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Case Report

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Breakage of the Fins of S-ROM Stem in Total Hip Arthroplasty [Version 1, 1 Approved]

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Introduction

The S-ROM modular hip system (Depuy, Warsaw, Indiana) has been the most popular modular femoral hip system for the previous two decades [1]. Good results of total hip arthroplasty (THA) with the use of the S-ROM modular hip system have been achieved in primary THA [2-4], revision THA [5-7], and THA with concomitant subtrochanteric femoral shortening osteotomy [8]. One of the S-ROM femoral component's unique design features are the fins of distal femoral stem. The fins can improve intimate contact between the prosthesis and bone by engaging with the distal endosteal cortical bone to increase rotational stability [9].

In this report, we present a case of one patient to whom total hip arthroplasty with the S-ROM implant failed because of a breakage of the fins of the distal femoral stem. To our knowledge, there has been no previously reported cases of such breakage.

Case Report

A 46-year-old male patient (height 170cm, weight 70kg) presented in February 2009 with secondary osteoarthritis of the right hip due to congenital coxa vara, to which nonoperative measures of pain relief had failed. In the preoperative physical examination, the right lower limb was about 6cm shorter than the left lower limb. The preoperative x-ray radiograph showed that the right neck/shaft angle was 90° and congenital dislocation of right hip (Figure 1). The patient underwent a right total hip arthroplasty (performed by a surgeon who has since retired) by Southern approach with the use of S-ROM total hip system in February 2009. An uncemented Depuy Duraloc 40-mm acetabular component with a polyethylene liner was implanted into the true acetabulum as 20° anteversion and 45° abduction. On the femoral side, an S-ROM standard 14×09×130 stem with 30 STD neck, 22.225mm head and a 14-B small ZTT sleeve were used. The greater trochanter and the lesser trochanter were reinforced with 2 cerclage wires after the subtrochanter osteotomy. A distal femoral shortening osteotomy was performed and the internal fixation was made by a locking plate and screws (Figure 2). The patient did well postoperatively with a resumption of moderate activity level and ambulation without support. At 12 months postoperative time, the patient underwent a procedure to remove the locking plate and screws of the distal femur.

In October 2012, the patient had a sudden onset of right thigh pain and stumbled. In April 2013, the patient presented to our hospital and complained of a history of worsening pain in right thigh and the decrease of ROM of the right hip. The erythrocyte sedimentation rate and C reactive protein were normal. Radiographs showed the distal femoral stem fins fractured and the lateral cortex was discontinuous. The sunk femoral stem loosened and dislocated as seen in Figure 3.

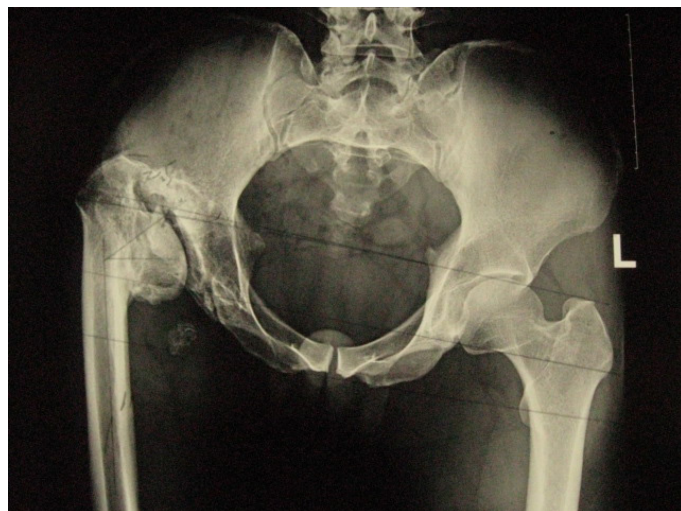


Figure 1: Preoperative radiograph, showed the right neck/shaft angle was 90° and the congenital dislocation of right hip.

