A surgeon in a blue scrubs, mask, and cap, pointing with a gloved hand. The background is a blurred operating room with other medical staff.

超音波在急診 骨骼肌肉系統應用

陳國智 西園急診醫學科



急救加護重症超音波工作坊
PAIN - Module (1) 工作坊
AEACUS Network President
(前)急診超音波委員會主委
(前)新光超音波訓練中心主任

Faculty

-WINFOCUS, PERCUSS, WFPICC
-台灣疼痛醫學會

POCUS Academy

FB: Emergency Ultrasound Training Center

Resuscitative

Diagnostic

Procedural
Guidance

Symptom- or
Sign-Based

Therapeutic



Diagnostician



Interventionist

ACEP

2016

Core Applications

Trauma

Intrauterine Pregnancy

AAA

Cardiac/HD Assessment

Biliary

Urinary Tract

DVT

Soft-tissue/Musculoskeletal

Thoracic/Airway

Ocular

Bowel

Procedural Guidance

12 核心

5大應用

REVIEW

Open Access



An overview of point-of-care ultrasound for soft tissue and musculoskeletal applications in the emergency department

Kuo-Chih Chen^{1,2}, Anning Chor-Ming Lin^{3,2*}, Chee-Fah Chong^{1,2} and Tzong-Luen Wang^{1,2}

Musculoskeletal Ultrasound in the Emergency Department

Vito Chianca, MD¹ Francesco Di Pietto, MD, PhD² Marcello Zappia, MD, PhD³
Domenico Albano, MD^{1,4} Carmelo Messina, MD^{1,5} Luca Maria Sconfienza, MD, PhD^{1,5}

¹IRCCS Istituto Ortopedico Galeazzi, Milano, Italy

²Dipartimento di Diagnostica per immagini, Pineta Grande Hospital, Castel Volturno (CE), Italy

³Department of Medicine and Health Sciences, Università del Molise, Campobasso, Italy

⁴Section of Radiological Sciences, Department of Biomedicine, Neurosciences and Advanced Diagnostics, University of Palermo, Palermo, Italy

⁵Dipartimento di Scienze Biomediche per la Salute, Università degli Studi di Milano, Milano, Italy

Address for correspondence: Vito Chianca, MD, IRCCS Istituto Ortopedico Galeazzi, via Riccardo Galeazzi 4, 20161 Milano, Italy (e-mail: vitorchianca@gmail.com).

Semin Musculoskelet Radiol 2020;24:167–174.



Soft tissue infection
Joint effusion
Foreign body
Long bone fracture
Muscle & Tendon injury
Vascular occlusion
Procedures

Seminars in

ROENTGENOLOGY

Musculoskeletal Ultrasound in the Emergency Department: Is There a Role?

Michael V. Perone, MD, and Corrie M. Yablon, MD <https://doi.org/10.1053/j.ro.2020.09.004>

Limitations of US

In the hands of highly skilled practitioners, the performance of MSK US in the assessment of superficial soft tissue and tendon injury is equal to MRI. A barrier to the performance of MSK US in the ED is the high degree of training that is required of personnel, both to scan and to interpret the images. Sonographers must be able to recognize the artifacts inherent to MSK US and must be able to manipulate the various parameters in order to optimize image quality. It is vital to have a sophisticated understanding of MSK anatomy and the varied sonographic appearances of tissues such as skin, subcutaneous fat, muscle, tendon, ligament, and synovium, both when normal and abnormal. Without this high level of understanding, the resulting images can be confusing at best, and cause missed diagnoses at worst. <https://doi.org/10.1053/j.ro.2020.09.004>

I-AIM

POINT



Acquire



Interpret



**Make
decision**



MSK POCUS

Effusion

Knee
Ankle
Hip
Elbow
Shoulder

Bones

Sternum
R 5th rib

Tendons

QT/PT/AT
Biceps LH

Dislocation

POCUS 常用探頭



弧



線



扇

MSK 常用探頭

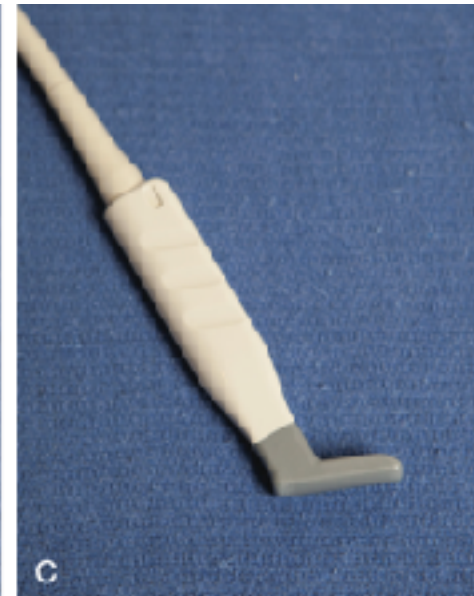
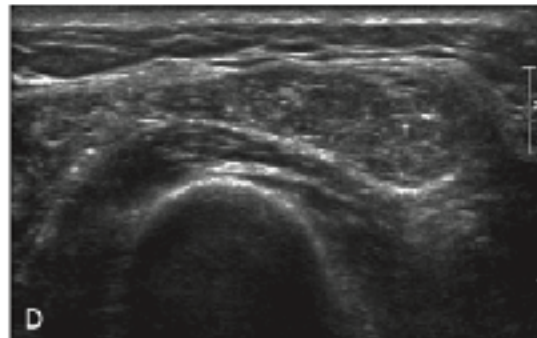
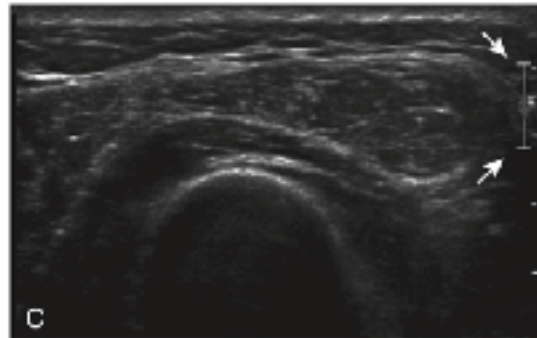
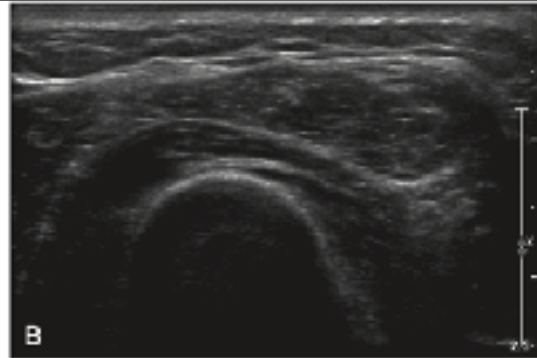


Image optimization



深度/Depth

焦點/Focus

亮度/Gain

Transducer Positioning

探頭

操作者的手

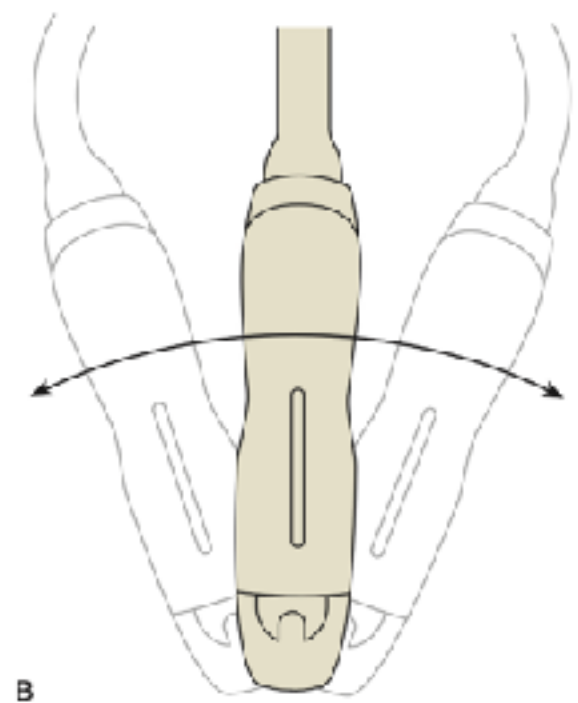
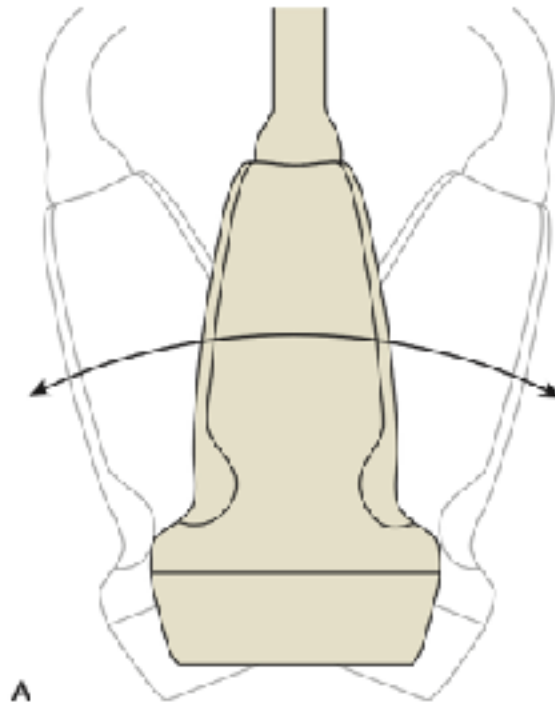
皮膚



