Pediatric POCUS in ER
超音波在兒科急症之應用

陳國智醫師 雙和醫院急診醫學科

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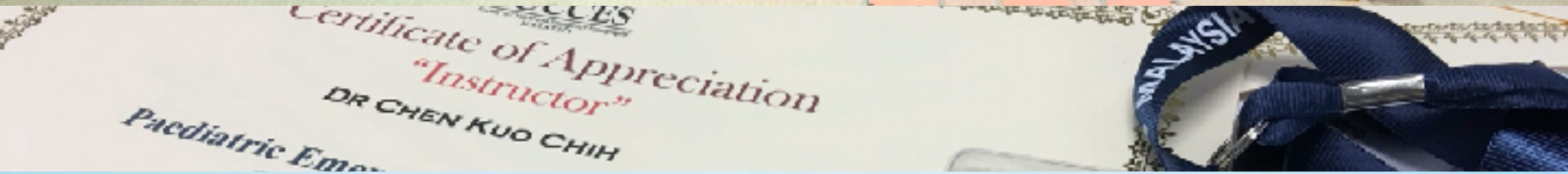
急診超音波臨床評核醫師
醫用超音波學會指導醫師
WINFOCUS director / instructor
Certified Interventional Pain Sonologist

急診 / 重症 / 介入 / 急性疼痛

經歷
新光急診超音波訓練中心主任
西園醫院急診醫學科主任
急診醫學會超音波委員會主委
台灣疼痛醫學會大體模擬手術講師
急救加護醫學會重症超音波負責人

juice119@gmail.com



PAEDIATRIC EMERGENCY AND CRITICAL CARE ULTRASOUND (PERCUSS)

17 & 18 July 2018

Allied Healthcare Centre of Excellence, Penang, Malaysia

WFPICC 2018 @ Singapore

2018.JUNE

14

THURSDAY

Faculty Instructors

Thomas Conlon, MD,
The Children's Hospital of Philadelphia, USA

Akira Nishisaki, MD, MSCE
The Children's Hospital of Philadelphia, USA

Venue

Chang Gung Memorial Hospital
No.5, Fuxing St., Guishan Dist., Taoyuan City 333, Taiwan

Pediatric Bedside Ultrasound Course

Intermediate level: Taiwan Society of Pediatric Emergency Medicine and Children's Hospital of Philadelphia

Course Agenda

8:00	
8:30	Registration
9:00	Pre-test, Faculty Introductions
9:30	Physics/Artifact of Ultrasound
10:00	Vascular Access and Guided Procedures
10:30	Cardiac Ultrasound
11:00	Thoracic Ultrasound
11:15	Break
12:00	HANDS ON Vascular access, Thoracic Ultrasound
12:30	Lunch
13:30	HANDS ON Cardiac Ultrasound
14:00	Volume Assessment
14:30	Shock Assessment
14:45	Break
15:30	RV and LV Function Assessment
15:30	HANDS ON Volume assessment
17:30	HANDS ON RV and LV function assessment
17:45	Break
18:30	Ultrasound Research and Quality Improvement Opportunity
19:00	Post-test, Questions and Concluding Remarks

Taiwan Society of Pediatric Emergency Medicine

PEDIATRICS®

Moving Beyond the Stethoscope: Diagnostic Point-of-Care Ultrasound in Pediatric Practice

Thomas W. Conlon, MD,[a] Akira Nishisaki, MD, MSCE,[a] Yogen Singh, MBBS, MD, DCH, FRCPCH,[b] Shazia Bhombal, MD,[c] Daniele De Luca, MD, PhD,[d,e] David O. Kessler, MD, MSc,[f] Erik R. Su, MD,[c] Aaron E. Chen, MD,[g] María V. Fraga, MD[g]

Pediatrics 2019;144: e20191402

SPECIAL ARTICLE

Point-of-care ultrasound: Is it time to include it in the paediatric specialist training programme?☆

Juan Mayordomo-Colunga[a,b,r,1], Rafael González Cortés[c,d,e,r,1], María Carmen Bravo[f], Roser Martínez Mas[g,s], José Luis Vázquez Martínez[h,r], Luis Renter Valdovinos[i,j,k,r], Thomas W. Conlon[l], Akira Nishisaki[l], Fernando Cabañas[m,n], José Ángel Bilbao Sustacha[o,t], Ignacio Oulego Erroz[p,q,r,*,1]

An Pediatr (Barc). 2019;91(3):206.e1-206.e13

PEDIATRICS®

Moving Beyond the Stethoscope: Diagnostic Point-of-Care Ultrasound in Pediatric Practice

Thomas W. Conlon, MD,[a] Akira Nishisaki, MD, MSCE,[a] Yogen Singh, MBBS, MD, DCH, FRCPCH,[b] Shazia Bhombal, MD,[c] Daniele De Luca, MD, PhD,[d,e] David O. Kessler, MD, MSc,[f] Erik R. Su, MD,[c] Aaron E. Chen, MD,[g] Maria V. Fraga, MD[g]

Pediatrics 2019;144: e20191402

Answer questions
Narrow differentials
Guide therapy
Direct consultation & disposition

POCUS應用/學習模板: I-AIM

Indication
Point / 掃描目的

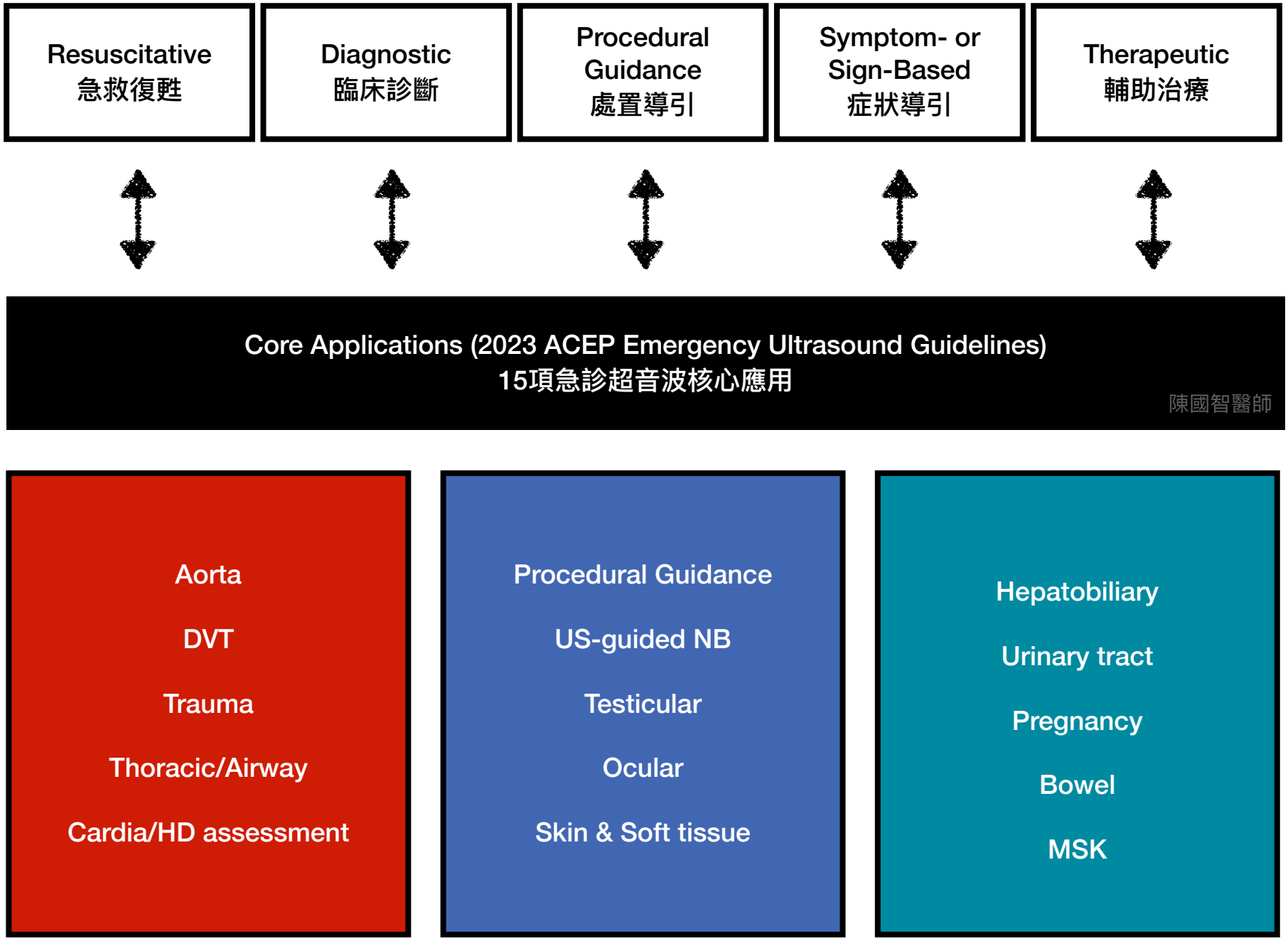
Acquire
取得影像

Interpret
判讀影像

Make decision
臨床決策

Bahner DP, et al. J Ultrasound Med 2012

Probe


Resuscitative
急救復甦
Diagnostic
臨床診斷
Procedural Guidance
處置導引
Symptom- or Sign-Based
症狀導引
Therapeutic
輔助治療
Core Applications (2023 ACEP Emergency Ultrasound Guidelines)
15項急診超音波核心應用
陳國智醫師
Aorta
DVT
Trauma
Thoracic/Airway
Cardia/HD assessment
Procedural Guidance
US-guided NB
Testicular
Ocular
Skin & Soft tissue
Hepatobiliary
Urinary tract
Pregnancy
Bowel
MSK

Scope of Practice

Application

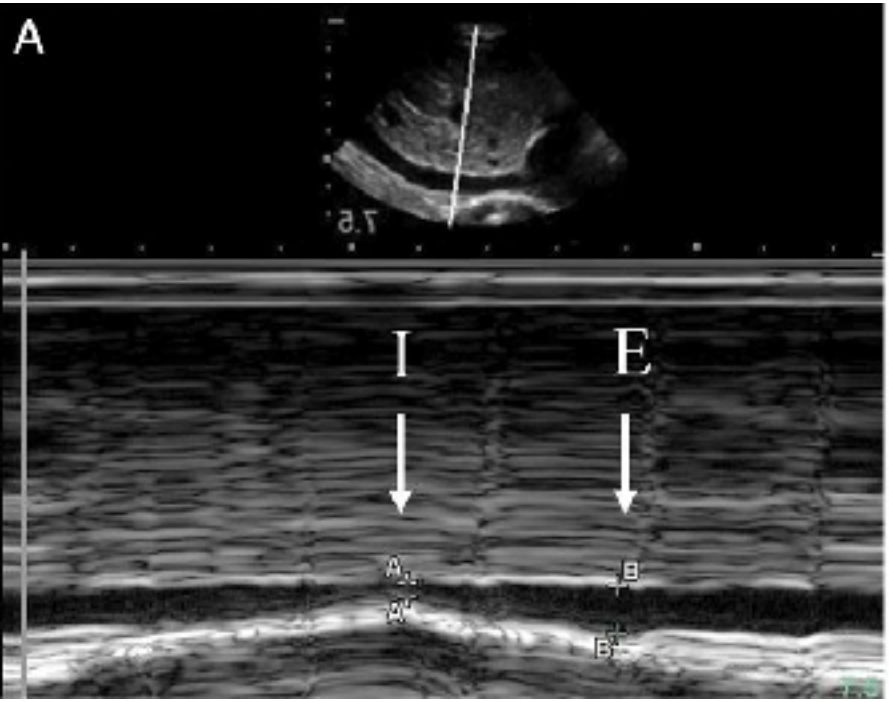
Amenability
超音波適用嗎

Measurability
有辦法測量嗎

Frequency
臨床上常見嗎

Hemodynamic: Fluid

Volume status



Fluid responsiveness

IVC variation

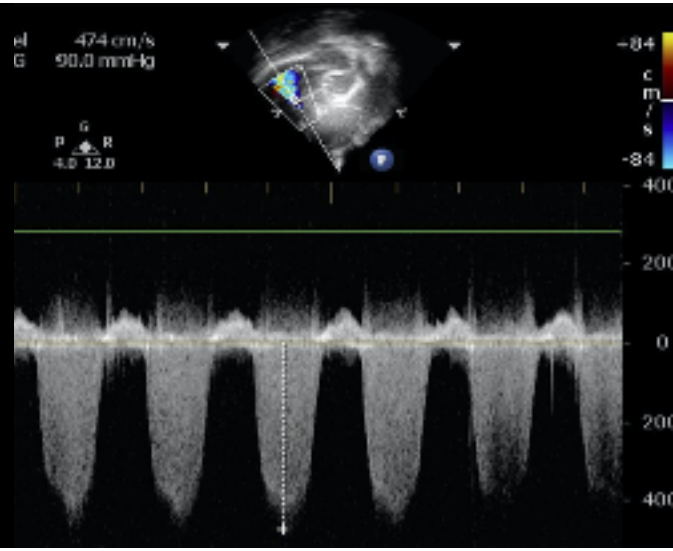
Aortic outflow velocity

Pediatrics 2019;144: e20191402

Hemodynamic: Resus

Cardiac function
Shock etiology

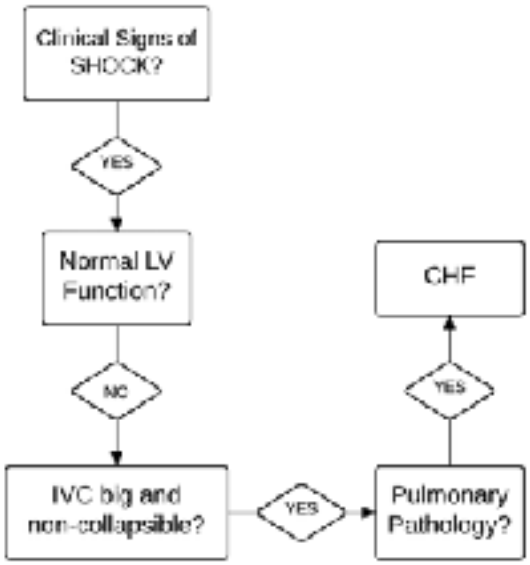
HQ-CPR

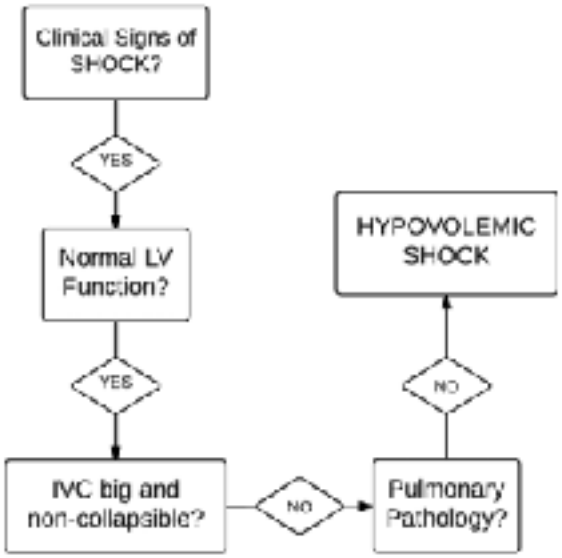


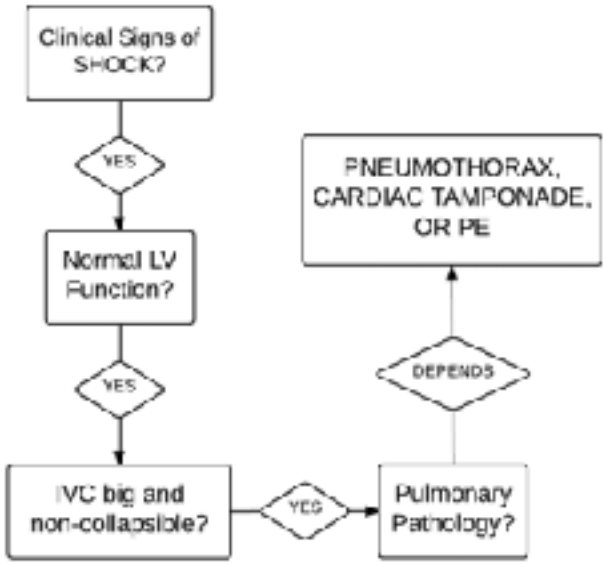
Pediatrics 2019;144: e20191402

Point-of-Care Ultrasound for Pediatric Shock

Daniel B. Park, MD, Bradley C. Presley, MD,† Thomas Cook, MD,‡ and Geoffrey E. Hayden, MD†*







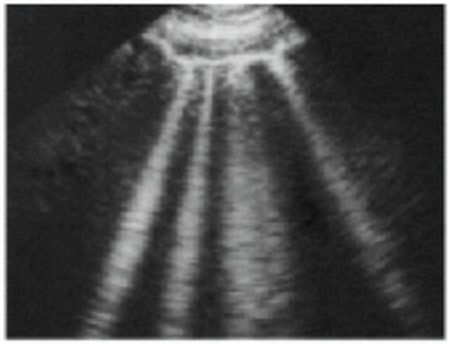
Pediatr Emer Care 2015;31: 591– 601

EMNote.org

Rapid Ultrasound in SHock Evaluation

RUSH Protocol	
PUMP:	LV contractility, RV strain, tamponade
TANK:	IVC variation, leaks, tank compromise
PIPE:	Aortic dissection, aneurysms, DVT

HI-MAP Approach	
H:	Heart
I:	IVC
M:	Morrison's pouch & E-FAST
A:	Aorta and deep veins
P:	Pneumothorax, PLE, PN, Pulm edema



@ jackcfchong

Hemodynamic

Echo parameters ?

TABLE 106-2 Pediatric Vital Signs by Age (Awake and Resting)

Age	Heart Rate, Upper Limit (beats/min)	Respiratory Rate, Upper Limit (breaths/min)	Blood Pressure,* Lower Limit (mm Hg)	Weight,† (kg)
0–1 mo	180	60	60/40	3–4
2–12 mo	160	50	70/45	5–10
12–24 mo	140	40	75/50	10–12
2–6 y	120	30	80/55	13–25
6–12 y	110	20	90/60	25–40
>12 y	100	20	90/60	40–60

*May be estimated by:

Systolic blood pressure (5th percentile) = 70 + [2 × (age in years)]

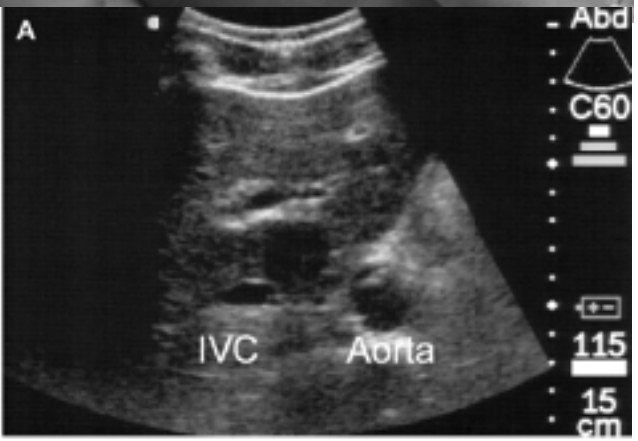
†May be estimated by:

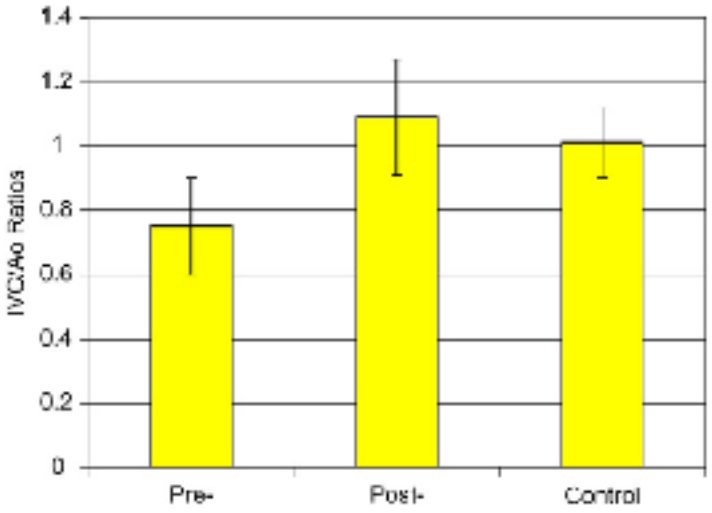
12 mo: weight (kg) = 4 + (age in months/2)

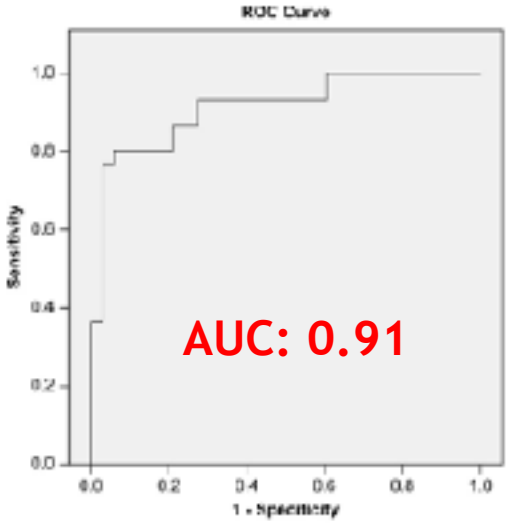
1–12 y: weight (kg) = 10 + [2 × (age in years)]

