

# Musculoskeletal Injections

## For the Family Physician

---

Stephanie Schmidt, MD, CAQSM

October 25, 2022

# Disclosures

I have no financial interests or conflicts to disclose.

# A little about me...

- Graduate of UConn Family Medicine Residency (Go Huskies!)
- Completed Primary Care Sports Medicine Fellowship at Christiana Care Health System in Delaware (Go Blue Hens!)
- Middlesex Health Primary Care in Westbrook
- Sports Medicine Clinic at Middlesex Family Medicine residency in Middletown
- Head Team Physician for Wesleyan University (Go Wes!)



# Objectives

- Review what we are injecting
- Understand indications for, contraindications against, and goals of injection
- Understand risks of joint injection
- Understand benefits and limitations of ultrasound guidance
- Overview of how to perform common MSK injections both with and without ultrasound guidance

# Where are we injecting?

- Intra-articular
- Tendon sheath
- Bursa
- Trigger point
- Nerve block

# What are we injecting?

- Anesthetic
- Corticosteroid (usually +anesthetic)
- Viscosupplementation

# Common local anesthetics

Medication	Onset of action (minutes)	Duration of action (hours)	Max volume of injection in mL*
0.25% bupivacaine (Marcaine)	30	8	60
0.5% bupivacaine	30	8	30
1% lidocaine (Xylocaine)	1 to 2	1	20
2% lidocaine	1 to 2	1	10

\*Increased risk of cardiac toxicity or arrhythmia above these dosages

# Common injectable corticosteroids

Steroid	Common concentration (mg per mL)	Common equivalent dose (mg)*	Solubility	Particulate?	Duration of action
Methylprednisolone acetate (Depo-Medrol)	40 or 80	40	Slightly soluble	Yes	
Triamcinolone acetonide (Kenalog)	10 or 40	40	Relatively insoluble	Yes	
Betamethasone sodium phosphate and betamethasone acetate (Celestone Soluspan)	3	7.5	Mixed solubility	Yes	
Dexamethasone sodium (Decadron)	4	8	Freely soluble	No	

\*Dose equivalent to 40mg of methylprednisolone acetate or triamcinolone acetonide



# Corticosteroid solubility

- Particulate steroids must undergo hydrolysis, lowering solubility (i.e. methylprednisolone, triamcinolone)
- Particulate steroids theoretically last longer at injection site
- Insoluble steroids linked to increased side effects because of longer duration in tissue
- Particulate steroids commonly used for peripheral injections, may have serious adverse effects in axial spine injections (blood vessel injury/spasm, embolization causing spinal cord infarction)
  - Methylprednisolone has higher percentage of large particles, triamcinolone intermediate size, betamethasone smallest

# Corticosteroid safety considerations: Local side effects

- Infection (rare)
- Post-injection flare (crystal induced synovitis), 2-10%
  - Typically lasts 12-48 hours, treat with NSAIDs and ice
- Skin changes/hypopigmentation
- tissue/fat atrophy
- Tendon rupture (<1%, highest risk w/ soft tissue injection around Achilles tendon and plantar fascia)

# Corticosteroid safety considerations: Local side effects

From a study on hip and knee joint injections:

- Accelerated OA progression
- Subchondral insufficiency fracture
  - Xray appearance can be normal unless articular surface collapse
  - What was once thought to be spontaneous ON now recognized as SIF w/o potential to heal leading to collapse
- Complications of osteonecrosis
  - ON w/o articular surface collapse often not seen on xrays; need MRI
- Rapid joint destruction, including bone loss

# Corticosteroid safety considerations: Local side effects

- Clinically important to identify SIF b/c steroid may block pain leading to inc wt bearing not allowing jt to heal (tx for SIF protected or non-wt bearing)
- Always get xray before injection
- Pts w/ no OA or mild OA on xray, get repeat xrays before injection to eval for progressive narrowing, articular surface changes

