CASE REPORT

Soft tissue releases, bone preservation and patient outcome following revision of the oldest total knee replacement

Ben Arthur Marson, Robert Gleeson, Richard Majkowski, Amit Atrey

Department of Trauma and Orthopaedics, Gloucestershire Royal Hospital, Gloucester, UK

Correspondence to
Ben Arthur Marson,
dr.b.marson@gmail.com

Accepted 21 May 2015

SUMMARY

The patient had a total knee replacement for arthritis secondary to Stills disease performed 35 years earlier, with 20 years of good function followed by 15 years of progressively worsening knee pain. A revision was completed, which improved the patient's quality of life and objective knee scores, with an increase in Oxford Knee Score from 22 to 42 and American Knee Society Score from 76 to 170. We discuss the technical aspects in revising this knee replacement, which is the oldest that we are aware of. The result has been a good recovery, which is the first available in the literature for future comparison.

BACKGROUND

We present a case of a revision of an Attenborough total knee replacement (TKR) that had been implanted 35 years earlier. This is, to the best of our knowledge, the longest surviving implant that has been successfully revised.

TKRs were first pioneered by surgeons including Walldius and Shires in the 1950s. The early implants were limited with a metal-on-metal design and a simple hinge that could not replicate the complex kinematics of the knee. This resulted in an unacceptably high revision rate.¹ The development and reporting of the forerunner to the modern knee replacement by Gunston in 1971 reinvigorated this branch of arthroplasty. Frank Gunston observed and applied the low-friction model proposed by Charnley for the hip, to the knee, and used metal surfaces articulating with a high-density polyethylene spacer. The articulating surfaces were contoured to mimic the natural movement in the knee; he also used a polymethylmethacrylate cement to hold the components to the bone.² Variations on this design have been developed and optimised to produce the implants that are used internationally today.

The Attenborough prosthesis was first described following its design in East Sussex, UK, as one of the early knee replacements. It is a stabilised, gliding construct in that the two components were designed to articulate through flexion and extension with a restraining rod to augment collateral ligament function.³ Initial results in the late 1970s were encouraging with multicentre trials demonstrating 85% of patients reporting no or mild discomfort at 1–4 years of follow-up and 77% of patients demonstrating a significant improvement in the range of motion.⁴ These findings were

replicated internationally with 84% 'good' or 'excellent' results at 1-year follow-up in a Swedish study published in 1981.⁵ However, it became less popular as an implant through the 1980s, with high reported rates of postoperative anterior knee pain, wound infections and aseptic loosening.^{6–8}

We are not aware of any reports of revision following such prolonged use of an Attenborough prosthesis nor of any other revision of any other implant after such a prolonged period of time in such a young patient. We aim to present our management strategy, the challenges we faced and the objective and subjective results.

CASE PRESENTATION

The patient is a 54-year-old accountant who presented to clinic with problems with his left-sided TKR. He had an Attenborough prosthesis implanted in 1979 for aseptic arthritis secondary to Still's disease. The Attenborough prosthesis had functioned well for 20 years, but had become increasingly painful and the patient had perceived increasing instability in the year prior to attending clinic. His range of movement was +10° to +50° flexion with no objective ligamentous instability; however, the stiffness in the knee made full evaluation difficult.

His medical history is significant only for Stills' disease and ankylosing spondylitis, which gives him back stiffness but is well controlled with simple analgesia.

INVESTIGATIONS

Radiographically, there was a significant amount of osteolysis around the femoral and tibial components with heterotrophic ossification along the patella tendon and evidence of a patellectomy (figure 1). The patient's inflammatory markers were measured and revealed normal C reactive protein of 5 mg/L and an elevated erythrocyte sedimentation rate (ESR) of 28 mm/h. The knee was aspirated, but no bacteria grew on culturing.

The patient was counselled about the undertaking of a revision knee replacement with the main goal being restoration of the mechanical axis to give him a pain-free knee. Secondary outcome was agreed to be improvement to the range of motion; but not guaranteed.

