Reconstruction of Massive Rotator Cuff Tear with Modified Debeyre’s Method in Combination with a Fascia Lata Patch: Clinical Results in 3 Patients

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Abstract

Objective: Every treatment method for massive rotator cuff tear has some disadvantages. The authors applied modified Debeyre’s method in combination with fascia lata patch grafting in order to achieve satisfactory results.

Subjects and Method: Three shoulders of 3 patients received surgery with this procedure. At surgery, torn end was at first freed from surrounding tissues according to the McLaughlin procedure. Modified Debeyre’s method (supra- and infra-spinatus muscles are freed from the scapula and advanced) was applied to patients whose torn end were unable to be drawn to proximal to the greater tuberosity of humerus with the arm at the side. Then, for 3 patients whose torn ends after the advancement were still unable to be drawn to proximal to the greater tuberosity, autologous fascia lata patch was grafted. The 3 patients’ clinical findings were evaluated by using the Japan Orthopaedic Association score (JOA score) before surgery, one year after surgery and at the last examination (24, 41, or 43 months). Conditions of reconstructed rotator cuff were also examined on MR images before and 2 years after surgery.

Results: The fascia lata patch successfully covered the torn part up to the insertion point of greater tuberosity. The average JOA score improved from 58 (range: 49~71.5) before surgery to 82 (73~95) one year later and 83 (73~97) at the final examination. Two shoulders had maintained the continuity of the reconstructed tendon, but one shoulder had partial re-tear.

Conclusion: Modified Debeyre’s method that makes supra- and infra-spinatus muscles advance is an excellent technique, and supplemental application of autologous fascia lata to the cases of insufficiently advanced tendon was thought to be useful.

Key words: massive rotator cuff tear, patch graft, clinical result, shoulder
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Introduction

Massive rotator cuff tear has been treated with various methods, but each method has advantages and disadvantages that need careful concern. The important points in choosing a treatment method to restore the normal or best possible function of the shoulder are (i) to improve the mobility by freeing the adhesions of torn end from surrounding soft tissues and (ii) how to draw and suture-fix the remained tendon to the greater tuberosity of humerus. The authors have studied a repair technique for massive rotator cuff tear, which is the combination of modified Debeyre’s method (advancement of the supra- and infra-spinatus muscle) with a fascia lata patch, and applied this technique to 3 shoulders of 3 patients.

Subjects and Method

The subject patients were 2 males and one female (3 shoulders, mean age: 70 years old, age range: 60~75 years old). Massive rotator cuff tear was defined as the lesion where 2 or more tendons including supra-spinatus muscle are torn in the size of 5 cm or larger.

In surgery, torn tendon was exposed according to the McLaughlin procedure, and drawn to the proximity to the greater tuberosity of humerus with the arm at the side. Because the tendons were unable to be sufficiently drawn, modified Debeyre method, i.e., both the supra- and infra-spinatus muscles are freed from the scapula and advanced, was applied. However, the advanced tendons were still unable to reach the greater tuberosity, approximately 5 × 12~14 cm of fascia lata was collected, double-folded, sutured to the advanced muscles with Ethibond thread and then suture-fixed to the insertion point of the greater tuberosity of humerus by using suture anchors (Fig. 1).

The patients conditions were evaluated 3 times, i.e., before surgery, one year after surgery, and at the final examination (24, 41 or 43 months after surgery).
surgery), by using the Japan Orthopaedic Association (JOA) score (JOA score). The reconstructed tendons were also examined with MRI before and 2 years after surgery.

Results

The defect areas of the 3 patients were able to be covered with the remained tendon and the fascia lata patch. The average JOA score improved from 58 (range: 49–71.5) before surgery to 82 (73–95) one year after surgery and then to 83 (73–97) at the final examination. On the MR images one year after surgery, the reconstructed tendons of 2 shoulders were in good conditions, but partial re-tear occurred in one shoulder.

Case No. 1.

