Preservation of the Femur in Young Patients undergoing Primary Hip Arthroplasty with Cemented Polished Stems

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ABSTRACT INTRODUCTION:
In young patients undergoing hip arthroplasty, it is preferable to use surgical techniques that preserve the femur for the long term. While some damage to the femur will result from the initial stem insertion surgery, and it might be argued that shorter stems are therefore an advantage, the main problem is progressive femoral bone loss in the long term, loosening, osteolysis and stress shielding resulting in significant femoral bone loss. The aim, therefore, when undertaking hip arthroplasty in young patients, should be to use a femoral stem that preserves bone by minimizing loosening, that has a low incidence of osteolysis and that minimizes the need for femur damage at future revision surgery and the need for long stem revision. This study examined preservation of the femur following the use of cemented polished stems in young patients after hip arthroplasty performed by community surgeons.

METHODS:
Between March 1988 and September 2005, 205 primary total hip arthroplasty (THA) with a cementless collarless polished double-taper stem were undertaken in 177 patients less than 55 years of age. The main diagnosis was primary osteoarthritis (47.1%). Eight hips in eight patients (4.4%) underwent THA for primary and secondary tumours but these cases were excluded from this prospective review. The study cohort therefore comprised 197 hips in 169 patients.

The median age of the patients at initial surgery was 47 years (range 16-54) years. The procedures were performed by surgeons with varying experience in primary THA, including 18 supervising consultant orthopaedic surgeons, 19 arthroplasty fellows and 25 orthopaedic trainees. A posterior approach was used in 160 hips (81%).

The polished stems used were the Exeter and the CPT. There was one monobloc Exeter stem, 122 modular Exeter stems, 32 CPT stainless steel stems and 42 CPT cobalt-chrome stems with 12/14 neck tapers. A cemented Exeter acetabular component was used in 65 hips. An uncemented acetabular component was used in 131 hips. Anteroposterior (AP) pelvis, AP and rolled lateral hip radiographs were taken at each clinical review. Radiographs of hips with five or more years of follow-up, including any revisions, were analyzed. Prosthesis to cement and cement to bone radiolucencies, cement fractures and osteolysis were recorded in each Gruen and lateral zone. Osteolysis was graded according to Goetz into mild, intermediate and extensive. The femoral component was classified as possibly or probably loose using the criteria of Harris et al. Definite loosening was defined as vertical subsidence of more than 5mm. The distance the stem migrated into the hollow centralizer was measured to determine stem within cement subsidence. A further measure of stem within canal subsidence was the width of any radiolucency at the shoulder of the prosthesis at the p-c interface in Gruen zone 1 measured parallel to the stem long axis. Femoral bone deficiencies were classified according to Paprosky and the EndoKlinik. Post-operative femoral fractures were classified using the Vancouver system.

Patients were assessed pre-operatively and at regular post-operative intervals. Outcomes collected included the Harris pain and Hip scores and activity levels using the SICOT Activity Score. Revision was defined as major where all the implant composite at the prosthesis-bone interface, including the cement, was removed or minor if it involved removal of part of the composite, excluding removal at the prosthesis-bone interface, and included head exchange, cement-in-cement stem exchange and acellular liner exchange. Femoral stems continued to be followed clinically and were included in the radiographic analysis.

Survival analyses were undertaken using the Kaplan-Meier method and 95% confidence intervals (CI) were calculated. Survival curves were compared using the log rank test. Survival analysis was not reported after 13 years as there were less than 20 patients in this group. A worst case analysis (WCA) was used to report all patients lost to follow up as a failure.

RESULTS:
Fourteen patients (15 hips) died. Four patients (four hips) were lost to follow-up. Seventeen patients (17 hips) had revision of either component or revision of both components. The surviving 139 patients (161 hips, 82%) had no acetabular or femoral revision and the mean follow-up was 8 years (median 7, range 2–19).

The median pre-operative Harris hip and pain scores were, 38 (range 10-84) and 10 (range 0-44), respectively, and at latest follow-up were 81 (range 30-100) and 42 (range 10-44), respectively. The level of activity improved post-operatively from semi sedentary to light labour.

Survivorship of the polished collarless double tapered stems at 13 years, using the endpoint revision for aseptic loosening, was 100% (worst case analysis 96.5%) and no stems were radiographically probably or possibly loose. No stem was revised for aseptic loosening up to 19 years. Five stems were revised for other reasons using standard length stems. In four of these the femur was preserved by cement-in-cement stem exchange and in one bone was restored by impaction grafting. One B2 periprosthetic fracture was treated by revision to a long cemented stem and a one B1 fracture was treated by internal fixation. Excluding only the two fractures, only 8% of femurs had mild and 4% had intermediate osteolysis, 98% had Paprosky type I and only 2% had type II defects; 77% had Endoklinik grade 0 and 23% had grade 1 bone loss.

There were fifteen acetabular revisions. Two for recurrent dislocation, three at the time of cement in cement stem exchange, eight for aseptic loosening, one for component and cement fracture and one for infection. There were nine acetabular components radiographically classified as loose. Eleven acetabular components had osteolysis. Osteolysis was more common around Exeter acetabular components inserted in the early part of the study.

DISCUSSION:
This study demonstrates that the femur is well preserved in young patients undergoing THA with a cemented collarless polished tapered stem. This is because the causes of bone loss associated with cementless stem fixation were minimized, major periprosthetic femoral fractures were avoided by using a cement technique and, in the mid-term, when revision is required a standard length stem and bone preserving cement-in-cement exchange can usually be used. In the long term the risk of bone loss due to aseptic loosening is minimal and there was relatively little osteolysis. As a result, at latest follow up, 99% of the THA had either the original primary femoral stem in situ which was radiographically not loose or another standard length stem had been inserted using cement-in-cement revision or revision using impaction grafting. Importantly, our study demonstrates that reliable long term results in young patients can be achieved with these types of cemented stems used at THA by community based general orthopaedic surgeons even if they undertake relatively few THA.

REFERENCES: