



Late prosthetic joint infection due to *Rothia mucilaginosa*

Frederick MICHELS, Johan COLAERT, Filip GHEYSEN, Thierry SCHEERLINCK

From the AZ Groeninge Hospital, Kortrijk, Belgium

We report a chronic hip arthroplasty infection with *Rothia mucilaginosa*, a Gram-positive germ belonging to the normal flora of the human oral cavity. Successful treatment was achieved by a two-stage hip arthroplasty revision and intravenous administration of vancomycin. This case report illustrates the potential virulence of *R. mucilaginosa* in patients with a joint prosthesis.

We propose to routinely perform specific staining and prolonged culturing techniques for unusual germs such as *Rothia mucilaginosa* when the clinical history, physical examination or intra-operative findings suggest an implant infection.

This paper reviews current antibiotic prophylaxis guidelines for infection prevention of joint arthroplasties during dental procedures.

Keywords : hip arthroplasty ; infection ; *Rothia mucilaginosa*.

INTRODUCTION

The infection rate of total hip arthroplasties is approximately 1% (5). Most commonly such infections are caused by gram-positive cocci, especially coagulase-negative staphylococci (CNS) and *Staphylococcus aureus* (5). *Rothia mucilaginosa* shares the coccal morphology and positive catalase activity with staphylococci, and is commonly considered as a CNS. However, *R. mucilaginosa* can easily be distinguished from staphylococci and micrococci by a weak catalase activity and the inability to grow on 5% NaCl agar. The natural

habitat of *R. mucilaginosa* is the oral cavity and upper respiratory tract. To our knowledge, this is the first reported case of prosthetic infection with this unusual germ.

CASE PRESENTATION

Our patient is a 59-year-old man who underwent a bilateral total hip arthroplasty for osteoarthritis, in May 1992 (right side) and December 1992 (left side). Both interventions were successful and the patient had an uneventful recovery and a satisfactory result. His medical history revealed diabetes type II and arterial hypertension. In March 1994 a dental extraction was performed, covered by antibiotic prophylaxis (penicillin 2 g orally 1 hour before and 1 g 6 hours after the procedure). Three months after that procedure the patient started to complain about right groin and mid-thigh pain. In September

■ Frederick Michels, MD, Orthopaedic Resident.

■ Johan Colaert, MD, Clinical microbiologist. Department of Laboratory Medicine and Bacteriology.

■ Filip Gheysen, MD, Chairman of the Department of Orthopaedic Surgery.

AZ Groeninge Hospital, Kortrijk, Belgium.

■ Thierry Scheerlinck, MD, Chief of Clinic.

Department of Orthopaedic Surgery, Academic Hospital of the Vrije Universiteit Brussel (AZ VUB), Brussels, Belgium.

Correspondence : Frederick Michels, OLV van Lourdeslaan 78, 1090 Brussels, Belgium.

E-mail : frederick_michels@hotmail.com.

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1996 a draining sinus tract developed on the right hip scar. The sinus tract was resected and debridement of a supposedly superficial infection was performed. All cultures were negative. In 2002, a technetium bone scintigraphy revealed increased isotope uptake around the right femoral hip implant, compatible with stem loosening. A labelled leukocyte scintigraphy was negative. Only the femoral hip component was revised with an uncemented stem and per-operative cultures were negative.

In October 2004 the patient was readmitted for persisting groin pain. He was afebrile and physical examination revealed swelling of the right hip and pain on hip rotation. The white blood cell count (WBC) was $7.86 \times 10^9/l$ with $5.6 \times 10^9/l$ neutrophils. The erythrocyte sedimentation rate (ESR) was 30 mm/h (normal : < 20 mm/h) and the C-reactive protein (CRP) level 47 mg/l (normal : 0-5 mg/l). Renal and liver parameters, urinalysis and other laboratory tests were all within normal limits. There was no heart murmur.

During a debridement procedure in October 2004, abundant purulent fluid was found below the tensor fasciae latae muscle. After 48 hours, all cultures were negative, but because of the long and suspicious history of repetitive infections, agar plates were incubated for another 24 hours. Finally, gram-positive cocci were isolated on blood agar (trypticase soy agar with 5% horse blood) but not on Chapman agar, which is a selective agar for the isolation of staphylococci as it contains 5% NaCl. The colonies were non-haemolytic, mucoid and adherent to agar ; additional biochemical tests are shown in table I. Based on these findings, the pathogen was identified as *R. mucilaginosa*. Although sensitivity screening was hampered by the slow growth of the micro-organism, the germ was considered to be resistant to penicillin and oxacillin, but sensitive to several other antibiotics (table II). An isotopic scintigraphy with labelled lymphocytes showed limited hyperactivity around the right femoral implant, compatible with a low-grade infection. The patient was treated with levofloxacin but the effect on the erythrocyte sedimentation rate and C-reactive protein levels was limited.

