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ORIGINAL STUDY

Two-stage total knee arthroplasty for non-salvageable septic arthritis in diabetes mellitus patients

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Pyogenic knee arthritis in a patient with advanced osteoarthritis is a serious medical problem. We have performed arthroscopic debridement in 136 patients with pyogenic knee arthritis from January 1999 to December 2001. Five of these patients were diabetic, they did not respond to the standard treatment protocol and they continued to have infection. For these patients, we performed open arthrotomy, with implantation of antibiotic cement as a spacer, and staged total knee arthroplasty. The clinical results were evaluated using the Hospital for Special Surgery (HSS) scoring system. At an average follow-up of 38 months (range : 29 to 46), the average pain score was 83 and the functional score was 73 with no patient having recurrence of the infection. This study shows that just as a 2-stage revision is now done for infected total knee arthroplasty, primary uncontrolled infected knees may be treated by a 2-stage arthroplasty as well.

INTRODUCTION

Septic arthritis is a very severe condition and the knee is the joint most frequently involved in adults (*17*). It is crucial to start treatment early if a good prognosis is to be achieved (*12, 17*). Appropriate debridement of the joint is regarded as a hallmark of therapy in addition to using a sufficient dosage of the correct, organism-specific antibiotics. However, it is still debatable whether to use an open arthrotomy with subtotal or complete synovectomy (*12*) or an arthroscopy with debridement and synovectomy (*18, 20*). Previous studies have also shown that diabetic patients are prone to infection and have a significantly increased incidence of joint infection (*4*).

Infection after total knee arthroplasty has been treated by several different methods. The treatment options include one-stage revision (*3*), resection arthroplasty and arthrodesis (*13, 22*), amputation (*10*), and two-stage knee reimplantation (*9*). The

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success rate of a 2-stage procedure with reimplantation of a new prosthesis has proven that this approach is an efficient method for eliminating infection (*9*). If an infected total knee arthroplasty (TKA) can yield good results with a 2-stage exchange of prosthesis, then we should consider that the same method could be used to treat primary pyogenic arthritis of the knee joint in patients who did not have a prosthesis, based on the same principles used for revision of an infected total knee arthroplasty.

In this study, we report our experience with primary arthroplasty after debridement, and the use of antibiotic cement spacers to treat primary septic arthritis of the knee in diabetic patients, who did not respond to conventional treatment.

CASE REPORTS

Case 1

A 70-year-old female presented to the emergency room with a five-day history of acute signs and symptoms of septic arthritis of the right knee. She had received several intraarticular steroid injections for osteoarthritis with the last injection taking place one week before she came to the emergency room. She was being treated for diabetes for the last 15 years. At presentation, aspiration of the knee joint was done and this confirmed frank pus ; she was taken to the operation theater where an arthroscopic debridement procedure was carried out (*11*). The arthroscopic findings corresponded to Gächter's stage IV infection including suppurative hyperemic synovium, and denudation of the articular cartilage from the medial femoral condyle and the proximal tibial condyle. Post-operatively, she was started on intravenous antibiotics covering both Gram-positive and Gram-negative organisms, and culture tests displayed the growth of *Staphlococcus aureus* sensitive to Vancomycin. Four weeks of Vancomycin treatment did not help in controlling her signs of infections, so another arthroscopic debridement was done. Six weeks following the second arthroscopy, the patient was still symptomatic and her ESR was 76 mm and C-reactive protein (CRP) 4.5 mg/dl. Therefore, open arthrotomy was done and antibiotic cement beads were inserted. Total knee arthroplasty was performed eight weeks later. At the latest follow-up at 46 months, the patient had an HSS (Hospital for Special Surgery) (*15*) score for knee pain of 82, and her functional score was 70. The knee had a range of motion of 5° to 90°. She had no other complaints. She subsequently underwent TKA on the opposite knee to treat advanced osteoarthritis (fig 1).

Fig. 1. — Case 1

a) Radiograph on admission showing destruction of the articular cartilage ; b) Arthroscopic findings showing erosions of the articular surface and synovial hypertrophy ; c) Antibiotic impregnated cement inserted as a spacer ; d) Last follow-up radiograph showing both knees. TKR for OA on her contralateral knee.

