

Essentials of Arthrography

Arthrography 101: Shoulders & Hips

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Originally presented at part of RSNA
Essentials Course, 12/1/2009
Attended by 1,700 Radiologists

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Disclosures...

I have no financial disclosures



I will be mentioning off-label Gd use



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How "essential" is arthrography?

"Arthrography": Opacify a Joint
Isn't this an archaic technique?
NO!

UW 2009:
>1100 joint injections

Of all of you sitting here,
how many have been asked to
stick a needle into a joint at least
once this year?



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Arthrography is an old technique

1906: Pneumoarthrography

TB ⇒ Synovial thickening

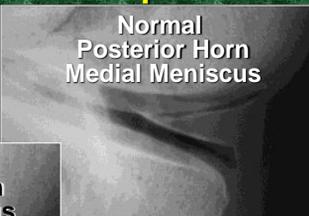
Mosby Year Book, 1992, 1995
Ronald L. Eisenberg
(Currently out of print)

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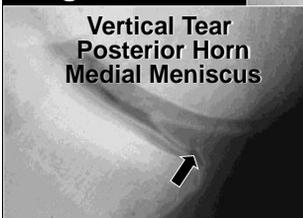
Arthrography common pre-MRI

Double Contrast
Knee Arthrography
>1960 – 1990
@UW 1990: 800!

Normal
Posterior Horn
Medial Meniscus



Vertical Tear
Posterior Horn
Medial Meniscus



Required a lot of varus & valgus stress on the knee
⊖ Unpleasant for both patient and radiologist

Courtesy of Arthur De Smet, MD
University of Wisconsin, Madison

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Arthrography: 21st Century Therapeutic Tool

- Inject therapeutic agent into a joint
 - ✓ Hyaluronan (visco-supplementation)
 - ❖ FDA approved for OA knee



Typically injected blindly in clinic.
May ask for image guidance when
can't feel landmarks in knee.

- ✓ Steroid: weeks-months pain relief

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Essentials of Arthrography

Steroids UW MSK

Triamcinolone

- Suspension, not solution
- Granular, stays locally
- Need to re-suspend prior to use
- Commonly used for spine injections
 - ✓ UW 2009: >1000 ESI, NRB



Dexamethasone 10mg/ml

- Solution, used superficial structures
- Less subcutaneous fat atrophy

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Steroids in joints

Concern cartilage loss

Lidocaine Potentiates the Chondrotoxicity of Methylprednisolone

Arthroscopy, Vol 24, No 4 (April) 2009: pp 337-347

Tend NOT inject steroids

into large joints (hip, shoulder, knee)

- Unless specifically requested
- Patients awaiting arthroplasty

Often inject small joints

- Deep (Facets, SI): Triamcinolone
- Superficial (AC): Dexamethasone

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Arthrography: 21st Century

Therapeutic Tool

- ✎ Inject therapeutic agent into a joint
 - ✓ Hyaluronan (visco-supplementation)
 - ✓ Steroid: weeks-months pain relief

Diagnostic Tool

- ✎ Inject anesthetic agent into a joint
 - ✓ Prove pain is coming from within joint
 - ❖ e.g. Pt with bad DJD of hip and bad DDD of lumbar spine.
- Want to prove pain is from hip prior to hip arthroplasty surgery.

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Anesthetics UW MSK

ALWAYS provide skin anesthesia

- 1% Lidocaine: Bicarbonate (9:1)



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Anesthetics UW MSK

Intra-articular: Ropivacaine

- Longer acting than Lidocaine
- (Bupivacaine is chondrotoxic)
- DON'T mix in Bicarbonate
 - ✓ Will precipitate
- Can mix in Lidocaine



Which injection cocktail for which joint?

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Ken L Schreiberman, MD PhD, is a Professor of Radiology at the University of Wisconsin-Madison, where he is part of the 12-person Division of Musculoskeletal Imaging. Dr. Schreiberman has been sub-specializing in bone and joint imaging since he completed his fellowship at the Mallinckrodt Institute of Radiology in St. Louis in 1996.

