

THE CEMENTLESS ANATOMIC MEDULLARY LOCKING FEMORAL COMPONENT: AN INDEPENDENT CLINICAL AND RADIOGRAPHIC ASSESSMENT

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OBJECTIVE: To review the clinical performance of the anatomic medullary locking (AML) femoral stem in total hip arthroplasty.

DESIGN: A clinical and radiographic review.

SETTING: A tertiary lower limb joint replacement centre.

PATIENTS: Two hundred and twenty-one patients with noninflammatory gonarthrosis.

INTERVENTIONS: Two hundred and twenty-seven primary total hip arthroplasties with the noncemented AML component completed by two surgeons.

MAIN OUTCOME MEASURES: Independent review by two experienced reviewers of the postoperative Harris hip score, radiographs of component fixation, size and degree of diaphyseal fill.

RESULTS: Harris hip score was 84 (range from 43 to 98); component fixation showed bone ingrowth in 41%, stable fixation with fibrous ingrowth in 56% and unstable fixation in 3%; severe thigh pain in 4% of cases correlated with unstable fixation, and there was mild thigh pain in 20% of cases.

CONCLUSION: The AML femoral stem performs well in replacement arthroplasty compared with other noncemented stems.

OBJECTIF : Examiner le rendement clinique du blocage médullaire anatomique de la diaphyse fémorale dans une arthroplastie totale de la hanche.

CONCEPTION : Examen clinique et radiographique.

CONTEXTE : Centre tertiaire de remplacement des articulations des membres inférieurs.

PATIENTS : Deux cent vingt et un patients atteints de gonarthrose non inflammatoire.

INTERVENTIONS : Deux cent vingt-sept arthroplasties primaires totales de la hanche avec élément de blocage médullaire anatomique non cimenté réalisées par deux chirurgiens.

PRINCIPALES MESURES DES RÉSULTATS : Examen indépendant par deux examinateurs chevronnés des résultats postopératoires de Harris, radiographies de la fixation des éléments, taille et degré de remplissage de la diaphyse.

RÉSULTATS : Le résultat de Harris s'est établi à 84 (fourchette de 43 à 98); la fixation des éléments a révélé une interposition osseuse chez 41 % des sujets, une fixation stable avec interposition fibreuse chez 56 % et une fixation instable chez 3 %; on a établi une corrélation entre une douleur grave à la hanche dans 4 % des cas et une fixation instable, et l'on a enregistré une douleur légère à la cuisse dans 20 % des cas.

CONCLUSION : Le blocage médullaire anatomique de la diaphyse fémorale donne un bon résultat dans une arthroplastie de remplacement par rapport à d'autres diaphyses non cimentées.

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Total hip arthroplasty remains a viable treatment option for patients with disabling hip arthropathy, but controversy continues concerning the optimal method for fixation of the femoral component. Numerous publications have supported fixation utilizing modern cement technology,¹⁻⁶ and a similar number have supported osteointegration, making use of a noncemented porous-coated femoral component.⁷⁻¹³ In this paper we evaluate the 9-year experience of two senior arthroplasty surgeons (R.W.G. and T.W.P.), who used exclusively the two-thirds porous-coated anatomic medullary locking (AML) component (DePuy Inc., Warsaw, Ind.) for noninflammatory arthropathy. As such, the patient population has not been pre-selected in any way.

PATIENTS AND METHODS

Between June 1985 and December 1991, 324 primary total hip arthroplasties were performed in 304 patients for noninflammatory coxarthrosis. Of this patient population, 27 patients declined to have their cases reviewed, 51 patients were dead and another 19 patients had moved and were therefore unavailable for review. Thus, the study population included 227 primary total hip arthroplasties in 221 patients.

In each case a two-thirds porous-coated AML femoral component was placed in combination with a variety of acetabular components. One surgeon (R.W.G.) used only a posterior approach with capsular and external rotator repair (154 cases), whereas the other surgeon (T.W.P.) used either a similar posterior approach (53 cases) or a transtrochanteric approach (20 cases). All patients received antibiotic prophylaxis for infection and deep venous thrombosis and all were nursed

on the same orthopedic ward and underwent identical postoperative mobilization and physical therapy.

