

## ***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

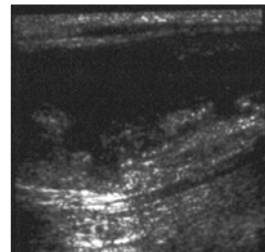


### ***Hematoma in Pro Football Player***



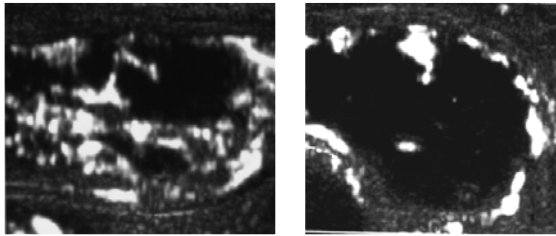
### ***AIDS Patient with Muscle Pain, Fever***

Hypoechoic collection in rectus femoris muscle



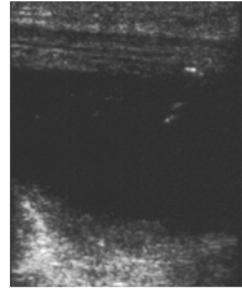
### **Muscular Abscess in AIDS Patient**

Power Doppler Confirms Inflammation, Guides Aspiration



### **Muscular Abscess in AIDS Patient**

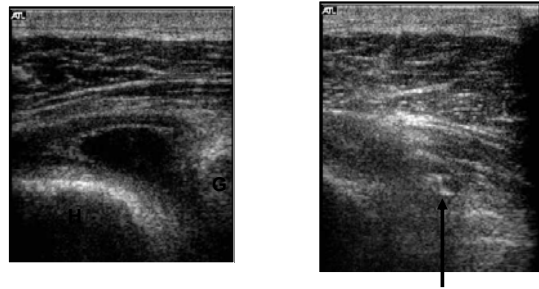
Needle aspiration confirms pyomyositis; catheter placed



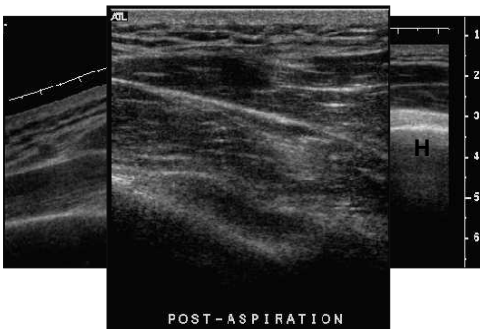
### **Joint Aspiration**

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

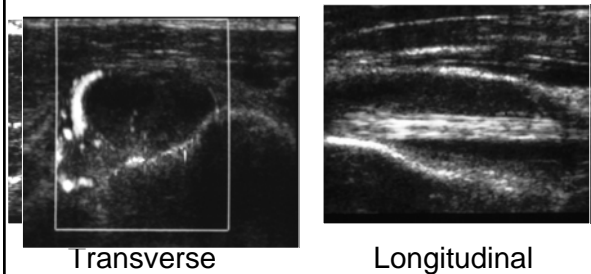
### **Aspiration of Shoulder Effusion**



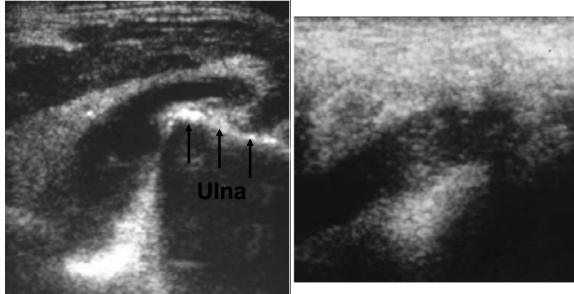
### **Aspiration of Shoulder Ganglion**



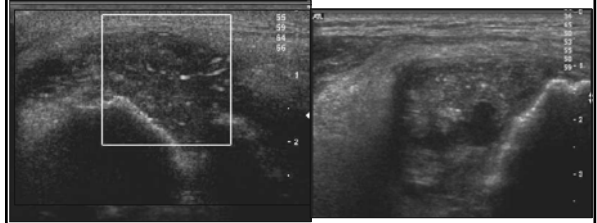
### **Hemophiliac with Fever and Shoulder Pain**