# Corticosteroid safety considerations: Systemic side effects

- Steroid presence in bloodstream
- Suppressed endogenous serum cortisol for 1 week post-injection
- Acute hyperglycemia (greater with soft tissue injection vs intra-articular)
- Facial flushing, up to 15%
  - Most frequently associated with triamcinolone

# Corticosteroid safety considerations: Contraindications

- Overlying soft tissue infection
- Broken skin at the injection site
- Septic arthritis
- Bacteremia
- osteochondral/intra-articular fracture
- Avascular necrosis
- Charcot joint
- Joint instability
- Known hypersensitivity to intra-articular agent
- Unstable coagulopathy
- Uncontrolled diabetes (relative)
- Prosthetic joint (relative)

# Corticosteroid safety considerations: Frequency of injections

- Max number and frequency uncertain
- Most studies in context of RA and OA
  - In RA, no change in joint arthroplasty rates between patients w/ 4+ vs less injections annually
  - In OA, IA steroid knee injections vs saline every 3 months x 2yrs produced no significant difference in cartilage thickness
  - OA pts have shorter duration of action; most of the benefit lasts max of 6 wks
- Potential side effects have led to general recommendation of no more than 3-4x annually (although RA pts may be able to tolerate more frequent injections)

# Mechanism of action: Intra-articular corticosteroids

- Reduce pain and inflammation by:
  - Reduce synovial blood flow
  - Lower local leukocyte and inflammatory modulator response
  - Alter local collagen synthesis



# Diluting corticosteroid with anesthetic

- Benefits
  - Rapidly relieve pain
  - Confirm needle placement
  - Diagnostic
  - Increase volume of injectate to help distribute corticosteroid

# Common indications for corticosteroid injection

- Inflammatory arthritides
  - Adult and juvenile RA
  - Crystal-induced arthritis
  - Spondyloarthropathies
- Noninflammatory arthritides
  - Osteoarthritis
- Nonarticular conditions
  - Bursitis
  - Carpal tunnel syndrome
  - Epicondylosis
  - Tenosynovitis

# Goal of corticosteroid injection

- Definitive treatment
- Pain control during rehabilitation
- Episodic symptom relief

# Goal of corticosteroid injection: Definitive treatment

- De Quervain tenosynovitis
  - Provides highest cure rate vs NSAIDs, splinting or combo (73-83% cure rate)
  - Most patients symptom-free after 1 injection
  - Safe during pregnancy, postpartum and while breastfeeding
- Trochanteric bursitis
  - First line treatment, especially in older adults
  - Rapid and prolonged improvement in pain and disability after 1 injection
  - 2.7-fold increase in number of patients who were pain free 5yrs after single injection vs no injection

# Goal of corticosteroid injection: Pain control during rehabilitation

- Rotator cuff syndrome
  - Decreases pain to allow patient to perform PT, ADLs, improve sleep
  - Helpful in differentiating between impingement (improved strength following injection) and RTC tear (no improvement in strength)
- Lateral epicondylitis
  - Short-term (<6wk) decrease in pain w/ injection
  - After 6 wks, PT reduces symptoms greater than injection
  - Reserve injection for pts whose pain limits participation in PT, ADLs

# Goal of corticosteroid injection: Episodic symptom relief

- Pain relief: Arthritis
  - Most common indication for intra-articular injection
  - Short-term treatment of arthritis
- Symptom relief: Carpal tunnel syndrome
  - Temporary relief; relief for one month post-injection that was greater than placebo
  - Pts who fail initial therapy with bracing, oral anti-inflammatories had clinical outcomes at 1 yr that were similar when treated with corticosteroid injections vs surgery

# Why use ultrasound?

- Ultrasound-guided injections overall more accurate than landmark guided injections (although studies limited, more research needed)
  - Increased accuracy upper extremity: GH joint, SA bursa, LHB tendon sheath, joints of hand and wrist
    - Not shown more effective: AC joint, elbow joint
  - Increased accuracy lower extremity: knee, ankle and foot
- Can use in-office
- No radiation (compared to fluoroscopy)
- Dynamic and can compare contralateral side

