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Original article

Mid-term outcomes after distally locked-to-standard primary stem exchange in 29 hip-prosthesis patients

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ABSTRACT

Background: Cementless locked femoral stems are used for revision surgery in patients with bone loss to induce spontaneous bone reconstruction, allowing subsequent replacement by a standard primary stem. The small number of patients and short follow-ups available to date preclude a valid assessment of this strategy.
Hypothesis: After distally locked stem revision, replacement by a standard primary stem does not induce complications, and the quality of the bone reconstruction allows strong fixation of a regular primary stem.
Materials and methods: We retrospectively evaluated 29 patients in whom a distally locked femoral stem was replaced by a standard primary stem between 1998 and 2010 (cemented in 27, cementless in 2 cases). The reason for the procedure was stem breakage, stem migration, or thigh pain. Mean patient age was 63 years (range, 39–78 years). Outcomes were evaluated based on the Postel-Merle d'Aubigné [PMA] score and Harris Hip Score [HHS]. In addition, radiographs were obtained to assess prosthesis fixation and the Hofmann cortical index measured the bone reconstruction.
Results: The distally locked stem was removed via a postero-lateral approach without femoral osteotomy in all the 29 cases. In one patient, an intra-operative fracture occurred during femoral preparation. Mean follow-up after the exchange procedure was 75 months (range, 3–188 months). Postoperative ccomplications occurred in 9 (32%) patients and consisted of chronic infection in 2 patients (after 3 and 76 months), post-traumatic peri-prosthetic fractures treated with internal fixation in 3 patients (after 100, 138, and 182 months), aseptic loosening in 3 patients (after 13, 39, and 122 months), and recurrent instability in one patient (after 63 months). All cause revision stem survival after 75 months was 72% (95% confidence interval, 47%–87%). In the 19 patients who still had their revision stem at last follow-up, the mean PMA score was 16.7 (range, 13–18) and the mean HHS was 88.2 (range, 59–99). The Hofmann index remained unchanged [36.5% (range, 28%–58%) before the exchange and 32.9% (range, 20%–57%) after the exchange; $P = 0.129$].
Discussion: This study confirms the feasibility of substituting a distally locked stem with a standard primary stem. No specific complications occurred and no technical difficulties arose when extracting the long stems. However, the 32% complication rate and, more specifically, the occurrence of loosening in 10% (3/29) of patients mandates caution in the use of this technique, which should not be proposed routinely, and suggests a need for considering cementless fixation of the standard primary stem.
Level of evidence: Level IV, retrospective study.

1. Introduction

The increasing number of total hip arthroplasty (THA) revisions [1] and the high prevalence of bone loss found during these procedures prompted the development of cementless locked femoral stems, which were first introduced in 1987 [2]. Ultime™ (Wright Medical, Créteil, France) was a titanium alloy stem equipped with three to five locking screws and partially coated with hydroxyapatite at the metaphysis to induce secondary proximal fixation [3]. Early case-series studies showed that this stem was well tolerated and stable in older patients. In some patients, however, particularly those in the younger age groups, spontaneous femoral bone repair was followed by thigh pain or breakage of the stem or screws. These complications were ascribed to inadequate osteo-integration of the locked stem, whose replacement by a standard primary stem was therefore advocated [2–4]. This sequence, from a long-to-shorter stem, had been envisioned initially by the designers of the locked stem but rarely used in everyday practice, except in the event of

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failed locked stem fixation [2,3]. The only published data on long-to-short stem substitution comes from a 2011 study by Miletic et al. [4] in 15 patients, most of whom received a cementless standard primary stem. Highly satisfactory results were recorded after a mean follow-up of 55 months. We are unaware of any published studies reporting long-term outcomes of long-to-short stem substitution.

We hypothesised that long-to-short stem substitution was not associated with any specific complications and that bone reconstruction around the distally locked stem allowed stable fixation of the standard primary stem. The objectives of this study were to establish the technical feasibility of long-to-short stem substitution, particularly regarding locked stem extraction without femoral osteotomy, and to evaluate the mid-term outcomes of the standard primary stems.

2. Material and method

2.1. Patients

We retrospectively studied a single-centre series of patients who underwent exchange of a distally locked stem for a standard primary implant. Of 217 Ultime™ distally locked stems implanted between April 1995 and May 2008, 29 (in 29 patients) were replaced by a standard primary stem between March 1998 and November 2010.

