Orthopaedics & Traumatology: Surgery & Research 101 (2015) 759–761

Available online at

ScienceDirect

www.sciencedirect.com

Elsevier Masson France

EM|consulte

www.em-consulte.com/en

Technical note

Conversion of total shoulder arthroplasty to reverse shoulder arthroplasty made possible by custom humeral adapter

J. Matsoukis [a,*], F. Billuart [a], K. Houssam [b], F. Dujardin [b], G. Walch [c]

[a] *Département de chirurgie orthopédique, groupe hospitalier du Havre, BP 24, 76083 le Havre cedex, France*
[b] *Département de chirurgie orthopédique et traumatologique, CHU de Rouen – Charles-Nicolle, 1, rue de Germont, 76031 Rouen, France*
[c] *Centre orthopédique Santy, 24, avenue Paul-Santy, 69008 Lyon, France*

ARTICLE INFO

Article history:
Received 27 February 2015
Accepted 12 June 2015

Keywords:
Shoulder
Reverse arthroplasty
Revision
Modular

ABSTRACT

Reverse shoulder arthroplasty (RSA) is increasingly being used to revise anatomical total shoulder arthroplasty cases. This procedure's high complication rate has been reduced by the availability of modular shoulder systems, which allows the humeral component to be preserved during the conversion. This case report describes the revision of an anatomical shoulder implant inserted in 1998. Polyethylene wear and the resulting metal-on-metal contact had caused metallosis. Since the existing humeral implant was not compatible with standard conversion products, the manufacturer provided a custom humeral adapter that allowed the humeral stem to be preserved. This approach greatly simplified the surgical procedure and resulted in good anatomical and clinical outcomes after 9 months of follow-up.

1. Introduction

An increasing number of anatomical total shoulder arthroplasty (TSA) cases are being revised by reverse shoulder arthroplasty (RSA). The results are quite satisfactory but complications occur in up to one-third of cases [1–3], partly because the humeral component needs to be removed. Recent studies [4–7] have highlighted the advantages of modular implant systems that allow conversion of an anatomical TSA to a RSA, while preserving the well-fixed humeral implant and even the metal-backed glenoid component. This case report describes the revision of an anatomical total shoulder implant inserted in 1998 that was not compatible with current conversion kits. A custom humeral adapter simplified the reverse arthroplasty conversion by allowing us to keep the humeral stem.

2. Case report

A 71-year-old male patient in good general health consulted us for pain in the left shoulder and cracking that had started a few months earlier. TSA (Aequalis®, Tornier, Montbonnot, France) had been performed by one of the authors in 1998. This implant consisted of a cemented modular stem with spacer, humeral head and metal-backed glenoid component. The outcome had been highly satisfactory for 15 years, with a Constant score of 75 recorded in 2010. Clinical examination found a flexible shoulder with subscapularis (SS) insufficiency. The Constant score had dropped to 30. Radiographs revealed significant polyethylene wear with minimal osteolysis at the base of the humeral stem and near the expansion screws on the glenoid component (Fig. 1). The implants were well fixed and no radiolucent lines were visible. CT scans confirmed severe polyethylene wear (Fig. 2) and showed that implant inclination was normal. However metal-related artefacts made it difficult to evaluate the glenoid bone stock. The SS was in mediocre condition with grade 2+/3 fatty infiltration. The upper and posterior rotator cuff muscles were in excellent condition. The fact that the polyethylene insert was completely worn out 16 years after the initial surgery led us to fear metallosis due to metal-on-metal contact. The indication for arthroplasty revision was made. The surgical decision algorithm was based on the condition of the SS and glenoid observed intraoperatively. If the SS was considered functional, arthroplasty would only be performed at the humerus and the glenoid would be reconstructed with an iliac crest autograft if necessary. If not, the problem would much more complex because a reverse arthroplasty would have to be performed. This would require changing the humeral stem and providing solid glenoid baseplate fixation, which may require reconstruction with a tricortical iliac crest graft. For the latter case, the original implant's manufacturer (Tornier) could provide us with a custom humeral adapter (Fig. 3) that would considerably simplify the reverse arthroplasty conversion procedure by allowing the humeral stem to be preserved after the humeral head and spacer

* Corresponding author. Tel.: +33 2327 33261.
E-mail address: jean.Matsoukis@ch-havre.fr (J. Matsoukis).

