Available online at www.sciencedirect.com

ScienceDirect

Journal of the Chinese Medical Association xx (2017) 1−6

www.jcma-online.com

Original Article

Cement augmentation in the proximal femur to prevent stem subsidence in revision hip arthroplasty with Paprosky type II/IIIa defects

Shang-Wen Tsai [a,b], Cheng-Fong Chen [a,b], Po-Kuei Wu [a,b], Chao-Ming Chen [a,b], Wei-Ming Chen [a,b,*]

[a] *Department of Orthopaedics and Traumatology, Taipei Veterans General Hospital, Taipei, Taiwan, ROC*
[b] *Department of Orthopaedics, School of Medicine, National Yang-Ming University, Taipei, Taiwan, ROC*

Received July 6, 2017; accepted November 9, 2017

Abstract

Background: Subsidence remains a common complication after revision hip arthroplasty which may lead to prolonged weight-bearing restrictions, leg-length discrepancies or considerable loss of function. We evaluated the effectiveness of cement augmentation in the proximal femoral metaphysis during a revision of femoral components to prevent post-operative stem subsidence.

Methods: Forty patients were enrolled. Follow-up averaged 67.7 months (range: 24−149). Twenty-seven patients had a Paprosky type II defect and 13 had a type IIIa defect. All revision hip arthroplasty used a cementless, cylindrical, non-modular cobalt−chromium stem. The defect in the metaphysis was filled with antibiotic-loaded bone cement. Thirteen patients who had undergone stem revision only was allowed to walk immediately without weight-bearing restrictions. Twenty-seven patients who had undergone revision total hip arthroplasty was allowed partial weight-bearing within 6 weeks after surgery in the consideration of acetabular reconstruction.

Results: Three patients (7.5%) had post-surgery stem subsidences of three mm, five mm, and 10 mm, respectively, at three, one, and 14 months. There were no acute surgical site infections. There were three femoral stem failures: two delayed infections and one periprosthetic Vancouver B2 fracture. Both five- and 10-year survivorships of the femoral implant were 90.1%.

Conclusion: An adequate length of the scratch-fit segment and diaphyseal ingrowth remain of paramount importance when revising femoral components. To fill metaphyseal bone defects with antibiotic-loaded bone cement may be an alternative method in dealing with proximal femoral bone loss during a femoral revision.

Keywords: Bone defect; Cement augmentation; Femur; Revision hip arthroplasty; Subsidence

1. Introduction

Femoral bone defects remain a challenge when revising femoral components. The extent of the bone defect determines the surgical technique used. The Paprosky femoral bone loss classification system is normally used to guide decision making.[1,2] Type II and III bone defects are more prevalent among patients who have undergone femoral component. Those two defects can be adequately treated using an extensively coated, diaphyseal locking stem[1,2] Two types of cementless revision stems—a cylindrical, non-modular cobalt−chromium stem, and a tapered, fluted, modular titanium stem—are commonly used. For both types of stem, however, subsidence remains a frequently reported complication (incidence: range = 8.4−84%).[3−15] A considerable loss of function because of prolonged weight-bearing restrictions and problem with leg-length discrepancies because of

Conflict of interest: The authors declare that they have no conflicts of interest related to the subject matter or materials discussed in this article.

* Corresponding author. Dr. Wei-Ming Chen, Department of Orthopedics and Traumatology, Taipei Veterans General Hospital, 201, Section 2, Shi-Pai Road, Taipei 112, Taiwan, ROC.

E-mail address: wmchen@vghtpe.gov.tw (W.-M. Chen).

https://doi.org/10.1016/j.jcma.2017.11.008

subsidence are major concerns. Therefore, many surgeons recommend a protective weight-bearing or non-weight-bearing program for six to eight weeks after surgery.[3,5,7,8,11,14,15] However, early ambulation without weight-bearing restrictions and the prevention of stem subsidence remain goals to be achieved.

We have developed a simple technique, which was to fill metaphyseal bone defects with antibiotic-loaded bone cement during revision with a cementless, extensively coated, diaphyseal locking stem. We hypothesized that patients who had been treated using this technique could be allowed to walk with a more aggressive weight-bearing program and would achieve good stem survival with minimal stem subsidence.

