

Spontaneous Dissociation of Prosthetic Humeral Head: A Case Report

Abigail N Byrne, B.A., Caitlin M McCarthy, B.A., and Laurence D. Higgins, M.D.

Sports Medicine Service, Department of Orthopaedic Surgery, Brigham and Women's Hospital, Harvard Medical School, Boston, MA 02114

Abstract: Dissociation of a Morse taper arthroplasty is an uncommon occurrence, especially in the shoulder, reported in only one publication in the English literature.¹ In response to reported dissociations of Morse taper modular humeral components, Blevins et al. identified conditions that would interfere with the Morse taper interface strength. The relevant cases were reported only in a single component design and occurred between 1988-1992. Subsequent reports of consecutive arthroplasties with this prosthesis failed to document further episodes of Morse taper dissociation.²

In contradistinction, dissociation of the femoral heads in hip arthroplasty has been more commonly reported.^{4,10-14} It most frequently occurs during reduction of a dislocated prosthesis that then needs to be surgically addressed. The dissociation is not always apparent on post-reduction radiographs, underlining the importance of scrutinizing the images for radiolucencies and the position of the head of the prosthesis in the acetabular cup.⁷

The present case pertains to a DePuy Global Advantage total shoulder prosthesis implanted in 2008. This prosthesis is a third generation anatomical model, unlike the 1988-1992 second generation component previously reported in the literature. Heretofore, there have been no cases of humeral head dissociation in third generation total shoulder prostheses.

The authors have obtained the patient's informed written consent for print and electronic publication of the case report.

Keywords: dissociation, shoulder, arthroplasty, case report, metallosis, articulation

A 65-year old female patient presented to our clinic three and a half years status post right total shoulder arthroplasty for rheumatoid arthritis. At the time of surgery, she underwent uncomplicated insertion of a DePuy Global Shoulder prosthesis, whereby the rotator cuff muscles were reportedly intact. She described pain and poor function of the shoulder since the procedure, with increasing pain and decreasing function over the preceding 8 months. The pain

was reported as a 6/10 at rest to a 10/10 at its worst and awakened her from sleep; she reported a subjective shoulder value of 25%. Crepitus was noted during physical examination. The patient denied any inciting event or trauma.

Radiographs taken the day of the initial visit revealed dissociation of the humeral head from the humeral stem. The male component of the Morse taper appeared to be articulating with the glenoid component. CT revealed adequate glenoid

