Quality in Point of Care Ultrasound: What you should know in 2025

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The ASPIRE Collaborative Meeting
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Disclosures

- No personal financial, consulting, or contractual relationships with any vendor
- Grants paid to University of Michigan from industry sources for research where I am a PI / Co-I include:
  - ImaCor, Inc.
  - Apple, Inc.

Agenda

- Background, current state and essential applications of POCUS
- Why invest?
- Competency
- Quality and safety considerations
  - Examples
  - Measure, maintain and improve
- Future
- Hands on simulation for YOU!


Point of care
ultrasound
“POCUS”
https://www.asra.com


Goal Directed Exam
Airway
"POCUS"
Heart
Lungs
Yes, No, or…
I don't know
Vascular
Abdomen
https://www.asra.com

Value Proposition of POCUS

Bedside

Fewer complications

Available

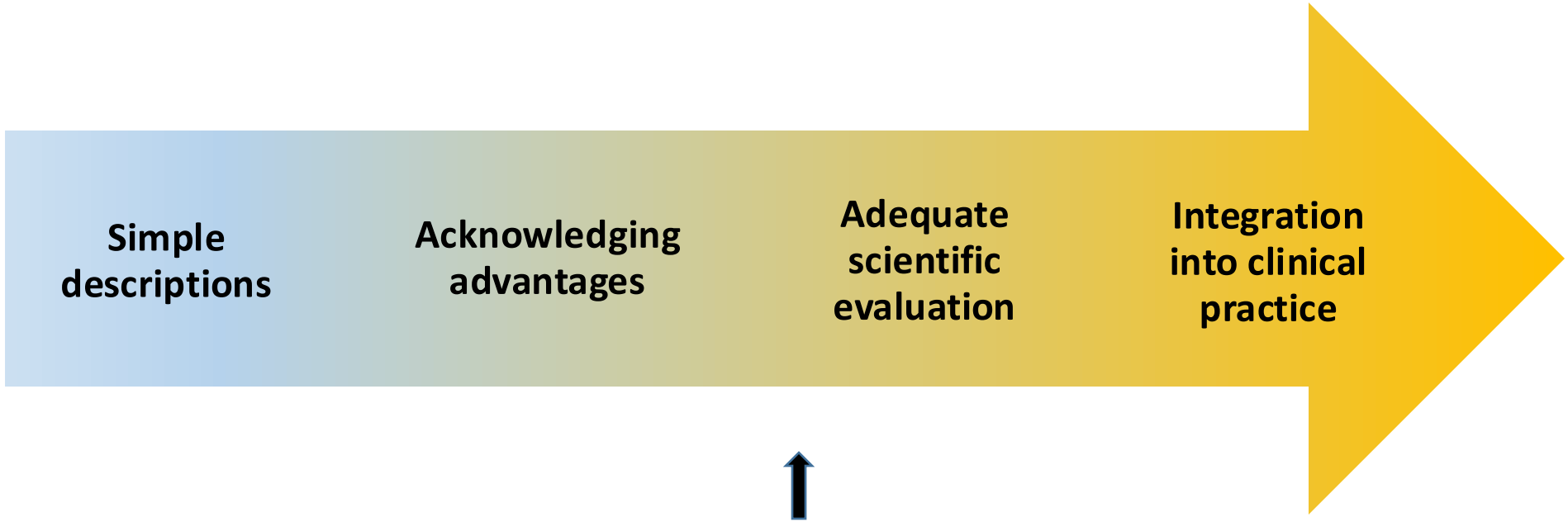
Non-invasive

Faster Decisions

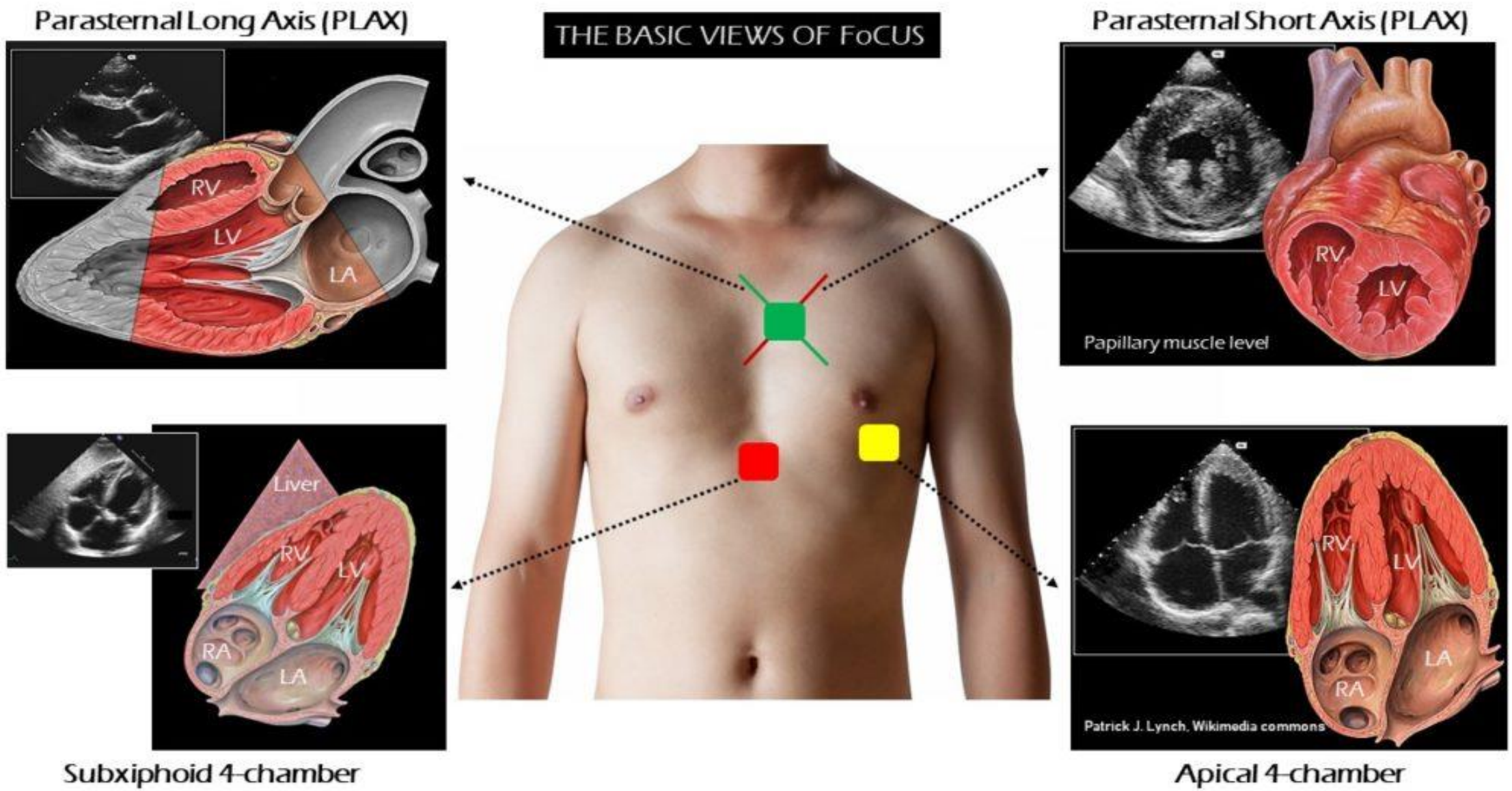
Evolution of POCUS

Emergency Medicine → Critical Care → Perioperative Anesthesiology →

- Surgical specialties
- Inpatient wards
- Outpatient care
- Family medicine

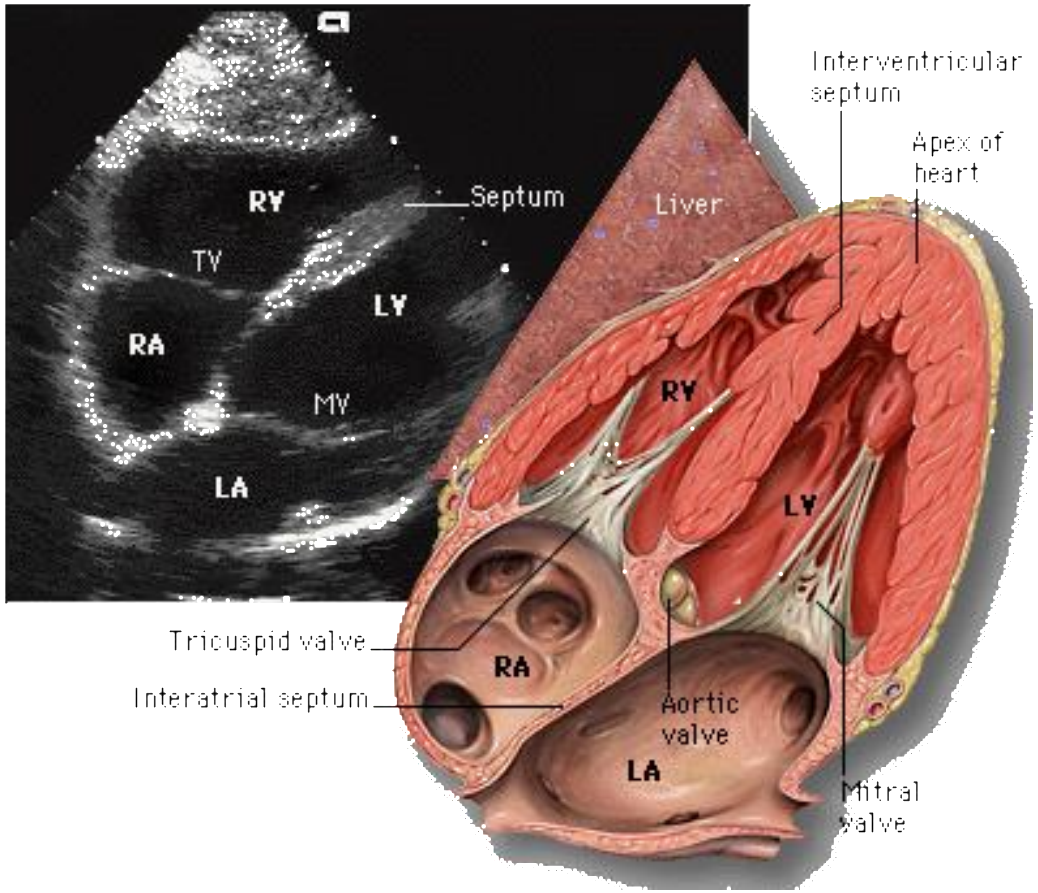

Simple descriptions
Acknowledging advantages
Adequate scientific evaluation
Integration into clinical practice
Point of Care Ultrasound
Vascular access
Regional ultrasound
Cardiac TEE

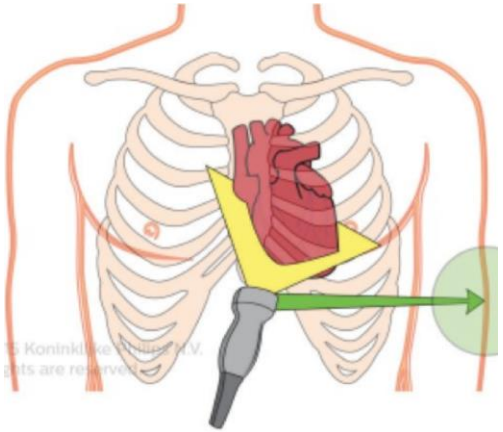
POCUS applications you should know in 2025

