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Results of Cemented Anatomically Adapted Total Hip Arthroplasty A Follow-Up Longer Than 10 years

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ABSTRACT

This retrospective single-center study evaluated the >10-year follow-up (FU) and survival of 2 anatomically adapted cemented total hip arthroplasties (THAs) in a series of 308 patients (323 THAs) with a mean age of 76.2 years at operation. At a mean of 11 years of FU, patient-reported outcome measures, clinical examination, and plain radiography were analyzed. In 6 THAs, the femoral and/or acetabular component was revised. Reasons for revision were aseptic loosening and infection. At >10 years of FU, there was an overall survival for both THAs of 98.1%. Radiographic radiolucent lines were seen in 15 THAs affecting Gruen zone 4 and Delee and Charnley zone II. We conclude that both anatomically adapted cemented THAs have an excellent survival at 11 years of FU.

Cemented total hip arthroplasty (THA) in older patients (>65 years of age) results in an effective fixation of the implant to the host bone and shows better implant survival compared with uncemented fixation in this age group [1]. Over the last years, the use of cement fixation in Scandinavia and the Netherlands has remained steady at approximately 30% of all THAs [2,3]. Different types of femoral stems with varying anatomical shapes and geometries are thought to lead to better fixation and better overall survival rates [4], especially in uncemented femoral stems. In cemented femoral stems, the anatomical geometry would be of lesser importance. Both straight tapered stems as well as anatomically shaped cemented stems show excellent long-term survival [5,6]. Nevertheless, studies have shown the importance of anatomically shaped and adapted cemented femoral stems, resulting in a better overall survival of the cemented THA [7]. This retrospective single-center study is designed to evaluate the survival and clinical benefits of 2 different short anatomically shaped cemented THAs (Anatomic Benoist Girard, ABG I and II). The primary aim was to evaluate the overall survival with revision for any reason as end point. The secondary outcome was the clinical and radiological evaluation of the femoral and acetabular component (AC) and the evaluation of the patient-reported outcome measurements (PROMS).

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Patients and Methods

Before the start of the study, institutional review board approval was obtained (no. 14-N-03) and registered online (www.trialregister.nl).

Patients

This study comprises 308 patients, 323 THAs in total. Patient characteristics are summarized in Table 1. All patients who were included for cemented THA between May 2000 and December 2004 received a cemented ABG I or II femoral stem and ABG II cemented AC (Stryker, Hérouville Saint Clair, France). In all patients, the ABG I or II femoral stems were combined with the cemented ABG II standard AC. A lateral approach (n = 236, 73.1%), a posterior approach (n = 75, 23.2%), and an anterolateral approach (n = 12, 3.7%) were used by 6 orthopedic surgeons or residents under direct supervision. Primary osteoarthritis was the most frequent index diagnosis for THA (97.2%) (Table 2).

Implants

The ABG cemented femoral stem is a short anatomically shaped chrome cobalt femoral stem with primarily proximal fixation. In comparison to other anatomically adapted femoral stems, the ABG THA has a higher "shoulder" that facilitates proximal contact to the cancellous metaphyseal bone [8,9]. The ABG I femoral stem has been widely used since 1989 in Western European countries. Since 1997, there has been an adjustment of the femoral stem geometry because of the high failure rates of the uncemented version [9], which led to the introduction of the ABG II femoral stem for both the uncemented and cemented

Table 1
Patient Characteristics of the Total Cohort.

	N = 308
Mean age at operation, y (range)	76.2 (55.6-93.0)
THA, n	323
Left, n (%)	133 (41.2)
Male, n (THA, %)	63 (67, 20.5)

versions. The main differences between the ABG I and II femoral stems concern the overall length which has been reduced by 8% and the proximal and distal diameters which have been reduced by 10% [10]. The articulations used were cobalt/chromium on highly cross-linked nitrogen-irradiated polyethylene (PE) in 322 cases (99.7%) and aluminum oxide ceramic on highly cross-linked nitrogen-irradiated PE in only 1 case (0.3%).

Evaluation

Patients received a letter containing an appointment date for follow-up (FU) and 2 different PROMs: the Dutch-translated and -validated version of the Western Ontario and McMaster University Index (WOMAC) [11,12] and the Oxford Hip Score [13–15]. The WOMAC can be scored from 0 to 100 (best score = 100, worst score = 0), and the Oxford Hip Score can be scored from 12 to 60 (best score = 12, worst score = 60). An overall questionnaire was used in which patients were asked whether they have had any revision surgery of their THA, whether they experienced pain of the THA using the visual analogue scale [16] (no pain = 0, worst pain = 100), and whether they were able to walk unaided. If patients were not able to attend the FU appointment, we used the information of the different PROMs. Patients who did not respond to the invitation for the FU appointment and did not return the PROMs were contacted by telephone and asked if they had revision surgery of their THA. Patients who died during the >10-year FU were reported, and the medical records were analyzed to determine if revision surgery had been performed in our medical center. The general practitioner of the deceased patients and patients who could not be reached by repeated phone contacts was contacted, and inquiries were made on possible revision surgery in other medical centers. If the general practitioner had no patient-related information, patients were considered as lost to FU. Different survival analyses were carried out for the 2 different types of femoral stems, ABG I and II, in combination with the cemented ABG II AC.

