

Gross Trunnion Failure of the Accolade I Femoral Stem with Metal-on-Polyethylene Eccentric Wear: A Report of 2 Cases

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Abstract

This report presents two cases of gross trunnion failure (GTF) following total hip arthroplasty (THA) that demonstrate dissociation of the femoral head from the trunnion, as well as elevated serum ion levels and metal-on-polyethylene eccentric wear. Risk factors for GTF including body mass index (BMI) >30 kg/m², male sex, low angled neck, high offset femoral stems, and large alloy metal heads were present in both patients. Patients that have risk factors or specific components prone to GTF should be monitored closely for symptoms, elevated serum ion levels, and radiographic signs of GTF to avoid catastrophic failure necessitating revision arthroplasty.

Keywords: Elderly; Male and female; Gross trunnion failure; Trunnionosis; Stryker accolade I femoral stem; Metallosis; Adverse local tissue reaction; Obesity; Inability to ambulate; Pain; Elevated cobalt and chromium serum ion levels; Dissociation of modular femoral head; Revision total hip arthroplasty; Accolade TMZF

Introduction

Gross trunnion failure (GTF) results from the loss of trunnion material at the Morse taper interface due to mechanically assisted crevice corrosion (MACC) and subsequent mechanical failure. Adverse local tissue reaction (ALTR) may be associated with trunnionosis or GTF [1]. The Stryker Accolade I femoral component (Stryker Orthopedics, Mahwah, NJ) composed of titanium–molybdenum–zirconium–iron alloy (TMZF) with a V40 trunnion has been associated with ALTR and GTF. There are two cobalt-chromium alloy metal heads that are also associated with ALTR and GTF in several case reports when used with the Stryker Accolade I femoral component [2,11].

Retrieval analysis found that catastrophic failure of the trunnion and a characteristic wear pattern of the trunnion with a “bird beak” appearance was observed when Accolade I stems were paired with either MITCH or LFIT femoral heads [3]. Factors other than the specific implants increase the risk of GTF. They include a BMI >30 kg/m², male sex, high activity level, larger CoCr alloy metal heads, increased neck length, small stem taper diameters, TMZF metal alloys, and high offset stems [11,15]. The Accolade I stem combined with V40 trunnions and CoCr alloy heads was most prone to fretting corrosion under simulated corrosion conditions [17]. This was not the case when a ceramic head was combined with a V40 trunnion [17]. In one systematic review of the literature, the Stryker Accolade I femoral stem was most associated with GTF, even in hip replacements with metal-on-polyethylene articulations [18]. While the Accolade I stem seems prone to GTF, other stems have also been associated with this catastrophic problem [19]. This report describes two cases of GTF, with a discussion of risk factors and recommendations for clinical surveillance.

Case Presentation

Case 1:

This patient was a 77-year-old male with a history of progressive left hip pain for two years, which acutely worsened with an associated mechanical “clunking” noise and decreased ability to bear weight or ambulate. His past medical history included dementia, hypertension, coronary artery disease, a bovine aortic valve replacement, hyperlipidemia, and depression. Index THA was performed in 2011. A Stryker Accolade I femoral component and a porous cup with a metal-on-polyethylene articulation were implanted at an outside hospital. Records revealed the components included a 40 mm, +4 CoCr metal alloy head, a V40 taper, and a 127-degree neck-shaft angle. The patient was 6’2”, 268 lbs, and had a BMI of 34.4. His left lower extremity was shortened by 2.5 cm, and he had a posterolateral left hip surgical incision which appeared to be well healed without active signs of infection. Any motion of the left hip was painful, and his sciatic nerve was intact. Serum cobalt was 45 ug/L. Serum chromium was 15.3 ug/L. Erythrocyte sedimentation rate (ESR) was 50 mm/hr, and C reactive protein (CRP) was 5.42 mg/dL. A joint aspiration was performed 03/09/2021 resulting in a corrected leukocyte count of 1,271 based on Ghanem et al adjusted fluid leukocyte count equation [20]. Aerobic and anaerobic cultures were negative. Radiographs demonstrated an uncemented total hip replacement, and there was dissociation of the femoral head from the trunnion (Figure 1).

Asymmetric wear was present at the proximal tip of the trunnion. Otherwise, the implants were well placed and well fixed. The treatment plan included revision THA with acetabular liner exchange to a constrained liner and revision of the femoral component. The expected outcome was a routine postoperative course typical of revision THA, improved pain, ability to bear weight, and a long-term reduction in serum metal ion levels. Revision THA was performed on 03/11/2021. The acetabular liner was exchanged for a Stryker Trident 0 degree constrained acetabular liner, because of soft tissue damage and asymmetric polyethylene wear. Intraoperatively, the trunnion had a typical “bird beak” sign, which made it necessary to revise the femoral component (Figure 2). A Biomet Echo Bi-Metric standard femoral stem, using a Biomet Biolox delta option ceramic head and taper adapter, was implanted (Figure 3). When last seen in the clinic on 04/12/21 the patient was ambulating with a walker and his surgical incision was well-healed. He passed away for unrelated reasons prior to his next scheduled follow-up appointment.

