

**Slide 1** Ladies and Gentlemen, Dear Colloquies,

**Firstly** I would like to thank the organizing committee for inviting me for this talk.

**Slide 2** In my talk, Acromioclavicular joint injuries, I will discuss the pure dislocations without fractures. During my talk, I will try to remind you about the surgical anatomy, the function, and the Classification of ACJ dislocations.

**Then** I will discuss the decision making process for treatment, regarding the literature . In other words, What evidence based is ,

and **finally** I will briefly mention some common used operations today.

I will not go through the complications, since there is another lecture on this topic.

**Slide 3** These injuries are quite common, and present the 12%-15% of all shoulder injuries

**Historically** the first reports of ACJ separation come from **Hippocrates (460-377 B.C.)**. **Galen** (129-199 A.D.) treated himself with a tight bandage after having an ACJ- dislocation, but he abandoned the treatment because it was uncomfortable.

**Slide 4** Surgical anatomy:

The articular surfaces are covered with hyaline cartilage up to the age of 20 years, and then become fibrocartilage. In between there is an fibrocartilaginous disk.

The shape and the inclination of the articular surfaces also show variations, so there is variability in congruity of the joint. In most of them, approximately 50%, the distal end of the clavicle overrides the acromion and in some underrides.

### **Slide 5** Stability of the ACJ:

The stability of the joint is based on static and dynamic stabilizers.

**Static Stabilizers** are:

1. The **Acromioclavicular ligaments complex**, which consists of the superior, inferior, anterior and posterior ligaments surrounding the joint. This Lig Complex offer stability in horizontal level, in other words check the anteroposterior mobility
2. The **Coracoclavicular Ligament**, is a very strong lig and consist of the **Conoid** Ligament, lying medially, and the **trapezoid** ligament lying laterally. The CC-Lig offer stability in vertical level, i.e. check the superoinferior mobility of the joint. The normal coracoclavicular space is 1.1- 1.3 cm.

**Slide 6** Dynic stabilizers are the deltoid and the Trapezius muscles.

### **Slide 7** Function:

The ACJ is the only connection of the upper extremity with the axial skeleton. So the ACJ helps to couple the glenohumeral abduction and flexion with the scapular rotation, so that the **synchronous glenohumeral and scapulothoracic motion** can take place. Only through this complex motion is the full abduction and overhead elevation of the arm possible.

The CC-Lig is the prime suspensory Lig of the upper extremity. That's why when there is an ACJ- dislocation the arm drops down and the distal clavicle appears elevated.

### **Slide 8** The range of motion,

**Inman and colleagues** in 1944 suggested that the total range of motion in the ACJ is 20 degrees. They also demonstrated that with full elevation of the arm,

the clavicle rotates upwards 40- 50 degrees. So they opposed the use of coracoclavicular screw or fusion of ACJ.

**On the other hand, Codman and Rockwood** later theorized that the range of motion at the ACJ is approximately only 5 degrees. They based on the observation that patients with developed bony bar between coracoid and clavicle, or with coracoclavicular screw, are able to almost full elevate the arm. So they concluded that main motion takes place in scapular level.

So the ROM in ACJ is still in debate.

**Slide 9** **The Mechanism of injury** is direct force on acromion from superior to inferior, usually after falling on the shoulder with the arm at the side of the body.

**Slide 10** **Classification of ACJ Dislocations:**

The most common classification is the Rockwood classification

- 1. Type I:** Simple Sprain of AC -Ligs , No elevation of clavicle.
  - 2. Type II:** Tear of the AC Ligs but intact CC-Lig,
  - 3. Type III:** Tear of AC and CC- Ligs. The Clavicle appears elevated.
  - 4. Type IV:** All the Lig are disrupted and the clavicle is dislocated posteriorly through the trapezius muscle. Beware that in this case the AP -X-ray may show normal CC-space.
- Sparse reports of bipolar clavicular dislocation (i.e. Dislocation in ACJ and in Sternoclavicular Joint)
- 5. Type V:** in this type the distal end of the clavicle is gross elevated ( the CC-space may appears greater than 100%-300 % of the normal space). The muscles are also grossly detached.
  - 6. Type VI:** The clavicle is displaced inferior in the subacromial or supcoracoid space.

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**Beware of in Type III** the elevation of clavicle as up to 50%-100% in the affected side compare to the normal side. The Deltoid and Trapezius muscles are detached from the distal end of the clavicle.

**Uncommon** association of fracture of the clavicle with ACJ separation.

**Extremely uncommon** additional fracture of coracoid.

**Slide 12, Beware of in Type IV** The clavicle is posterior dislocated through the trapezius muscle . The AP- X-RAY may show normal CC-space. And there are sparse reports of bipolar dislocation ( i.e. In ACJ and sternoclavicular joint)

**Slide 13 Beware of in type V**, The clavicle is grossly elevated, more than 100-300 % compare to normal side, and the muscles are grossly detached.

### Slide 14 X-RAYS Evaluation:

**For better results and for the possibility of comparison**, it is better to take an AP X-ray of both shoulders on the same image.

**Zanka View** is better, so avoiding the\_ superimposition of distal clavicle and acromion

**Slide 15** Usually the **stress view with weighs** is necessary to unmask any effort of the patient to hold the shoulder in the right position.

**Further X- Ray views**, like axillary lateral view, or Stryker view should be done if there is suspicion posterior dislocation of the clavicle of Coracoid Fracture.

**Slide 16** **Where is actually the deformity?** Since the CC-Lig is the main suspensory Lig of the arm , when it is disrupted, the arm drops down and the clavicle looks to be elevated. Of course there may be a little upwards force from the trapezius muscle , but the main deformity occurs because of the drop of the arm.

