

Findings that shed new light on the possible pathogenesis of a disease or an adverse effect

Dietzia species pacemaker pocket infection: an unusual organism in human infections

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Summary

An 87-year-old man presented 10 months following permanent pacemaker insertion with cellulitis-like inflammation around the impulse generator. Symptoms improved with oral flucloxacillin, but only days after stopping, the infection recurred, and he was admitted from clinic for intravenous antibiotics. Suspecting the source was likely *Staphylococcal*, intravenous flucloxacillin was started, and the patient's inflammatory markers responded adequately. Two samples of fluid were aspirated from the pacemaker site. These showed no bacterial growth using routine microbiological culture techniques. The samples were sent for 16S rDNA PCR and *Dietzia* species was detected in both samples. *Dietzia* species is an *Actinomyces*-like organism, which is not commonly associated with human infection, but is reported to have been isolated from clinical specimens and thus presumptively associated with human disease. The pacemaker was explanted and the pocket debrided with no complications. He made a full recovery after a prolonged course of flucloxacillin.

BACKGROUND

- ▶ Pacemaker infections are relatively common, although accurate determination of their overall incidence in the population is problematic. The underlying microbiological aetiology should be sought in order to instigate appropriate therapy.
- ▶ *Dietzia* is a recently established genus of *Actinomyces*-like organisms, which until recently have not commonly been detected in clinical specimens, probably due to previously-incorrect identification by common microbiological techniques.
- ▶ The management of pacemaker infections should take place under the primary supervision of a cardiologist, with input from clinical microbiologists and potentially cardiothoracic surgeons, depending on the severity and need for device explanation and debridement of the pocket.
- ▶ 16S rRNA gene sequencing using the PCR is useful and may aid in the detection of certain organisms difficult to isolate using standard microbiological techniques.

CASE PRESENTATION

An 87-year-old man with global worsening left ventricular function and moderate-severe mitral regurgitation was referred to cardiology for further management. Coronary angiography revealed subcritical disease, with moderate stenosis in the left main stem and left anterior descending arteries, not requiring intervention. In view of his worsening effort dyspnoea and poor systolic function in the presence of a complete left bundle branch block, resynchronisation therapy with biventricular pacing was performed.

Ten months later he was seen in cardiology outpatients with cellulitis-like inflammation around the pacemaker pulse generator. He improved clinically with 6 days of oral

flucloxacillin, and was prescribed a further 21 days on antibiotics at this time.

One month later, the infection appeared to have resolved and the patient remained well. He was advised that should the infection recur, he would require admission for intravenous antibiotics.

Almost exactly 1 year postpacemaker insertion, the patient was admitted to hospital again with inflamed skin overlying his pulse generator, and a subcutaneous boggy swelling suspected to be infected. He was haemodynamically stable and not overtly septic.

INVESTIGATIONS

Initial investigations revealed a normal white count of 10.6 (reference range 4.0–11.0) and a C reactive protein elevated only mildly raised at 12 (reference range 0–5). Chest x-ray revealed no consolidation or evidence of any infection. The previously inserted pacemaker was well positioned. Urinalysis was negative.

Cultures of the aspirate taken from the boggy swelling overlying the pacemaker site showed no microorganisms on routine microscopy and culture. The samples were sent for 16S rDNA PCR and *Dietzia sp.* was identified. Further subclassification was unavailable. 16S rDNA PCR is a technique that can be used to detect bacteria that do not grow on routine microbiological culture media or where there has been prior antibiotic treatment which can prevent subsequent bacterial growth. Further superficial wound swab later showed a scanty growth of *Bacillus cereus*, not thought to be clinically significant.

DIFFERENTIAL DIAGNOSIS

Although it is most likely for a pacemaker infection to occur within the first 2 weeks of implantation or following

revision of the device, chronic or late infections may also occur.¹ The source is typically contamination at the point of initial implantation or later revision. The most common contaminants of the site are skin flora, including Gram positive organisms such as *Staphylococci* and *Streptococci*.

Deeper infections should be considered, which may either occur as a result of lead implantation, or secondary to seeding from a distant site, such as a discitis.

In cases of suspected pacemaker infection, endocarditis, either as a source or as a secondary infection, should be ruled out. Vegetations may occur on the pacemaker leads and spread to the adjacent tricuspid valve leaflets.

TREATMENT

Prior to isolation of the pathogen, intravenous flucloxacillin was commenced on microbiologist advice in view of his previous response to this antibiotic, to cover a likely Meticillin sensitive staphylococcal infection often *S aureus* or coagulase negative *Staphylococci* from the skin, which possibly dated from the initial implantation. The patient began to respond well to this, with a significant fall in white cell count and inflammatory markers.

