Fundamentals of Ultrasound-guided Procedures

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Disclosures

- Consultant: Bioclinica
- Book Royalties: Elsevier
- Not relevant to this lecture

See www.jacobsonmskus.com for syllabus other educational material

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Technique:

- In versus out of plane approach
- Planning needle course
- Transducer selection
- Needle selection
- Marking skin
- Sterile technique
- Needle visualization

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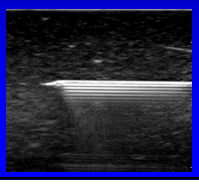
Technique:

- In plane approach
  - Long axis of needle along long axis of transducer
  - See entire needle including tip
  - Most accurate



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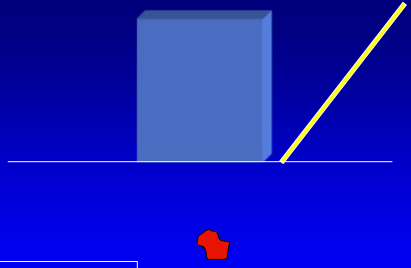

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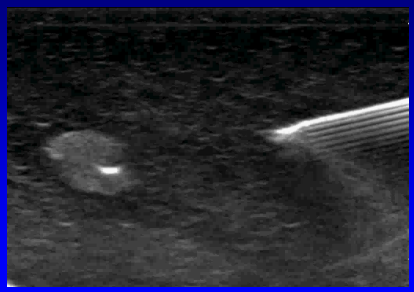
In Plane Approach



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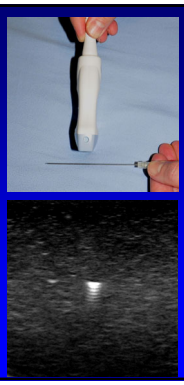
Technique:

- Out of Plane Strategy
- "OOPS"
- Short axis of needle crosses ultrasound beam
- Less accurate
- US: could represent needle shaft or tip



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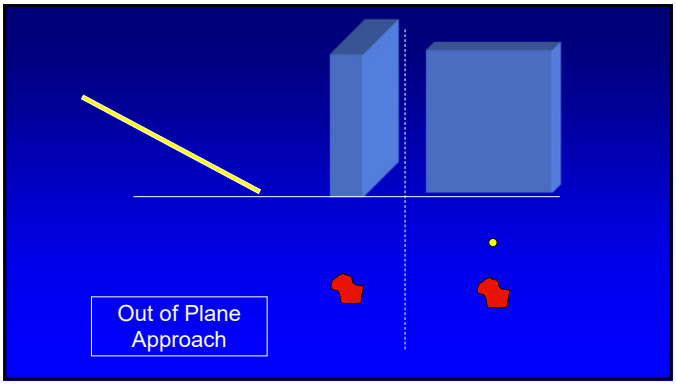

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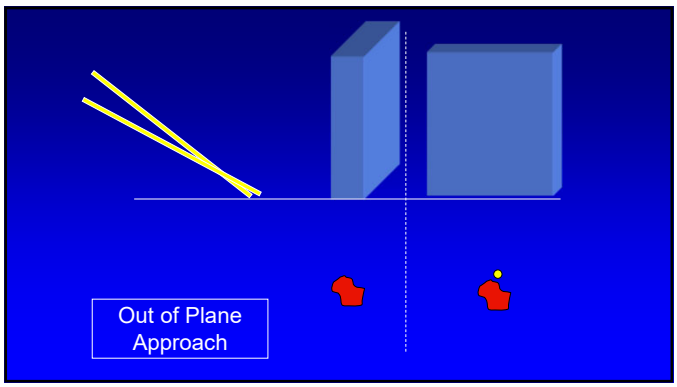

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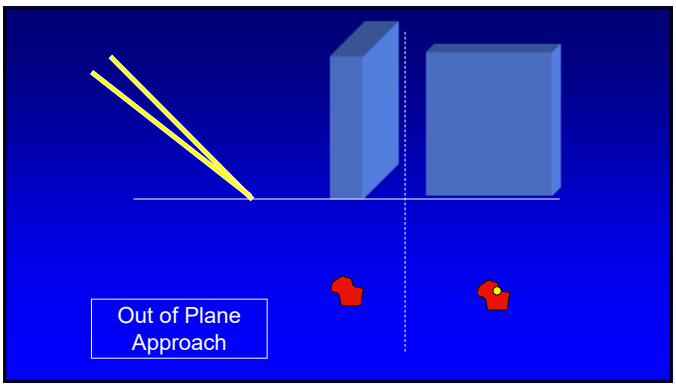