Adverse Events

If an adverse event occurred during FU, it was classified as patient related (eg, psychological problems), wound related (eg, wound leakage, postoperative bleeding), surgery related (eg, infection), or prosthesis related (eg, dislocation, fracture, and loosening).

Table 2
Patients' Primary Index Diagnosis for Indication of THA of the Total Cohort (N = 323 THAs), Differentiated Between ABG I and II Femoral Stems.

Diagnosis	n (%)	ABG I (%)	ABG II (%)
Primary osteoarthritis	314 (97.2)	224 (97)	90 (97.8)
Rheumatoid arthritis	1 (0.3)	1 (0.4)	0
Congenital hip dysplasia	1 (0.3)	1 (0.4)	0
Femoral fracture	6 (1.9)	5 (2.2)	1 (1.1)
Broken dynamic hip screw	1 (0.3)	0	1 (1.1)

Physical Examination

Examination consisted of gait assessment, leg length discrepancy, lateral thigh pain on palpation, and range of motion.

Radiological Evaluation

Anteroposterior and lateral radiographs were taken of the operated side(s). Radiographs were examined for periprosthetic osteolysis and radiolucency. A radiolucent line of >1 mm was considered relevant and described according to the Gruen zones [17] for the femoral stem and the zones of Delee and Charnley [18] for the AC. Varus or valgus malpositioning of the femoral stem was assessed as well as cortical bone hypertrophy or resorption and whether the femoral stem was undersized. Polyethylene wear and linear head penetration of the insert were measured using Roman software [19]. All radiographs were examined performed by 3 observers (2 orthopedic surgeons and 1 radiologist).

Statistical Analysis

Statistical evaluation and analysis were performed using SPSS 21.0 software (IBM SPSS, Armonk, NY). Survivorship analysis using Kaplan-Meier was carried out with revision for any reason and revision for aseptic loosening as the end point. The 95% confidence intervals (95% CIs) were calculated and reported. Log-rank (Mantel-Cox) test was used to compare the statistical differences of the survival outcomes between both the ABG I and II femoral stems. We considered *P* values ≤ .05 to be significant for all statistical analyses.

Results

At a mean of 11.0 years of FU, 146 patients (156 THAs, 48.3%) had died of unrelated causes. Seven patients (7 THAs, 2.2%) did not respond, and additional information could not be obtained. These patients were considered lost to FU. The remaining cohort consisted of 155 patients (160 THAs, 49.5%) with a mean age of 85.3 years (range, 66.8-101.1) at FU. Patient distribution is summarized in Fig. 1.

Survivorship Analysis

At FU, 6 patients (6 THAs, 1.9%) had undergone revision surgery of the femoral stem and/or AC after a mean of 18 months (range, 1.0-40.4) after initial surgery. The main reason for revision surgery was aseptic loosening (0.6%) and infection (1.2%), resulting in survival for any reason and aseptic loosening of, respectively, 98.1% (95% CI, 96.6-99.4) and 99.4% (95% CI, 98.5-100). In 3 patients, both the femoral stem and AC were revised; in 2 patients, only the AC was revised; and in 1 patient, the femoral stem was revised. Of the 6 patients who had undergone revision surgery, 5 patients were initially treated for primary osteoarthritis and 1 patient for a femoral fracture. Kaplan-Meier survival analysis with revision for any reason and aseptic loosening of either one or both of the cemented femoral stems is shown in Figs. 2 and 3.

There was no statistically significant difference in the survival rates of the ABG I and II femoral stems ($P = .873$, Table 3). In total, 5 ACs were revised, resulting in a survival rate of 98.5% (95% CI, 96.9-99.7) for the cemented ABG II AC. A worst case scenario, in which all patients lost to FU were considered to have revision surgery of either the femoral stem or AC, would indicate a survival of 96.0% (95% CI, 93.8-97.8).

In 48 patients (49 THAs, 15.2%), a postoperative complication occurred; these complications are summarized in Table 4. Two patients with a surgery-related adverse event had revision surgery of the femoral stem and AC because of a high-grade infection.