

A Novel Antero-Medial Cortical Window Technique for Removal of Well-Fixed Fully Porous Stem in Revision Total Hip Arthroplasty

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Abstract

Fully porous-coated cementless stem has the advantage of good initial metaphyseal to diaphyseal fixation. However, it is very difficult to remove the stem when complications develop. Extraction of a stem may cause huge damage to the femur. A long stem may be required to ensure stability for subsequent femoral reconstruction. Here we present a case employing a novel technique of minimizing invasion to the femur when a wellfixed, extensively porous-coated cementless stem needs to be removed.

A 58-year-old woman had a revision total hip arthroplasty for trunnionosis after the left total hip arthroplasty. In the operation we made two cortical windows to the femur. It enabled us to reach all circumferences of the stem. By this technique the stem could be easily removed and the femoral canal structure was preserved. The femur could then be reconstructed with a stem of normal length. The Anatomic Medullary Locking (AML) stem is a representative implant of a fully porous-coated cementless stem that brings out the problems of trunnionosis which leads to adverse reaction to metal debris and stem neck fracture. Revision total hip arthroplasty is on the increase because of these complications. It is considered that our technique is useful in such cases.

Keywords: Total hip arthroplasty; Stem removal; Surgical technique; Trunnionosis; Adverse reaction to metal debris

Introduction

Various types of stems have been used in primary Total Hip Arthroplasty (THA). The fully porous-coated stem has the advantage of good initial metaphyseal to diaphyseal fixation [1]. However, it is pointed out that this stem presents the problem of the difficulty of stem removal. Cases of stem removal include infection, dislocation, stem neck fracture, and Adverse Reaction to Metal Debris (ARMD) [2]. When removal of a well-fixed stem is mandatory, dividing a femur vertically along the fully length of the stem would cause huge damage to the femur. We devised an original method of both minimizing invasion to the femur when removing a well-fixed stem and also of reconstructing by using not a long stem but a standard stem. We introduce this technique through a case of trunnionosis with an Anatomic Medullary Locking (AML) stem (Depuy, Warsaw, Indiana).

Case Report

A 58-year-old woman suffered from left hip joint pain. She was diagnosed as bilateral osteoarthritis secondary to dysplasia of the hip. She had an operation of cementless Total Hip Arthroplasty (THA) of her left hip at another hospital. The operation was performed using a femoral head with a 28 mm diameter and +6 mm neck length (Endurance head; Depuy, Warsaw, Indiana) and an extensively porous-coated cementless femoral component (size 11 mm AML-plus; Depuy, Warsaw, Indiana). The postoperative course was uneventful. At five years and five months after the operation, a mass was palpable on the anterior side of her left thigh. She felt discomfort and attended at our hospital. There was no redness or local heat on her left thigh. Her body

temperature was 36.0°C. A blood test was performed, which showed a white blood cell of 5480/ μ l, and C-reactive protein at 0.1 mg/dl. X-ray showed heterotopic ossification in her left hip joint (Figure 1).

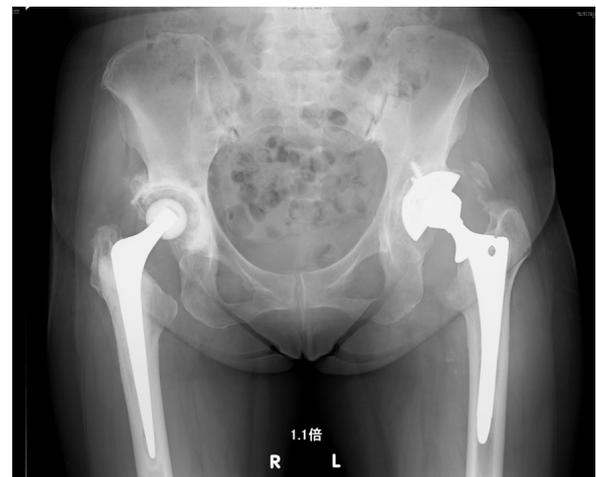


Figure 1: Preoperative X-ray of bilateral hip joint, there was heterotopic ossification in a left hip joint. There was no osteolysis in the zones of the stem.

Computed tomography images showed an abnormal large mass on her left hip joint (Figures 2A and B). Although this was considered as a condition of Adverse Reaction to Metal Debris (ARMD), infection could not be ruled out from the differential diagnosis. Revision left

THA was therefore planned with thorough preparations preoperatively.

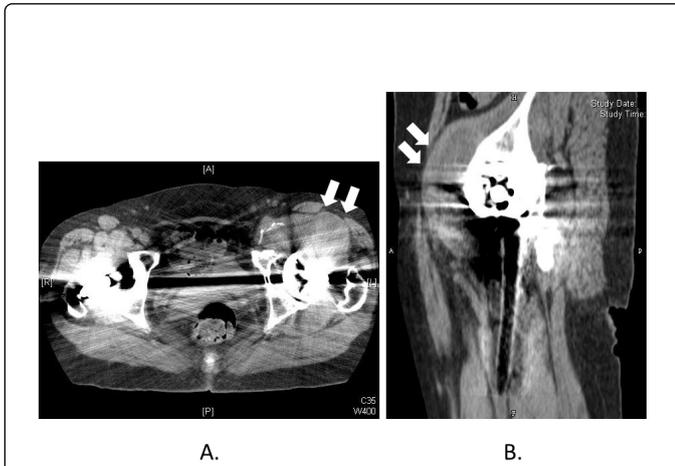


Figure 2: Preoperative CT image of bilateral hip joint A. axial view, B. sagittal view. Abnormal shadow of large mass was detected with a focus on a left hip joint (white arrow).

A Glassman's approach was used in the left revision THA [3]. Much metal debris was detected with a focus on the head-neck junction (Figure 3).

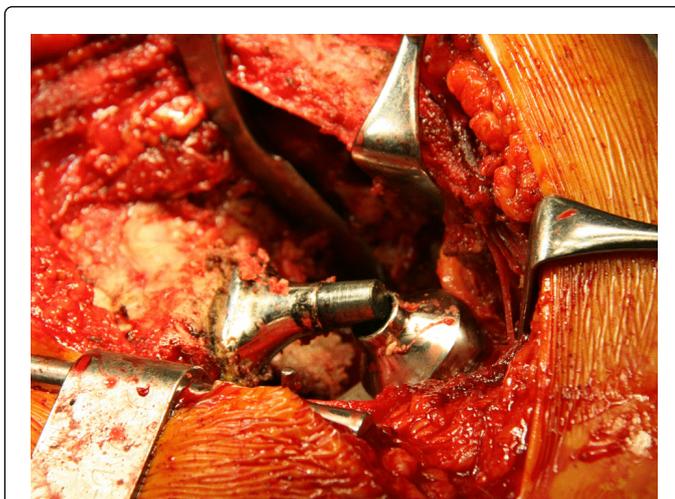


Figure 3: Intraoperative photo taken at revision total hip arthroplasty of left hip. Metal debris was detected with a focus on a head neck junction.

No visible wear was detected at articulating surface. First, release between the stem and femoral bone was performed from the proximal side of the femur using a 2 mm diameter Kirschner wire and a thin-bladed chisel. This is the conventional method of stem removal. However, the stem could not be removed by knocking it. We made two cortical windows using a steel bar with a 5 mm diameter at the anteromedial part of the femur (Figure 4).

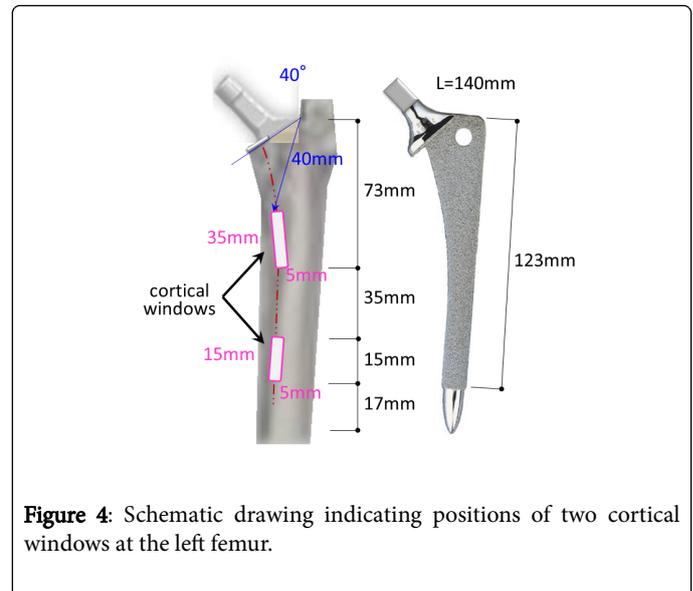


Figure 4: Schematic drawing indicating positions of two cortical windows at the left femur.

One cortical window was made 40 mm distally from the tip of the femur, 35 mm long and 5 mm wide, and the other cortical window was made 35 mm distally from the lower end of the proximal cortical window, 15 mm long and 5 mm wide. The stem was detached from the medullary canal using a 2 mm diameter Kirschner wire through these cortical window. A 2 mm diameter Kirschner wires were inserted between stem and femoral bone from the window in succession (Figure 5).

