)	%	Subjects (N=50)	%	
15-30	13	26.0	10	20.0	0.785
31-45	17	34.0	16	32.0	
46-60	20	40.0	24	48.0	
Mean age (in years)	45.03	5.38	47.32	6.43	0.056

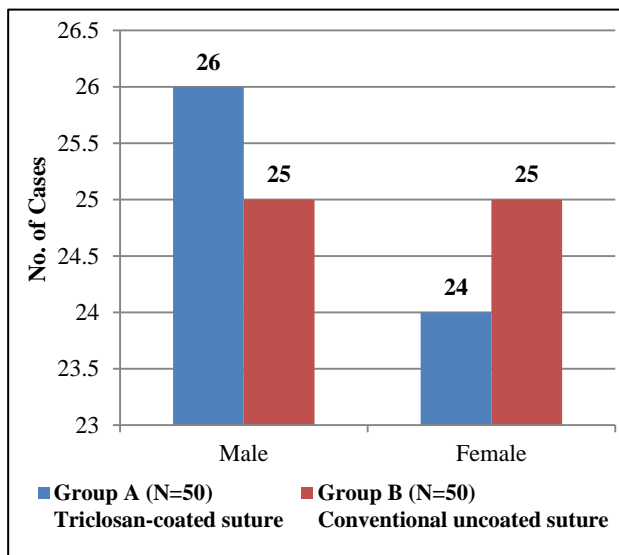


Figure 1: Comparison of gender of subjects in both groups.

Table 2: Comparison of diabetic status of subjects in both groups.

Diabetes mellitus	Group A triclosan- coated suture		Group B conventional uncoated suture		P value
	Subjects (N=50)	%	Subjects (N=50)	%	
DM present	8	16.0	9	18.0	0.790
DM absent	42	84.0	41	82.0	

Among 50 subjects in triclosan- coated suture group, 8 (16%) had diabetes mellitus. In comparison to it, in Conventional Uncoated Suture group there were 9 (18%) diabetic subjects (Table 2). There was no significant difference of diabetic status among both the groups (p 0.790).

Table 3: Comparison of WBC count of subjects in both groups.

Study groups	Subjects (N)	WBC count	
		Mean	Standard deviation
Group A triclosan- coated suture	50	5988	1024
Group B conventional uncoated suture	50	6302	1245

In this study mean WBC count in triclosan- coated suture group was 5988±1024 while it was 6302±1245 in conventional uncoated suture group (Table 3). There was no significant difference in WBC count between both the groups (p 0.171). Among 50 subjects in Triclosan-Coated Suture group, only 2 (4.0%) had surgical site infection while in conventional uncoated suture group, 8 (16.0%) had surgical site infection (Table 4). Incidence of surgical site infection with use of triclosan- coated suture was significantly lower compared to conventional uncoated suture group (p 0.04).

Table 4: Comparison of surgical site infection in both groups.

SSIs	Group A triclosan- coated suture		Group B conventional uncoated suture		P value
	Subjects (N=50)	%	Subjects (N=50)	%	
SSIs present	2	4.0	8	16.0	0.04
SSIs absent	48	96.0	42	84.0	

Table 5: List of organisms isolated from SSI patients.

Study groups	Organism isolated from SSI cases
Triclosan coated suture group	<i>Staphylococcus aureus</i>
	Coagulase negative staphylococci (<i>Staphylococcus epidermidis</i>)
Conventional uncoated suture group	<i>Staphylococcus aureus</i>
	<i>Staphylococcus aureus</i>
	<i>Pseudomonas aeruginosa</i>
	Coagulase negative Staphylococci (<i>Staphylococcus epidermidis</i>)
	<i>Klebsiella pneumoniae</i>
	<i>Staphylococcus aureus</i>
	Coagulase negative Staphylococci (<i>Staphylococcus epidermidis</i>)
	<i>Staphylococcus aureus</i>

All the SSIs were superficial type SSIs. In present study *Staphylococcus aureus* was the most common organism responsible for superficial surgical site infections in current study. Out of total 10 SSIs, in 5 cases (50%) *Staphylococcus aureus* was isolated. Other important common organism includes coagulase negative *Staphylococci- Staphylococcus epidermidis* (Table 5).

All the SSIs patients were admitted to the hospital and treated with antimicrobials according to the culture and sensitivity reports followed by secondary suturing and were discharged after the hospitalization for 14 days (mean).

DISCUSSION

Surgical site infection remains a major burden in health care and so it is imperative that more research is done to find new innovative ways of reducing it. This study was conducted among 100 cases underwent surgery in the tertiary care hospital. The subjects were randomly divided in to two equal groups to compare rate of surgical site infections between triclosan- coated suture and conventional uncoated suture.