Tintinalli's Emergency Medicine, 9e

IVC/Ao ratio as an objective tool in assessment for dehydrated children

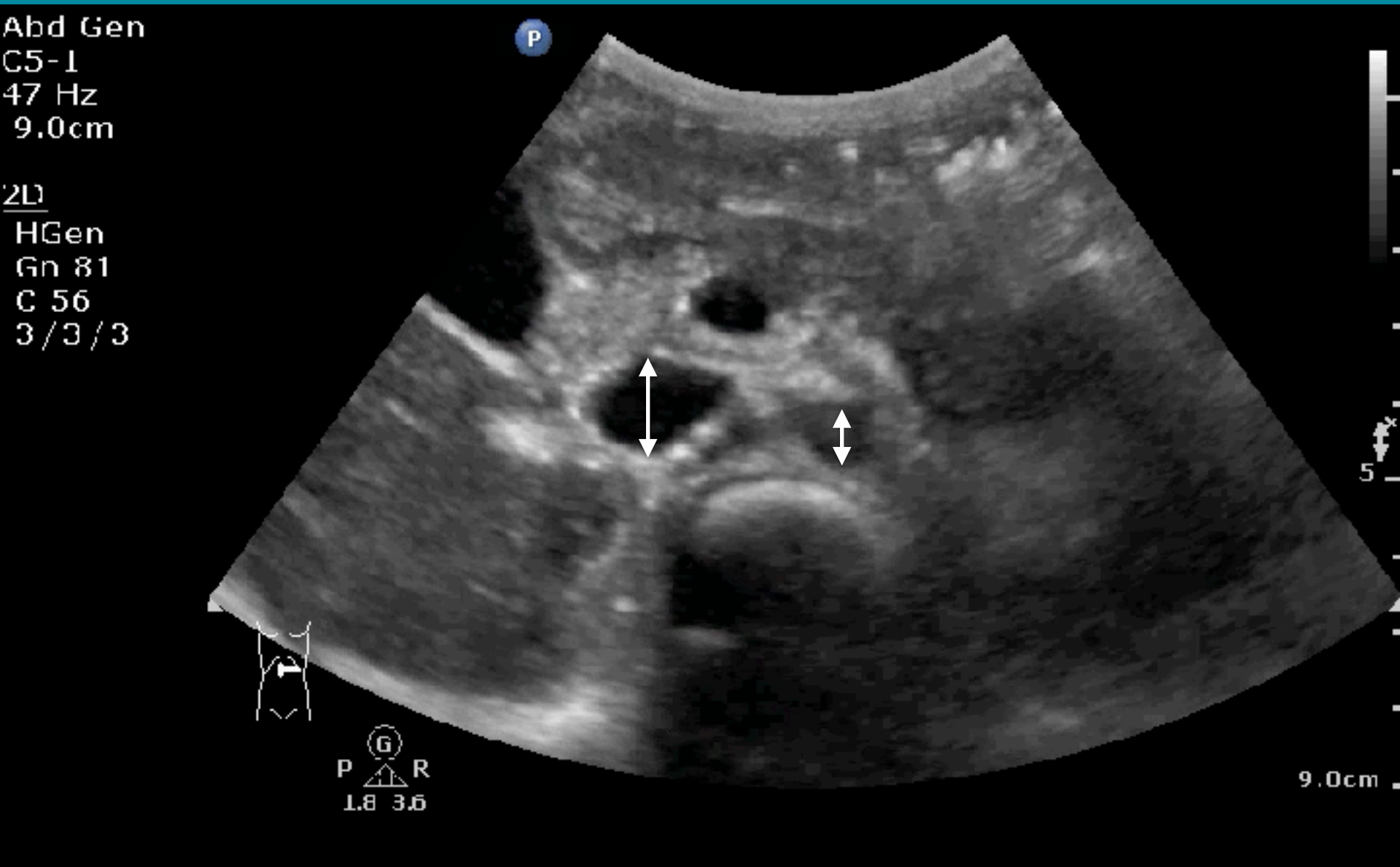






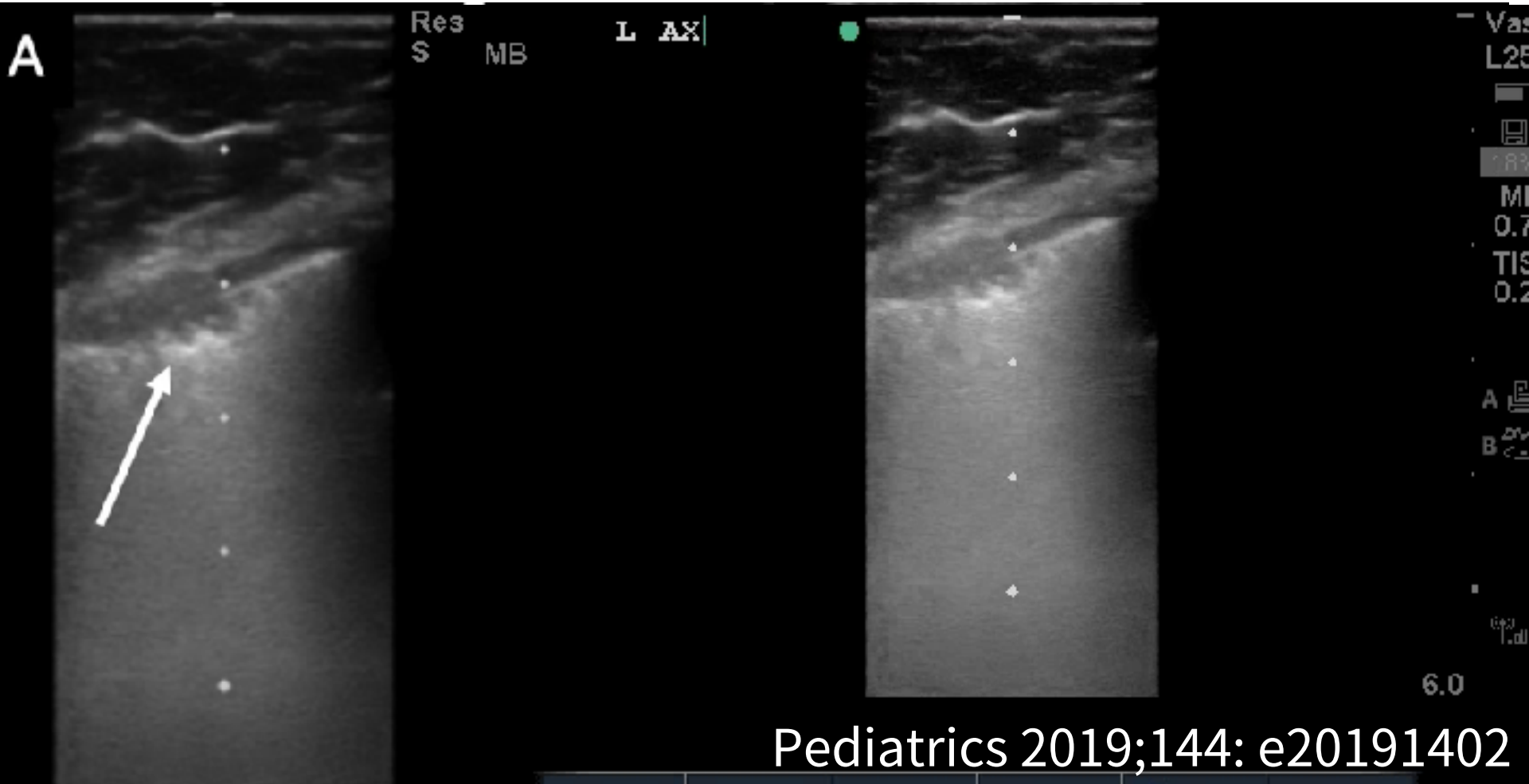
Acad Emerg Med 2007; 14:841–845

IVC/Ao ratio : 0.8 ~ 1.2



Lung: Pneumonia

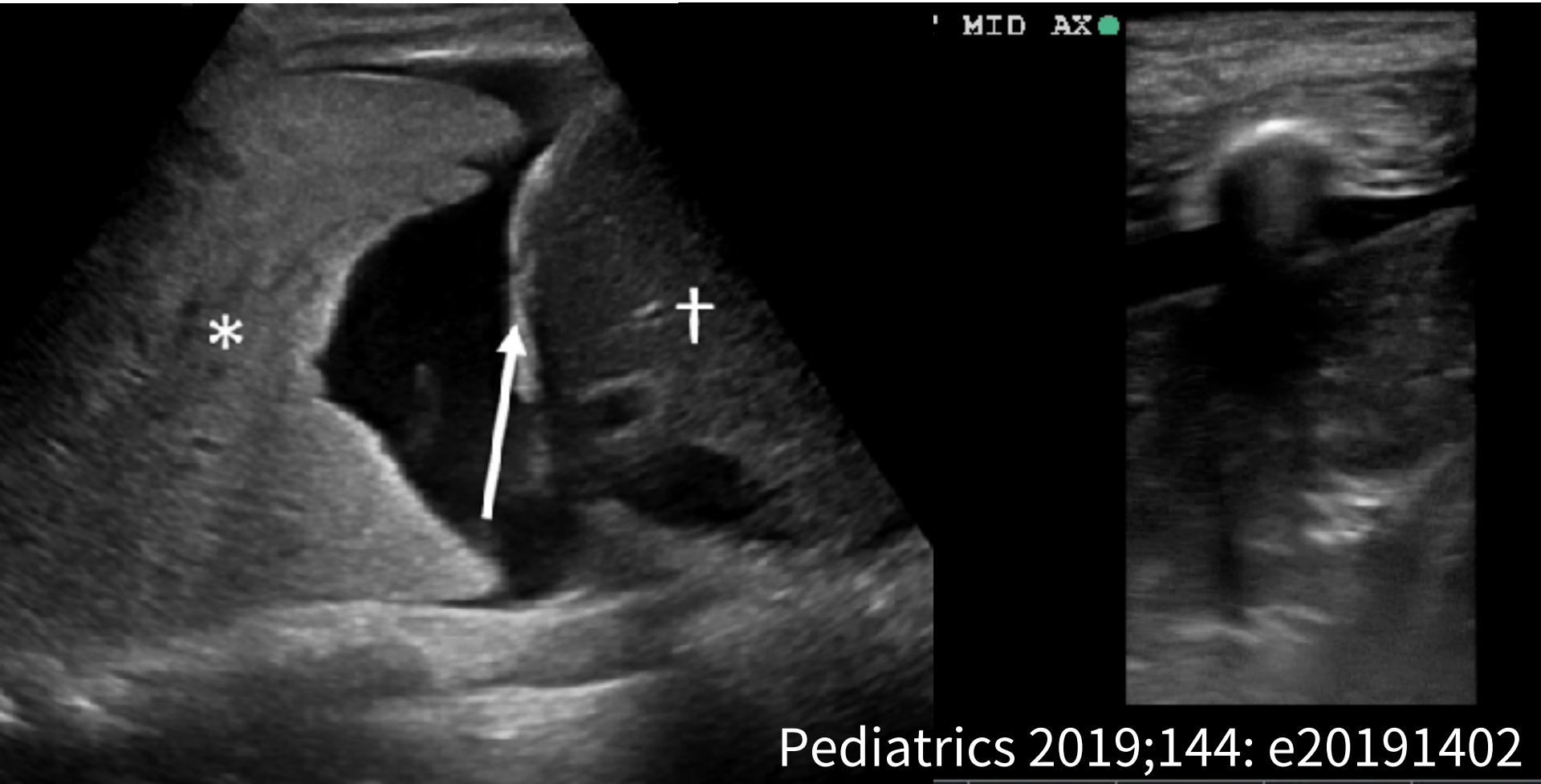
Subpleural consolidation



Pediatrics 2019;144: e20191402

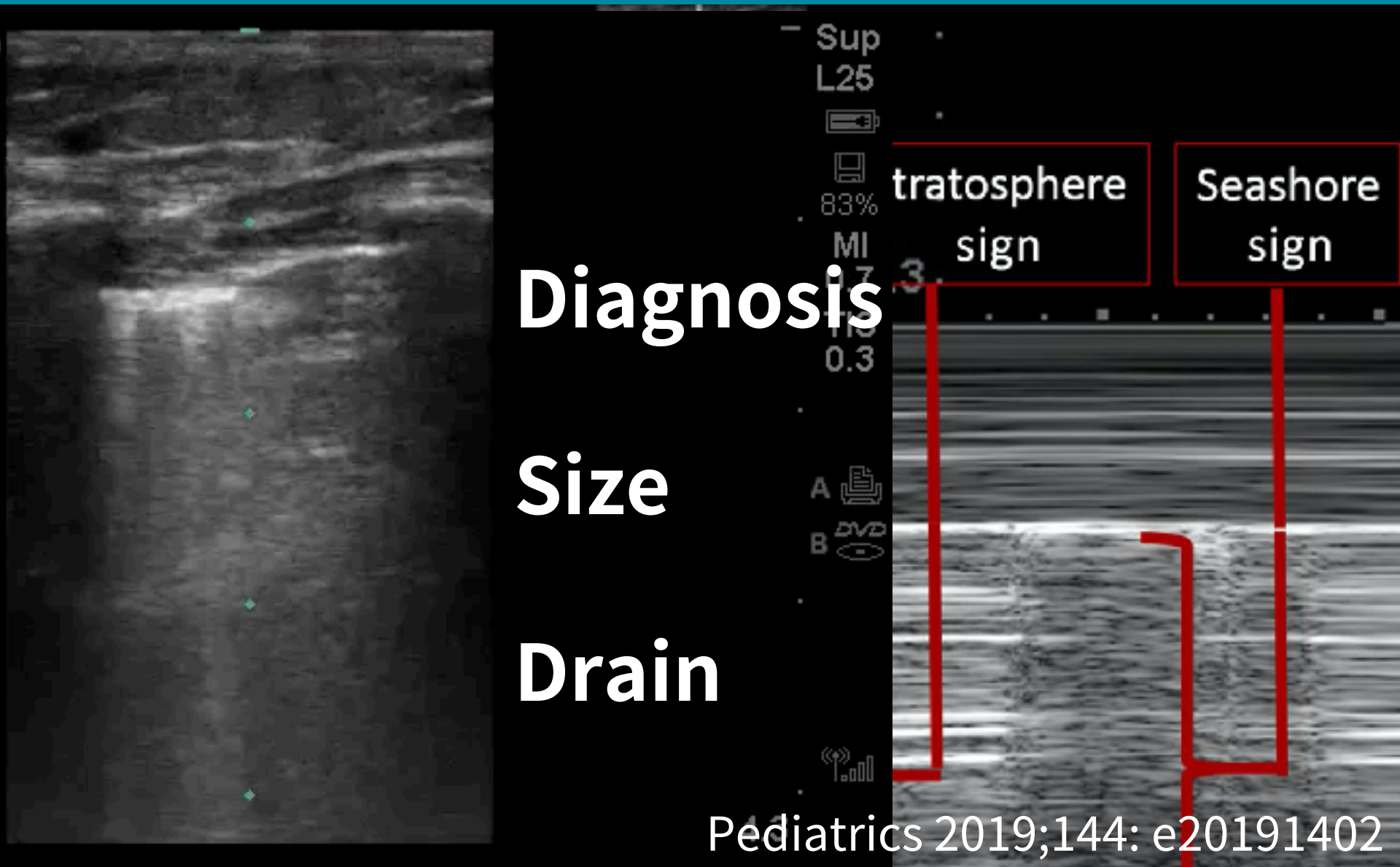
Lung: Pneumonia

Hepatization



Pediatrics 2019;144: e20191402

Lung: Pneumothorax



Diagnosis

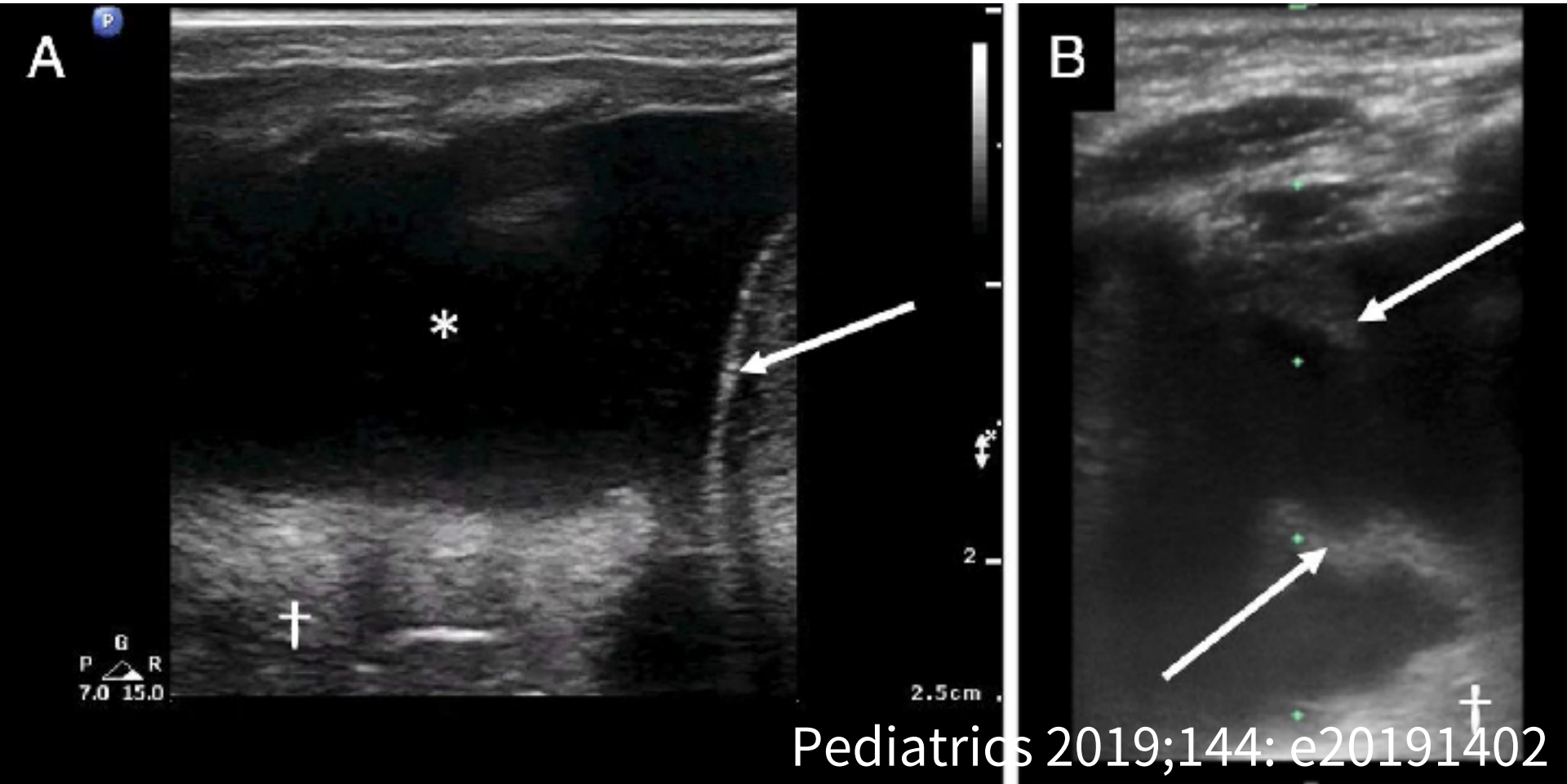
Size

Drain

Pediatrics 2019;144: e20191402

Lung: Pleural effusion

Diagnosis Nature Drainage

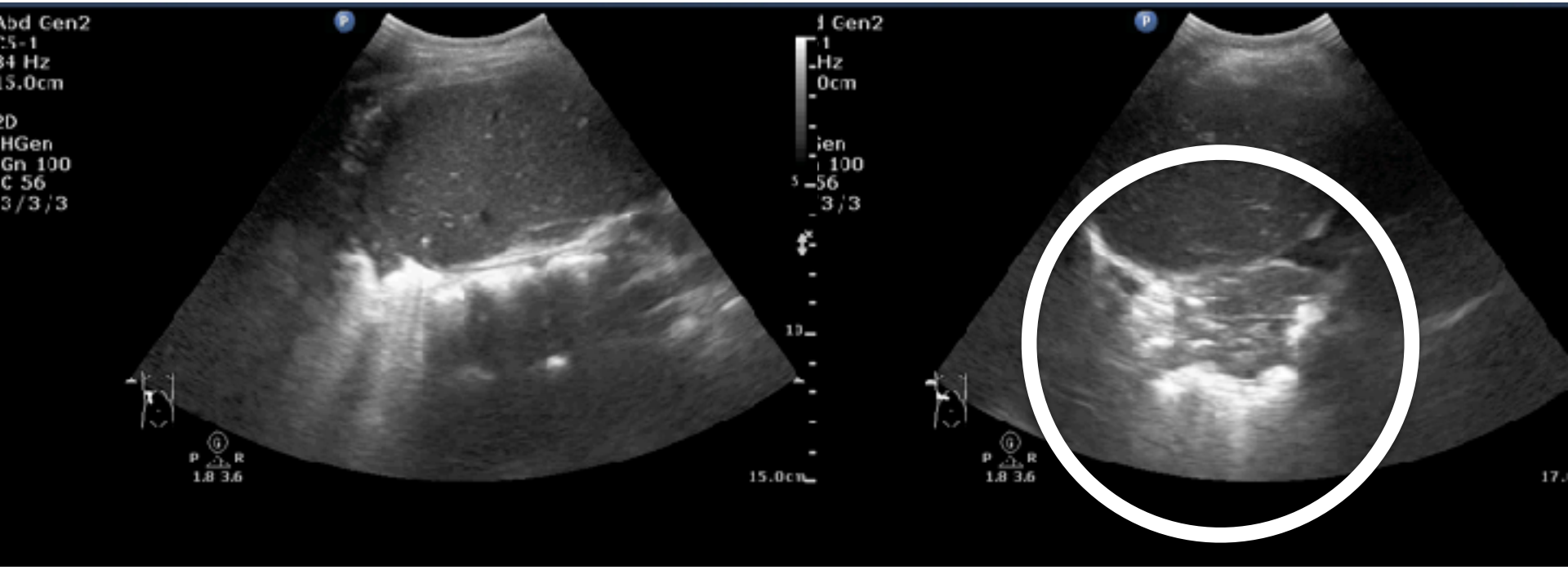


Pediatric ABDOMEN

P	Pyloric stenosis
A	Appendicitis / Adenitis
B	Biliary
D	Diaphragm
O	Intussusception / SBO
M	Moving fluid or gas
E	Ectopic pregnancy
N	Nephropathy

