Elbow Interventional Techniques and PRP

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Outline
- Joint
- Bursa
- Cyst
- Tendon treatments

Joint / Bursa: Aspiration and Injection
- Aspiration:
  - Infection, crystal disease
- Injection:
  - Anesthetic: Lidocaine, Ropivacaine
  - Steroids
  - Therapeutic or diagnostic

Elbow Joint
- Olecranon recess
- Elbow flexed
- In plane
- Lateral to medial

Olecranon Bursa
- Arm extended
- Axial plane
- Lateral to medial
- Avoid cubital tunnel
Cyst Aspiration

- Ganglion cyst:
  - Large bore needle
  - Wrist, knee: lobular, anechoic or hypoechoic
- Other cysts:
  - Paralabral cysts: shoulder and hip labrum
  - Paramensical cysts

“Cyst” Algorithm

- Multilocular
- Non-compressible
- Bursa: anatomic or adventitious
- Direct Trauma
- Other
  - Ganglion cyst
  - Paralabral cyst, paramensical cyst
  - Inflammatory:
    - Rheumatoid
    - TB, fungal
    - Pannus
    - Synovial osteochondromatosis
  - Hematoma
  - Seroma
- Solid Neoplasm:
  - Myxoid liposarcoma
  - Synovial Sarcoma

Percutaneous Tendon Treatments

- Corticosteroid
- Fenestration (dry needling, tenotomy)
- Hyperosmolar dextrose, prolotherapy
- Whole blood (autologous)
- Platelet-rich plasma
- Stem cells
- Other: deer antler velvet, amniotic membrane


Tendinosis

- Terms used instead of tendinitis
- No acute inflammatory cells
  - Primarily mucoid degeneration
  - Chondroid metaplasia
- Ultrasound:
  - Hypoechoic tendon
  - Heterogeneous, ill-defined
  - Possible increased thickness


Peritendon Steroid Injections

- Shoulder: minimal transient pain relief
- Elbow: common extensor tendon
  - Pain returns worse than before injection
- Gluteal:
  - 72% showed improvement at 1 month
- Hamstring:
  - 24% had symptom relief beyond 6 months

Coombes BK et al. JAMA 2013; 309:461
Labrosse JM et al. AJR 2010; 194:202
Zissen MH et al. AJR 2010; 195:993
Tendon Fenestration
• Also called "dry-needling" or tenotomy
• Needle repeatedly passed through areas of tendinosis
• Disrupts area of tendinosis
• Bleeding causes release of growth factors
• Stimulates tendon healing

Fenestration: technique
• No NSAIDS x 2 weeks prior
• Ultrasound guidance: in plane
  – Long axis to tendon
• 20 or 22 gauge needle
• 20 – 30 passes until area soft
• Minimal Lidocaine: over tendon

Fenestration: technique
• Cover entire tendon abnormality
• Contact bone if at tendon abnormality
• Pull needle out of tendon to redirect
• Also redirect medial to lateral
  – Pivoting at needle entrance
  – Cone-shaped area

Fenestration: technique
• Contraindications:
  – Not delineated in literature
  – Prior steroid injection < 3 months ago
  – Bleeding disorders
  – Infection
  – Tendon tear > 50% thickness?

Post-procedure:
• No ice
• Rest for 2 weeks
  – Daily activities okay
  – Gradual return to activities
• Follow-up:
  – Referring physician, physical therapy
• No NSAIDS: 2 weeks

Tendon: healing
• Inflammatory phase
  – First week after injury
  – Fibrin clot
  – Cell migration, neovascularity
• Proliferation phase
  – 1 to 4 weeks
  – Fibroblasts synthesize collagen and extracellular proteins
• Remodeling phase

Galloway MT et al. JBJS 2013; 95:1620
Common Extensor Tendon (Elbow)

- 58 patients
- Outcome: average 28 months
  - Pain level and difficulties with related activities
  - 64% excellent, 16% good, 7% fair, 13% poor
  - No adverse effects
- Follow-up study: 57 patients
  - 93% excellent or good results
  - Corticosteroid injection not needed

Discussion: other treatments

- Fenestration is often combined with other treatments:
  - Platelet-rich plasma or whole blood injection
  - Hyperosmolar dextrose or prolotherapy
- Common extensor tendon (elbow):
  - There is no benefit of injecting steroids during tenotomy
  - Risk of tendon rupture

