

The Elbow Instability

경북의대 정형외과

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Biomechanics of elbow dislocation

Constraints to elbow instability

3 primary static constraints to elbow instability - the ulnohumeral articulation, MCL, LCL
Secondary constraints - the radial head, the common flexor and extensor origins, the capsule
Dynamic stabilizer - muscles (anconeus, triceps, brachialis...) that produce compressive forces.

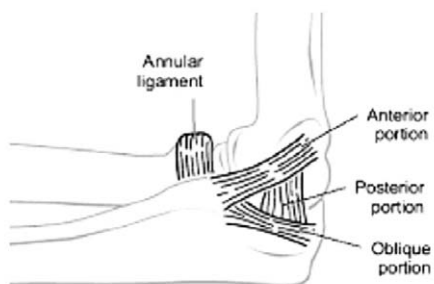


Figure 1 Medial view of the elbow demonstrating the ligaments (from fracture article).

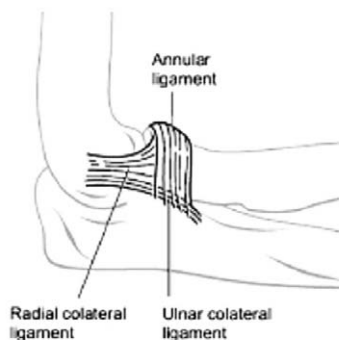


Figure 2 Lateral view of the elbow demonstrating the ligaments (from fracture article).

Pathoanatomy

Disruption of the circle of soft tissue or bone from the lateral side and progresses to the medial.
Stage 1 - the lateral collateral ligament is partially or completely disrupted
Stage 2 - additional disruption anteriorly and posteriorly
Stage 3A - all of the soft tissue around and including the posterior part of the MCL are disruption
3B - the entire medial collateral complex is disrupted
3C - the entire aspect of the humerus has been stripped of soft tissue

This circle of disruption (Horii circle)

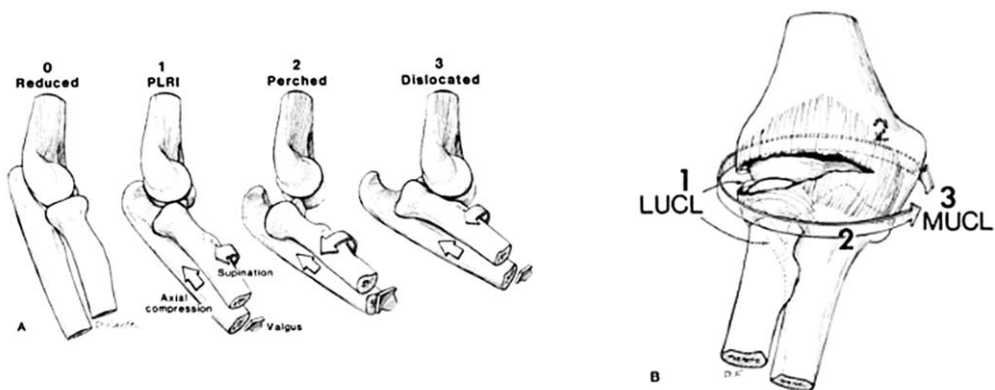


Fig. 3.

Classification of elbow instability

According to 5 criteria

- (1) the articulation or articulations involved (the elbow or the radial head);
- (2) the direction of displacement (valgus, varus, anterior, or posterior rotator);
- (3) the degree of displacement (subluxation or dislocation);
- (4) the timing (acute, chronic or recurrent);
- (5) the presence or absence of associated fractures

Acute Elbow Dislocation (Simple)

Appears to subluxate or dislocate → splint and AP&lat radiographs

No subluxation → discharge / splint or sling

Reevaluation in 5~7 days: subluxation or incongruence → forearm pronation and evaluation of stability / stability is restored → hinged brace or cast-brace / elbow require an extension block of more than 30~40° → surgical repair should be considered

Lateral pivot-shift maneuver

Patient placed supine on the table / The elbow is supinated, and a mild to moderate forced valgus stress is applied while the elbow is flexed past approximately 40°.

