

Acremonium Species Pacemaker Site Infection

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Key words:
Pacemaker infection, fungi, pacemaker site, acremonium spp.

Pacemaker implantation is complicated by pacemaker site infection with a reported incidence of approximately 2%. Pacemaker site infection, apart from appropriate antimicrobial therapy, requires pacemaker removal as well. We describe the case of a 53 year-old woman with pacemaker site infection due to the fungus *Acremonium* spp (former *Cephalosporium*). This, to the authors' knowledge, is the first case worldwide attributed to the aforementioned fungus and the second case of fungal infection involving the pacemaker pocket exclusively. It is of interest that fungal infection developed in a non-diabetic and non-immunosuppressed patient.

Manuscript received:
May 15, 2001;
Accepted:
March 2, 2002.

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Infections following the implantation of a pacemaker constitute an infrequent but dangerous complication. Up to three years following the initial implantation, the average incidence of infection is 2%, ranging from 0.5-12.6% in various studies¹. However, the incidence of the most serious infections, such as microbiemia and infectious endocarditis, do not exceed 0.5%¹. The responsible microorganisms are mainly microbes, though, fungi have also been implicated in rare cases^{1,2}. Our case concerns a pacemaker site (pocket) infection due to the saprophytic fungus *Acremonium* spp (former *Cephalosporium*). It should be noted that no other case of fungal infection, attributable to the aforementioned fungus involving the pacemaker pocket exclusively, was found in either Greek or international literature. It is also interesting that the fungal infection developed in a non-diabetic and non-immunosuppressed patient.

Case description

A 53-year old woman with sick sinus syndrome was admitted (in May 1996) to the Department of Cardiology for implantation of a permanent pacemaker. A dual-

chamber pacemaker (DDD-R) was successfully implanted in the right subclavian area. Access to the right cardiac chambers was achieved through the right cephalic vein. One gr. Vancomycin i.v. was administered, prior to the implantation of the pacemaker. The haematological and biochemical tests before the implantation were normal and the patient was discharged 48 hours later.

The patient did not comply with the pacemaker follow-up protocol. Fifteen months later, she was admitted to the hospital due to displacement of the pacemaker generator, which was accompanied by thinning and mild redness of the overlying skin (Figure 1). The pacemaker was re-implanted in its initial position. In this second procedure, 1 g of vancomycin was i.v. infused preoperatively and 1 g ciprofloxacin was administered daily for one week.

Three months later the patient was readmitted due to purulent drainage from the surgical wound. She reported that, despite the initial healing of the wound, after forty-five days approximately, she first noticed redness and hardening in the area of the incision, while a few days later, she discovered purulent fluid drainage.



Figure 1. Chest x-ray showing dislocation of a dual-chamber pacemaker in the right hemithorax.

No fever was diagnosed upon hospital admission. The electrocardiogram showed a properly functioning dual-chamber pacemaker with periods of spontaneous and paced rhythm (pacing on demand). On cardiac auscultation the only finding was a systolic 2/6 regurgitant murmur at the left sternal edge, which had also been noticed (with the same characteristics) during the previous hospitalisations. During examination of the surgical wound, two fistulas with a purulent drainage were found (Figure 2). Samples for culture were collected and due to suspected staphylococcal infection, 2 gr vancomycin were administered daily. The laboratory tests results were the following: Hct: 36.8 g/dl, white cell count: $6.900/\text{mm}^3$, ESR: 29, CRP: 3.2 mg/l, glucose 86 mg/dl and urea 27 mg/dl. Hepatic enzymes, hormonal and immunological test results were normal. In addition, blood cultures and tests for possible immunosuppression were negative. Gram staining revealed numerous polymorphonuclear cells and rare fungal blastocytes. No microorganisms were detected. A transthoracic echocardiogram showed mild regurgitation of the tricuspid valve, without detectable vegetations at valves, leads, atrial and ventricular endocardium.

After the culture sampling from the surgical incision, the pacemaker was removed. The leads were extracted (without thoracotomy) with the use of the VascoExtor system (VascoMed, Germany) using a locking guide wire technique (as described elsewhere³⁻⁵). No vegetations were noted on the leads and the cultures of the lead tips were sterile. In addition, a thorough surgical cleaning of the pacemaker pocket was



Figure 2. Infection of the surgical incision, with fistulas at both lateral sites.

performed after the device removal. During the same session a new pacemaker was placed in the left subclavian region (Figure 3). Vancomycin was administered postoperatively at a dosage of 2 gr daily.

Four days later, all cultures of the purulent surgical incision drainage developed (in Sabouraud dextrose agar 2%) an exclusive fungus. Based on the macroscopic (colony morphology) and microscopic findings, the fungus was identified as *Acremonium* species (Figure 4). Vancomycin was stopped and fluconazole was administered at 400mg daily for a period of 3 weeks. Both surgical incisions healed ra-



Figure 3. Chest x-ray showing the new pacemaker implanted at the left subclavian region.