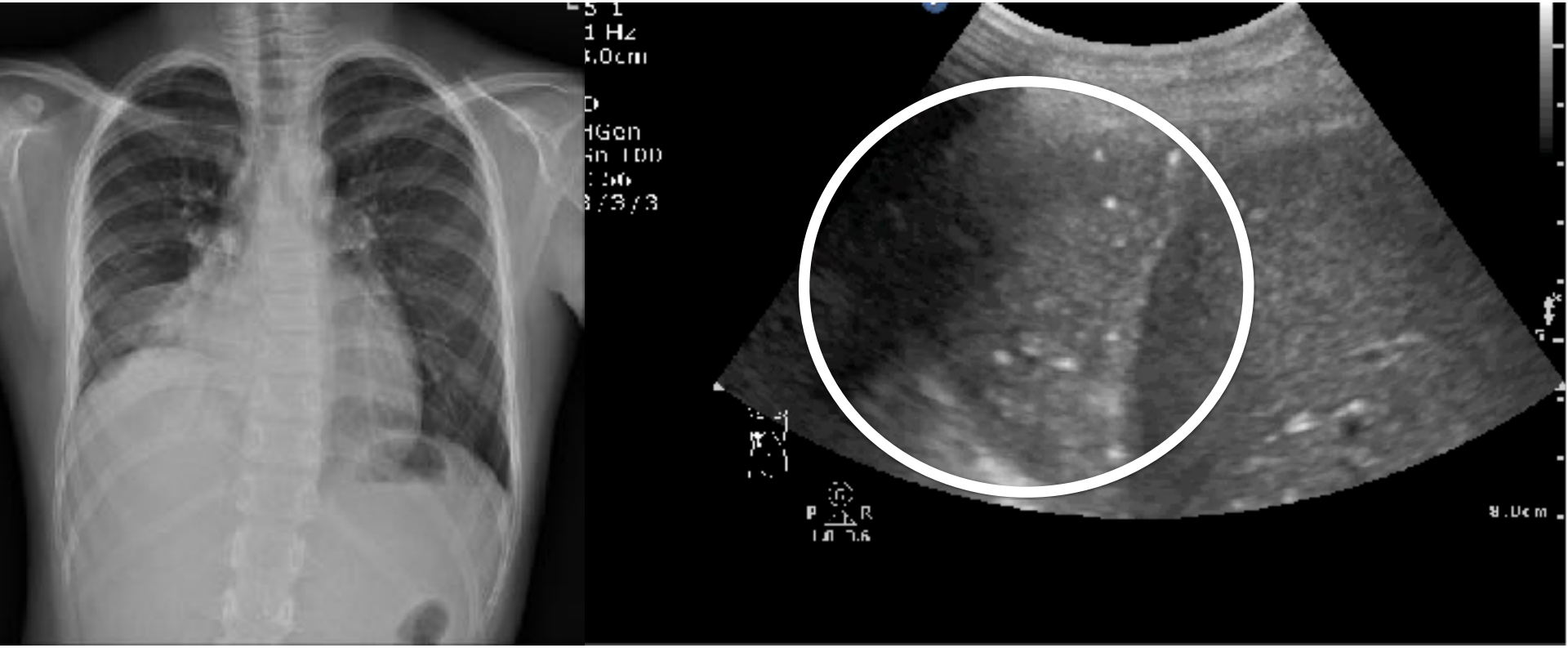
9M, Fever and ABD pain

Diaphragm for outsider



上腹痛一定要將肺炎列入鑑別診斷

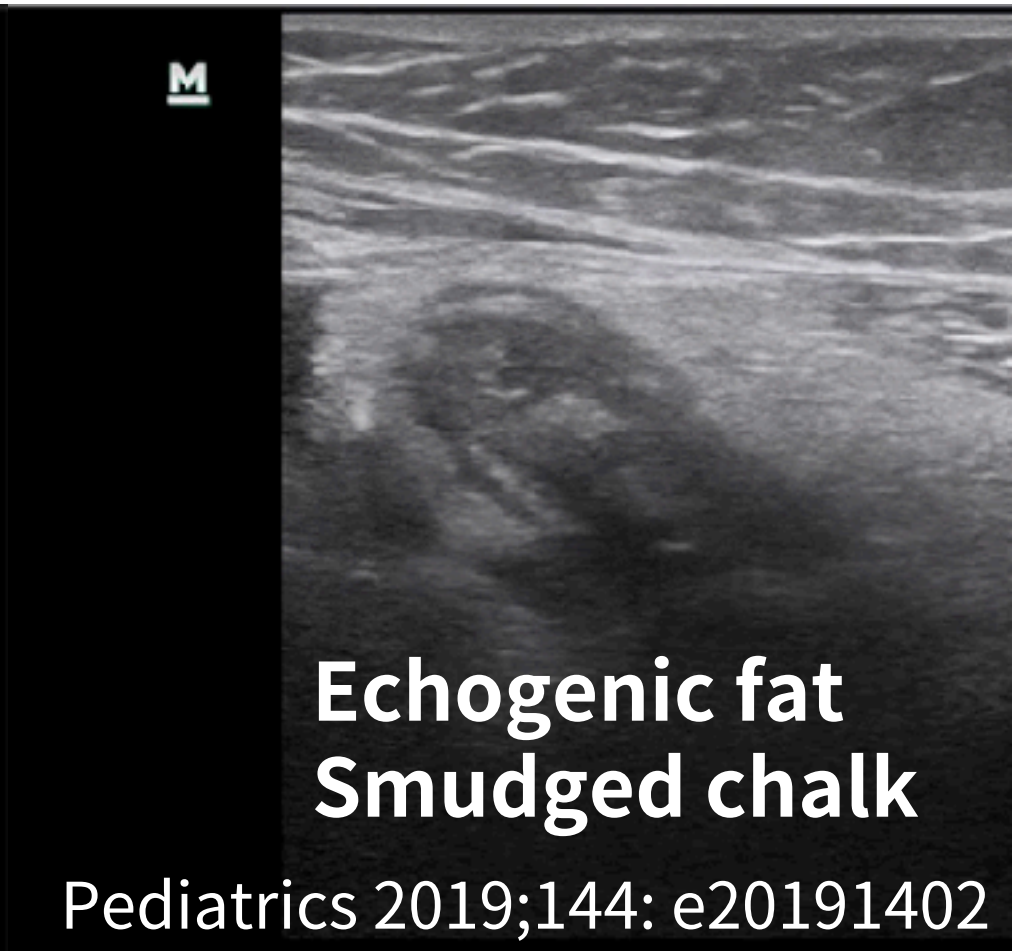
Upper ABD pain consider pneumonia



Abdominal pain

Landmark Linear Compression

Diameter > 6mm

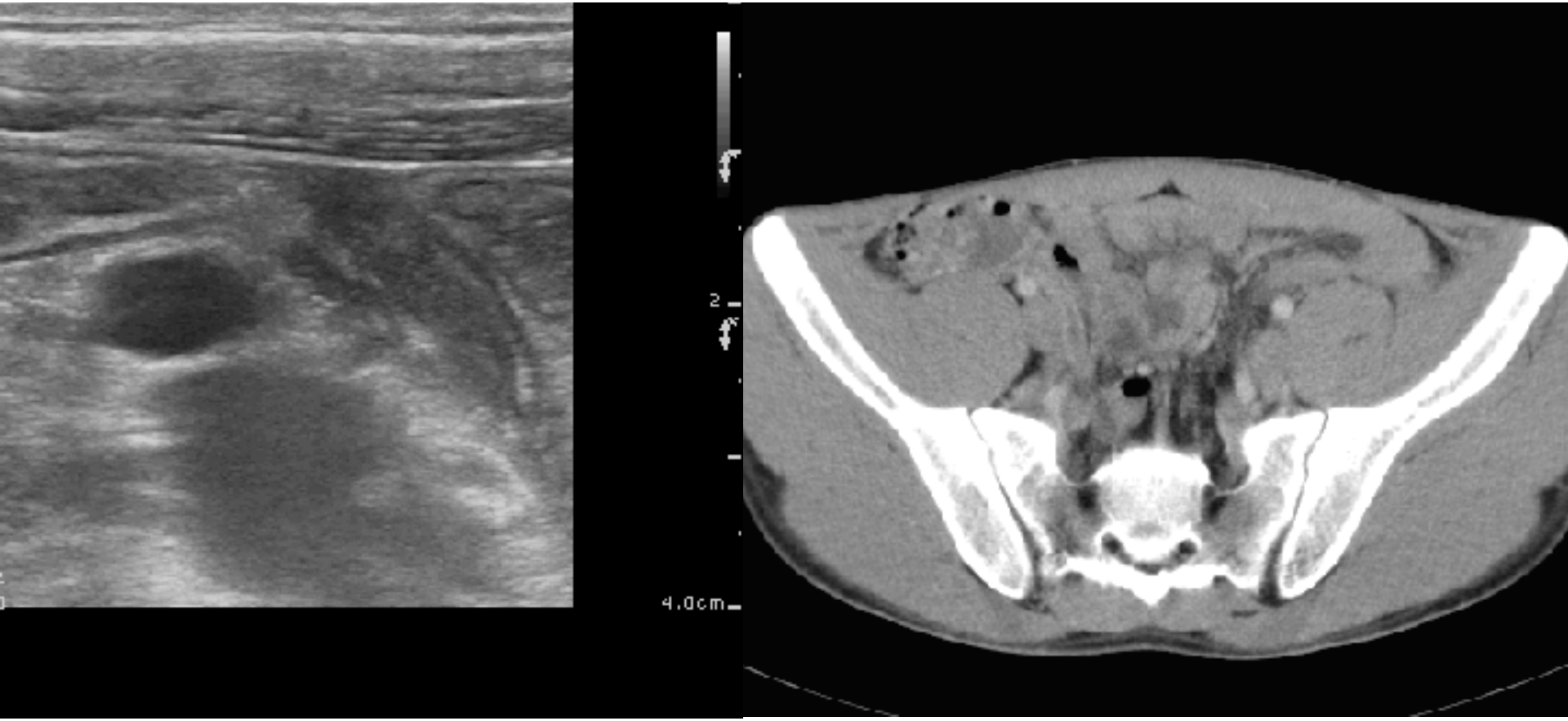


Echogenic fat
Smudged chalk

Pediatrics 2019;144: e20191402

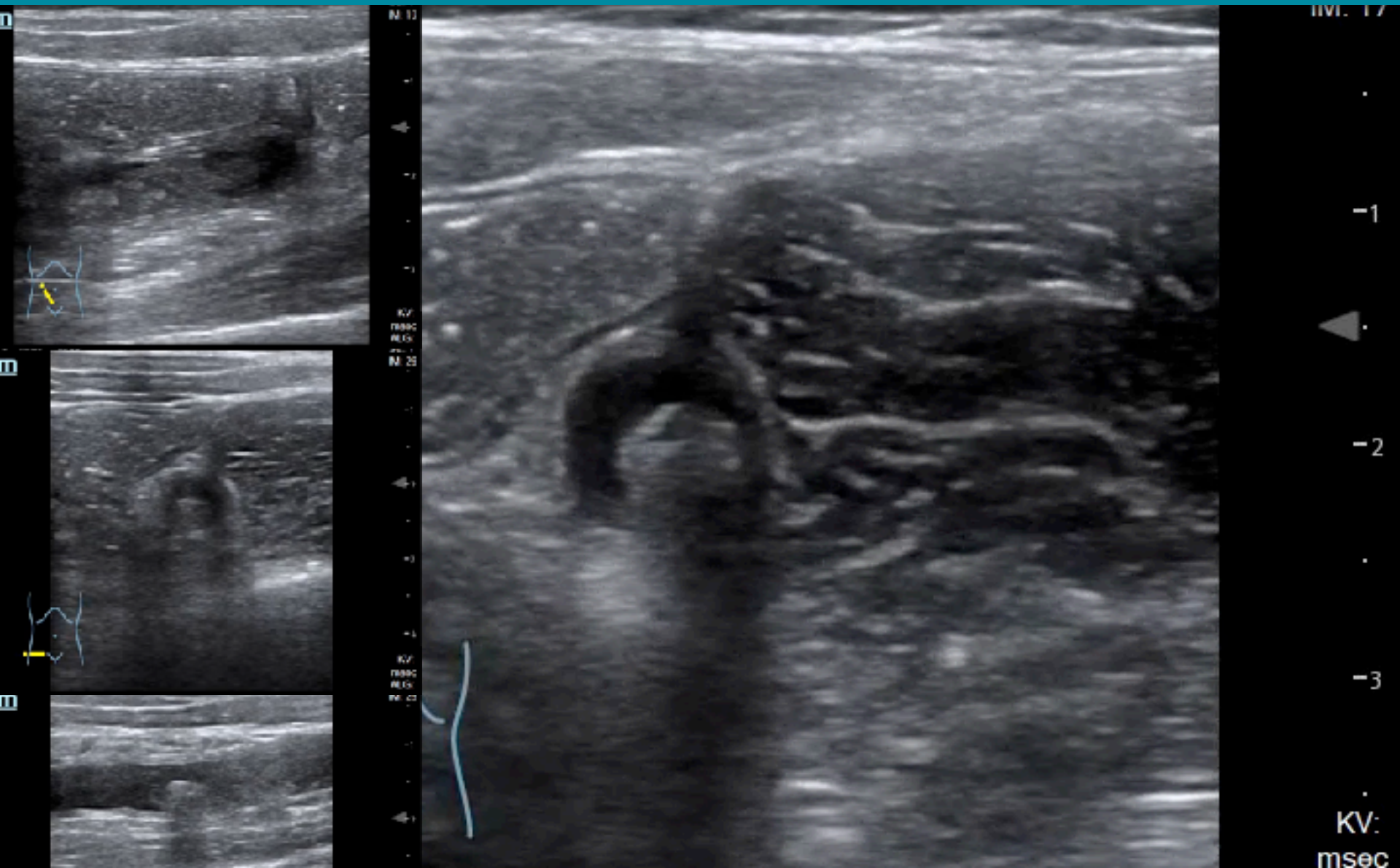
Appendicitis

Landmark Linear Compression

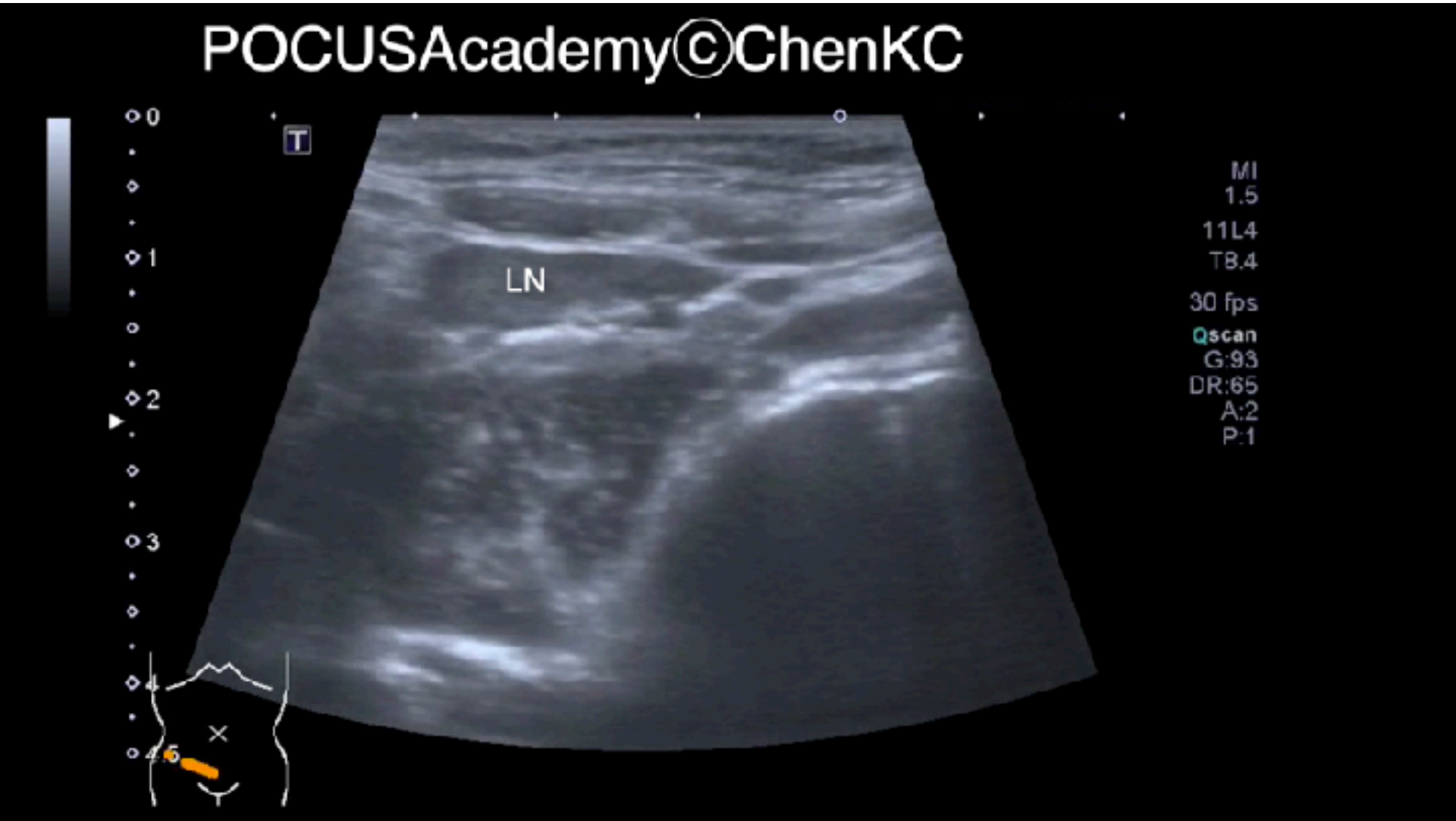


15F, abdominal pain for half day

15F, abdominal pain for half day

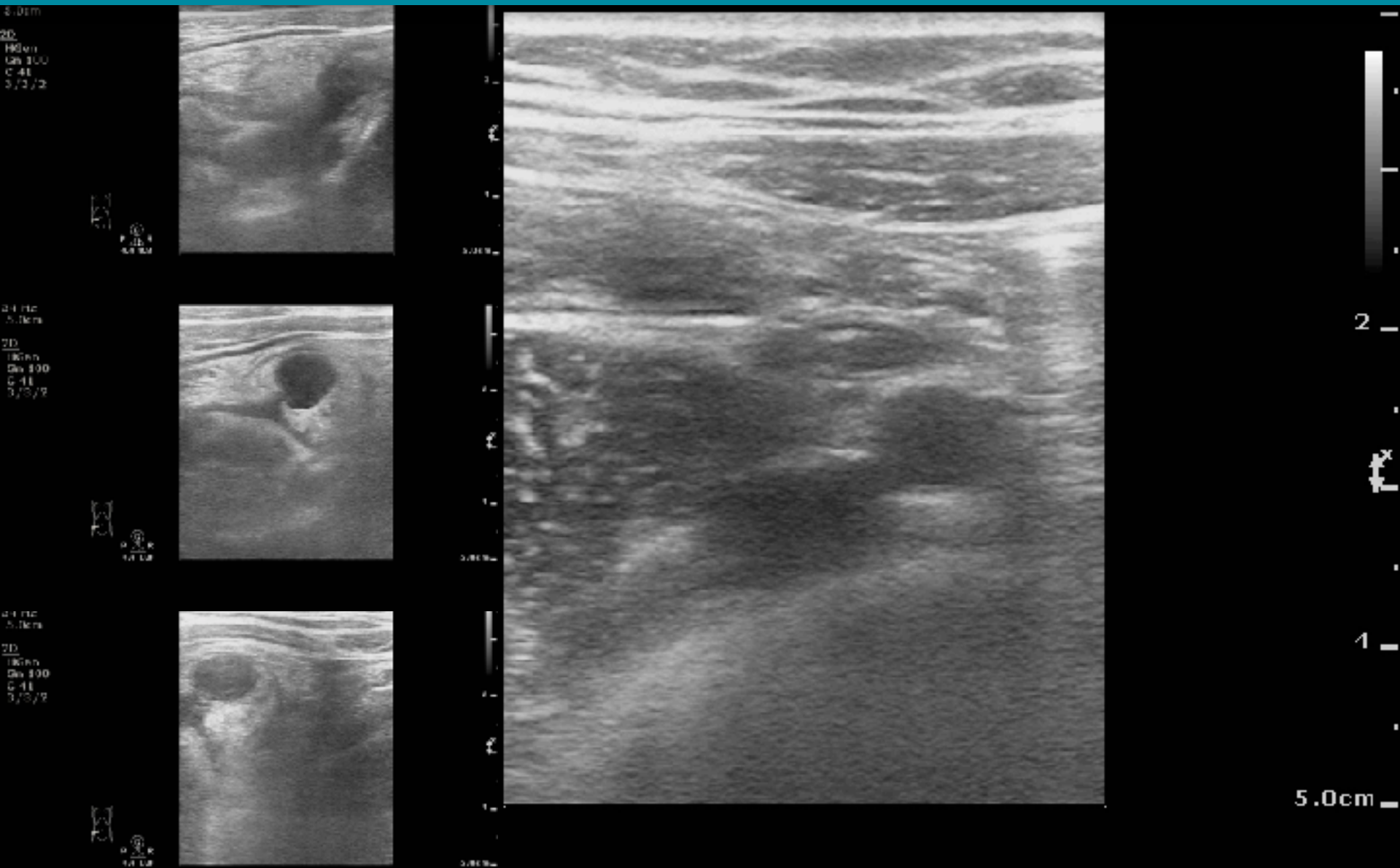


Mesenteric adenitis

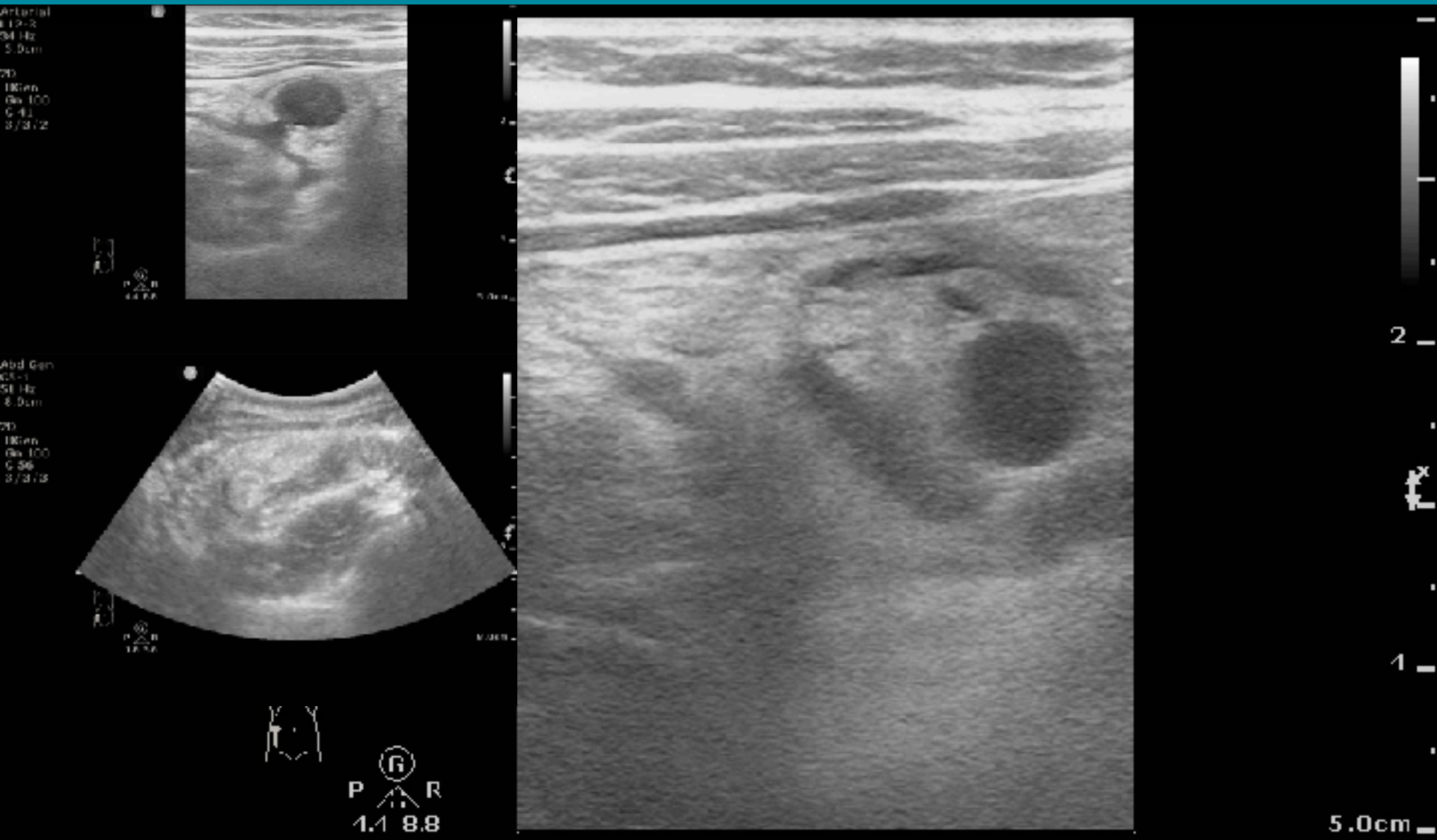


