CARPAL INSTABILITY

Ligaments

Intrinsic

Scapho-lunate ligament: Dorsal component stronger than volar ligament

Luno-triquetral ligament: Volar component stronger than dorsal ligament

Extrinsic

Palmar

1. Radio-scapho-capitate ligament

2,4. Long and Short Radio-lunate ligament

3. Ulno-lunate, Ulno-triquetral ligament

5. Ulno-capitate ligament

Poirier: Between RSC & LRL

Dorsal

8. Dorsal radio carpal ligament

5. Dorsal intercarpal ligament
Scapho-lunate interosseous ligament [SL ligament]

C shaped structure 3 parts:

1. Dorsal [3 mm thick, transverse fibers]
2. Proximal [thin fibrocart and blends with radio-Scapho-lunate ligament]
3. Volar [1 mm and oblique]

Dorsal is bulky and important. Division of SLIL causes DISI [Dorsal intercalated segmental instability].

**Load Transmission**

<table>
<thead>
<tr>
<th></th>
<th>Scaphoid- 60% and Lunate</th>
<th>40%</th>
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<tbody>
<tr>
<td></td>
<td>Scaphoid-trapezium-trapezoid</td>
<td>23%</td>
</tr>
<tr>
<td></td>
<td>Scapho-capitate</td>
<td>28%</td>
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<tr>
<td></td>
<td>Luno-capitate</td>
<td>29%</td>
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<tr>
<td></td>
<td>Triquetro-hamate</td>
<td>20%</td>
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**Theories**

I Row Theory

Proximal Row is connected by interosseous ligament and moves independently from distal row.
Scaphoid tends to flex on radial deviation

II Column Theory [Navarro 3 longitudinal columns]

Central: Flex and Extend (Lunate, Capitate, Hamate)
Lateral: Mobile (Scaphoid, Trapeziun, Trapezoid)
Medial: Rotation (Triquetrum, Pisiform)

III Teleisnik theory

Scaphoid is stabilizing link
Trapezium and Trapezoid is added to the central column.
Triquetrum is the pivot for rotation
Type of instability

A. **Static Dissociate** (intrinsic ligament)
   - VISI [volar intercalated segmental instability]
   - DISI [Dorsal intercalated segmental instability]

B. **Static Non-Dissociative** (Extrinsic ligament) ie., CIND
   - Dorsal carpal subluxation
   - Midcarpal instability
   - Volar carpal instability

C. **Dynamic instability**

D. **Adaptive carpal instability** (Following Colle’s or; Barton’s fracture)

**Mechanism**

- Isolated ligamentous injury
- Perilunate dislocation
- Displaced Scaphoid injury
- Malunited Colle’s fracture

Any fall with extension, ulnar deviation of the wrist and intercarpal supination (landing on Thenar eminence) can cause ligamentous disruption. This occurs sequentially, with failure initiated on the radial aspect, then around lunate and lastly at the ulnar side.

**DISI**

**Symptoms**

- Pain: Radial side DISI
  - Ulnar side VISI
- Grip strength: may be weak
- Painful clicks on wrist movement
Signs
Localizing tenderness
Ballotable tests
Kirk Watson test

X rays
PA in Neutral, Ulnar deviation, Radial deviation
Lateral in neutral, flexion, extension
PA= neutral clenched fist

Radiological signs
Terry Thomas > 3mm
Cortical ring sign 7 mm from the proximal pole
Lunate Trapezoid shaped Lunate
Scapholunate angle 45º Normal
>70 º means DISI
<30 º VISI
Lunocapitate angle 0-10 º [>30 in DISI]

Other imaging
Image Intensifier: EUA
Arthrogram
Radiocarpal and midcarpal +/-MRI is very useful
MRI: Gadolinium has become gold standard
Bone Scan: Localise. Not required as a routine
Arthroscopy: Presently: is very popular
  Scapho-Lunate ligament stretches by 100% before rupture.
**Giessler’s Classification**

**Grade I** Attenuation of interosseous ligament;
- No midcarpal step off
- Treatment: cast for 6 wks

**II** Mid carpal step off.
- Treatment: Reduce and K wire

**III** Complete separation demonstrated from Radiocarpal and Midcarpal
- 1 mm probe can be passed between scaphoid and lunate
- Treatment: Repair and K wire

**IV** As in III and 2.7 scope can be passed easily
- Open repair and capsulodesis

**Principle of treatment**

**Acute Dynamic** Splint
- Does not require repair

**Acute static** Early open repair of Scapho-lunate ligament and K wire

1. **Open repair**
   - Dorsal Approach
   - Use K wires as a Joy stick into the Scaphoid and lunate and reduce
   - Initial fixation is radius to ulna with a K wire
   - Then fix Scaphoid to radius
   - The scapholunate ligament which usually ruptures from Scaphoid is repaired to Scaphoid with a bony stitch
   - Above elbow thumb spika for 8 wks

