ARTICLE IN PRESS

Orthopaedics & Traumatology: Surgery & Research xxx (xxxx) xxx

Contents lists available at ScienceDirect

Orthopaedics & Traumatology: Surgery & Research

journal homepage: www.sciencedirect.com/journal/orthopaedics-and-traumatology-surgery-and-research

Original article

Revising short-stem THA with either a new short stem or a primary stems: A feasible and durable strategy

Sinan Kara [a], Julie Manon [a,b], Thomas Van den Wyngart [a,b], Hervé Poilvache [a,b], Maya Ramos Prieto [c], Diarra Seydou [a], Olivier Cornu [a,b,*]

[a] Orthopaedic and Trauma Department, Cliniques Universitaires Saint-Luc UCL, Brussels, Belgium
[b] Neuromuskuloskeletal Lab (NMSK), Institute of Experimental and Clinical Research (IREC), UCLouvain, Brussels, Belgium
[c] HIS Hospitals, ULB University, Brussels, Belgium

ARTICLE INFO

Keywords:
Cementless total hip arthroplasty
Short hip stem
Anterior approach
Minimally invasive approach
Hip prosthesis
Revision total hip arthroplasty

ABSTRACT

Background: Short-stem total hip arthroplasty (THA) has gained popularity due to its bone-preserving design, reduced stress shielding, and facilitation of future revisions. However, concerns persist regarding a higher incidence of complications especially during the learning curve. The feasibility of revising Fitmore short stems using either a new short or a standard primary stem, rather than dedicated revision implants, remains debated.
Methods: We retrospectively reviewed 44 consecutive revisions following primary implantation of a Fitmore® metaphyseal short stem. Revision femoral components were classified as short, primary, or revision stems. Indications for revision, stem choice, and outcomes were analyzed.
Results: Revision was performed using a short stem in 11 cases, a standard primary stem in 26 cases, and a revision stem in 7 cases. Mean follow-up was 69 months. The mean Harris Hip Score was 82.3 ± 8.4. Two patients (4.5%) required re-revision, one due to traumatic periprosthetic fracture and the other for hematogenous infection.
Conclusion: Revision of failed short-stem THA using new short stem or standard primary stems is feasible in the vast majority of cases, with excellent mid-to long-term outcomes and a low re-revision rate. These findings challenge the notion that short stem revisions inherently require complex revision implants.
Level of evidence: IV; Retrospective consecutive case series.

1. Introduction

Total hip arthroplasty (THA) remains a highly effective treatment for advanced hip joint disease, particularly in younger and more active patients [1–3]. In recent years, short-stem femoral implants have gained increasing popularity [4–6]. These stems aim to preserve proximal bone stock, reduce stress shielding, and facilitate future revisions [7–10]. They also allow for less invasive surgical techniques, potentially reducing postoperative pain and accelerating recovery.

Several studies and joint registry data from Germany, Australia, and Switzerland have reported excellent mid-term outcomes with short stems, with survival rates comparable to those of conventional implants [11–13]. Although short stems aim to preserve bone for future revision, the feasibility of performing such revisions using standard or short femoral stems—rather than dedicated revision implants—remains under debate.

The main indications for revision THA (rTHA) include aseptic loosening, periprosthetic fractures, and infection. In these settings, preservation of bone stock is critical for enabling a straightforward revision. One of the theoretical advantages of short-stem THA is that, by sparing the diaphyseal bone and focusing on metaphyseal fixation, they may allow future revisions using either a new short stem or a standard primary stem, rather than requiring a dedicated revision implant [14,15].

However, this assumption is not well supported by clinical data. Very few studies have examined whether revision of a failed short stem can reliably be performed using a standard-length stem, nor have they evaluated the clinical outcomes of such a strategy. Revision of the historical Louvain stem [16,17] using a standard femoral stem appeared straightforward; however, whether this strategy remains feasible with modern metaphyseal short stems such as the Fitmore® stem remains unclear. The present study therefore focuses exclusively on revision strategies following failure of the Fitmore® metaphyseal short stem.