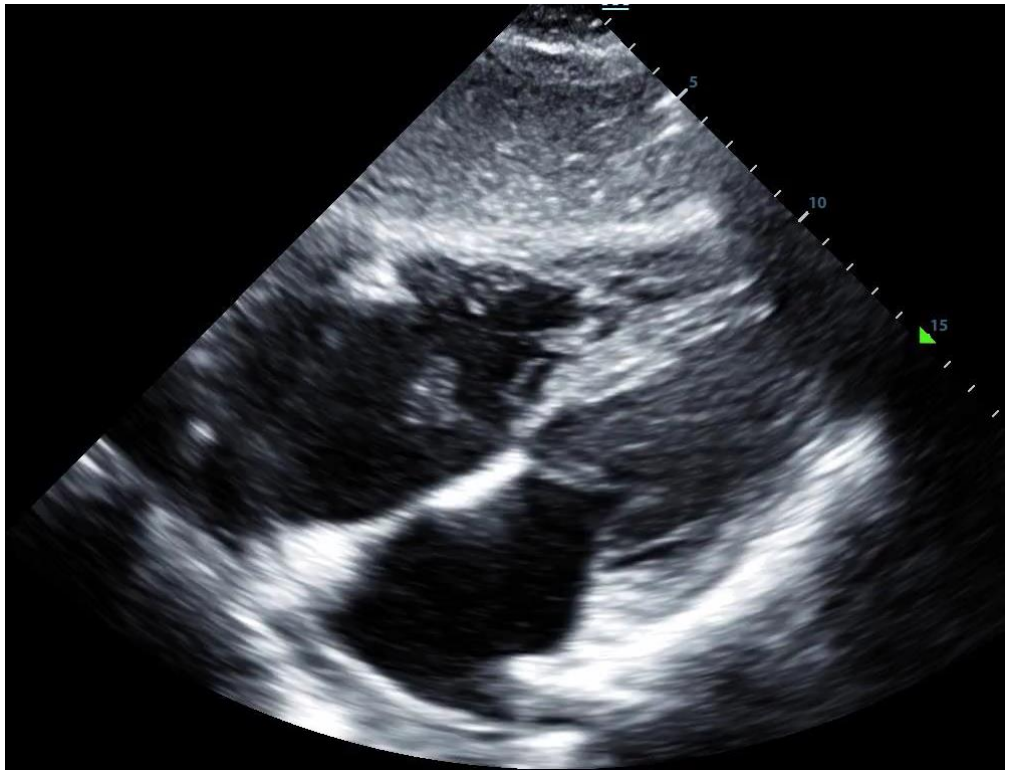


Anesthesiology 2020

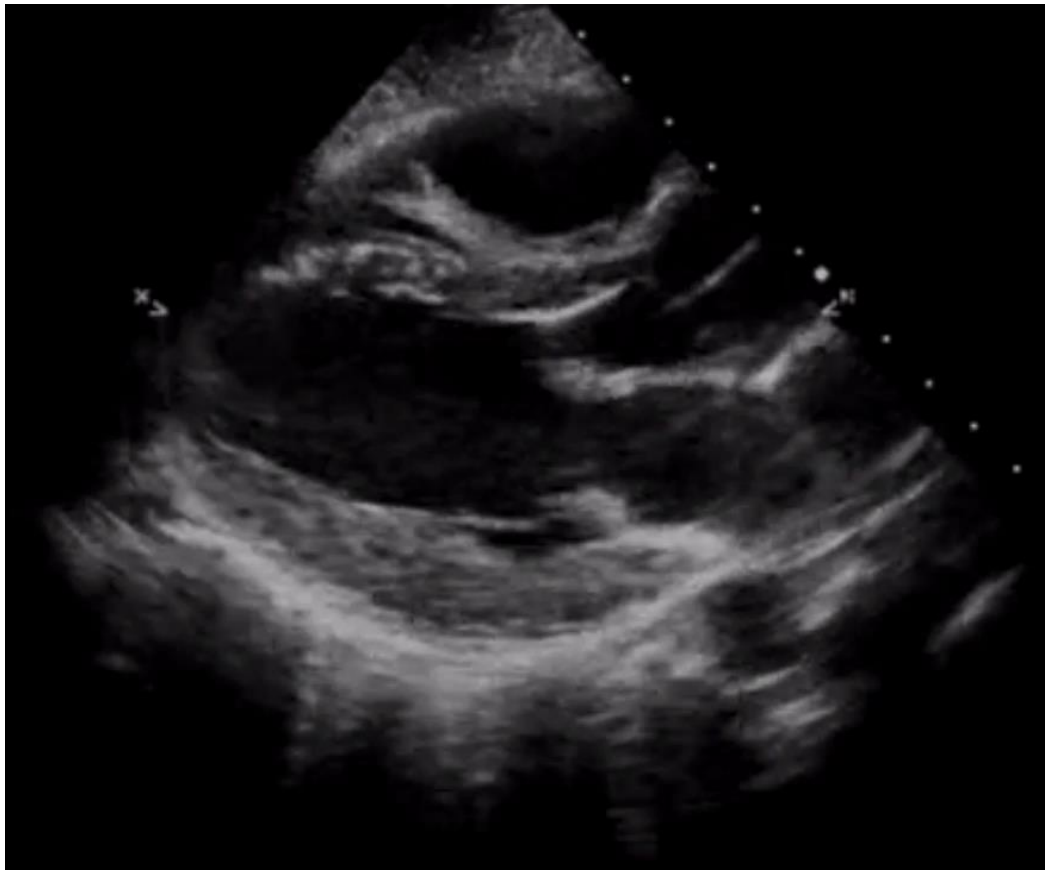
Subcostal view



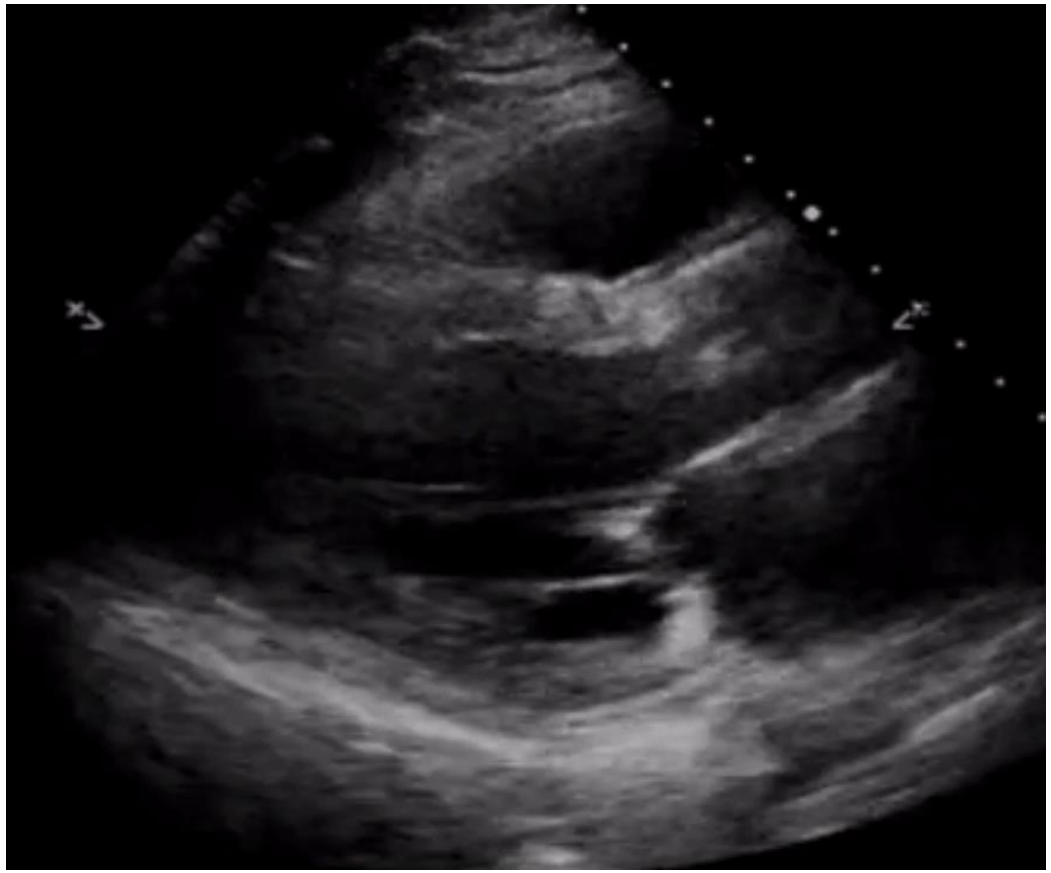




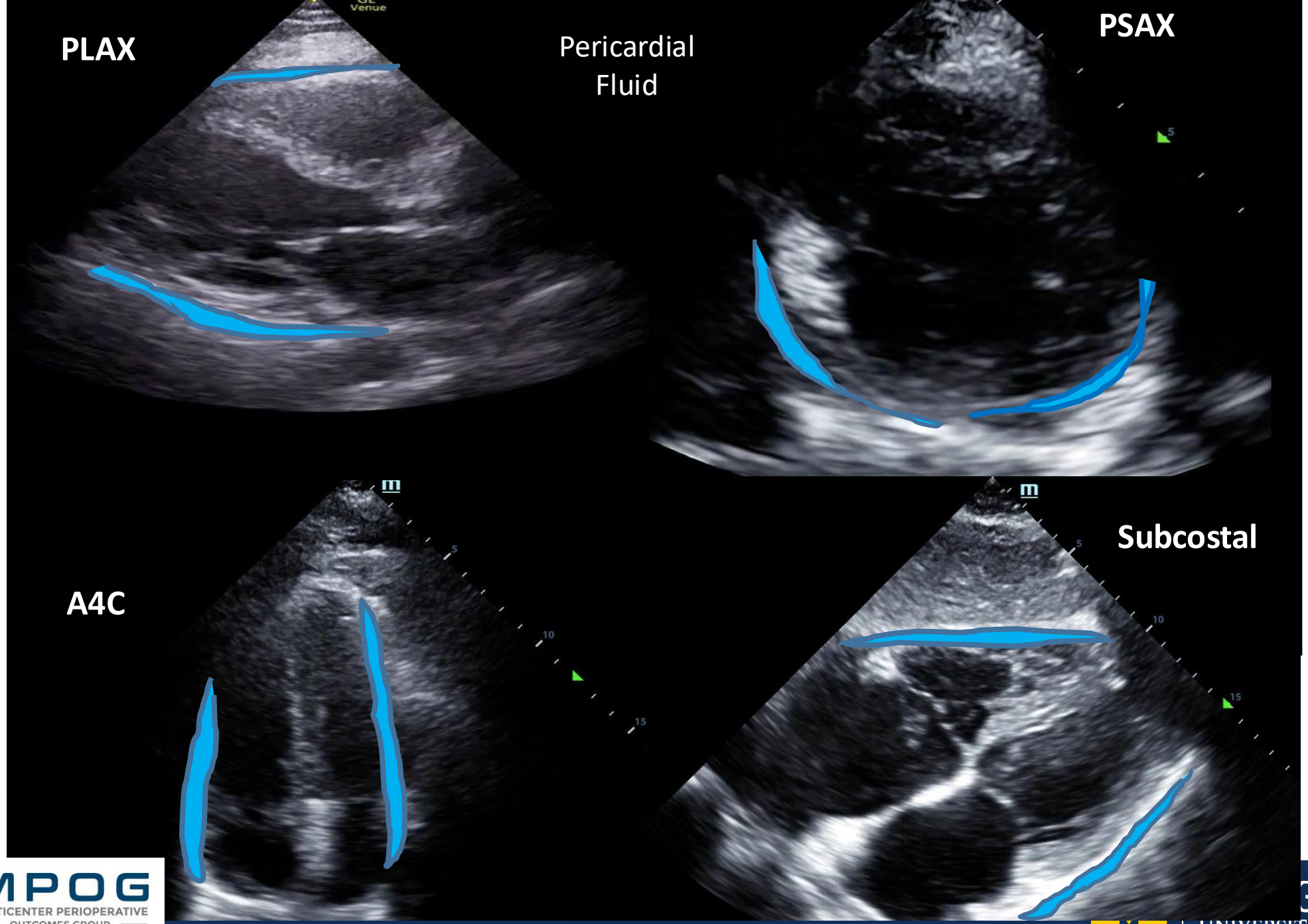
Left ventricular function



Normal systolic function



Abnormal systolic function


PLAX
Pericardial
Fluid
PSAX
A4C
Subcostal

GUIDELINES AND STANDARDS

Guidelines for Performing a Comprehensive Transthoracic Echocardiographic Examination in Adults: Recommendations from the American Society of Echocardiography

Carol Mitchell, PhD, ACS, RDMS, RDCS, RVT, RT(R), FASE, Co-Chair, Peter S. Rahko, MD, FASE, Co-Chair, Lori A. Blauwet, MD, FASE, Barry Canaday, RN, MS, RDCS, RCS, FASE, Joshua A. Finstuen, MA, RT(R), RDCS, FASE, Michael C. Foster, BA, RCS, RCCS, RDCS, FASE, Kenneth Horton, ACS, RCS, FASE, Kofo O. Ogunyankin, MD, FASE, Richard A. Palma, BS, RDCS, RCS, ACS, FASE, and Eric J. Velazquez, MD, FASE, *Madison, Wisconsin; Rochester, Minnesota; Klamath Falls, Oregon; Durham, North Carolina; Salt Lake City, Utah; Ikoyi, Lagos, Nigeria; and Hartford, Connecticut*

Journal of the American Society of Echocardiography 2019

SPECIAL ARTICLE

International Evidence-Based Recommendations for Focused Cardiac Ultrasound

Gabriele Via, MD, Arif Hussain, MD, Mike Wells, MD, BSc, BSc Hons, MBBCh, FCEM, Dip PEC, Robert Reardon, MD, Mahmoud ElBarbary, MD, Vicki E. Noble, MD, James W. Tsung, MD, MPH, Aleksandar N. Neskovic, MD, PhD, FESC, FACC, Susanna Price, MD, MBBS, BSc, MRCP, EDICM, PhD, FFICM, FESC, Achikam Oren-Grinberg, MD, MS, Andrew Liteplo, MD, RDMS, Ricardo Cordioli, MD, Nitha Naqvi, MD, MSc, MRCPCH, Philippe Rola, MD, Jan Poelaert, MD, PhD, Tatjana Golob Gulič, MD, Erik Sloth, MD, PhD, DMSc, Arthur Labovitz, MD, FACC, Bruce Kimura, MD, FACC, Raoul Breitkreutz, MD, Navroz Masani, MBBS, FRCP, Justin Bowra, FACEM, CCPU, Daniel Talmor, MD, MPH, Fabio Guarracino, MD, Adrian Goudie, BMedSci(Hons), MBBS, FACEM DDU, Wang Xiaoting, MD, Rajesh Chawla, MD, FCCM, Maurizio Galderisi, MD, Micheal Blaivas, MD, FACEP, FAIUM, Tomislav Petrovic, MD, Enrico Storti, MD, Luca Neri, MD, and Lawrence Melniker, MD, MS, International Liaison Committee on Focused Cardiac UltraSound (ILC-FoCUS) for the International Conference on Focused Cardiac UltraSound (IC-FoCUS)

Journal of the American Society of Echocardiography 2014

FoCUS Clinical Utility

- Triage patients
- Determine benefit from fluid loading
- Narrow the differential diagnosis when undifferentiated shock
- During pulseless electrical activity cardiac arrest, FoCUS identifies patients with myocardial mechanical activity and those with none
- Risk-stratifies patients with pericardial effusion
- Directs the management of patients with LV systolic dysfunction
- Essential part of the initial assessment of patients with cardiopulmonary instability

FoCUS and Clinical Outcomes

- Cardiac arrest:
  - more accurate than EKG for determining mechanical cardiac function
  - changes management
  - improves the clinician's ability to predict outcome
  - more accurate than the physical examination for diagnosing the cause of cardiac arrest
  - more accurate than the physical examination for assessing cardiac function
- Shock and hemodynamic instability:
  - accurately assesses global LV systolic function, when compared with comprehensive standard echocardiography
  - narrows the differential diagnosis
  - changes management
  - improves outcomes
  - should be part of the initial assessment of a hemodynamically unstable patient

FoCUS and Clinical Outcomes

- Estimating Central Venous Pressure, Diagnosing Hypovolemia, and Predicting Fluid Responsiveness:
  - accurately identify patients with low central venous pressure
  - accurately identify patients who may benefit from fluid loading
- Physical examination:
  - more accurate than the physical examination for assessing LV systolic function and detecting valvular disease
- Screening for Cardiovascular Disease:
  - useful in screening asymptomatic patients at risk for cardiovascular disease.

Randomized, controlled trial of immediate versus delayed goal-directed ultrasound to identify the cause of nontraumatic hypotension in emergency department patients*

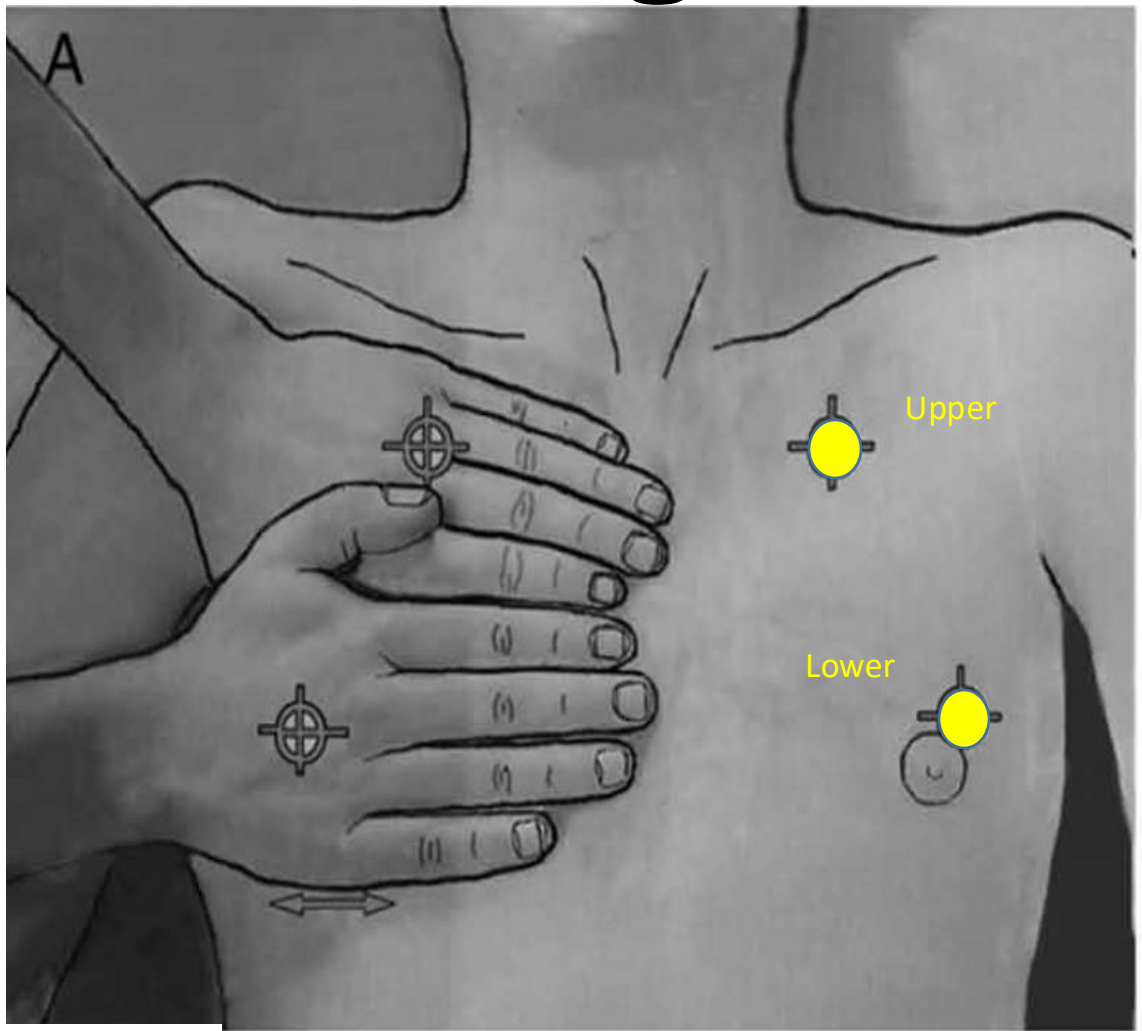
Crit Care Med 2004

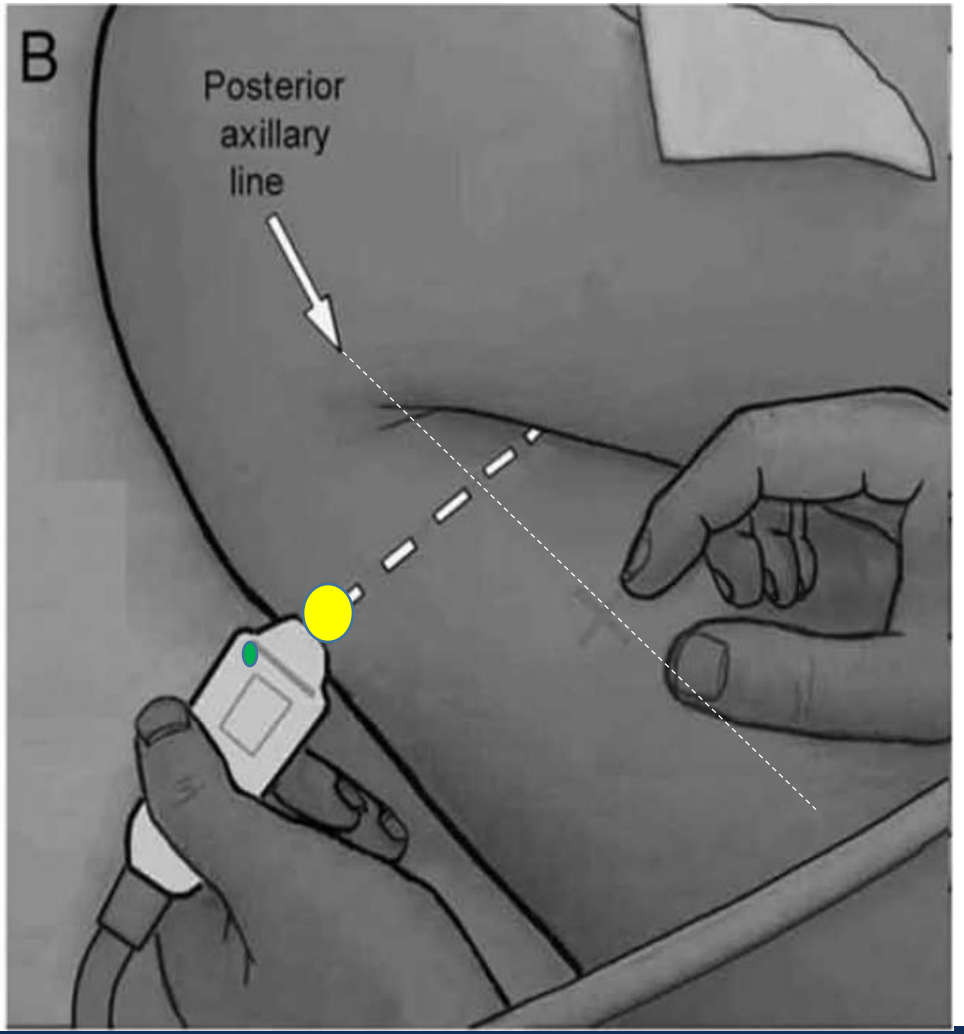
Alan E. Jones, MD; Vivek S. Tayal, MD; D. Matthew Sullivan, MD; Jeffrey A. Kline, MD

- 184 patients presenting to emergency department in non-traumatic, symptomatic, undifferentiated shock.