9F, RLQ pain, referred from LMD for appendicitis

9F, RLQ pain, referred from LMD for appendicitis

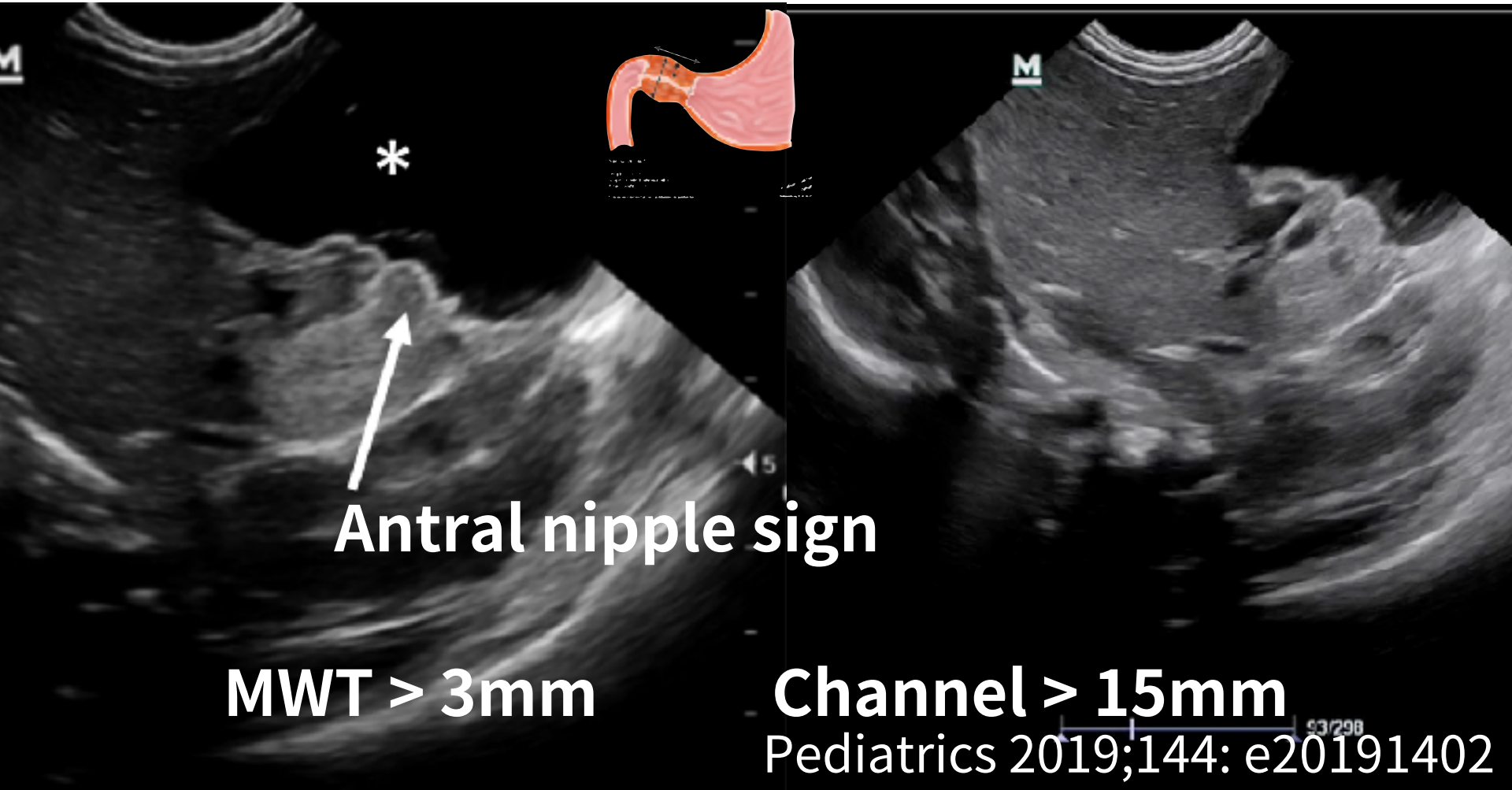


Mesenteric adenitis



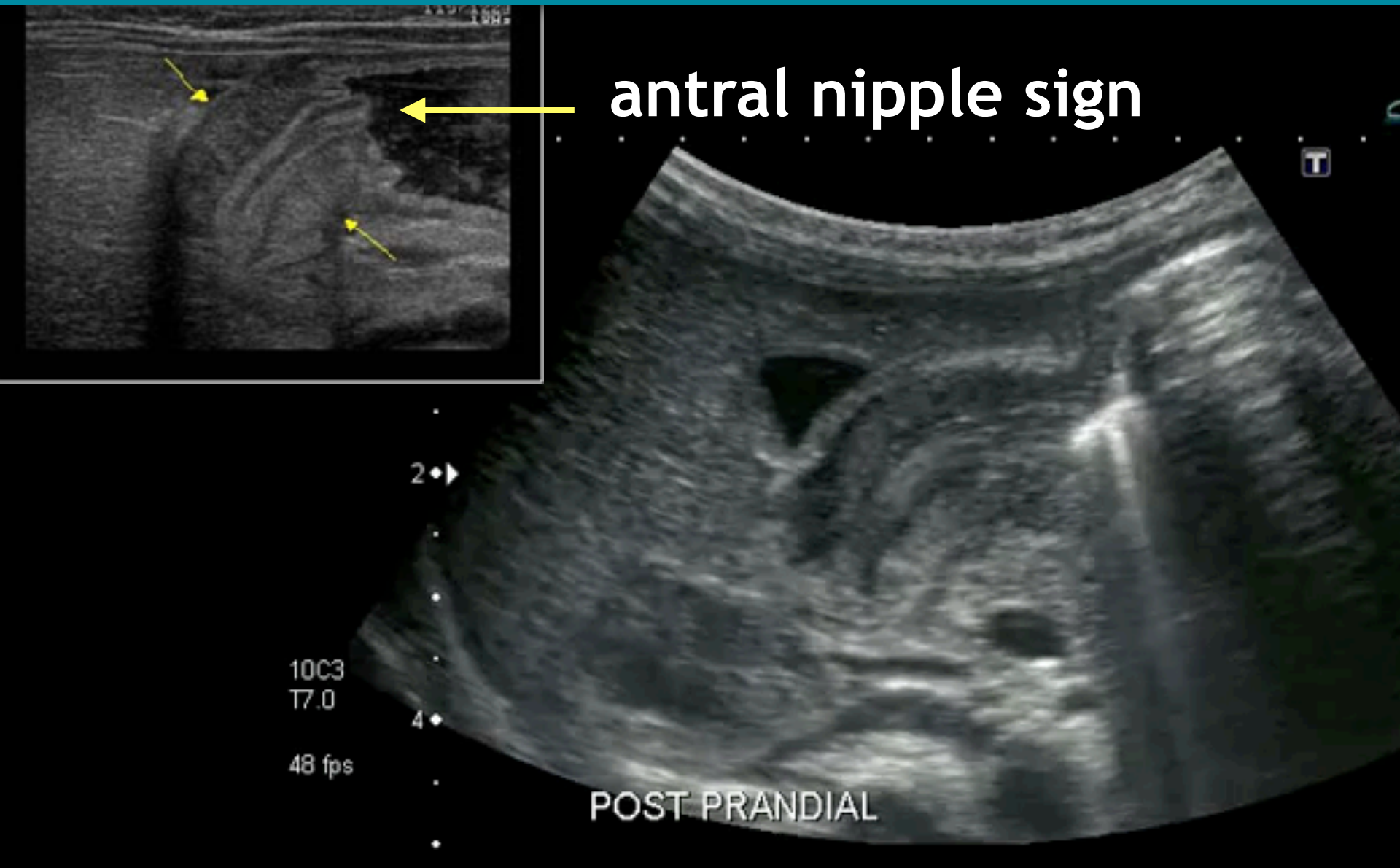
Vomiting

1 ~ 3 m ; nonbilious vomiting

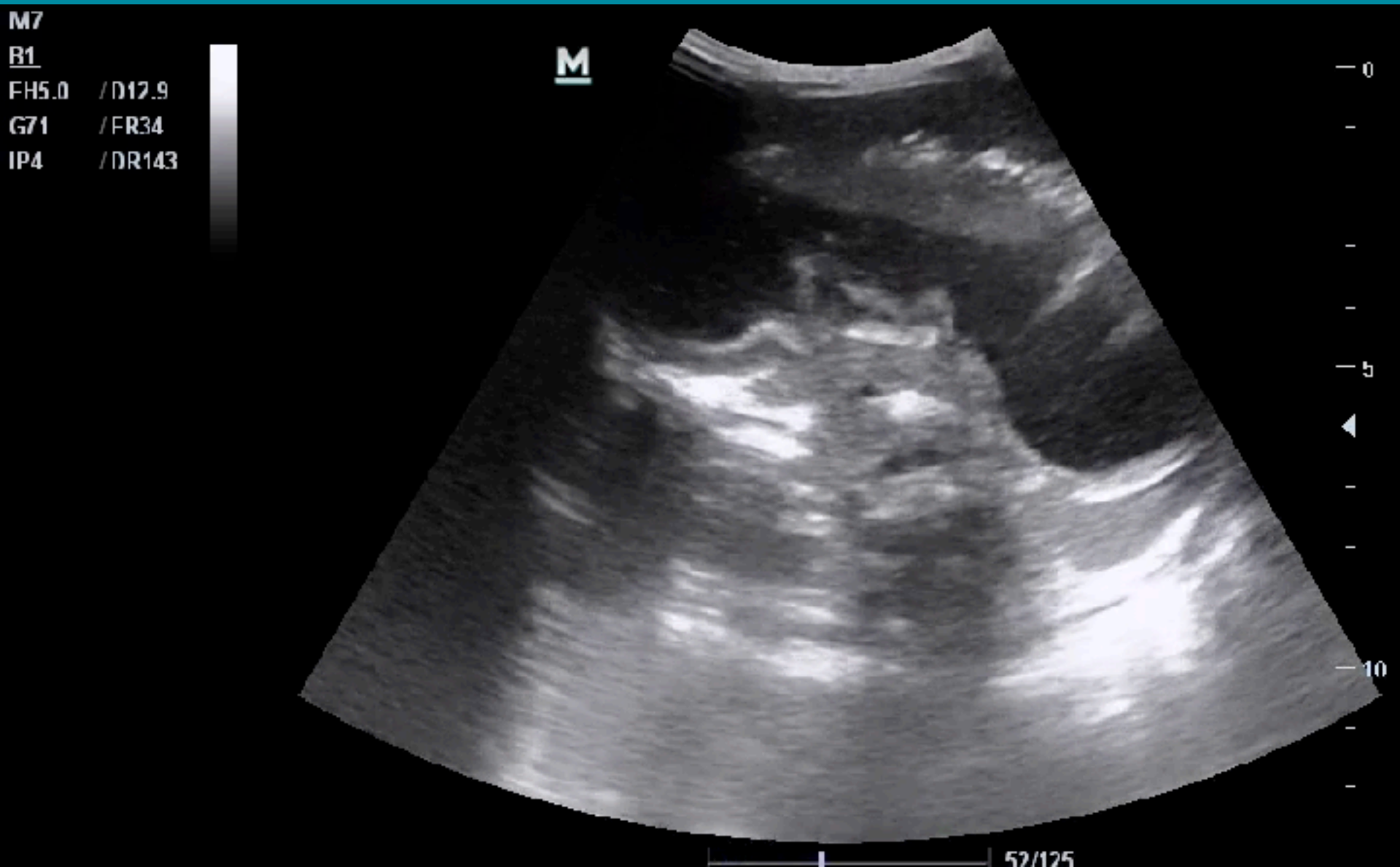


Pediatrics 2019;144: e20191402

Pyloric stenosis



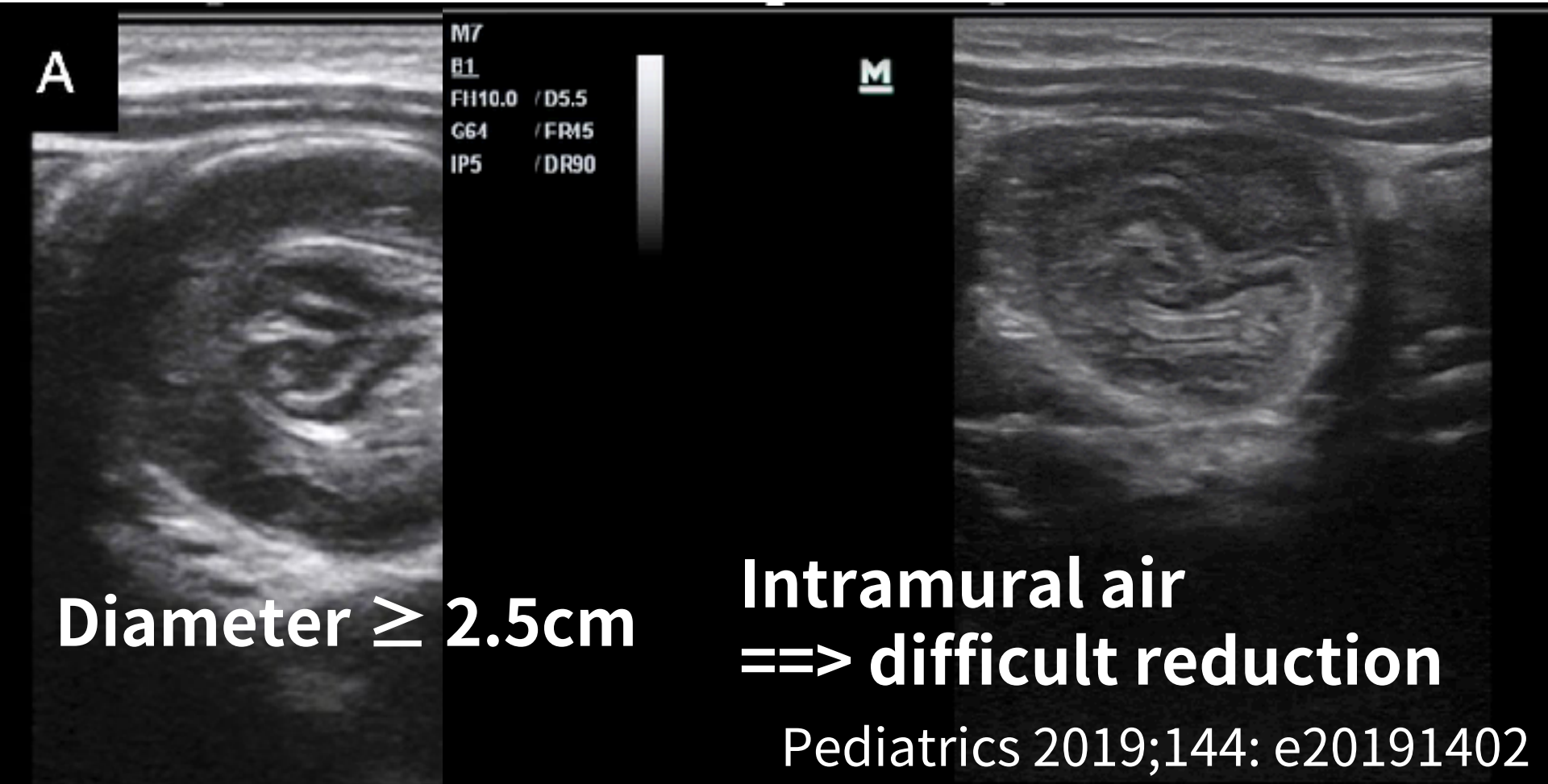
2 m/o vomiting for 1 mo



2 m/o vomiting for 1 mo

Vomiting

High suspicion; Periodic pattern



Diameter ≧ 2.5cm

Intramural air
==> difficult reduction

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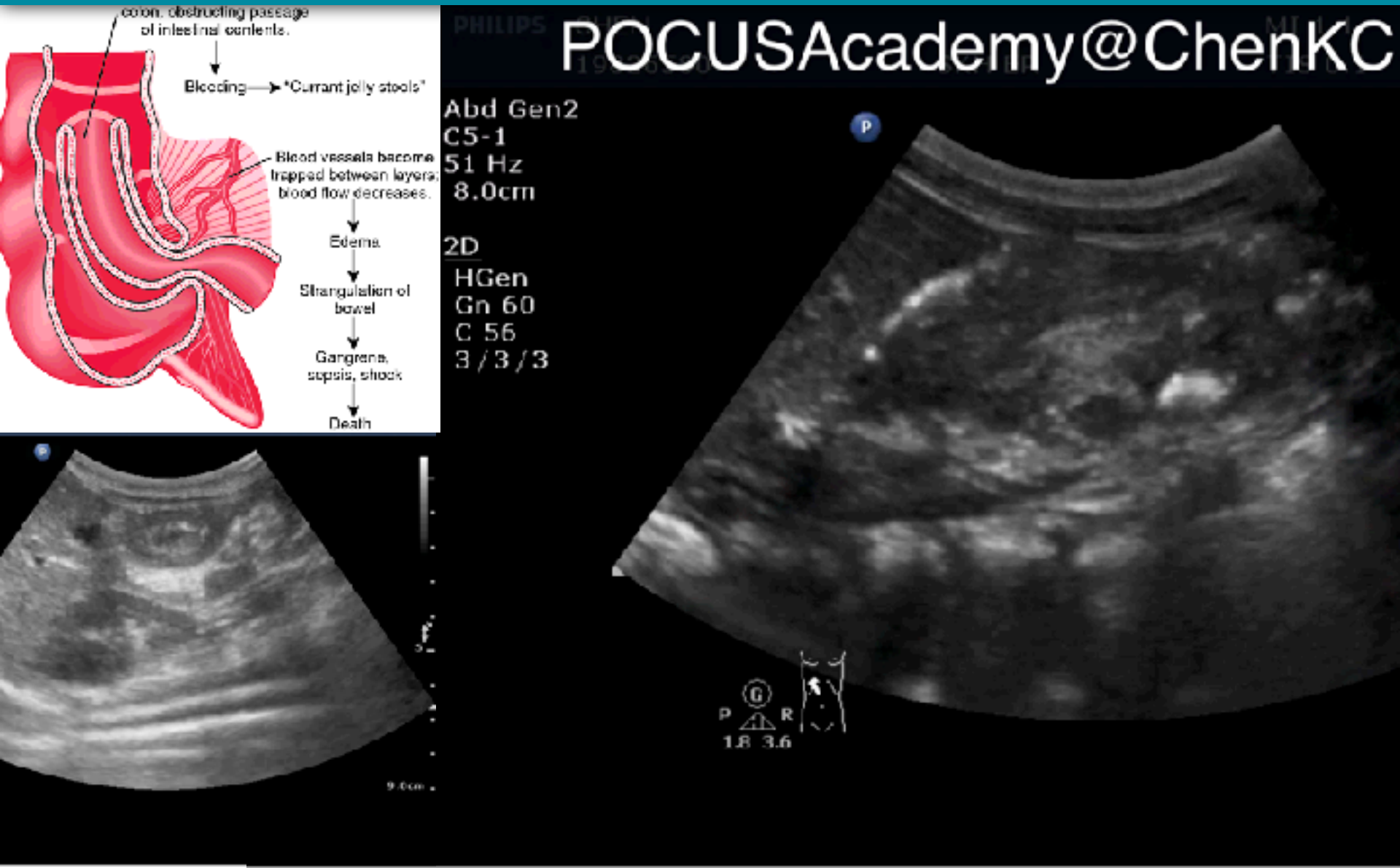
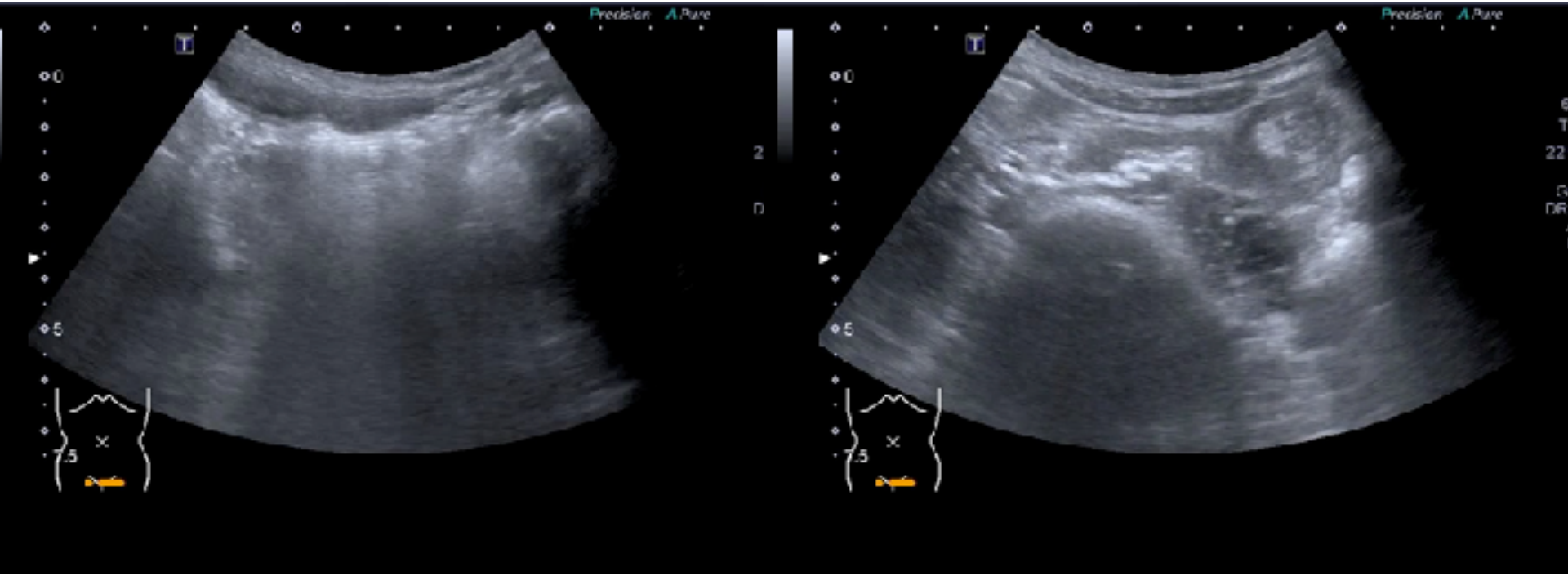