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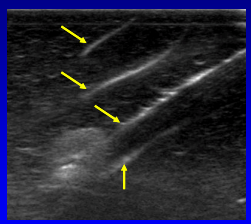
Out of Plane Approach



Superficial joints:
•AC, SI, CMC, MCP, PIP, DIP

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Technique: guidance

- Always confirm in the orthogonal plane (90 degrees)
- Ensure needle tip in target
- Especially important:
  - Small targets
  - Out of plane approach

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Technique:

- In versus out of plane approach
- Planning needle course
- Transducer selection
- Needle selection
- Marking skin
- Sterile technique
- Needle visualization

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Technique: plan ahead

- Needle path
  - –Shortest distance
  - –Avoid neurovascular structures

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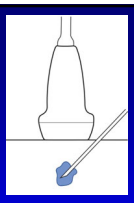
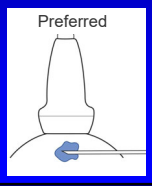
Technique: curved surface

- More room to work
- Puncture site away from transducer
- Access tendon sheath in short axis
- Needle perpendicular to sound beam





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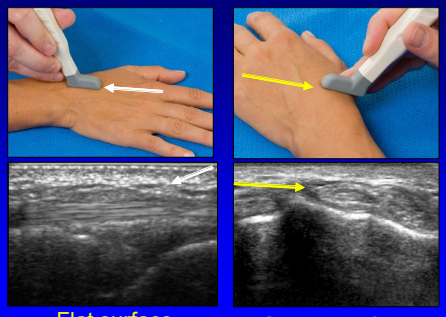

Flat surface Curved surface

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Technique:

- In versus out of plane approach
- Planning needle course
- Transducer selection
- Needle selection
- Marking skin
- Sterile technique
- Needle visualization

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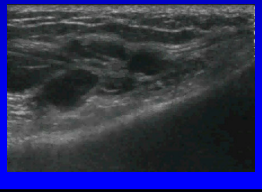
Technique: transducer

- Most applications:
  - –> 10 MHz
  - –Linear transducer



12 - 5 MHz Linear

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Technique: transducer

- Superficial:
  - > 10 MHz
  - Linear transducer
  - Small footprint

15 - 7 MHz
Compact linear

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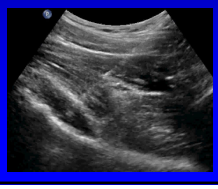
Technique: transducer

- Deep structures:
  - < 10 MHz
  - Curvilinear transducer
  - Hip, piriformis, posterior shoulder



9 - 4 MHz
Curvilinear

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Scanning: basics

- Holding transducer:
  - Anchor hand/transducer
  - 5th finger or hand on patient
- Holding needle:
  - Your "good" hand

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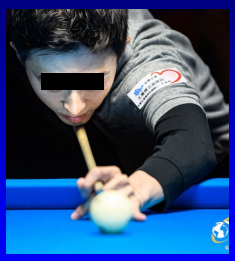
Scanning: basics

- In plane approach
- Transducer end facing you
- Needle entering from end facing you
- Similar to looking down a pool stick or aiming an arrow



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Scanning: basics

- Beam is focused
  - Narrower than transducer width
  - 2 mm
- Sweep transducer slowly
  - Only millimeters at a time

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Technique:

- In versus out of plane approach
- Planning needle course
- Transducer selection
- Needle selection
- Marking skin
- Sterile technique
- Needle visualization

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Technique:

- Needle selection
  - Do not want needle to bend
    - Stay in plane w/ sound beam
  - 20 or 22 gauge
  - Small parts: 25 gauge
  - Aspiration: 18 gauge, trocar or stylet

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Technique:

- In versus out of plane approach
- Planning needle course
- Transducer selection
- Needle selection
- Marking skin
- Sterile technique
- Needle visualization

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Step #1: mark skin

(these are not my kids)

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Technique:

- "X" marks puncture site
- "--" marks plane for transducer and needle
- Cleanse entire area

Free hand technique

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Technique:

- In versus out of plane approach
- Planning needle course
- Transducer selection
- Needle selection
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- Sterile technique
- Needle visualization