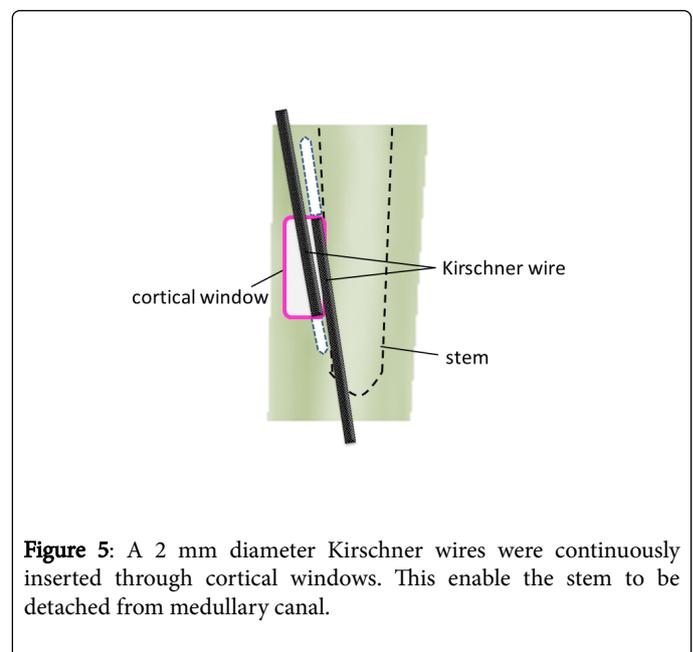
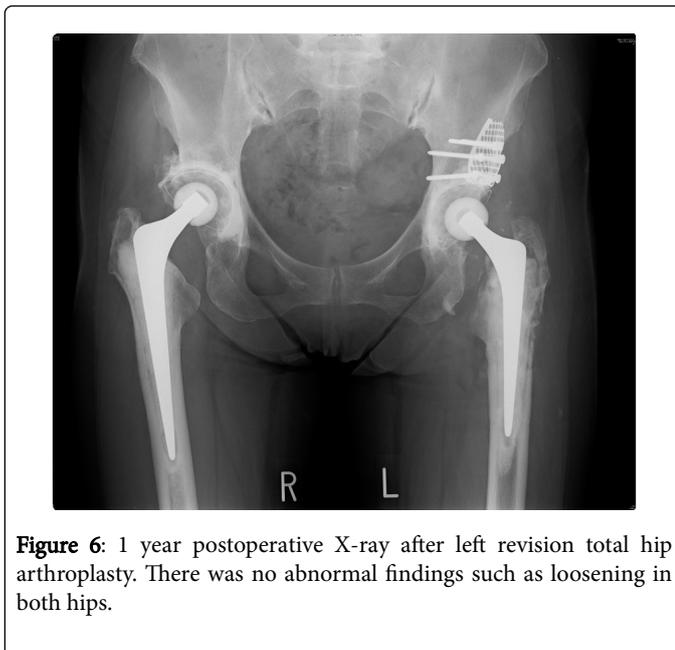


Figure 5: A 2 mm diameter Kirschner wires were continuously inserted through cortical windows. This enable the stem to be detached from medullary canal.

After this procedure, the stem was easily removed. The two cortical windows were closed with two convex allografts of cortical bone from tibial plateau, measuring 40 mm × 10 mm and 20 mm × 10 mm, respectively. For fixation we used three meshed ultra-high molecular weight polyethylene (UHMWPE) tapes (Nesplon Cable Systems; Alfresa Pharma Corporation, Osaka, Japan) with a 5 mm width, using a double-loop sliding knot technique, and we tightened up using the Tighting Gun TGL (Alfresa Pharma Corporation, Osaka, Japan). This

technique reconstructed containment of the femur. It was possible to reconstruct the femur by standard stem. An Exeter V40 35.5-sized hip stem (Stryker Orthopedics, Mahwah, New Jersey) was cemented using the interface bioactive bone cement technique [4]. It was possible to reconstruct the femur by standard stem. At the acetabular side, after the polyliner was removed, the screws fixing the cup were loosened. The cup was also loosened and easily removed. There was no sign of metal wear and debris on the cup. A revised cemented cup was fixed with impaction bone grafting [5] (Figure 6).