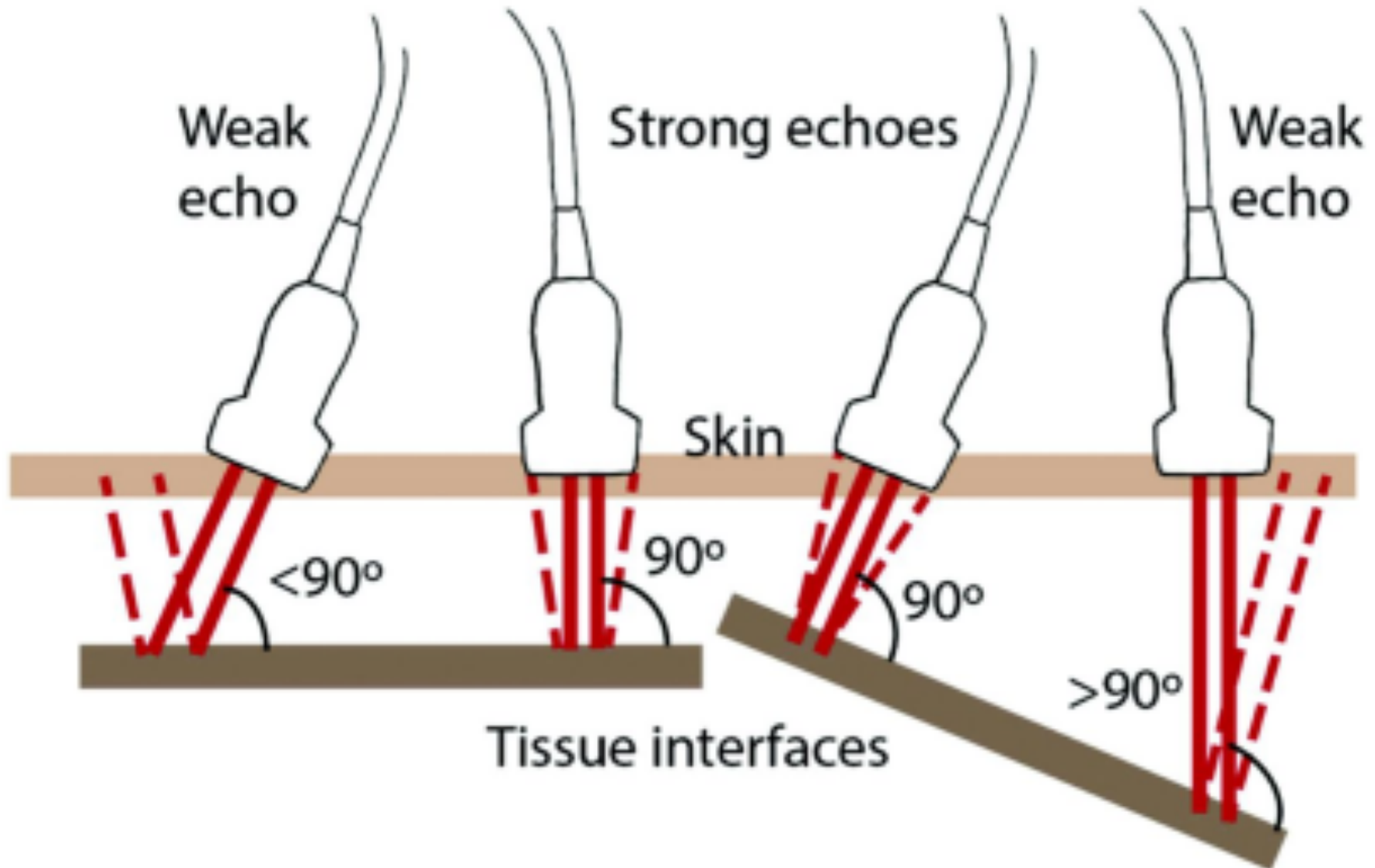
Transducer maneuver

探頭的操控

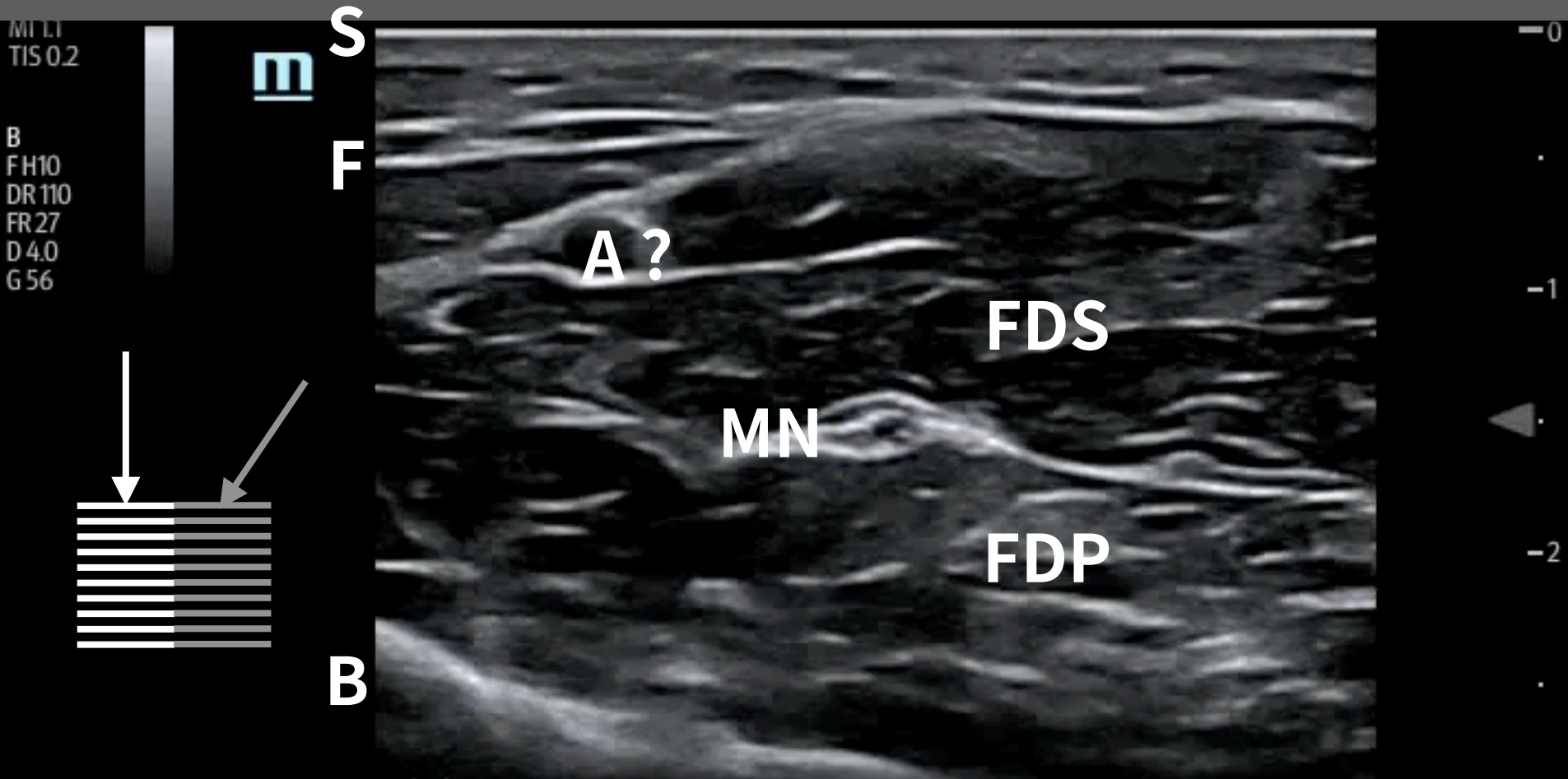
Rock 扇 Tilt



Perpendicular to Target



Anisotropy



Tendon

Nerve

Muscle

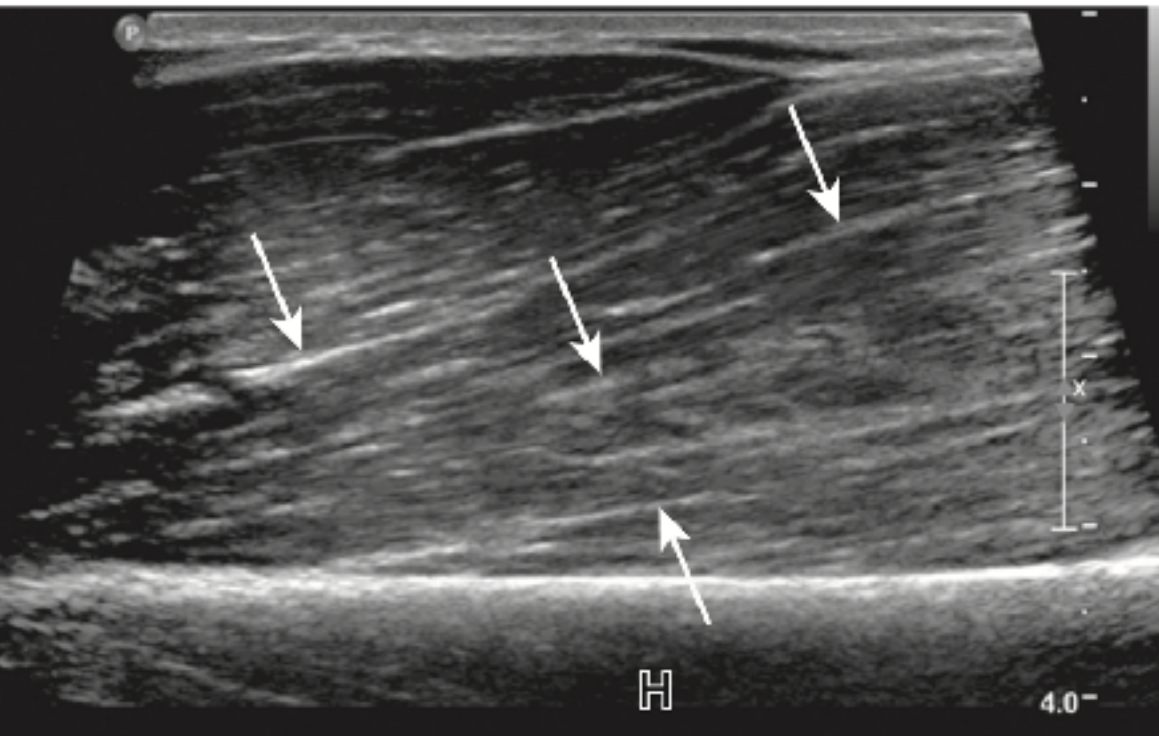
Muscle

Grade of Injury

I : no fiber disruption

II : partial fiber disruption

III: complete fiber disruption

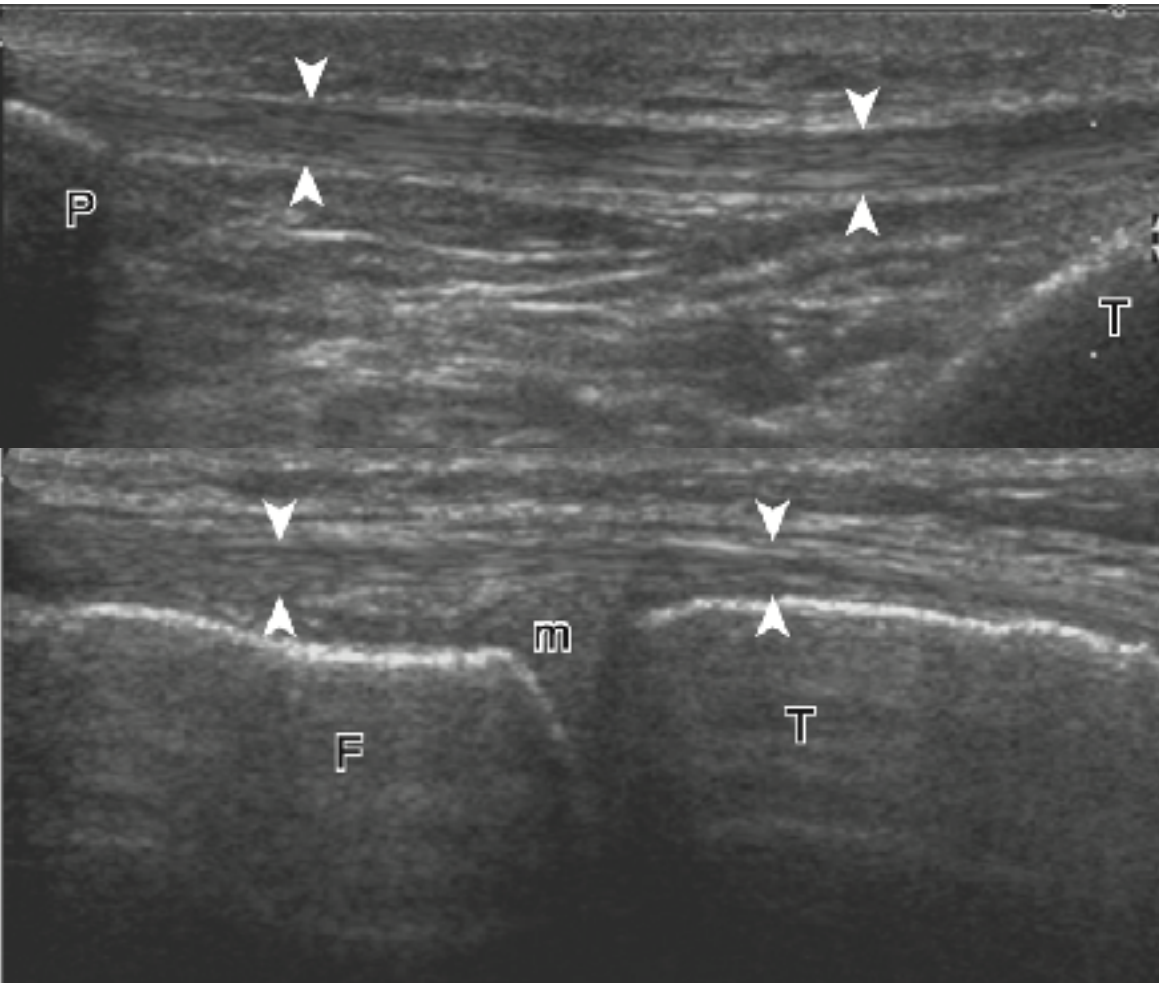


Bristal brush

Hypoechoic
mucle

Hyperechoic
fibroadipose tissue

Tendon



Hyperechoic

Fibrillar

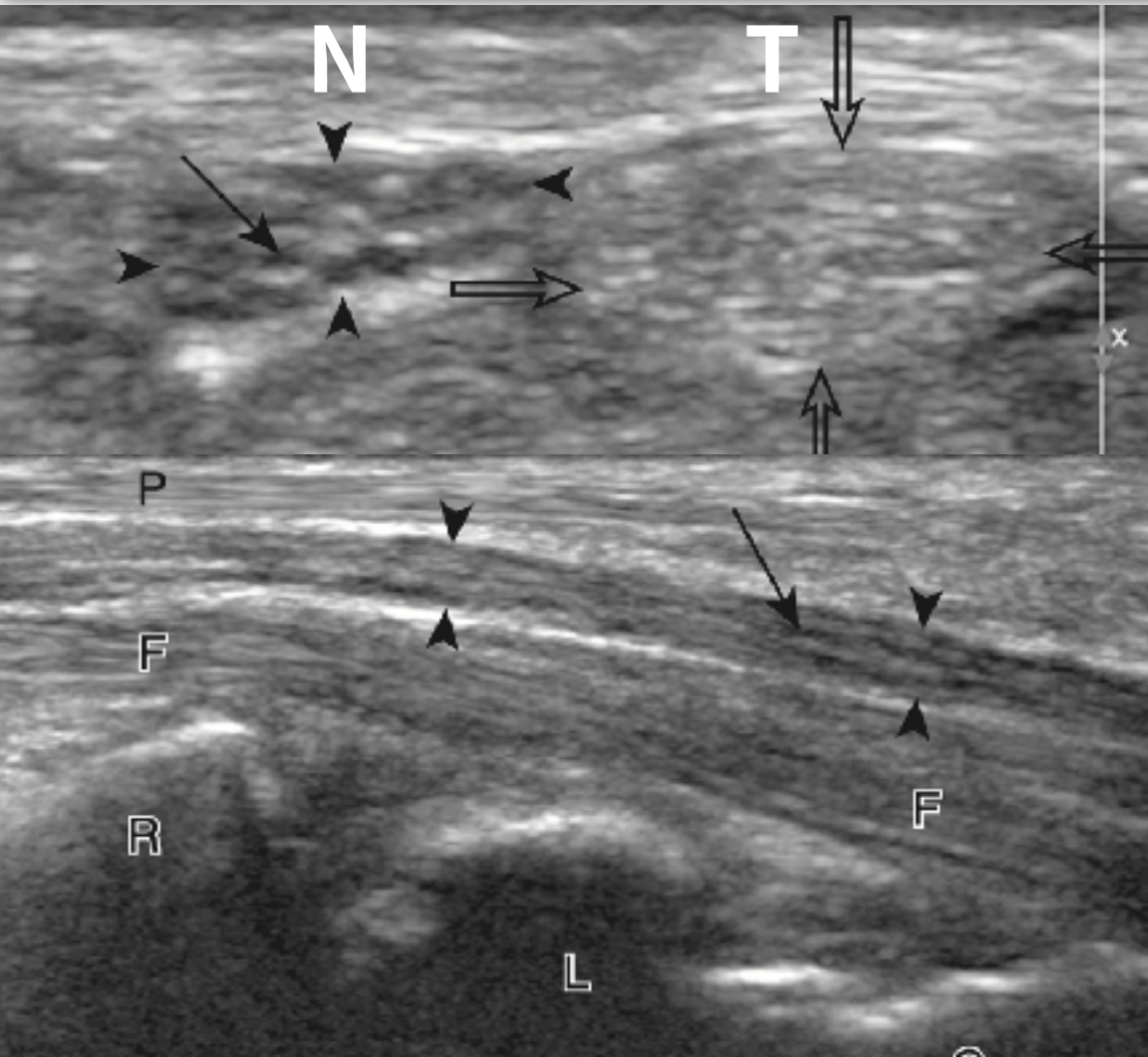
Grade of Injury

I : no fiber disruption

II : partial fiber disruption

III: complete fiber disruption

Nerve



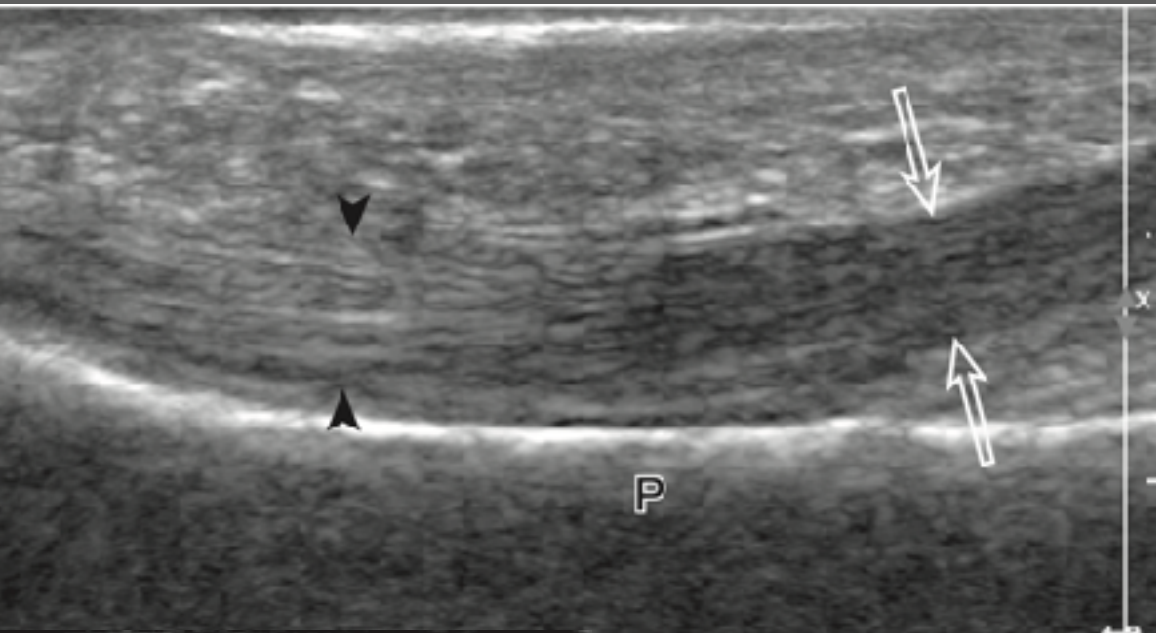
Hypoechoic

Hyperechoic

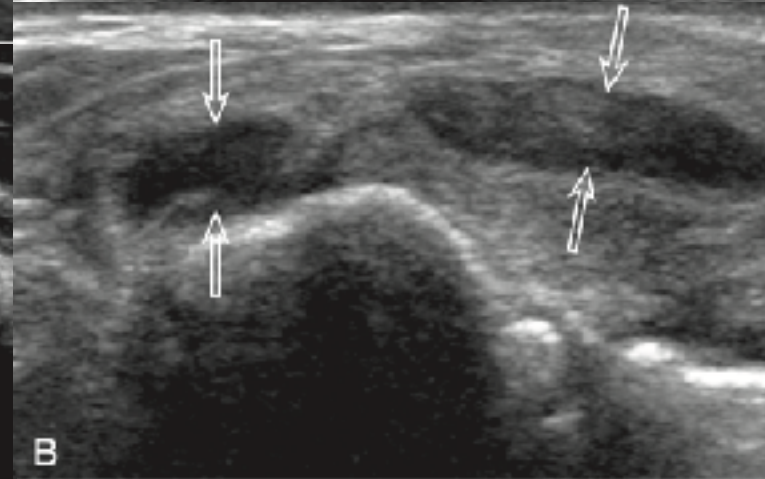
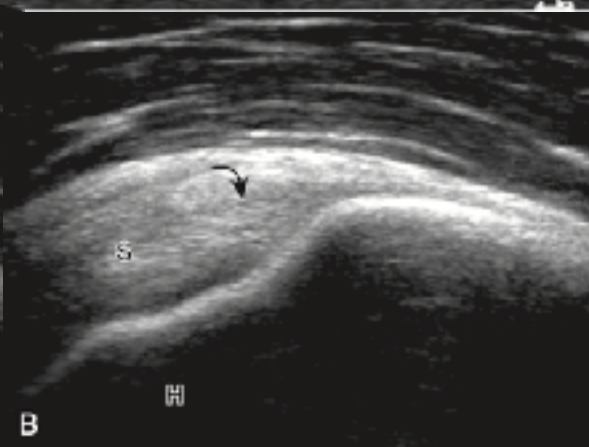
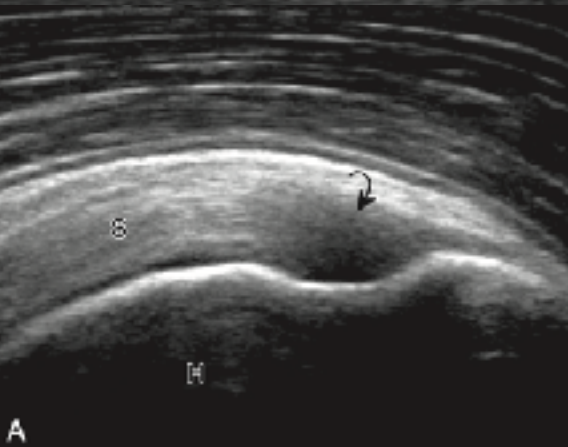
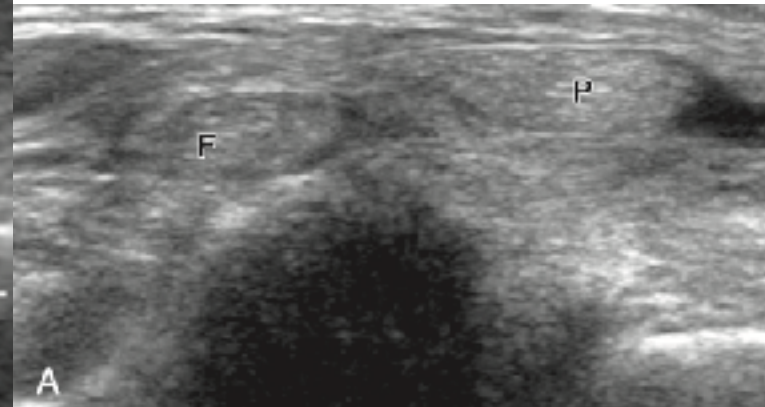
Honeycomb

Fibrillar

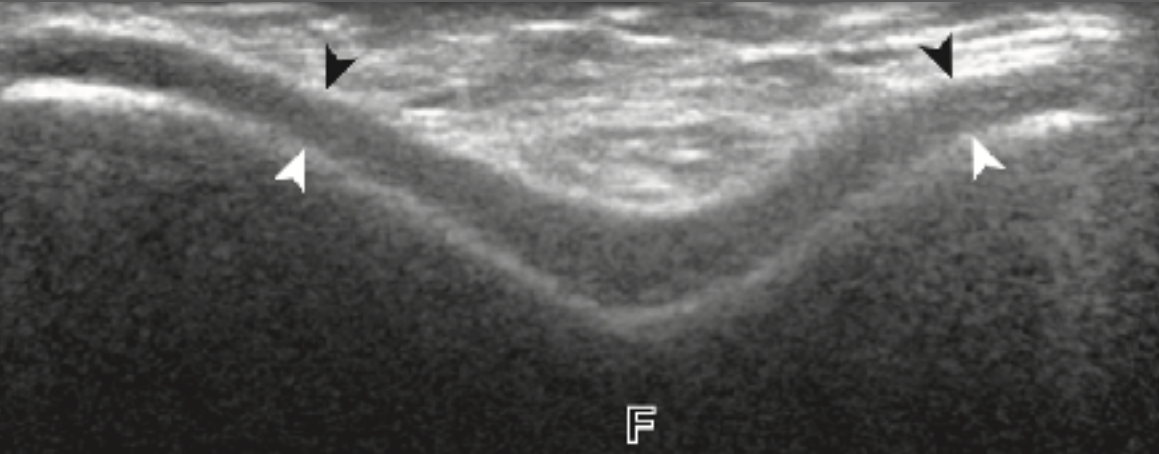
Anisotropy



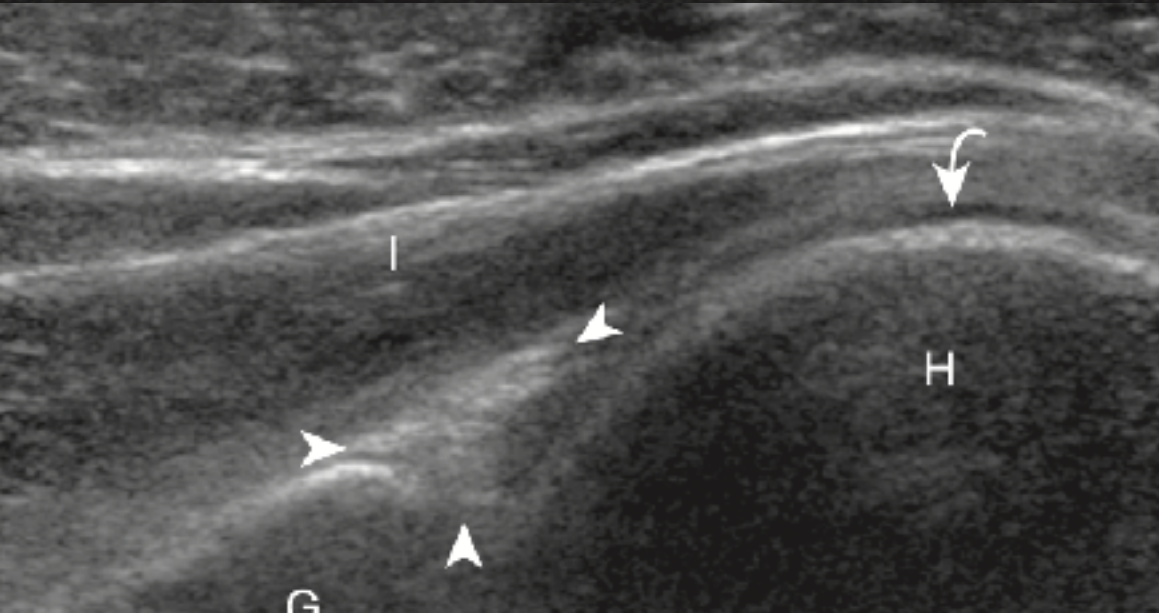
角度/垂直



Cartilage



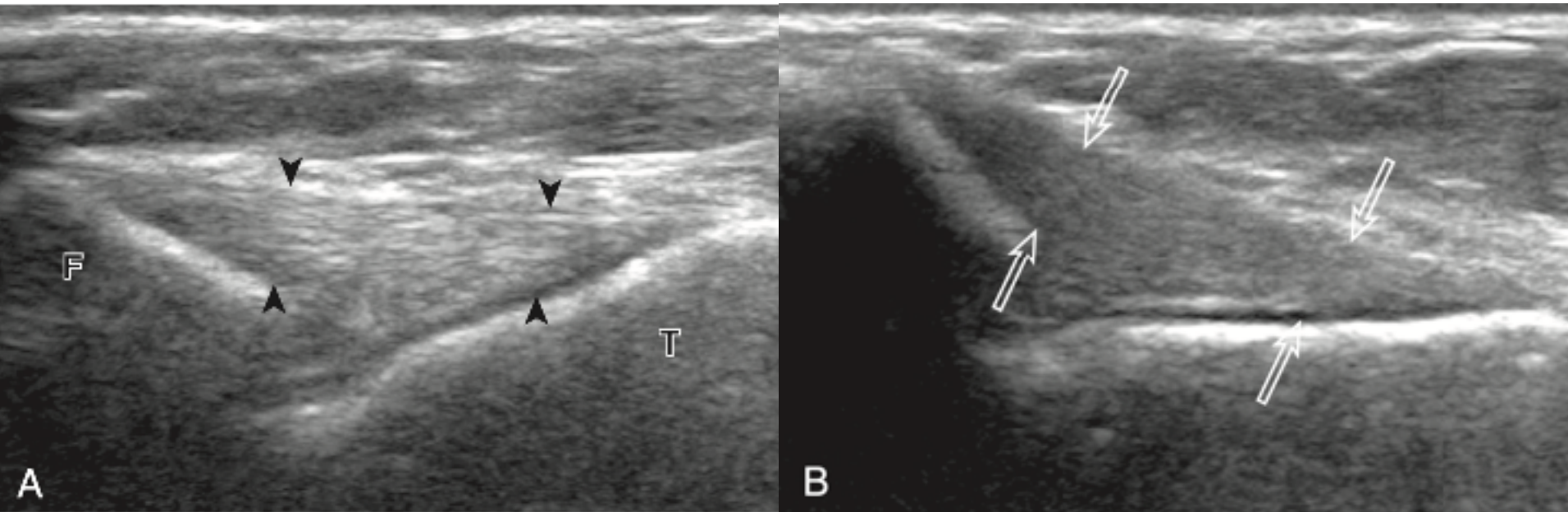
**Hypoechoic
hyaline
cartilage**



**Hyperechoic
fibrocartilage**

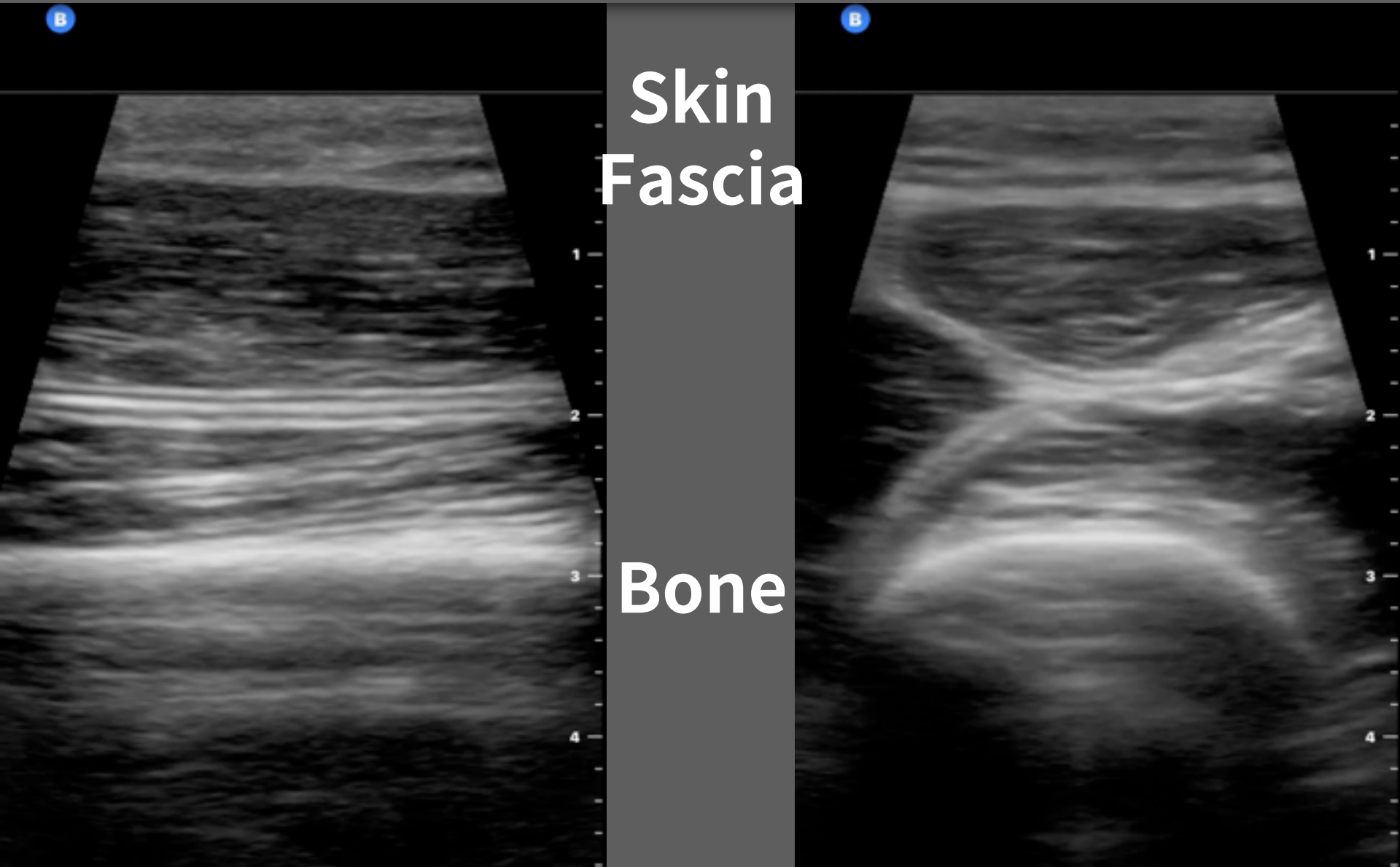
Artifact ?

