If you play with fire, you might get burned…

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I have no conflict of interest to declare
Case - 1

- 50-year-old male

2005:
- Surgical closure of atrial septal defect
- Ablation of atypical atrial flutter
- Sinus dysfunction requiring pacemaker implantation (persistent left superior vena cava and absent right superior vena cava)

2016: asthenia for months
- Swelling of the pacemaker pocket
- Pus during percutaneous aspiration of the generator pocket
- Pus culture remained sterile
- Body scan: negative
- Negative blood culture (2 sets)

The patient was referred for pacemaker removal
If you suspect a pacemaker infection

A. Percutaneous aspiration of the pacemaker pocket is the first step you should take
B. Transoesophageal echocardiography is facultative
C. Local symptoms at the site of pacemaker infection are always patent
Class III

1. Percutaneous aspiration of the generator pocket should not be performed as part of the diagnostic evaluation of CIED infection. (*Level of Evidence: C*)
Should we perform Transoesophageal echo?

American guidelines

European guidelines

ESC guidelines 2015

Baddour et al. Circulation 2010
Quizz - 2

In case of local device infection

A. You should perform complete hardware removal
B. You should remove the pacemaker generator only
Cardiovascular medicine

Local symptoms at the site of pacemaker implantation indicate latent systemic infection

D Klug, F Wallet, D Courcol

Results: Regardless of cultures in 79.3% of patients, segments were positive, observations or laboratory cultures. In a subgroup of 30 patients with manifestations strictly limited to the pacemaker implantation site, cultures of intravascular lead segments were positive in 72%. Infection recurred in 4/8 patients without complete lead body extraction (50%) v 1/97 patients (1.0%) whose leads were totally extracted (p < 0.001).

1. Prolonged (i.e. before and after extraction) antibiotic therapy and complete hardware (device and leads) removal are recommended in definite CDRIE, as well as in presumably isolated pocket infection.
Case – 2

- Laser assisted extraction of the pacemaker + lead
- **Bartonella Henselae** detected on polymerase chain reaction (PCR) performed on pus sample
- Pacemaker and proximal lead culture positive at **Propionibacterium acnes**
- Culture of tip lead negative
- Blood PCR negative for Bartonella and **Propionibacterium acnes**
Case - 3

Generator device infection due to Bartonella Henselae and propionibacterium acnes

VANCOMICINE + GENTAMICINE
(before PCR results) then DOXYCYCLINE + GENTAMICINE followed by AMOXICILLINE 8G/24H + DALACINE 1.8G/24H
Coagulase-negative staphylococci

A. Are the leading cause of pacemaker-related infection
B. Their presence in a pacemaker pocket is always pathogenic
Coagulase-negative staphylococci

- A. Are the leading cause of pacemaker-related infection
- B. Their presence in a pacemaker pocket is always pathogenic
In 25% of patients in which hardware removal was performed for a non-infectious cause, germs were isolated from pacemaker pocket.
Pacemaker re-implantation at Day 7
Concerning the timing of re-implantation after infected hardware removal

A. A 72-hour delay after blood culture become negative is recommended before a new device is implanted
B. A new device must not be implanted before the end of antibiotic regimen
C. The timing of re-implantation depends on the presence/absence of valvular vegetations
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Brief focus on cardiac infection at Bartonella

1\textsuperscript{st} Infective endocarditis in 1993 \(\approx\) 300 cases
1\textsuperscript{st} IE on prosthetic valve in 2002 (\textit{Klein Em Inf Dis})
\(\approx\) 20 cas
Pacemaker related IE = 0

Courtesy of Caroline Pariset
Bartonella, the 2\textsuperscript{nd} commonest cause of negative blood culture IE

<table>
<thead>
<tr>
<th>Microorganism</th>
<th>Present study(^a) (n = 740)</th>
<th>France [3] (n = 348)</th>
<th>France [29] (n = 88)</th>
<th>Great Britain [30] (n = 63)</th>
<th>Algeria [31] (n = 82)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bartonella species</td>
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<td>Coxiella burnetii</td>
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<td>82.9</td>
<td>50.8</td>
<td>54.8</td>
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</tbody>
</table>

\(^a\) Patients classified as excluded were not included in this analysis.

**NOTE.** Data are percentages. HACEK, Haemophilus, Actinobacillus, Cardiobacterium, Eikenella, Kingella.

*Fournier et al, 2010*
Guidelines for the diagnosis, prevention and management of implantable cardiac electronic device infection. Report of a joint Working Party project on behalf of the British Society for Antimicrobial Chemotherapy (BSAC, host organization), British Heart Rhythm Society (BHRS), British Cardiovascular Society (BCS), British Heart Valve Society (BHVS) and British Society for Echocardiography (BSE)


7.4 What laboratory methods should be used during processing?

Pus samples or fluid (e.g. collected via a needle and syringe or even just a syringe from a discharging wound) are generally more reliable than swabs for Gram staining and culture. These samples should be plated onto a range of media (solid and liquid) to recover the most likely pathogens (Table 1). Suitable culture media and incubation conditions are as follows: chocolate agar (35–37°C in 5% CO2 for 48 h), cationic lactose electrolyte deficient broth (CLED) or MacConkey agar (35–37°C in air for 24 h), blood agar (35–37°C in an anaerobic cabinet for 48 h) and Sabouraud agar (30°C in air for 5 days). An enrichment broth (e.g. Robertson’s cooked meat broth) should also be inoculated and incubated at 37°C for at least 48 h before subculture onto the same media. These media should recover the vast majority of bacteria and fungi that have been implicated in ICED infection.

Lead tips should also be cultured using the media listed above, though it is important to note that lead tips may become contaminated during the process of extraction if the generator pocket is infected, giving rise to false-positive results. ICED infection may occasionally be caused by fastidious or slow-growing bacteria such as Mycobacterium spp.,12,13 Nocardia spp.14 and anaerobic staphylococci.15 If culture of pocket site tissue is negative despite convincing evidence of infection, microbiologists may wish to consider prolonged incubation of media or, preferably, referral of tissue for amplification and sequencing of bacterial 16S rRNA genes to detect cryptic causes not detected by routine culture. The use of sonication for the recovery of bacteria from ICEDs may have a useful role to play in patients with clinical signs of infection and this merits further study.16

7.3 How should the generator pocket be sampled at the time of removal?

Summary:

- **Recommendation 7.3:** In patients with clinical evidence of infection, tissue (~2 cm²) should be excised from the pocket site and sent for culture. [B]

Culture of tissue has been shown to have a statistically greater sensitivity than swab culture for recovery of pathogens implicated in ICED.64 In the microbiology laboratory, tissue should be subjected to Gram’s stain and culture. It is recommended that pocket site tissue is only taken from patients who show clinical evidence of ICED infection, as detection of colonization (or contamination) in the absence of signs of infection is of little clinical value and may lead to unnecessary antimicrobial therapy or even surgery.
Take home messages

- Hardware removal is mandatory in pacemaker related infection

- Additional microbiological exams may decrease the percentage of culture negative pacemaker related infection (role of PCR +++)

THANKS FOR YOUR ATTENTION