

## Triclosan Coated Suture Inhibits colonization of Bacteria Responsible for Surgical Site Infection – An *in Vitro* Efficacy Study

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### Abstract

**Introduction:** Surgical site infection is one of the common healthcare associated infections, has significant impact on associated morbidity, mortality and exerts economic burden on the patient as well as on health care system. In addition to other measures, local inhibition of colonization of bacteria would provide clinical benefits. Antibacterial suture such as Triclosan coated suture prevents local growth of bacteria during critical initial stage of wound healing. At the end of 24 hrs of incubation at 37°C, 17-19 mm of zone of inhibition was seen for both *S aureus* and MRSA for Triclosan coated suture, while no zone was found around for non-coated suture.

**Methods:** The study evaluated *in vitro* efficacy of antibiotic coated Triclosan suture using zone of inhibition model against commonly reported organisms in SSI (*Staphylococcus aureus*, Methicillin resistant *Staphylococcus aureus*).

**Results:** Triclosan coated suture prevents colonization of bacteria at the surgical site, thus reduce the risk of SSI, also it would have positive financial impact such as minimizing the treatment cost and reduced hospital stay. We believe the clinical effectiveness of Triclosan coated suture in minimizing the risk of SSI would be beneficial to health care settings in Nepal.

**Conclusion:** The use of Triclosan coated suture for wound closure would be highly beneficial in controlling the SSI, morbidity, mortality and short hospital stay.

**Keywords:** Surgical site infection, triclosan, antibacterial coated suture, bacterial colonization.

### Introduction

Surgical site infection (SSI) is one of the common healthcare acquired infections (HAIs), mainly in hospitalized patients. In 2002, World Health Organization has released the guidelines to simplify the definitions of HAI and defines SSI as a purulent discharge around the wound or the insertion site of the drain, or spreading cellulitis from the wound (1). As per the Guideline for Prevention of Surgical Site Infection, 1999 released by the US Centre of Disease Control and Prevention (CDC) classifies SSIs as being either incisional or organ/space, occurred within 30 days after the operation (2). The prevalence rate of SSIs reported as 0.5 to 20% worldwide (2, 3). SSI in Asian countries

is under evaluated and very minimal information available in the public domain. In Asian countries, the prevalence rate of SSI reported at 2 to 21% for India (4), and 7.3% in Pakistan (5). The prevalence rate of SSI in Nepal is so far not reported. The study conducted at Manipal Teaching Hospital, Pokhara in 2004 by Giri B et al reported 7.3% SSI rate in inpatients and outpatients undergoing surgical procedures in General Surgery department, considered to be higher than developed countries. *E. coli* was the most commonly identified organism (6). Authors also have highlighted the need for surveillance systems for SSI and hospital guidelines for antibiotic prophylaxis. In 2013, Giri S

et al has published the study on incidence of SSI and associated risk factors in patients who underwent abdominal surgery in the surgical wards of Tribhuvan University Teaching Hospital (TUTH) in Kathmandu, Nepal, from January 2011 to June 2011. The overall rate of SSI was 23% (7). In another study, the incidence rate of SSI in women who underwent caesarian section as emergency procedure reported as 12.6% (8). The prevention and effective management of SSI is critical as it may lead to increase in hospital stays, cost, and affecting patient's quality of life. The cause of SSI could be multifactorial, including foreign material like sutures used. Antibacterial coated sutures such as Triclosan coated suture are available to address the unmet need of inhibition of bacterial growth at wound site. Triclosan (2,2,4'-trichloro-2'-hydroxyphenyl ether) is synthetic broad-spectrum anti-microbial agent present in the market for more than 40 years (9) and acts by inhibiting FabI gene which encodes the Enoyl-acyl carrier protein reductase enzyme (ENR) which is essential in fatty acid biosynthesis. It acts by disrupting the cell membrane causing cell contents to leak (9, 10). Triclosan inhibits the growth of microorganisms primarily responsible for SSI such as *Staphylococcus aureus*, Methicillin resistant *Staphylococcus aureus* (MRSA), *Staphylococcus epidermidis*, Methicillin resistant *Staphylococcus epidermidis* (MRSE), *Escherichia coli*, and *Klebsiella pneumoniae* (11).

In this *in vitro* antimicrobial evaluation, we have compared the anti-microbial property of triclosan coated polyglactin 910 suture with non-coated polyglactin 910 suture for commonly reported microorganism; *S. aureus* and MRSA, using zone of inhibition assays.

## Methods

The study was conducted at department of microbiology, Tribhuvan University Teaching Hospital, Kathmandu.

## Suture Material

Triclosan coated polyglactin 910 suture (Vicryl PLUS®, Size 2-0, Ethicon, Inc. Somerville, NJ) and non-coated polyglactin 910 without triclosan (Vicryl®, Size 2-0, Ethicon, Inc. Somerville, NJ) were taken from sterile single peelable foil packages. They were cut aseptically into 4 cm length and store at room temperature until use.

