Available online at www.sciencedirect.com

ScienceDirect

journal homepage: www.elsevier.com/locate/jor

Case Report

Case report: Eumycetoma and mycotic arthritis of the knee caused by *Arthrographis kalrae*

David Chen-Guan Ong^{a,c,*}, Riaz Khan^{a,b,c}, Clay Golledge^{a,c},
Richard Carey Smith^{a,b,c}

^a Department of Orthopaedic Surgery, Hollywood Private Hospital, Perth 6009, Australia

^b Department of Surgery, University of Western Australia, Perth 6009, Australia

^c Department of Orthopaedic Surgery, Sir Charles Gairdner Hospital, Perth 6009, Australia

ARTICLE INFO

Article history:

Received 26 July 2013

Accepted 7 December 2013

Available online 27 January 2014

Keywords:

Mycetoma

Infection

Total knee replacement

ABSTRACT

A 33-year-old male presents following a penetrating injury to his right knee. Clinically he demonstrated pain, an effusion and fevers. At diagnostic arthroscopy, no microbiological growth was cultured. Delayed growth yielded the fungus *Arthrographis kalrae*. He was treated with a three-stage total knee arthroplasty. The first stage consisted of soft tissue debridement. The second stage involved femoral and tibial osteotomies and insertion of antifungal-impregnated cement spacers. Definitive total knee joint prosthesis were implanted during stage three. At 2 years follow up, he demonstrated a pain free range of motion and has returned to competitive tennis. To the authors' knowledge this is the first report implicating *A. kalrae* as an invasive pathogen of the knee in an immunocompetent host.

Copyright © 2013, Professor P K Surendran Memorial Education Foundation. Publishing Services by Reed Elsevier India Pvt. Ltd. All rights reserved.

1. Introduction

Mycetoma can be defined as a chronic, progressive, inflammatory, granulomatous infection of subcutaneous tissue, skin, and bones. It is most commonly caused by fungus (Eumycetoma) or actinomycetes (Actinomycetoma).¹ It is considered an atypical cause of arthritis and is a rarely reported disease in Australia. It is more prevalent in African countries including Niger, Senegal, Sudan, Somalia, North Cameroon, Kenya and Chad.²

Arthrographis kalrae (*A. kalrae*) can commonly be isolated from soil and compost but has only rarely been reported to be an opportunistic pathogen of humans.¹ *A. kalrae* has been

described as a pathogen in infections of invasive sinusitis and meningitis,³ the dorsum of the hand (causing Eumycotic mycetoma),⁴ the lung (in bronchial alveolar lavage fluid),⁵ a corneal ulcer and keratitis.⁶

Patient history often reveals a penetrating mechanism of injury which allows for the inoculation of soil-based organisms into the subcutaneous tissue. Commonly, those at risk include labourers, those who work barefoot and those who live in rural areas.³ The characteristic findings are clinical subcutaneous swellings and the presence of hyphae and spores consistent with *A. kalrae* on histological examination.⁷ It is known to spread contiguously to involve adjoining skin with the formation of multiple sinuses.⁷

* Corresponding author. Department of Orthopaedic Surgery, Hollywood Private Hospital, Monash Avenue, Nedlands 6009, Australia.

E-mail address: ongchenguan@gmail.com (D.C.-G. Ong).

2. Case report

2.1. Initial presentation

A 33-year-old male sustained a penetrating injury to his right knee with sheet metal in May 2009. He presented to hospital two months later with unilateral right knee pain, an effusion and a healed 2 cm wound. Symptoms failed to resolve and he was investigated with diagnostic arthroscopy. When initial intra-operative specimens did not yield any microbiological growth the working diagnosis of inflammatory arthropathy was made. He was treated with multiple arthroscopic wash-outs (Jul 09, Nov 09, Jan 10), none of which grew an organism. He received methotrexate, 10 mg oral prednisolone daily and an yttrium synovectomy. MRI investigation demonstrated a popliteal collection and the patient proceeded to an open synovectomy and popliteal dissection in April 2010. Extended culture of intra-operative specimen samples grew the fungus *A. kalrae* sensitive to liposomal Amphotericin B and intravenous therapy was commenced immediately.

Fourteen months from his original injury, his condition progressively worsened, and he was referred to one of the authors (RJJK) for definitive management. He was constitutionally unwell with recurrent fevers and a worsening of his right knee effusion and pain. There was a large diffuse swelling of his right knee that was mainly synovitic fullness and a moderately sized effusion. His ligaments were intact and he displayed no lymphadenopathy. His range of motion was 0–120° with no crepitus.