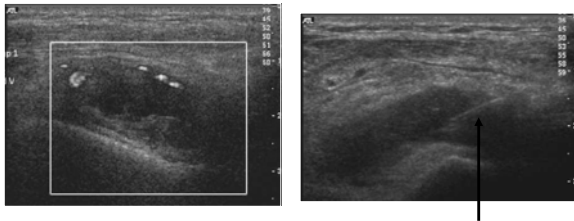
**Elbow Effusion in Gout**



**Elbow RA:  
Where to Tap the Joint?**

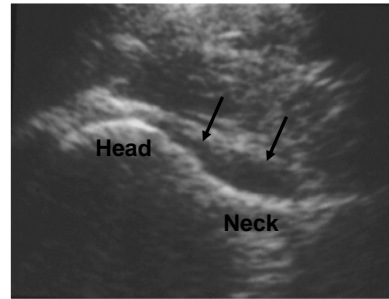


**Ultrasound Guides Successful  
Aspiration**

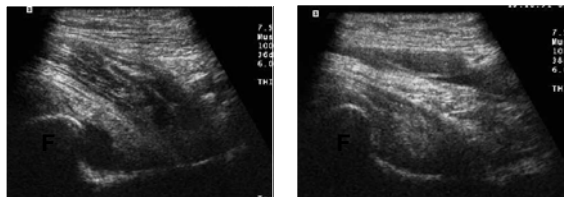


**Septic Hip Effusion**

Longitudinal US



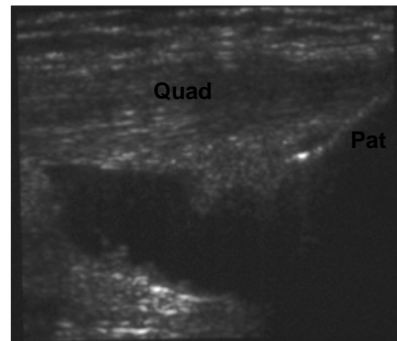
**Hip Aspiration in Patient with  
Osteoarthritis**



