UP-TO DATE REVIEW AND CASE REPORT • SHOULDER - ARTHROPLASTY



Review and clinical presentation in reverse shoulder arthroplasty in deltoid palsy

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Abstract

Deltoid palsy is a classical contraindication for reverse shoulder arthroplasty (RSA). However, in cases associating axillary nerve palsy and rotator cuff tear or glenohumeral arthritis, few options remain. We present a case in which combining RSA with transfer of the pectoralis major and upper and middle trapezius transfer provided satisfactory results in a patient suffering of both an irreparable rotator cuff tear and a deltoid palsy. *Level of evidence* IV.

Keywords Shoulder arthroplasty \cdot Deltoid palsy \cdot Axillary nerve palsy \cdot Tendon transfer \cdot Pectoralis major \cdot Trapezius \cdot Rotator cuff tear

Introduction

Indications for reverse shoulder arthroplasty (RSA) have augmented over the last years beyond cuff tear arthropathy in older patients to include, among others, massive rotator cuff tears [1, 2]. However, deltoid palsy remains a classic contraindication [3, 4], leaving only few options like glenohumeral joint fusion [3]. In this paper, we will present the solution found in a patient, suffering of a massive irreparable rotator cuff tear and a complete deltoid palsy. We combined the use of tendon transfers with a reverse shoulder arthroplasty.

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Patient's description

A 73-year-old patient consulted 3 years after a high velocity accident resulting in a left glenohumeral dislocation associated with an axillary nerve lesion and a massive rotator cuff tear treated by closed reduction and physiotherapy. He presented with a painful paralytic shoulder. The deltoid (anterior, middle and posterior) and the teres minor did not recover at all and were completely atrophic. Preoperative active range of motion was poor with: 10° of anterior elevation, no abduction, 20° of external rotation internal rotation reached the sacrum (Fig. 1). Passive mobilisation was unrestricted in all planes. Pain was evaluated at 4 out of 10 on a visual analogic scale (VAS). The ASES score was rated at 40/100, the SSV was evaluated at 20% of a normal shoulder. the SST was at 1/12, and the Constant score was evaluated at 14. Electromyographic study did not detect any contraction in the deltoid after muscle stimulation and no muscular fibrillation in the deltoid. Preoperative MRI showed complete rupture of supraspinatus (SS), infraspinatus (IS) and subscapularis. Retraction according to the Patte classification [5] was stage 3 for the SS and IS and stage 2 for the subscapularis. Fatty degeneration was stage 3 according to the Goutallier classification [6] with muscle atrophy in all three muscles. Teres minor was atrophied.



Fig. 1 Preoperative range of motion. **a** Active anterior elevation; **b** abduction; **c** internal rotation; **d** preoperative X-ray, anteroposterior view; **e** deltoid atrophy; **f** external rotation; **g** preoperative X-ray, lateral view

Surgical technique

Surgery was performed under general anaesthesia in the beach chair position. A superolateral approach was extended in a V-Y incision (Fig. 2a) to harvest the upper and middle parts of the trapezius which were detached from the acromion. Both were dissected from the supraspinatus until the scapular spine tubercle. The clavicular part of the pectoralis major was detached from the clavicle, keeping its humeral insertion, and was rotated in a flip flap manner to reach the anterior aspect of the acromion as described by Resch et al. [7] (Fig. 2b, c). A reverse shoulder arthroplasty (Arrow Reverse Shoulder Prosthesis, FH orthopaedics[©]) was implanted. The humeral stem was press-fitted with 15° of humeral retroversion and a 10° inferior tilt of the glenoid baseplate. A posterosuperior cancellous autograft from the humeral head was applied under the baseplate to compensate the posterosuperior erosion of the glenoid. The upper and middle trapezius were attached together to the anterolateral portion of the greater tuberosity with trans-osseous nonabsorbable sutures.

The reversed clavicular head of the pectoralis major was attached proximally to the anterior aspect of the acromion and to the lateral end of the clavicle in the same manner. The subscapular was not suitable for a repair. The patient was immobilised in a cast in 30° of abduction and neutral rotation for 6 weeks and then began passive and assisted active motion between the sixth and twelfth weeks with the brace kept during the night until the twelfth week. After the twelfth week, full active motion and gentle strengthening was begun. Patient was allowed to return to unrestricted activities after 6 months.

Results

At 14-month follow-up, the patient had recovered active anterior elevation to 60° , abduction to 45° , external rotation to 20° and internal rotation reached the sacrum (Fig. 3). Pain was rated 3 out of 10 on a VAS. SSV was evaluated at 50% of the normal shoulder. There were no clinical or radiological signs of instability.