Table I. — Biochemical tests of the *R. mucilaginosa* isolate

Biochemical test	Reaction
Adherence (blood agar)	+
Growth in 5% NaCl	-
Catalase reaction	+ (weak)
Coagulase reaction	-
Gelatin hydrolysis	+
Esculin hydrolysis	+

Table II. — Antibiotic susceptibilities of the *R. mucilaginosa* identified as the pathogen in this case

Test	Reaction
Penicillin	R
Oxacillin	R
Amikacin	S
Levofloxacin	S
Tetracycline	S
Erythromycin	S
Vancomycin	S
Clindamycin	S

R : resistant, S : susceptible.

A two-stage revision of the right total hip arthroplasty was performed in May 2005 (fig 1). All implants were removed, bone was debrided and a spacer made of gentamicin-impregnated cement was implanted into the acetabulum and femoral shaft. The cultures taken during implant removal were again positive for *R. mucilaginosa*. Antimicrobial susceptibilities were unchanged. Because of persisting high CRP levels and a persisting subpyretic state despite 6 weeks of intravenous antibiotic treatment a second debridement procedure was performed. After that, the patient received intravenous vancomycin during 4 weeks and the ESR and C-reactive protein level both decreased. Finally, a re-implantation procedure was performed 3 weeks later (fig 2). The postoperative course was uncomplicated and intravenous vancomycin was continued for 2 weeks. Six weeks postoperatively the white blood cell count was $8.97 \times 10^9/l$, erythrocyte sedimentation rate 28 mm/h and C-reactive protein level 15 mg/l. One year later, the white blood cell count, erythrocyte sedimentation rate and C-reactive protein level were normal and the clinical result was excellent.



Fig. 1. — Preoperative AP radiograph : note the presence of cortical thickening and calcifications in the soft tissues around the proximal femur.



Fig. 2. — Postoperative AP radiograph : two-stage revision was performed with an antibiotic-loaded cement spacer (first stage) and uncemented implants (second stage).

DISCUSSION

Prosthetic joint infections are extremely difficult to treat without a microbiological diagnosis. In our case, repetitive cultures were negative although the clinical history strongly suggested a low-grade infection. Finally, and after prolonged cultures, an unusual organism was found.

This favours the theory that some implant loosening, considered as aseptic based on the absence of clinical signs of infection and failure to isolate bacteria, might well be missed low-grade infections. As stated by Nelson *et al* (9) : “The absence of evidence was clearly not evidence of absence”. As such, cultures originating from joint replacements should not only be performed on the classic agar plates for 48 hours, but should also be incubated for at least five days in liquid enriched media. When the history, physical examination or intra-

operative findings suggest the possibility of an unusual infection, the microbiology laboratory should perform special staining and prolonged culturing techniques for unusual germs such as : fungi, mycobacteriae, *E. coli*, *Mycoplasma* or *Brucella* species, and small colony variants of *Staphylococcus aureus* (6). This requires a good collaboration between the orthopaedic and microbiology department. In some cases, it might even require specific expertise within both departments. Ultrasonication can be useful to disrupt the bacterial biofilm layer and to increase the yield of standard culture techniques (9). Polymerase chain reaction (PCR) can be used to amplify the genetic material of a pathogen and facilitate its detection even when present in very small amounts (7, 12). PCR techniques as well as the use of germ specific monoclonal antibodies and polyclonal antibodies combined with immunofluorescence microscopy

allowed detection of bacteria in culture-negative samples (12). These molecular diagnostic techniques seem promising but are not yet routinely available. Moreover, clear cut criteria for the diagnosis of clinical relevant infections are often not well defined (7, 9).

