Shoulder Hemiarthroplasty After Previous Pectoralis Major Transfer for Irreparable Subscapularis Tear

A Case Report

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Abstract

Case: A 30-year-old woman with an irreparable subscapularis tear presented with persistent painful anterior instability despite several open and arthroscopic stabilization procedures. A pectoralis major tendon transfer (PMTT) was performed. The patient subsequently developed progressive glenohumeral arthritis over the next 10 years, ultimately necessitating shoulder arthroplasty.

Conclusions: PMTT provides valuable anterior soft-tissue reconstruction stabilization for subscapularis insufficiency in a multioperated shoulder. Ten years later, the transfer was found to be intact and managed like a native subscapularis during anatomic shoulder replacement, thus avoiding a reverse arthroplasty in a young patient.

Open stabilization procedures for anterior instability are a risk factor for subsequent subscapularis dysfunction[1]. Pectoralis major tendon transfer (PMTT) has been described as a salvage procedure in cases of an irreparable subscapularis tear[2,3]. Long-term outcome studies have reported improvement in pain and function, however, outcomes are often poor in the setting of prior anterior stabilization procedures in young patients with instability[4-6]. Progressive glenohumeral arthritis can develop, which may require future shoulder replacement. Shoulder arthroplasty is challenging in these patients because of high expectations regarding range of motion, return to work and sporting activities[7,8].

We report the case of an active 30-year-old female who underwent a PMTT for an irreparable subscapularis tear after several prior anterior stabilization procedures. She developed glenohumeral arthritis 10 years following the transfer, which was treated with hemiarthroplasty through the same deltopectoral approach and transferred tendon.

The patient was informed that data concerning the case would be submitted for publication, and she provided consent.

Fig. 1-A

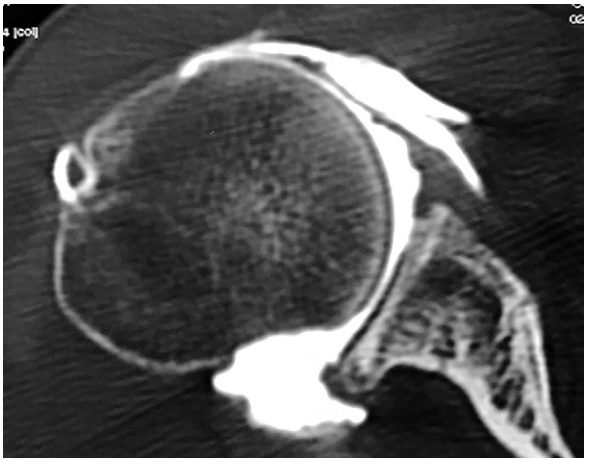

Fig. 1-B

Figs. 1-A and 1-B Fig. 1-A Preoperative anterior-posterior and lateral x-rays showing a single anchor still in place and a resorption of the anterior bone block. **Fig. 1-B** Preoperative axial computed tomography scan image showing the retracted tear of the subscapularis.

Disclosure: The **Disclosure of Potential Conflicts of Interest** forms are provided with the online version of the article (http://links.lww.com/JBJSCC/B99).

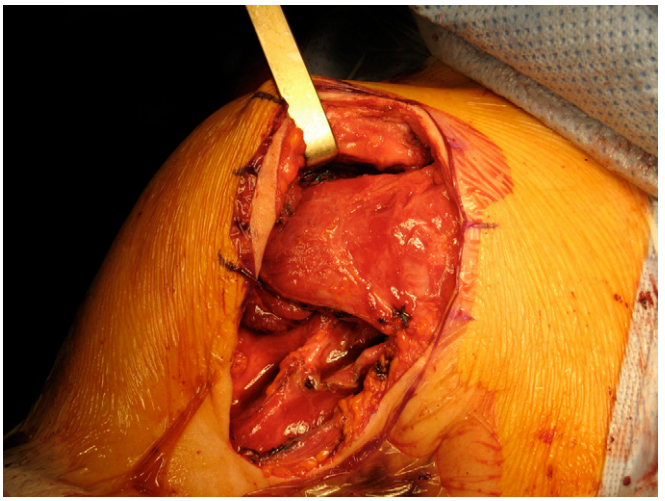

Fig. 2

Pectoralis major tendon transfer on the lesser tuberosity through a deltopectoral approach.

Case Report

A 30-year-old woman was referred to us for an unstable and painful right dominant shoulder. She previously developed recurrent traumatic anterior instability while playing handball and underwent an open Latarjet procedure at the age of 19 years. Five years later, her instability recurred because of a nonunion of the coracoid bone block. This was revised with an Eden-Hybinette iliac crest bone block procedure. She developed progressive lysis of the bone block over time causing pain and recurrent anterior instability. Furthermore, she underwent 2 subsequent arthroscopic Bankart procedures before our evaluation.

