

Παρακέντηση αρθρώσεων και εξέταση αρθρικού υγρού



ΠΑΝΕΠΙΣΤΗΜΙΑΚΟ ΝΟΣΟΚΟΜΕΙΟ ΗΡΑΚΛΕΙΟΥ

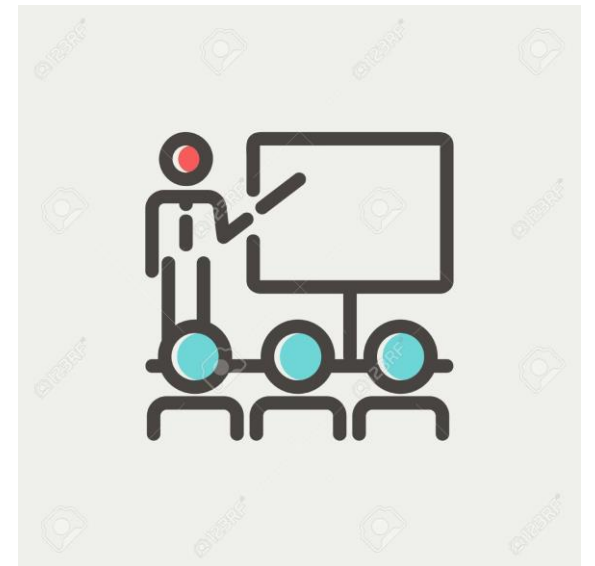
4^ο ΔΙΑΠΑΝΕΠΙΣΤΗΜΙΑΚΟ ΠΡΟΓΡΑΜΜΑ ΕΚΠΑΙΔΕΥΣΗΣ ΣΤΗ ΡΕΥΜΑΤΟΛΟΓΙΑ 2022-24

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Ρευματολογική Κλινική ΠΑΓΝΗ

- Δεν υπάρχει σύγκρουση συμφερόντων για την συγκεκριμένη ομιλία

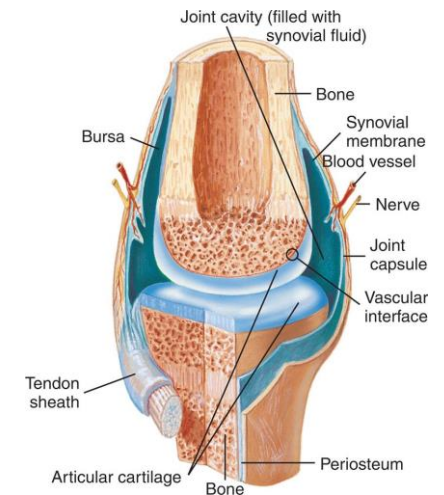
Presentation structure

- Synovial fluid analysis and microscopy (clinical implications)
- Common joint and soft tissues injections in rheumatology
- Practical points before and after procedure
- Complication of joint and soft tissue infections



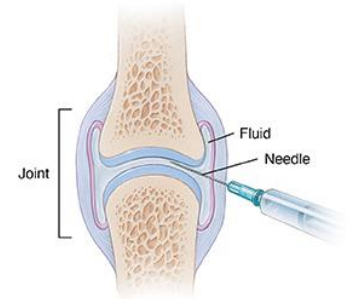
Synovial fluid

- Synovial fluid is physiologic, and acts as a joint space lubricant of articular cartilage, and nutrient source through diffusion for surrounding structures.
- Synovial fluid is produced as an ultrafiltrate of blood plasma → filtration through the synovial membrane
- Synovial fluid production is mainly from fibroblast like type B synovial cells.
- Changes in synovial fluid volume and content occur in response to trauma, inflammation and infection



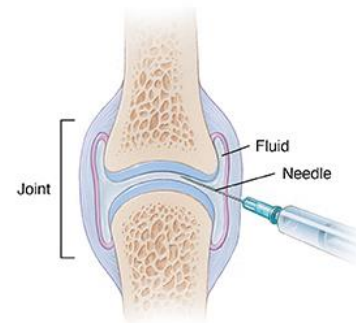
Joint aspiration and synovial fluid analysis

- Invaluable diagnostic tool (if we can aspirate joint better to do so)
- Differentiate between inflammatory vs non-inflammatory arthritis (number of cells)
- Confirm diagnosis of septic arthritis-bursitis/tenosynovitis (Gram stain & culture)



Joint aspiration and synovial fluid analysis

- Confirm diagnosis and differentiate types of crystal induced arthritis (microscopy)
- Many information's coming from fluid color (PVNS & Hemarthrosis)
- Combine with clinical findings and imaging



Synovial fluid appearance and analysis

	Colour	Clarity	Viscosity	WBC count (mm ³)	Neutrophil count	Gram stain	Crystals
Normal	Colourless	Translucent	↑	< 200 cells/mm ³	<25 %	Negative	Negative
Non-inflammatory	Straw like / yellow	Translucent	↑	200 - 2000 cells/mm ³	<25 %	Negative	Negative
Inflammatory	Yellow	Cloudy	↓	2000–50,000 cells/mm ³	>50 %	Negative	Positive
Septic	Yellow/green	Cloudy / opaque	↓	>50,000 cells/mm ³	>75 %	Positive	Negative
Haemarthrosis	Red/ xanthochromic	Bloody	Variable	200-2000 mm ³	50-75 %	Negative	Negative

Septic arthritis

- Needs to be excluded ,especially in cases of monoarthritis
- The synovial fluid always must be sent for Gram stain & culture
- Gram stain is positive in app 50 % of cases

TABLE 104.2 LIKELIHOOD OF A DIAGNOSIS OF JOINT SEPSIS DEPENDING ON THE NUMBER OF WHITE BLOOD CELLS IN SYNOVIAL FLUID

Synovial fluid white blood cell counts	Likelihood of a diagnosis of joint sepsis
Less than 25,000/mm ³	0.32
More than 25,000/mm ³	2.9
More than 50,000/mm ³	7.7
More than 100,000/mm ³	28

Reproduced with permission from Margaretten ME, Kohlwes J, Moore D, Bent S. Does this adult patient have septic arthritis? JAMA 2007;297:1478-1488.

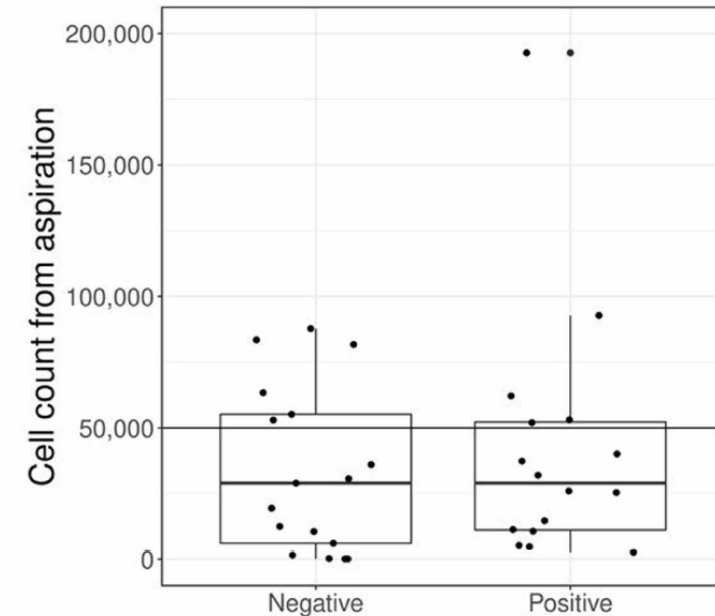
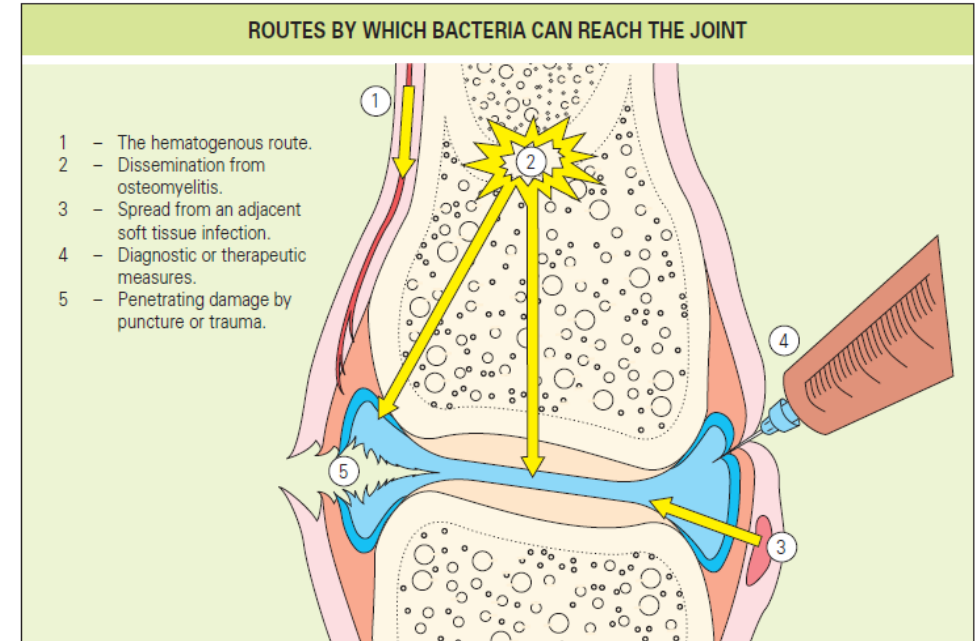


FIGURE 1: Synovial fluid cell count between groups

Septic arthritis

TABLE 104.1 USUAL CAUSATIVE ORGANISMS OF SEPTIC ARTHRITIS AND OSTEOMYELITIS

Septic arthritis	Osteomyelitis
<i>Staphylococcus aureus</i>	<i>Staphylococcus aureus</i>
<i>Streptococcus pyogenes</i>	<i>Streptococcus pyogenes</i>
<i>Streptococcus pneumoniae</i>	<i>Streptococcus pneumoniae</i>
Coagulase-negative staphylococci	Coagulase-negative staphylococci
<i>Hemophilus influenzae</i>	<i>Hemophilus influenzae</i>
<i>Kingella kingae</i>	<i>Kingella kingae</i>
<i>Mycobacterium tuberculosis</i>	<i>Mycobacterium tuberculosis</i>
<i>Neisseria gonorrhoeae</i>	<i>Peptostreptococcus</i> species
<i>Neisseria meningitidis</i>	<i>Neisseria meningitidis</i>
<i>Escherichia coli</i>	<i>Escherichia coli</i>
<i>Proteus mirabilis</i>	Anaerobic bacilli
<i>Pseudomonas aeruginosa</i>	
<i>Klebsiella pneumoniae</i>	
<i>Salmonella</i> species	
Polymicrobial	
Fungi	



BOX 104.1 RISKS AND PREDISPOSITION FACTORS FOR THE DEVELOPMENT OF SEPTIC ARTHRITIS

- Rheumatoid arthritis
- Prosthetic joints
- Low socioeconomic status
- Advanced age
- Intravenous drug abuse
- Alcoholism
- Diabetes
- Intra-articular injection
- Cutaneous ulcers

Special pathogens

- Joint tuberculosis (TB) is an uncommon manifestation of TB that typically presents with subacute or chronic atraumatic inflammatory symptoms in single, large, weight-bearing joints.
- Specialized mycobacterial culture is the gold standard for diagnosis of TB, but nucleic acid amplification tests (NAAT) from synovial fluid are increasingly accessible and allow for rapid diagnosis of joint TB.

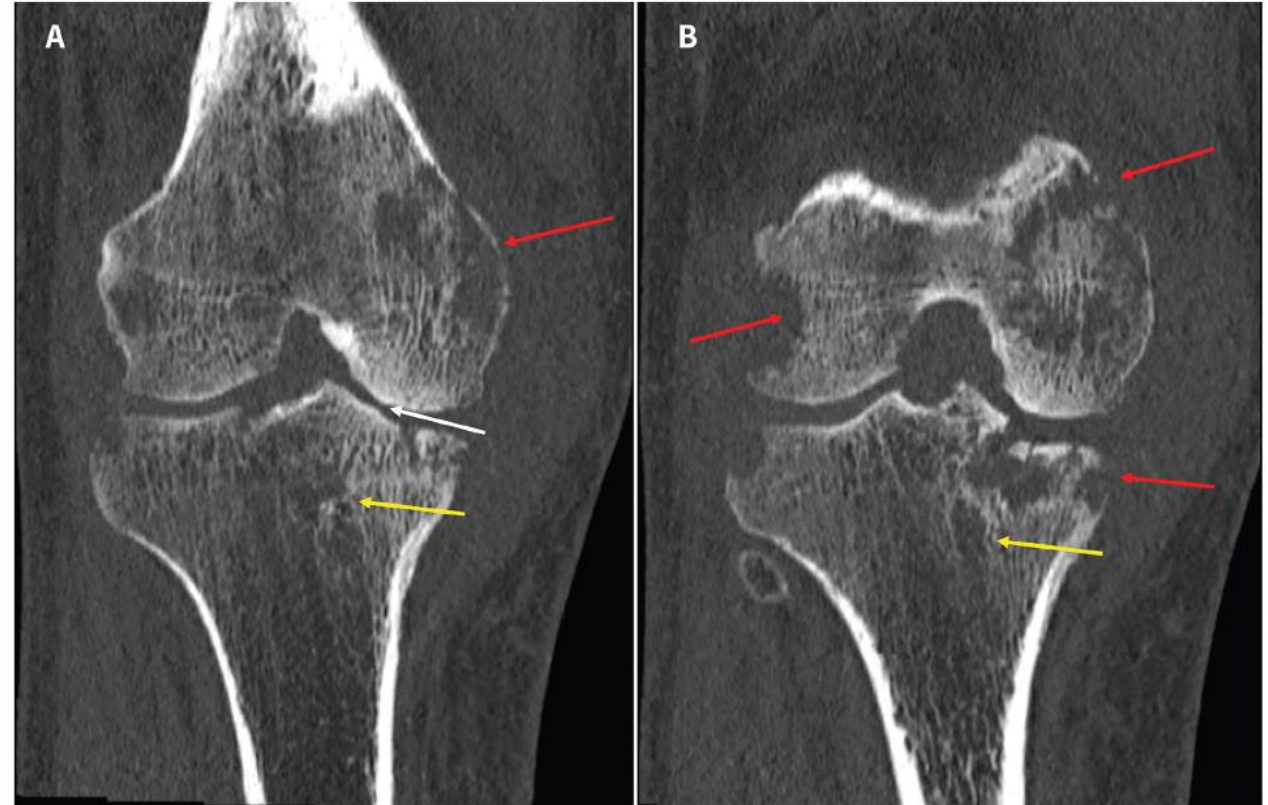
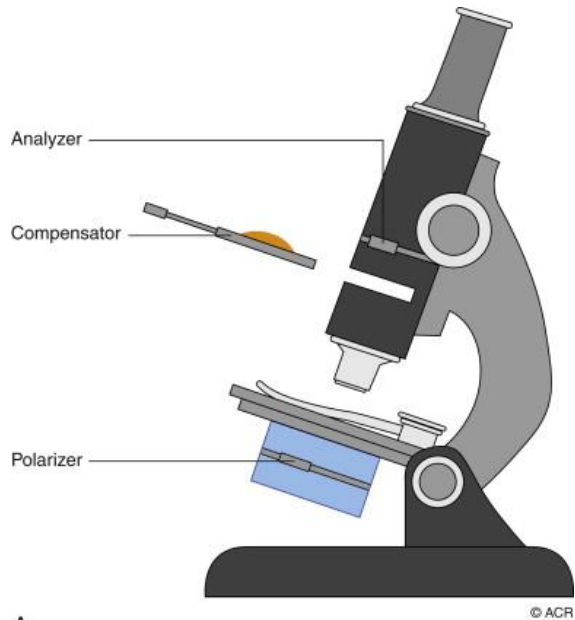
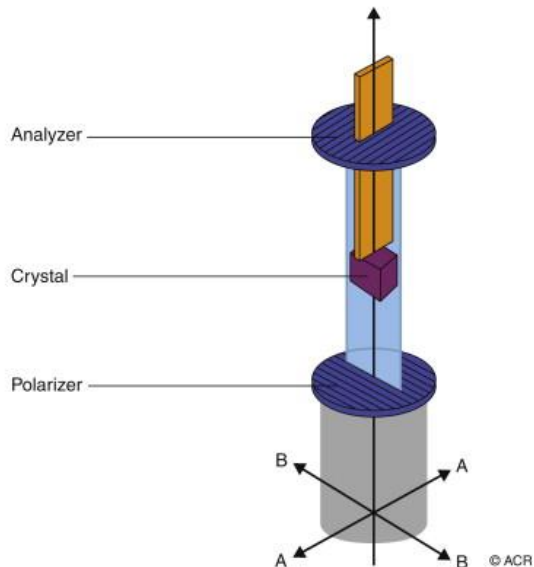


Figure 2: Serial computed tomography scans (coronal view) of the right knee of a 47-year-old man with joint tuberculosis, showing the Pheemister triad of tuberculosis arthropathy including juxta-articular osteopenia (yellow arrows), peripheral osseous erosions (red arrows) and joint space narrowing (white arrow, panel A).



