Original Article

Pak Armed Forces Med J 2015; 65(Suppl): S136-39

ADULT CARDIOTHORACIC SURGICAL SITE INFECTION REGISTRY; A PRELIMINARY ANALYSIS AND QUALITY IMPROVEMENT INITIATIVE

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ABSTRACT

Objective: To establish the adult cardiothoracic surgical site infections registry to determine adult surgical site infection (SSI) rates and study impact of quality improvement initiatives on SSI rates.

Methods: The adult Cardiothoracic SSI registry was developed and monthly SSI rates were monitored for both CABG and valvular heart surgeries inclusive of, chest and leg SSIs. Process improvements were instituted to control the increased SSI rate in October 2014 after a multidisciplinary brainstorming session.

Results: A total number of 734 cardiac surgeries were carried out and the cumulative SSI rate was 1.7% (n=13) for this period of six months i.e. August 2014 to January 2015 and that for Chest infections was 1.3% (n=10) and for leg wound (harvest site) infections was 0.4% (n=3). There was an increase in SSI rate in October 2014 of 5% (n= 04). After process improvements the SSI rate declined to 1% in November 2014 and has remained less than or equal to 2% as of January 2015.

Conclusion: A high SSI rate was investigated and multi-modal process improvements and infection control measures were implemented, leading to a decrease in SSI rate from 4% to 1%.

Keywords: cardiothoracic surgery, registry, surgical site infection, quality improvement

INTRODUCTION

Amongst healthcare associated infections (HAIs), surgical site infections (SSIs) are a preventable cause of increased morbidity and mortality and are associated with substantial financial costs[1]. SSI rates are an indicator of the quality of surgical and postoperative care, which necessitates the need for robust surveillance systems for these healthcare-associated infections[2]. In cardiac surgery, mediastinitis is a severe SSI often warranting surgical redo. Patients undergoing coronary artery bypass grafting (CABG) are at a greater risk for infection due to their relatively older age and the presence of comorbid conditions like Diabetes mellitus and obesity[3]. Quality improvement measures for reducing SSIs included infection control measures such as adequate patient skin asepsis, pre-operative prophylactic antibiotics; strict glycemic control and surveillance of SSI rates for feedback to the surgeons[4]. We developed the adult Cardiothoracic SSI registry for surveillance purposes, which is an ongoing registry in tandem with Plan-Do-Check-Act (PDCA) cycle for reducing our center's SSI rates. We present a preliminary analysis over a period of six months.

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Operational Definitions

Surgical Site Infection (SSI)

An SSI was defined as an infection related to the cardiothoracic surgery and which occurred at or near the surgical incision inclusive of within 30 days of that operative procedure. According to the proposed Centers for Disease Control and Prevention (CDC) classification, infection of surgical wounds of sternotomies was considered as superficial if only the skin and subcutaneous tissue was involved; deep, when the infection reached the sternum but did not involve it and as organ or space infections when sternal osteomyelitis or mediastinitis occurred[5,6].

The clinical criteria being used to define a SSI included any of the following:

- A purulent exudate draining from a surgical site
- A positive pus culture obtained from a surgical site that was closed primarily
- The surgeon's diagnosis of infection

METHODOLOGY

The adult Cardiothoracic SSI registry was developed in a 250 bedded tertiary Cardiac care teaching hospital. The Adult Heart Surgery

Unit of our hospital performs an average of 25 heart surgeries weekly. The study population consisted of all patients who underwent cardiac surgery between August 2014 and January 2015, who met the following inclusion criteria: aged more than 18 years, having undergone cardiac surgery through longitudinal median sternotomy; inclusive of coronary artery bypass grafting (CABG) also including those with both chest and leg site incisions and those patients who had undergone valve repair or replacement.

SSI numerator data was collected and operative procedure category denominator data on all procedures included in the selected procedure categories on monthly basis. Although this is an ongoing registry, for the purpose of this analysis the 30 day period for surveillance was used, however the patients who present post discharge within 90 days post procedure with deep infections or mediastinitis are being included in this registry. All procedures included in the monthly surveillance plan are being followed for superficial, deep, and organ space (mediastinitis) SSIs. The methodology being used includes direct examination of patients' wounds during follow-up visits to adult cardiothoracic surgery outpatients' department, patient readmissions and review of medical records. We are using a specially designed data collection tool adapted from the Association of Practitioners in Infection Control (APIC) which includes patient demographics, type of cardiothoracic surgical procedure, type of SSI and SSI culture reports[7].