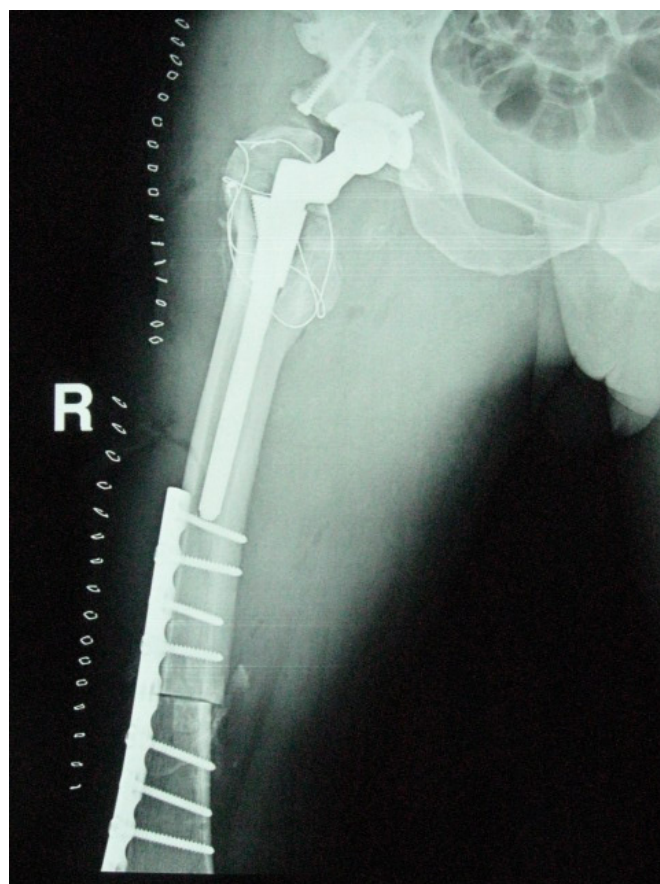


Figure 2: Radiograph after initial operation.

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Figure 3: Pre-revision operation radiographs, showed the breakage of the fins of the distal stem and the lateral cortex was discontinuous. The sunk femoral stem loosened and dislocated.

The patient then underwent a revision of a right hip arthroplasty procedure (performed by the correspondent author: Dr. Gu Guishan) with the removal of the S-ROM femoral stem and insertion of a prolonged 200mm Solution stem (Depuy, Warsaw, Indiana). The acetabular was untouched. Intraoperatively, the proximal part of the S-ROM femoral stem was found to be loose and was removed with ease. Bony union at the subtrochanter site was not acquired. The two distal stem fins were bonded to the cancellous bone and was removed by forceps. At 4 months follow-up, the patient did well with resumption of normal activities and ambulation without support (Figure 4 and Figure 5).

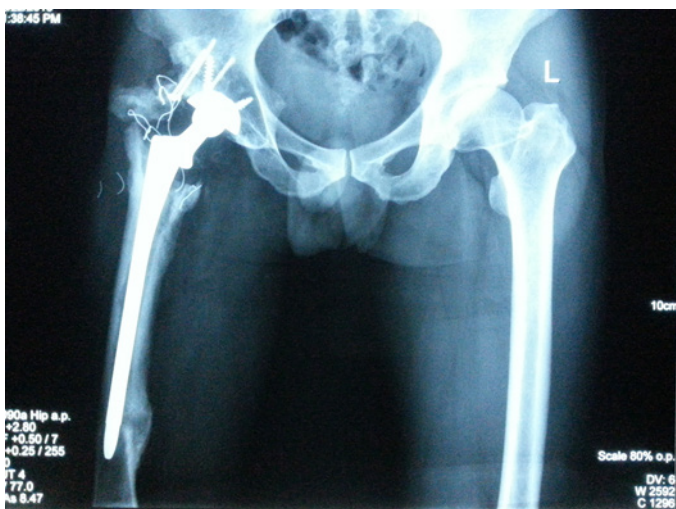


Figure 4: Post-revision operation radiograph.