A



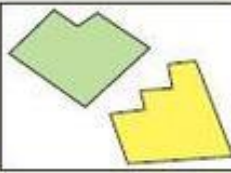


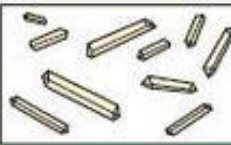
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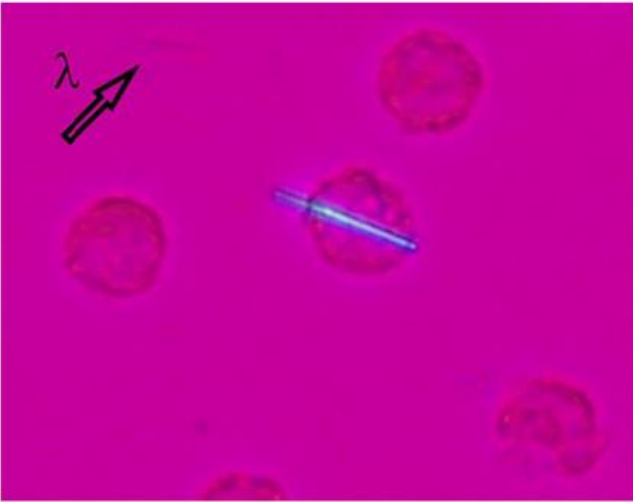
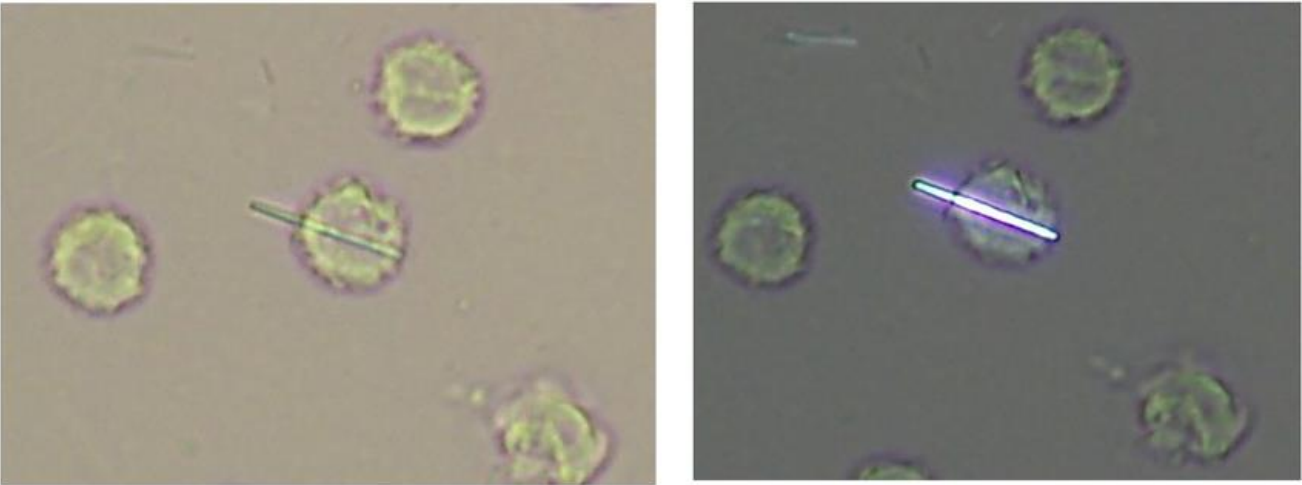
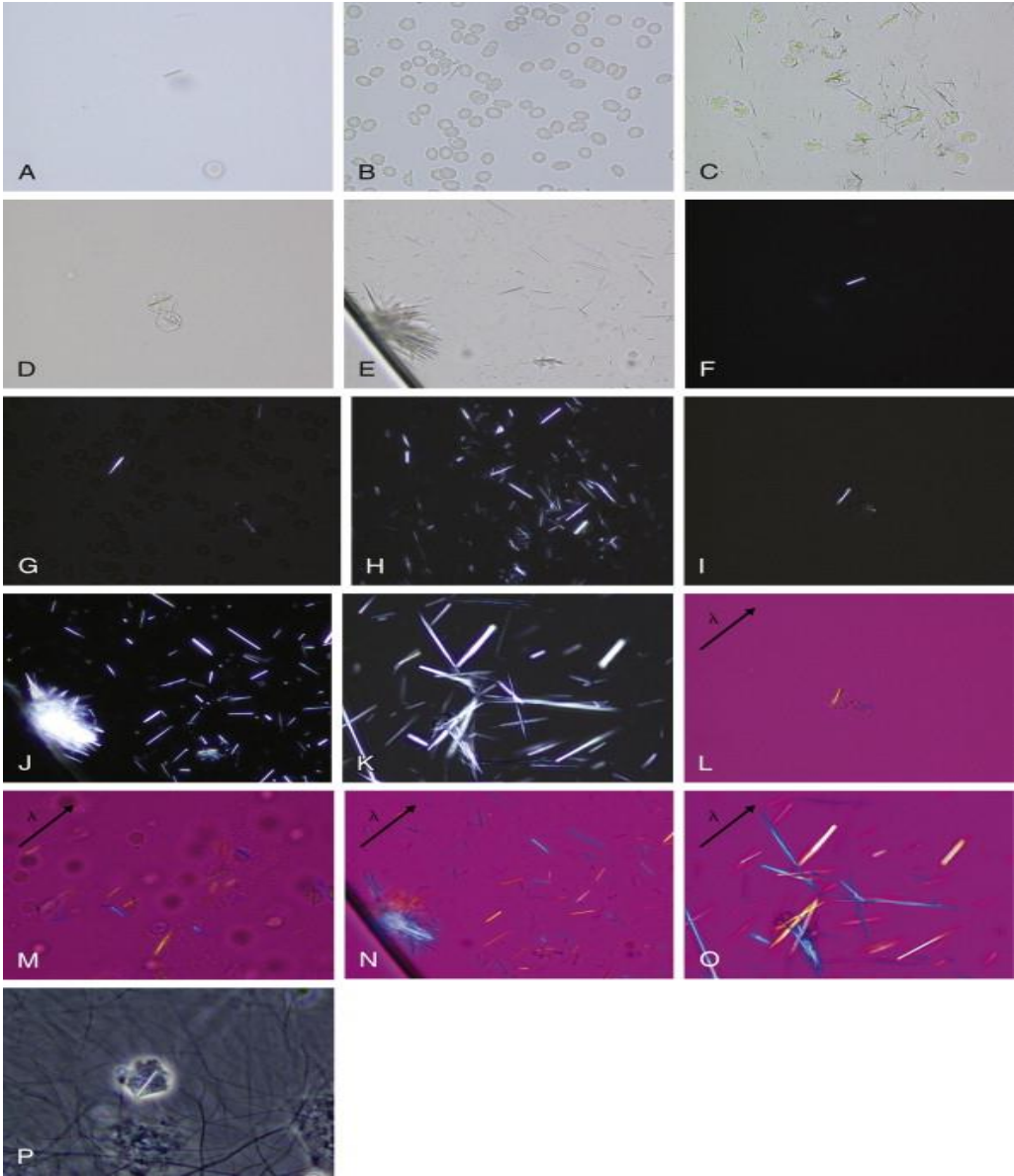
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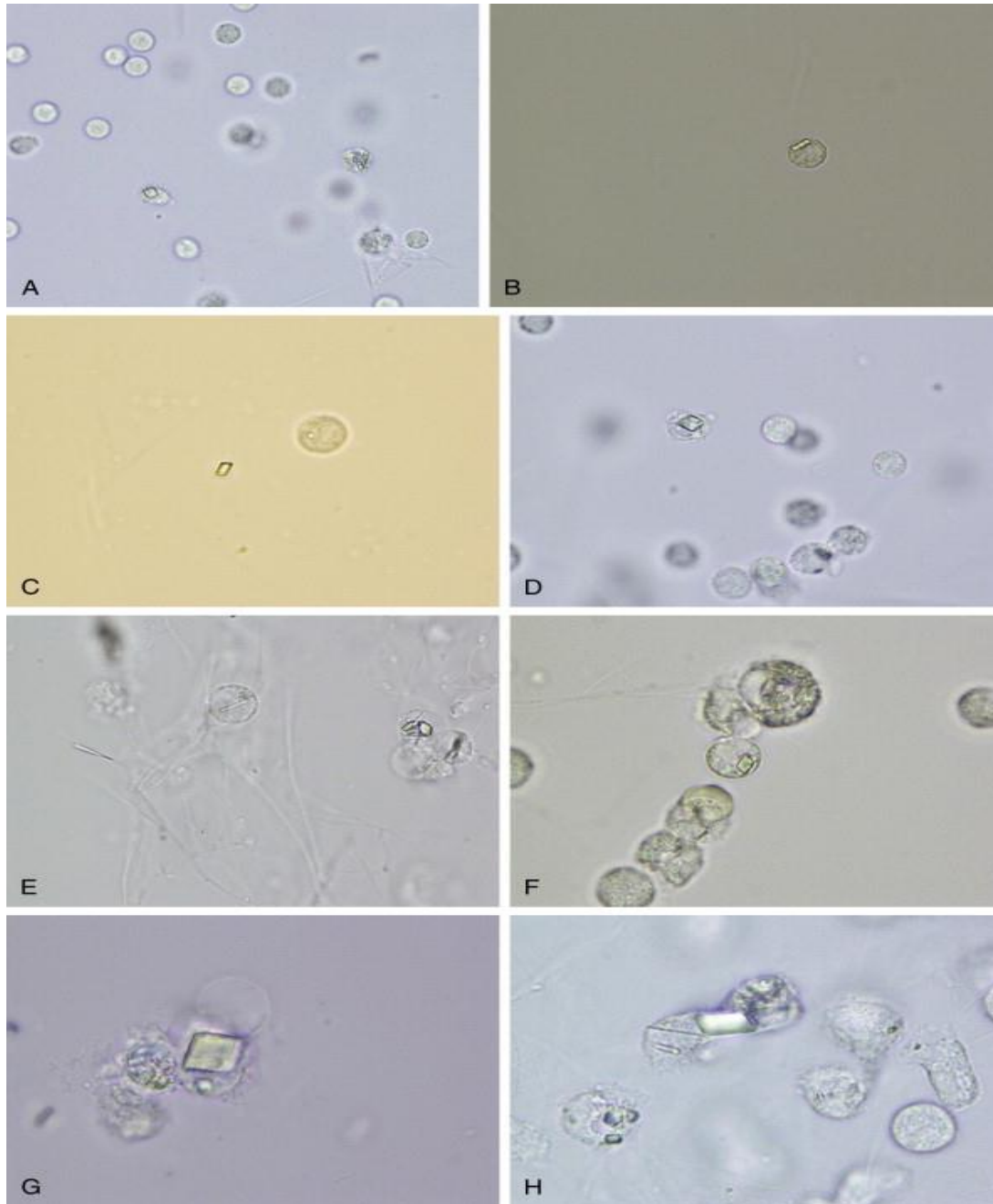
Table 12-5 Characteristics of Synovial Fluid Crystals

Crystal	Shape	Compensated Polarized Light	Significance
Monosodium urate	Needles		Negative birefringence Gout
Calcium pyrophosphate	Rhombic square, rods		Positive birefringence Pseudogout
Cholesterol	Notched, rhombic plates		Negative birefringence Extracellular
Corticosteroid	Flat, variable-shaped plates		Positive and negative birefringence Injections
Calcium oxalate	Envelopes		Negative birefringence Renal dialysis
Apatite (Ca phosphate)	Small particles Require electron microscopy		No birefringence Osteoarthritis

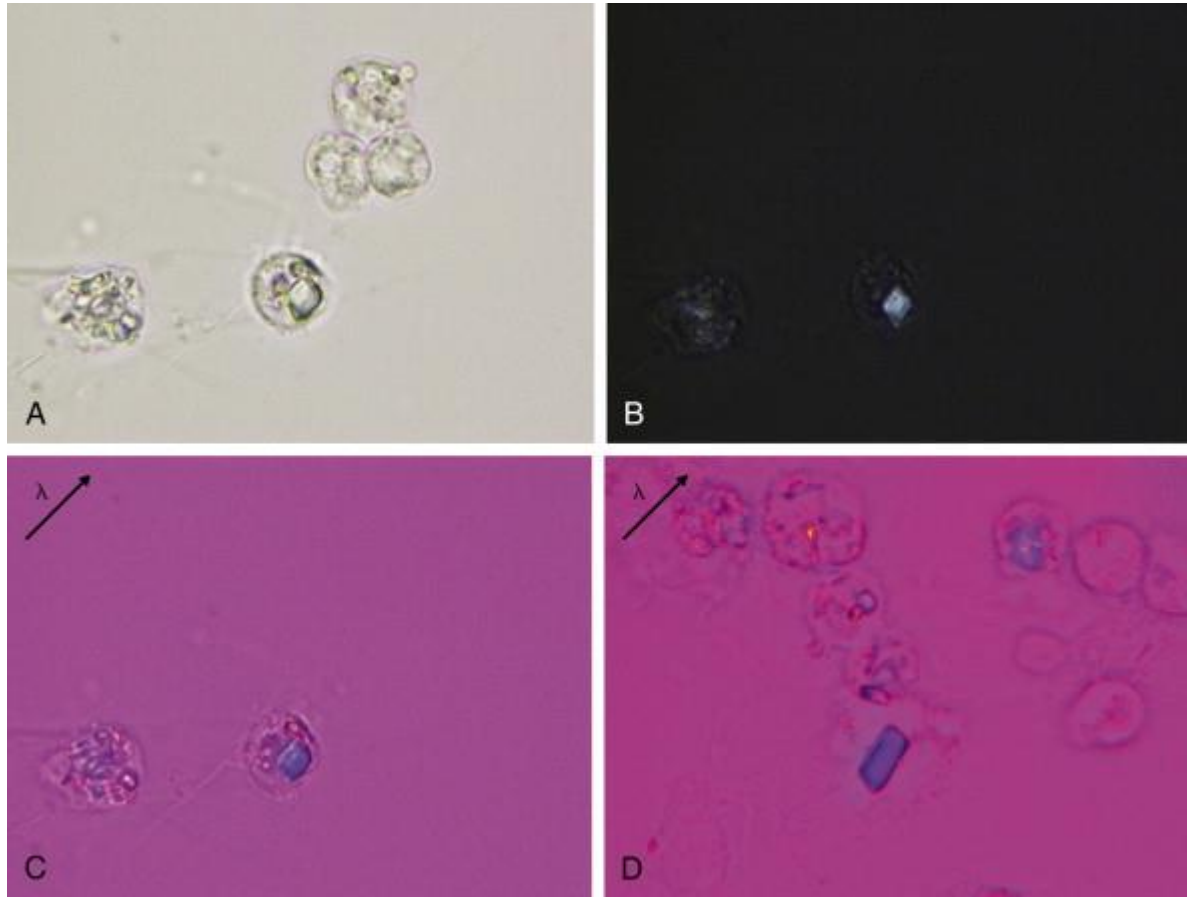
Monosodium urate (MSU) crystals.



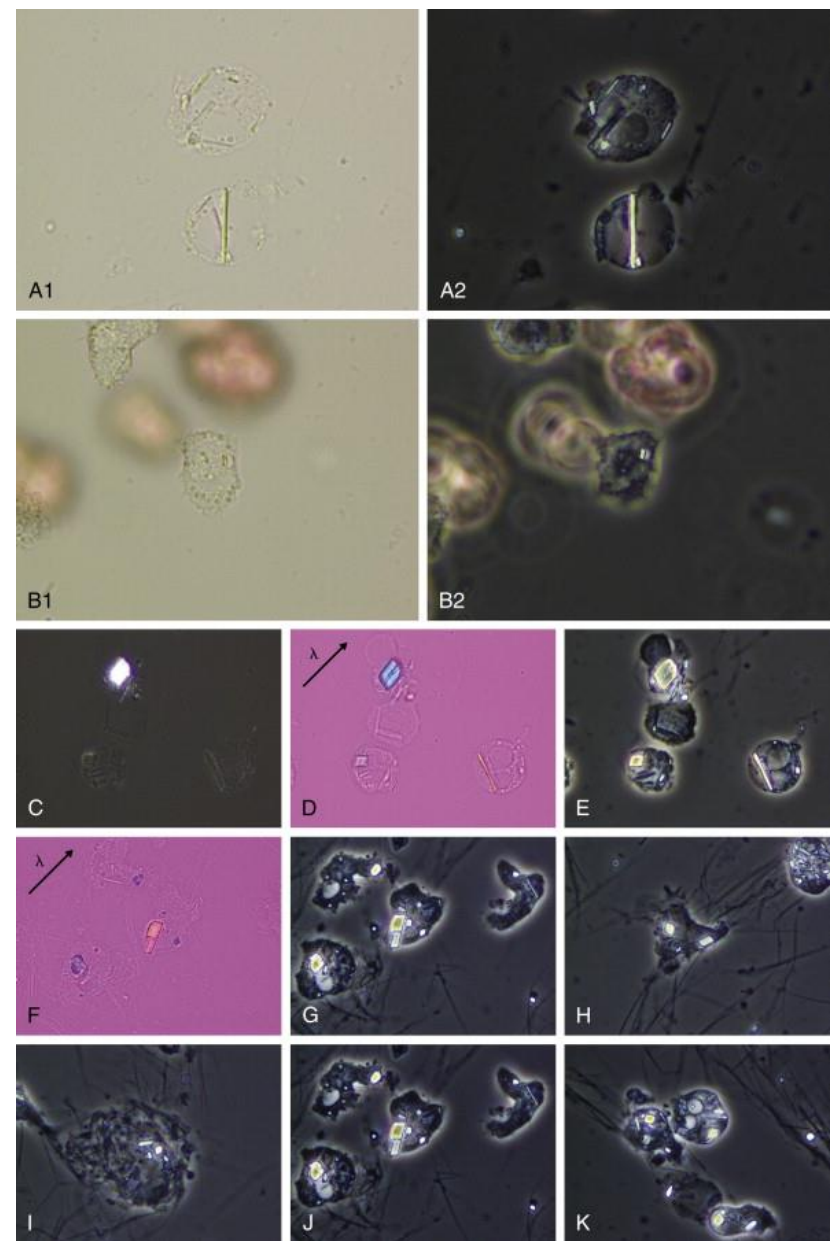
MSU crystals in a synovial fluid sample seen under light microscopy (a) using ordinary light, (b) polarized light, and (c) first-order red compensator. λ shows the axis of the compensator



Calcium pyrophosphate dihydrate (CPPD) identification by shape with a brightfield microscope.



Calcium pyrophosphate dihydrate (CPPD) compensated polarized microscope



Calcium pyrophosphate dihydrate (CPPD) as seen with phase contrast microscopy.

HADD Arthropathy (Milwaukee shoulder)



Fig. 187.4 Basic calcium phosphate crystal-associated destructive arthritis (Milwaukee shoulder syndrome). This elderly patient has visible swelling in both shoulders (a). Aspiration revealed a large amount of blood-stained fluid (b) that contained numerous particles of basic calcium phosphates.