Case 2

A 73-year-old lady presented after suffering for four days with high fever, pain and swelling in the left knee, and she had a similar history of diabetes and intra-articular steroid injection. After aspira-

Fig. 2. — Case 2

a) Radiograph on admission shows the AP and lateral view of the left knee ; b) AP and lateral view of the left knee with antibiotic cement *in situ* ; c) Twenty-nine months after TKR, the radiograph showed ectopic ossification.

tion of the knee joint in the emergency room, she had arthroscopic debridement performed on the same day. Her arthroscopic findings were Gächter's stage IV. Post-operative antibiotics and care were the same as in the previous case. Her culture report came as Methicillin resistant *Staphylococcus aureus* (MRSA), and due to the chronic pus discharge, she required a second arthroscopic debridement procedure four weeks later. Even after six weeks of antibiotic therapy, her symptoms did not subside and her ESR was 96 mm and her CRP was 7.4 mg/dl ; therefore, we performed open arthrotomy and inserted antibiotic cement beads. Seven weeks later, we removed the antibiotic cement and performed TKA. At 29 months of follow-up, she had a pain score (HSS) of 81 and functional score of 69. Flexion of her knee was 5° to 90°. Her follow-up radiograph showed ectopic ossification, which we feel was the cause of her lower functional score and lower range of movement (fig 2). She is presently ambulatory with the support of a walking stick.

Case 3

A 67-year-old lady with a past history of diabetes and osteoarthritis of her right knee had received an intraarticular steroid injection, and was then referred to us after a five-day history of acute signs of septic arthritis in her right knee. After performing knee joint aspiration, she was taken for emergency arthroscopic debridement and started on intravenous antibiotics active on *Staphylococcus aureus*. Her arthroscopic findings were Gächter's stage III. Four weeks later, the patient's symptoms were still active, and her ESR and CRP protein were 86 mm and 5.6 mg/dl, respectively. Therefore, we proceeded with an open arthrotomy along with implantation of antibiotic cement beads. Eight weeks later, TKA was done. The patient continued to complain of knee pain post-operatively, so we continued antibiotics for another 6 weeks. At follow-up 37 months later, her range of movement was 5 to 100°, her HSS score for pain was 81 and her functional score was 65.

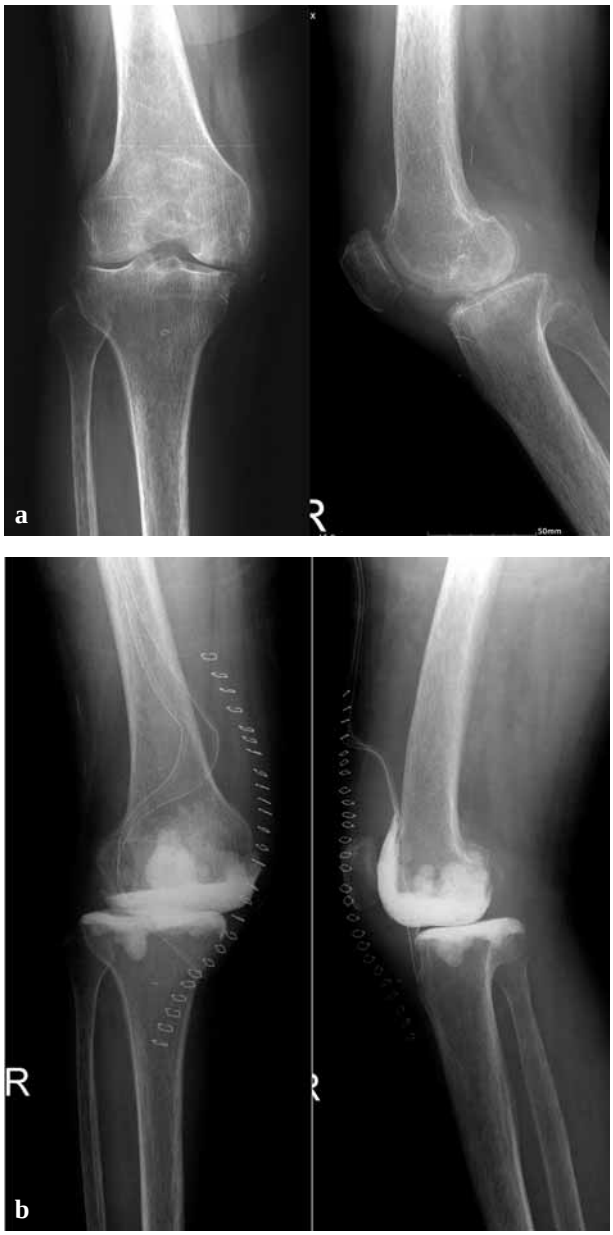

Fig. 3. — Case 5

a) Radiograph on admission ; AP and lateral view of the right knee ; b) AP and lateral view of the left knee with antibiotic cement *in situ* ; c) Thirty-six months of follow-up showed no signs of loosening or infection.

