Joint Contractures Following Intra-articular Fracture Surgery: Where Are We Now?

Kenneth A Egol MD

Department of Orthopedic Surgery

Disclosure

• Consultant for Exactech
  – Surgeon Designer of a PHLP
  – Royalties

• As PD and Vice Chair for education
  – Receive grants for resident education
  – Stryker, Synthes
  – Research Support
    – Synthes

Intrinsic Components

– Intra-articular adhesion
– Articular malalignment
– Loss of articular cartilage

Extrinsic Components

– Capsular and ligamentous contracture
– Heterotopic ossification
– Extra-articular malunion
– Skin contracture

Introduction
Risk Factors

- Open Fractures
- Burns
- Spinal Cord Injury
- Head Trauma
- Immobilization
- Heterotopic Ossification
- Mal-union
- Patient Compliance
- Compartment Syndrome

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- History
  - Injury
  - Soft tissue status
  - CRPS
- Exam
  - Joint ROM
  - Skin Condition
  - Nerve injury
- Imaging
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Pathophysiology

- Structural Changes of Capsule After Trauma
  - Thicker Capsule
  - Increased collagen (type I, III, and V)
  - Increased collagen cross-linking
  - Decreased proteoglycan and water
  - Disorganized fiber orientation
  - Increased lymphocytic migration
  - Key Cell – Myofibroblast

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Pathophysiology

- Molecular Basis of Arthrofibrosis

- Increases in:
  - Low dose TNF-α
  - Transforming growth factor beta (TGF-β1)
  - Fibronectin ED-A
  - Matrix metalloproteinases (MMP-1,2,9,13,15)

Myofibroblast

- Myofibroblasts
  - Tissue fibroblasts – express
  - Cause collagen contraction
  - Elevated in pathologic fibrotic conditions
  - Number of cells inversely related to range of motion

Elbow

- Non Operative
  - Goal: 100 degrees of motion
  - < 6 Months
  - Splinting
    - Static Progressive
    - Dynamic
Elbow Contracture Release Outcomes: Recent Literature

  - Prospective study of 43 patients
  - Open arthrolysis for posttraumatic elbow stiffness
  - Median gain of 42° in postoperative range of motion (range -50-144°)

  - Prospective study of 54 patients with traumatic elbow contracture
  - Arthroscopic arthrolysis by a single surgeon
  - Improvement in range of motion both intraoperatively and in follow-up
  - Some loss at final follow-up 2 years (124°±22°)

  - Retrospective study of 103 patients
  - Open posttraumatic elbow contracture release
  - Result in full range of motion to achieve flexion/extension arc of motion of 124°±2°
  - 88 patients ultimately achieving flexion/extension arc > 100°
### Knee

**Knee- Operative Treatment**

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Type of Release</th>
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<tbody>
<tr>
<td>Arthroscopic Release</td>
<td>Posterlateral.</td>
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<td>Open quad ITG</td>
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<td>Posterior Release</td>
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</tbody>
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**Key: MA: Medial Anterior; AL: Anterior Lateral; ML: Medial Lateral; VL: Vastus Lateralis**

### Knee Contracture Release Outcomes: Recent Literature

- **Knee Contracture Release Outcomes:**
  - **Recent Literature:**
      - Retrospective evaluation of 31 patients
      - Modified quadricepsplasty technique
      - 51\% of patients had good results and 19.35\% had excellent results at 1 year
      - Increased range of knee motion at 1 year: -82°.

      - Retrospective review of 14 patients
      - Arthroscopic lysis of adhesions following fractures
      - Mean total ROM increased 72° to 127°
      - Mean pre-op in-office total ROM was 73°, increased to 104° at latest follow-up.

      - Prospective study
      - Comparing minimally invasive arthroscopic arthrolysis with conventional open arthrolysis (quadricepsplasty)
      - Minimally invasive group had better results (95.0\% vs 73.33\%)
      - Better postoperative final joint range of motion (104.75°±17.87° vs 90.67°±19.64°)
Heterotopic Ossification - Hip

- **RISK FACTORS**
  - Spinal Cord and Traumatic Brain Injury
  - Incidence 10 - 53%
  - Correlates with injury level and severity
  - Thermal Injury
  - Burns >20% of surface area
  - Soft tissue contracture vs. HO
  - Hip Arthroplasty
  - Increased risk with approach, ischemia time, and cemented implants
  - Fractures
  - Acetabular fractures
  - Trochanteric flip lowest risk
  - Ventilator dependency higher risk

**Prevention**

- **NON-OPERATIVE MANAGEMENT**
  - Radiation
    - 700 - 800 cGy 24 hours pre-op or 48-72 hours post-op
    - Prevalence of HO decreases to 25%
  - NSAIDs
    - Inhibit osteogenic differentiation
    - Selective Cox 2 equally as effective as NSAIDs
  - Bisphosphonates
    - First generation - inhibit osteoclasts and osteoblasts
    - Conflicting data on efficacy
    - Potential to help with burn injuries and SCI

**Operative Management**

- **WHEN TO INTERVENE - Excision**
  - Painful ROM
  - Mechanical block to ROM
  - Progression of HO
  - CT - assess intra-articular lesions
  - Evaluate bone mineral density
  - Early resection - may prevent intra-articular complications
Hip Heterotopic Ossification Excision Outcomes: Recent Literature


- Review of 18 patients undergoing severe heterotopic ossification (HO) excision after ORIF of acetabular fractures.
- Combined radiation and indomethacin
- Mean Harris hip score was 84.5 (range 38-100) at 5 years
- Mean hip joint arc was 144° (range 90°-260°)


- Review of 26 patients
- Mean hip flexion-extension arc significantly improved almost 100 degrees
- Mean Harris hip score improved from 58.1 pre-op to 82.5 post-op.

Summary

- Uncommon but significant complication following trauma
- Careful history and physical exam is key
- Advances imaging to assess intrinsic vs extrinsic causes
- Pathophysiology related to changes in the joint capsule and heterotopic bone
- Surgical intervention is effective
- Prophylaxis does not appear to be
Bibliography