	Group 1 (88pts) • Standard care • POCUS at time 0	Group 2 (96pts) • Standard care • POCUS delayed
Median # viable dx:	6	9
Correct dx @ 15min	80%	50%

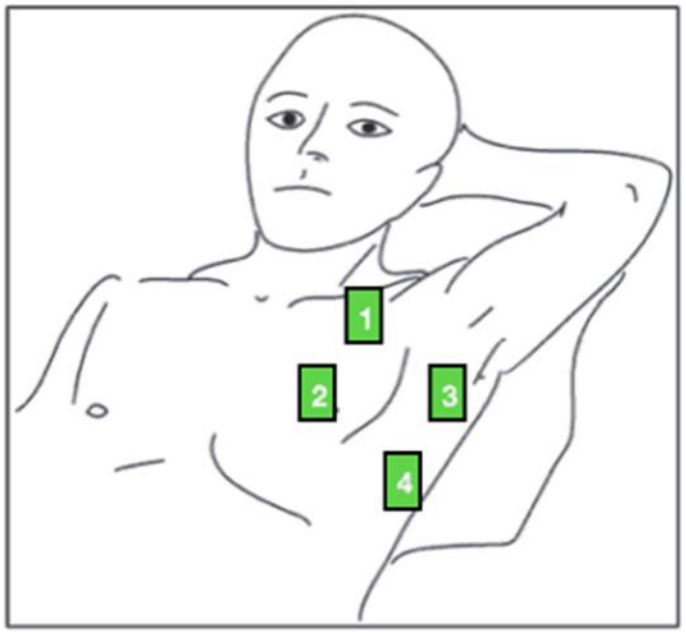
POCUS Lung Exam

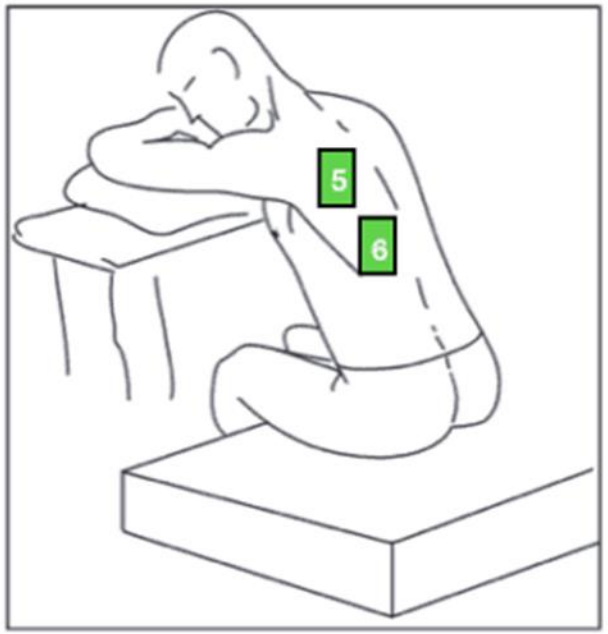




POCUS Lung Exam

12-Point Lung Ultrasound Exam
(*6 points on each side)





#	Lung Field
1	Anterior Superior
2	Anterior Inferior
3	Lateral Superior
4	Lateral Inferior
5	Posterior Superior
6	Posterior Inferior

POCUS Lung Exam

Conditions:

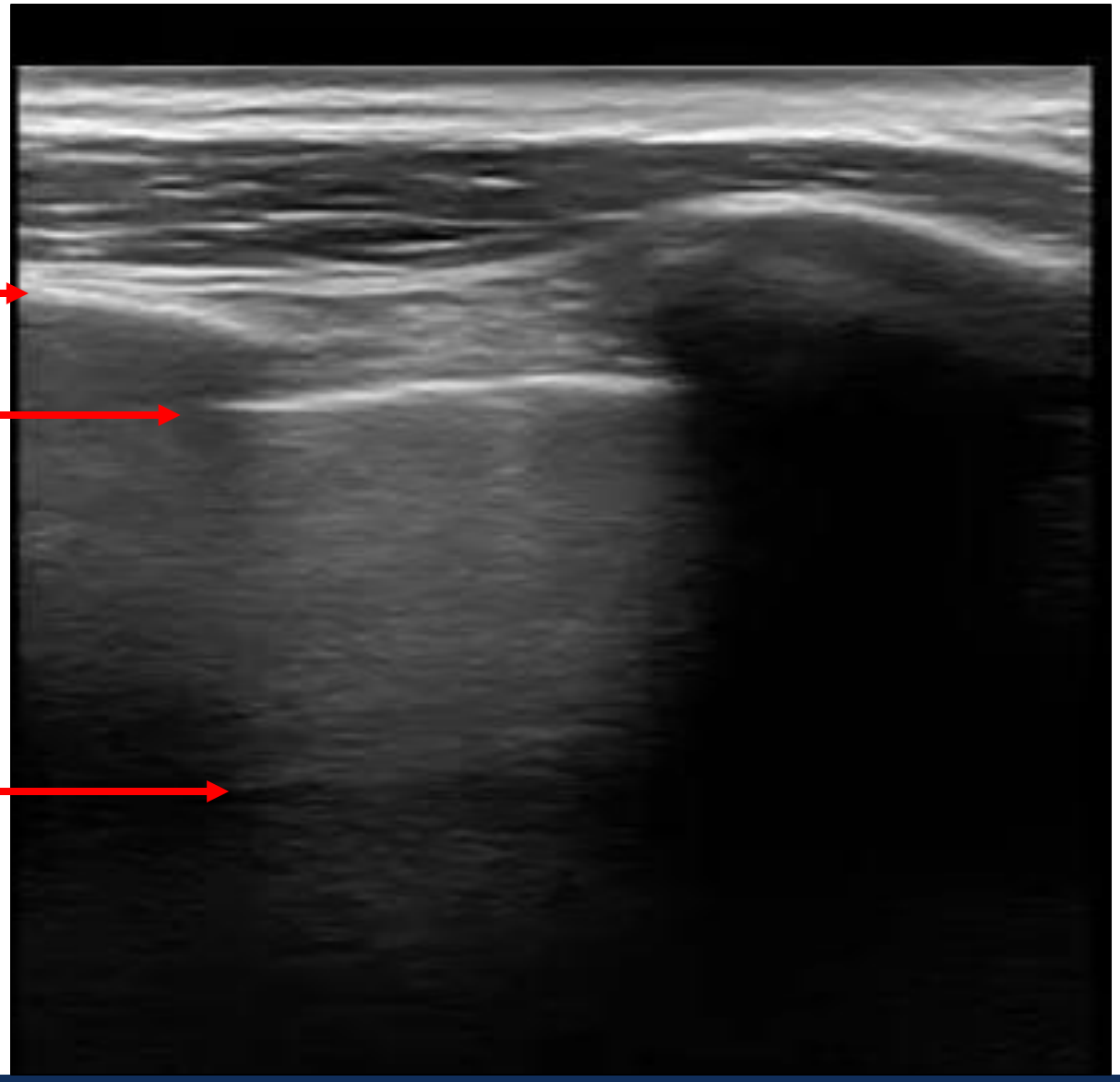
- Acute respiratory failure
- Undifferentiated shock
- Management of fluid resuscitation
- Evaluation of intubation
- Serial evaluations: effusion, edema, functional lung volume
- Diaphragm function

POCUS Lung Exam

Findings:

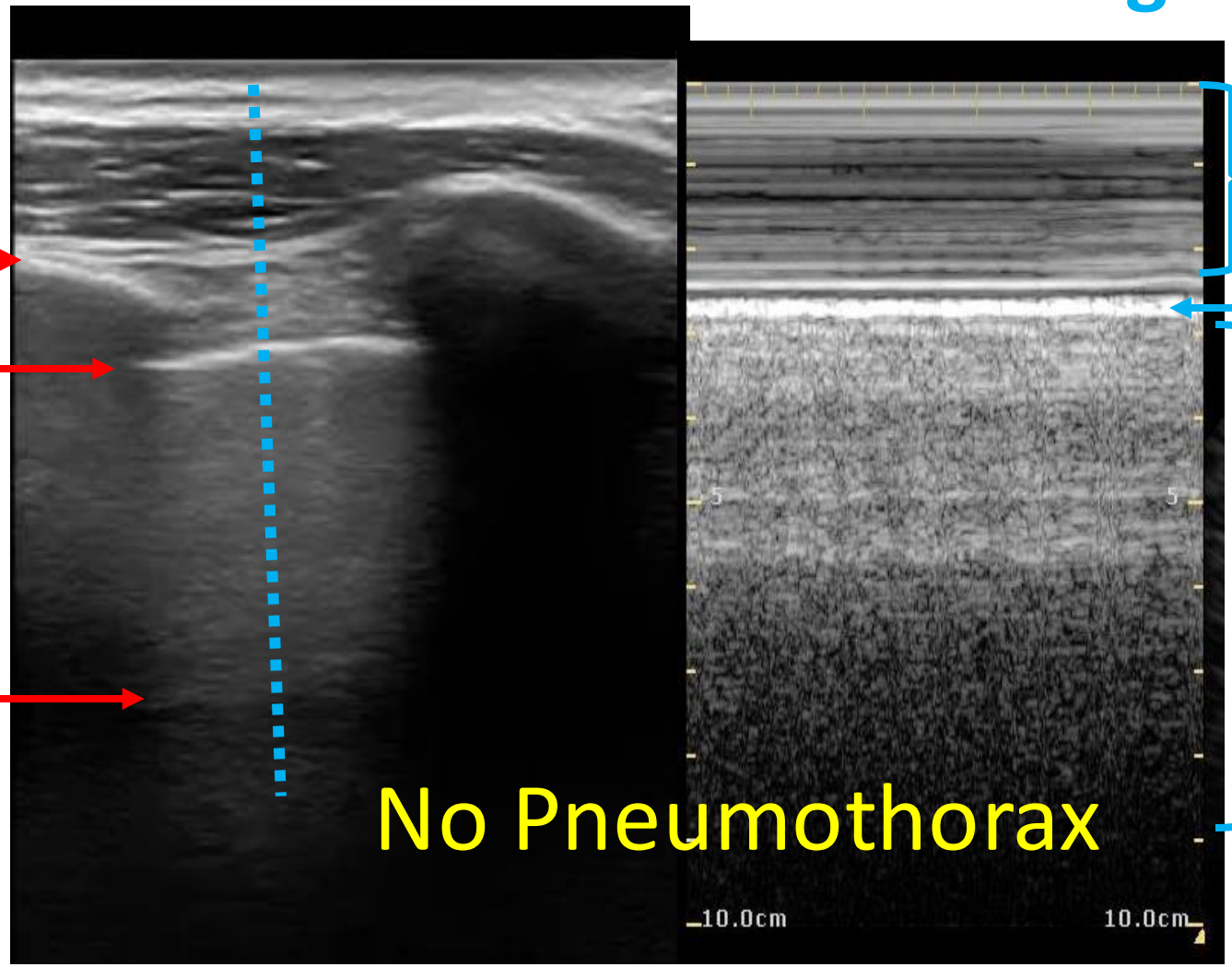
- Ultrasound artifacts: normal vs abnormal
- Normal, Edema, COPD, Asthma, PE
- Mainstem intubation
- Pneumothorax
- Alveolar interstitial fluid: Congestive heart failure
- Consolidation: PNA, atelectasis
- Pleural effusion

Dynamic Lung Exam



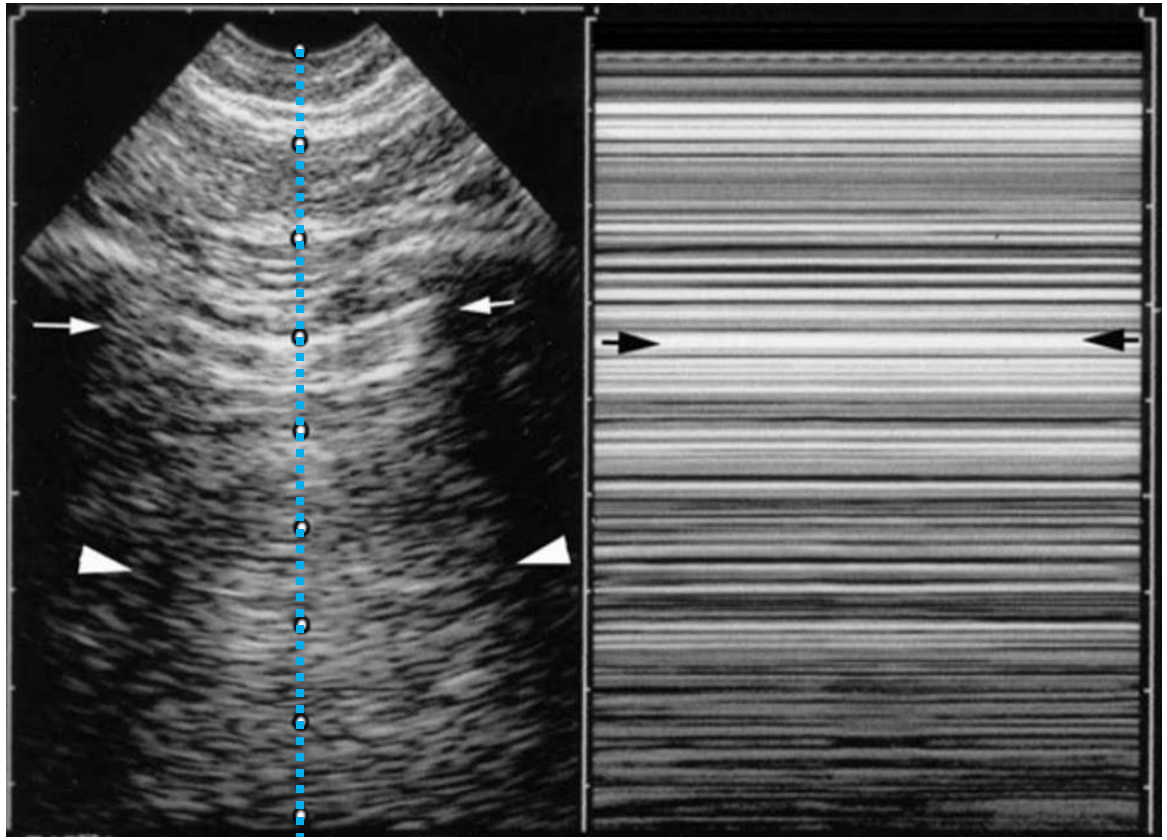
Motion mode: “M-mode”

“Seashore Sign”



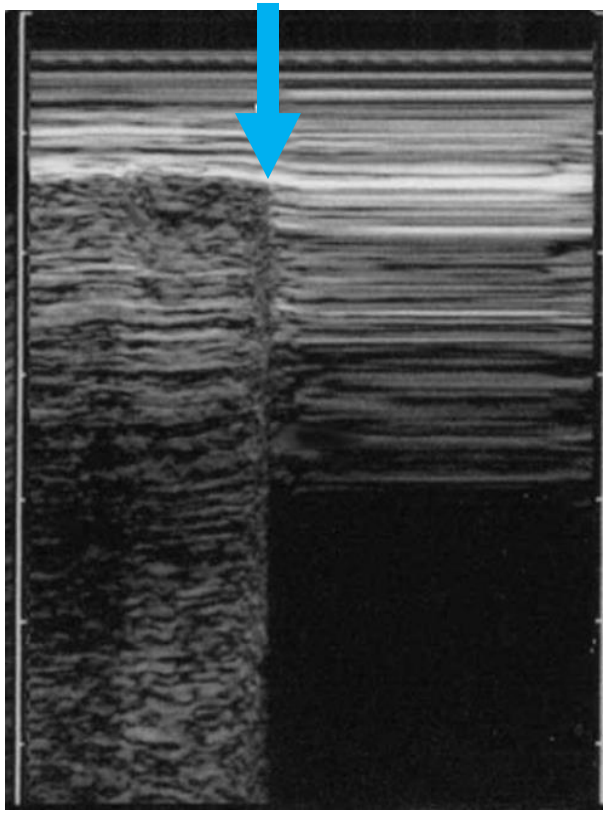
Pneumothorax

M-mode Stratosphere sign



A' profile: A lines, no lung sliding

Lung point



Prospective Evaluation of Thoracic Ultrasound in the Detection of Pneumothorax

Scott A. Dulchavsky, MD, PhD, Karl L. Schwarz, MD, Andrew W. Kirkpatrick, MD, Roger D. Billica, MD, David R. Williams, MD, Lawrence N. Diebel, MD, Mark R. Campbell, MD, Ashot E. Sargysan, MD, and Douglas R. Hamilton, MD, PhD

J Trauma. 2001;50:201–205.