* Corresponding author.
E-mail address: olivier.cornu@saintluc.uclouvain.be (O. Cornu).

https://doi.org/10.1016/j.otsr.2026.104645
Received 28 June 2025; Accepted 24 February 2026
Available online 7 March 2026

Please cite this article as: Sinan Kara et al., *Orthopaedics & Traumatology: Surgery & Research*, https://doi.org/10.1016/j.otsr.2026.104645

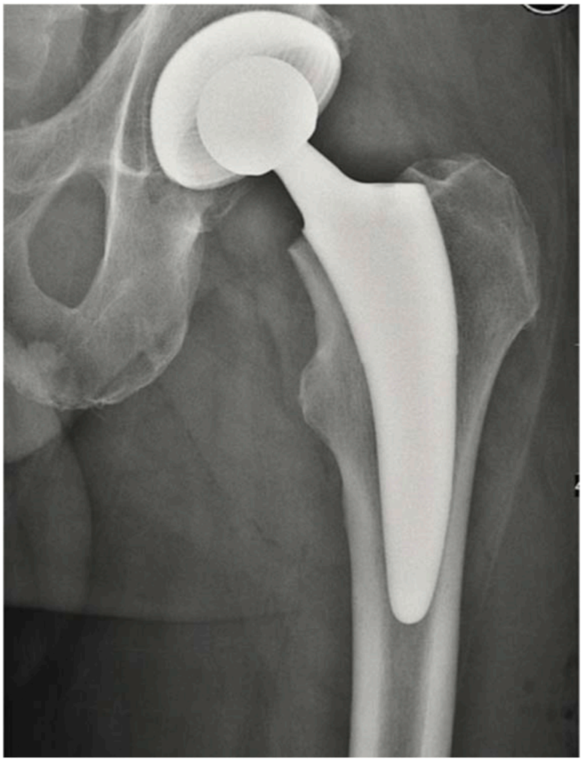

Fig. 1. Radiograph of a Fitmore® hip prosthesis.

Table 1
Types of stems used for revision procedures and their respective numbers. In cases with preserved metaphyseal bone, we favored either short stems or uncemented standard primary stems, most commonly the Avenir® stem. When metaphyseal fixation was not deemed sufficiently reliable, cemented stems (e.g., CMK21®) were considered.True revision stems (e.g., Revitan®, Echelon®) were reserved for cases of Paprosky type III defects, periprosthetic fractures, or severe bone loss precluding metaphyseal or standard diaphyseal fixation. The diversity of implant brands reflects the multi-surgeon nature of the study and evolving institutional collaborations with different manufacturers over time.

Short stem	Fitmore® (Zimmer Biomet) (11)
Standard primary stem	
Uncemented	Avenir® (Zimmer Biomet) (7)
Cemented	CMK 21® (Smith&Nephew) (1) Avenir® (Zimmer Biomet) (19)
Revision stem	
Uncemented	Revitan® (Zimmer-Biomet) (4) Echelon® (Smith&Nephew) (2)

The aim of this study is to assess the feasibility of revising short-stem THA using a standard primary stem and to evaluate the associated clinical and radiographic outcomes.

2. Material and methods

This retrospective study was conducted in a tertiary university reference center, including the follow-up of patients treated between 01/09/2010 and 30/01/2025. The study protocol was approved by the university's ethics committee.

This is a consecutive series of 44 patients identified from a total of 795 Fitmore short-stem THAs performed at our institution between 2010 and 2023. Two arthroplasty-trained surgeons were involved in the revisions.

The Fitmore hip stem (Zimmer Biomet, Winterthur, Switzerland) is a curved, noncemented implant with a trapezoidal cross-section (Fig. 1), available in 56 sizes across three stem families (A, B, and C) [18]. Fixation occurs primarily in the metaphyseal region. The implant follows the femoral canal's curve, preserving the trochanter and gluteal insertions. This design aims to restore key biomechanical parameters, such as femoral offset and leg length, whilst maintaining soft tissue balance. According to the SFHG classification of short stems, Fitmore stem belongs to type 3 [19]. Our study includes 44 Fitmore-type prostheses, implanted between 2011 and 2022. Indications for rTHA were identified, along with the timing of revisions, the type of femoral stem used for revision, the duration of post-revision follow-up, and associated complications. Bone stock at the time of revision was assessed using the Paprosky classification for femoral bone loss [20]. For each revision case, intraoperative findings and preoperative imaging (standard radiographs and CT scans when available) were used to assign a Paprosky grade. In cases with preserved metaphyseal bone, either short stems or uncemented standard primary stems were favored (Table 1, Fig. 2). When metaphyseal fixation was not deemed sufficiently reliable, cemented stems were considered. True revision stems were reserved for cases of Paprosky type III defects, periprosthetic fractures, or severe bone loss precluding metaphyseal or standard diaphyseal fixation.