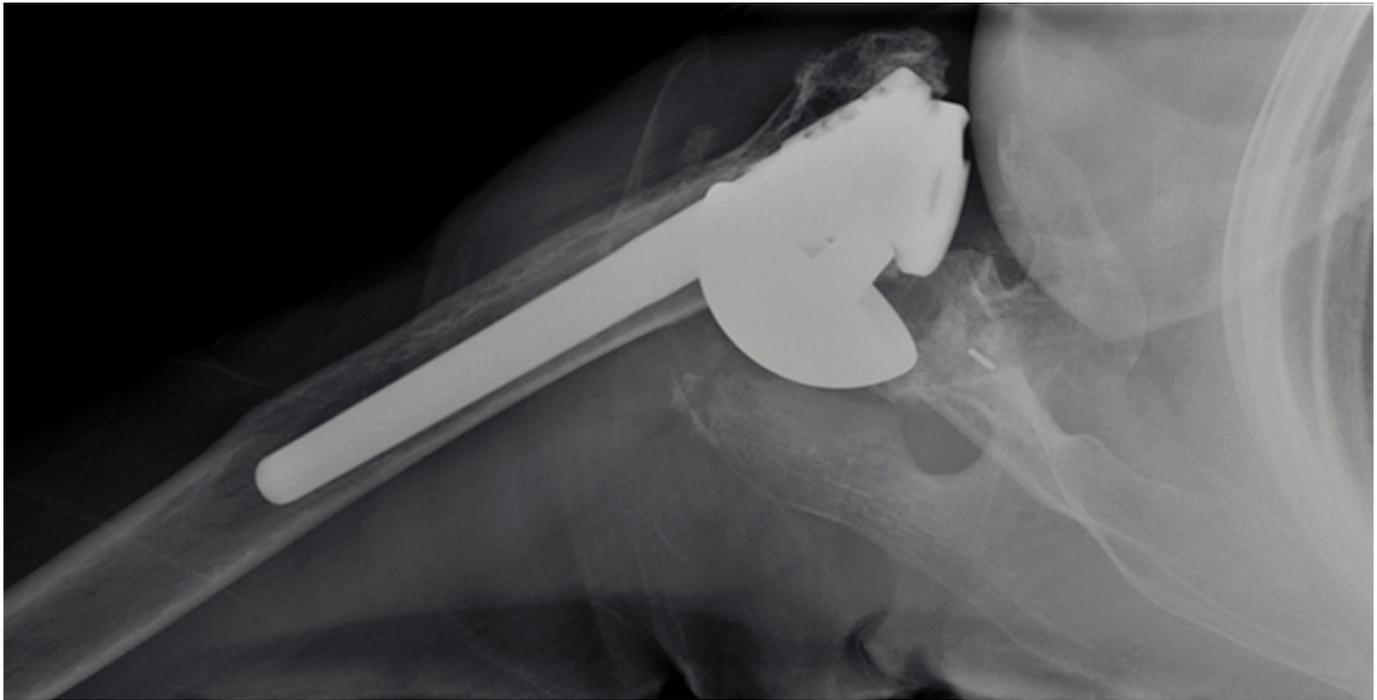


FIGURE 1. Plain films of the dissociated prosthesis at initial presentation

bone stock, an asymptomatic os acromiale, and the dissociation of the Morse taper (Figure 1).

On physical examination, the patient demonstrated a pseudoparalytic shoulder with significant atrophy of the spinati muscles. There was marked tenderness to palpation over the proximal humerus at the site of the humeral com-

ponent, with the appearance of the humeral component statically subluxed anteriorly and superiorly (anterior/superior escape). Range of motion on the affected side was less than 25° of forward flexion and abduction (Table I). The patient demonstrated a 20° lag in external rotation at 0° along with positive lift-off, bear hug

TABLE 1. Strength and ROM at initial presentation		
	Right	Left
<i>Forward Elevation</i>	40 °	160 °
<i>External Rotation at 0 °</i>	20 °	50 °
<i>External Rotation at 90 °</i>	40 °	80 °
<i>Internal Rotation</i>	to the body	30 °
<i>Isolated Abduction</i>	20 °	100 °
<i>External Rotation</i>	2.4/2.3 kg	3.1/2.6 kg
<i>Internal Rotation</i>	2.8/3.1 kg	2.5/2.9 kg
<i>Supraspinatus</i>	1.3/0.8 kg	3.6/3.4 kg

*Plain films of the dissociated prosthesis at initial presentation



FIGURE 2. Deterioration of the glenoid bone stock due to articulation of male Morse taper component with glenoid polyethylene component

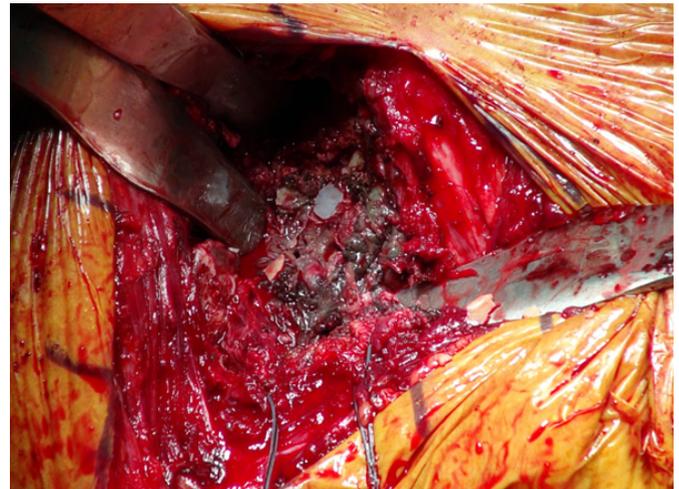


FIGURE 3. Metallosis and scarring within articular space as observed during revision

and belly press tests, although examination was difficult due to pain. Furthermore, the patient has documented rotator cuff deficiency with tears of the subscapularis and supraspinatus.