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Essentials of Arthrography

Department of Radiology
University of Wisconsin - Madison

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Musculoskeletal Interventional Information

Interventional MSK Scheduling Guidelines
Interventional Pediatric Pre/Post Care Guidelines
Patient Medications and MSK Procedures
Imaging and Interventional Procedures at UWMHealth.org

Spine and Extremity Injection Volumes Combined

Spine:
blood patches
cervical epidural
cervical nerve block
discography
facet injection
lumbar and sacral nerve blocks
lumbar epidural
SI joint injections

Upper extremity:

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Injection Cocktails

Extremity Injections						Spine Injections						
	0.5% Bupivacaine	1% P.P Lidocaine	Normal Saline	Contrast 300	Dexamethasone 10 mg/ml		0.5% Bupivacaine	1% P.P Lidocaine	1.5% P.P Lidocaine	1% Dexamethasone 10 mg/ml	Contrast 300	Volume to Inject
Triceps bursa	3.5 ml	3.5 ml							2 ml		2 ml	2 ml
Acromioclavicular bursa	2 ml					1 ml			2 ml		2 ml	10 ml
Subacromial bursa	2 ml					1 ml			2 ml		2 ml	2 ml
Wrist	1 ml					1 ml			1.5 ml		1.5 ml	2 ml
Hand and first metacarpal	1 ml					1 ml			1.5 ml		1.5 ml	2 ml
Shoulder	4 ml	4 ml (2% max)				1 ml Only if suspected						
Elbow	2 ml					1 ml Only if suspected						
Wrist	2 ml					1 ml Only if suspected						
Hand and first metacarpal	1 ml	1 ml (2%)							5 ml	0.1 ml	3-6 ml	
Thoracic		1 ml							5 ml	0.1 ml	3-4 ml	
Lumbar		0.5 ml (0.25% max)	2.5 ml	2.5 ml		0.1 ml, 100 mg/ml			5 ml	0.1 ml	13-15 ml	
Cervical		0.25 ml (0.125% max)	2.5 ml	2.5 ml		0.1 ml, 200 mg/ml			5 ml	0.1 ml	5-10 ml	
Neck									5 ml	0.1 ml	5-10 ml	
Shoulder									5 ml	0.1 ml	13-15 ml	
Elbow									5 ml	0.1 ml	3-6 ml	
Hand/cepal									5 ml	0.1 ml	3-4 ml	

NOTE: use Dexamethasone instead of Kenalog if superficial injection to minimize atrophy skin pigmentation

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Arthrography: 21st Century

Therapeutic Tool

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Diagnostic Tool

- Inject anesthetic agent into a joint
 - ✓ Prove pain is coming from within joint
- Aspirate fluid from joint
 - ✓ Septic → Culture (Gram Stain, Cell count)
 - ✓ Crystals → Polarizing microscopy
- Prudent to first confirm there IS fluid in joint

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Sub-deltoid Bursitis (No fluid in joint)

T2fs
Fluid in sub-deltoid bursa

T1fs+Gd(IV) T1fs+Gd(IV)

T2fs T2fs

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Sub-deltoid Bursitis (No fluid in joint)

Don't need to do fluoroscopic-guided aspiration of shoulder capsule...

T1fs+Gd(IV) T1fs+Gd(IV)

Instead, do ultrasound-guided aspiration of bursal fluid collection.

pre-aspiration post-aspiration

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Arthrography: 21st Century

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 - ✓ Crystals → Polarizing microscopy
- Inject contrast prior to MR or CT

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Arthrography: 21st Century

No longer used as a primary diagnostic tool

Nowadays, surgeons want to see more...
They want to see torn end of supraspinatus:

LT SHOULDER ARTHRO

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Arthrography: Why we do it

Therapeutic Tool

- Inject therapeutic agent into a joint
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Diagnostic Tool