- 382 trauma patients; Lung US compared to CXR
- 37 of 39 identified by US
- 95% sensitive; 2 unidentified b/c of subcutaneous air
- 100% true negative rate

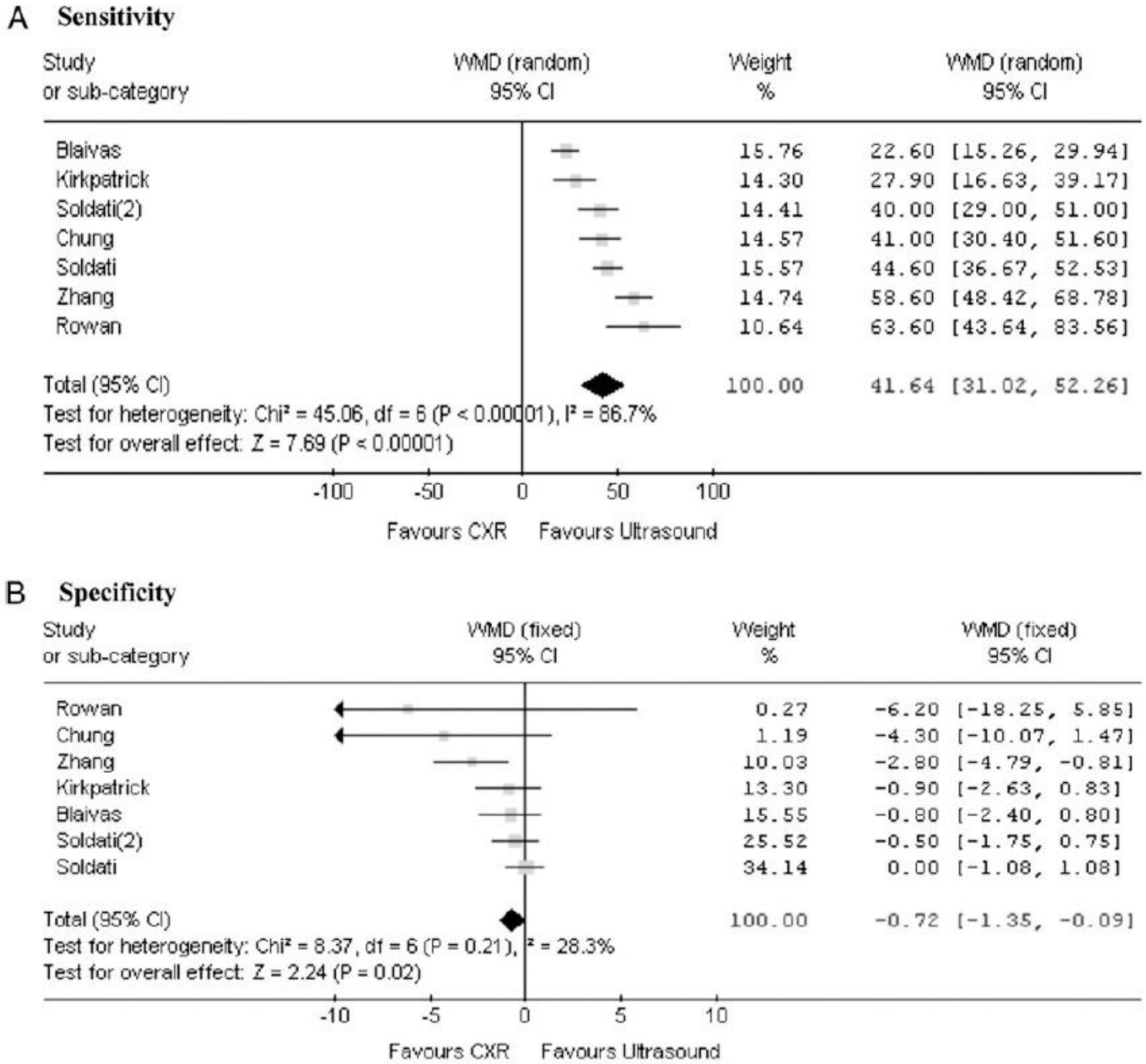
A Prospective Comparison of Supine Chest Radiography and Bedside Ultrasound for the Diagnosis of Traumatic Pneumothorax

Acad Emerg Med. 2005

Michael Blaivas, MD, RDMS, Matthew Lyon, MD, RDMS, Sandeep Duggal, MD, RDMS

- 176 blunt trauma patients; with CT as gold standard
- US more sensitive than supine CXR (98% vs 75%)
- US allowed differentiation between small, medium, and large PTXs with good agreement with CT results.

CHEST 2012; 141(3):703–708



WMD = weighted mean difference; CI = confidence interval

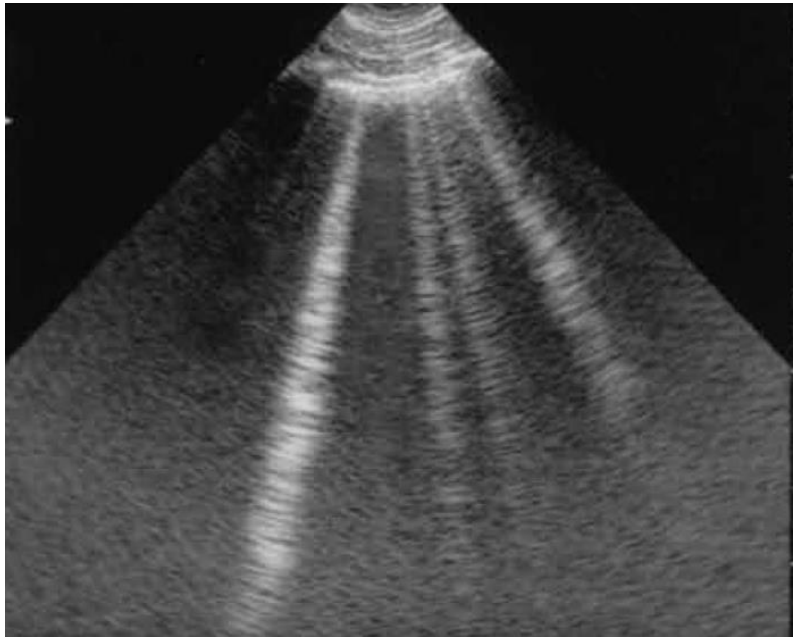
Sensitivity

- US: 91%
- CXR: 50%

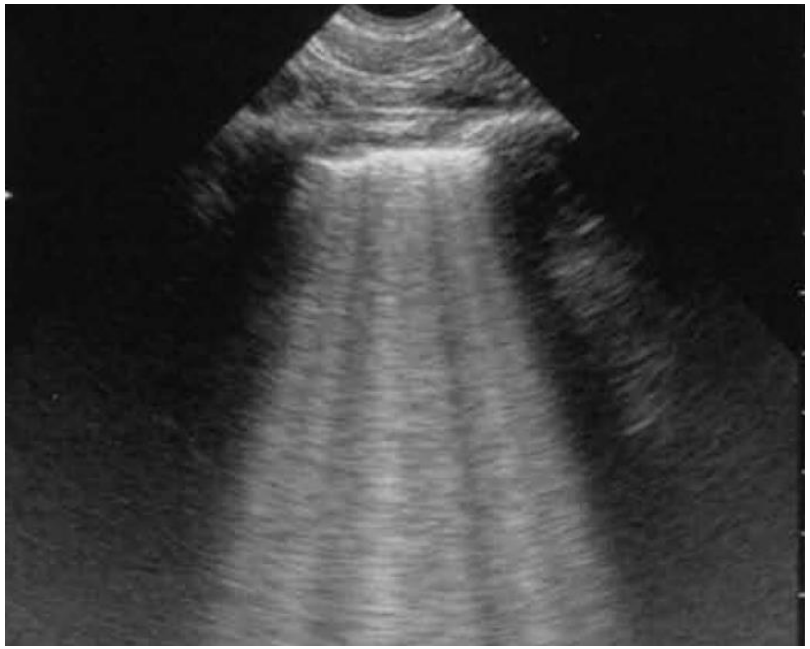
Specificity

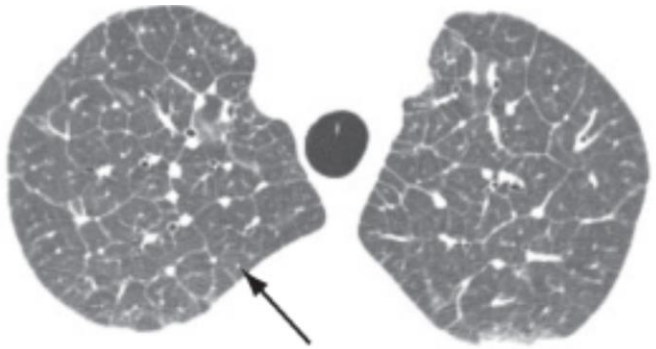
- US: 98%
- CXR: 99%

Intralobular septa thickening due to edema



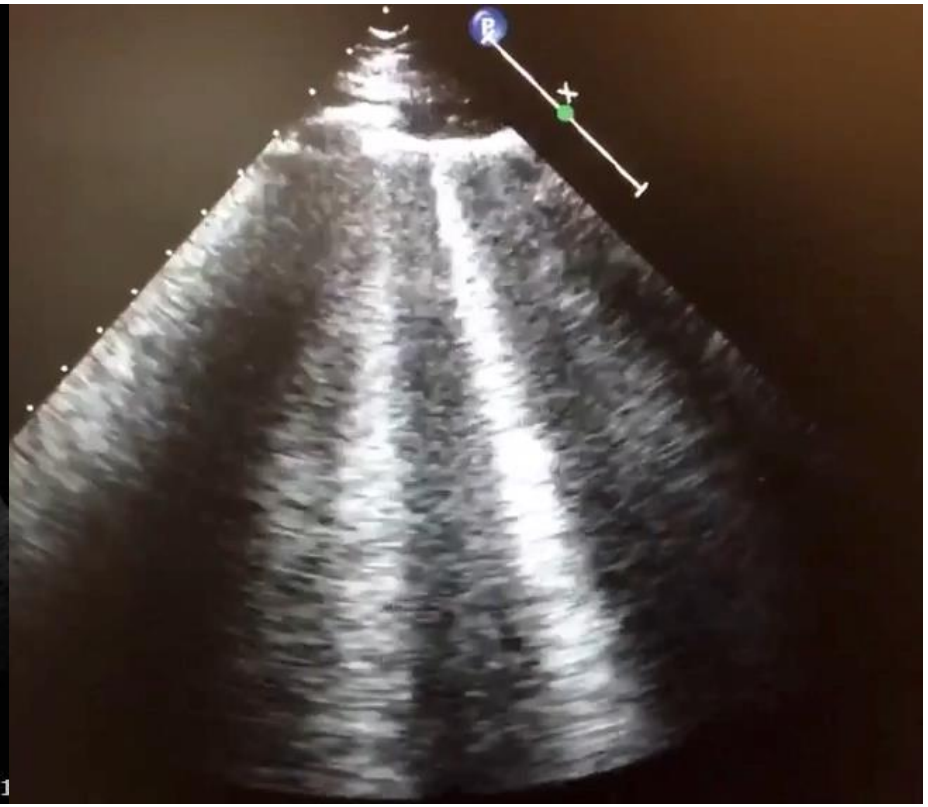
Ground glass pattern due to alveolar edema





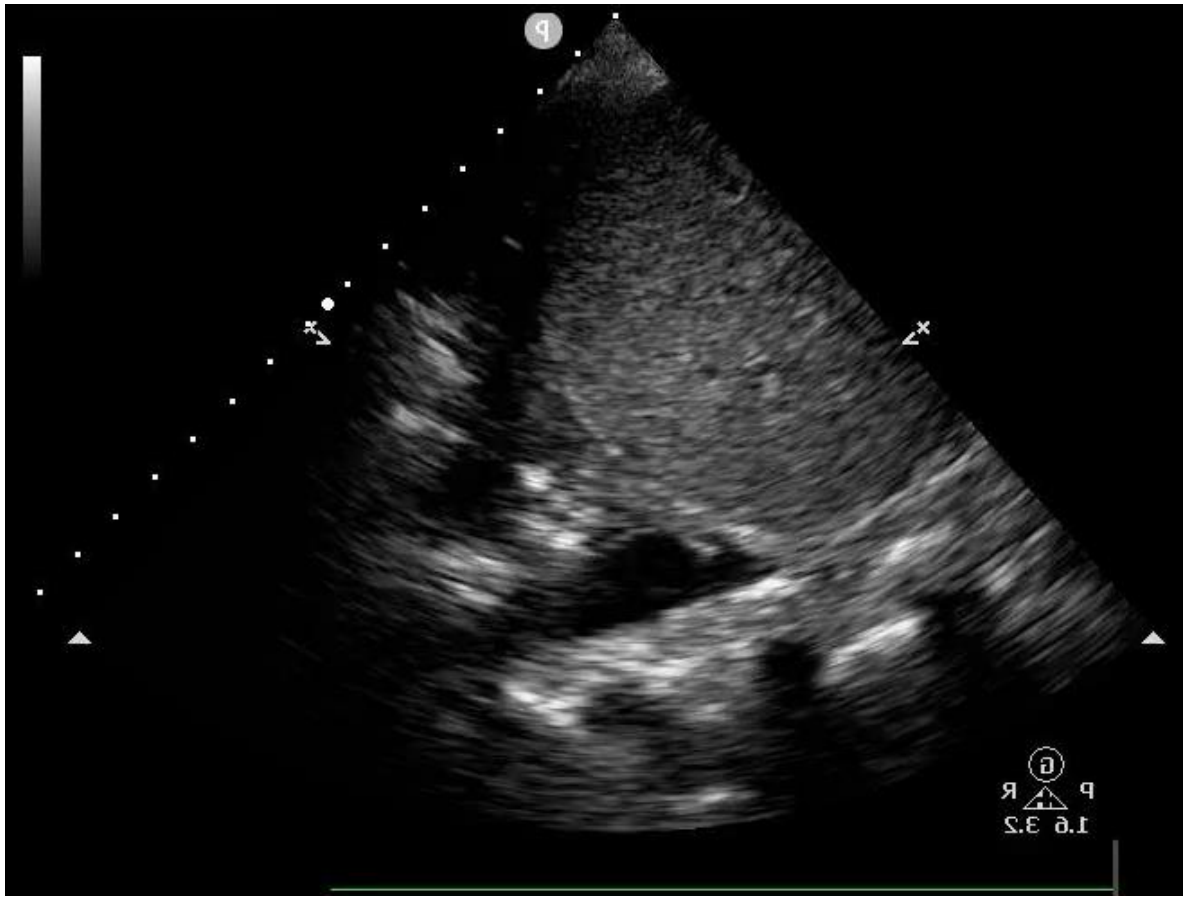
Pulmonary Edema

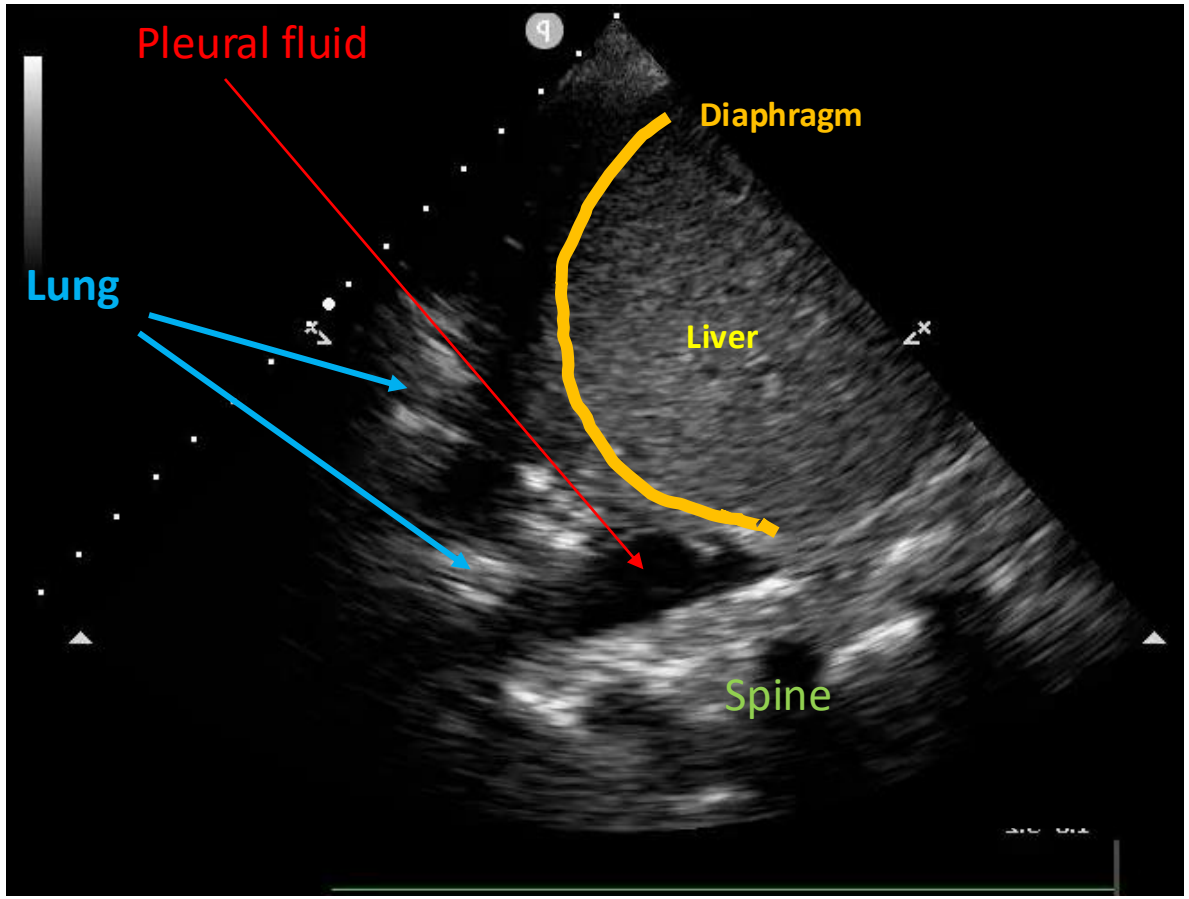
My case: mild to none



Example: significant

Pleural Fluid





Comparative Diagnostic Performances of Auscultation, Chest Radiography, and Lung Ultrasonography in Acute Respiratory Distress Syndrome