Due to a variety of medical and family issues, the patient delayed surgical intervention despite her discomfort for a period of nine months. At her immediate pre-operative visit, radiographs confirmed persistence of the Morse taper dissociation.

The decision was made to proceed with conversion to reverse arthroplasty with transfers of

the latissimus dorsi and the teres major tendons to improve function and diminish pain. Intraoperative findings included significant glenoid damage, resulting from articulation of the humeral male Morse taper component with the glenoid polyethylene component, including fracture of the polyethylene (Figure 2). Due to the prolonged period of dissociation, moderate metallosis and marked scarring were also found with resultant component instability (Figure 3). The humeral head had migrated to the posterior aspect of the shoulder, and the subscapularis, supraspinatus,



FIGURE 4. (A) Passive Forward Flexion, 3 months status post revision and conversion to Reverse Arthroplasty (B) External Rotation at 90°, 3 months status post revision and conversion to Reverse Arthroplasty



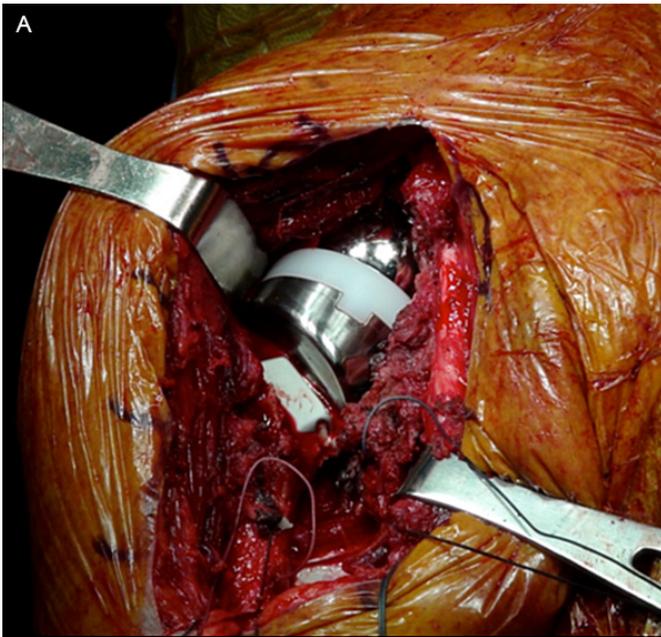


FIGURE 5. (A) Revision and Conversion to Reverse Arthroplasty (B) Plain films demonstrating well placed reverse prosthesis 3 months status post revision and conversion

and infraspinatus were noted to be deficient.

Three months after revision, the patient was doing well without pain and actively engaged in physical therapy. She demonstrated forward flexion to 80° actively, and 150° passively with active external rotation to 45° bilaterally (Figure 4a-4b). Radiographs from the three month visit show a well placed reverse prosthesis without evidence of hardware complications (Figure 5a-5b).

Discussion

This case marks the first time in the literature that spontaneous dissociation of a humeral head in the third generation shoulder arthroplasty has been reported. It also represents a deviation from the literature on dissociation of a Total Hip Arthroplasty, which is often precipitated by a dislocation or other trauma. However, similar to cases of dissociations in the hip literature, this case was not caught at the onset of the patient's discomfort. Consequently, the

patient spent several months with a dissociated humeral head, leading to significant inflammation and metallosis. The metallosis itself is an unnecessary contributor to the patient's prolonged discomfort.⁸ Additionally, the degree of metallosis and subsequent scarring necessitated extensive debridement, which, coupled with the loss of glenoid bone stock due to articulation of the humeral component, inherently limited the options for revision arthroplasty and may have a negative impact on the patient's long-term functional outcomes.