http://dx.doi.org/10.1016/j.otsr.2015.06.019
1877-0568/

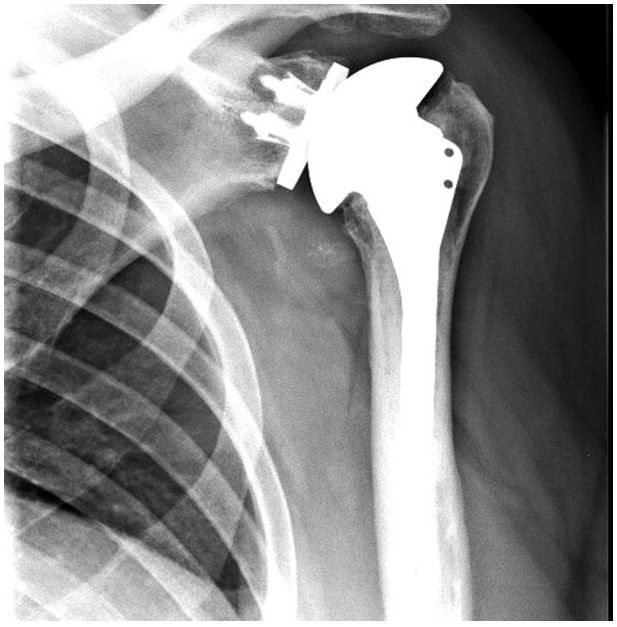

Fig. 1. Radiograph showing polyethylene wear 16 years after total shoulder arthroplasty but with very little osteolysis.

were removed. This decision would be made in the context of a risk-benefit assessment for the patient. French laws make the surgeon and manufacturer responsible for the outcome when custom implants are used. Approval from the French National Agency for Medicines and Health Products Safety (ANSM) was not required.

The surgical procedure was performed in 2014 using a deltopectoral approach. After extensive periglenoid arthrolysis, the axillary nerve was identified and multiple samples collected for microbiology testing. After the humeral head and spacer were removed, we found that the polyethylene insert was almost completely gone. Severe metallosis was present in the soft tissues particularly in the SS, which was non-functional; this was brought on by significant wear on the posterior side of the metal-backed glenoid component where it contacted the humeral head (Fig. 4). The glenoid bone stock was very good, except for limited osteolysis around the expansion

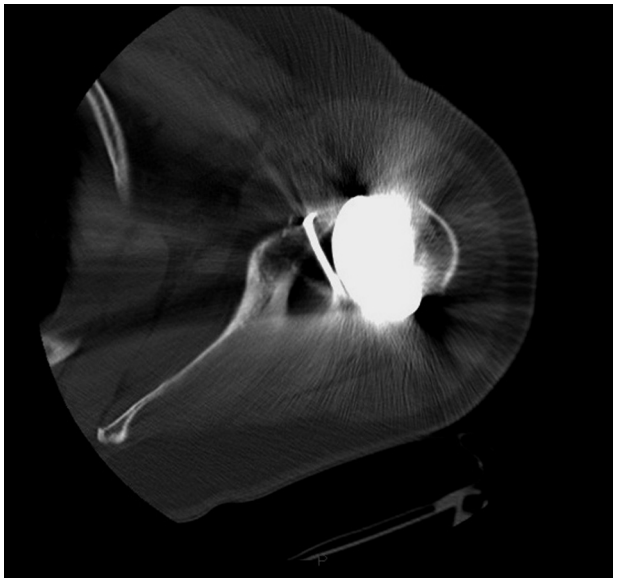

Fig. 2. CT slice showing significant wear in the polyethylene insert and posterior part of the metal glenoid baseplate.

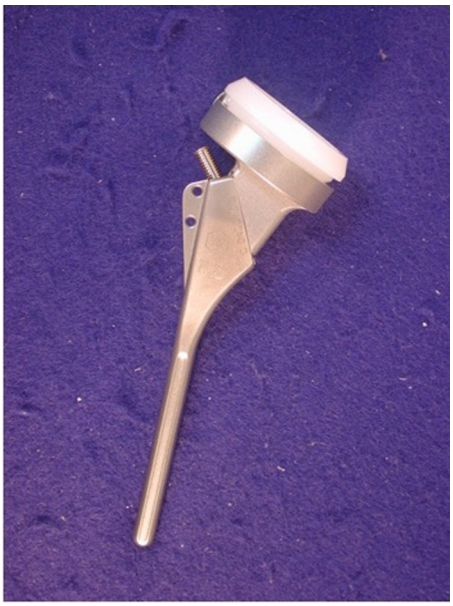

Fig. 3. Stem and custom humeral adapter with locking screw and humeral insert.

