Pk Heart J 2024:58(01)
ISSN:0048-2706 E-ISSN:2227-9199

Assessing Surgical Site Infection Rates Among Post Cardiac Surgery Patients - A Prospective Observational Study

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ABSTRACT

Globally, cardiovascular diseases are the leading cause of death, claiming approximately 17.9 million lives per year [1]. Cardiovascular diseases is now the leading cause of death in India with a death rate of 272 per 100,000 population in India [2]. Surgical site infections amongst patients who have undergone cardiac surgery adds to the morbidity of the patients. Our study focusses on the pre-operative, intraoperative and post operative strategies to reduce the incidence of surgical site infection among patients undergoing elective coronary artery bypass grafting and aortic and / or mitral valve replacement. Pre-operatively, patients with fasting blood sugar < 160mg/dl were considered for elective cardiac surgery. Bilateral lower limb arterial doppler was done to rule out peripheral vascular disease. Scrubbing of patients with povidone iodine and chlorhexidine scrub allowing for a contact time of 3 minutes prior to incision was implemented. Post-operative strict glycemic control monitoring for up to a minimum of 6 weeks was done. Out of 398 patients, 18 patients (4.5%) had surgical site infection in our study.

The global average ranges from 3.5% - 28.6%.

Keywords: *Surgical site infection, CABG, valve replacement, glycemic control, morbidity*

INTRODUCTION

Globally, cardiovascular diseases are the leading cause of death, claiming approximately 17.9 million lives per year [1].

Cardiovascular diseases are now the leading cause of death in India with a death rate of 272 per 100,000 population

in India [2].

Cardiovascular disease rates are highest in the states of Tamil Nadu, Kerala and Punjab. Type II diabetes mellitus, systemic hypertension, cigarette smoking, obesity and dyslipidemia are the main risk factors affecting the Indian population [3]. Surgical site infections in Europe varies from between 3.5% to 21%. Mortality can reach up to 25% in those patients [4][5].

Surgical site infections can be classified as superficial surgical site infections and deep surgical site infections. Superficial SSI involves the pectoralis fascia, subcutaneous tissue and skin [6]. Deep surgical site infections involve the mediastinum, substernal space and the sternal bone [7]. Surgical site infection adds to the morbidity in patients who have undergone cardiac surgery.

Interventions taken at the pre-operative, intra-operative and post operative level of care can significantly affect the incidence of surgical site infections. Strict hospital protocols are in place to combat surgical site infections globally.

AIM

The aim of the study is to observe the prevalence of surgical site infections among patients who have undergone cardiac surgery in our hospital

METHODS

PLACE OF STUDY: Department of cardiothoracic and vascular surgery, Sri Ramachandra Institute of Higher Education and Research.

1. **Type of Study:** A Prospective observational study
2. **Period of study:** April 2024 to December 2024
3. **Sample size:** 400.

Inclusion Criteria

1. Patients who will consent for the study
2. Patients age >19 years
3. Elective coronary artery bypass grafting
4. Elective valvular heart surgeries.

Exclusion Criteria

1. Patients age < 18 years
2. Emergency cases
3. Patients who refuse to participate in the study

Patients who underwent previous cardiac surgical procedures

METHODOLOGY

This is a prospective observational study that will be conducted in Sri Ramachandra Institute of Higher education and research from April 2024 to December 2024 after getting Institutional ethical committee approval and clinical trial registration.

Inclusion criteria comprised of patients undergoing elective coronary artery bypass grafting and valve surgeries aged >19 years. Patients age < 18 years, Emergency cases, patients having history of previous cardiac surgery and those who refuse to participate in the study will be excluded from the study

Patients will be priorly informed about the study and consent will be obtained. Eligible participants will be preoperatively optimized with fasting blood sugar (FBS) levels of <180mg/dl. Bilateral lower limb arterial doppler will be done for all patients undergoing coronary artery bypass grafting to ensure adequate vascularity of the lower limb.

