MASTERCLASS *Clinical cases from the Royal National Hospital for Rheumatic Diseases*

Series editors P J Maddison, A K Bhalla

Salvage of the infected arthroplasty

Alistair C Ross

Advances in joint replacement surgery have revolutionised the management of end stage rheumatic disease. As a result the number of joint replacements carried out world wide has risen rapidly. Although the prevalence of deep infection is low (1-2%), there has inevitably been a corresponding rise in the number which have become infected. In response, treatment of the infected arthroplasty has evolved over the last 10 years to a point where successful salvage of the infected arthroplasty may now be expected in over 90% of cases.

Case 1: Salvage of the infected total hip arthroplasty

A 64 year old woman presented in 1982 with osteoarthritis of the right hip and underwent a total hip replacement, from which she made an excellent recovery. In 1987 she underwent aortic valve replacement, which was complicated by a *Streptococcus viridans* subacute bacterial endocarditis. Shortly after, her right thigh became swollen and painful with reddening of the overlying skin. She developed a persistently discharging sinus, which grew an identical *S viridans*. She felt unwell and was unable to walk more than 50 metres despite support. She climbed stairs on all fours and was kept awake at night by the pain. She presented to us in 1989 (fig 1A) and underwent two stage exchange arthroplasty. Bone scintigraphy showed high isotope uptake around both components of the implant (fig 1B). At the first operation thick green pus was present around both components of the implant. These components were removed, the soft tissues and sinus were carefully debrided, and all the cement was meticulously extracted. This disclosed seven cloacae in the upper femur. Gentamicin beads were implanted and the patient placed on skeletal traction (fig 1C). She was treated with systemic antibiotics for six weeks by which time her erythrocyte sedimentation rate (ESR) and C reactive protein had returned to normal. A second stage procedure was undertaken in which the gentamicin beads were removed. The hip was thoroughly examined, but there was no sign of residual infection. A cup was cemented into the acetabulum and the femoral side was reconstructed using allograft bone and an uncemented femoral prosthesis (fig 1D). The patient made an uneventful recovery and remains in good health and free from infection two and a half years

later. The functional result is excellent, even when assessed by scoring systems for primary hip replacement.

COMMENT

Infection should be suspected in any patient with pain in the region of a previous joint replacement. Provided that inflammatory joint disease is not the underlying problem, the presence of an acute phase response with a raised ESR and C reactive protein concentration can be helpful in confirming the diagnosis.¹ The infecting organism must be identified, either by preliminary aspiration of the hip with a large bore needle, culture of any draining fluid, or if indicated, open biopsy of the synovium and periprosthetic tissue under general anaesthetic. All specimens must be sent for aerobic and anaerobic culture. It is important to remember that coagulase negative staphylococci are a common cause of infection after total joint replacement.^{2 3}

The first stage of treatment is the same in all cases. The patient undergoes a thorough debridement of the infected joint with excision of all sinuses, infected material, cement, cement-bone membrane, and implant. There are then three principal pathways which can be taken. The first is to leave the patient with a resection (Girdlestone) arthroplasty; the second, to reimplant a prosthesis as part of the same procedure (one stage revision); the third, to implant a prosthesis at a later stage (two stage revision).

The functional result of a resection arthroplasty is almost always unsatisfactory. The leg is considerably shortened and the patient walks with a pronounced limp on one or two crutches. This is particularly true when resection arthroplasty is carried out for sepsis. A recent review by Grauer *et al* once again confirms these observations.⁴

One stage revision can yield excellent results.^{5 6} The key factors in the success of this procedure are early identification of the infecting organism, wide debridement of the infected joint with removal of all infected material, the availability of a wide range of implants, and the use of cement loaded with large quantities of appropriately chosen antibiotics. Opinion remains divided about the choice of one or two stage revision for the infected total hip arthroplasty. Our policy is that if an organism cannot be isolated or is virulent (as in case 1) a two

Royal United Hospital
and Royal National
Hospital for Rheumatic
Diseases, Bath and Bath
and Wessex Orthopaedic
Research Unit

A C Ross

Correspondence to:
Professor P J Maddison,
Royal National Hospital
for Rheumatic Diseases,
Upper Borough Walls,
Bath BA1 1RL.