Anesthesiology 2004; 100:9–15

Daniel Lichtenstein, M.D., Ivan Goldstein, M.D.,† Eric Mourgeon, M.D.,† Philippe Cluzel, M.D., Ph.D.,‡ Philippe Grenier, M.D.,§ Jean-Jacques Rouby, M.D., Ph.D.‖*

	Auscultation, %	Chest Radiography, %	Lung Ultrasonography, %
Pleural effusion			
Sensitivity	42	39	92
Specificity	90	85	93
Diagnostic accuracy	61	47	93
Alveolar consolidation			
Sensitivity	8	68	93
Specificity	100	95	100
Diagnostic accuracy	36	75	97
Alveolar–interstitial syndrome			
Sensitivity	34	60	98
Specificity	90	100	88
Diagnostic accuracy	55	72	95

- 384 Lung regions in 32 ICU pts with ARDS
- Compared to gold standard of CT
- **Lung US better:**
  - **Effusion**
  - **Consolidation**
  - **Edema**

Lung POCUS: Putting it all together

- A lines
- B lines
- Lung sliding
- Lung pulse
- Lung point
- Effusion
- Consolidation

BLUE-Protocol and FALLS-Protocol

Two Applications of Lung

Ultrasound in the Critically Ill

Daniel A. Lichtenstein , MD , FCCP
CHEST 2015

Bedside Lung Ultrasound in Emergency (Acute Dyspnea) —the BLUE protocol

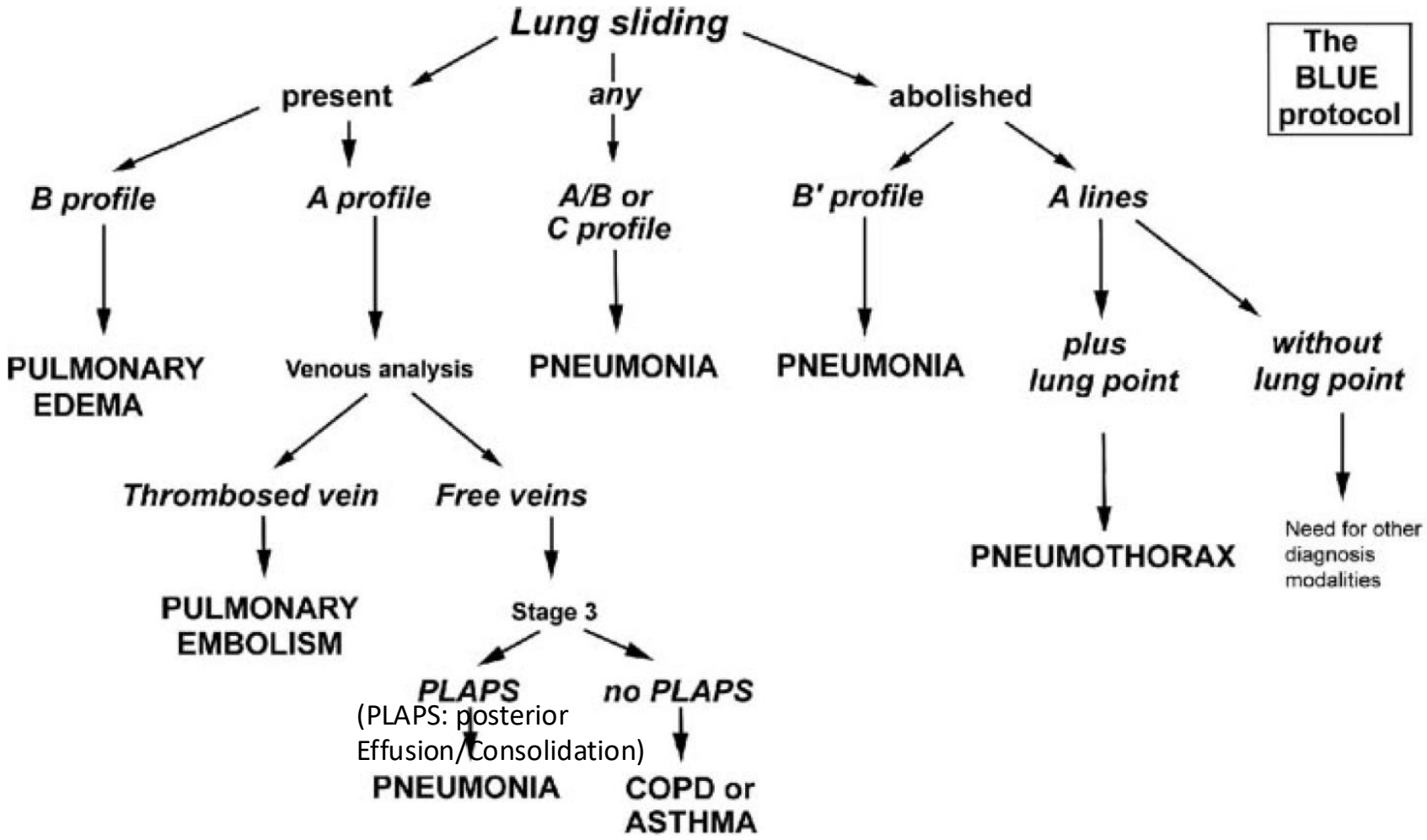


Table 2. Differential diagnosis for hemodynamic failure

Filling	Vasodilatory	Afterload	Contractility
Tamponade	Sepsis	Pulmonary embolus	Myocardial ischemia
Pneumothorax		Pulmonary hypertension	LV systolic dysfunction
Hypovolemia		LVOT obstruction	
		Severe aortic stenosis	

Deshpande R et al. Curr Opin Anaesthesiol. 2017

FAST / E-Fast exam

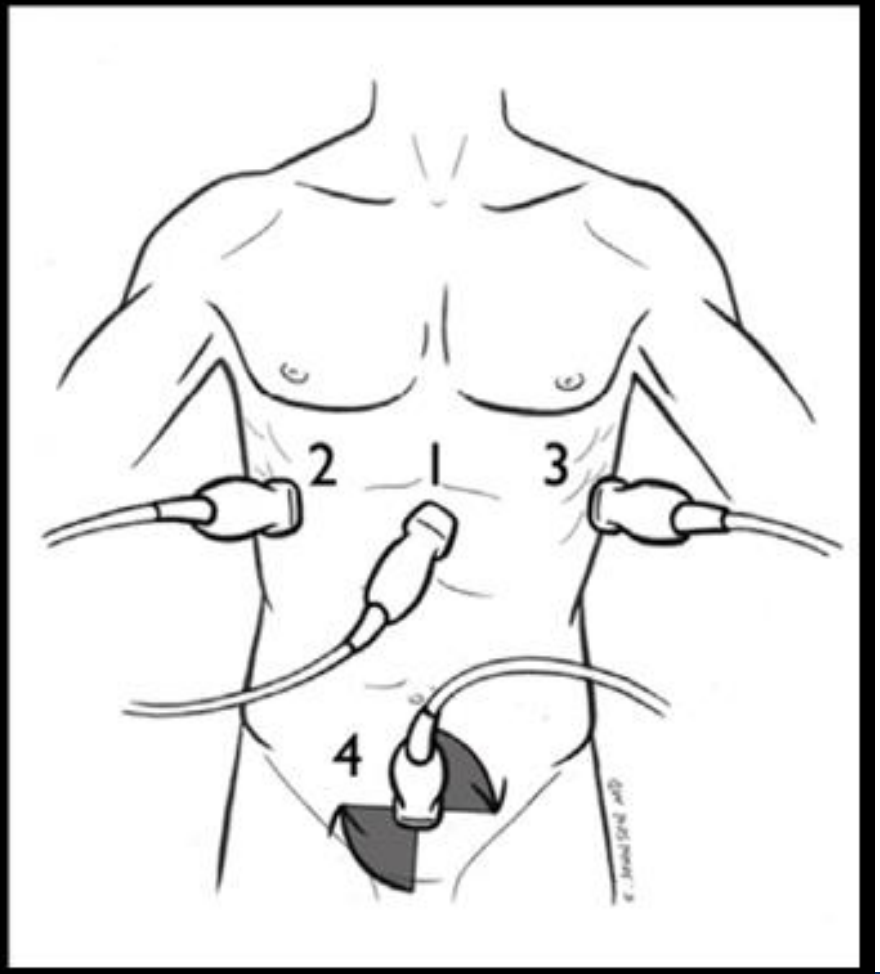
TRAUMA FAST EXAM

1 Cardiac-Subxiphoid

2 RUQ-Hepatorenal

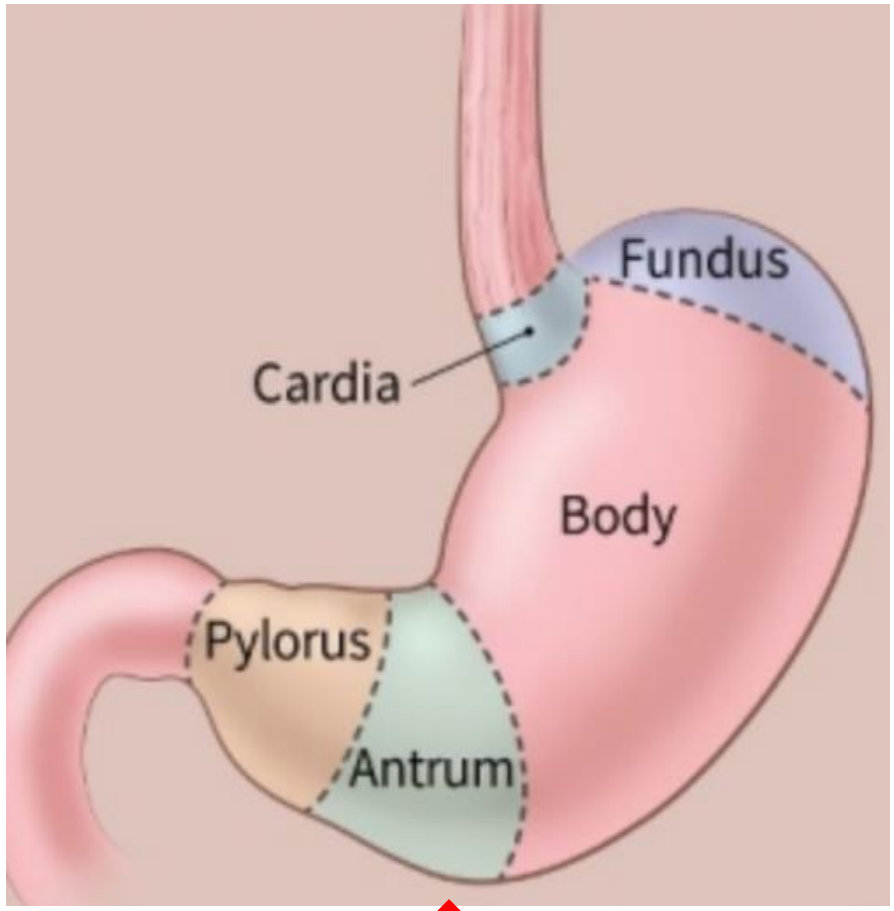
3 LUQ-Splenorenal

4 Suprapubic Views



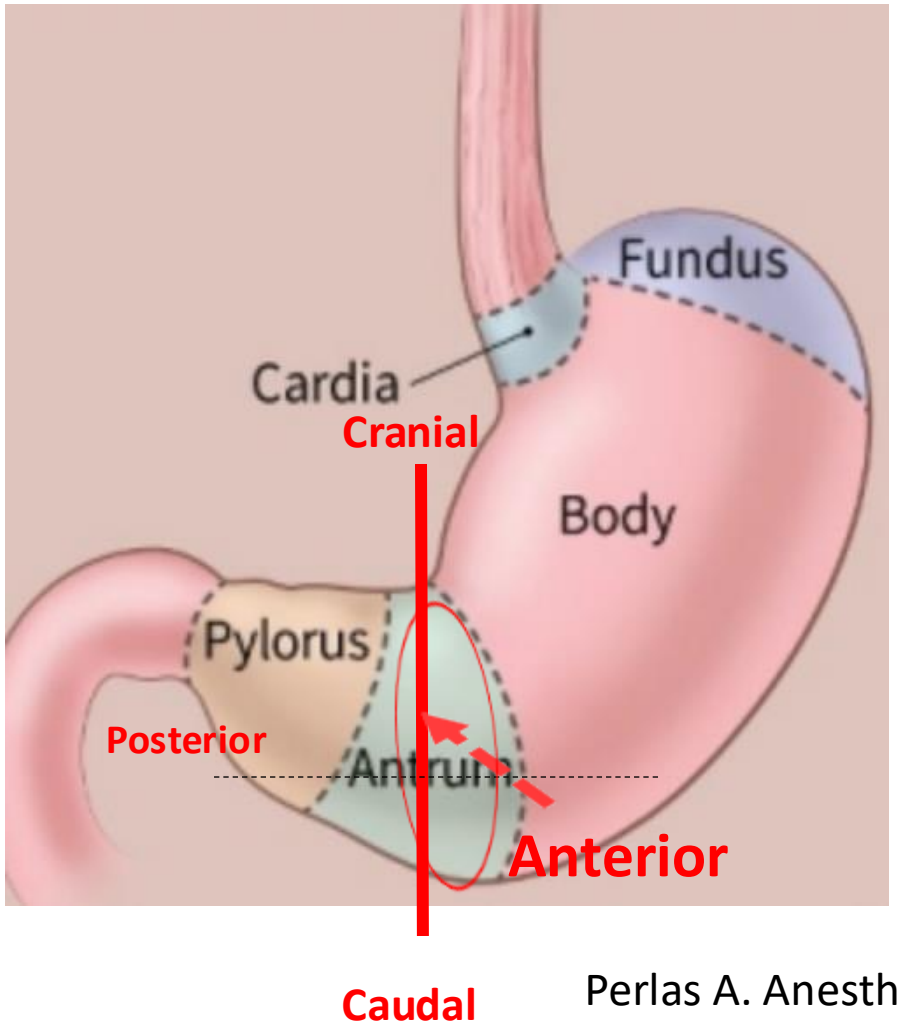
Gastric Content: Nature and Volume

- Empty, not empty
- Gas, fluid, or solid
- **Gastric antrum** provides the most reliable quantitative information for gastric volume



