

ORIGINAL ARTICLE

**Frequency of Surgical Site Infection after Open Appendectomy  
using Antimicrobial Sutures**

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**ABSTRACT**

**OBJECTIVE:** To determine the frequency of Surgical Site Infection after open appendectomy using antimicrobial sutures.

**METHODOLOGY:** Present study design was prospective case series conducted after the approval from the Research, Training and Monitoring Cell of CPSP in Department of Surgery, Dr.Ruth K.M Pfau, Civil Hospital Karachi/ Dow University of Health Sciences Karachi from December 2017 to May 2018 with non-probability sampling technique. All patients between the age of 15-40 years of either sex who visited the Emergency Department and were diagnosed clinically with acute appendicitis were included in the study. Patients with generalized peritonitis or per-operative findings of malignancy, perforation, or gangrenous appendix were not enrolled. Open appendectomy was carried out in all patients and antimicrobial coated sutures were used all through the surgery and patient was kept under follow-up for 3 months in surgical OPD to detect any clinical feature of SSI and the data was analyzed using SPSS version 17.

**RESULTS:** Among 139 studies cases 76 (54.68%) were male and 63 (45.32%) were females with a male to female ratio of 1.2:1. The age range was from 15 to 40 years with a mean age of  $27.23 \pm 5.97$  years. The majority of the patients 88 (63.31%) were between 15 to 30 years of age. In this study, frequency of SSI after appendectomy using antimicrobial coated suture was found in 14 (10.07%) patients.

**CONCLUSION:** The results demonstrate that the frequency of surgical site infection after incorporating antimicrobial sutures (Triclosan) is not significantly different statistically as expected in clean-contaminated abdominal surgery.

**KEYWORDS:** Acute appendicitis, antimicrobial coated sutures, open appendectomy, surgical site infection.

**INTRODUCTION**

The vermiform appendix is a worm-like blind-ended projection from the posteromedial end of the caecum with an average length of 7.5 and 10 cm<sup>1</sup>. Inflammation of the appendix simply termed as appendicitis is often caused by the obstruction of its orifice from an appendicolith, hypertrophied submucosal lymphatic tissue especially in young age groups, malignancy, intraluminal parasites infestation or any other mechanical cause. The luminal blockage heralds the inflammatory process and can progress to localized ischemia secondary to increased intraluminal pressure, formation of a localized abscess, or generalized peritonitis after perforation<sup>2</sup>.

Acute appendicitis is one of the most common causes of acute abdomen in the emergency department with 5.7-57 cases per 100,000 populations with lifetime risk percentages of 8.6 and 6.7 for males and females respectively. Interestingly the surgical intervention is high in females in the second and third decades as compared to males (23 vs 12)<sup>3</sup>. Regardless of the cause, inflammation of the appendix warrants early surgical intervention and is considered as a gold standard approach in most uncomplicated cases<sup>4</sup>.

Any form of delay in clinical diagnosis or surgical intervention can possibly lead to increased morbidity including appendicular perforation and postoperative Surgical Site Infection (SSI), particularly in complicated cases<sup>5-7</sup>. SSI has been reported in different studies as one of the most common complications of appendectomy and may reach up to 40% in type IV (infected or dirty type) of surgery after perforated viscus<sup>1,8,9</sup>. SSI is the most common cause of nosocomial infection after the urinary tract and globally a major healthcare challenge for physicians with serious consequences. This includes patient dissatisfaction after a negative impact on their psychological and physical quality of life, increased hospital stay and economic burden, and litigation. As a result, health care professionals are blamed wholly for the SSI in society but in reality, patient or disease-related factors are more responsible<sup>10</sup>.

The surgical intervention of any form of disease can set in a complex cascade leading to invasion of normal microbial organisms and resulting in major infections. Every effort is made to reduce perioperative morbidity and mortality by improving different components of clinical care. Preoperative skin antisepsis with either chlorhexidine alcohol or povidone-iodine scrub addresses only superficial bacteria. In addition to multiple endogenous sources of wound infection, the commonly used suture materials are exogenous and react like foreign bodies and nidus for bacterial colonization. As a result of this understanding, different strategies including irrigation of wounds with topical antibiotics or antibiotic coated sutures were used with the expectation of decreased post-operative growth of bacterial colonization of surgical wounds<sup>11</sup>. The specific quantity of microbes required to develop an infection or infective threshold is surprisingly decreased in tissues after contamination by the sutures and knots made within<sup>12</sup>. Therefore use of antimicrobial sutures can actively inhibit most commonly involved pathogenic microorganisms such as *Staphylococcus aureus*, *Staphylococcus epidermidis*, methicillin-resistant *S. aureus* (MRSA), and methicillin-resistant *S. epidermidis* (MRSE) can reduce their pathogenicity and the overall prevalence of SSI<sup>13</sup>. The objective of this study was to determine the frequency of Surgical Site Infection after open appendectomy using antimicrobial sutures.

