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Once an arthrodesis, always an arthrodesis?

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Background: An arthrodesis of the shoulder is historically a solution for severe shoulder joint problems, for which no prosthetic solution is deemed possible. With the introduction of the reverse shoulder arthroplasty (RSA), which is intrinsically stable at the glenohumeral joint, it seems logical to consider conversion of a painful arthrodesis into a RSA, provided that the deltoid was not destroyed during the arthrodesis.
Methods: Four patients (2 men, 2 women; age 46-66 years) with a longstanding arthrodesis (5-11 years) visited our clinic with a painful shoulder (mainly around the scapula) with the request to provide more mobility. In all, the shoulder was fused in 60° to 80° of abduction, 20° to 40° of flexion, and 40° to 50° of internal rotation. All patients refused an osteotomy as treatment for the pain. A preoperative electromyelogram showed activity in at least the posterior or middle parts of the deltoid, or both. They were offered revision of arthrodesis to a reverse prosthesis. All complications, especially instability, were discussed. Surgery was performed through the previous deltopectoral scar. In 3 cases, the osteotomy was lateral to the original joint line, providing some lateralization.
Results: Follow-up was 22 to 60 months. The Constant-Murley score improved from 15-21 to 30-60. No dislocations occurred. All patients were satisfied, especially with the increased, although not impressive, rotations. Pain did not disappear but decreased considerably, from visual analog scale 8-10 to 0-4.
Conclusion: Conversion into a RSA is a safe procedure in patients with a painful arthrodesis and grossly intact deltoid, providing better glenohumeral mobility (especially rotations), leading to improved patient satisfaction.
Level of evidence: Level IV, Case Series, Treatment Study.

Keywords: Shoulder arthrodesis; glenohumeral arthrodesis; conversion; reverse shoulder arthroplasty; reverse shoulder prosthesis; electromyographic analysis deltoid muscle

Humeroscapular arthrodesis, commonly termed as "shoulder arthrodesis," is a well-established operative procedure.[5,7,20,21] It can consist of an extra-articular (acromiohumeral) fusion, an intra-articular (glenohumeral) fusion, which recently also has been reported as an arthroscopic assisted procedure,[11,14,18,24] or a combination of both. The indications include severe instability, post-traumatic brachial plexus injuries, paralysis of the rotator cuff and deltoid muscles, infection, failed arthroplasty, and iatrogenic bone deficiency.[5,7,20,21] Ideally, a well-positioned shoulder arthrodesis allows the patient to reach his back pocket, groin, mouth, and have slight external and internal rotations,[5,21] with the optimal position of the arthrodesis being 10° to 15° of forward flexion and abduction and 45° of internal rotation.[5]

The most frequent complications after shoulder arthrodesis are nonunion (5%-20%), fracture of the ipsilateral humerus (10%-15%), and infection (3%-5%), and

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generally, the loss of functional motion is approximately 50%.[7] Although the most common goal of fusion is pain reduction, very few patients report being completely pain free after the arthrodesis.[5,21] Safran and Iannotti[21] reported that of the 26% of patients still had moderate to severe pain, 59% had pain over the surgical area, 29% had pain in the periscapular region, and 12% had diffuse pain. Groh et al[8] described a malpositioned arthrodesis as being the main reason for the pain in their series and demonstrated substantial pain relief with a corrective osteotomy below the fusion mass. Another alternative treatment for a painful arthrodesis could be conversion to a prosthetic arthroplasty. Although, the results of joint arthroplasty after attempted hip and knee arthrodesis are well described,[1,4,10,12,13,16,19,23] only 3 reports[9,17,22] describe a total of 5 cases, mentioning the technique and results of hemiarthroplasty and total shoulder arthroplasty after glenohumeral arthrodesis, with good pain relief but poor function.