screws. Based on these findings, we decided to convert the implant to a reverse shoulder configuration using the humeral adapter. The glenoid bone was not reconstructed because the defect created by osteolysis around the screws could be used for the baseplate peg. Overall, the procedure was fairly simple and lasted 135 minutes. Excellent baseplate fixation was achieved and the joint was easily reduced. Use of a 36-mm glenosphere and 6-mm insert resulted in no significant arm lengthening. Microbiology testing was negative; metallosis of the soft tissues was confirmed by the anatomic pathology group.

The postoperative course was uneventful with limited blood loss (2 g decrease in haemoglobin). The shoulder's appearance on radiographs was satisfactory (Fig. 5). Using Orthoview software, the increase in arm length was determined to be 2 cm using the superior end of the glenoid and a fixed marker on the humeral implant (tuberosity reattachment holes) as landmarks. The clinical outcome was good: Constant score of 70 and active forward flexion of 150° (Fig. 6) after 9 months follow-up.

3. Discussion

In most cases, the decision to revise a hemiarthroplasty or anatomical TSA by converting it to RSA is related to a non-functional rotator cuff in elderly patients or instability. The humeral implant is typically well fixed, independent of whether it is cemented or

Fig. 4. Wear on the posterior side of the metal glenoid baseplate due to metal-on-metal contact with the humeral head.

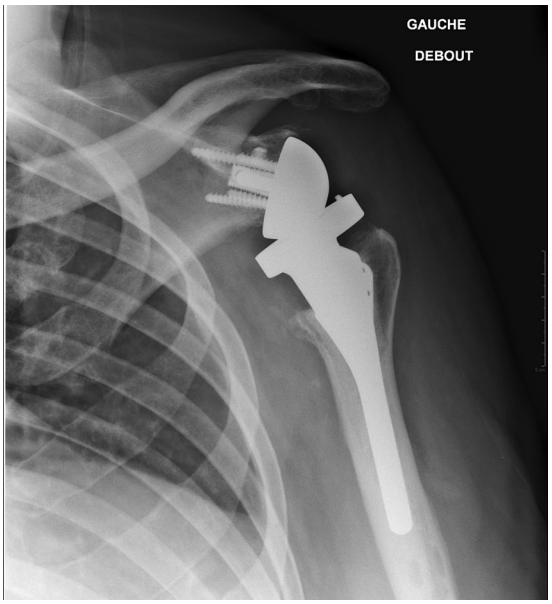

Fig. 5. Postoperative radiograph showing how 2 cm of arm lengthening was arrived at.

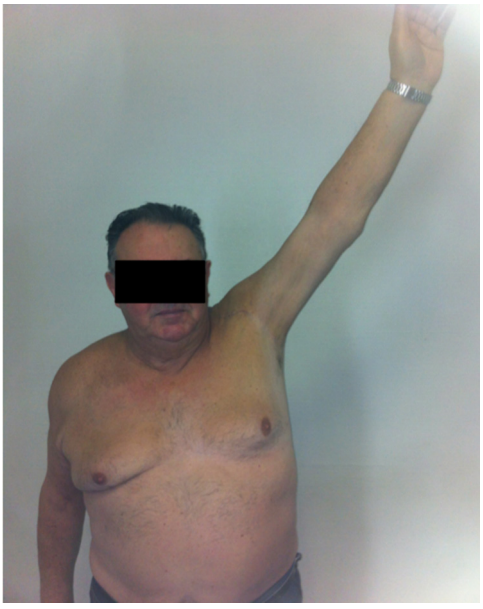

Fig. 6. Active forward flexion of 150° at 9 months after surgery.

not. A priori, revision implies that the implants must be removed. If the humeral stem has not loosened, this can be a technically difficult procedure with morbidity that is by no means insignificant (long surgery time, blood loss, humerus fracture, non-union after humerus osteotomy). The modularity that exists within current shoulder implant systems improves the treatment options [4–7] as it reduces the complication rate and simplifies the surgery by allowing a well-fixed and well-positioned humeral implant to be preserved. The modularity that allows for RSA conversion typically involves the humeral component. However five implant manufacturers (FH Orthopaedics, Lima, Zimmer, Arthrex and Biomet) now offer modular glenoid components that make it possible to place the glenosphere on the preserved glenoid metal-back baseplate.

