

POSTOPERATIVE INFECTIONS FOLLOWING CARDIOVASCULAR PROCEDURES IN A UNIVERSITY HOSPITAL IN TURKEY: DISTRIBUTION AND MICROBIOLOGICAL FINDING

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Background. Postoperative infections are a serious healthcare problem, causing considerable extra morbidity, mortality and costs. The present study was conducted to identify the incidence of postoperative infections following cardiovascular procedures in relation to the type of surgery and examine the causative organisms.

Methods. A total 1252 consecutive patients underwent cardiovascular surgery between January, 2005 and December, 2007, at the Pamukkale University Hospital. This study was performed with laboratory and clinical based active surveillance method. The nosocomial infections were defined according to the Centers for Disease Control and Prevention (CDC) criteria.

Results. A total 90 postoperative infections occurred in 81 of 1252 patients. The prevalence of patients with nosocomial infection among who undergone cardiovascular surgery was 6.5%. The incidence rate of nosocomial infection following cardiovascular surgery was 7.2%. The prevalence of nosocomial infections following coronary artery bypass graft (CABG), valvular surgery, CABG and concomitant valvular surgery, aortic and peripheric vascular surgery were 7.2%, 7.1%, 9.4%, 7.1% and 4.8%, respectively. Surgical site infections (SSIs) (52.3%) were the most frequent infections (superficial incisional 16.7%, deep incisional 30.0% and organ/space 5.6%) followed by pneumonia (30.0%), urinary tract infections (14.4%), and blood stream infections (n=3; 3.3%). The incidence of SSIs following CABG, valvular surgery, CABG and concomitant valvular surgery, aortic and peripheric vascular surgery was 4.1%, 2.2%, 6.3%, 5.4%, and 4.2%, respectively. A total 56 microorganisms were isolated from 90 infection attacks, 64.3% of them being isolated in SSIs. The most frequent isolated microorganism was *Staphylococcus aureus*.

Conclusion. The most frequent detected infection following cardiovascular surgery was surgical site infection and *S. aureus* was responsible for most of them.

Key Words: Cardiovascular surgery, postoperative infection, *Staphylococcus aureus*, methicillin resistant

INTRODUCTION

Nosocomial infections are important problems in all types of hospitals, these infections result in high mortality, morbidity, prolonged hospital stay and severe economic burden (1). Coronary artery bypass grafting and heart valve operations are the most commonly performed cardiac operations (3). Approximately 470 000 coronary artery bypass graft (CABG) are performed annually in the United States (4). Rapidly increasing of these procedures consumes considerable healthcare resources and causes significant mortality and morbidity. The rate of nosocomial infections in cardiovascular surgery units are reported to be between 2% and 50% (5). In Turkey, the mean of these infections at the cardiovascular surgery clinics were reported to be 13.8% (6). Surgical site infections are the most important and commonly seen infectious complications in cardiovascular surgery (7).

The aim of this study was to identify the incidence of postoperative infections following cardiovascular procedures in relation to the type of surgery and examine the causative organisms in a small university hospital.

MATERIAL AND METHODS

Pamukkale University Hospital is a 354 beds tertiary care centre, situated in the city of Denizli. The present study was performed prospectively over a period of 24 months from January 2005 to December 2007. This study was performed with laboratory and clinical based active surveillance method. Daily monitoring and observations of the presence of any nosocomial infection like urinary tract, surgical site, blood stream infection or pneumonia, were conducted according to the NNIS and CDC (8,9). Data collected from each infection included: demographic data, operation type, infection site and microorganisms isolated from these sites. Patients were visited daily from a specialist of infectious diseases and an infection control nurse from the initial of hospitalization. After the patients discharged from hospital, the sur-

veillance was continued by the same method. Patients were called for the first and second control visits after the discharged from hospital ten days and one month later, respectively. Patients with prosthetic valve replacement were followed up for one year.

RESULTS

There were 822 men and 349 women with a mean age 53.7 ± 15.4 years (2-87) and 55.1 ± 14.8 years (1-95) in patients' group without postoperative nosocomial infections. On the other hand, there were 58 men and 23 women with a mean age 57.7 ± 12.2 years (20-80) and 60 ± 10.9 years (41-78) in patients' group with postoperative nosocomial infections.

A total 90 postoperative infections occurred in 81 of the 1252 patients. The prevalence of patients with nosocomial infection among who had undergone cardiovascular surgery was 6.5%. The incidence rate of nosocomial infection following cardiovascular surgery was 7.2%. The prevalence of nosocomial infections following coronary artery by-pass graft (CABG), valve repairment, CABG and concomitant valv repairment, aortic and peripheric surgery were 7.2%, 7.1%, 9.3%, 7.1% and 4.8%, respectively. The highest prevalence of

Table 1. Prevalance and incidence rate of nosocomial infections according to cardiovascular surgery type.

Operation type	Number (%)	Number of patients with nosocomial infection (%)	Number of infections (Incidence rate)
Open heart surgery	941	66 (7.0)	73 (7.8)
- Artery by-pass graft (CABG)	539	39 (7.2)	42 (7.8)
- Valve repairment	182	13 (7.1)	14 (7.7)
- CABG and concomitant valv repairment	32	3 (9.4)	4 (12.5)
- Aortic surgy	56	4 (7.1)	5 (8.9)
- Other (ASD, VSD, Cardiac tamponade)	132	7 (5.3)	8 (6.1)
Peripheric vascular surgery	311	15 (4.8)	17 (5.5)
Total	1252	81 (6.5)	90 (7.2)

postoperative nosocomial infections among patients who had undergone cardiovascular surgery according to the type of surgery was seen among patients with CABG and concomitant valv repairment surgery (Table 1).