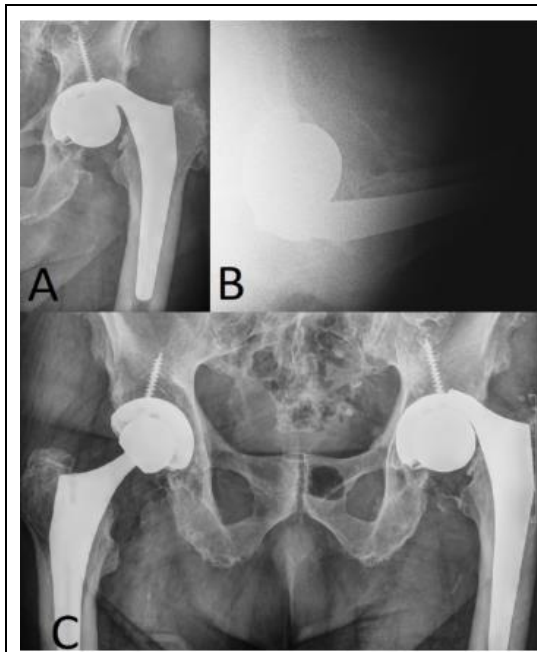


Figure 1: 1A-1C Radiographs (Case 1). Preoperative anteroposterior left hip (A), lateral left hip (B), and anteroposterior pelvic (C) radiographs demonstrating gross trunnion failure with dissociation at the femoral head-neck junction.



Figure 2: 2A-2F Intraoperative photographs (Case 1 and 2) demonstrating circumferential erosion of the trunnion and a medial defect of the femoral neck in Case 1 (A-C) and eccentric wear of the polyethylene acetabular liner in Case 2 (D) and circumferential erosion of the trunnion in Case 2 (E-F).

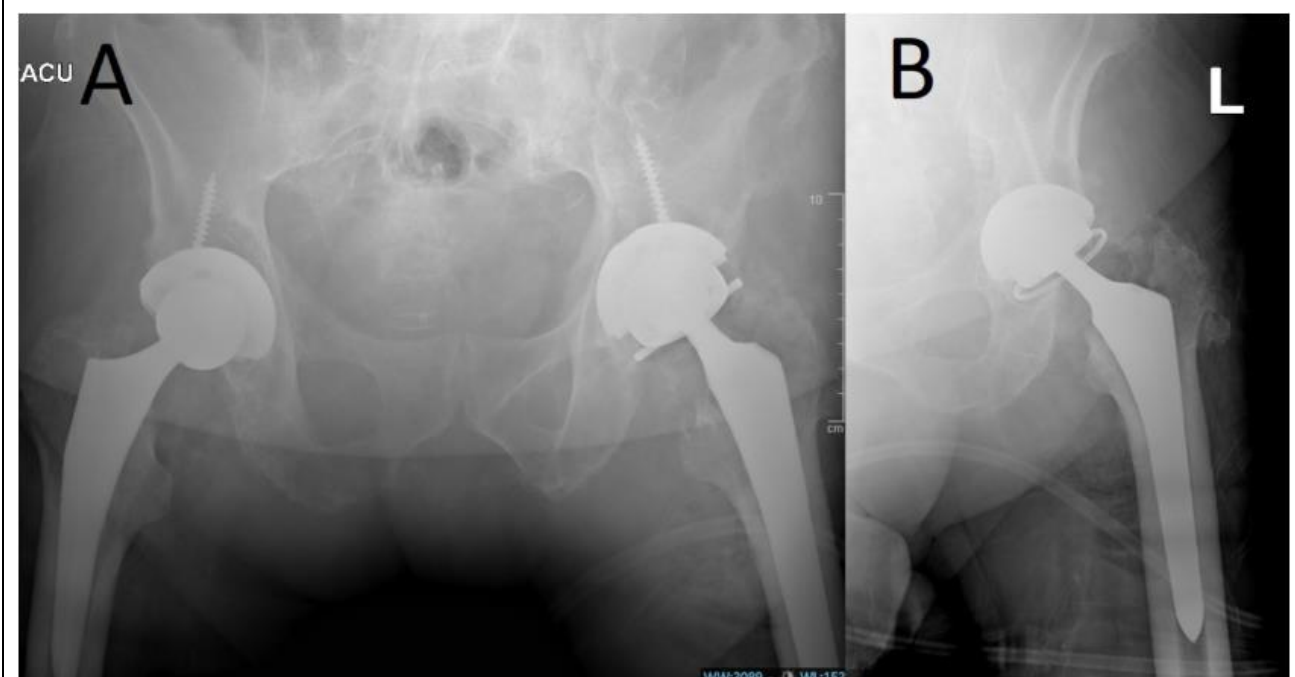


Figure 3: 3A-3B Radiographs (Case 1). Postoperative anteroposterior pelvic (A) and anteroposterior left hip (B) radiographs following left hip revision arthroplasty.