Functional evaluation was performed using the Harris Hip Score (HHS) at the latest available follow-up, based on clinical examination and/or standardized telephone interviews. Results were analyzed as continuous variables (mean, standard deviation, median) and categorized according to standard HHS thresholds (poor < 70, fair 70–79, good 80–89, excellent ≥ 90). A Survival analysis was performed using the Kaplan-Meier method to estimate the probability of THA survival after revision with 95% confidence interval. The event was defined as a second revision surgery. The analysis was conducted using Jamovi software (v.2.6.44.0, 2025). Comparing revision outcomes between these two distinct design philosophies offer valuable insight into the evolution of bone-preserving implants and their implications for revision strategies.

3. Results

Our study included 44 patients (18 women and 26 men), with a median age at implantation of 59 years. At the time of primary surgery, patients were aged from 18 to 83 years. Revision surgeries were performed by two different surgeons using three different surgical approaches, with the majority being anterolateral (62%), posterior (20%) and anterior (18%) approaches.

The mean time from primary THA to revision was 23.7 months, with a median interval of 10 months. The time to revision ranged widely, from as early as 2 days to as late as 144 months, reflecting a highly heterogeneous distribution.

In our study cohort, four primary indications for prosthetic revision in THA were identified. These indications are listed in Table 2. Revision for aseptic loosening ($n = 20$) were classified as Paprosky type I ($n = 8$) or II ($n = 9$). We observed three early fixation failures characterized by early subsidence of the Fitmore short stem, resulting in secondary leg-length shortening; these cases were classified as aseptic loosening and were related to stem undersizing. When revision was required, the femoral component was frequently exchanged for a larger stem within the same implant family to restore metaphyseal fit and stability. Two patients required revision with a longer stem due to medullary canal obliteration and the need for suspended osteotomy. Among the 15 patients who sustained periprosthetic fractures, 5 required revision with a long stem owing to diaphyseal extension below the tip of the short stem (Vancouver B2); eight were revised with a standard cemented stem and cerclages, and in two cases a new short stem could be used, as the fracture line was limited to the proximal cortex. Infection led to 9 revisions with 3 adressed with a new short stem and 6 with a standard implant fixed with antibiotic loaded cement. Furthermore, the main revision stem inserted after a primary THA by Fitmore hip prosthesis remained the standard stem (Fig. 3).