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Arthrography: What we need

IMAGE GUIDANCE

- Can't be assured of getting a needle into hip/shoulder without imaging
 - ✓ With experience, should be able to blindly get a needle into knee
 - ✓ Knees commonly injected in clinic
 - ✓ Clinics may request image guidance when injecting knees of "larger" pts.
- Young patients: Ultrasound

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Ultrasound: Pediatric Hips

Right Fri 20:55 UW Peds ER

Left

Joint Effusion Joint Capsule

Diaphysis Meta GP

No Fluid

GP Meta Diaphysis

Diaphysis Meta GP

GP Meta Diaphysis

Fri 16:25 Outside Clinic

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Ultrasound: Pediatric Hips

Right Fri 20:55 UW Peds ER

Joint Effusion Joint Capsule

Diaphysis Meta

Sat 03:10 UW Peds OR

Fri 23:30 UW Peds ER

Post aspiration 2ml pus

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Arthrography: What we need

IMAGE GUIDANCE

- Can't be assured of getting a needle into hip/shoulder without imaging
 - ✓ With experience, should be able to blindly get a needle into knee
 - ✓ Knees commonly injected in clinic
 - ✓ Clinics may request image guidance when injecting knees of "larger" pts.
- Young patients: Ultrasound
- Most patients: Fluoroscopy
- Preferably C-arm Fluoroscopy

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RSNA 2009 Essentials of Arthrography

C-Arm Fluoroscopy



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C-Arm Fluoroscopy



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Positioning Patient



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Arthrography: What we need

TARGET SITE ⊕
 ↳ Keys to Arthrography

Target is NOT the joint

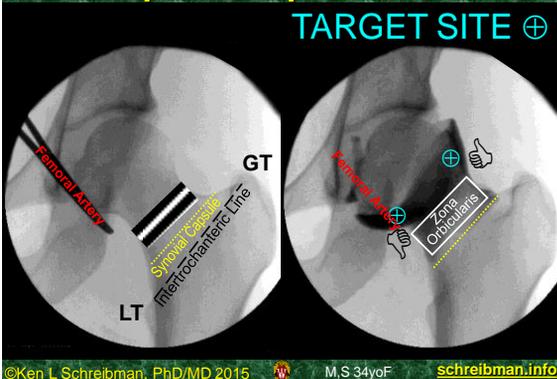
- Don't necessarily need to position needle between 2 articular surfaces

Target is the **CAPSULE**

- Just need to have the needle touch a bone within the capsule

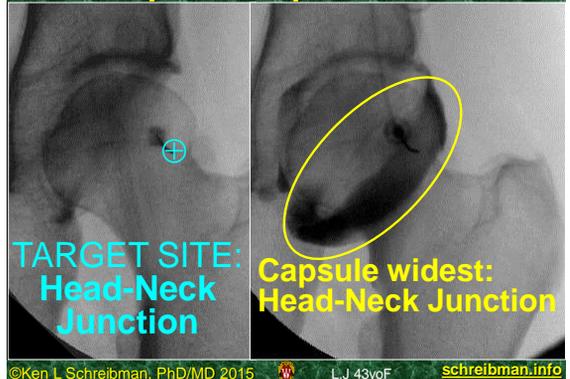
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Joint Capsule: Hip



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Joint Capsule: Hip



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Essentials of Arthrography

Joint Capsule: Shoulder

TARGET SITE ⊕: RC Interval

Supraspinatus
Cor
Subscapularis
LT

↓ Bursa = RCT
↑ Subscapularis Recess
↑ Biceps Groove
↑ Axillary Recess
Places contrast normally flows...

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Arthrography: What we need

Non-sterile tray

- Metal pointer & marker
✓ To localize & mark target ⊕
- Metal R/L
✓ To prove which side

A, W 42yoM
\$1.25/each

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Arthrography: What we need

IMAGE GUIDANCE
TARGET SITE ⊕
NON-STERILE TRAY
STERILE TRAY

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Sterile Tray

If tray is set up before patient enters it is important to **COVER TRAY** to prevent patient contaminating it!