### **Slide 17** Should an MRI investigation be done ??

The answer is yes, because with the MRI , we can direct asses of the torn ligs , and in addition we can assess the glenohumeral joint for concomitant lesions, which appear up to 25 % of the cases. **Most of them are SLAP Lesions**, which also necessitate treatment, and **possibly play a role in decision** making for the treatment.

### **Slide 18** Treatment:

**There is no doubt** that the treatment of type I and type II injuries is conservative. **In the past**, more strict measures have been used.

Today the tendency is to use a sling for 10 day to 2 weeks for comfort and then progressive mobilization as tolerated. Heavy lifting or contact sports should be avoided for 10-12 weeks.

**Slide 19** Type IV, V, IV , **no doubt** that the treatment is surgical. More than 150 procedures have been used, which means that none of them is the **"ideal"** for all cases.

**Slide 20** The treatment of Type III is controversial . There is no consensus regarding treatment of type III injury.

**While searching** in the literature, I found two recent representative publications, one from JBJS published in this year and the other from Arthroscopy Journal published last year.

The second publication is from Arthroscopy Journal published in February 2013

**Slide 21, Slide 22, Slide 23, Slide 24, Slide 25, Slide 26**

**Slide 27** **From historical point of view**, The most important facts are:

In 1941 **Bosworth** described his technique of placing a screw between the clavicle and the coracoid.

In 1972 Weaver and Dunn described their procedure consisting of excision of the distal end of the clavicle and stabilizing the clavicle by inserting the acromioclavicular Lig in the medullary cavity of the clavicle.

**Slide 28:** These are some examples of methods, which are not generally used any more. (Cerclage wires, K-Wires, Hook Plate, Bosworth screw .

### **Slide 29, Slide 30**

Nowadays, five key elements remain essential to successful surgical management.

1. Anatomic and accurate reduction of ACJ ( correction of superior displacement and correction in anteroposterior direction)
2. Direct or indirect repair ( by closing the CC-gap) in acute stage, and reconstruction ( by using graft) of CC-Lig in chronic stage
3. Protection of the CC-Lig repair or reconstruction with synthetic material or rigid implant, to maintain ACJ stability in the early stage.
4. Repair of the Deltoid and Trapezius fascia in High Type of injuries and
5. Arthroscopy of glenohumeral joint may be indicated even in open procedures
6. Distal clavicle resection only in patient with chronic dislocation and clinical evidence of osteoarthritis

**Slide 31** Many procedures have been described either open ,or arthroscopic, or arthroscopic assisted. All have advantages and disadvantages.

**Slide 32** Among the most popular arthroscopic techniques, is the use of Tight Rope developed by ARTHREX. This Technique uses two buttons and a continues loop of fiber wire # 5. This necessitate a bony tunnel from the clavicle to coracoid of 4 mm diameter.

Of course a Twin Tight rope device can be used to repair both deltoid and conoid lig. This matches to CC-Lig anatomy

**Slide 33** The newest device called the "Dog bone" also developed by Arthex , consisted of two loops of Fiber Tape and two buttons. The advantage of this device is, that the needed bony tunnel from clavicle to coracoid, is only 3 mm diameter. This is because the " Dog Bone " implant doesn't need to pass through the bony tunnel.

**Slide 34** Another device is the Twin Tail TightRope. It is an attractive technique , open one, which necessitate a coracoid tunnel of 4,5mm and two clavicular tunnels of 4,0 mm diameter.

**Slide 35** In a delayed or chronic stage, the CC-Lig must be reconstructed ,so the use of a graft, usually autograft of Gracilis or Semitendinosus is needed. A number of procedures have been published passing the tendon graft either through, or around the coracoid. All these methods use additional protection for the graft .

**Slide 36** The Graft Rope is one of these techniques; It's an arthroscopic one, and incorporates the graft in the implant. The implant is similar to Tightrope. The disadvantage of this Implant is the large diameter of the needed bony canal, which is 6mm. (brave surgery). That's why it is not widely used any more.

**Slide 37** On this slide we can compare the strength of some devises to the native CC-Lig regarding the load to failure.

**Slide38** For arthroscopic procedure , there are some basic steps.

The Arthroscopic Procedure consists of some basic steps:

- 1. Diagnostic Arthroscopy of glenohumeral joint
- 2. Opening of a window in rotator interval
- 3. Preparation of coracoid
- 4. Mini skin incision on the top of the clavicle
- 5. Insertion of K- wire from clavicle to coracoid
- 6. Over drilling over K-wire for tunnel
- 7. Insertion of nitinol wire

- 8. Passing the TightRope, flipping the button, reduction of ACJ and tie the knots

### Slide 39

In this Video, I would like to demonstrate all these steps.

### Slide 40

These are the X-Rays of the patient of the video.

The mean length, width, and thickness of the coracoid were 16.8 mm (SD, 2.5 mm), 15.0 mm (SD, 2.2 mm), and 10.5 mm (SD, 1.7 mm), respectively. ( [Arthroscopy](#). 2011 Nov;27(11):1485-9

We can generally divide all these operations in four types: ( At least for historical point of view)

1. Primary ACJ- Repair: Pins, or screws, or K- wires with cerclage have been used in an attempt to repair the disrupted ACJ.
2. Primary CC-Lig fixation: Screws , Wires, Fascia , synthetic material and other devises used to fix the clavicle to coracoid, with or without lig repair
3. Excision of the distal end of the clavicle, has also been used, but it is meaningless to be performed in acute stage and especially in types II and above injuries.
4. Dynamic Muscle transfers , I.E. transfer of the coracoid with the Coracobrachialis and short head of Biceps tendon to the Clavicle. Not used any more.