18th ESSKA Congress
9 – 12 May 2018
Glasgow, UK

ESSKA

Anterior Cable Tears:
Diagnosing an Essential Lesion in Rotator Cuff Tears

P. Roache, San Francisco, CA, USA, California Pacific Medical Center

INTRODUCTION

The importance of the **superior capsule** in **normal shoulder kinematics** and rotator cuff function has been recently highlighted with the success of superior capsular reconstruction (SCR).
The **Rotator Cuff Cable** is the lateral insertion of the **superior capsule** and has been documented to be **essential for both function of the rotator cuff and overall shoulder kinematics.**
The **Rotator Cable Anterior Attachment** has been recently studied**.**
The anterior attachment of the cable behind the biceps is now known to be larger than the tendon in the anterior footprint.
Anterior Cable Tears (ACT) are biomechanically important resulting in **abnormal glenohumeral kinematics**. The clinical relevance of repairing tears in the Anterior Cable has been reported in cadaver study. The Cable is an essential biomechanical structure in the capsular cylinder and compliments the rotator cuff tendons.
Despite the established importance of the Rotator Cable, it's not specifically identified, discussed, or addressed as part of ARCR in the current state of the art. Most often it is simply referred to in non-specific language as the "deep layer" or "lamina" of the rotator cuff tendons.

AIM

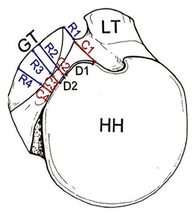
The purpose of this study was to evaluate the surgical diagnostic details of injury to the anterior attachment in Anterior Cable Tears (ACT) observed in patients undergoing ARCR.

METHOD

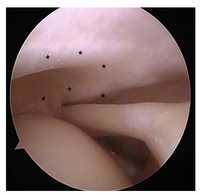
90 consecutive primary shoulder arthroscopies prospectively collected and evaluated for Anterior Cable Tears (ACT). The Data was reviewed retrospectively :

- **ACT** were evaluated for corresponding **injury to the anterior cable attachment**
- Injury to the cable attachment was assessed using the **tendon and capsular zones as described by Nimura et. al JSES 2012**
- Changes in Cable position , Shape and associated injuries were assessed

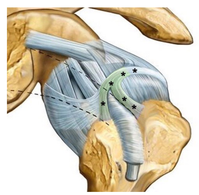
Data divided into 2 groups:
Group 1 underwent a primary ARCR Procedure (n=42)
Group 2 underwent a primary Non-ARCR procedure (n=48)



Nimura zones:
capsular zones noted as **C,**
tendon zones noted as **R**
Reprinted with permission:
Nimura A, et.al JSES,2012,21,867-872



Arthroscopic Normal anterior cable marked with *



Anterior Cable as it attaches anteriorly marked with *

Statistical Analysis performed using SPSS Version 22 (IBM corp,2013)

RESULTS

ARCR group(n=42) vs **Non-ARCR group (n=48)**

- **71%** with **Abnormal** Cable position.
- **93%** with injury to Nimura Capsular zone **C1**
- **76%** with injury to Nimura Tendon zone **R1**

- **2.1%** with **Abnormal** Cable position.
- **25 %** with injury to Nimura Capsular zone **C1**
- **0 %** with injury to Nimura Tendon zone **R1**

ARCR group

Abnormal Cable Position (n=30) vs ***normal*** Cable Position (n=12)

- **100%** of ARCR shoulders with abnormal anterior cable position had injury to **C1** . *The majority were high grade or complete tears*
- **97%** of ARCR shoulders with abnormal anterior cable position had injury to **R1**

- **75%** of ARCR shoulders with normal anterior cable position had injury to **C1**. *The Majority were low grade tears and no complete tears*
- **25%** of ARCR shoulders with normal anterior cable position had injury to **R1**

ARCR group
Abnormal Cable position

Moderate displacement (n=20) vs ***Severe*** displacement (n=10)

- **100%** with injury to **C1** . *85%* were high grade or complete injuries
- **95%** with complete or partial injury to **R1**
- **15%** with injury anterior to C1 and R1 in the **Lateral Rotator interval** (**LRI**). *0% with complete injury*

- **100%** with injury to **C1** . *100% were* complete injuries
- **100%** with complete injury to **R1**
- **100%** with injury anterior to C1 and R1 in the **Lateral Rotator interval** (**LRI**). *30% with complete injury*

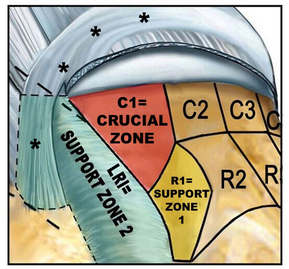
3 anatomic zones of the cable anterior attachment defined by results

C1 zone: The crucial zone for maintaining cable position and full function.
R1 zone: A primary support zone lateral to C1. It provides reinforcement to C1 for maintaining cable position. Represents the Supraspinatus Central tendon insertion.
Lateral Rotator Interval (LRI): A secondary support zone anterior to C1.It includes the structures of the lateral rotator interval and they act as a secondary reinforcement anterior to the C1 and R1 zones for maintaining cable position

