



Original Research Article

In vitro comparison of efficacy of triclosan coated & uncoated sutures against the bacteria isolated from SSI at tertiary care hospital, Aurangabad

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ABSTRACT

Most common Health Care Associated Infections (HAI) are Urinary tract infection (UTI) – 33%, Pneumonia – 15%, Surgical Site Infections (SSI) – 15%, Blood stream infections – 13%, & other miscellaneous infections – 24%. SSI is defined as infection at the surgical site that occurs within 30 days of the surgical procedure or within one year – if there is an implant or foreign body such as prosthetic heart valve or joint prosthesis. Wound infections are always multifactorial. Risk factors for SSI include co-morbidity, malnutrition, nicotine, suture and implanted foreign material. SSI increases morbidity & mortality in post surgical patients, & also increases hospital stay, it affects quality of life and increases financial burden to healthcare system. It may lead to major complications such as sepsis and death. Patient related risk factors are smoking, obesity and diabetes. Skin preparation with antiseptic and preoperative antibiotic prophylaxis for clean-contaminated and contaminated surgery have proved efficient for decreasing SSI. Sutures in contaminated tissues may enhance penetration of micro organisms in deeper tissues & biofilm formation and this may protect organisms from host defence mechanism. One of the risk factors is the foreign material which includes suture. Commonly isolated pathogens from SSI are *Staphylococcus aureus*, *CONS*, *Enterococcus* species, *E.coli* & resistant pathogens like MRSA & candida (due to widespread use of broad spectrum anti-microbial agents.) In this study we have compared in vitro efficacy of triclosan coated polyglactin 910 suture with non – coated sutures against common bacteria isolated from SSI.

Materials and Methods: We have randomly selected the strains of MRSA, MRCONS, *Staphylococcus hemolyticus*, *E. Coli*, *Klebsiella*, & *Acinetobacter* species isolated from clinical samples of SSI. These isolates were tested against triclosan coated & non coated sutures which are commercially available. Similar length of (4cm) of sutures cut & tested for zone of inhibition on lawn culture made on Muller Hinton Agar (MHA) by using 0.5 McFarland standard of above strains by touching 4 to 5 colonies of each bacterium. It is incubated overnight at 37°C & examined for zone of inhibition.

Results: zone of inhibition of coated & uncoated sutures has been measured & compared for each strain.

Conclusion: In vitro, triclosan coated sutures showed good antibacterial activity than non coated sutures & hence triclosan coated sutures may help in reducing bacterial SSI rate and thus reduce cost & duration of hospital stay for the patient.

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1. Introduction

Most common Health Care Associated Infections (HAI) are Urinary tract infection (UTI) – 33%, Pneumonia – 15%, Surgical Site Infections (SSI) – 15%, Blood stream infections – 13%, & other miscellaneous infections – 24%.¹

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SSI is defined as infection at the surgical site that occurs within 30 days of the surgical procedure or within one year – if there is an implant or foreign body such as prosthetic heart valve or joint prosthesis.² Wound infections are always multifactorial.³ Risk factors for SSI include co-morbidity, malnutrition, nicotine,⁴ suture and implanted foreign material.^{5,6} SSI increases morbidity & mortality in post surgical patients³, & also increases hospital stay,