2. **Blatt’s Capsulodesis**
   - This procedure is indicated only when the rotation of the scaphoid can be reduced
   - Dorsal approach
   - Elevate 1 cm flap of the capsule with intact attachment proximally to radius
   - Reduce the volar flexed scaphoid
   - Transfix the scaphoid to the capitate
Fix the flap of the capsule to the distal part of the scaphoid (Prevents volar flexion of scaphoid). Drill hole from dorsal to volar and tie it over a button

3. Brunelli reconstruction

FCR tendon left intact distally and is divided proximally. The split tendon is passed from volar to dorsal at the distal Scaphoid. Attached to distal radius [original Brunelli] or to the dorsal lunate

4. STT fusion with a radial styloidectomy

Indication: When Scaphoid rotation is fixed.
STT fusion is always combined with radial styloidectomy

Disadvantages  
50% of Flexion-Extension is lost
30% Non-union, Early wrist arthritis.

Treatment of SLAC

Proximal row carpectomy
4 corner fusion
**VISI**

Ligament between Lunate and triquetrum is C shaped and the palmar region is the thickest

**The "balanced lunate" concept**

- S-L ligament influences volar tilt of Lunate
- L-T ligament influences dorsal tilt of Lunate

**X ray**

Look for scapholunate relation

[A=Normal; B =DISI, C =VISI]

A, Break in Gilula’s arcs 1 and 2
B, Lateral radiograph  S-L angle in lateral: <30º
C. Luno-capitate: Zigzag >15 °
D. Luno-triquetral: N 16 °

Key elements on a normal PA view.

1. The carpal bones form three smooth arcs;
2. Carpal bones are separated by a 1- to 2- mm space;
3. Scaphoid has an elongated shape;
4. Radius has an ulnar inclination of 15 to 25 degrees;
5. Radial styloid projects 8 to 18 mm (average 13 mm).

Volar intercalated segment instability (VISI).

The lunate tilts palmar
The capitolunate angle increases
The scapholunate angle is maintained.
The zigzag pattern is in the opposite direction.
Clinical

Fall on the dorsiflexed wrist with a hypothenar contact point

Symptoms are usually

- Diminished wrist motion and weakness
- A sensation of instability or giving way
- The ulnar nerve paraesthesiae
- A painful wrist clunk with deviation is often present.

Diagnoses

1. Arthrography: Been replaced by MRI
2. Videofluoroscopy: "clunk" that occurs with deviation.
3. Bone scanning can be useful in identifying the site of acute injury
4. Selective midcarpal injection of local anesthetic
5. Wrist arthroscopy: gold standard

Treatment

VISI less understood than DISI

Options include Corticosteroid injection

- Immobilization
- Ligament repair
- Ligament reconstruction with tendon grafts,
- Limited intercarpal arthrodesis: L-T arthrodesis [50% non-union]
- Ulnar shortening
- Total wrist arthrodesis

CIND

DISI and VISI can occur without damage to interosseous ligament injury

Described by Dobyn’s.

MIDCARPAL CIND

Usually ulnar sided wrist pain

Test: like that of TFCC, when moved the wrist from radial to ulnar side, a click and pain
Fluoroscopy and movement
MRI: Synovitis of midcarpal joint
Pathology: volar or dorsal subluxation of capitate occur due to weakness in the Dorsal carpal or Palmar radioscaphocapitate ligament

Rx: Capsular reefing Or limited arthrodesis

ULNAR TRANSLOCATION

Translocation of carpal bones common in rheumatoid and can be treated by isolated Chamay’s radio-lunate fusion in selected cases. Otherwise: wrist arthrodesis or proximal carpal row excision

Causes for ulnar side pain
1. Non-union of ulnar carpal and metacarpal bones
   Ulnar styloid: NU
2. Ligament: VISI
   TFCC
3. Ulnar impaction syndrome
4. Lunatomalacia [Keinbocks’s]
5. IRUJ dislocation or subluxation
6. Tumors like: intraosseous ganglion
7. Vascular and nerve: Guyon’s canal entrapment
   Thrombosis of ulnar syndrome [Hypothenar hammer syndrome]
8. Tendinitis: FCU and ECU
9. Various osteoarthritis
10. Ulnar styloid: NU
11. Carpometacarpal boss
Assessment

Hand examination with tests of ligament stability [Clinical examination of the Hand]

Imaging

X ray
CT: Fracture which is not clear on X rays; CT is a preferred. E.g., hook of Hamate or IRUJ subluxation
Arthrography
MRI: TFCC tear. Brighter in T2 due to fluid
Arthroscopy
Fluroscopy
Bone scan