ROTATOR CUFF REPAIR: TIPS FOR THE DIFFICULT TEAR

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COI

• J&J Mitek: consultant fee, institutional grants
• Smith & Nephew: consultant fee, institutional grants
• Cayenne Medical: consultant
• * No effect on this presentation
MY PHILOSOPHY

• All rotator cuff tears can be repaired
• Not all rotator cuff tears should be repaired
• Nothing works in everyone but everyone deserves a chance
• Previous surgery is not a contraindication unless RC tissue has been excised.
PATIENT SELECTION

• Pain and functional impairment: what really bothers the patient?
• Quality of bone and soft tissues: Pre op MRI: evaluate atrophy of muscle and cysts in bone
• Comfort/Skill level with advanced techniques
PRE OP ASSESSMENT: PHYSICAL EXAM

• Assess for source of pain: not always RCT: *palpate* the tear and the tendons
• Passive ROM: look especially at internal rotation in abduction (post-inf capsule)
• Check for impingement, biceps and a/c joint
  – Inject if unclear
DIAGNOSTIC STUDIES

• Radiographs
  – Check PA for superior migration, a/c djd, lateral impingement
  – Check outlet for acromial type, A-H distance
  – Check axillary for DJD, Post subluxation
DIAGNOSTIC STUDIES

MRI

- Atrophy in muscles?
- Retraction?
- Associated pathology: labrum, biceps, djd
- Tendon edge and quality
- Adhesions on nerve?
SURGERY: POSITIONING

• Lateral or beach chair equal for RCT repair
• Position should allow arm rotation and inferior traction
• Must have access to anterior/posterior and medial shoulder for instrumentation
  – Medial posterior portal
  – Nevaiser portal
INTRAOPERATIVE

• Consider inferior capsular release: it helps all cases
• View and shift the tendons to see what goes where
• Add *oblique* convergence stitches to decrease tension
• Preserve medial bursa for vascularity and add trephination holes in GT: think biology
RELEASES INCREASE AS TEAR SIZE INCREASES

- Small tear = CHL release
- Medium = CHL + PIGHL
- Large = CHL + capsule under torn tendon
- >2 tendon with retraction = CHL, 360 degree capsule, SS nerve?
SUPRASCAPULAR NERVE: WHEN TO RELEASE?

• EMG/NCS proven entrapment
• Severe (grade 3B to 4B) atrophy
• Revision RCR when tendon is retracted medial to the glenoid
GREATER TUBEROSITY PREPARATION

- Debride away dead tissue
- Remove or impact old anchors
- Trough at articular edge
- Micro-fracture or trephinate to provide easy access for stem cells
- Preserve bone at critical anchor points
TREPHINATION
“ROWS” INCREASE AS TEAR SIZE INCREASES

- Small tear = single row, CHL release
- Medium = double row, CHL + PIGHL
- Large = double row, CHL + capsule
- >2 tendon with retraction: CHL,
  - Capsule, CHL, SS nerve ant and posterior
SURGICAL TECHNIQUE: CONVERGENCE=MEDIAL ROW

- Easier with intact subscapularis
  - Repair subscap as 1st step
- Start posterior-medial → anterior-lateral
- With proper release SS & IS almost a free graft
CONVERGE OBLIQUELY

- RCT PULL ALONG LINE OF MUSCLE ACTION
- CONVERGE IN OPPOSITE DIRECTION OF MUSCLE PULL
  – OBLIQUE LINES UP MUSCLE AND TENDON FOR REPAIR
MIDDLE ROW

- Anchor just off articular surface and at bicipital groove
- Mattress sutures in IS and SS
  - Enter at muscle tendon junction if viewing from the top.
- Preserve one limb of each for suture bridge
LATERAL ROW

- Anchor placed on lateral footprint or “around the corner” and down on the shaft
- Boileau tension band stitch on the lateral tendon to pull it down with compression
- Add medial sutures to anchor to create a suture bridge to add mild compression effect
INITIAL POST OP

• Abduction pillow
  – Relaxes repair
  – Optimal position for blood flow to critical zone

• Cryotherapy early and often

• Passive ROM for first 4 to 8 weeks

• Start scapular retraction early (POD 1)
POST OP COURSE

• Keep abduction pillow at night until tendon healed to bone, usually 4 to 8 weeks
• Passive motion only until you palpate tendon healing without swelling
• Encourage scapular retraction at all times: remember supine rehab
• Brace/tape early and often for balance
ADJUNCTIVE MEASURES

• Neuromuscular stimulation
  – Infraspinatus
  – Deltoid
• Aquatic therapy
• Scapular bracing
CONCLUSIONS

• Most RCT can be repaired and should be repaired.
• >90% patients heal and are satisfied with current techniques.
THANK YOU
ISAKOS 2011
Rio de Janeiro, Brazil
Single vs Dual Row Cuff Repair

Richard L. Angelo, M.D.