Anisotropy



Anterior talofibular ligament

Define 3 layers

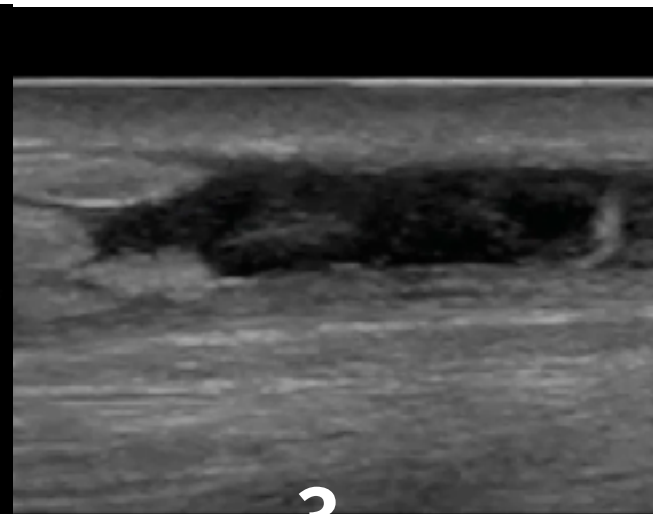
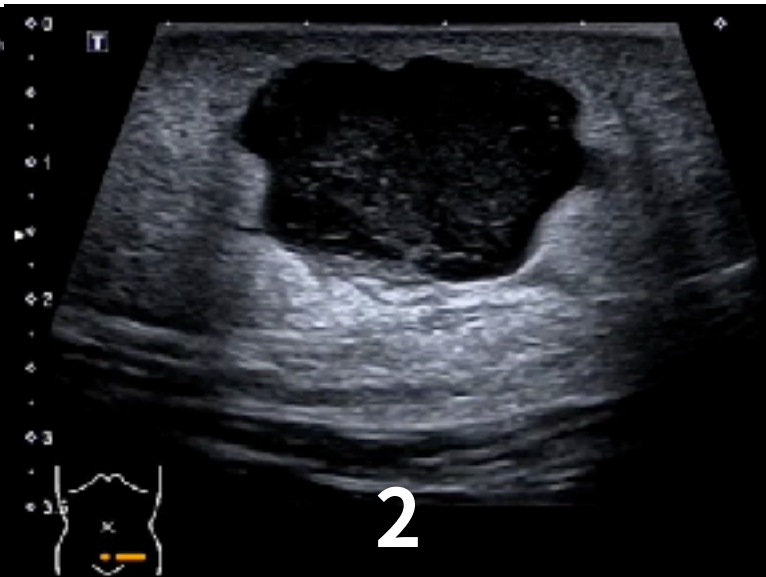


Soft tissue infection

Cellulitis

Abscess

NF



Cobblestone

Collection

Fascial fluid >4mm

Soft tissue infection

Cellulitis

Abscess

NF



Cobblestone

Collection

STAFF

Point-of-Care Ultrasonography for the Diagnosis of Skin and Soft Tissue Abscesses: A Systematic Review and Meta-analysis

Michael Gottlieb, MD*; Jacob Avila, MD; Mark Chottiner, MD; Gary Peksa, PharmD

Study 14 ; Patients 2656

Study	Study Population	Country	Study Location	Study Population	Mean Age, Years	Female Patients, %	Abscesses, %	Sonographer Specialty	Sonographer Experience	Criterion Standard
Dorland, 1987	25	Israel	ID	Pediatrics	2	58.5	74	MD	MD	Presence on initial US or recurrent abscesses at 72 hr
Page-Wells, 2000	55	United States	ID	NO	NO	NO	NO	Emergency medicine	MD	Presence on US
Squires, 2005	109	United States	ID	Adult	39	31	60	Emergency medicine	A, R	Presence on US if drainage attempted or resolution of symptoms if no drainage attempted
Royal, 2006	128	United States	ID	Adult	42	41	43	Emergency medicine	A	Presence on US at initial visit or 32 hr follow-up
SWFZ, 2010	87	United States	ID	Pediatrics	0.2	42	44	Emergency medicine	A, F	Presence on US if drainage attempted or resolution of symptoms if no drainage attempted
Dentle, 2012	47	United States	ID	Adult	NO	NO	85	Emergency medicine	A, R	Presence on US
Isenhardt, 2012	45	United States	ID	Pediatrics	5.3	65	72	Pediatric emergency medicine	A, F	Presence on US
Moran, 2014	262	United States	ID	Pediatrics	7	68	61	Pediatric emergency medicine	A, F	Presence on US at initial visit or 2 day follow-up. All other cases were designated as no abscess
Radical, 2014	114	United States	ID	Pediatrics	7	54	64	Pediatric emergency medicine	A, F	Presence on US at initial visit or at 10 day follow-up. All other cases were designated as no abscess
Hoskins et al., 2007	32	United States	ID/C	NO	NO	NO	NO	MD/FP	MD	NO
Lois, 2015	305	United States	ID	Pediatrics	7.7	64	41	Emergency medicine	A, F, R	Presence on US at initial visit or 7 to 10 day follow-up. All other cases were designated as no abscess
Despert, 2018	109	United States	ID	Adult	32.8	45	NO	Emergency medicine	A, R	Repeated US with purulent drainage within 10 days
Levine, 2019	27	United States	ID	Pediatrics	5.1	35	31	Pediatric emergency medicine	A	OT or radiology ultrasonography
Moray, 2019	1,215	United States	ID	Adults and pediatric	50	52	60	Emergency medicine	A, F, R	Presence on US at initial visit or first follow-up. All other cases were designated as no abscess

NO, Not described; US, inclusion and drainage; A, attending physician; R, resident physician; MD, medical medicine; FP, family practice; F, fellow physician; C, computer sonography

Sensitivity 94.6%

Specificity 85.4%

LR+ 6.5

LR- 0.06

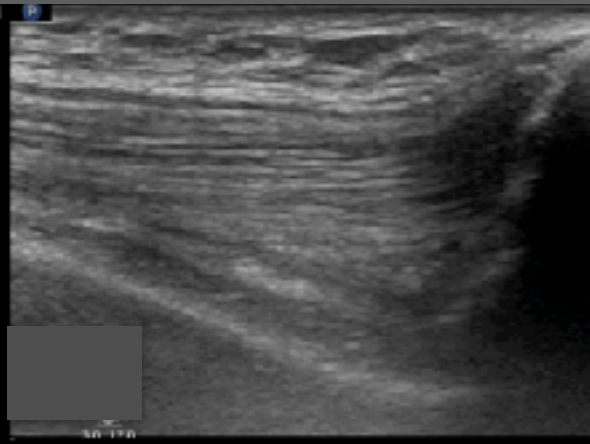
Ann Emerg Med 2020;76:67-77

Lower extremity joints



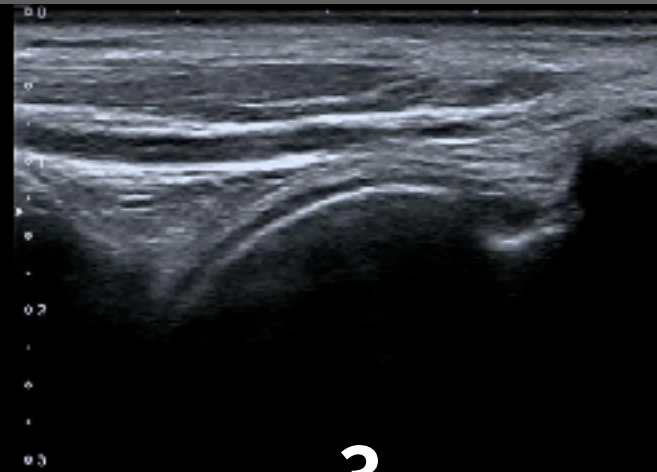
1

Hip



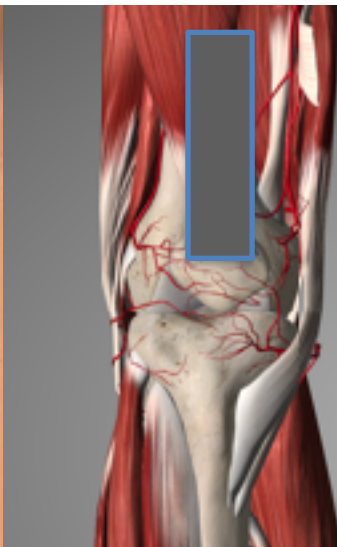
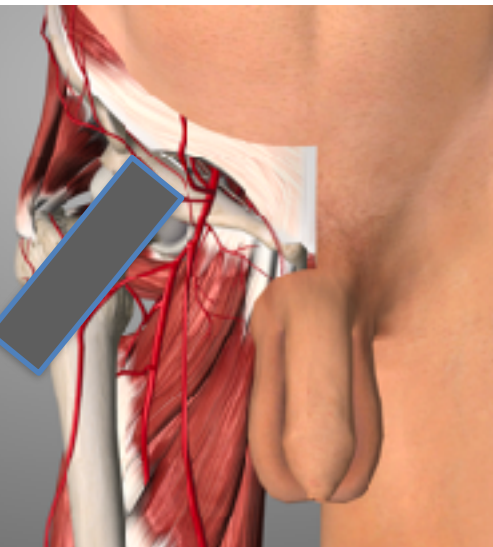
2

Knee

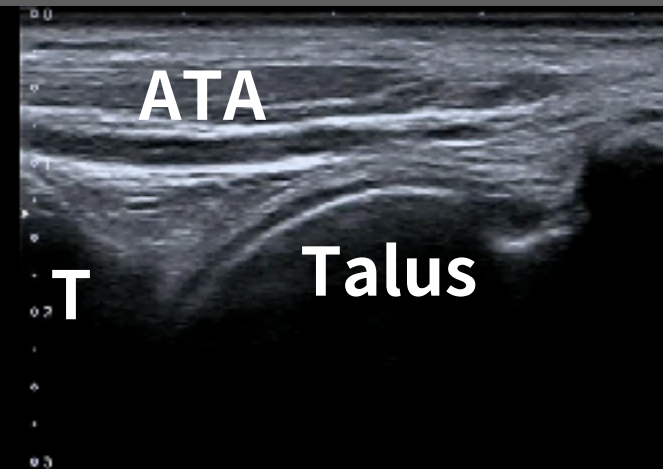
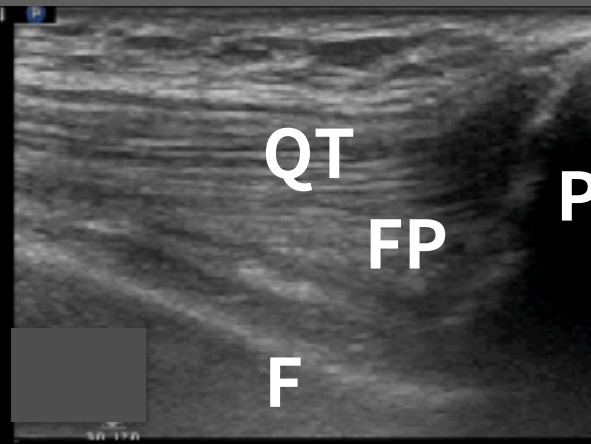
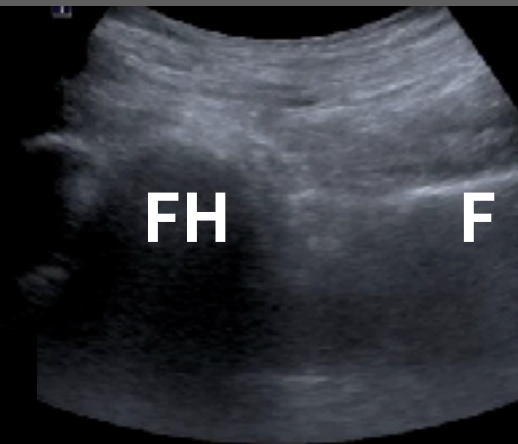


