HIP

The radiological outcome of uncemented femoral stems in rheumatoid patients undergoing total hip arthroplasty: results at minimum eight years

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Abstract

Background: Rheumatoid arthritis is a multi-systemic disease which affects all synovial joints. Compromised bone quality may have a negative impact on prosthesis incorporation after total hip replacement, resulting in an increased risk of aseptic loosening and early implant failure.

Materials and methods: Between 2002 and 2007, 49 patients (age 29–80 years) underwent total hip replacement. Radiographs were evaluated for signs of loosening or failure.

Result: Of the 49 hips, there was one case of stem subsidence, and one case of aseptic loosening. There were no revisions in the current series. Complications included eight (16.3%) intra-operative calcar fractures, which healed uneventfully.

Conclusion: We report satisfactory radiological results, and revision rate in a group of rheumatoid patients at mid-term review following total hip replacement with uncemented femoral stems.

Key words: rheumatoid arthritis, uncemented stem, femoral stem, hip, total hip arthroplasty, radiological assessment

Citation: Abughalya MS, Ryan P, Goga IE. The radiological outcome of uncemented femoral stems in rheumatoid patients undergoing total hip arthroplasty: Results at minimum eight years. *SAOJ* 2017;**16**(3):22-26. DOI 10.17159/2309-8309/2017/v16n3a1

Editor: Prof Anton Schepers, University of the Witwatersrand

Received: March 2016 *Accepted:* October 2016 *Published:* August 2017

Funding: No funding was received for the writing of this article.

Conflict of interest: The authors declare they have no conflicts of interest relating to this article.

Introduction

Rheumatoid arthritis (RA) is a chronic systemic inflammatory disorder characterised by multiple joint involvement. The hip joint is commonly affected (15–30% of patients).[1]

The disease process, medication and steroid use affect bone properties which lead to changes in bone bio-mechanics.[2,3] Destruction of articular cartilage, bony deformity and protrusion are commonly seen in rheumatoid hip disease. Alterations to joint morphology, as well as bone quality contribute to an increased risk of intra- and post-operative complications.[4]

There is a two-fold increase in the frequency of osteoporosis compared to the general population.[5] This results in a decreased potential for bony in/on-growth to uncemented prosthesis, and a decrease in fixation strength, with early aseptic loosening. For this reason, cemented total hip replacement (THR) has been considered by many to be the gold standard for patients with RA.[1] With modern cementing techniques, stem survival rates are increased as the relative risk for stem loosening decreases.[6]

The use of uncemented prostheses for hip arthroplasty continues to rise as shown in numerous national joint registries.[7,8] Although there have been some disappointing results for certain uncemented femoral stem designs used in this patient group – with high rates of subsidence and loosening – others have been more encouraging.

With this in mind, we set out to perform a mid-term review of the radiological outcomes of a group of rheumatoid patients who had total hip replacements at our institution.

Methods and materials

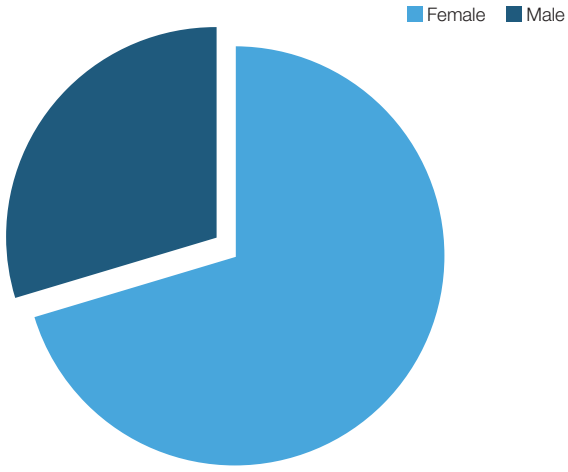
This study was conducted at the local arthroplasty unit in Durban, KwaZulu-Natal. From 2002 to 2007, 61 cementless primary total hip replacements were performed in 46 rheumatoid patients. At the time of review, three patients had demised, and nine were lost to follow-up.