A 75-year-old male. The patient was a farmer and a right-handed person. Pain occurred on the right shoulder when he carried a heavy stuff, then the shoulder became hard to elevate, and muscle atrophy was gradually developed on the back of the shoulder. The patient was referred to our office 3 months after the initial pain occurred. MR images depicted massive tear including supra- and infra-spinatus muscles and subscapularis muscle. The range of motion of the shoulder joint was 30° for flexion, 30° for abduction, 5° for external rotation, to buttock for internal rotation. The JOA score was 49 (pain: 20, function: 3, range of motion: 8, X-ray evaluation: 3, stability: 15). Radiograms depicted osteophyte formation in the acromioclavicular joint (Fig. 2a, arrow), and arthrograms revealed leakage of contrast medium in the subacromional bursa (Fig. 2b, arrow). At surgery, supra- and infra-spinatus muscles had full-thickness tears, and the supra-spinatus muscle was drawn inside by approximately 6 cm at maximum (Fig. 3a). Subscapular muscle also had a partial tear, and the long head tendon of humeral biceps was completely torn. These lesions were repaired with the above-mentioned method.
Fig. 3 Case No. 1
a: Intraoperative finding. The head of humerus exposed (arrow) and massive rotator cuff tear was observed. * Greater tuberosity.
b: After reconstruction. The defect area was covered with the fascia lata (arrow). Arrow head: suture thread. * Greater tuberosity.

(Fig. 3b). After surgery, the patient worn a flexible shoulder brace at the zero-position, then the abduction angle decreased gradually since 3 weeks after surgery, and the brace was removed 7 weeks after surgery. During the weeks when the brace was used, the patient was carefully monitored in order to avoid nerve compression and decubitus development. Passive exercise was started after the removal of the brace, and active exercise was started since 8 weeks after surgery.

T2-weighted MR images before surgery depicted massive tears, and the damaged tendons were depicted as a high-intensity area (Fig. 4a, arrow). T2-weighted images 2 years after surgery showed that a low signal intensity area that reflects the reconstructed tendons covered the humeral head (Fig. 4b, arrow head). The JOA score was improved to 77 (pain: 30, function: 12, range of motion: 17, X-ray evaluation: 3, stability: 15), and then to 79 at the 44th month examination (pain: 30, function: 12, range of motion: 19, X-ray evaluation: 3, stability: 15). Active range of motion also improved, i.e., flexion: 115°, abduction: 105°; external rotation: 40°, to L1 for internal rotation.

Case No. 2.
A 75-year-old male. The patient is a carpenter and a right-handed person. He hit the left shoulder when he fell, then the arm elevation became
difficult due to persisting pain and muscle weakness. At the initial examination, active range of motion was 50° for flexion, 40° for abduction, 20° for external rotation, and to buttock for internal rotation. The JOA score was 54.5 (pain: 20, function: 6.5, range of motion: 8, X-ray evaluation: 5, stability: 15). At surgery, supra- and infra-spinatus muscles had full-thickness tear, and the supra-spinatus muscle was drawn to proximal by approximately 5 cm. Reconstruction surgery was performed as described above. After surgery, the patient wore a flexible shoulder brace at the zero-position, the arm was gradually descended since 4 weeks after surgery, and the brace was removed 6 weeks after surgery. MR images one year after surgery showed good condition of the repaired tendons, and there were no re-tears. The JOA score at that time was 95 (pain: 30, function: 20, range of motion: 25, X-ray evaluation: 5, stability: 15). At the final examination (24 months after surgery), the JOA score was 97, and active range of motion was 160° for flexion, 160° for abduction, 45° for external rotation, and to T7 for internal rotation. Patient satisfaction level was quite high.

Case No. 3.

