



Complications of Distal Biceps Tendon Repair
How to Avoid !!



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FORE Upper Extremity Course 2017



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SPECIAL THANKS

- Christopher C. Schmidt, MD
- Andrew Malarkey , DO

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Overview

- Epidemiology
- Biceps Anatomy
- Mechanism of Injury
- Treatment Implications
- **Complications**

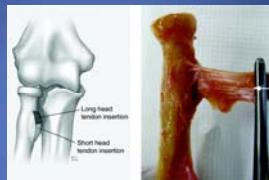


Epidemiology

- Rare Incidence
- Men 30 to 60 years of age
 - Dominant extremity
 - Some Bilaterality (Len Ruby)
 - Women age 70??
- Risk Factors
 - Anabolic steroid use
 - Hypovascularity of tendon
 - 7.5 X risk in smokers
 - Intrinsic degeneration
 - Mechanical impingement



Biceps Tendon Anatomy



- Radial tuberosity acts as a cam, increasing the biceps moment arm.

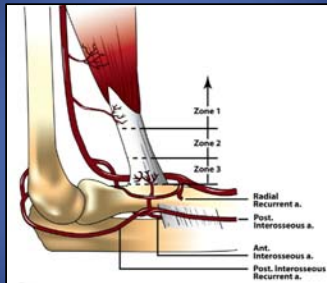


Mechanism of Injury

- Unexpected extension force to flexed elbow with a reactive eccentric contraction of biceps
- Underlying factors
 - Hypovascularity
 - Intrinsic degeneration
 - Mechanical impingement



Hypovascularity at Zone 2



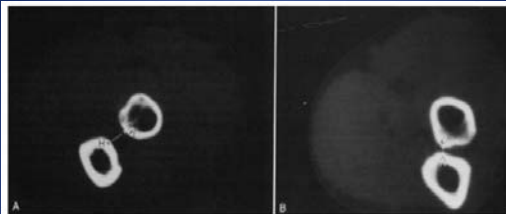


Fig. 2
Computed tomography scan demonstrating the decrease in radioulnar space at the level of the radial tuberosity as the forearm goes from full supination (A) to pronation (B). (Reprinted, with permission from Elsevier, from: Seiler JG 3rd, Parker LM, Chamberland PD, Sherbourne GM, Carpenter WA. The distal biceps tendon. Two potential mechanisms involved in its rupture: arterial supply and mechanical impingement. J Shoulder Elbow Surg. 1995;4:149-56.)



50% Decrease in Radial-Ulnar Space with Pronation





Nonoperative outcomes

- Complete tears
 - Loss of strength:
 - 40-50% supination
 - 20% flexion
 - 15% grip strength
 - Loss of endurance
- Partial tears
 - Chronic tendinosis- extended conservative care ~ 1 year
 - Partial traumatic tears
 - If an event , surgery!!



Distal Biceps Tendinosis: Evidence-Based Review

- Micah C. Hobbs, DO, Joe Koch, BS, H. Brent Bamberger, DO
- JHS 2009 Volume 34, Issue 6, Pages 1124–1126
- We believe that acute traumatic detachment can be partial. When a patient presents with **acute symptoms after an injury**, without pre-existing symptoms of elbow pain, and the MRI scan demonstrates partial detachment of the distal biceps tendon without substantial tendinosis, **we favor a treatment approach comparable with that for acute complete ruptures.**
- **FIX IT!**



Evolution of Operative Treatment

- Tenodesis
- Boyd and Anderson 1961 Two Incision
 - Radioulnar Synosis Concern
 - Muscle Split
- Single Incision
- Arthroscopic



Singe vs. Two-Incision Technique

- Point of controversy for quite some time
- Timeline
 - Boyd and Anderson developed 2 incision technique due to nerve injuries with one incision approach
 - Later modified by Failla with muscle splitting approach



Two Incision Bone Tunnel Repair

- Best visualization of tendon footprint
- Violates interosseus membrane
 - Increased risk of HO ???
 - Avoid violation of ulnar periosteum
- Reduced risk for nerve injury



Single Incision Fixation

- Suture Anchor
 - Interference Screw
 - Cortical Button
 - with/without interference screw
- Reported increase risk for LABC and PIN neuropraxia
- No violation of interosseus membrane





Anatomic vs. Non-Anatomic Repair

- Could be considered complication if taking into account weakness
- Relevant?
- **Possibly better supination strength**

Proper placement of the distal biceps tendon during repair improves supination strength—a biomechanical analysis

Max Profhuma-Pastor, MD, FRCS^{*}; Nikita Louiri, BSc; J. Whitcomb-Pallock, MD, MS, FRCS; Steven Papp, MD, MS, FRCS

Conclusion

This study supports the idea that an anatomic repair of the biceps tendon onto the lateral side of the radial tuberosity is important. In this position, the biceps can generate supination torque similar to that of an intact muscle throughout a full range of motion. If the biceps is repaired too distally, the biceps will not be able to generate full supination torque from neutral to full supination.