Intra-operatively, protocols with respect to surgical technique and theatre atmosphere will be implemented. With respect to surgical technique, conservative use of electrocautery (40 alternating current) on the left internal mammary artery

(LIMA) bed after harvesting LIMA, avoiding the use of titanium clips when harvesting great saphenous vein (GSV) from the lower limbs and the use of closed negative suction Romovac drains in obese patients (BMI > 30) will be implemented. Patients will first be cleaned with Chlorhexidine scrub with a contact time of 3 minutes. Prior to draping the patient, Betadine scrub will be used with a contact time of 3 minutes. The number of personnel in the OT complex during the surgery will comprise of 3 cardiac surgeons (1 operating surgeon, 2 assistant surgeons), 2 cardiac anaesthetists, 2 scrub nurses, 2 circulating nurses, 1 OT technician and 2 perfusion technologists. Cardiopulmonary bypass machine will be assembled outside the OT complex and will only be brought into the OT when it is required.

Post operatively, the patient will be followed up for 1 month. During this time, serial arterial blood gas (ABG) analysis will be done in the ICU and blood sugar levels will be controlled with Inj. Human actrapid infusion if CBG >180mg/dl. Once patient is shifted to the ward, referral will be sent to the endocrine department for optimization of blood glucose levels. Capillary blood glucose (CBG) levels will be monitored 3 times a day. Chest and the leg wound will be daily inspected in the morning and evening by the cardiac surgical team and dressing will be done for the same. A well-trained registered nurse will be appointed to counsel and educate the patients regarding wound care.

If there is evidence of redness, warmth, serous discharge from the wound site, wound gaping these patients will be subjected to a culture and sensitivity test. If organism growth is confirmed from the wound, sensitive antibiotics will be initiated and dressing twice a day will be done by the surgical team. These patients will be followed up weekly via telephone by the well-trained nurse.

DATA ANALYSIS

With 7% infection rate derived from a clinical departmental audit done in SRIHER between 1st June 2022 – to 31st May 2023, sample size was calculated as 400 with an absolute precision of 2.5 and 95% confidence level. The data obtained were entered in Microsoft Excel (Microsoft Corp., Redmond, WA), and the results were analyzed using SPSS (Statistical Package for the Social Sciences) version 21 (IBM Corp., Armonk, NY). All the data collected will be expressed in the form of bar graphs and pie charts.

RESULTS

A total of 398 patients satisfied the inclusion criteria and were enrolled in the study after obtaining their consent.

Figure 1 shows the number of patients who underwent elective coronary artery bypass grafting and valve replacement every month from April 2024 to December 2024. The figure also highlights the number of patients infected in the above-mentioned time period.

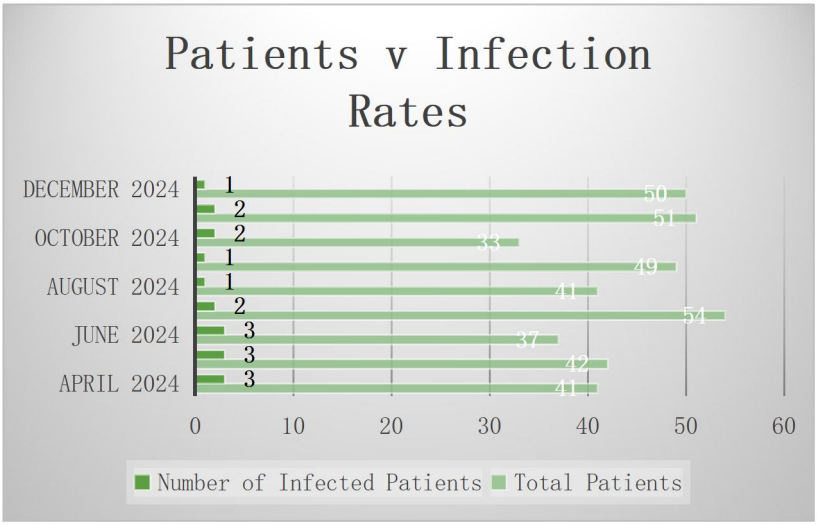

Fig 1. Number of patients operated and the number of surgical site infections encountered from April 2024 to December 2024.

