

Pasteurella multocida infected total knee arthroplasty: a case report and review of the literature

KB Ferguson, R Bharadwaj, A MacDonald, B Syme, AM Bal

NHS Ayrshire and Arran, UK

ABSTRACT

Pasteurella multocida is a rare cause of prosthetic joint infection. This infection generally follows significant animal contact, usually licks and scratches. We report a case of *P multocida* infection that was treated with linezolid with salvage of the implant. Linezolid is generally active against Gram-positive organisms only with the exception of *Pasteurella*, which is Gram-negative. We extensively review the previous reported cases of implant infection with *P multocida*.

KEYWORDS

Implant infection – Linezolid – *Pasteurella*

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CORRESPONDENCE TO

Abhijit Bal, Department of Microbiology, University Hospital Crosshouse, Lister Street, Kilmarnock KA2 0BE, UK
E: abhijit.bal@aaaht.scot.nhs.uk

Deep infection represents one of the most devastating complications of total knee arthroplasty. The rate of infection is quoted in the literature as ranging from 1% to 5%.¹ Traditionally, Coventry's three-stage classification (early, delayed and late) has been used although it has been updated and modified by the more recent Tsukayama's classification into four categories, based on presentation.² Treatment options for infected prosthetic joints often comprise of one or more of the following: antimicrobial therapy, arthroscopic washout, open knee debridement with or without change of polyethylene insert, one-stage or two-stage revision and arthrodesis.

The most commonly implicated organisms associated with infected prostheses include *Staphylococcus aureus* (22%), coagulase-negative staphylococci (22%), alpha and beta-haemolytic streptococci (9% and 5% respectively), enterococci (7%), aerobic Gram-negative bacilli (25%) and anaerobes (10%).¹ Occasionally, infection may be caused by rarer organisms, particularly in the immunocompromised host. Determining the causative organism influences antibiotic therapy. We report a rare case of *Pasteurella multocida* infection of a knee implant where selection of appropriate antibiotics made a crucial impact on the overall management.

Case History

A 67-year-old woman presented to the orthopaedic department 13 weeks following a primary left total knee replacement for osteoarthritis. The postoperative course had been

uneventful until three days prior to her presentation to the department when she reported having woken up with acute pain, swelling and erythema of her left knee. She was unable to mobilise because of the pain and was also complaining of flu-like symptoms. There was no history of trauma or any invasive therapeutic procedure in the interim period. Initial observations noted a fever of 40.1°C with an associated tachycardia of 107bpm and a blood pressure 156/82mmHg. On examination, her left knee was warm, swollen and erythematous with a tense effusion. There was a 2cm × 2cm fluctuant and pointing area on the lateral aspect of her knee. The knee was held in 5° of flexion. Any attempted passive movement was exquisitely painful.

Laboratory investigations revealed an elevated white cell count ($17.2 \times 10^9/l$) with a neutrophilia ($14.2 \times 10^9/l$) and a C-reactive protein (CRP) of 347mg/l. Under aseptic technique in theatre, 60ml of pus was aspirated from the fluctuant pointing area over the lateral aspect of the knee. However, it was felt that this was communicating with the knee joint. The initial Gram stain demonstrated numerous white cells but no organisms. Radiography of the knee was satisfactory and did not show any obvious lucencies around the implant. The patient returned to theatre the following day for an open washout and debridement along with exchange of polyethylene insert. Tissue from the infected knee was sent for bacteriological investigations.

Culture from the aspirate and from the knee tissue grew *P multocida*. As the patient was allergic to penicillin (itchy rash), she was commenced on linezolid and ciprofloxacin



Figure 1 Anteroposterior radiography of left knee with no obvious lucencies.



Figure 2 Lateral radiography of left knee with no obvious lucencies.

as per the sensitivities and microbiology advice of the senior author. The ciprofloxacin course was a total of eight weeks combined with linezolid for the first four weeks, as recommended by Health Protection Agency guidelines.⁵ Owing to the risk of peripheral neuropathy, linezolid should not be given for more than four weeks. The patient

improved with the antibiotics and washout. Her inflammatory markers came back to normal after two weeks, and there was a significant clinical improvement in the appearance and range of motion of the knee.