DISCUSSION

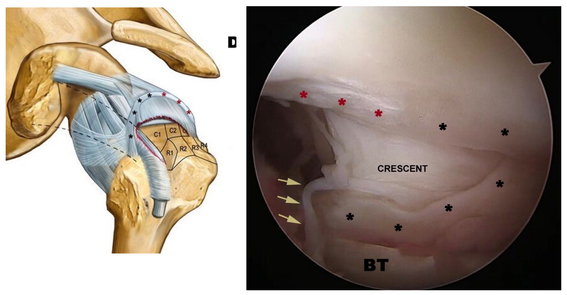
The Crucial Zone (C1) and the 2 support zones (R1 & LRI) create a ***Cable Anterior Foundation(CAF)*** for maintaining or preserving Anterior Cable Function.
The ***Cable Anterior Foundation (CAF)*** provides a ***coupling (Couplage)*** for the **force transmission** from the cable and superior capsule to the anterior superior corner of the proximal humerus. The ***CAF*** provides a ***Couplage*** of the **horizontal force couple** of the anterior and posterior Rotator cuff.

Rotator Cable Anterior Attachment

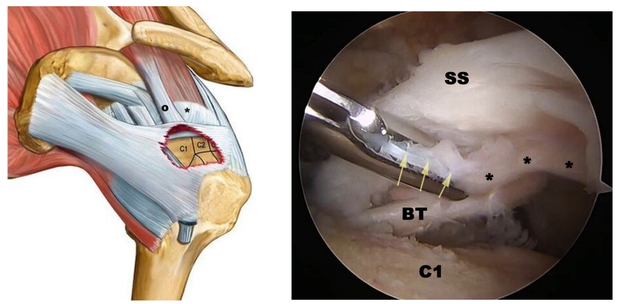


The 3 Zones of the "Cable's Anterior Foundation (CAF)" or "Couplage"

ACT with medialization of cable(yellow arrows), Anterior cable marked *, Posterior cable marked *: note the "U" shape from the arthroscopic view



ACT is deep to the **SS** tendon edge (yellow arrows), anterior cable marked *, note the exposed Crucial zone at C1 directly behind the Biceps tendon (**BT**)



CONCLUSIONS

- **Anterior Cable Tears (ACT)** with cable disruption have **predictable pattern of injury** to the Cable's Anterior Attachment **3 zones of the Cable's Anterior Foundation disrupting** the functions of the **Couplage.**
- This disruption and the **pattern of injury** can be **specifically diagnosed** at the time of **surgery.**
- Establishes a **diagnostic criteria** and is an **important first step in determining effective treatments for repair of the cable or Recouplage.**
- **ACTs are the rotator cuff equivalent of a Bankart lesion.**

REFERENCES

Mihata T, Lee TQ, Watanabe C, Fukunishi K, Ohue M, Tsujimura T, Kinoshita M, et al. *"Original Article with Video Illustration."* Clinical results of arthroscopic superior capsule reconstruction for irreparable rotator cuff tear. *Arthroscopy: J Arthroscopic and Related Surg.,* 2013; 29(3), 459-470.

Mihata T, McGarry MH, Pirolo JM, Kinoshita M, Lee LQ. Superior capsule reconstruction to restore superior stability in irreparable rotator cuff Tears: A Biomechanical Cadaveric Study. *Am J Sports Med.,* 2012; 2240-2248.

Mesiha MM, Derwin KA, Sibole SC, Erdemir A, McCarron JA. The biomechanical relevance of anterior rotator cuff cable tears in a cadaveric shoulder model. *J Bone and Joint Surg. Am,* 2013; 95, 1817-1824.

Pinkowsky G, ElAttrache N, Peterson A, Akeda M, McGarry M, Lee T. Partial-thickness tears involving the rotator cable lead to abnormal glenohumeral kinematics. *J Shoulder Elbow Surg.,* 2017; 26(7), 1152-1158.

Nguyen ML, Quigley RJ, Galle SE, McGarry MH, Jun BJ, Gupta R, Burkhart SS, Lee TQ, et al. Margin convergence anchorage to bone for reconstruction of the anterior attachment of the rotator cable. *Arthroscopy: J Arthroscopic and Related Surg.,* 2012; 28(9), 1237-124

Burkhart SS, Esch JC, Jolson SR. The rotator crescent and rotator cable: An Anatomic Description of the Shoulder's "Suspension Bridge." *J Arthroscopic and Related Surg.,* 1993; 9(6), 611-616.

Nimura K, Kato A, Yamaguch K, Mochizuki T, Atsushi Okawa A, Sugaya H, Keiichi Akita K. The superior capsule of the shoulder joint complements the insertion of the rotator cuff. *J Shoulder Elbow Surg.,* 2012; 21, 867-872.

Adams CR, DeMartino AM, Rego G, Denard PJ, Burkart SS. The rotator cuff and the superior capsule: Why we need both. *Arthroscopy: J Arthroscopic and Related Surg.,* 2016; 32(12), 2628-2637.

Ishihara Y, Mihata T, Tambolia M, Nguyena L, Park KJ, McGarry MH, Takai S, Lee TQ, et al. Role of the superior shoulder capsule in passive stability of glenohumeral joint. *J Shoulder and Elbow Surg.,* 2014; 23, 642-648.

ACKNOWLEDGEMENTS

Statistical analysis : Jeanie McGee, Phd

Iillustrations: Denise Thompson

CONTACT INFORMATION

Paul B. Roache, MD (PBR@RoacheMD.com)
45 Castro Street, Ste. 337
San Francisco, CA 94123 USA