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Two-Stage Cementless Revision Total Hip Arthroplasty for Infected Primary Hip Arthroplasties

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ABSTRACT

The main purpose of the present study was to analyze the clinical features, the most common infective agents, and the results of two-stage total hip revision using a teicoplanin-impregnated spacer. Between January 2005 and July 2011, 41 patients were included. At the clinical status analysis, physical examination was performed, Harris hip score was noted, isolated microorganisms were recorded, and the radiographic evaluation was performed. The mean Harris hip score was improved from 38.9 ± 9.6 points to 81.8 ± 5.8 points ($P < 0.05$). Infection was eradicated in 39 hips. Radiographic evidence of stability was noted in 37 acetabular revision components, and all femoral stems. Two-stage revision of the infected primary hip arthroplasty is a time-consuming but a reliable procedure with high rates of success.

More than 600.000 hip arthroplasty surgeries are carried out worldwide each year and 90% of recipients are over 65 years old [1]. The increasing numbers of hip arthroplasty surgery have been unfortunately accompanied by an unavoidable increasing incidence of complications. Periprosthetic infection following primary total hip arthroplasty (THA) is a serious complication which generally requires revision arthroplasty [2]. The prevalence of infection following hip arthroplasty surgery has been reported as 1%–2% in primary THA and 3%–4% in revision THA [3]. The diagnosis of deep persistent infection, ideal surgical treatment approach, and duration of antibiotic therapy are still controversial in the literature [4]. Different therapeutic strategies including long-term antibiotic suppression, surgical debridement, one-stage revision, two-stage revision, Girdlestone resection arthroplasty, arthrodesis, and amputation have been described in the literature as the management of an infected THA [5–13]. Many authors have recommended two-stage revision surgery as the first choice in the management of late onset prosthetic joint infection, and reported success rates above 90% [14–16]. Different agents such as gentamycin, vancomycin, tobramycin or clindamycin have been used in different studies analyzing the clinical results of two-stage revisions.

The main purpose of the present study was to analyze the clinical, functional and radiographic outcomes of two-stage revision THA using a teicoplanin-impregnated cement-spacer in a series of infected primary total hip arthroplasties.

Materials and Methods

Between January 2005 and July 2011, 44 consecutive patients who underwent two-stage revision THA with a diagnosis of deep persistent prosthetic joint infection were included in our study. Three patients were excluded from the study because 2 of them died due to chronic medical problems unrelated to the periprosthetic joint infection and its treatment, and the other one was lost to follow-up. Therefore the present study evaluated the clinical and functional outcomes of 41 patients. The indication for THA was primary coxarthrosis in 37 hips (90.2%), femoral neck fracture in 2 hips (4.9%), and avascular necrosis of the femoral head in 2 hips (4.9%). A periprosthetic joint infection was considered as evident according to the criteria defined by the standardized American Academy of Orthopedic Surgeons (AAOS) consensus guidelines for periprosthetic joint infection (Table 1) [17]. Clinical data of our patients were evaluated retrospectively after having approval from the local ethical research committee.

The patients included 23 males and 18 females with a mean age of 62 ± 14.1 years (range, 28–87 years). The mean post-operative follow-up time was 4.5 ± 1.9 years (range, 2–8 years). All cases were unilateral. Twenty-one patients had left hip involvement whereas 20 patients had right hip involvement. The implants removed during the first stage surgery included 16 cemented and 25 cementless designs. Two surgeons performed all surgeries included in the study. A cementless press-fit revision THA composite with metal-on-polyethylene weightbearing surface

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Table 1
The Criteria Defined by the Standardized AAOS Consensus Guidelines for Periprosthetic Joint Infection.

Defining Periprosthetic Joint Infection
1. A sinus tract communicating with the prosthesis; or
2.A pathogen isolated by culture from two separate tissue or fluid samples obtained from the affected prosthetic joint; or
3.Four of the following criteria exist:
a. Elevated serum erythrocyte sedimentation rate (ESR) or C-reactive protein (CRP) concentration
b. Elevated synovial white blood cell (WBC) count
c. Elevated synovial neutrophil percentage (PMN%)
d. Presence of purulence in the affected joint
e. Isolation of a microorganism in one culture periprosthetic tissue or fluid
f. Greater than five neutrophils per high-power field in five high-power fields observed from histologic analysis of periprosthetic tissue at 400 times magnification

design and monoblock revision type femoral stem was implanted in all hips as the second stage of the treatment.

Surgical Technique

All patients were operated in lateral decubitus position and posterolateral approach with elevation of the vastus lateralis was preferred in all hips. In the first stage of revision, any active draining sinus was excised following skin incision, any tendons of short external rotators that could be identified were tagged for latter reattachment, and pseudocapsules with soft tissue scars were excised and kept in a sterile container for histo-pathologic evaluation as well as the laboratory cultivation. Hip was dislocated posteriorly. Additional scar tissues were excised circumferentially from the host-implant interface of both components. Joint fluid, soft tissue and bone tissue specimens were obtained for microbiological culture via extensive surgical debridement. Removal of all implants and cement was performed. Following debridement of all necrotic and infectious tissues, antibiotic-impregnated cement spacer was placed in the articular space. We applied teicoplanin-impregnated polymethylmethacrylate (PMMA) (Cemex Isoplastic, Tecres spa, Italy) cement spacer which was fashioned intra-operatively as hand-mixed for 5 min. Hand-mixing technique was preferred to increase porosity of the cement and improve elution of the antibiotic. All spacers were in the form of a hemi-arthroplasty construct reinforced with inclusion of a Steinmann wire to prevent breakage. The spacer contained an average of 7.2 ± 2.6 g (range, 4–16 g) of teicoplanin for all hips.