Triclosan is an antimicrobial agent that is commercially used in many products such as soaps, deodorants, shower gels and toothpastes because of its antimicrobial efficacy with low toxicity to humans. Hence, triclosan-coated absorbable suture materials were commercially launched to prevent surgical site infections.⁶

The zone of bacterial inhibition surrounding the knotted sutures using triclosan coated suture material in vitro colonization experiments showed an antimicrobial effect over *Staphylococcus aureus* and *Staphylococcus epidermidis*.³⁹ In vivo studies on triclosan-coated sutures exhibited significant inhibition of bacterial colonies on its surface near the infected site without compromising the mechanical property of the suture.⁷

In the present study, there was no significant difference of age and gender distribution among both the groups.

In a study by Varsha et al, SSI rate was higher in male (7.4%) than female (5.1%).⁸ In a study by Khan MA et al, females (27%) showed higher SSI rate than males (18%).⁹ However in a study by Berard et al, gender is not a risk factor of SSI.¹⁰

SSI is affected by many intrinsic and extrinsic factors. Patient related factors include age, sex, comorbidity and medical history. In addition, surgical factors are depilation, skin sterilization, ventilation of the operation room, aseptic operative techniques, and the use of antibiotics.¹¹ In present study there was no significant difference of diabetic status among both the groups (p 0.790).

The influence of the suture material on SSIs has been developed over the last 50 years. During that period surgeons have shown that surgical sutures, like any other implant in human body, can cause microbial adherence and colonization. When the sutured material becomes contaminated, local mechanisms of wound decontamination become ineffective.⁶ Triclosan coated polyglactin 910 was developed to prevent microbial colonization of suture material in operative wounds.¹²

In the present study, among 50 subjects in triclosan-coated suture group, only 2 (4.0%) had surgical site infection while in Conventional Uncoated Suture group, 8 (16.0%) had surgical site infection. Incidence of surgical site infection with use of Triclosan- Coated Suture was significantly lower compared to Conventional Uncoated Suture group. (p 0.04) This shows that Triclosan- Coated Suture material is better in preventing SSIs.

Hoshina et al, in a retrospective controlled trial including both emergency and elective surgeries reported the rate of SSI as 12.2% in conventional coated polyglactin 910 group and 6.6% in coated polyglactin 910 with triclosan suture group.¹³ The difference was statistically significant. In the present study, SSIs were seen in elective cases alone, but this was statistically insignificant. The present study differs from this study with respect to closure of subcutaneous tissue alone instead of entire abdominal wall. These results are comparable to findings of my study.

Galal et al, showed that triclosan-coated polyglactin 910 reduced the incidence of SSIs from 15% to 7%.¹⁴ In a study done by Rozzelle et al, in CSF shunt surgery, the infection rate was 4.3% among triclosan-coated group and among control group SSI rate was 21%.¹⁵

Seim et al, failed to demonstrate a reduction of superficial SSI when triclosan coated polyglactin 910 (Vicryl plus) was used as compared to plain vicryl.¹⁶ It is important to note that the mechanisms leading to surgical site infections are not fully understood, however the existence of a foreign material like a suture is recognized to lower the size of bacterial in oculi essential to develop infection, hence creating an antibacterial environment within the wound is thought to reduce the risk of SSI. This was the thinking behind the creation of antimicrobial coated sutures.¹⁶

In present study *Staphylococcus aureus* was the most common organism responsible for superficial surgical site infections in our study. Out of total 10 SSIs, in 5 cases (50%) *Staphylococcus aureus* was isolated. Other important common organism includes coagulase negative *Staphylococci*.

In a study by Mundhada et al, out of 32 cases of SSIs, 29.16% had *Staphylococcus aureus*, 20.83% had *E. coli*

and 18.75% had *P. aeruginosa*, 14.58% had *K. pneumonia*, 12.5% had *Acinetobacter* and 4.16% cases had *Staphylococcus aureus*.¹⁷ So, in this study *Staphylococcus aureus* is the predominant organism.

CONCLUSION

Triclosan coated suture, surely, helps in preventing one of the most dreaded postoperative complications, i.e. surgical site infection which, not only increases the short-term morbidity of the patient but also has long-term implications. The desire of a good cosmetic result postoperatively, both by the surgeon and the patient is hindered if postoperative surgical site infection occurs.

Triclosan coated suture cuts down the cost for management of surgical site infection, though it is slightly costlier than the conventional non coated suture. So, authors can say that triclosan coated polyglactin 910 is a new hope in the prevention of surgical site infection postoperatively.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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