Impact of Musculoskeletal Ultrasound Imaging in Guiding Minimally Invasive Treatments

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Overview

• Real time US imaging allows interventions that are otherwise either difficult or impossible
• Interventions can be
  – Diagnostic
  – Therapeutic
  – Both diagnostic and therapeutic

Procedure Details

• Aseptic conditions
  – Chlorhexidine scrub
  – Sterile drapes and probe cover
• Local anesthetic: 1% lidocaine
• Free-hand technique

Hematoma in Pro Football Player

AIDS Patient with Muscle Pain, Fever

Hypoechoic collection in rectus femoris muscle
Muscular Abscess in AIDS Patient
Power Doppler Confirms Inflammation, Guides Aspiration

Muscular Abscess in AIDS Patient
Needle aspiration confirms pyomyositis; catheter placed

Joint Aspiration
- Often referred to ultrasound after “dry tap”
- Send fluid for crystals, culture and sensitivity
- Decompression alleviates symptoms

Aspiration of Shoulder Effusion

Aspiration of Shoulder Ganglion

Hemophiliac with Fever and Shoulder Pain
Transverse
Longitudinal
Elbow Effusion in Gout

Elbow RA: Where to Tap the Joint?

Ultrasound Guides Successful Aspiration

Septic Hip Effusion

Hip Aspiration in Patient with Osteoarthritis

Septic Knee Effusion
Foot Ganglion

Aspiration of Foot Ganglion

Knee Ganglion in Runner

Baker’s Cyst Aspiration

Baker’s Cyst Aspiration: Attempt number 2

Lateral Knee Effusion Communicates With Baker’s Cyst
Baker’s Cyst Aspiration: Attempt Number 3 with Tourniquet

Therapeutic Injections

- Inject combination of steroid and local anesthetic
  - Total volume depends on size of injected joint, bursa, etc.
  - 0.5 to 2cc triamcinolone (40 mg/cc) or equivalent mixed with lidocaine or bupivacaine
- Monitor injection in real time
- Assess for symptomatic relief

Subdeltoid Bursa Injection

Injection of Iliotibial Band Bursitis in a Runner

Biceps Tenosynovitis

Biceps Tendon Sheath Injection
PTT Tenosynovitis

Baker's Cyst with Pannus

Hip Labral Cyst Injection

Hip Injection: Real Time

Guidance for Hip Injection in Osteoarthritis
Power Doppler confirms correct site

Morton’s Neuroma Injection
Calcific Tendinosis of Supraspinatus
Percutaneous needle fenestration / aspiration

Treatment of Rotator Cuff Calcification

Calcific Tendinosis

Arthroscopic Removal of Calcium

Treatment of Gluteus Medius Calcifications
Why “Tendinosis”?

- “Tendinitis” implies inflammation
- Histological analysis of chronic tendon conditions demonstrates scant, if any inflammation

Histologic Correlation

Normal Tendinosis

Tendinosis

- Disorganized collagen fibers
- Increase in mucoid ground substance
- Random neovascularization
- Focal necrosis
- Fibrocartilaginous metaplasia
- Calcification
- Interstitial tearing

Tendinosis

- Difficult to treat
- Often has prolonged course which ultimately leads to surgery
- To avoid surgery, less invasive treatments can be tried

Percutaneous Tenotomy

- Tennis elbow
  (Dunkow, et al. JBJS 2004; 86B: 701-704)
- Achilles tendinosis
- Patellar tendinosis

Percutaneous Needle Tenotomy

- Tennis elbow
- Rotator cuff
  (Aina, et al. Radiology 2001; 221: 455-461)
**Percutaneous Needle Tenotomy**

- Repetitive needling of abnormal tendon
- Break up degenerated, calcified scar tissue
- Create bleeding
- Stimulate healing

**Percutaneous Needle Tenotomy**

- Principle can be applied to any tendinotic area
  - Rotator cuff
  - Common extensor tendon
  - Patellar tendon
  - Achilles
  - Plantar fascia

