# I'd Tap that

# Ultrasound-Guided Procedures

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UT Health
San Antonio

# Advantages of Ultrasound Guidance

Fewer complications

Reduced time

Fewer attempts

Higher success rates

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# Procedures

- Vascular Access: Central and Peripheral
- Abscess vs Cellulitis: I&D
- **Pericardiocentesis**
- **Paracentesis**
- **Arthrocentesis**
- **Peritonsillar Abscess Drainage**
- Nerve Blocks
- Lumbar Puncture
- Endotracheal Tube Confirmation
- FB Localization
- Thoracentesis

# The Basics

- Dynamic Guidance vs Static Assistance
- Number of Operators
- Needle to Transducer Orientation
- Technical Guidance

# Dynamic Guidance vs Static Assistance

- Pre-Scan, Prep, Poke, Path
- Dynamic guidance
- Static assistance

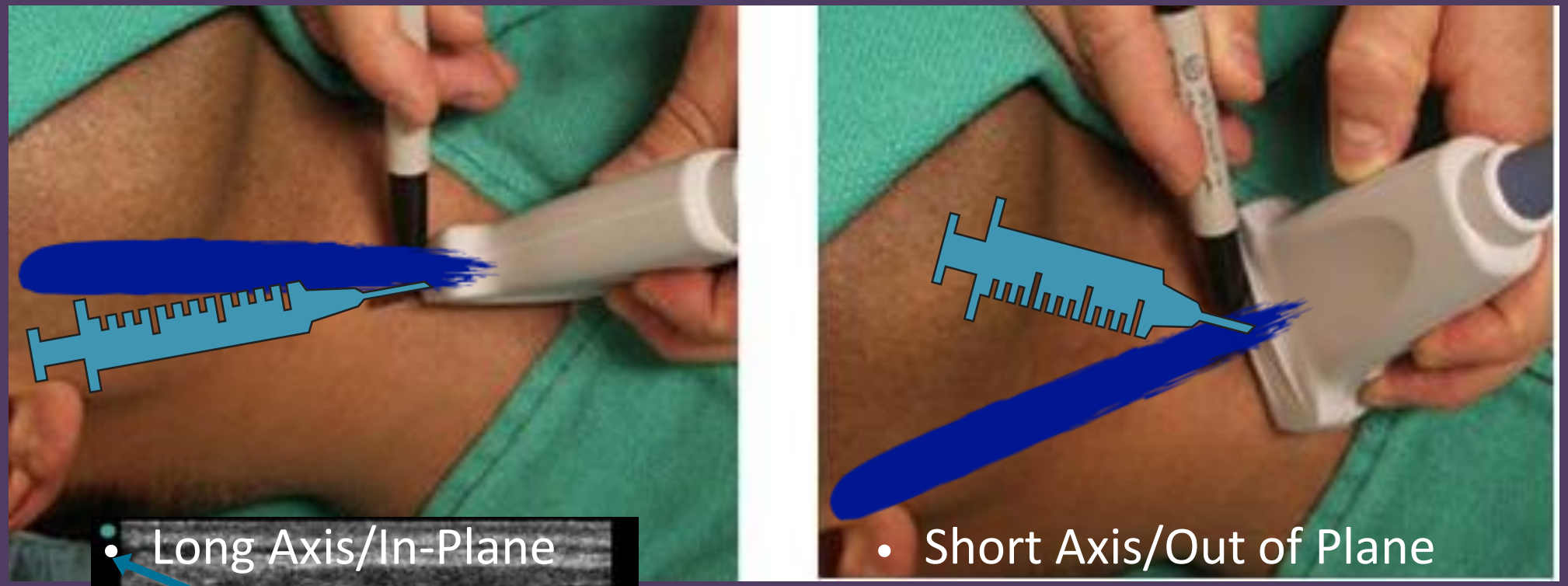
# Number of Operators

Single Operator

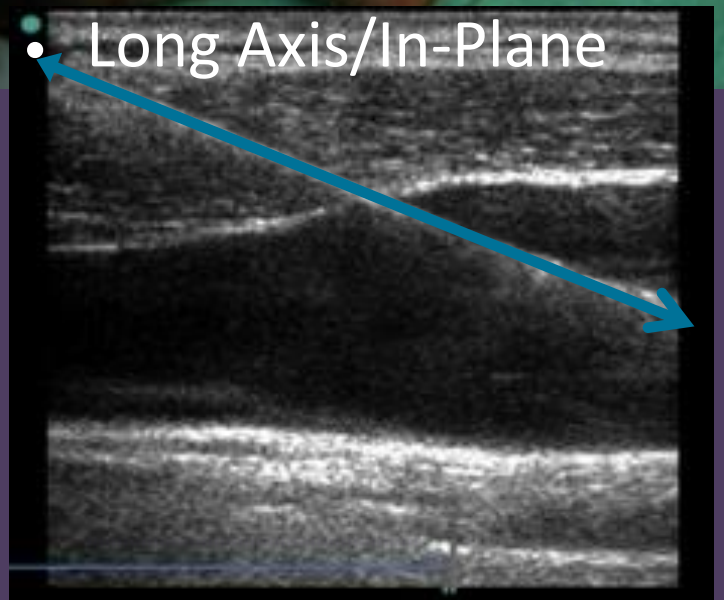
Hand- eye coordination

Double Operator

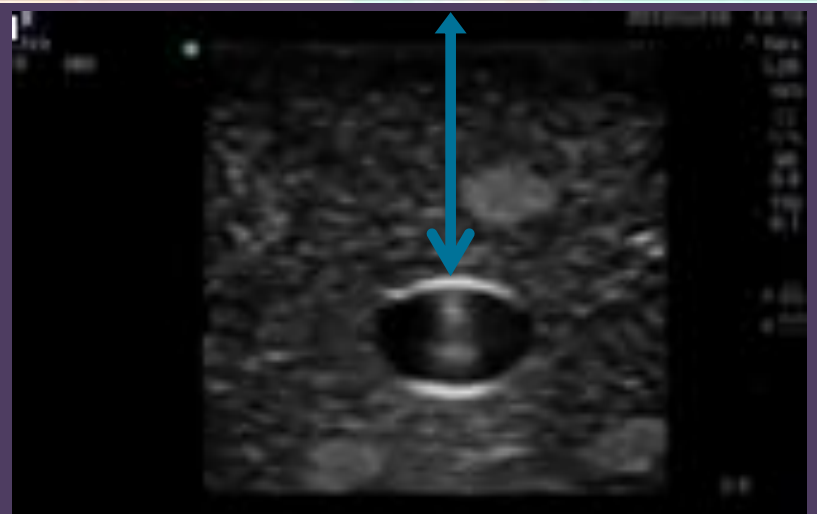
# Needle to Transducer Orientation



- Long Axis/In-Plane



- Short Axis/Out of Plane




# IN PLANE

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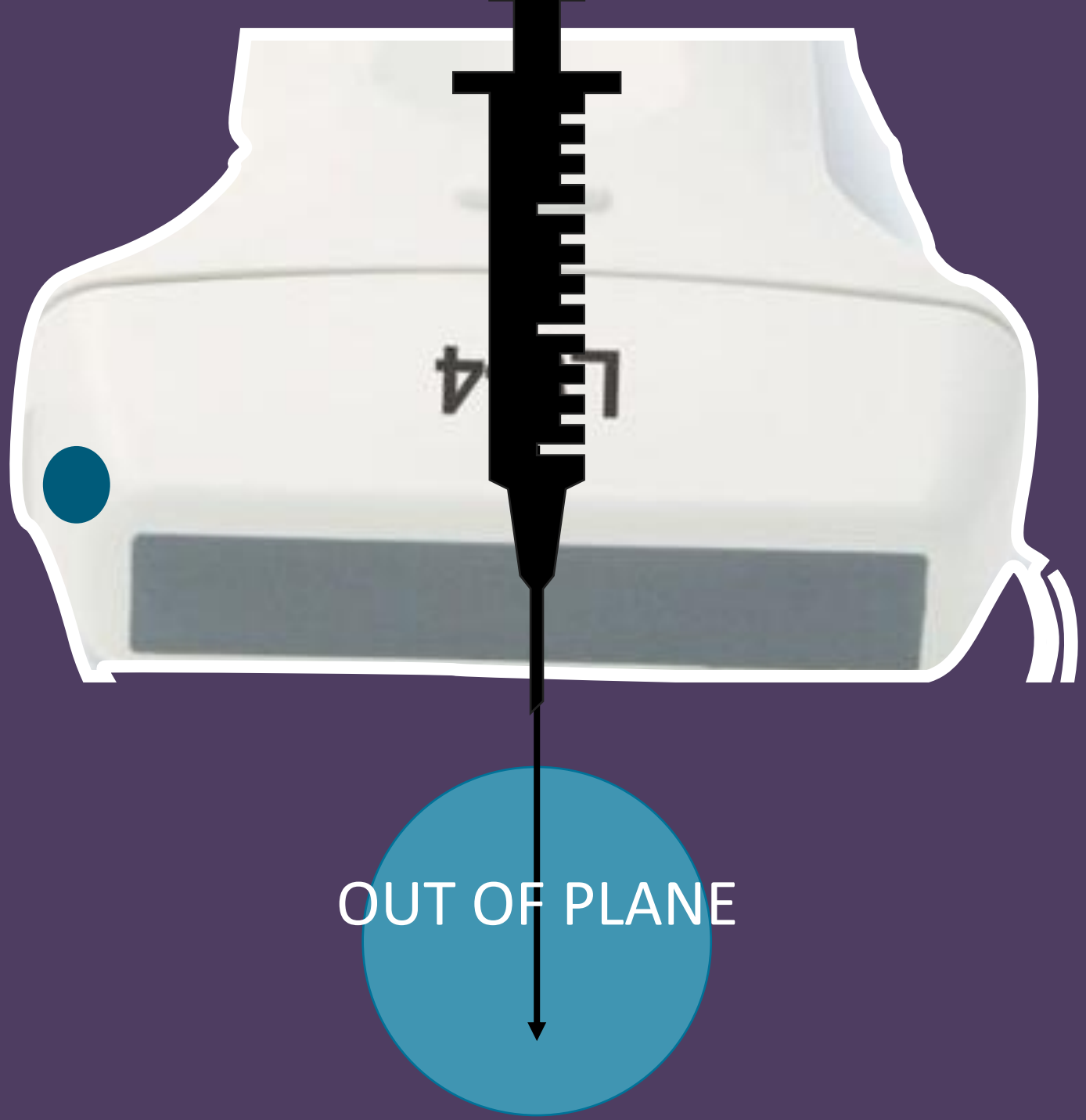