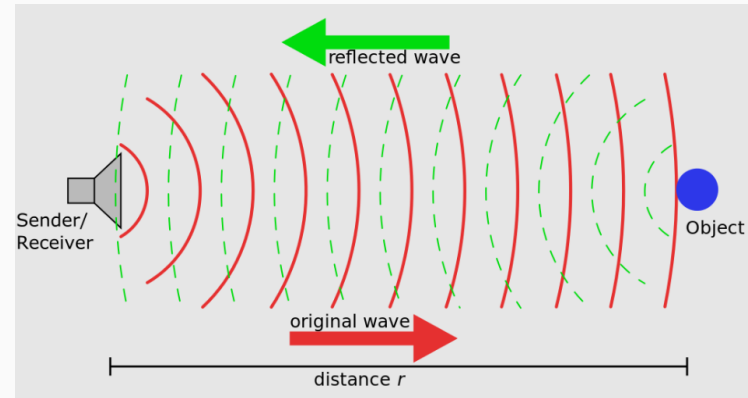
# Limitations of ultrasound

- User/technique dependent
- Challenging to learn to read
- Can be expensive to purchase for office
  - Handheld options more affordable but own limitations



# How an ultrasound machine works

- Transducer emits sound waves into body
- Sound waves reflected back to transducer as echoes
- Generates electrical signals, sent to US machine
- Machine uses speed of sound and time of echo's return to calculate distance to tissue
- Distances used to generate 2-D images
- Gel used to prevent air pockets (air blocks US waves)



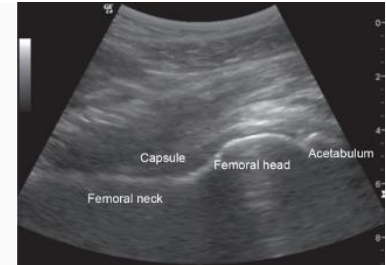
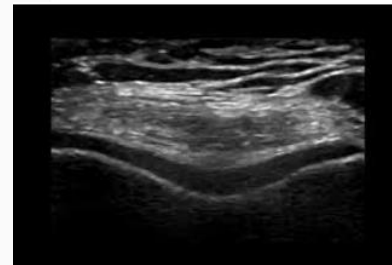
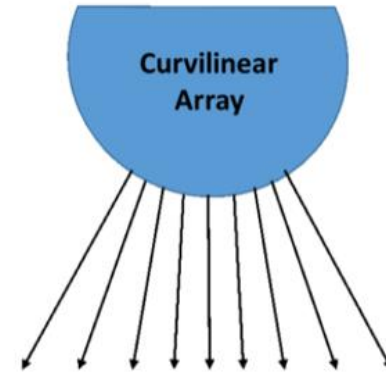
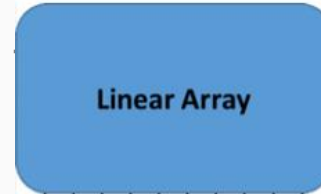
# Ultrasound basic terminology

- Frequency: number of ultrasound waves per second
  - Lower frequency = deeper penetration but lower resolution (better for deeper structures such as hip joint)
  - MSK requires relatively high frequency probe for good image quality (3-17MHz)

Frequency	Depth Penetration	Resolution
Low	↑	↓
High	↓	↑

# Ultrasound basic terminology

- Footprint: part of the probe that touches patient where waves are emitted and returning echoes received
  - Curvilinear probe has curved and wide footprint
  - Linear probe (inc hockey stick) has flat and thinner footprint
- Field of view: field of vision probe displays on screen
  - Linear FOV has parallel perpendicular lines = square/rectangle
  - Curvilinear FOV has wider depth of field