With the introduction of the reverse shoulder arthroplasty (RSA), there is now a shoulder implant available that is intrinsically stable at the glenohumeral joint and relies solely on the deltoid muscle for the production of motion.[3] Depending on the indication for the arthrodesis, we hypothesized that conversion from a painful arthrodesis to a RSA, with a grossly intact deltoid muscle, should lead to less pain and to improvement of function. However, up until now, such a conversion has not yet been described. The purpose of this study was therefore to determine the results and describe the surgical technique in 4 patients, converting a painful shoulder arthrodesis into a RSA.

Case report

Patient 1

A 63-year-old woman was evaluated for a painful scapulothoracic joint and poor range of motion (ROM) after a shoulder arthrodesis for post-traumatic arthritis 11 years earlier (Fig. 1) at another institution. The shoulder was fused in 60° of abduction (angle measured between the humerus and lateral border of the scapula according to Vastamaki[25]), 20° of flexion, and 50° of internal rotation. She refused an osteotomy. After a discussion of the several options, on her request, the arthrodesis was conversed into a cemented stemmed total shoulder arthroplasty (TSA). The preoperative magnetic resonance imaging (MRI) demonstrated that the rotator cuff muscles were mildly atrophic but did not show fatty degeneration. Two years later, she had less pain, but still a poor ROM. X-ray imaging showed a mild superior migration of the humerus, and she asked for more function. An electromyographic (EMG) evaluation revealed that only the middle part of the deltoid muscle showed less activity. The TSA was converted into a RSA,

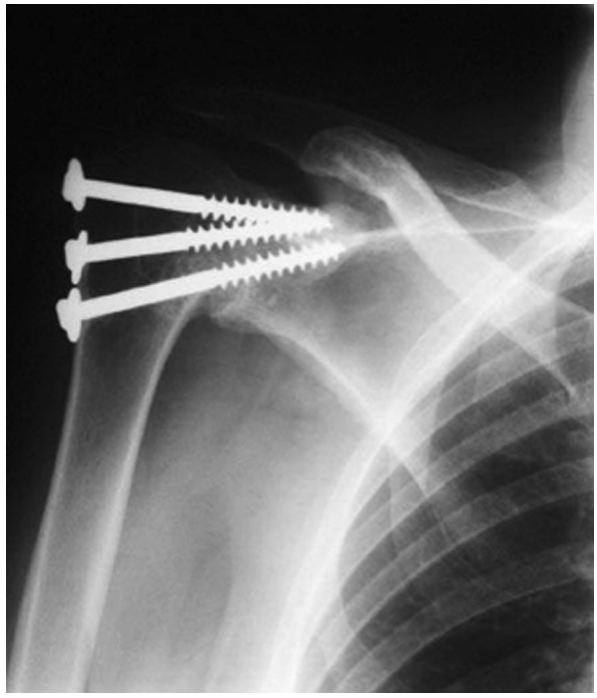

Figure 1 Preoperative radiograph demonstrates the glenohumeral fusion of patient 1.

further decreasing the pain and improving the active ROM, resulting in an increase in absolute Constant-Murley score from 20 to 46 at the 1-year follow-up. X-ray imaging at 1 year demonstrated some mild ossification around the liner. Two years later (at 3 years of follow-up) she still experienced no pain, but her ROM was decreased (Table I). Radiographic evaluation at that time demonstrated extensive ossification around the liner (Fig. 2), for which surgical exploration was planned. However, she developed a breast carcinoma of which she died a year later.

Patient 2

A 46-year-old man was evaluated for pain and restricted ROM after a shoulder arthrodesis for glenohumeral arthritis 5 years earlier (Fig. 3) at another institution. Before the arthrodesis, he underwent two subacromial decompressions. The shoulder was fused in 80° of abduction (angle between the humerus and lateral border of the scapula), 30° of flexion, and 50° of internal rotation with an absolute Constant-Murley score of 21 (Table I). The EMG evaluation demonstrated an active middle and posterior part of the deltoid muscle. At the time of surgery, via a deltopectoral approach, an osteotomy through the native head was performed, 2 cm lateral from the original joint line, thus creating a long-necked scapula, at which the base plate of the RSA was placed (Fig. 4). At the latest follow-up, 5 years after surgery, the patient experienced no pain and had an absolute Constant-Murley score of 60