Original Article

Bacterial Infection of Pacemaker in Patients with Endocarditis

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Abstract

Background: The advancement of technology in recent decades has been lead to use the electrophysiology cardiac devices. Although these devices are used increasingly, but the frequency of subclinical infection is unknown. We investigate bacterial infections due to implantable cardioverter defibrillator (ICDs) in patients with endocarditis.

Materials and Methods: Population of the study was considered among all adult patients in whom the cardiac electrophysiology device was removed. Associated infection endocarditis defined by the Duke criteria. 35 pacemakers (PM) were aseptically removed from these patients during January 2012 to November 2014. Intraoperative swabs from the different part of devices were collected, cultured in BHI (Brain Heart Infusion Broth) and then bacterial classical cultures were done under aerobic and anaerobic conditions. Biochemical and differential media were used to detect the bacteria species. Data analysis was performed by using SPSS version 16 software.

Results: 13 cases of 35 patients with endocarditis diagnosed by modified Duke Criteria and removed pacemaker had positive culture. Of the 13 cases with infection 43% were identified as gram positive and 57% had gram negative bacteria.

Conclusion: Based on our study and similar studies, bacteria can colonize in electrophysiology devices which can lead to bacterial infections.

Keywords: Pacemaker, Bacterial infection, Endocarditis

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Introduction

Permanent pacemakers (PPMs) are increasingly being used for the prevention and treatment of various cardiac rhythm disturbances[1]. These devices are increasingly used in order to maintain an adequate heart rate, also they are cost effective, and could reduce morbidity and mortality rate among patient suffering from heart diseases[2-6]. Factors such as diabetes and chronic renal failure, coronary heart disease, early and late prosthetic valve endocarditis, aortic valve endocarditis, hypertension, the number of previous operations, inhabiting central venous lines, experienced bacteremia, could significantly increase risk of infection[7-10]. Infection is a rare but serious and life threatening complication will follow with cardiovascular implantable electronic device[1] (CIED). The infection may involve the Generator Pocket (GP), the leads or both component. A study among permanent pacemaker (PM) recipients indicated annual incidence of 550 cases of infective endocarditis per million recipients[11]. In an analysis of implantation

of CIED between 1997 and 2004 in the United States, rates of implantation for PMs increased by 60% and 19% respectively[12]. Approximately more than 75% of device recipients had one or more coexisting illnesses, and 70% of them were 65 years of age or older[12]. These data are constant and also are similar with findings from last population-based surveys in Minnesota[13-14]. Patients with PMs were encounter with rising in the number of bacterial endocarditis among 1975 to 2004. Staphylococcal species cause the mass of PMs and CIED infections[15-22]. A versatility of coagulase-negative *Staphylococcus* (CoNS) species have been explained to cause CIED infections[23]. CoNS is well accredited as a common cause of bacteriological specimen contamination. Moreover, sometimes polymicrobial infection involves more than 1 species of CoNS[24]. *Propionibacterium acnes*, *Corynebacterium* species, gram-negative bacilli including *Candida* species, *Pseudomonas aeruginosa*, and account for a minority of PMs and CIED infections[19-20,25]. Nontuberculosis mycobacteria and fungi other than *Candida* are rarely identified as pathogens in CIED infection[26,27]. Aim of this study was to determine the prevalence of bacterial infection due to implantable pacemaker in patient with endocarditis diagnosed by modified Duke criteria being admitted to cardiology divisions of hospitals of Shahid Beheshti University of Medical Sciences of Tehran, Iran.

Methods

Population of the study were considered from patients with endocarditis diagnosed by modified Duke Criteria whom pacemakers were removed among January 2012 to November 2014. In this study 35 pacemakers were tested. After obtaining informed consent from patients with endocarditis pacemakers were removed aseptically in normal saline sterile containers. Containers were transported to the microbiology laboratory. Intraoperative swabs from the generator pocket (GP) were collected after removal of the devices. By using classical culture method, cotton dipped swabs were placed in BHI broth, then inoculated to sheep blood, chocolate, and MacConkey agar and incubated aerobically for 48 hours. An additional sheep blood agar was used for anaerobic culture, incubated for 1 week. Thioglycolate was used for medium enrichment. Microorganisms were identified by standard microbiological methods such as culture isolation, biochemical, differential and serological diagnosis. Microbiological outcome was defined as growth of bacteria irrespective of the number of colony forming unit (CFU). Data analysis was performed by using SPSS version 16 software.

Results

Out of 35 patients completed the study, 13 cases were diagnosed as bacterial infected. In 13 patients with bacterial contamination, 14 bacteria were identified which 43% positive and 57% gram-negative bacteria have been reported. Bacterial infection in female patients studied were 100% of the group of gram-negative bacteria, including *Prevotella* and *E. coli*. In male patients studied, 50% of bacterial infections associated with gram-positive bacteria and 50% of bacterial infections associated with gram-negative bacteria (Chart 1-4 and Table 1-4).