# Probes



*Linear probe*



*Curvilinear probe*



*Hockey stick probe*

	Linear	Curvilinear	Hockey stick
Frequency	High (7-15MHz)	Low (1-6MHz)	High (8-18MHz)
Penetration	Shallow	Deep	Shallow
Resolution	Excellent	Poorer	Excellent
Footprint	Medium	Wider	Small
Application	Most versatile	Good for deep structures (hip joint, glenohumeral joint)	Irregular surfaces, small joints (hands, feet)

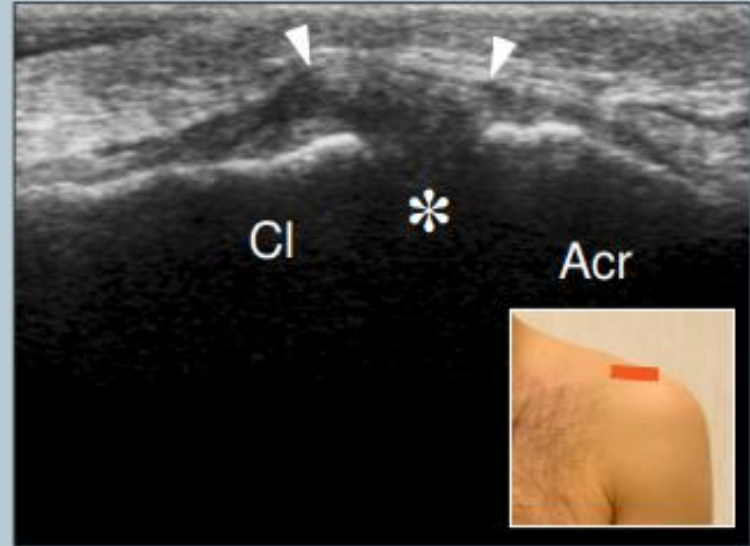
# Common injections covered today:

- AC joint
- Subacromial/subdeltoid bursa
- First dorsal compartment of wrist (de Quervain's tenosynovitis)
- Greater trochanteric pain syndrome
- Hip joint

# USG injection AC joint

Place the transducer in the coronal plane over the shoulder to examine the acromioclavicular joint. Sweep the transducer anteriorly and posteriorly over this joint to assess the presence of an os acromiale. Shifting the probe posterior to the acromioclavicular joint, it is possible to assess the status of the supraspinatus muscle.

*Legend:* Acr, acromion; arrowheads, superior acromioclavicular ligament; asterisk, acromioclavicular joint space; Cl, clavicle



# USG injection AC joint

- Patient seated or lying supine
- Stand lateral to the patient
- Supplies:
  - Small syringe (i.e. 3mL)
  - 25-gauge needle
  - 0.5mL of steroid (such as 20mg triamcinolone acetonide)
  - 0.5mL of 1% lidocaine without epinephrine

# USG injection AC joint

Video clip of ultrasound guided corticosteroid injection of the acromioclavicular joint:

<https://www.youtube.com/watch?v=4JI2JxqRX2g>



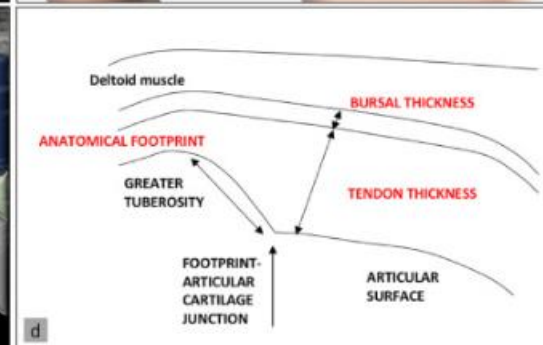
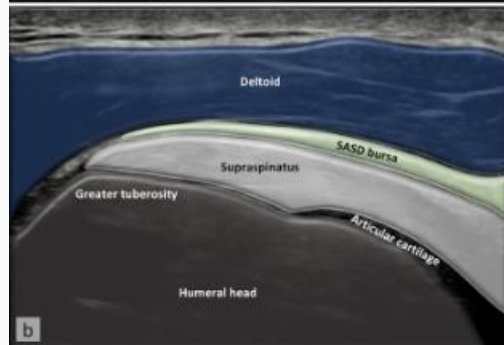
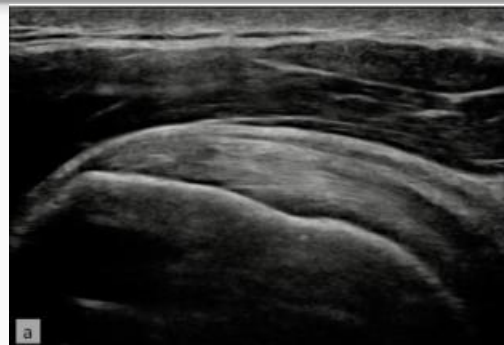
# Landmark guided steroid injection AC joint