She initially presented with 5/10 pain on visual analog scale (VAS) and functional impairment with overhead activities. She denied recurrent dislocation since her last operation. Active forward elevation (AFE) was 180°, and active external rotation at the side (AER1) was 70°. Passive external rotation at the side was increased compared with her contralateral shoulder (90° vs. 70°) and active internal rotation (AIR) was to the sacrum. Apprehension in abduction-external rotation (AER2) and relocation tests were positive as were subscapularis lift-off and belly press tests.

Computed tomography–arthrogram showed resorption of the iliac crest bone block with no evidence of glenohumeral arthritis and a full-thickness, retracted tear of the subscapularis tendon with grade 3 fatty infiltration[9] (Fig. 1). The humeral head was well centered without static anterior migration or decreased acromiohumeral index. The remaining rotator cuff tendons were intact with no signs of fatty infiltration. Given her clinical presentation, an open PMTT and anterior capsular shift was indicated.

Pectoralis Major Tendon Transfer

Using a deltopectoral approach, a full-thickness tear of the subscapularis was confirmed along with a patulous anterior capsule. Owing to the previously performed Latarjet procedure, the coracoid process and conjoint tendon could not be identified. A vertical capsulotomy was performed at the joint line and corresponding cartilage defects along the anterior glenoid and humeral head were noted. The anterior capsule was shifted and reapproximated to the anterior glenoid with two 1.4-mm soft-suture anchors (JuggerKnot; Zimmer Biomet) permitting 45° of AER1. Next, the pectoralis major was exposed and released from the humerus and mobilized from its adhesions. Three #5 nonabsorbable sutures (Ethibond; Ethicon) were passed through

Fig. 3-A

Fig. 3-B

Figs. 3-A and 3-B Fig. 3-A Preoperative anterior-posterior and lateral x-rays showing moderate osteoarthritis with and a centered humeral head. **Fig. 3-B** Preoperative axial computed tomography scan image showing the pectoralis major tendon transfer still in place.