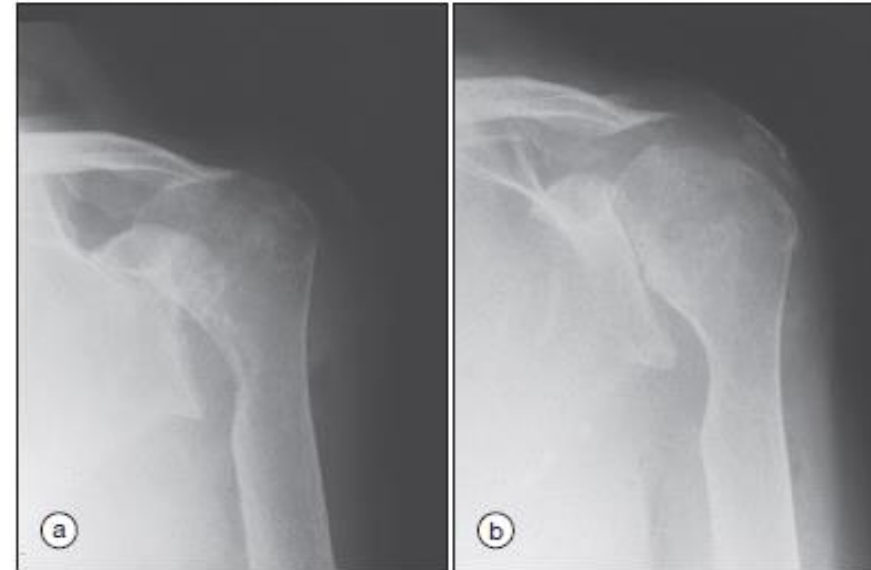


Fig. 187.7 Anteroposterior radiographs of a shoulder joint affected by basic calcium phosphate crystal-associated destructive arthritis (Milwaukee shoulder syndrome). The extensive destruction of periarticular tissues, including the rotator cuff, has led to instability of the shoulder. The upward subluxation (a) of the humerus can be overcome by traction on the shoulder (b). Note the extensive atrophic destruction and loss of bone of both the acromion and the glenohumeral joint.

CPPD Arthropathy

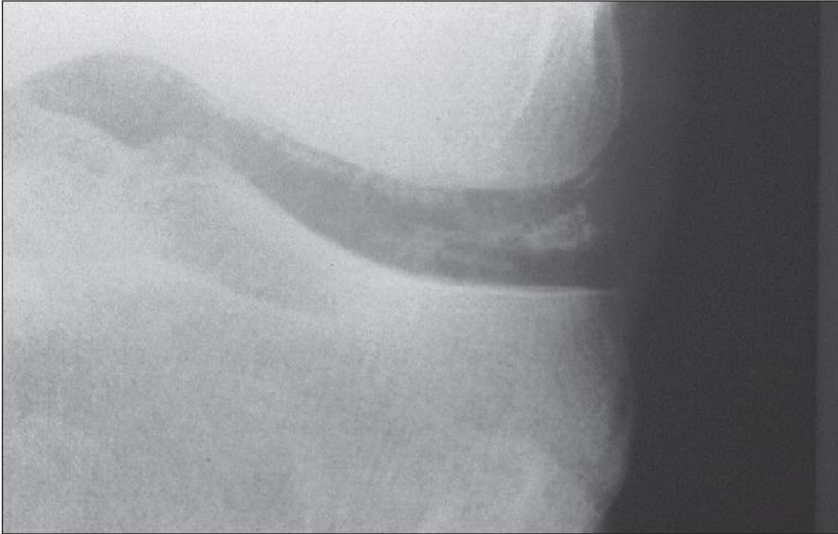


Fig. 186.7 Knee radiograph showing chondrocalcinosis of both fibrocartilage (meniscus) and hyaline cartilage.

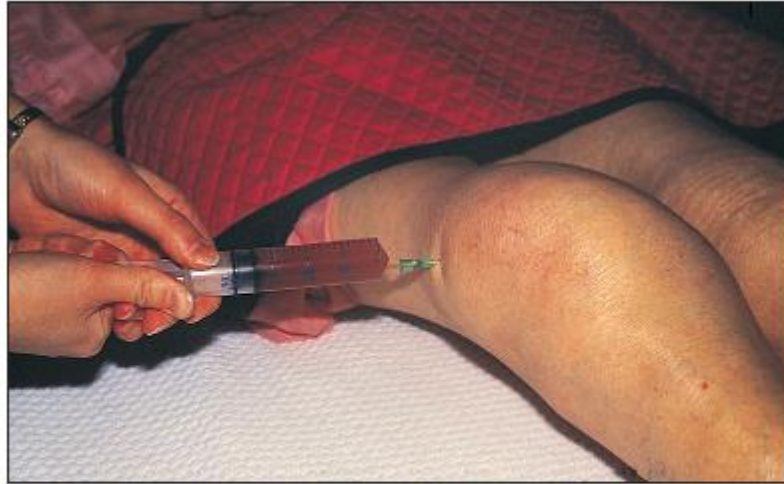


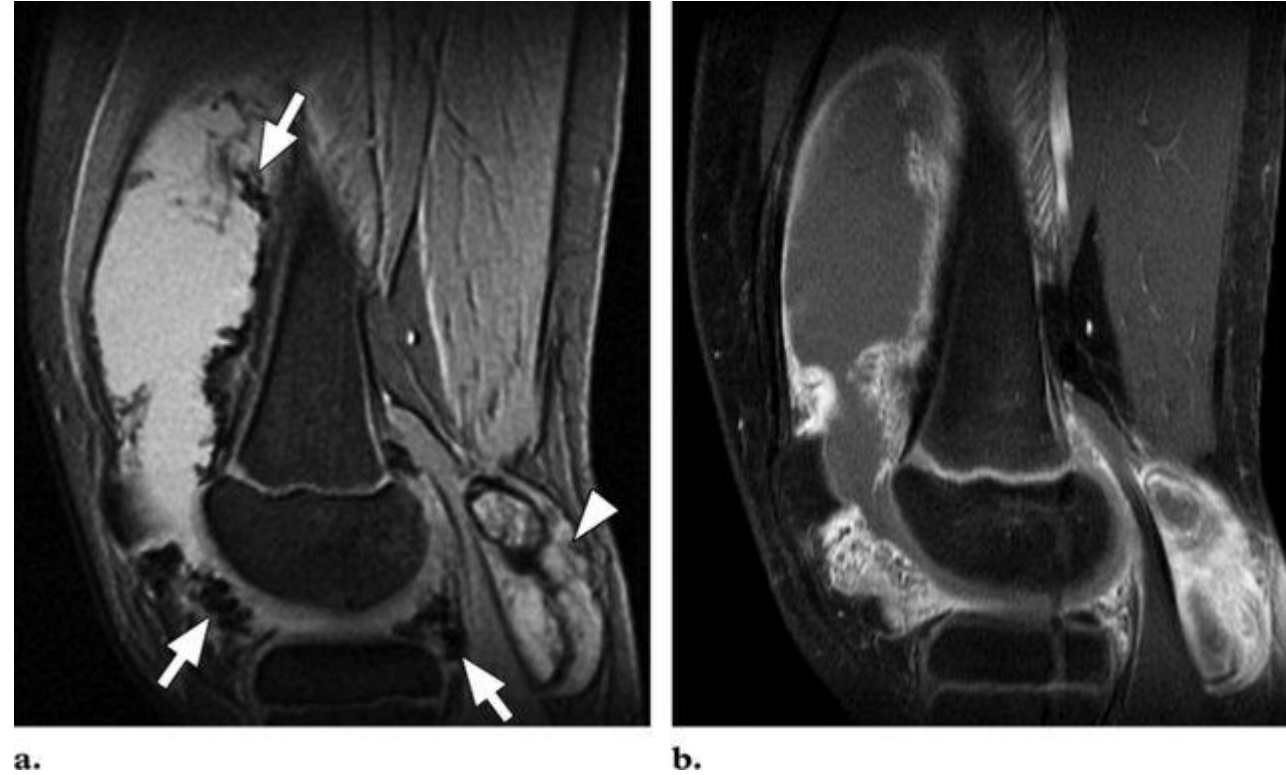
Fig. 186.3 Acute CPP crystal arthritis affecting the knee. Seen here in an elderly woman with background chronic pyrophosphate arthropathy. Bloodstaining of synovial fluid is common in this situation.



Fig. 186.11 Knee radiograph showing hypertrophic osteoarthritis features. Note prominent patellofemoral involvement, typical of pyrophosphate arthropathy.

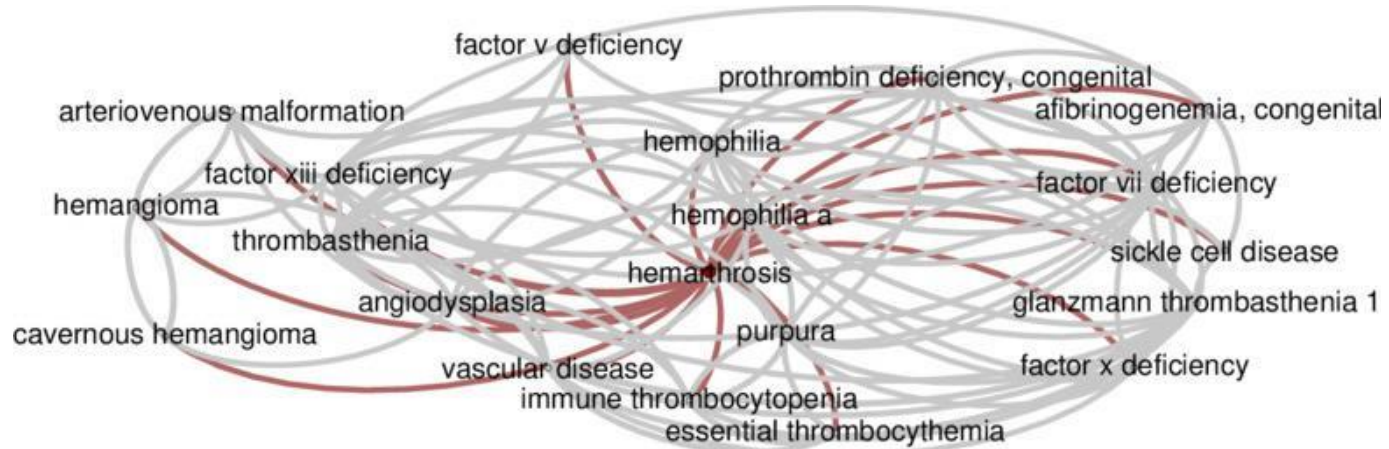
PVNS

- Pigmented villonodular synovitis (PVNS) refers to a subtype of tenosynovial giant cell tumors that diffusely affect the soft tissue lining of joints and tendons
- Pigmented villonodular synovitis typically occurs in the large joint of the upper and lower extremities.
- **Incidental hemarthrosis from aspiration** of a chronically inflamed joint can also provide an important diagnostic clue

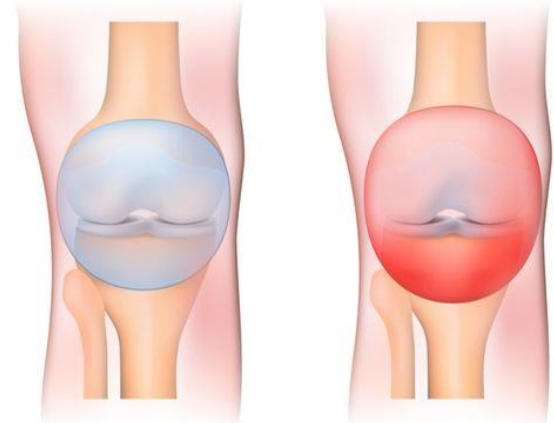


Pigmented villonodular synovitis. (a) Sagittal multiplanar GRE MR image of the knee joint shows moderate to severe joint effusion and a Baker cyst (arrowhead). Synovium shows irregular nodular thickening with dark areas of hemosiderin deposition

Hemarthrosis



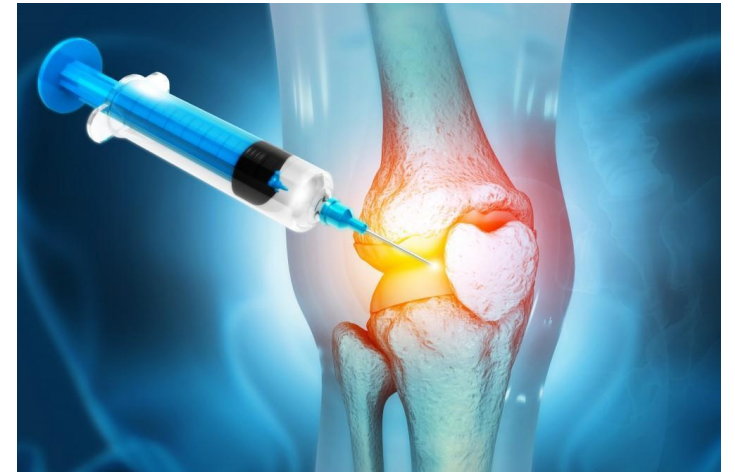
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- Trauma
- Anticoagulation
- Previous joint manipulation

Joint and soft tissue injections in rheumatology practice

- Joint and soft tissue injections are commonly performed as part of a rheumatology practice
- These procedures are very valuable as therapeutic tools.
- With the recognition of poor accuracy of nonimage-guided injection procedures, particularly into the knee, shoulder and hip the use of image guidance for these procedures is becoming more commonplace.
- Musculoskeletal ultrasound is now being used to help guide certain injection procedures



Injectable materials and techniques

```
graph TD; A[Injectable materials and techniques] --> B[materials]; A --> C[techniques]; B --- D[• Steroids ( long acting)  
• HA  
• PRP  
• SVF, SCs  
• Hypertonic solutions ( dextrose), prolotherapy  
• Anesthetics]; C --- E[• Dry needling ( degenerative tendinopathy)  
• Barbotage ( calcific tendinopathy)  
• Hydrodistension ( frozen shoulder)  
• Hydrodissection ( degenerative Achilles tendinopathy, nerve entrapment )];
```

materials

- Steroids (long acting)
- HA
- PRP
- SVF, SCs
- Hypertonic solutions (dextrose), prolotherapy
- Anesthetics

techniques

- Dry needling (degenerative tendinopathy)
- Barbotage (calcific tendinopathy)
- Hydrodistension (frozen shoulder)
- Hydrodissection (degenerative Achilles tendinopathy, nerve entrapment)

Before procedure –practical points

- Ask for allergies
- Inform consent from patient
- Patient should be comfortable positioned (preferably to lye down)
- Cleansing per protocol
- Keep the drying time (at least 2 min)



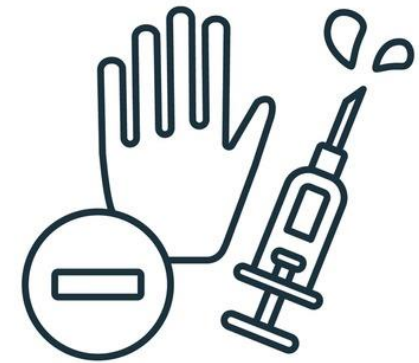
Before procedure –practical points

- Prepare and choose promptly your materials (especially needles)
- Probe positioning for US guidance (good and clear image ➡ successful injection)
- Make the proper choice regarding injectable steroids (superficial or deep located joint-size/sheath/bursa)



Table 2.5 Contraindications to local anesthetic/corticosteroid injection procedures

Allergy to injectate
Unstable or inaccessible joints
Primary severe coagulopathy
Uncontrolled diabetes
Charcot joint
Generalized infection
Septic arthritis
Lack of response to two or three prior injections
Weight-bearing tendons (e.g., Achilles tendon, patellar tendon)
Osteomyelitis of an adjacent bone
Need for a high degree of anticoagulant therapy
Osteochondral fracture of adjacent bone



CONTRAINDICATIONS

Ultrasound guided procedures



S. Fukui, R. Rokutanda, S. Kawaai et al.

Best Practice & Research Clinical Rheumatology 37 (2023) 101832

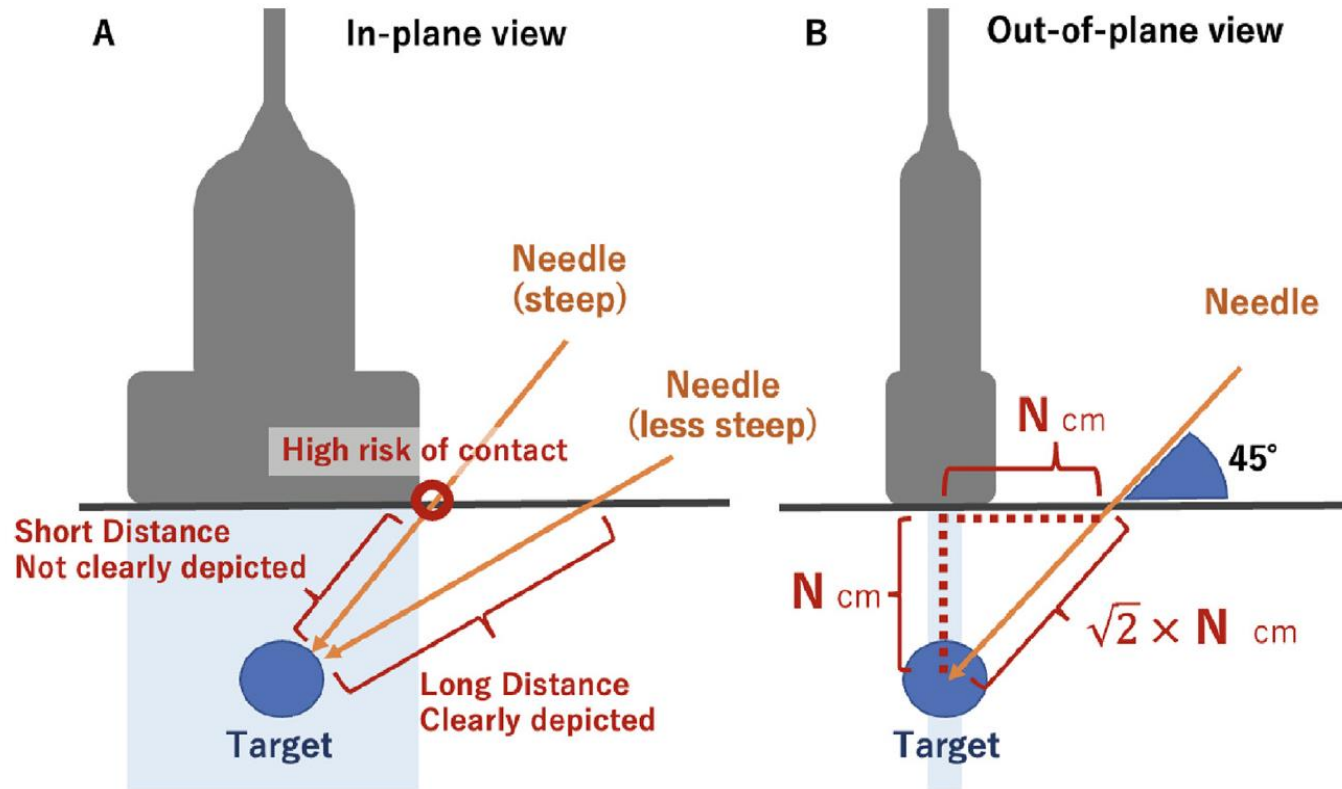
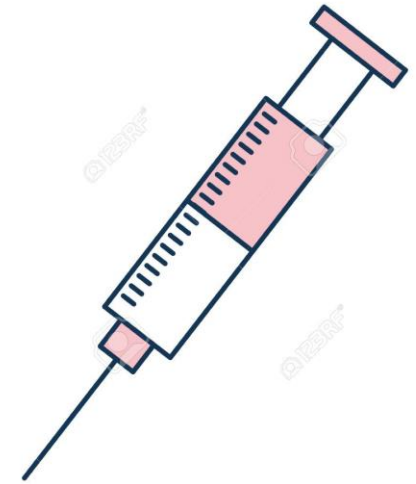


Fig. 3. In-plane and out-of-plane view method in US-guided procedures.