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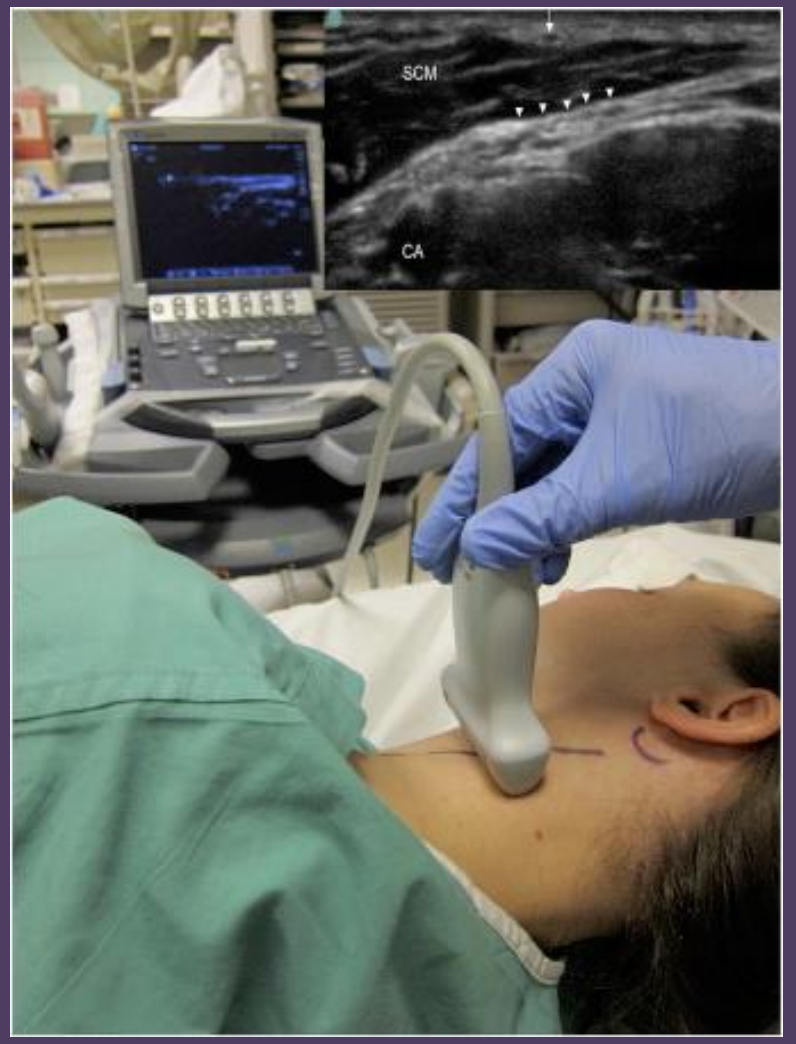
# Technical Aspects

- POSITIONING!!!!!!!

- Have patient maintain **same position** throughout procedure

# Technical Aspects

- Proper position of ultrasound machine: placed where operator can easily visualize screen
- Screen and transducer notch aligned!

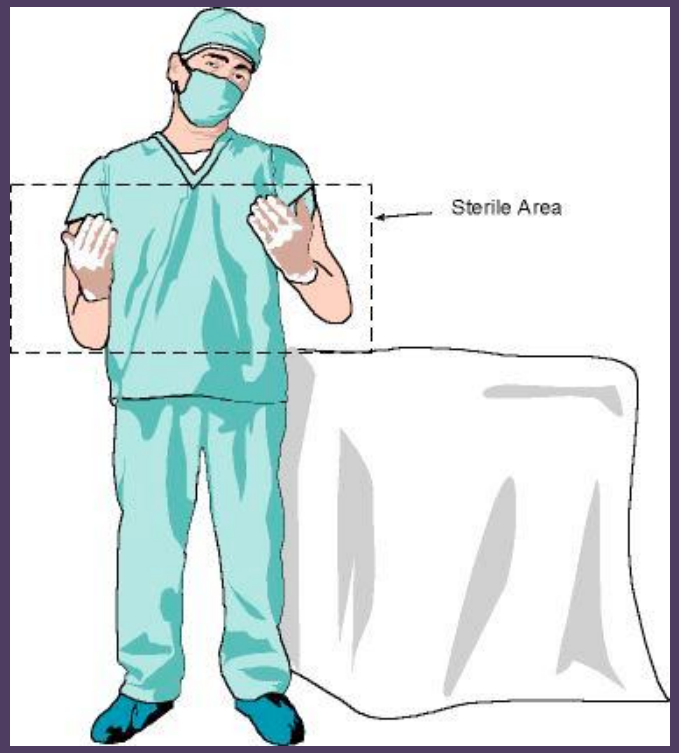


# PRO TIP

Align the ultrasound screen to be in direct line of sight to where you are performing your procedure.

# Technical Aspects

- Sterility when performing any invasive procedure
  - Sterile gown, mask, cap, gloves
  - Sterile transducer sheath
  - Sterile ultrasound gel or surgical lubricating jelly



1

Probe Selection

2

Holding the probe

3

Factors affecting visualization

4

Sonographic localization of instrument

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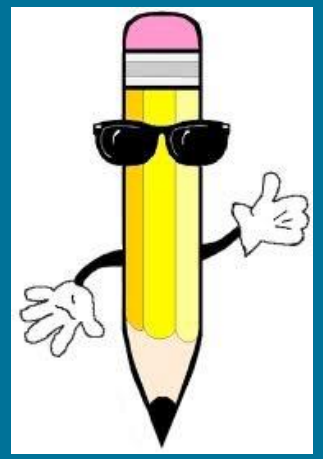
# Holding the Probe

- Hold probe close to patient's skin for better fine motor control-like a

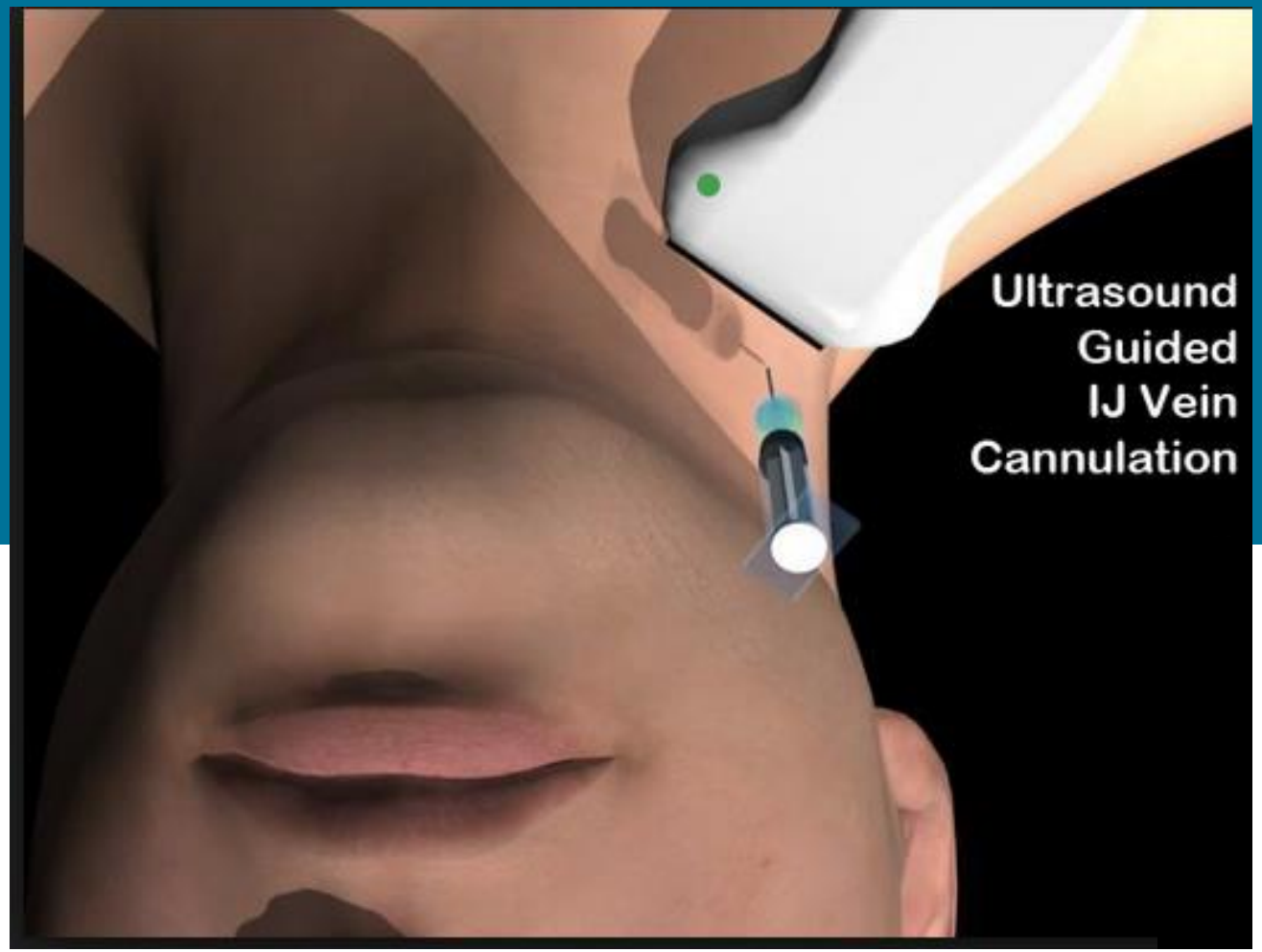


- Maintain light hand contact with patient

# Factors Affecting Visualization

- Large diameter needle
- Keep needle angled 60-90 degrees to beam
  - Steep needle angle hard to visualize!

# Venous Catheterization

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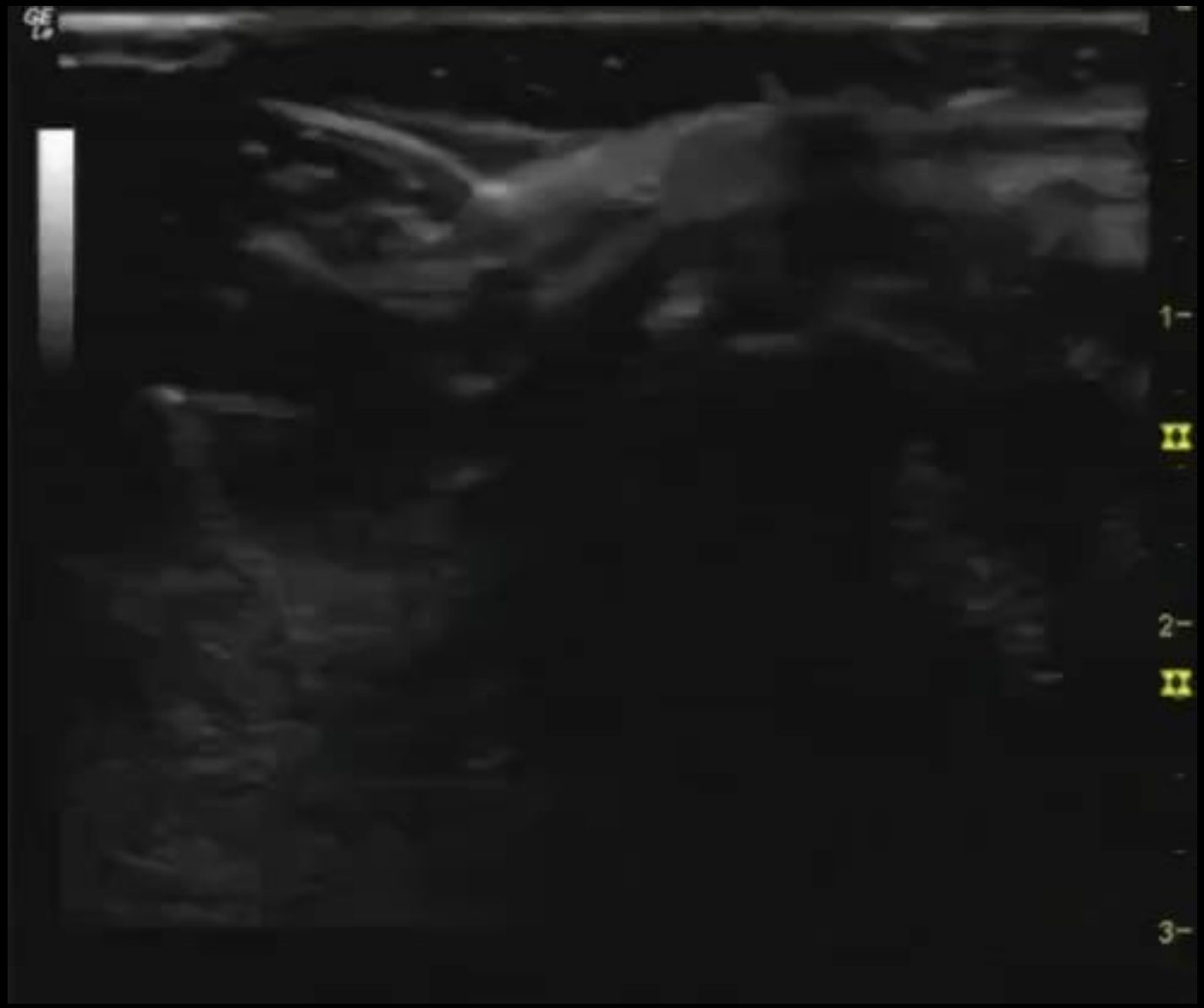
1
2
3