Whole Blood Injection

- Autologous whole venous blood
- Injected into abnormal tendon during fenestration
- Release of growth factors that will promote healing
- Refractory tendinopathy may be helped
  - Additional studies are needed

Kampa RJ et al. Int J Clinical Practice 2010; 64:1813

Whole Blood Injection: Common Extensor Tendon

Biceps Brachii Tendon: whole blood injection

Whole Blood Injection + Fenestration
Platelet-Rich Plasma

- Autologous venous blood
- Centrifuged
- Concentrated platelet sample
- Platelets degranulate:
  - Alpha granules: contain 95% of growth factors
  - Secrete additional growth factors (7 days)
  - Bind to cell membrane receptors: healing


Platelet-Rich Plasma: uses

- Historically:
  - Used in maxilla-fascial surgery: 1990’s
- Other surgeries:
  - Fracture, non-union, bone fusion
- Cosmetics:
  - Alopecia, scars, wrinkles
- Tendon and ligament injuries
- Osteoarthritis


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PRP: what’s in the mix

- Platelet count:
  - 500K ideal (in vitro)\(^1\)
  - Tenocyte proliferation, migrations, collagen type I production
  - Less effectiveness if higher, even cell death
- White blood cells:
  - Leukocyte poor or rich concentrations
  - Poor: less catabolic cytokines, more healing\(^2\)

\(^2\)McCarrel TM et al. JBJS 2012; 94:e143

PRP: Arthrex

- One of many available systems
- Double syringe system
- Leukocyte poor
- No anticoagulant needed
- Venous draw: 15 ml
- Place directly in centrifuge: 5 min
- 2 - 5 ml PRP
- Platelet concentration: 200 – 500K

Post-procedure:

- Patellar tendon:
  - Knee brace (locked) x 2 weeks
  - First week non-weight bearing with crutches
- Achilles tendon:
  - Walking boot x 2 weeks
- Follow-up: referring physician + physical therapy
**PRP: safety**

- Pain: up to several days
- Risks:
  - Infection: PRP has antibacterial effects
  - Tumor:
    - Insulin-like growth factor (IGF) linked to cancer
    - IGF is **not** elevated in PRP preparations


**PRP: injections**

- Tendon
- Muscle
- Ligament
- Osteoarthritis
- Cartilage

**Common Extensor Tendon: PRP**

- 22-gauge needle
- In plane with transducer and long axis to tendon
- Fenestrate prior to or during PRP injection
- Most common: one treatment

**Common Extensor Tendon**

- PRP vs fenestration: 230 subjects
  - 24 weeks: PRP higher success (84% vs 68%)
- PRP, fenestration, steroid (in tendon):
  - No significant difference
- PRP vs whole blood: **no difference**

**Common Extensor Tendon**

- PRP vs steroid (+fenestration)
  - **PRP significantly better at 2 years**
- Metaanalysis: **inconclusive**
- PRP is superior to steroids
- PRP is equal to lidocaine
  - Martin GI, J Ortho Surg Res 2019; 23:14

**PRP: Gluteus Minimus**

- Long Axis
PRP and Tendon Injection

- Gluteal Tendons: greater trochanter
  - Randomized controlled: 30 patients
  - PRP versus fenestration alone
  - Significant improvement at weeks 1 and 2
  - Approximately 80% had long term improvement: up to 1 year follow-up
  - No difference between treatment groups\(^1\)
  - Two injections: more sustained response\(^2\)

\(^1\)Jacobson JA et al. J Ultrasound Med 2016; 35:2413

PRP and Tendon Injection

- Gluteal Tendons: greater trochanter
  - Randomized controlled: 80 patients
  - PRP versus steroid injection
  - Ultrasound-guided: 5 – 6 needle passes
  - Patients with > 4 months of symptoms had greater clinical improvement with PRP at 12 weeks


PRP: proximal patellar tendon

Step #1: tendon fenestration

Fenestration
Post-fenestration

PRP and Tendon Injection

- Patellar tendon
  - Randomized controlled: 23 patients
  - PRP + fenestration versus fenestration alone
  - PRP better at 12 weeks, no different at 26 weeks\(^1\)
  - PRP no better than saline\(^2\)

