

Bilateral Fractures of Anatomic Medullary Locking Hip Arthroplasty Stems in a Single Patient: A Case Report

Sean E Slaven¹, Colin J Harrington¹, John P Cody¹

Learning Point of the Article:

Patients with a previously well-functioning fully porous-coated THA presenting with a new complaint of thigh pain should be thoroughly evaluated for possible stem fracture, which may be a subtle radiographic finding.

Abstract

Introduction: Stem fracture is a rare complication of total hip arthroplasty (THA) using fully porous-coated femoral stems. Bilateral fractures in a single patient have not been previously reported.

Case Report: A 48-year-old female underwent bilateral staged primary THA with fully porous-coated anatomic medullary locking femoral prostheses. She subsequently sustained stem fractures of her right and left prostheses in the 13th and 14th years after their implantation, respectively.

Conclusion: The bilateral nature of this rare complication in a single patient supports the notion that stem fracture results from a mismatch between the mechanical stresses encountered in vivo and the structural properties of small-diameter stems. Surgeons should be cognizant of this potential complication when evaluating patients at long-term follow-up with new-onset pain.

Keywords: Fully porous-coated prosthesis, stem fracture, total hip arthroplasty.

Introduction

Stem fracture is a very rare complication associated with the use of fully porous-coated femoral stems, with only 17 cases reported in the literature [1, 2, 3, 4, 5, 6]. Most of the reported cases of stem fracture occurred after a fully porous-coated prosthesis was used in revision arthroplasty, and bilateral stem fracture in one patient has never been reported. We report a case of a single patient who underwent sequential total hip arthroplasty (THA) of both hips with an anatomic medullary locking (AML) femoral prosthesis and subsequently sustained femoral stem fractures bilaterally in the 13th and 14th post-operative years. The patient was informed that information about their case would be submitted for publication, and they provided consent.

Case Report

A healthy and active female underwent primary THA of the right hip for end-stage osteoarthritis in May 2003, at age 48. After an uncomplicated post-operative course and rehabilitation, she underwent primary THA of the left hip in December 2003, at age 49. She again had no post-operative complications and recovered well with reported improvement in pain and function of both hips. Both surgeries were performed by a single, fellowship-trained arthroplasty surgeon at our institution using an AML femoral prosthesis with Pinnacle Acetabular component (DePuy, Warsaw, IN, USA) and a metal-on-metal articulation. The stem diameter of both prostheses was 12 mm.

After the immediate post-operative follow-up period, she next presented to the clinic in November 2008 for routine

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Author's Photo Gallery



Dr. Sean E Slaven



Dr. Colin J Harrington



Dr. John P Cody

¹Department of Orthopaedic Surgery, Walter Reed National Military Medical Center, Bethesda, Maryland, USA.

Address of Correspondence:

Dr. Sean E Slaven,
Department of Orthopaedic Surgery, Walter Reed National Military Medical Center, 8901 Rockville Pike, Bldg 19, Floor 2, Room 2010,
Bethesda, Maryland 20889, USA.
E-mail: sean.e.slaven@gmail.com

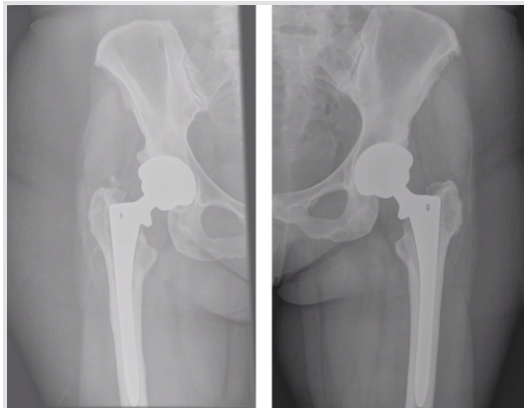


Figure 1: Post-operative radiographs of the patient's femoral implants, before any symptoms.

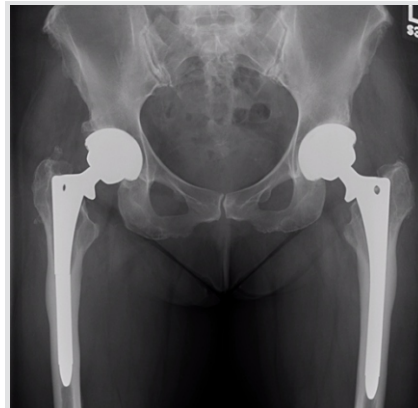


Figure 2: Radiographs demonstrating fracture of the right femoral stem.