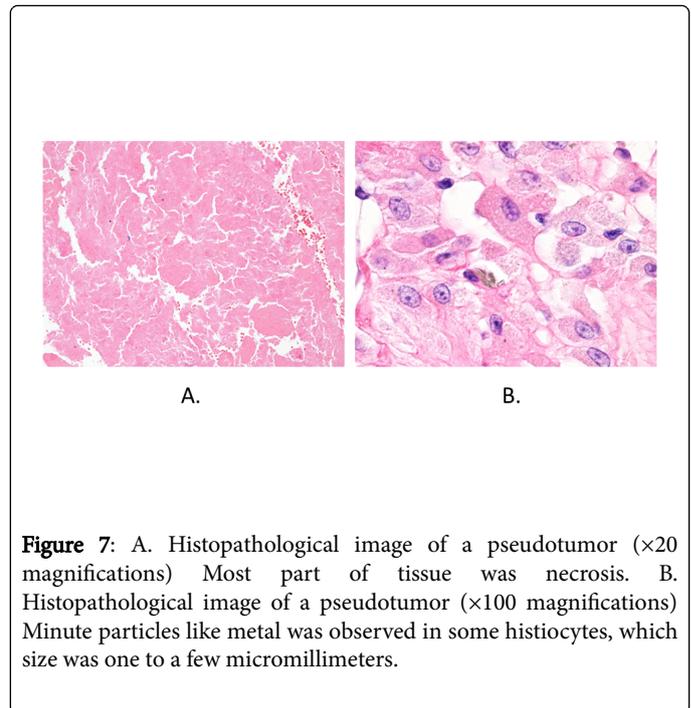


Cobalt and chromium was detected in the hip joint fluid which was taken intraoperatively. Histological examination showed that most of the pseudotumor was necrotic tissue. Some cells showed the intake of metal debris of 2-3 μm in size (Figures 7A and B). Four years postoperatively the left hip showed a good clinical course.

Discussion

ARMD denotes the reaction of metal debris from the interface between metal implants to the tissue covering the hip prosthesis. However, recently similar phenomenon have been described in the setting of non-metal-on-metal prosthesis. Wear was observed between the head and the neck, termed trunnionosis. Donaldson et al. [6] reported that increased offset was associated with greater motion at femoral head-neck junction. In our case much metal debris was detected in the joint space intraoperatively, especially at head-neck junction. Head implant was designed for a long neck. Trunnionosis was developed which led to ARMD. Thus a revision THA was required even though the femoral component was well fixed. The stem had to be entirely replaced because the conus of the stem neck was damaged.

Osteotomy extended up to the diaphysis of the femur is often necessary when a cementless stem without loosening needs to be removed for any other inevitable reason [7,8]. Some knacks and pitfalls should be considered in order to minimize invasion to a femur and to reconstruct the femur.



One, the luminal structure is weakened after the stem is removed if femoral osteotomy or the femoral cortical windows extend to the distal end of the stem. In such cases, a long stem is needed for femoral reconstruction. Osteotomy or cortical windows should be made proximally from the tip of the stem to reconstruct the femur by standard stem.

Another technical point is that the osteotomy or cortical window should be performed at the anteromedial part of the femur. As the shape of the medial side of a stem is curved, it is difficult to reach there from the anterior side of the femur. Especially, it is impossible to approach the medial side of a stem which has a collar, as is the case with the AML stem, from the proximal side of a femur. Hence, a cortical window needs to be made at the anteromedial side of the femur.

Piyakunmala et al. [9] reported another method, whereby the cortical bone of the posterior aspect of the proximal femur was cut into a rectangle which was then excised. A long stem for reconstruction was needed in this approach because the window was long. Schmidt et al. [10] reported that a well-fixed cementless stem was removed using unique surgical instruments. A Swiss Orthoclast handpiece (EMS Medical GmbH, Konstanz, Germany) and specially shaped flexible chisels were needed for stem removal. However, these instruments were expensive and difficult to obtain.

In our method, two small cortical windows safeguarded the strength of the canal structure of the femur. Additionally, our cortical windows did not extend to the distal end of the inserted stem. The advantage of these contrivances was that the stem was removed without compromising the cylindrical form of the femur. This enabled us to reconstruct the femur using a cemented standard stem, not a long stem. Moreover, inexpensive tools such as a 2 mm diameter Kirschner wire were used in our method. This instrument is accessible and readily available in any hospital.

There will be greater opportunities to use this technique because cases of revision hip arthroplasty for ARMD from AML stem are increasing. We believe that our novel anteromedial cortical window technique will be in demand at many hospitals.

Conclusion

Removal of a well-fixed cementless stem is technically demanding and the invasion makes it difficult to reconstruct the femur. However, an anteromedial cortical window technique enables us to remove the stem safely and femoral reconstruction can therefore be performed by standard stem. We believe that our technique is useful for revision THA in cases of well-fixed cementless stem. More cases are required to monitor the outcome and complications of this technique.

Conflict of Interest

All authors declare that they have no conflict of interest.

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