3

Ankle



LE Joint effusion



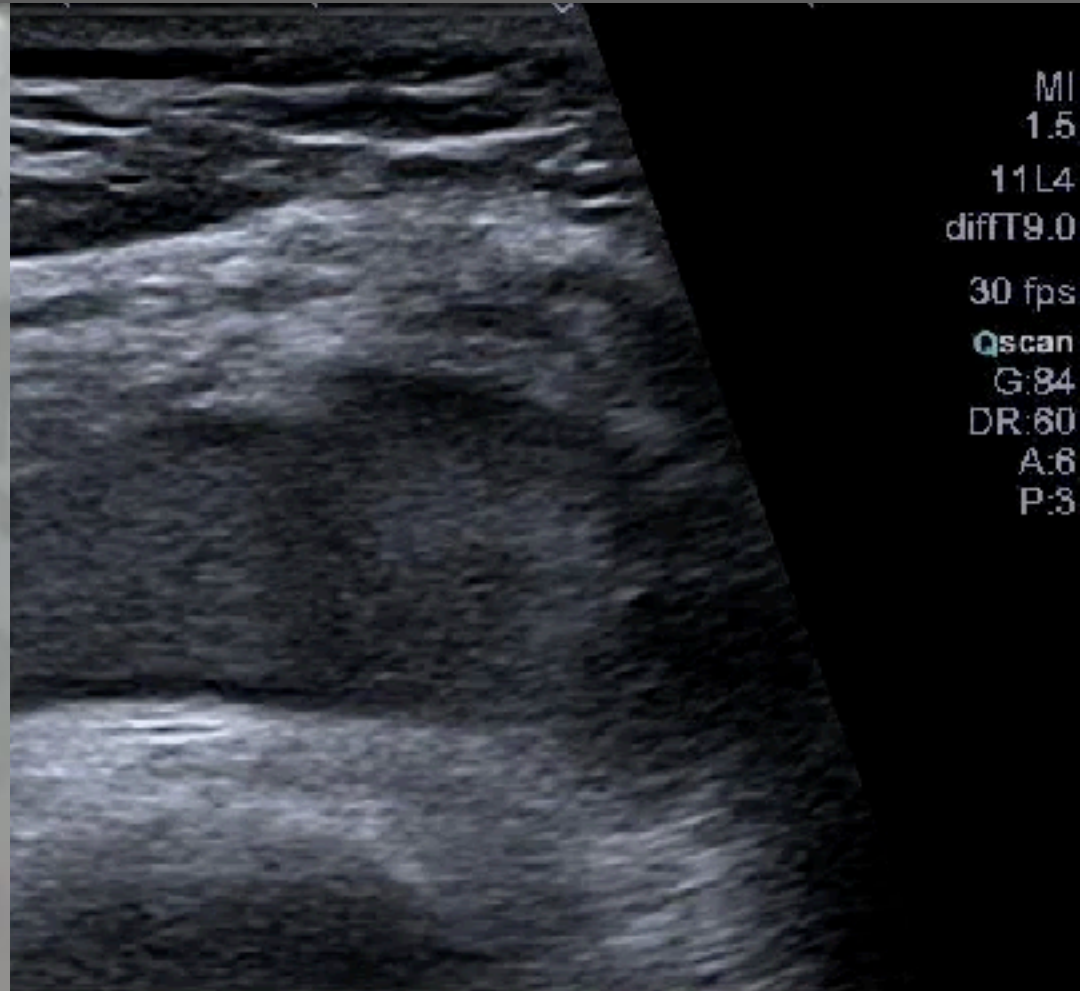
Hip

Knee

Ankle

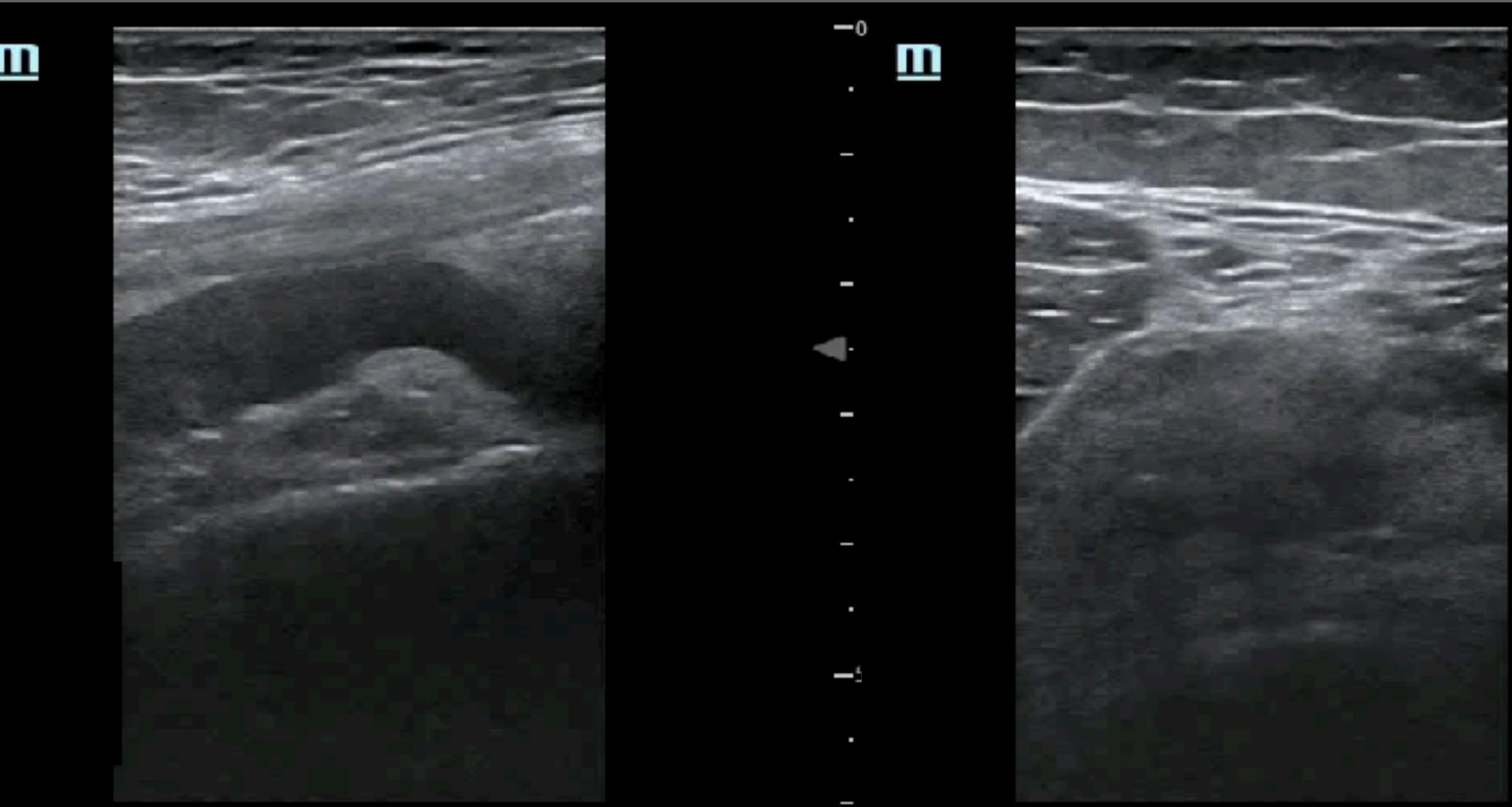


Needling for hemarthrosis



MI
1.5
11L4
diffT9.0
30 fps
Qscan
G:84
DR:60
A:6
P:3

Lipohemarthrosis



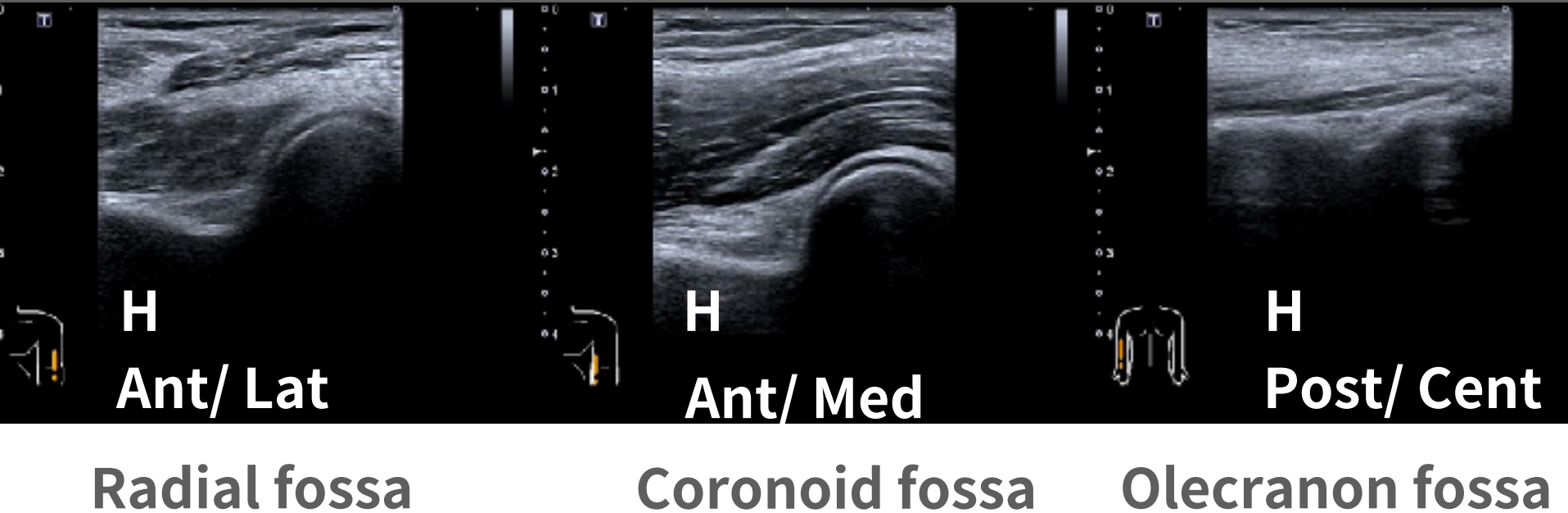
Baker's cyst

ADU GEN2
C5-1
47 Hz
9.0cm

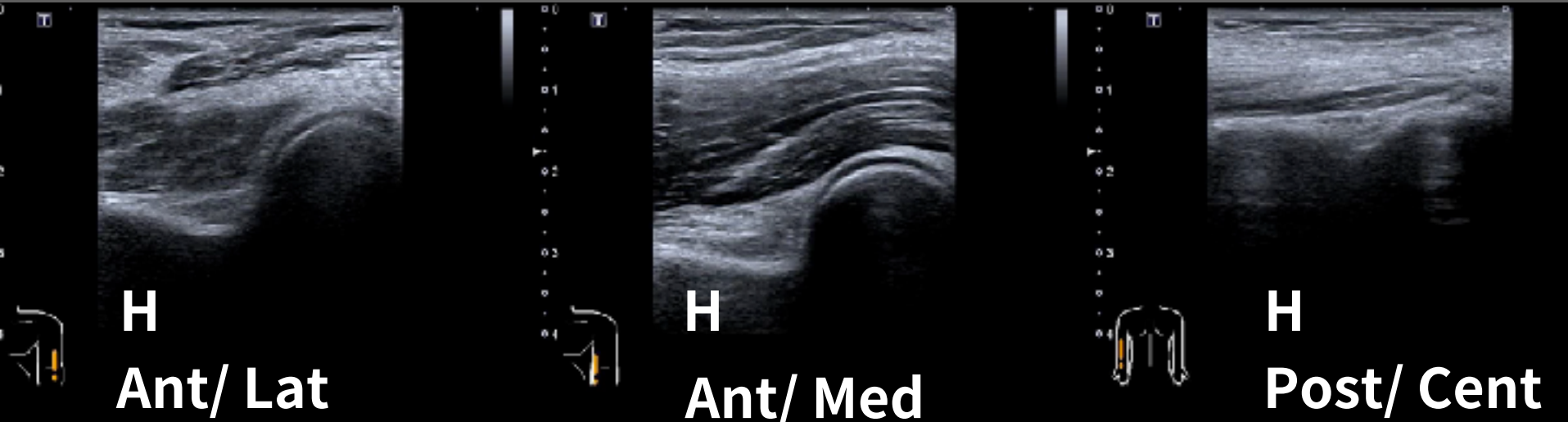
2D
HGen
Gn 85
C 56
3/3/3



Elbow fossa



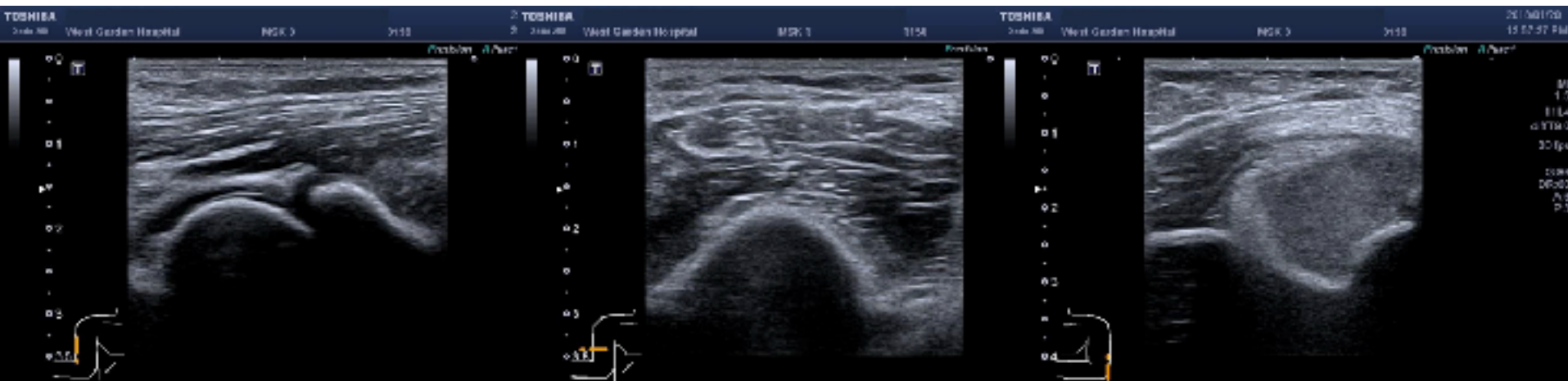
Elbow effusion



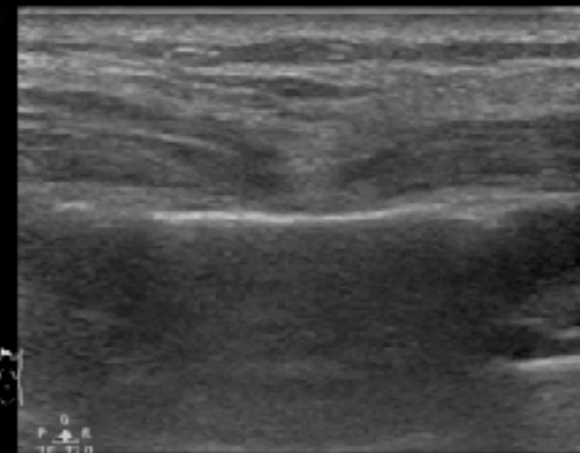
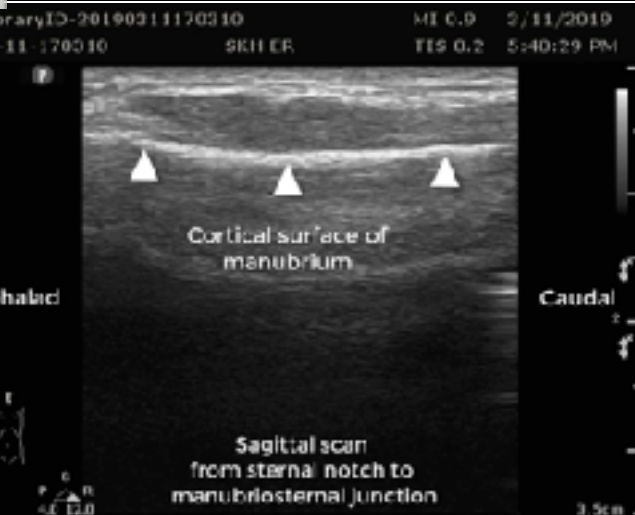
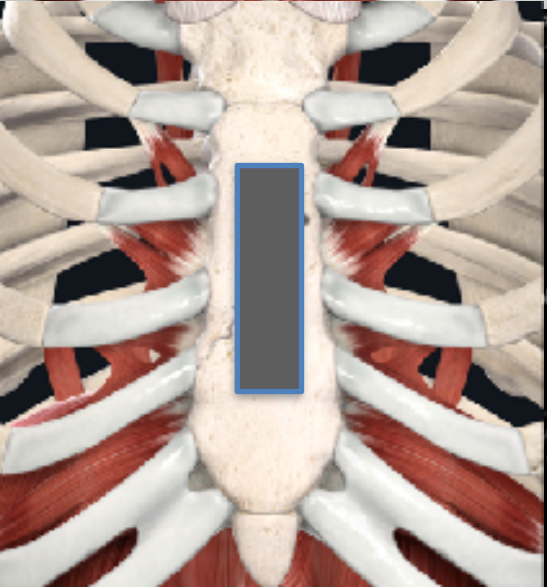
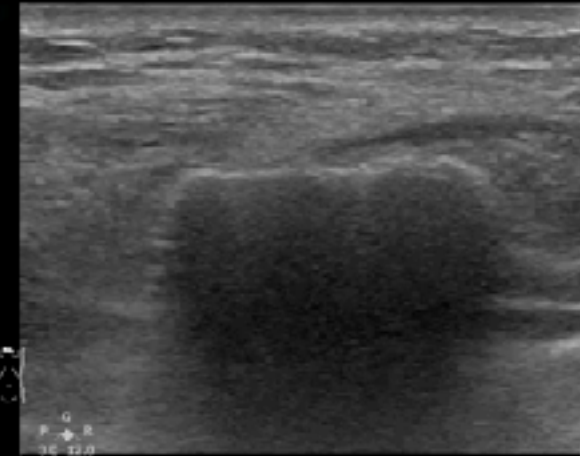
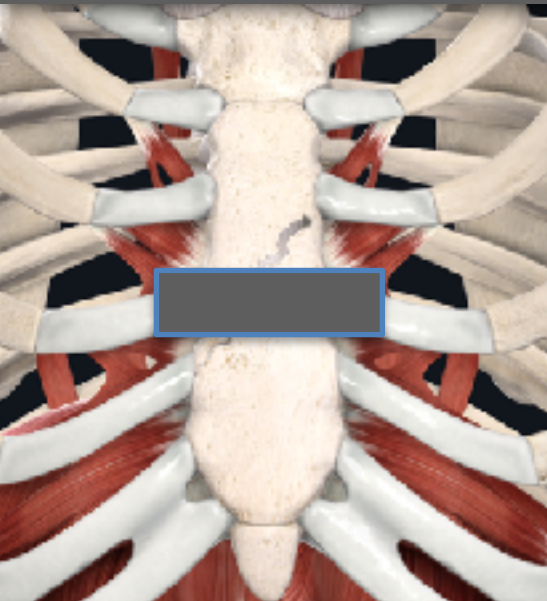
Radial fossa

Coronoid fossa

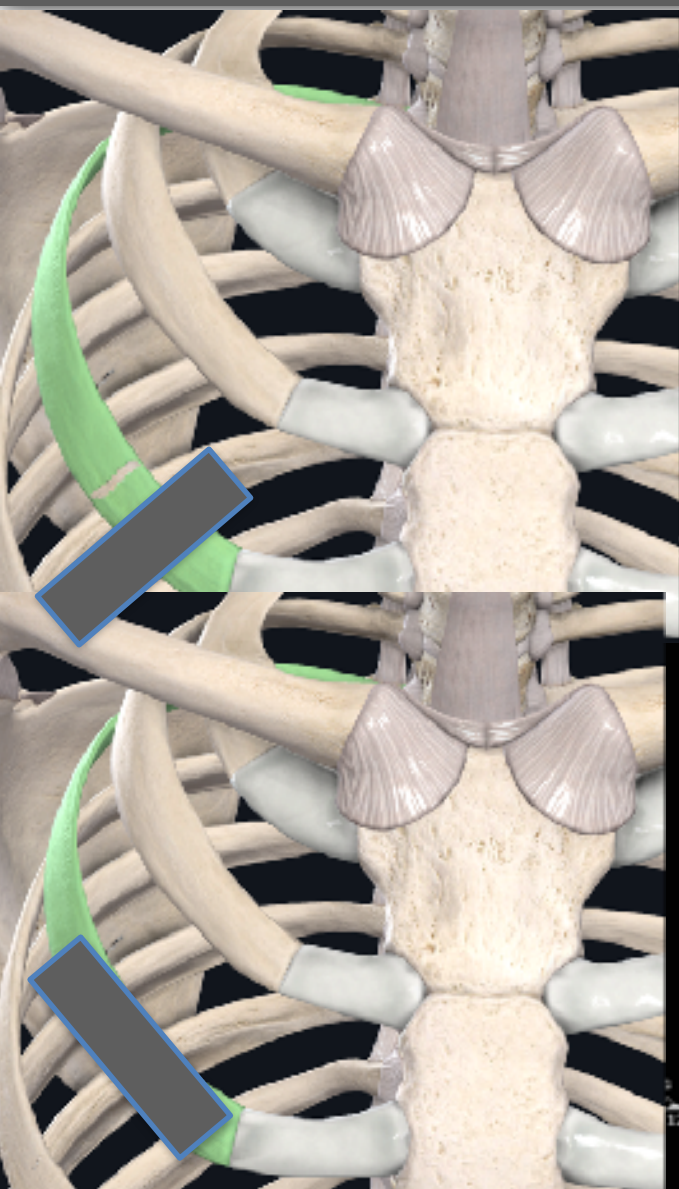
Olecranon fossa



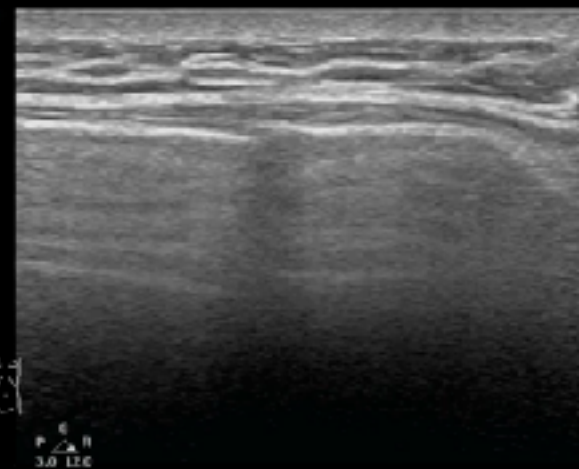
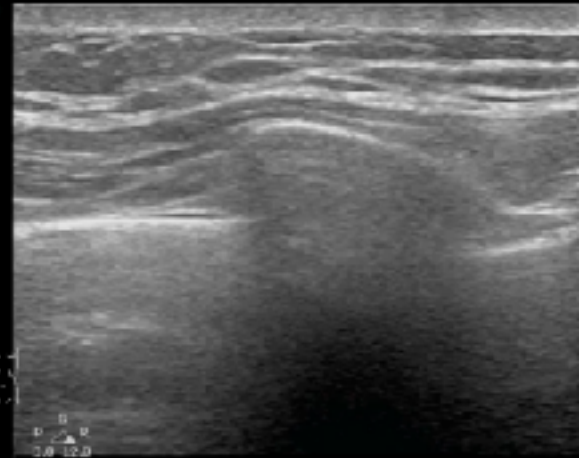
Sternal fracture



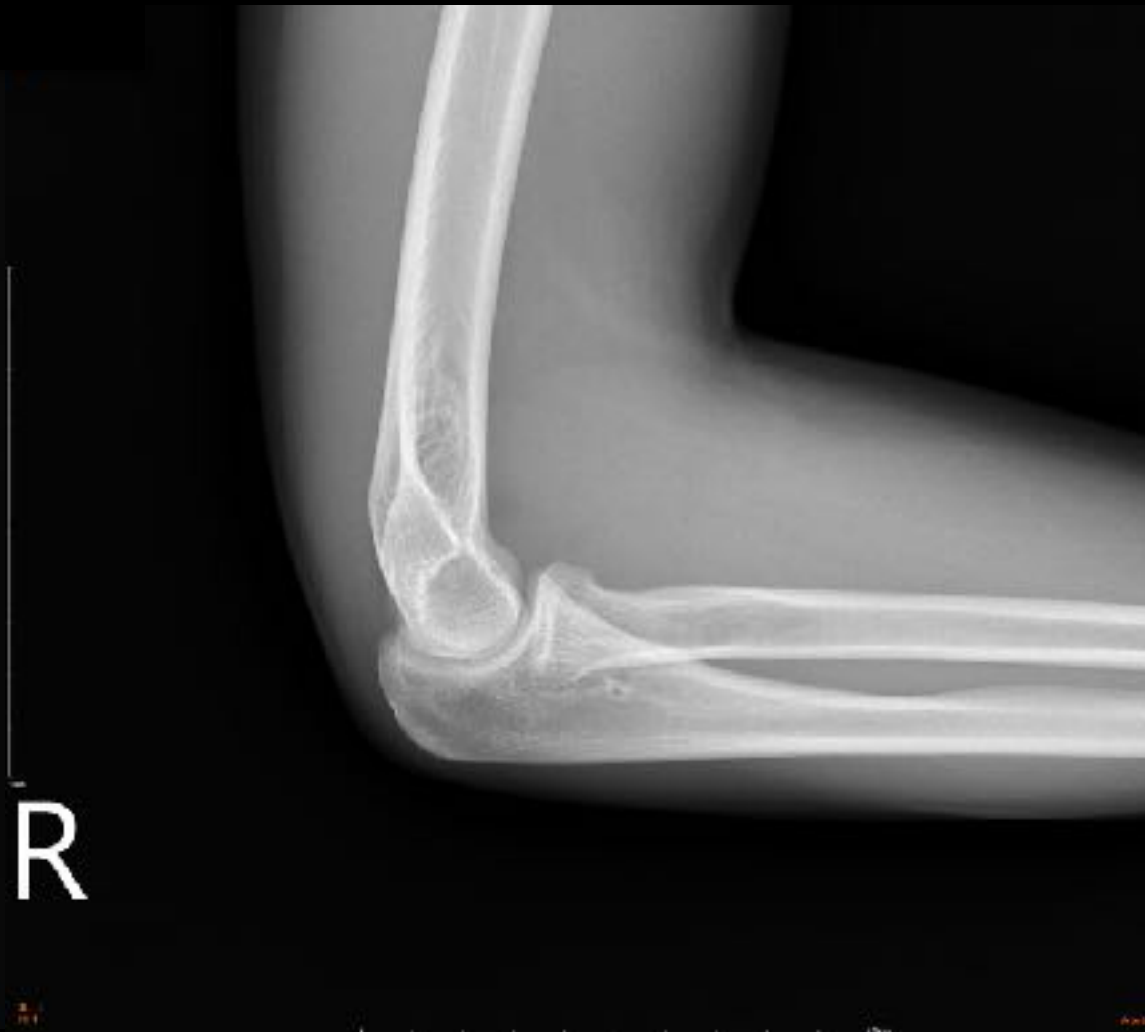
Rib fracture



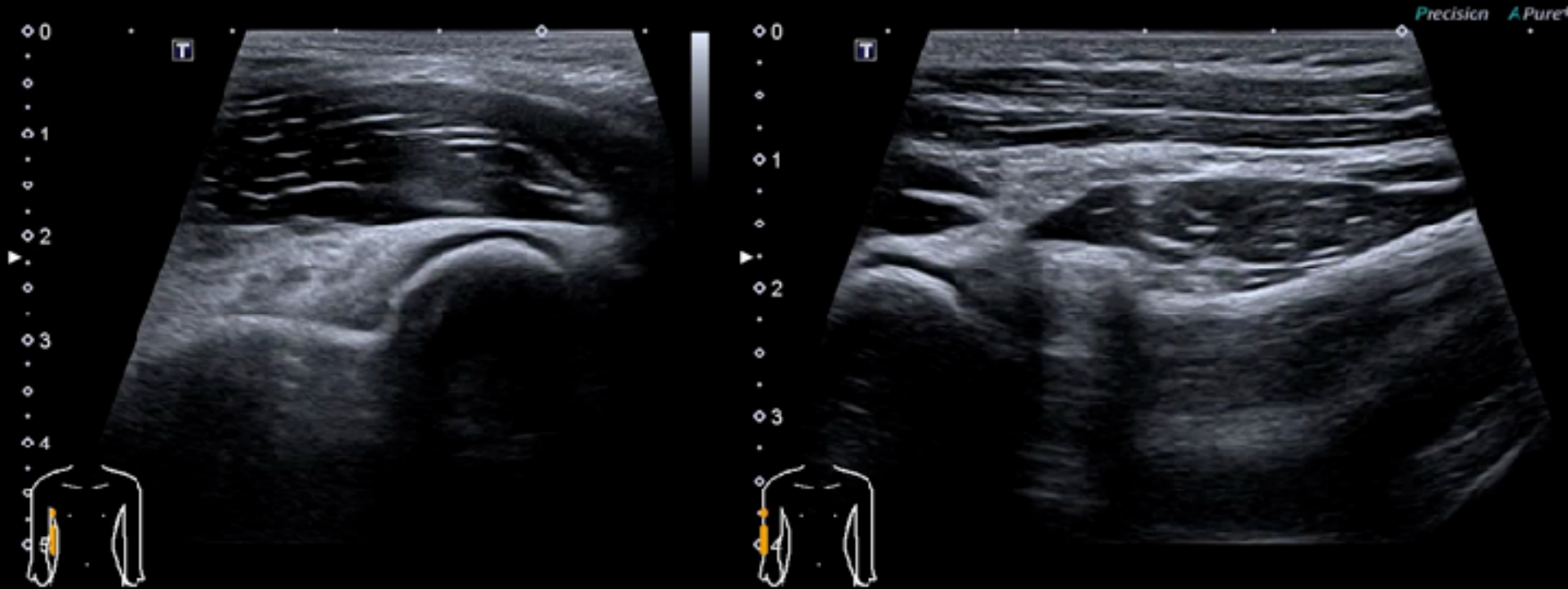
2C190311170310 MI 0.9 3/11
SID SKH ER TIS 0.2 5:40



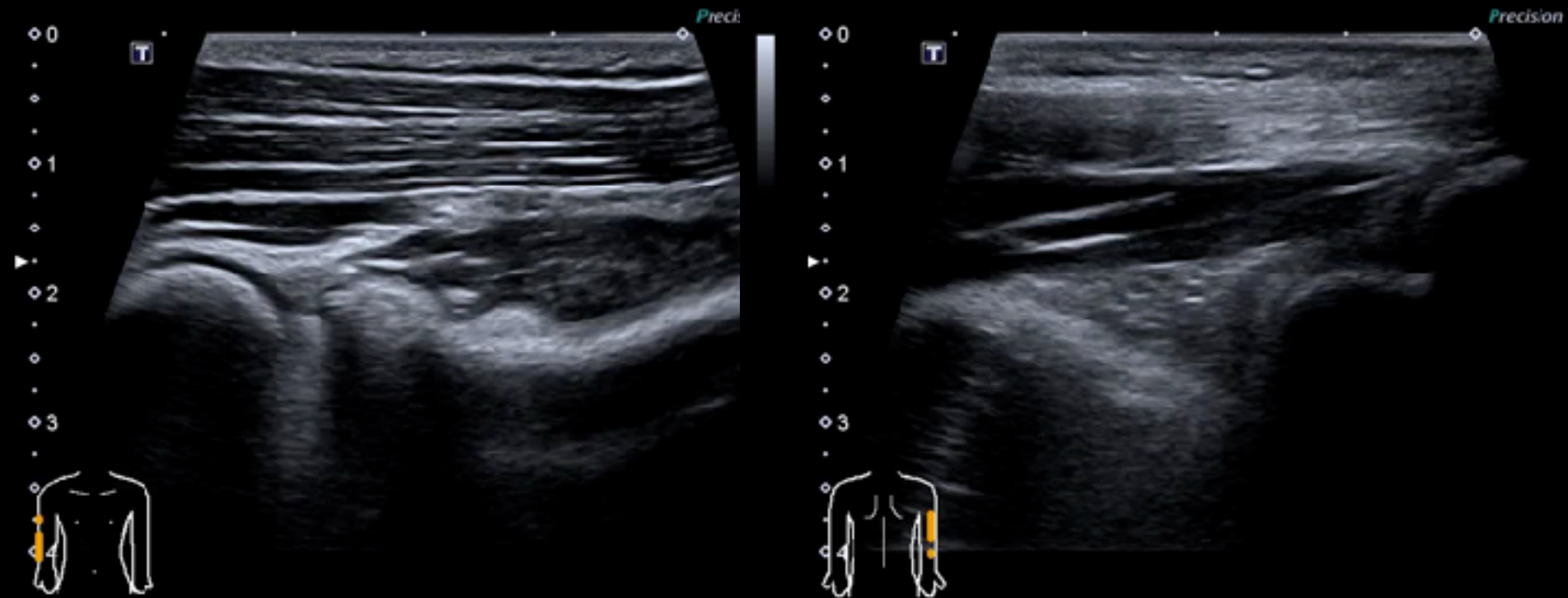
M/18, 機車車禍，致右手肘疼痛



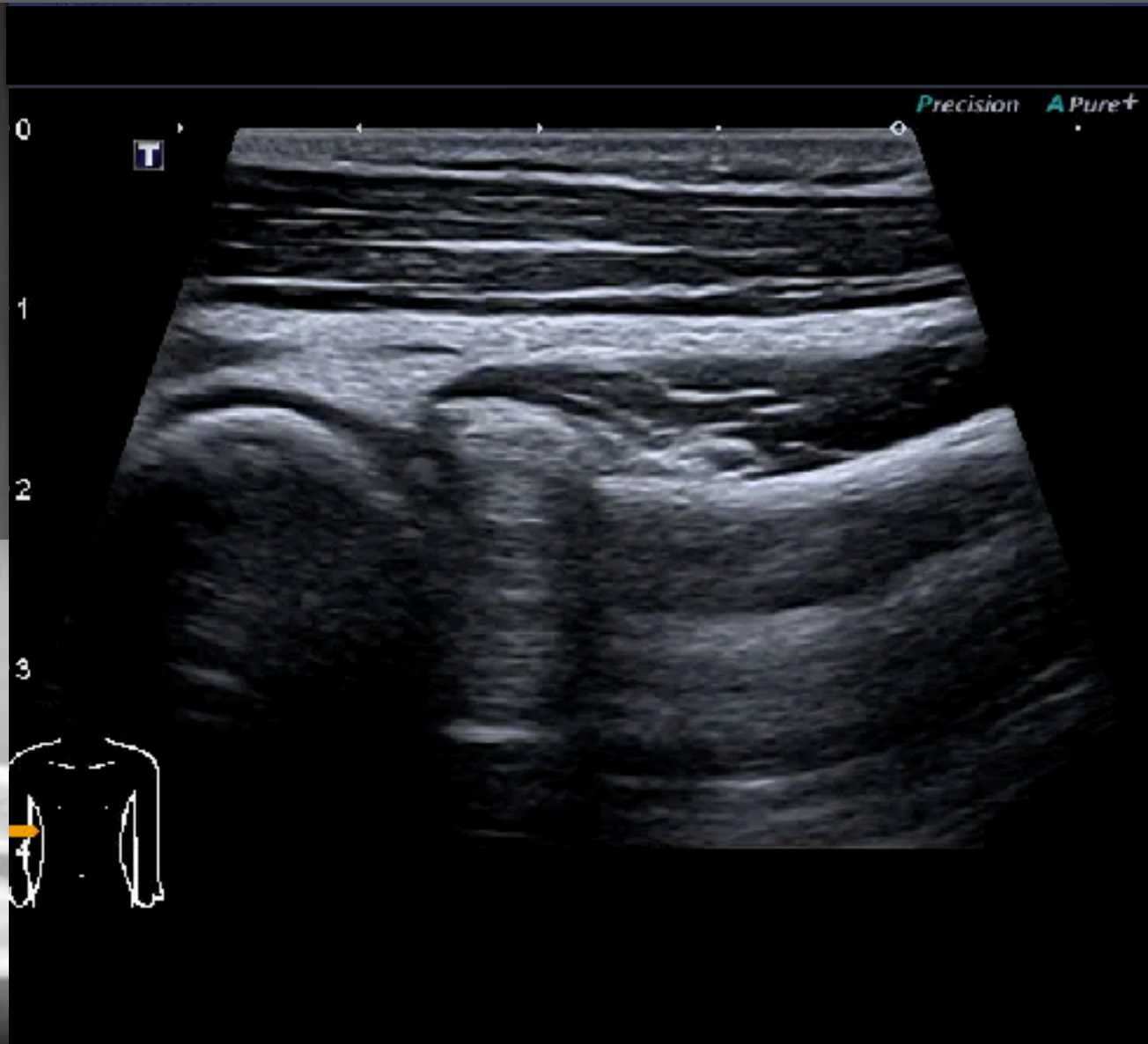
M/18, 機車車禍，致右手肘疼痛



M/18, 機車車禍，致右手肘疼痛



Radial head fracture & Hemarthrosis

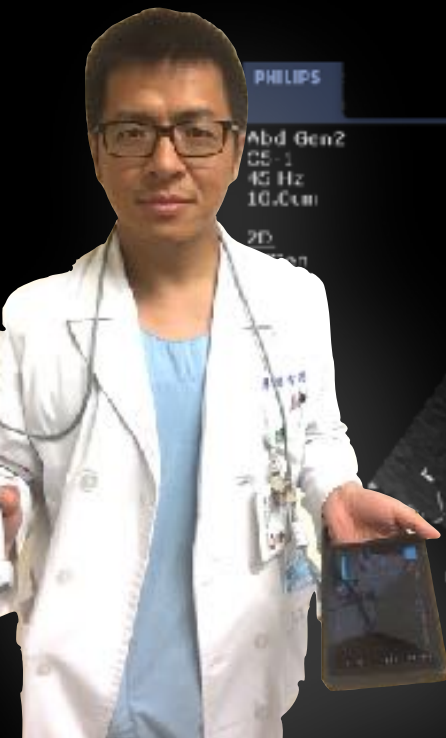


How to interpret ?

