HUMERAL SHAFT FRACTURES: ORIF, IMN, NONOP…What to do?

TRAUMA 101 2018 – FRACTURE CARE FOR THE COMMUNITY ORTHOPEDIST

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DISCLOSURES

● Independent Device Design contract related to SI joint fusion with Mayo Clinic Ventures and CoorsTek Medical

● None related to this talk
GOALS AND OBJECTIVES

• Why the humerus is unique
• Principles of nonoperative treatment
• Surgical indications
• Pros and cons of plating and nailing
• How to manage radial nerve injury
HUMERAL SHAFT FRACTURES

• Different from other diaphyseal fractures
• Acceptable deformity much greater
  • Shoulder ROM
• Leg length inequality ≠ arm length inequality
HUMERAL SHAFT FRACTURES

NON-OP WORKS!
NONOPERATIVE TREATMENT

- Hanging Arm Cast
- Coaptation Splint
- Velpeau
- Abduction Brace
- Functional Brace
TREATMENT PROTOCOL

- Minimal reduction
- Over lateral deltoid
- Upright position
- Until comfortable
FUNCTIONAL BRACE

- Prefabricated vs. custom
- Snug as tolerated
- Add collar and cuff
- Encourage early motion
FUNCTIONAL BRACE

6 weeks

3 mos
FUNCTIONAL BRACING

Balfour et al, JBJS 1982
Zagorski, et al, JBJS 1988
Sarmiento et al, JBJS (Br) 1990
Wallny et al, JOT, 1997
Sarmiento et al, JBJS 2000

UNION RATES: 94-100%
Words of Wisdom

• Apply coaptation splint in ER
  • May check ONE x-ray
  • Let hang out for a week or so
• Change to functional brace
  • May check ONE x-ray
• See back q2-3 weeks for imaging evaluation
• **Must Must** let gravity do its job
• Watch out for varus-producing anatomy
HUMERAL SHAFT FRACTURES

- Almost all patients have some minor deformity and shortening

- Acceptable Healing
  - 20° anterior angulation
  - 20° varus angulation
  - 2.5 cm shortening

- 40% have some loss of shoulder ROM
- 25% have some loss of elbow ROM

Sarmiento et al, JBJS 82A: 478, 2000
OPERATIVE INDICATIONS

• OPEN FRACTURES
  – Significant soft tissue injury that precludes bracing

• FLOATING ELBOW

• VASCULAR INJURY

• POLYTRAUMA

• PATHOLOGIC FRACTURES

• BRACHIAL PLEXOPATHY

• INTRA-ARTICULAR EXTENSION

• FAILURE OF NON-OPERATIVE MANAGEMENT
Bilateral Fractures
OPERATIVE TREATMENT

- ORIF with plates
- Antegrade nails
- Retrograde nails
- Flexible nails
- Flexible locked nails
- External fixation
EXTERNAL FIXATION

- Neurologic risk
  - Radial nerve

- Elbow and shoulder stiffness

- Pin tract infections

- Malunion

- Rarely used definitively
EXTERNAL FIXATION

- Massive soft tissue injury/contamination
- Vascular injury
- Severe polytrauma
ANTEGRADE NAILING

• Closed technique
• Load sharing
• Mechanical advantages
• Consider in:
  • Pathologic fx
  • Segmental fx
  • Polytrauma
  • Osteoporosis
ANTEGRADE NAILING

- Technical factors important:
  - Countersink nail
  - No fx distraction
  - Minimize cuff injury
    - Rotator interval
    - Medial start point
  - Avoid radial n. injury
    - Anatomic reduction or expose
OPEN REDUCTION INTERNAL FIXATION

GOLD STANDARD

- Anatomic reduction/ compression or bridging
- High union rates (96%)
- Exposures extensile
- Allows radial nerve protection
- Early weight bearing
OPEN REDUCTION INTERNAL FIXATION

• Plate size:
  • 4.5 broad LC-DCP
    • Historical
  • 4.5 narrow LC-DCP
    • Current
  • 3.5 LC-DCP
    • Future?