The patients were reviewed at an average of 4 years after arthroplasty (range from 2 to 9.2 years) by two experienced independent observers (D.G.C. and B.R.S.). This review included a clinical rating as described by Harris,¹⁴ a detailed history regarding thigh pain, and plain anteroposterior and lateral radiographs. Immediate postoperative and 3-month follow-up x-ray films were also used for comparison. Radiographic evidence of femoral component fixation was evaluated according to the recommendations of Engh and Bobyn.⁷ Radiographs were reviewed for the presence of spot welds, calcar resorption, periprosthetic sclerosis, distal pedestal formation and component migration. Fixation status was classified as either bone ingrowth, stable fibrous or unstable. In addition, the degree of diaphyseal fill was calculated at the distal extent of porous coating (Fig. 1). Areas of cortical bone atrophy identified by standard radiographic techniques were quantified (Fig. 2). The presence and severity of thigh pain were reviewed. Differences in the findings were analysed by the *t*-test, a probability value of less than 0.05 being considered significant.

FINDINGS

The diagnosis was osteoarthritis in all but eight cases: three were cases of avascular necrosis, four of post-traumatic arthritis and one of previous hip sepsis.

There was a similar distribution of right (107) and left (120) hip replacements. The average patient age was 58 years (range from 40 to 93 years). This average is relatively young because 51 older patients (average age 78 years) died and therefore were not included in the study population. The

average final Harris hip score was 84 points (range from 43 to 98).

No correlation could be found between final Harris hip score and patient age, weight, sex or preoperative diagnosis. Likewise no difference was noted between the two surgeons' patient populations.

Radiographic evaluation revealed that 41% (92) of femoral components had bone ingrowth fixation, 56% (128) had stable fibrous fixation and 3% (7) had unstable fixation. There was no correlation between ultimate fixation type and degree of diaphyseal fit.

On careful review, the overall incidence of persistent thigh pain (longer than 2 years) was 24%. Twenty percent (45) of patients viewed this as an activity-related pain, which was not disabling. There was no correlation with either component size or degree of diaphyseal fill. Four percent (nine) of patients felt that the pain was indeed disabling, interfered with activities of daily living and negatively affected the overall efficacy of the total hip arthroplasty. There was a significant ($p = 0.01$) correlation with unstable component fixation in the patients with severe thigh pain.

Calcar atrophy sufficiently advanced to be uncovered with routine radiographic techniques occurred in 126 hips (56%) (Fig. 2). This atrophy extended for an average of 2.2 mm below the component collar. The maximum measured calcar loss was 15 mm. No correlation was found between the degree of proximal cortical atrophy and either femoral component size (10.5 to 19.5) or diaphyseal component fit (6.4 to 1.00).

The incidence of heterotopic bone, as described by Brooker and associates¹⁵ was as follows: grade 0 — 55%, grade 1 — 35%, grade 2 — 7% and grade 3 — 3%.

Revision surgery was required in five cases. Two cases of femoral frac-

ture required revision to longer-stemmed components. One loose and painful femoral component was converted to a cemented component. Two cases of accelerated acetabular polyethylene wear required acetabular revision. Both patients were heavy-set farmers, with great demand upon their arthroplasties.

DISCUSSION

The use of noncemented femoral components in total hip arthroplasty was developed in response to dissatisfaction with the long-term functional results and survival of cemented components.^{1,9,16} Proponents of cemented

fixation would suggest that recent changes in cement technology have resulted in improved durability of fixation of the cemented femoral component.^{2-5,17} They would also suggest that the incidence of thigh pain is much lower than that reported using cementless femoral components.^{6,9-13,18} This independent review of a nonselected series of patients revealed a 20% incidence of persistent thigh pain. We could not uncover any surgical factor predisposing to this problem. We did find that patients with severe thigh pain (4%) had a high incidence of radiographic loosening of the femoral component. This would suggest, therefore, that although thigh pain

does occur with use of the AML femoral component, it is unlikely to be disabling, unless the component is loose. This conclusion compares favourably with previous published data on cementless arthroplasty.^{2-5,7}

Previous studies have attempted to correlate component size and fit with the presence and severity of proximal cortical atrophy.^{8,10,11,19-21} We did not identify any such correlation. We suspect that this is because of the relative insensitivity of our radiographic measurement of cortical atrophy compared with the techniques used in previous studies.^{17,20,21} It is our impression, however, that the severity and progression of cortical bone loss associ-