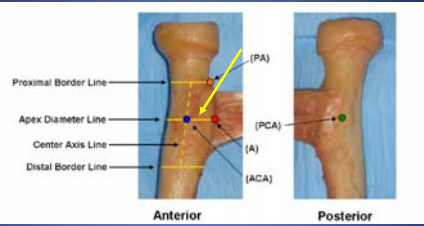
The effect of biceps reattachment site

Christopher C. Schmidt, MD^{1,2,3,4}, David M. Weir, MS⁵, Andrew S. Wong, MD¹, Michael Howard, MD¹, Mark Carl Miller, PhD⁵



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⁵Thomas School of Engineering, University of Pittsburgh, Pittsburgh, PA, USA

- Cadaveric biomechanical study
- Comparison of moment arm and range of motion in pronation/supination.
- Reattachment in Anterior/Central position
 - Reduced supination ROM
 - Reduced torque at 60 deg supination
 - Relative to native insertion/anatomic repair

Operative Treatment



- A= anatomic
- ACA= anterior/central

Anatomic vs. Non-Anatomic Repair



- Make sure to maximally supinate
- Or....

J Bone Joint Surg (2015) 97, 809-811

Single incision power optimizing cost-effective (SPOC) distal biceps repair

Cary Tanner, MD^{1*}, Toby Johnson, MD², Pavel Muradov, MD³, Lisa Husak, MPH³

*Santa Pacific Orthopedic Center Fresno, CA, USA
²Department of Orthopaedic Surgery, University of California San Francisco Fresno, Fresno, CA, USA

SCIENTIFIC ARTICLE

Complications Following Distal Biceps Repair

Richard A. Cain, MD, Jason A. Nydick, DO, Matthew I. Serin, MD, Bailey D. Williams, BS,
John A. Polikandriotis, PhD, Alfred V. Hess, MD




- JHS 2012
- Reviewed 198 patients
- 72 (36%) complications
- > complications with repair >28 days from injury
 - Minor:
 - LABC paresthesia 26%
 - Radial sensory paresthesia 6%
 - Superficial infection 2%
 - Major:
 - PIN injury 4%
 - Symptomatic HO 3%
 - Re-rupture 2%
- 6 additional surgeries




Complications



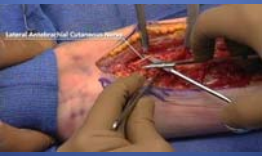
- 10-40% of time complications occur
 - Nerve Injury
 - Palsies
 - Neurapraxias
 - Heterotopic Ossification
 - Synostosis
 - Rerupture
 - Timing
 - Vascular

6% of Time Require Reoperation







Nerve Injuries

- Lateral Antebrachial Cutaneous
 - Encountered regardless approach but more common with anterior/single incision
 - 20 to 25% Cases
 - Painful neuroma or paresthesias
 - Increased Complications if greater than 3 weeks
 - Kelly, JBJS 2000



Nerve Injuries

- Posterior Interosseous Nerve
 - Wraps around proximal radius 1.0-1.5 cm distal to midpoint of tuberosity
 - 5% of Cases, Most Neurapraxia
 - Supination Moves Nerve from Field
 - Drilling in ulnar direction preferred





SCIENTIFIC ARTICLE

Proximity of the Posterior Interosseous Nerve During Cortical Button Guidewire Placement for Distal Biceps Tendon Reattachment

Nicola Thunn, MD, Douglas Hutchinson, MD, Chong Zhang, MS, Sebastian Drago, MD, Andrew R. Tysse, MD

- 30 degree ulnar drilling technique resulted in greater distance from PIN
- Confirmed with other studies
 - Saluda et al Arthroscopy 2008
 - Lo et al Arthroscopy 2011



Drilling Distal/Radial = **BAD**



An Assessment of Nerve Proximity During Distal Biceps Brachii Tendon Reattachment: A Cadaveric Study



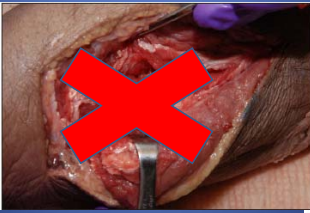
Matthew Daggett, DO/MBA, Taylor Brown, MS, Barth Wright, PhD, Anthony Olinger, PhD, Ganesh Thiagarajan, PhD, James Harris, MS, Timothy Roberts, DO

Guide wire angled 45 deg vs previous studies of 30 deg



Posterior Interosseous Nerve Incarceration With Endobutton Repair of Distal Biceps

