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Short Stems Versus Conventional Stems in Cementless Total Hip Arthroplasty: A Long-Term Registry Study

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ABSTRACT

Background: Short stems in total hip arthroplasty (THA) have recently gained increasing popularity, allowing mini-invasive exposures and bone-sparing approaches. However, long-term studies and recommendations for the routine use are not available. The aim of this report was to compare the survival rates and the reasons for revision of short stems versus conventional stems in cementless THAs, in a registry-based population.
Methods: The Registry of Prosthetic Orthopedic Implants (RIPO) was inquired about cementless THAs performed since 2000 to 2016. The stems were divided into short (<12 cm) and conventional ones, and then, classified according to the classification by Feyen and Shimmin: short stems with neck-retaining osteotomy (group A: 1684 hips), short stems with standard osteotomy (group B: 2727 THAs), and conventional stems (group C: 57,359 cases). Demographics, survivorships, and reasons for revision were investigated and compared.
Results: Short stems were preferentially implanted in younger patients and normal morphologies. Short and conventional stems showed comparable survival rates at long-term follow-up (>90% at 15 years). The rates of stem aseptic loosening, intraoperative fractures, and periprosthetic fractures were similar in the 3 groups. Group B had higher rates of revisions due to primary instability (early dislocations and impingement-related events; $P < .05$). Revisions due to pain were nonsignificantly higher in group B.
Conclusion: Short stems are reliable implants at long-term follow-up. The comparison with conventional stems showed no additional risk of premature aseptic loosening and intraoperative and periprosthetic fractures. However, the high rate of revisions due to pain and, mostly, primary instability should be investigated in clinical trials.

Cementless conventional stems in total hip arthroplasty (THA) were reported to achieve dependable clinical and radiological outcomes, with long-term survival rates [1]. However, the technical developments of the implants, with special regard to young patients and mini-invasive approaches, led to short stem designs [2–5].The rationale of the short stems was a secure primary fixation in the metaphysis, relying on a 2-point anchorage and an anatomic shape to fill and fit the proximal femur [2–5]. The axial and rotational stability provided by the diaphyseal engagement in the long stems was considered negligible [2–5]. In this way, these implants aimed to provide long-term durability, bypass the proximal-distal mismatch, preserve the bone stock and the soft tissues, allow mini-invasive approaches and reduce the thigh pain to a minimum [2–5].

The first outcomes of short stems seemed encouraging, confirming some of their theoretical advantages [2–6]. The short design reduced the bone resorption when compared to long-stemmed implants (3% vs 20%), and it improved the distal and lateral bony ingrowth [7]. Moreover, the finite element analysis described a more anatomical distribution of the strain in short and ultrashort stems [8]. Clinically, the results of short-stemmed THAs were successful, mostly in young cohorts: thigh pain was

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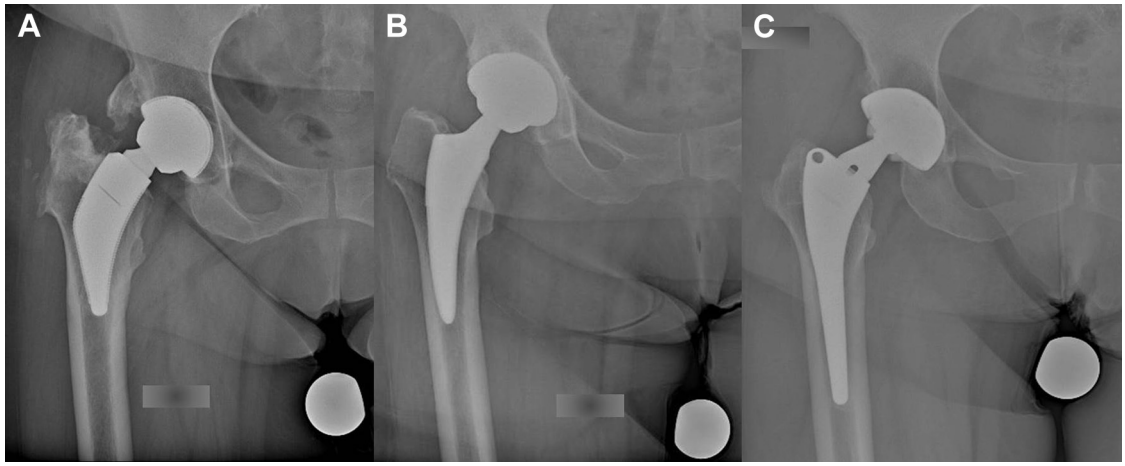

