Orthopedic Injuries: Fractures of the Distal Radius and Forearm

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DISCLOSURES

• No disclosures relevant to this discussion
WRIST, FOREARM FRACTURES

- AO documentation center: 10-14% of all fractures (1980 - 1996)
- >640,000 annually in US
- Inherently unstable
- Mistreatment can lead to malunions and nonunions
  - Cosmetically unappealing
  - Functionally impeding

ANATOMY

- radius
- ulna
- Distal radius and ulna
- Scaphoid
- Carpals
- Trapezium
- Metacarpals
- Hamate
- Capitate
- Pisiform
- Triquetrum
- Lunate
ANATOMY

FOREARM BONES

• Radial Bow
  • Critical for rotation

• Interosseous Membrane
  • Tethers ulna to radius
FOREARM

• Volar compartment:
  • Flexor Muscles
  • Pronators

• Dorsal compartment:
  • Extensor muscles
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Distal Radius Fractures

- Epidemiology
  - Most UE FX
  - Bimodal
  - Increasing incidence
  - Among most common fx seen in Orthopedic practices

- Mechanism of Injury
  - Most common: fall outstretched wrist in dorsiflexion
  - High energy: displaced, highly unstable

Imaging

Plain films:

- 3 views wrist:
  - Posteroanterior
  - Lateral
  - Oblique

- Normal Relationships:
  - Radial inclination: 21 -25°
  - Ulnar variance: 0 - +2mm
  - Palmar tilt: 11-12°
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Eponyms

- Colles Fracture
- Smith Fracture (Reverse Colles)
- Barton Fracture
- Chauffeur Fracture
Colles Fracture

- Most common FOOSH (extended wrist)
- Dorsal angulation (apex volar)
- Dorsal displacement
- Radial shift
- Radial shortening

Smith Fracture

- FOOSH (flexed wrist)
- Volar angulation (apex dorsal)
- Volar displacement
- Radial shortening
**Barton Fracture**

- Volar or Dorsal
- Carpal Bones displaced with fractured radial rim

**Chauffeur Fracture**

- Radial styloid fracture
  - Origin: caused by car back-fire while crank turned to start car
  - Mechanism: scaphoid compressed against styloid
• “One consolation only remains, that the limb will at some remote period again enjoy perfect freedom in all its motions, and be completely exempt from pain: the deformity, however, will remain undiminished through life.”
  - Abraham Colles

• Recommendation: “tin splint”

### Treatment

#### Non-displaced Fractures
- Padded, molded splint (plaster/fiberglass)
- Cast when swelling

#### Displaced Fractures
- Attempt at reduction
- Padded, molded splint
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Reduction

- Hematoma block
  - Local anesthetic injection in fracture site
- Finger traps (traction weight)
- Reverse fracture mechanism
- Splint
  - Traditionally “sugar tong”

Splint

“Sugar Tong”

- Above elbow
  - Pron/Sup
  - + Flex/Ext
Splint

“Sugar Tong”

- Above elbow
  - @ Pron/Sup
  - + Flex/Ext

A Comparison of Immediate Postreduction Splinting Constructs for Controlling Initial Displacement of Fractures of the Distal Radius: A Prospective Randomized Study of Long-Arm Versus Short-Arm Splinting

Matthew R. Bong, MD, Kenneth A. Egel, MD, Matthew Lehman, MD, Kenneth J. Koval, MD

From the Department of Orthopaedic Surgery, New York University Hospital for Joint Diseases, New York, NY.

**Purpose:** To compare, in a prospective, randomized manner, the sugar tong splints with a combination sugar tong-gauntlet splint in terms of patient satisfaction and the ability to maintain reduction of distal radius fractures.

**Methods:** A total of 151 patients with displaced distal radius fractures were enrolled. The patients' inflate results are available for follow-up evaluation and were included in the study population. These were 83 men and 68 women with a mean age of 60 years. Thirty-eight fractures were immobilized in a short-arm radial gutter splint and 47 in a sugar tong splint. Early returnability was compared with the ability to mycotoxins in the radial gutter splint group and 47 in a sugar tong splint. The initial patient cohort concluded that no statistically significant differences were found in terms of patient satisfaction and the ability to maintain reduction of distal radius fractures.