A 60-year-old female who is a hotel manager and she is a right-handed person. There was no trauma, but pain and muscle weakness gradually developed on the right shoulder. At the initial examination, active range of motion was 130° for flexion, 120° for abduction, 30° for external rotation, and to L1 for internal rotation. The JOA score was 71.5 (pain: 15, function: 14.5, range of motion: 22, X-ray evaluation: 5, stability: 15). At surgery, supra- and infra-spinatus muscles had massive tears. A flexible shoulder brace was worn at the zero-position after surgery. The arm was gradually descended since 4 weeks after surgery, and the brace was removed 7 weeks after surgery.

The JOA score one year after surgery was 76 (pain: 30, function: 11, range of motion: 15, X-

Fig. 4  Case No. 1

a: Preoperative MR image. Massive rotator cuff tear was depicted. Arrow: the end of the torn rotator cuff.
b: MR image 2 years after surgery. It depicted the low signal intensity area (arrow head) that reflects the reconstructed rotator cuff with sufficient thickness and that covered the humeral head. *Greater tuberosity.
ray evaluation: 5, stability: 15). At the final examination (41 months after surgery), radiograms revealed mild arthrosis changes (Fig. 5a). T2-weighted MR images showed a high signal intensity area in a part of the reconstructed tendons (Fig. 5b, arrow), and the patient was diagnosed as having partial re--tear of the tendons. With conservative treatment, pain disappeared though range of motion was slightly limited, and the patient was satisfied with this result.

**Discussion**

Various surgical techniques have been introduced for reconstruction of massive rotator cuff tears, e.g., the McLaughlin procedure (tendon advancement)\(^7\), Debeyre's method (supraspinatus advancement)\(^2\), and several patch methods that utilize the tendon of long head of biceps\(^9\), fascia lata\(^6\), or synthetic materials\(^10\). Equivalent approach is musculotendon transfer that utilizes latissimus dorsi muscle\(^3\), trapezius muscle\(^5\), or teres minor muscle\(^11\). However, each method has its own advantages and drawbacks. The McLaughlin procedure applied to massive rotator cuff tear has a high risk of re-tear around the insertion point of greater tuberosity of humerus because of the increased tension of the advanced tendon. In musculotendon transfer, volume of tendon components in the transferred muscle is not sufficiently large, and it is often difficult to cover the defect area. In addition, transferred muscle is unable to take the function of original tendon because its fiber direction is different from the original tendon. In patch methods, mobility of remained tendon is poor, and improvement of tendon function is sometimes unexpectable\(^1\). Synthetic materials also causes unwanted histological or biochemical reactions of the body\(^5\).

In treatment for massive rotator cuff tear, there are 2 important points: (i) improvement of mobility of the tendons by freeing the adhesions of the torn end to surrounding soft tissues and
(ii) drawing and suturing the remained shrunken tendons to the insertion point of the greater tuberosity of humerus. Regarding the second point, modified Debevre's method is preferable to the McLaughlin procedure because it can advance the supra- and infra-spinatus muscles longer. However, for the patients like our cases whose torn end was unable to draw to the insertion point of greater tuberosity with the modified Debevre's methods, autologous fascia lata patch was useful to cover the defect area. We also thought that the double-folded fascia lata produced certain thickness and improved tensile strength. The point to be concerned in this procedure is whether the free fascia lata is remodeled to tendon, but Sano et al\textsuperscript{12}) reported the formation of direct insertion and remodeling of the fascia to tendon after surgery that utilized autologous fascia lata patch. The combination of modified Debevre's method and fascia lata patch is one of useful techniques for the reconstruction of massive rotator cuff tear that is often irreparable. However, because partial re-tear occurred in one of the 3 shoulders after surgery with this method, application of this technique needs to be carefully examined in a same manner to the other treatment methods.

In summary, we performed modified Debevre's method in combination with fascia lata patch to 3 shoulders of massive rotator cuff tear. Patients satisfaction was quite high even though one patient developed partial re-tear that was confirmed on MR images. We consider this combination is a useful surgical procedure for massive rotator cuff tear.

References