In certain cases, patients have been successfully revised with a new

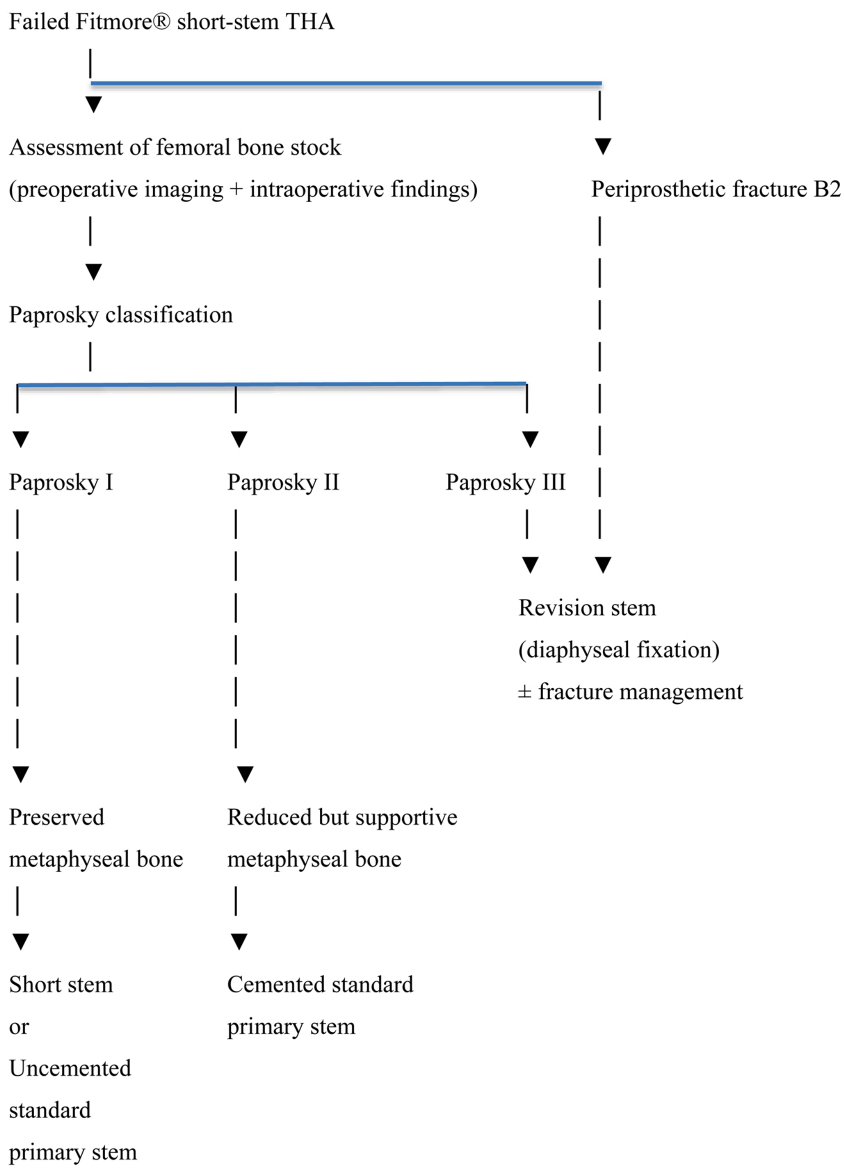

Fig. 2. Decision-making flowchart for femoral stem selection during revision of failed metaphyseal short-stem total hip arthroplasty (Fitmore®). The revision strategy was based on preoperative imaging and intraoperative assessment of femoral bone stock. In the presence of preserved metaphyseal bone (Paprosky type I), revision was preferentially performed using either a new short stem or an uncemented standard primary stem. When metaphyseal support was reduced but still present (Paprosky type II), a cemented standard primary stem was considered. Dedicated revision stems were reserved for cases with severe bone loss (Paprosky type III) or periprosthetic fractures compromising metaphyseal fixation (e.g., Vancouver B2–B3 fractures). This algorithm illustrates the practical applicability of a bone-preserving revision strategy after failure of a metaphyseal short stem.

Table 2
Summary of rTHA indications in patients with Fitmore® stems.

Cause	Fitmore (n = 44)	Total (%)
Aseptic loosening	20	45.5
Periprosthetic fracture	15	34.1
Infection	9	20
Polyethylene wear	0	0

Fitmore stem, which was selected as the revision implant due to favorable bone stock and adequate anatomical conditions (Fig. 4).

The mean follow-up duration was 69 months, the standard deviation was 35 and the median was 74 months. At final follow-up, the mean Harris Hip Score was 82.3 ± 8.4 (median 84.5), with 75 % of patients achieving a good to excellent outcome (HHS ≥ 80), reflecting overall satisfactory postoperative function after revision THA. During the follow-up period, only two patients required a second revision, resulting in a re-revision rate of 4.5%. Two failures of revision surgery were observed: one patient revised for aseptic loosening subsequently sustained a Vancouver B2 periprosthetic fracture five years later, and another patient revised for infection developed a new hematogenous infection with a different microorganism three years after revision.

All 42 other patients did not experience any kind of postoperative complication during their clinical and radiological follow-up period. Implant survival after revision was excellent, with a Kaplan-Meier estimated survival of 96.4% (95% CI 90.2–98.7) at 5 years and 89.0% (95% CI 62.1–98.7) at 10 years (Fig. 5). Among the hip prosthesis revisions requiring the use of a revision stem (15%), the main indications were, in most cases, periprosthetic fractures, necessitating the implantation of a long stem (Fig. 6).