PRP and Tendon Injection

- Achilles tendon
  - Randomized controlled: 54 patients
  - PRP versus saline injection
  - No significant difference at 24 weeks\(^1\) and 1 year\(^2\)

- Metaanalysis
  - PRP + eccentric physical therapy compared with saline
  - No difference in outcomes: clinical or ultrasound findings\(^3\)

\(^1\) de Vos RJ et al. JAMA 2010; 303:145
\(^3\) Zhang YJ. Clin Orthop Relat Res 2018; 39:1623

PRP and Tendon Injection

- Rotator cuff
  - PRP not beneficial\(^1\)

- Supraspinatus
  - Interstitial tear
  - No difference between PRP and saline\(^2\)

\(^1\) Hurley ET et al. Arthroscopy 2019; 35:1584

PRP and Tendon Injection

- Plantar fascia
  - PRP versus corticosteroid (40 patients)
  - PRP more effective and durable

Monto et al. Foot Ankle Int 2014; 35:313

PRP and Muscle Injection

- Proximal hamstring
  - PRP versus rehabilitation only
  - Randomized controlled: 28 patients
  - PRP group: full recovery earlier
    - 27 days versus 42 days (average)


PRP and Muscle Injection

- Gastrocnemius: rat model
  - PRP versus saline injection: 46 rats
  - Followed to 14 days
  - Outcome: strength and histologic analysis
  - No significant difference between groups


Adductor Tear: PRP

- Target: tendon tear
- Efficacy uncertain
**PRP and Muscle Injection**
- Hamstring
- PRP versus rehabilitation alone
- 10 National Football League players
- Median time: return to play
  - PRP = 20 days vs. rehabilitation = 17 days
- No significant difference between groups


**PRP and Ligament Injection**
- Ulnar collateral ligament: elbow
  - Partial tear on MRI
  - 34 athletes: followed for 70 weeks
  - 88% returned to play, average 12 weeks
  - Joint space widening:
    - Decreased from 28 to 20 mm
    - Change in widening: 7 to 2.5 mm


**PRP and Knee Osteoarthritis**
- Several studies evaluating PRP and knee OA
- Most studies show superior results with leukocyte-poor PRP compared with saline or hyaluronic acid
- Mild OA responds better
- No anatomic information
- One study showed same results with 1 or 2 injections

Wang D. et al. JBJS Reviews 2017; 5:1

**PRP and Cartilage**
- Meta-analysis: 21 papers
- Increased chondrocyte and mesenchymal stem cell proliferation
- Proteoglycan and Type II collagen deposition
- Increase chondrocyte viability
- Migration of stem cells
- Hyaline vs. fibrocartilage?


**Labrum: PRP**
- Platelet-rich plasma injection
- Inject into labral tear (yellow arrow)
- Efficacy unknown

White arrowheads = needle
PRP and Meniscus

- 15 patients
- US-guided PRP injection
- Meniscal degeneration
- 67% had functional improvement
- Grade 2 degeneration improved to Grade 1

Ozyalvac ON. et al. J Ortho Surg 2019; 28:1

PRP: issues

- Different PRP systems
  - Variable platelet concentrations
  - Leukocyte poor versus rich
- Studies:
  - Variable controls, often unblinded
  - Often not compared to other treatments
  - Variable follow-up time points
  - How many injections?
  - Acute versus chronic conditions?
  - Which tendon?

PRP: where are we today?

- Promotes healing, does not cause harm
- Need: randomized controlled trials
- Meta-analysis:
  - No conclusive evidence to support PRP use
  - Supports ultrasound-guided leukocyte-rich PRP for tendinopathy (still controversial)
  - Supports use for knee osteoarthritis
- Accuracy? What about cost effectiveness

1Sheth U. et al. JBJS 2012; 94:298
2Fitzpatrick J. et al. AJSM 2017; 45:226
3Wang D. et al. JBJS Reviews 2017; 5:1

Take Home Points

- Joint or bursa:
  - Aspiration or injection
- Cyst: large bore needle
- Fenestration / Tenotomy:
  - Is effective, do not inject steroids
- PRP: not proven better than other treatments
  - What about cost effectiveness?

Syllabus on line and other educational material:
www.jacobsonimskus.com
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