Case 4

A 75-year-old diabetic lady presented with acute features of septic arthritis of her left knee, and she also underwent the similar protocol of aspiration, emergency arthroscopic debridement and administration of the appropriate intravenous antibiotics. Her culture grew *Staphylococcus aureus* and she had a Gächter's stage III infection. Four weeks later her symptoms still persisted with an ESR of 78 mm and a CRP of 5.3 mg/dl. She underwent an open arthrotomy with implantation of antibiotic cement beads. She had a TKA 8 weeks later. At 40 months follow-up, she has a range of movement from 5° to 120° and a HSS score of 85 and 80 for pain and function, respectively. One year and five months later, she underwent a TKA on her right knee without any complaints.

Case 5

A 74-year-old female presented with a history of fever and increased pain after an intraarticular steroidal injection in her right knee was given for osteoarthritic pain ; she was taken for emergency arthroscopy after knee aspiration in the emergency room. Her arthroscopic findings were Gächter's stage III ; after the initial debridement and intravenous antibiotics, an open arthrotomy was performed six weeks later due to uncontrolled infec-

tion and her high ESR and CRP level. Antibiotic impregnated cement was incorporated in the joint at that time. She underwent TKA six weeks later, and on her last follow-up at 36 months (fig 3), her flexion was from 5° to 120°, and her HSS score was 85 and 82 for pain and function, respectively.

DISCUSSION

Septic arthritis is a serious condition which can destroy articular cartilage and bone, and this can lead to functional limitation and increasing morbidity and mortality, especially in the elderly (*22*). The knee joint is the most commonly affected joint, and it accounts for 40% to 50% of all septic arthritis (*2*). Delayed diagnosis and delays in starting treatment are the most common reasons for the complications and morbidity of septic arthritis of the knee (*24*). There are many added risks involved in pyogenic arthritis, but second to age, diabetes mellitus is considered the main risk factor for septic arthritis (*5*). The third risk factor for the increased rates of infection is the intraarticular administration of steroid, and this has been repeatedly reported in the literature (*8*). Among the 136 patients treated for septic arthritis in this study, five patients were diabetics who showed an uncontrolled infection after the intra-articular administration of steroids.

Pyoarthrosis may be treated in several ways (*5, 14, 24*). Arthroscopy is currently accepted as the standard mode of treatment (*21, 24*). Reports have been published showing that arthroscopic procedures can be used to treat even Gächter's stage IV infection (*21*). A few resistant cases in the literature have been effectively treated with primary TKA (*5, 13, 14*). In our report, all the cases presented in the emergency room with septic arthritis needed immediate drainage. All the patients were treated with a combination of arthroscopic irrigation and systemic antibiotic therapy. During arthroscopy, aspirates and biopsy specimens were taken for Gram staining, bacteriological culture and antibiotic sensitivity tests. The infection was staged and treated according to the Gächter criteria (*19*).

There is an ambiguous agreement concerning the necessity of using a combination of arthroscopy and antibiotics. Some authors also advocate intraarticular antibiotics (*6, 7*), while others refrain from the use of intraarticular antibiotic administration (*16, 20*). Argen *et al* (*1*) have described a chemical synovitis which was induced by intraarticular instillation of antibiotics. In the present study, no antibiotics were added to the irrigation solution since several clinical and experimental studies have demonstrated sufficient antibiotic levels in the synovial fluid after intravenous administration of antibiotics (*6*).

Despite the good to excellent results reported by several authors on arthroscopic therapy for septic arthritis in infants and adults (*19, 21, 24*), five of our cases did not respond at all. At the initial arthroscopy, two of the five patients showed stage IV infection, and three cases showed stage III infection. The severity decreased from the initial stage of infection, but none of the five diabetic infected joints were cured with repeated arthroscopic irrigation/debridement and systemic antibiotic therapy. The criterion for success was the complete elimination of infection.

The overall success for 2-stage revision for an infected total knee arthroplasty has been shown to be over 90% (*9, 23*), and this led us to perform a similar method of treatment for these uncontrolled infected knees. Similar case studies (*5, 13, 14*) in selected cases have shown the elimination of infection, the avoidance of arthrodesis and even the prevention of amputation with a satisfying functional result. Our cases, with an average follow-up of 38 months, have shown similar results with an average HSS score of 83 and 73 for pain and function, respectively, although a study by England *et al* (*4*) has shown a higher rate of infection in diabetic patients undergoing TKA. Our patients had no further complications in spite of the associated diabetes mellitus other than ectopic ossification in one patient.

In summary, we performed TKA as a staged salvage procedure for five patients with diabetes mellitus having irreversible articular damage and uncontrolled infection. All five patients now have functioning knees, and none of them presently has any clinical signs of infection. However, we stress the need for obtaining a high-risk patient consent.

Moreover, the age criterion is over seventy years and case selection should be made at those medical centers having the confidence, equipment, skill and experience to perform these procedures. The methods described herein could be an alternative for treating infected arthritic knees.

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