Case 2:

This patient was a 62-year-old male with right hip pain for two weeks aggravated by weight bearing after hearing a loud “pop” during ambulation, and he was unable to bear weight on presentation. Index THA was performed on 12/02/2010 using a Stryker Accolade I femoral stem with a high offset, 36 mm head, standard neck length, and a V40 taper. He also had a 52 mm Stryker Trident porous acetabular component with a polyethylene liner. Past medical history included morbid obesity, diabetes mellitus, hypertension, hyperlipidemia, and obstructive sleep apnea. Physical examination revealed the patient was 6’0”, 345 lbs, and his BMI was 46.8. The right lower extremity was shortened, and any motion was painful. There was a well healed anterolateral incision over the hip, and he was neurovascularly intact. ESR was 27 mm/hr, CRP was 0.85 mg/dL, serum cobalt was 5.2 ug/L, and serum chromium was 1.2 ug/L. Radiographs demonstrated an uncemented total hip replacement, and there was dissociation of the femoral head from the trunnion (Figure 4). Asymmetric wear was present at the proximal tip of the trunnion. Otherwise, the implants were well placed and well fixed.

The treatment plan included revision THA with acetabular liner exchange to a constrained liner and revision of the femoral component. The expected outcome was again a routine postoperative course typical of revision THA, improved pain, ability to bear weight, and a long-term reduction in serum metal ion levels. Revision THA was performed 04/13/2021. The acetabular liner was exchanged for a Stryker Trident 0 degree constrained acetabular liner, because of soft tissue damage and asymmetric polyethylene wear (Figure 2).

Intraoperatively, the trunnion had a typical “bird beak” sign, which made it necessary to revise the femoral component (Figure 2). A Biomet Echo Bi-Metric Standard femoral stem, using a Biomet Modular metal head, was implanted (Figure 5). When seen on 10/13/21 and 4/20/22, the patient was ambulating independently and had a well-healed surgical incision. Serum cobalt and chromium levels were reduced on 10/13/21 to 1.2 ug/L and < 1 ug/L respectively. On 4/20/22, they were 1.4 ug/L and 1.4 ug/L respectively.

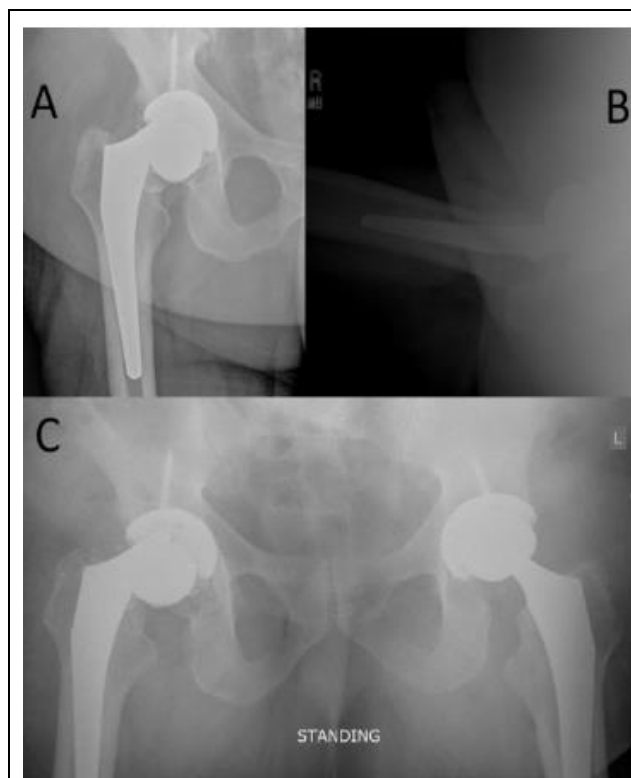


Figure 4: 4A-4C Radiographs (Case 2). Preoperative anteroposterior right hip (A), lateral right hip (B), and anteroposterior pelvic (C) radiographs demonstrating gross trunnion failure with dissociation at the femoral head-neck junction.