2. Methods

This retrospective study, conducted in a single medical center from May 2001 to June 2011, was approved by the Institutional Review Board (IRB #2016-07-004C). Paprosky classification used in clinical practice to determine the surgical method throughout the study period.[1] All patients were operated on by the same senior attending physician involved in this study. The type of femoral bone defect was classified based on preoperative radiographs and intraoperative findings. For patients with Paprosky type II and IIIa bone defects, an extensively coated, diaphyseal locking stem was the selected implant. Impaction bone grafting technique was used for patients with Paprosky type IIIb and IV defects. Allograft prosthetic composite was an alternative option for Paprosky type IV cases. Megaprostheses were not used in the present study to revise femoral components.

Forty patients with Paprosky type II and IIIa defects who had undergone revision of femoral components were enrolled. Surgical indications included aseptic loosening, two-stage reconstruction after resection arthroplasty for septic loosening, recurrent dislocation, and periprosthetic fracture. Patients with a tumor in the proximal femur or a follow-up of less than two years were excluded.

The mean age of the 40 enrollees (27 men and 13 women) was 60.9 years (range: 39–85 years) (Table 1); mean operation time was 112 min (range: 70–163); Estimated blood loss was 960 mL (range: 500–1850); and the mean follow-up was 67.7 months (range: 24–149). Indications for index surgery were aseptic loosening (n = 29), two-stage reconstruction after resection arthroplasty for septic loosening (n = 7), recurrent dislocation (n = 2), and periprosthetic fracture (n = 2). A modified Hardinge approach was used in 36 patients. For the other four patients (three with a cemented stem and one with a cementless stem), a posterior approach with an extended trochanteric osteotomy was used because it was difficult to remove the stems. Cylindrical non-modular cobalt–chromium stems (Depuy AML®; Warsaw, IN, USA) were implanted in all 40 patients.

An extended trochanteric osteotomy was done to remove distal cement plugs or well-fixed stems.[16] Before the femoral stems were implanted, any source that led to impingement, e.g., cement, neocortex, and soft tissue membrane, was removed from the canal. We anticipated obtaining a scratch-fit segment of healthy distal femoral diaphysis within five to seven cm. To avoid stem penetration of the nearby pedestal, the femoral canal was first prepared with the aid of a flexible reamer using a 2.5-mm ball-tipped reaming rod (Synthes, West Chester, PA, USA) and intraoperative fluoroscopy. This was followed by serial straight reaming of the femoral canal. In general, a better press-fit mechanism was obtained by under-reaming the femoral canal by 0.5 mm. A femoral trial was initially inserted to determine its optimal length and version. A mark was made on the intertrochanteric area as a reference for a subsequent femoral stem implantation. The femoral stem was implanted about one cm away from its designated position, after which the defect in the proximal femoral metaphysis and medial calcar area was filled with Vancomycin-loaded bone cement at the late-working phase. One gram Vancomycin were hand-mixed in each half a pack of 40 g cement polymer (Simplex® P cement, Stryker). The stem was then introduced to the designated position (Figs. 1 and 2). Cable or cerclage wire was reserved for patients with an intraoperative femur fracture, a greater trochanter fracture, or when extended trochanteric osteotomy was done.

Thirteen patients who had undergone stem revision only was allowed to walk immediately without weight-bearing restrictions. Twenty-seven patients who had undergone revision

Table 1
Demographic information of the enrolled patients.

Variable	Value
Number of patients	40
Age[a] (years)	60.9 (range: 39–85)
Gender	
Male	27
Female	13
Mean follow-up[a] (months)	67.7 (range: 24–149)
Indication of revision	
Aseptic loosening	29
Septic loosening	7
Recurrent dislocation	2
Periprosthetic fracture	2
Index revision surgery	
Total revision	27
Femoral stem only	13
Surgical approach	
Posterior approach with ETO	4
Modified Hardinge approach without ETO	36
Paprosky classification	
II[b]	27
IIIa[b]	13
Estimated blood loss[a] (milliliters)	960.0 (range: 500–1850)
Operation time[a] (minutes)	112.0 (range: 70–163)
Harris hip score[a]	
Preoperative	29.0 (range: 17–39)
Latest follow-up	76.0 (range: 55–91)

ETO: extended trochanteric osteotomy.
[a] Values expressed as mean (range).
[b] Paprosky classification type II: damaged metaphyseal bone stock with an intact diaphysis; Paprosky classification type IIIa: nonsupportive metaphysis with more than 4 cm intact diaphyseal bone for distal fixation.

Please cite this article in press as: Tsai S-W, et al., Cement augmentation in the proximal femur to prevent stem subsidence in revision hip arthroplasty with Paprosky type II/IIIa defects, Journal of the Chinese Medical Association (2017), https://doi.org/10.1016/j.jcma.2017.11.008