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Overview

- Prevalence
- History
- Pathogenesis
- Anatomy
- Examination
- Imaging
- Treatment
- Rehabilitation
There is a LOT that we do not know about rotator cuff tears, even in 2013!

Centuries of research on anatomy, biomechanics, modes of failure, and repair techniques

» Can be frustrating for both surgeons and patients alike, but also rewarding
Prevalence

- Prevalence of cuff tear quite high even in asymptomatic populations
  - Increasing prevalence with age
  - MRI in patients over 60 years 54%

- One of the most prevalent orthopedic conditions
- 400,000 surgeries a year in US

Sher et al. JBJS 1995
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History

• 1st described in 1834 by JG Smith
• 1st repair performed in 1909 by Codman
• 1st published results 1944 by McLaughlin
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Pathogenesis

- Originally thought to be due to “impingement”
  - Impingement coined 1972 by Charles Neer
- Compression of rotator cuff on CA arch:
  - Anterior edge acromion, CA ligament, AC joint
    - Chronic repetitive syndrome
    - Leads to degeneration of tendon
Newer understanding of pathogenesis suggests rotator cuff disease as *continuum*.

- Start with tendon strain
- Progress to inflammation and fibrosis
- Leads to tendon failure
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Pathogenesis

- Precise cause of degeneration unknown
- Other proposed causes include advanced age, elevated BMI, even high cholesterol
- Probable decreased vascularity and ischemia
• Smoking
  » Proposed to important risk factor
  » Nicotine is vasoconstrictor
  » Carbon monoxide decreases cellular oxygen
  » Leads to tendon degeneration

• Smoking correlates with tear presence and tear size

Baumgarten et al. CORR 2010
Carbone et al. JSES 2012
Controversy about interplay between intrinsic (cuff tissue) and extrinsic (impingement) factors in rotator cuff disease

Still not clear what is the primary cause

Without knowing the cause it is difficult to know the right solution!
• Subscapularis
  » Largest tendon
  » Anterior shoulder
  » Lesser tuberosity
  » Internal rotation
• **Supraspinatus**
  » Most commonly involved
  » Large 23 x 16 mm footprint
  » Greater tuberosity
  » Forward flexion
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Anatomy

- **Infraspinatus**
  - Second largest tendon, interdigitates with supraspinatus
  - External rotation
• Teres minor
  » Smallest muscle-tendon unit
  » External rotation of abducted arm
• Pain
  » Location
  » Duration
  » Factors that exacerbate
  » Factors that alleviate

• Weakness

• Traumatic versus insidious onset

• Prior treatment
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Examination

- Check cervical spine for referred pain
- Inspect for muscle atrophy
- ROM and strength testing
- My red flags for RCT are:
  - History of trauma
  - Crepitus with motion
  - RC weakness
• Special Tests
  » Neer and Hawkins for Impingement
  » Jobe (empty can, drop arm) for RCT
  » External rotation lag
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Imaging

- Standard radiographs
- Arthrogram
- Ultrasound
- MRI

» Best to assess early degeneration, partial tear, other pathology in shoulder
Partial Articular Tear

Small Full Thickness

Large Full Thickness
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Imaging

Normal Muscle Belly
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Treatment

• Controversy rotator cuff management
• Consensus statement from AAOS 2012
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Treatment

• Nonoperative Measures
  » Physical therapy
  » NSAIDs
  » Injection
Issue #1

» Should we attempt nonoperative treatment for acute tears?

*Acute Traumatic Rotator Cuff Tears and Surgery*

5. Early surgical repair after acute injury is an option for patients with a rotator cuff tear.

Strength of Recommendation: Weak

elderly patients and small tears
Should we attempt nonoperative treatment for chronic tears?

- Duration of symptoms
- Patient characteristics including expectations and activity level

Full Thickness Tears and Symptomatic Patients

2. Rotator cuff repair is an option for patients with chronic, symptomatic full thickness tears.

Strength of Recommendation: Weak
Issue #3

» Should we *inject* known rotator cuff tears?

