Thank You

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- It is indeed an honor and privilege to be invited to participate and share information.

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Rehabilitation Following Massive Rotator Cuff Repairs (What is best and for Whom?)
In this report we describe the clinical and pathological findings of cuff-tear arthropathy in twenty-six patients and discuss the differential diagnosis and a hypothesis on the pathomechanics that lead to its development.

Rehab-Massive RTC Tears

Although treatment of cuff-tear arthropathy is extremely difficult, the preferred method appears to be a resurfacing total shoulder replacement with rotator-cuff reconstruction and special rehabilitation.


Rehab-Massive RTC Tears

- Massive rotator cuff tears (MRCT) include a wide variety of lesions in terms of tear pattern, functional impairment, and reparability.
- There is insufficient evidence to establish an evidence-based treatment algorithm for MRCTs.
- Treatment is based on patient factors and associated pathology, and includes personal experience and data from case series.


Rehab-Massive RTC Tears

- The most consistent definition was a massive rotator cuff tear with active elevation less than 90°, but studies inconsistently included stiffness, external rotation loss, arthritic changes, neurologic status, and pain.
- There were 6 different techniques:
  1) nonoperative rehabilitation
  2) rotator cuff repair,
  3) muscle transfer
  4) hemiarthroplasty
  5) reverse total shoulder arthroplasty
  6) reverse total shoulder arthroplasty with muscle transfer

Postoperatively, all approaches showed improvement.

Pseudoparalysis of the shoulder has a variable definitions in the literature without consideration of degree or sub-stratification of other confounders such as the presence of arthritis or pain.

The literature supports treating this condition with any variety of treatments.

We propose an algorithm to serve as a treatment guideline to aid in surgical decision making for this condition.


The treatment modality specifically chosen for the massive, irreparable rotator cuff tear must be tailored to the individual patient, their needs and expectations, and their ability to comply with intensive rehabilitation!!!
*** Recurrent tears occur more frequently in the early postoperative period.

*** Survivorship analysis revealed 74% of all failures occurred atraumatically in the first 3 months

- 11% occurred between the 3rd and 6th month after repair
- Early failures are a prognostic factor for long-term outcomes.
- Efforts to improve healing during the initial 3 months have long-term implications for maintenance of cuff integrity and clinical outcomes.


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Rotator Cuff Rehabilitation

“The threshold of fixation strength needed for early motion and RTC healing is unknown.”


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Timeline for Healing & Strength of RTC Repairs ???

<table>
<thead>
<tr>
<th>Phases</th>
<th>I</th>
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<th>III</th>
<th>IV</th>
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<td>Protect Phase</td>
<td>Recovery skill</td>
<td>RTS</td>
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Best Guess!!!
Based on animal studies, Cadaveric studies and Biomechanical lab Studies
NO HUMAN DATA!!!

JP Warner, MD
Harvard
RTC Factors-Trends

- Sling immobilization for 6 weeks after arthroscopic RTC repair does not result in increased stiffness
- *** Slower rehab may improve the rate of tendon healing


RTC

*LEVEL OF EVIDENCE – 1*

"However, recent approaches show that longer immobilization may enhance tendon healing and quality"


Rotator Cuff Rehabilitation

- 6 RCTs-482 patients
- No significant differences in shoulder function with either protocol
- Early ROM group: 3.5° in flexion at 1 year PO
- Early ROM exercise tended to cause higher rate of recurrent tendon tears and the effect became statistically significant with larger tears

**Rotator Cuff Rehabilitation**

- 28 studies (1,729 repairs)
- Re-tears
- Early rehab: 13.7%; delayed: 10.5% (p=.36)
- For >5 cm tears, the risk of re-tear was greater for early versus delayed PROM for double-row anchor (DA) repairs (56.4% vs 20%, P = .002)


**Rotator Cuff Rehabilitation**

- For tears (>5 cm) the risk of structural tendon failure was higher in the early vs delayed group
- Early AROM was associated with increased risk of structural defect for small and large RTC tears, and thus, might not be advisable after RTC repair


**RTC Rehabilitation**

- The risk of re-tear is greatest for massive 3-tendon tears, which may require longer periods of protection
- Clinical relevance is the identification of patients at risk of re-tear and the adjustment of their rehabilitation strategy and time for return to activity

Elevated fear-avoidance beliefs were associated with poorer improvement in functional status from intake to discharge among people in the following 2 of the 8 shoulder disease categories:

1) muscle, tendon, & soft-tissue disorders
2) osteopathies, chondropathies, & acquires musculoskeletal deformities


139 patients with shoulder pain
Patients with high pain catastrophizing
And low pain self-efficacy were associated with worse scores on the SPADI
Psychosocial factors are associated with patient complaints in shoulder disorders

