

Rationale and Surgical Technique of Rotator Cuff Repair

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Rotator cuff disease

- Rotator cuff tendinosis
- Partial thickness cuff tears: Articular surface, Bursal Surface, Intratendinous
- Full thickness cuff tears : Anterosupreior, Posterosuperior
- Cuff arthropathy : still under dabate

Combined Cause and Decision Clues

- Extrinsic
 - Trauma, microtrauma, impingement, Secondary impingement
- Intrinsic
 - Hypovascularity, Degeneration of tendon
- Conservative treatment clue
 - Asymptomatic cuff tear: 10~90%
- Surgical treatment clue
 - Tear size extension, m atropy & contracture, Progressive symptomatic

Repair according to clinical state

- Above 1 year duration: Ant shoulder pain, Referred pain to upper arm, Night aggrevation
- Muscle weakness: Difficulty of overhead activity, Limitation of active motion : more large tear
- More than 1 cm² tear size

Physical finding of RCT

- Depression of supraspinatus & infraspinatus fossa: Atrophy of muscle & Chronic tear
- Crepitus by subacromial roughness
- Rent sign: large tear
- PTRCT: frequent stiffness
- Pseudo-weakness: By pain inhibition, Lidocaine injection test

- Posterosuperior RCT
 - Thumb up test or full can test: : SS strength
 - Ext rotation lag: SS & IS
 - Drop sign: IS
- Anterosuperior RCT
 - Belly press & lift off test & Increased ER : Sbs

Mini-Open Rotator Cuff Repair

- Yamaguchi et al. *ICL* 2003: Transitioning to arthroscopic rotator cuff repair, pros: stiffness result from deltoid insult, Cons: Mason Allen stitch
- Chun et al. autumn conference of KOA 2004
Ant mini-open: prevention to deltoid injury
- Nicholson et al. ASES 2000: Mini-open rotator cuff repair, Deltoid injury by retractor
- Paulos et al. *Am J Sports Med* 1994: mini-approach to rotator cuff repair
- Levy et al. *Arthroscopy* 1990. Arthroscopic assisted rotator cuff repair

Surgical Methods of Mini-Open Repair

- Arthroscopic Acromioplasty & mobilization of tendon
- Tagging suture by arthroscopy
- Anchor insert at deadman angle if needed
- Anterior mini-open
- Lat. portal extension: avr. 3.5(2.5~4) cm
- Deltoid split: between ant & mid fiber
- Cuff repair: Transosseous technique /Anchor technique

Arthroscopic Rotator Cuff Repair

- n Nottage et al. *Arthroscopy* 2003
lower fibrous ankylosis, better early motion in arthroscopic technique than mini-open.
- n Weber *AANA* 2001.
Comparison of all arthroscopic and mini-open, Early motion, reduce hospitalization
- n Snyder et al. *J Shoulder Elbow Surg* 2002
Preop/Postop UCLA: 17.2/33.7, ASES: 42.2 / 94.9
- n Burkhart et al. *Arthroscopy* 2001
Excellent & Good: 95%, no difference btw tear size, repair pattern
- n Gartsman et al. *JBJS* 1998
Early effectiveness of arthroscopic repair for FTRCT

Principle steps for cuff repair

- Glenohumeral joint examination: pathology correction
- Synovectomy & sup capsule release prn
 - Acromioplasty / subacromial smoothing: Bursotomy & evaluation of tear pattern
 - Tendon mobilization: Mobilization, if needed
- Margin convergence if needed
 - Cuff end to bone repair
 - Protected rehabilitation

Ideal repair for rotator cuff tear

- High initial fixation strength: provided
- Minimal gap formation: allowed
- Mechanical stability: maintained, Until tendon to bone healing process

Advantage of tendon to tendon repair

- Reducing tear size: reducing the repair area of tendon to bone
- Reducing tension at tear site
- Reducing repair failure
- Preventing tear size increment
- Bring tear margin to GT: from medial
- Partial repair in massive tear: maintain balanced force couple

Tendon to tendon repair

Anatomical footprint reconstruction -Biomechanical study-

- Apreleva & Warner et al. 2002 Arthroscopy
 - Single row with SAS (suture anchor simple) → **covered 67% original SS insertion**
 - More lateral anchor placement → increase repair-site area
 - Large contact area btw tendon and bone → improve biological healing
- Waltrip & Andrews et al. 2003 AJSM
 - Initial fixation strength of double layer repair: exceed single layer repairs
 - Either suture anchor or transosseous tunnel