Biomechanics

A. Supporting Dual Row Mechanical Advantage:
   improved footprint restoration with DR
   * Apreleva – Arthroscopy 2002
   - 20% larger footprint coverage with transosseous vs single row repair
   * Tuoheti – AJSM 2005
   - DR repair generated 42% greater contact area than transosseous and 60% > SR
   * Mazzocca – AJSM 2005
   - 1.75 – 2 X greater footprint coverage with DR vs SR
   * Meier – JSES 2006
   - DR recreated 100% of footprint; TO 71%; SR 46% coverage

greater contact pressure with DR
   * Mazzocca – Arthroscopy 2010
   - of DR repairs, only the transosseous equivalent (TOE) showed greater pressure over time (160 minutes) than the SR repair
   * Baums – Knee Surg Sports Traumatol Arthrosc 2009
   - DR (arthroscopic Mason-Allen) suturing showed greater contact pressures than SR (Mason-Allen) configurations
   * Park – JSES 2007
   - suture bridge = ave 0.27 MPa vs DR = 0.19 MPa

decreased gap formation / greater load to failure with DR
   * Smith – JBJS 2006
   - gap formation under static load DR = 3.8 mm vs SR = 5 mm
   - repair failure under cyclic load DR = 320 N vs SR = 224 N
   * Kim – AJSM 2006
   - gap formation DR = 3.6 mm vs SR = 7.6 mm
   - ultimate failure load 48% greater DR vs SR
   - stiffness increased by 46% DR vs SR
   * Meier – Arthroscopy 2006
   - repair failure for TOS = 75 vs SR = 789 vs DR > 5000 loading cycles
   * Ahmad – AJSM 2008
   - significantly less gap formation DR vs SR on cyclic loading
   - gapping with internal rotation > external rotation > neutral
   * Park – JSES 2007
   - ultimate load to failure significantly greater with suture bridge TOE (DR) = 443 N vs DR (double anchor) = 299
   * Park AJSM 2008
   - greater resistance to shear with external rotation with DR
   - greater stress at anterior aspect of repair with internal rotation

passive rotation revealed greater fixation strength with DR
   * Ahmad – AJSM 2008
   - with cyclic loading and internal rotation gapping: SR = 3.1; DR = 2.29 mm
B. Suggesting that there may be minimal biomechanical difference SR vs. DR
no difference in gap formation SR vs DR

* Lorbach - Arthroscopy 2010
  - modified Mason-Allen SR = DR suture bridge with radiostereometric
    and digital video analysis in 3 different planes

* Mahar – Arthroscopy 2007
  - no differences in tendon elongation for SR vs DR

triple-loaded anchors may improve SR fixation

* Barber - Arthroscopy 2010
  - single row of triple-loaded anchors were more resistant to stretching
    5 to 10 mm than DR

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Anatomy

does dual row repair restore normal anatomy?

* Leek – Arthroscopy 2010
  - tying medial row mattress sutures increases DR construct stability / stiffness
* overconstraining medial row fibers is non-anatomic with abduction and rotation
* can overtensioning and tension mismatch be avoided with available tissue?

stiffer construct may over-constrain medial cuff (non-anatomic) and may help to
explain medial row failures

* Trantalis – Arthroscopy 2008
  - 5 case reports of medial row failures of mattress sutures in DR constructs
* Yamakado – Arthroscopy 2010
  - 4 case reports of isolated medial row failure of mattress sutures in DR

improved structural healing with DR

* Sugaya Arthroscopy 2005
  - healing SR: 44% sufficient thickness; 31% decr. thickness; 25% failed
    DR: 73% “ “ 17% “ 10 % “
* Charousset AJSM 2007
  - anatomic healing with footprint reestablishment: SR = 40%; DR = 61%.
* Duquin AJSM 2010
  - systematic review of failure rates stratified according to tear size:
    SR or transosseous - retear: < 1cm = 17%; > 5 cm = 69%
    DR “ = 7% “ = 41%

? compromised tendon vascularity with suture-bridge constructs? – little data

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Considerations: Single vs. Dual Row Cuff Repair

