Journal of Surgery and Trauma 2015; 3(1-2):14-18.

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ORIGINAL ARTICLE

The prevalence of wound infection in patients undergoing coronary artery bypass graft surgery in a hospital in Mashhad city from 2009-2011

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Received: October 1, 2015 ***Revised: May 30, 2016*** ***Accepted: June 6, 2016***

Abstract

Introduction: Postoperative wound infection is a complication that occurs after coronary artery bypass graft surgery. The aim of this study was to examine the incidence of wound infections after coronary artery bypass graft surgery among the patients operated in Ghaem Hospital in the city of Mashhad from 2009-2011.

Methods: This cross-sectional study was performed in the years 2009 to 2011 on 360 patients who underwent open heart surgery in Ghaem Hospital in Mashhad city. Data collection instruments consisted of demographic characteristics form and questionnaires concerning history of diseases, site of wound infection, depth of wound (deep or superficial), and the type of micro-organism growth. Patients were followed for 3 months, and the incidence of sternal and lower extremities wound infections was recorded. The data were analyzed in SPSS (V: 16) using chi-square test. The significant level was set at $p<0.05$.

Results: We evaluated 360 patients undergoing coronary artery bypass graft surgery. The total prevalence of wound infection after surgery was 84 (36%). From among patients who had wound infections, 54 patients (64.5%) had superficial infection (8.3% of the total) and 30 patients (36%) had deep infection (15% of the total). Sternal wound infection after surgery was observed in 49 patients (58%) and lower extremity in 35 cases (42%). Micro-organisms that grew in the cultivation of the sternum area included 8 cases of Enterococci cases, 9 Staphylococci cases, and 29 negative cultures. In foreleg area, 3 cases were Enterococci, 5 Staphylococcus cases, and 32 negative culture.

Conclusions: Our findings confirm that the postoperative wound infection after coronary artery bypass graft surgery is a common complication and new preventive strategies should be developed to reduce it.

Key Words: Prevalence; Postoperative; Wound Infection; Surgery; Coronary Artery Bypass Graft

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Introduction

Among the major health issues are hospital-acquired infections. In fact, patients' safety, monitoring, and prevention of these infections can be counted as first priorities of hospitals and all health systems that aim to provide higher safety for patients [1]. Hospital-acquired infections consist of complications that can lead to prolonged hospitalization, long-term disability, increased bacterial resistance to antibiotics, high economic loss, high costs for patients, and increased mortality rate [2-5].

The risk of hospital-acquired infections exists in the whole world. Estimates show that more than 4.1 million patients in developed and developing countries are susceptible to such infections and suffer from its complications to some extent [6,7]. Although information on hospital-acquired infections and their effects have been included in many reports, such as the World Health Organization (WHO) reports, the importance of these infections have been neglected by specialists and health policy-makers, as the prevalence and mortality rate of surgical site infection is still not included on the list of 136 top diseases [8,9]. Criteria for describing surgical site infection and detection of infection in patients are based upon the interpretation of clinical and laboratory findings [10,11].

Risk factors and preventive measures depend on two factors: the characteristics of the patient and surgical features and techniques [12-16]. Patient characteristics include diabetes and malnutrition, smoking, taking steroids, long-term hospitalization before surgery, age, and blood transfusion before surgery. Surgical features and techniques are based on the accuracy of the surgeon and other personnel in the operating room [17-19].

According to the statistics, about 10% of patients admitted to hospitals suffer from nosocomial infections [5], which are significantly associated with complications and mortality and impose high costs on patients [12].

According to the WHO reports, the most common nosocomial infections include urinary tract infection (26-28%), surgical site infection (19-22%), lower respiratory tract infection (15-18%), and bacteremia (8-11% of all infections) [12]. Similar studies in this regard suggest that the most common infections involve urinary tract infection (45%) and wound infection (30%) [19,20]. Therefore, the current study aimed to assess the prevalence of wound infection in patients undergoing artery bypass graft (CABG) surgery in Ghaem Hospital of Mashhad city from 2009 to 2011.

Methods

This cross-sectional study included all patients who underwent isolated CABG surgery in Ghaem Hospital of Mashhad city in years 2009-2011. The research method was census. In this study, 360 patients, who had undergone CABG surgery, were included. Inclusion criteria comprised of artery bypass graft surgery, age between 30 and 75 years, and weight between 40 to 100 kg; exclusion criteria comprised of having no implements such as artificial valves, re-operation, and/or any infection in any part of the body before surgery. The data was collected by demographic characteristics form, questionnaire and observation of disease history using patient records.