**Results:** A total of 151 fractures showed loss of fracture reduction at the initial follow-up evaluation. Twenty-one fractures immobilized with the radical gutter splint displaced more than 15° of the radial gutter splint immobilized with a sugar tong splint. This difference was not significant. When the sugar tong splints were evaluated based on eight fractures immobilized with the radial gutter splint and 47 in a sugar tong splint, no differences were found in the ability to maintain reduction in both radial and unstable displaced fractures. Patients in the sugar tong radial gutter splint group had significantly better quality of life, shoulder, and elbow scores than those patients whose fractures were immobilized with a sugar tong splint.

**Conclusions:** Both the sugar tong splint and the short-arm radial gutter splint had comparable patient satisfaction. The sugar tong splint is easier to apply and is better tolerated by patients. Based on our study, we recommend the use of a short-arm radial gutter splint for initial immobilization of displaced distal radius fractures.

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**Type of Study:** Single-blinded. Prospective, Level II.

**Key words:** Distal radius, immobilization, splinting.
Sugar Tong vs Short Arm

A Comparison of Immediate Postreduction Splinting Constructs for Controlling Initial Displacement of Fractures of the Distal Radius: A Prospective Randomized Study of Long-Arm Versus Short-Arm Splinting

Matthew R. Bong, MD, Kenneth A. Egel, MD, Matthew Leibman, MD, Kenneth J. Koval, MD

From the Department of Orthopaedic Surgery, New York University Hospital for Joint Diseases, New York, NY.

Purpose: To compare, in a prospective, randomized manner, the sugar tong splint with a short arm splint, in terms of patient satisfaction and the ability to maintain reduction of displaced radial fractures.

Methods: A total of 111 patients with displaced radial fractures were randomized. 80 patients (80 fractures) were included in the study. There were 76 men and 16 women with a mean age of 60 years. The right arm was involved in 65 patients and the left arm in 46. Forty-three patients had a mild fracture and 47 had an unstable fracture. The initial patient follow-up measurement occurred a mean of 4 days after splint application.

Results: A total of 111 fractures showed loss of fracture reduction at the initial follow-up evaluation. Seventy-three fractures were randomized to the sugar tong splint and 38 to the short arm splint. The difference was not significant. When the splint constructs were evaluated based on fracture stability, no difference was found between the splints. Ability to maintain fracture reduction in both stable and unstable displaced fractures. Patients in the short-arm radial shaft fracture group had significantly better Disabilities of the Arm, Shoulder, and Hand scores.

Conclusions: Both the sugar tong splint and the short-arm radial shaft fracture had comparable performance in maintaining the initial reduction of radial fractures. The short-arm splint tolerated better by patients. Based on our study, we recommend the use of a short-arm radial shaft splint for initial immobilization of displaced radial fractures. (J Hand Surg 2019;44:1101-1106.)

Type of study: Level I evidence: Prospective, level II, randomized.

Key words: Distal radius, immobilization, splinting.

Sugar Tong vs Short Arm

Comparable maintenance of reduction

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Type of study: Level I evidence: Prospective, level II, randomized.

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Comparable maintenance of reduction

Short arm more comfortable

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From the Department of Orthopedic Surgery, New York University Hospital for Joint Diseases, New York, NY.

Purpose: To compare, in a prospective, randomized manner, the sugar tong splint with a short-arm radial gutter splint to determine the optimal means to maintain reduction of distal radius fractures.

Methods: A total of 116 patients with displaced distal radius fractures were enrolled. 80 patients (8 fractures each) were randomized at the time of surgery into the following groups: (1) sugar tong splint, (2) short-arm radial gutter splint. Forty fractures had a stable fracture pattern and 46 had an unstable fracture pattern. The initial postoperative manipulation occurred a mean of 4 days after splint application.

Results: A total of 53 fractures showed loss of fracture reduction at the initial follow-up evaluation. Seventeen fractures were randomized with the radial gutter splint. Eleven fractures were randomized with the sugar tong splint. There was no statistically significant difference in terms of the number of patients who required surgery for loss of reduction. Twenty-two fractures were randomized with the sugar tong splint, and 31 were randomized with the short-arm radial gutter splint. No significant difference was noted between the 2 groups. The means of the reduction loss are not statistically different between the 2 groups. The mean percentage reduction loss was 0.1% for the sugar tong splint and 0.2% for the short-arm radial gutter splint. The mean percentage reduction loss was 0.2% for the sugar tong splint and 0.2% for the short-arm radial gutter splint.

Conclusions: Both the sugar tong splint and the short-arm radial gutter splint had comparable performance in maintaining the initial reduction of distal radius fractures. Both the short-arm radial gutter splint and the sugar tong splint are better for patients based on our study. We recommend the use of a short-arm radial gutter splint for initial immobilization of displaced distal radius fractures. (Osteoporos Int. 2007;18:363-369.)