**Percutaneous Needle Tenotomy**

- Local anesthetic
- 18-22 G needle is guided through abnormal region of tendon
- Scar and calcification is broken up
- Edge of bone is abraded

**Selection criteria**

- Chronic pain and disability
- Failed at least 3 of the following
  - Localized corticosteroid injection
  - NSAID's
  - Counterforce bracing
  - Physical therapy
  - Cock-up wrist splints

**PNT for Tennis Elbow**

- Ultrasound-guided needle insertion
- Needle is inserted into the tendon to break up scar tissue
- Needle is withdrawn

**PNT for Tennis Elbow**

- Image of ultrasound-guided needle insertion
- Needle is inserted into the tendon to break up scar tissue
- Needle is withdrawn
PNT for Tennis Elbow

Needle Removing Enthesophyte at Lateral Epicondyle of Elbow

Follow-up Study
Non-steroid Group

- 58 patients responded to phone survey
- 6 months-5 years follow-up
- 62% of patients: excellent results
- 20% good results
- 18% fair or poor results
- No major complications

Results

- McShane, et al, RSNA 2006
- 52 patients responded to phone survey
- 6 months-3 years follow-up
- 58% (30/52): excellent results
- 35% (18/52): good results
- 7% (4/52) fair or poor results
- No major complications
51-year-old Runner With Heel Pain, Achilles Tendinosis

PNT of Achilles Tendon

38-Year-Old Woman with 2 years of increasing right “hip” pain

MRI of hip negative x 2
MRI of LS Spine Negative
US of Tender Area: Right Iliac Crest

Iliac Bone

Bilateral Comparison

External Oblique Tendinosis

“Blackjack dealer’s hip”

External Oblique Tendinosis Treatment

Football Player with Groin Pain

Adductor Tendinosis Treatment
**US-Guided Partial Plantar Fasciotomy**

- Fields S, et al. Presented at RSNA 2005
- 30 patients with persistent plantar fasciitis
- 18 Gauge needle
- Repeated puncture of fascia
- 1 ml of steroid injected
- All patients showed improvement
- No complications

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**Plantar Fasciitis**

![Image of Plantar Fasciitis]

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**US Guided Nerve Blocks**

- Most often used for temporary blockade
- Eases performance of musculoskeletal interventions
- Can supplement with local lidocaine

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**Ultrasound Guided Tibial Nerve Block**

![Image of Ultrasound Guided Tibial Nerve Block]

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**Plantar Fasciitis Needle Therapy**

![Image of Plantar Fasciitis Needle Therapy]

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**Other US-Guided Treatment Alternatives**

- Shock wave therapy
- Sclerosis of neovessels
- Whole blood injection
- Growth factor (PDGF) injection
- Dextrose injection
- Stem cell injection
14 y.o. Soccer Player Felt a “Pop” and Acute Pain

Normal muscle

Rectus femoris tear

Femoral Nerve Block

Rectus Femoris Tear: Treatment

Healed Muscle Tear

Baseline

Follow-up

The Future: A Logical Progression

• Open surgery
• Arthroscopic surgery
• Ultrasound guided surgery?

Carpal Tunnel Syndrome

• Carpal Tunnel release can now be done endoscopically
• The endoscope adds to the morbidity, although less so than open release
Carpal Tunnel Syndrome: Pretreatment

Carpal Tunnel Syndrome: Treatment

Trigger Finger Release

24-year-old professional tennis player with arm weakness

Normal Posterior Interosseous Nerve

Posterior Interosseous Nerve Entrapment
Posterior Interosseous Nerve Release

Conclusions
- Wide range of US-guided procedures in sports medicine
  - Aspirations
  - Injections
  - Needle tenotomy
  - Fasciotomy
  - Trigger finger releases
  - Nerve releases
- Great potential for future investigation