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CASE REPORT

Reverse shoulder arthroplasty after radial-to-axillary nerve transfer for axillary nerve palsy with concomitant irreparable rotator cuff tear

Dane H. Salazar, MD*, Peter N. Chalmers, MD, Susan E. Mackinnon, MD, Jay D. Keener, MD

Department of Orthopaedic Surgery, Washington University Medical Center, St. Louis, MO, USA

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The primary indication for reverse shoulder arthroplasty (RSA) remains rotator cuff tear arthropathy. However the indications for RSA have recently expanded to include irreparable cuff tears with pseudoparalysis, select acute proximal humeral fractures, nonunions of proximal humeral fractures, inflammatory arthritis, osteoarthritis with severe glenoid bone loss, and chronic fixed dislocations of the shoulder.[8]

Central to the RSA function is an intact deltoid muscle, and thus, patients with axillary nerve palsy or deltoid dysfunction have typically been contraindicated for this surgery.[2] We present a patient with an axillary nerve palsy and a concomitant irreparable rotator cuff tear treated with RSA after undergoing a successful radial-to-axillary nerve transfer to restore deltoid function.

Case report

The patient is a 52-year-old right hand–dominant woman who 4 years prior developed insidious onset, atraumatic but progressive right shoulder pain. At presentation, her history, physical examination, and advanced imaging was consistent with a rotator cuff tear, and she underwent a right arthroscopic rotator cuff repair at another institution. Intraoperatively, she was described as having a large rotator cuff tear involving the supraspinatus and infraspinatus tendons that was arthroscopically repaired without apparent intraoperative complications. Postoperatively, the patient was slow to progress in therapy and had substantial subjective shoulder weakness. Repeat advanced imaging to investigate the integrity of the rotator cuff repair confirmed a failure of repair healing.

She was referred to an experienced shoulder and elbow surgeon at a high-volume academic tertiary referral center for further management and subsequently underwent a revision rotator cuff repair performed through an open incision 1 year after the index surgery. Postoperatively, she complained of new dense numbness overlying the lateral shoulder and lateral arm. She now had subjective and objective weakness and failed to progress in her rehabilitation program. She was unable to actively abduct or forward elevate her arm. At this time, results of electromyography and nerve conduction velocity studies demonstrated a complete axillary nerve palsy with evidence of axonotmesis. There were no findings of peripheral nerve injury or cervical radiculopathy.

Because of the severe dysfunction of her right shoulder, she sought the opinions of 2 shoulder and elbow surgeons at separate high-volume academic tertiary referral centers to explore additional treatment options. During this workup,

This study was approved under protocol from the Washington University in St. Louis Institutional Review Board and found to be exempt.

*Reprint requests: Dane H Salazar, MD, Department of Orthopaedic Surgery, Washington University Medical Center, 660 S Euclid Ave, Campus Box 8233, St. Louis, MO 63110, USA.

E-mail address: dsalazar@post.com (D.H. Salazar).

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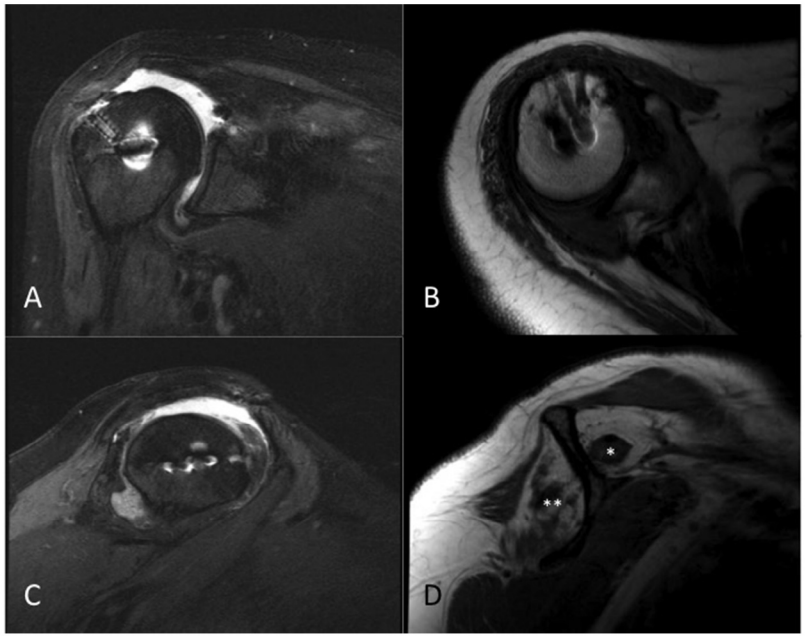