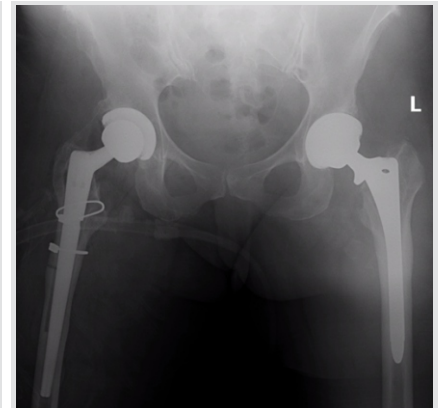


Figure 3: Radiographs demonstrating revision right total hip arthroplasty.

evaluation. Radiographs at that time demonstrated 3 mm of osteolysis in the bilateral proximal femurs, Gruen zones 1, 2, 6, and 7 (Fig.1). She reported no pain or functional limitations.

In December 2015, she presented to the clinic with the chief complaint of the right thigh pain. She had sustained a low-energy ground-level fall 2 weeks prior to presentation and subsequently developed unremitting right thigh pain a week later, exacerbated by weight-bearing. Radiographs revealed a fracture through the femoral stem of her right THA prosthesis (Fig. 2). She underwent laboratory testing and hip aspiration to rule out infection and subsequently underwent revision right THA using a restoration modular prosthesis with a ceramic on polyethylene articulation (Stryker, Mahwah, NJ) in December 2015, at 12.6 years postoperatively (Fig. 3). She rehabilitated well and reported pain relief and excellent function of her right hip.

In April 2017, she presented with the complaint of hip and thigh pain, this time on her left side. Initial radiographs of her hip prosthesis demonstrated no obvious abnormalities and were read as normal (Fig. 4). She returned to the clinic in May 2017 with continued thigh pain with weight-bearing, and new radiographs demonstrated a fracture through the femoral stem of her left THA prosthesis (Fig. 5). When further scrutinized in retrospect by the orthopedic surgery team, the previous radiographs from April demonstrated a subtle non-displaced fracture of the femoral stem. The patient underwent revision

left THA using a restoration modular prosthesis with a ceramic on polyethylene articulation (Stryker, Mahwah, NJ) in May 2017, at 13.4 years postoperatively (Fig. 6).

Both revision surgeries were performed using an extended trochanteric osteotomy (ETO) at the level of the stem fracture, and trephines were used to enable removal of the distal aspect of the stem. The stem was able to be removed uneventfully in both cases using this technique. Fixation of the ETO was performed using cables (Fig. 6). At 1 year follow-up from her most recent surgery, she continues to report complete pain relief and excellent function in both hips (Fig.7).

Discussion

We report on the first known case of bilateral femoral stem fracture in the same patient. The fracture of a fully coated stem is a rare complication with only 17 cases reported in the literature [1, 2, 3, 4, 5, 6] (Table 1). Fully porous-coated cylindrical femoral stems have demonstrated satisfactory long-term results with an acceptable survival rate in both primary and revision THA [1, 7, 8, 9]. The peak time period for fully porous-coated stem usage in primary THA dictates that many patients are now in the >10 year follow-up period and are at potential risk for this complication. The similar timing of the failure of both stems supports the notion that this rare complication occurs as the result of a mismatch between the mechanical stresses encountered in vivo and the structural properties of small diameter fully porous-coated stems rather than as a result of individual implant defects or accidental trauma.

A number of patient and implant-related risk factors have been

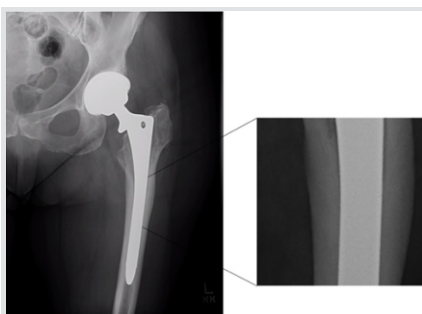


Figure 4: Initial radiographs after presentation for left thigh pain (read as negative). Cortical hypertrophy is evident at the level of the subtle fracture line through the stem.



Figure 5: Radiographs demonstrating fracture of the left femoral stem.