In the remaining 34 patients, 49 uncemented THRs were performed.

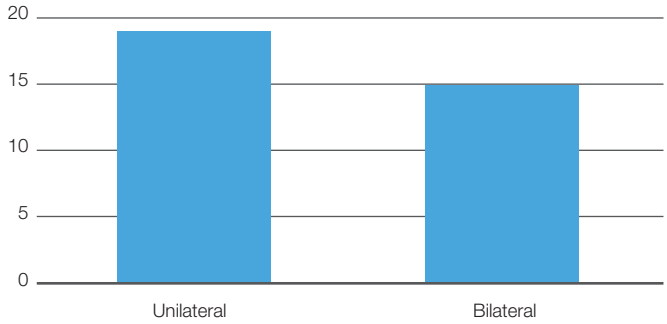
At the time of hip arthroplasty, the patients were aged between 29 and 80 years (mean of 58.4 years) (SD=12.12) *(Table I)*. There were ten males, and 24 females *(Graph 1)*, with 70.8% of the patients being female. Fifteen patients had bilateral THRs and 19 patients had unilateral THRs *(Graph 2)*.

Table I: Descriptive statistics

	Mean (SD) n=51
Age (years)	58.43 (12.12)
Years between surgery and final follow-up	8.82 (1.70)



Graph 1. Sex of patients



Graph 2. Uni and bilateral split

All patients were operated on through a modified Harding approach. All patients had index surgery without previous hip surgery. The femoral component was a collarless fully hydroxyapatite coated stem (Corail, De Puy international Ltd) in 34 hips and a tapered grit blasted stem (CLS Zimmer, Warsaw) in four.

Follow-up ranged from 8 to 13 years (mean of 8.8 years) (SD=1.70).

The hips were evaluated radiographically pre-operatively and post-operatively by standardised anteroposterior view and lateral view of the hips. All measurements were taken by using Siemens *syngo*.plaza software, and magnification errors were accounted for.

The radiological assessment was made according to the following criteria:

- Stem subsidence defined as a >5 mm change in distance between the top of the stem and greater trochanter[9] as in *Figure 1*
- Stem position in relation to the long axis of the femoral shaft in anteroposterior view as shown in *Figures 2a and b*, valgus or varus more than 3 degrees[10]

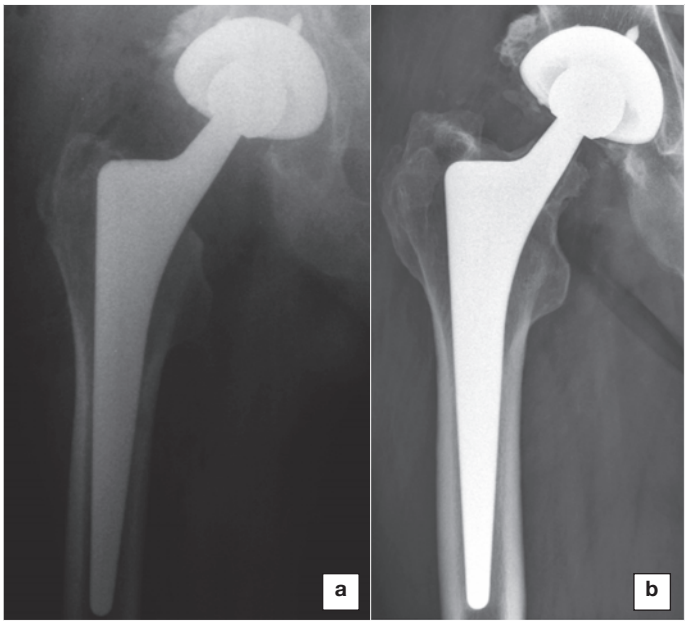


Figure 1. (a) Immediate post-operative and (b) most recent film showing stem subsidence, but solid stem fixation