- Palpate clavicle in medial to lateral direction
- At lateral aspect of clavicle, small depression (may be tender)
- Injection point directly over AC joint



# USG injection Subacromial/subdeltoid bursa

- Patient lying supine on table
- Shoulder internally rotated, elbow approximately 90 degrees, place hand under buttocks with palm down
- Probe positioned with supraspinatus tendon viewed in longitudinal axis



# USG injection Subacromial/subdeltoid bursa

- Supplies:
  - 5-mL syringe
  - 22-gauge 1.5-inch needle (22 gauge for better visualization on ultrasound; alternatively, could use 25-gauge)
  - 1mL of steroid (such as 40mg of triamcinolone acetonide)
  - 3-4mL of 1% lidocaine without epinephrine

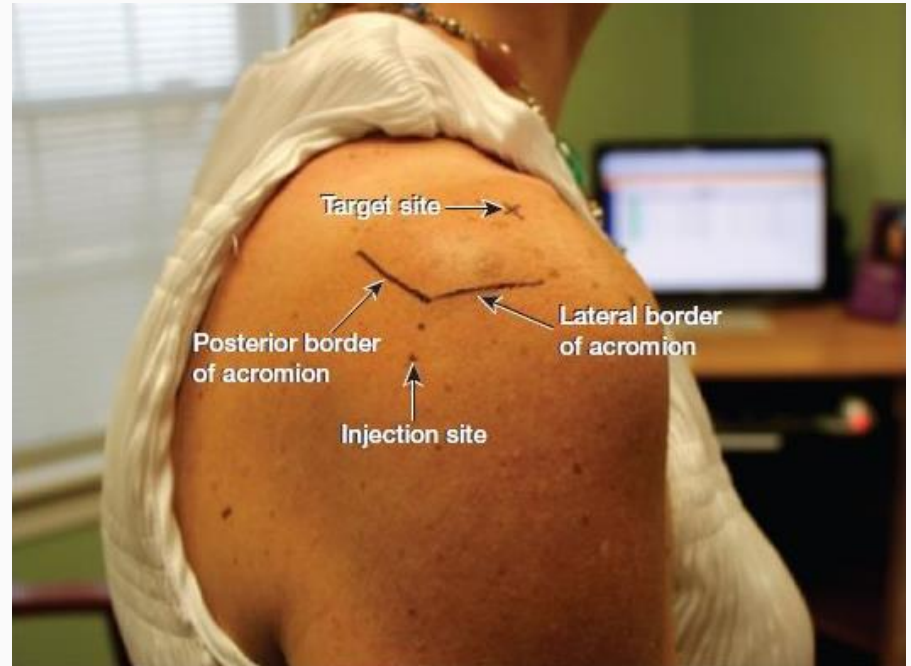
# USG injection Subacromial/subdeltoid bursa

Video clip of ultrasound guided corticosteroid injection of the subacromial/subdeltoid bursa:

<https://www.youtube.com/watch?v=tm0noUsmydl>

# Landmark guided steroid injection Subacromial/subdeltoid bursa

- Patient seated
- Palpate and mark lateral and posterior edges of acromion
- Drop vertically 2cm below posterolateral corner of acromion
- Place index finger at superior aspect of acromion posterior to AC joint



# Landmark guided steroid injection Subacromial/subdeltoid bursa

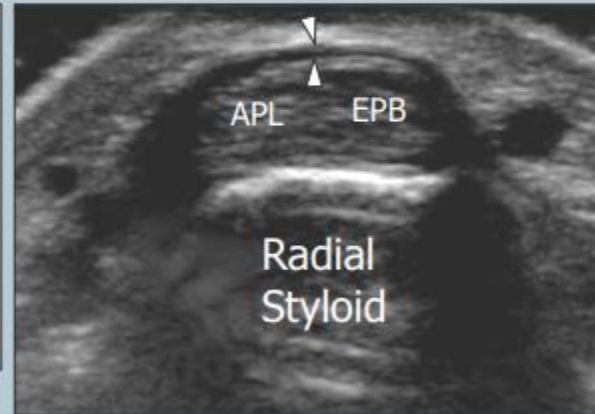
- Position needle 30-degree angle to skin, tip directed cephalad toward acromion
- Direct needle under acromion, advance until tip touches undersurface of acromion, then back up 1-2mm



# USG injection wrist first dorsal compartment for de Quervain's tenosynovitis

Keeping the patient's wrist halfway between pronation and supination, place the probe over the lateral aspect of the radial styloid to examine the first compartment of the extensor tendons - abductor pollicis longus (ventral) and extensor pollicis brevis (dorsal). Check the retinaculum and note the possible occurrence of a vertical septum that splits the compartment in two distinct spaces. Follow the abductor pollicis longus distally over the scaphoid to assess possible accessory tendons.

*Legend:* APL, abductor pollicis longus; arrowheads, retinaculum; EPB, extensor pollicis brevis



# USG injection wrist first dorsal compartment for de Quervain's tenosynovitis

- Position wrist halfway between supination and pronation
- Place small rolled towel under wrist for slight ulnar deviation (radial styloid will pop up)
- Supplies:
  - Small syringe
  - 25-gauge needle (can use 22-gauge if need improved visualization)
  - 0.25-1mL of steroid (10-40mg of triamcinolone acetonide)
  - 0.5-1mL of 1% lidocaine without epinephrine



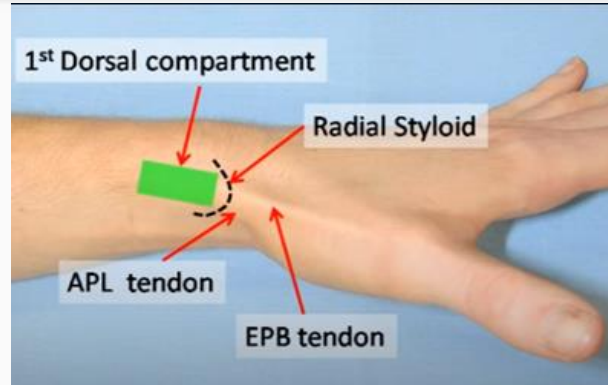
# USG injection wrist first dorsal compartment for de Quervain's tenosynovitis

Video clip of ultrasound guided corticosteroid injection of the first dorsal compartment of the wrist for De Quervain's tenosynovitis:

<https://www.youtube.com/watch?v=zqcETh5NEfE> (0:09 start)

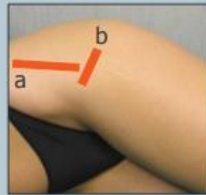
# Landmark guided injection wrist first dorsal compartment for de Quervain's tenosynovitis

- Palpate to identify area of tenderness in tendon sheath containing APL and EPB (inject directly between)
- Position needle at 45 degree angle directed proximally
- Advance needle towards convergence of the tendons, inject; bulge should form



# USG injection greater trochanteric pain syndrome

Moving the probe down to reach the greater trochanter, the gluteus minimus tendon is seen as an anterior structure that arises from the deep aspect of the muscle and inserts into the anterior facet of the greater trochanter.