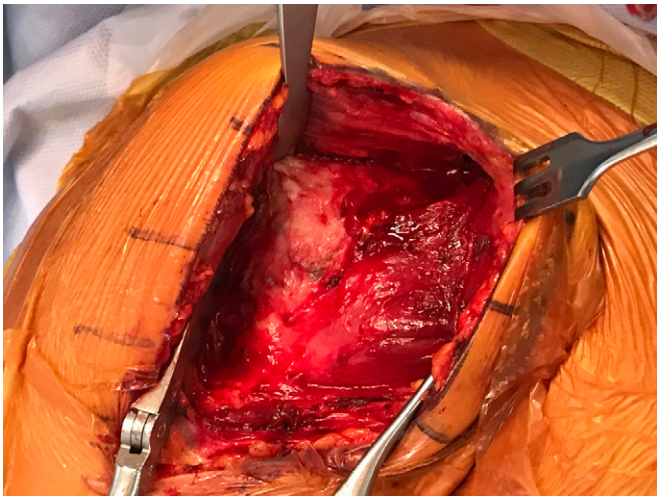

Fig. 4-A

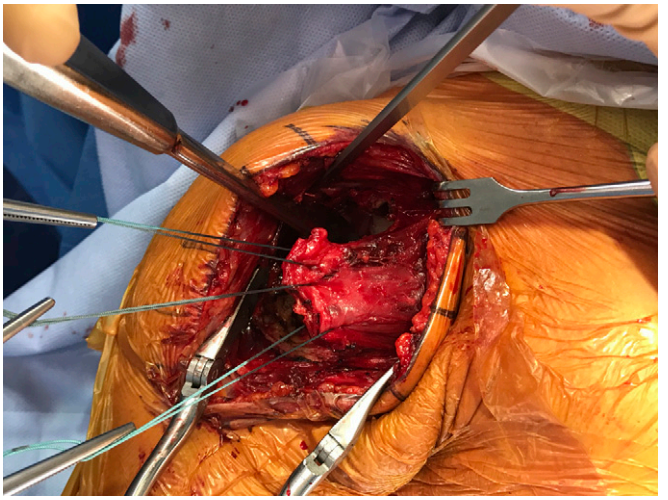

Fig. 4-B

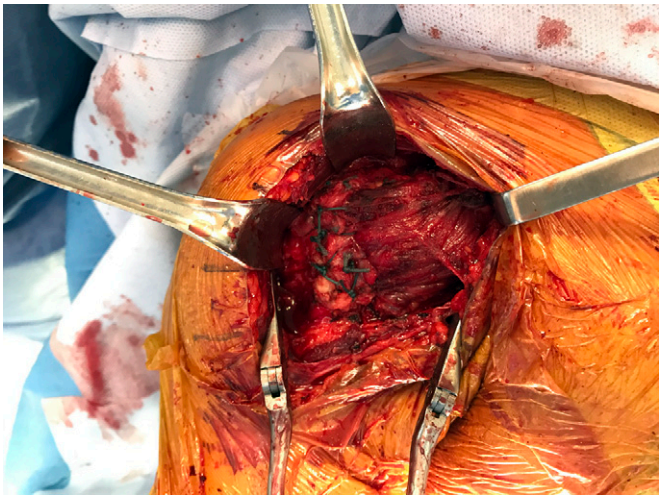

Fig. 4-C

Fig. 4 Figs. 4-A, 4-B, and 4-C Fig. 4-A The pectoralis major tendon was found to be intact and still anchored to the lesser tuberosity. **Fig. 4-B** Tenotomy of the pectoralis major tendon provided access to the glenohumeral joint. **Fig. 4-C** Reattachment to the pectoral major tendon to the lesser tuberosity after implantation of the humeral stem and pyrocarbon head.

the tendon in a modified Mason-Allen configuration. The free limbs were shuttled through transosseous tunnels in the lesser tuberosity to secure the transferred tendon (Fig. 2). Postoperatively, the arm was placed in a sling for 6 weeks. A rehabilitation protocol was introduced to allow for progressive recovery of passive range of motion with limitation of AER1 to 30°[10]. Active motion was permitted as tolerated after 6 weeks.

At the 2-year follow-up, her pain was 3/10 on VAS without recurrence of anterior instability or signs of apprehension on examination. AFE was 180°, AER1 70°, and AIR to the midlumbar spine. Internal rotation strength was 4/5[11]. At the 10-year follow-up, she had progressive pain resistant to over-the-counter medications and nonoperative modalities. She endorsed night pain and significant limitations at home and at work as an administrative assistant. AFE was now 130°, with AER1 to 40°, and AIR to the third lumbar spine. Radiographs showed moderate glenohumeral arthritis. The posterosuperior rotator cuff was intact as was the PMTT without evidence of muscle atrophy or fatty infiltration (Fig. 3). As such, this patient was indicated for hemiarthroplasty.

Hemiarthroplasty

We used a deltopectoral approach through her previous incision. The PMTT was found to be intact which allowed for tenotomy through the transferred tendon in a similar fashion to the standard subscapularis tenotomy technique (Fig. 4). The superior edge of the PMTT was identified and released, therefore opening the "neo rotator interval." No additional releases or nonroutine techniques were performed. A cementless stem with a pyrocarbon head (Ascend Flex; Tornier) was press-fit into the humerus. For deep closure, a tension-free transosseous repair of the PMTT to the lesser tuberosity was possible with 3 #5 nonabsorbable sutures and reinforced by 3 additional stiches. The patient was instructed to wear a sling for 6 weeks. Passive range of motion began the day after surgery with no external rotation restriction. Activities of daily living were allowed at 6 weeks, and rehabilitation was continued without any strengthening exercises.

At the 2-year follow-up, the patient was very satisfied with her outcome, with no signs or symptoms of shoulder instability. She returned to her previous work activities without limitations. On examination, recovery of range of motion (AFE

Fig. 5-A

Fig. 5-B

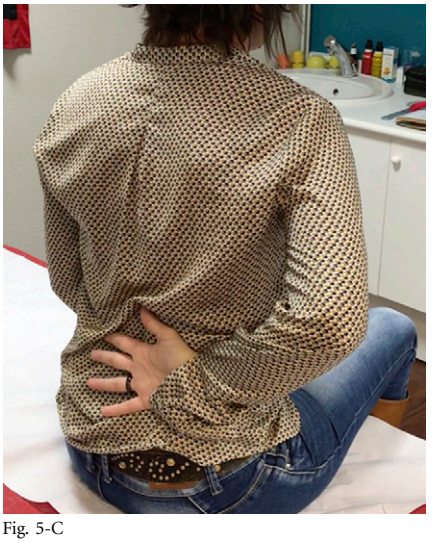

Fig. 5-C

Fig. 5 Figs. 5-A, 5-B, and 5-C Fig. 5-A Active forward elevation. **Fig. 5-B** Active external rotation with the arm at side. **Fig. 5-C** Active internal rotation.