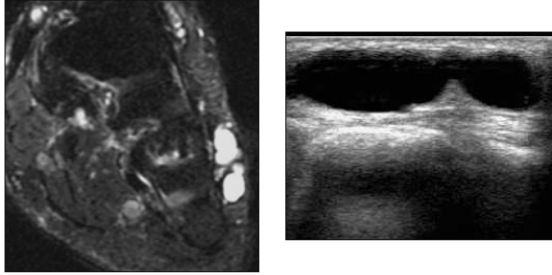
Before

After

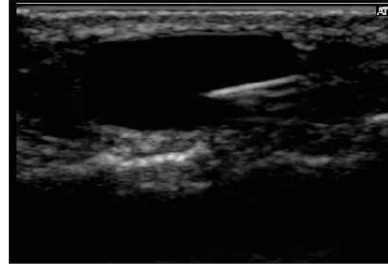
**Septic Knee Effusion**



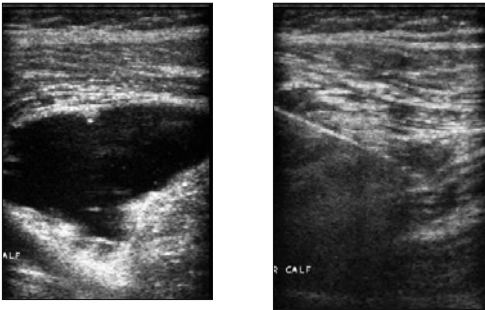
**Foot Ganglion**



**Aspiration of Foot Ganglion**



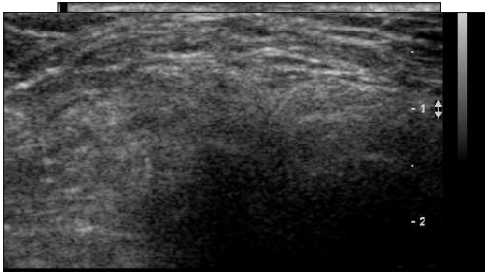
**Knee Ganglion in Runner**



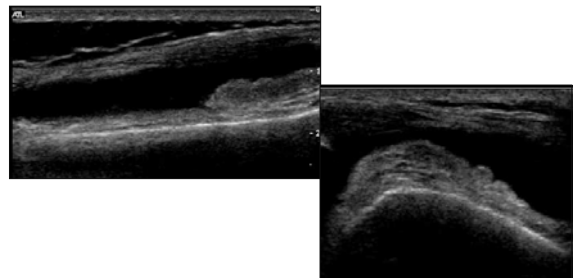
**Baker's Cyst Aspiration**



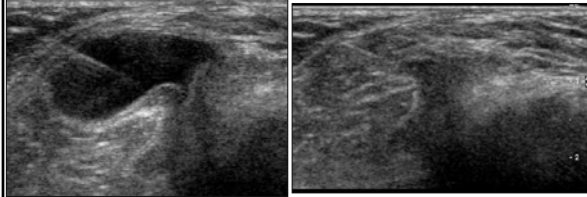
**Baker's Cyst Aspiration:  
Attempt number 2**



**Lateral Knee Effusion  
Communicates With Baker's Cyst**



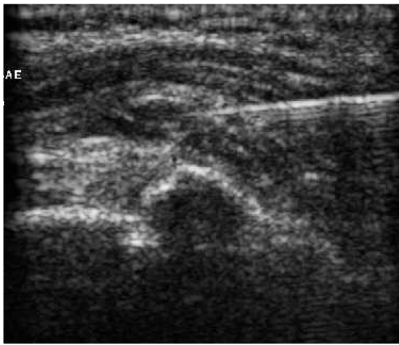
**Baker's Cyst Aspiration:  
Attempt Number 3 with  
Tourniquet**



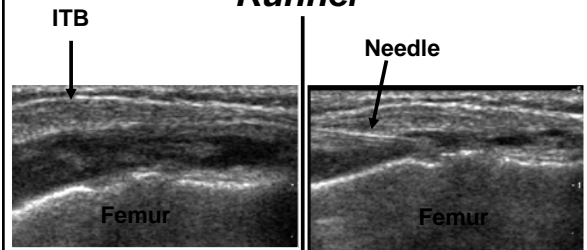
**Therapeutic Injections**

- 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**

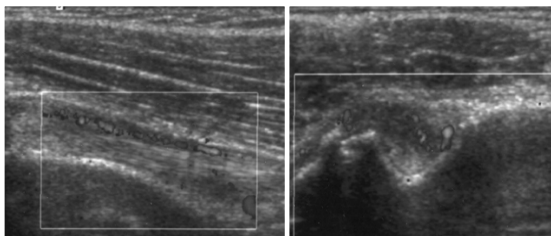


**Injection of Iliotibial  
Band Bursitis in a  
Runner**

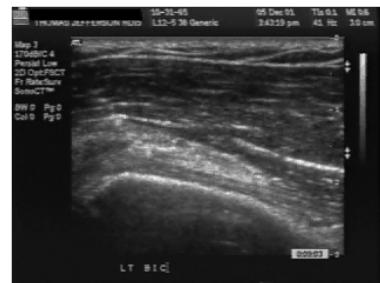


**Biceps Tenosynovitis**

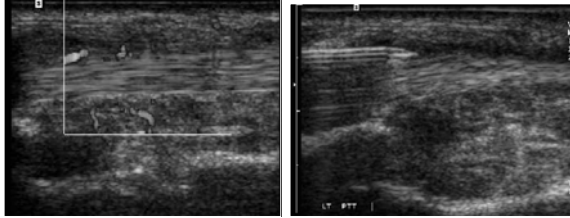
Longitudinal                      Transverse