Fishbone Diagram Procedure

The fishbone diagram identifies many possible causes for an effect or problem. It can be used to structure a brainstorming session. It immediately sorts ideas into useful categories[8]. for improving the SSI rates after October 2014, the problem statement (effect) outlined was the increased rate of surgical site infections for Cardiopulmonary Bypass Surgery from a baseline of 1% to 4% (Fig-1). Brainstorming for the major categories of causes of the problem was carried out by a multidisciplinary team the Infection Control Committee and possible various causes were outlined as shown in Fig-2. We reassessed our preoperative patient preparation inclusive of hair removal, antiseptic body washes, skin asepsis, prophylactic antibiotic administration, operating room practices, surgical technique, evaluated causative microorganisms, post -operative care inclusive of glycemic control, surgical dressings.

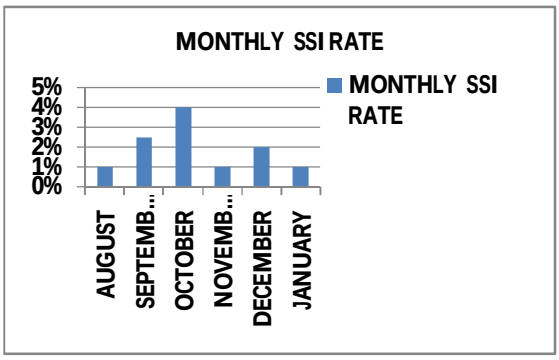

Figure-1: Monthly Cardiothoracic SSI rates from August 2014 to January 2015.

Table-1: General characteristics of surgical site infection cases n=13 from Aug 2013 to Jan 2015.

Variables	Mean ± SD
Age of patients	55 ± 12 Years
Height of patients	161 ± 6 cm
Weight of patients	7 4± 12 kg
Body Mass Index (BMI)	29± 5 kg / m^2
Time to presentation	21± 9 days

Statistical Analysis

Data was entered in the Statistical Package for the Social Sciences (SPSS) version 21 for analysis. Numeric variables were analyzed as descriptive statistics, through measures of central tendency (mean and median) and variability (minimum, maximum and standard deviation – SD). Surgical site infection rate was expressed as a percentage.

RESULTS

A total of 734 Cardiothoracic procedures were carried out from 1st August 2014 to 30th January 2015, inclusive of 483 (66%) CABG procedures and 251 (34%) valvular heart surgeries.

The cumulative SSI rate was 1.7% (n=13) for this period of six months i.e. August 2014 to January 2015 and that for Chest infections was 1.3% (n=10) and for leg wound (harvest site) infections was 0.4% (n=3). Amongst the patients who presented with SSIs (n=13), 85% (n=10) were males and 15% (n=3) were females. The mean age of these patients with SSIs was 55 ± 12 SD Years and the average BMI was 29±5 SD Kg/m^2 (overweight category) and the average time to presentation was 21±9 SD days as shown in Table-1. There were 77% (n=10) chest site infections inclusive of 7 superficial, 1 deep SSI and 2 cases of Mediastinitis. Gram negative bacteria were implicated in leg site infections and mostly Staphylococci were implicated in Chest SSIs as shown in Fig-3.

There was an increase in SSI rate in October 2014 of 4% (n=04) as shown in Fig-1. After process improvements as outlined in Fig-2 the SSI rate declined to 1% in November 2014 and has remained less than or equal to 2% as of January 2015.

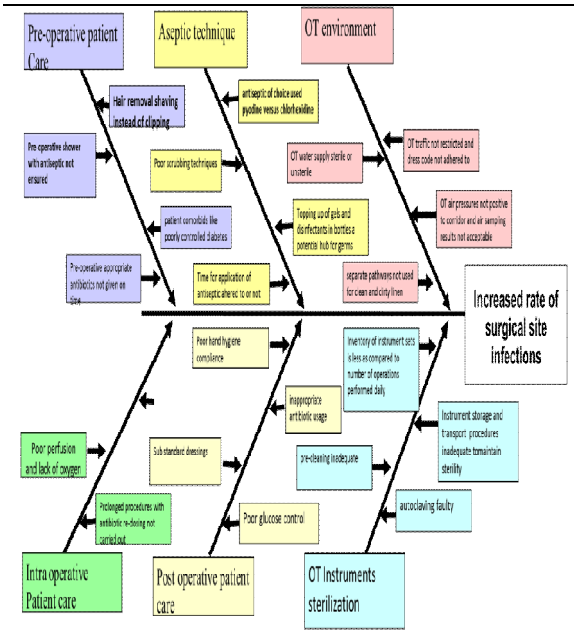

Figure-2: Fishbone diagram for increased rate of surgical site infections.