One gram of intravenous Cefazolin-sodium administration at 8 h intervals was routine prophylactic antibiotherapy until the microbiological culture results were obtained post-operatively. After obtaining the microbiological culture results, intravenous antibiotic therapy was rearranged according to antibiotics sensitivity tests of the isolated microorganism. The antibiotic therapy continued during hospital stay and after discharge from the hospital, until the serum CRP and ESR levels decreased. Prophylactic low molecular weight heparin (Enoxaparin-sodium) was started 12 h following the operation with 60 mg/day dosage administered subcutaneously, and continued at least four weeks post-operatively for all patients. The patients were discharged with outpatient parenteral antibiotic treatment following the agreed decision of the orthopedic surgeon and infectious diseases specialist, and were requested to follow-up weekly to check serum CRP and ESR levels. Antibiotic treatment was discontinued at the end of an average 8 ± 4 week period (range, 4 to 20 weeks) post-operatively. The reason for prolonged antibiotic treatment in some patients was resistant elevated serum levels of CRP and/or clinical symptoms of infection. We did not perform routine or selected joint aspirations after antibiotics were discontinued. The mean time period past from the first stage to revision surgery was 6 ± 3 months (range, 1–13 months).

In the second-stage, cement spacer block was removed and a new debridement was performed first to remove all necrotic tissue during revision surgery. Intra-operative soft and osseous tissue sampling for microbiologic culture was repeated, and cementless revision prosthetic components (Echelon Revision Hip System, Smith and Nephew Orthopedics Inc, Memphis, TN, USA; Solution Revision Hip System, DePuy Orthopedics Inc, Warsaw, IN, USA) were then implanted following the preparation of the acetabular cavity and the femoral canal (Fig. 1). Post-operative antibiotic therapy determined according to the microorganism isolated in the first stage cultures was administered and continued up to 4 weeks according to the consultations with infectious diseases department. Low molecular weight heparin (Enoxaparin-sodium) was also administered and continued as the same protocol applied during the first stage of the treatment.

Data Collection

Following revision THA, clinical as well as the radiographic evaluation was carried-out at the eighth week, third, sixth and twelfth months, and annually thereafter. At the clinical status analysis, physical examination of the operated hip joint was performed, the patients were observed for any limping, and the Harris hip score was noted. Isolated microorganisms from surgical samples were recorded. Limping status of the patients was assessed by one of the authors at the latest clinical follow-up, and determined according to the 'Limp' section of Harris hip score. Clinical cure of the infection, with no clinical signs of inflammation as well as normalized CRP and ESR findings, was assessed by one of the authors at the latest clinical follow-up. We did not perform joint aspiration routinely at the latest follow-up. However, a joint aspiration was performed to exclude a septic loosening of the components for the patients with suspected radiographic signs. Aseptic loosening was determined according to the presence of all the criteria including the absence of any clinical symptoms of infection, normal serum CRP and ESR

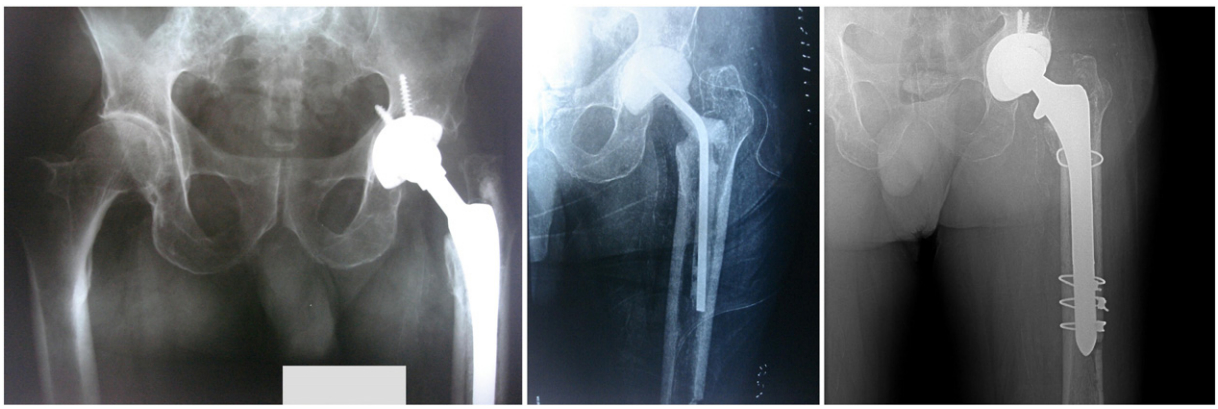

Fig. 1. Radiographic images of infected primary total hip arthroplasty pre-operatively (A), following implant removal (B), and after the revision surgery (C).