JAMES VAN DEN BOGAERDE, MD; EDWARD SHIN, MD



Journal of Shoulder and Elbow Surgery
 ELBOW
Prognosis for recovery of posterior interosseous nerve palsy after distal biceps repair
 Phillip T. Nigro, MD*, Richard Cain, MD*, Mark A. Highell, MD**
*Florida Orthopaedic Institute, Tampa, FL, USA
 **University of South Florida College of Medicine, Tampa, FL, USA



- 9 of 280 patients with PIN Palsy (3.2%)
- Average Time to Resolution 86 days (Range 41-145 days)



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NERVE INJURIES

- Superficial Branch of Radial Nerve
 - 5%
 - Neurapraxia
 - Typically due to excessive lateral retraction

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Superficial Radial Nerve




Fig. 2. Anterior approach to left arm. (A) Superficial branch of the radial nerve and the vascular leash of Henry can be seen. (B) Leading proximal edge of supinator can be seen. (C) PIN (not seen) is protected by a Hohmann retractor.

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Heterotopic Ossification

- Distal biceps repairs are predisposed to this condition
- Asymptomatic HO reported in 10-25% cases
- *May result in radioulnar synostosis*

Clinically Relevant

Radioulnar Heterotopic Ossification After Distal Biceps Tendon Repair: Results Following Surgical Resection



Robert W. Wysocki, MD, Mark S. Cohen, MD

Extensive Heterotopic Ossification After Suspensory Cortical Fixation of Acute Distal Biceps Tendon Ruptures

Armando F. Villa, MD, Ryan C. Korman, MD, Michelle Wolcott, MD, and Joel B. Greenstein, MD

Bilateral Distal Biceps Ruptures with Heterotopic Ossification Following the Endobutton Repair

Andy R. Malarkey, DO; H. Brent Bamberger, DO
Grandview Hospital & Medical Center Orthopedic Surgery Residency, Dayton OH

Heterotopic Ossification

- Prevention Strategies?
- Approach?
 - Kelly et al JBJS 2000
 - Sotereanos et al. JSES 2004


Increased with 2 Incisions



Bottom Line: Rates of Radioulnar Synostosis are rare and can occur in both types of Repair Keener et al JSES 2011

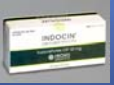





The use of indomethacin in the prevention of postoperative radioulnar synostosis after distal biceps repair



Callista L. Costopoulos, DO¹, Joseph A. Abboud, MD¹, Matthew L. Ramsey, MD¹, Charles L. Getz, MD¹, Daniel S. Sholder, BS¹, John P. Taras, BS¹, Daniel Huttman, MD¹, Mark D. Lazarus, MD¹

- 104 patients received medication with synostosis rate 0.96%
- 8 patients did not receive medication with synostosis rate of 37%
- Underpowered, Retrospective but...may be of benefit








Heterotopic Ossification

- Tips and Tricks For Prevention
 - Hemostasis
 - Clearing of Bone Debris
 - NSAIDs



Any approach may cause HO, the issue becomes radioulnar synostosis

May need to reattach tendon if bone excised



Rerupture



- Rare occurrence, 1.2%-4.4%
- Typically occurs within 3 weeks
- Chronic Repairs >60 degrees of flexion at musculotendinous junction
- Does technique matter?
 - Bottom Line: Avoidance of Eccentric Load in Early Post-op Period



Biomechanical Evaluation of 4 Techniques of Distal Biceps Brachii Tendon Repair

Augustus D. Mazzocca,* MD, Kevin J. Burton,* MD, Anthony A. Romeo,* MD, Stephen Santangeli,† Douglas A. Adams,† PhD, and Robert A. Arciero,† MD
From the *Department of Orthopaedic Surgery, University of Connecticut Health Center, Farmington, Connecticut, †Orthopaedic Associates of Hartford, Hartford, Connecticut, and the †Department of Orthopaedic Surgery, Rush Medical College, Rush Presbyterian-St. Luke's Medical Center, Chicago, Illinois

- Cadaveric study
- Comparison of load to failure
 - Bone tunnel (310N)
 - Suture anchor (381N)
 - Interference screw (232N)
 - Cortical button (440N)
- Clinical outcomes show no difference



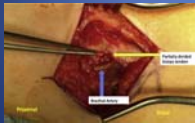
RERUPTURE

- Revision
 - Increased Infection
 - HO
 - Repair Failure
 - NV Injury



Vascular Injuries

- More likely in chronic injuries
- Radial recurrent vessels
- Case Reports of Brachial Artery Injury



STIFFNESS

- 4% of time
- Limit post-operative mobilization to no more than 3 weeks
- Rotation concerns tend to be more common
- Does fixing in extreme flexion lead to increased stiffness?



THANK YOU

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