Terrible triad of the elbow

Vasu Pai
? “Terrible triad of the elbow"

- Posterior dislocation of the elbow
  - + Fractures of the radial head
  - + Fracture of coronoid process

- Uncommon injury  5% of dislocation
Problems

- Difficulties
- Rarity of injury
- Exposure
- Achieving stability

- Poor outcome
- Recurrent instability
  [15% to 35%]

- Stiffness

- There are few published reports on this injury
  - Jupiter and Ring, Mckee
PATHOGENESIS

I Disruption of the stabilizing lateral soft-tissue structures
   a. Avulsion of the lateral epicondyle 60%
   c. Midsubstance rupture 35%
   d. Ulnar detachment of LCL ?

   Need Repair. Morrey: Isometric point

II Coronoid type I fracture with extensive anterior capsule [Controversy]
   Not required to repair
      • Regan and Morrey[1992] Type I not important for stability
      • Beingessner [2007] Cadaveric study: not important

   Always repair
      • Mckee/Pugh [2004] Important
      • King [1993], Terada [2000]

   The location of the capsule insertions well within the Type I region and the most coronoid tip fractures included disruption of the anterior capsule.
      • JSE Volume 449: 259-261, 2006
III  Radial head fracture:  Usually comminuted
   1. **Open reduction and internal fixation**: Best when possible

   2. **Excision of head of the radius**
      High evidence of instability [Morrey]
      High evidence of Osteoarthritis [Josephson]

   3. Replacement
      **Silicon replacement** [Synovitis]
      **Metal prosthesis**: uniblock or modular
      Pugh, Mckee, Ring
Our standard protocol

- Reduction of the dislocation
- ORIF or Replacement of radial head
- Repair anterior capsule to coronoid
- Repair lateral structures
- Brace for 4 weeks
- Early ROM at ten days in the brace
Terrible triad

In a Cadaveric elbow study.

Excision of the radial head Fully destabilized the elbows and removal of the coronoid

Excision of the radial head Posterolateral rotatory laxity of 19°
And repaired collateral ligaments

Replace head, reconstruct
Collaterals, Repair coronoid Full stability

• Terrible triad: could not be stabilized by radial head replacement alone, but additional coronoid reconstruction restored stability.

Elbow JBJS 86 A: 975
Materials and methods

- **Methods**
- 4 patients [2005-2006]
- Dunedin Hospital[1], Hawkes Bay[2], Gisborne [1]
- Single Surgeon [VP]
- All had standard protocol
- A fracture of the anterior chip fracture of the coronoid process
- Grossly comminuted fracture of the radius and posterior dislocation
Patient 36 M [MNJ] 21/7/1971

X-ray images of the right knee.
Following Closed Reduction
Exposure

- A direct lateral incision
- Patient supine; Forearm in pronation
- Between FCU and anconeus
- The detachment of the lateral collateral ligament in a "sleeve" of tissue, leaving a characteristic "bare spot" on the posterolateral aspect of the distal humerus
- Annular ligament is divided
  - anterior to anconeus
Exposure of radial head

- A portion of the common extensor origin-lateral ligament complex can be seen hanging down from the bare lateral condyle.

- One big portion of the head
Excision of radial head

• All the fragments of the radial head were removed

• The radial neck was divided above the bicipital tuberosity. The saw cut (with an oscillating saw) was made above the tuberosity

• Trial components are implanted, and then the elbow is put through a range of motion to determine the size that best restores joint stability.

• The definitive components are then inserted.
Repair: I Fix the coronoid

The deepest structure, the coronoid, is addressed first.

The coronoid fragment with the capsule [Type I]

Type-II or III 1 or 2 small-fragment (3.0 or 3.5-mm) lag screws from the posterior surface of the ulna
[Or a plate from the medial side]
LCL repair

Repair the LCL:
• suture anchors.

In the center of rotation of the elbow laterally, located at the center of the capitellar circumference in the lateral condyle.
• Check concentric reduction: Arc 20° to 130°

Valgus instability alone is usually well tolerated postoperatively and is not an indication for further surgical intervention

• A residual posterior or posterolateral instability is not acceptable.

• Perform a repair of the medial structures or apply a hinged external fixator to the elbow
Case 2: AW  6/3/1972
III case mono block
## Materials and method

<table>
<thead>
<tr>
<th>Case</th>
<th>Occupation</th>
<th>Gender</th>
<th>Age (Y)</th>
<th>Event</th>
<th>Grade</th>
<th>Diagnosis</th>
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<tbody>
<tr>
<td>Case 1</td>
<td>Labourer</td>
<td>M</td>
<td>28</td>
<td>Fall</td>
<td>G 10-125</td>
<td>None</td>
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<tr>
<td>Teacher</td>
<td></td>
<td>M</td>
<td>32</td>
<td>Bike</td>
<td>G 10-130</td>
<td>Radial N neuropraxia</td>
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<tr>
<td>Bush work</td>
<td></td>
<td>M</td>
<td>28</td>
<td>Fall</td>
<td>G 10-130</td>
<td>None</td>
</tr>
<tr>
<td>Engineer</td>
<td></td>
<td>M</td>
<td>34</td>
<td>Bike</td>
<td>20-100</td>
<td>Limitation of ROM</td>
</tr>
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</table>
### Reported studies

<table>
<thead>
<tr>
<th>No</th>
<th>Type of Rx</th>
<th>Out come</th>
<th>Complications</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>
| **Ring** | Radius: ORIF 5, Excise 4  
Coronoid: not repaired  
LCL repaired in 3 | 4/11: G-E              | 5 post op disloctn  
each: arthrosis, synostosis, deformity |
| 11  |                                                                           |                        |                                                    |
| **Pugh and McKee** | Radius: ORIF or Replace  
Coronoid: Repair  
LCL: Repaired  
[6MCL; 2 hinged brace] | F-E: 112° ± 11°  
Rotation 136° ± 16°  
28/36: G-E | 2 synostosis  
1 recurrent instability |
| 36  |                                                                           |                        |                                                    |
| **Popovic** | Floating radial head replacement  | 8/11 E-G               | -                                                  |
| 11  |                                                                           |                        |                                                    |
| **Pai** | Radius: Radial head  
Coronoid: Repaired  
LCL repaired | 3/4 E-G  
1Fair | 1 Neuropraxia of Radial N |
| 4 [type I] |                                                                         |                        |                                                    |
Summary

In a “Terrible triad” Coronoid fracture repair is important irrespective of the size. The type I [smaller fractures] associated with elbow instability should now be regarded as the most troublesome. [Cf Type II and III]

Radial head: should be fixed or replaced.

- Resection of the radial head:
- Instability [Ring]
- Late osteoarthritis [Josefsson CORR246]
Our protocol

- (1) Replacement of the radial head,

- (2) Fixation of the coronoid fragment or anterior capsule: Anchoring stitch [Mitek]

- (3) Repair of the LCL: Anchoring stitch [Mitek]

- (4) This allows early mobilization, enhancing the functional outcome.
If elbow is still unstable

- Persistent elbow instability in spite of repair of the coronoid, radial head, and lateral collateral ligament, the literature has suggested:
  - A brief period of hinged external fixation
  - MCL repair
• There is scarce information in the literature to help define optimal treatment

• Choosing the ideal treatment between replacement or internal fixation of the radial head can be difficult.

• In unfixable radial head fracture with dislocation, replacement of the head is appropriate. However, long term results are not available.