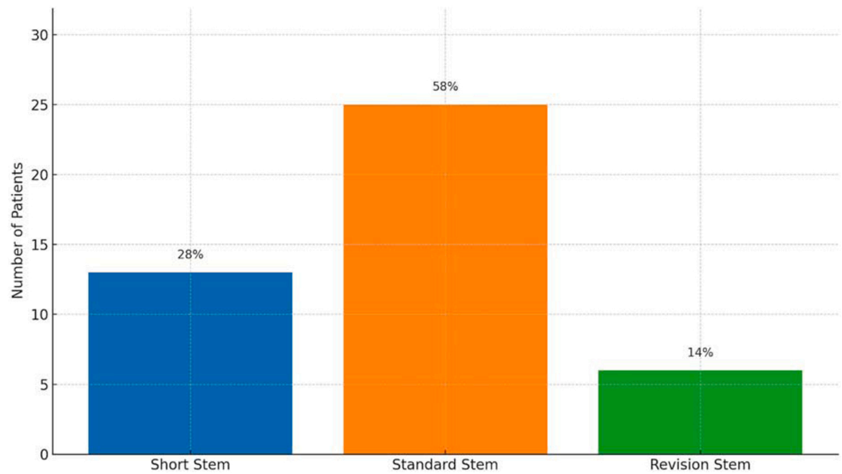

Fig. 3. Type of stems used for rTHA, after a primary Fitmore hip stem. Short stems were used in 28% of cases, standard stems in 58%, and revision stems in 14%.

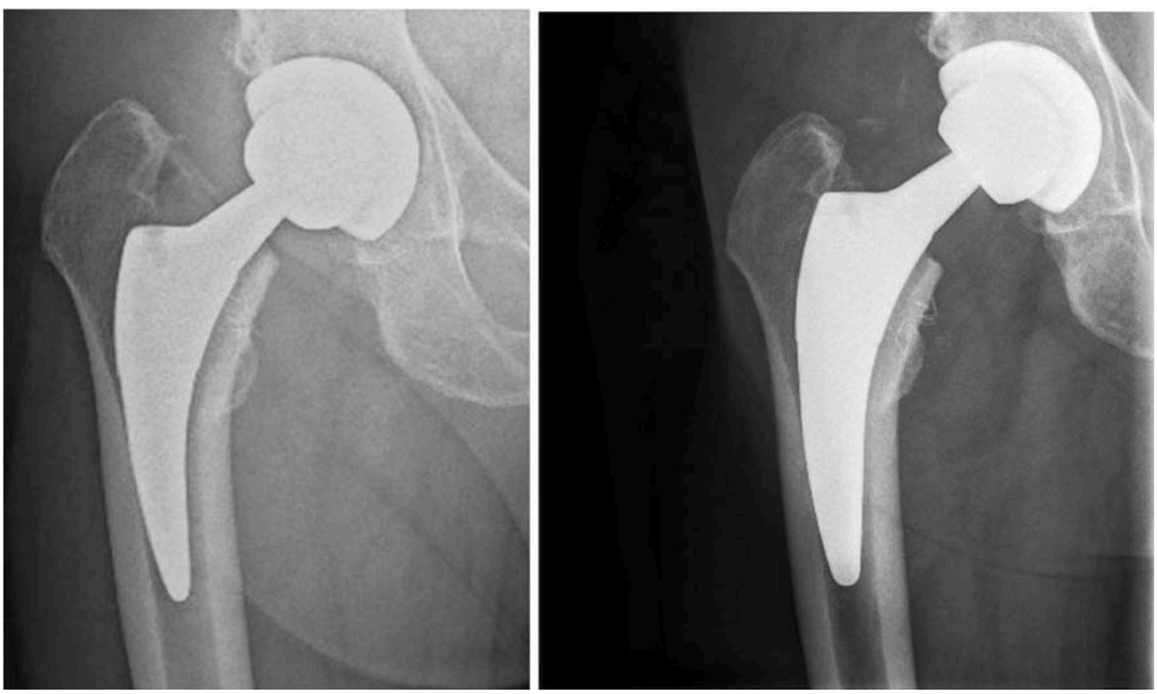

Fig. 4. Revision of an aseptic early loosening of a Fitmore® femoral stem using a new Fitmore® stem for revision. Preoperative radiograph (left) showing an aseptic loosening of a Fitmore B4-EXT femoral® stem in a right total hip arthroplasty. Post-revision radiograph (right) demonstrating successful reimplantation with a Fitmore® B8-EXT femoral® stem. At 7-year follow-up, the revision stem remained well-positioned with no complication or sign of loosening.

