

개방적 복원술 Open Repair of Rotator Cuff Tears

고려대학교 의과대학 정형외과학교실

박 정 호

Contents

1. Elements of Open Repair of Rotator Cuff Tears
2. Characteristics of Mini-Open Repair
3. Dilemma in Treatment of Massive Rotator Cuff Tears

Elements of Open Repair of Rotator Cuff Tears

I. Skin Incision

1. Beach chair, lateral, supine position
2. Langer's line
3. Mini-open repair - extension of anterolateral portal, transverse or vertical

II. Deltotrapezial Fascial Incision

1. "Deltoid on approach"-incision which parallels the anterior acromial border and proceeds down the raphe between the anterior and lateral deltoid¹⁾
2. Mini-open repair - lateral deltoid splitting
3. Minimize the deltoid detachment and detach the deltoid with its osteoperiosteal attachments from anterior acromion (and distal clavicle)
4. Deltoid split
 - A. <4 cm-axillary nerve is closer than 5 cm in 20% of cadavers, especially true of female with short arm spans²⁾
 - B. Stay suture
 - C. Retract deltoid - avoid excessive "pull"

III. Bone Excision

1. Acromioplasty- anterior and inferior two-step acromioplasty (Rockwood)
2. Minimal to no bone debridement (acromial smoothing)
3. Distal clavicle resection or removal of osteophyte of acromioclavicular joint
4. Resection of the coracoacromial arch (CA ligament release)³⁾
 - A. Remove CA ligament in subperiosteal fashion and repair back to the acromion in a more medial position
 - B. Endanger the deltoid origin, impair the superior stability, adhesion

between the cuff and acromion - "should not be thoughtlessly divided"
(Codman)

5. Mini-open repair - arthroscopic acromioplasty, CA ligament release, distal clavicle resection, removal of osteophyte of AC joint

IV. Bursal Excision

1. Remove thickened, inflamed or fibrotic bursa and scar tissue - an increase in inflammatory mediators, afferent nerve endings and their products in inflamed subacromial bursa is a source of pain^{4,5)}
2. Assessment of rotator cuff tear - size, shape, location, depth, retraction, tendon mobility, reparability, tissue quality
3. Mini-open repair - arthroscopic and/or open bursectomy

V. Tendon Preparation

1. Humeral rotation to expose tear
2. Traction sutures

VI. Cuff Mobilization

1. Three stages of sequential release(1)
 - A. Humeroscapular motion interface is freed between the cuff and the deltoid, acromion, CA ligament, coracoid, coracoid muscle
 - B. Coracohumeral ligament/rotator interval capsule is sectioned around the coracoid process (interval slide)
 - i. CH ligament excision or incision of the coracoid base should result in as much as 1 cm of lengthening itself²⁾
 - C. Divides the capsule from the glenoid just outside the glenoid labrum
 - i. Medial dissection from the point of origin into the biceps tendon and the supraspinatus fossa should be limited to 3 cm (suprascapular nerve was on average between 2.5 and 3 cm medial to glenoid rim)
 - ii. Dissection from the posterior rim of the glenoid into the infraspinatus fossa should not exceed 2 cm
 - iii. Supraspinatus and infraspinatus could be advanced laterally for more than 1 cm²⁾

VII. Cuff Repair

1. Gently decorticate cuff "footprint"
 - A. Bony trough is not recommend - increase the distance of tendon excursion and may create a sharp edge of bone over which the tendon has to pass⁹⁾
 - B. Healing of rotator cuff tendons to cortical bone is comparable to

- healing in a cancellous bony trough⁷⁾
2. Transosseous vs. suture anchors ~ “A frictionless surface” (Codman)
 3. Transosseous suture
 - A. Sutures - #2 nonabsorbable, braided
 - B. Cuff stitch - simple vs. mattress vs. modified Mason-Allen suture
 - i. mattress suture inferior than simple suture⁸⁾
 - ii. Mason-Allen suture do not slide or allow slack and may lead to suture breakage⁶⁾, but better grasping power in compromised tendon tissue⁹⁾
 - C. Drill holes at least 2~3 cm below the tip of tuberosity
 - i. Osteopenic bone - more distally suture can be passed
 - D. Bury the tendon edge in a trough to prevent iatrogenic impingement
 4. Any necessary side-to-side repair is carried out using a buried knot technique
 5. Routine debridement of the tendon edges is not recommended - healthy granulation tissue present over the tendon edges indicating a neovascular response⁶⁾
 6. Anterior and posterior tendon to bone stitches are tied first and then the middle sutures in 10° to 15° of forward flexion, 10° abduction and slight internal rotation position⁶⁾
 7. Tissue defects
 - A. Biceps hypertrophy²⁾
 - i. Can be used to advance and reattach posterior cuff
 - ii. Can augment rotator interval and anterosuperior deficient coverage
 - B. Tissue deficiency or thin repair
 - i. Partial repair - make “functional cuff tear”¹⁰⁾
 - ii. Augmentation - good result with polyester implant (Wallace) or ineffective with small intestinal submucosa¹¹⁾
 8. Check repair 140 degrees of forward elevation and 40 degrees external rotation