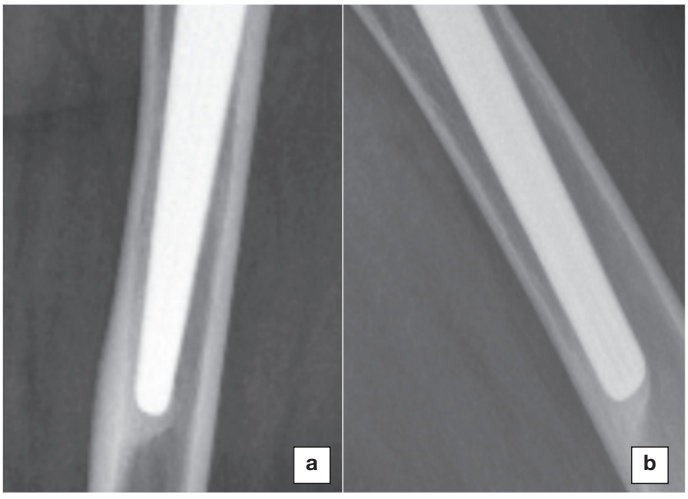


Figure 2. (a) AP view and (b) lateral view, demonstrating reactive bone formation from the tip of the femoral prosthesis towards the medial and anterior cortices

Figure 3. AP radiograph of right femoral stem demonstrating reactive double line formation in Gruen zone 1

Figure 4. Right hip replacement with medial calcar resorption/osteolysis

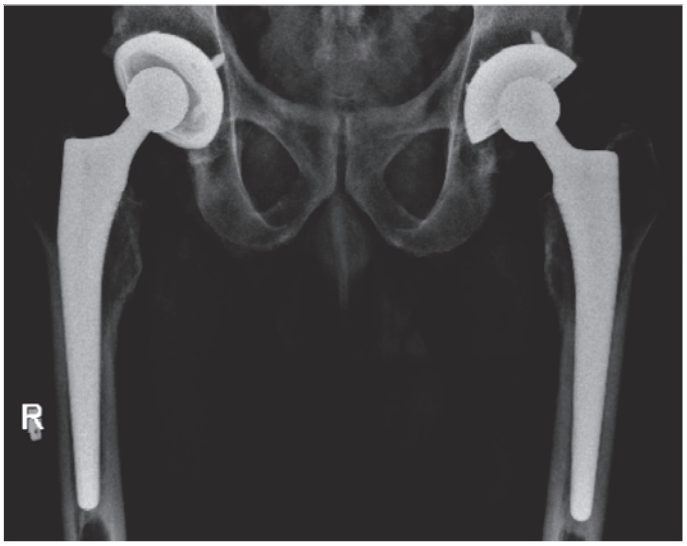


Figure 5. Bilateral THRs and bilateral proximal stress shielding

- Loosening of the stem based on Gruen zones[11] as result of subsidence >5 mm, progressive change in the stem position >3 degrees, or continuous radiolucency more than 2 mm[12] (*Figure 3*)
- Stability of the femoral stem was graded as stable ingrown fixation or unstable according to Engh's criteria[13]
- Femoral remodelling as evidenced by calcar resorption, cortical hypertrophy (*Figure 4*)
- Stress shielding as evidenced by a decrease of bone quality of the trochanters due to unloading of the proximal femur (*Figure 5*).

Data was analysed with Stata v.12. Descriptive statistics were calculated for the data, including mean and standard deviation for continuous data, and frequency and proportions for categorical data. Chi-squared tests were used to identify significant associations between categorical variables. A significance level of $p<0.05$ was deemed significant.