- Not a black and white issue
- Each surgeon has preference
- Depends on many factors

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*Rotator Cuff Tears and Corticosteroid Injections*

3. b. We cannot recommend for or against subacromial injections for patients with rotator cuff tears.

Strength of Recommendation: Inconclusive
Issue #4

» Should we recommend PT or home exercise for full thickness rotator cuff tears?
  • In select patients yes
  • My opinion is that it may be effective in some

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Rotator Cuff Tears and Exercise

3. a. We cannot recommend for or against exercise programs (supervised or unsupervised) for patients with rotator cuff tears.

  Strength of Recommendation: Inconclusive
We know that tears have a high prevalence, but know relatively little about progression of tear size or tear symptoms.

Zingg et al. JBJS 2007

- Large rotator cuff tears
- Motion stayed the same but
  - ↑ arthritis, ↑ size tear, ↑ atrophy
- 50% of tears became surgically irreparable
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Natural History

Yamaguchi et al. JBJS 2006

• **39%** of tears even if non painful will progress

• Patients treated without surgery should be followed regularly

• Change in symptoms may indicate tear enlargement
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Natural History

Mall et al. JBJS 2010

• With development of pain, size of cuff tear increased significantly
  » 40% of partial tears had progressed to full

• Those who remained asymptomatic had no change in tear size
  » Rate of tear progression 23% in symptomatic group versus 4% in asymptomatic group
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Natural History

Safran et al. AJSM 2011

• Tear progression in symptomatic patients age 60 or less over 29 months
  » Tear progression more than 5 mm in 49%
  » No change tear size 43%

• Found correlation between ↑ in pain and increase in tear size at final ultrasound eval
Full Thickness Tears and Asymptomatic Patients

1. In the absence of reliable evidence, it is the opinion of the work group that surgery not be performed for asymptomatic, full thickness rotator cuff tears.

Strength of Recommendation: Consensus
Multiple ways to repair open and arthroscopic

More ways to fix something usually means we don’t have the answer…
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Surgical Management

OPEN versus Mini OPEN

- Outcomes at 3 months better in mini open
- Final follow up no difference

JBJS 2009
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Mini Open versus Arthroscopic

- Mini-open good record
  » Reports of stiffness
  » 85-93% satisfaction

- Arthroscopic repairs
  » Less stiffness
  » Functional results equal to open
  » 90% Satisfied
Arthroscopic Repair

- Started early 1990s
- Avoid open complications
- Diagnostic and therapeutic benefits
- Decreased pain
- Possible earlier rehab
Arthroscopic Repair

Tear Configuration
Arthroscopic Repair
Double Row Repair
Double Row Arthroscopic Rotator Cuff Repair
**Surgery – Arthroscopic, Open, Mini-Open**

10. c. We cannot recommend for or against a specific technique (arthroscopic, mini-open or open repair) when surgery is indicated for full thickness rotator cuff tears.

Strength of Recommendation: Inconclusive
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Rehabilitation

- Depends on tear size and surgeon preference
- New concern about failure of tendon healing
  - Galatz et al. JBJS 2004
  - 2 cm tears @12 months after arthroscopic repair
    - ROM started POD #1
    - 17 of 18 did not heal
    - Excellent pain relief and function
- Results deteriorate at 2 years
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Rehabilitation

Lee et al. Arthroscopy 2012

• Compared ROM and healing rates between 2 protocols after arthroscopic RCR

• **Group 1**
  » Early immediate rehab with unlimited PROM
  » Sling for 6 weeks then start AROM

• **Group 2**
  » Minimum PROM to prevent stiffness
  » Sling for 6 weeks then AROM
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Rehabilitation