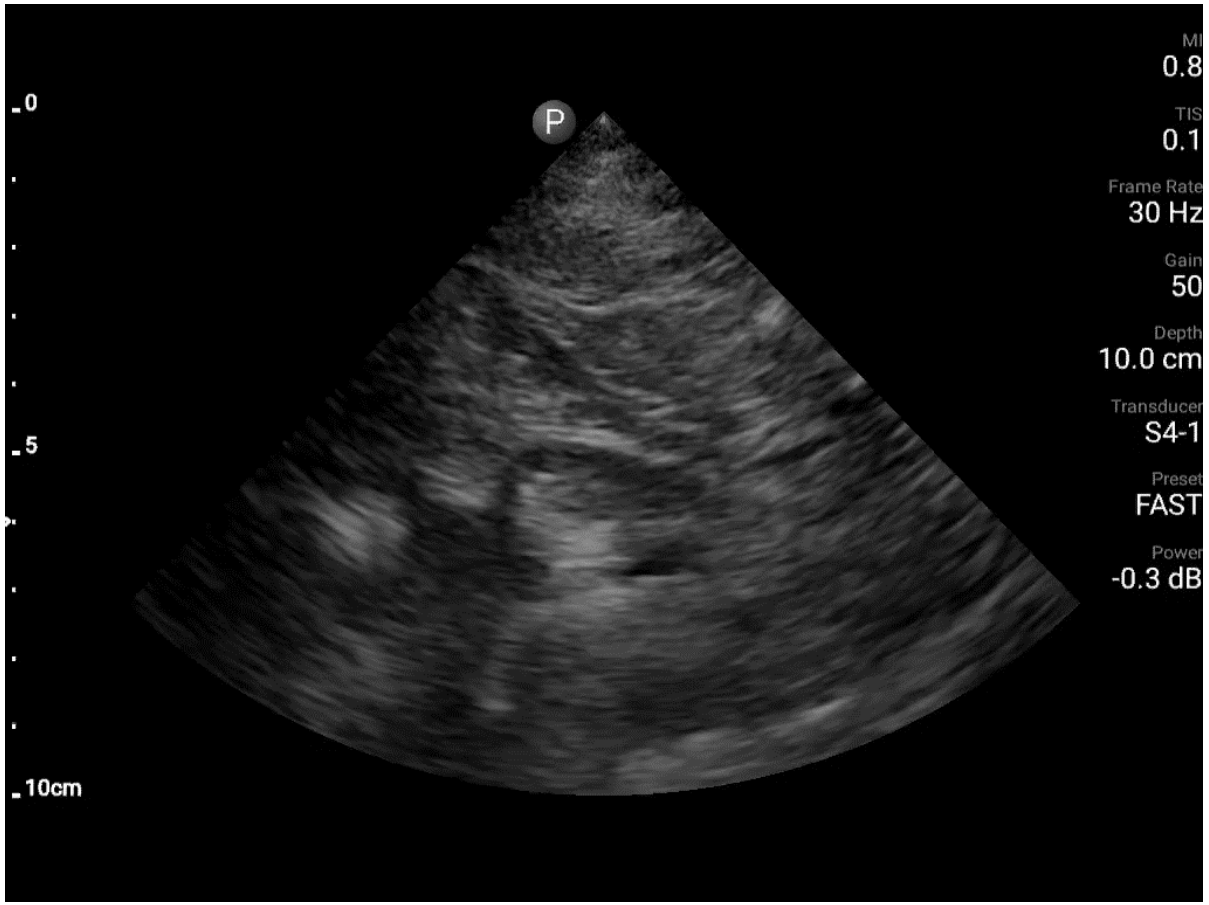
Perlas A. Anesthesiology 2009

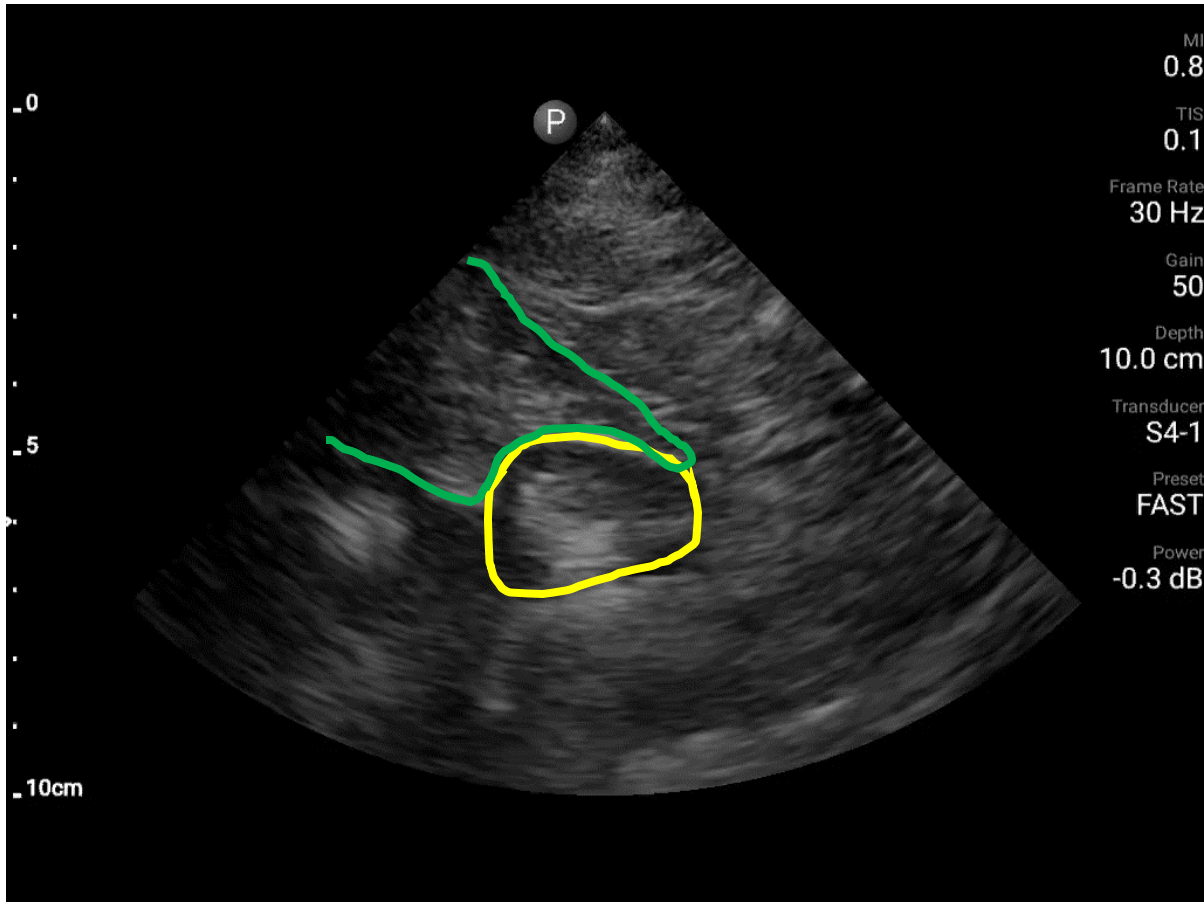
Gastric Content: Nature and Volume



Perlas A. Anesthesiology 2009

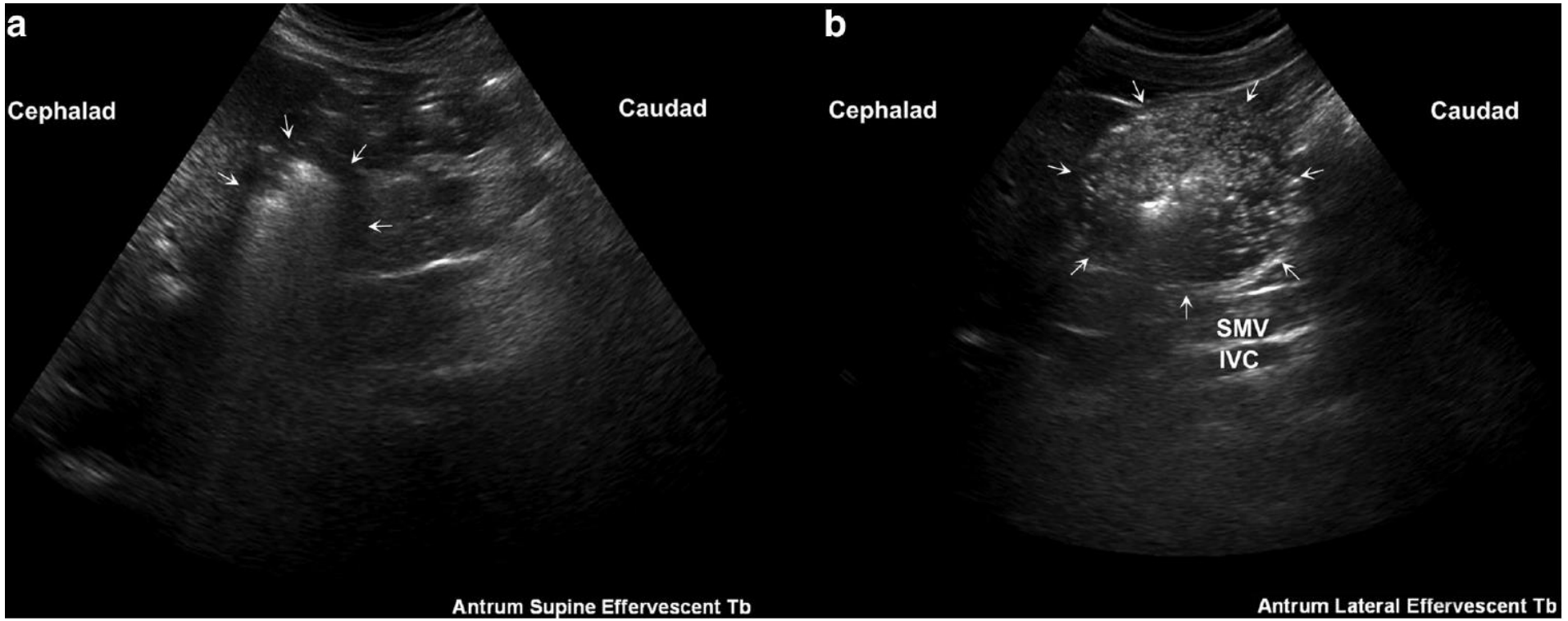
Gastric Exam





Gas while supine

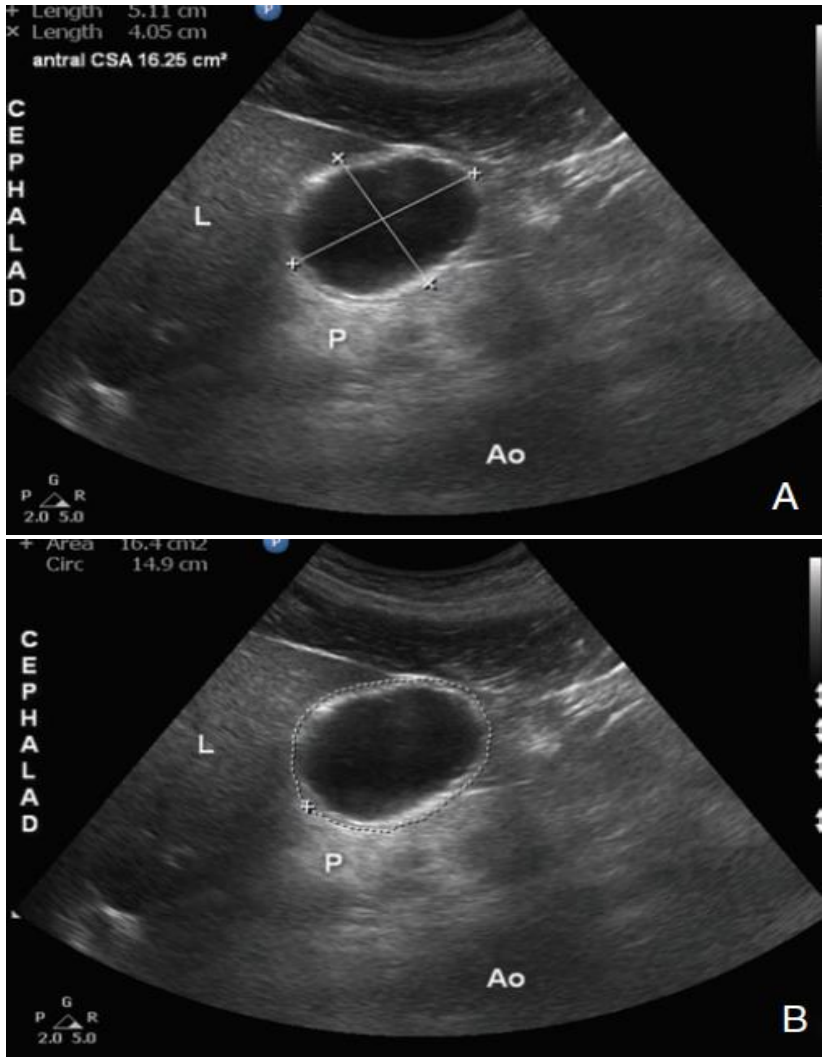
Gas while right lat decub



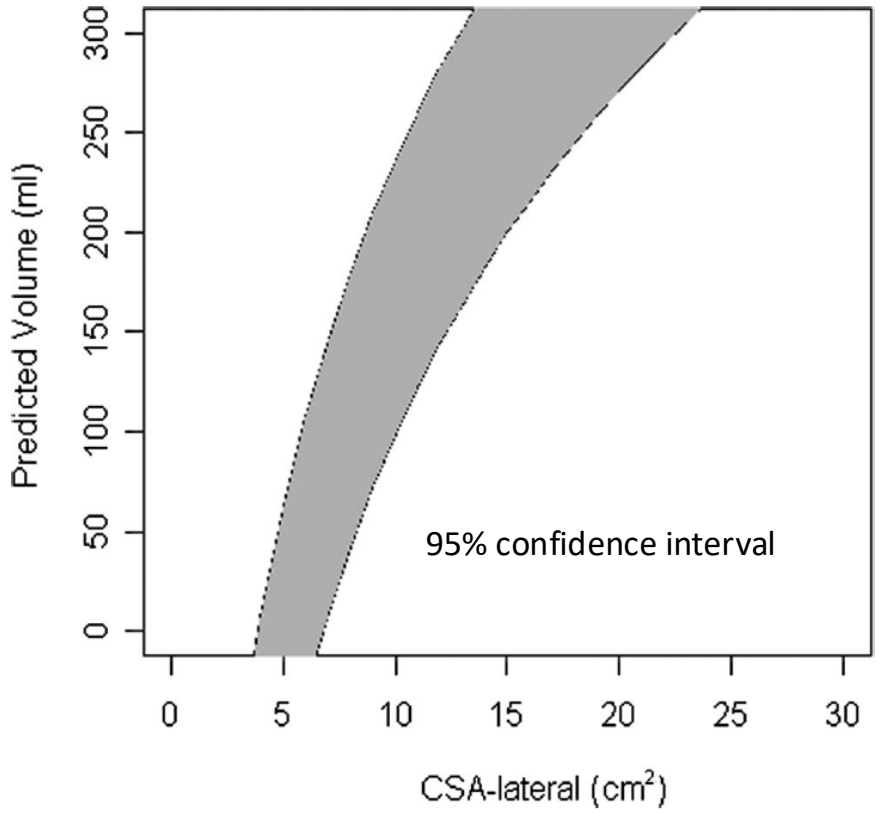
Solid

Perlas et al. Anesthesiology, V 111, No 1, Jul 2009

Antral cross-sectional: estimate gastric volume



- Right lateral decubitus
- 5 cm^2 < 50cc
- 25 cm^2 > 300cc



Perlas et al. Anesthesiology, V 111, No 1, Jul 2009

Van de Putte. Br J of Anes 113 (1): 12–22, 2014

gastric volume predicted by gastric antral CSA, stratified by patient age

Right lat CSA (cm^2)	Age (yr)						
	20	30	40	50	60	70	80
3	45	32	20	7	0	0	0
5	74	62	49	36	23	10	0
7	103	91	78	65	52	40	27
9	133	120	107	94	82	69	56
11	162	149	136	123	111	98	85
13	191	178	165	153	140	127	114
15	220	207	194	182	169	156	143
17	249	236	224	211	198	185	173
19	278	266	253	240	227	214	202
21	307	295	282	269	256	244	231
23	337	324	311	298	285	273	260
25	366	353	340	327	315	302	289
27	395	382	369	357	344	331	318
29	424	411	398	386	373	360	347

Perlas A, Ultrasound assessment of gastric content and volume. Anesthesiology. 2009;111(1):82-9.