Fig. 2 Peroperative views. **a** Incision drawing; **b** flap harvesting. Pm = pectoralis major; d = deltoid; t = trapezius flap; **c** pectoralis major flap positioned in a flip flap manner without stretching its pedicle (*)



Fig. 3 Post-operative range of motion. a Active anterior elevation; b abduction; c post-operative X-ray, lateral view; d post-operative aspect; e external rotation; f internal rotation; g preoperative X-ray, anteroposterior view

Discussion

In cases of delayed treatment of shoulder lesions combined with axillary nerve lesions, nerve graft or neurotisation by a branch of the radial nerve [8] is no longer possible [4], especially in elder patients and when electromyographic study does not show any muscular fibrillation. The remaining therapeutic possibilities are tendon transfers around the shoulder or shoulder fusion. The latter provides a limited gain of motion [9] and is an irreversible procedure with a high incidence of complications [10]. It is only recommended as a last resort in patients with no functional muscles around the shoulder that can be used as a transfer [9, 11]. In this case, since good transfers were available, we decided to perform a deltoid reconstruction.

The trapezius muscle is commonly used as a transfer in adult brachial plexus palsy [9]. It is a long known procedure [12] that has shown good results [13, 14]. Aziz et al. [13] reported M4 or better muscle function in the 27 patients of their study, with pain relief for 24 of the 27 patients. The average gain in shoulder abduction was 45° and 35° of shoulder flexion. Monreal et al. [14] reported comparable results regarding the gain of mobility with 46° of gain of abduction and 37° of gain of flexion.

The pectoralis major transfer was reported by Hou and Tai [15] in deltoid paralysis. Combined with the upped trapezius transfer, it provided a fair deltoid reconstruction with functional abduction and forward elevation [15].

However, in this case, because of the massive rotator cuff tear, the isolated restauration of the deltoid function by tendon transfer would have caused superior escape of the humeral head [9] and would have left the shoulder still pseudoparalytic. This was managed by using a reverse shoulder arthroplasty. Other possibilities could have been superior capsular reconstruction using fascia lata autograft or human dermal allograft [16, 17]. However, considering the age and the history of severe trauma, we chose a reverse shoulder arthroplasty to anticipate upcoming arthritis. Using a semi-constrained prosthesis also changes centre of rotation of the joint, providing an improvement of the function of the tendon transfers. Using a RSA without tendon transfer would, however, be contraindicated because of the deltoid palsy [3].

Shoulder arthroplasty has already been reported in some case of neurological deficits. Werthel et al. [18] reported 8 cases of shoulder arthroplasty in sequelae of poliomyelitis including two cases associated with a rotator cuff tear. One of them was treated by a hemiarthroplasty with a suture of the cuff and the other treated by a reverse shoulder arthroplasty with satisfactory results and no case of dislocation. In this case, isolated reverse shoulder arthroplasty would not have been a good solution because of the deltoid palsy, because this kind of prosthesis requires a functional deltoid for stability and biomechanical function [4]. Marinello et al. [19] used posterior and middle deltoid rotationplasty to reconstruct the deltoid in their case series with a significant functional improvement. This solution was not possible here because of the palsy of the posterior and middle deltoid. Goel et al. [20] used a latissimus dorsi transfer to reconstruct the deltoid in a similar case according to the technique described by Itoh et al. [21], providing a pain free functional mobility. However, we decided to spare the latissimus dorsi in order to be able to use it as a tendon transfer in case of lack of external rotation. Elhassan et al. [4] described a similar intervention in patients with chronic deltoid palsy and glenohumeral arthritis. They combined a RSA with a pectoralis major transfer to reconstruct the deltoid. In 3 of their 31 patients, they performed an additional transfer of the lower trapezius on the infraspinatus to restore external rotation. They reported a gain of range of motion of 72° in shoulder flexion but no significant improvement in shoulder flexion.

This case provides a solution for difficult situations when patients requiring a reverse shoulder arthroplasty also present axillary nerve palsy. Although isolated axillary nerve injuries constitute only 0.3 to 6% of all brachial plexus injuries [22, 23], it is more frequent in anterior shoulder dislocations, proximal humeral fractures and most surgical procedures around the shoulder [23]. Those situations may subsequently require a reverse shoulder arthroplasty either because of an evolution towards arthritis or irreparable rotator cuff tear. It would also be a solution for patient suffering of rotator cuff tear associated with traumatic brachial plexus injury, situation encountered in 8,2% according to Brogan et al. [24]. It provides more mobility than a shoulder fusion and could also be considered in case of iatrogenic axillary nerve palsy following a shoulder arthroplasty although majority of cases resolves without needing a surgical intervention [25, 26].

Conclusion

This article presents a reliable solution combining reverse shoulder arthroplasty with pectoralis major and trapezius transfer to restore shoulder function in a desperate case associating deltoid palsy and rotator cuff tear.

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Compliance with ethical standards

Conflict of interest Dr. Werthel has a patent with FH Orthopedics for the Arrow shoulder arthroplasty with royalties paid. Dr. Valenti has a

patent FH Orthopedics Arrow with royalties paid. Dr. Kermarrec and Dr. Canales have nothing to disclose.

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