*Legend:* asterisk, gluteus maximus muscle; curved arrow, gluteus minimus tendon; Gmin, gluteus minimus muscle; GT, greater trochanter; void arrow, gluteus medius tendon; white arrow, gluteus minimus tendon; arrowheads, fascia lata

Long-axis and short-axis US images obtained over the lateral facet of the greater trochanter demonstrate the gluteus medius tendon as a curvilinear fibrillar band. Shifting the probe posteriorly, the anterior portion of the gluteus maximus can be seen covering the posterior part of the tendon of the gluteus medius. Coronal planes demonstrates the fascia lata which appears as a superficial hyperechoic band that, from cranial to caudal, overlies the gluteus medius muscle, the gluteus medius tendon and the greater trochanter.



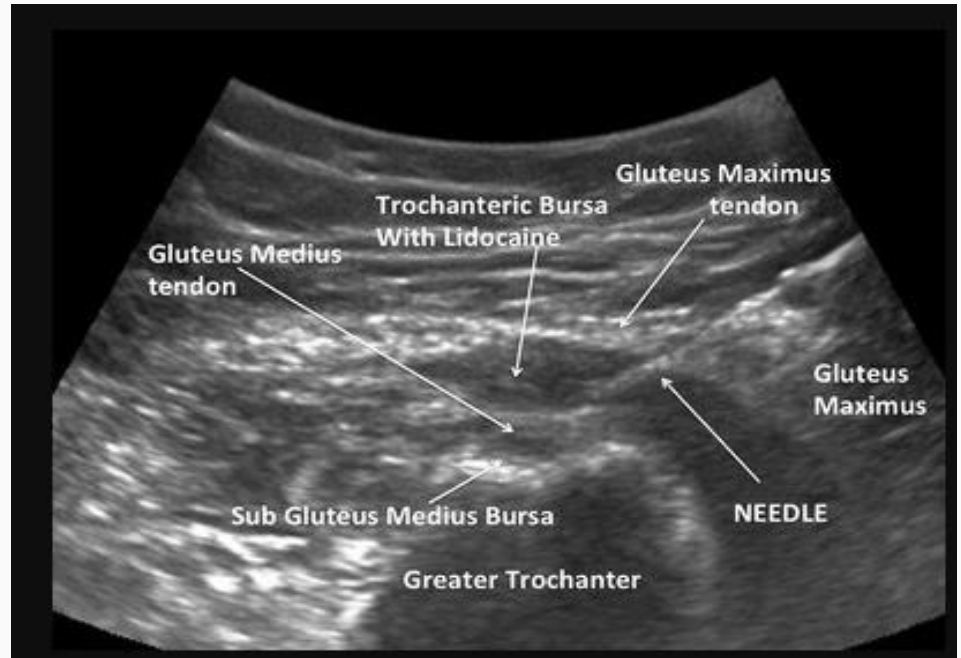
Due to a too small amount of fluid content, the bursae around the greater trochanter are not visible with US in normal conditions.

# USG injection greater trochanteric pain syndrome

- Position patient laterally with the affected hip on top and exposed
- Supplies:
  - 5-mL syringe
  - 22-gauge 1.5-inch needle (may need 3.5-inch spinal for obese patients)
  - 1mL of steroid (40mg of triamcinolone acetonide)
  - 3-4mL of 1% lidocaine without epinephrine

# USG injection greater trochanteric pain syndrome

- Subgluteus maximus bursa (greater trochanteric bursa)
- Subgluteus medius bursa (overlying the greater trochanter, deepest)