Res
S
MB
Ven
L25
32%
MI
0.8
TIS
0.1
A
B
3.1
Res
0
Guide
MB On
Dual
Page 1/2


NORTH SHORE EMERGENCY
09/17/13
CGELABERT. MNELSON
11:27:11 AM
sc/VENOUS
L10-5/CH8MHz
DR55/M3/P2
G90/E2/100%
MI1.5 TIs0.1
3.0 cm
13 Hz
ZSI 0

# Paracentesis

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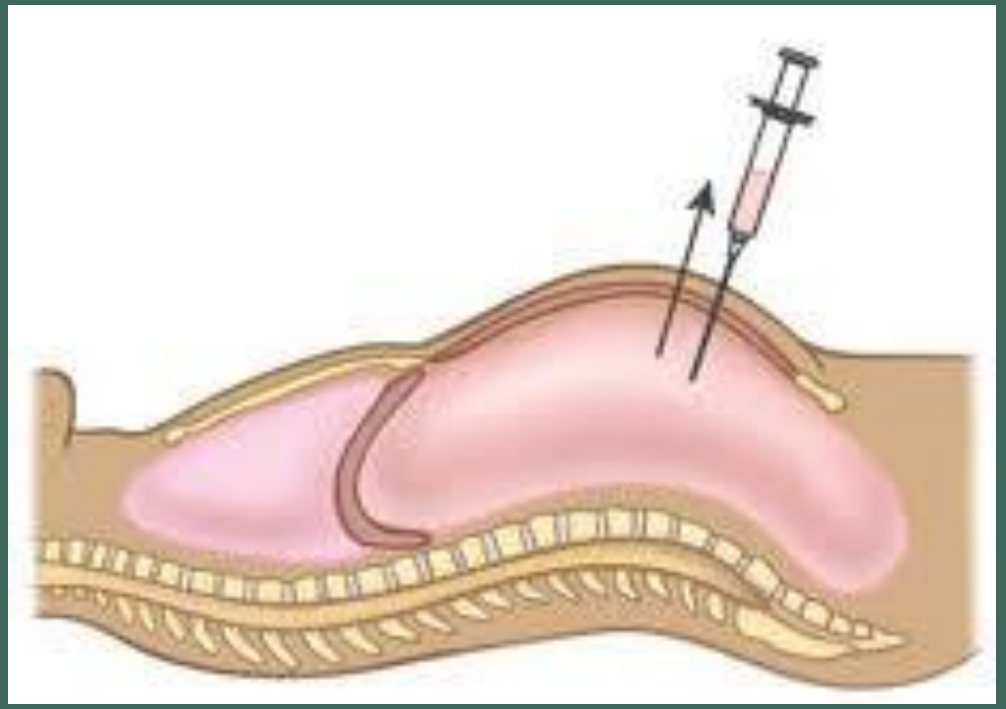
# Indications

- New onset ascites
- Diagnostic - r/o SBP
- Therapeutic

# Evidence

- Reported series of 100 paracentesis
- Higher success rate for ultrasound-assisted paracentesis vs traditional approach
- 95% vs 65%



Dewitz A, Jones R, Goldstein J. Emergency Ultrasound: Additional ultrasound guided procedures. Edited by Ma OJ, Mateer JR, Blaivas M. New York, McGraw Hill. 546-9, 2008

- Diagnostic paracentesis < 60 ml
- Small volume < 2 L
- Large volume > 4 L

# How much fluid?

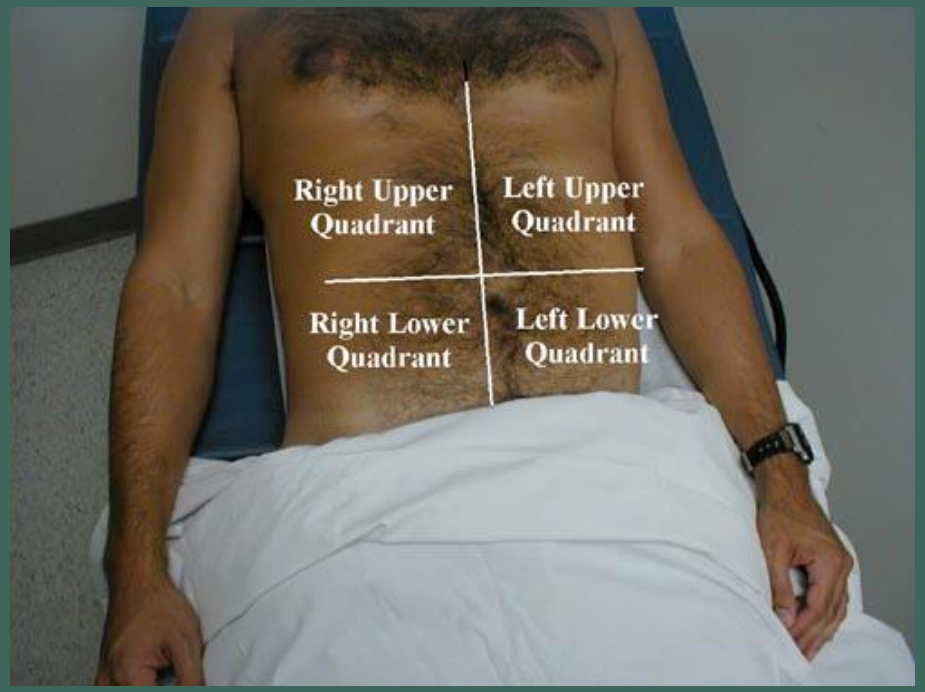
- Abdominal wall hematoma
- Inferior epigastric artery pseudoaneurysm
- Mesenteric hematoma
- Intraperitoneal hemorrhage
- Bladder/ bowel perforation
- Abdominal wall abscess
- Persistent ascitic fluid leak
- Peritonitis

# Anatomic Considerations

- Avoid upper quadrants (organomegaly)
- Avoid surgical scars (adhesions)
- Stay lateral to rectus muscles (epigastric vessels)
- Small gauge needle
- **EMPTY THE BLADDER**

# Anatomic Considerations

- Fluid depth of at least 3cm
- Thin portion of abdominal wall
- LLQ thinner than mid infraumbilical area (1.8cm vs 2.4cm)
- Left lateral oblique position - ascites increases from 2.86cm to 4.57cm



# Technique

- Low frequency transducer
- Head of bed slightly raised
- Left lateral oblique
- Locate bladder
- Mark fluid collection in 2 planes

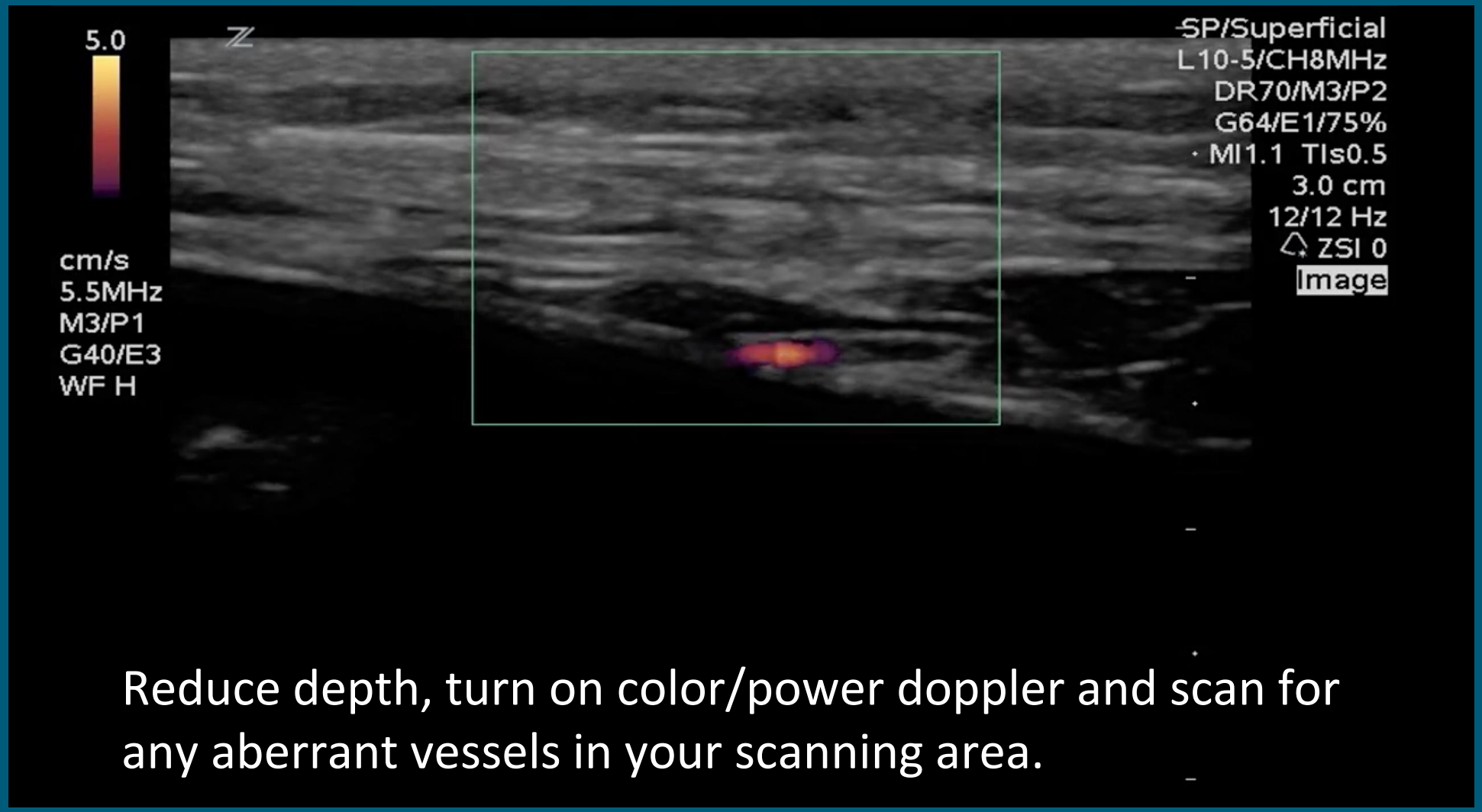
# Technique

- Note:
  - thickness of abdominal wall
  - depth of fluid pocket before hitting bowel
  - puncture angle
- Static vs dynamic guidance

# Ultrasound Findings

- Transudative ascites is anechoic
- Loops of bowel floating
- Complex fluid with internal echoes (leukocytes, erythrocytes, protein, fibrin)

# pro tip




Reduce depth, turn on color/power doppler and scan for any aberrant vessels in your scanning area.