**METHODOLOGY**

This cross-sectional interventional study was carried out at Department of Surgery Unit IV Dr.Ruth K.M Pfau Civil Hospital Karachi/Dow University of Health Science Karachi from November 2017 to May 2018 and was approved by REU of CPSP in June 2020. Informed consent was taken from all 139 patients after explaining details of the purpose of utilizing antimicrobial coated sutures in their wounds along with confidentiality. Patients of both sexes between the age of 15 and 40 who visited the emergency department were enrolled for the study after they met any 03 criteria to diagnose acute appendicitis including migratory right lower quadrant pain, nausea and vomiting, tenderness on clinical examination, and WBC count more than 12,000  $\mu$ L. We excluded patients with complicated appendicitis as it is a different entity as well as patients with preoperative findings of gangrenous or perforated appendicitis, malignancy, or inflammatory bowel disease. The open appendectomy was performed under general anesthesia by trainees having more than 2 years of clinical experience. The antimicrobial coated suture was utilized in ligation of the appendix and its mesentery, parietal peritoneal closure, muscles approximation, and sheath. All patients were kept under follow-up after surgery till 03 months of surgery in the hospital and surgical OPD. Surgical Site Infection was reported if there was either purulent drainage of any amount or microorganisms isolated from a culture of the fluid or tissue along with any two clinical features of infection among pain, localized tender swelling, and redness at the site of the surgical made incision.

Data was collected on predesigned proforma and SPSS version 17 was used for data analysis. Frequency and percentage were calculated for the qualitative data. P-Value < 0.05 was taken significantly and mean and standard deviation were calculated.

**RESULTS**

A total of 139 patients were included in our study that underwent open appendectomy with antimicrobial coated sutures. The mean age was  $27.23 \pm 5.97$  years while the age range was 15-40 years. The stratification of patients according to age groups and sex is shown in Tables I and II respectively. There were 76 (54.68) males and 63 (45.32) females with a male to female ratio of 1.2:1. Surgical Site infection was not found in 125 patients using antimicrobial coated sutures while 08 patients in age groups 15-30 years and 06 patients with the age group of 31- 40 years developed SSI. The overall frequency of surgical site infection (SSI) in our study after open appendectomy using antimicrobial coated suture was observed in 10.07% of patients.

**TABLE I:  
STRATIFICATION OF SURGICAL SITE INFECTION CONCERNING AGE GROUPS**

Age (years)	Surgical Site Infection		p-value
	Yes	No	
15-30	08	80	0.614
31-40	06	45	

**TABLE II:  
STRATIFICATION OF SURGICAL SITE INFECTION CONCERNING GENDER**

GENDER	Surgical Site Infection		p-value
	Yes	No	
Male	09	67	0.446
Female	05	58	

## DISCUSSION

The operative technique of closure of abdominal incisions utilizing different types of sutures has been evaluated in terms of postoperative wound infection. Over the last few decades, the superiority of different sutures has been claimed over one another even within the group of absorbable and non-absorbable sutures. Therefore the technique and suture material used for closure of abdominal fascia is mostly decided by personal preference of surgeons, hospital tradition, and local material supply<sup>14</sup>. 5-Chloro-2-(2,4-Dichlorophenoxy) phenol, a synthetic antimicrobial agent is new Triclosan-coated suture being utilized in clinical practice as a safe biochemical product having a wide spectrum of bactericidal and fungicidal efficacy<sup>15</sup>.

Sutures have been coated with Triclosan after getting approval from World Health Organisation (WHO), Centers for Disease Control and Prevention, American College of Surgeons and Surgical Infection Society (SIS) as a non-toxic and non-irritating biocompatible antimicrobial agent<sup>16,17</sup>. Triclosan forms an active zone around the suture material and resists the colonization of different bacteria's including methicillin-resistant staphylococcus species<sup>18</sup>. Additionally there has been reported a considerable in vitro reduction of both gram-positive and negative bacterial adherence to coated polyglactin 910 sutures with triclosan and non-interference in the mechanism of surgical wound healing<sup>19</sup>. Triclosan is used in a minuscule amount to coat the sutures and therefore no differences were reported in handling and other physical characteristics including suture tensile strength and post-implant absorption rate<sup>20</sup>. Additionally there has been reported a decreased inflammatory response in tissue adjacent to sutures coated with Triclosan along with 66.6% reduction in culture as compared to traditional sutures<sup>21</sup>.