Results

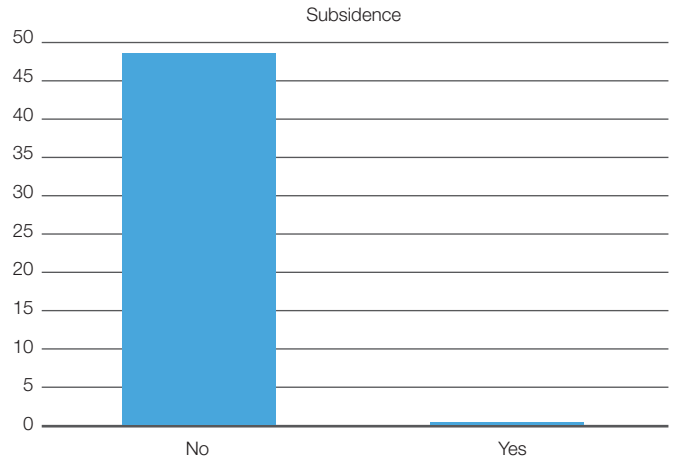
The records and radiographs of 49 patients were retrospectively analysed.

The stem position was central in 42 hips, varus in six hips, and valgus in one. There was one (1.9%) case of femoral subsidence *(Graph 3)*. This was noted in the six-week follow-up X-ray, and is considered to be due to undersizing of the femoral component (*Figure 1*). There were eight cases (16.3%) of intra-operative calcar cracks, six of which were fixed with Charnley wire, and two which were not. All fractures healed uneventfully, with no subsidence.

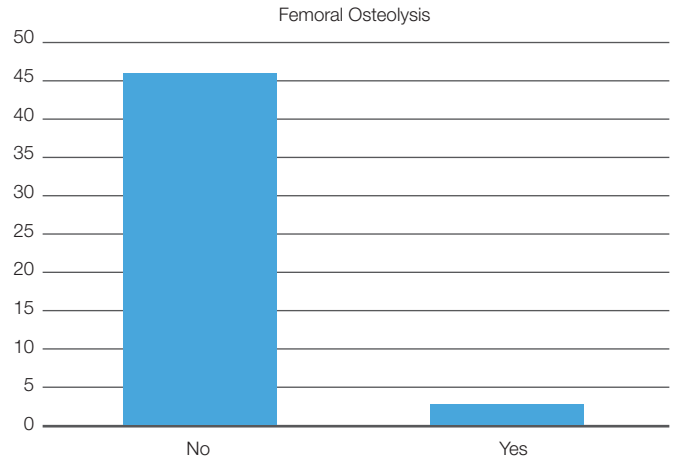
Reactive double line formation from bone remodelling was noted in zone 1 in five hips (*Figure 3*), and at the distal tip of the component in 28 hips (57.14%). Femoral calcar resorption was noted in two cases *(Graph 4)*, mild stress shielding was seen in 17 cases (33%), and more significant stress shielding in two hips (3.9%) *(Table II)*.

Although, one hip was deemed to be radiologically loose, there were no revisions in this group.

Chi-squared tests (Fischer's exact) indicated a significant association between femoral calcar resorption and femoral osteolysis ($p=0.001$), femoral stress shielding ($p=0.012$) and femoral alignment ($p=0.001$). However, no significant association was observed between femoral osteolysis and femoral calcar rounding ($p=0.12$), and femoral alignment ($p=0.072$). The sex of the patient was not significantly associated with any of the variables.



Graph 3. Indication of femoral subsidence



Graph 4. Indication of femoral calcar resorption

Discussion

Total hip replacement has been shown to be a hugely beneficial and cost-effective procedure in rheumatoid patients, improving hip function, relieving pain, and improving quality of life.[14,15] However, there remain concerns regarding periarticular bone stock in the rheumatoid patient. Akesson *et al.*[16] reported that compared to patients with primary osteoarthritis, rheumatoid patients going for hip arthroplasty showed an increase in bone turnover and a greater amount of unmineralised bone. This is postulated to be the cause of early implant loosening in rheumatoid patients.