Gastricultrasound.org

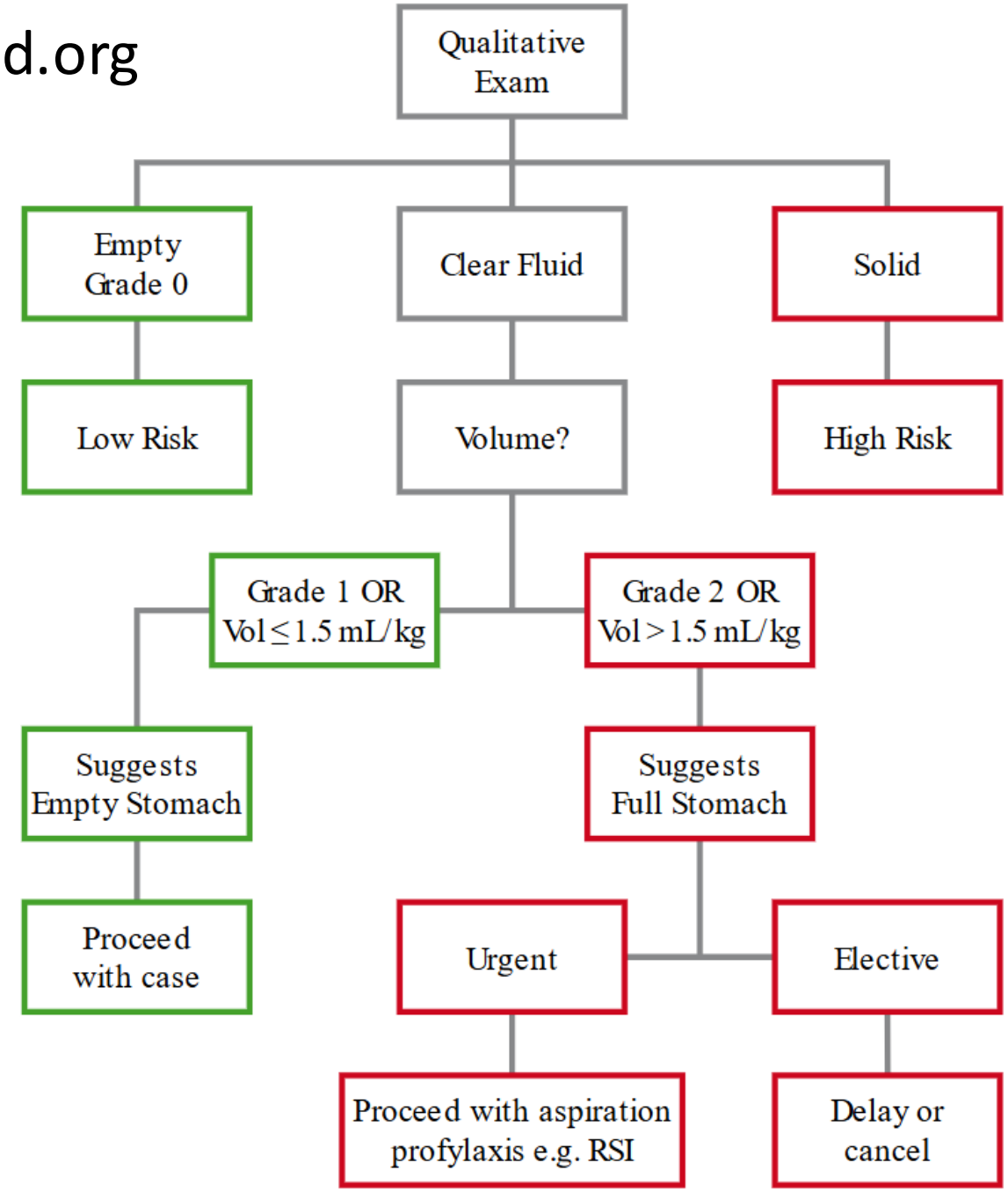
ANTRAL GRADING SYSTEM (GRADES 0 - 2)

GRADE	ANTRAL PRESENTATION	VOLUME IMPLICATIONS	ASPIRATION RISK
0	Empty in both supine and RLD position	Minimal	Low risk
1	Empty in supine, clear fluid visible in the RLD	⩽ 1.5 mL/kg, compatible with baseline gastric secretions	Low risk
2	Clear fluid visible in both positions	> 1.5 mL/kg, likely in excess of baseline gastric secretions	High risk

Solid

High risk

Gastricultrasound.org



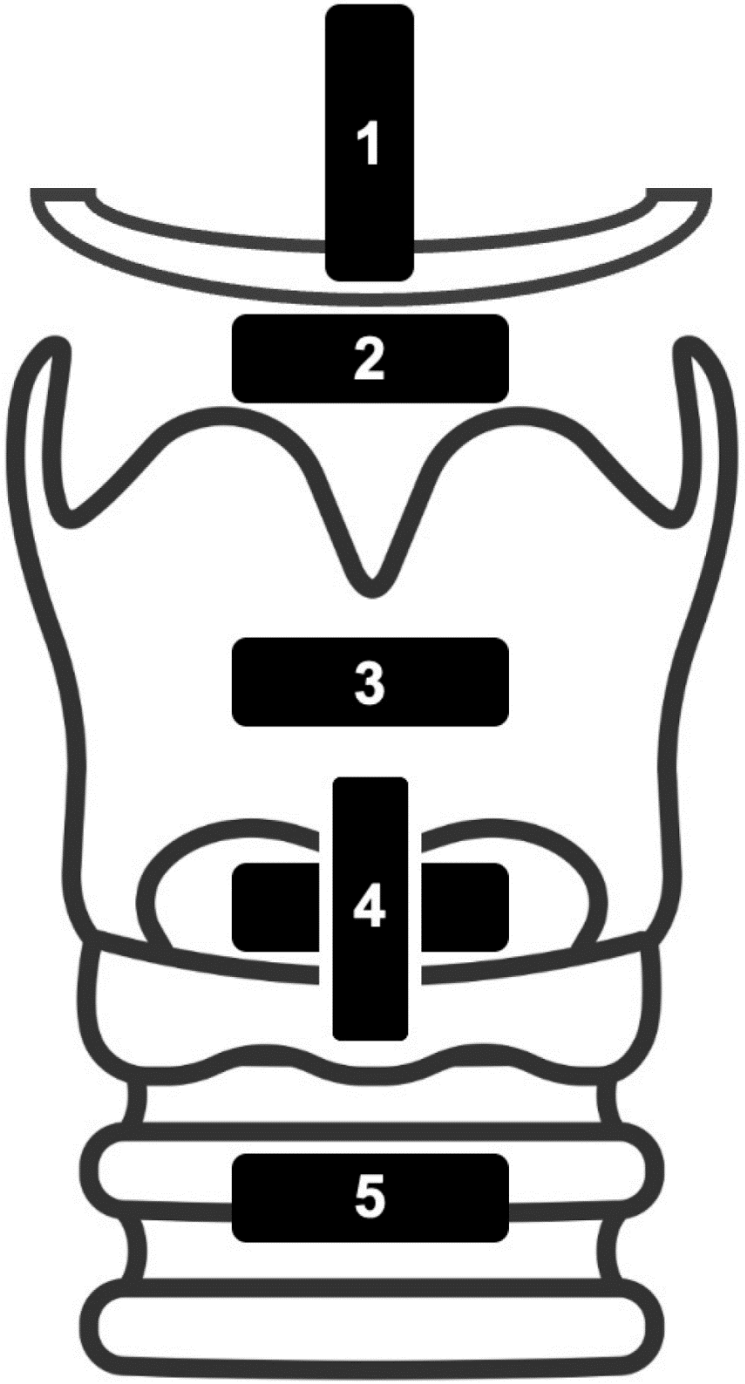
American Society of Anesthesiologists Consensus-Based Guidance on Preoperative Management of Patients (Adults and Children) on Glucagon-Like Peptide-1 (GLP-1) Receptor Agonists

- GLP-1 agonists are associated with adverse gastrointestinal effects such as nausea, vomiting and delayed gastric emptying
- Risk of regurgitation and aspiration of gastric contents when GLP-1 not held
- If GLP-1 agonists were not held as advised, proceed with 'full stomach' precautions or consider evaluating gastric volume by ultrasound, if possible and if proficient with the technique. If the stomach is empty, proceed as usual. If the stomach is full or if gastric ultrasound inconclusive or not possible, consider delaying the procedure or treat the patient as 'full stomach' and manage accordingly.

Oct 2024
https://www.asahq.org/

POCUS for the airway

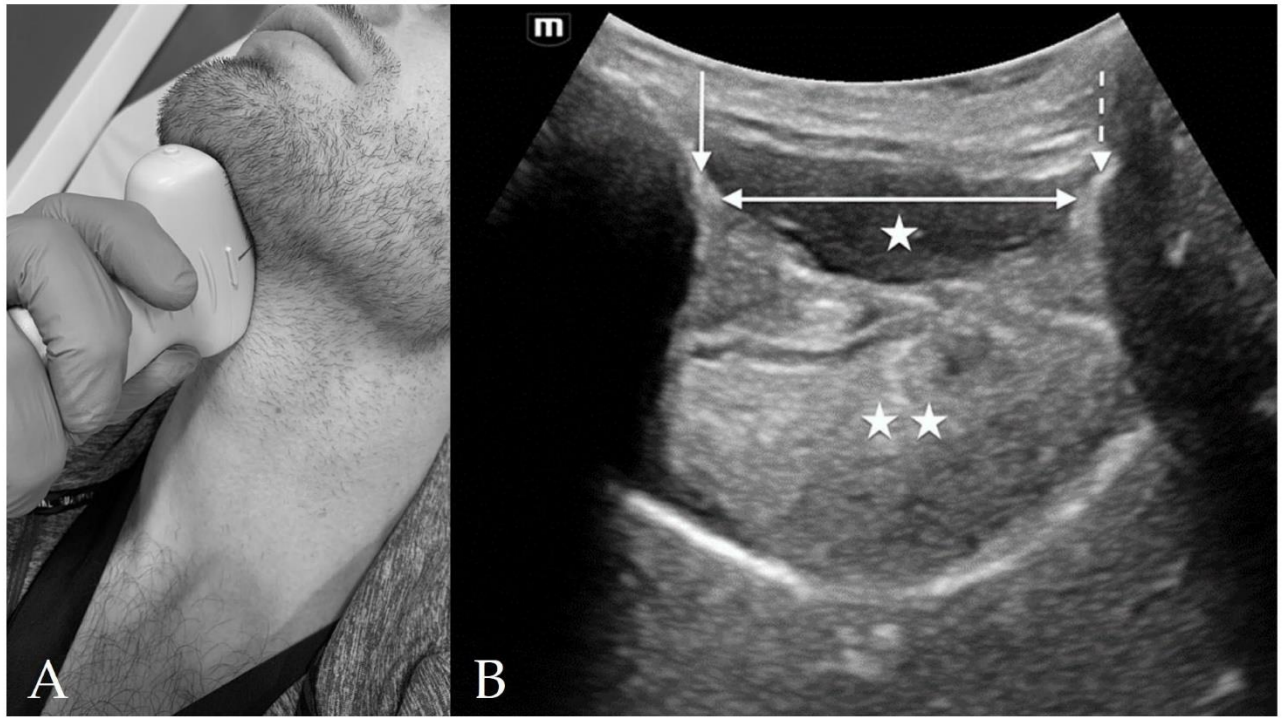
- Features predictive of difficult intubation
- Confirmation of endotracheal vs esophageal intubation
- Differentiation between tracheal and bronchial intubation
- Assist with emergent cricothyrotomy



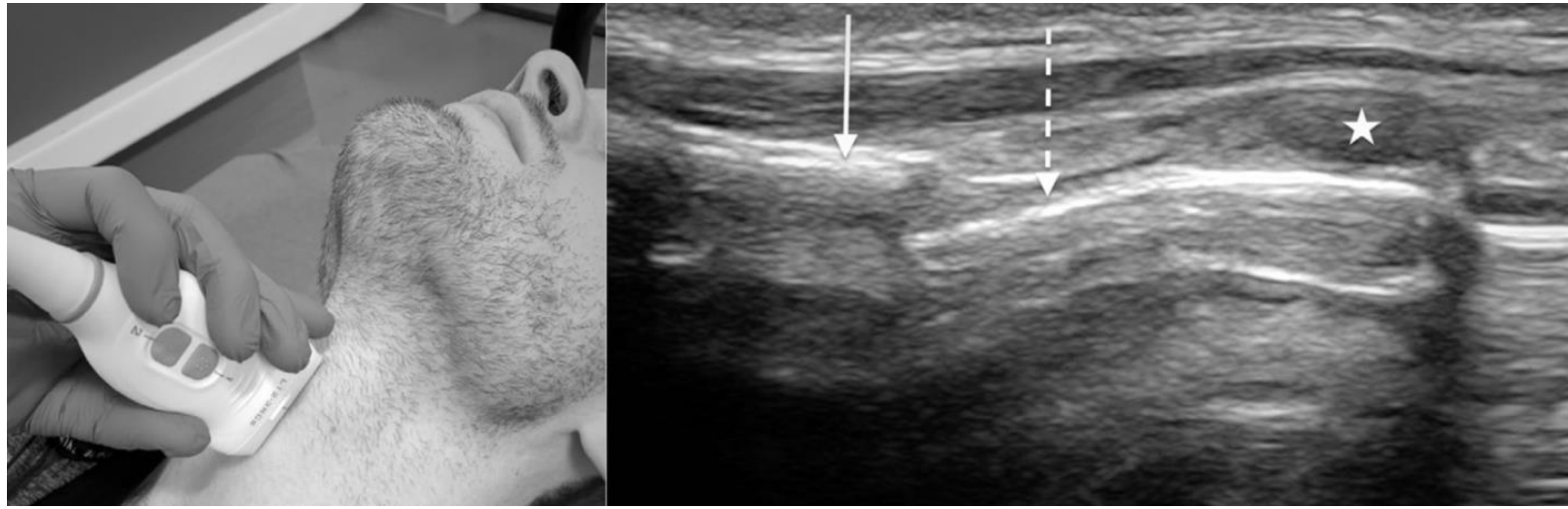
Upper Airway POCUS Views and Main Function
1. Suprahyoid: Oral space assessment
2. Thyrohyoid: Epiglottis identification
3. Thyroid: Vocal cord function
4. Cricothyroid: CTM identification
5. Suprasternal: ETT Confirmation

Diagnostics **2023**, *13*(9), 1541;