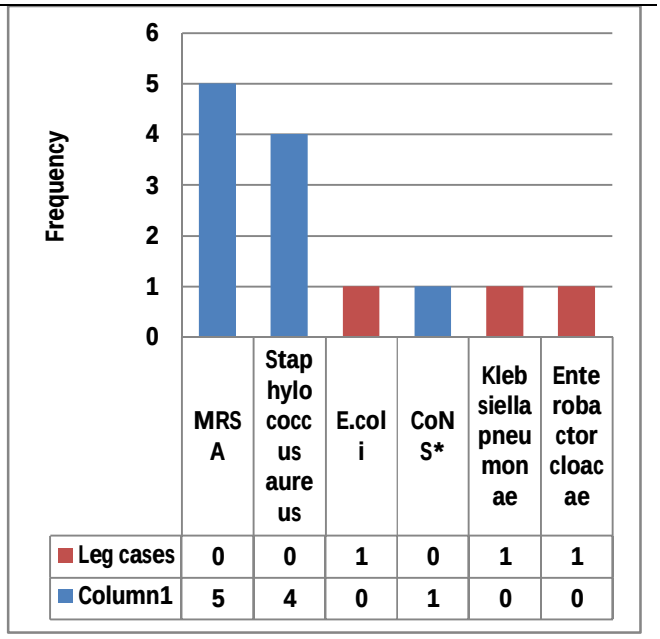

Figure-3: Microbiology of SSIs after Cardiothoracic Surgery (n=13).
*CoNS "Coagulase negative staphylococci

DISCUSSION

SSI rates vary with the type of surgical procedure performed. SSI rates as high as 10.6 percent occur after abdominal surgery[9]. For CABG surgery Fakih et al have reported a sternal SSI rate of 4 percent at a 608 bedded tertiary care hospital[10]. Our Chest SSI rate was less than 2% over this six month analysis, however; there was as significant increase in SSIs during October 2014. We carried out process improvements encompassing the perioperative processes focusing on hand hygiene, skin antisepsis and surgical scrub practices. We did not carry out risk stratification at this stage as this is an ongoing registry. Morikane et al reported SSI incidence rates for cardiovascular surgeries other than CABG and for CABG of 2.6% (151/5895) and 4.1% (160/3884), respectively. A high American Society of Anesthesiologists' (ASA) score and long duration of operation were significant in predicting SSI risk in their model[11]. Lola et el have reported a leg SSI rate of 0.6% somewhat similar to our findings of 0.4% for leg SSIs. However, unlike our findings gram positive cocci and gram-negative bacteria were implicated equally in their cohort of patients with SSIs[12].

Our study clearly outlines healthcare infection associated data if collected on a routine basis and in a systematic manner, can be utilized for SSI surveillance and can contribute towards quality improvement. King et al created a syndromic surveillance for surgical site infections (SSI) after CABG procedures utilizing data from the local Hospital Information Management Systems and cardiac registry with a cumulative SSI rate of 6.6%[13].

A multitude of microorganisms can cause cardiothoracic chest SSIs. Trouillet et al established that in chest SSIs occurring less than 30 days after sternotomy, the mostly common microorganisms isolated were methicillin-susceptible Staphylococcus aureus (MSSA), followed by Methicillin-Resistant S. aureus (MRSA) and gram-negative bacteria, coagulase-negative staphylococci are the pathogens[14]. This is similar to our findings, where mostly staphylococci were the causative bacteria[14]. Postoperative mediastinitis SSI rates from 0.4 to 5 percent have been reported, mostly ranging from 1-2% in most centers[15]. Our SSI rate for mediastinitis over six months was 0.3%.

Patients with ischemic heart disease are usually older, more likely to have history of tobacco use, diabetes and obesity which are risk factors for postoperative infection after cardiac surgery[16]. The average BMI of the patients with SSIs in our preliminary analysis is fairly high in the overweight category. Berg et al have further recommended that the European System for Cardiac Operative Risk Evaluation (Euro SCORE), height, weight, and diabetes should be include in SSI surveillance[17].

CONCLUSION

A high SSI rate was investigated and multi-modal process improvements and infection control measures were implemented, leading to a decrease in SSI rate from 4% to 1%. Cardiac surgery procedures should be monitored on a regular basis for post-operative SSIs by designing a registry for the purpose and customizing it to the institution needs and resources for process improvements for better patient outcomes.

Conflict of Interest

This study has no conflict of interest to declare by any author.

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