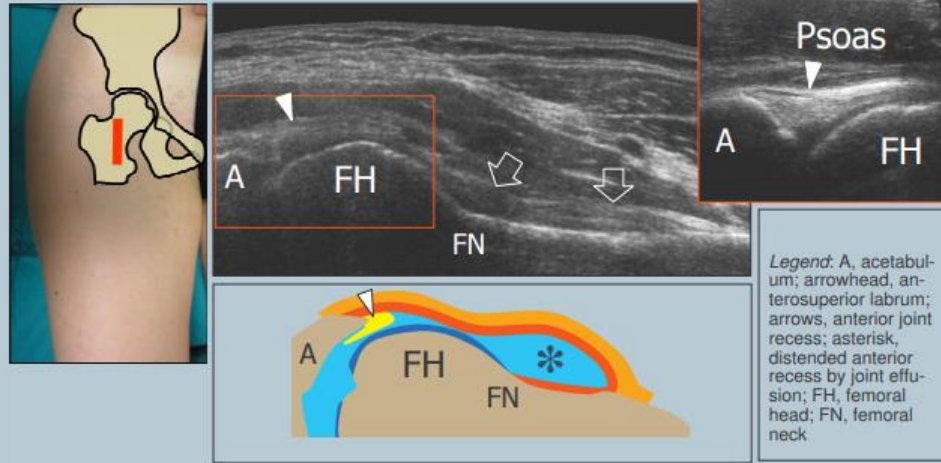


# Landmark guided steroid injection greater trochanteric bursa

- Patient in lateral decubitus position
- Identify point of maximal tenderness over greater trochanter by palpation
- Position needle perpendicular to skin, needle directed medially
- Advance needle to bone, back up 1-2mm then inject

# USG injection hip joint

With the patient supine, place the transducer in an oblique longitudinal plane over the femoral neck to examine the anterior synovial recess, using the femoral head as a landmark. In obese patients, lower frequency probes may help the examination. Cranial to the anterior recess, the fibrocartilaginous anterior glenoid labrum of the acetabulum can be detected as a homogeneously hyperechoic triangular structure (same appearance as the knee meniscus). Look at the iliofemoral ligament that can be appreciated superficial to the labrum.



# USG injection hip joint

- Position patient supine
- Supplies:
  - 10mL syringe with 10mL of 1% lidocaine without epinephrine and 22-gauge 3.5-inch spinal needle
  - 3mL syringe (easier to hold than 1mL syringe) with 1mL of steroid (40mg of triamcinolone acetate)



# USG injection hip joint

Video clip of ultrasound guided injection of the hip joint:

<https://www.youtube.com/watch?v=JvPzo2r9HCY>

# Other injections not covered:

## Upper extremity

- Glenohumeral joint
- Long head of biceps tendon sheath
- Elbow joint
- Lateral epicondyle
- Median nerve hydrodissection
- First CMC joint

## Lower extremity

- Sacroiliac joint
- Gluteus medius peritendinous
- Pubic symphysis
- Iliopsoas bursa
- Knee joint
- Pes anserine bursa
- Popliteal cyst
- Ankle joint
- Plantar fascia

# Billing

- Arthrocentesis/Aspiration/Injection w/o Ultrasound
  - Small joint/bursa (eg fingers, toes): CPT 20600
  - Intermediate joint/bursa (eg AC joint, wrist, elbow, ankle):CPT 20605
  - Large joint/bursa (eg shoulder, hip, knee): CPT 20610
- Arthrocentesis/Aspiration/Injection WITH Ultrasound
  - Small joint/bursa (eg fingers, toes): CPT 20604
  - Intermediate joint/bursa (eg AC joint, wrist, elbow, ankle): CPT 20606
  - Large joint/bursa (eg shoulder, hip, knee): CPT 20611
  - *NOTE: Requires permanent recording and reporting*
- Tendon sheath (eg de Quervain's): CPT 20550; if ultrasound used, also bill CPT 76942 (NOTE: cannot use with bundled codes!)
- Modifiers: 25 for single, 50 for bilateral, 59 for two DIFFERENT joints of same size (eg shoulder and hip)

Questions?

Thank you!