Furthermore, metallosis itself has the potential for significant negative impact. A potential cause of polyneuropathy is cobalt-chromium metallosis from hip arthroplasty.³ The long-term implications of debris from metal-wear were reviewed in 2007, pertaining to their potential toxicity, local and systemic implications, and influences on carcinogenesis.⁵ Although, as pointed out by Khan, et al., a causal relationship between orthopedics prostheses and toxic met-

al levels has not yet been demonstrated,⁶ and levels sufficient to be toxic are highly unlikely to be reached from deterioration of an implant, let alone metallosis.⁹ At best, metallosis is a localized inflammatory reaction of the peri-prosthetic bone and surrounding soft tissues in response to metallic debris. This inflammatory response is a common secondary complication in revision arthroplasty.

Conclusion

In the interest of patient outcomes in the face of a dissociated prosthetic humeral head, early detection is important. Careful inspection of radiographs is essential for identifying these cases. Early detection will hopefully preserve limited glenoid bone stock and prevent the development of significant metallosis. Early diagnosis and treatment may therefore improve patient outcomes.

References

1. Blevins FT, Deng X, Torzilli PA, Dines D, Warren RF. Dissociation of modular humeral head components: a biomechanical and implant retrieval study. *J Shoulder Elbow Surg.* 1997 Mar-Apr; 6(2): 113-24.
2. Gartsman GM, Russell JA, Gaenslen E. Modular shoulder arthroplasty. *J Shoulder Elbow Surg.* 1997 Jul-Aug; 6(4): 333-9.
3. Ikeda T, Takahashi K, Kabata T, Sakagoshi D, Tomita K, Yamada M. Polyneuropathy caused by cobalt-chromium metallosis after total hip replacement. *Muscle Nerve.* 2010 Jul;42(1):140-3. doi: 10.1002/mus.21638
4. Karaismailoglu TN, Tomak Y, Gulman B. Late detachment modular femoral component after primary total hip replacement. *Arch Orthop Trauma Surg.* 2001 Sep;121(8):481-2.
5. Keegan GM, Learmonth ID, Case CP. Orthopaedic metals and their potential toxicity in the arthroplasty patient: A review of current knowledge and future strategies. *J Bone Joint Surg Br.* 2007 May;89(5):567-73. doi: 10.1302/0301-620X.89B5.18903
6. Khan WS, Agarwal M, Malik AA, Cox AG, Denton J, Holt EM. Chromium, cobalt and titanium metallosis involving a Nottingham shoulder replacement. *J Bone Joint Surg Br.* 2008 Apr;90(4):502-5. doi: 10.1302/0301-620X.90B4.20302
7. Kitziger KJ, DeLee JC, Evans JA. Disassembly of a modular acetabular component of a total hip-replacement arthroplasty. A case report. *J Bone Joint Surg Am.* 1990 Apr;72(4):621-3.
8. Lederman ES, Nugent MT, Chhabra A. Metallosis after hemiarthroplasty as a result of glenoid erosion causing contact with retained metallic suture anchors: a case series. *J Shoulder Elbow Surg.* 2011 Sep;20(6):e12-5. Epub 2011 Jun 11. doi: 10.1016/j.jse.2011.03.004
9. Merritt K, Rodrigo JJ. Immune response to synthetic materials. Sensitization of patients receiving orthopaedic implants. *Clin Orthop Relat Res.* 1996 May;(326):71-9.
10. Namba RS, Van der Reis WL. Femoral head and neck dissociation after a total hip arthroplasty with a constrained acetabular liner. *Orthopedics.* 2000 May;23(5):489-91.
11. Pellicci PM, Haas SB. Disassembly of a modular femoral component during closed reduction of the dislocated femoral component. *J Bone Joint Surg.* 1990 Apr;72(4):619-20.
12. Spinnickie A, Goodman SB. Dissociation of the femoral head and trunion after constrained conversion total hip arthroplasty for poliomyelitis. *J Arthroplasty.* 2007 Jun;22(4):634-7. Epub 2007 Jan 22. doi: 10.1016/j.arth.2006.05.011
13. Star MJ, Colwell CW, Donaldson WF, et al. Dissociation of modular hip arthroplasty components after dislocation. *Clin Orthop Relat Res.* 1992 May;(278):111-5.
14. Woolson ST, Pottorff GT. Disassembly of a modular femoral prosthesis after dislocation of the femoral component. *J Bone Joint Surg.* 1990 Apr;72(4):624-5.