Out of the 398 patients, 272 patients were men and 126 were women.

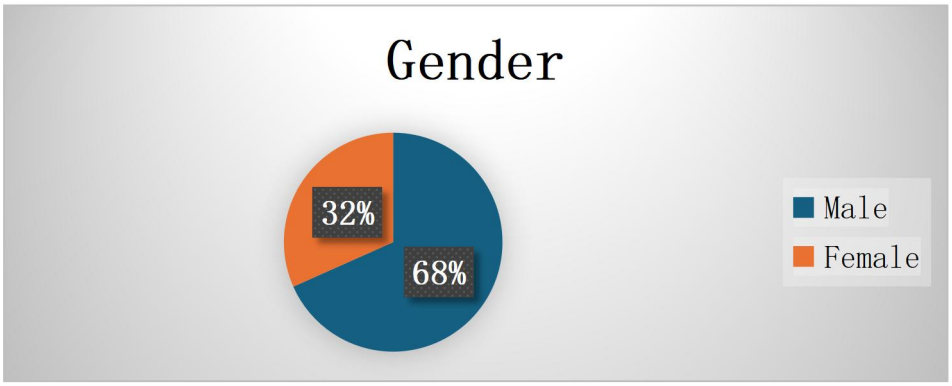

Fig 2. Gender

Out of the 272 male patients, 11 patients had post operative surgical site infection. 7 female patients had wound infection among the 126 patients who enrolled in the study

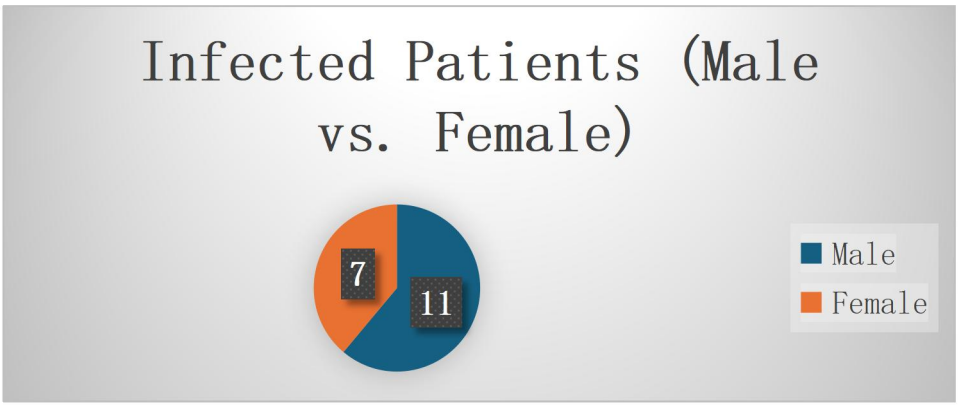

Fig 3. Infected patients (Male vs. Female)

290 patients underwent elective coronary artery bypass grafting and 108 patients underwent mitral and / or aortic valve replacement surgery between April 2024 and December 2024.

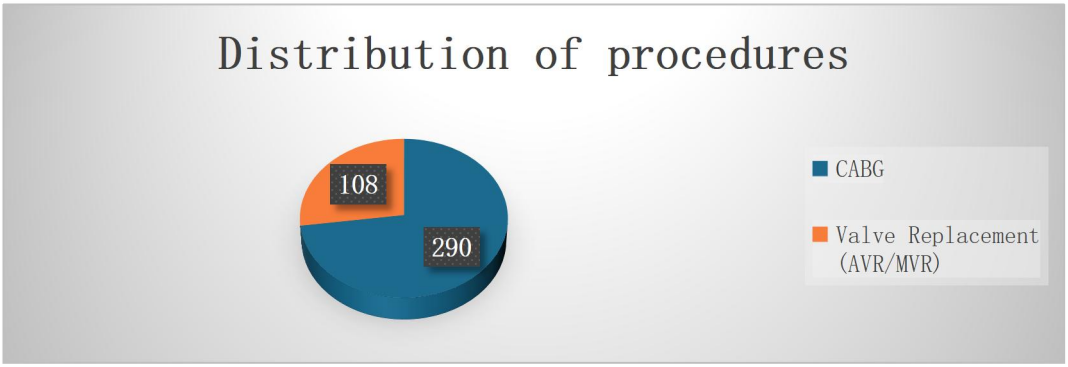

Fig 4. Distribution of procedures

16 patients out of the 290 patients who underwent coronary artery bypass grafting had post operative surgical site infection. In contrast, only 2 out of the 108 patients had surgical site infection following valve surgery.