On the day of surgery, the patient was re-examined and completed an Oxford Knee Score (OKS) and an American Knee Society Score (AKSS)

CrossMark

To cite: Marson BA, Gleeson R, Majkowski R, et al. *BMJ Case Rep* Published online: [please include Day Month Year] doi:10.1136/bcr-2014-208174

Figure 1 Preoperative radiographs showing Attenborough knee replacement in situ.

test. His OKS was 22/48 and his AKSS functional score was 55/100 and objective score 19/100.

TREATMENT

The approach to the knee was through a previous 'S-shaped' incision. The quadriceps tendon was partially divided to give further access. Again, access to the implants was limited until an excision of the extensive synovitis and scar was carried out, and medial, lateral and an extensive posterior release were performed. This gave good access to the joint (figure 2). There was no significant effusion present.

Both implants were removed with little difficulty but highlighted the extensive bone loss on both femoral and tibial sides. Metaphyseal bone was also extremely thin. Macroscopic analysis of the implants showed an Attenborough with a grossly worn polyethylene tibial component, but a functioning sliding mechanism (figure 3). Although the medial and lateral collateral ligaments were present, they were deemed to have little functional capacity.

Figure 2 Intraoperative view with Attenborough implant removed.

Figure 3 Wear on the Attenborough implant.

As with all revision knee operations, soft tissue balancing in varus and valgus, and flexion and extension had to be maintained. In this case, the medial collateral ligament was competent. We had planned to reconstruct the ligament if required, or use a fully constrained implant to ensure stability. The varus deformity meant the lateral collateral ligament was partially released.

For balancing of the flexion and extension gaps, the contracted soft tissues were released. This was significant contraction posteriorly, which was resolved by releasing the capsule and posterior cruciate ligament. There was also a significant anterior tissue contracture and synovitis, which, when released, allowed greater flexion. Awareness of the bone loss, the size of augments used and the geometry of the replacement implants, allowed perfect soft tissue balancing of the implant, although we and the patient were also realistic of the attainable range of movement after such a prolonged deformity.

On removing the tibial component, the thin metaphyseal anterior wall fractured. This was reinforced by adding a contoured Recon plate. With all the implants removed, and the appropriate resections performed, the knee was trialed with a Sigma TC3 revision knee (DePuy, Warsaw, Indiana, USA). The TC3 is a constrained design that allows stabilisation via either stem and/or metaphyseal cone fixation. In such poor bone stock, the stabilisation was reinforced by metaphyseal cones as well as diaphyseal stems. Despite the proximal anterior cortex fracture on the tibia, the metaphyseal fix was good. The relevant implants were positioned and articulating sides were additionally cemented at the bone interfaces (figure 4). Intraoperative range of movement was improved to +5° to 90° of flexion.

Figure 4 Intraoperative images of final implant position with recon plate.

Figure 5 Six-week postoperative radiographs with position of TC3 implant.

Although the extensor mechanism and skin closed well, it was decided that, to protect the wound, the patient would be kept in a range of movement brace until full healing had been achieved. This was kept from 0° to 15° for the first fortnight and then gradually increased on a weekly basis.

OUTCOME AND FOLLOW-UP

Following 6-week follow-up, the radiographic appearance of the knee was much improved (figure 5). At 18 weeks, the patient's OKS was 42/48, his functional AKSS was 93/100 and objective score 77/100, with a range of movement from 0° to 80°.

DISCUSSION

This case report details the progress of a patient who had a difficult revision TKR. We are not aware of any reports of revision following 35 years of prosthetic wear, though there is a report from Dendrinos *et al* describing their experience of revising 'old type' knee prosthesis, including the Attenborough. The maximum time from primary operation to revision in this series was 9 years. This group found that they had a 5-year success rate for the revision procedure of 50%.⁹ As patients with TKR for Still's disease are now entering advanced age, we expect these cases to become more common.