it affects quality of life and increases financial burden to healthcare system.⁷⁻¹⁰ it may lead to major complications such as sepsis and death.¹¹ Patient related risk factors are smoking, obesity and diabetes.^{10,12-14} Skin preparation with antiseptic and preoperative antibiotic prophylaxis for clean-contaminated and contaminated surgery have proved efficient for decreasing SSI.¹⁵ SSI, Its diagnosis consist of the infection with manifestations of pain, oedema, tenderness, redness, dehiscence, or positive culture from material or pus from surgical site. SSI are classified into superficial incisional SSI, deep incisional SSI, & organ/space SSI.¹⁶ Triclosan coated sutures reduce the colonization of bacteria⁷ & biofilm formation on suture material.¹⁷ Sutures in contaminated tissues may enhance penetration of micro organisms in deeper tissues & biofilm formation and this may protect organisms from host defence mechanism.^{3,18,19} One of the risk factors is the foreign material which includes suture.¹⁶ Commonly isolated pathogens from SSI are Staphylococcus aureus, CONS, Enterococcus species, E.coli & resistant pathogens like MRSA & candida (due to widespread use of broad spectrum anti-microbial agents.) [bailey] Triclosan was developed in 1960 & it is antibacterial as well as antifungal agent used in toothpastes, detergents, hand wash antiseptic solutions, soaps, toys etc.^{7,20} It's use in health industry started in 1972 & has been used in hand rubs, skin antiseptics, ointments, impregnated/coated catheters & sutures.¹¹ Triclosan (2,4,4'-trichloro-2'-hydroxydiphenyl ether) is a broad spectrum biocide, non specifically disrupting the bacterial cell membrane, targeting the Fab I gene which blocks the bacterial fatty acid synthesis through the action of enzyme enoyl-acyl carrier protein reductase (ENR).³ The triclosan is an antiseptic & not an antibiotic hence the risk of resistance is very low.³ Various studies have been conducted & stated that toxicity due to triclosan are considered low & it showed highly significant results in lowering risk of SSI.^{11,21} Triclosan having antimicrobial activity against Gram positive & Gram negative bacteria but less activity against P. aeruginosa.¹⁶ In this study we compared in vitro efficacy of triclosan coated polyglactin 910 suture with non – coated suture against common bacteria isolated from SSI.

2. Aims and Objectives

To compare in vitro efficacy of triclosan coated polyglactin 910 sutures with uncoated sutures against organisms isolated from SSI.

3. Materials and Methods

3.1. Inclusion criteria

All samples received for culture & sensitivity from surgical sites within given period.

3.2. Exclusion criteria

All isolates other than surgical site infections.

The study was carried out at Department of Microbiology, MGM Medical College & Hospital Aurangabad, Maharashtra from 2nd June 2017 to 2nd July 2017. In this period there were total 15 samples of SSI, out of these 09 samples were positive for bacterial isolates & 06 samples were sterile.

4. Isolation & Identification of bacteria from SSI

Samples from SSI were inoculated in Nutrient agar, Blood agar & McConkey's agar plates, incubated at 37°C overnight & isolates were identified in Vitek 2 compact system. We have isolated MRCONS – 2, Acinetobacter baumannii – 2, MRSA – 1, Staphylococcus hemolyticus – 1, Enterobacter cloacae complex – 1, E.coli – 1, & Klebsiella pneumoniae – 1.

4.1. In – Vitro testing of Triclosan coated & uncoated sutures against the bacteria isolated from SSI

We have randomly taken the strains of MRSA, MRCONS, Staphylococcus hemolyticus, E. Coli, Klebsiella, & Acinetobacter species isolated from clinical samples of SSI & these strains were tested against triclosan coated & non coated sutures which are commercially available (Ethicon). Lawn culture of isolated organisms were made on Muller Hinton Agar (MHA) plates by using 0.5 McFarland standard (corresponds to 1.5×10^8 bacteria/ml)⁷ of above strains by touching 4 to 5 colonies of each bacterium.¹⁶ Similar length of (4cm) of triclosan coated & non coated sutures cut with aseptic precautions & placed on half of inoculated plates each.¹ It is incubated overnight at 37°C & examined for zone of inhibition after 48 hr.¹⁶ Zone of inhibition were measured perpendicular to mid-point of suture material in millimetre.⁷

5. Results

5.1. Isolation & Identification of bacteria from SSI

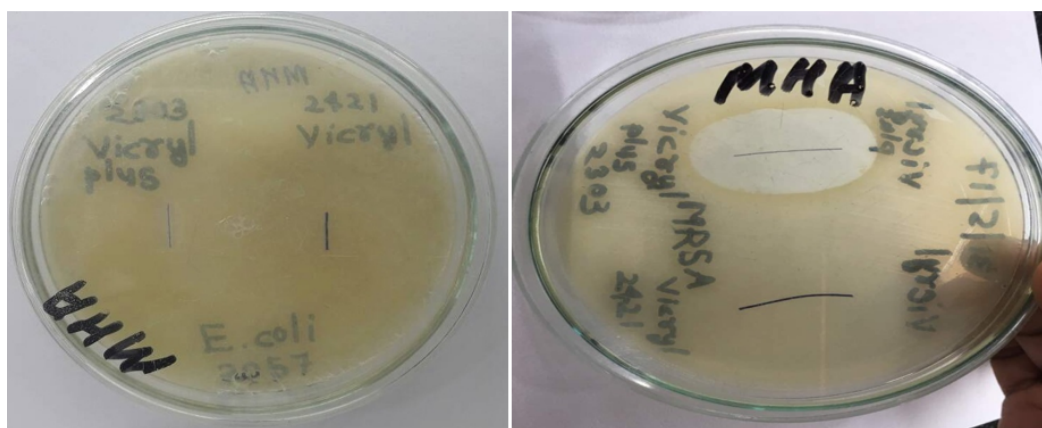
Total 15 samples of SSI were taken, out of these 09 (60%) samples were positive for bacterial isolates & 06 (40%) samples were sterile, in a single month's duration. Isolates were MRCONS – 2(22.2%), Acinetobacter baumannii – 2(22.2%), MRSA – 1(11.1%), Staphylococcus hemolyticus – 1(11.1%), Enterobacter cloacae complex – 1(11.1%), E.coli – 1(11.1%), & Klebsiella pneumoniae – 1(11.1%).