Abd/General
C6-2/CH6MHz
DR50/M2/P2
G70/E1/100%
MI1.4 TIs0.3
10.0 cm
15 Hz
ZSI 0


LLQ
Abd/FAST EXAM
C5-2/CH4MHz
DR65/M4/P2
G58/E1/100%
MI0.9 TIs0.1
16.0 cm
13 Hz
ZSI 0


LLQ
Abd/FAST EXAM
C5-2/CH4MHz
DR65/M4/P2
G58/E1/100%
MI0.9 TIs0.1
16.0 cm
13 Hz
ZSI 0


SonoSite

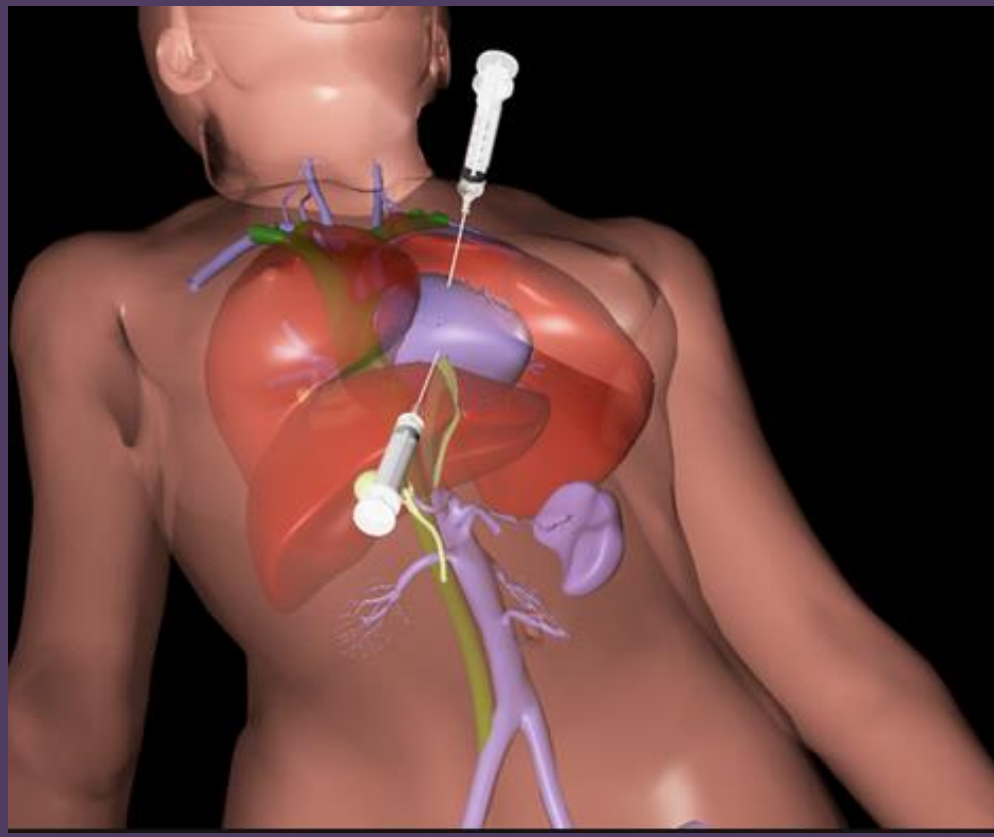
# Pitfalls

- Moving patient after fluid mapping
- Mistaking fluid for bladder, bowel, or cyst

# Pericardiocentesis

# Complications

- Pneumothorax
- Myocardium or coronary vessel laceration
- Hemopericardium
- Liver laceration
- Air embolism
- Dysrhythmia
- Cardiac arrest/death



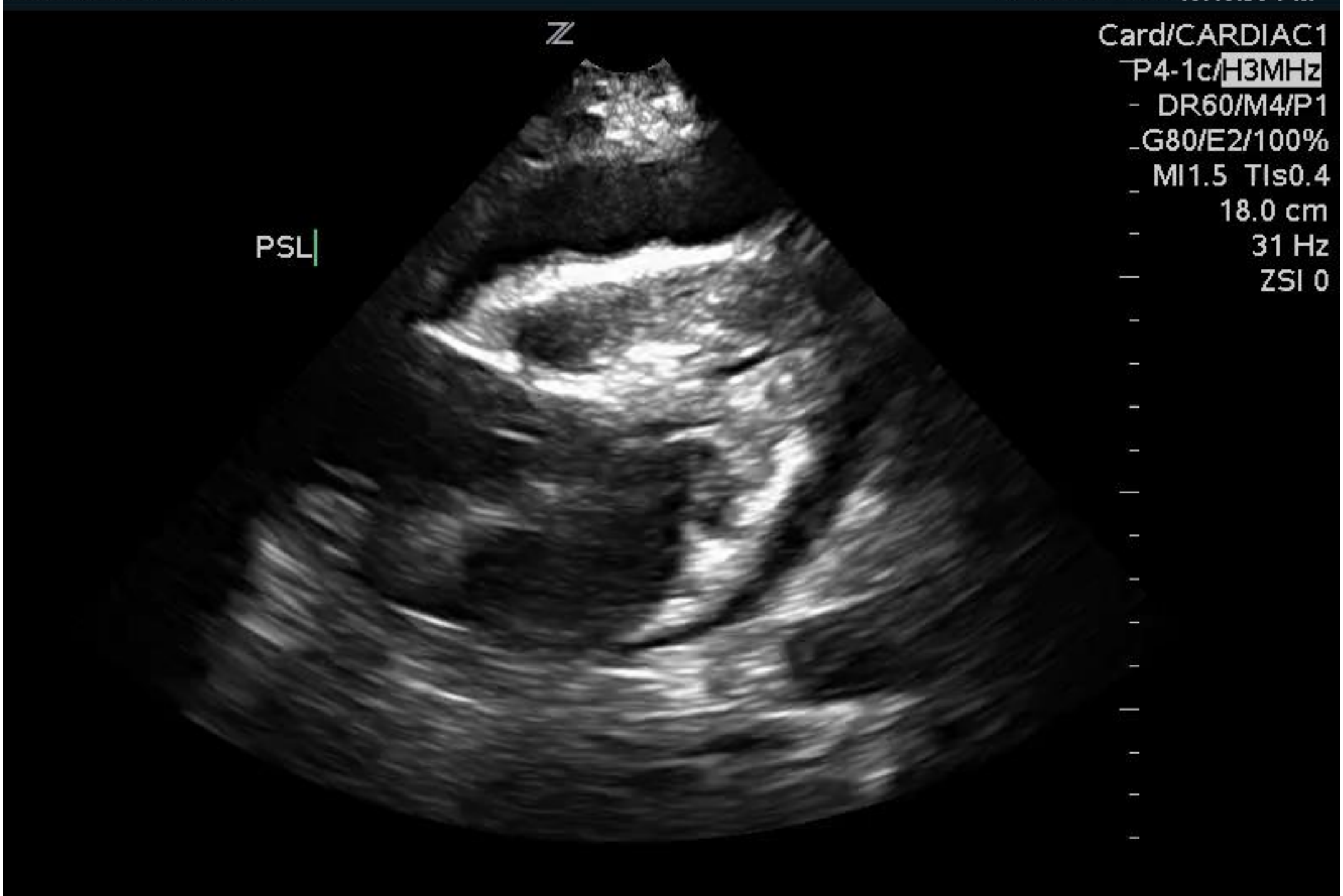
# Evidence

- 1,127 ultrasound-guided pericardiocenteses
- 97% success rate
- 4.7% complication rate

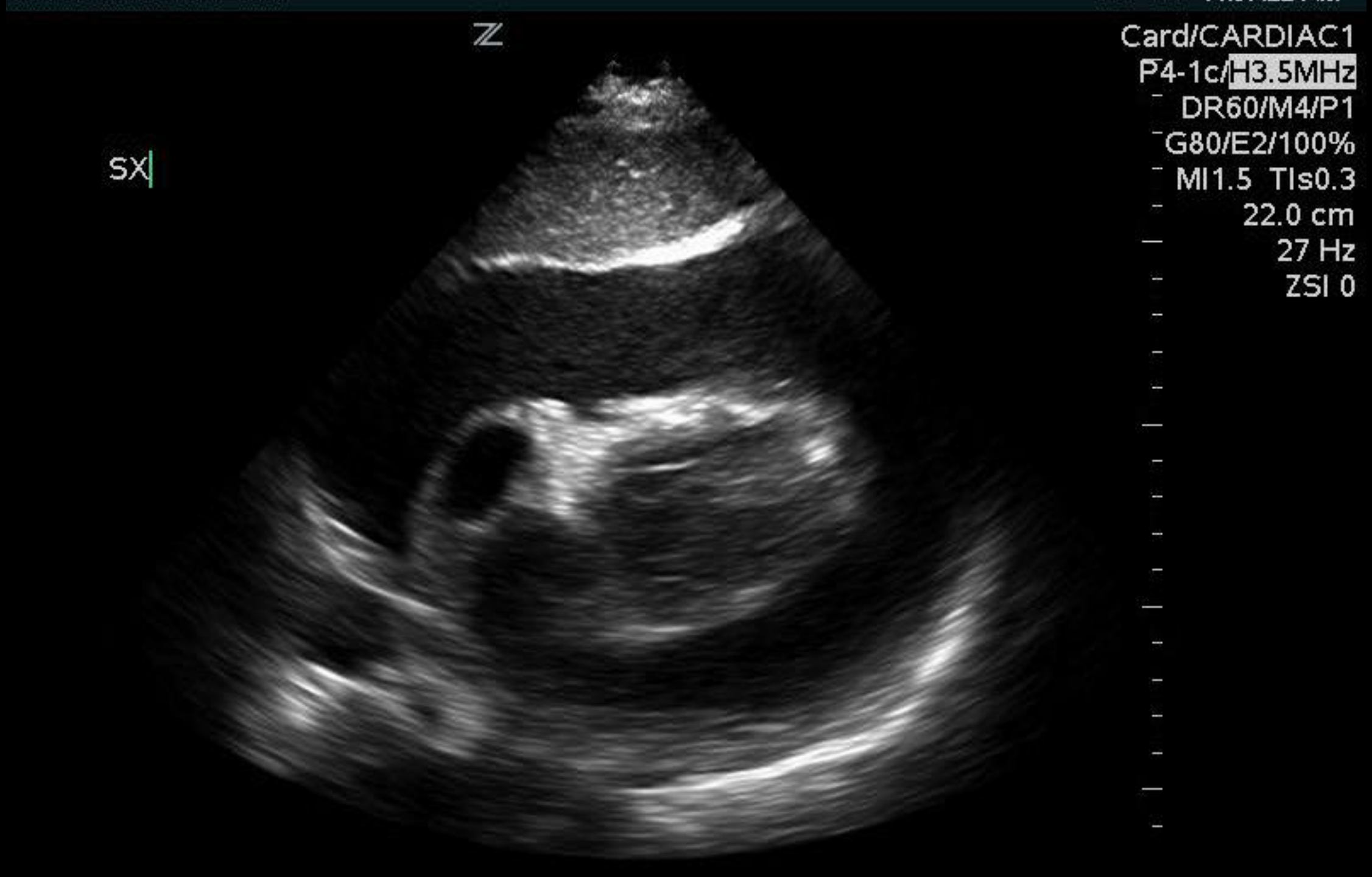
Tsang TS, et al.: Consecutive 1127 therapeutic echocardiographically guided pericardiocenteses: Clinical profile, practice patterns, and outcomes spanning 21 years. Mayo Clin Proc 77(5):429-436, 2002.