Biopsychosocial Reasons

- 169 patients with full-thickness RTC tears
- SF-36 mental component summary had the strongest association with shoulder pain and function and ASES and SST
- Psychosocial factors are associated with patient complaints in shoulder disorders


Rotator Cuff Research

- 433 subjects, 87 underwent surgery with 88% follow-up at 2 years
- The median age was 62 years, and 49% were female patients
- Multivariate modeling, identified patient expectations regarding physical therapy (P < .0001) as the strongest predictor of surgery
- Higher activity level (P = .011) and not smoking (P = .023) were also significant predictors of surgery


ASES-Rehabilitation-RTC

- Document represents the FIRST consensus rehabilitation statement developed by a multidisciplinary society of international rehabilitation professionals specifically for the postoperative care of patients with arthroscopic RTCR. (117 references)

**ASES-Rehabilitation-RTC**

**Purpose:** Aid clinical decision making during the rehabilitation of patients after arthroscopic RTC repair


**Overarching Philosophy of Rehabilitation:** Centered on the principle of the *gradual application of controlled stresses to the healing RTC repair* with consideration of RTC tear size, tissue quality, and patient variables


**Phase-to-phase progression is based on:**

1) Achievement of milestones
2) Criterion-Based
3) Impairment-based

In other words, the rehab program must consider all these variables. Therefore...

Rehab programs must be customized to the individual patient.

Rehab-Massive RTC Tears

To review the evidence for the effectiveness of therapeutic exercise for the treatment of full thickness (including massive and inoperable) tears of the rotator cuff.

There is consensus that the outcome of rotator cuff tendon surgery in the elderly is generally very poor.


In all studies an improvement in outcome scores was reported.

Findings suggest that some evidence exists to support the use of exercise in the management of full thickness rotator cuff tears.

A cohort study of 10 patients evaluating the change from baseline to twelve weeks in the shoulder function of patients undergoing a program of anterior deltoid strengthening and functional rehabilitation.

In spite of the long-standing nature of many of their shoulder problems, this rehabilitation program was shown to improve shoulder function in this group of patients.


The variation shown in the quality of life scores reflects the age group of this cohort who had a mean age of 75.5 years.

All patients deemed their pain and function to have improved over the three-month period.


Patients with massive rotator cuff tears who were treated with an anterior deltoid rehabilitation program.

We recommend that a structured deltoid rehabilitation program is suitable for elderly patients with massive rotator cuff tears.

Rehab-Massive RTC Tears

- Patients, completed a 3-month Anterior Deltoid Reeducation (ADR) program
- Eighteen of the 30 patients completed the program and had a follow-up at 24 months.
- Among these 18 cases, there were significant mean improvements between pre-ADR and follow-up outcome scores among all variables (P < .005).


Rehab-Massive RTC Tears

- The ADR program had a success rate of only 40%.
- A 3-month ADR program had limited success to treat irreparable RCTs.
- Results of this study could not reproduce the high rate of satisfactory results of 82% found in a previous study.


Rehab-Massive RTC Tears

Adaptive muscle activation strategies following a massive rotator cuff tear (MRCT) are inadequately understood, and the relationship among muscles during everyday activities has not been considered.

Rehab-Massive RTC Tears

In MRCT patients, a reorganization of muscle activation strategy along the upper limb kinetic chain is aimed at reducing demand on the glenohumeral joint.


Rehab-Massive RTC Tears

Increased activation of the latissimus dorsi and teres major muscles is an attempt to compensate for the deficient rotator cuff.

Re-education towards an alternate neuromuscular control strategy appears necessary to restore function.


Rehab-Massive RTC Tears

Controlled mobilization of augmented rotator cuff repairs during postoperative rehabilitation may provide mechanotransductive cues capable of guiding tissue regeneration and restoration of rotator cuff function.

STRATIFY THE PATIENT BASED ON THE SIZE OF THE TEAR

- Small tears (good tissue quality)
- Faster speed Rehab
- Medium - large tears (adequate tissue)
  Moderate speed rehab
- Large - massive tear (poor tissue, tenuous repair)
- Slow speed rehab ***

Top 8 List for Rehabilitation for Massive RTC Tears

1. Protect the RTC surgical repair
2. Facilitate early healing by mechanotransductive cues capable of guiding tissue regeneration and restoration of rotator cuff function
3. Gain full PROM as appropriate based on the surgery and patient variables
4. Prevent selective hypomobility of the surrounding tissues but protect the healing RTC surgical repair
5. Reestablish, if possible, the dynamic caudal glide and humeral head stability and control
6. Work on TAS, TBS
7. Do not overly stress the healing tissue
8. Work for restoration of specificity of function for the patient

Goals of Rehabilitation
A good day in the clinic!