Surgical site infection (%52.3) was the most frequent (superficial 16.7%, deep 30.0% and organ space 5.6%) detected postoperative nosocomial infection (Table 2). The incidence of SSIs fol-

Table 2. Types of nosocomial infections following cardiovascular surgery.

Nosocomial infection type	Number/Percentage among determined infections	Incidence rate among patients undergone cardiovascular surgery
Surgical site infections	47 (52.3%)	3.8%
Superficial incisional	15 (16.7%)	1.2%
Deep incisional	27 (30%)	2.2%
Organ/space	5 (5.6%)	0.4%
Pneumonia	27 (30.0%)	2.2%
Urinary tract infections	13 (14.4%)	1.0%
Blood stream infections	3 (3.3%)	0.2%
Total	90 (100)	7.2

lowing CABG, valvular surgery, CABG and concomitant valvular surgery, aortic and peripheral vascular surgery was 4.1%, 2.2%, 6.3%, 5.4%, and 4.2%, respectively.

A total 56 microorganisms were isolated from 90 infection attacks (Table 3), 64.3% of them being

Table 3. Distribution of isolated microorganisms.

Microorganism	Number (%)
S. aureus	18 (32.1)
Methicillin resistant S. aureus	10 (17.8)
Methicillin sensitive S. aureus	8 (14.3)
Pseudomonas aeruginosa	8 (14.3)
Esherichia coli	8 (14.3)
Klebsiella spp.	7 (12.5)
Coagulase negative staphylococci	5 (8.9)
Enterobacter spp.	4 (7.1)
Candida spp.	3 (5.4)
Enterococcus spp.	2 (3.6)
Acinetobacter baumannii	1 (1.8)
Total	56 (100)

isolated in SSIs. The most frequent isolated microorganism in SSIs was S. aureus (n=17; 47.2%) and 52.9% of these strains were methicillin resistant. Thirty-four (37.8%) infections were diagnosed based on the presence of clinical findings by a specialist in Infectious Diseases.

The most frequently used antibiotics in the treatment of nosocomial infections in our cardiovascular surgery were glycopeptides (56.2%), usually used in a combination regimen, and piperacilin-tazobactam (%34.8%), sefoperazone-sulbactam (28.3%) and imipenem (6.4%).

DISCUSSION

Nosocomial infections are potentially devastating complication of cardiac surgery. In our study, after the cardiovascular procedures, the infection prevalence and incidence rate was found as 6.5%. and 7.2%, respectively. This rates were comparable to Simsek et al. (6) who found the infection incidence rate as 6.9% and in their study the most frequent types of nosocomial infections were determined as surgical site infection, pneumonia, primary bloodstream infection, endocarditis and urinary system infection. Rebello et al. (10) reported an order of nosocomial infections like ours; surgical site infections, pneumonia, urinary tract infections and primary bloodstream infections were the major infections in their study. Although we did not investigate the risk factors for nosocomial infections in our cardiovascular surgery unit, the mean age of the patients with infection was higher in comparison with who had not an infection.

Surgical site infection rate was 3.8% in our study. According to National Nosocomial Infections Surveillance (NNIS) reports, the ratio of SSIs in the risk index category 0, 1, 2, and 3 was 1.25%, 3.39%, 5.43% and 9.76%, respectively (7). Our ratio of SSIs was found to be well-matched with NNIS reports. Our patients were evaluated daily by a specialist in infectious diseases and an infection control nurse for the presence of nosocomial infection. In addition, our patients were followed up well after dis-

charged from the hospital via their regular polyclinic controls. Cardiovascular surgery related SSIs have an important liability on the patients mortality, morbidity and also on the higher healthcare costs (7). This type of infection has US\$ 8 200 to US\$ 42 000 additional costs which are attributable to excess length of stay (LOS) and intensive care unit stays (9,11). Reduction of SSIs can be achieved by appropriate control measures. Infection control specialists should carry out most suitable surveillance programs for cardiovascular surgery units (12).

Similar to the reports by Leppetier et al. (13) and Sharma et al. (14), *S. aureus* was the most frequently isolated microorganism in our study. A study from Turkey reported the rate of methicillin resistant *S. aureus* (MRSA) as 58.4% (15). In our study we also determined a high ratio of MRSA. Due to the high incidence of MRSA, the most frequently used antibiotics were glycopeptides (56.2%).

CABG surgery was the dominant operation type in our cardiovascular surgery unit and the number of these operations continues to increase everyday. As a result of this rapidly increase, the highest number of nosocomial infections, especially surgical site infections, occurred after CABG. Farrington et al. (16) determined 4.3 % SSIs in 433 open heart surgery. In another study the rate of SSIs was found as 30.5% after CABG (17).

In conclusion, the most frequently detected infection following cardiovascular surgery was surgical site infection and it is an important point to follow up the patients after discharged from the hospital. The most commonly isolated pathogen was MRSA. In order to control MRSA infections and reduce the ratio of nosocomial infections there should be strict control measures and guidelines applied in every hospital. The healthcare workers must be educated regularly via infection control programmes.

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