Intussusception



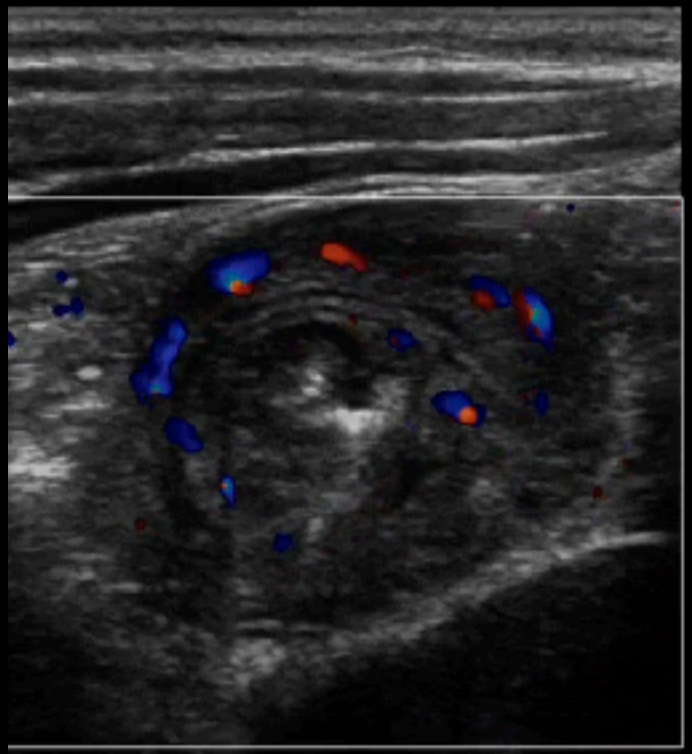
7F, severe ABD pain & sweating, subsided now

Small bowel intussusception w/ Spontaneous reduction



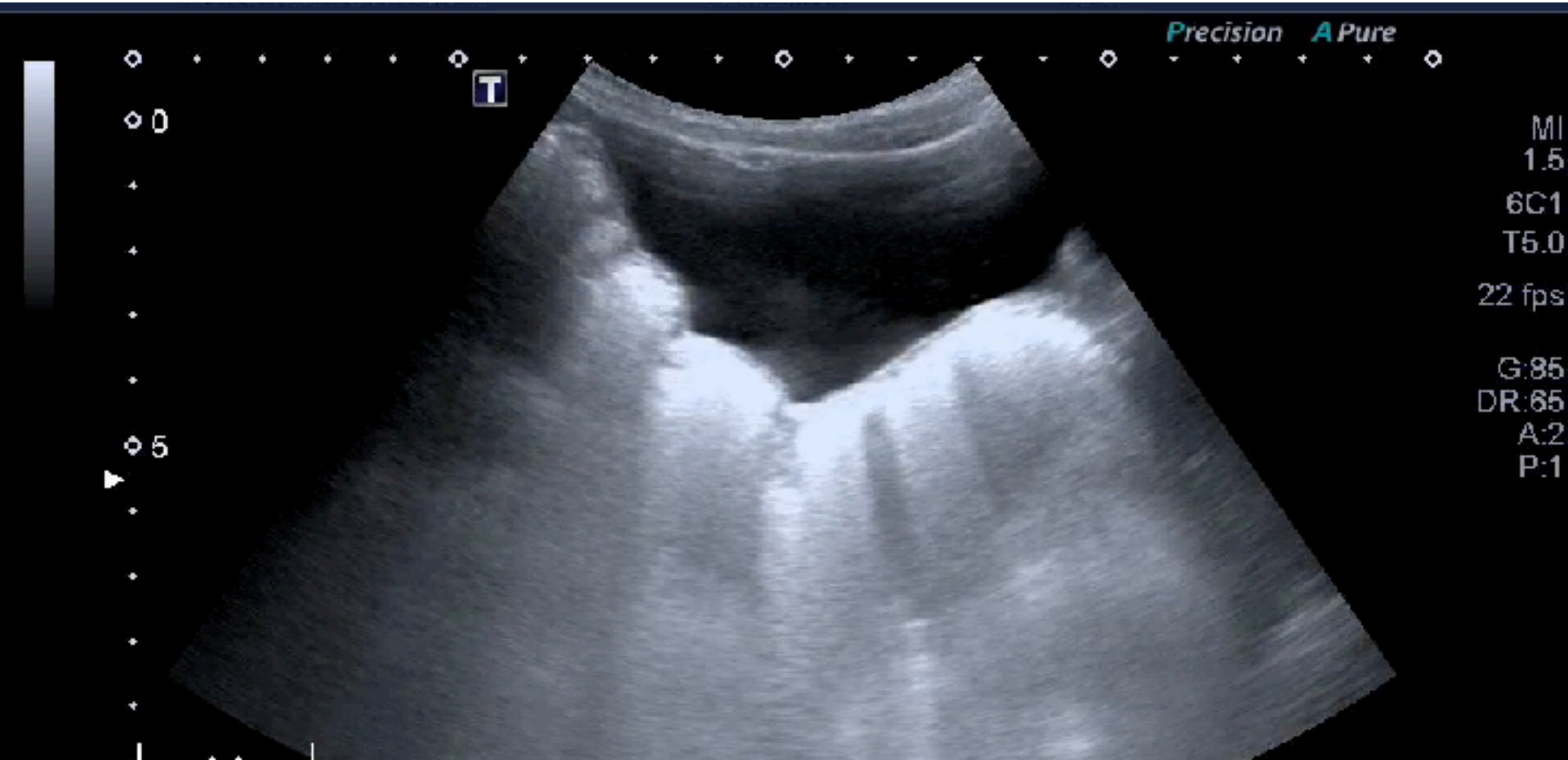
5M, intermittent abdominal pain for 2-3 days

Intussusception



5M, abdominal pain for one hour

Stool impaction



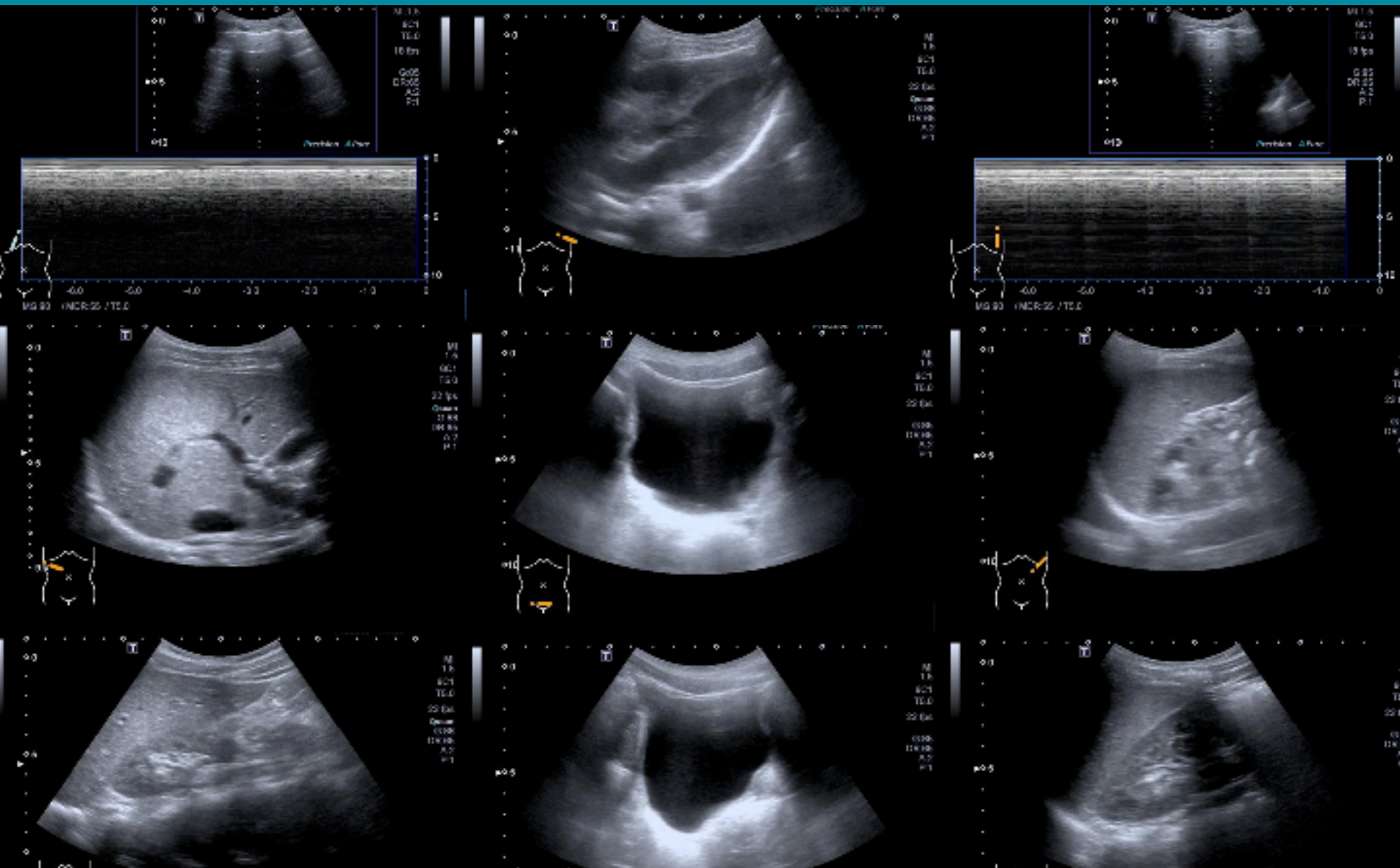
Trauma

Up to 30% pediatric solid organ injury
—no free fluid on FAST

Children with hemoperitoneum
—most managed non operatively

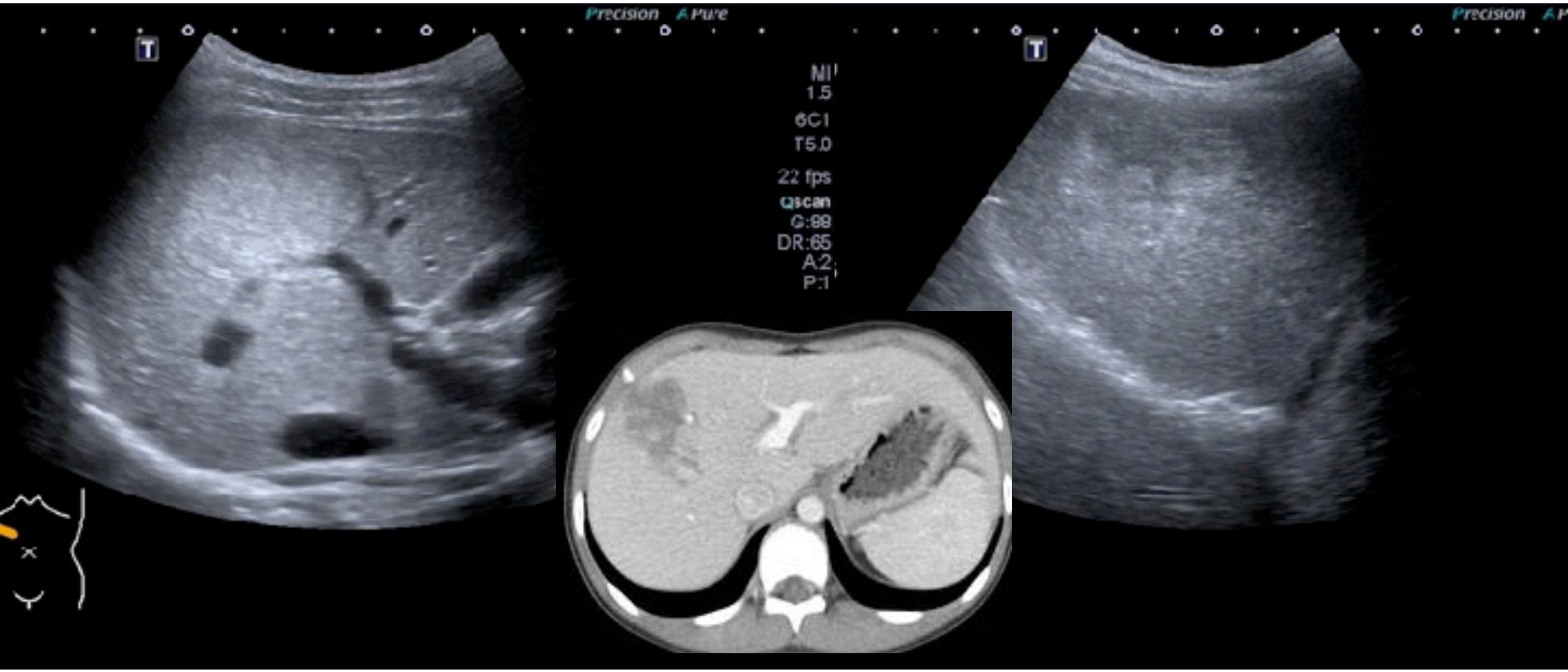
Lung / Heart / Procedure
Find bleeder in unstable & multiple injuries
Dynamic or Serial FAST for BAT
CEUS: Contrast-enhanced US