Current Concepts in
Rehabilitation of Rotator Cuff
Pathology: Nonsurgical and
Postoperative Considerations
Ellenbecker, TS, Davies, GJ.
Orthopaedic Knowledge Update:
Sports Medicine 5, Chapter 23
© 2016 American Academy of
Orthopaedic Surgeons
Goals of Rehabilitation

1) Protect the RTC surgical repair

2) Facilitate early healing by mechanotransductive cues capable of guiding tissue regeneration and restoration of rotator cuff function.

3) Gain full PROM as appropriate based on the surgery and patient variables: 45°, 90, 0°
Some surgeons and scientists believe that a 6-week period of strict immobilization is preferred. However, there is no clear human evidence to support strict immobilization vs early protected ROM with limits of <90° of FE and <30° of ER within the first 6 weeks. Thigpen, CA, et. al. The American Society of Shoulder and Elbow Therapists' consensus statement on rehabilitation following Arthroscopic rotator cuff repair. JSES. 25:521-535, 2016.


Goals of Rehabilitation
1. Prevent selective hypomobility of the surrounding tissues but protect the healing RTC surgical repair.
Goals of Rehabilitation

5) Reestablish, if possible, the dynamic caudal glide and humeral head stability and control.
"Dynamic Caudal Glide"

Rotator Cuff Muscles (SS, IS, TM)
Perform As A Functional Dynamic Unit
Depressing the Humerus
Concomitantly With Shoulder
Abduction, flexion and scaption.

Inman Force Couple.
Inman, et al. JBJS 26: 1-30, 1944
The Effect of Neuromuscular Electrical Stimulation of the Infraspinatus on Shoulder External Rotation Force Production After Rotator Cuff Repair Surgery

ASES-Rehabilitation-RTC

- Deltoid Re-education Program using Biofeedback

Goals of Rehabilitation

- Work on TAS, TBS
**Goals of Rehabilitation**

7) Do not overly stress the healing tissue.

**Goals of Rehabilitation**

8) Work for restoration of specificity of function for the patient.

**Rehab-Massive RTC Tears**

Superior capsule reconstruction (SCR) is a recently-developed surgical technique for the treatment of massive, irreparable rotator cuff tears.

As this technique has only been recently developed, an evidence-based rehabilitation protocol has not been previously designed.
The existing evidence is supplemented by the experience of the senior author who has performed more than forty superior capsule reconstruction procedures to date.

Rehabilitation protocol consists of four distinct phases:
1) maximal protection
2) range of motion and muscular endurance
3) muscular strength
4) return to activity.

Slideboard-assisted scaption for deltoid activation.

Mounting evidence that eccentric exercise is not only a therapeutic intervention influencing muscle morphology, but also targets unique alterations to neuromuscular control because it is beneficial to peripheral and central neural activity:
- Alpha motorneuron recruitment/firing
- Sarcolemma activity
- Corticospinal excitability
- Brain activation

Seated, assisted forward elevation with external rotation resistance.

- Dynamic joint function is not completely restored by RTC repair, thus compromising shoulder function and leading to long-term disability.
- Strength deficits persisted at 24 months for most patients
- GHJ mechanics and shoulder strength are not fully restored with current RTC repair techniques


Rehabilitation-RTC

- 164 Patients
- Isometric strength in FF, IR, ER @ 6,12,18,24 months FU

To reach the strength of the uninjured contralateral shoulder in all 3 planes of motion, recovery took:

1) 6 months in patients with small tears
2) 18 months in patients with medium tears
3) Patients with large-to-massive tears showed continuous improvement in strength up to 18 months; however, they did not reach the strength of the contralateral shoulder at final follow-up

**Rehabilitation-RTC**

- This study recommends that regardless of pain relief and improved shoulder function, patients with larger than medium tears should be encouraged to continue with rehabilitation for the maximal restoration of muscle strength beyond 1 year postoperatively.


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**Summary And Conclusions**

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**Goals of Rehabilitation**

- 1) Protect the RTC surgical repair
- 2) Facilitate early healing by mechanotransductive cues capable of guiding tissue regeneration and restoration of rotator cuff function
- 3) Gain full PROM as appropriate based on the surgery and patient variables
- 4) Prevent selective hypomobility of the surrounding tissues but protect the healing RTC surgical repair
- 5) Reestablish, if possible, the dynamic caudal glide and humeral head stability and control
- 6) Work on TAS, TBS
- 7) Do not overly stress the healing tissue
- 8) Work for restoration of specificity of function for the patient
Congratulations and Thanks
To Rush for Chicago Sports
Medicine Symposium-2017