# Sonographic signs of tamponade

- Right ventricular **DIASTOLIC COLLAPSE**
- Right atrial **SYSTOLIC COLLAPSE**
- Dilated IVC with lack of inspiratory collapse


Z
PSL
Card/CARDIAC1
P4-1c/H3MHz
DR60/M4/P1
G80/E2/100%
MI1.5 TIs0.4
18.0 cm
31 Hz
ZSI 0


APICAL
Card/CARDIAC1
P4-1c/H3MHz
DR60/M4/P1
G80/E2/100%
MI1.5 TIs0.4
20.0 cm
29 Hz
ZSI 0

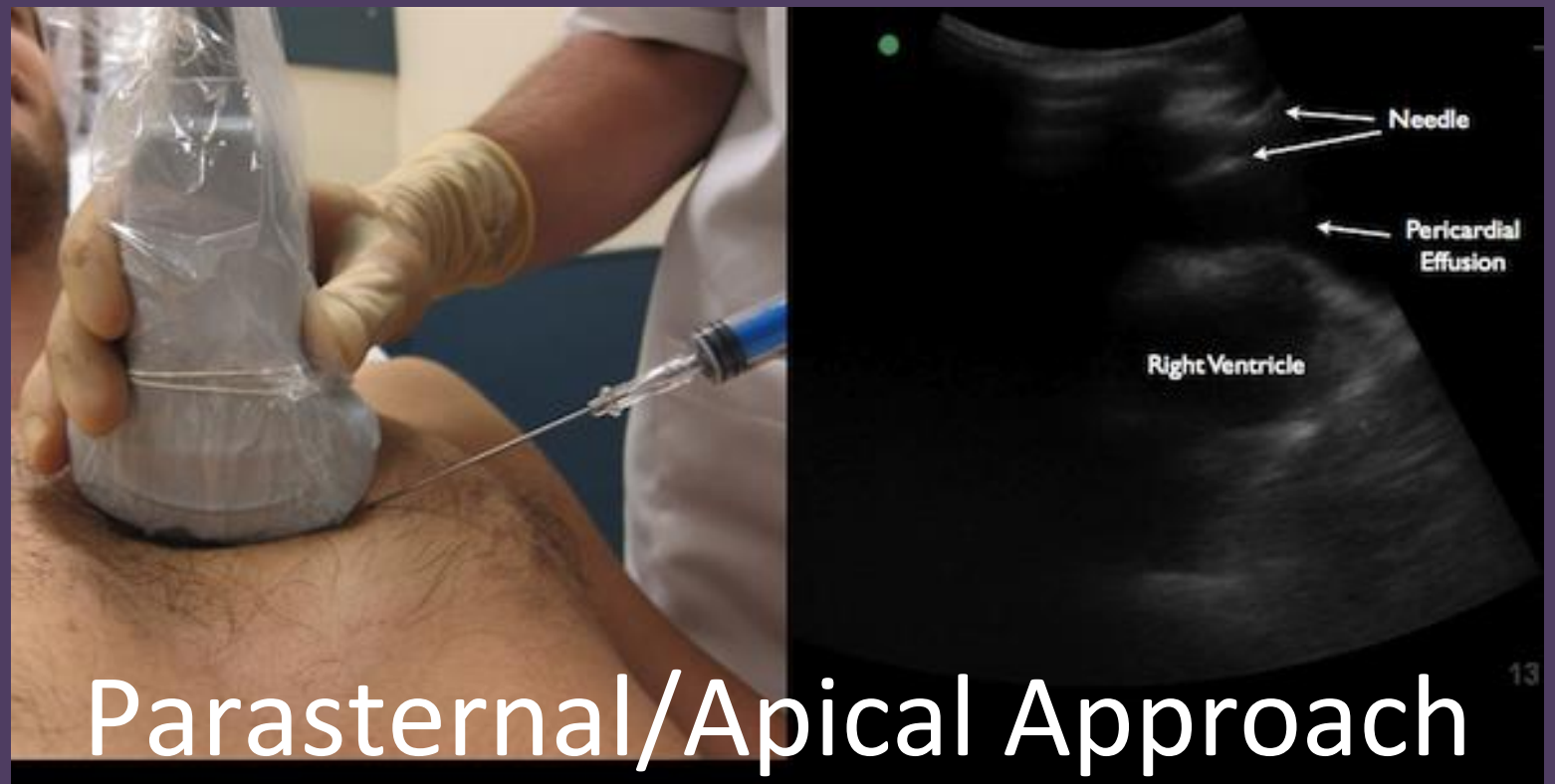

Z
SX
Card/CARDIAC1
P4-1c/H3.5MHz
DR60/M4/P1
G80/E2/100%
MI1.5 TIs0.3
22.0 cm
27 Hz
ZSI 0

# Approaches

- Subxiphoid
  - most often performed “blind”
- Parasternal/Apical
  - ultrasound guidance
  - Ensures that lung and other organs not in pathway of needle

Some authors recommend needle at away site from probe

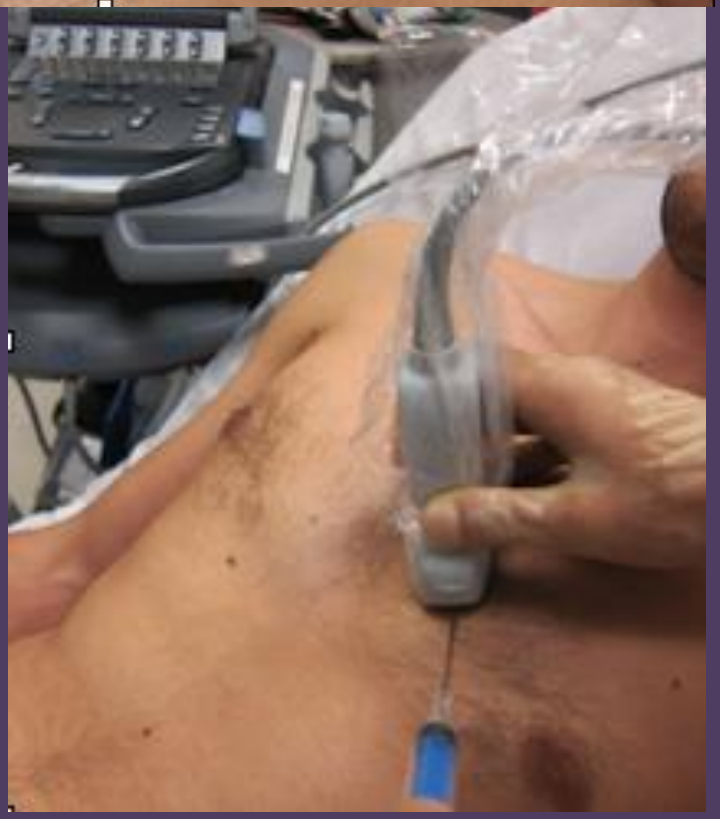
- Standard Views
- Position: LLD if necessary
- Ideal location between parasternal and apical view (largest fluid collection)
- Long-axis orientation with **<u>longitudinal needle guidance</u>**




# Parasternal/Apical Approach

# Technique

- In-plane approach
- 14-18 gauge 5-8 cm teflon-sheathed angio-catheter
  - (Or spinal needle mounted on a syringe)
- Once fluid obtained,  advance needle several mm’s and then advance sheath and remove needle



# Static Approach

- Subxiphoid view
- Note fluid depth
- Do not move patient between mapping and needle insertion

# Agitated Saline

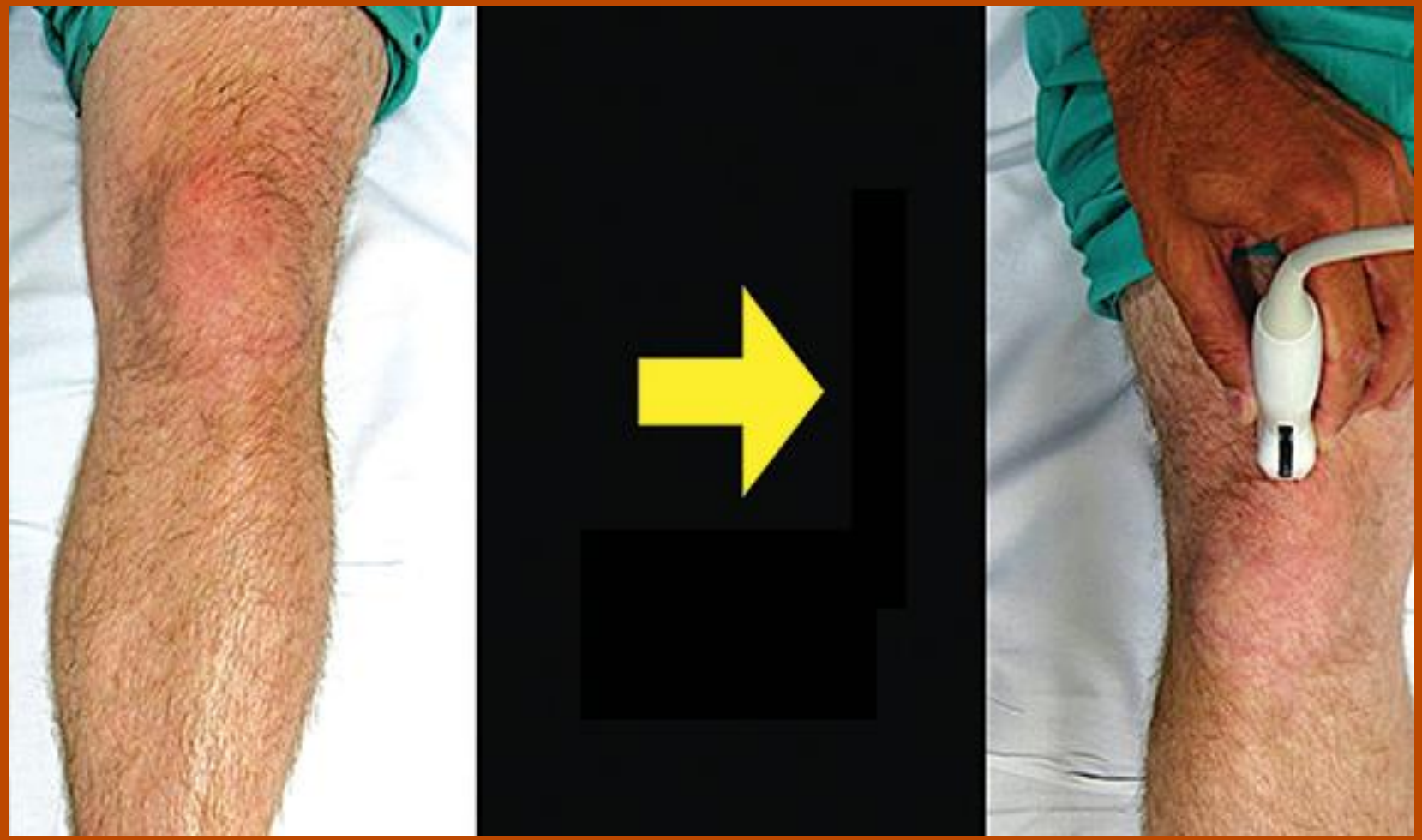
- If no fluid obtained, inject 5 cc agitated saline
- If “bubble” contrast is pericardial sac, then continue procedure
- If “bubble” contrast is in myocardium, sheath should be withdrawn