Common joint and soft tissue injections

Shoulder

1. Injection of AC joint
2. Injection of SASD bursa
3. Injection of GH joint



Main indications : Osteoarthritis > Inflammatory arthritis
 Clinically : painful palpation

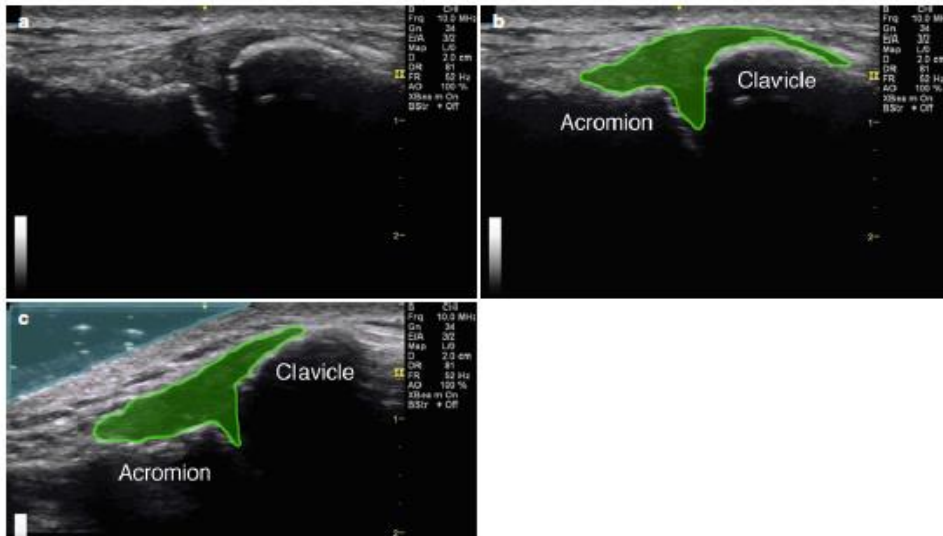


Fig. 2.4 (a) Coronal view of the acromioclavicular joint. (b) Green indicates AC joint fluid within the joint capsule, acromion and clavicle labeled. (c) Coronal view for a gel standoff approach, light blue indicating gel

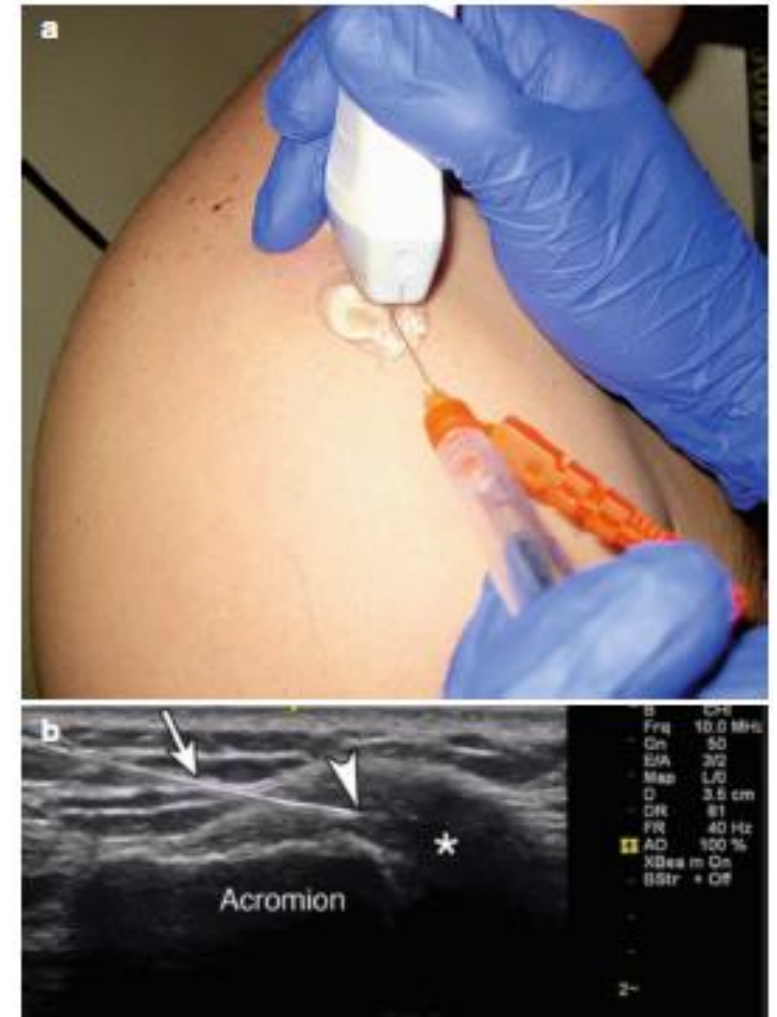


Fig. 2.5 (a) Example of coronal probe position over AC joint with gel standoff in-plane injection technique. (b) Asterisk indicates injectate in AC joint space, arrow points to needle, arrowhead points to needle tip, acromion labeled

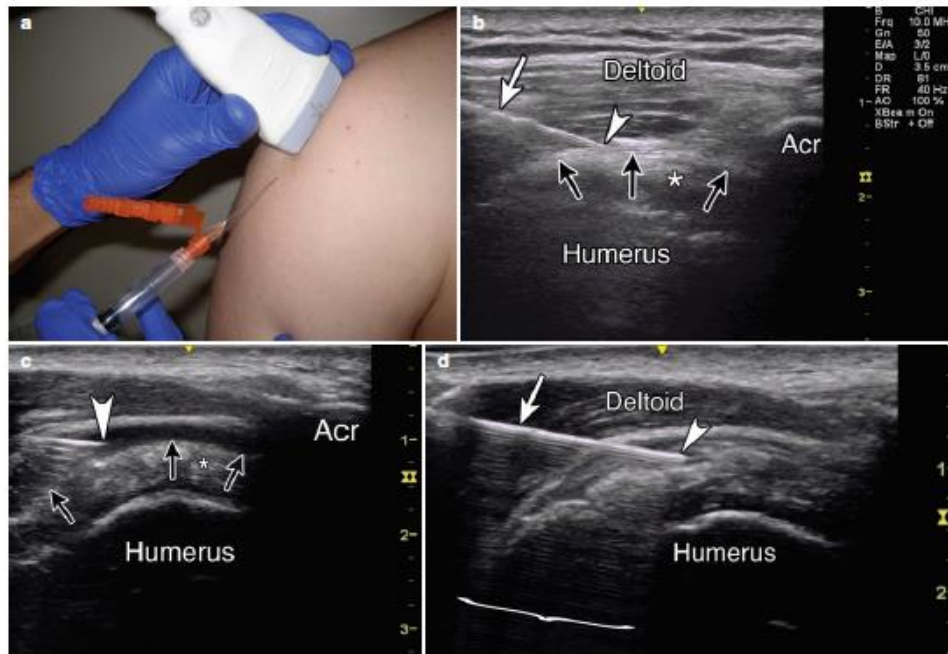


Fig. 2.11 (a) Example of probe position over SASDB with in-plane injection technique. (b) Example of in-plane needle approach, white arrow indicates needle, white arrowhead indicates needle tip, humerus and deltoid labeled, Acr acromion, black arrows indicate location of SASDB, asterisk indicates supraspinatus muscle with anisotropy. (c) White arrowhead indicates needle tip, black arrows indicate injectate filling bursa, asterisk indicates supraspinatus muscle with anisotropy, Acr acromion, humerus labeled. (d) Example of calcific tenotomy, white arrow indicates needle, white arrowhead indicates needle tip, bracket indicates needle reverberation, deltoid and humerus labeled

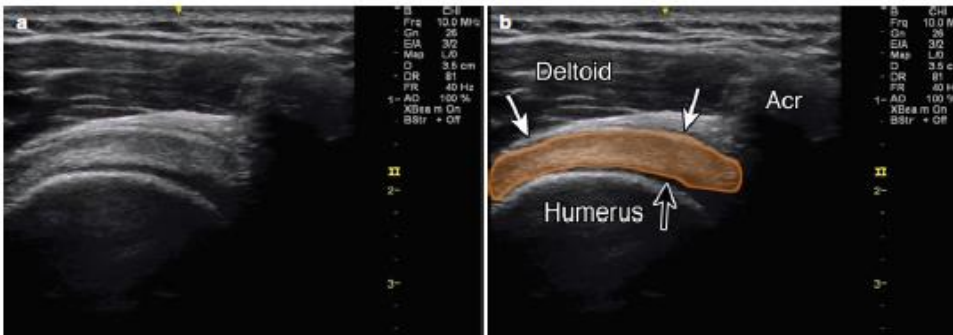


Fig. 2.10 (a) Coronal view of the SASDB. (b) Deltoid and humerus labeled, Acr acromion, black arrow indicates hyaline cartilage, white arrows indicate SASDB, orange indicates supraspinatus muscle

Main indications :

- SASD bursitis
- RC degenerative tendinopathy
- Calcific tendinopathy
- RC impingement syndrome





Fig. 66.24 Posterior approach to the right shoulder in frozen shoulder.

Main indications :

- Inflammatory arthritis
- OA
- Crystal induced arthritis
- Possible septic arthritis

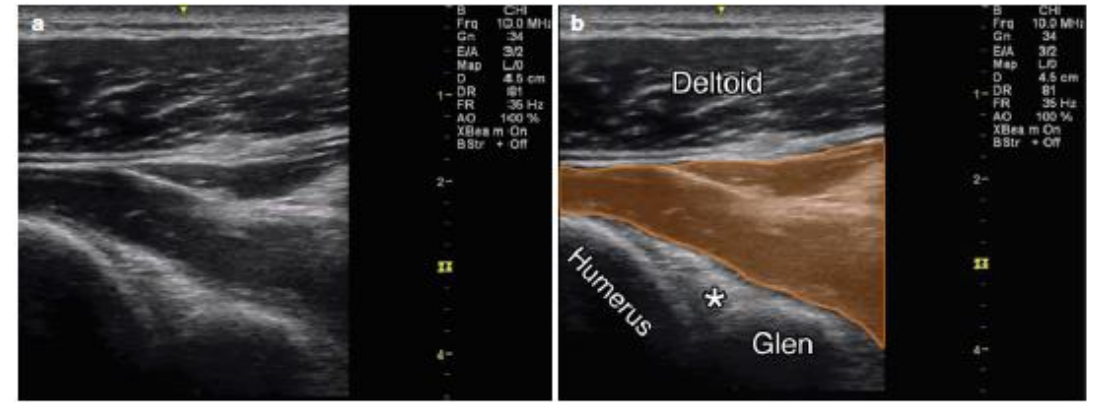


Fig. 2.8 (a) Posterior view of glenohumeral joint. (b) View of the posterior glenohumeral joint, deltoid and humerus labeled, Glen glenoid, asterisk indicates labrum, orange overlies infraspinatus muscle

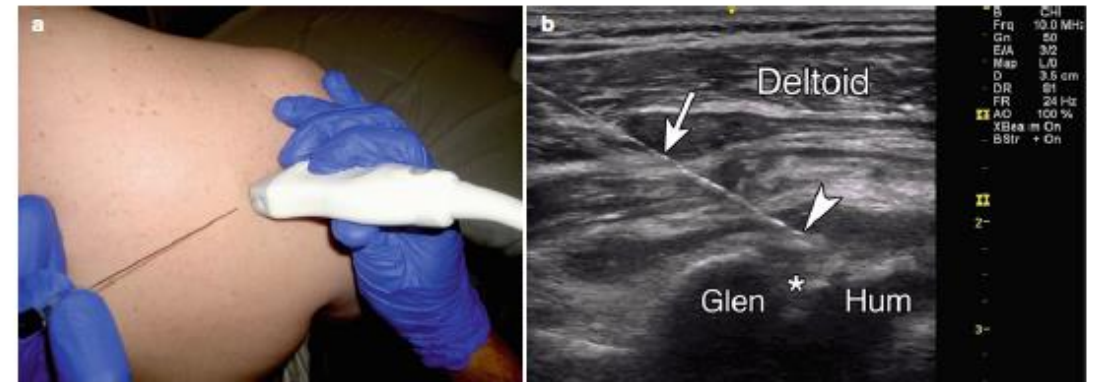
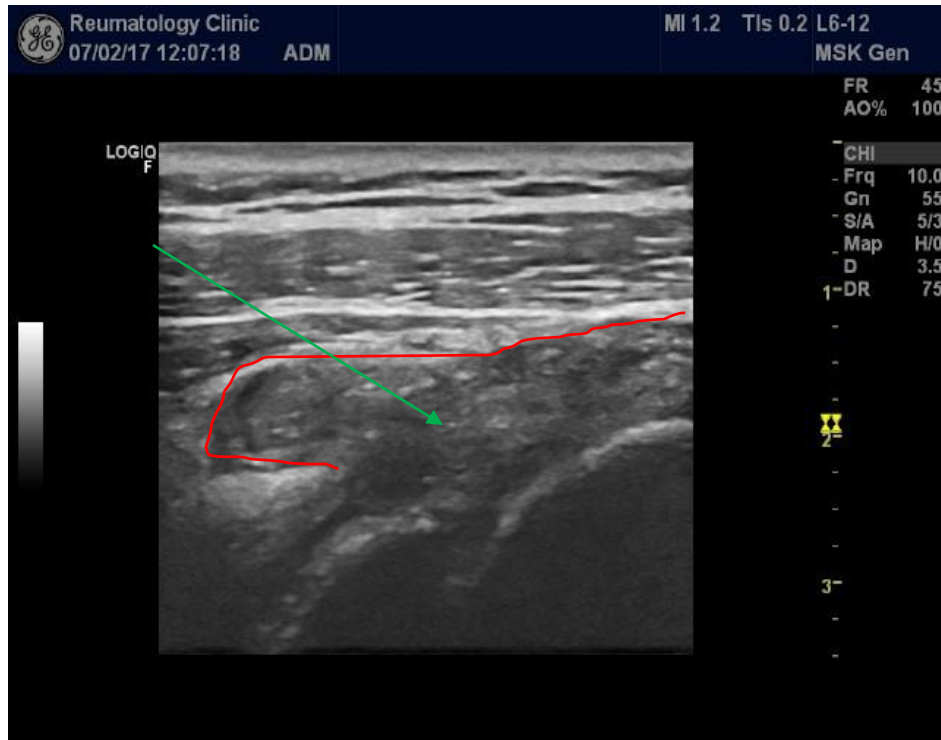
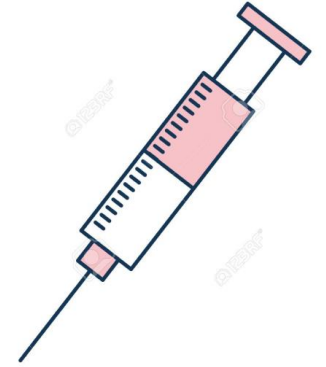


Fig. 2.9 (a) Example of probe position over posterior glenohumeral joint. (b) Example of in-plane needle approach, white arrow indicates needle, white arrowhead indicates needle tip, Hum-humerus, Glen glenoid, asterisk indicates labrum, deltoid labeled

