MASSIVE ROTATOR CUFF TEARS: CONSIDERATION OF TECHNICAL POINTS

Jae-Myeung Chun
Asan Medical Center, University of Ulsan College of Medicine, Seoul, Korea

Operative repair has been widely accepted procedure for rotator cuff tear. Problems in repairing massive tear include large size of defect, extensive adhesions, contracture of torn tendon, poor quality of tendon tissue, muscle atrophy, and osseous changes. Repair of massive rotator cuff tear is one of challenging procedures for these problems. Due to the difficulties of repair of the massive tear, some surgeons prefer to choose other options, including nonoperative treatment, debridement, partial repair, tendon transfer, repair with fascia graft, synthetic material, and allograft.

Purpose of repair of massive rotator cuff tear is to reconstruct an effective connection between rotator cuff muscle and the proximal humerus, to rebuild a direction of the force of the rotator cuff to centralization of the humeral head, to prevent further progression of tear, and to prevent development of cuff tear arthropathy. To obtain these purposes, the reasonable primary treatment would be anatomical complete repair of the tear as much as possible.

For a good repair, anatomical dissection is essential part of approach. In cases with massive tear of the rotator cuff, the remaining cuff tissue would be displaced due to the muscle action, weight of the arm and effect of superior migration of the humeral head. Supraspinatus tendon is usually retracted medially, and located beneath the acromion and tethered to the coracoid process by shortened coracohumeral ligament. Infraspinatus tendon is also retracted medially beneath the acromion with the supraspinatus tendon. Teres minor tendon is usally retracted distally and posteriorly. Subscapularis tendon is usually displaced medially and anteriorly. In many cases of massive tear, tear of the tendon is three-dimensional. In many cases, there are laminar tears within the tendon tissue. These three dimensional configuration, superoinferior, mediolateral and anteroposterior directions, should be considered in repairing surgery. Anterosuperior approach is widely used for the repair of the rotator cuff. This approach is also suitable for the massive tear. Ordinarily, a part of the anterior deltoid is detached from the acromion. In difficult situation, small portion of the mid-deltoid can also be detached from the lateral aspect of the acromion. Detachment of small portion of the mid-deltoid rather than excessive retraction would be better to approach to the posterior aspect of the rotator cuff. In cases of tear of subscapularis, a deltopectoral approach can be used with anterior extension of the anterosuperior approach.

The coracoacromial ligament is detached from the acromion as long as possible. The fiber of the coracoacromial ligament is continuous to inferior aspect of the acromion. The coracoacromial ligament should be detached from the inferior aspect of the acromion rather than from the anterior tip of the acromion. Detachment of the mid-deltoid from the lateral aspect of the acromion may be helpful detaching the coracoacromial ligament from the inferior aspect of the acromion. The detached coracoacromial ligament should not be excised. Advantages of preserving the detached coracoacromial ligament are to provide anatomical landmark between the deltoid and subacromial space, to protect the deltoid muscle during retraction of the muscle, and to give an opportunity reattachment of the detached ligament to the acromion. The repaired coracoacromial ligament may be helpful to prevent superior migration of the humeral head in case of weak cuff mechanism.

Decompression should be a part of the repair procedure of cuff tear. Purpose of decompression in repairing procedures is to make an operating space for releasing retracted cuff tissue from the inferior portion of the acromion, to provide enough room for passing repaired cuff tendon, to give an opportunity adapting postoperative edema, and to prevent recurrence of tear in case of weak cuff mechanism. Dr. Neer designed anterior acromioplasty for the decompression. There have been many modifications after the original Neer's anterior acromioplasty. There are some controversies about the best technique of the decompression. Dr. Rockwood developed two-step acromioplasty to prevent recurrence of impingement phenomenon. Enough decompression would be safer to adjust immediate postoperative edema, and to provide more opportunities to adapt in case of weak cuff mechanism. However, too aggressive decompression has a risk of iatrogenic fracture of the acromion. Dr. Rockwood suggested removal of any protrusion beyond the clavicle for the guideline of the amount of decompression. This guideline is very convenient and practical ensuring a good decompression without risk of overzealous decompression. The first-step should be done with a rongeur, and the second step can be done with an osteotome through the cancellous portion of cut surface. A cut through the cancellous portion would be safer method to avoid iatrogenic fracture of the acromion.