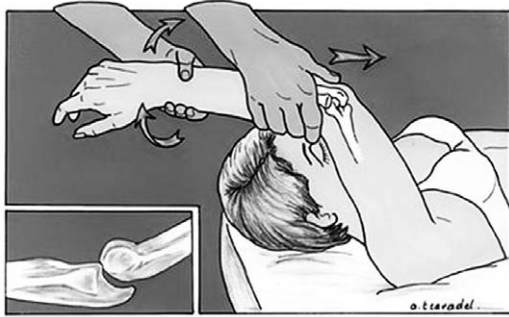


Fig. 4.

Management of acute dislocations

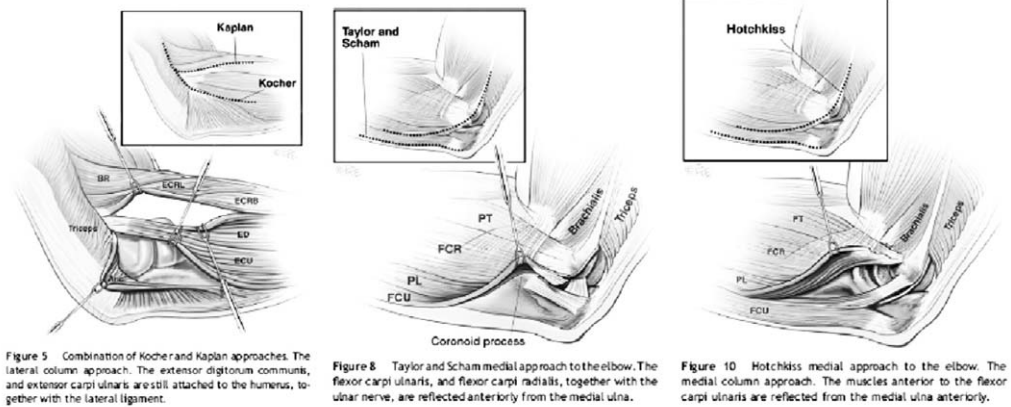


Figure 5 Combination of Kocher and Kaplan approaches. The lateral column approach. The extensor digitorum communis, and extensor carpi ulnaris are still attached to the humerus, together with the lateral ligament.

Figure 8 Taylor and Scham medial approach to the elbow. The flexor carpi ulnaris, and flexor carpi radialis, together with the ulnar nerve, are reflected anteriorly from the medial ulna.

Figure 10 Hotchkiss medial approach to the elbow. The medial column approach. The muscles anterior to the flexor carpi ulnaris are reflected from the medial ulna anteriorly.

Fig. 5.

Acute Elbow Dislocation (Complex: Associated with Fracture)

The terrible-triad injury

Combination of an elbow dislocation and fractures of the radial head and coronoid process

Fractures of the coronoid process

Type I - small fleck of bone,

Type II - involves 50% of the height of the coronoid process or less,

Type III - more than 50% of the height of the coronoid process

Coronoid process - primary stabilizer of the elbow and its critical role in the presence of a radial head fracture and ligament injury



Fig. 6.

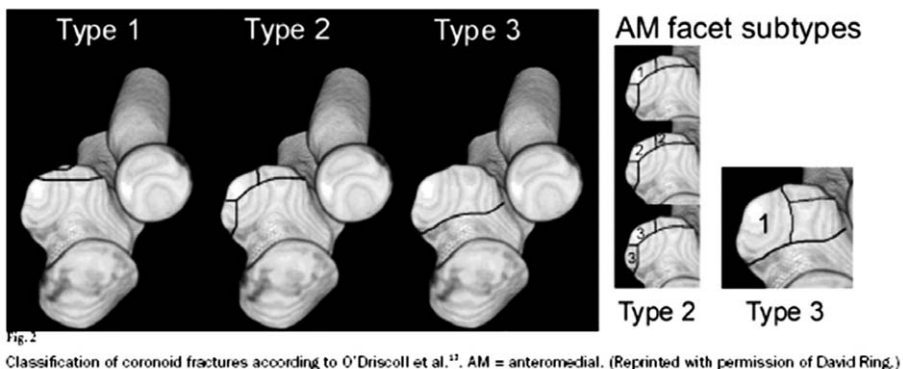


Fig. 7.