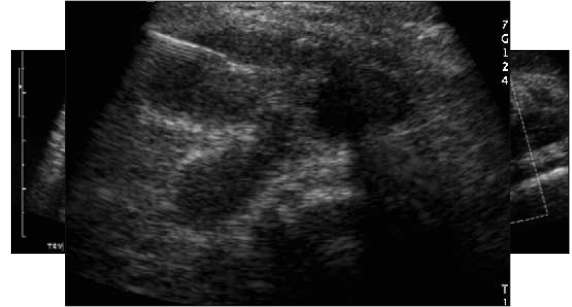
**Biceps Tendon Sheath  
Injection**



### ***PTT Tenosynovitis***



### ***Baker's Cyst with Pannus***



### ***Hip Labral Cyst Injection***

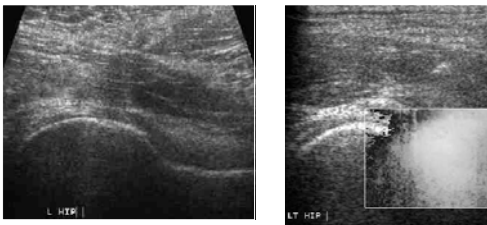


### ***Hip Injection: Real Time***

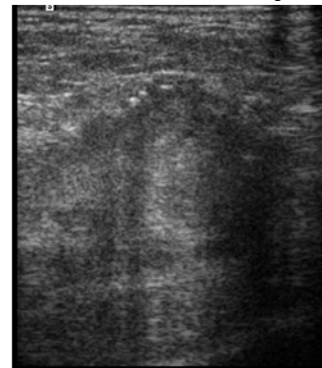


### ***Guidance for Hip Injection in Osteoarthritis***

Power Doppler confirms correct site

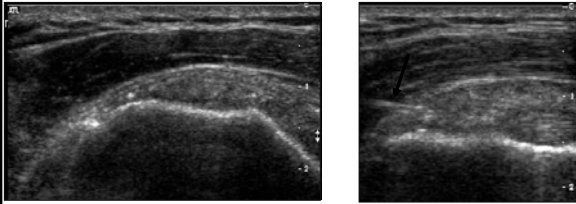


### ***Morton's Neuroma Injection***



## ***Calcific Tendinosis of Supraspinatus***

Percutaneous needle fenestration / aspiration



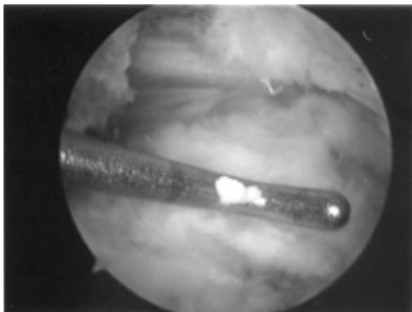
## ***Treatment of Rotator Cuff Calcification***



## ***Calcific Tendinosis***



## ***Arthroscopic Removal of Calcium***



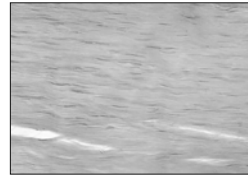
## ***Treatment of Gluteus Medius Calcifications***



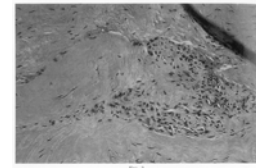
## Why “Tendinosis”?

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

## Histologic Correlation



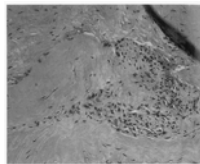
Normal



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  
(Testa, et al. Med Sci Sports Exerc 2002; 34: 573-580)
- Patellar tendinosis  
(Testa, et al. Med Sci Sports Exerc 1999; 31: 1509-1515)

## Percutaneous Needle Tenotomy

- Tennis elbow  
(Altay, et al. Clin Orthop 2001; 127-130)
- Rotator cuff  
(Farin, et al. Radiology 1995; 195: 841-843)  
(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

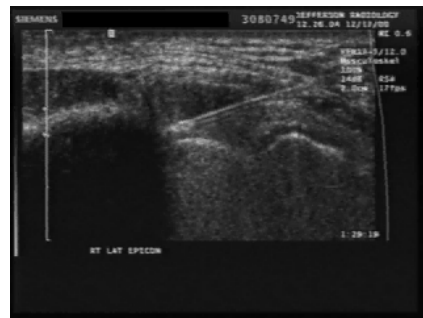
### ***Percutaneous Needle Tenotomy for Tennis Elbow***