Status of the acromioclavicular joint should be evaluated preoperatively. Intact acromioclavicular joint should be preserved without damage. Painful acromioclavicular joint with advanced degenerative change should be considered to resectional arthroplasty of the joint. Partial removal of the acromioclavicular joint may make further damage to the joint. Total resectional arthroplasty of the acromioclavicular joint can be done without damage of the superior acromioclavicular ligament. Stability of the distal

clavicle can be preserved with intact superior acromioclavicular ligament.

After decompression, status of torn area should be carefully evaluated. Gentle handing of torn ends of the tendon is another essential part of the surgery. The torn ends of the tendon should be handled with multiple tagging sutures, instead of forceps. Configuration of the tear is three-dimensional, rather than two-dimensional. Careful examination should be given to find any directions of tear. Usually, capsular layer is more displaced and covered by tendinous layer. Capsular layer should be evaluated to avoid incomplete repair. Repair should be done with full thickness repair to avoid remaining partial thickness tear. Incomplete repair may make incomplete transfer of power of rotator cuff to the proximal humerus. It may make weakness of cuff mechanism. Every effort should be given to rebuild a complete cuff mechanism. Any adhesion around the rotator cuff should be systemically released. Contracture of the rotator interval area may be released, using interval-sliding technique. Repair of the tendon should be designed with traction of the multiple tagging sutures to various directions. The least tensile direction with the most natural course of the tendons should be selected. Intact long head of the biceps brachii should be preserved. Superficial frayed area of the biceps tendon may be debrided. Tenodesis of the long head of biceps brachii can be considered for the case of torn tendon. Remnant of the original stump of the long head should be debrided to avoid impingement between the humeral head and the glenoid.

Freshening of the torn ends of the tendon may be done very carefully. Length of the tendon should be preserved as much as possible. Freshening with an oblique fashion from superficial side distally to deep side proximally provides fresh beds for healing with preservation of the tendon as long as possible. Overzealous trimming should be avoided to prevent excessive tension over the repair site. For severely contracted tendon, freshening of the end of the tendon may be omitted to avoid excessive tension over the repair site. Inside of laminar tear also should be freshened by curettage to promote healing.

Number-two nonabsorbable suture is widely accepted suture material. Recently, absorbable suture has been developed for rotator cuff repair. This material is strong enough for a relatively long period to maintain repair. Dr. Copeland has compared nonabsorbable and absorbable sutures, and he could not find any differences between the two suture materials. Some surgeons prefer use Mason-Allen suture. Simple interrupted sutures can be used for usual situations. With extremely weak tissue or wide laminar tear, Mason-Allen sutures may be helpful to augment repairs.

Repair without bony trough is simpler method with less bleeding than bony

trough method. Repair method without bony trough preserves bony tissue. It may prevent iatrogenic fracture of the greater tuberosity in osteoporotic bone. This method provides more natural course of tendon without any stress arising areas. Curettage or rongeuring of the superficial surface of greater tuberosity to make bleeding bony bed is enough for tendon to bone repair.

Passing sutures through bony tunnels may be technically demanding procedures. Bony tissue should be preserved as much as possible to avoid iatrogenic fracture and failure of repair. In an osteoporotic bone, it may be dangerous to make big bony tunnel. A tactic of progression from the least invasive technique to more invasive technique is reasonable way passing sutures through the greater tuberosity. In osteoportic bone, a strong needle can be inserted through the greater tuberosity. If failed to passing a strong needle, serial trials of an awl, punch or burr would be reasonable way of individualization. This tactic of individualization would protect bony tissue as much as possible and adjust to the quality of bone of the individual patient. It was not necessary to use a button or bone plate to prevent pull out of the suture through the bone.

After repair of the cuff, the quality of repair, amount of tension, degree of decompression should be checked. The detached coracoacromial ligament and the deltoid muscle should be carefully reattached to the acromion.

Postoperatively, an arm should be protected in about 20 degrees of abduction position for five weeks. At the evening of the operating day, exercise begins with gentle passive forward elevation. The next day, self-exercise using patient's opposite arm for passive forward elevation was educated. In a couple of days, pendulum exercise and external rotation exercise was added. After five weeks, strengthening exercises were started. Strengthening exercises should be done continuously and progressively for couple of months. Stretching exercises for posterior capsular contracture and internal rotation should be done at the last session of the exercises.