From a technical point of view, conversion results in lengthening of the arm. Werner et al. [5] found an average of 2.6 cm arm lengthening in a set of 14 patients who had five different types of implants; the authors felt the postoperative outcome was not affects by the lengthening. This lengthening is slightly greater than the average lengthening of 1.6 cm reported by Lädermann et al. after primary RSA [8]. In a radiographic simulation study, Teschner et al. [9] estimated that lengthening would be 1.1 to 3.3 cm after conversion, depending on implant type. The metaphyseal modularity offered by some manufacturers could prevent this lengthening by lowering the humeral insert. But the deep intra-osseous recess needed for this modular component adds to the complexity of the surgery and there are potential complications related to the additional metal interface. Arm lengthening could make conversion impossible unless the humeral implant is removed due to excessive tension on the soft tissues. This was found in nearly 25% of the 29 patients evaluated by Kany et al. [7], particularly when the stem was implanted too high. To limit arm lengthening, the smallest glenosphere provided by the manufacturer (typically 36 mm in diameter) and the thinnest possible insert should be used.

Preservation of the humeral stem is not guaranteed and depends on if the reverse arthroplasty implants can be reduced intraoperatively. If reduction is impossible, the implant must be removed, the humeral cut made again and the soft tissues released by lowering the humeral component. When preparing for a revision procedure, the surgeon must keep the possibility of having to perform a humeral osteotomy to extract the implant in mind and must make sure to have long humeral stems available.

If a modular shoulder was implanted before conversion systems were conceived, a custom adapter is an elegant solution for preserving the humeral stem if the manufacturer agrees to make one. The surgeon and manufacturer are entirely responsible for the outcome of this procedure and approval of the ANSM is not necessary in France. If a stemless shoulder arthroplasty or shoulder resurfacing had been performed initially, there would be no challenges surrounding conversion and the humeral stem.

Disclosure of interest

J. Matsoukis, F. Billuart, K. Houssam and F. Dujardin declare that they have no conflicts of interest concerning this article. G. Walch receives royalties from Tornier Inc. for patents filed related to shoulder implants.

References

[1] Wall B, Nove-Josserand L, O'Connor DP, Edwards TB, Walch G. Reverse total shoulder arthroplasty: a review of results according to etiology. J Bone Joint Am 2007;89:1476–85.
[2] Patel D, Young B, Onyekwelu I, Zuckerman J, Kwon Y. Reverse total shoulder arthroplasty for failed shoulder arthroplasty. J Shoulder Elbow Surg 2012;21:1478–83.
[3] Ortmaier R, Blocher M, Mayer M. Reverse shoulder arthroplasty in revision of failed shoulder arthroplasty – outcome and follow up. Int Orthop 2013;37:67–75.
[4] Castagna A, Delcogliano M, De Caro F, et al. Conversion of shoulder arthroplasty to reverse implants: clinical and radiological results using a modular system. Int Orthop 2013;37:1297–305.
[5] Werner BS, Boehm D, Goelke F. Revision to reverse shoulder arthroplasty with retention of the humeral component. Acta Orthop 2013;84(5):473–8.
[6] Wieser K, Borbas P, Ek ET, Meyer DC, Gerber C. Conversion of stemmed hemi or total to reverse shoulder arthroplasty: advantages of a modular stem design. Clin Orthop Relat Res 2015;473(2):651–60.
[7] Kany J, Amouyel T, Flamand O, Katz D, Valenti P. A convertible shoulder system: is it useful in total shoulder arthroplasty revisions? Int Orthop 2015;39(2):299–304.
[8] Lädermann A, Walch G, Lubbeke A, Drake G, Melis B, Bacle G, et al. Influence of arm lengthening in reverse shoulder arthroplasty. J Shoulder Ebow Surg 2012;21:336–41.
[9] Teschner H, Vaske B, Albrecht U, Meller R, Liodakis E, et al. Conversion of hemi into reverse shoulder arthroplasty: implant design limitations. Arch Orthop Trauma Surg 2014;134:1683–9.