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Anatomy

- Rotator cuff (RTC) consists of four muscles originating on the scapula that insert on the tubercles of the proximal humerus.
- Blood supply from five arteries [2, 3]:
 - Anterior humeral circumflex a. Anterior cuff
 - Posterior humeral circumflex a. Posterior

that includes the capsule, superior glenohumeral ligament, and coracohumeral ligament.

Muscle	Origin	Insertion	Function	Innervation
Supraspinatus	Supraspinous fossa	Superior/middle facet of greater tubercle (GT)	Abduct humerus	Suprascapular nerve (C5)
Infraspinatus	Infraspinous fossa	Posterior facet GT	Externally rotate humerus	Suprascapular nerve (C5)
Teres minor	Lateral border of scapula	Inferior facet GT	Externally rotate humerus	Axillary nerve (C5)
Subscapularis	Subscapular fossa	Lesser tubercle	Internally rotate humerus	Upper and lower subscapular nerve (C5–6)

- The rotator cuff muscles form a common tendon that covers the superior, anterior, and posterior aspects of the humeral head [1].
- Insertion of tendon on tubercles referred to as “footprint.”
- “Rotator interval” = Region between tendinous junction of supraspinatus and subscapularis

- Suprascapular a. Superior and posterior cuff
- Thoracoacromial a. Supraspinatus
- Subscapular a.

Function

- RTC muscles provide stability to the glenohumeral joint by compressing the humeral head in the shallow glenoid fossa, resisting translation of the head during movement.

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- Cuff muscles activate individually to counter-balance each other and keep the humerus centered in the glenoid (i.e., subscapularis and infraspinatus). Also, anterior RTC balances the superior moment generated by the deltoid.
- In abduction, the subscapularis provides static stability to anterior translation, while the infraspinatus and teres minor limit posterior translation [4].
- Can also be due to shoulder instability (15%)
 - Acute SIT tears in patients >40 yo with a shoulder dislocation
- Trauma (10%)
 - Acute subscapularis tears seen in younger patients (hyperabduction/external rotation injury) [10].
 - Greater tuberosity fx is a RTC tear equivalent.

Epidemiology

- Rotator cuff disease is the most common shoulder disorder treated by orthopedic surgeons, with over 17 million people in the USA alone at risk for disabilities caused by the disease.
- Studies show surgically demonstrable full-thickness RTC tears present in about 20% of elderly patients; MRI studies show up to 40% prevalence [5].
- RTC show correlation with increasing age
 - 30% cuff tears in patients >40 years old and up to 80% prevalence in patients >60 years old [6]
- Asymptomatic tears are very common
 - Over 10% of full-thickness tears in population above 50yo are asymptomatic.
 - Limited healing potential in RTC leads to increase in tear size and progression of partial-thickness tears to full thickness [7].

Etiology

- Rotator cuff pathology is a continuum of disease typically beginning with subacromial or subcoracoid impingement (75%)
 - Internal impingement in overhead throwing athletes causes partial-thickness RTC tears [8]
 - Chronic degenerative tears in older patients involving SIT (supraspinatus, infraspinatus, teres minor)
 - Natural history is progression of tear in size and symptoms [7].
 - Genetic component; strong relationship between RTC tears and family history established [9]

Pathology

- Impingement syndromes cause calcification and tendon degeneration near the RTC insertion (calcific tendonitis):
 - Most often associated with the supraspinatus due to its location between the superior humeral head and acromion
 - Tears most common on articular side, not bursal side [11]
- Disease progression leads to chronic degenerative tears or acute avulsion injuries of the RTC.
- Can lead to rotator cuff arthropathy:
 - Shoulder arthritis in setting of RTC dysfunction
 - Combination of chronic massive RTC tear, glenohumeral cartilage destruction, subchondral osteoporosis, and humeral head collapse

Presentation

- Insidious onset of pain anterior/anterolateral shoulder pain, especially with overhead activities
- Limited active range of motion (especially elevation in scapular plane) and passive range of motion usually preserved
- Night pain = poor indicator for successful nonoperative treatment
- Instability of shoulder
 - Massive RCT can present with pseudoparalysis of shoulder (active forward flexion less than 90°, limited active abduction, passive ROM intact)

Exam

- Impingement tests
 - Neer impingement sign
 - Hawkins modification
 - Impingement test
 - Jobe's test
- Subscapularis (weakness to IR at 0° abduction)
 - Internal rotation lag sign
 - Lift-off test
 - Belly press
- Supraspinatus (weakness to elevation in scapular plane)
 - Jobe's test
 - Drop sign
- Infraspinatus (weakness to ER at 0° abduction)
 - External rotation lag sign
- Teres minor (weakness to ER at 90° abduction)
 - Hornblowers sign

Workup

- Radiographs
 - AP
 - Shoulder outlet view
- MRI
 - Gold standard.
 - Evaluate muscle quality, degree/shape/size of tear, and retraction.
 - Often see humeral head cysts in chronic RCT tear.
- Ultrasound
 - Inexpensive, allows for dynamic testing
 - Similar sensitivity/specificity to MRI but highly user dependent [12]

Classification

- RTC tear size
 - Small: 0–1 cm
 - Medium: 1–3 cm
 - Large: 3–5 cm
 - Massive: >5 cm, involving multiple tendons

- Tear shape
 - Crescent: Mobile, can be repaired to bone with minimal tension
 - U shape: Similar to crescent but with deeper medial extension of tear
 - L shape: Similar to U shape but with one leaf that is more mobile than the other

Treatment

- Nonoperative – 1st line for most tears. Partial tears have good outcomes with therapy, ranging from 45% to 82% satisfactory results in studies. 1^o tx for all asymptomatic tears.
 - Physical therapy – immobilization > passive movement > RTC and scapular stabilization strengthening
 - NSAIDS
 - Subacromial corticosteroid injections
- Surgical management
 - Arthroscopic repair
 - Single row suture anchor repair preferred in smaller tears
 - Double row repairs for larger tears with poor quality tissue.
 - No clinical advantage but may improve structural integrity [13]
 - Open repair
 - Less preferred due to deltoid detachment, larger incision, and higher complication rate
 - Tendon transfers
 - Pectoralis major – Reserved for massive RTC tears in young patients with anterior rotator cuff insufficiency
 - Latissimus dorsi – Patients with massive RTC, posterior rotator cuff insufficiency, and intact subscapularis
 - Reverse shoulder arthroplasty
 - RTC arthroplasty with intact deltoid
 - Massive RCT with shoulder ROM <90° abd/fflex
 - Patient age >70 years

Postoperative Course

- Initial immobilization in sling for 6 weeks
 - Early passive motion with strengthening at 1.5–3 months post-op.
 - Full return to activity at 4–5 months.
 - Large and massive tears have longer course of recovery.

Complications

- Axillary (posterior portal) and musculocutaneous (anterior) nerve injury
- Excessive swelling of tissues due to fluid extravasation from arthroscope fluid
- Postoperative stiffness (more common in open technique)
- Infection (rare in arthroscopic procedure)

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