The decision was taken to explant the pacemaker pulse generator and leads (right atrial, right ventricular and left ventricular (coronary vein) leads), having checked that the patient was not pacemaker dependent. The procedure was uncomplicated, and following explantation both the wound and pocket were debrided and cleaned.

Seven days following device removal, the patient was switched to oral flucloxacillin for a further 3 weeks, and discharged home with early follow-up.

OUTCOME AND FOLLOW-UP

Since discharge, this gentleman remains well. He has no further evidence of infection around the original pacemaker site, and his inflammatory markers have fallen, with his most recent blood tests checked at follow-up almost 2 months after the end of his antibiotic course showing a normal white cell count of 7.3 and a very mildly raised C reactive protein of 7 mg p/l.

His postinfection echocardiogram shows moderate-severe left ventricular impairment, with an ejection fraction of 38%. There was no evidence of endocarditis.

ECG showed sinus rhythm, with first-degree heart block and old complete left bundle branch block. As the patient seemed to not regress after withdrawal of resynchronisation pacing, it was elected to adopt a 'watch and wait' approach and avoid further pacemaker implantation at present.

DISCUSSION

The recently established *Dietzia* genus can be differentiated from other similar organisms using 16S rRNA gene sequence data²; however, the most commonly used identification equipment has been found to have incorrectly

identified certain *Dietzia* strains as *Rhodococcus sp.* with varying accuracy depending on the strain.^{2 3} *Dietzia* strains are widely distributed in the environment for example, soil and marine sediments; it has been isolated from fish and also from the skin of healthy humans – the likely carriage is by arthropod vectors. *Dietzia* are opportunistic pathogens. There is no specific information currently available about specific virulence factors but the limited reported cases of human infection are associated with prosthetic material, suggesting limited virulence. According to a recent review, there are six well-described *Dietzia spp.*, and three of these have been associated with pathology in humans, having been identified in clinical specimens.^{2 4} The three species isolated from clinical specimens are *Dietzia maris*, *Dietzia cinnamea* and *Dietzia papillomatosis*. *D maris* as a cause of human infection has been reported in four cases in the literature; the first was isolated from a blood culture taken through a central line and the central line catheter tip on removal in an immunocompromised patient,³ the second from a hip prosthesis⁵ and the third was found in the blood of a patient with cardiorespiratory insufficiency.⁶ The fourth came from aortic and pericardial samples in a patient with aortitis and aortic dissection.⁷ The former three cases were successfully treated with targeted antibiotic therapy, but the latter unfortunately died following irreversible complications of dissection and the subsequent inflammatory response.^{3 5 7} *D cinnamea* was isolated in one clinical specimen reported in the literature, but this was not known to be associated with symptomatic infection.⁸ The final documented strain, *D papillomatosis*, was isolated in a patient with a rare but benign dermatological condition thought to be bacterial in origin due to its response to antimicrobial therapy.⁹ On this occasion however, the bacterial isolate was not thought to be have directly caused disease by invasive mechanisms.⁹

The other strains of *Dietzia* have only been isolated from environmental sources thus far.

In this patient it is most likely that infection with *Dietzia* occurred from contamination from the skin at the time of the original pacemaker implantation. Many organisms of

relatively low virulence that form part of the normal skin flora (eg, coagulase negative *Staphylococci*, *Corynebacterium spp*) can present with later-onset infections. Although *Dietzia spp* have been found in the aquatic and terrestrial environment, *D maris* has been detected on the skin of 'normal' humans using 16S PCR.¹⁰ Our patient responded well to flucloxacillin therapy. This antibiotic was chosen initially on the assumption that the most likely causative organism was coagulase negative *Staphylococcus* and had shown clinical response by the time the 16S PCR result was available. As we did not grow the organism we were unable to test for specific antibiotic sensitivities. *Dietzia* would normally be sensitive to penicillin. In the future, this patient may require reinsertion of a pacemaker. In this situation, recurrence of *Dietzia* would be unlikely like any low virulence skin organism.

Learning points

- ▶ *Dietzia* sp is a rare cause of infection in humans, but may become more prevalent as awareness is raised to its detection by means not previously used routinely (16S rRNA gene sequencing).
- ▶ Strains of *Dietzia* have been found and presumed as the cause of infection in at least two prosthetic devices in humans. These are potentially treatable with targeted antimicrobial therapy, as was seen in the cases described in this report.
- ▶ Opportunistic infection may occur in immunocompetent patients, who undergo an invasive procedure where they are exposed to entry of this microorganism, with pathological consequences.

Competing interests None.

Patient consent Obtained.

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