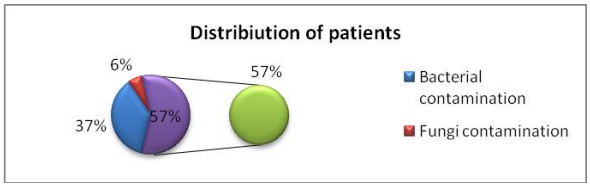

Chart 1. Percentage of pacemaker contamination in study patients

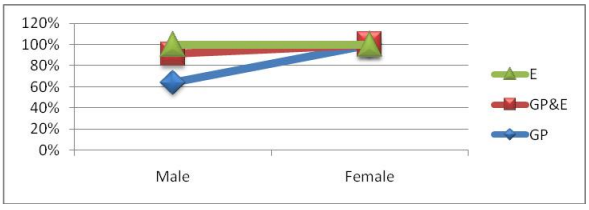

Chart 2. Pacemaker polluted areas in the study population according to sex of patients

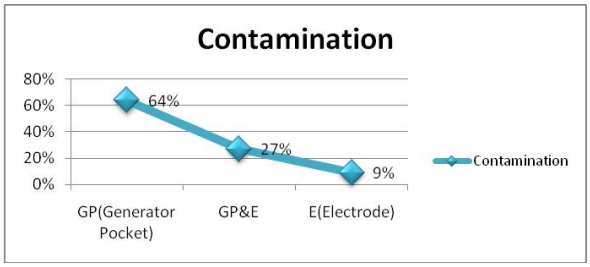

Chart 3. Contamination percentage of different parts of pacemaker in study patients

Table 1: Frequency of bacteria isolated from Pacemaker of female patients.

Bacteria	Number	Percentage
E. coli	1	50
Prevotella	1	50
Total	2	100

Table 2: Frequency of gram positive bacteria isolated from Pacemaker of male patients.

Bacteria	Number	Percentage
Staphiloccocus aureus	1	17
Staphiloccocus epidermidis	2	33
Methicillin-resistant Staphylococcus aureus	2	33
Streptoccocus viridence	1	17
Total	6	100

Table 3: Frequency of gram negative bacteria isolated from Pacemaker of male patients.

Bacteri	Number	Percentage
Klebsiella pneumonia	2	25
Acinetobacter bumanni	1	12.5
Burkholderia cepacia	1	12.5
Proteus mirabilis	1	12.5
Prevotella	1	12.5
Escherichia coli	2	25
Total	8	100

Table 4: Frequency of underlying diseases in study.

Kind of disease	Number	Percentage
Diabetes	2	15.4
Steroid therapy	2	15.4
Dental abscess	1	7.7
Prosthodontic Surgeries	1	7.7
Chronic Respiratory Disease	1	7.7
Malignancy	1	7.7
Total	8	61.6

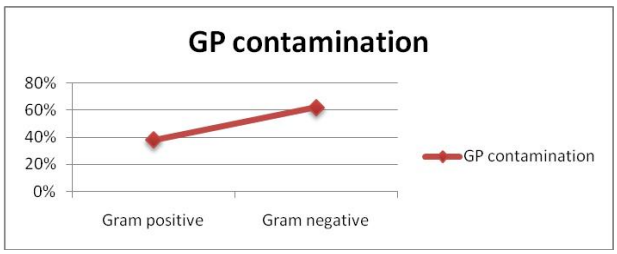

Chart 4. Distrubiotion of GP (Generator Pocket) contaminant bacteria in study

Discussion

The present study proved the incidence of bacterial infections in patients with endocarditis who recipient pacemaker. The gender distribution of patients based on 85% males and 15% females were reported. This is indicated that the men are encounter with greater risk of affecting to heart disease and use of pacemaker than women. With study on patients receiving pacemaker, the result show that various bacteria can be the cause of outbreak in bacterial infections due using the pacemaker. Out of 35 patients in this study, 13 cases were reported with bacterial infection that abundance of bacteria in these patients were 43% gram-positive bacteria and 57% were gram-negative. In our study gram-positive bacteria, were included the 33% Staphylococcus epidermidis, 33% Methicillin-resistant Staphylococcus aureus (MRSA), 17% Staphylococcus aureus and 17% Streptococcus viridence and the gram-negative bacteria, were included 25% *Klebsiella pneumoniae*, 25% *E. coli* and an equal proportion were included *Burkholderia cepacia*, *Acinetobacter*, *Prevotella* and *Proteus mirabilis* bacteria. Meanwhile, in a study was conducted in 2011 by Daniel Z. Uslan, largest share of pollution was linked to *E. coli* and was reported the amount of 45% of total infection[10]. In other words, gram-negative bacteria responsible for most pollution, whereas in our study Staphylococcus epidermidis and MRSA were reported as 33% of total pacemaker infections. In another study that was conducted on bacteria that infecting pacemaker in the years of 1974 to 1994 was determined that *Staphylococcus epidermidis* is the most common bacterial infection that this result is entirely consistent with the results obtained in the present study[28]. In another study carried out in 1997 was determined that out of 10 cases of bacterial contamination in the different parts of pacemaker, 6 items related to the GP,

3 Item related to the E and 1 bacterial contamination was reported in both the GP and E[29]. This result is inconsistent with the results of our study, which this may be due to changes in the type of bacteria that infect pacemaker in these two studies. Statistical analysis of our results show that gram-negative bacteria are more prevalent than gram-positive bacteria in pacemaker infection and this is probably due to the diverse and influential adhesion in the pathogenesis of gram-negative bacteria and connection to various levels such as surfaces in pacemaker. Based on these results, the most common site of bacterial infection (69%) in male and female patients studied was related to GP (Generator Pocket) which this can be attributed despite the good conditions for bacterial colonization and biofilm formation in GP area than Electrode area in Pacemaker. Underlying disease in 62% of patients in our study showed the relationship between pacemaker infections with underlying disease in patients received the pacemaker. Diabetes and several cases of the disease which are treated with steroids are most cases (30.8%) among patients with a history of underlying disease that Illustrate the importance of these diseases in the community and their role in heart disease and other diseases that associated with.

Conclusion

According to this study and similar researches microorganisms can colonize Cardio Vascular Implantable Electronics Devices (CIED) such as pacemakers, so using pacemakers can cause bacterial infections leading to endocarditis. For this reason following up such patients from time of implantation until recruitment and also providing, the possibilities to do further studies to discuss adequate pre-emptive antibiotic therapy in patients receiving CIED, is recommended.

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