Elbow

1. Injection of common extensor compartment (LE)
2. Injection of the olecranon bursa
3. Injection of the elbow joint



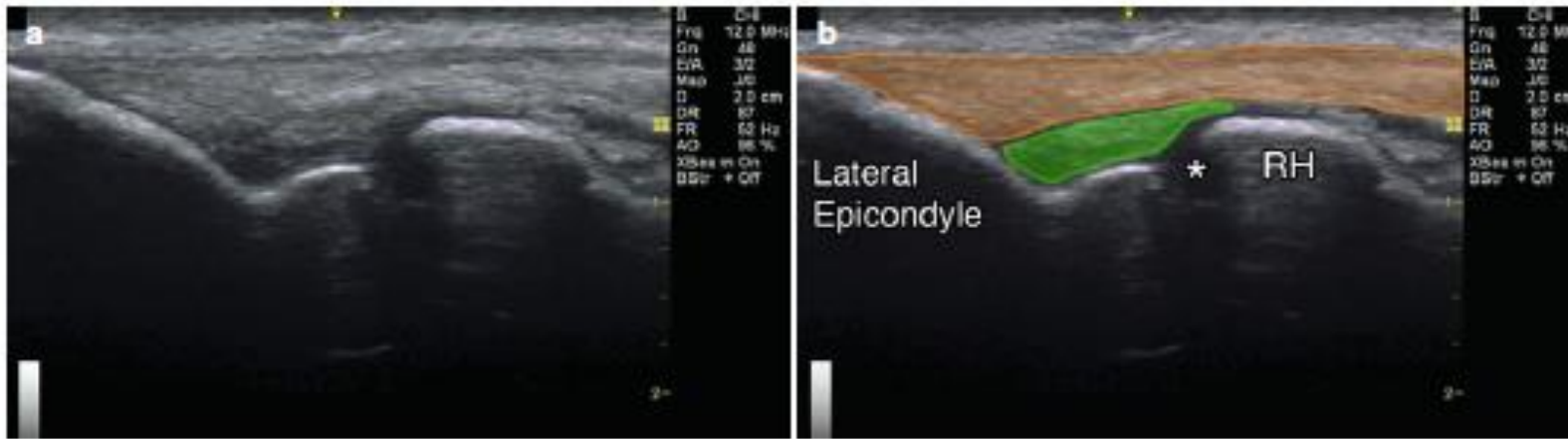


Fig. 3.8 (a) Coronal view of common extensor tendon. (b) *Green* indicates radial collateral ligament, *orange* indicates common extensor tendons, *RH* radial head, *asterisk* indicates joint space, lateral epicondyle labeled

- Main indications :
- Lateral epicondyle pain syndrome

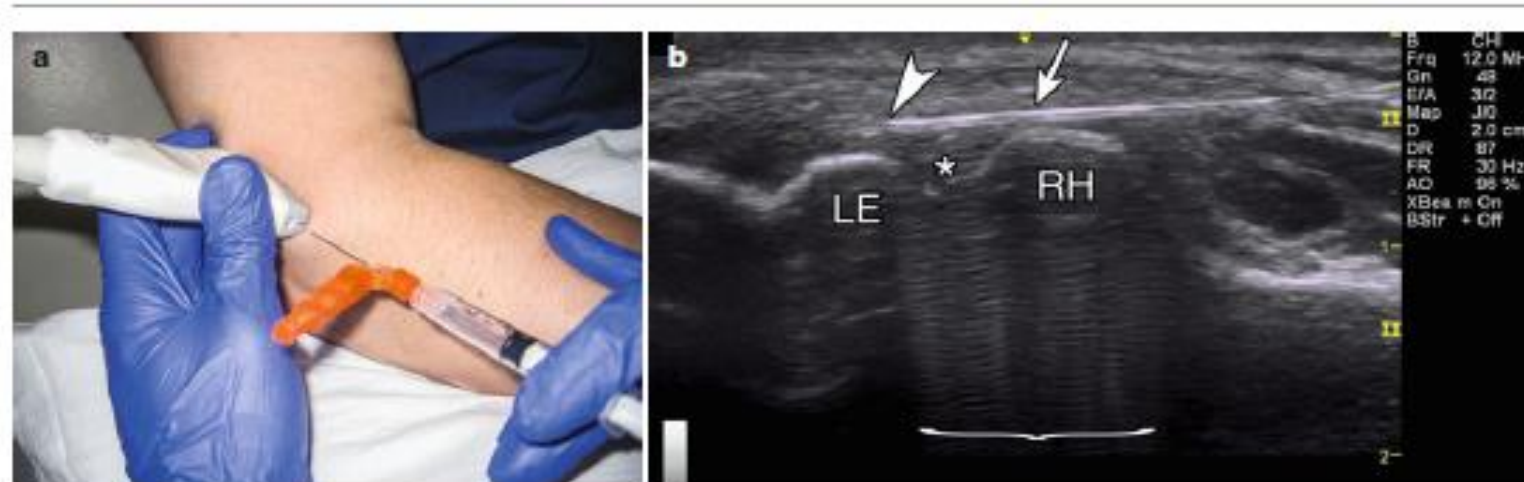


Fig. 3.9 (a) Example of probe position over common extensor tendon. (b) Example of in-plane long-axis approach, *arrow* indicates needle, *arrowhead* indicates needle tip, *asterisk* indicates joint space, *bracket* indicates needle reverberation, *LE* lateral epicondyle, *RH* radial head



Fig. 66.22 Injection in right tennis elbow (lateral epicondylar syndrome).



Main indications :

- Possible septic bursitis
- Gout

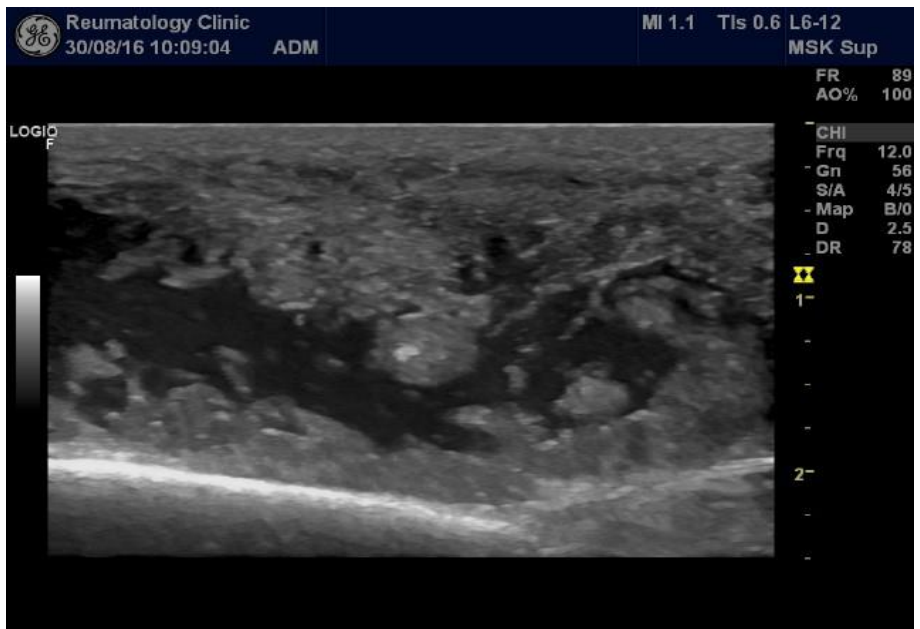
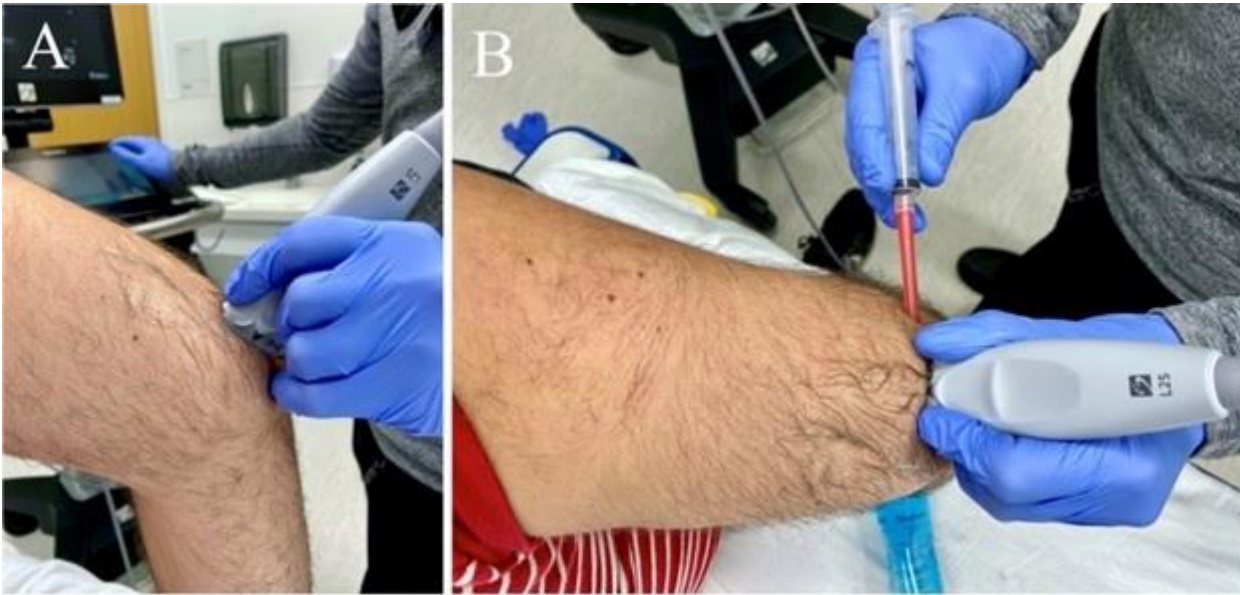


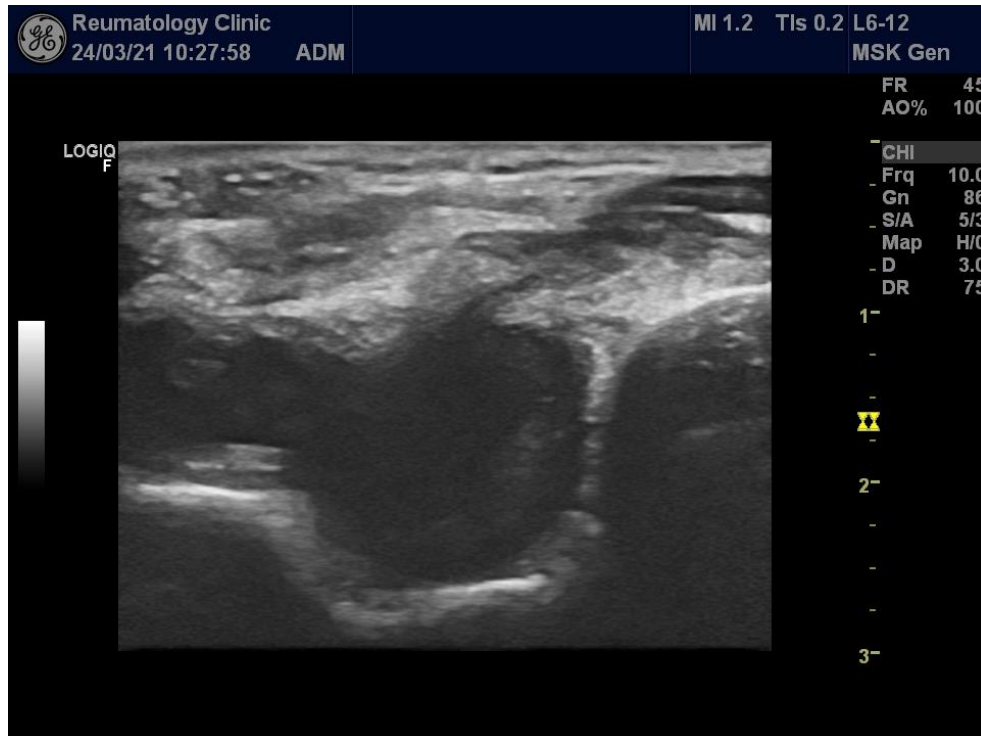
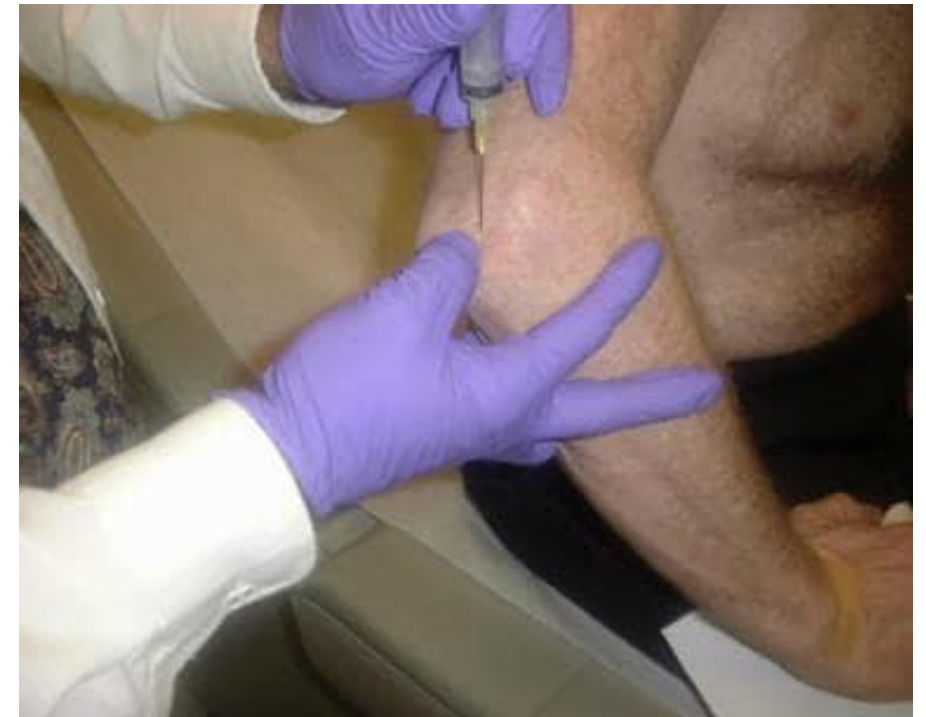
Fig. 3.13 (a) Example of probe position over olecranon with in-plane injection technique. (b) Example of in-plane axial approach, *arrowhead* indicates needle tip, *asterisk* indicates fluid-filled bursa, olecranon labeled

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Main indications :

- Inflammatory arthritis
- OA
- To exclude septic arthritis

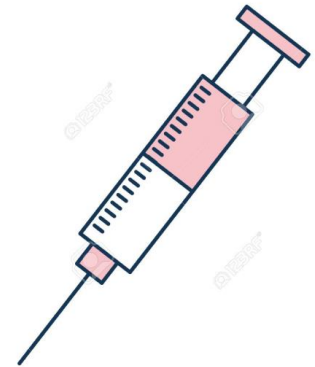


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Common joint and soft tissue injections in rheumatology practice

Wrist and hand

1. 1st CMC joint
2. 1st Extensor tendons compartment (De Quervain's)
3. Trigger finger & flexor tenosynovitis
4. Wrist joint
5. MCP joint
6. PIP joint



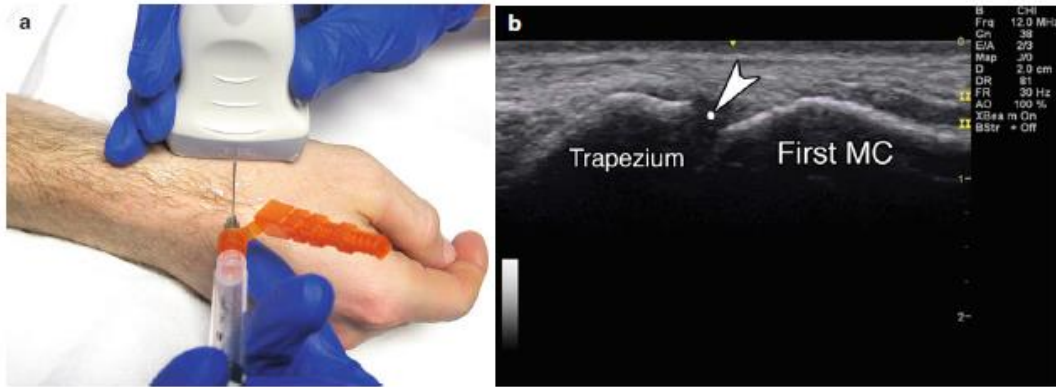


Fig. 4.17 (a) Example of longitudinal probe position over CMC joint. (b) Example of out-of-plane approach. *White arrowhead* points to needle tip. Trapezium and first metacarpal bone labeled

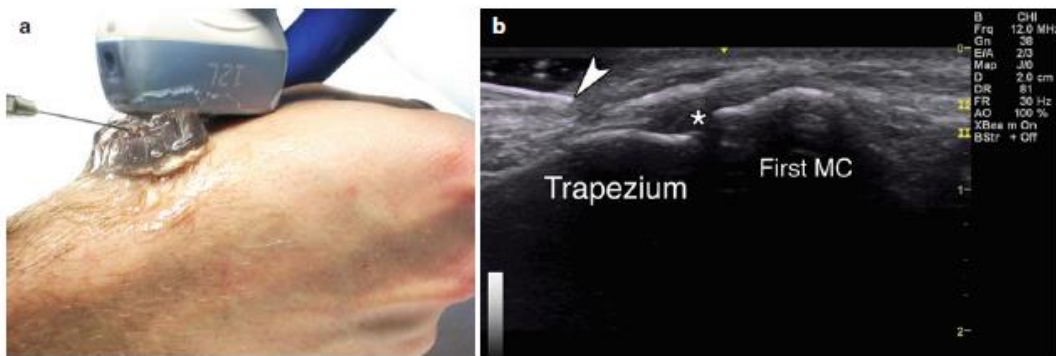


Fig. 4.18 (a) Example of probe position over CMC joint with gel standoff technique. (b) Example of in-plane approach. *White arrowhead* points to needle tip approaching joint. *Asterisk* indicates CMC joint space. Trapezium and first metacarpal bone labeled

Main indications :

- Osteoarthritis
- Crystal induced arthritis



Fig. 66.6 Injection of the left trapeziometacarpal joint in osteoarthritis.