Reported series of the use of cemented THRs in rheumatoid patients show varying degrees of success. Poss *et al.*[17] reported results at seven years' follow-up: 96% of the patients in this study were happy with their outcome, and were clinically improved. Despite 31% femoral stem subsidence, there was only a 1.6% revision rate.[17] Ranawat *et al.*[18] reported 8% femoral loosening at an average 4.3 years' follow-up with cemented stems. Severt *et al.*[19] reviewed 75 rheumatoid patients at an average of 7.4 years, and reported three loose stems, and one revision for aseptic loosening. Creighton *et al.*[20] found that cemented prosthesis survival in RA patients is comparable, if not better, compared to other diagnoses.

With the introduction of modern cementing techniques, femoral stem survival rates have improved. Rasquinha[21] reported on 15 THRs at 15-year follow-up, with no aseptic loosening or stem revisions.

When considering cemented THR one should remain cognisant of the risk of haemodynamic instability inherent during the cementing process.[22,23] Deep infection rates may also be increased due to the increase in operating time, and the local deep tissue injury from cement curing.[17,19,24-27] The calculated cost of utilising cemented prostheses should include the increase in theatre time, which may be as much as 20 minutes longer on average than uncemented THR.[28]

Cementless fixation of femoral stems has become more popular, and good long-term results can be expected if there is solid biological integration. However, subsidence rates as high as 80% have been reported.[29] Implant loosening does not necessarily correlate with implant survival. Unger *et al.*[25] reported an overall 16.7% revision rate in RA patients at 12.1 year follow-up, with a further 15.7% prostheses being radiologically loose.

According to a study from the national Finnish register, uncemented prostheses performed better in both juvenile and old rheumatoid patients when compared to matched groups of patients with cemented stems.[30,31]

In the Swedish Hip Arthroplasty Registry between 1992 and 2007, it was shown that the risk of revision for uncemented femoral stems for any reason was lower than that for cemented stems. Revision for aseptic loosening was also lower in the uncemented group, after adjusting for age, sex, and underlying diagnosis.

However, reasons for revision differed between the two groups, with a higher proportion of the revisions in the uncemented hips being for fractures (17%) compared to that of cemented stems (6% of the revisions in this group).[27]

Table II: Categorical proportions

		N (%)
Sex	Male	14 (29.2)
	Female	34 (70.8)
Type of femoral implant	Corail	44 (89.8)
	Zimmer	4 (8.2)
	Unknown	1 (2.0)
Femoral alignment	Central	38 (79.2)
	Valgus	1 (2.1)
	Varus	9 (18.7)
Femoral reactive double line formation	None	45 (91.8)
	Superolateral	4 (8.2)
Femoral stress shielding	None	32 (65.3)
	Mild	16 (32.7)
	Moderate	1 (2.0)
Femoral calcar rounding	No	47 (95.9)
	Yes	2 (4.1)
Femoral calcar resorption	No	43 (87.8)
	Mild	5 (10.2)
	Severe	1 (2.0)
Femoral cortical thickening	No	46 (93.9)
	Medial	3 (6.1)
Femoral osteolysis	No	46 (98.0)
	Yes	1 (2.0)
Femoral reactive bone formation	No	20 (40.8)
	Yes	29 (59.2)
Subsidence	No	48 (98.0)
	Yes	1 (2.0)
Femoral component fixation		49 (100.0)

Although we had one case of subsidence, and one case of femoral component loosening, there were no revisions in this series.

Several studies report the most common complication in uncemented total hip arthroscopy (THA) is intra-operative fracture, which may or may not need fixation. Such fractures do not necessarily affect implant stability or long-term survival.[32-35] In this series, there was a 16.3% fracture rate; however, none of these stems subsided, or were radiologically loose.

Conclusion

In this current retrospective case series, we have demonstrated satisfactory radiological results at a minimum of eight years post-surgery. Although, previous studies consider cemented femoral prostheses as the gold standard for rheumatoid patients, this study confirms that cementless femoral stem fixation is a safe alternative.

Compliance with ethics guidelines

Ethics clearance was approved by BREC (Biomedical Research Ethics Cpmmittee) which is registered with the South African National Health Research Ethics Council (REC-290408-009) and has US Office for Human Research Protections (OHRP) Federal-wide Assurance (FWA678).

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