The management of this patient provided several challenges. The first was confirming the diagnosis of aseptic loosening given raised inflammatory markers. Identification that the elevation in ESR was chronic and had been previously investigated by the general practitioner was reassuring, but intra-articular aspiration was required and indicated to confirm a sterile joint.

The second challenge was maintaining bone stock while removing the Attenborough prosthesis. The concern was that removal of the old prosthesis may result in a catastrophic fracture of either femoral condyle. To accommodate this, a hinged

endoprosthesis knee replacement was available as back up prior to surgery. This would have been used to reconstruct and replace the distal femur had fracture occurred or if metaphyseal bone stock had been too deficient.

The third challenge was the technical approach to the knee minimising soft tissue damage. While preoperative planning helped prepare for minimal tissue disruption, the procedure was improved by having the combined experience of three consultant knee surgeons present for this case. Though difficult to schedule, the advantage of this additional experience and the collaboration between the surgeons helped to provide such a positive outcome.

Learning points

- ▶ Revision of old knee replacements is likely to become more common as patients with Still's disease who had total knee replacements live longer lives.
- ▶ Revision of such an old prosthesis may be technically challenging and require augments.
- ▶ Revision may be associated with dramatic improvements in functional outcome.

Twitter Follow Ben Marson at @drbmason

Contributors BAM wrote and collected functional outcome data. RM and RG were senior surgeons for the revision. AA reviewed and followed up the patient, and was the lead consultant. All were involved in the drafting and editing of the manuscript.

Competing interests None declared.

Patient consent Obtained.

Provenance and peer review Not commissioned; externally peer reviewed.

REFERENCES

- 1 Tooms RE. Knee arthroplasty. In: Edmonson AS, Crenshaw AH, eds *Campbell's operative orthopaedics*. 6th edn. St Louis: CV Mosby, 1980:2161–79.
- 2 Gunston FH. Polycentric knee arthroplasty prosthetic simulation of normal knee movement. *J Bone Joint Surg Br* 1971;53:272–7.
- 3 Attenborough CG. The Attenborough total knee replacement. *J Bone Joint Surg Br* 1978;60-B:320–6.
- 4 Vanhegan JAD, Dabrowski W, Arden GP. A review of 100 Attenborough stabilised gliding knee prosthesis. *J Bone Joint Surg Br* 1979;61-B:445–50.
- 5 Kofoed H. The Attenborough total knee prosthesis. Results of 25 operations evaluated according to two different assessment systems. *Acta Orthop Scand* 1981;52:561–8.
- 6 Simison AJ, Noble J, Hardinge K. Complications of the Attenborough knee replacement. *J Bone Joint Surg Br* 1986;68:100–5.
- 7 Kershaw CJ, Themen AE. The Attenborough knee. A four- to ten-year review. *J Bone Joint Surg Br* 1988;70:89–93.
- 8 Manning DW, Chiang PP, Freiburg A. Hinge implants. In: Bono JV, Scott RD, eds. *Revision total knee arthroplasty*. New York: Springer, 2005:227–8.
- 9 Dendrinos GK, Mavropoulou A, Polyzoides AJ. Late failure and revisions of old-type total knee replacements. *Acta Orthop Belg* 1991;57:274–84.

Copyright 2015 BMJ Publishing Group. All rights reserved. For permission to reuse any of this content visit <http://group.bmj.com/group/rights-licensing/permissions>.
BMJ Case Report Fellows may re-use this article for personal use and teaching without any further permission.

Become a Fellow of BMJ Case Reports today and you can:

- ▶ Submit as many cases as you like
- ▶ Enjoy fast sympathetic peer review and rapid publication of accepted articles
- ▶ Access all the published articles
- ▶ Re-use any of the published material for personal use and teaching without further permission

For information on Institutional Fellowships contact consortiasales@bmjgroup.com

Visit casereports.bmj.com for more articles like this and to become a Fellow