Main indications :

- Tenosynovitis of first extensor compartment

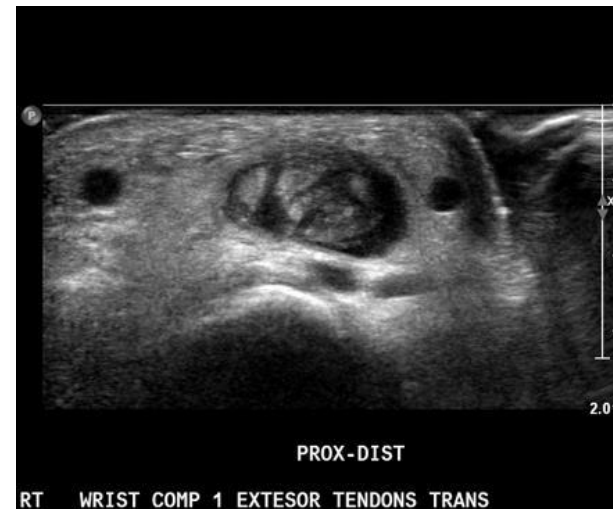
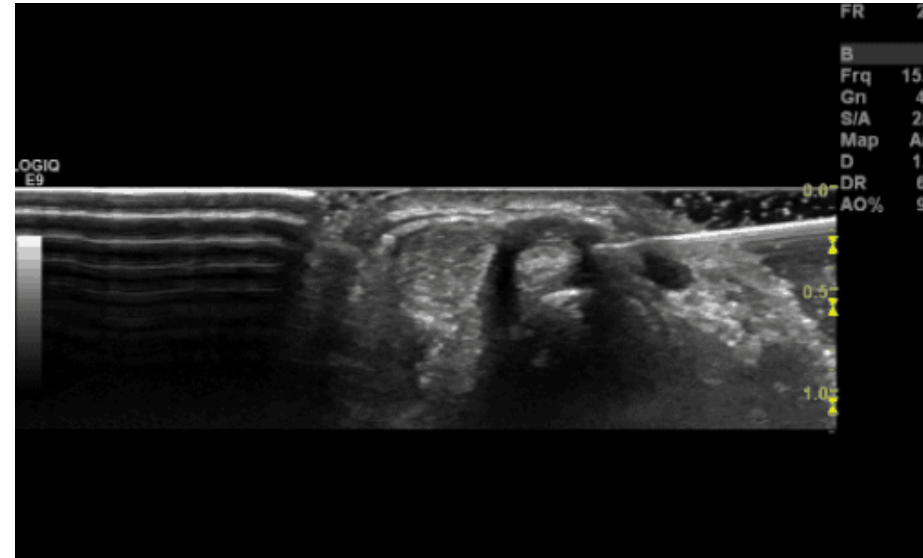
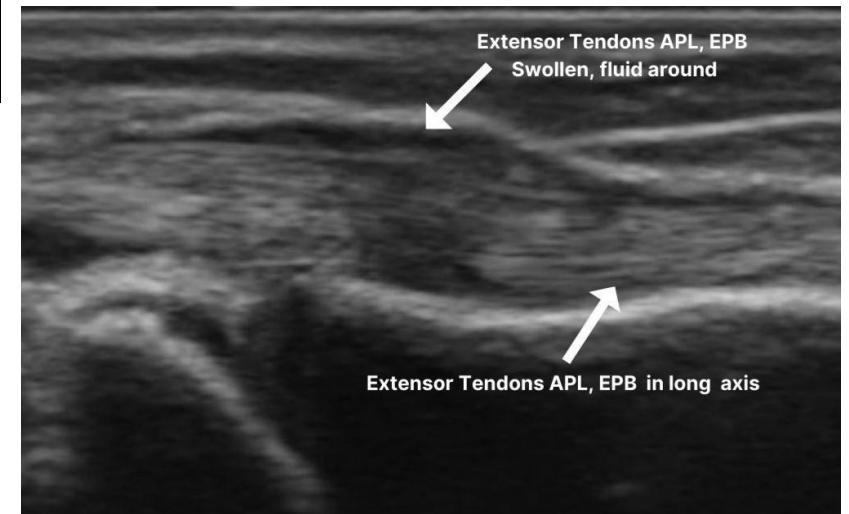


Fig. 66.17 Injection of right de Quervain tenovaginitis.



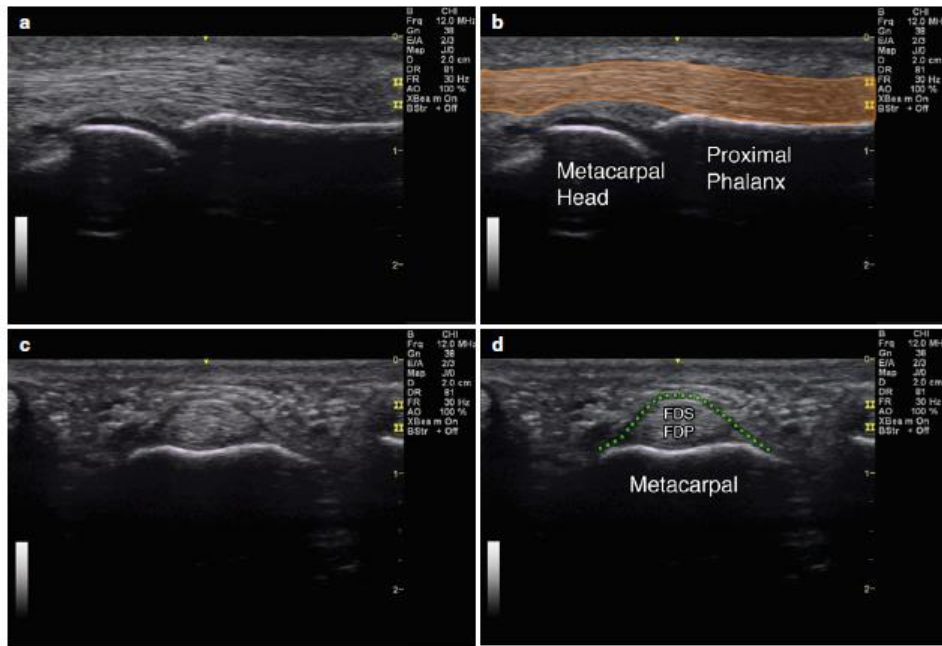


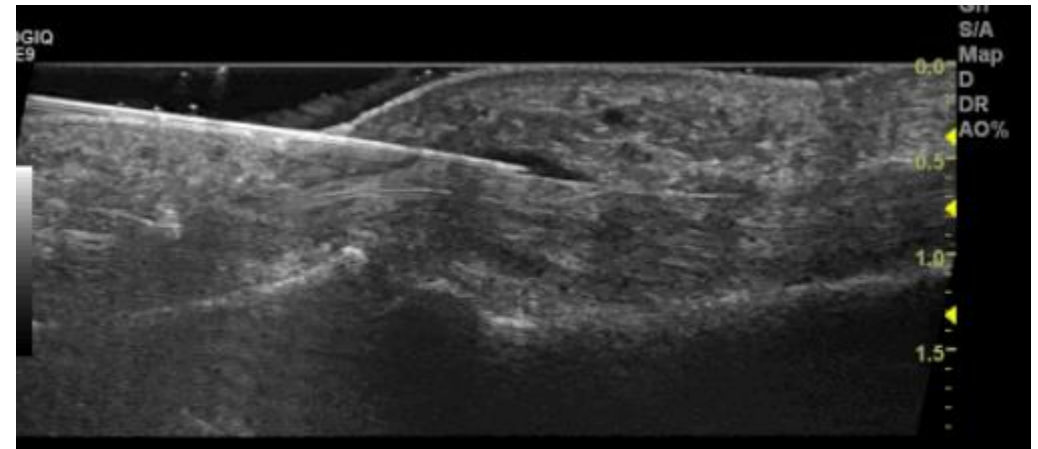
Fig. 4.13 (a) Sagittal view over FDS and FDP. (b) Orange – flexor digitorum superficialis and profundus tendons, metacarpal head and proximal phalanx labeled. (c) Axial view over A1 pulley at metacarpal head. (d) Dotted green line – tendon sheath, FDS, FDP, and metacarpal labeled

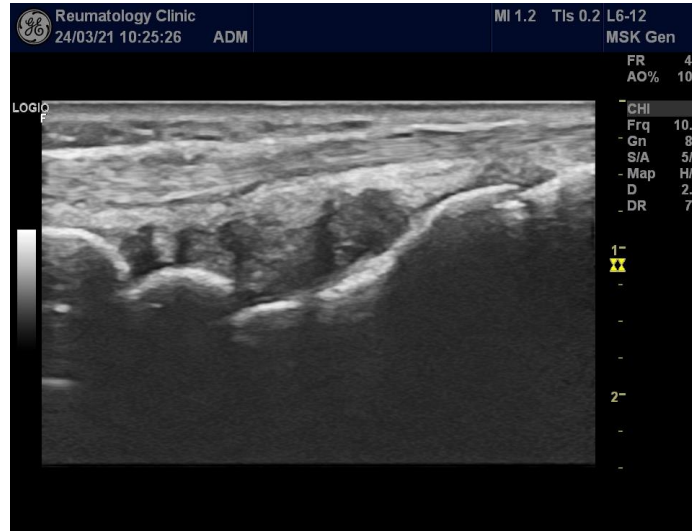
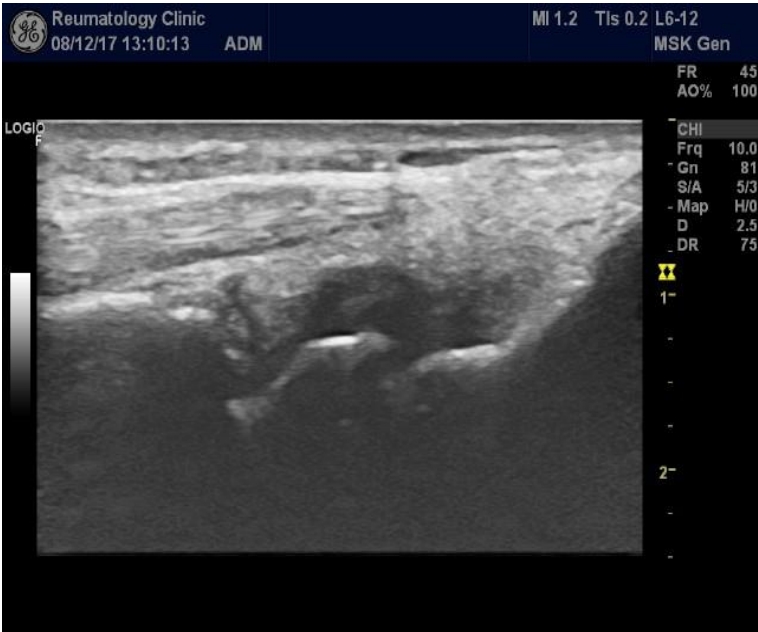
Main indications :

- Trigger finger
- Flexor tenosynovitis



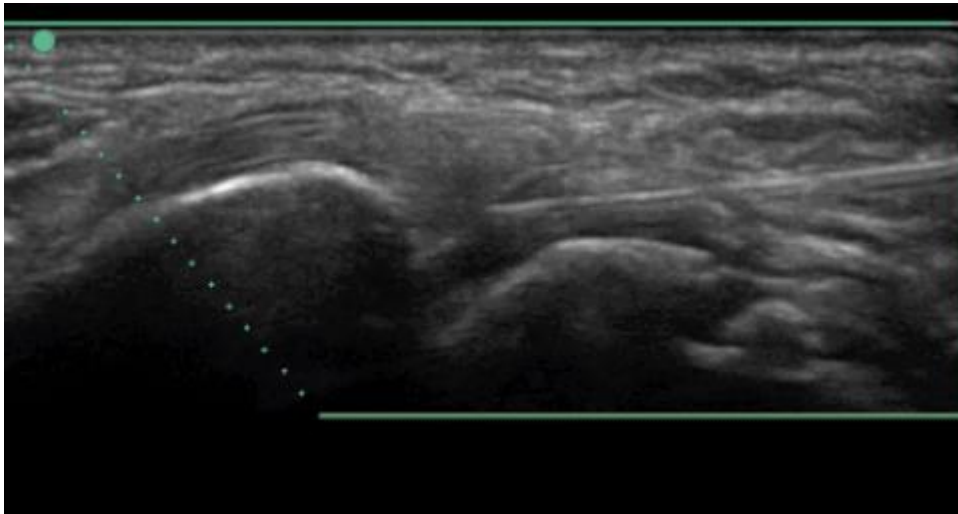
Fig. 66.9 Injection of trigger finger, right index finger.





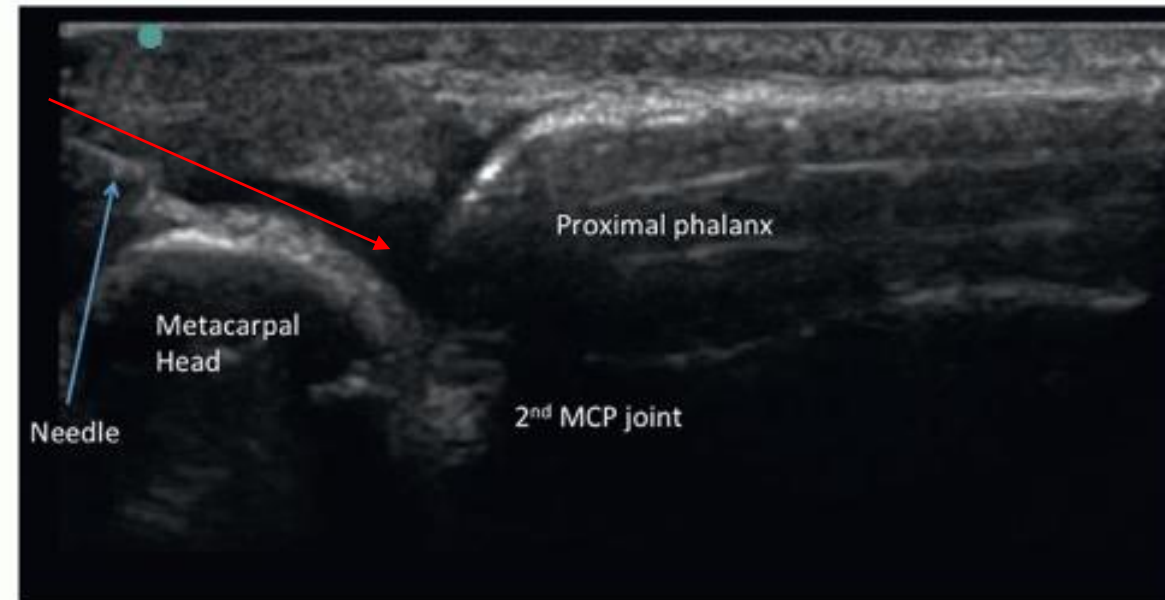
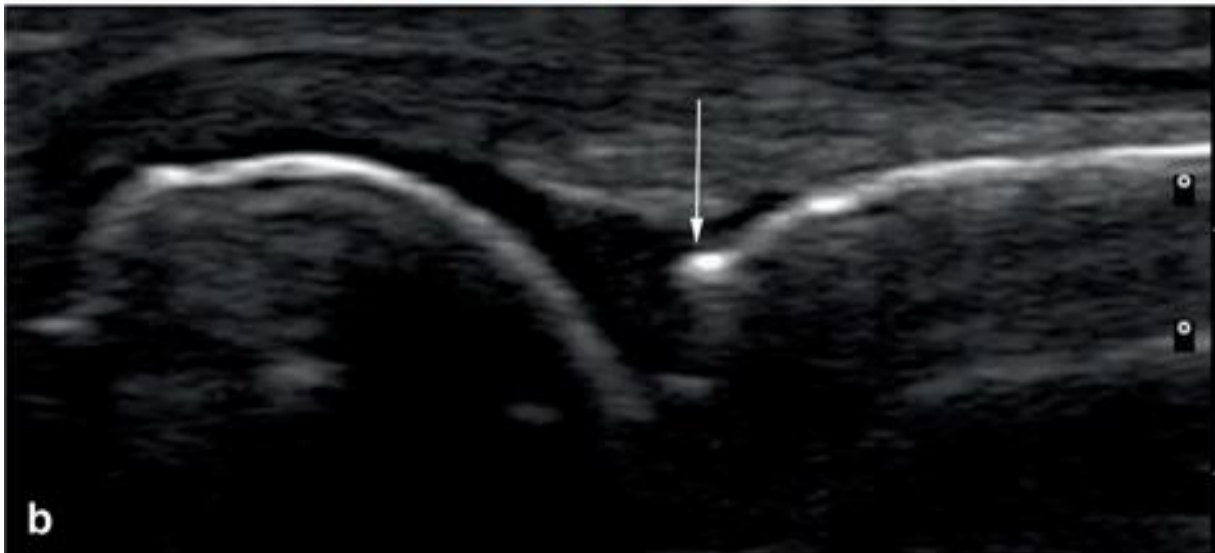
Main indications :

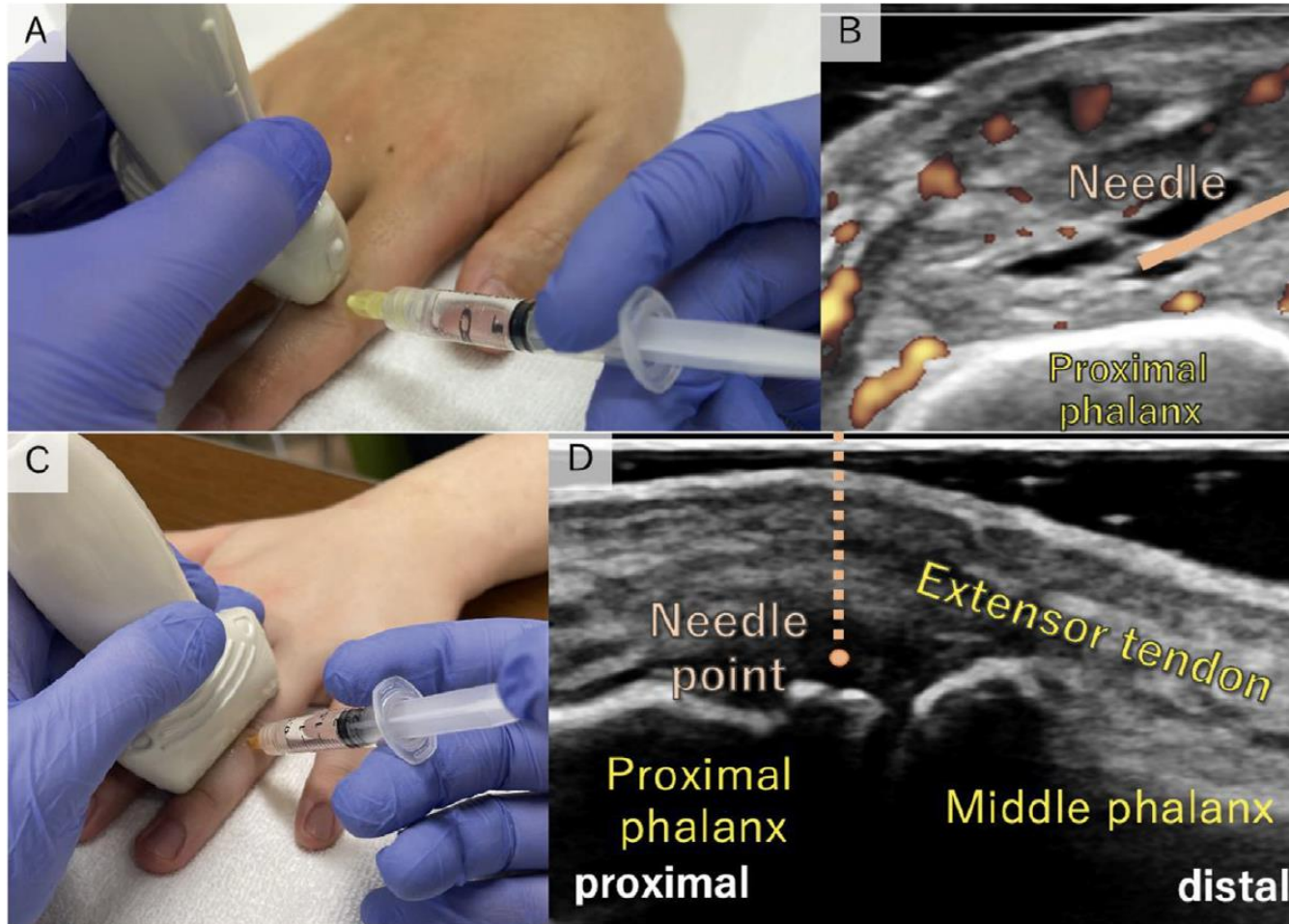
- Inflammatory arthritis of radiocarpal joint