Results and complications

The terrible triad is a grave and complex injury

Suggest that lesions of both the coronoid and the radial head need to be stabilized or reconstructed whenever possible

Hinged External Fixation for Unstable Elbows

Primary indication

- (1) Persistent instability in association with an acute fracture-dislocation despite attempted ligament repair and fracture fixation or radial head replacement or both;
- (2) Gross acute instability in a patient who is not a candidate for surgery;
- (3) Delayed treatment (approximately 4 weeks or more after the time of injury) of a dislocated and stiff elbow

Relative indication - need to protect the stability and the fracture reduction during rehabilitation following surgical treatment of an unstable elbow

Recurrent Elbow Instability

LCL insufficiency is most commonly seen after elbow dislocation

Both the medial and the lateral collateral ligament complex are acutely disrupted with an elbow dislocation, the residual insufficiency most commonly involves the lateral collateral ligament complex for reasons that have not yet been elucidated

History & Exam

Instability, pain and discomfort, painful catching, slippage, or clicking with flexion and extension.

Reduction in pronation.

Lateral pivot-shift maneuver, the posterolateral rotator drawer test, apprehension test

Medial Instability

Pitchers are prone to elbow injuries because of high and repetitive valgus stresses on the elbow.

Recurrent instability after a simple elbow dislocation is rare

Etiology

The anterior bundle of the medial ulnar collateral ligament (MCL) of the elbow is the primary restraint and is often attenuated with time, leading to functional incompetence and ultimate failure.

Clinical Presentation

Pitchers with a history of medial elbow pain, reduced velocity, and loss of command may have an MCL injury in evolution.

Diagnosis

Physical examination and imaging can confirm the diagnosis.

Management

- Treatment begins with rest and activity modification.
- All medial elbow pain is not MCL injury.
- Surgery is considered only for talented athletes who wish to return to competitive play and may include elite scholastic and other collegiates and professionals.

The technique for MCL reconstruction was first described in 1986. Many variations have been offered since then, which can result in predictable outcomes, allowing many to return to the same level of competitive play.

4 Different types of MCL reconstruction

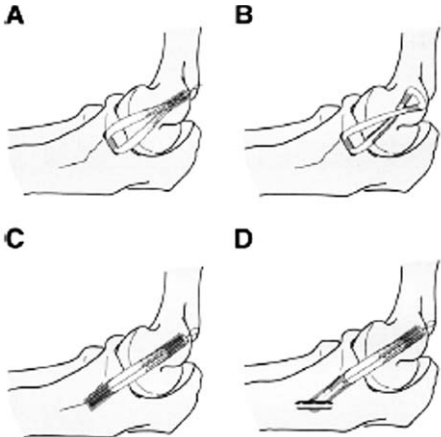


Figure 2 The four MCL reconstructions are illustrated: docking (A), figure eight (B), interference screw (C), and EndoButton (D).

Fig. 8.

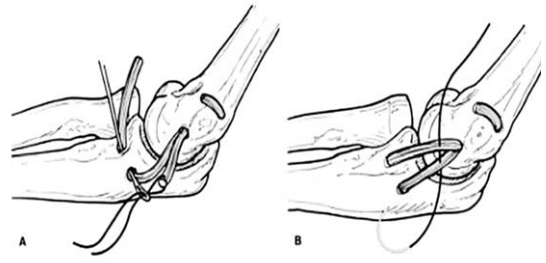


Fig 30-9. The graft is passed in a figure of eight fashion. (Modified from Jobe F. *Operative Techniques in Upper Extremity Sports Injuries*. Philadelphia: Mosby; 1996, with permission.)

Fig. 9.

Lateral Instability

Posterolateral rotatory instability of the elbow is the most common pattern of chronic lateral elbow instability.

Etiology

The primary lesion in posterolateral rotatory instability is injury or attenuation of the lateral ulnar collateral ligament.

Diagnosis

Posterolateral rotatory instability is diagnosed on the basis of careful history taking and specific physical examination techniques. (Table top relocation test, Pivot shift test)



Fig. 10.