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Sterile Tray: Prep & Drapes

Clean & sterilize skin
Sticky drape with hole
4x4" sponges
Additional sterile drapes/towels
Sterile covers for image intensifier and controls

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Sterile Tray: Syringes

Local anesthetic (1% Lido:Bicarb 9:1)

- 10ml syringe w/skin needle ↑

Contrast (iohexol 300 mg/ml)

- 5ml syringe w/connecting tube ←

Cocktail

- 10ml syringe w/18g drawing up ↑ needle

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Arthrography: How we do it

Local anesthesia

~~"You will feel a bee sting"~~



"This will burn for a few seconds, and then will be numb"

2 needles

- Skin: 30g 1/2" needle
- Deeper: 1 1/2" needle

www.edububble.com/people/ks/art/2578224-2-scary-hairy

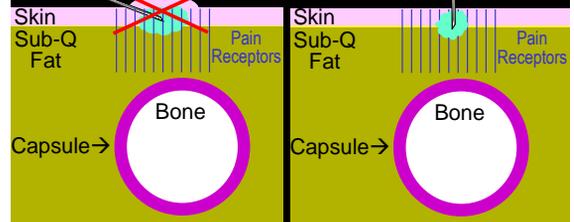
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Local Anesthesia

Skin: 30g 1/2" needle

- DON'T raise a wheal

Advance needle vertically



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Local Anesthesia

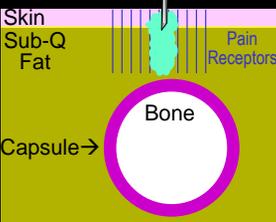
Skin: 30g 1/2" needle

Deeper: 1 1/2" needle

Advance needle vertically

Shoulder: RC Int

- Can reach bone with 1 1/2" needle
- Use 22g
 - ✓ Anesthesia
 - ✓ Advance needle through capsule, touching bone



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Local Anesthesia

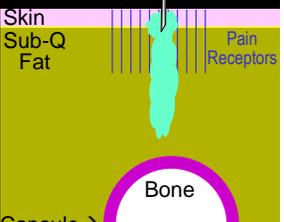
Skin: 30g 1/2" needle

Deeper: 1 1/2" needle

Advance needle vertically

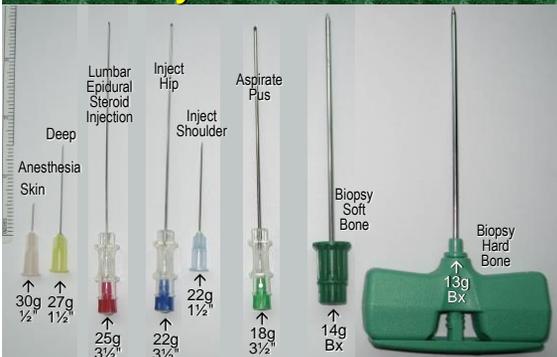
Hip:

- Can't reach bone with 1 1/2" needle
- Use 27g
 - ✓ Anesthesia only
- Use 22g 3 1/2" spinal needle to reach bone



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Sterile Tray: Needles



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Keys to Arthrography

ADVANCE NEEDLE SLOWLY

Don't just jab it in there...



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Essentials of Arthrography

Keys to Arthrography

ADVANCE NEEDLE SLOWLY

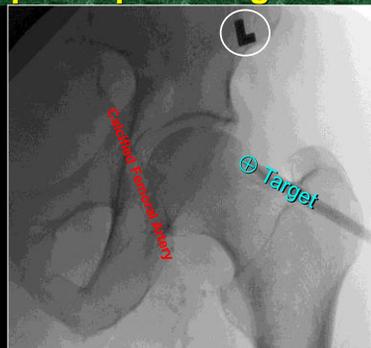
Use 2 hands:

- One hand on needle hub
- One hand on patient's skin
- Allow needle to pass between your thumb & index finger tips so you can feel the needle being advanced
- Advance just a few mm at a time
- Check fluoro, readjust position