The patient was further investigated with a white cell bone scan that demonstrated intense focal activity in the medial femoral condyle suggestive of a localized osteomyelitis. CT and MRI imaging of the right knee showed the redevelopment of multiloculated superficial and deep fluid collections posterior to the knee joint (Fig. 1). There was osseous irregularity of the articular surfaces of the medial and lateral femoral condyles and tibial plateaus with more extensive cortical loss of the medial femoral condyle and erosions of the articular surface of the patella.

The patient was taken to theatre for a combined anterior and posterior exploration and debridement (RCS/RJJK). An

Fig. 2 – MRI demonstrating the main abscess sack wall infiltrating into the neurovascular bundle.

open synovectomy was performed first via a medial parapatellar (MPP) approach with the patient lying supine. A large amount of pus and debris was present within the knee. The quality of the cartilage, particularly on the femoral condyles, was poor and in areas and delaminating showing exposed bone beneath.

The patient was then rolled into the prone position for a dissection and debridement of the popliteal fossa. The main abscess sack was excised but the wall infiltrated into the sheath around the tibial nerve (Fig. 2). An epineural dissection was incorporating ensuring aggressive debridement without loss of function. Complete excision without tibial nerve compromise was therefore impossible. Another abscess was identified deep to the popliteal artery and vein was removed after careful dissection. The wounds were thoroughly irrigated with 8 L of normal saline. Post-operatively he was

Fig. 1 – Sagittal MRI of the right knee. A Extensive synovial proliferation in response to the known intra-articular fungal infection. B Synovial proliferation extending along the popliteus sheath with nodular thickening extending 6 cm below the level of the tibial plateau.

Fig. 3 – Intra-operative photographs taken of the knee. A Demonstration of the marked infected cortical erosions on the femoral condyles. B After femoral and tibial osteotomies were performed.

managed in a hinged knee brace and the wounds healed uneventfully.

Post-operative antifungal therapy consisted of 10 days of broadspectrum 800 mg IV Teicoplanin and oral Ciprofloxacin 750 mg BD. Intravenous therapy with liposomal amphotericin B 300 mg OD and oral therapy with posaconazole 400 mg BD followed. Sensitivity studies obtained from intra-operative specimens demonstrated susceptibility to the selected antifungal agents.

Three months later, there was no evidence of active infection. The patient reported pain and a ROM of 0–40°, but was systemically well. Serological markers (WCC 5.3 $\times 10^9/L$, CRP 5.7 mg/l ESR 11 mm/h) were consistent with quiescence of infection. Given the extensive chondral damage in all compartments of the knee and ongoing pain and stiffness we elected to proceed with the first stage of a two-stage total knee joint replacement. The MPP approach was used and a tibial tubercle osteotomy (TTO) was necessary to achieve adequate

exposure because of inability to flex beyond 40°. Further soft tissue debridement was required. Femoral and tibial osteotomies were performed to remove the cortical erosions, and bone ends fashioned to receive an implant (Fig. 3).

Polymethylmethacrylate cement (Simplex P with 80 mg of Tobramycin, Stryker, USA) spacers were made using molds (Biomet, Warsaw IN, USA); 150 mg of amphotericin B (X-Gen, NY, USA) was added to the cement powder (Fig. 4). The patient was allowed to mobilise and weight bear as tolerated using crutches. Post-operative knee flexion was measured at 0–30°.

At three month post first stage surgery, antifungal therapy was ceased and the patient remained afebrile. Serological inflammatory markers (WCC 6.4 $\times 10^9/L$, CRP 5.4 mg/l, ESR 11 mm/h) were consistent with eradication of infection. Antifungals were ceased for 6 weeks prior to the patient's return to theatre for the second stage of the total knee replacement. The MPP was used and the osteotomy re-opened. A posterior stabilised total knee joint arthroplasty (Genesis II, Smith and

Fig. 4 – Post-operative plain radiographs demonstrating polymethylmethacrylate spacers in situ. A Anterior-posterior right knee film. B Lateral right knee with tibial tuberosity osteotomy noted.

Fig. 5 – Post-operative plain radiographs at 2-year-follow up. A Anterior-posterior right knee film. B Lateral right knee film.