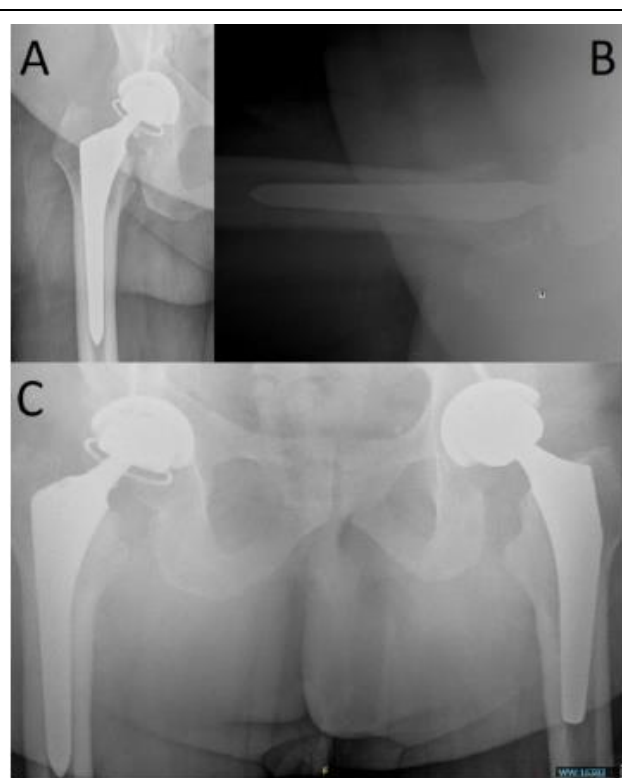


Figure 5: 5A-5C Radiographs (Case 2). Postoperative anteroposterior right hip (A), lateral right hip (B), and anteroposterior pelvic (C) radiographs following right hip revision arthroplasty.

Tables: Demographic data for all cases are shown in Table I, and metal ion levels for all cases are shown in Table II.

TABLE I: Patient Demographics and Surgical Data	Case 1	Case 2
Date of Index THA	2011	12/02/2010
Date of Revision	03/11/2021	04/13/2021
Age at Revision (yr)	77	62
Sex	M	M
Height (ft+in)	6+2	6
Weight (lbs)	268	345
BMI	34.4	46.8
Stem Type	Accolade I	Accolade I
Offset	Lateral	Lateral
Head Size (mm)	40	36
Head Material	CoCr	CoCr
Cup Type	Trident	Trident

TABLE II: Metal Ion Levels	Case 1	Case 2
Pre-revision Serum Cobalt (ug/L)	45	5.2
Pre-revision Serum Chromium (ug/L)	15	1.2
Post-revision Serum Cobalt (ug/L) at 6 Month Follow-up	Not obtained	1.2
Post-revision Serum Chromium (ug/L) at 6 Month Follow-up	Not obtained	<1
Post-revision Serum Cobalt (ug/L) at 12 Month Follow-up	Not obtained	1.4
Post-revision Serum Chromium (ug/L) at 12 Month Follow-up	Not obtained	1.4

Discussion

GTF is a catastrophic complication following THA. Known risk factors include BMI of $>30 \text{ kg/m}^2$, male sex, high activity level, larger diameter and CoCr alloy metal head, longer neck lengths, small stem taper diameters, less stiff metal alloys, such as TMZF, and stems with a high offset. The Stryker Accolade I femoral stem with CoCr alloy metal femoral heads has been associated with a disproportionate number of cases of GTF, and they have been voluntarily discontinued by Stryker. However, only 3 cases of trunnionosis as a cause for aseptic failure were documented in a recent long-term analysis of the survivorship of this stem in 2609 patients, with smaller femoral size and larger femoral head offset being independent risk factors for aseptic failure despite an overall excellent survivorship [21]. Prior to gross trunnion failure, patients may develop trunnionosis and elevated serum chromium and cobalt ion levels. Both cases in this series demonstrated the majority of known risk factors, elevated serum ion levels, and the pairing of a Stryker Accolade I femoral stem with a CoCr alloy metal head. In one of these cases, we were able to confirm a reduction in serum metal ion levels after revision THA.

Conclusion

These two cases describe both preoperative and intraoperative concerns regarding revision following GTF. We believe that patients who have undergone THA utilizing the Stryker Accolade I femoral stem should be monitored annually for symptoms, radiographic signs, and elevated serum ion levels. Unfortunately most patients are asymptomatic until dissociation of the femoral head occurs. Both of our cases following GTF demonstrate asymmetric wear of the proximal trunnion radiographically, which should alert a surgeon that femoral revision will be required, as well as asymmetric wear of the polyethylene liner intraoperatively. We recommend liner exchange to a constrained liner in this scenario, particularly if soft tissue compromise as the result of ALTR or pseudotumor formation is observed, to reduce the risk of subsequent dislocation following revision arthroplasty.

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