JPEG

# Pitfalls

- Failure to consider location of vessels:
  - internal mammary artery 3-5cm lateral to parasternal border
  - neurovascular bundles inferior to ribs
- Failure to consider location of needle when no fluid is obtained
- Failure to consider alternative approach if lung tissue obscures parasternal approach

# Arthrocentesis



# Background

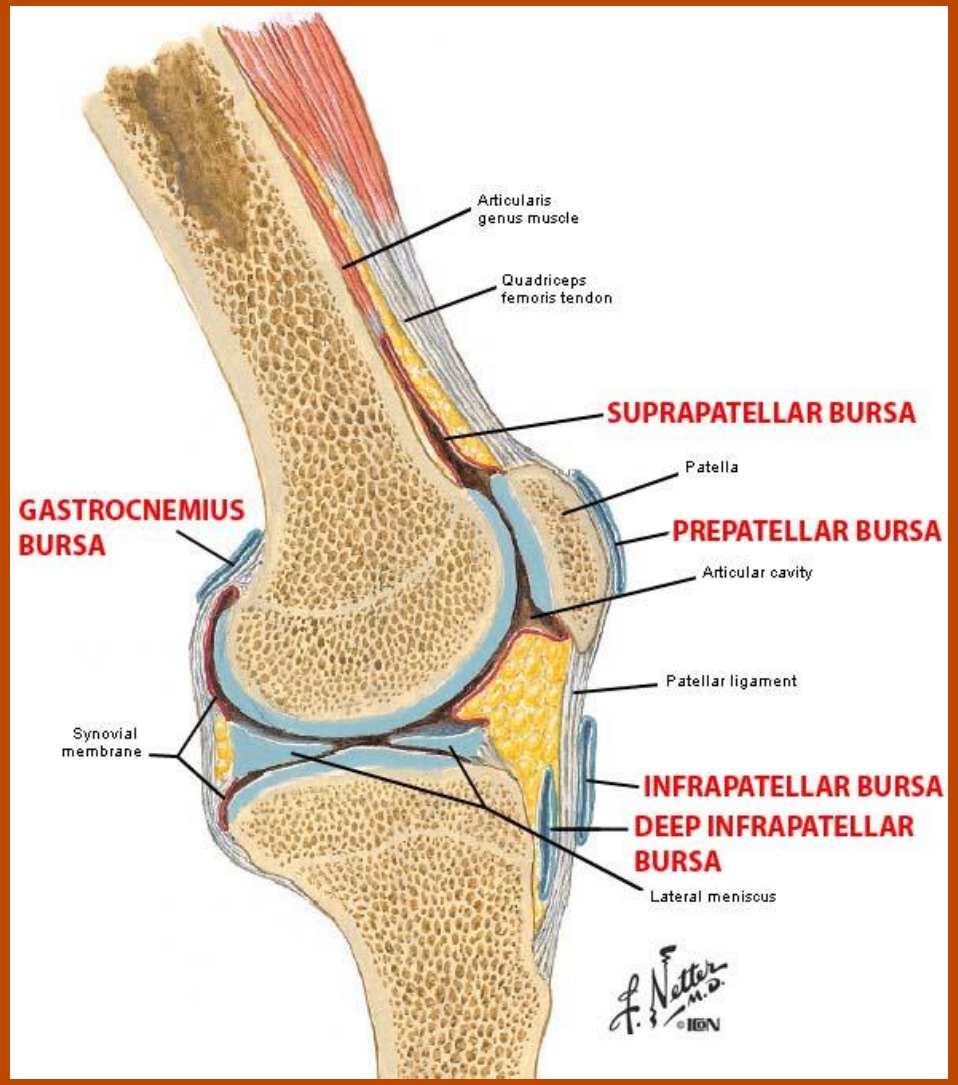
- US to confirm the presence of an effusion before performing a diagnostic arthrocentesis
- Mimics such as cellulitis, prepatellar bursitis, or abscess that may be difficult to distinguish from joint effusion on physical examination are easily identified with US
- US increases success of arthrocentesis and decreases complications


1 Adhikari S, Blaivas M. **Utility of bedside sonography to distinguish soft tissue abnormalities from joint effusions in the emergency department**. J Ultrasound Med. 2010;29:519-526.

2 Sibbitt WL Jr, Kettwich LG, Band PA, et al. **Does ultrasound guidance improve the outcomes of arthrocentesis and corticosteroid injection of the knee?** Scand J Rheumatol. 2012;41:66-72.

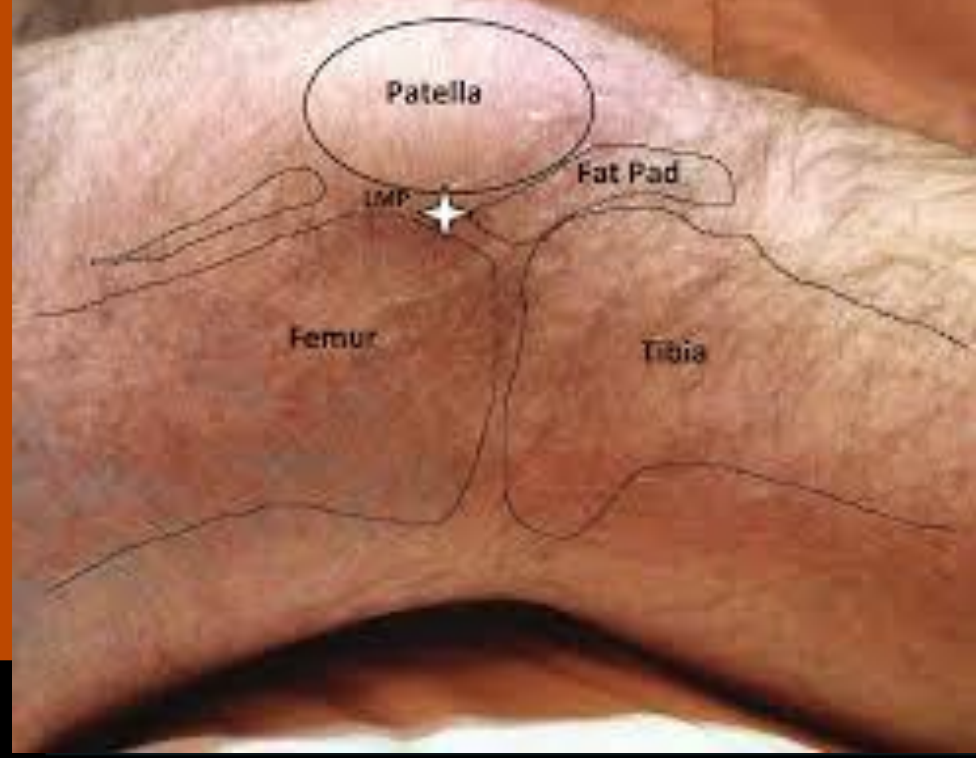
# Anatomic Considerations

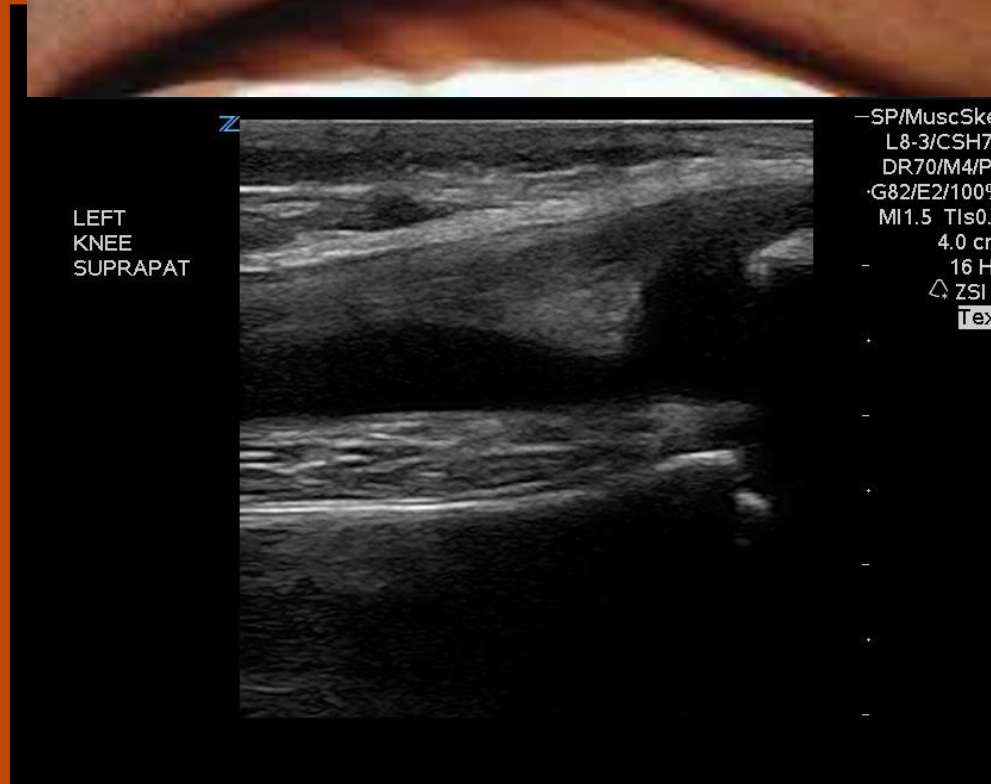
- Suprapatellar bursa communicates directly with knee joint
- Avoids any tendons or bony or ligamentous structures
- Facilitates simple and accurate tap



# Position/Setup

- Linear transducer
- Indicator toward head
- Supine position with knee slightly flexed (roll a towel underneath for comfort)
- Begin scanning at patella and scan cephalad