Nephew, USA) was performed with computer-assisted navigation. The same cement composition was used: 150 mg of amphotericin B (X-Gen, NY, USA) added to 80 mg of antibiotic-laden cement (Simplex P with Tobramycin, Stryker, USA). On this occasion the tibial tubercle osteotomy was fixed with two small fragment AO screws. Physiotherapy was commenced the day after surgery. On discharge the patient had an active range of motion of 0–70° and was ambulating independently on two crutches. Cultures from the second stage surgery demonstrated a delayed growth of *A. kalrae* on one tissue specimen. Thus the patient was commenced on long term suppressive oral antifungal therapy consisting of 400 mg posaconazole once daily and 500 mg terbinafine twice daily. Sensitivity to antifungal agents were confirmed on intra-operative specimen susceptibility results.

2.2. Follow up

At latest follow up (2 years post-operation), the patient demonstrated a range of motion of 0–90°. He mobilised pain free without aids. Functionally he had returned to full time work as a labourer without restrictions, and was playing regular competition tennis (Fig. 5).

3. Discussion

Fungal arthritis is often associated with a diagnostic delay due to difficulty in its identification resulting in a longer duration of illness and chronic status,^{8,9} as in this case. Furthermore, initial treatment for suspected inflammatory arthropathy with prednisolone, methotrexate and yttrium almost certainly aided disease progression.

The clinical management of Eumycetoma and mycotic arthritis remains largely undefined within the medical literature, with no specific guidelines available. Treatment options that are currently published within limited case series and case reports advocate a combination of surgical drainage and

antifungal therapy. The duration and timing of peri-operative antifungal therapy for the treatment of *A. kalrae* has no clear standard at present. Antifungal agents have been shown to reduce the size of lesions when used prior to surgery, and reduce the risk of recurrence, when used at least 6–12 months after surgery.^{10–12}

Our case demonstrated that *A. kalrae* infection has the capacity to spread in a locally aggressive fashion. The infection infiltrated nerve sheaths thus rendering complete surgical removal impossible without significant loss of function. We decided to proceed with a staged total knee joint replacement to allow the infection to be medically controlled prior to the definitive implantation of a prosthesis. The alternative we considered, if the infection could not be eradicated, was an en bloc resection of the knee with a megaprosthesis replacement, more commonly performed following bone tumour resection.

4. Conclusion

This case demonstrates that *A. kalrae* has the potential to cause invasive arthritis in an immunocompetent host. A three-stage total knee joint arthroplasty combined with suppressive antifungal therapy resulted in a pain free and good functional outcome at 2 years follow up.

Conflicts of interest

All authors have none to declare.

REFERENCES

1. Baki R, Mathur DR. Incidence and changing pattern of Mycetoma in western Rajasthan. *Indian J Pathol Microbiol.* 2008;51:154–155.

2. Develoux M, Audoin J, Treguer J, Vetter JM, Warter A, Cenac A. Mycetoma in the Republic of Niger: clinical features and epidemiology. *Am J Trop Med Hyg.* 1988;38:386–390.
3. Dieng MT, Sy MH, Diop BM, Niang SO, Ndiaye B. Mycetoma: 130 cases. *Ann Dermatol Venereol.* 2003;130(1 pt 1):16–19.
4. Chin-Hong P, Sutton D, Roemer M, Jacobson M, Aberg J. Invasive fungal sinusitis & meningitis due to *Arthrographis kalrae* in a patient with AIDS. *J Clin Microbiol.* 2001;39:804–807.
5. Degavre B, Joujoux JM, Dandurand M, Guillot B. First report of mycetoma caused by *Arthrographis kalrae*: successful treatment with itraconazole. *J Am Acad Dermatol.* 1997;37:318–320.
6. Perlman EM, Binns L. Intense photophobia caused by *Arthrographis kalrae* in a contact lens-wearing patient. *Am J Ophthalmol.* 1997;123:547–549.
7. Fahal AH. Mycetoma: a thorn in the flesh. *Trans R Soc Trop Med Hyg.* 2004;98:3–11.
8. Sigler L, Kennedy MJ. *Aspergillus*, *Fusarium*, and other opportunistic moniliaceous fungi. In: Murray PR, Baron EJ, Pfaller MA, Tenover FC, Tenover RH, eds. *Manual of Clinical Microbiology.* 1999:1212–1241.
9. Choi SW, Lee TJ, Kim MK, Lee M, Jung JH. A case of fungal arthritis caused by *Hansenula anomala*. *Clin Orthop Surg.* 2010;2:59–62.
10. Welsh O. Mycetoma. Current concepts in treatment. *Int J Dermatol.* 1991;30:387–398.
11. Mahgoub ES. Mycetoma. *Semin Dermatol.* 1985;4:230–239.
12. Cuellar ML, Silveira LH, Espinoza LR. Fungal arthritis. *Ann Rheum Dis.* 1992;51:690–697.