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Example: Hip Arthrogram



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Example: Hip Arthrogram



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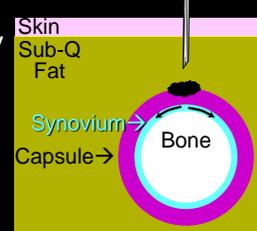
Keys to Arthrography

ADVANCE UNTIL HIT BONE

- Don't stop at the capsule

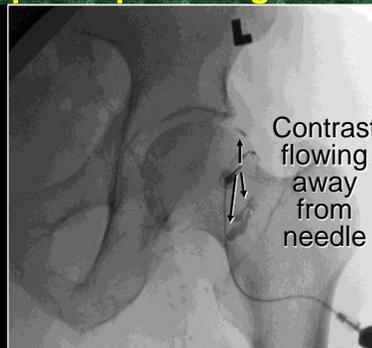
WATCH FIRST DROP OF CONTRAST

- Should flow away from needle tip
- If contrast stays by needle tip, needle is NOT in a space! (Extravasation)



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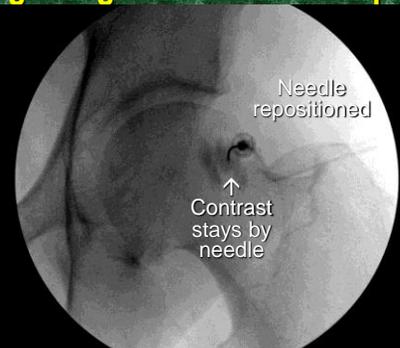
Example: Hip Arthrogram



Contrast flowing away from needle

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Recognizing Extravasation: Hip



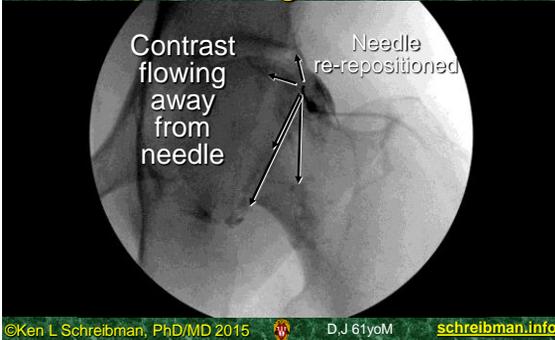
Needle repositioned

Contrast stays by needle

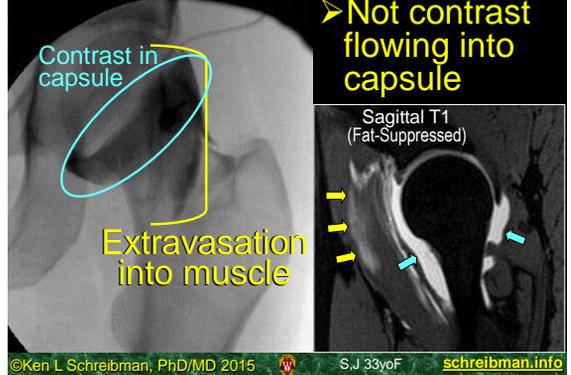
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Essentials of Arthrography