The follow-up process was as follows: the patients were informed about symptoms of infection before surgery, including fever, secretion, and redness of wound site, and the necessity of referring to cardiac surgery ward (researchers) was emphasized. All cardiac surgeons were prepared to assess the clinical signs of wound site infection during the next referrals and refer the patients who had signs of fever, secretion, and redness to the researchers. In addition, the patients and their families were asked at regular intervals for the presence of infection (discharge, redness, or tearing open of the surgical site wound) by phone every 2 weeks (at least 6 calls with each patient) and patients who had any signs of infection were asked to refer to the hospital. All the patients who referred were visited. A sterile specimen was taken from those who had symptoms of wound infection, or were suspicious of wound infection to identify the cause of the incidence of infection by a microbiologist. Afterwards, the specimens were investigated in laboratory by laboratory equipment by a microbiologist and the laboratory (wound culture and antibiugram) results were given to the patient while a copy of it was kept to be presented to the physician for data analysis. The data were analyzed in SPSS (V: 16) using chi-square test. The significant level was set at $p<0.05$.

Results

A total of 360 patients, who underwent CABG surgery were included in this study. Of these

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Table 1: Frequency and percentage of wound infection in patients undergoing surgery on coronary artery bypass graft

Variables		N.	%
Gender	Female	175	48.5
	Male	185	51.5
Wound infection	Without infection	276	77
	With infection	84	23

Table 2: Frequency and percentage of wound infections according to wound site in patients undergoing surgery on coronary artery bypass graft

Infection type	Deep		Superficial		Total	
Infection site	N	%	N	%	N	%
Sternum	20	24	29	34.5	49	58
Graft extraction site (foreleg)	10	12	25	30	35	42
Total	30	36	54	64.5	84	100

patients, 175 (48.5%) were female and 185 (51.5%) were male. From among them, 84 (23%) had wound infection (Table 1) of whom 54 patients (64.5%) had superficial infection (8.3% of total) and 30 patients (36% of the 84 patients with wound infection) had a deep infection (15% of total). Among patients with superficial infection, 29 patients (34.5%) had sternal infection, and 25 patients (30%) had lower limb infection. Among patients with deep infection, 20 patients (24%) had infection in the sternum and 10 patients (12%) in the lower extremity. Generally, 49 patients (58%) had sternal infection and 35 patients (42%) suffered from lower extremity infection (Table 2).

In this study, the laboratory results of wound secretion culture were negative in 58 patients (69%) who had symptoms of wound site infection. The result of discharge culture revealed Staphylococcus aureus in 15 patients (18%) and Acinetobacterin in 12 patients (13%).

As for wound culture patients with sternal wound infections, 26 patients had negative culture, 9 patients had staphylococcus aureus, and 8 patients had enterococci. However, in patients with lower extremity infection (the graft extractionsite), 32 patients had negative culture, 5 patients had Staphylococcal culture, and 3 patients Enterococcus .

Discussion

In our study, 84 patients (23%) had wound infection. The number in other studies varied. For example, in the study by Faghri and colleagues, it was 13 (4.7%) in terms of sternal infection [4]; 3 (0.74%) in the study by Safi et al that assessed the rate of infection after sternotomy [21]; 1,327 patients (1.8%) in Woodward's study that investigated 73,700 patients [11]; and 116 (18.8%) in Bhatia's study [20]. Moinipoor et al evaluated a total of 4,621 patients who underwent different cardiac surgeries, and they found that just 82 cases (1.77%) developed deep sternal wound infection which was a very low rate [22]. As observed, the infection rate of our study was significantly higher than other studies, a fact which can be because we have assessed superficial and deep infections as wound infection, while other studies have only reported deep infection and have not mentioned superficial infection. In fact, superficial infection accounted for 8.3% of total which is compatible with findings from other studies. Other factors can include the physical structure of the operating room that can be effective on the incidence of infection, including improper ventilation, problems related to personnel's dressing room, sanitary WC, and the method of entering the patient into the operating room [8,18, 23].

