

## Arthrocentesis Workshop

### Focus on the Knee and the Shoulder

*Katherine Temprano, MD  
Division of Rheumatology  
University of Kentucky*

### Learning Objectives

- Describe indications for arthrocentesis/joint injections
- Review anatomy of knee and shoulder
- Learn techniques for arthrocentesis and joint injections
- Review synovial fluid analysis

## Case 1

- 55 y/o white male with RA currently on methotrexate 20mg po qweek and prednisone 7.5mg po qd presents to the ER with complaints of joint pain and swelling
- On exam, there is evidence of synovitis of bilateral wrists, MCPs and MTPs
- His right elbow is warm, tender to palpation with minimal erythema, with 1+swelling
- What should you do?

## Case 2

- 67 y/o AA male with history of diabetes, hypertension, hyperlipidemia and gout presents to your primary care office complaining of right knee pain
- On exam, he is afebrile
- You notice warmth, 2+swelling and tenderness to palpation of right knee with pain upon flexion and extension
- Should you tap the joint?

### Case 3

- 26 y/o white female with little significant past medical history presents to the ER with complaints of fatigue, fever, joint pain and skin rash
- She admits to being an IV drug user
- On exam, she is febrile to 102, tachycardic
- There is a 2/6 SEM at LLSB
- There is 1+ swelling with tenderness to palpation of her R shoulder, L knee, R wrist
- Blood cultures are preliminary positive for gram positive cocci
- Should you tap her joint(s)?

### Indications for Arthrocentesis

- If you think about it, you probably should do it
- Never assume what is going on in the joint!
  - A patient with history of gout can ALSO have a septic joint
- A joint effusion that has never been tapped should be tapped

## General Principles of Arthrocentesis

- Take a good history and perform thorough joint exam
  - Which joints hurt, if any?
  - Is there associated AM stiffness?
  - Was there any trauma associated?
  - Previous episodes?
  - Exacerbating/alleviating factors?
  - Time course to event?
  - Any previous treatment/injection/intervention?

## Contraindications to Arthrocentesis

- Contraindications for arthrocentesis are few
  - Established overlying infection (i.e. cellulitis) considered a contraindication to inserting a needle into a joint - theory that could introduce infection into the joint
  - However, if the inflammation in underlying joint or bursa is thought to be cause of infection, then arthrocentesis should be pursued

## Contraindications to Arthrocentesis

- Generally try to avoid needle insertion through an area of disrupted skin (i.e. psoriasis) as increased numbers of colonizing bacteria
- Caution with patients with bleeding diathesis or anticoagulated as risk of hemarthrosis. Risk is still low even with INR range as high as 4.5 - use caution and smallest needle possible

## Frequency of Steroid Injections

- Depends on what you are performing them
- In general, prefer not to inject steroids more than 3-4 times/year into any one lesion
  - Consider effectiveness of injection
  - Potential for systemic absorption
  - Potential for tendon weakening

## Corticosteroid Injections - Indications/Efficacy

- Inflammatory Arthritis
  - Rheumatoid Arthritis
  - Crystal Induced Arthritis (usually relief in 24-48 hours)
  - Spondyloarthropathies
  - Juvenile Idiopathic Arthritis (oligoarticular)
- Noninflammatory Arthritis
  - Osteoarthritis (Knee 60-80% response at 1-6 weeks, better than placebo)

- Nonarticular Conditions (tendinitis, bursitis, myofascial pain)
  - Painful shoulder (rotator cuff tendinitis, frozen shoulder)
  - Lateral epicondylitis (tennis elbow)
  - Carpal tunnel (90% short term response, variable at 6-12 mos)
  - deQuervain's tenosynovitis (70-90% better, relapse 30% at 1 year)
  - Trochanteric bursitis (60-70% at 6 mos)
  - Knee pain syndromes (anserine bursitis, etc., - majority respond)

## Corticosteroid Injection

- Most commonly used
  - Triamcinalone acetonide (Kenalog®)
  - Triamcinalone hexacetonide (Aristospan®) has longer lasting effect
  - Methylprednisolone acetate
- Large joints (shoulder, knee)
  - 40mg triamcinalone acetonide
- Medium joints (elbow, wrist)
  - 20 mg
- Small joints (MCP,PIP)
  - 5-10mg