Bath medalion reproduced
with permission of the
Royal National Hospital for
Rheumatic Diseases, Bath.

stage revision is probably safer.⁷ Antibiotics should then be given for at least 28 days and reimplantation delayed until no clinical or radiological sign of infection can be found. In the absence of inflammatory joint disease, repeated ESR and C reactive protein concen-

trations should be normal. It has been shown that delaying reimplantation of the prosthesis for more than one year reduces the reinfection rate significantly,² but it prolongs the time that the patient has to walk on an excision arthroplasty with all its attendant problems.

Figure 1 Patient No 1. (A) Infected right total hip arthroplasty. (B) Bone scintigraph showing high isotope uptake around both components of the implant. (C) Patient receiving skeletal traction. (D) Reconstruction of the femoral side of the hip using allograft bone and an uncemented femoral prosthesis.

Case 2: Salvaging the infected total knee arthroplasty

A 56 year old man, with a history of osteomyelitis of the left tibia, presented in 1986 with severe pain in the left knee. There had been no sign of infection around the knee for 40 years. Flexion was restricted to 30 degrees. Radiographs of the knee showed a marked loss of joint space, and a diagnosis of osteoarthritis secondary to old infection was suggested. A total knee replacement using an uncemented Freeman-Samuelson prosthesis was performed, but the knee was painful after the operation and his range of movement remained restricted (fig 2A). During the following two years there was no improvement, and in April 1990 he became systemically ill with fever and severe pain which kept him awake at night. A diagnosis of infection around the prosthesis was supported by scintigraphy. Two stage exchange of the prosthesis was undertaken. The first stage consisted of removal of the uncemented prosthesis and meticulous debridement of the soft tissues. Cultures of the soft tissues grew a *Staphylococcus aureus*. A spacer for the joint was fashioned using cement impregnated with antibiotic and the wound was also packed with gentamicin beads (fig 2B). He was mobilised in a plaster of Paris back slab and treated with systemic antibiotics for six weeks. By this time the ESR and C reactive protein had returned to normal and a technetium scan showed no further sign of infection. He was taken back to theatre where the spacer and beads were removed and the soft tissues were further debrided. This left a large defect, which was filled with allograft bone from three femoral heads. An Insall-Burstein prosthesis was then cemented in place (fig 2C). He remained non-weight-bearing for six months and has subsequently walked with two sticks. He is free from infection but has slight discomfort

when bearing weight on the affected knee and has only regained his preoperative range of movement.

COMMENT

Salvaging the infected knee replacement is difficult. Over the past 10 years several approaches to the problem have been proposed. The soft tissues around the infected arthroplasty may be debrided if infection is identified early and the components securely implanted. Alternatively, debridement may be accompanied by removal of the prosthesis and all cement, either leaving the knee as an excision arthroplasty or proceeding to arthrodesis. Finally, an exchange arthroplasty can be undertaken in one or two stages.

Choice of the appropriate procedure depends on local and general factors. The general factors are the age, weight, and general condition of the patient and the underlying disease. The local factors include the magnitude of bone loss and ligamentous instability and the presence or absence of antibiotic resistant organisms or multiple pathogens.