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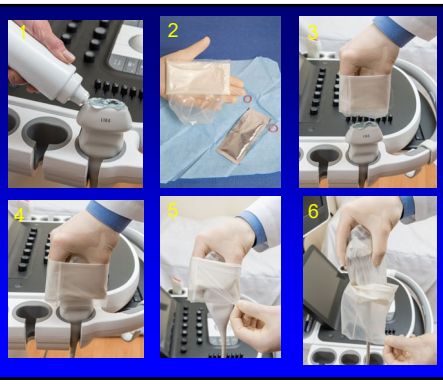

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Technique:

- Ergonomics
  - Patient laying in front
  - Monitor beyond
    - Left hand seen at left side of monitor
  - Secondary monitor
  - Chair

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Technique:

- In versus out of plane approach
- Planning needle course
- Transducer selection
- Needle selection
- Marking skin
- Sterile technique
- Needle visualization

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Technique: free hand

- Insert needle 1 cm into soft tissues
- Find needle by moving transducer
- Elongate needle in long axis to see entirety to tip
- Advance needle under visualization

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Technique: guidance

- DO NOT advance needle unless completely seen longitudinally to tip
- DO NOT move transducer and needle at same time

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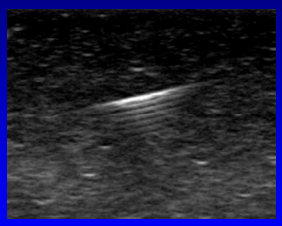
Technique: in plane



Needle and transducer not parallel

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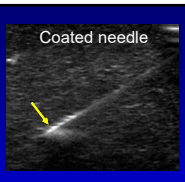
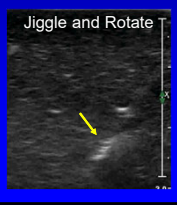
Needle Visualization

- Coated needle
- "Jiggle" the needle
- Rotate needle: bevel
- Needle perpendicular to sound beam





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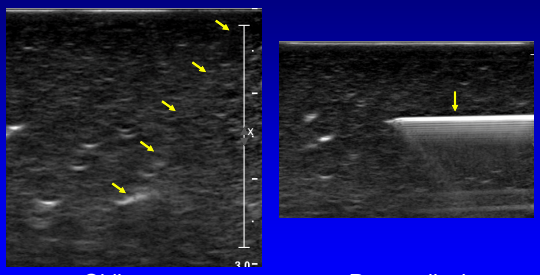
Needle Anisotropy: 20-gauge



Oblique

Perpendicular

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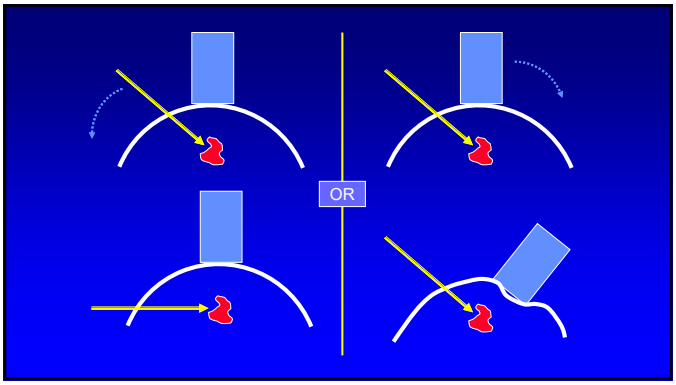

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Needle Orientation

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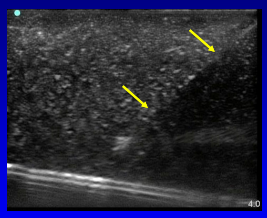
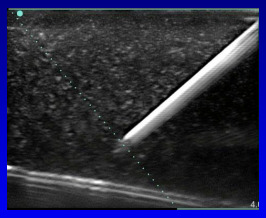
Beam Steering



Normal



With Beam Steering

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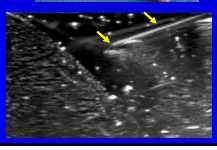
Sterile Gel Standoff

- Lift distal transducer off skin
- Thick layer of sterile gel between transducer and probe
- Superficial targets
- See needle prior to entering skin and target



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Joint Aspiration and Injection

- Aspiration:
  - Infection, crystal disease
- Injection:
  - Anesthetic: Lidocaine, Ropivacaine
  - Steroids
  - Therapeutic or diagnostic

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Considerations

- Aspiration:
  - Consider trocar (or stylet)
  - Prevent needle blockage
  - Especially calcific tendinitis
- Steroid injection:
  - Flush needle after injection
  - Reduces skin depigmentation and subcutaneous fat atrophy