Main indications :

- Inflammatory arthritis





Main indications :

- Inflammatory arthritis
- OA

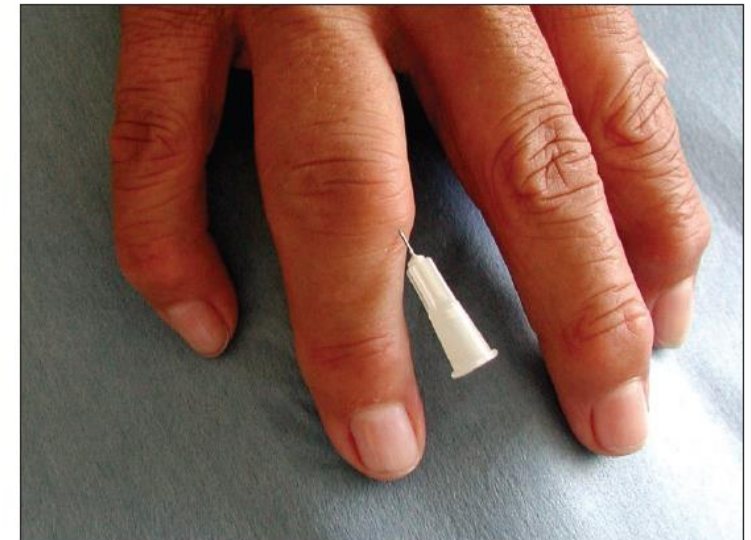


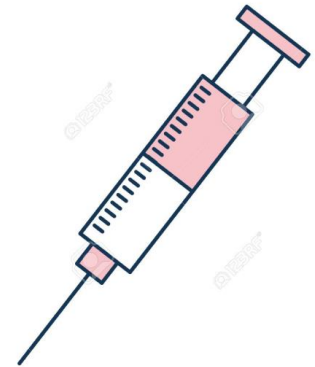
Fig. 66.3 Injection of right fourth proximal interphalangeal joint in osteoarthritis.

Fig. 4. Ultrasound-guided injections to the finger (proximal interphalangeal) joint: In-plane method (A, B) and Out-of-plane method (C, D).

Common joint and soft tissue injections in rheumatology practice

Hip

1. Hip joint (anterior recess)
2. GT area



Main indications:

- Inflammatory arthritis
- Osteoarthritis

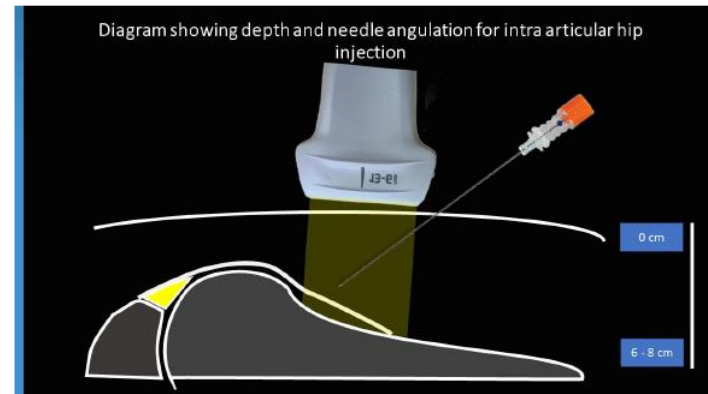


Fig. 5.2 (a) Example of sagittal oblique probe position over femoral head/neck junction with in-plane needle position. (b) Example of in-plane long-axis approach. *White arrow* indicates needle. *Arrowhead*

indicates needle tip. *Black arrows* indicate joint capsule. *Asterisk* indicates effusion. *IP* iliopsoas muscle, *FH* femoral head

Main indications :

GTPS (Great trochanteric pain syndrome)

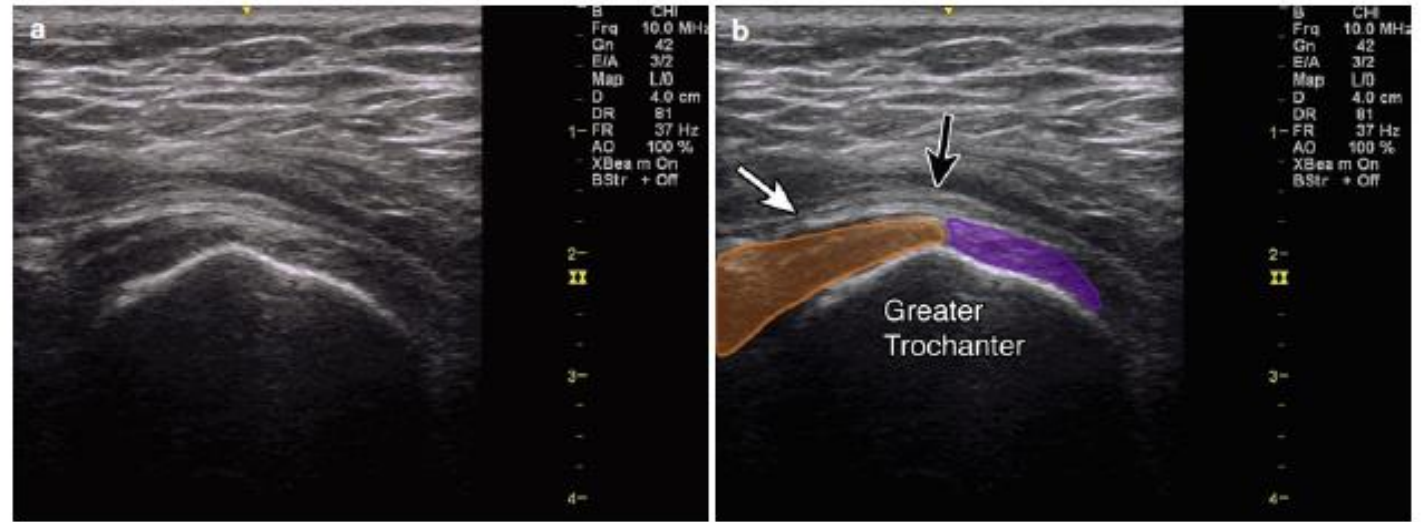


Fig. 5.3 (a) Transverse view of the greater trochanter. (b) Purple indicates gluteus minimus attaching to anterior facet. Orange indicates gluteus medius attaching to lateral facet. Black arrow indicates iliotibial

tract. White arrow indicates subgluteus maximus bursa (trochanteric bursa). Greater trochanter labeled

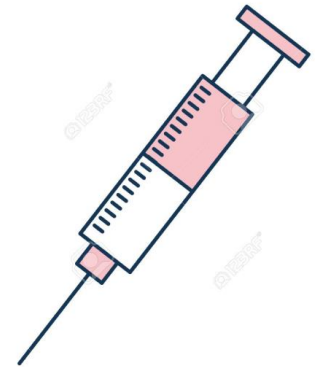


Fig. 5.4 (a) Example of probe position over greater trochanter with in-plane injection technique. (b) Example of in-plane axial approach. White arrow indicates needle. Arrowhead indicates needle tip. Asterisk indicates anisotropy within tendon. Greater trochanter labeled

Common joint and soft tissue injections in rheumatology practice

Knee

1. Knee joint (suprapatellar +parapatellar recess)
2. Baker's cyst
3. Pes anserinus



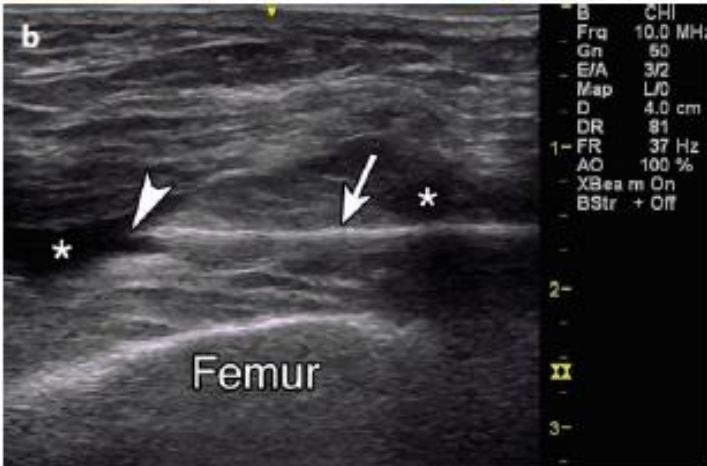


Fig. 6.2 (a) Example of probe position over suprapatellar joint recess with in-plane injection technique. (b) Arrowhead indicates needle tip within joint recess, arrow points to needle, asterisk indicates effusion, femur labeled

Main indications :

- Inflammatory arthritis
- OA
- To exclude septic arthritis



Fig. 66.33 Knee injection, lateral approach, right knee osteoarthritis.

Main indications :

- Advanced OA
- Dry joint

Medial knee injection

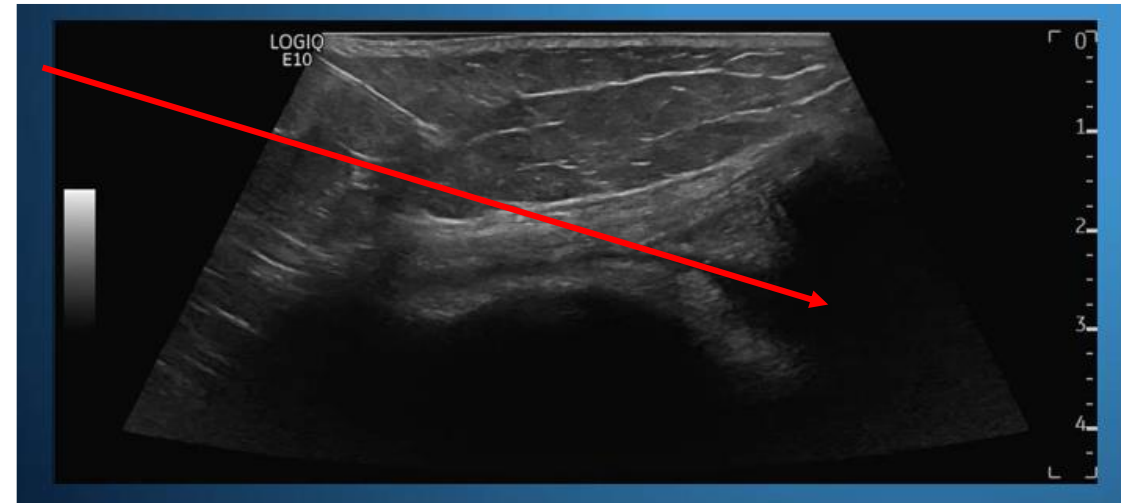




Fig. 6.14 (a) Example of sagittal probe position over posterior knee with in-plane injection technique. (b) Arrow indicates needle, arrow-head indicates needle tip within Baker's cyst

Main indications :

- Decongestion of SMMG bursa
- Pain in the medial compartment of the knee for PAS

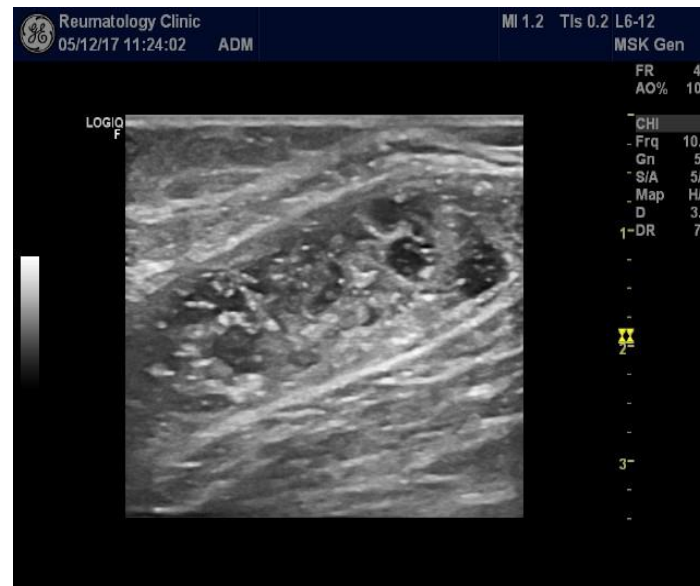
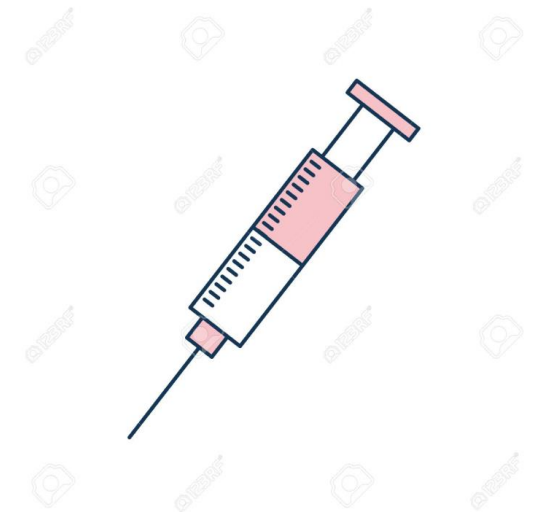


Fig. 66.35 Injection in right pes anserinus syndrome.

Common joint and soft tissue injections in rheumatology practice

Ankle and foot

1. Tibiotalar joint (anterior recess)
2. Subtalar joint
3. 1st MTP joint
4. Retrocalcaneal bursa
5. Plantar fascia



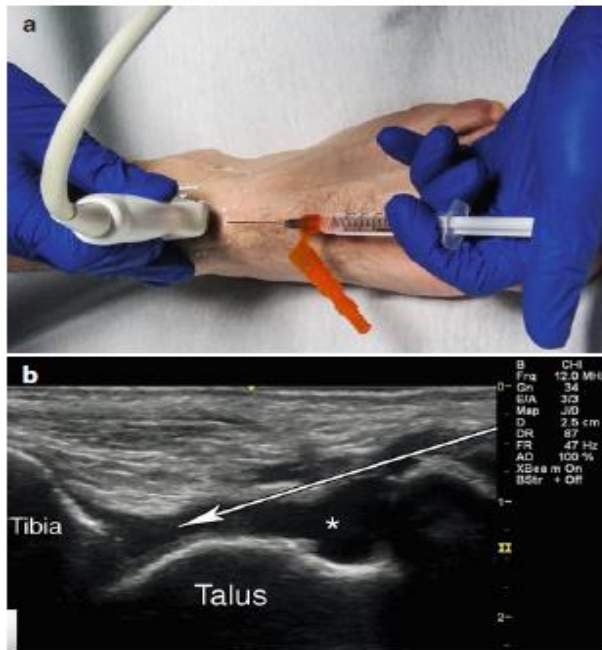


Fig. 7.2 (a) Example of sagittal probe position over anterior tibiotalar joint with in-plane needle position. (b) Sagittal view tibiotalar joint. Arrow indicates needle trajectory. Asterisk indicates effusion. Tibia and talus labeled

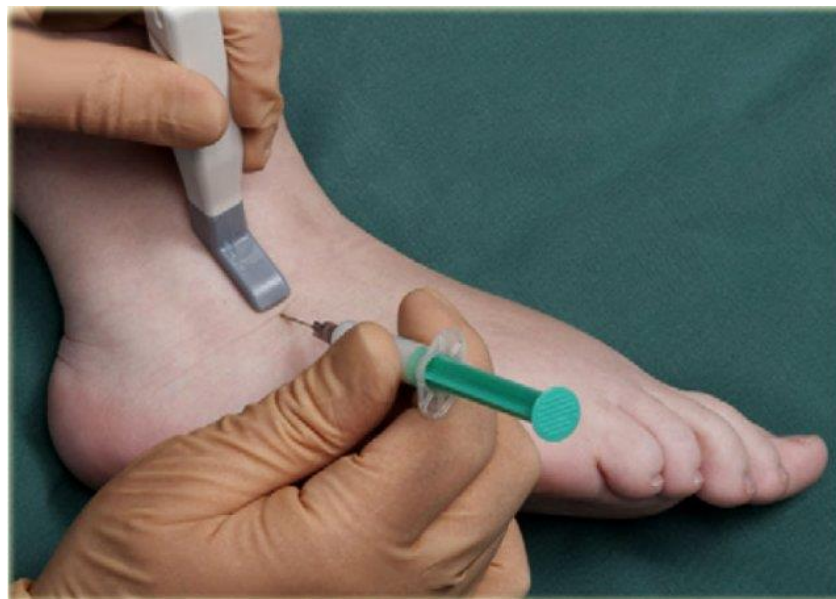
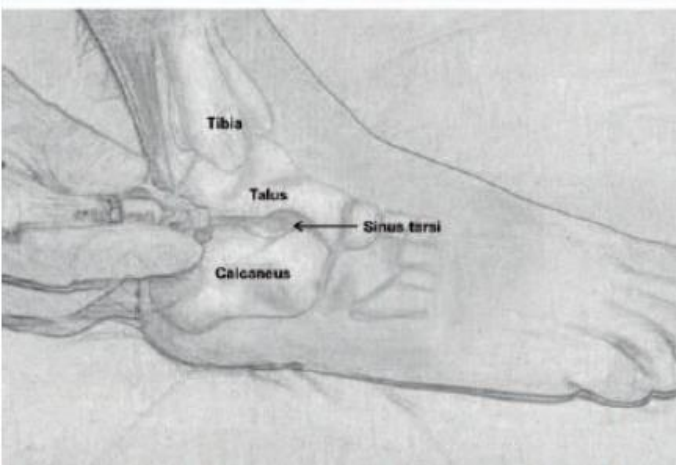


Main indications :

- Inflammatory arthritis
- OA

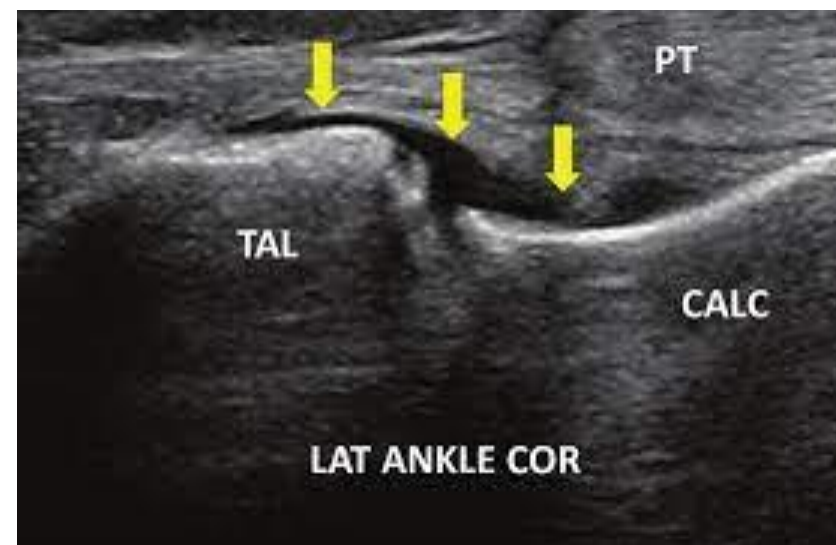


Place the patient in supine position. The joint line is first identified by flexing and extending the joint. A point is taken just medial to the tibialis anterior. The dorsalis pedis artery lies lateral to the extensor hallucis tendon. The needle should be directed tangent to the curve of talus.