## Contraindications to Corticosteroid Injection

- Never inject steroids into infected joints
- If any suspicion for infection, aspirate joint first and analyze/culture fluid first
- Don't inject prosthetic joint
- Hypersensitivity to injection ingredient
- Repeated use in weight-bearing joints may lead to further joint degeneration?
- Don't inject directly into tendon body

## Complications

- Latrogenic infection - most serious but least common complication
  - Incidence of infection was 0.005% in a series of 400,000 injections
  - Higher rates in patients with RA, debilitated patients or immunosuppressed

## Complications

- Local irritation of synovial and subcutaneous tissues and atrophy of soft tissues related to effects of locally injected steroids
  - Lipodystrophy (skin dimpling)
  - Loss of skin pigment (esp. in darker skinned patients)
- Postinjection “flare” can occur few hours after injection and last up to 48 hours



## Complications

- Direct injection of steroids into tendon body can lead to weakening or rupture of tendon
  - Risk of tendon rupture is low in hands/wrists (less than 0.2%)
  - Highest risk is in area of Achilles tendon and plantar fascia (up to 10%)

## Complications

- Systemic absorption
  - Studies documented a decrease in plasma cortisol and suppression of the hypothalamic-pituitary axis lasting from 2-7 days after a single injection
  - A single injection of triamcinolone in knees of RA pts showed a transient marked reduction in serum markers of bone formation within day of injection, normalizing after 14 days

## Complications

- Erythema, warmth, and diaphoresis of face and torso within minutes to hours after steroid injections - related to systemic absorption

## Complications

- Avascular necrosis of bone (0.1% to 3%) but probably more related to systemic steroid use

## Informed Consent/Risks

Always use informed consent!!

In general

- Bleeding
- Infection
- Damage to organs

Covers most everything . . . . .

## The Knee

- Effusions of knee
  - Trauma
  - Cruciate and meniscal tears
  - Hemarthrosis
  - RA or psoriatic arthritis
  - OA
  - Reactive arthritis
  - Gout or pseudogout

## The Knee

- Prepatellar and infrapatellar bursitis
  - Clergyman's and housemaid's knee
  - See in coalminers, carpet layers, etc.
  - Can be prone to infection
- Baker's cyst - posteriorly, occur in RA, can rupture during violent flexion of knee, can mimic acute DVT

## The Knee - Exam

- Inspect
  - Hollows alongside the patella disappear if effusion
  - Note if erythema
  - Look for quadriceps wasting

## The Knee - Exam

- Palpate
  - Produce bulge sign medially with effusion when gentle pressure on opposite side
  - Tender to palpation superiorly in prepatellar bursitis
  - Note temperature with back of hand
  - Tenderness along lower medial aspect of knee in anserine bursitis
  - Tender along medial or lateral joint line in ligamentous or meniscal injury
- Examine full active and passive ROM
  - Extension to 0° and flexion to 130°-150°, note if crepitus

## The Knee - Aspiration/Injection Technique

- Position patient
  - Lie supine, towel rolled up under knee, goal to keep quads relaxed
  - Note: Prepare most materials outside of patient room to reduce anxiety and make sure you have obtained informed consent
- Find Site for Aspiration
  - Feel for superior and inferior pole of patella, then medial border of patella, locate site about middle of patella
  - Mark with closed pen and make indentation
  - Put on nonsterile gloves
- Clean Site
  - Povidone-iodine x 3 in circular motion working way out from indentation
  - Alcohol x 3 in similar fashion

## The Knee - Aspiration/Injection Technique

- Anesthetize
  - Spray with ethyl chloride over injection site
  - Use appropriate gauge 1.5 inch needle with 1-2 cc of 1% lidocaine to find the joint space and anesthetize simultaneously
    - Can use 18-20g needle if planning to aspirate unknown fluid type with adequately sized syringe attached
- Aspiration
  - Insert needle parallel to undersurface of patella
  - In smooth motion, inject some lidocaine, then advance needle, pull back to look for synovial fluid, continue this until obtain synovial fluid
  - Aspirate as much fluid as possible, changing syringes if needed with hemostat

