

VIDEO SESSION - CASE REPORT

Microbiology of Cardiac Device Infections in a Tertiary Hospital

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ABSTRACT

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BACKGROUND: A cardiac device (CD) infection is a very important challenge for cardiology and clinical microbiology specialists, because of the increasing use of implantable CDs. Several host- and procedure-related factors increase the risk of CD infection. A CD infection commonly involves a permanent pacemaker (PPM) or an implantable cardioverter defibrillator (ICD) device, which like any other foreign body can become infected. Cardiac device infection may be a primary infection when the device and/or pocket itself is the source of infection, usually due to contamination at the time of implant or a secondary infection due to bacteremia from a different source contaminating the leads and/or the device and/or the pocket. Cardiac device infections are generally considered as pocket infections when the infection involves the subcutaneous pocket containing the device and the subcutaneous segment of the lead. The outcome is associated with the patient's status, the echocardiographic findings and the type of the isolated microorganism. When microorganisms adhere to device's surface form biofilms and serious complications ensue which are associated with significant morbidity and mortality. The purpose of this study was to assess recent data in a tertiary hospital for management of CD infection according to the proper antibiotic therapy on the basis of the responsible microbiological factors and antibiotic susceptibility testing.

METHODS: Over the last one year clinical samples from patients with suspected CD infection were microbiologically examined with Gram and Ziehl - Neelsen stains, cultured in common and selective medium in aerobic, CO₂ και anaerobic conditions as well as in automated BACTEC system. The identification of the isolated microorganisms and the antibiotic susceptibility testing was performed with the automated system VITEK 2, API32A, API 20A (BioMerieux), E test (AB Biodisk) and other complementary tests.

RESULTS: A total of 118 clinical samples with possible CD infection out of 552 patients with implantable CDs (21.3%) were examined in our hospital. Sixty per cent were male. The median age of patients was 61.5 years. Clinical evidence of CD infection included several signs and symptoms such as local signs of inflammation, erythema, pain, swelling, warmth, wound dehiscence, erosion, tenderness or purulent drainage, skin ulceration, generator/lead erosion, intraoperative purulence at generator pocket or several laboratory test abnormalities such as leukocytosis or anemia. A total of 37 patients with positive cultures out of 118 (31.3%) were included in the study, whereas 5 patients had polymicrobial infection. Devices included 35 PPMs and 2 ICDs. A CD infection was microbiologically confirmed based on positive cultures from cardiac device

ABBREVIATIONS

CD = cardiac device
CoNS = coagulase negative
staphylococcus
ICD = implantable cardioverter
defibrillator
MRSA = methicillin resistant *S. aureus*
PPM = permanent pacemaker

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MICROBIOLOGY OF CARDIAC DEVICE INFECTIONS IN A TERTIARY HOSPITAL

TABLE 1.

Cardiac device infection Specimen	n	%
generator pocket	5	13.5
electrode leads	6	16.2
pus from the concerning area	26	70.3
Total	37	

infection specimens as shown in Table 1 below.

Relapse was defined only in one patient, i.e. the recurrence of the device infection with the same organism based on similar antibiogram. A CD infection occurred after initial device implantation in 35 patients and after a revision (i.e., system upgrade, lead revision, or generator replacement) in 2 patients. Sixty-three microorganisms were isolated as shown in Table 2 below.

CONCLUSIONS: In 37 out of 118 patients with suspected CD infection (31.4%) microbiological infection was confirmed. The predominant causative CD infection pathogens included common skin flora microorganisms, i.e. Gram positive cocci, such as coagulase negative staphylococci (*CoNS*), *S. aureus*, *Aerococcus viridans*, *Streptococcus spp.* and *Peptococcus spp.* The main etiological agents were *Staphylococci* followed by gram-negative bacilli including *Klebsiella pneumoniae*, *Proteus mirabilis*, *Pseudomonas aeruginosa*, *Acinetobacter baumannii*, *Citrobacter koseri*, *Stenotrophomonas maltophilia* and *Bacteroides fragilis*. *CoNS* (n=22) were the most common cause of CD infection with 50% methicillin-resistant strains. *S. aureus* infection is very important because of methicillin-resistant strains (MRSA 3 out of 5 strains *S. aureus*). No fungi or mycobacteria were detected as etiological agents. The majority (70%) of cases presented with a pus infection and a minority (29.7%) had PPM or ICD or electrode related infection. Polymicrobial infection was present in 3 (8.1%) patients. In 81 out of 118 suspected CD infection patients (68.6%) with localized inflammatory signs at generator pocket or erosion of device/lead the cultures were negative. *Because Staphylococci* were the most common pathogens for CD infection cases, empiric antibiotics for suspected CD infection should include

TABLE 2.

Gram positive cocci	Gram negative bacilli		
Aerobic microorganisms			
Staphylococcus epidermidis	17	<i>Klebsiella pneumoniae</i>	7
Staphylococcus aureus	5	<i>Proteus mirabilis</i>	6
Staphylococcus hominis	3	<i>Pseudomonas aeruginosa</i>	4
Enterococcus faecalis	2	<i>Acinetobacter baumannii</i>	4
Staphylococcus haemolyticus	1	<i>Citrobacter koseri</i>	3
Staphylococcus capitis	1	<i>Stenotrophomonas maltophilia</i>	1
Aerococcus viridans	1		
Streptococcus parasanguis	1		
Streptococcus anginosus	1		
Total	32	Total	26
Anaerobic microorganisms			
Peptococcus spp.	1	<i>Bacteroides fragilis</i> group	1
Total	33	Total	27

coverage for staphylococci while awaiting microbiological results. These findings should assist clinicians in identifying CD infection patients who are at increased risk of infection, as well as in developing strategies to minimize the modifiable risks. All patients received antimicrobial treatment. Most patients (97%) received a combination of intravenous and oral antibiotics. Only 3% were treated with oral antibiotics alone. Patients with inescapable contamination of the site when part of the device or lead erodes through the overlying skin without proven evidence of infection must be treated as pocket infections. The very important point is that only in 37 patients out of 552 implantable CDs (6.7%) we proved CD infection in our studied cohort.