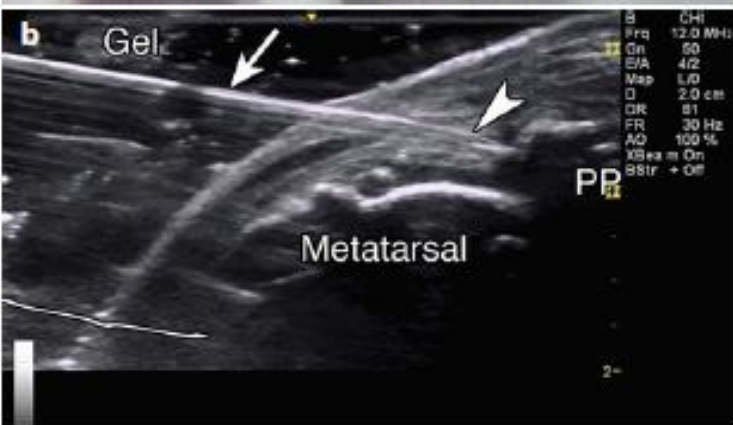
Main indications :

- Inflammatory arthritis (RA)
- OA



Place the patient in the supine position and the ankle in the inversion position. Identify the joint line by eversion and inversion of the joint. The joint line is anterior and inferior to lateral malleoli.

Insert the needle perpendicular to the direction toward the medial malleolus for approximately 1 inch (Figure 54-10). Insert the needle through the resistance of the ligament until you feel the tissue give; this indicates that you are in the joint space. Aspirate and then slowly inject the syringe. If you feel high resistance to the plunger, it means you are still in the ligament. Push the needle further until you can easily inject the plunger. Follow the postinjection care steps.



- Main indications :
- OA of first MTP joint
 - Hallux rigidus
 - Gout

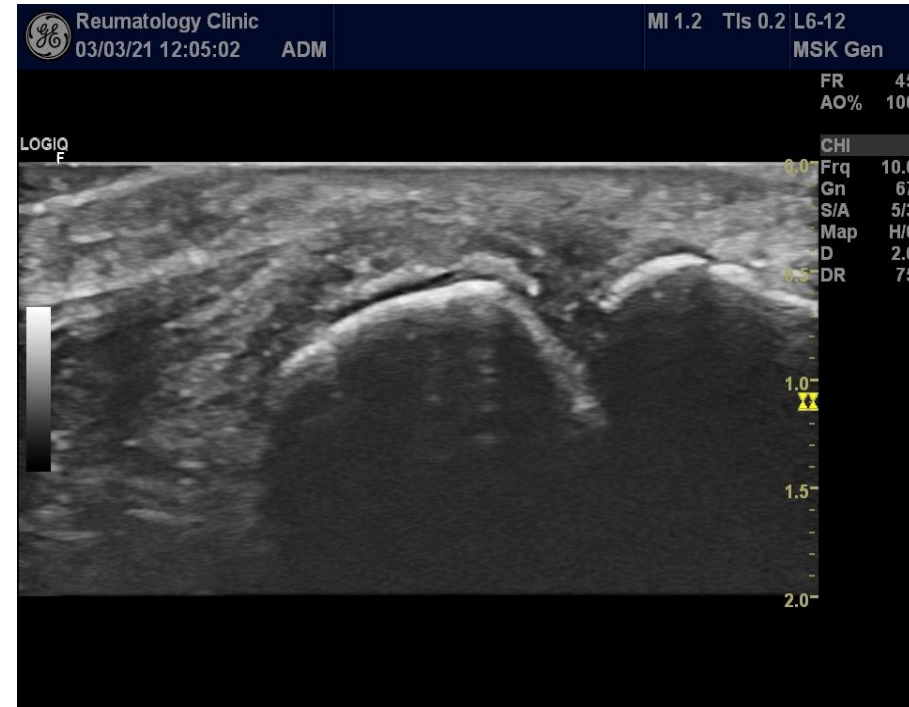
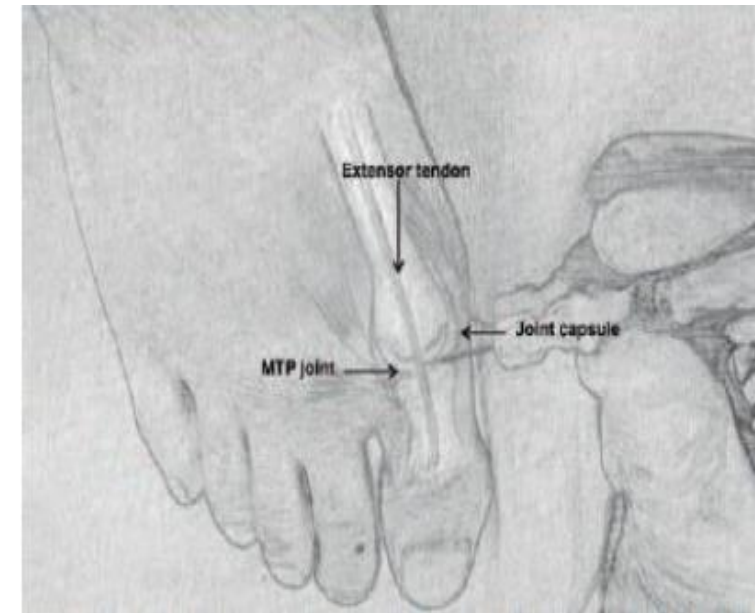


Fig. 66.38 Aspiration of left first metatarsophalangeal joint in gout.

Fig. 7.18 (a) Example of sagittal probe position with gel standoff over first MTP joint with in-plane needle position. (b) Sagittal gel standoff view of first MTP with arrowhead indicating entry into joint. Arrow indicates needle. Bracket indicates needle reverberation. PP proximal phalanx. Metatarsal and gel labeled



Main indications :

- Plantar fasciitis

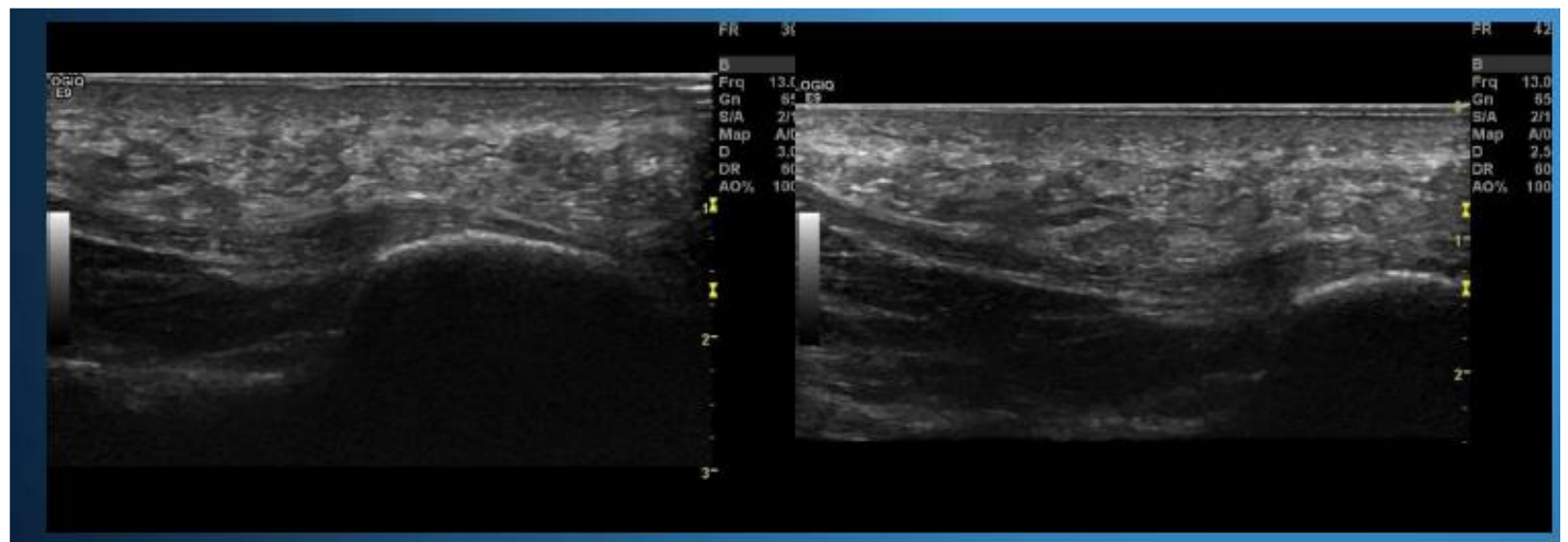


Fig. 7.23 (a) Example of coronal probe position over plantar fascia with in-plane needle position. (b) Example of in-plane injection. Arrowhead indicates needle tip. Arrow indicates needle. Bracket indicates needle reverberation. Calcaneus labeled



- Main indications :
- Retrocalcaneal bursitis
 - Insertional tendinopathy
 - Enthesitis due to SpA

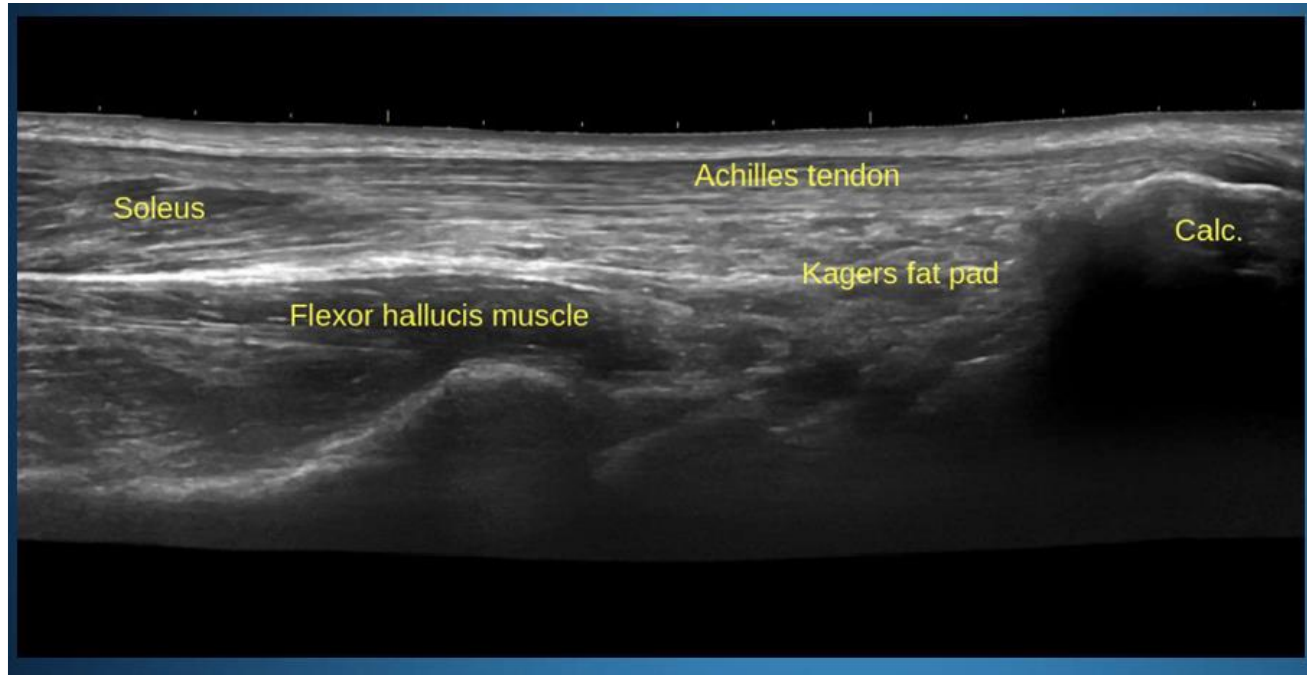


Fig. 7.10 (a) Example of axial probe position over retrocalcaneal bursa with in-plane needle position. (b) *Arrow* indicates needle trajectory into retrocalcaneal bursitis. Cross section of Achilles labeled. Calcaneus labeled

After procedure –practical points

- Explain the effect of local anesthetic (pain return after the anesthetic wears off)- combine with long acting anesthetic such as Ropivacaine
- Procedure flow sheet
- Patient must have contact number if any problem after injection
- Give clear instructions regarding activity level after procedure
- Patient can use ice and and or pain killers after procedure
- Consider follow up visit in selected cases



Complications of corticosteroid injections and infiltrations

- Local bleeding
- Allergy (local/systemic)
- Facial flushing
- Skin atrophy-hypopigmentation
- Fat atrophy
- Infection

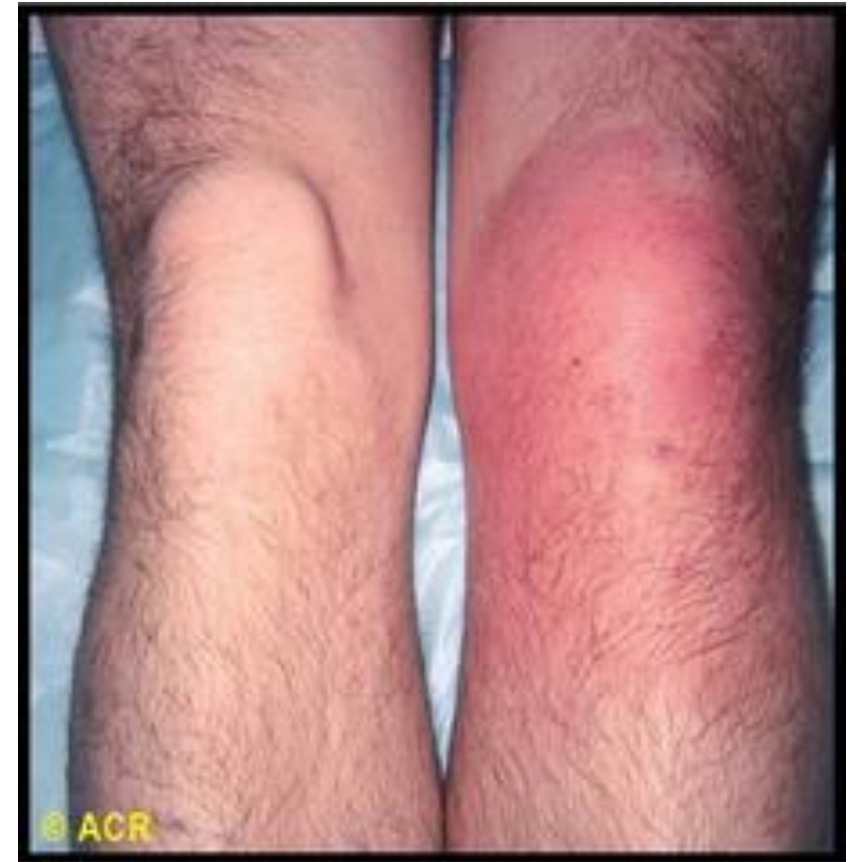


Figure 1: Skin hypopigmentation and subcutaneous fat atrophy associated with corticosteroid injection around the injection site



Complications of corticosteroid injections and infiltrations

- The rate of a septic arthritis following corticosteroid injection is 0.6-4.8 cases per 100,000 procedures.
- Tendon rupture (Achilles, patellar & supraspinatus)
- Nerve damage
- Transient hyperglycemia in DM patients lasting 2-3 days after injection



Conclusion



- Despite new imaging techniques , synovial fluid analysis in many cases is invaluable diagnostic tool
- Joint and soft tissue injections are important part of everyday rheumatology practice
- Ultrasound guidance increase accuracy and effectiveness of such interventions
- Ultrasound guided MSK interventions must be established part of specialty training.