Figure 5 highlights the number of infections that occurred in the chest or leg or chest and leg.

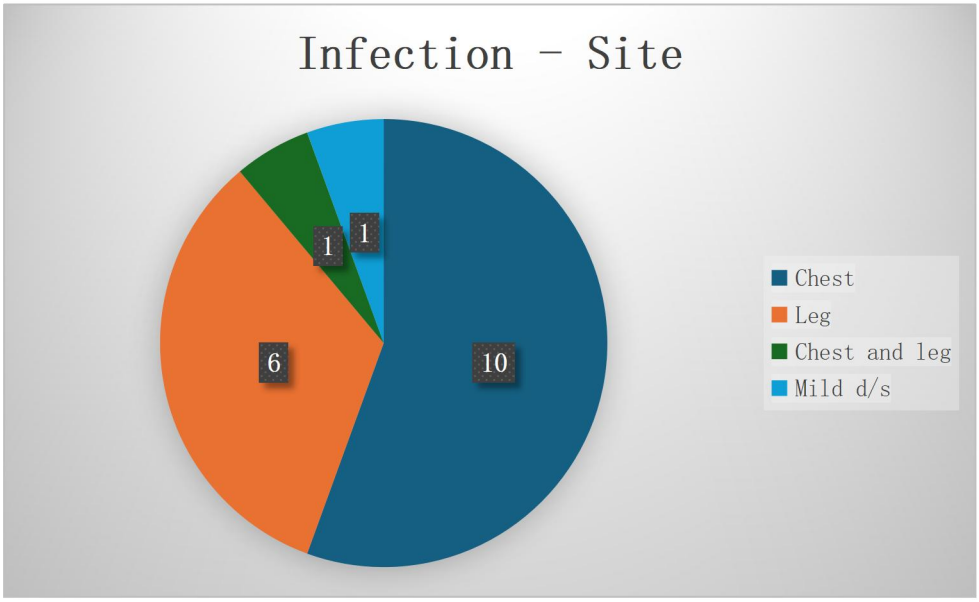

Fig 5. Infection - site

Among the 18 infected patients, 9 patients had no growth when the wound was swabbed for bacterial culture and sensitivity. Figure 6 shows the organisms that were isolated among the infected patients.

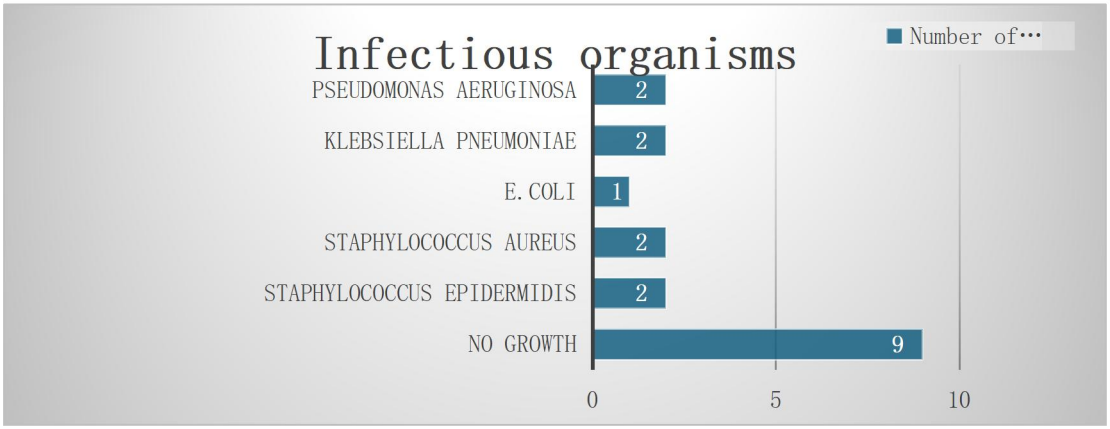

Fig 6. Organisms

Among out study of 398 patients, 18 patients had surgical site infection. The percentage of infections in the 6-month period, in our study, is 4.55%