Fig. 1. Anteroposterior X-rays of 3 implants, one for every group, were provided, marked with the corresponding letter. A-type stem, short stem with neck sparing resection: Parva (Adler Ortho, Milan Italy; 289 THAs) at 5 years; B-type stem, short stem with standard resection: Fitmore (Zimmer, Warsaw, US; 555 THAs) at 7 years; C-type stem, conventional stem: Apta (Adler Ortho, Milan, Italy; 5717 THAs) at 7 years. In all the cases, a good osseointegration was evident, the first stem showing mild heterotopic ossifications.

occasional, and good to excellent clinical outcomes were achieved. The survival rate was stable and not inferior to the conventional implants [2–6,9–13]. However, most of the reports were small case series with short-term or mid-term follow-ups [2–6,9–13].

This report aims to describe the survival rates and the reasons for revision of 3 cohorts of THAs, retrieved from a regional implant registry: the 3 groups included standard stems, short stems with standard neck resection and short stems with femoral neck sparing resection, according to the classification by Feyen and Shimmin[3].

Materials and Methods

The Registry of Prosthetic Orthopedic Implants (RIPO) is the arthroplasty registry of Emilia-Romagna region, involving more than 4,450,000 inhabitants [14]. It actively collects primary and revision hip, knee, and shoulder arthroplasty procedures since January 2000 [14]. The database includes the clinical conditions of patients, the features of surgical procedures, the type (batch and code) and fixation of implants, similar to the most important national registries. It involves 68 orthopedic units in Emilia-Romagna [14].

The database of RIPO was inquired about cementless THAs. Three clusters of THAs were identified basing on the stem length and the height of osteotomy. The groups were divided according to the definition of short stem (<120 mm), the classification by Feyen and Shimmin, and the device description and surgical technique provided by the manufacturers [2–5]. Thus, the 3 groups were A, short stems with femoral neck sparing resection; B, short stems with standard neck resection; C, standard stems (Fig. 1). The demographic features, the survival rates, and the reasons for revision were eventually evaluated and compared.

To avoid the bias due to the lack of follow-up data, the analysis was limited to patients living in Emilia-Romagna region. In fact, procedures on residing patients are systematically captured by the registry, as every hospital admission is always billed back to the Emilia-Romagna region itself, even if the patient is treated outside the region; thus, the data are sure. On the other side, there is no guarantee that patients who undergo the primary arthroplasty in Emilia-Romagna but do not reside in the region will be captured by the registry in case of a revision surgery, as the patients have no stable relationships with the health system in the Emilia-Romagna region.

RIPO achieved a stable capture rate of 98%, acting on resident patient analysis, crossover comparisons with the Hospital Discharge Database and missing data retrieval [14]. A lack of adhesion is responsible for the missing data [14].

Ethical approval was not necessary as the registry collects personal data as standard practice and protects the identity of the patients with specific formats.

Statistical Analysis

Statistical analyses were performed using SPSS 14.0 for Windows, version 14.0.1 (SPSS Inc, Chicago, IL) and JMP, version 12.0.1. (SAS Institute Inc, Cary, NC, 1989-2007). Survivorship analysis was performed using Kaplan-Meier analysis considering revision of one or more single components (stem and/or cup and/or insert) as the end point. Wilcoxon tests looked for statistically significant differences between the survival curves. The significance threshold was set at $P < .05$. To avoid the bias related to different follow-ups, the correlations were measured at the same follow-ups (4 years) for all the involved cohorts. Hazard ratios were calculated via a Cox multivariate regression model.

Results

A total of 57,359 cementless THAs were eventually included in the study (surgeries performed between January 1, 2000 and

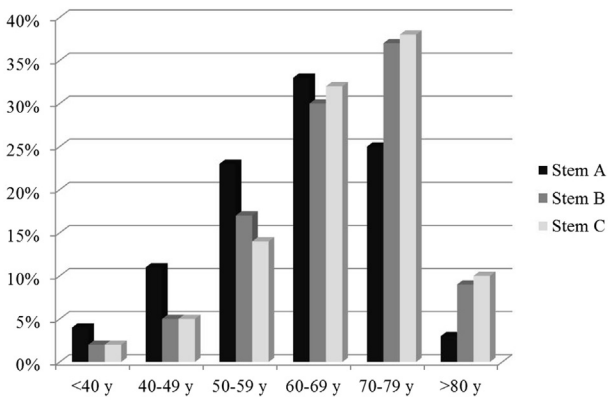

Fig. 2. Age distribution (in percentages) by decades showed that short stems with neck retention were preferentially implanted in younger patients, whereas B-type stems were diffused among all the decades.