Recognizing Extravasation: Hip & Repositioning Needle



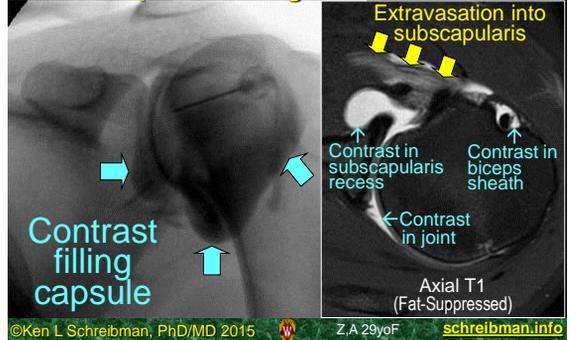
Recognizing Extravasation: Hip



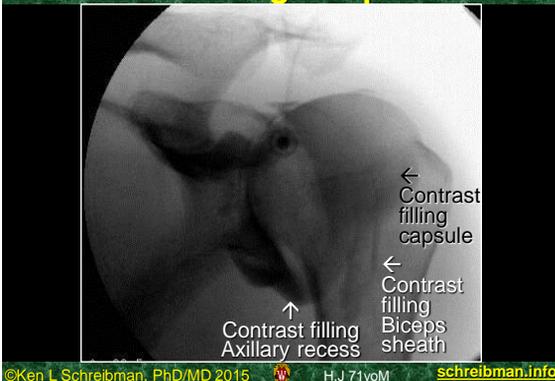
Recognizing Extravasation: Shoulder



Recognizing Extravasation: Shoulder & Repositioning Needle



Shoulder Arthrogram pre MRI



Sterile Tray: Syringes



Essentials of Arthrography

Two Tips...

MR Arthrogram

- ☞ **Make sure Gd gets into cocktail!**
- ✓ 0.1ml Gd in 1ml (tuberculin) syringe



Make sure Gd doesn't get trapped in the hub, but actually enters solution

Two Tips...

MR Arthrogram

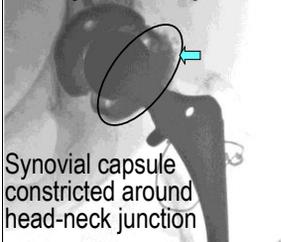
- ☞ **Avoid Air Bubbles!**
- Air in joint causes susceptibility artifact
- ✓ Get air out of arthrogram needle hub
- ✓ Extra needle on connecting tube



Drop tip extra needle into hub of arthro needle. Fill the hub from bottom to top. Remove extra needle and do wet-connect.

Metal Hip: Injecting

Prove you're "in" by seeing contrast flow into synovial capsule



Synovial capsule constricted around head-neck junction

Can't see metal needle thru metal prosthesis
Capsule is thick and fibrotic (like wood)

Skin
Sub-Q Fat

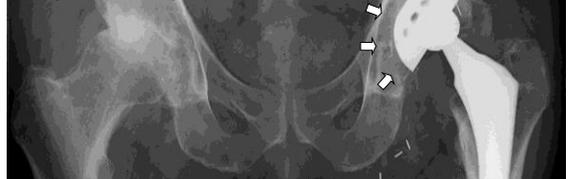
Don't stop when touch wood...
Go until touch metal

Capsule →
Synovium →



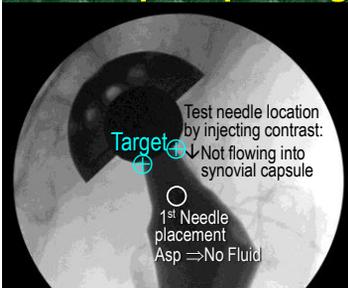
Metal Hip: Aspirating

Loose acetabular component
r/o infection pre replacement
Requested aspiration



When aspirating suspected pus, use: ✓ 18g Needle ✓ 20ml Syringe

Metal Hip: Aspirating



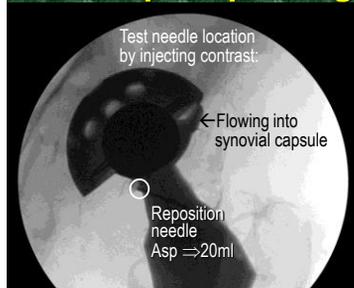
Test needle location by injecting contrast:
Target ⊕
Not flowing into synovial capsule

1st Needle placement
Asp ⇒ No Fluid



When aspirating suspected pus, use: ✓ 18g Needle ✓ 20ml Syringe

Metal Hip: Aspirating



Test needle location by injecting contrast:
← Flowing into synovial capsule

Reposition needle
Asp ⇒ 20ml



When aspirating suspected pus, use: ✓ 18g Needle ✓ 20ml Syringe