VIII. Deltotrapezial Fascia Repair

1. Deltoid repair with nonabsorbable suture
2. Carefully reattach deltoid to prevent deltoid dehiscence
3. Poor results were associated with lateral acromionectomy or deltoid detachment

IX. Postoperative Care

1. Sling and passive motion for 4~6 weeks
 - A. Immediate continuous passive motion

- B. To allow more motion and to allow it sooner (Codman)
- 2. Full motion by 6 weeks
- 3. Active motion - start at 4~6 weeks
- 4. Strengthening - start at 8~12 weeks
- 5. Return to full activity 4~6 months
- 6. Should be individualized

X. Clinical Results

1. Open repair vs. min-open repair - no difference in outcomes¹²⁾
2. Open repair
 - A. Functional improvement 70~95%, pain relief 85-100%⁶⁾
 - B. 7 of 24 arthroscopic-assisted rotator cuff repair were converted to an open end approach because of the quality of the tendon tissue and configuration of the tear requiring soft tissue releases¹³⁾
3. Mini-open repair
 - A. Small and moderate-sized tears had better functional outcome with arthroscopically assisted repair¹⁴⁾
 - B. Shorter hospitalization, earlier return to activity¹⁴⁾, greater active forward flexion¹²⁾
4. Determinants - tear size¹⁴⁾, minimally retracted tears, good preoperative motion and strength, good tissue quality, no subscapularis involvement¹³⁾
 - A. Good prognostic factors²⁾
 - i. Intact biceps
 - ii. Strong deltoid
 - iii. Traumatic (younger)
 - iv. No prior symptoms
 - v. Acute repair
 - B. Poor prognostic factors
 - i. Involvement of subscapularis, teres minor
 - ii. LH biceps rupture
 - iii. Severe weakness
 - iv. High riding head
 - v. Muscle atrophy
5. Postoperative cuff integrity - no significant effect on outcomes¹⁵⁾

Characteristics of Mini-Open Repair

1. Advantages of mini-open repair(3)

- A. Glenohumeral assessment (and treatment of pathology) - 60.5% had associated intra-articular pathology and 12.5% had major abnormalities¹⁶⁾

- B. Deltoid preservation
- C. Less morbidity
- D. Cosmesis
- E. May allow for better handling of tendon retraction and poor tissue quality than arthroscopic repair

2. Disadvantages of mini-open repair

- A. Difficult to mobilize retracted tear
- B. Suture placement difficult due to limited exposure
- C. Required good arthroscopic skill
- D. Unable to access subscapularis/long head of biceps
- E. Increased deltoid trauma due to excessive pull
- F. Increased incidence of postoperative stiffness

3. Patient selection

- A. Preserved passive/active ROM
- B. Small to medium-sized tear
- C. Minimal to moderate retraction
- D. No superior humeral head migration
- E. No muscle atrophy
- F. Subscapularis not involved

Dilemma in Treatment of Massive Rotator Cuff Tears

1. Repair of massive tears

- technically challenging due to poor quality of remaining tissue, significant tendon retraction, bursal scarring, adhesions to adjacent structures

2. Two groups

- A. Atraumatic - elderly, neglected (chronic), weak, muscle atrophy, pain
- B. Traumatic - younger, normal prior to injury, marked sudden weakness, minimal muscle atrophy, pain

3. CAN it be repaired

- A. Assess only following cuff mobilization
- B. Inspection alone inadequate
- C. Don't know till you try

4. SHOULD it be repaired

- A. Debridement - works(17) (83%) or deteriorates with time¹⁸⁾ (84→68%)

- B. Debridement inferior to repair and repair superior to debridement¹⁹⁾
- C. Preserve CA arch

5. DOES it heal

- A. Structural failure but clinical success^{20,21)}
- B. Cuff healing
 - i. Don't know unless you image
 - ii. Clinical exam unreliable to assess
- C. Better function with intact repair
- D. Debridement vs. failed repairs

6. Open repair of massive tear in patients aged 65 years or over²²⁾

- A. Excellent or good 44%, poor 23%, satisfaction 44%, pain relief 93%
- B. Significant variables - female sex, symptom duration than 34 months, American Society of Anesthesiologists grade
- C. Appropriately selected patients can be expected to have good functional outcome

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