Journal of Orthopaedics 13 (2016) 437–442

Contents lists available at ScienceDirect

Journal of Orthopaedics

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

Original Article

Should well-fixed uncemented femoral components be revised in infected hip arthroplasty? Report of five trial cases

Kiyokazu Fukui *, Ayumi Kaneuji, Syusuke Ueda, Tadami Matsumoto

Department of Orthopaedic Surgery, Kanazawa Medical University, Kahoku-gun, Ishikawa 920-0293, Japan

ARTICLE INFO

Article history:
Received 19 May 2015
Accepted 27 September 2015
Available online 1 November 2015

Keywords:
Infected hip arthroplasty
Two-stage revision
Uncemented femoral component retention
Fluorodeoxyglucose positron-emission tomography
FDG-PET

ABSTRACT

Background: Well-fixed femoral component removal remains difficult and complicated.
Methods: We report herein the outcomes of two-stage surgery involving retention of bone-ingrown uncemented stems, aggressive soft-tissue debridement, and delayed reimplantation of an acetabular component in 5 patients for infected hip arthroplasty.
Results: By a mean follow-up point of 4.2 years after the second-stage operation, none of the 5 patients experienced recurrence of infection, and the mean Harris hip score had improved from 63 to 86 points by the latest follow-up evaluation.
Conclusion: Two-stage revision with retention of well-fixed uncemented stems could be an alternative treatment option in hip periprosthetic infection.

1. Introduction

Prosthesis infection is a serious complication after total hip arthroplasty (THA). Some authors have advised removing all components to eradicate infection if it occurs more than 3 weeks after the primary THA.[1] Recently, acetabular removal equipment such as the Explant system (Zimmer, Warsaw, IN, USA) has been refined to the point that well-fixed acetabular components can be removed efficiently with minimal bone loss.[2,3] However, femoral component removal remains difficult and complicated. An extended trochanteric osteotomy or cortical window is often required for removing a well-fixed femoral stem. This may lead to unexpected intraoperative femoral perforation or fracture, increased intraoperative blood loss, and increased duration of surgery. Furthermore, these procedures usually require extensive soft-tissue dissection, which causes devascularization in the proximal femur, which may in turn lead to formation of sequestrum, causing a recurrence of infection.

In these situations, we wondered whether patients could be treated successfully for their infections without removal of well-fixed femoral components by using aggressive debridement and an antibiotic-impregnated cemented femoral head in a two-stage procedure. It has been reported that circumferential bone ingrowth of uncemented stems prevents polyethylene wear particles from invading the distal portion of the stem.[4] If circumferential bone ingrowth of uncemented stems acts as a barrier against intrusion by infected joint fluid and microorganisms such as polyethylene wear particles, then infection could be treated without the removal of a well-fixed stem, and the risk of recurrent infection and implant failure would be lower. To our knowledge, there have been only 4 reports on the results of stem-retaining two-stage revision in infected THA.[5–8] We report herein the outcome of such a procedure in 5 patients monitored for a mean of 4.2 years.

2. Patients and methods

Between January 2009 and April 2014, 9 patients underwent two-stage revision to treat infected hips after THA. Our basic process was two-stage revision: removal of implants, debridement, and insertion of antibiotic-impregnated cement spacers in the first stage, and implantation of new prostheses in the second stage.[9] In the first stage, we removed acetabular components, heads, and cemented and cementless stems without exception. When an uncemented stem was well fixed and there was radiographic evidence of bone ingrowth, we tried removing the stem, usually by an extended trochanteric osteotomy or cortical window, even if intraoperative femoral perforations or fractures occurred as late as the end of 2008. At the beginning of 2009, we stopped revising well-fixed uncemented stems when we could

* *Corresponding author.*
E-mail address: 66406kf@kanazawa-med.ac.jp (K. Fukui).

http://dx.doi.org/10.1016/j.jor.2015.09.006
0972-978X/

determine that the infection had not reached the femoral side, because we recognized the potential of circumferential bone ingrowth of uncemented stems to prevent not only polyethylene wear particles but also infected joint fluid and microorganisms from invading distally.

By the time of this report, we had treated 5 patients (1 man and 4 women; 5 hips) without removal of their uncemented stems. The average age of patients at the first stage of treatment was 65.8 years (range, 54–70 years). Patients' body mass index averaged 26.5 kg/m^2 (range, 20.1–33.8 kg/m^2). The surgical procedures performed before infection were primary THA in 3 patients and bipolar uncemented hip hemiarthroplasty in 2 patients. The mean follow-up period was 4.2 years (range, 3.5–5 years). A diagnosis of infection was made when there was drainage of pus, positive findings on cultured aspirated fluid and/or tissue, or histological evidence of infection.[10] We determined the extent of the infection after assessing findings for several imaging modalities: plain radiography, computed tomography, magnetic resonance imaging, and bone scintigraphy. In cases for which we found it difficult to judge whether the infection had invaded the femoral component, we also performed fluorodeoxyglucose positron-emission tomography (FDG-PET).

