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

Trauma 101: Fracture Care for the Community Orthopedist

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DISCLOSURES

I have no disclosures

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!

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

NONOPERATIVE TREATMENT
**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

- 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 eval
• 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

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

Triceps Split
Triceps Sparing

Triceps Split
& nerve mobilization
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

<table>
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<th>Shoulder Pain</th>
<th>Radial Nerve</th>
<th>Reoperations</th>
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<td>87</td>
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RECOMMENDATION: Don’t need to explore early Spontaneous recovery rate 90-95%

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 nerve 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 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
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
• Technique, technique, technique!