In our study, from among the patients who had a wound infection, 54 patients (64.5%) had superficial infection and 30 patients (36%) had deep infection. Among patients with superficial infection, 29 patients (34.5%) had sternal infection, and 25 patients (30%) had lower limb infection. Among patients with deep infection, 20 patients (24%) had infection in the sternum and 10 patients (12%) in the lower extremity. Generally, 49 patients (58%) had sternal infection and 35 patients (42%) lower extremity infection; the most important report in other studies comes from Safi et al where 3 patients (0.74%) were reported with sternal infection [21]. In addition, in a study conducted in Sweden on 4,732 patients, 74

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(1.56%) had a deep substernal infection [24]; deep substernal infection was reported in 1,327 patients (1.8%) in another study [25]. In Bhatia's study, 650 patients were studied and 75% of patients had sternal wound infection, 21.3% had fore leg infection, and 3.4% had upper arm infection [20]. Other studies have reported similar rates for surgical site infection that shows the need to improve surgical techniques of surgeons, emphasize equipment sterility in operating room, and provide the necessary education to the operating room's personnel [8, 18, 23].

In our study, the laboratory results of wound discharge culture were negative in 58 patients (69%) who had symptoms of wound site infection. The result of discharge culture was Staphylococcus aureus in 15 patients (18%) and Enterococci in 12 patients (13%). Among patients with sternal wound infections, 26 patients (31%) had negative culture, 9 patients (11%) had Staphylococcus aureus, and 8 patients (9.5%) had Enterococci. However, in patients with lower extremity infection (the graft extraction site), 32 patients (38%) had negative culture, 5 patients (6%) had Staphylococcal culture, and 3 patients (3.5%) Enterococcus. Faghri's study reported 13 cases of wound infection including 4 cases of Staphylococcus epidermidis, 4 Klebsiella pneumonia, 3 Escherichia coli, and 2 Pseudomonas [4]. In Bhatia's study, sternal infection bacteria included Methicillin-susceptible Staphylococcus epidermidis; lower extremities infection bacteria included Escherchia coli and methicillin-sensitive Staphylococcus epidermidis; and upper arm infection included methicillin-susceptible Staphylococcus and Staphylococcus epidermidis [20]. There are differences between the current study and other studies in terms of causes of disease, which can be due to climatic or genetic differences. This, however, requires further research before one can make certain statements on this issue.

The major risk factors for wound infection were reported differently in the reviewed studies. For example, the first study concluded that wound was associated with sex, history of hypertension, heart failure, and hypoxemia. The study by Faghri and colleagues concluded that the most important risk factor for developing wound was diabetes mellitus type II, although age and gender distribution of patients was different in the two groups with/without infection [4]. Other studies [6] indicated the risk factors for surgical wound infection to include malnutrition, infection in the body, diabetes, obesity, and smoking. Also, wound infection occurs more in emergency surgery than elective procedures [6,26] and it has been shown that factors such as the age of the surgeon performing the surgery greater than 60 years, emergency surgery, duration of connecting the patient to the heart and lung devices are of the most important risk factors for wound infection [6,23,26,]. In addition, Safi's study, published in 2010, assessed 388 patients and concluded that only low pre-operative cardiac output was significantly associated with the incidence of wound infection, while other risk factors such as obesity, diabetes mellitus, renal dysfunction, hypertension, aortic clamp duration, cardiopulmonary bypass duration, smoking, and chronic obstructive pulmonary disease were not significantly associated with it [21]. In other studies [24], the main risk factors included smoking, obesity, and diabetes type II, among which poorly controlled diabetes mellitus was the most important risk factor for wound infection [24,25].

In the study by Foruzan-nia et al, mortality rate of infection was 36 (1.8%) and morbidity was 88 (4.4%) [27]; Hassantash's study showed a mortality rate of 5.2% [23] and other studies showed significantly higher mortality rates in patients with deep sternal wound [24]. Kubotah also found that the mortality rate of deep sternal wound infection in 30 days after surgery was higher than other wound complications. [25] Another study indicated that deep sternal wound infection increased patients' hospital stay and costs. Regarding the use of antibiotics, no antibiotic regimen was associated with this risk factor [20].

The most important limitation of the current study was the inadequate sample size. In addition, the findings were more valuable if this study was multicenter.

Conclusions

Our findings confirm that the postoperative wound infection after CABG surgery is a common complication, and new preventive strategies should be developed to reduce it.

Acknowledgements

The authors thank the participating patients for their contribution to this study.

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