NYU Langone Health

Department of Orthopedic Surgery

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

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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

Introduction

- **Intrinsic Components**[1]
  - Intra-articular adhesion
  - Articular malalignment
  - Loss of articular cartilage
- **Extrinsic Components**
  - Capsular and ligamentous contracture
  - Heterotopic ossification
  - Extra-articular malunion
  - Skin contracture

Courtesy Eric Strauss MD

Risk Factors

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

Courtesy Kenneth Egol MD

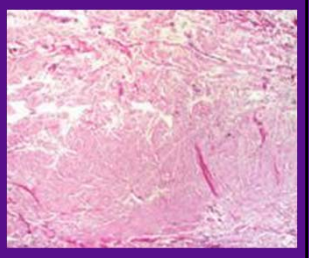
Work Up

- History
  - Injury
  - Soft tissue status
  - CRPS
- Exam
  - Joint ROM
  - Skin Condition
  - Nerve injury
- Imaging
  - XRAY, CT, MRI

Courtesy Kenneth Egol MD

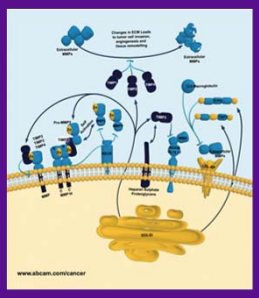
Pathophysiology

- 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



Pathophysiology

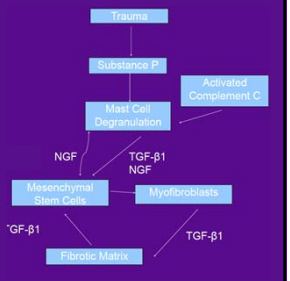
- **Molecular Basis of Arthrofibrosis**
- **Increases in:**
  - Low dose TNF-α
  - Transforming growth factor beta (TGF-β1) Fibronectin ED-A
  - Matrix metalloproteinases (MMP-1,2,9,13,15)



Abcam.com

Myofibroblast

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



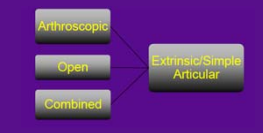
Elbow

- Non Operative
  - Goal: 100 degrees of motion
  - < 6 Months
  - Splinting
    - Static Progressive
    - Dynamic

Google Images

Elbow

- Operative
  - Goal: 100 degrees of motion
  - Arthroscopic
    - Technically Challenging
    - Useful for simple, intrinsic contractures=Arch of motion > 80 degrees4
    - Contraindications: Previous nerve transposition, severe contracture, extrinsic cause

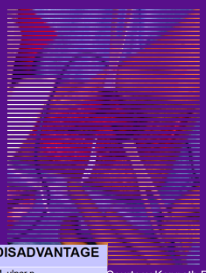


Courtesy Laith Jazrawi MD

Courtesy Kenneth Egol MD

Elbow

- Operative
  - Open
  - Front door to elbow is in the back
  - Identify and mobilize nerves
  - If complex intraarticular malunion
    - May require TEA



Courtesy Kenneth Egol MD

	ADVATAGE	DISADVANTAGE
Lateral	A, P, L, Good outcomes, Increased patient satisfaction	M, ulnar n.
Posterior	A,P,M,L, Ulnar n.	Extensive
Medial	A,M,P, MCL, Ulnar n.	L, Not performed in isolation
Anterior	A, M, L	Posterior, NV damage

Key: Anterior (A), Posterior (P), Medial (M), Lateral (L)

Elbow Contracture Release Outcomes: Recent Literature

- Pettersen, Petter Morten, et al. "Increased ROM and high patient satisfaction after open arthrolysis: a follow-up-study of 43 patients with posttraumatic stiff elbows." *BMC musculoskeletal disorders* 17.1 (2016): 74.
  - Prospective study of 43 patients
  - Open arthrolysis for posttraumatic elbow stiffness
  - Median gain of 42° in their postoperative range of motion (range -50-144°)

Lubiatowski, Przemysław, et al. "Prospective outcome assessment of arthroscopic arthrolysis for traumatic and degenerative elbow contracture." *Journal of shoulder and elbow surgery* (2018).
  - Prospective study of 54 patients with extrinsic elbow contracture
  - Arthroscopic arthrolysis by a single surgeon
  - Improvement in flexion/extension ROM both intraoperatively and in follow-up.
  - Some loss at final follow up- 2 years (124°±22°).

Haglin, Jack M., et al. "Open surgical elbow contracture release after trauma: results and recommendations." *Journal of shoulder and elbow surgery* 27.3 (2018): 418-426.
  - Retrospective study of 103 patients
  - Open posttraumatic elbow contracture release
  - Resulted in a significant mean increase to elbow flexion/extension arc of motion of 52°±18°
  - 88 patients ultimately achieving flexion/extension arc > 100°

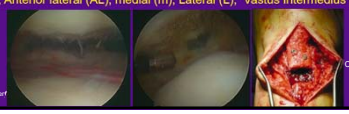
Knee

- Causes Extension
  - Posterior impingement
  - Anterior adhesions
  - Soft tissue retractions
  - Patella Baja
- Causes Flexion
  - Anterior impingement
  - Contraction of ACL/PCL
  - Posterior joint capsule contracture
  - Gastroc contracture

Knee- Operative Treatment

	Arthroscopic Release	Open quad Release	TTO	Posterior Release
Indication	Flexion +/- Extension	Extra-articular Flexion	Flexion + patella baja	Extension
Approach	Portals: AM/AL, Accessory MSP/LSP	Lateral retrovastus approach to femur	Midline	Posterior Medial +- Lateral
Technique	Suprapatellar bursa, M/L patellar retinaculum, femoral adhesions, Infrapatellar fat pad	Do not release scar tissue directly off femur, consider release of rectus tendon +/- VI	Proximalization planed to achieve ideal ratio. Extensive retinacular release. Bone cuts 5-7x2cm. Secure w/ 2, 4.5mm Screws	Must due anterior release first to achieve flexion. Release capsule off femur. Add lateral release if more extension is needed. Can release gastroc

Key: Anterior medial (AM), Anterior lateral (AL), medial (m), Lateral (L), Vastus Intermedius (VI)



Courtesy Eric Strauss MD

Knee Contracture Release Outcomes: Recent Literature

Persico, Federico, et al. "Treatment of extraarticular knee extension contracture secondary to prolonged external fixation by a modified Judet quadricepsplasty technique." *Strategies in Trauma and Limb Reconstruction* 13.1 (2018): 19-24.

- 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°.

Giltings, Daniel, et al. "Arthroscopic lysis of adhesions improves knee range of motion after fixation of intra-articular fractures about the knee." *Archives of orthopaedic and trauma surgery* 136.12 (2016): 1631-1635.

- 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.

Xing, Wenzhao, et al. "Comparison of minimally invasive arthrolysis vs. conventional arthrolysis for post-traumatic knee stiffness." *Journal of Orthopaedic Science* 23.1 (2018): 112-116.

- 70 patient 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 FACTORS2**
- • 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
    - Inhibits 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 INTERVENE8- 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

Wu, Xin-Bao, et al. "Surgical resection of severe heterotopic ossification after open reduction and internal fixation of acetabular fractures: a case series of 18 patients." *Injury* 45.10 (2014): 1604-1610.

- 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 194° (range 90°-260°)

Macheras, George A., et al. "Results from the surgical resection of severe heterotopic ossification of the hip: a case series of 26 patients." *European Journal of Orthopaedic Surgery & Traumatology* 27.8 (2017): 1097-1102.

- 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

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Thank You

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