Ilizarov external fixation – A novel method for treatment of T-condylar elbow fractures in children and adolescents

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Background

• T-condylar fractures rare in skeletally immature children
• Occur in older children and adolescents
• Surgery challenging
• Complications common
Background

• Treatment surgical

• Goals
  – Restore articular surface
  – Rigid fixation for early ROM

• Options
  – Closed reduction with pinning
  – Pinning combined with titanium nails
  – *ORIF*
ORIF

- Current standard of care
- Technically challenging
- Large exposure
- Extensive soft-tissue stripping
- Occasional olecranon osteotomy
Ilizarov

- Minimally invasive
- No soft-tissue stripping
- Rigid construct allows early motion
- No study in literature
Purpose

• To assess the clinical and functional outcomes of patients with t-condylar fractures of the humerus treated with small wire external fixation.
Ilizarov Technique

- Pre-op films of uninjured arm for sizing
Ilizarov Technique

• Preconstruct frame
  – composite arc proximal
  – Full or 5/8 ring distal
  – Mid shaft transmission ring
Ilizarov Technique

- 4 mm proximal half-pin
- Traction
- 1.8 mm smooth wire at med epicondyle
- Frame centered and fixed
Ilizarov Technique

- 2 more proximal half-pins
- 1.8 mm olive wires in opposite directions
- Olive wires tensioned simultaneously to restore joint
- Final reduction with connecting rods
Methods

- Retrospective case series
- Two surgeons
- Minimum 1 year follow-up
Methods

• Chart review
  – Demographics
  – Mechanism of injury
  – Operative time
  – Duration of time in frame
  – Complications

• Radiograph review
  – OTA fracture classification
Methods

Late clinical review

- Carrying angle
- ROM
- X-rays
  - Anterior humeral line
  - Lateral distal humeral or Baumann’s angle
- PODCI <18yrs
- Upper Limb DASH > 18yrs
Results

- 15 patients (11 males and 4 females)
- Mean age at injury: 11.5 years (range 8-15 years).
- OTA Fracture Classification:
  - 85% C1.1 fractures
  - 7% C2.1 fractures
  - 7% C2.2 fractures
Results

• Mechanism of Injury
  – 27% sports
  – 13% playground
  – 13% motorized vehicle
  – 13% skates
  – 13% fall
  – 20% other
Results

• 1 Grade I open fracture.
• 3 patients ipsilateral upper extremity fractures
Results

• Mean OR time: 113 minutes (range 60-150 minutes).
• One intraoperative arthrogram to assess the reduction.
• Mean time in frame: 57 days (range 35-115 days).
Results

• Complications
  – persistent serous drainage from pin sites while in the frame (3),
  – transient ulnar neuropraxia (1),
  – loss of flexion (2),
  – loss of extension (1),
  – malunion causing cubitus varus (1)
  – No pin tract infections
Results

• Late review
  – 4 patients
  – All males
  – Average age at follow-up 17.5 (11-24 yrs)
  – Average length of follow-up 95 months (39 to 141 months)
Results

• Late review
  Range of motion:
  – Mean flexion: 127° (range 110 - 150°),
  – Mean extension: 3° (range 0 - 8°),
  – Mean pronation: 85° (range 70 - 90°),
  – Mean supination: 90°

• Mean carrying angle
  +3° (-10° - +8°)
Results

- Late radiographic review
- Mean lateral distal humeral angle 89°
- Anterior humeral line: intersected the capitellum in all cases except the one malunion.
Results: Outcome Scores

• PODCI
  – Pediatric global function 92 (1)
  – Adolescent global function 92.5 (2)

• Upper Limb-DASH 0 (1)
Case 1

- 15 year old boy
- Dirt bike accident
- Type C1.1 fx
Case 1

- 10 year follow-up
- No complaints
- Upper-Limb DASH: 0
Case 2

- 13y/o R hand dominant boy
- Fell playing tennis
- Left C2.1 T-condylar fracture
Case 2

- 5.9 year follow-up
- Adolescent PODCI: 93
- Mild asymmetry noted by him but not parents
- College tennis scholarship
Discussion

• Challenging Fracture
• Current Literature
  – Rx options: ORIF, CR pinning + TEN
    • Rockwood and Wilkins’ Fractures in Children
    • Lovell and Winter’s Pediatric Orthopaedics
  – Injury not mentioned
    • Skeletal Trauma in Children
    • Tachdjian’s Pediatric Orthopaedics
Discussion

- Safe and effective technique
- Minimally invasive
- No soft-tissue stripping or disruption of fracture hematoma
- Rigid fixation allows early motion
Limitations

• Small series
• 4/15 long term follow-up
• No control group
Conclusion

• Results should **broaden** the conversation about management of this difficult fracture
• Stimulate comparative prospective series
Thank You