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One-Stage Revision Arthroplasty Using Cementless Stem for Infected Hip Arthroplasties

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ABSTRACT

The objective of this retrospective study was to evaluate our results with one-stage revision using cementless femoral stem for infected hip arthroplasties. Twenty-four patients were included in the study. The acetabular component was cemented in 9 cases. In 2 patients a structured bone allograft was necessary to fill an acetabular defect. After a mean follow-up of 44.6 months, 23 patients showed no signs of infection (95.8%), the mean functional response according to the Merle d'Aubigné scale was 13.8 and the mean Harris Hip Score was 65.4. One-stage revision hip arthroplasty using cementless femoral stem was associated with a high success rate.

Infection remains a serious complication after total hip arthroplasty (THA) and is one of the leading causes of hip revision surgery. Two-stage exchange revision has been classically advocated for the treatment of chronic hip prosthesis infection [1,2]. This strategy requires two major surgeries and a prolonged period of limited mobilisation between first and second stage. The reported success rates after two-stage exchange range from 80% to 95% [3–5] but it is associated with complications and a high economic cost [6]. One-stage exchange using antibiotic-loaded cement is an alternative to 2-stage approach with a high success rate (75% to 90%) in appropriately selected patients [7–9]. However, despite the fact that first reports using one-stage exchange without local antibiotic had bad results [10], recent reports [5,11,12] suggest that in some circumstances this could be a good alternative. The objective of our study was to evaluate our results using one-stage revision for infected hip arthroplasties using cementless stems and review the literature using this approach.

Material and Methods

Between January 1998 and November 2007, all patients with a chronic infected hip arthroplasty treated with a one-stage arthroplasty and a cementless stem were retrospectively reviewed. During the study period, the 1-stage exchange contraindications (exclusion criteria) were fistula, and major soft tissue defect compromising wound closure and/or bone defect affecting implant stability. The final decision for either one- or two-stage revision was at the discretion of the treating surgeons, who considered all the particularities of the patients and the concrete conditions at the surgical field. There were no standard criteria for selecting either arthroplasty type during the period of this study and the rationale for choice of treatment option could not be ascertained from a retrospective review. Infection was considered when the patient presented two or more intraoperative cultures positive for the same microorganism.

The variables recorded were: age of prosthesis, prior condition of the patient according to the surgical risk scale of the American Society of Anesthesiology (ASA), clinical manifestations, presence of radiological signs of loosening of the stem defined according to the radiological criteria of the Engh classification [13], serum concentration of C-reactive protein (CRP) and erythro-sedimentation rate (ESR), stem and cup type used for the arthroplasty, need of allograft during surgery, post-surgical complications, and clinical and functional evolution (assessed with Merle d'Aubigné scale and Harris Hip Score) after at least 2 years from one-stage arthroplasty. In some cases, bone scintigraphy with ^{99m}Technetium (and Technetium-99 m

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HMPAO labeled leukocytes) and/or culture of synovial fluid obtained by percutaneous puncture guided by computerized tomography (CT) were performed and recorded for this study.

Surgical Procedure

The patient was placed in a lateral position and removal was always performed through pre-existing incisions according to the Hardinge's direct lateral approach. When facing a difficult removal of the implant, a major trochanter osteotomy was performed using the Wagner technique with fenestrations in the anterior femoral diaphysis when necessary. Meticulous surgical debridement to clear dead space and residual bacterial colonization was emphasized. All necrotic tissue was excised and the wound was washed out with 10 l of normal saline [14]. In all cases, cementless stems were used and the cup was cemented depending on the bone stock quality, using either cemented or cementless cups. When the cup was cemented, all polyethylene cups were used, whereas when the cup was not cemented then metal backed cups were used. Regarding the cemented cases, 40 g of cement were mixed with either 2 g of vancomycin or 1 g of gentamicin. Structured bone allograft was used when important acetabular bone defect was present.