## The Knee - Aspiration/Injection Technique

- Injection
  - If performing steroid injection, remove previous syringe with hemostat, keeping needle in joint, attach pre-filled steroid syringe, smoothly inject steroid and remove needle/syringe
  - Apply pressure with gauze
  - Clean and apply Band-aid®

## The Shoulder

- Need correct diagnosis first - what responds well to steroid injection?
  - Rotator cuff tendinitis (subscapularis, infraspinatus)
  - Supraspinatus tendinitis (may be calcific)
  - Frozen shoulder (adhesive capsulitis)
  - Subacromial bursitis
  - Bicipital tendinitis
  - OA of AC joint
  - Inflam arthropathies (RA, PsA, SNSA, etc.)

## The Shoulder - Anatomy

- Subscapularis medially rotates the arm
- Infraspinatus and teres minor externally rotate
- Supraspinatus abducts the arm to 90°

## The Shoulder - Exam

- Assess C-spine ROM to assure not referred pain to the shoulder from neck
- Need shirt off to full inspect bilateral shoulders
  - Joint swelling
  - Asymmetry/atrophy
  - Redness
- Palpate for focal tenderness
  - Tender over biceps in groove - bicipital tendinitis
  - Tender over lateral tip of shoulder - supraspinatus tendinitis

## The Shoulder - Exam

- Abduct both arms to 90° with palms facing ceiling - “painful arc”
  - Restriction = supraspinatus tendinitis
- Hands behind head to occiput (external rotation)
  - Restriction = infraspinatus tendinitis
- Hands behind chest and raise thumbs as high as can (internal rotation)
  - Restriction = subscapularis tendinitis



## The Shoulder - Exam

- If all movements are restricted/painful - could be frozen shoulder
- Sometimes can only tell which tendon involved by restricted movement of that site

## The Shoulder - Injection

- Same prep techniques as knee but pt is sitting up - here we will focus on where needle should go!

## The Shoulder - Injection Anterior Approach

- Palpate coracoid process and head of humerus
- Injection site is medial to humeral head, and 1 cm lateral and inferior to the coracoid process
- Inject 1cc steroid with 1 cc 1% lidocaine
- Advance needle horizontally and in slight lateral direction
- Inject when no resistance is felt to plunger
- Post-injection, AROM should now be pain free

## The Shoulder - Injection Posterior Approach

- Palpate the posterior tip of the acromion process with the tip of the thumb
- Place the index finger of the same hand on the coracoid process - the imaginary line between the index finger and the thumb marks the track of the needle
- Advance the needle (again using about 1cc steroid and 1cc 1% lidocaine) about 1in below the tip of the thumb (below the tip of the acromion and medial to head of humerus) towards the index finger
- There will be no resistance as needle point will be in capsule of shoulder joint

## The Shoulder - Injection Subacromial Approach (Lateral)

- Palpate the most lateral point of the shoulder and make indentation about 1/2 in below the tip of the acromion
- Advance needle (again 1cc steroid and 1cc 1% lidocaine) medially below acromion process, horizontally in slight posterior direction along line of supraspinatous fossa

## The Shoulder - Injection Acromioclavicular Joint

- AC OA is common cause of pain in >50 y/o
- May be osteophyte over joint space
- Abduction of arm from horizontal to vertical position will produce pain over AC joint
- Very small joint space only accepts 0.5 cc fluid

## The Shoulder - Injection Acromioclavicular Joint

- Palpate the joint space and insert needle either superiorly or anteriorly, ensuring only the tip of the needle enters the joint space
- May only need 5/8 in needle for this one
- If push needle too far, will enter the shoulder capsule from above

## The Shoulder - Injection Bicipital Tendon Sheath

- Palpate the bicipital groove (intertubercular sulcus) palpable at the lateral tip of the head of the humerus
- When the patient rotates the arm medially and laterally, the groove becomes more easily identifiable
- Use 1cc steroid and 1cc 1% lidocaine for this tenosynovitis
- DO NOT inject into the substance of the bicipital tendon as this could cause rupture
- After injection, if done right, patient will feel immediate relief of pain on resisted supination

## The Shoulder - Injection Bicipital Tendon Sheath

- May only need 5/8 in needle
- Patient sits with arm loose at side in slight external rotation
- Make indentation over most tender spot in bicipital groove - needle enters here just below skin mark
- Direct needle in upward direction into bicipital groove
- When needle point enters substance of tendon, resistance increases sharply