- 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***



### ***PNT for Tennis Elbow***



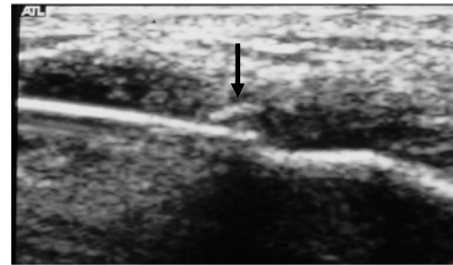
### ***PNT for Tennis Elbow***



### ***PNT for Tennis Elbow***



### ***Needle Removing Enthesophyte at Lateral Epicondyle of Elbow***



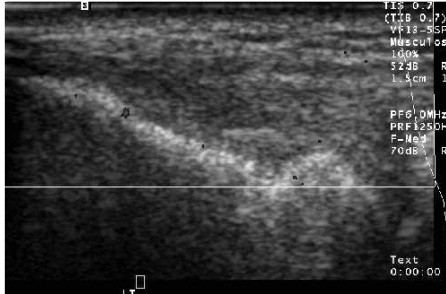
### ***PNT for Tennis Elbow Results***

- McShane, et al. J Ultrasound Med 2006; 25:1281-1289
- 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

### ***Follow-up Study Non-steroid Group***

- 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

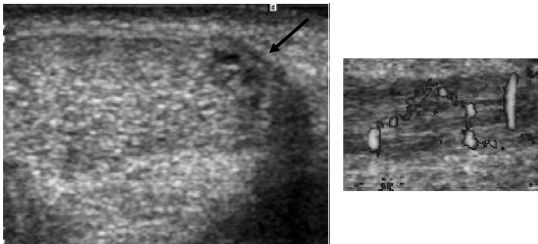
**Baseline Imaging**



**Follow-up Imaging**



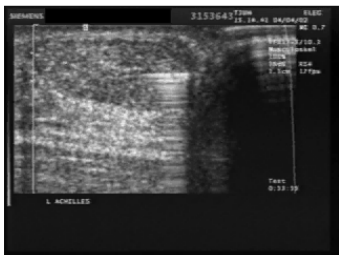
**51-year-old Runner With Heel Pain, Achilles Tendinosis**



**PNT of Achilles Tendon**



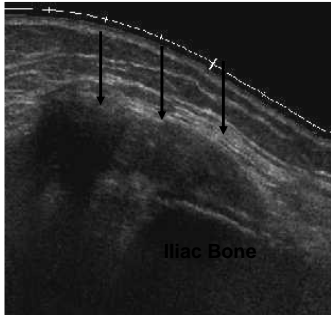
**PNT of Achilles Tendon**



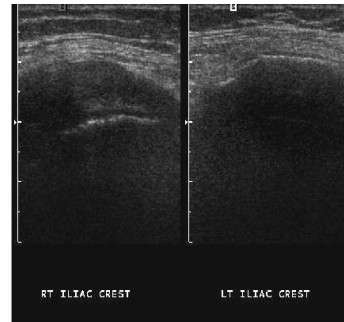
**38-Year-Old Woman with 2 years of increasing right "hip" pain**

**MRI of hip negative x 2  
MRI of LS Spine Negative**

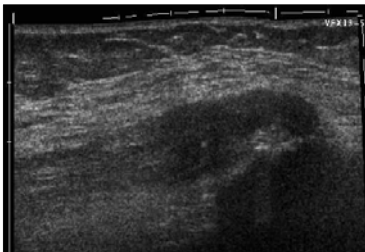
**US of Tender Area: Right Iliac Crest**



**Bilateral Comparison**

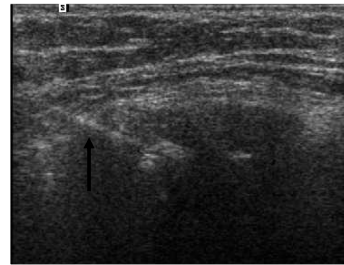


**Extended Field of View: External Oblique Tendinosis**



**"Blackjack dealer's hip"**

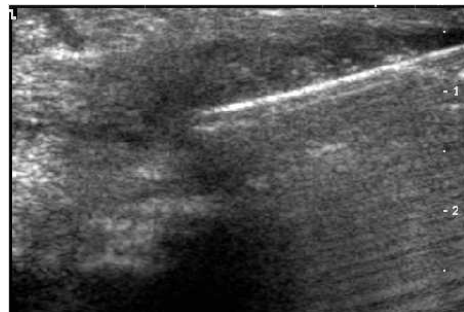
**External Oblique Tendinosis Treatment**