DISCUSSION

Surgical site infections are associated with poorer prognosis among patients who have undergone cardiac surgery. Cardiac surgical infections can pose a threat to life in view of their proximity to vital organs. Much attention has been given to the pre-operative and post operative strategies to combat surgical site infections. Intraoperative risk factors for surgical site infections include emergency surgery, harvesting bilateral internal mammary arteries, combined procedures; CABG with valve and prolonged surgery duration. Our study focuses on the intraoperative measures undertaken by surgeons to reduce the incidence of surgical site infection

In our study, we had restricted the number of medical personnel inside the operation theatre once the procedure has commenced. Overcrowding inside the operation theatre increases the risk of surgical site infection in the post operative period. Medical personnel in the operation theatre were required to don sterile gowns. It is postulated that the constant movement of doctors and staff in to and out of theatre exposes the patient to infection in the form of fomites.

Prior to surgery, patients are scrubbed down with 4% chlorhexidine with a contact time of 2 minutes. Following the chlorhexidine scrub, 10% povidone iodine was used to prepare the surgical site (entire chest and bilateral lower limbs) with a contact time of 3 minutes. This has proved effective in controlling the rate of surgical site infections in our study. The antibacterial effect of povidone iodine begins 30 seconds after it is applied on the skin [8]. Chlorhexidine eliminates all vegetative bacteria when it is in contact with the skin between 30 seconds to 2 minutes [9]. Reduced contact times of both solutions were observed in patients with infections in view of unstable hemodynamics on table.

Silk ties were preferred to titanium clips in ligating great saphenous vein perforator branches in our study. Titanium clips tend to slip and have poor holding power when ligating large perforator branches and this leads to hematoma formation. This predisposes to the patient to surgical site infections. Silk, being a braided material, is a potential nidus for infection; however, in our study they were found to be superior to titanium clips in securing hemostasis in the leg.

Pre-operative bilateral lower limb peripheral arterial doppler scans was done for all patients undergoing elective coronary artery bypass grafting. Peripheral vascular disease is one of the factors for poor wound healing. Among some patients, despite good dorsalis pedis pulsation, arterial doppler scans revealed peripheral vascular disease. Saphenous vein harvesting was done on the limb showing triphasic flow in the arterial tree. There was a significant decrease in the incidence

of post-operative leg infections.

Strict glycemic control was implemented in the pre-operative, intra-operative and post-operative setting. Patients with fasting blood sugars more than 160mg/dl were optimized and then taken up for surgery. Intra-operative insulin infusion was administered to control the blood sugars. An endocrinologist was assigned to control the post-operative blood sugars. Daily dressing of the wound was done and patients were educated regarding personal hygiene and wound care. After discharge from the hospital, a special nurse was engaged to follow up with our patients' blood sugar values for a minimum of 6 weeks. Alterations in oral hypoglycemic agents or insulin was advised based on the glycemic trend.

CONCLUSION

Globally, the incidence of surgical site infection ranges between 3.5% and 26.8%[10,11,12,13,14]. The number varies due to various epidemiological, patient, environmental factors and the type of surgery that is being performed. Surgical site infection needs to be addressed at the pre-operative, intra-operative and post operative level. Strict glycemic control, increasing the contact time of 4% chlorhexidine and 10% povidone iodine, using free silk ties instead of titanium clips to secure hemostasis in the donor site, pre-operative bilateral lower limb arterial doppler scan and restricting movement of operation theatre personnel in and out of the theatre are the intraoperative strategies to reduce the rate of post operative surgical site infection.

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