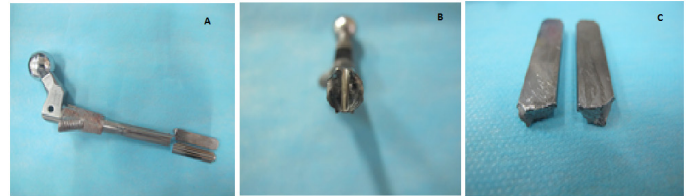


Figure 5: (A) the removed prosthesis. (B) the fractured surface. (C) the two fractured fins of the S-ROM stem.

Discussion

Breakage of the S-ROM femoral component is a documented complication. Patel A et al [3] reported two cases in which the stem-sleeve junction of the S-ROM femoral component fractured. Another breakage of almost the same position was reported by Mehran N et al [9]. However, to our knowledge, this is the first report of a breakage of the fins of the S-ROM stem.

The S-ROM modular stem was designed to generate maximal contact between the stem and the endosteum in the metaphysis and the diaphysis. Corrective osteotomy may also be performed because the S-ROM modular stem achieves both proximal and distal stability, respectively [10].

The proximal S-ROM modular stem is composed mainly of three parts: the stem, sleeve, and head. Due to the selecting of the optimal type and size of the three parts, the S-ROM modular stem permits easy adjustments to anteversion, offset, and leg length to provide optimal biomechanical reconstruction of the deformed femur in THA. The common conditions in which the S-ROM modular stem has been widely used includes: developmental dysplasia of the hip (DDH), prior surgery (eg, osteotomy), posttraumatic deformity, secondary osteoarthritis (eg, Legg-Calvé-Perthes disease, slipped capital femoral epiphysis, and sepsis), and coxa vara and coxa valga deformities [11]. Considering the deformity of the proximal femur in this case, we believe the use of S-ROM modular stem was the optimal choice for the initial operation of the patient in 2009. It is also testified by the recovery period between February 2009- October 2012. In that time, the patient did well with resumption of a moderate activity level and ambulation without support.

The distal S-ROM modular stem is a flute-like shape with coronal slot between two fins. There are splines 1.25mm in height covering the surface of two fins. During the surgical procedure, the stem is placed through the sleeve to engage the taper proximal via a cold weld, with the splines penetrating distally into the endosteal cortical bone for rotational stability and the coronal slot reducing the stem stiffness [9]. This is the mechanism of distal fixation, which is important when shortening osteotomy performed.

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In this case, we believe the S-ROM stem was undersized in the initial operation as showed by the Figure 2 in which the femoral stem didn't engage with the endosteal cortex. The rotational stability of the S-ROM modular system depends on the distal femoral stem fins engaging with the endosteal cortex. Thus, the undersizing of the femoral stem would decrease the strength of this interface. The patient's daily activities may create a torque that exceed the strength of the interlock between the stem and endosteal cortex, as well as the interlock between the sleeve and stem. With the distal fit not being optimal, the proximal sleeve would experience most of the rotational moment [12]. Thus, the patient had an evidence of stem loosening as seen in the figment 3. After loosening of the S-ROM stem, the distal fins would impinge with the lateral endosteal cortex repeatedly as long as the patient walks. Eventually, the lateral cortex of the distal femoral was thoroughly penetrated as we witnessed in the revision operation. In our view, this is the integrated mechanism that caused the breakage of the fins of S-ROM stem.

Unfortunately, the initial operation that was performed in 2009 was under a surgeon who has since retired. Our absence of the initial surgery and recovery period places a limitation on us in excluding some factors that may also caused the breakage of the fins of S-ROM stem, such as: whether the patient complied with the doctor's orders strictly, whether the right lowe limb bore weight earlier than a reasonable time, etc. However, we believe the undersizing of the S-ROM stem is the main reason of the breakage.

Conclusion

This case highlights the importance of clinicians being cautious for the possibility of the breakage of distal femoral fins of S-ROM prosthesis, especially those might be undersized. It also highlights the benefits of a long-term clinical and radiographic review of THA patients to enable early detection and prevention of the breakage of prosthesis.

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