**Football Player with Groin Pain**



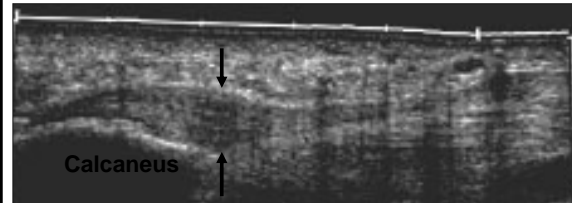
**Adductor Tendinosis Treatment**



### ***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

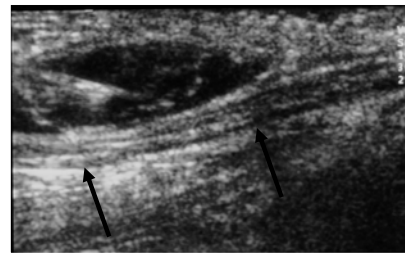
### ***Plantar Fasciitis***



### ***US Guided Nerve Blocks***

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

### ***Ultrasound Guided Tibial Nerve Block***



### ***Plantar Fasciitis Needle Therapy***

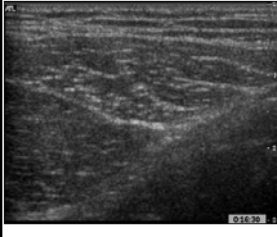


### ***Other US-Guided Treatment Alternatives***

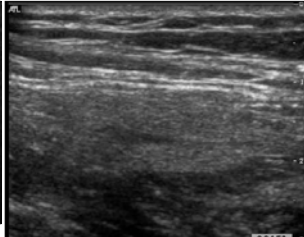
- Shock wave therapy
- Sclerosis of neovessels
- Whole blood injection
- Growth factor (PDGF) injection
- Dextrose injection
- Stem cell injection

**14 y.o. Soccer Player Felt a "Pop" and Acute Pain**

Normal muscle



Rectus femoris tear



**Femoral Nerve Block**

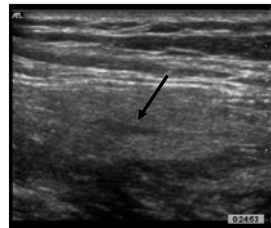


**Rectus Femoris Tear: Treatment**

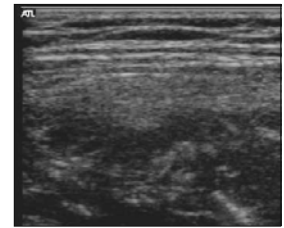


**Healed Muscle Tear**

Baseline



Follow-up



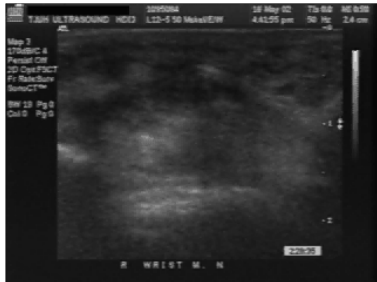
**The Future: A Logical Progression**

- 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

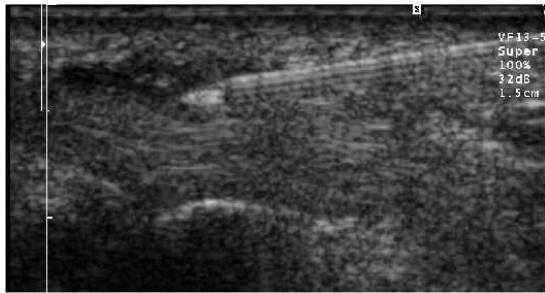
**Carpal Tunnel Syndrome:  
Pretreatment**



**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**