The meta-analysis by Guo et al<sup>19</sup> (13 RCT, 5256 participants) concluded that SSI was low in patients who dealt with antimicrobial coated sutures as compared to wounds closed traditional sutures. Similarly another meta-analysis of 13 randomized clinical trials involving 3568 patients also supported the role of antimicrobial coated sutures as an effective strategy in reducing the SSI rate<sup>22</sup>. In addition to abdominal surgery antimicrobial coated sutures are also used in clean and clean-contaminated fields including neurosurgery, gynecological, orthopedics, breast and plastic, vascular and sternal wounds in cardiac surgery and has been reported to reduce the incidence of SSI<sup>23,24</sup>.

However, the role of antimicrobial coated Sutures has been criticized in some studies as results were insignificant or produced no difference in reducing wound infection closed with antimicrobial coated sutures<sup>25-27</sup>. A meta-analysis by Henriksen NA et al<sup>28</sup> consisting of eight RCT concluded that Triclosan-coated PDS sutures were not superior to Triclosan vicryl in reducing wound infection in abdominal wall surgery (OR 0.85; 0.61-1.17). Another review consisting of seven RCT and 836 patients by Chang et al reported an insignificant role of antimicrobial coated sutures in reducing SSI and wound breakdown (OR = 0.77; 95% CI: 0.40-1.51)<sup>29</sup>. Surprisingly no difference in clean head and neck cancer surgeries was noted to decrease the frequency of SSI where incisions were closed with antimicrobial coated sutures and SSI was noted about 14.9%.<sup>30</sup> Another study by Deliaert AE et al<sup>31</sup> questioned the protective role of antimicrobial coated sutures in breast reduction surgery and warned for potential adverse effects. He had observed the high rate of wound dehiscence in surgery dealing with antimicrobial coated sutures. Similarly Arslan NC 2018<sup>32</sup> reported increased rates of wound dehiscence and seroma formation in a group of patients dealt with TC Sutures after primary closure of wounds in pilonidal sinus and there was no difference in time to healing.

A prospective clinical randomized double-blinded trial by Steingrímsson et al<sup>33</sup> including 357 patients reported that sternal wound infection was not decreased in the group where antimicrobial sutures were applied and similarly the role of antimicrobial coated sutures was insignificant to reduce leg wound infection and economic burden after vein harvesting in 328 patients who underwent open cardiac surgery (CABG)<sup>34</sup>. Another prospective and randomized trial by Soomro R 2017<sup>35</sup> including 378 patients demonstrated the results similar to our study that no significant differences were obtained when Triclosan coated sutures were used on the occurrence of postoperative surgical site infection.

## **CONCLUSION**

In our study, the frequency of surgical site infection (SSI) after appendectomy using TC suture was 10.07% that is quite insignificant to claim the effectiveness of TC sutures alone about prevention of SSI and economically cost-effectiveness especially in 3<sup>rd</sup> world countries where the cost of delivering care is a serious concern. Although disagreement with other studies in positive favor of antimicrobial coated sutures may be due to the number of patients studied in our study and therefore further studies are required to recommend its use in routine. Abdominal surgery itself is the most common independent risk for SSI, therefore other risk factors are exigent including patient and procedure-related which need to be determined and optimized to achieve the goal.

Patient-related factors including age, lifestyle, smoking, diabetes, cardiac diseases, and procedure-related factors e.g., prophylactic antibiotics, meticulous sterile techniques, universal precautions, type and duration of surgery, and other intraoperative tissue handling must be addressed to develop strategies to control SSI.

**Ethical permission:** College of Physicians & Surgeons Pakistan ERC letter No. CPSP/REU/SGR-2016-183-7876 dated: 08-06-2020.

**Conflict of Interest:** There is no conflict of interest among the authors.

**Financial Disclosure / Grant Approval:** There was no funding agency.

**DATA SHARING STATEMENT:** The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions

## **AUTHOR CONTRIBUTIONS**

Gul A: Data collection, initial workup

Ahmed R: Discussion writing

Kazim E: Introduction writing

Kumar D: Methodology writing

Zulfikar I: Critical review

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