4. Discussion

This study demonstrates that revision total hip arthroplasty (rTHA) following failure of short-stem implants, can be successfully managed in the majority of cases using a new short stem or standard primary femoral stem. With an overall implant survival rate of 96.4% at 5 years post-revision and a very low re-revision rate (4.5%), our findings support the use of new short stem or primary stem as a reliable option in short-stem revisions. To the best of our knowledge, this is among the first studies to specifically report midterm outcomes of short-stem THA revised using either short or standard primary stems. Our re-revision rate of 4.5% and implant survival of 96.4% at 5 years compare favorably with existing literature. For instance, Stauss et al. reported stem survival rates of 95.7% at 5 years, 95.6% at 10 years, and 95.5% at 15 years after revision of short-stem THAs, regardless of the revision implant used [21]. However, unlike their study, ours emphasizes that most revisions could be performed successfully with primary stems, either short or standard, without the need for complex revision implants. Similarly, in a review, Cavagnaro et al. found a stem-related survival rate of 95.6% at 4.7 years in Paprosky type I–II femoral defects using primary cementless stems, and Innocenti et al. reported a 93.7% survival at 2 years using tapered stems in a comparable context [22,23]. Our revision-free survival aligns with large registry data: the 2024 UK NJR reports 94–96 % 10-year survival for primary short stems; the 2024 AOANJRR cites 95.2 %; SwedeHip 2023 shows 94.7 % [24–26]. These data support the durability observed in our cohort. Functional outcomes after revision remain inherently lower than after primary THA, which is consistent with the nature of revision surgery and with contemporary revision series. Our rate of 75 % of patients achieving a good to excellent functional outcome (HHS $\geq$ 80) compares favorably with recent series of revision THA: for instance, Park et al. reported a mean postoperative HHS of 83/100 at mean follow-up 16 years, and Carender et al. 81/100

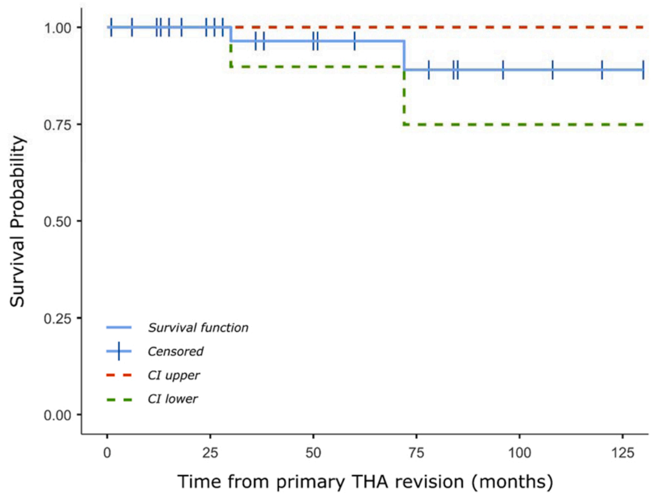

Fig. 5. Kaplan-Meyer survival rate of rTHA after primary short stem. Implant survival after revision was excellent, with a Kaplan-Meier estimated survival of 96.4% (95% CI 90.2–98.7) at 5 years and 89.0% (95% CI 62.1–98.7) at 10 years.

at 10 years [27,28]. This suggests that a substantial proportion of patients may recover satisfactory hip function. Conversely, older series such as Verspeek et al. reported more modest functional outcomes (mean HHS 74), underlining that modern implant designs and surgical techniques might improve functional prognosis after revision [29]. These results directly support the core rationale behind short-stem THA: the preservation of proximal femoral bone stock to facilitate future revisions. In our cohort, 86% of patients were revised with either another short stem or a standard-length stem, avoiding the need for revision-specific implants in most cases. Secondary revisions occurred in the context of trauma, not implant failure, and remained rare even at extended follow-up.