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Joint Aspiration and Injection

- Know which joint recesses become distended and which are accessible
- For joint access:
  - Aim for joint fluid seen at ultrasound
  - Aim for specific joint recess
  - If no recess, aim for joint space

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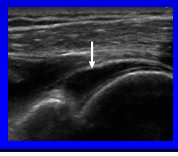
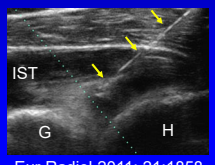
Glenohumeral Joint

- Posterior joint recess
  - In plane
  - Transducer: axial
  - Lateral to medial
  - Most reliable site*





Eur Radiol 2011; 21:1858

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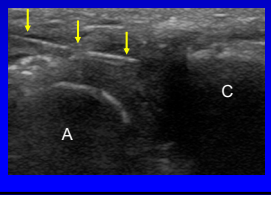
Acromioclavicular Joint

- In plane
- Transducer: coronal
- Lateral to medial



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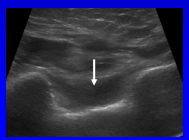
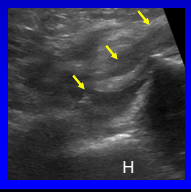
Elbow Joint

- Olecranon recess
- Elbow flexed
- In plane
- Lateral to medial





Invest Radiol 1998;33:117

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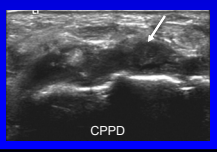
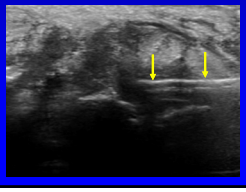
Wrist Joints

- Dorsal recesses
- In plane
- Transducer: axial
- Medial or lateral





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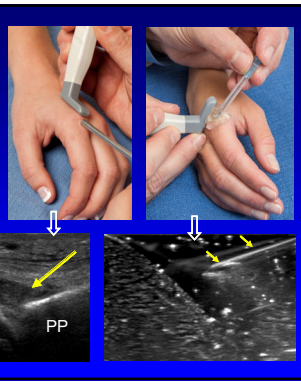
MCP Joints

- Dorsal recesses
- In plane
- Parasagittal or transverse
- Sterile gel stand off



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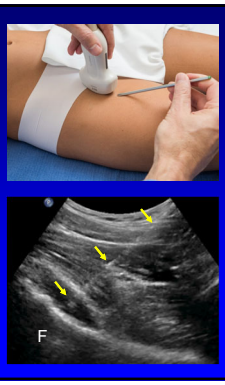
Joint injection

- Anterior recess
- In plane
- Transducer:
  - Parallel to femoral neck
  - Consider curvilinear
- Needle: distal to proximal
- 97% accuracy[1]

[1]Smith J. J Ultrasound Med 2009; 28:329



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Knee Joint

- Suprapatellar recess or medial/lateral recesses
- In plane
- Transducer: axial
- Needle: lateral to medial

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Ankle Joint

- Anterior joint recess
- In plane
- Transducer: sagittal
- Needle: inferior to superior

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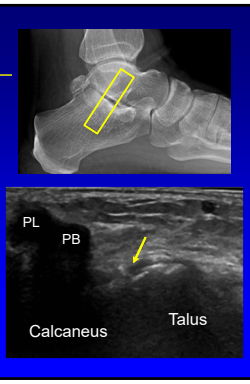
Posterior Subtalar Joint

- Lateral joint recess
- Out of plane
- Transducer: coronal
- Place roll: varus
- Avoid: peroneal tendons



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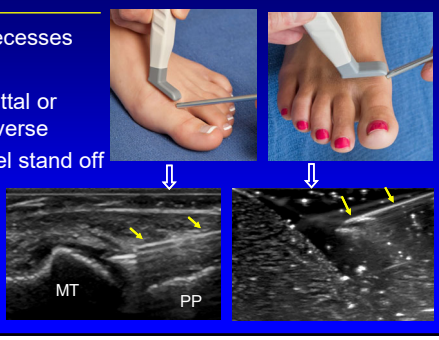
MTP Joints

- Dorsal recesses
- In plane
- Parasagittal or transverse
- Sterile gel stand off



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Take Home Points:

- Perform diagnostic imaging first
- Image long axis to needle
- Must see entire needle to tip
- Do not move needle and transducer at same time
- Ergonomics

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Thank you!

Syllabus on line and other educational material:
www.jacobsonmskus.com

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