Consult

Capture

Compare



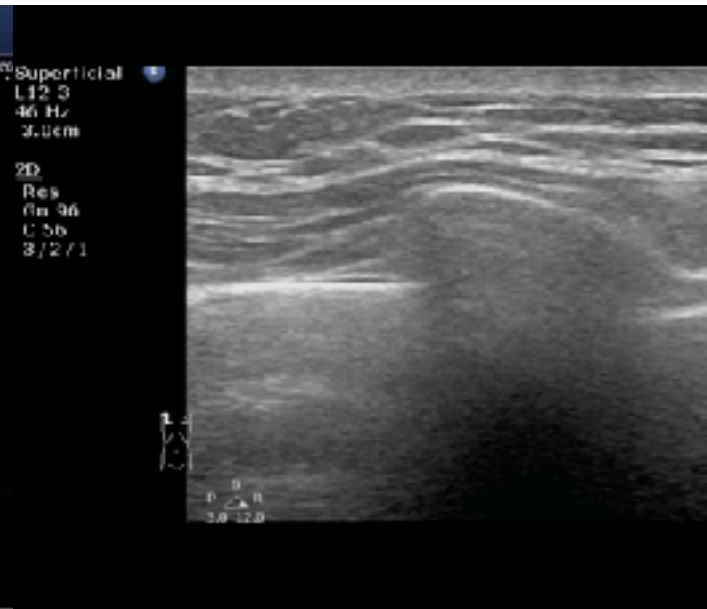
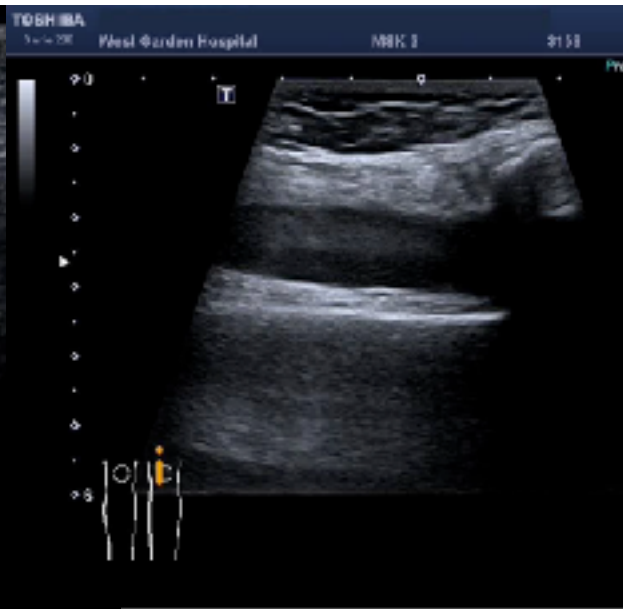
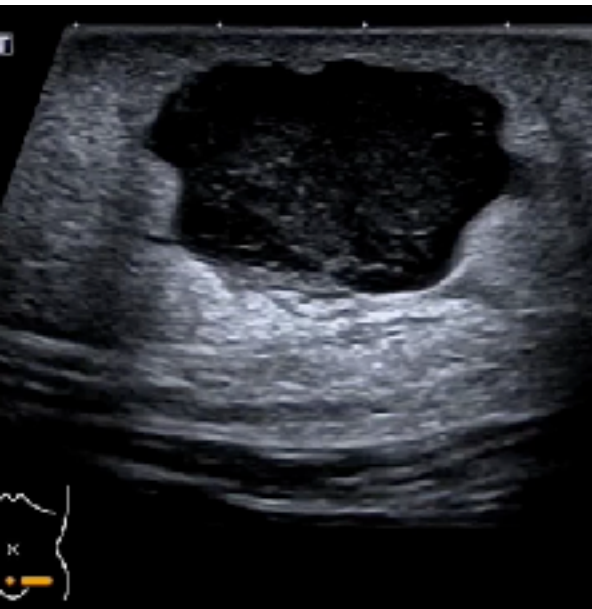
Sono-Anatomy Sono-Pattern Sono-Diagnosis
看不懂時就橫縱都錄一段影片事後看或問專家

Essential ER MSK POCUS

Soft tissue

Joint

Bone



Abscess

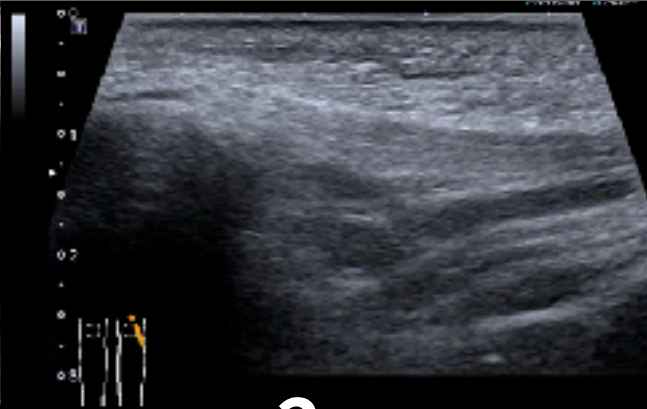
Effusion

Occult

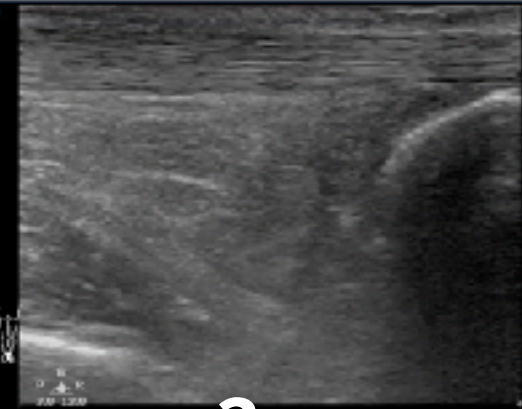
Tendon



1



2

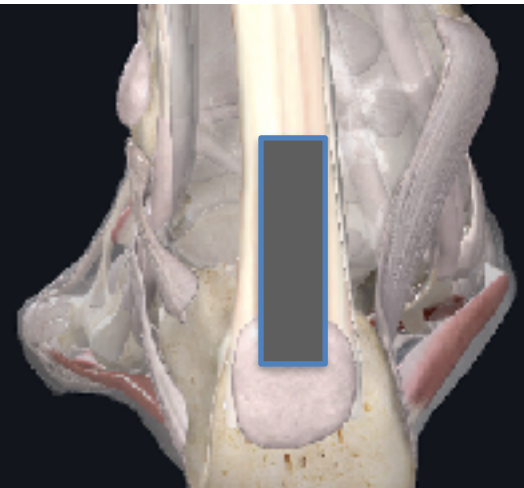


3

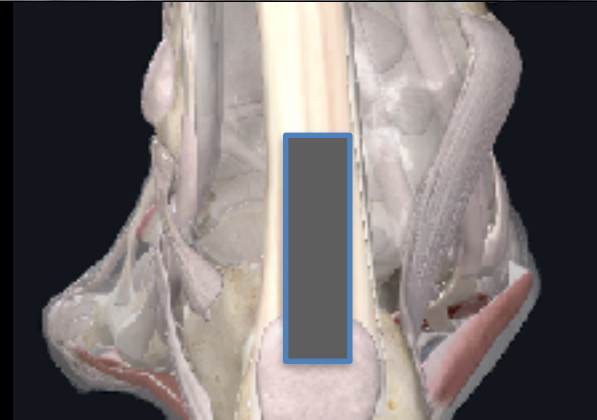
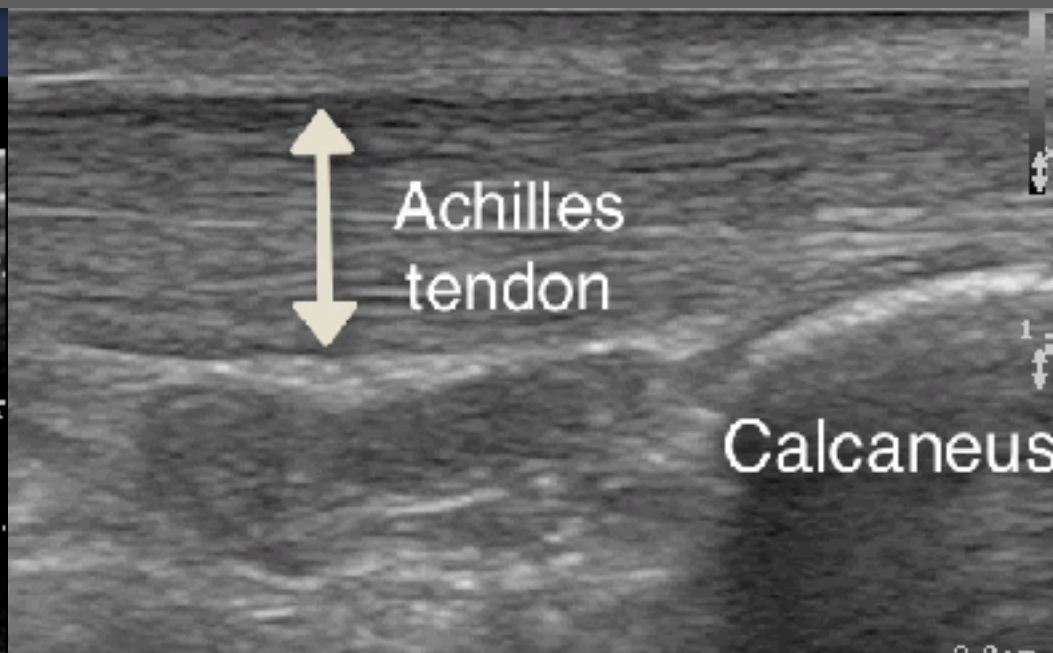
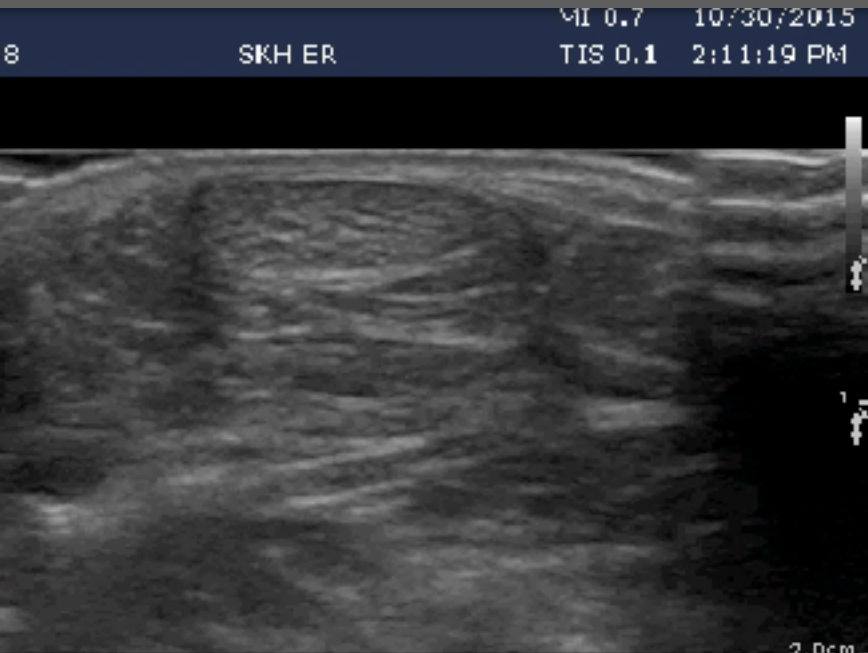
**Quadriceps
Tendon**

**Patellar
Tendon**

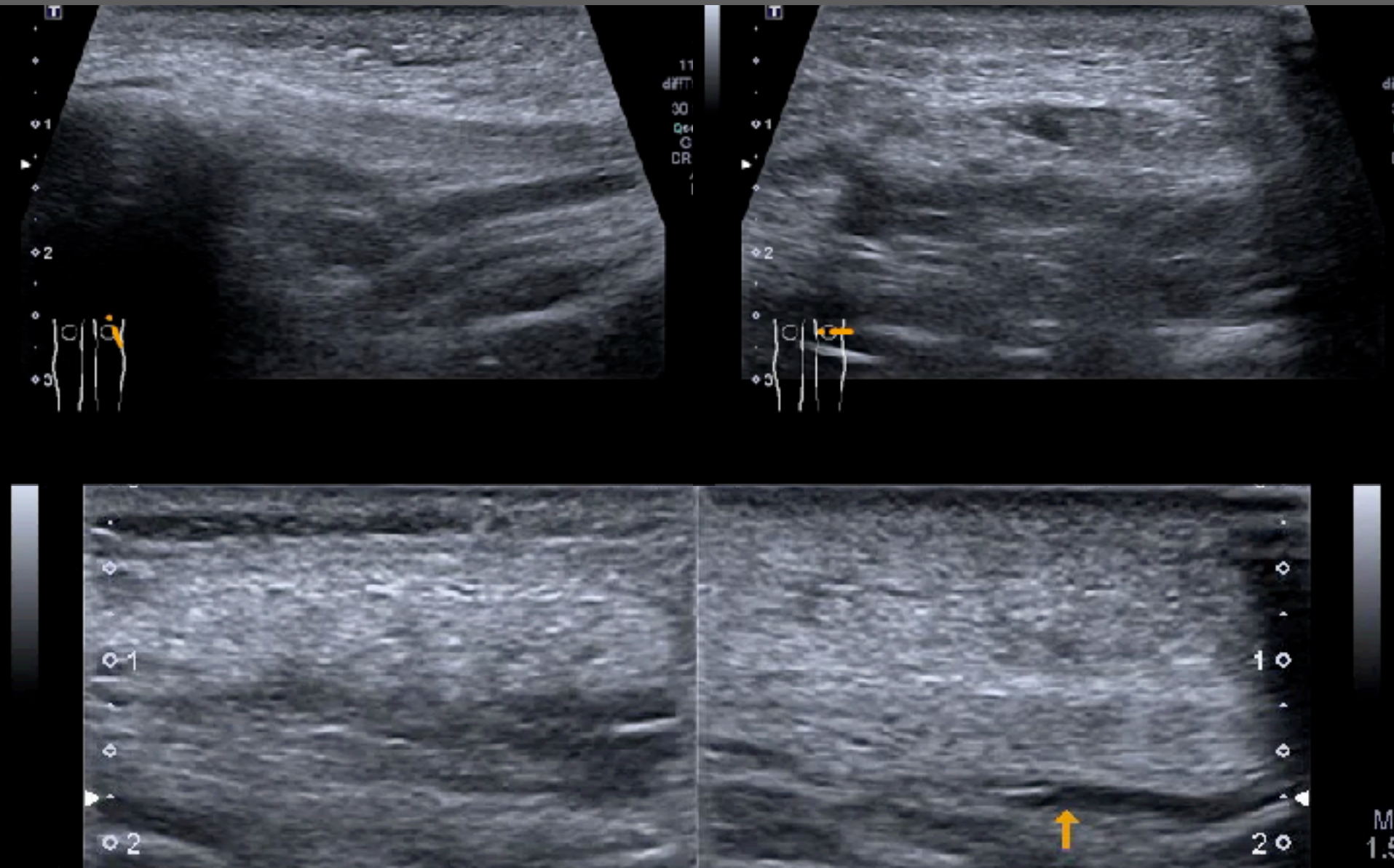
**Achilles
Tendon**



Achilles tendon rupture



Patellar tendon injury



58M, right leg pain while running



Calf muscle tear

Left calf



Right calf



Point-of-care ultrasound for the diagnosis of shoulder dislocation: A systematic review and meta-analysis

Michael Gottlieb, MD*, Dallas Holladay, DO, Gary D. Peksa, PharmD

Department of Emergency Medicine, Rush University Medical Center, Chicago, IL, United States of America

Study 7 ; Assessment 739 ; Dislocation 306

Table 1
Characteristics of the included studies.

Study	Study population	Country	Study location	Mean patient age	Male patients (%)	Shoulder dislocations (%)	Ultrasound transducer	Ultrasound technique	Operator experience
Bianchi 1994	10	United States	ND	35.5 years	ND	2 (20%)	Linear	Posterior	ND
Abbasi 2013	142	Iran	ED	31.6 years	126 (91.3%)	71 (50%)	Linear	Anterior + lateral	Attending, resident
Ahmadi 2016	108	Iran	ED	30.1 years	91 (84.1%)	13 (12%)	Linear	Anterior + lateral	Attending
Akyol 2016	197	Turkey	ED	33.9 years	164 (80.6%)	99 (50%)	Linear	Posterior	Attending
Lahham 2016	84	United States	ED	45 years	52 (62%)	19 (22.6%)	Linear	Posterior	Student
Seyedhosseini 2017	163	Iran	ED	35.9 years	140 (83.3%)	79 (48.5%)	Curvilinear	Posterior	Attending, resident
Secko 2018	35	United States	ED	ND	ND	23 (66%)	Linear or curvilinear	Posterior	Attending

ND, not described; ED, emergency department.

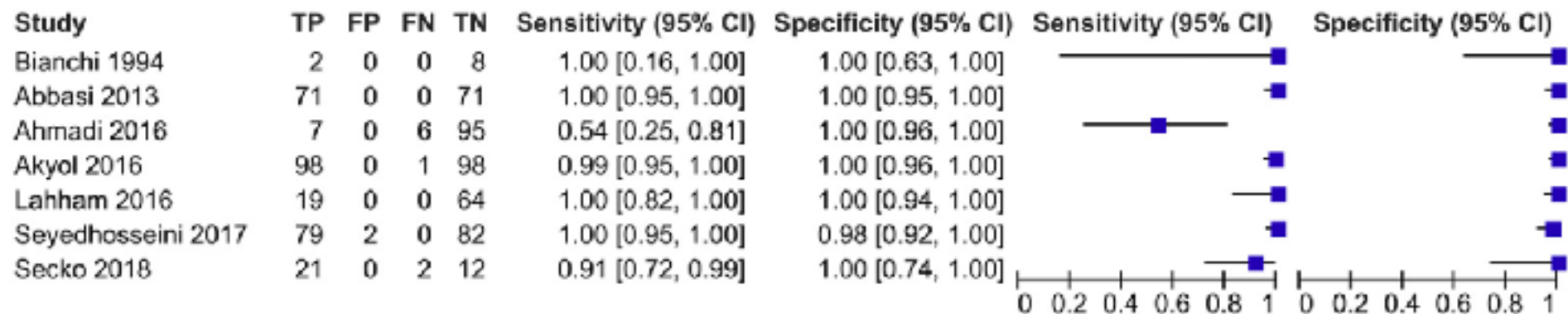
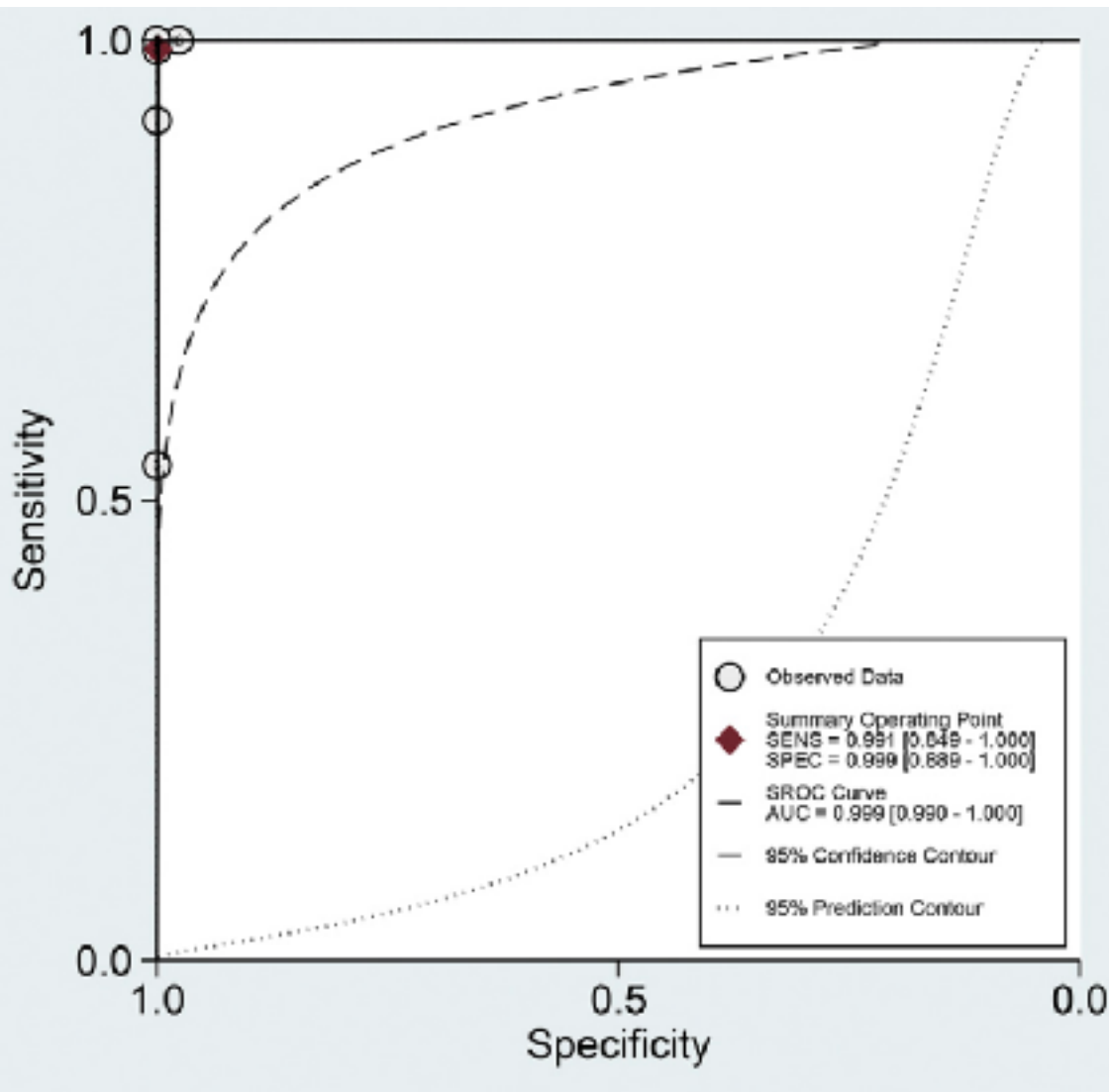


Fig. 2. Forest diagram of the overall sensitivity and specificity of ultrasound for identifying shoulder dislocations.