Double row rotator cuff repair

vLo & Burkhart 2003 Arthroscopy

- Medial row: just lateral to articular surface of head
- Lateral row: just medial to drop-off of GT
- May potentially improve strength and healing of rotator cuff repair

constructs

- De Beer et al 2002
 - 58 cases by footprint reconstruction, 90% excellent and good results, 89% intact cuff shown by ultrasound

Our Double row rotator cuff repair

Modified Mason-Allen stitch

- combination of horizontal mattress suture, vertical single suture
 - strong tissue-holding stitch, less strangulation than Krackow, Bunnel stitch
 - common in open cuff repair
 - technically difficult arthroscopically

Arthroscopic Mac stitch

- MacGillivray and Ma: 2004 Arthroscopy
 - tendon-suture interface: weak link in rotator cuff repair
 - simple modification of suture placement
 - combination of a horizontal and vertical loop at the site of repair
 - increase the strength of tissue fixation

Arthroscopic Mac stitch

- side-to-side sutures firstly
- Another horizontal loop: 10 mm medial to edge of cuff tendon
- suture from the suture anchors: medially to previous horizontal loop

configuration of the massive cuff stitch (Mac stitch)

- because arthroscopic modified Mason-Allen stitch: very difficult
- broken into 2 separate loops essentially
- horizontal loop will increase the strength of the repair
- Same as modified Mason-Allen stitch

Our arthroscopic Mac stitch

Our modified Mac stitch technique

- Connecting horizontal loop with vertical suture loop
- Initially: horizontal loop made, Secondly: vertical suture made, Connecting with 2 loop by PDS
- Vice versa possibly
- Non sliding Revo knot

- Similar as modified Mason Allen stitch

Mattress double anchor footprint repair

- Millett et al, Arthroscopy 2004
 - novel, arthroscopic rotator cuff repair technique
 - suture linked between 2 anchors
 - similar to transosseous techniques

Mattress double anchor

- alternative suture configuration with interlocking of the sutures : to prevent cutout from the tendon
- sutures criss-cross from 4 separate anchors : interlocked
- maximize tendon compression, maximize repair surface area

Partial thickness tear

- General principles: Tear depth < 50%: Debridement only, Tear depth > 50%: Debridement & Repair
- Surgical selection
 - Arthroscopic repair: Convert to make full-thickness and repair, Arthroscopic trans-tendon repair
 - Mini-open repair

PASTA transtendon repair

- Habermeyer et al
 - Arthroscopy 2004
 - Modified arthroscopic Mason Allen technique
 - Intra articular repair for PASTA
 - Combination of mattress stitches and single vertical stitches
 - Excellent visualization, Sufficient initial refixation strength

Comparison of All Arthroscopic Repair versus Mini-open Repair of Full Thickness Rotator Cuff Tear

Activity of Daily Living

Visual Analogue Scale

UCLA scores

UCLA Final Results

Massive Rotator Cuff Tear

- JBJS(A), 2005 Boileau: > 5 cm, More than 2 tendons, More retraction to glenoid

- Kim, 2004, Ulsan RCT symposium: Massive = not irreparable, Repairable = not always functional
- Arthroscopy. 2005 Ida et al
 - Arthroscopic repair of small-to-massive tears: outcomes equivalent to open repair
- Repair of massive tear
 - Open / Mini-open / Arthroscopic
 - Muscle transfer
 - Tendon graft, Synthetic, allograft, xenograft

Massive rotator cuff tear

- Majority of tear: repair to bone primarily
 - Bigliani et al JSES 1992, Rokito JBJS(A) 1999
- Arthroscopic / open debridement
 - Savoie OCNA 1997 / Rockwood JBJS(A) 1995
 - Restoration of strength: inferior to repair, Deterioration of result
- Tendon transfer
 - Warner ICL 2001, Gerber OCNA 1997: latiss dorsi
- Partial repair
 - Arthroscopy Burkhart et al. 1994, Emphasizing balanced force coupling

Open repair in massive cuff tear

Summary of surgical management

- Primary goal of surgical treatment: reduced pain, additionally functional recovery & preventing progression
- Process: decompression: prevent impingement, repair: recovery of muscle strength, joint stability, rehabilitation
- Arthroscopic vs open/mini-open repair
 - open/miniopen repair : gold standard
 - same at fundamental concept
 - primary goal of repair :
 - anatomical reposition of cuff end
 - Complete healing of cuff and bone insertion
 - Recovery of cuff function