On closer questioning following the culture results, the patient revealed she had a cat and three dogs as pets. She stated that her dogs frequently licked her on her legs but she denied any bites or scratches. She was discharged home on oral antibiotics and was mobilising satisfactorily at the time of discharge. She was followed up at weekly intervals in the clinic for clinical review and check of inflammatory markers to ensure that there was no flare-up or recurrence of the infection. Repeat radiography of the left knee at six weeks was satisfactory. She is still under regular follow-up and is presently completely asymptomatic, with normal white cell count and CRP.

Discussion

P. multocida is a facultatively anaerobic Gram-negative coccobacillus. It is a commensal in the nasopharyngeal tract of domestic pets such as cats and dogs.⁴ Bacteria are transferred to their paws by licking. Consequently, cases of *Pasteurella* infection in humans can often be attributed to bites or scratches.⁵ Infection with *Pasteurella* is more commonly associated with cat bites, probably because cats are colonised more frequently.⁶ Data suggest that 50% of cat bites and 15–20% of dog bites become infected.^{5,7} Infections have also been known to occur in patients without a history of bites or scratches.⁸ Although the mode of transmission in such cases is unclear, inadvertent inoculation of the pathogen followed by direct spread or indirect dissemination cannot be ruled out (eg infection of the lick or scratch wounds followed by bacteraemia). Contamination of bone allograft has also been speculated as a possible mode of acquisition.⁹

Septic arthritis, with or without osteomyelitis, is uncommon with *Pasteurella* and infection involving prosthetic joints is very rare. In such cases, however, it is very important to definitively identify *Pasteurella* because standard therapy for prosthetic joint infection (eg flucloxacillin or vancomycin) is not appropriate for this species. *Pasteurella* is susceptible to penicillin, amoxicillin, cephalosporins, tetracyclines, co-trimoxazole and chloramphenicol. Clindamycin and erythromycin are not active.¹ The optimal antibiotic therapy for deep seated infection with *Pasteurella* in patients allergic to beta-lactam antibiotics is uncertain. The Health Protection Agency guidelines recommend combination therapy with ciprofloxacin and linezolid in such cases.⁵ Surprisingly, linezolid, whose activity is generally limited to the Gram-positive bacteria, has been found to be effective against *Pasteurella*.¹⁰

P. multocida is an uncommon causative organism in prosthetic joint infection and after an extensive literature search only 22 published cases (including our report) could be found (Table 1).^{6,8,9,11–28} An overwhelming majority of patients were women (18 of 21 cases where this information was available). Patients' age ranged from 55 to 88 years.

Table 1 Details of reported cases of *Pasteurella multocida* prosthetic infections