Mean age at THA revision surgery with implantation of an Ultime™ distally locked femoral stem was 59 years (range, 38–79). There were 20 men and 9 women with a mean body mass index of 27.3 kg/m^2 (range, 19.7–36.3). The reasons for implantation of the distally locked stem were stem loosening in 20 patients, a Vancouver B3 [5] peri-prosthetic fracture in 5 patients, re-implantation of a total hip-prosthesis as part of the two-stage management of prosthetic infection in 3 patients, and an intra-operative fracture during implantation of a primary prosthesis in one patient. Bone loss was severe in 6 (20%) patients (SOFCOT stage III or IV) [6]; bone loss stages in the remaining patients were stage 0 ($n = 3$), stage I ($n = 9$), and stage II ($n = 10$). A trans-femoral approach was required in all the 29 patients to remove the stem and/or cement (Table 1), warranting the use of a distally locked cementless stem in the 22 patients with moderate bone loss (stages 0 to II).

Mean age at long-to-short stem substitution was 63 years (range, 39–82 years). The mean Postel-Merle d'Aubigné [PMA] score [7] was 11.4 (range, 8–14) and the mean Harris Hip Score [8] was 43.3 (range, 10–70). The reason for the substitution was stem breakage with no femoral fracture in 2 patients, screw breakage with stem migration in 2 patients, stem subsidence at a distance from unlocking in 4 patients, and thigh pain due to poor osteo-integration in 21 patients. In contradiction to the underlying principle of the distally locked stem design, none of the patients underwent routine conversion to a standard primary stem. At the time of de-escalation, the SOFCOT bone loss stage was 0 in 5 patients, I in 22 patients, and II in 2 patients. The standard stem was cemented in 27 patients and cementless in 2. One patient required implantation of a new distally locked stem after a femoral fracture, which occurred intra-operatively (Table 1) during the preparation for a cemented standard primary stem leaving 28 cases available.

2.2. Operative technique

All 29 procedures were performed via a postero-lateral approach with an additional lateral incision in the thigh for the removal of the locking screws. The stem contours were released first to allow extraction without a femoral osteotomy. The choice of the standard primary stem was at the discretion of the surgeon, who selected a cemented Contact™ stem (Wright Medical, Créteil, France) in 27 patients and a cementless Profemur-L™ stem (Wright Medical, Créteil, France) in 2 patients. In one patient, a femoral fracture occurred intra-operatively during the preparation of the femur and required implantation of a new distally locked stem. The cement was injected in the anterograde direction using a syringe with distal aspiration. Bone grafting was not used. A single patient underwent cup revision; a cemented polyethylene cup was replaced by a dual mobility cup cemented into the original reinforcement cage.

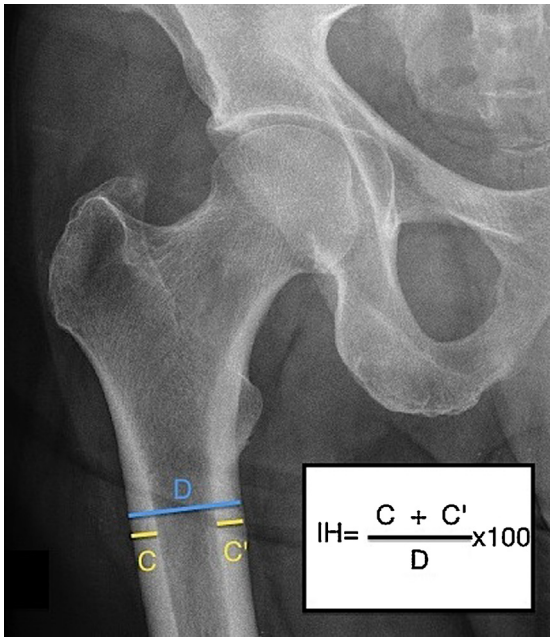

Fig. 1. Method used to determine the Hofmann index (HI): the sum of the thicknesses of the medial (C′) and lateral (C) cortices is divided by the femoral diameter (D) and the result is converted to a percentage.

2.3. Assessment methods

Clinical outcomes were evaluated at least follow-up based on the PMA score [7] and HHS [8]. An antero-posterior pelvic radiograph and lateral hip radiograph were obtained for the evaluation of implant position. In addition, peri-prosthetic lucencies were identified and classified according to Grüen et al. [9] in patients with cemented stems, and evidence of failed osteo-integration was sought in those with cementless stems. For both cemented and cementless stems, subsidence or migration over more than 5 mm or 5° was considered significant. Bone loss was evaluated using the SOFCOT staging system [6] and bone repair using the Hofmann cortical index [10] determined 1 cm and 10 cm distal to the lesser trochanter (Fig. 1); the values of these parameters at the time of the substitution procedure and at last follow-up were compared. Failure was defined as revision surgery for loosening, peri-prosthetic fracture, or infection.

2.4. Statistical methods

The data were described using the mean ± SD with the range. To compare the PMA score, HHS, and Hofmann index values obtained postoperatively and at last follow-up, we used the non-parametric Wilcoxon test for paired samples, with P values of 0.05 or less being considered significant. A Kaplan–Meier plot with the 95% confidence interval (95% CI) was established to assess the overall stem survival.