Distal Clavicle and Acromioclavicular Problems

단국대학교 의과대학 정형외과학교실

서 중 배

Anatomy of the acromioclavicular joint[16,17]

- Diarthrodial joint
- Surrounded by a joint capsule with synovial lining
- Coated with hyaline cartilage
- Meniscal homologue which has tremendous variation in size and shape
- Its actual function in the joint is negligible

· **The static stabilizer**

Acromioclavicular (capsular) ligaments: Primary restraint to AP translation
Superior and posterior portions are thicker than inferior and anterior.

Coracoclavicular ligaments: Vertical stability
Trapezoid and conoid ligaments
The trapezoid ligament insertionends approximately 16mm from the AC joint line.
The mean lengths of the ligaments from coracoid to clavicle were 19.3 and 19.4 mm for the trapezoid and conoid respectively.
* Two major function
(1) They mediate synchronous scapulaohumeral motion by attaching the clavicle to the scapula.
(2) They strengthen the AC articulation.

Coracoacromial ligament

· **Dynamic stabilizer**

Deltoid and trapezius muscles
Deltotrapezial fascia is interdigitate with superior AC ligament.
These muscles add stability to the joint when they contract or stretch.

Biomechanics[12]

Acromioclavicular joint motion

5~8 degrees motion with forward elevation and 180 degrees abduction
The clavicle rotates between 40 and 50 degrees during full overhead elevation.

(Synchronous scapula clavicular rotation)
This is coordinated by the coracoclavicular ligaments.

Acromioclavicular capsular ligaments

The superior and posterior capsular ligaments contribute 56% and 25%, respectively, of the force required to produce posterior displacement.
Posterior horizontal instability of the distal clavicle can cause abutment of the posterolateral portion of the clavicle into the spine of the scapula.
Saving superior and posterior ligaments is important when removing the distal clavicle.

Coracoclavicular ligaments

Controversial about the role of CC ligaments
In general, trapezoid ligament may be a restraint for posterior or superior displacement, and conoid ligament may be a restraint for anterior or superior displacement.

Coracoacromial ligament

A secondary glenohumeral stabilizer in longstanding massive rotator cuff tear

Acromioclavicular joint injury

Mechanism of injury[16)]

Direct force
Most common cause of AC joint injury
Falling on the shoulder with the arm at the side
Indirect force
Upward indirect force by the upper extremity
Downward indirect force through the upper extremity

Classification and Physical/X-ray findings[16)]

Type I: Minor strains of the acromioclavicular ligament and joint capsule.
The acromioclavicular joint is stable, and pain is minimal.
No palpable displacement of the joint
Type II: Caused by more significant forces
Acromioclavicular ligament and the joint capsule ruptured
The coracoclavicular ligaments remain intact.
The acromioclavicular joint is unstable, especially in the anteroposterior plane.
On X-ray, the lateral end of the clavicle rides higher than the acromion, usually by less than the thickness of the clavicle even on

stress view.
Considerable pain and tenderness

Type III: Rupture of both the acromioclavicular and coracoclavicular ligaments
Tenderness on both AC joint and CC interspace
Unstable in both horizontal and vertical directions
The distal clavicle is above the acromion by at least the thickness of the clavicle.

Type IV: The same structures are disrupted as in type III injuries.
The distal clavicle is displaced posteriorly into or through the trapezius muscle.
The sternoclavicular joint should be always examined.

Type V: Injuries the distal attachments of the deltoid and trapezius to the clavicle are both detached from the distal half of the clavicle.
Significant drooping of the shoulder
The acromioclavicular joint is displaced from 100% to 300%.
Gross separation between the clavicle and the acromion

Type VI: Rare and caused by extreme abduction
The distal clavicle is displaced under the coracoid and behind the conjoined tendons.

X-ray evaluation

Routine shoulder AP view: overpenetration
Zanca view: 10~15 degrees cranial tilt with 1/3-1/2 penetration for clear view of AC joint
AP stress view: 10~15 pounds of weight on the wrist
Coracoclavicular distance
Stryker notch view for suspicious fracture of coracoid base

Treatment[7,16)]

Type I

Nonoperative treatment
The symptoms subside after a week or so.
Heavy lifting and contact sports should be delayed until there is a full range of motion and no pain to joint palpation (This usually takes 2 weeks).

Type II

Nonoperative treatment
Sling for 10-14 days until the symptoms subside.
Heavy lifting and contact sports should be avoided for 8~12 weeks to

allow complete ligament healing.

Type III[6,12]

Treatment of type III injuries has become less controversial in recent years, but still controversial.

Most authors recommend nonoperative treatment for most of type III AC joint injuries.

Operative stabilization is considered in heavy manual laborer, in the dominant arm in overhead athlete, active patients with more severe degrees of displacement or in patients with brachial plexus injury.

Type IV, V, VI

Nearly always require operative treatment.

Surgical procedures can be divided into 4 categories[6,7,16].