Figure 1 Preoperative (before nerve transfer and reverse shoulder arthroplasty operations) magnetic resonance images. (**A**) T2 coronal image demonstrates recurrent tear of the superior rotator cuff with proximal humeral migration. (**B**) A T1 axial image demonstrates previous anchors and deltoid atrophy. (**C**) A T2 sagittal image shows complete tear of the supraspinatus and infraspinatus tendons. (**D**) A T1 sagittal image establishes the substantial atrophy and fatty infiltration of the supraspinatus fossa (*) and infraspinatus fossa (**).

another magnetic resonance image again demonstrated a recurrent rotator cuff tear (Fig. 1). On the basis of her advanced imaging and work-up, the axillary nerve was felt to be in continuity. She was eventually referred to our institution to be evaluated for a nerve transfer in hopes of regaining deltoid function with a radial-to-axillary nerve transfer.

On presentation 14 months after the revision surgery, she had substantial shoulder dysfunction. Visual inspection revealed deltoid atrophy and a complete inability to actively forward elevate, abduct, or extend her right shoulder. There was no evidence of innervation of the deltoid except perhaps a flicker of contraction in the posterior head. Attempted elevation did not reveal any proximal humeral escape. Subsequent electromyography and nerve conduction velocity studies at our institution redemonstrated severe axillary neuropathy. Fibrillations were present in all 3 heads of the deltoid with some motor units present. There was no evidence of triceps or supraspinatus denervation. The patient subsequently underwent radial-to-axillary nerve transfer 2 months later by a senior author (S.M.).

Intraoperatively, the deltoid muscle appeared grossly healthy, with no apparent fatty infiltration. The axillary nerve was identified in the quadrangular space. The axillary nerve was markedly compressed and scarred in the quadrangular space, and it was neurolysed. The tendon of the long head of the triceps was released to further decompress the quadrangular space, keeping the muscle intact. Intraoperative stimulation demonstrated weak but definite contraction with direct stimulation of the anterior and posterior branches of the axillary nerve to the deltoid muscle and the branch to the teres minor. The radial nerve and triceps branches were identified below the teres major muscle.

The long, lateral, and medial triceps nerve branches were identified and confirmed with intraoperative stimulation. The 2 medial triceps branches were divided very distally to avoid the need for a nerve graft. They were mobilized proximally towards the axillary nerve.[3]

Under microscope magnification, the epineurium of the anterior and posterior axillary nerves was opened widely, and an end-to-side nerve transfer was performed from the triceps nerve to the anterior branch of the axillary nerve to the deltoid muscle. The second triceps branch was transferred in an end-to-side nerve transfer to the posterior branch and to the branch to the teres minor (Figs. 2 and 3).

The patient's postoperative course was uneventful, and her surgical wounds healed without complication. Over a 6-month course, deltoid motor function improved, and physical examination showed 3+/5 muscle strength grading of the posterior and middle heads of the deltoid. Because of the large rotator cuff tear, the patient continued to have dysfunction of active forward elevation and adducted external rotation.

At 18 months after her nerve transfer surgery, she was graded as a British Medical Research Council 4-/5. She was felt to have reached maximal nerve recovery and was deemed to have sufficient deltoid power, to allow for RSA with all 3 portions of the deltoid contracting strongly. The patient subsequently underwent a right RSA 18 months after the nerve transfers, performed by a senior author (J.D.K.). Radiographs are displayed in Fig. 4. The patient's postoperative