Type of study - Level of evidence: Prospective, level III.

Key words: Distal radius, immobilization, splinting.

Stiffness

- Move fingers immediately

- Splint should not be too distal

(Proximal palmar crease)

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Where to send?

Orthopedic Surgery Clinic

- Mildly displaced fx
- No sensory change
- Closed fx

To ED

- Significant displacement
- Sensory change
- Open fx

When do we operate?

- Intraarticular, unstable, mal-reduced
- Open fractures
- Acute carpal tunnel syndrome
Volar Plate Fixation Versus Plaster Immobilization in Acceptably Reduced Extra-Articular Distal Radial Fractures
A Multicenter Randomized Controlled Trial

Marjolein, et al. JBJS April 2019

(Level 1 RCT)
Acceptably reduced extra-articular distal radius fractures

Operative fixation vs Cast:
- ORIF better functional outcomes after 12 mos (DASH scores)

Acute Carpal Tunnel Syndrome

Differentiate from:

CTS:
- Slow onset
- Not painful

Median nerve injury:
- Symptoms do not worsen
Acute Carpal Tunnel Syndrome

PRESENTATION:
• Rapid onset
• Sudden increase in CT pressure
• Exquisite pain (cannot get comfortable)
  (Akin to compartment syndrome)
• Loss of 2 pt discrimination

REQUIRES
URGENT SURGICAL DECOMPRESSION
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SURGERY (What do we do?)

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Forearm Fractures
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Epidemiology
• Men>Women
• Open fx common
  • 2nd only to tibia)

Mechanism
• High energy > ground level fall

Radius and Ulna Shaft Fx

Mechanism

Indirect trauma
• Axial load through hand
  • “Both bone”
  • Fx at different levels

Direct Trauma
• Direct impact to forearm
  • May have 1 bone fx
  • Both bones fx at same level
Clinical Evaluation

- Gross deformity forearm
- Pain, swelling

**IMPORTANT:**
- Open fracture?
- Check compartments
- Neurovascular exam

Imaging

- AP/Lateral forearm

**IMPORTANT:**
- Image wrist/elbow
- Dedicated views

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Imaging

- Isolated forearm shaft fracture uncommon
- Direct mechanism
  - “Night stick fracture”

Imaging

- Forearm “ring”
- Rings often break in 2 places
- Associated injuries common!
  - Wrist/elbow
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Associated Injuries

Galeazzi Fx
- Distal 3rd radial shaft
- Ipsilateral DRUJ dislocation (ulna)

Monteggia Fx
- Proximal 3rd ulna shaft
- Ipsilateral PRUJ dislocation (radial head)
Treatment

Differentiate from distal radius and ulna fractures!!!
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Treatment

Non-operative
- Rare indications
- Isolated distal 3rd ULNA SHAFT
  - Minimal displacement/angulation

Operative
- Most forearm fractures
- Includes ALL Radius shaft fractures
  - (including non-displaced)

Compartment Syndrome

HIGH INDEX OF SUSPICION!!
Compartment Syndrome

6 Ps

- Pain
- Poikilothermia
- Paresthesia
- Pallor
- Pulselessness
- Paralysis

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PAIN!

- **FIRST** presenting system
- Most sensitive finding
- Pain out of proportion to injury
- Pain with passive stretch of fingers

OPEN FRACTURES

- **Antibiotics**
  - 1st gen cephalosporin
  - Aminoglycoside
  - Penicillin
- **Tetanus**

Operative (Urgent)

- Debridement
- Irrigation
- Fracture fixation
Factors Influencing Infection Rate in Open Fracture Wounds

MICHAEL J. PATZAKIS, M.D., AND JEANETTE WILKINS, M.D.

(CORR 1989)

1104 Open fractures (prospective)

“...most important factor in reducing the infection rate ... early administration of antibiotics ... antibacterial activity against both gram-positive and gram-negative microorganisms. “

Infection rate:
4.7% when antibiotics given <3 hours
7.4% when antibiotics given >3 hours

Surgery (What do we do?)
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CONCLUSION

- Wrist and forearm fractures are common
- Prompt diagnosis is necessary
- Mistreatment can be
  - Cosmetically unappealing
  - Functionally impeding
CONCLUSION

BE WARE!!:

- Distal radius fractures:
  - Acute carpal tunnel syndrome

- Forearm fractures:
  - Compartment syndrome

CONCLUSION

Open Fractures:

Most important intervention to reduce infection rate:

- Prompt antibiotic administration
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