Table 1: Published cases of fully porous-coated stem fractures

Case report/series	Number of cases	Time to fracture (years)	Stem diameter (mm)	BMI (kg/m ²)	ETO* (%)
Sotereanoset <i>et al.</i>	2	6	--	--	--
Busch <i>et al.</i>	5	3 (1.2-6)	13.1 (12-15)	42.3 (37-60)	4/5 (80)
Landaet <i>et al.</i>	3	1.7 (0.9-2.3)	14 (13-15)	--	1/3 (33)
Lu <i>et al.</i>	4	3.75 (1.9-7.2)	11.75 (11-12)	29.1 (22-38)	3/4 (75)
Gallardet <i>et al.</i>	2	2.6 (2.1-3.1)	11.5 (11-12)	26.2 (24.7-27.7)	2/2 (100)
Chun <i>et al.</i>	1	4	14	33.3	0/1

*ETO: Extended trochanteric osteotomy, BMI: Body mass index



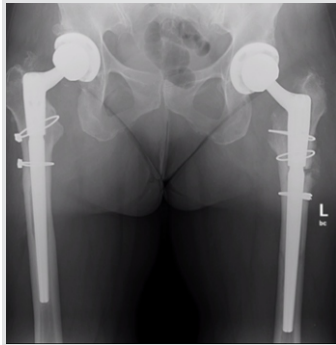


Figure 6: Radiographs demonstrating revision left total hip arthroplasty.

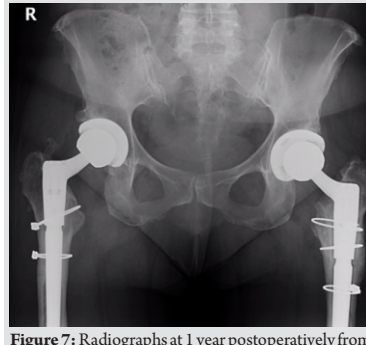


Figure 7: Radiographs at 1 year postoperatively from the left revision total hip arthroplasty. Both extended trochanteric osteotomies healed completely.

thought to contribute to prosthetic fracture. In a 2005 study, Busch et al. demonstrated a body mass index (BMI) >30 kg/m², poor proximal bone support, and diameter of femoral stem <13.5mm, and the use of an ETO was associated with stem fractures[2]. Additionally, younger, more active patients with proximal osteolysis and distal bony ingrowth may be subjected to increased cycles of cantilever loading, increasing the risk of stem fracture[3]. Although the previous studies demonstrated an acceptable survival rate, concerns regarding proximal osteolysis and the prevalence of stress shielding in fully porous-coated stems have led to a decreased use of these implants in recent years[9, 10]. Furthermore, a revision of a fully porous-coated cylindrical femoral stem is a technically challenging procedure that often necessitates use of an ETO[2,3,11]. In retrospect, our patient was at increased risk for stem fracture due to her BMI >30 kg/m², proximal osteolysis, bilateral stem diameters of 12mm, relatively young age, and high activity level following primary THA.

Unlike most other reports in the literature, our patient sustained her stem fracture following primary THA as opposed to a revision procedure[1, 2, 3,5]. Chun et al. recently reported a fracture of a fully coated femoral stem (VerSys Beaded Fullcoat; Zimmer, Warsaw, IN) after primary THA for nonunion of an intertrochanteric fracture in a patient with risk factors of BMI

>30 and poor posteromedial bone support. The femoral stem used in that case was 14mm and 2mm larger diameter than the stems used in our patient. Although our patient did sustain a low-energy ground-level fall 2 weeks before presenting with the right femoral stem fracture, a majority of patients with prosthetic fractures presented due to insidious hip pain without a history of trauma, similar to presentation for her left stem fracture[3,5].

With this information in mind, it is vital for practicing orthopedic surgeons to recognize potential risk factors for prosthetic stem fractures in both primary and revision arthroplasty with fully porous-coated prostheses. Specifically, overweight patients with stems <13.5 mm in diameter should be considered high risk, especially in patients presenting with new thigh pain in follow-up. We recommend increased clinical and radiographic vigilance in evaluating these patients as they present in follow-up.

Conclusion

Stem fracture is a known but rare complication following implantation of a fully porous-coated femoral stem. We report a case of bilateral stem fracture in the same patient at similar times after index surgery, which highlights the strong impact of her risk factors for stem fracture. The fracture can initially be a subtle radiographic finding and result in delayed diagnosis and treatment.

Clinical Message

Patients with a previously well-functioning fully porous-coated THA presenting with a new complaint of thigh pain should be thoroughly evaluated for possible stem fracture, which may be a subtle radiographic finding.

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