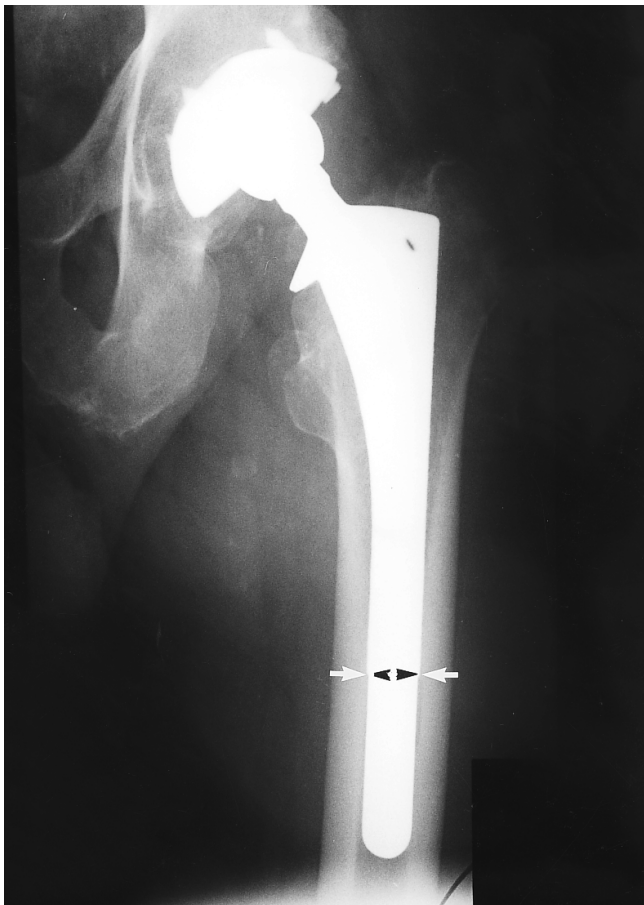


FIG. 1. Calculation of degree of diaphyseal fill. Each case was assigned score equal to diameter of femoral component divided by endosteal diameter. These measurements were taken at level of distal extent of porous coating (arrows).

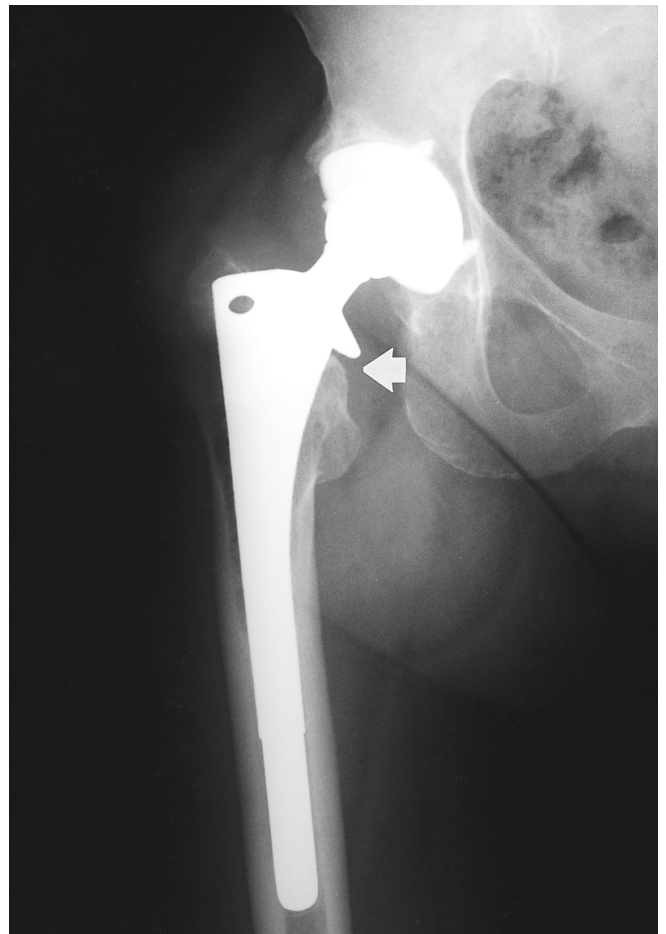


FIG. 2. Typical medial bone resorption. Amount of atrophy was determined by measuring perpendicular distance between medial extent of component collar and underlying medial cortex. Arrow shows calcar region.

ated with stress relief is much less of a clinical problem than either osteolysis induced by particulate debris or severe thigh pain from unstable fixation of the femoral component.

We could not document any relationship between diaphyseal fill and ultimate type of component fixation. It has been shown previously that stable initial fixation is a prerequisite for stable biologic fixation. Our results suggest that stable initial multipoint fixation may be obtained without maximal diaphyseal fill. It remains our practice, however, to maximize diaphyseal cortical contact and neutral component angulation by ensuring central placement of the intramedullary reamer entrance hole and using the largest possible component.

In summary, the AML porous-coated femoral component has been shown in this series to perform well, with an overall loosening rate of 3% at average 4-year follow-up. Stable fixation was achieved in 97% of cases: bone ingrowth in 41% and stable fibrous fixation in 56%. There has been no suggestion that patient age, diagnosis, weight or sex adversely affect these excellent clinical results. We found no evidence that proximal cortical atrophy is related to either increased femoral component size or increasing degree of diaphyseal fill. We have shown that severe disabling thigh pain suggests unstable AML femoral component fixation.

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