160°, AER1 40°, AER2 90°) was demonstrated with minimal pain (1/10 on VAS). The Constant score was 71 points (pain 11/15, activity 18/20, mobility 36/40, and strength 6/25) and subjective shoulder value was 80% (Fig. 5). X-rays showed no signs of loosening or malposition of the prosthesis (Fig. 6).

Discussion

To our knowledge, this is the first case report of hemiarthroplasty performed 10 years after a PMTT for an irreparable subscapularis tear. PMTT was first described in 1997[2] to restore the lost force-couple associated with irreparable anterosuperior tears. Jost et al.[12] and Resch et al.[13] then reported on successful functional improvement in older patients at 32 months and 28 months of follow-up, respectively. Moroder et al.[4] later reported excellent long-term functional outcomes at the 10-year follow-up. PMTT has also been reported for subscapularis insufficiency after prior anterior stabilization procedures at a mean of 49 months after surgery[6]. In this younger patient population (mean

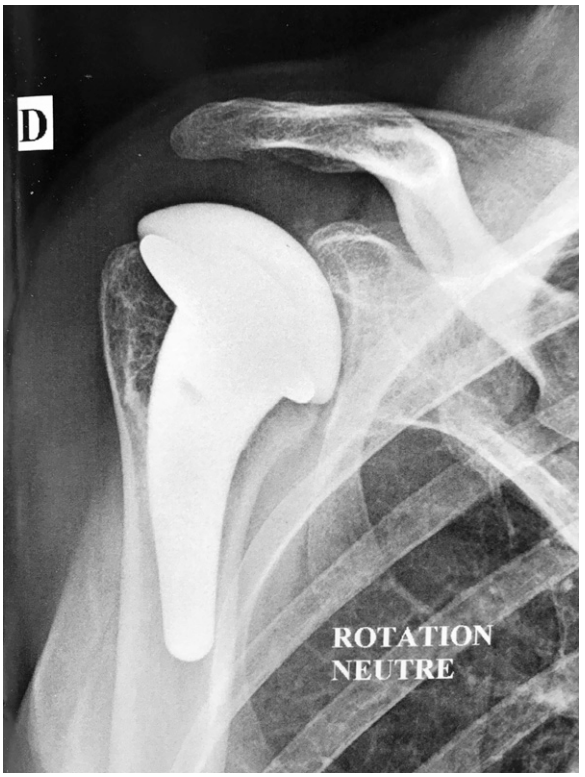

Fig. 6

Anterior-posterior x-rays showing the hemiarthroplasty at the 2-year follow-up after surgery.

age 37 years), significant functional improvement, pain relief, and absence of instability were observed except in patients with preoperative static anterior subluxation. The 2-year follow-up evaluation after PMTT in our patient was consistent with these findings.

Moroder et al. also reported on radiographic progression of cuff tear arthropathy requiring revision to reverse arthroplasty (RSA) in 1 case[4]. Similarly, we observed the development of arthritis in our patient which was likely multifactorial in etiology (instability arthropathy, bone block graft resorption, and multioperated shoulder). Both the posterosuperior cuff and PMTT were intact, resulting in a centered humeral head on the glenoid in both the axial and coronal planes. Anatomic total shoulder arthroplasty (TSA) has been described as a viable treatment option in this setting with good midterm results[14-17]. However, this procedure can be associated with high complication (up to 40%) and revision rates for instability, glenoid loosening, or cuff rupture[15,18]. For patients with previous bone block procedures, there is added difficulty to achieve appropriate soft-tissue balancing after TSA, mainly because of subscapularis insufficiency[15]. As an alternative, RSA was originally proposed by Raiss et al. with high satisfaction rates, no recurrence of instability or implant loosening at a mean 3.5-year follow-up in patients with a mean age of 70 years[19]. This was later confirmed by Clavert et al. with longer follow-up (6.6 years)[20]. Although RSA is a viable option in older patients with cuff deficiency, this option is uncommonly recommended in younger, active patients[21].

PMTT can be useful to compensate for an irreparable subscapularis tear in a young patient after multiple failed stabilization procedures. If future arthroplasty becomes indicated in the setting of an intact posterosuperior cuff, PMTT offers the possibility to implant an anatomic hemiarthroplasty. We chose to use a pyrocarbon head in this young patient to potentially decrease the risk of glenoid wear based on the tribological and elastic characteristics of the pyrolytic carbon[22]. At the time of surgery, the PMTT in our patient resembled a native subscapularis tendon with good tissue quality. Though latissimus dorsi tendon transfer has been proposed as an alternative because of its posteriorly-directed vector force[23], the tendon is relatively thin in nature. We question whether this could offer the same reparability with future arthroplasty. This may have implications in young patients because an unbalanced force-couple may necessitate RSA. ■

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