Point-of-care ultrasound for the diagnosis of shoulder dislocation: A systematic review and meta-analysis

Michael Gottlieb, MD*, Dallas Holladay, DO, Gary D. Peksa, PharmD

Department of Emergency Medicine, Rush University Medical Center, Chicago, IL, United States of America



Sensitivity 99.1%

Specificity 99.9%

LR+ 796.2

LR- 0.01

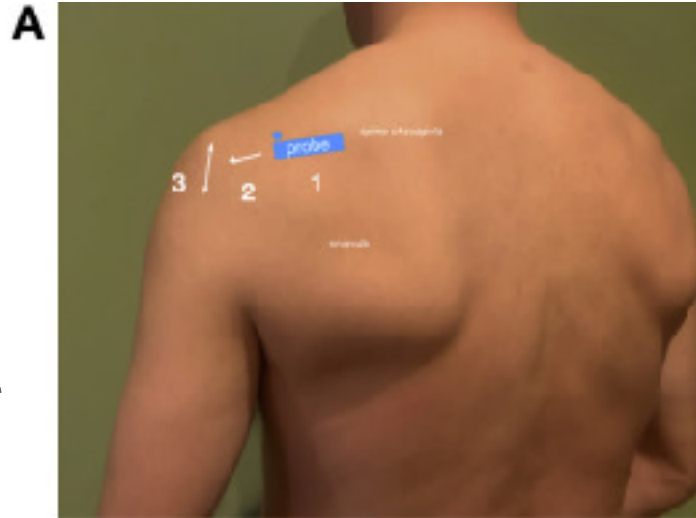
AJEM 2019;37:757-761

Musculoskeletal Ultrasonography to Diagnose Dislocated Shoulders: A Prospective Cohort

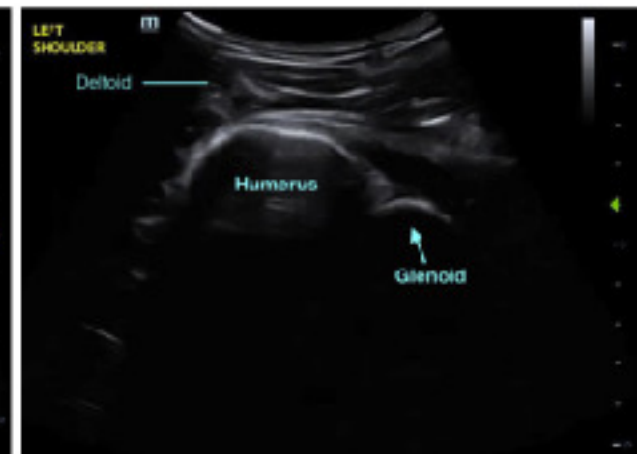
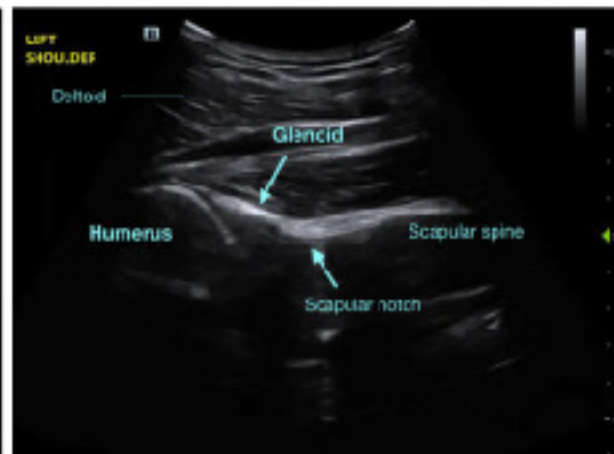
Michael A. Secko, MD, RDMS*; Lindsay Reardon, MD; Michael Gottlieb, MD; Eric J. Morley, MD; Mathew R. Lohse, MD
Henry C. Thode, Jr, PhD; Adam J. Singer, MD

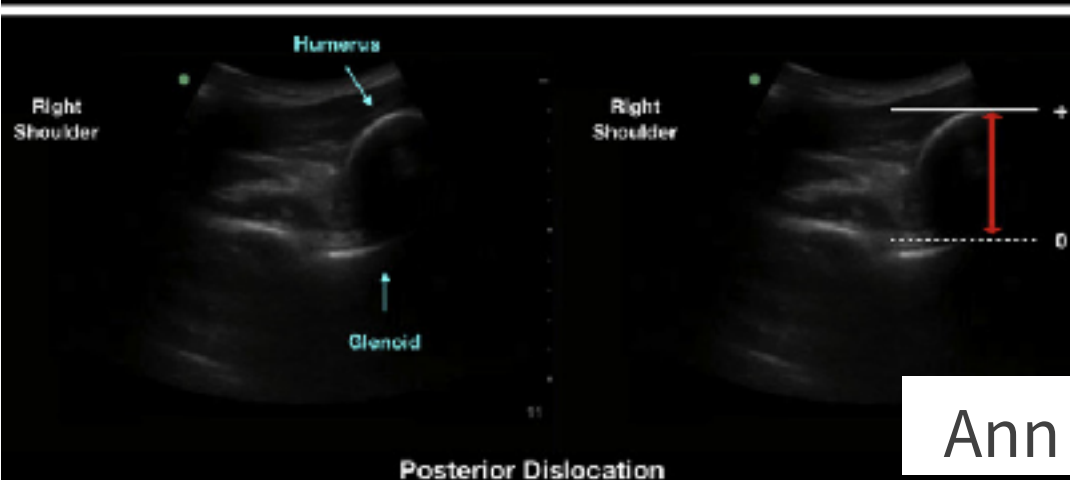
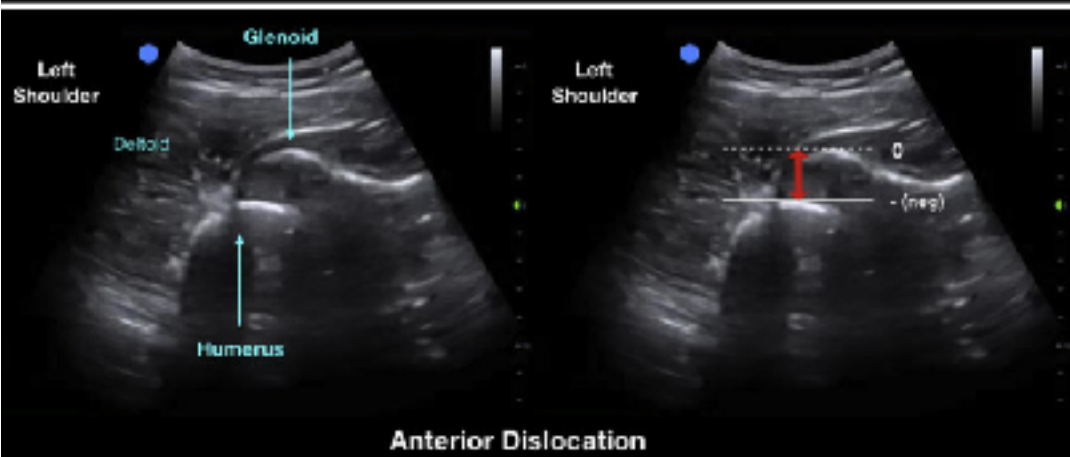
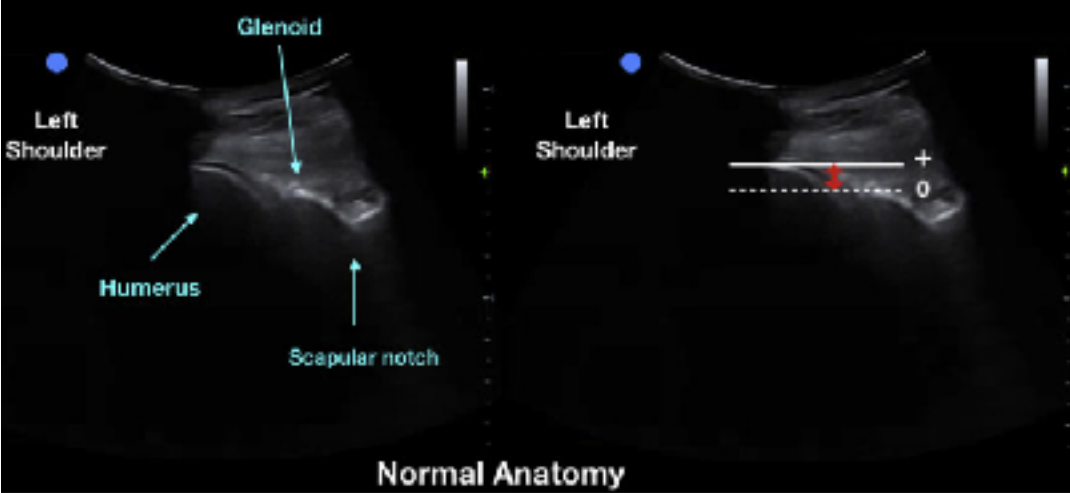
Multicenter
Prospective
Observational

65 patients



B





Sensitivity 100%

Specificity 100%

Sens (Fx) 92%

Spes (Fx) 100%

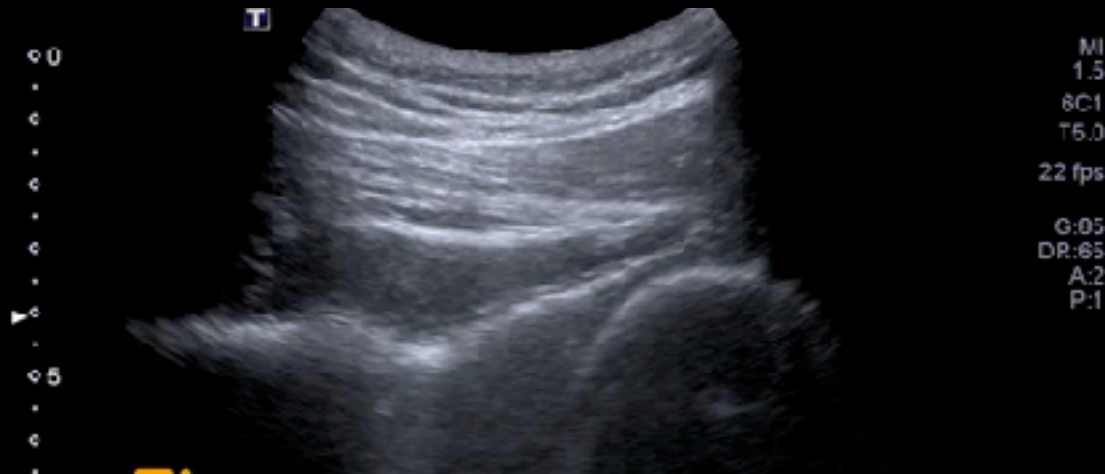
Median 19s

GH(d-A) -1.83cm

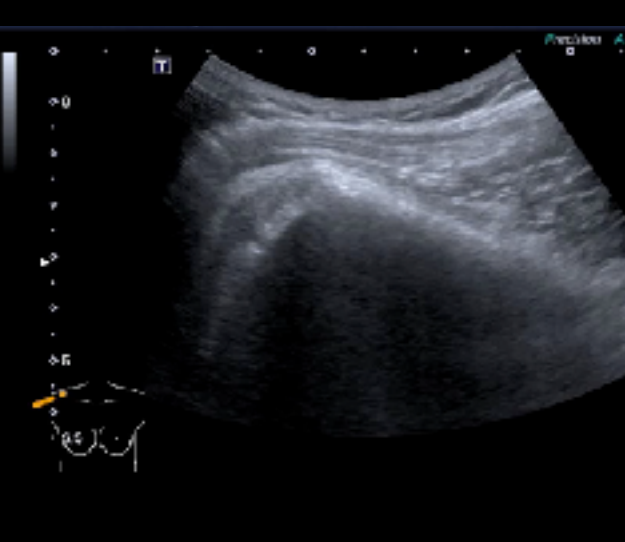
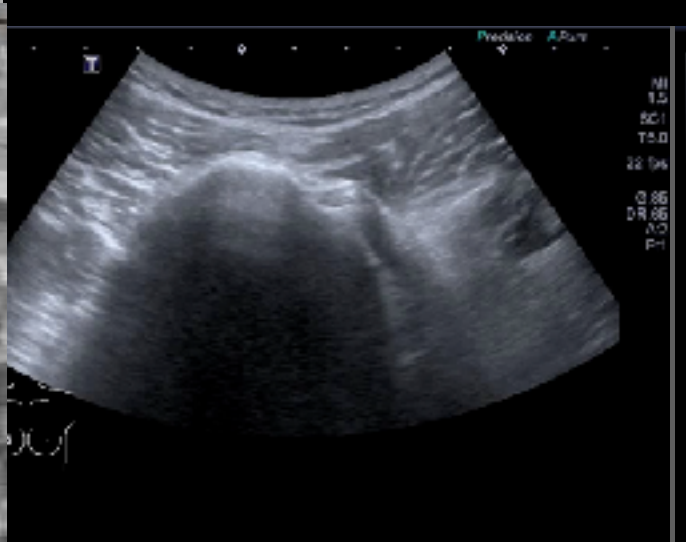
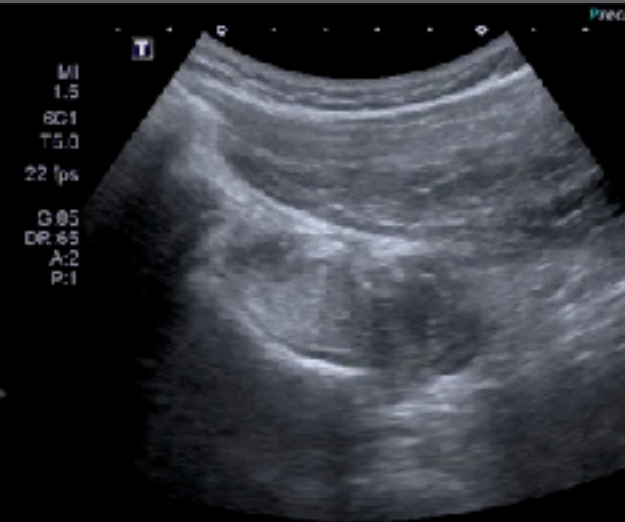
GH(d-N) 0.22cm

GH(d-P) 3.3cm

M/20, 工作時從階梯滑下用手去抓致右肩脫位



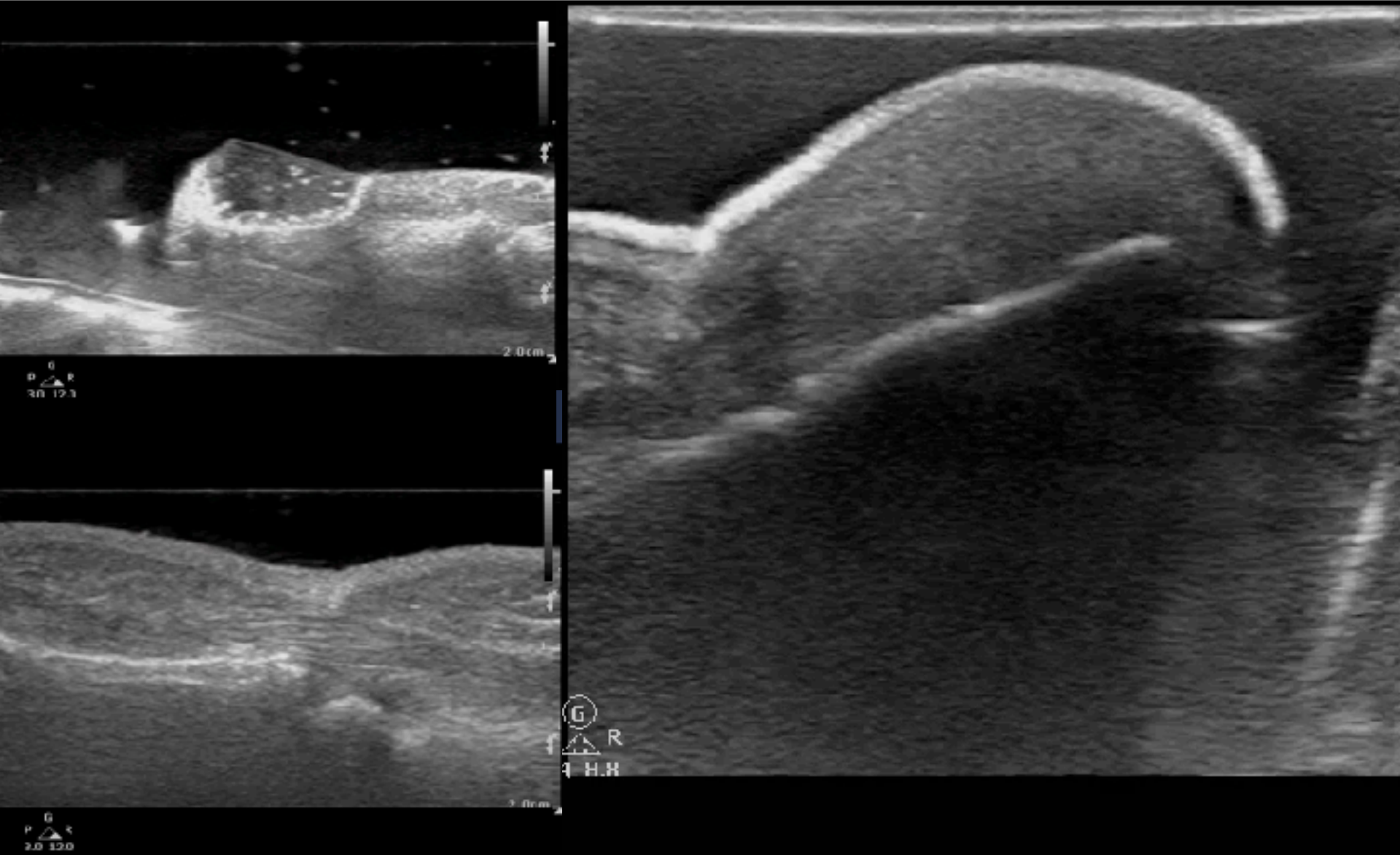
Anterior approach for diagnosis, block & reduction



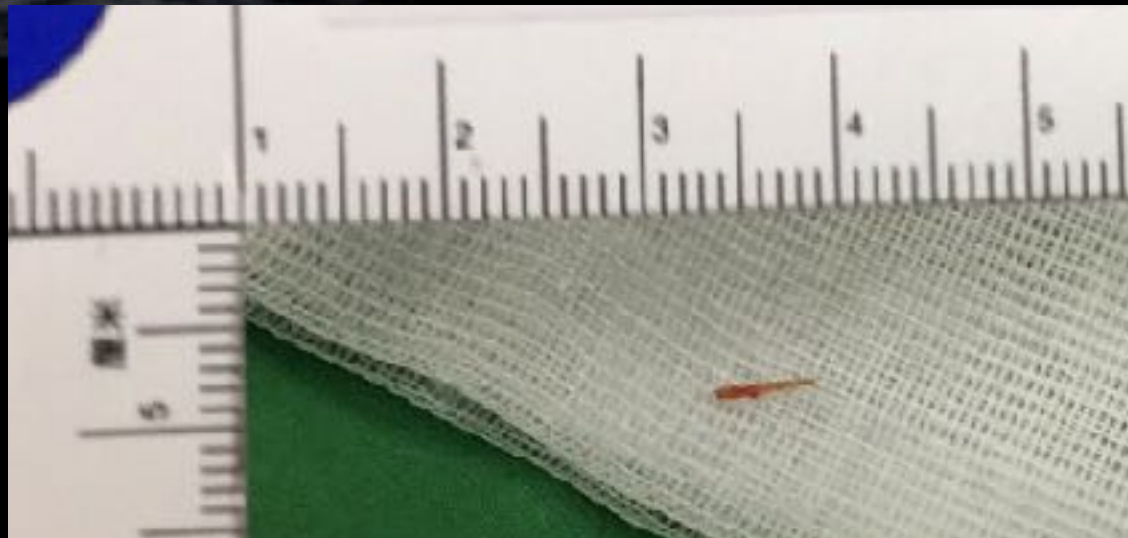
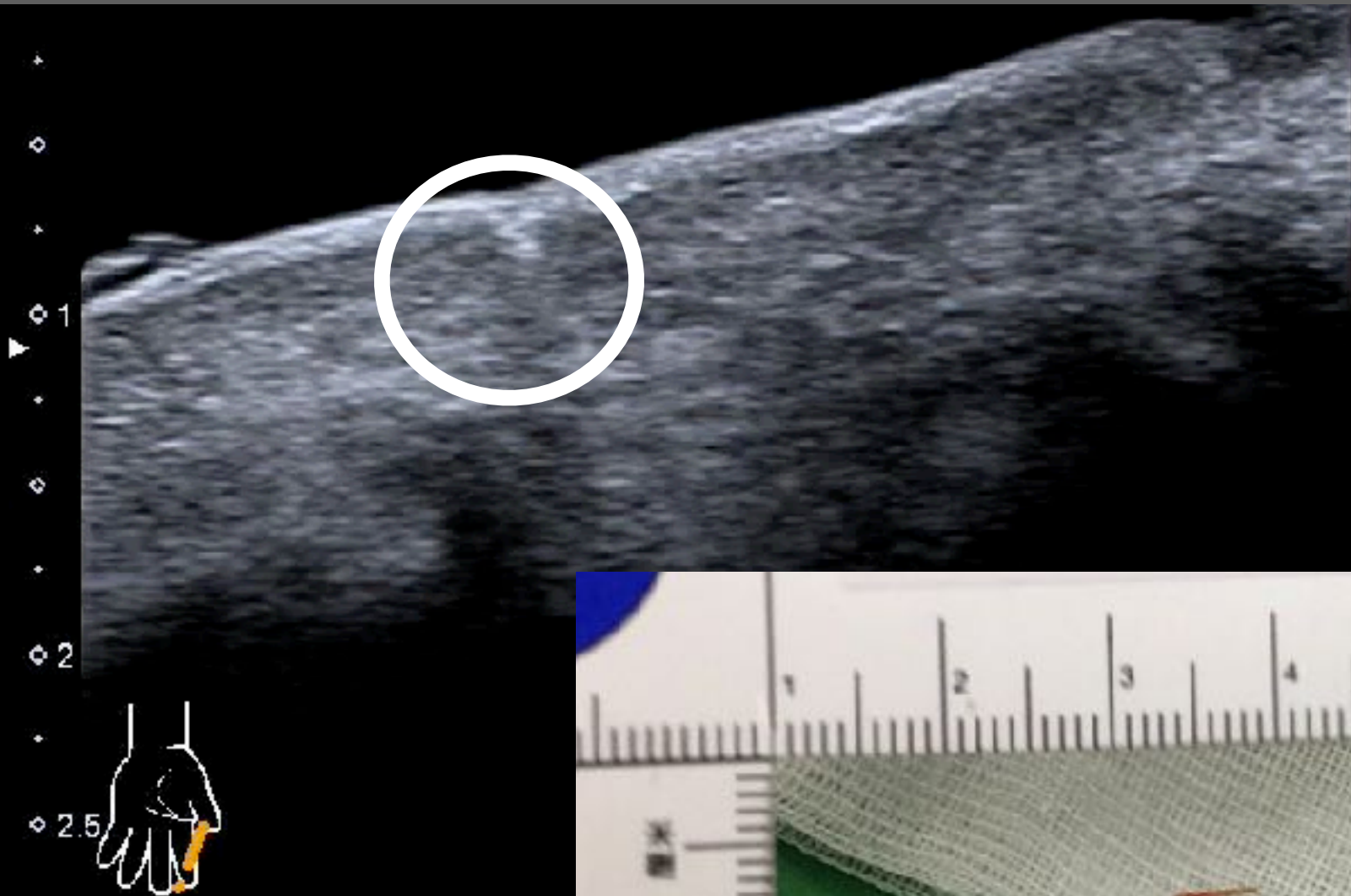
左手中指腫痛



