Humeral Nailing

False accusations

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ST5
Why the bad reputation?!
Poor evidence:

- **Meta-analysis:**
  - Bhandari et al, Acta orthopaedica, 2006
  - 3 RCT
    - Re-operation: RRD 74%, NNT 10
    - Shoulder impingement: RRD 90%, NNT 6
Abstract. 1995 No published data so far.

1:7 (2 impingement)

8:6

Figure 1. Statistical pooling of 3 studies (155 patients) revealed that plate fixation results in a significant reduction in reoperation rates ($p = 0.03$) as compared to intramedullary nail fixation.
Shoulder pain + impingement

Abstract. 1995 No published data so far. 1:6 (5 anti-grade)
6 shoulder dysfunction..nail
6 elbow dysfunction …plate

Figure 2. Statistical pooling of 3 studies (155 patients) revealed that plate fixation results in a significant reduction in shoulder impingement and pain ($p = 0.002$) as compared to intramedullary nail fixation.
Old evidence

- Rodriguez, 1995, JOT:

- RCT 20 patients each,
  - Antigrade nailing Vs DCP
  - ALL UNITED, but:
  - IMN:
    - 19 removal b/c symptomatic
    - All protected in brace for 6 months
Hackethal nails
Old implants & technique

• Hems, 1996, Injury

• The Oxford experience:
  – Russell Taylor nails, interlocking, retrospect.
  – 21 non-pathological:
    • 7 non-union
    • 5 un-satisfactory shoulder function
  – Technical problems nail insertion
  – Fracture and soft tissue distraction.
Criticism to nails

- Non union
- Radial nerve injury
- Shoulder pain, rotator cuff & impingement
  … metal work removal.
Recent evidence
Changulani, 2007, Int. Orth

- RCT
- 23 antigrade reamed Interlocking IMN Vs 24 plates.
  - No difference: union rate, ASES.
  - Nerve: 1 radial... DCP, 1 axillary...IMN
  - 4 shoulder impingement... IMN removed... improved. 19%
  - 3 Deep infection... DCP
  - Union time IMN 6.3, DCP 8.9 wks. (p<0.001)
  - 1 nail broken at distal screw
Chapman, 2000, JOT

- RCT
- 38 IMN antigrade locked Vs 46 DCP
  - No diff
    - non union (3 DCP, 2 IMN)
    - Nerve injury (1 DCP, 2 IMN (PIN))...All recovered
    - Iatrogenic comminution (1:1)
    - Joint dysfunction & stiffness (6 shoulder: 6 elbow)
  - 4:1 removal of metal
  - 3 deep infections...DCP
  - 2 heterotopic ossification...DCP
Putti, 2009, J Orth Surg

- RCT
- 16 IMN antigrade, locked, unreamed Vs 18 DCP
  - No difference
    - Union rate (1 non-union...DCP)
    - ASES (45.2, 45.1)
    - Re-operation (1 DCP, 1 IMN (ROM))
  - IMN:
    - 2 transient radial nerve palsy
    - Shoulder: 1 impingement, 1 frozen shoulder, 13 pain (subsided 1 year)
    - 1 iatrogenic greater tuberosity fracture
  - DCP:
    - 1 Non union surgery
    - 1 frozen shoulder
Accusations

- Non union
- Radial nerve injury
- Shoulder pain, rotator cuff & impingement
  … metal work removal.
Non union

- Linn, 1997, JOT
- Crates, 1998, Clin Orthop
- Redmond, JBJS, 1996
- Shazar, 1998, Orthop
- Rommens, 1995, JBJS
- Rodriguez, 1995, JOT

- Recent Literature:
  - DCP 2-10%
  - IMN 0-8%
Radial nerve injury

• Same incidence in all previous studies
• IMN: don’t see the nerve
  – Risk being entrapped in fracture site

• DCP: can see the nerve (approach)
  – Risk of fibrosis, direct injury, entrapment under plate.
  – Radial nerve sensitive
    • Average to ONSET of recovery 16 wks (5-30)
  – Risk 2-5%

(Wang, 2009, JOT)
• Martinez, 2004, Acta
• Kesmenli, 2003, Acta

• Linn, 1997, JOT
  – 48 prospective IMN, locked Vs 25 DCP retro
  – IMN: all united, no nerve injury, faster
  – DCP: 1nerve, 1 Deep infection, 1 non-union

• ‘indications of nerve exploration were progressive nerve palsy in one patient and spiral fractures with lateral spike with nerve palsy in two patients and without palsy in one patient’
Wang, 2009, JOT

- 707 humerus fixations
- 46 Secondary radial nerve injuries
  - 3 IMN, (+ 4 Ender nails)
  - 39 DCP (DID NOT mention proportion of each fixation)
    - 12: nerve was explored intra-op
    - 5 regained 4/5 power (20-30 wks)
Cognet, Rev Chir Orthop Reparatrice Appar Mot,

- French
- 30 pt. radial nerve palsy + humerus fracture. All explored.
- 30% DCP, 33% IMN
- 6 secondary…. ALL DCP
  - 6 direct conflict w/ plate
  - 10 compression at intermuscular septum
  - 5 nerve graft
  - 2 tendon transfer
• Their conclusion
  – Increase risk of radial nerve injury and persistent palsy in
    • Distal 3rd
    • Spiral
    • PLATE FIXATION

• Be careful if you prefer to “SEE the nerve is intact”
Shoulder problems

• Obvious higher incidence of
  – Removal of metalware
  – Shoulder symptoms

• BUT
  – RCT….. Same functional results
  – Symptoms improve if prominent nail removed
  – Similar problems in Elbow with DCP
  – Some plating patients had frozen and/or painful shoulders
Romens, 2009, JOT

- 99 Synthes Unreamed interlocking nails.
- Acute fractures
  - 9% open
  - 8% polytrauma
  - 5% primary radial palsy
• Not a simple procedure
• Meticulous technique
  – Entry point
    • Cuff incision and repair
    • Screening
  – Compress fracture **BEFORE** locking (manual or compression device)
  – Proximal nail tip below cartilage
• Non union: 3%
• Radial nerve palsy: 3 %
  – All explored, one incarcerated in # site
• Shoulder function (Constant score):
  – 91% excellent, 5.4% good, 2% fair, 1% poor
• Re-operation
  – 3 radial nerve
  – 3 non union
  – 1 relocation of misplaced locking screw
  – 1 superficial wound infection
• Non metal impingement
Accusations

• Non union
  – similar to DCP

• Radial nerve injury
  – similar, maybe less

• Shoulder pain, rotator cuff & impingement
  … metal work removal.
  – Can be minimised to 3% with careful technique
  – DCP …Elbow stiffness and dysfunction.
Advantages

• Preservation of fracture biology and haematoma

• Decreased risk of injury to radial nerve

• Load sharing… Osteoporosis

• Can be faster and easier procedure

• Metal removal ….DCP …radial nerve
Better to nail these
Avoid nailing these

- Spiral + distal third fracture (Holstein-Lewis fractures)
- Primary Radial nerve palsy
Summary

• In the past: nail and technique problems
  BAD REPUTATION
• New nails + good technique = Good results better
• Similar union rate and radial nerve palsy
• Nails have their advantages (fracture biology, load sharing, easy)
• Shoulder problems can be minimized with good technique… **DO NOT** ‘just shove it in’.