10/M, Traffic accident with RUQ pain



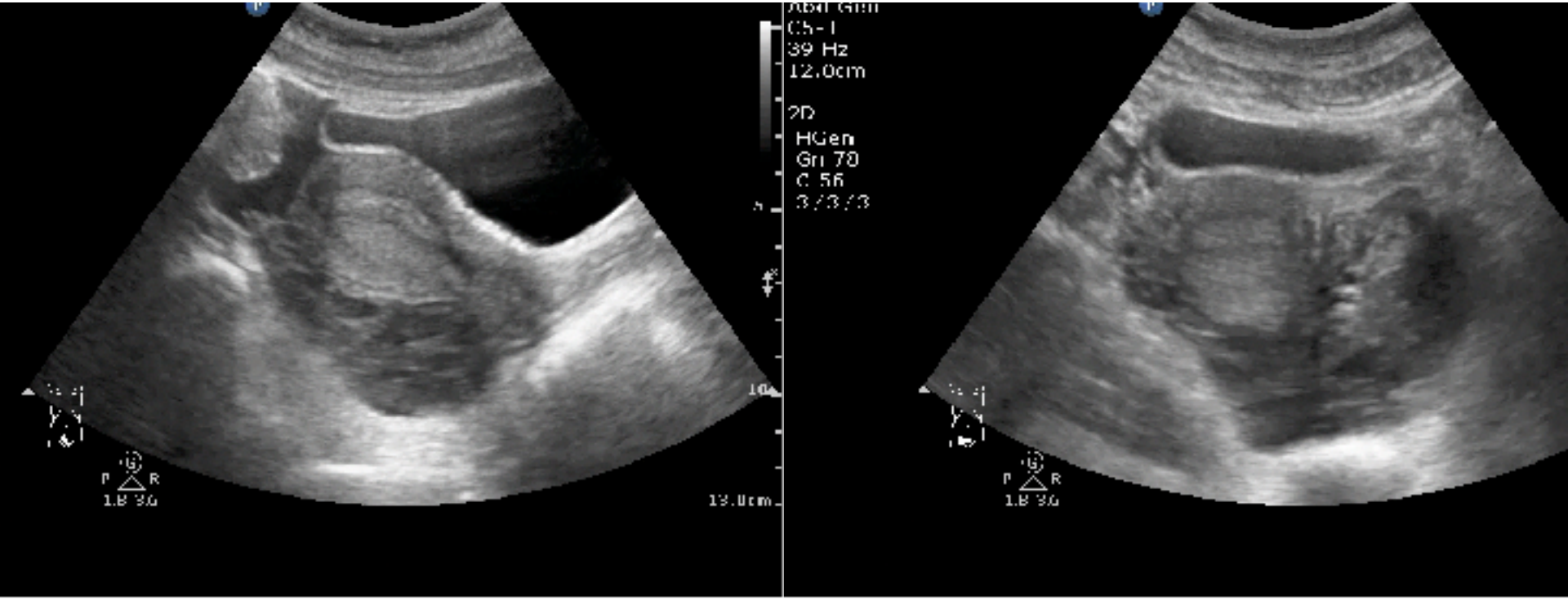
10/M, Traffic accident with RUQ pain

EFAST focused on Free things

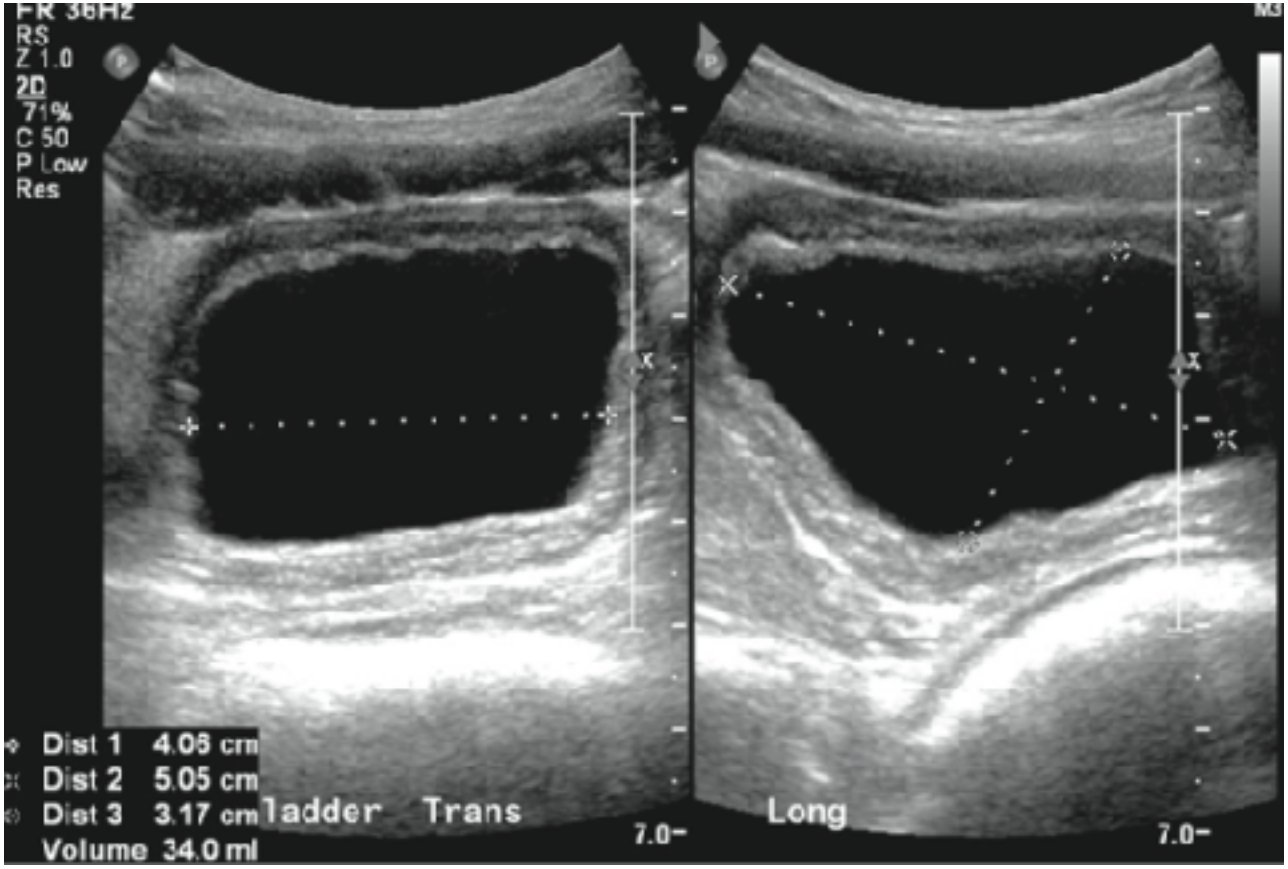


14F, acute lower ABD pain w/ cold sweating

FAST for moving fluid



Before the catheter

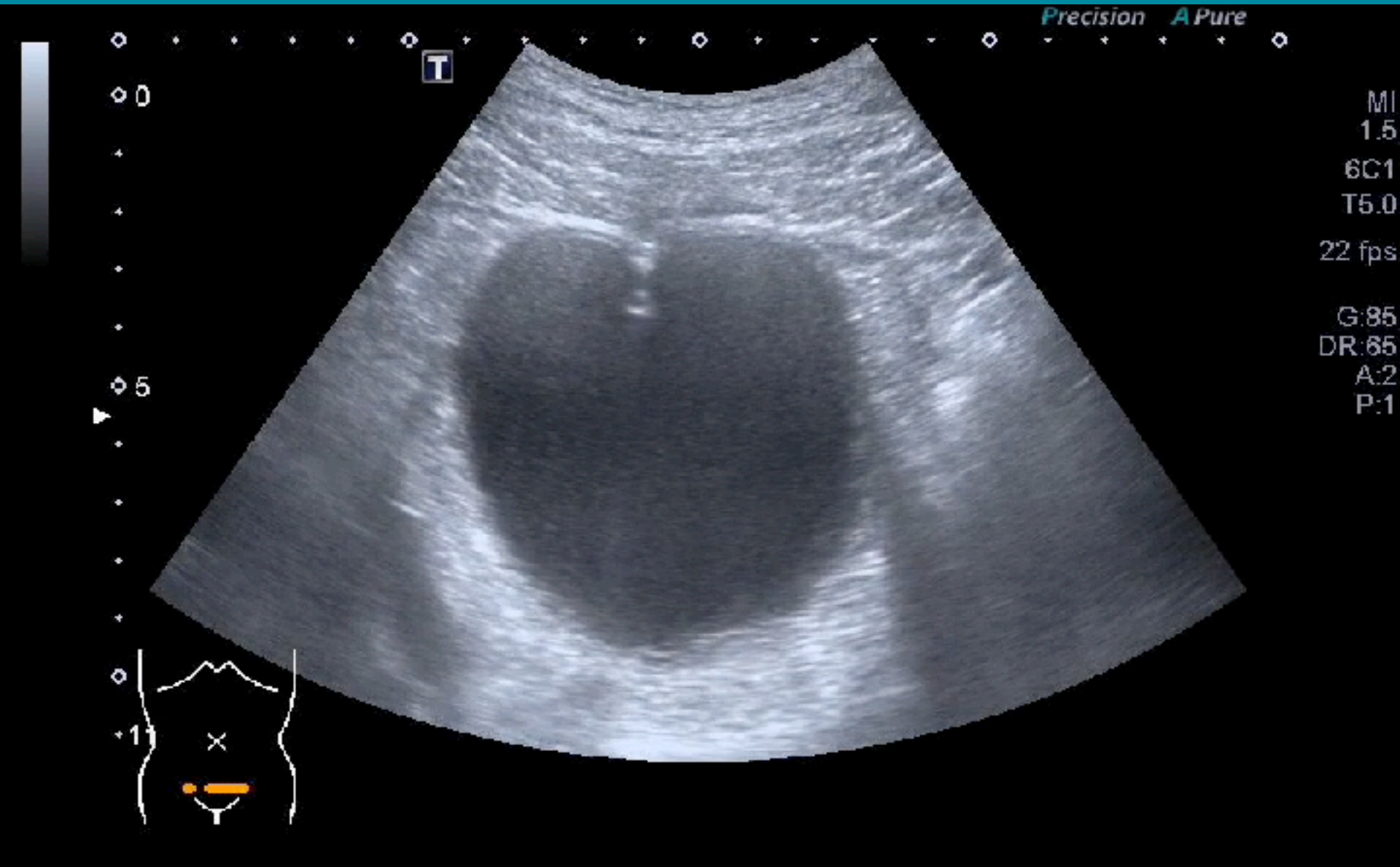


Transverse diameter ≥2 cm

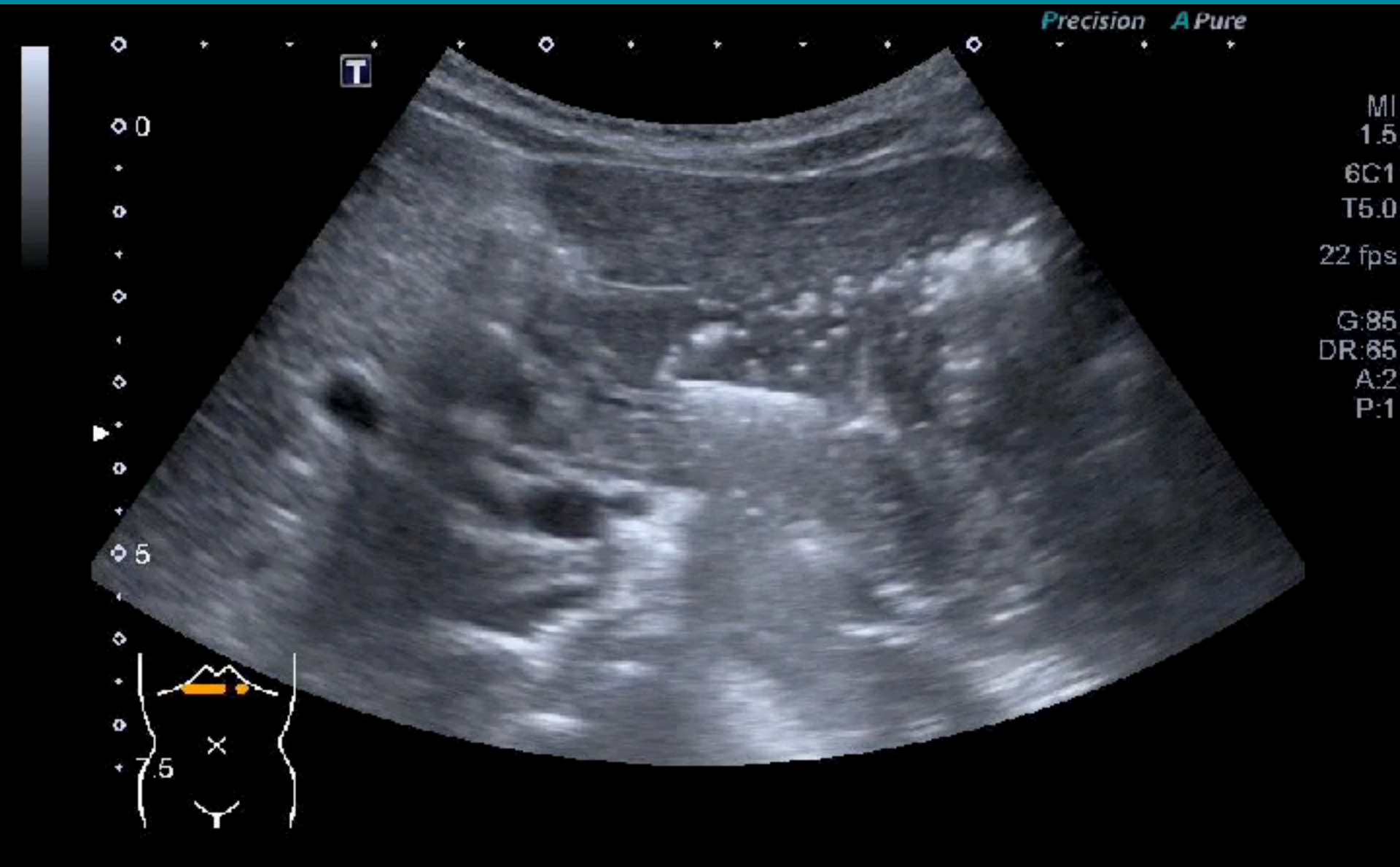
~ bladder volume ≥ 2.5 cm3

Witt et al. AEM 2005

Suprapubic aspiration



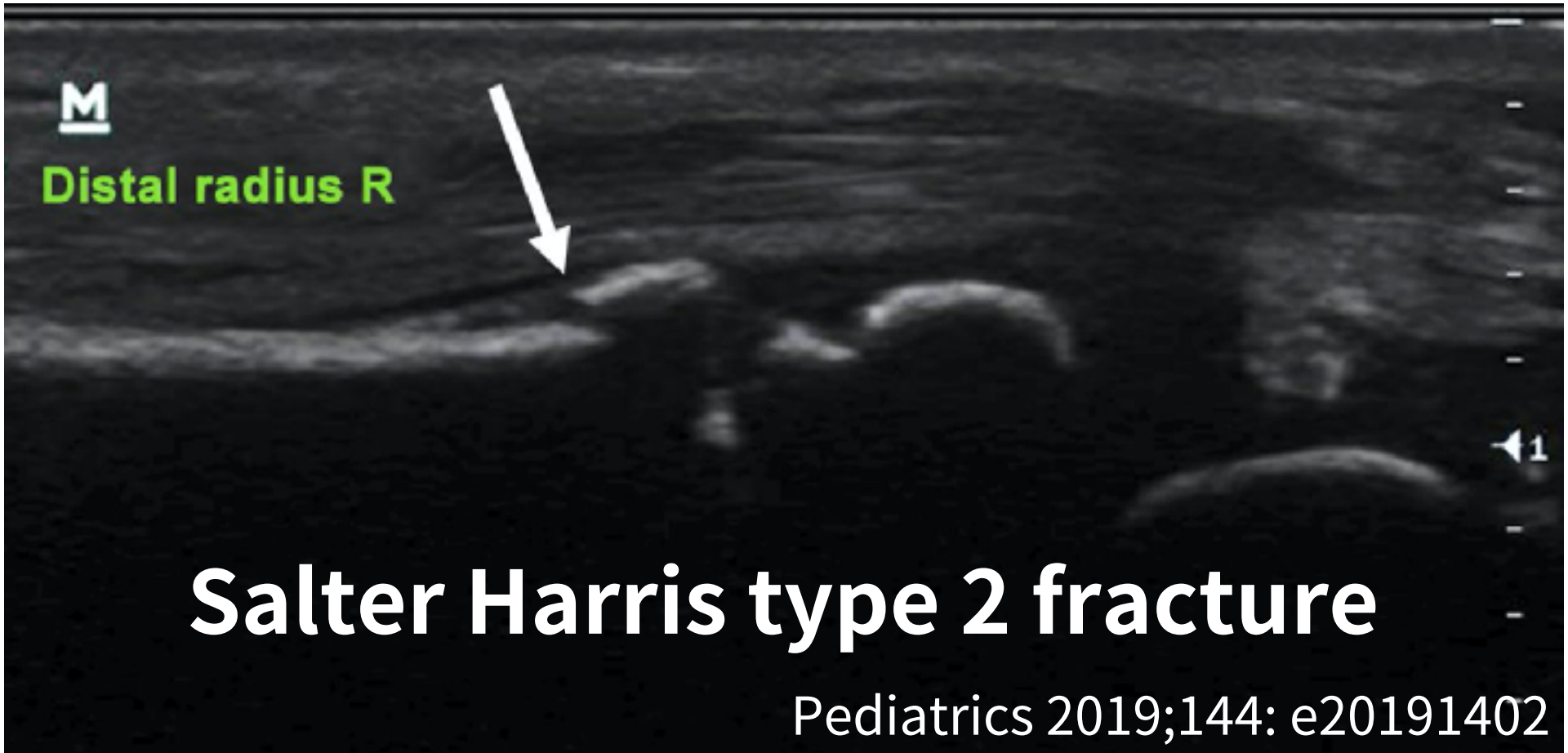
2F, Swallow coin



Coin in stomach

Soft tissue & MSK

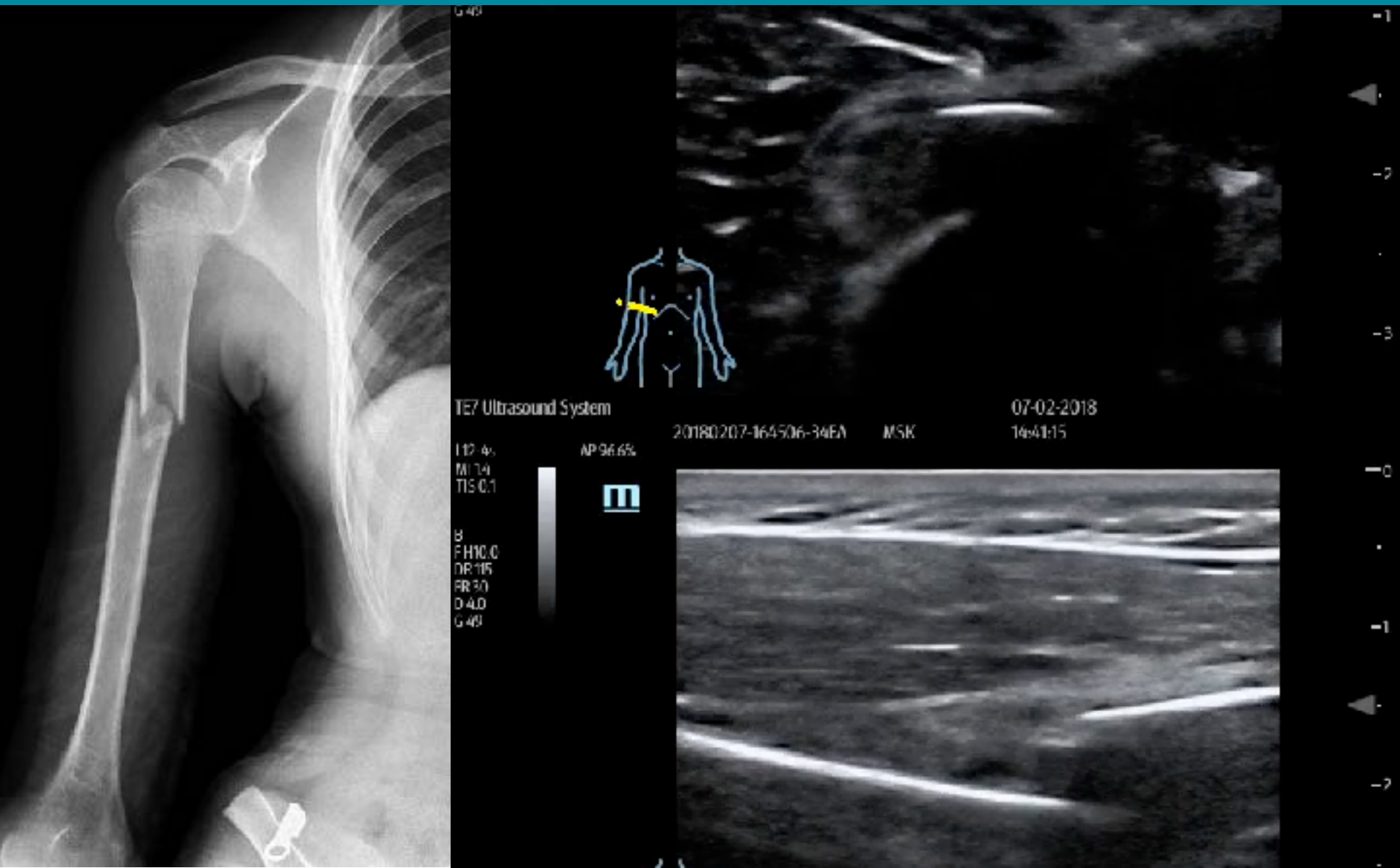
Fracture / Reduction / Effusion



