Case Report

Taper Fracture of Uncemented Femoral Stem after Total Hip Arthroplasty

Salim Al Habsi Jatinder Singh Luthra Hamid Al Badei

Department of Orthopedics, Khoula Hospital, Muscat, Sultanate of Oman

Keywords

Taper · Hip arthroplasty · Stem fracture

Abstract

Fracture through the tapered femoral neck of total hip arthroplasty is extremely rare. We report the taper neck fracture of a cementless stem in an extensively porous-coated femoral prosthesis used for total hip arthroplasty due to chronic hip infection 8 years previously in a 42-year-old man, weighing 110 kg with a body mass index of 39. We consider that cyclical loading stresses, fretting corrosion, and high body mass index are possible potential risk factors of such fracture.

© 2018 The Author(s)
Published by S. Karger AG, Basel

Introduction

Fracture of femoral prostheses in total hip replacement is a rare complication in total hip arthroplasty [1]. According to Swedish registry data [1] and retrospective data in the USA [2] the percentages of revision total hip surgeries done for implant fracture were 1.5 and 1%, respectively. Reports in the literature have identified multiple risk factors for prosthetic stem fracture, including increasing patient weight, higher levels of activity, relatively younger age, male gender, valgus stem positioning, and relatively undersized stem relative to the patient's

anatomy [3–7]. The most frequently reported site of fracture is the stem of the femoral component. However, fracture of the taper neck of femoral prosthesis is very rare with very few cases reported in the literature.

There are a few case reports of fracture of the monobloc neck of the femoral component as well as fracture of the monobloc acetabulum component [8]. Here we present a case of taper fracture of the monobloc femoral component of an uncemented metal-on-metal total hip arthroplasty. The patient was informed that data and images concerning the case would be submitted for publication, and he provided consent.

Case Report

We present the case of a 42-year-old male with a background history of right total hip replacement who presented to the emergency department with sudden onset of right hip pain; the patient heard a click in the right hip after getting up from a sitting position. Subsequently, he was unable to bear weight and had painful hip movement. On examination he had a significant pain in the right hip and groin in all hip movements associated with tenderness over the right hip. The right leg was shortened and externally rotated. There was no neurovascular deficit. The patient weighed 110 kg and had a body mass index (BMI) of 39.

An anterior-posterior pelvic radiograph identified a transverse fracture through the neck head junction in the nonmodular monobloc femoral stem (Fig. 1). The inclination of the acetabular component measured 38 degrees. Inflammatory markers were normal.

His primary total hip replacement had been carried out 8 years prior to this presentation. He had secondary osteoarthritis secondary to chronic infection around the hip at the age of 22. A 13 × 135 mm bimetric proximally porous 40% HA-coated stem was used with a 46-mm metal head and 9-mm offset. His postoperative course was uneventful and he was discharged home in a timely manner. He had been pain free in the left hip at early follow-up appointments. However, the patient did not follow-up after the first year as he remained asymptomatic. Early postoperative radiographs demonstrated a well-positioned prosthesis with no evidence of fracture or loosening.

The patient underwent revision of the right femoral component through a posterior approach. At the time of surgery, there was no evidence to suggest infection. The stem was confirmed to have fractured at the head-neck taper interface. The acetabular component was in excellent condition, with no evidence of scratches or loosening. The orientation was also felt to be satisfactory (inclination approximately 36 degrees, anteversion approximately 10 degrees), and so the cup was not revised.

The stem was well fixed and trial of extraction failed. An extended trochanteric osteotomy was performed around 16 cm from the tip of the greater trochanter. Bone ingrowth was removed with osteotome and the stem was removed after making it free. ETO was repaired with multiple stainless steel cerclage wires. A biometric stem 250 × 11 mm in size was impacted into the femur and found to be well fitting. A size 28 (+9) head was snapped onto the 52-degree acetabulum linearly and was impacted into the taper of the stem. A 9-hole locking T plate was used to reinforce the trochanteric repair (Fig. 2).

Discussion

The prevalence of fracture of femoral prostheses in total hip replacement ranges from 0.23% [9] to 11% [10]. Many factors including technical, material, and mechanical factors could contribute to failure of the femoral stem in total hip prostheses. The fractures occurred between 14 months and 5 years postoperatively [4].

The site of fracture in our case is rare, with only a few reported cases in the literature [8, 11, 12]. Most of these have been noted to occur with a cemented stem, with fewer published reports of cementless nonmodular stem fracture. To our knowledge, this case is the second report of a fracture of taper neck in nonmodular uncemented femoral prosthesis.

Early monobloc components demonstrated fatigue fracturing through the implant stem [9, 10, 13]. Gilbert et al. [14] reported two cases of femoral stem fracture at the neck region, less than 1 mm distal to the taper in the modular stem. The conclusion of the paper was that the reasons for component fracture were intergranular porosity of the implant, an intergranular corrosive attack of the microstructure of the neck, and cyclical loading stresses.

Morley et al. [11] reported a case of a fracture of the standard cemented C-stem combination with a large metal-on-metal articulation which occurred at the head-neck junction. Analysis of the fractured stem showed evidence of fatigue failure with possible corrosion. In addition, the authors concluded that use of large femoral heads with neck adaptors and narrow tapers could be the reason for taper fracture [11]. Another study reported 3 cases of taper neck fracture in metal-on-metal bearing articulations in total hip replacement [12]. The failure mechanism was probably due to insufficient stability at the taper interface resulting in increased micromotion during loading, facilitating fretting and crevice corrosion and ultimately resulting in fracture of the stem taper. Femoral component fracture is almost always preceded by loosening of the component, and it has been suggested that prevention of this loosening is key to preventing stem fracture [15, 16]. However, this is not the case in taper neck fracture where the preoperative radiograph and CT scan showed no evidence of loosening.