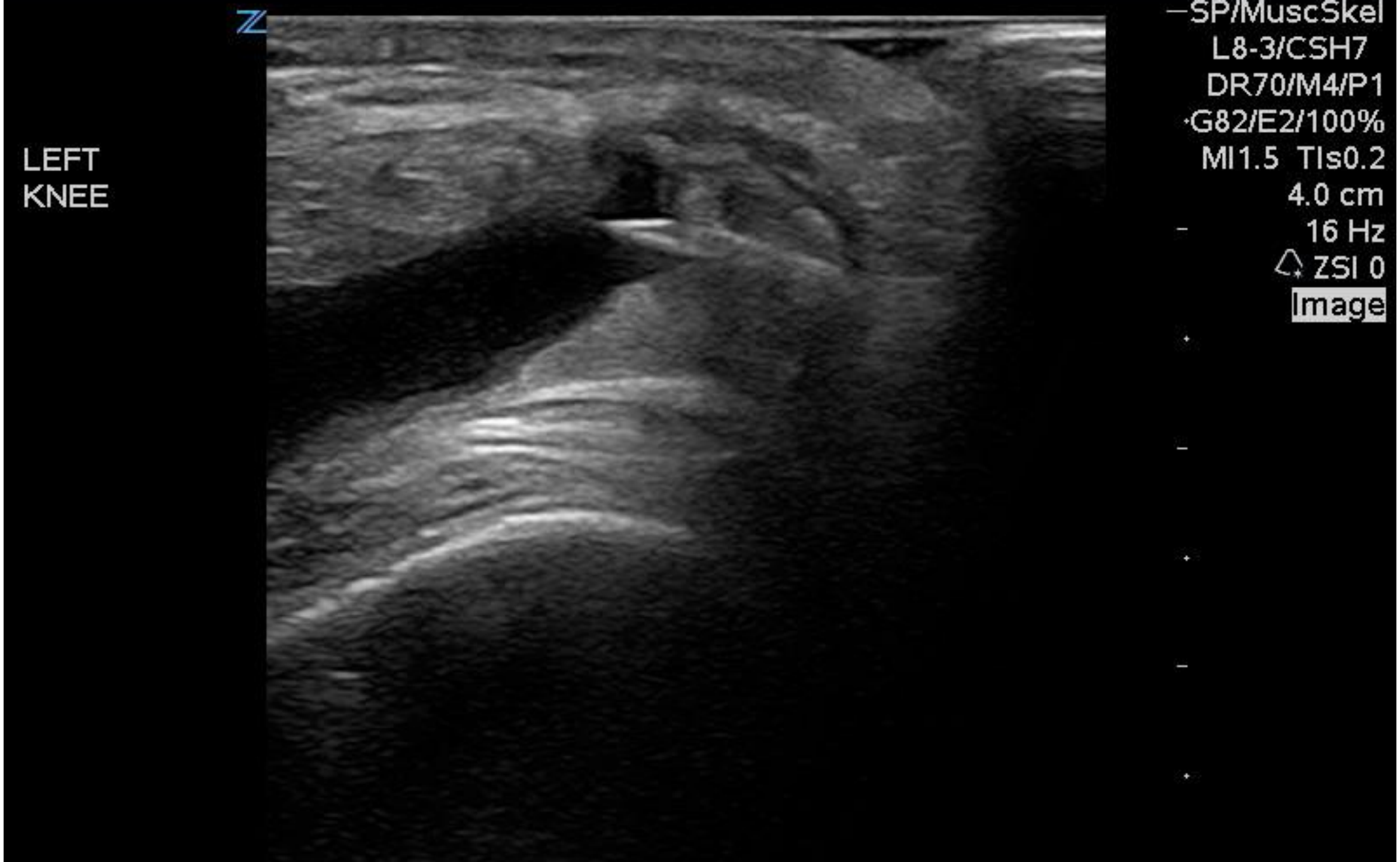



Lateral to median in-plane technique

Once identified effusion, rotate transducer transverse

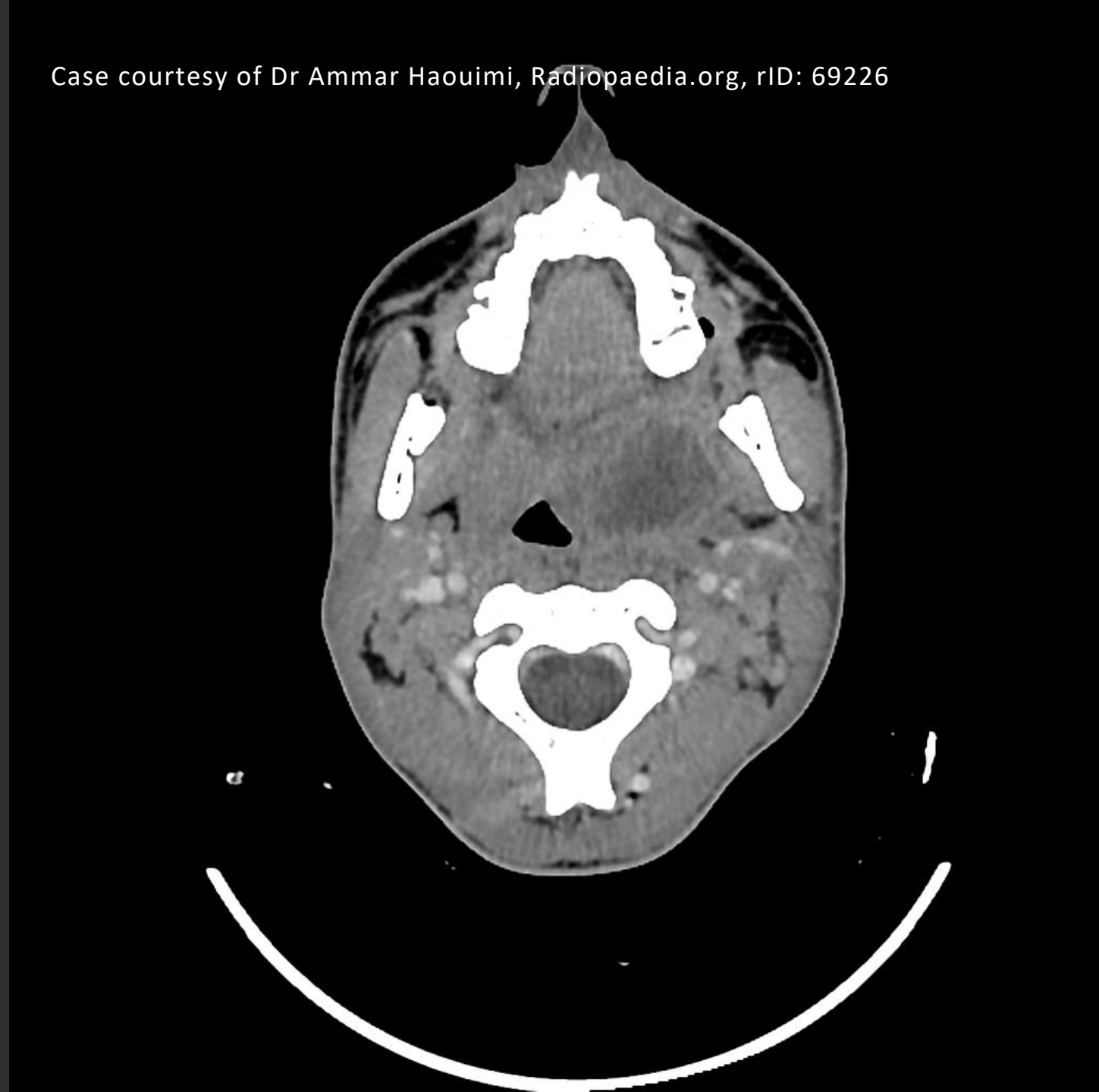
Prep, anesthesia, sterile

Needle will traverse between IT band and vastus lateralis

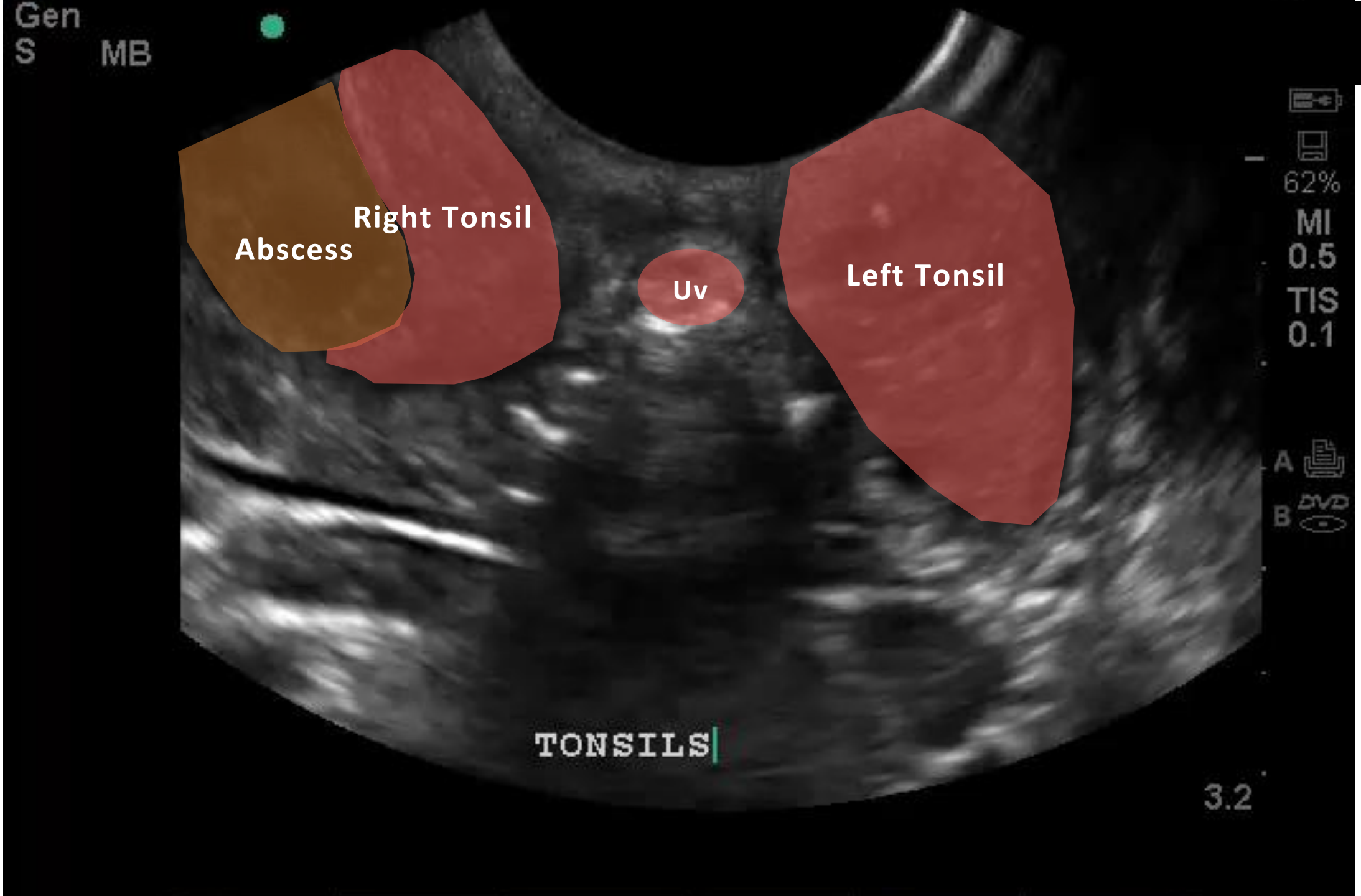

LEFT
KNEE
SP/MuscSkel
L8-3/CSH7
DR70/M4/P1
G82/E2/100%
MI1.5 TIs0.2
4.0 cm
16 Hz
ZSI 0
Image

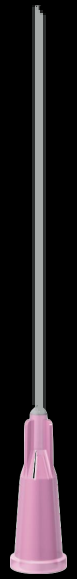
# Peritonsillar Abscess

- CT nearly 100% sensitive
  - $$$
  - Can not guide drainage
- Perceived risk of carotid artery injury