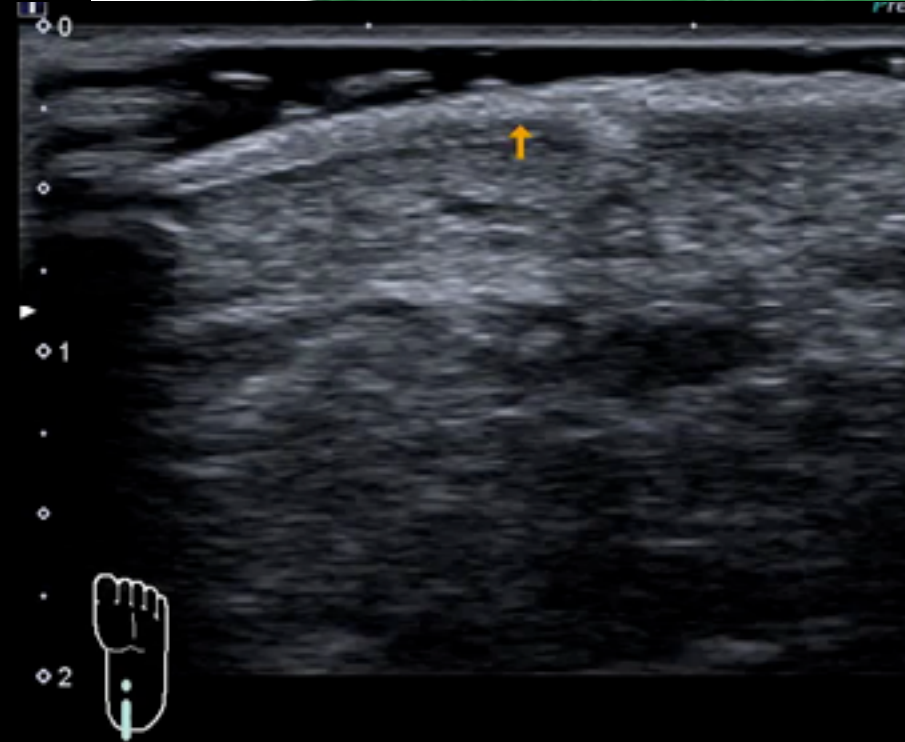
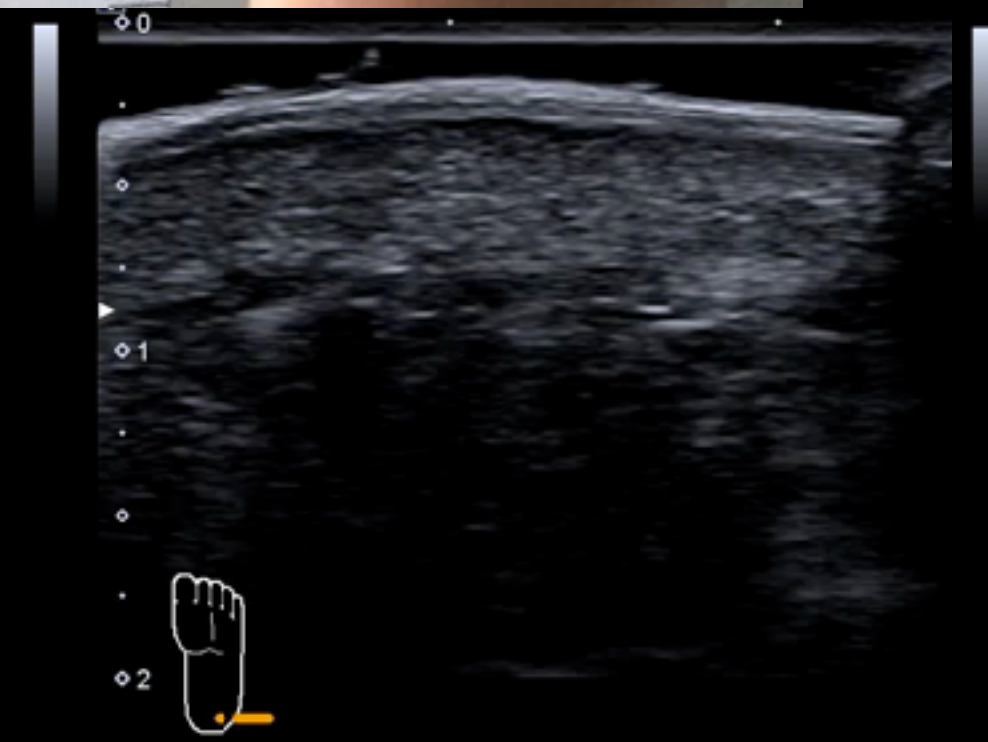
Water bath method



Water bath



踩到碎玻璃，覺得有異物

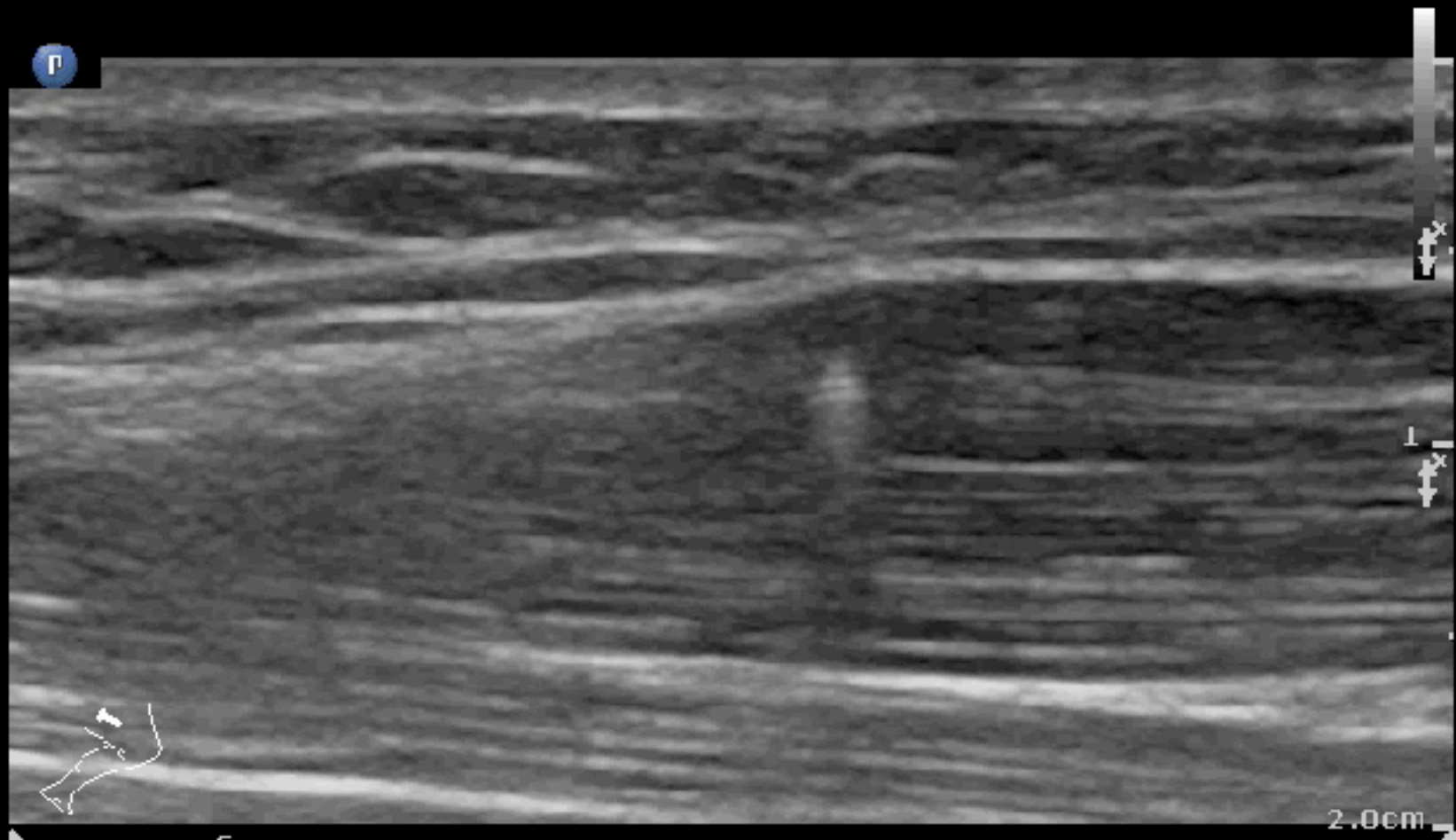




superficial
L12-3
34 Hz
2.0cm

2D

Gen
Gn 60
C. 57
4/3/2



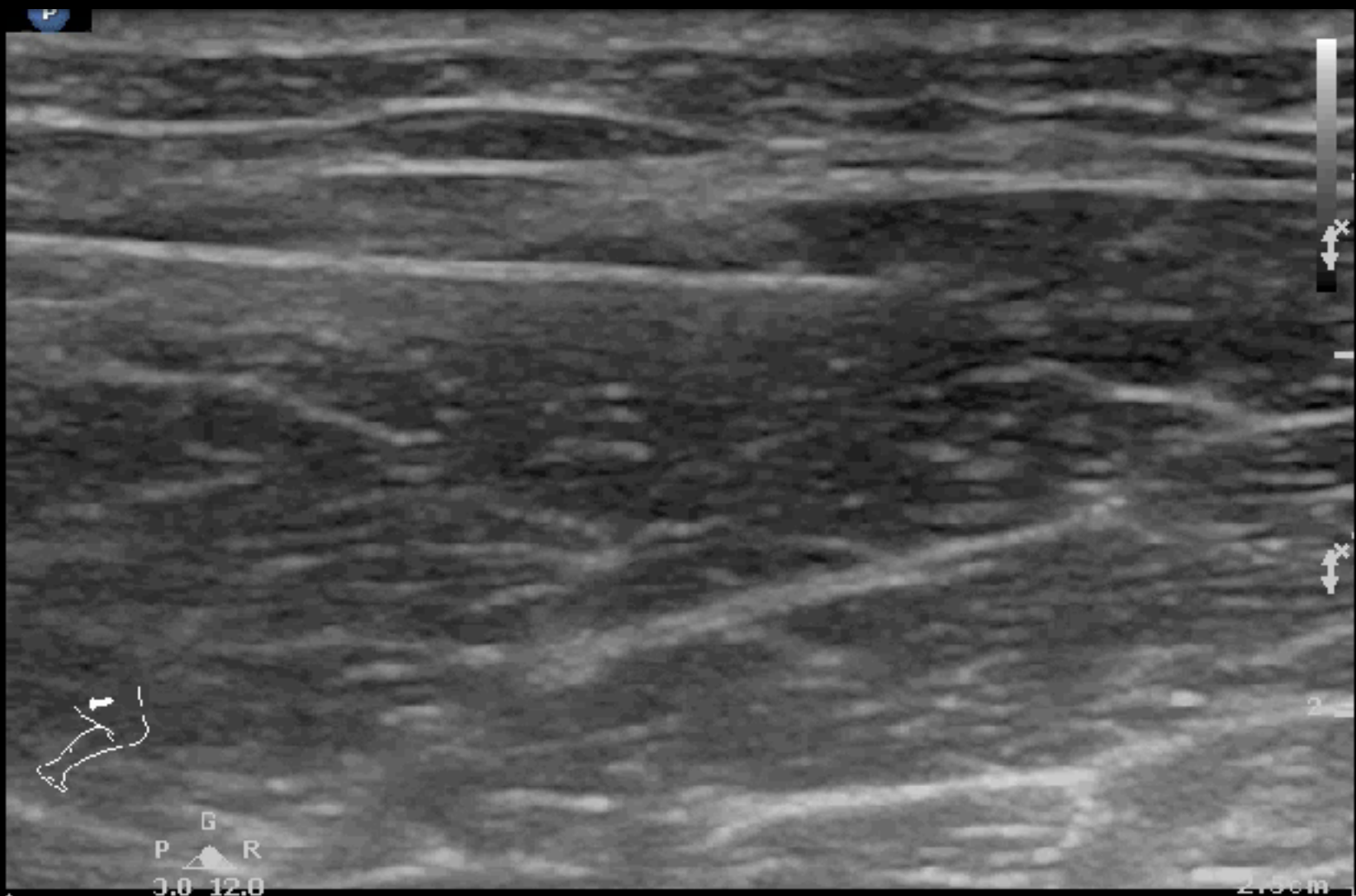
P R
3.0 12.0

2.0cm

Superficial
L12-3
34 Hz
2.5cm

2D

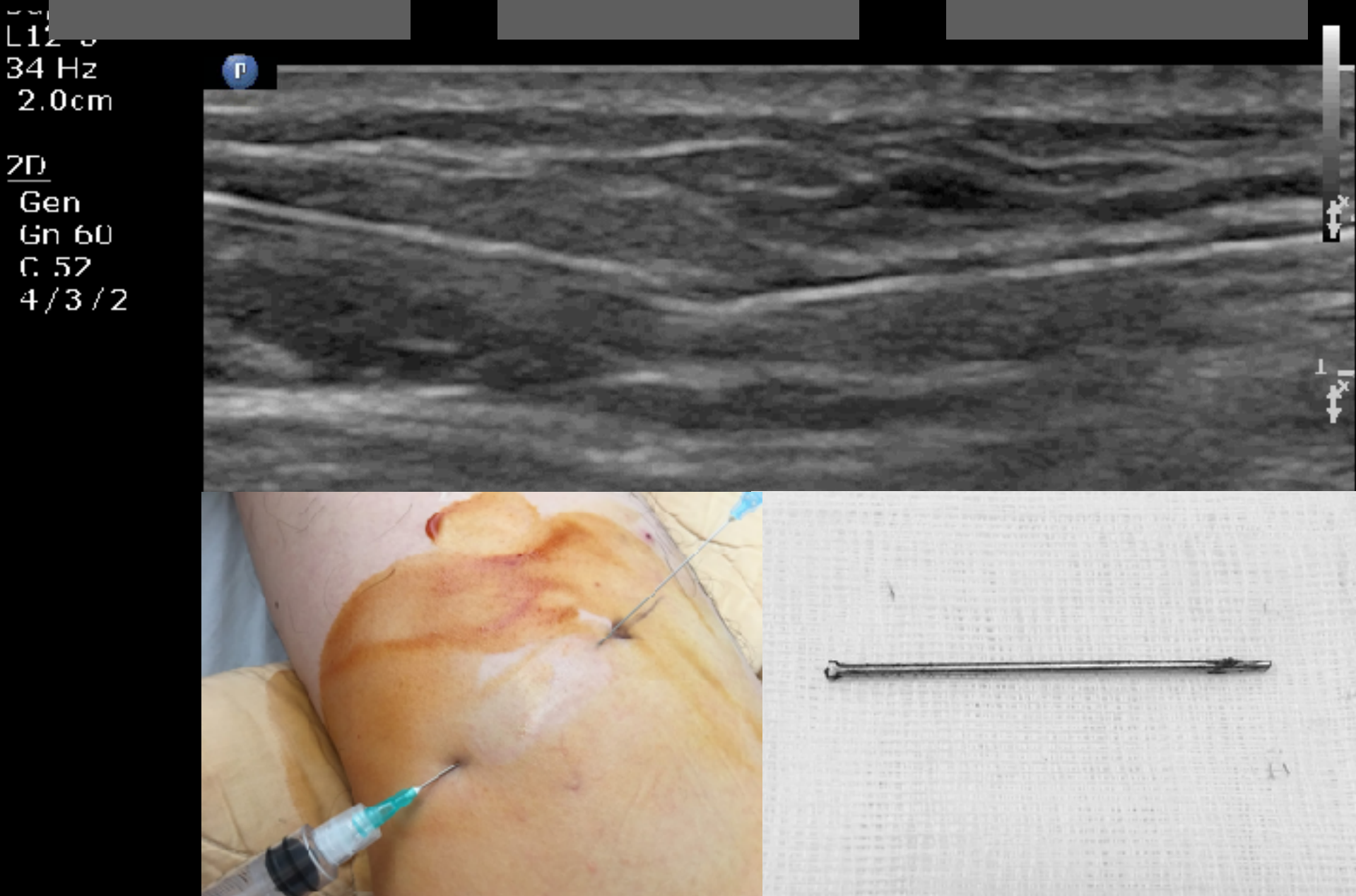
Gen
Gn 60
C 52
4/3/2



Localization

2 needle

Removal



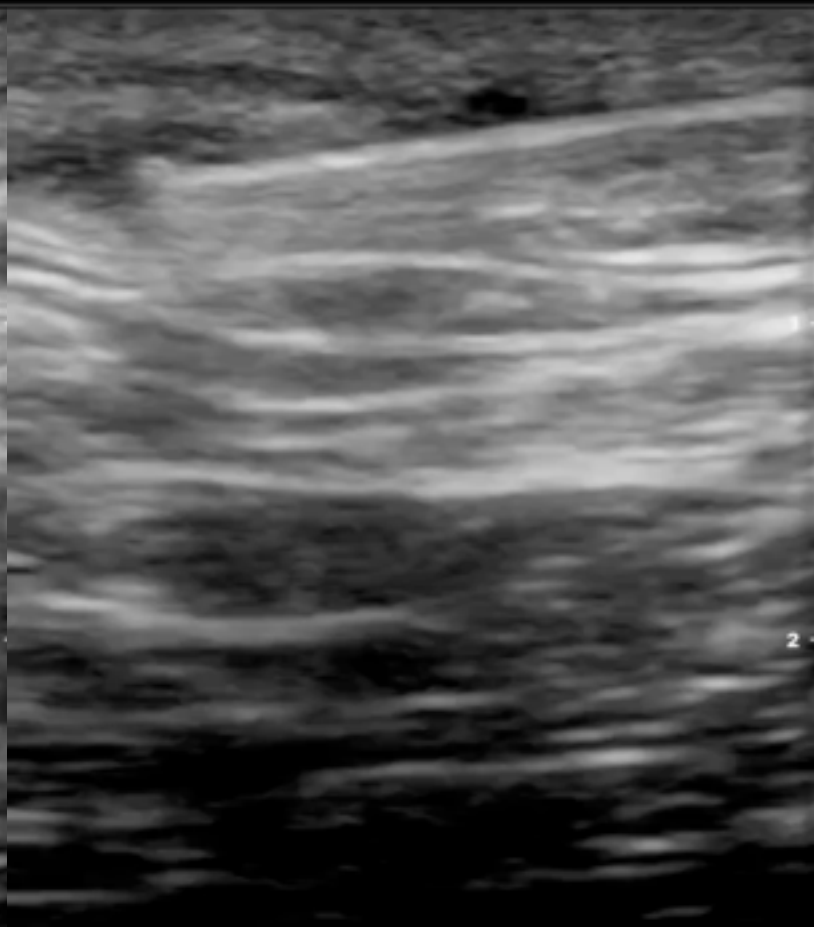
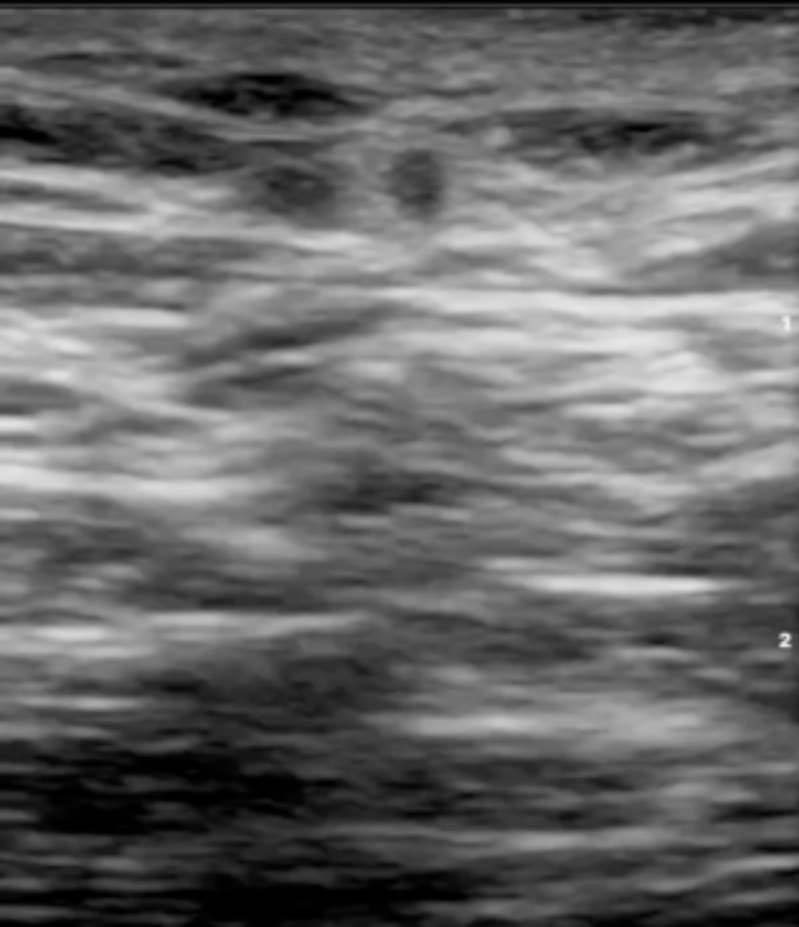
大腿痛和異物感