The chronically infected knee responds badly to simple debridement when the prosthesis is left in place.⁸ Excision arthroplasty with removal of all potentially infected tissue has recently been reassessed.⁹ Residual pain is nearly always present and many patients develop sufficient knee instability to warrant an arthrodesis or a knee-ankle-foot orthosis.⁹

Removal of the implant, followed by debridement of the joint and arthrodesis is the 'traditional' method of treating failed infected total knee replacements. A variety of methods have been used to enhance the arthrodesis, including external fixation in compression, intramedullary nailing, or, in difficult cases,

Figure 2 Patient No 2. (A) Total knee replacement using an uncemented Freeman-Samuelson prosthesis. (B) Spacer for the knee joint and packing with gentamicin beads. (C) An Insall-Burstein prosthesis.

both. The main problem has always been to achieve a satisfactory fusion, particularly in the presence of infection where bone stock is often of poor quality and quantity. Furthermore, a fused knee does not guarantee freedom from infection.¹⁰

We prefer to salvage the infected total knee arthroplasty prosthesis using a modification of the two stage procedure described by Wilde and Ruth in 1988.¹¹ The infecting organism is identified preoperatively by aspiration or synovial biopsy. This is followed by a thorough debridement of the knee with excision of all sinuses and infected soft tissues, the bone cement membrane, and all previously implanted material. All tissues are sent for aerobic and anaerobic culture. The knee is thoroughly irrigated and a cement spacer fashioned from cement impregnated with antibiotic. The wound is closed in layers without drainage, and a bulky dressing is applied. The knee is aspirated again after two or three weeks. If no organisms are grown a further debridement is undertaken after four weeks, when culture of the soft tissues and any free fluid is repeated and reimplantation carried out. If the preoperative cultures are positive only the debridement is undertaken. The process is repeated until all cultures are clear. Using this protocol we expect to eradicate the infection in about 90% of patients. If, however, there is massive bone loss and severe ligamentous instability from the

outset we agree with others¹² that arthrodesis is a better solution. Even after successful revision for infection, knee function is not as good as that achieved after a primary knee replacement or a revision carried out for aseptic loosening.

- 1 Sanzen L, Carlsson A S. The diagnostic value of C-reactive protein in infected total hip arthroplasties. *J Bone Joint Surg [Br]* 1989; 71: 638-41.
- 2 McDonald D J, Fitzgerald R H Jr, Ilstrup D M. Two-stage reconstruction of a total hip arthroplasty because of infection. *J Bone Joint Surg [Am]* 1989; 71: 828-34.
- 3 Hope P G, Kristinsson K G, Norman P, Elson R A. Deep infection of cemented total hip arthroplasties caused by coagulase-negative staphylococci. *J Bone Joint Surg [Br]* 1989; 71: 851-5.
- 4 Grauer J D, Amstutz H C, O'Carroll P F, Dorey F J. Resection arthroplasty of the hip. *J Bone Joint Surg [Am]* 1989; 71: 669-78.
- 5 Buchholz H W, Elson R A, Engelbrecht E, Lodenkamper H, Rottger J, Siegel A. Management of deep infection of total hip replacement. *J Bone Joint Surg [Br]* 1981; 63: 342-53.
- 6 Carlsson A S, Josefsson G, Lindberg L. Revision with gentamicin-impregnated cement for deep infections in total hip arthroplasties. *J Bone Joint Surg [Am]* 1978; 60: 1059-64.
- 7 Ross A C. Infection complicating orthopedic procedures and arthroplasties. *Curr Opin Rheumatol* 1990; 2: 628-34.
- 8 Schoifet S D, Morrey B F. Treatment of infection after total knee arthroplasty by debridement with retention of the components. *J Bone Joint Surg [Am]* 1990; 72: 1383-90.
- 9 Lettin A W F, Neil M J, Citron N D, August A. Excision arthroplasty for infected constrained total knee replacements. *J Bone Joint Surg [Br]* 1990; 72: 220-4.
- 10 Morrey B F, Westholm F, Schoifet S, Rand J A, Bryan R S. Long-term results of various treatment options for infected total knee arthroplasty. *Clin Orthop* 1989; 120-8.
- 11 Wilde A H, Ruth J T. Two-stage reimplantation in infected total knee arthroplasty. *Clin Orthop* 1988; 236: 23-35.
- 12 Wilde A H, Stearns K L. Intramedullary fixation for arthrodesis of the knee after infected total knee arthroplasty. *Clin Orthop* 1989; 248: 87-92.