Authors	Age/sex	Site	Implant removal?	Antibiotics and duration	Outcome	Animal contact
Griffin, 1975 ¹¹	64 F	TKR	No	AMP	Cure	Cat scratch
Maurer, 1975 ¹²	55 F	TKR	No	PEN, 2 wks	Cure	Lick by dog
Sugarman, 1975 ¹³	33 F	TKR	No	PEN, 60 wks	Treatment failure – revision	Lick by dog
Arvan, 1978 ¹⁴	72 F	TKR	No	PEN, 3 wks	Cure	Cat bite
Spagnuolo, 1978 ¹⁵	72 F	TKR	No	PEN, 3 wks	Cure	Cat bite
Gomez-Reino, 1980 ¹⁶	64 F	TKR	No	CLN, 6 wks	Treatment failure – revision	Cat bite
Mellors, 1984 ¹⁷	Not known	B/L TKR	No	PEN	Cure	Cat scratch
Orton, 1984 ¹⁸	74 F	TKR	No	PEN, TET, 12 wks	Treatment failure – revision	Cat bite
Gabuzda, 1992 ¹⁹	88 F	TKR	Yes	PRP, 3 wks, then PEN, 3 wks	Cure	Cat bite
Guion, 1992 ²⁰	45 F	TKR	Yes	CTX, 6 wks	Cure	Lick by dog
Braithwaite, 1992 ²¹	48 F	THR	Yes	PEN, FLU, 6 wks	Cure	Cat bite
Antuña, 1997 ²²	73 F	TKR	Yes	CIP, 10 wks	Cure	Dog bite
Takwale, 1997 ²³	57 F	THR	Yes	PEN, 4 wks, then CIP, 8 wks	Cure	Cat scratch
Maradona, 1997 ²⁴	73 F	TKR	No	PEN, 3 wks, then CIP, 3 wks	Cure	Dog bite
Chikwe, 2000 ⁹	69 M	THR	Yes	Not known	Cure	Dog contact
Stiehl, 2004 ⁸	63 M	TKR	Yes	PTZ, CIP	Cure	None
Mehta, 2004 ⁶	84 F	THR	Yes	PEN, CIP, 1 wk, then CIP, 7 wks	Cure	Cat scratch
Mehta, 2004 ⁶	57 F	THR	Yes	PEN, 4 wks, then CIP, 8 wks	Cure	Cat scratch
Polzhofer, 2004 ²⁵	73 F	TKR	No	CLI, 3 wks	Cure	Cat bite
Heym, 2006 ²⁶	72 F	TKR	No	AMX, DOX, 8 wks	Treatment failure – revision with CIP, RIF, 9 wks	Lick by dog
Kadokia, 2008 ²⁷	80 F	TKR	No	CFX, 2 wks, then CIP, 8 wks	Cure	Cat bite
Heydemann, 2010 ²⁸	66 M	TKR	No	CTR, 4 wks	Cure	Cat scratch

AMP = ampicillin; AMX = amoxicillin; B/L = bilateral; CFX = cefuroxime; CIP = ciprofloxacin; CLI = clindamycin; CLN = cefalotin; CTR = ceftriaxone; CTX = cefotaxime; DOX = doxycycline; FLU = flucloxacillin; PEN = penicillin; PRP = penicillinase resistant penicillin; PTZ = piperacillin/tazobactam; RIF = rifampicin; TET = tetracycline; THR = total hip replacement; TKR = total knee replacement

Underlying factors included rheumatoid arthritis (8 cases), osteoarthritis (6 cases), steroids (7 cases), diabetes (2 cases) and cancer (1 case) although some of these factors are also the common indications for joint replacement. Seventeen cases involved the knee joint (one case with bilateral infection) and only five hip joint infections have been reported. Of the 22 cases of *P. multocida*, 15 required joint revision (in 4 cases, revision was undertaken after the initial conservative management failed), 8 patients were cured with antibiotics and washout with salvage of the implant, and 1 patient underwent washout with exchange of the polyethylene spacer. Most patients received either one of the beta-lactam antibiotics or ciprofloxacin. One patient was

treated with clindamycin although this antibiotic is known to be inactive against *Pasteurella* in vitro.

Conclusions

Our report has several learning points. Correct and timely identification of this pathogen was crucial to the outcome. Although there is a lack of evidence owing to the paucity of cases, patients with a history of implant surgery who have pets at home should be advised to seek medical attention following any bite or scratch, particularly if they have a history of rheumatoid arthritis and steroid use, so that timely prophylaxis can be administered before sepsis becomes deep seated.

Finally, we used linezolid successfully for the treatment of implant infection with *Pasteurella*. The activity of linezolid is generally limited to the Gram-positive spectrum and its activity against *Pasteurella* (which is Gram-negative) is therefore not well known even to infection specialists. Linezolid has an excellent tissue penetration and this may offer an added advantage when conservative therapy without joint replacement is planned in penicillin intolerant patients with *Pasteurella* sepsis.

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