These findings are particularly relevant in the current context, where the number of primary THAs in younger and more active patients is increasing. Registry data already show a rising burden of rTHA in patients aged 45–64 years [30], emphasizing the need for prostheses that are revision-friendly. While short stems were introduced with this goal in mind [14], few studies have actually demonstrated that such revisions are indeed simplified. Our data address this gap by confirming that a standard femoral stem is sufficient in most revision scenarios.

The primary causes of revision in our cohort—aseptic loosening, periprosthetic fracture, and infection—mirror those reported in national registries [31]. Notably, we observed a higher proportion of periprosthetic fractures. This coincided with the introduction of the minimally invasive anterolateral Röttinger approach at our institution, a transition that likely increased femoral stress during the learning curve. In addition to stem alignment challenges inherent to the curved metaphyseal geometry of the Fitmore design, the early use of a mini-anterolateral approach with cementless stems has been associated with a higher risk of periprosthetic femoral fracture, which probably contributed to the fracture pattern observed in our series [32]. Regarding aseptic loosening, adequate lateral cortical contact is essential for primary stability of short femoral stems; undersizing resulting in lack of lateral cortical support may lead to early subsidence and subsequent aseptic loosening [33]. Revision of failed metaphyseal short stems can be safely performed using short or standard primary stems in the majority of cases, without compromising mid-term outcomes. In our series, the choice of revision implant was primarily based on preoperative and intraoperative assessment of metaphyseal bone stock. Revision using a new short stem or an uncemented standard primary stem was only considered when the metaphyseal region, particularly the Merkel zone, remained intact and supportive (Paprosky type 1) [20]. In cases where metaphyseal bone was preserved but insufficient for reliable press-fit fixation (Paprosky type 2), a cemented primary stem was selected. Revision stems with exclusive diaphyseal fixation were reserved for periprosthetic fractures or, more rarely, for cases with non-supportive metaphyseal bone where neither short nor standard stems, even cemented, could be adequately stabilized.

This study has several limitations. First, its retrospective design and relatively small sample size limit the generalizability of our findings. Second, procedures were performed by two surgeons using three different approaches, introducing possible technical heterogeneity and short follow-up range introduce potential bias.

Lastly, some follow-up data were extracted from regional databases (RSW, CoZo, Orthopride), which, although generally reliable, may contain administrative inaccuracies. Despite these limitations, the consistency of our results, the long duration of follow-up, and the practical relevance of our findings support the robustness of our conclusions.

5. Conclusion

This retrospective study confirms the feasibility and durability of revising short-stem and stemless total hip arthroplasties using short or standard primary stems. In our series, the vast majority of patients (86%) were successfully revised without the need for revision specific implants, and the rate of re-revision was very low (4.5%). With 89% survival at 10 years post-revision, these results support the use of either short stems or primary stems as a first-line option in most cases of short stem THA failure. These findings reinforce the original rationale behind short-stem designs: preserving proximal femoral bone stock to facilitate simpler and more conservative revision procedures. Although further studies are needed to confirm these outcomes in larger prospective cohorts, our data suggest that short-stem THA does not compromise future revision strategies—and may, in fact, simplify them.

CRediT authorship contribution statement

The authors' specific contributions to this work are detailed below, in accordance with the CRediT (Contributor Roles Taxonomy) guidelines.

Sinan Kara, MD: Conceptualization; Investigation; Writing - original draft; Visualization; Project administration.

Julie Manon, MD, PhD: Formal analysis; Methodology; Data curation; Writing - original draft; Writing - review & editing.

Thomas Van den Wyngart, MD: Formal analysis; Data curation; Writing - review & editing.

Hervé Poilvache, MD, PhD: Supervision; Validation; Writing – review & editing.

Maya Ramos Prieto, MD: Investigation; Formal analysis; Validation.

Diarra Seydou, MD: Resources; Data curation; Investigation.

Olivier Cornu, MD, PhD: Conceptualization; Methodology; Supervision; Writing - review & editing.

Declaration of Generative AI and AI-assisted technologies in the writing process

During the preparation of this work, the author(s) used ChatGPT (OpenAI, San Francisco, CA) in order to assist with language refinement. After using this tool, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

Funding

None.