(1) **Acromioclavicular reduction and intra-articular AC joint fixation**

Transfixation of AC joint with K-wires, pins, screws with or without repair or reconstruction of A-C or C-C ligaments

High rate of hardware complication

Damage to the disc and joint - degenerative arthritis

(2) **Acromioclavicular reduction, and extra-articular CC ligament repair and CC fixation**

(A) Coracoclavicular screw

A screw fixation between clavicle and coracoid process with or without C-C ligament repair

Bosworth, Kennedy: modified Bosworth technique

Removal of screw after 8 weeks or more

(B) Cerclage technique (between coracoid and clavicle)

Dacron or other synthetic tape10)

PDS suture or cerclage

Risk of bony erosion, failure of fixation

(3) **Distal clavicle excision**

Resection of the lateral end of the clavicle has been proposed for the treatment of both acute and old acromioclavicular dislocations.

If the CC ligaments are disrupted, they must be repaired or reconstructed

Distal clavicle resection (Mumford procedure, 1941)

Distal clavicle resection and CC ligament reconstruction with CA ligament (Weaver and Dunn, 1972)

In recent articles, they recommend that distal clavicle resection should be saved for late complications such as AC arthritis.

Arthroscopic distal clavicle resection

(4) **Dynamic muscle transfers**

Transfer of coracoid process with attached coracobrachialis and biceps short head to the undersurface of clavicle
Act as dynamic depressor of clavicle
Risk of nonunion and musculocutaneous nerve injury: high
Recent report: high failure rate (50%), especially in old age
Not recommended in acute dislocation

Complications of treatment[9)]

A. Complications of nonsurgical treatment

(1) Skin and wound problems
Usually at the point of direct impact
Subsequent treatment using Kenny-Howard sling

(2) Osteolysis of the clavicle
Also referred to as posttraumatic osteolysis
Pain, especially with flexion and abduction of the arm
Usually self limiting in most cases
Treatment: Rest and activity modification
Excision of distal clavicle if necessary

(3) Posttraumatic arthritis and loss of function
Up to 24% in conservatively treated Type I and II injuries
Treatment: Activity modification, NSAID
Intra-articular injection of steroid
Excision of distal clavicle if pain persists
With CC stabilization when any residual instability exists

(4) Neurovascular injury
Some patients with chronic AC joint instability
Traction effect on brachial plexus
Thoracic outlet syndrome

B. Complications of surgical treatment

(1) Preoperative complications
Skin problem
Potentially increase postoperative infection and skin breakdown

(2) Intraoperative complications
Depend on the type of operation
Inadequate ligament length

Compromise of the coracoid attachment
Excessive lateral clavicle resection
Neurovascular injury

(3) Postoperative complications
Loss of reduction
Fracture
Hardware failure, implant migration
Infection
Muscle detachment
Ossification, osteolysis
AC arthritis

Distal clavicle fracture[1,3]

- Roughly 10~15% of all clavicle fractures
- Disproportionately high rate of nonunion compared to other fractures in the clavicle
(Especially in type II distal clavicle fracture)
- Direct blow or fall onto the top of the shoulder
- Focal pain on top of the shoulder
- The deformity is similar to an AC joint injury.
- Tenderness usually more medial to AC joint injury
- Radiologic evaluation includes:
Shoulder trauma series and Zanca view
CT for comminution and SC joint evaluation
MRI for soft tissue injuries

Classification (Neer)

Type I: Minimally displaced
Fracture lateral to CC ligaments
Stable fracture
Type II: Proximal fragment detached from CC ligaments
Unstable
Type IIA: Both the conoid and trapezoid remain attached to the distal fragment.
Type IIB: The conoid ligament is torn.
Type III: Intra-articular extension to into the AC joint

* Type II fractures are unstable injuries, secondary to four displacing forces

(1) The weight of the arm
(2) The pull of the pectoralis major, pectoralis minor, and latissimus dorsi
(3) Scapular rotation, which affects the distal segment but not the proximal
(4) The pull of the trapezius muscle, which draws the medial segment posterior and superior

Treatment

Type I

Nonoperative treatment
A sling is enough to support.
Figure-of-eight bandage or Kenny-Howard sling is not necessary.
Passive and active exercises when the patient s comfort allows.
Contact sports area avoided until the fracture appears to be healed.
A very small percentage of patients have any residual symptoms.

Type III

Similar to type I
Potential late complication such as AC joint arthritis
Distal clavicle resection in chronically symptomatic patients

Type II

Controversial[1]
Many authors advocate surgical approach due to the relatively high risk of nonunion.
But some authors reported only small percentage of nonunion rate.
In some reports, there were no correlations between the nonunion and functional disability.

Surgical techniques for Type II distal clavicle fracture

(1) Transacromial K-wire fixation[7]
    Originally described by Neer
    Risk of AC joint arthritis, pin migration
    Delay in rehabilitation
    High rate of nonunion even after this operation[11]
(2) Clavicular (hook) plate[15]
    Theoretically stronger than K-wire fixation
    Simple cerclage wire
    For long oblique fracture
    Whether this fixation is strong enough, is questionable.
(3) Tension band technique[4,5,13,14]

No violation of AC joint
Suture wire or PDS (Levy, 2003)
Relatively easy operation compared to CC fixation

(4) Coracoclavicular fixation
Temporary coracoclavicular screw to indirectly reduce the fracture[2,18]
Coracoclavicular sling with Mersiline or Dacron tape
Technically demanding
Delayed rehabilitation
Risk of bony erosion of clavicle or coracoid[8]

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