## Organisms and Culture Preparation

*S. aureus* (ATCC 6538) and MRSA (ATCC 33591), were maintained on Tryptic Soy agar (TSA; Difco, Detroit, MI). The cultures from organisms were cultivated for 24 h at 37°C in tryptic soy broth. 2 sets of culture plates specific to each microorganism were prepared.

## In Vitro Evaluation using ZOI assay

In the Tryptic Soy agar plate for each organism, 4 cm pieces of Triclosan coated suture and a similar length of uncoated suture were placed on two halves of each plate and incubated at 37°C for 24 hrs. After overnight incubation at 24 hrs, we compared the zone of inhibition around triclosan coated suture with that of uncoated suture in each set of agar plate. The results were tabulated and a good quality photograph taken for record.

## Results

At the end of 24 hrs incubation at 37°C, a good zone of inhibition was found for triclosan coated suture in both *S. aureus* and MRSA agar plate as compared to non triclosan coated suture. For both *S. aureus* and MRSA organisms, 17-19 mm zone of inhibition found and non-coated suture had no zone of inhibition, in each set of agar plates (Table 1, Figure 1, 2).

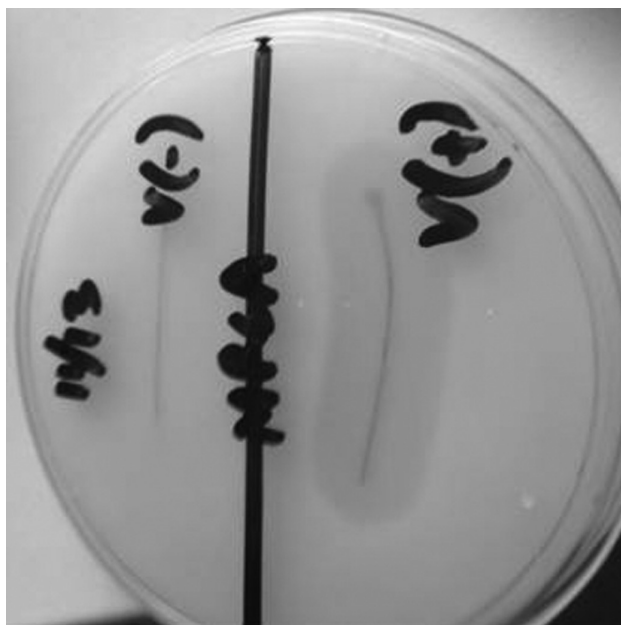
**Table 1. Zone of inhibition around coated and uncoated sutures**

	Micro-organism tested	Coated Suture - Zone of Inhibition (in millimeter)		Non Coated Suture - Zone of Inhibition (in millimeter)	
		1	2	1	2
1	<i>S. aureus</i>	17 mm	19 mm	0	0
2	MRSA	17 mm	19 mm	0	0

**Figure 1: *Staphylococcus aureus*: Zone of inhibition around Triclosan Coated suture and no zone of inhibition around non coated suture**



**Figure 2. Methicillin resistant *Staphylococcus aureus*: Zone of inhibition around Triclosan Coated suture and no zone of inhibition around non coated suture**



## Discussion:

In this *in vitro* efficacy study, Triclosan coated polyglactin 910 suture showed inhibition of colonization of *Staphylococcus aureus* and Methicillin resistant *Staphylococcus aureus* around the suture as compared to no inhibition of these organisms in non-coated suture. Our study results were similar to *in vitro* studies published earlier. Rothenburger S et al have shown 10-16 mm inhibition for various sizes Triclosan coated polyglactin 910 (Vicryl PLUS®) sutures. The same study also had shown a good zone of inhibition for *Staphylococcus epidermidis* (12). In an Indian study published in 2014, Triclosan coated suture showed good antibacterial activity *in-vitro* against the common bacteria isolated from post-operative wound infection such as *S. aureus*, MRSA, CoNS, MRSE, *E. coli*, *Klebsiella*, *Citrobacter*, *Proteus* and *Acinetobacter* (13). The study conducted by Edmiston C *et al* evaluated comparative adherence of bacterial isolates to the antibacterial coated and non-coated surgical sutures. The results demonstrated a statistical significant reduction in Gram-positive and Gram-negative bacterial adherence to a Triclosan-coated braided suture and decreased microbial viability compared to non-coated suture (14). Similar favorable zone of inhibition studies were published for other types of Triclosan coated sutures such as Povidone-iodine (PDS PLUS®) and Poliglecaprone 25 (Monocryl PLUS®) sutures (15, 16).

The safety and clinical effectiveness of triclosan coated suture has been established through number of clinical studies in various therapeutic indications. Till date, 6 meta-analyses, >20 randomized controlled clinical trials and > 10 other clinical studies have been published on triclosan coated suture. Three meta-analyses have shown the ~30% decrease in SSI risk (17).

## Conclusion:

Considering the high prevalence rate of SSI in Nepal, the use of Triclosan coated suture for wound closure would be highly beneficial in controlling the SSI, associated morbidity and mortality, treatment cost & short hospital stay.

**Conflict of interest:** None declared

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**Conflict of interests:** None Declared

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