Case report of a successfully treated gentamicin and ciprofloxacin resistant *Serratia marcescens* prosthetic joint infection

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ABSTRACT

We report the case of an eradicated multiresistant *Serratia marcescens* prosthetic hip joint infection. It is estimated that enteric Gram-negative organisms account for approximately 8% of prosthetic joint infections. However, the evolving multiresistant strains of organisms being encountered in hospital acquired infections is making eradication increasingly difficult. We describe our surgical and microbiological approach to this in a complex case.

KEYWORDS

Antibiotic resistant bacteria – Gram-negative – Arthroplasty – Bone cement – Total femoral replacement

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Case History

A 61-year-old male patient with a past medical history of obesity underwent right knee revision arthroplasty surgery for instability following a previously unsuccessful revision for instability. Preoperative aspiration of the joint was negative on both occasions for infection.

One week following revision surgery, the wound was explored for haematoma. Operative specimens were taken prior to debridement and lavage. Extended tissue cultures grew *Enterobacter cloacae*. Shortly following surgery, a sinus developed over the wound, from which a *Propionibacterium* spp of uncertain significance was cultured. The patient responded well to therapy with doxycycline.

The patient subsequently underwent three surgical procedures in quick succession following a fall while on holiday in Monaco two months after the revision surgery. He suffered a periprosthetic fracture, which was fixed with a plate, and a second fall, in which the plate fractured and further operative fixation was performed. Two weeks following the second fixation, a haematoma was evacuated from the knee. Tissue samples grew coagulase negative *Staphylococcus* and *E. cloacae*. He was treated with ciprofloxacin and metronidazole. A further sinus developed, which was explored in theatre and again grew coagulase negative *Staphylococcus* and *E. cloacae*.

A further periprosthetic fracture led to another revision procedure consisting of direct exchange of the distal femur with vancomycin and ampicillin added to Copal® (Heraeus, Wehrheim, Germany) bone cement containing gentamicin

and clindamycin. Preoperative aspirate grew ciprofloxacin, gentamicin and carbapenem susceptible *E. cloacae*, gentamicin resistant, amoxicillin and vancomycin susceptible *Enterococcus* and flucloxacillin resistant, vancomycin susceptible coagulase negative *Staphylococcus*. The same three species with identical antibiograms were grown from five operative tissue samples.

One month later, the patient was again revised with a custom prosthesis following two dislocations that had to be reduced in theatre with open procedures. Vancomycin and gentamicin were added to Copal® bone cement containing gentamicin and clindamycin. He was given systemic teicoplanin and meropenem in addition.

The patient progressed well for nine months until the knee dislocated yet again. This was revised and progress was initially good but six months later he started to complain of increased pain in the knee and thigh. Aspirate of the knee at this time grew flucloxacillin and gentamicin resistant coagulase negative *Staphylococcus* that was susceptible to teicoplanin and vancomycin. He subsequently underwent a total femoral replacement. Vancomycin was added to Copal® bone cement containing gentamicin and clindamycin. Coagulase negative *Staphylococcus* resistant to doxycycline, tetracycline, gentamicin and teicoplanin but susceptible to vancomycin was grown from five out of five tissue samples. Postoperatively, he was treated with systemic linezolid and ciprofloxacin for six weeks.

One month later the patient underwent an open reduction of a dislocated total femoral replacement. Five out of

Figure 1 Cement coated total femoral replacement

Figure 2 Silver coated total femoral replacement

Figure 3 Silver coated total femoral replacement implanted

five tissue samples grew *Serratia marcescens*. He was given systemic ciprofloxacin for this, to which the organism was at this stage susceptible. Two months later a sinus developed over the wound. The leg was grossly swollen and 1.5l of fluid was aspirated from the thigh, which again grew *S marcescens*, now resistant to ciprofloxacin. Subsequently, he underwent a first stage revision of the total femoral replacement in which the prosthesis was washed and coated in Copal[®] cement with 2g vancomycin and 2g meropenem added to it (Fig 1). *S marcescens* was again grown from all five tissue samples processed, and postoperative meropenem and clindamycin was continued for six weeks.

Three months later a total femoral replacement coated with silver (Figs 2 and 3) was reimplanted with 2g meropenem added to each mix of Copal[®] bone cement. Meropenem and teicoplanin were given systemically. No growth was seen on the tissue samples. The patient remains clinically well with his prosthesis sterile at 18 months.

Discussion

Prosthetic joint infections are a serious complication of surgery. Over the lifetime of a prosthetic joint, it is estimated that 1–2% will become infected.¹ Staphylococci remain the most common infecting agent.^{2,3} Enteric Gram-negative organisms including *Serratia* and *Enterobacter* infections

are less common, accounting for 8% of isolates in a previous study.³

In our unit, tissue samples are inoculated on to blood agar media and into both aerobic and anaerobic broth cultures. The broth cultures are incubated for seven days, followed by a terminal subculture. Broth cultures showing signs of growth on inspection are subcultured on to a wide range of solid agar media for incubation in both aerobic and anaerobic conditions.

Conclusions

The sequence of events in this case is exceedingly rare. We describe the management of a recurrent infected prosthetic joint with multiple procedures and targeted antibiotics to a pathogen with increasing antimicrobial resistance. While the mainstay of treatment of prosthetic joint infections remains surgical, effective treatment is only possible with the support of microbiology colleagues to provide accurate diagnoses and antibiotic guidance. Indeed, we are increasingly seeing problems with multi-resistant pathogens in healthcare. This was highlighted recently in the public domain with the publication of the *Annual Report of the Chief Medical Officer*.⁴ By utilising a multidisciplinary approach to these complex cases, sterility can be achieved through a combination of thorough

surgical debridement and targeted antibiotics delivered both locally and systemically.

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