Figure 4. Microscopic morphology of *Acremonium* species colony, cultured from the purulent drainage of the surgical incision ($\times 800$).

pidly (Figure 5) and patient showed no infection recurrence during two and a half years follow-up.

Discussion

Infectious complications following pacemaker implantation include: infection of the pacemaker pocket (site), with possible development of an abscess and externalisation of the device, endocarditis, septic phlebitis and sepsis^{1,2,6}. The most common of the aforementioned infections, is that of the pacemaker site, although a decline in its incidence is observed. More specifically, in recent reports the incidence of the pacemaker site infection is $<1\%$ compared to the average incidence of 2% reported in previous publications^{1,2}. The factors that predispose to the develop-



Figure 5. Healing of the infected wound at the right side and presence of a surgical incision at the left side, due to the implantation of a new pacemaker. A scar, due to an old burn, can be also seen at the right side.

ment of infection include cardiologist experience, extended duration of the intervention, history of previous interventions in the area (cases of pulse generator replacement) and creation of local haematomas during the operation^{1,2,7}. Potential predisposing factors associated with the patient are immunosuppression and diabetes mellitus². In the majority of cases, inoculation of the responsible microorganism takes place during the pacemaker implantation¹. Other mechanisms that have been implicated on rare occasions are haematogenous dissemination and local skin corrosion¹.

Staphylococcus is the most often isolated microorganism in pacemaker site infections ($75\text{-}92\%$)¹. In cases of early infection (<2 weeks), staphylococcus aureus is frequently isolated while in later infections staphylococcus coagulase negative is usually isolated^{2,8}. Gram negative microorganisms are rarely isolated². Pacemaker infection by fungi is extremely rare². The fungi that have been isolated in an up-to-date review of the literature include: *Aspergillus flavus*, *Candida albicans*, *Petrididium boydii* and *Acremonium* spp. In all cases except one, electrode and endocardium infection was diagnosed^{7,9-16}. In the aforementioned single publication, pacemaker site infection by *Candida albicans* was described in a patient with insulin-dependant diabetes mellitus and lymphopenia². The present case constitutes the second report of fungal infection involving the pacemaker pocket exclusively and the first one worldwide, due to the fungus *Acremonium* species.

The fungi of the *Acremonium* genus are among the eight fungi that represent approximately 95% of the saprophytic fungi which are isolated in clinical laboratories¹⁷. In humans it has been mostly implicated for the development of chronic granulomatous infections of the skin and hypoderma, mostly in upper and lower extremities which are called eumycotic mycomas¹⁸. More rarely, the fungus cause generalized infections involving the endocardium (endocarditis) and/or the eyes (endophthalmitis)¹⁶. A case of infectious endocarditis caused by *Acremonium* spp has been described in Greek literature in a patient without a pacemaker¹⁹.

In the reported case, the diagnosis of pacemaker site infection, not affecting the leads and the endocardium, was based on the excellent general condition of the patient, the low erythrocyte sedimentation rate, the negative blood cultures, the absence of fever and the absence of vegetations in the transthoracic echocardiogram. Based on the aforementioned findings it was deemed unnecessary to per-

form a transesophageal echocardiogram. The absence of vegetations was also verified after the percutaneous removal of the pacing system, confirming a pacemaker pocket infection. Of the aforementioned factors predisposing to infection, the only one present in our patient was the performance of a second procedure in the same area due to displacement of the pulse generator. Although both procedures were performed using an aseptic technique, we believe that the infection was probably caused by the inoculation of the fungus during one of these procedures. However, it is surprising that the infection developed in a non-diabetic and non-immunosuppressed patient. Moreover, a possibility that cannot be excluded is the disturbance of the balance of the local flora by the perioperative administration of vancomycin and ciprofloxacin, resulting in a subsequent unhampered development of the fungus. It should be noted that the perioperative administration of antibiotics in pacemaker implantation, is widely used in clinical practice although there is no scientific evidence that it is beneficial^{1,2,20}.

Another parameter that should be considered, is that the patient had an old burn in the area where the pacemaker was implanted. This had resulted in the formation of scar tissue (Figure 5). However, in the literature review, no potential inclination was documented in similar cases for the development of fungi.

After removal of the system, due to suspected in-hospital infection by staphylococcus (which displays a high tolerance to methicillin in our hospital) vancomycin was administered. In addition, the pacemaker was immediately removed [using intravascular (intravenous) technique], even though 15 months had passed since the initial implantation. Even though this method is clearly less traumatic, it is not without complications^{1,3}. However in our case, intravenous extraction was successful and without complications.

Therapeutic management of infections caused by *Acremonium* spp, has not yet been determined, due to the rareness of the infection²¹. In the case of our patient, after removal of the pacing system and surgical cleaning of the infected wound, we administered fluconazole at a daily dosage of 400 mg. This treatment, although largely based on experience, probably contributed to the eradication of the fungal infection, since the patient remained asymptomatic over a follow-up period of two and a half years.

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