* healing rates are comparable for small to medium tears
* structural healing may be improved with DR constructs
* DR may improve outcomes for large and massive tears (although these tears may tend to have
  inadequate quality tissue for a DR repair)
* consideration for a dual row repair appears reasonable for medium – large tears where adequate
  quality tissue is available
* when adequate quality tissue is not available, a single row suture anchor technique with fixation at
  the medial aspect of the footprint using a modified Mason-Allen suture configuration with
  the cuff under low tension is best
* confirm security of the anterior aspect of the repair construct
* caution should be exercised when employing a technique to tie medial mattress sutures if there is
  thinning or poor quality tissue for the medial row
* OR time and cost must be weighed with potential for improvement in structural healing and
  potential for more durable repair
Outcomes

<table>
<thead>
<tr>
<th>Study</th>
<th>Exid</th>
<th>Fix’n / # Pts</th>
<th>F/U mo.</th>
<th>Clinical Outcomes</th>
<th>Structural Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Burks I</td>
<td>SR anchor 20 / DR anchor 20</td>
<td>12</td>
<td>No difference in UCLA, ASES, Const, WORC, SANE</td>
<td>MRI defect in 2 pts each group</td>
<td></td>
</tr>
<tr>
<td>Francheschi I</td>
<td>SR 30 / DR 30</td>
<td>24</td>
<td>UCLA SR: 11.5 – 32.9, DR: 10.1 – 33.3</td>
<td>MRA def SR: 12/16, def DR: 8/26</td>
<td></td>
</tr>
<tr>
<td>Grasso I</td>
<td>SR 40 / DR 40</td>
<td>25</td>
<td>No difference in Dash, Constant or strength</td>
<td>not reported</td>
<td></td>
</tr>
<tr>
<td>Charousset II</td>
<td>SR 35 / DR 31</td>
<td>28</td>
<td>Constant SR: 56.6 – 80.7, DR: 53.6 – 82.7</td>
<td>CTA defect SR: 21/35, DR: 12/31</td>
<td></td>
</tr>
<tr>
<td>Park II</td>
<td>SR 40 / DR 38</td>
<td>24</td>
<td>Constant SR: 41.6 – 76.7, DR: 44.2 – 79.7</td>
<td>none</td>
<td></td>
</tr>
<tr>
<td>Sugaya IV</td>
<td>SR 39</td>
<td>41</td>
<td>ASES, UCLA no different</td>
<td>MRI defect: SR: 25% (31% thin), DR: 17% (10% *)</td>
<td></td>
</tr>
</tbody>
</table>

Dual Row and Bridging Techniques

- anchor placement (through portal immediately lateral to acromion – LA)
  - *medial row* adjacent to articular margin: **must ADDuct arm (fig. 1)** to prevent too shallow of an approach to the tuberosity (fig 2) which risk anchor penetration of the humeral articular surface!!!

  ![fig. 1](image1)
  ![fig. 2](image2)

- *lateral row* 10 mm lateral to corner of tuberosity (want intact cortical bone on corner of tuberosity to prevent sutures "cutting through" bone and medializing effective fix’n): **must ABDuct arm (fig. 3)** to permit anchor to enter perpendicular to cortex of lateral tuberosity

  ![fig. 3](image3)
suture passage
* if medial row, pass paired sutures in horizontal mattress orientation; repeat for second pair of sutures; must place posterior sutures posterior enough and anterior sutures anterior enough to minimize creation of "dog ears", ie introduce antegrade passer through anterior portal to gain appropriate access to place most posterior suture vs introducing cannulated crescent hook from posterior; attempt to space medial sutures evenly along cuff from posterior to anterior
* if using lateral row anchors with separate sutures, pass single limb in simple vertical fashion for both sutures of lateral anchor; crossing adjacent sutures from 2 anchors improves "apex" fixation

bridging option A - (fig. 4) (for knotless suture anchors with suture interference fixation)
* isolate and tie medial mattress sutures, then deliver sutures out of a separate portal other than the one being used to tie
* through lateral acromial portal, punch / tap lateral aspect of greater tuberosity in preparation for the knotless device
* deliver 1 limb of each medial suture pair out the lateral subacromial portal and load in the chosen posterior knotless device
* insert knotless anchor, tension each limb, and deploy anchor
* repeat sequence with 2nd limb of each medial pair inserted into anterior lateral anchor

bridging option B - (fig. 5) "TOE" technique - transosseous equivalent
* similar to technique A except that sutures are not tied from medial row
  - may consider if cuff is thinner than normal to avoid medial row failure
* must employ anchors which "lock" suture in lateral anchor on deployment, otherwise entire repair is in jeopardy
* both limbs of each medial suture pair must be loaded / fixed into the same anchor to allow for tensioning and avoid creation of a "continuous loop" through several anchors

* if 2 medial anchors used, each with 2 pairs of mattress sutures, load 1st and 3rd pairs through first lateral anchor and 2nd and 4th pairs through second lateral anchor (spreads fixation in netting effect)