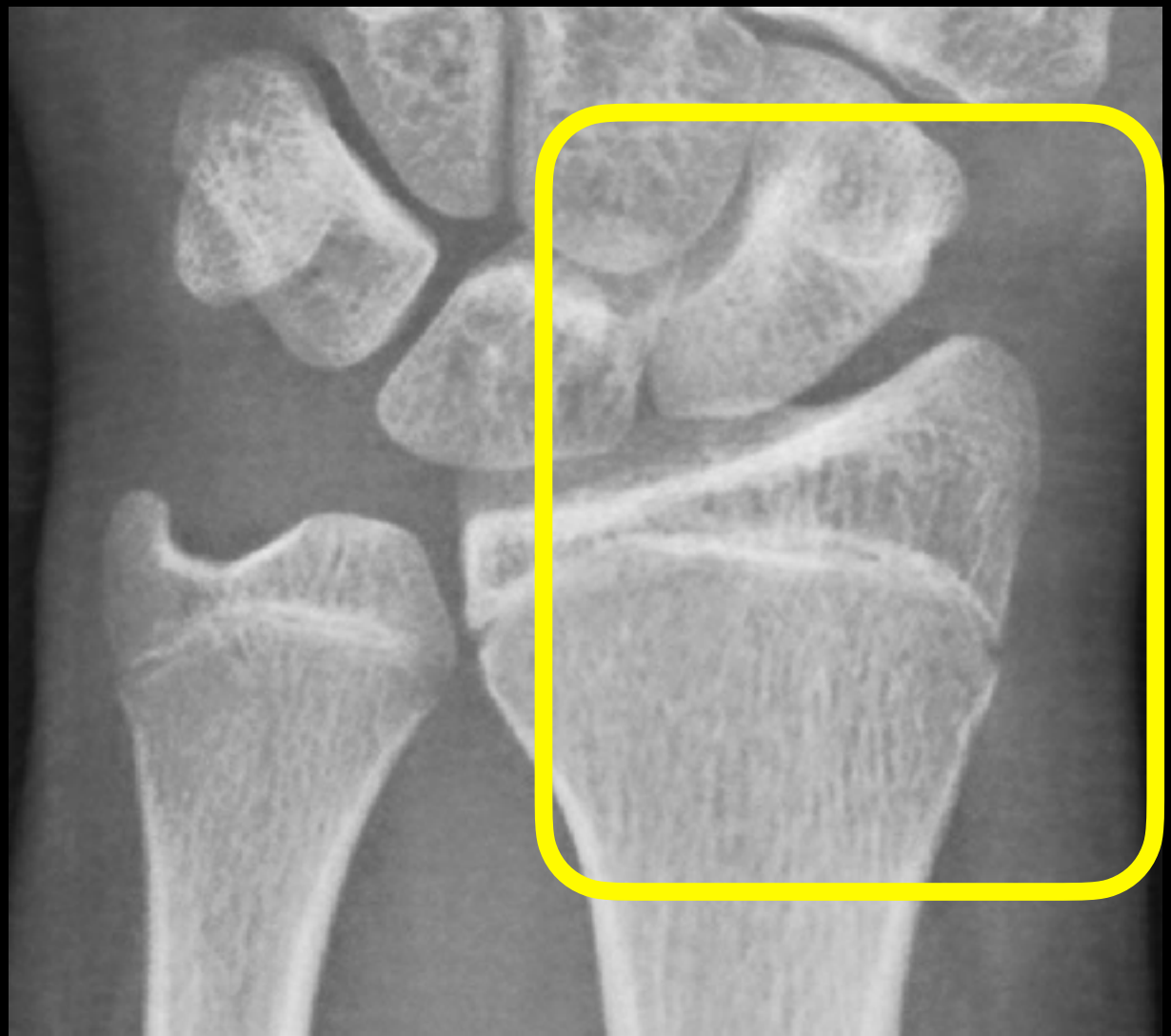
Salter Harris type 2 fracture

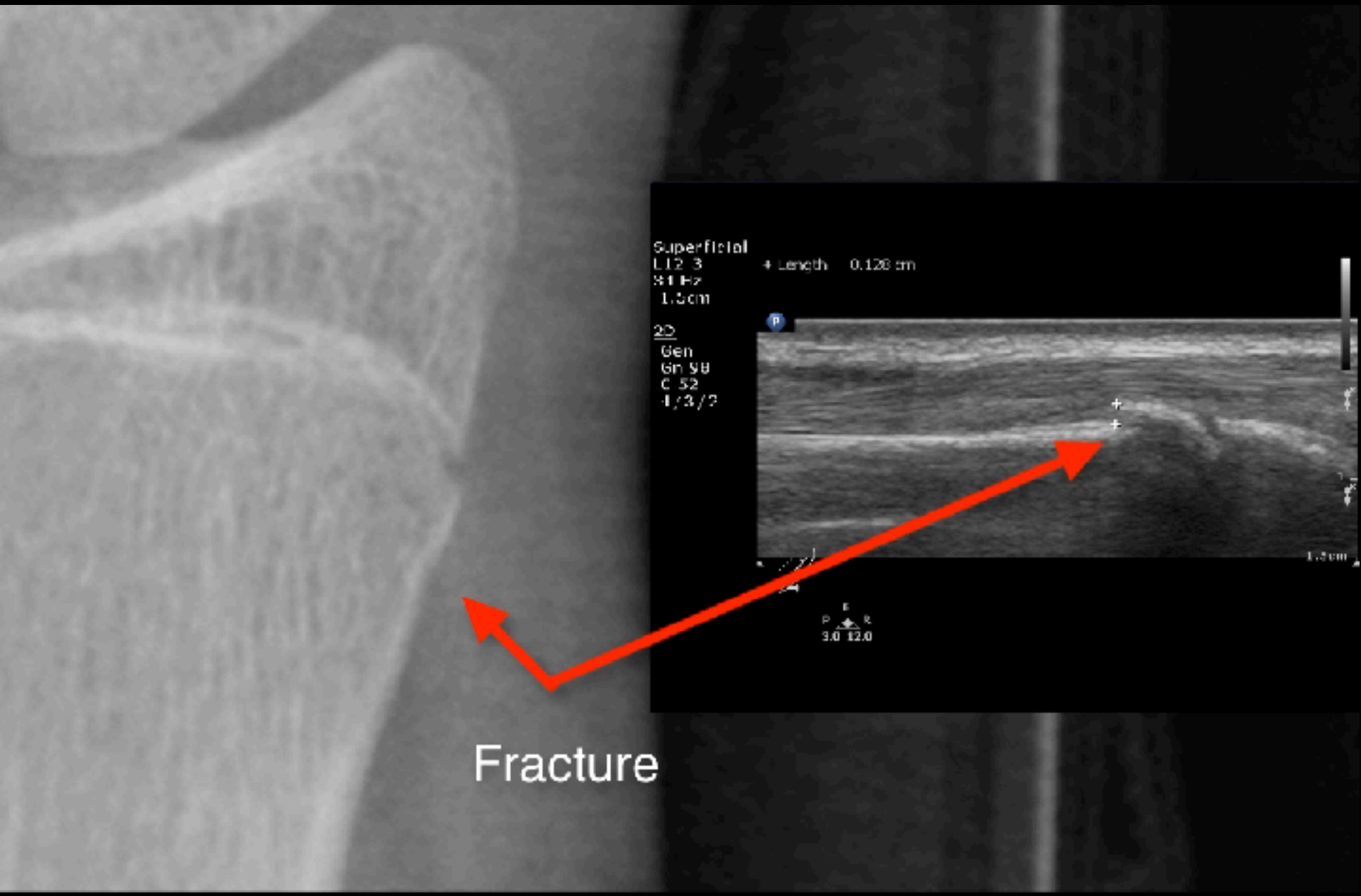
Pediatrics 2019;144: e20191402

Humeral fracture



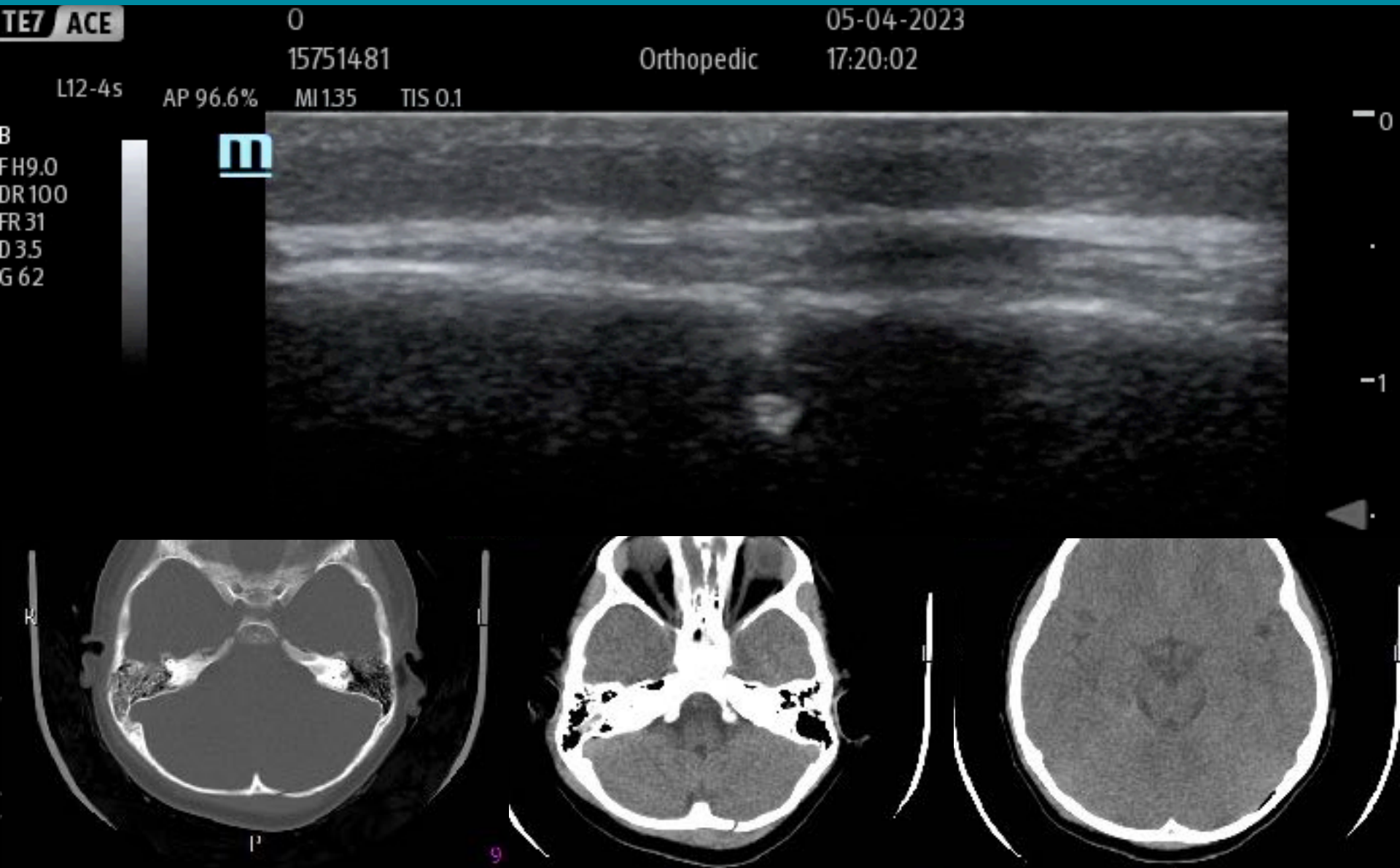
15M with left wrist pain

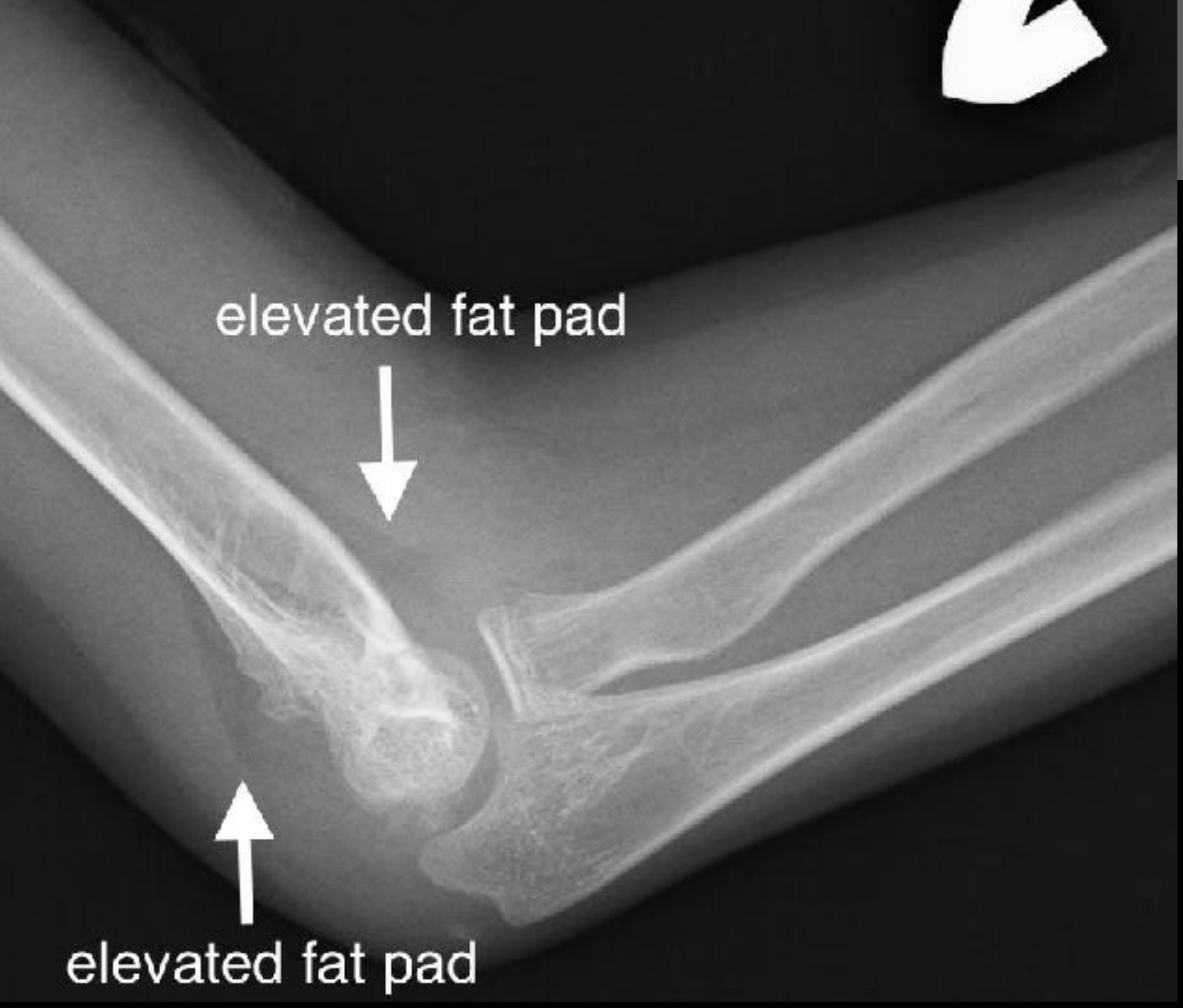


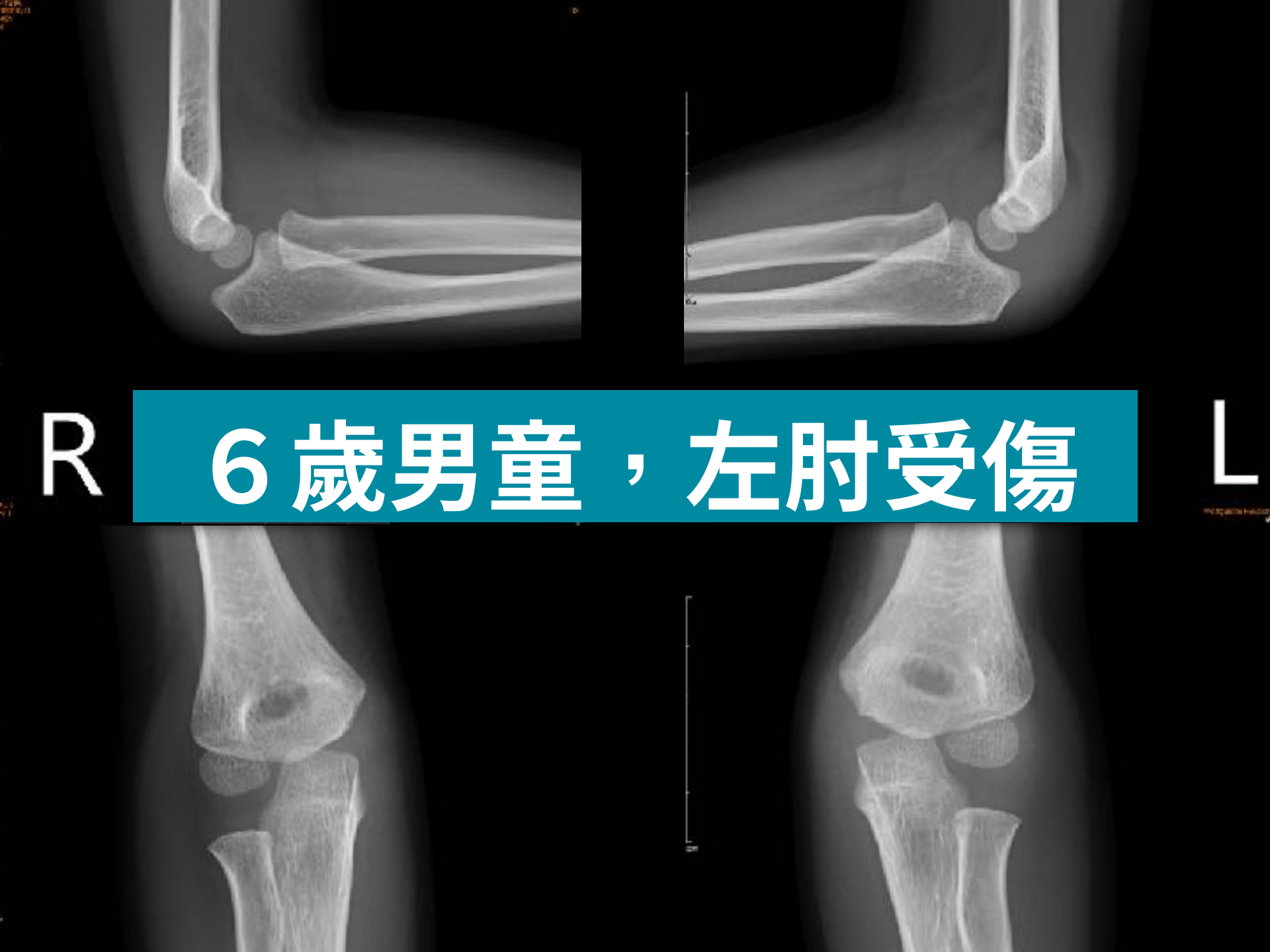


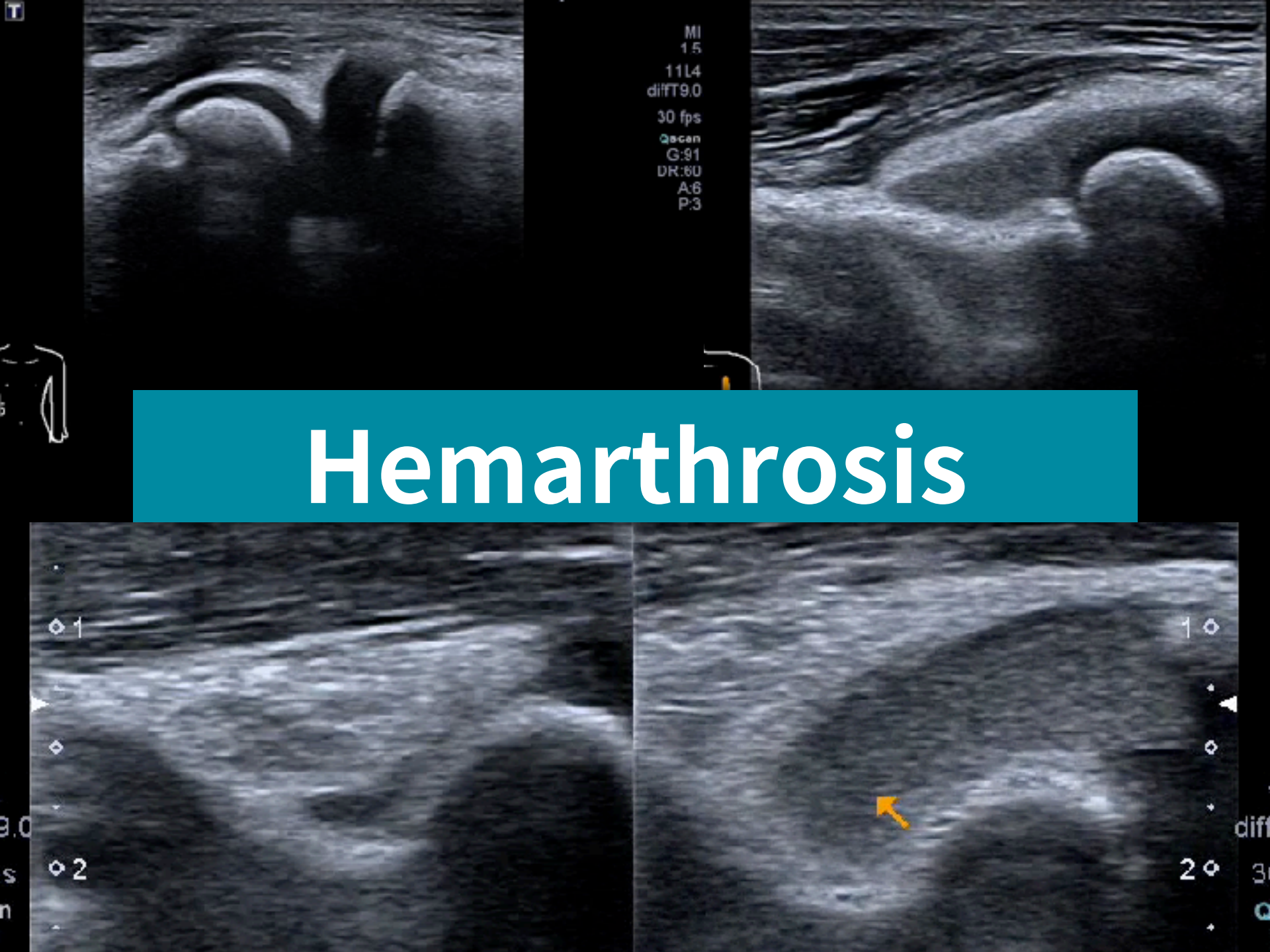
Fracture

4F, TA, AMS

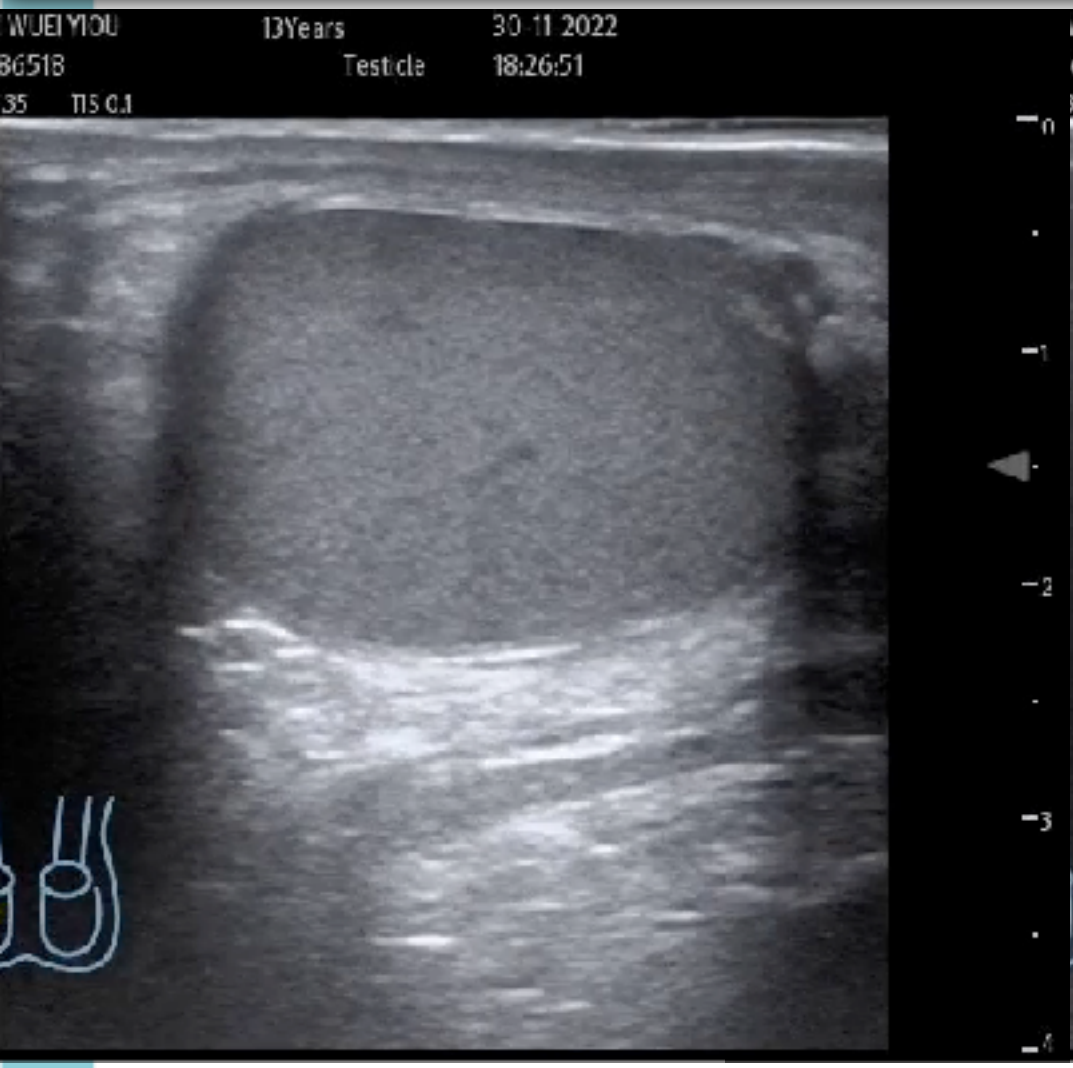

TE7 ACE
0
15751481
Orthopedic
05-04-2023
17:20:02
L12-4s
AP 96.6%
MI 1.35
TIS 0.1
B
F H9.0
DR 100
FR 31
D 3.5
G 62
0
-1

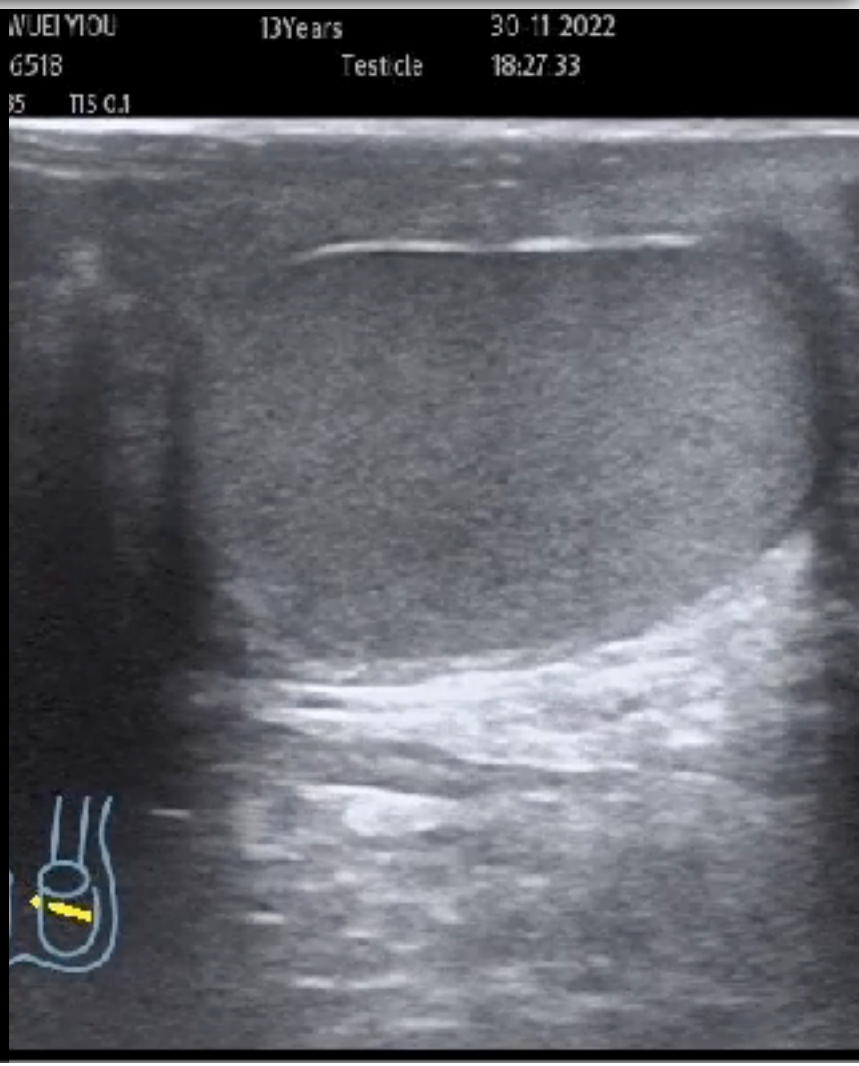

elevated fat pad
elevated fat pad


R
6歲男童，左肘受傷
L

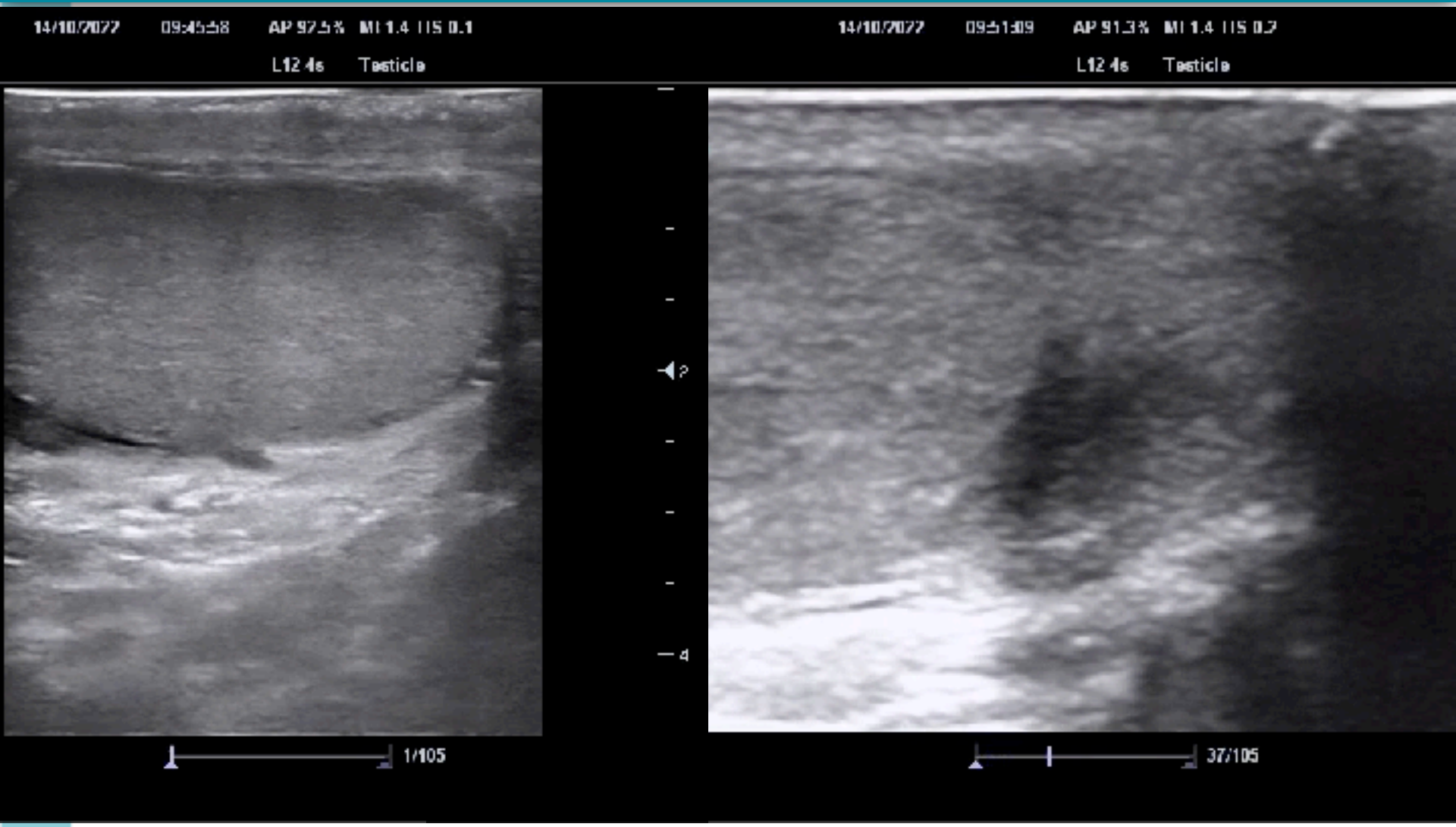