Obesity is a well-known risk factor for poor outcome and complication after total hip replacement including taper neck fracture. Almost all cases of taper neck fractures described in the literature occurred in patients with high BMI. Obesity is not an uncommon finding in patients undergoing total hip replacement, and current data estimate that up to 30% of adult males in countries of the gulf region are obese [17]. Our patient had a BMI of 39 and this may have played a role in the failure of the implant. In the above case, the possible risk factors for taper neck fracture include relatively young active patient, male sex, and heavy weight.

The revision surgery in the above case was performed 8 years after the primary surgery. However, the acetabulum component was not revised as preoperative CT scan showed no evidence of lysis around the implants and the patient was asymptomatic prior to the fracture.

The limitation of this case report includes the absence of the experimental study or metallurgical analysis of the broken femoral stem to illustrate the actual cause of failure of the prosthesis. In conclusion we propose that the possible cause of the fracture at the neck taper of uncemented femoral prosthesis in this patient was a combination of cyclical loading stresses, fretting corrosion, and high BMI.

Statement of Ethics

The authors have no ethical conflicts to disclose.

Disclosure Statement

The authors have no conflicts of interest to declare.

Funding Sources

No specific funding was received for this study.

References

- Kärrholm J. The Swedish Hip Arthroplasty Register (www.shpr.se). *Acta Orthop*. 2010 Feb;81(1):3–4.
- Clohisey JC, Calvert G, Tull F, McDonald D, Maloney WJ. Reasons for revision hip surgery: a retrospective review. *Clin Orthop Relat Res*. 2004 Dec;429:188–92.
- Wroblewski BM. Fractured stem in total hip replacement. A clinical review of 120 cases. *Acta Orthop Scand*. 1982 Apr;53(2):279–84.
- Carlsson AS, Gentz CF, Stenport J. Fracture of the femoral prosthesis in total hip replacement according to Charnley. *Acta Orthop Scand*. 1977;48(6):650–5.
- Pacheco V, Shelley P, Wroblewski BM. Mechanical loosening of the stem in Charnley arthroplasties. Identification of the “at risk” factors. *J Bone Joint Surg Br*. 1988 Aug;70(4):596–9.
- Jarvi K, Kerry RM. Segmental stem fracture of a cemented femoral prosthesis. *J Arthroplasty*. 2007 Jun;22(4):612–6.
- Grivas TB, Savvidou OD, Psarakis SA, Bernard PF, Triantafyllopoulos G, Kovanis I, et al. Neck fracture of a cementless forged titanium alloy femoral stem following total hip arthroplasty: a case report and review of the literature. *J Med Case Reports*. 2007 Dec;1(1):174.
- Baratz MD, Abdeen A. Fracture of a Tapered Femoral Neck After Total Hip Arthroplasty: A Case Report. *JBJS Case Connect*. 2014 Jan;4(1):1–4.
- Charnley J. Fracture of femoral prostheses in total hip replacement. A clinical study. *Clin Orthop Relat Res*. 1975 Sep;111:105–20.
- Martens M, Aernoudt E, de Meester P, Ducheyne P, Mulier JC, de Langh R, et al. Factors in the mechanical failure of the femoral component in total hip prosthesis. Report of six fatigue fractures of the femoral stem and results of experimental loading tests. *Acta Orthop Scand*. 1974;45(5):693–710.
- Morley D, Starks I, Lim J. A Case of a C-Stem Fracture at the Head-Neck Junction and a Review of the Literature [accessed 2018 June 26]. Available from: <https://www.hindawi.com/journals/crior/2012/158604/>.
- Morlock MM, Bunte D, Ettema H, Verheyen CC, Hamberg Å, Gilbert J. Primary hip replacement stem taper fracture due to corrosion in 3 patients. *Acta Orthop*. 2016;87(2):189–92.
- Heck DA, Partridge CM, Reuben JD, Lanzer WL, Lewis CG, Keating EM. Prosthetic component failures in hip arthroplasty surgery. *J Arthroplasty*. 1995 Oct;10(5):575–80.
- Gilbert JL, Buckley CA, Jacobs JJ, Bertin KC, Zernich MR. Intergranular corrosion-fatigue failure of cobalt-alloy femoral stems. A failure analysis of two implants. *J Bone Joint Surg Am*. 1994 Jan;76(1):110–5.
- Galante JO, Rostoker W, Doyle JM. Failed femoral stems in total hip prostheses. A report of six cases. *J Bone Joint Surg Am*. 1975 Mar;57(2):230–6.
- Crowninshield RD, Brand RA, Johnston RC, Milroy JC. An analysis of femoral component stem design in total hip arthroplasty. *J Bone Joint Surg Am*. 1980 Jan;62(1):68–78.
- ALNohair S. Obesity in Gulf Countries. *Int J Health Sci (Qassim)*. 2014 Jan;8(1):79–83.

Fig. 1. Anteroposterior radiograph of the hip showing tapered femoral neck fracture.

Fig. 2. Postoperative anteroposterior radiograph showing long biometric stem. A T plate was used to reinforce the trochanteric repair.