Intraoperative Microbiology and Histology

Samples for the microbiological study were always taken before the administration of antibiotic prophylaxis. At the time of prosthesis removal, at least six periprosthetic samples from different sites were submitted to the laboratory for culture. Immediately after obtaining the samples for culture, antibiotic treatment with teicoplanin in combination with ceftazidime was initiated. Liquid samples aspirated from the surgical site with a sterile syringe were immediately inoculated into Batec 9000 Blood Culture Systems (Becton Dickinson Diagnostic Instruments, Sparks, Maryland) and incubated for five days [15]. Positive flasks are subcultured in aerobic and anaerobic agar media. Swab samples were obtained by passing a sterile swab (Deltalab invasive sterile Eurotube collection swab with Stuart transport medium; Rubí, Catalonia, Spain) over the areas of tissue, bone or fluid that were suspected of being infected. Solid periprosthetic tissue samples were immediately placed into a separate sterile universal bottle. Solid tissue samples and swab samples were cultured in both aerobic and anaerobic agar media and in thioglycolate broth enriched with vitamin K and hemin and were incubated for ten days. Positive cultures were sent for microorganism identification and sensitivity testing. The treatment was modified according to the result of the cultures and the antibiogram.

Samples for the histological study were obtained from the periprosthetic membrane around the stem. The samples were then fixed with formalin and embedded in paraffin; 4-μm sections were cut and stained with hematoxylin–eosin. The Pathology Department at our hospital follows Mirra's criteria (adapted by Feldman), considering a positive result for infection when ≥ 5 neutrophils per high-power field ($400\times$) were found in at least five separate microscopic fields [16].

Follow-Up and Evaluation

After discharge, patients were seen monthly while they continued antibiotic treatment. The definitive oral antibiotic treatment was selected according to the antibiogram. The duration of intravenous and oral antibiotics was not standardized and this was decided according to the clinical manifestations and the CRP values of each case. Later, the patients were followed-up visits every six months for a minimum of 24 months. At each visit, clinical response and adverse events were recorded. Outcome was classified as follows after the final visit: 1) cure, when the patient presented no local signs of inflammation and CRP remained below 1 mg/dl; 2) failure, when these criteria were not met. At the final visit, functional results were

Table 1
Main Characteristics of the Patients Included in the Study.

n	Age/Gender/ASA	Comorbidities	Primary Diagnosis	Age of the Prosthesis (Months)	CRP (mg/dL)[a]/ESR (mm/h)[b]	Signs of Loosening
1	79/M/2	None	Osteoarthritis	24	3.7/16	Yes
2	77/F/3	AHT, OAT	Fracture	36	1.6/55	Yes
3	74/F/2	None	Osteoarthritis	18	1.6/66	Yes
4	73/F/2	None	Osteoarthritis	18	0.6/72	Yes
5	60/F/2	AHT	Fracture	3[c]	2.4/60	Yes
6	50/M/1	Smoking	Osteonecrosis	48	3.7/61	Yes
7	59/M/1	Smoking, Alcoholism, OAT	Osteonecrosis	1[c]	3.0/NP	No
8	75/M/2	AHT, DM	Fracture	24	1.6/41	Yes
9	77/F/2	None	Fracture	60	2.0/49	Yes
10	76/F/4	DM	Osteoarthritis	94	7.5/NP	Yes
11	81/F/2	AHT, CVH, obesity	Fracture	18	1.1/31	No
12	61/F/2	AHT	Osteoarthritis	96	0.5/22	Yes
13	72/F/2	CVH	Osteoarthritis	12	4.2/96	Yes
14	89/F/3	AHT	Osteoarthritis	10	2.2/69	Yes
15	77/F/2	None	Osteoarthritis	36	2.5/NP	Yes
16	76/M/3	None	Osteoarthritis	72	0.9/20	Yes
17	82/F/2	None	Fracture	76	0.5/18	No
18	70/M/2	DM	Osteoarthritis	53	1.5/35	No
19	78/F/2	None	Osteoarthritis	12	0.7/84	No
20	56/F/3	AHT, CRI, OAT	Osteonecrosis	88	0.2/NP	Yes
21	68/F/4	CRI, OAC	Fracture	51	1.2/52	No
22	83/M/1	None	Fracture	84	1.3/20	Yes
23	70/M/1	None	Osteoarthritis	96	1.8/43	Yes
24	74/M/2	AHT	Osteoarthritis	26	0.6/38	Yes

M: male; F: female; CRP: C-reactive protein; ESR: erythro-sedimentation rate; CT: computerized-tomography; MSCNS: methicilin-susceptible coagulase-negative staphylococci; NP: not performed; AHT: arterial hypertension; OAT: oral antiaggregation therapy; DM: diabetes mellitus (type II); CVH: chronic C virus hepatopathy; CRI: chronic renal insufficiency, OAC: oral anticoagulation.

[a] Normal range: 0–1 mg/dl.

[b] Normal range: 5–20 mm/h.

[c] Cases in which previous open débridement had been performed prior to the one-stage arthroplasty.