The first procedure consisted of removal of the acetabular components, including the liner and head (inner and outer head in hemiarthroplasty), debridement of dead tissue, and insertion of an antibiotic-impregnated cement spacer. All operations were done using a posterolateral approach. During the procedure, several samples were sent for culturing and sensitivity tests and for histological evaluation. Osteolytic lesions, if present, were curetted. Osteolytic lesions in the proximal part of the femur were curetted radically until we confirmed an area of bone ingrowth between the proximal part of the femur and the porous area of the inserted cementless stem. We impregnated 3 types of antibiotics (vancomycin, tobramycin, and cefotaxime) in the molded cement spacer, using the methods reported by others.[11–13] We pulverized 6 g of antibiotics (3 × 2 g) and mixed it thoroughly with 2 bags (80 g in total) of polymethylmethacrylate polymer (Simplex-P; Stryker, Kalamazoo, MI, USA). Then we added the contents of 2 ampules of liquid monomer (40 mL in total) to the mixture. During the doughy stage of polymerization, the mixture was molded into a hemispheric shape around the sterilized head. The head, constructed in the cement spacer mold (Biomet, Warsaw, IN, USA), was fitted on the neck portion of the stem. The curetted space in the proximal femur was filled with antibiotic-impregnated alpha-tricalcium phosphate cement (Biopex-R, Pentax Co, Tokyo, Japan). The cement-spacer cup was then reduced into the acetabulum. The bare area of the stem surface was covered as completely as possible with the same antibiotic-impregnated cement. A closed-suction drainage system was inserted, and it was removed 5 to 7 days after surgery, at a point when the amount of daily drainage was <50 mL.

Antibiotics for postoperative treatment were selected on the basis of the sensitivities of the organism identified in cultures. These antibiotics were administered intravenously for 4–6 weeks after the first procedure. The interval between the 2 procedures was determined on the basis of improvement in clinical and laboratory findings related to infection, including stabilization of medical condition, appropriate response to infection treatment such as a return to near normal levels of serum C-reactive protein (CRP), reduction of serum erythrocyte sedimentation rate (ESR), and satisfactory wound status.

Trilogy cementless acetabular cups (Zimmer) and Longevity highly cross-linked polyethylene-on-metal head articulations (Zimmer) were used for second-stage reconstruction for all 5 patients. Acetabular cups were inserted after being reamed to the same size and were fixed with 2 or 3 screws.

Postoperative clinical and radiographic follow-up evaluations were performed at 2 and 6 weeks; at 3, 6, 9, and 12 months; and every 6 months thereafter. At the time of each evaluation, hematological studies were performed to check for recurrence of infection, and Harris hip scores[14] were recorded. Treatment failure was defined as a recurrence of infection.

3. Results

Our study was approved by our institutional review board. None of the 5 patients had any recurrence of infection during the mean follow-up period of 4.2 years (range, 3.5–5 years) after the second-stage operation (Table 1). The mean Harris hip score had improved from 63 to 86 points (range, 78–93 points) by the latest follow-up evaluation. There were no major complications such as intraoperative fractures, dislocations, deep vein thrombosis, or pulmonary embolism. In addition, no loosening of acetabular or femoral components had occurred by the latest follow-up examination.

3.1. Selected case report

In April 2000, a 61-year-old woman underwent a bipolar uncemented hip hemiarthroplasty for femoral-neck fracture at another hospital. An AML (DePuy, Warsaw, IN, USA) stem was used in that procedure. After surgery, the patient experienced discomfort in her operated hip joint. Furthermore, her CRP-positive state had continued unabated since her operation. A prosthesis infection was diagnosed, and she was then given antibiotics. However, her symptoms did not decrease and hematological findings did not improve, so she was referred to our hospital.

Radiographs obtained at the first office visit at our institution demonstrated no obvious abnormality except for a slight joint-space narrowing between the acetabulum and the outer artificial femoral head (Fig. 1A). However, computed tomography showed osteolytic lesions in the acetabular side even though the uncemented stem was well fixed (Fig. 1B and C). Magnetic resonance imaging revealed abscess formation around the anterior aspect of the proximal femur (Fig. 1D–F). FDG-PET was performed to determine whether the infection had spread to the distal part of the stem (Fig. 1G). Hematological examination showed a mildly elevated CRP level (1.12 mg/dL) and an elevated ESR (72 mm in

Table 1
Patients' characteristics.

Patient number	Age at first-stage revision [years]	Gender	Type of prior arthroplasty	Infectious organism	Femoral implant	Interval between procedures [months]	Duration of follow-up [months]
1	61	F	HA	Coagulase-negative *Staphylococcus*	AML stem (DePuy)	2	48
2	76	F	THA	*Peptostreptococcus micros*	Omniflex stem (Stryker)	5	60
3	68	F	THA	*Propionibacterium acnes*	Anatomic stem (Zimmer)	2.5	48
4	54	M	THA	Coagulase-negative *Staphylococcus*	Super Secur-Fit HA stem (Stryker)	2.5	59
5	70	F	HA	Coagulase-negative *Staphylococcus*	Super Secur-Fit HA stem (Stryker)	2.6	42

HA, hemiarthroplasty; THA, total hip arthroplasty.