Lee et al. Arthroscopy 2012

• Improved ROM @ 3 months In Group A
• No significant differences @ 1 year

• Repeat MRI showed re tears in:
  » 23.3% of cases in Group A
  » 8.8% of cases in Group B
  » Difference not significant ($p=0.1$)
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Return to Activity

• Very slow and all patient should be educated about this in advance
• Functional recovery **starts** 3 months
• Improvement over one year, then stabilization
• Negative predictors include
  » Female sex
  » Heavy upper body work
  » Poor bone quality
  » Lack of tendon healing
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Outcomes

• Clinical outcomes of large tears less satisfactory than small ones
• Re rupture rate high after large tears
  » But to confuse the issue even more…
• Structural failure does not necessarily define clinical failure
  » Functional results in patient with healed tear are usually superior to those without healed tear…but not always!
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Outcomes

Small supraspinatus tears repaired by arthroscopy: are clinical results influenced by the integrity of the cuff after two years? Functional and anatomic results of forty-six consecutive cases

- 46 small tears with mean f/u 35 months
- Good or excellent result 76.1%
- Satisfied or very satisfied in 91.3%
- Supraspinatus completely healed in 71.8%
Small supraspinatus tears repaired by arthroscopy: are clinical results influenced by the integrity of the cuff after two years? Functional and anatomic results of forty-six consecutive cases

- Retearing is relatively common
  - Has no effect on clinical result i.e. satisfaction, range of motion, strength and pain
  - Except patients who healed had better ability to perform activities of daily living
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Outcomes

Jost et al. JBJS 2006

• Measured outcomes mean 7.6 years after structurally failed rotator cuff repair
• Clinical outcomes remained significantly improved over the preoperative state
  » Including pain, function, strength, satisfaction

Harryman et al. JBJS 1991

• In spite of these results most would agree functional results better with healed tear
Factors associated with poor results?

- Smoking
- Diabetes
- Tear size
- Older age
- Obesity
- Workers compensation
- Cervical disease
- Medical comorbidities
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Consensus Guidelines

Confounding factors – Age, Atrophy/Fatty Degeneration and Worker’s Compensation Status

7. a. It is an option for physicians to advise patients that the following factors correlate with less favorable outcomes after rotator cuff surgery:

- Increasing Age
- MRI Tear Characteristics
- Worker’s Compensation Status

Strength of Recommendation:
- Increasing Age: Weak
- MRI Tear Characteristics: Weak
- Worker’s Compensation Status: Moderate
Previous focus of research has been on repair construct (suture material, type of repair)

Weakest link = understanding biology

Understand process of tendon degeneration in order to optimize healing

- Natural history
- Genetic predisposition
- Disease prevention
- Mechanism of failure
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Future Directions

- Continued research on biology of treatment
  - Biologics
  - Gene therapy
  - Tissue engineering
Case #1

• 40 YO male

• “I’m a dry waller, I was lifting a heavy bucket of mud at work and felt a sudden tearing sensation in my left shoulder…”
Case #1

• Inspection normal
• Active flexion to only 30°
• Crepitus with ROM
• + Drop Arm Test
• Rotator cuff strength 4/5
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Case #1

- MRI
- Large acute rotator cuff tear
- Surgical management
Case #2

- 58 YO female
- “My right shoulder has been sore from repetitive use at the deli counter”
- Pain with repetitive use, significant night pain when sleeping on the right
Case #2

- Inspection normal
- Good ROM
- No crepitus
- + Neer + Hawkins
- Negative empty can
- 5 of 5 rotator cuff strength
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Case #2

- No weakness
- Chronic onset of pain
- Therapy and injection
- If no improvement after 6 weeks consider MRI to rule out RCT
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Summary

• Treatment algorithm for RCT even in 2013 is constantly evolving
• Much we still do not know about rotator cuff tears and their treatment
• Can be frustrating to patient and providers
• Know your patient and their expectations
• Educate your patient about outcomes
• Can be rewarded with good results
THANK YOU

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