• Over-contour posterior plate

• No shorties!!

• Locking screws typically not necessary
ANTEROLATERAL APPROACH

- Extensile
  - DP proximally
- “Cannot access distal quarter”
- Retract biceps medially
- Elevate brachialis
Alternative Operative Exposures of the Posterior Aspect of the Humeral Diaphysis

WITH REFERENCE TO THE RADIAL NERVE

BY MICHELLE GERWIN, M.D., ROBERT N. HOTCHKISS, M.D., AND ANDREW J. WEILAND, M.D., NEW YORK, N.Y.

Investigation performed at The Hospital for Special Surgery, New York City
Alternative Operative Exposures of the Posterior Aspect of the Humeral Diaphysis

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*Continuation of radial nerve to forearm, piercing intermuscular septum

lower lateral brachial cutaneous nerve

cutaneous nerve

posterior aspect of intermuscular septum

lower lateral brachial cutaneous nerve
## NAIL VS PLATE: PRT’s

Changulani et al., SICOT 2006  
Chapman et al., JOT 2000  
McCormack et al., JBJS[Br] 2000  
Bolano et al., AAOS 1995

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RADIAL NERVE PALSY?
CLOSED FRACTURE

*Pollack et al, JBJS, 1981*

- 24 Radial Nerve Palsies
- Incidence: 11%
- All Resolved Eventually
- 8% (2) Required Late Exploration

**RECOMMENDATION:**
Don’t need to explore early
Spontaneous recovery rate 90-95%
RADIAL NERVE PALSY?
OPEN FRACTURE

Foster et al, JHS, 1993

• 14 Patients with open fractures
• 64% (9) with nerve injury interposed or lacerated

RECOMMENDATION:
Explore and ORIF
**CLOSED FRACTURE**
Radial n palsy after reduction

*Bostman et al., Acta Orthop Scand 1986*

- 59 patients: immediate radial nerve palsy
  - Useful recovery: 46/59 (88%)
- 16 patients: secondary radial nerve palsy
  - Useful recovery: 14/16 (87.5%)

**RECOMMENDATION:**
Exploration not required
(More controversial)
Radial Nerve Palsy After Humeral Shaft Fractures
The Case for Early Exploration and a New Classification to Guide Treatment and Prognosis

Gerard Chang, MD*, Asif M. Ilyas, MD


• 30% don’t recover – explore early to explore

1. Early nerve injury characterization, subsequent early treatment – Time dependent repair and outcomes correlate

2. Early exploration is significantly easier

3. Allows concomitant ORIF = quicker functional recovery and rehab

4. “Facilitates” primary bone healing and decreases chances of 2º bone healing with nerve entrapment
RADIAL NERVE RECOVERY

• Average time to first sign of recovery: 7 weeks
  • But may take as long as 6 months!
• Average time to complete recovery: 6 months
  • But may take as long as 21 months!
Case example
• 75 y/o active male
• Non smoker
• Right side weak from head injury 1968
  • **Mildly** hemiparetic
• 10 weeks after nonop mgmt trial
3 weeks postop
3.5 months later
My Practice: Humeral Shaft Fractures

• Patient history and desires
• Trial of nonop management
• Not 3 months!
  • Pull trigger at 6 weeks
• Plate is my implant preference (4.5 narrow, non-locked)
  • Posterolateral approach (Gerwin-Hotchkiss)
• Nailing-pendulum may swing back in favor
  • Straight nails
SUMMARY

• Closed treatment in most injuries
  • Early functional brace
• Know multiple treatment options
  • Customize care based on pt/injury factors
• Know exposures
• Plates work well – go long or go home!
• Radial nerve injury ≠ surgery?? Discussion…
• Technique, technique, technique!