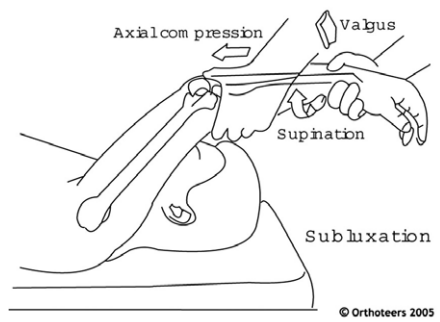


Fig. 11.

Treatment

Reconstruction of the LUCL with repair of the surrounding soft tissue structures is recommended in patients who have symptoms of recurrent lateral instability.

Open and arthroscopic reconstruction techniques have resulted in improvement of elbow function and satisfactory results in most patients, although mild limitation in terminal extension of the elbow is a common finding.

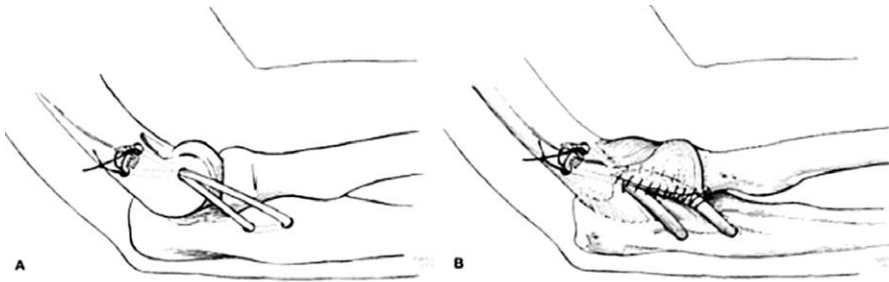


Fig. 12.

Rehabilitation

70~80° flexion with the forearm in full pronation for 10~14 days/ protected motion in a hinged brace for 2-6 weeks

After 6 weeks, removal of the hinged splint for sedentary activities.

At the end of additional 6 weeks, splint discontinued. Protection for a total 12 weeks after surgery

After 12 weeks, activity is gradually resumed, with 100% activity allowed at 6 months

Results

No degenerative arthritis, radial head is intact → 90% have a satisfactory outcome with no subsequent subluxation

Radial head excision or degenerative arthritis → 67~75% of satisfactory result

| Author(s)/Year | Number of Elbows | Procedure or Approach | Mean Patient Age (Range) | Mean Follow-up (Range) (Months) | Results |
|--|------------------|---|--------------------------|---------------------------------|--|
| O'Driscoll, et al. (1991) ² | 5 | LCL reconstruction with tendon graft | 12 (5-46) | 20 (15-30) | 4 stable; 0 unstable Excellent, 4; Death by drowning, 1 |
| Nestor, et al. (1992) ³ | 11 | LUCL with (5) or without (4) PLT or PLT/LAD (2) | 28 (9-46) | 42 (24-68) | 10 stable; 1 unstable Excellent, 7; Fair, 3; Poor, 1 |
| Sanchez-Sotelo, et al. (2005) ³ | 44 | Lateral ligamentous repair or reconstruction for posterolateral rotatory instability of the elbow | 35 (9-80) | 72 (26-182) | 39 stable; 5 unstable Excellent, 19; Good, 13; Fair, 7; Poor, 5 |

Summary of treatment principles

Reduction of acute dislocations and management after reduction

Closed reduction, forearm in neutral.

3~5 days, place the elbow in a splint and start allowing movement unless the elbow tends to subluxate or dislocate

Careful examination and radiographs - every 5~7 days for the first three weeks

Management of acute fracture dislocation

Fix the bones internally and repair the ligaments so that early motion can be commenced

Repair of an acute ligament injury

Indicated in all fracture-dislocations requiring internal fixation of the radial head or the coronoid process or both.

Avulsion - repair directly to bone with heavy suture

Passing a heavy absorbable suture through the same course as that for a late ligament reconstruction and fixing it to the normal ligament attachment on the epicondyle and the ulna augments the repair