5.2. In – Vitro testing of triclosan coated & uncoated sutures against the bacteria isolated from SSI

Each bacterium, was tested against triclosan coated & uncoated suture. The zone of inhibition around triclosan coated & uncoated sutures were measured. Wide zone

Table 1: Zone of Inhibition around coated and uncoated suture materials

Organism isolated (%)	Zone of inhibition (Coated sutures)	Zone of inhibition (Uncoated sutures)
MRCONS (22.2%)	14 – 16 mm	0 - 1 mm
Acinetobacter baumannii (22.2%)	11 mm	0 - 1 mm
MRSA (11.1%)	13 – 14 mm	1 mm
Staphylococcus haemolyticus (11.1%)	15 mm	2 mm
Enterobacter cloacae complex (11.1%)	8 mm	1 mm
Escherichia coli (11.1%)	9 mm	1 mm
Klebsiella pneumonia (11.1%)	8 mm	1 mm

**Fig. 1:** Good zone of inhibition around coated sutures & no zone of inhibition around uncoated sutures

of inhibition was found against triclosan coated sutures than uncoated sutures. The zone of inhibition against triclosan coated sutures were – for MRSA 13 to 14 mm, for *Acinetobacter baumannii* 11 mm, for MRCONS 14 to 16 mm, for *Staphylococcus hemolyticus* it was 15 mm, for *Enterobacter cloacae* complex it was 8 mm, and for *Klebsiella pneumoniae* it was 8 mm. While there were no zone of inhibition against uncoated sutures by all organisms

6. Discussion

Triclosan coated sutures inhibit in vitro growth of MRCONS, *Acinetobacter baumannii*, MRSA, *Staphylococcus hemolyticus*, *Enterobacter cloacae* complex, *E. coli*, & *Klebsiella pneumoniae*. The clinical efficacy of triclosan had been studied against uncoated sutures. Zone of inhibitions around coated and uncoated sutures were comparable with the study of Sarkar et al, S. Soumya et al and Prachi et al did not found any zone of inhibition around coated sutures in *Enterococcus* and *Pseudomonas* species, while as we did not have these isolates we could not have tested these organisms. Various studies depicted that, antimicrobial activity of triclosan coated sutures persisted for 96 hrs,²² & for up to 7 days in aqueous environment.²³ While we have tested for 48 hrs as Sarkar et al and it is comparable with the findings. SSI commonly occur from commensal organisms such as coagulase negative staphylococci, diphtheroids,

Pseudomonas, & *Propionibacterium* species which are consistently present on patient's skin. Thus it is assumed that use of triclosan coated sutures could significantly reduce the SSI rate by inhibiting the growth of commensal organisms & thereby reducing the cost & duration of the hospital stay. *Enterococcus* & *Pseudomonas* are the exceptional organisms where these triclosan coated sutures were not show inhibition of growth.³

7. Conclusion

In vitro antibacterial efficacy of Triclosan coated polyglactin 910 sutures is sufficient to inhibit or reduce the in vitro colonization of the suture materials by MRCONS, *Acinetobacter baumannii*, MRSA, *Staphylococcus hemolyticus*, *Enterobacter cloacae* complex, *E. coli*, & *Klebsiella pneumoniae* compared to uncoated suture materials.

8. Limitations

The study has to be done on large number of samples for longer periods for comparison.

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10. Source of Funding

None.

11. Conflict of Interest

None.

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