- US improves accuracy of diagnosis between peritonsillar abscess (PTA) and peritonsillar cellulitis (PTC)

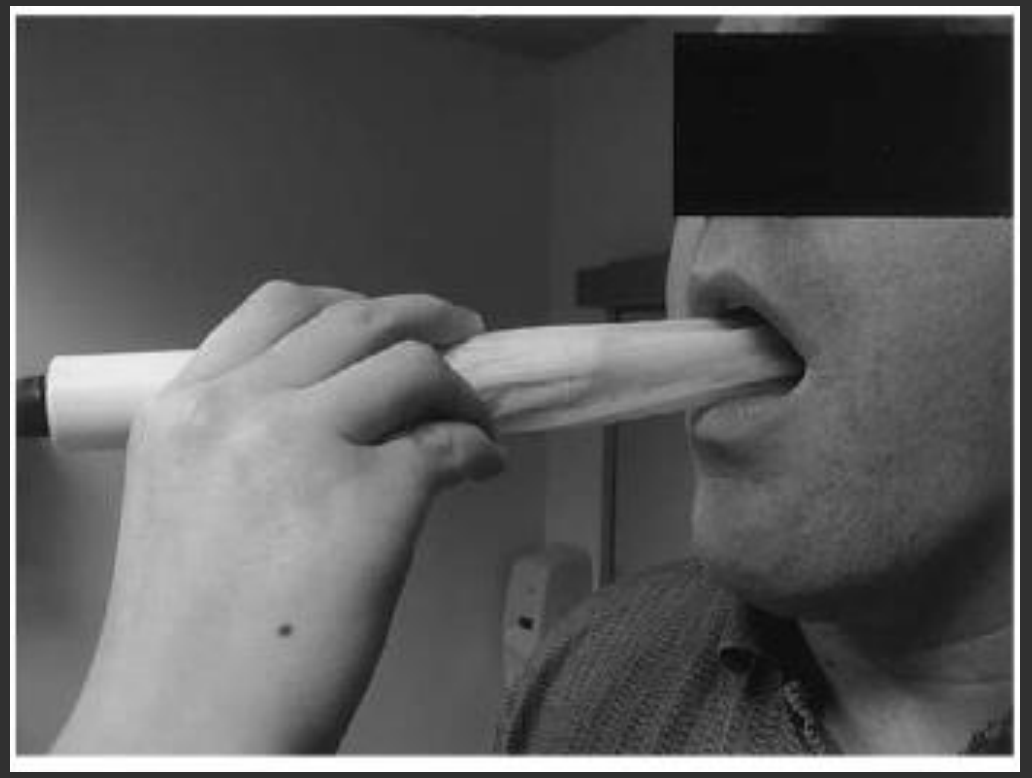

Gen
S MB
Abscess
Right Tonsil
Uv
Left Tonsil
62%
MI
0.5
TIS
0.1
A
B
DVD
TONSILS
3.2

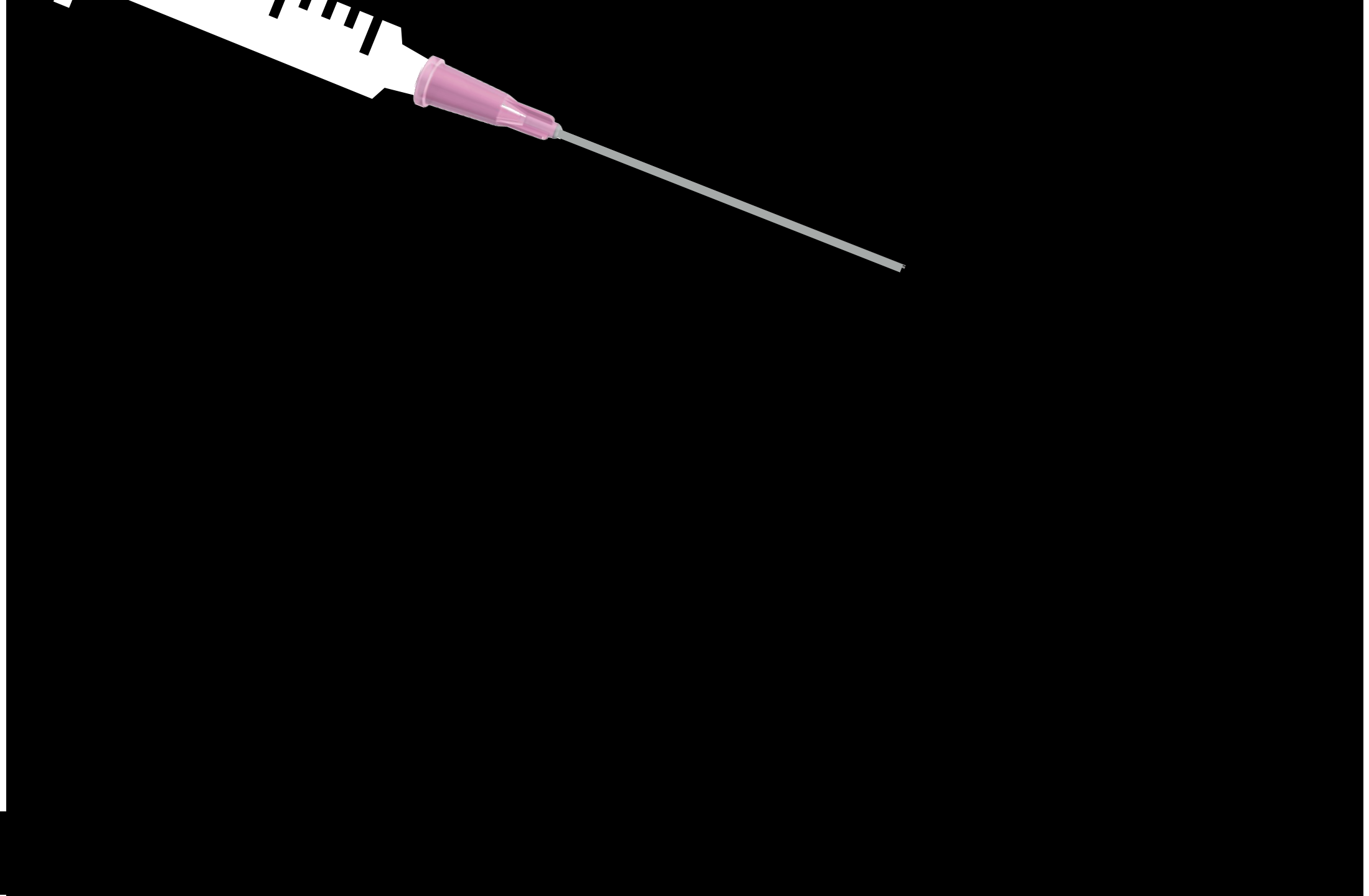



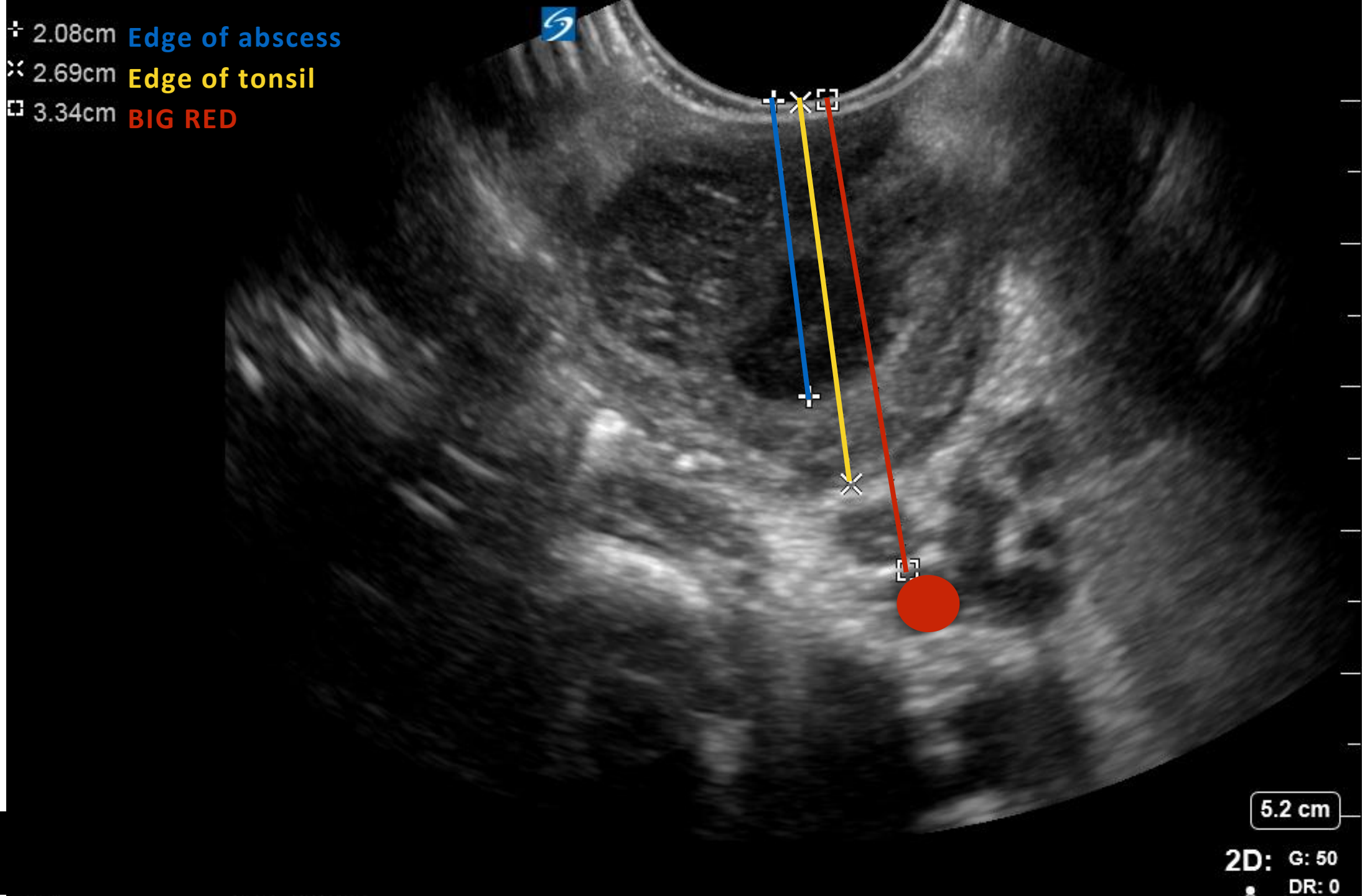

# THE SETUP

# TECHNIQUE

- Anesthetize skin
- EndoCAVITARY probe-left hand, 18 Ga needle w/syringe-right hand.
- Indicator (thumb) to patient's right
- Insert needle
- Aspirate






2.08cm Edge of abscess
2.69cm Edge of tonsil
3.34cm BIG RED
5.2 cm
2D: G: 50
DR: 0


TOPICAL
ANESTHETIC
SPRAY
NET WEIGHT
2 oz. (57 g)
M5655
OR SINGLE USE

# THE SETUP


# THE SETUP

- Decrease complication rate
- Increase success rate
- Important to understand anatomy and basic principles
- Practice, practice, practice!

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