## The Shoulder - Injection Bicipital Tendon Sheath

- Maintain gentle pressure on the plunger while at the same time withdrawing the needle slowly until the resistance disappears. At this point the needle is in the synovial sheath and you can inject

## Post Injection Counseling

- May recommend joint rest or rest of affected area for at least 1 day after steroid injection
- Caution as the use of lidocaine may also make symptoms improve and then patient pursues more activity than they should, increasing injury risk

## What Do I Do with the Fluid?

- Directly observe
  - Note color of fluid (yellow, pink, blood)
  - Note amount of fluid obtained
  - Note turbidity
    - Clear - normally can read newsprint through it
    - Slightly turbid - print is blurry
    - Turbid/cloudy - can't read print through fluid
    - Purulent - Thick pus like fluid

## What Do I Do with the Fluid?

- Send for cell count (purple top or green top with heparin to prevent clotting and preserve cell morphology), crystals, gram stain and culture (red top - sterile and without additive) - if plenty of fluid, can also send in yellow top to possibly increase yield of culture
- Do not send fluid for protein, RF, ANA, complement, RBC count or glucose

## Synovial Fluid Analysis

	Normal	Noninflam	Inflam	Septic	Hemorrhagic
• Volume (ml)	<3.5	>3.5	>3.5	>3.5	>3.5
• Viscosity	High	High	Low	Mixed	High
• Clarity	Clear	Clear	Cloudy	Opaque	Mixed
• Color	Colorless/straw	Straw/yellow	Yellow	Mixed	Red
• WBC/mm <sup>3</sup>	<200	200-2,000	2,000-75,000	>100,000	Same as blood
• Polys (%)	<25	<25	>50	>75	Same as blood
• Gram stain	Negative	Negative	Negative	Often positive	Negative

## Synovial Fluid Analysis

- Cell Count
  - WBC  $<2000 \text{ mm}^3$  considered non-inflammatory
  - WBC  $>100,000 \text{ mm}^3$  should be considered infected
  - WBC between 50,000 and 100,000  $\text{mm}^3$  can be infected or inflammatory
- Differential
  - Non-inflammatory fluid has  $<50\%$  neutrophils
  - Infected fluid usually has  $>95\%$  neutrophils
  - Non-infectious, inflammatory fluid has  $>50\%$  neutrophils

## Pitfalls and Pearls

- Handy to have an arthrocentesis tray made up for your office (see list of supplies/equipment needed)
- You can dramatically increase anxiety of patient if they watch you get everything ready in the room



## Pitfalls and Pearls

- If needle strikes bone, withdraw needle slightly and redirect needle beneath skin surface
- If needle is in joint and not getting fluid
  - Possibly more soft tissue than fluid present
  - Fluid too thick, try again with larger gauge
  - Needle has clotted off
- If patient appears pale, diaphoretic, c/o faintness
  - Stop procedure and lay patient supine

## Pitfalls and Pearls

- Any amount of fluid obtained can be analyzed - even if just got 1 or 2 drops - cap the syringe and send it - choose what test you want the most
- LABEL correctly or the lab will pitch it! Must have patient ID, date/time and identify what type of fluid and from where obtained
- Send fluid to lab promptly
- Don't analyze fluid for crystals that has been contaminated by steroids - first get fluid, then inject steroids and don't use needle to aspirate fluid with which you have withdrawn steroid!

## Pitfalls and Pearls

- If going to just do injection, can mix steroid and lidocaine - mix gently - no need to shake syringe up too much!
- Don't inject steroid into infected joint
- Don't inject directly into tendon - can lead to tendon rupture!
- Remember to obtain informed consent, ask patient if allergic to latex, betadine, lidocaine, etc., prior to procedure and be sure to write a procedure note (see example of procedure note) when done

## References

- Silver, T. Joint and Soft Tissue Injection, Injecting with Confidence. Third Edition, Radcliffe Medical Press, United Kingdom, 2002.
- Wise, C. The Rational Use of Steroid Injections in Arthritis and Nonarticular Musculoskeletal Pain Syndromes. Bulletin on Rheumatic Diseases; 52 (1)