Declaration of competing interest

None.

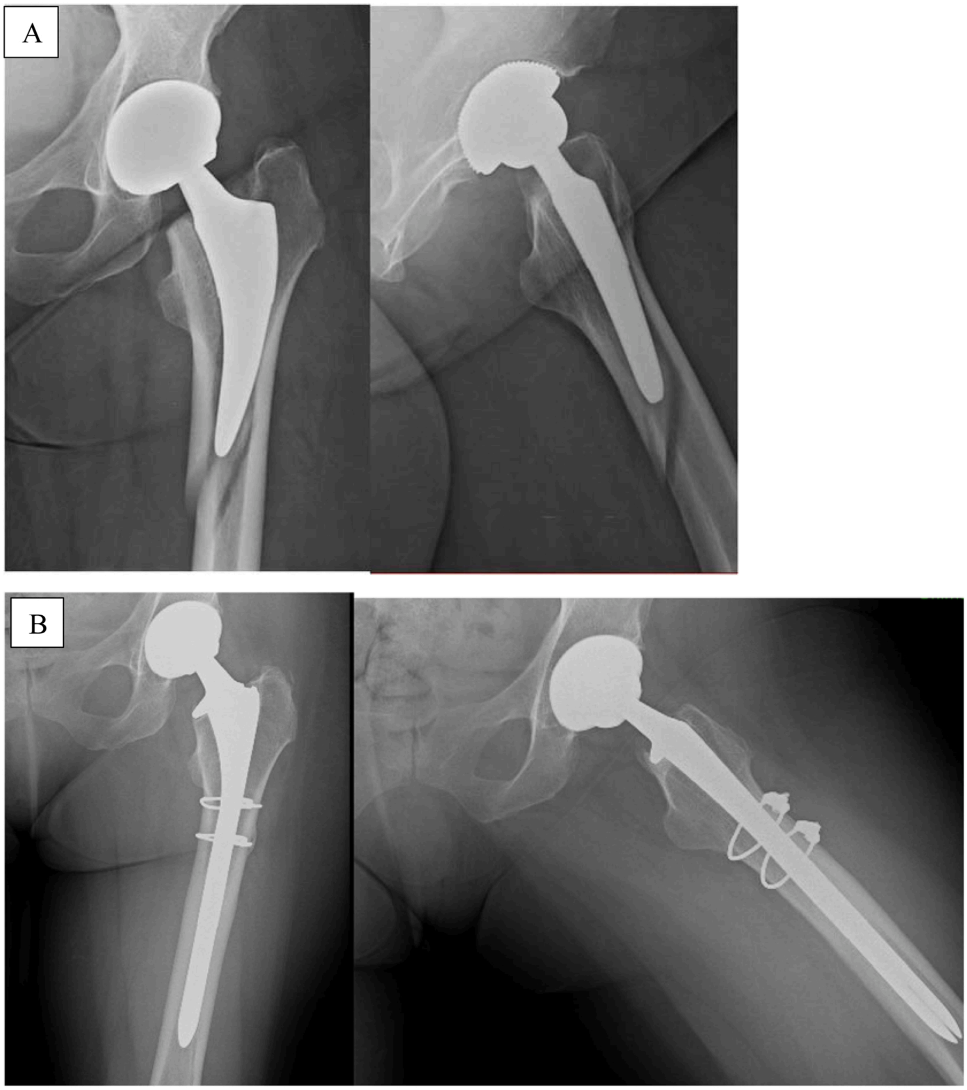

Fig. 6. Illustration of Vancouver type B2 fracture after primary short stem with the need of a revision stem (Echelon®, Smith & Nephew). Preoperative anteroposterior view showing a Vancouver type B2 fracture around a Fitmore short femoral stem (A). Four year postoperative follow-up radiograph after revision total hip arthroplasty using a cementless Echelon® femoral stem and cerclage wiring (B).

Acknowledgements

Grant was provided by FSR-F.N.R.S. Funds ("Fonds National de la Recherche Scientifique", Belgium) awarded to Dr. Julie MANON (Application ID40017892 (ASP) and ID 40032213 (CSPD)).

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