To date no prosthetic joint infection with *R. Mucilaginosus*, formerly classified as *Stomatococcus mucilaginosus*, has been reported. The spectrum of infections caused by *R. mucilaginosus* includes endocarditis, bacteraemia, intravascular catheter infection, meningitis and peritonitis (3, 8, 11). Bone and joint infections are rare. Only one case of osteomyelitis (10) and one case of spondylodiscitis (4) have been described. Two reports suggest that infections with *R. Mucilaginosus* may be underreported, as this germ may be misidentified as *Staphylococcus*, *Micrococcus* or *Streptococcus* (1, 3). They suggest that a Gram positive coccus producing sticky colonies adherent to the agar surface should be considered as *R. Mucilaginosus*. It can be differentiated from *Micrococcus* and *Staphylococcus* by failure to grow in a nutrient medium supplemented with 5% sodium chloride (1, 3), such as the Chapman agar used in this case. Because of the limited number of cases reported, accurate information about the optimal treatment of osteoarticular infections is not available. A few reports found *R. mucilaginosus* to be penicillin-resistant and suggest the use of vancomycin to treat invasive infections (3, 8, 11). In the presence of a chronic infection of a joint replacement, eradication without complete implant removal is illusory. Antibiotics alone or in combination with debridement or with partial implant removal are not effective (6). This was once more demonstrated in the present case. Despite the low virulence of the germ, successful infection control was only achieved after a two-stage procedure and intravenous vancomycin. Neither sinus tract resection and debridement, nor resection arthroplasty with implantation of a gentamicin impregnated cement spacer and the administration of levofloxacin have been successful. This suggests that, although *R. mucilaginosus* is a low virulent commensal, it can be difficult to eradicate in the presence of an implant.

In our patient, the portal of entry remains unclear. Direct seeding into the joint at surgery is

generally the most common origin, and although the infection appeared only two years after a successful implantation, this possibility cannot be excluded. Because *R. mucilaginosus* is part of the normal flora of the human oral cavity, a haematogenous seeding from the patient's mouth is another possibility. Our patient underwent a dental extraction for infection one year and ten months after an uneventful primary total hip arthroplasty. A few months later, and despite the administration of antibiotic prophylaxis with penicillin, he developed a deep prosthetic hip infection. However, we can question whether the dental procedure caused the bacteraemia that seeded the prosthetic hip, or if the hip was already contaminated during the hip replacement itself or due to the presence of a chronic dental infection.

According to an advisory statement of the American Dental Association (ADA) and American Academy of Orthopaedic Surgeons (AAOS) from 1997 (2) and a recent review (5) antibiotic prophylaxis is not routinely indicated for most dental patients with total joint replacements and is not indicated for patients with other orthopaedic implants (pins, plates and screws). However, our subject was a high-risk patient (hip arthroplasty within two years) undergoing a high-risk dental procedure (dental extraction for infection, table III). Moreover, he had non-insulin dependent diabetes and this should also be taken into account, although *sensu stricto* only type I diabetes is considered a high-risk factor. As such, our patient should have received antibiotic prophylaxis with amoxicillin, cephalexin or cephadrine, all the more as the tooth extraction was performed to treat an infection. However, in this case the germ (*R. mucilaginosus*) was resistant to penicillin and amoxicillin. That might explain the inefficacy of the antibiotic prophylaxis.

This case emphasises the importance of a good dental hygiene and adequate antibiotic prophylaxis for high-risk patients undergoing high-risk dental procedures in the presence of a total joint replacement. It also emphasises the need for an optimal collaboration between experienced orthopaedic surgeons and microbiologists to treat rare arthroplasty infections successfully.

Table III. — Current recommendations of antibiotic prophylaxis for patients with a joint replacement undergoing dental procedures (1, 4)

Antibiotic prophylaxis for joint arthroplasty patients is advised for high-risk patients undergoing high-risk procedures but not for low-risk procedures.

High-risk patients

- Inflammatory arthropathies : rheumatoid arthritis, systemic lupus erythematosus
- Disease-, drug- or radiation-induced immunosuppression
- Insulin-dependent (Type I) diabetes
- First 2 years after joint replacement
- Previous prosthetic joint infections
- Malnourishment
- Haemophilia

High-risk procedures

- Dental extractions
- Periodontal procedures including surgery, subgingival placement of antibiotic fibres or strips, scaling and root planning, probing, recall maintenance
- Dental implant placement and reimplantation of avulsed teeth
- Endodontic (root canal) instrumentation or surgery only beyond the apex
- Initial placement of orthodontic bands but not brackets
- Intraligamentary local anaesthetic injections
- Prophylactic cleaning of teeth or implants where bleeding is anticipated

Suggested antibiotic prophylaxis regimens

1. Patients not allergic to penicillin
 - cephalexin, cephadrine or amoxicillin 2 g orally 1 hour prior to the procedure
 - cefazolin 1 g or ampicillin 2 g IM/IV 1 hour prior to the procedure if unable to take oral medication
2. Patients allergic to penicillin
 - clindamycin 600 mg orally 1 hour prior to the procedure
 - clindamycin 600 mg IV 1 hour prior to the procedure if unable to take oral medication

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