MI
1.5
11L4
diffT9.0
30 fps
Qscan
G:91
DR:60
A:6
P:3
Hemarthrosis

13M, 被同學踢到睪丸

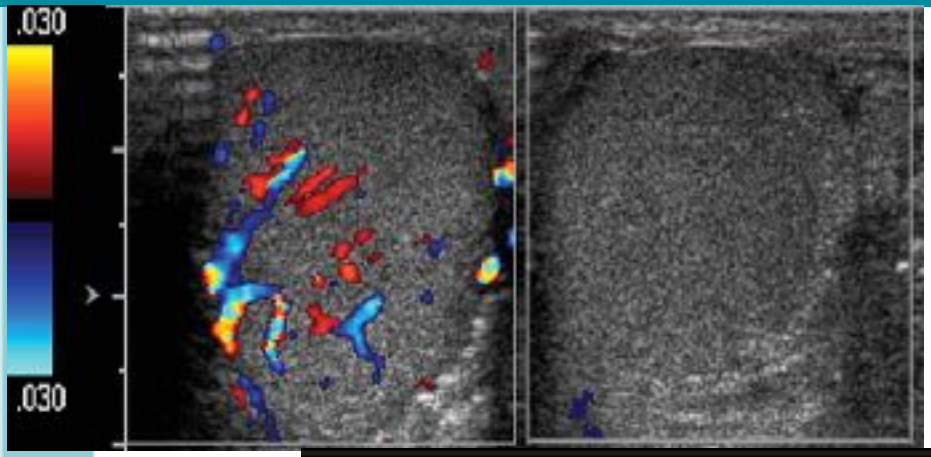

WUEI YIOU
13Years
30-11-2022
86518
Testicle
18:26:51
35
TI5 0.1


WUEI YIOU
13Years
30-11-2022
6518
Testicle
18:27 33
35
TI5 0.1

56M, scrotal hematoma



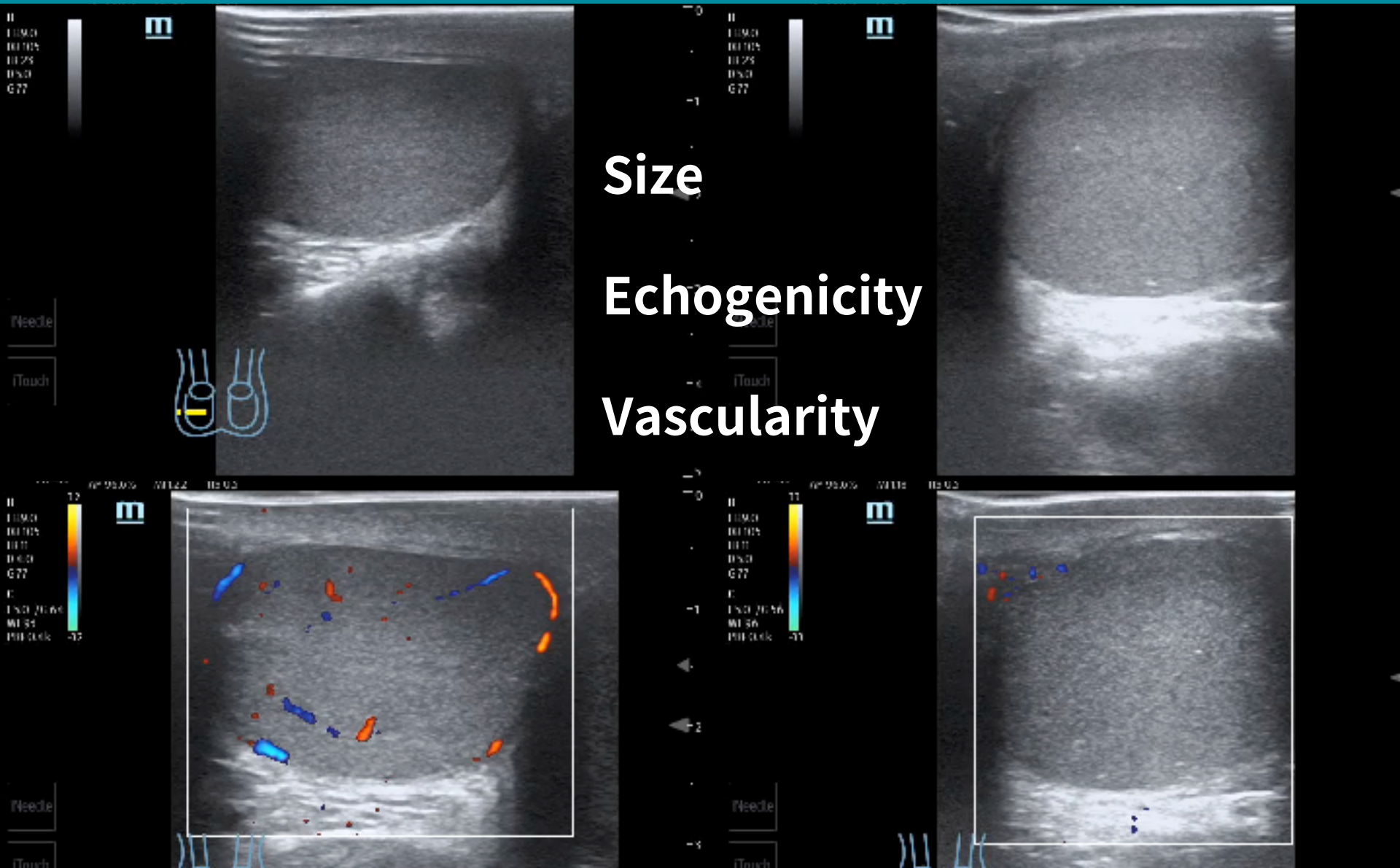
Testicular torsion

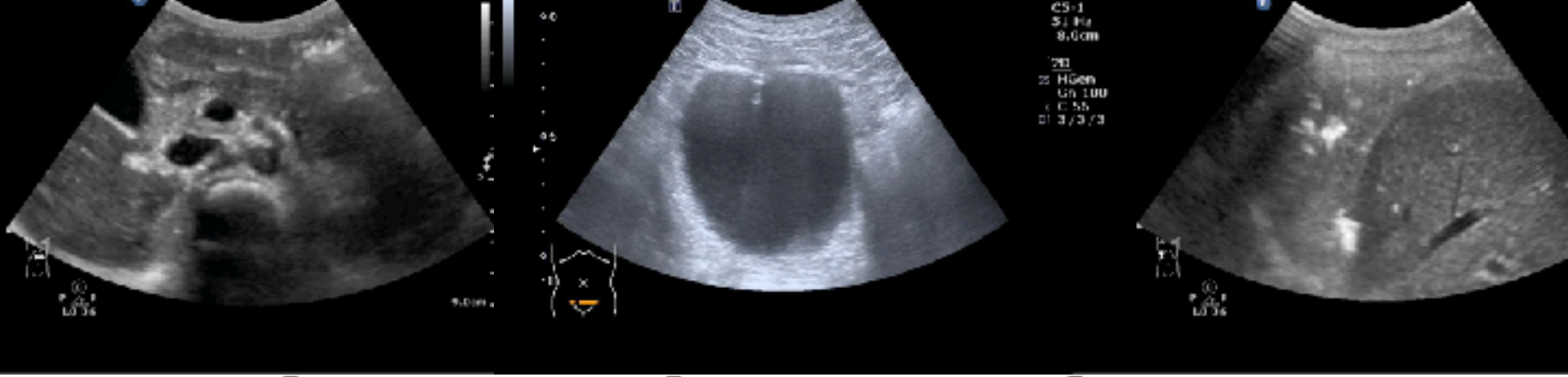


Most common: 12-18 years
Golden hours: 6 hours

Bhatt S , Dogra V S Radiographics 2008;28:1617-1629

TESTICULAR TORSION





specialists. We do

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car

tha diagnostic POCUS makes us

We do POCUS because we should.