TIS: 0.01, MI: 0.26, Small Organ

TIS: 0.01, MI: 0.26, Small Organ

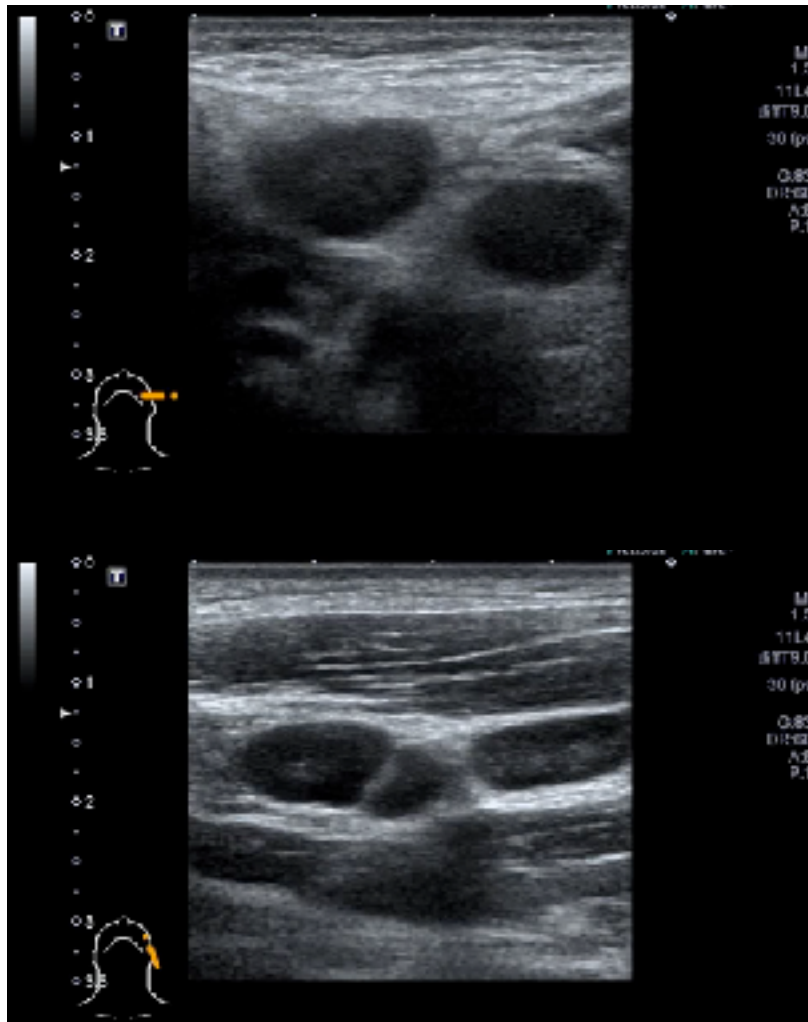
B

B

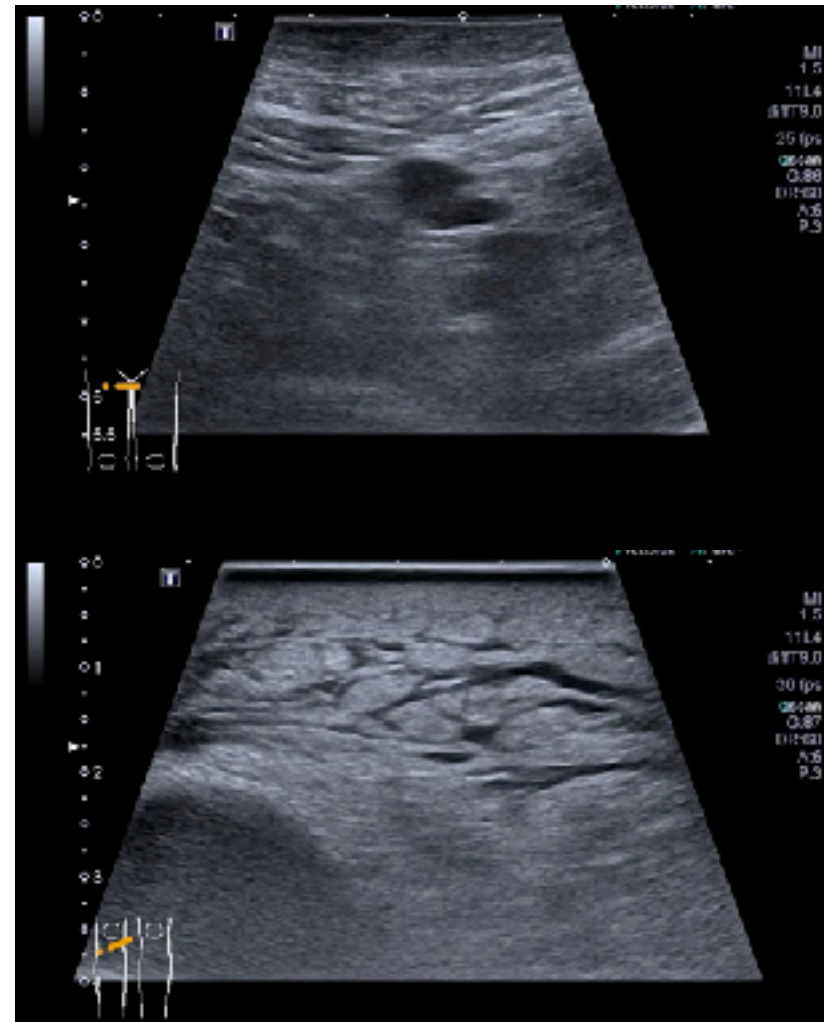


Lymphadenopathy

39M, fever & neck pain



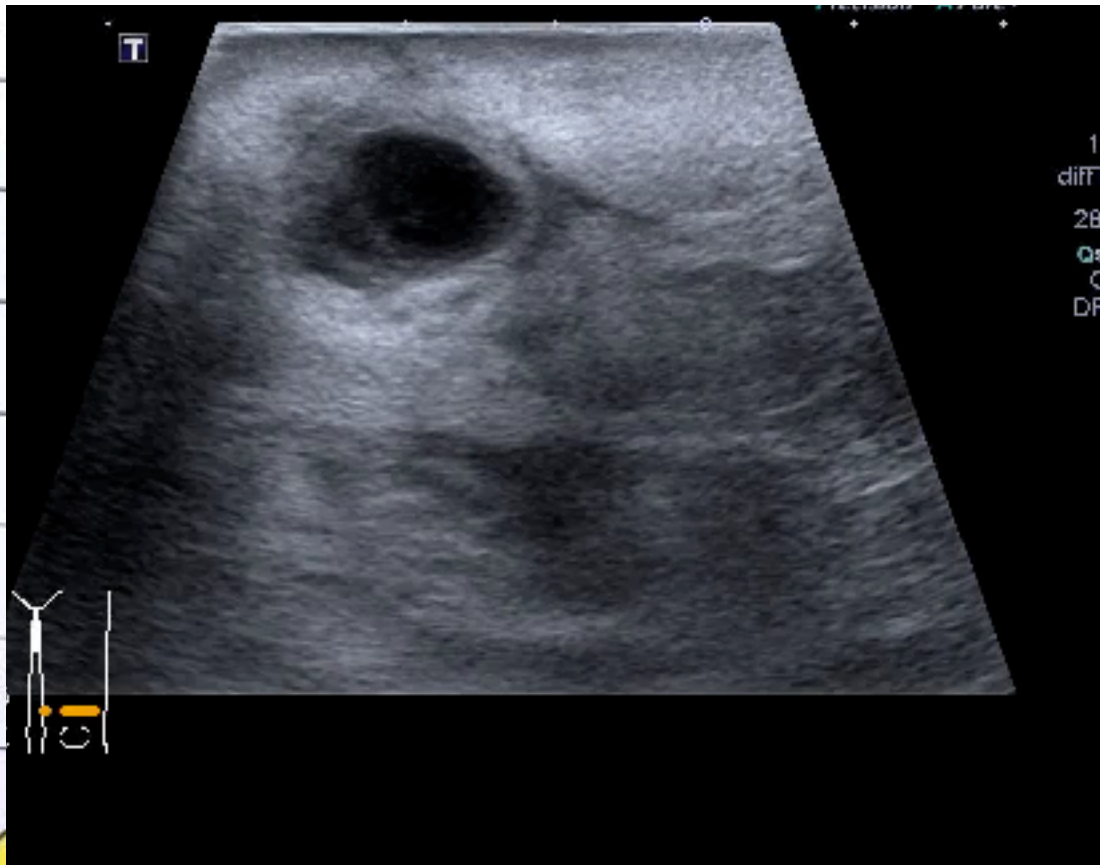
86M, F & R leg redness



71M, 2個月前CABG，近一週左大腿紅腫



Abscess (*S. aureus*)

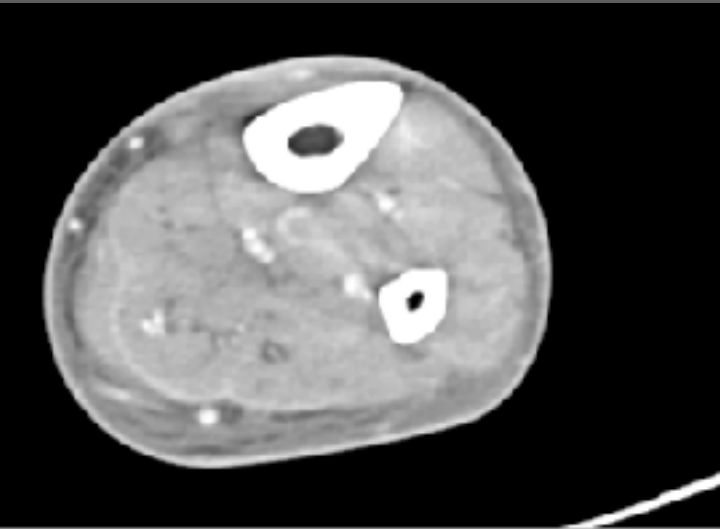


60M, Right leg contusion & swelling 1wk

Diagnosis → Adductor canal block → I & D

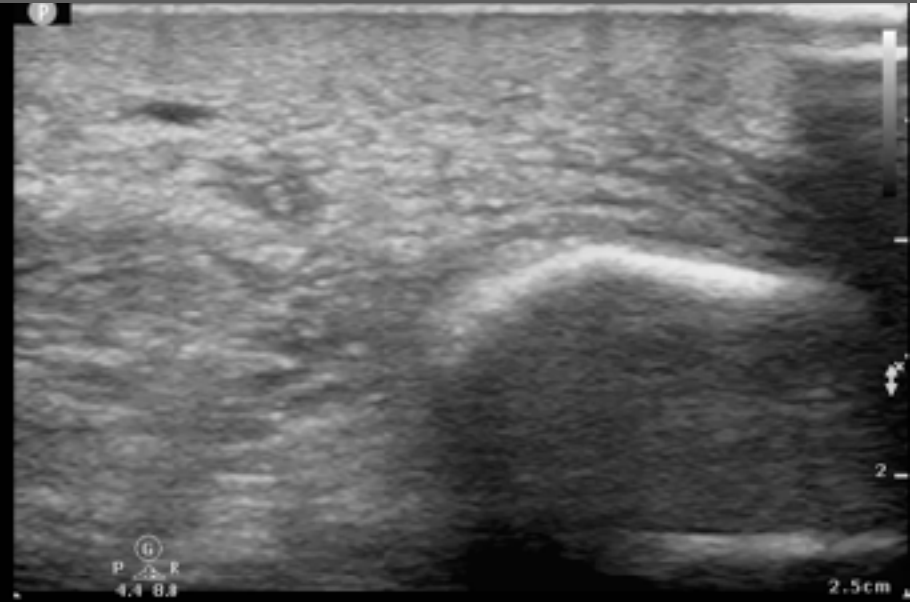


60M, L leg swelling & redness for 2 weeks



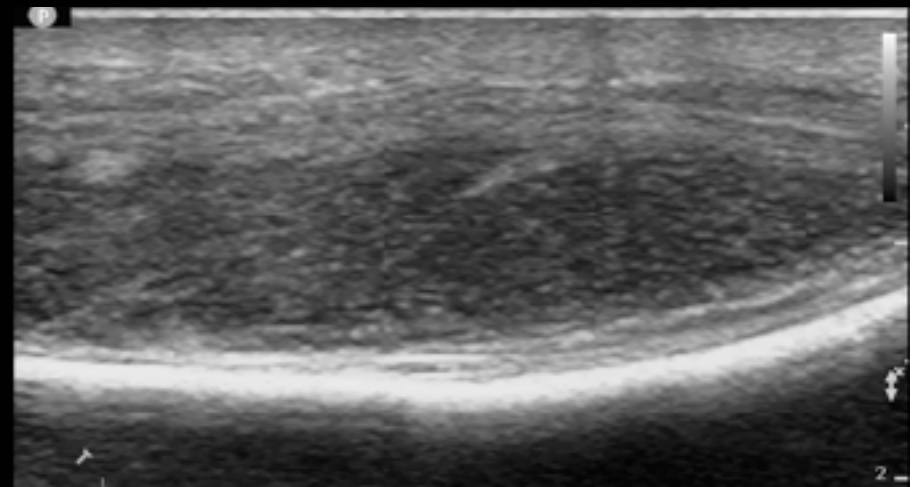
Arterial
L12-3
49 Hz
2.5cm

2D
HGen
Gn 78
C 41
3/3/2

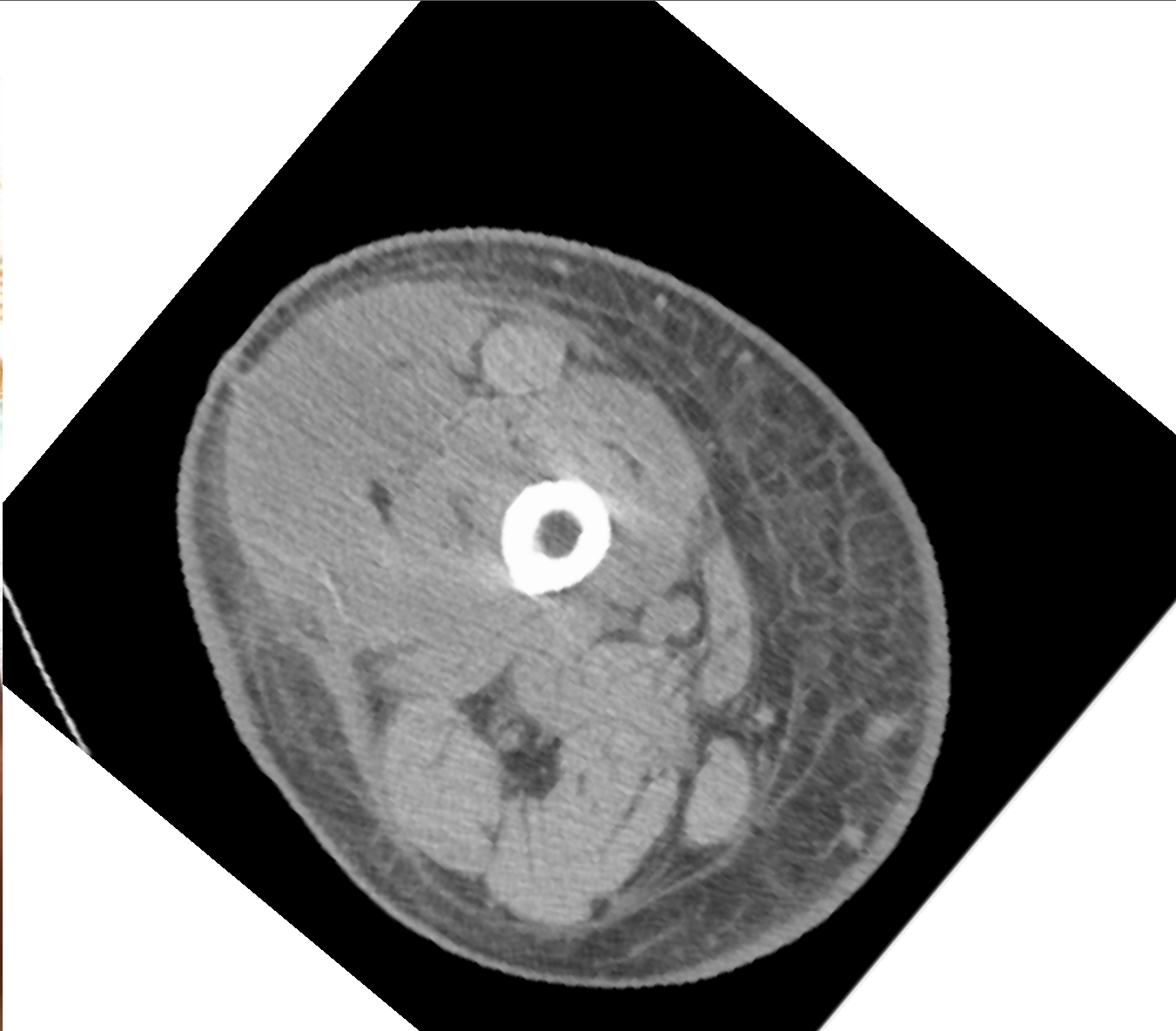


Arterial
L12-3
49 Hz
2.5cm

2D
HGen
Gn 76
C 41
3/3/2



38M, recurrent thigh painful swelling



Necrotizing fasciitis

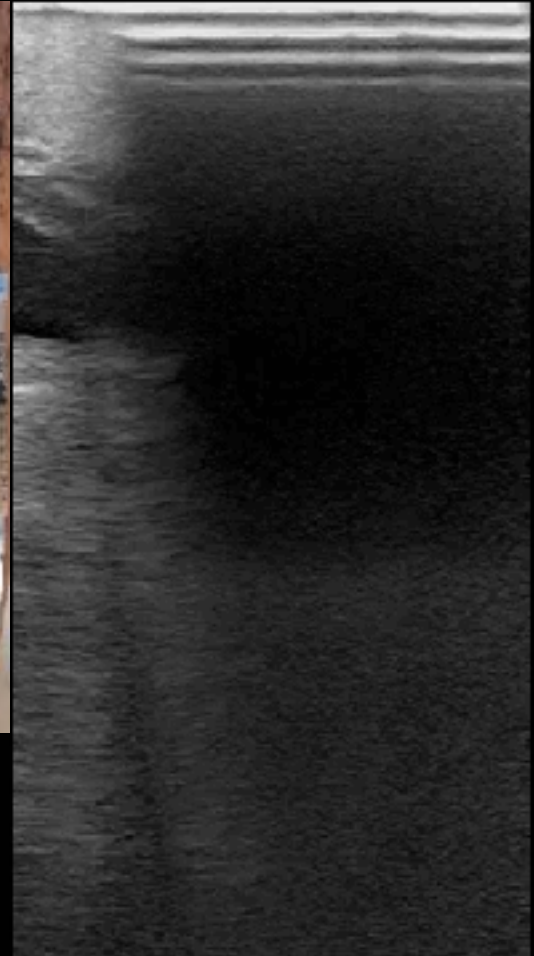
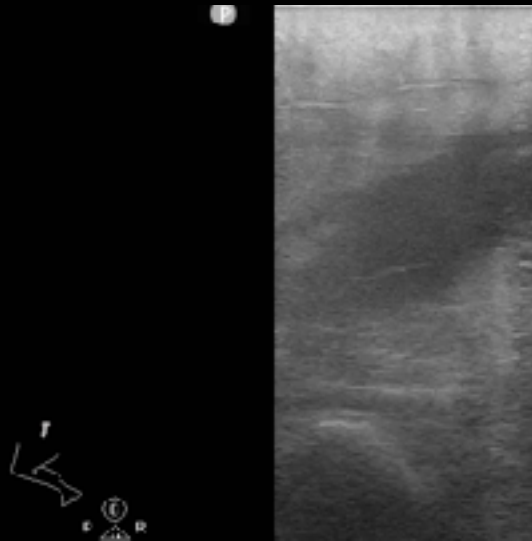
Abd Gen
C5-1
51 Hz
8.0cm

2D
HGen
Gn 65
C 56
3/3/3



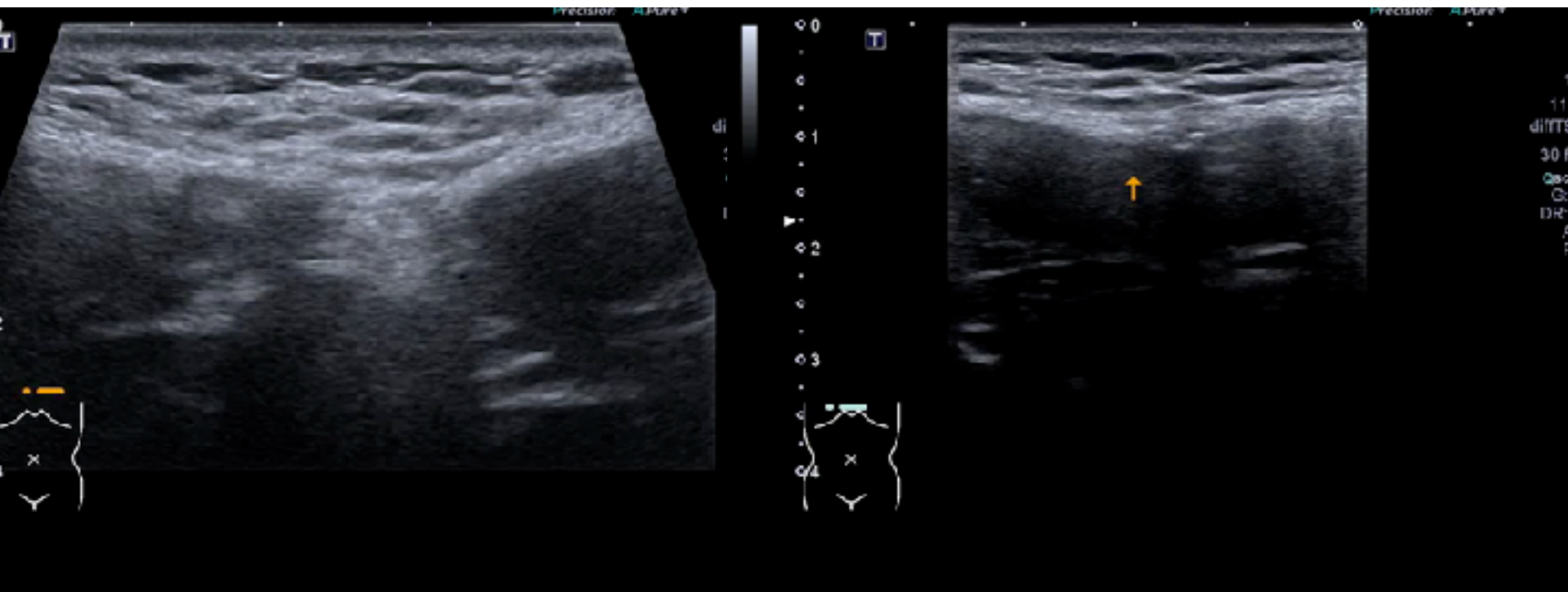
Arterial
L12-3
26 Hz
8.0cm

2D
HGen
Gn 100
C 41
3/3/2



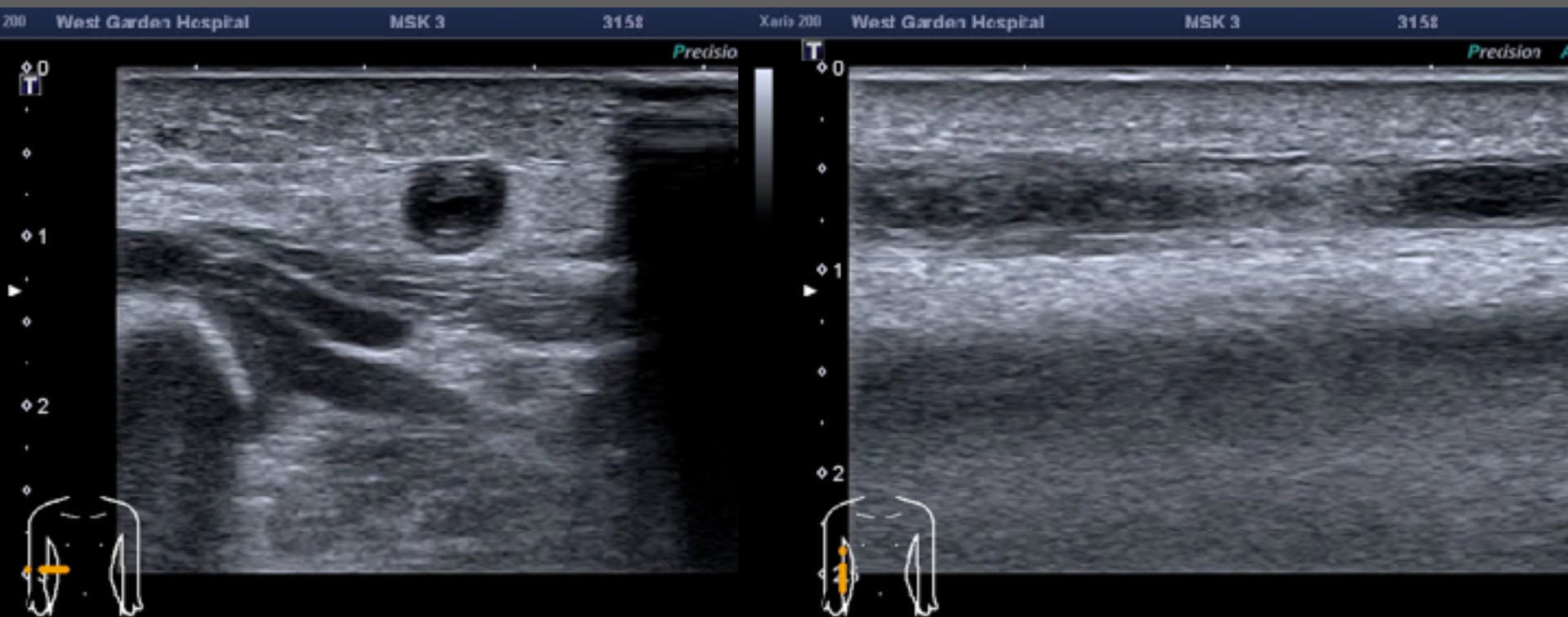
28M, 劍突處突起會痛，約2週

Prominent xiphoid process ==> Xiphodynia



54歲男，注射處腫痛

Superficial thrombophlebitis



Pattern recognition

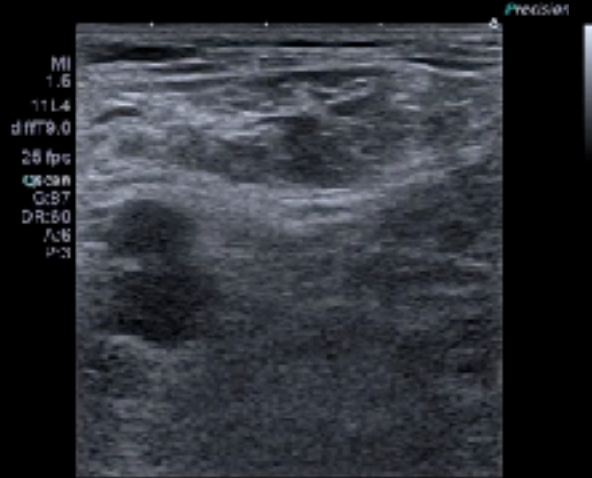
Axillary pain

前幾天腋下長一顆東西



Inguinal pain

右腳和鼠蹊痛1天



Thigh pain

上個月拔右髌釘子，
預計明天拆線，剛突然腫痛



Abscess

Lymphadenitis

Hematoma

Diagnostician

沒被骨頭空氣擋到的都看得到



Interventionist

只要找到縫隙針就送得到