Suprahyoid View



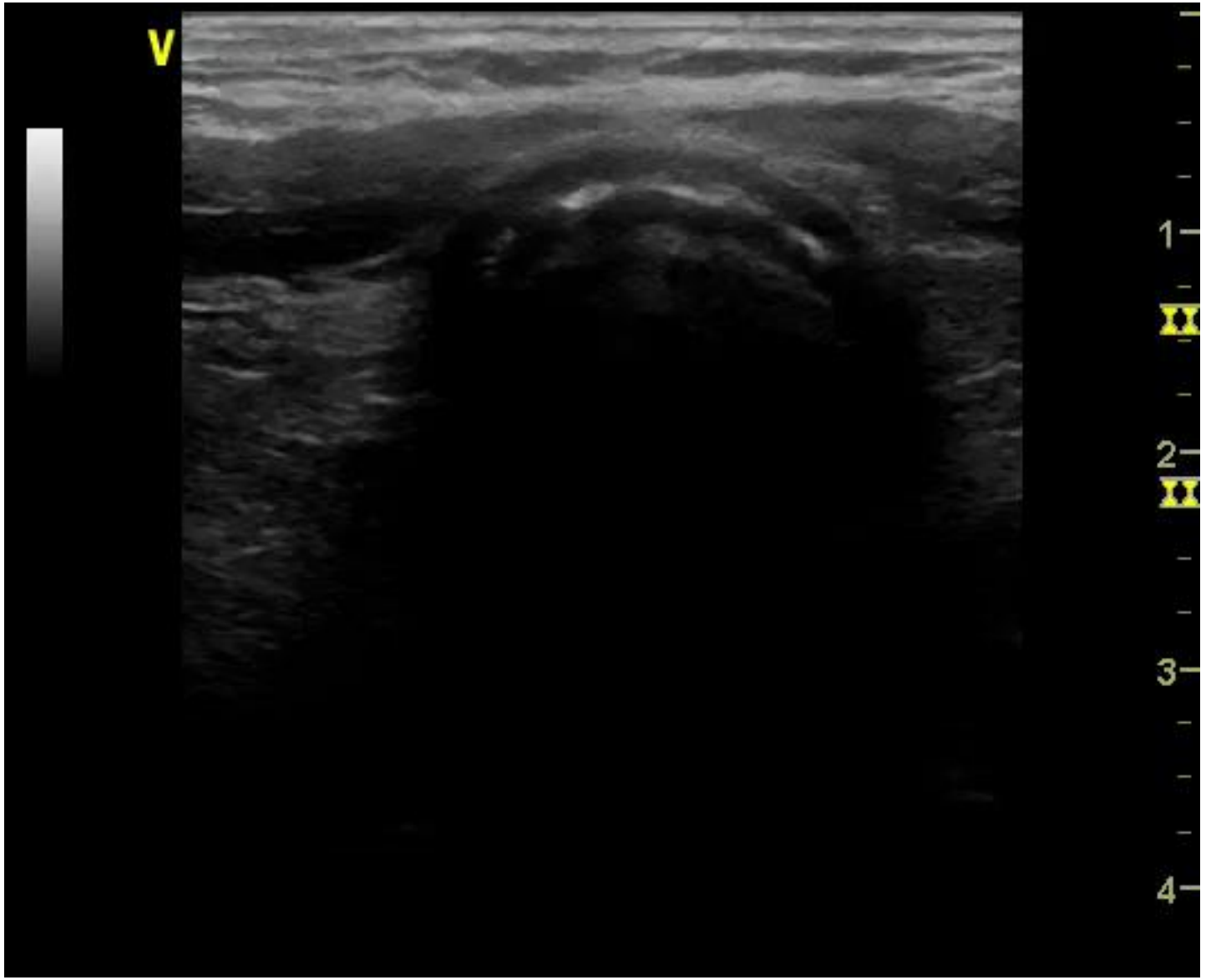
Cricothyroid View



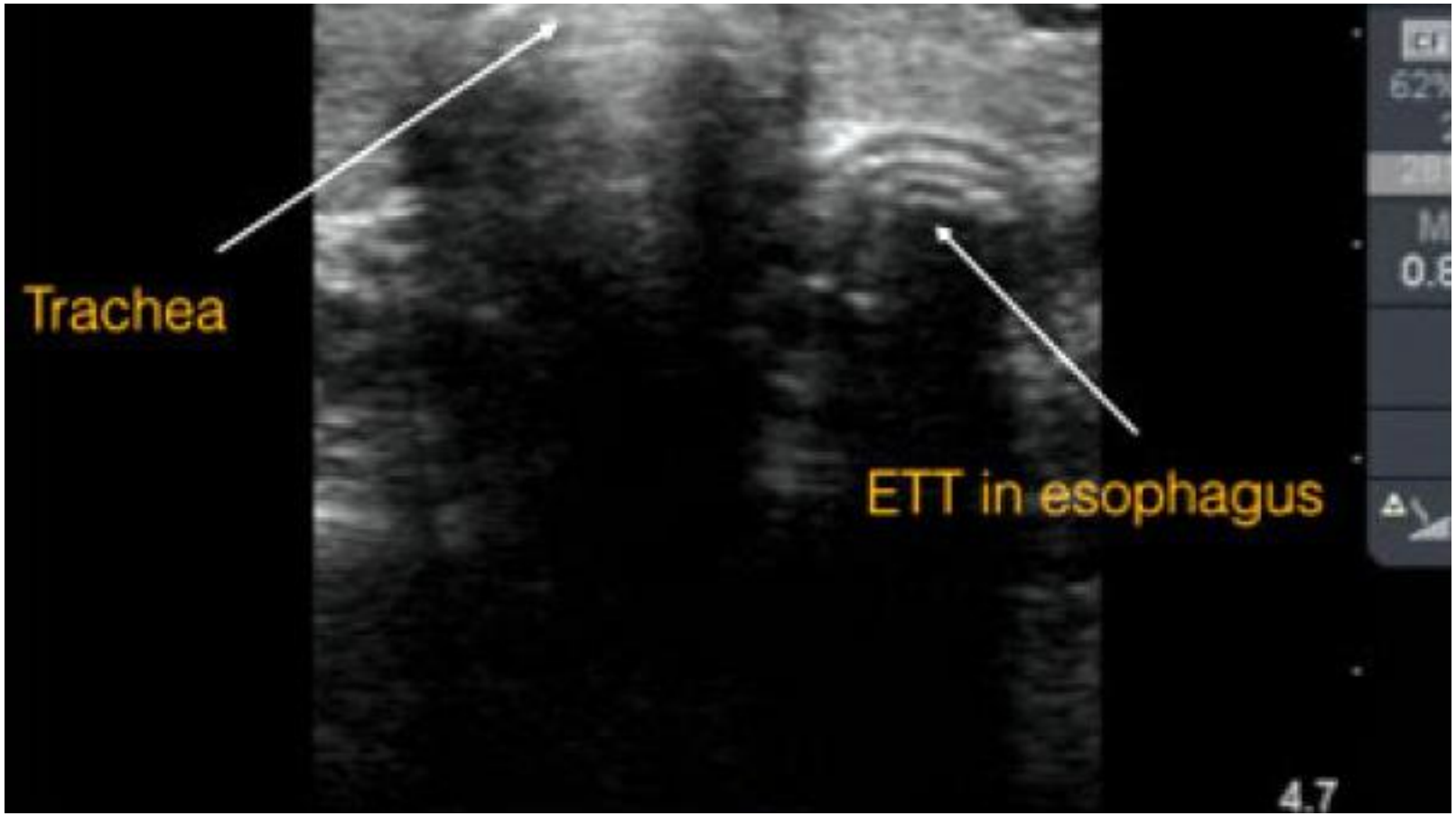
Diagnostics **2023**, *13*(9), 1541;

Diagnostics 2023, 13(9), 1541;

Tracheal dilation



Esophageal intubation



Why develop a POCUS skillset?

Why develop a POCUS skillset?

- Support clinical assessment
  - adjunct to clinical exam and focused sonography
  - more timely diagnoses and interventions

Why develop a POCUS skillset?

- Support clinical assessment
  - adjunct to clinical exam and focused sonography
  - more timely diagnoses and interventions
- Feasible to learn

Ultrasound is not new to Anesthesiology

- Regional anesthesia
  - Localization of vasculature before block
  - Real-time imaging of anesthetic spread

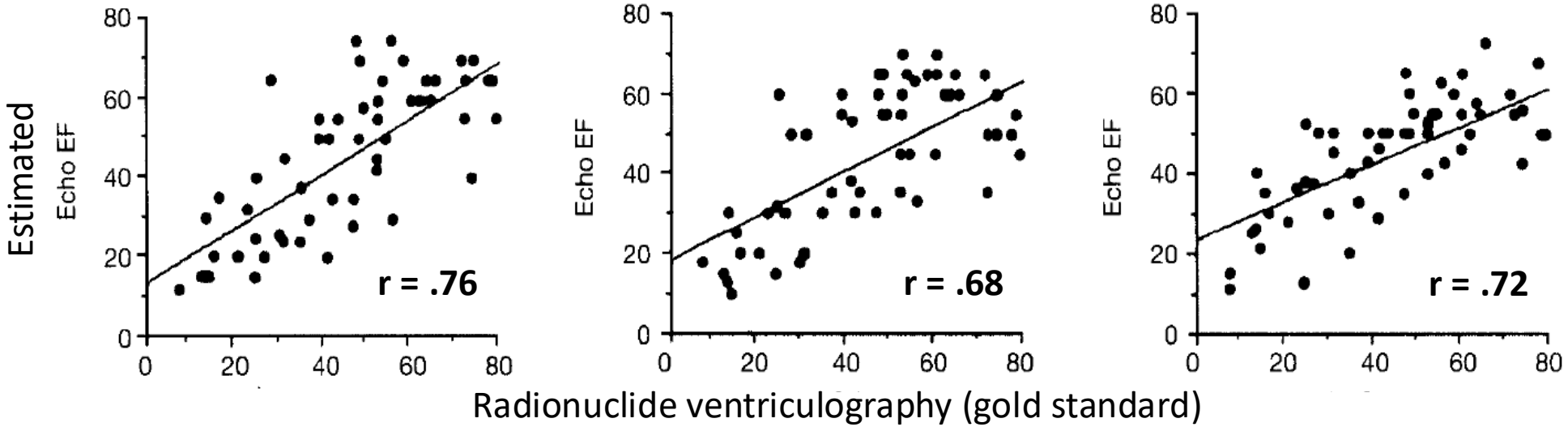
- Cardiac anesthesia
  - Transesophageal Echocardiography: Independent image acquisition and interpretation

- Core ultrasound skills
  - Peripheral and central vascular access

Visual Estimation of Ejection Fraction by Two-Dimensional Echocardiography: The Learning Curve

Clin. Cardiol. 18, 726–729 (1995)

OLAKUNLE AKINBOBOYE, M.D., JOHN SUMNER, M.D., AASHA GOPAL, M.D.,* DONALD KING, M.D.,* ZHANGING SHEN, M.D.,*
PHILIP BARDFELD, M.D.,† LISA BLANZ, R.N., EDWARD J. BROWN, JR., M.D.



1st year fellow

Private practice 10 yrs

Experienced sonographer

CHEST

Original Research

CHEST ULTRASONOGRAPHY

Assessment of Left Ventricular Function by Intensivists Using Hand-Held Echocardiography*

Roman Melamed, MD; Mark D. Sprenkle, MD; Valerie K. Ulstad, MD; Charles A. Herzog, MD; and James W. Leatherman, MD, FCCP

2 h of didactic instruction on echocardiography
4 h of hands-on training

Table 1—*Normal vs Abnormal LV Function*

Limited TTE by Intensivist	Formal TTE by Echocardiographer: Normal Findings	Formal TTE by Echocardiographer: Abnormal Findings
Normal findings	22	4
Abnormal findings	2	16

CHEST /135/6/ JUNE, 2009

Why develop a POCUS skillset?

- Support clinical assessment
  - adjunct to clinical exam and focused sonography
  - more timely diagnoses and interventions
- Feasible to learn
- ACGME and ABA expectations

ABA THE AMERICAN BOARD OF ANESTHESIOLOGY

APPLIED Exam Objective Structured Clinical Examination (OSCE) Content Outline

Part B: Technical Skills related to POCUS

- Interpret echocardiograms and ultrasound images
- 2-dimensional and color flow Doppler, and M-mode (lung ultrasound) to identify relevant anatomy, make qualitative diagnostic assessments, and provide treatment recommendations.

Scenarios may include the following:

- Biventricular function and wall motion
- Presence or absence of an atrial septal defect
- Volume status assessment- hypovolemia and response to volume therapy
- Pulmonary emboli
- Air emboli
- Basic valvular lesions
- Pericardial effusions
- Aortic dissection
- Pleural effusion
- Pneumothorax
- Pulmonary edema

ABA THE AMERICAN BOARD OF ANESTHESIOLOGY

APPLIED Exam Objective Structured Clinical Examination (OSCE) Content Outline

Heart
- Parasternal Long Axis
- Parasternal Short Axis (Left Ventricle Midpapillary)
- Apical Four Chamber
- Subcostal Four Chamber
- Subcostal IVC View

Lung
- Pleura
- Diaphragm
- Artifacts (A-lines, B-lines)

ABA THE AMERICAN BOARD OF ANESTHESIOLOGY

APPLIED Exam Objective Structured Clinical Examination (OSCE) Content Outline

Abdomen (2026)

- Right Upper Quadrant
- Left Upper Quadrant
- Pelvis
- Gastric (content & volume)

Airway-related structures (Testing to start 2027)

- Trachea
- Tracheal rings
- Cricoid cartilage
- Cricothyroid membrane
- Thyroid cartilage
- Vocal cords
- Hyoid bone
- Epiglottis
- Tongue
- Esophagus

Why develop a POCUS skillset?

- Support clinical assessment
  - adjunct to clinical exam and focused sonography
  - more timely diagnoses and interventions
- Feasible to learn
- ACGME and ABA expectations
- Many other providers are learning and using
  - Trainees
  - Other specialties
  - CRNAs
  - APPs

How do we ensure high quality pocus?

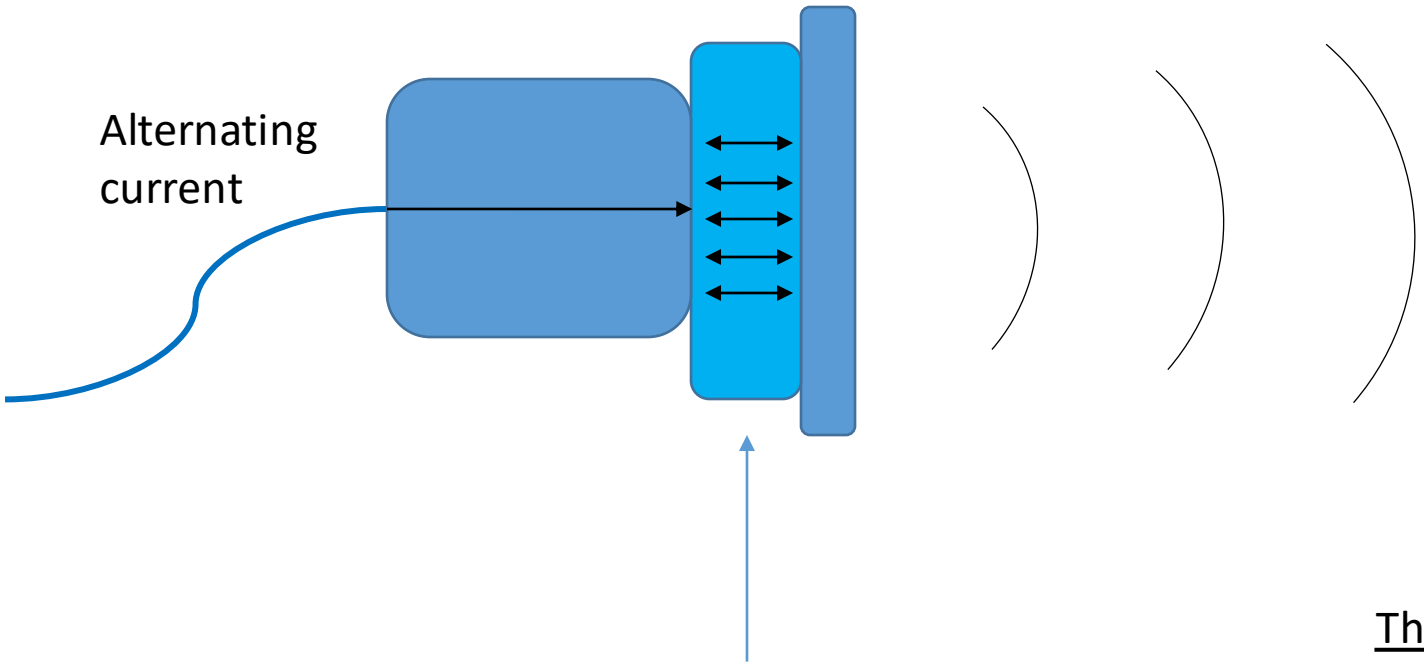
How do we ensure high quality pocus?

- Competency

How do we ensure high quality pocus?

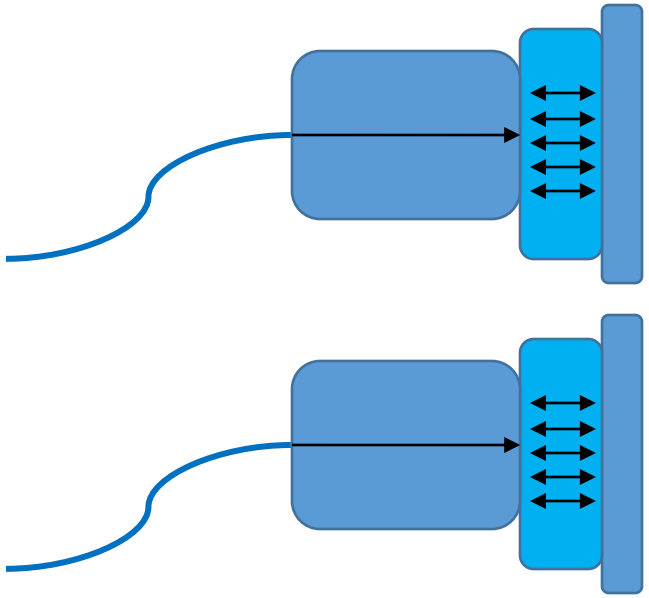
- Competency
  - Ultrasound physics

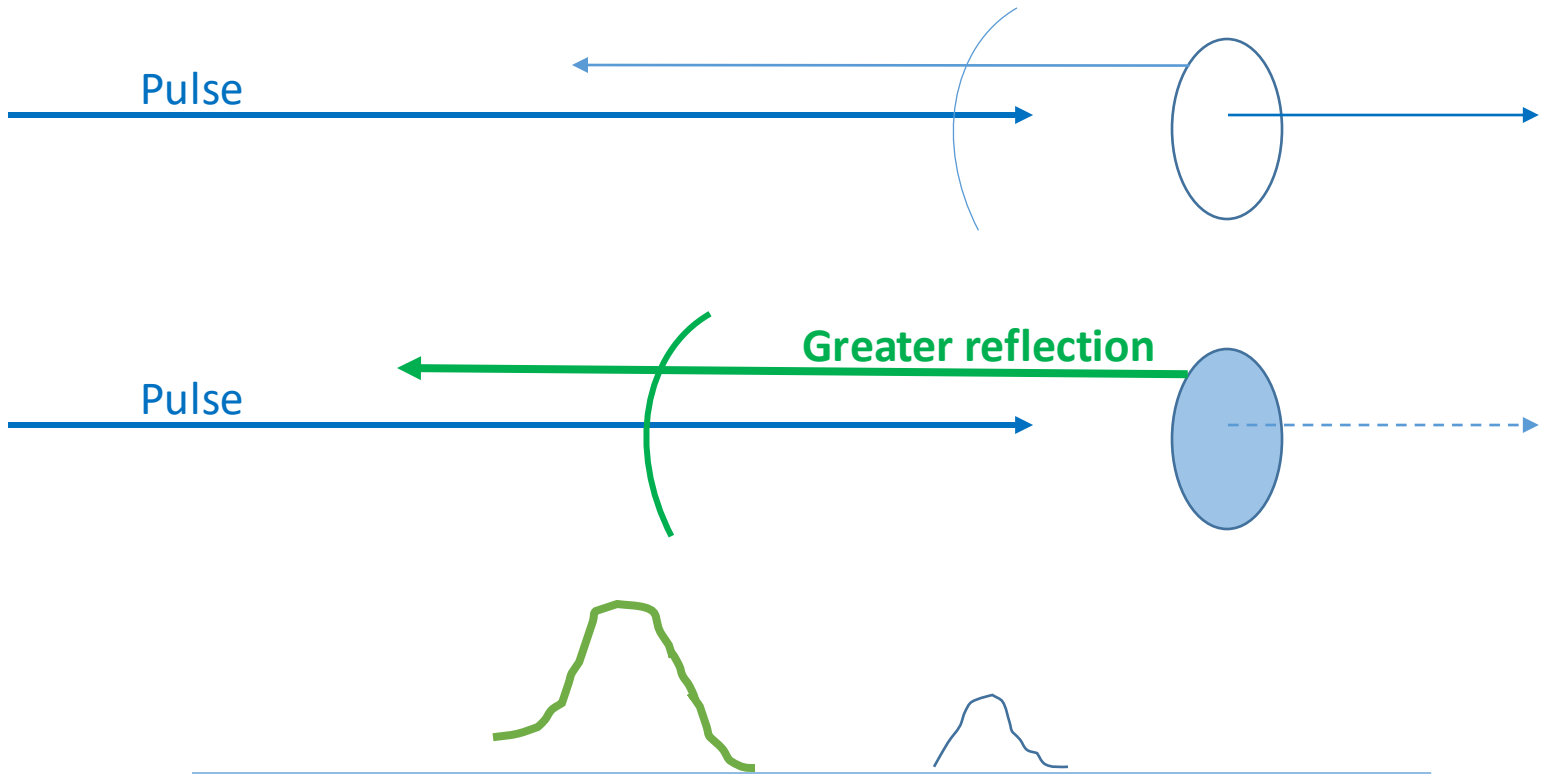
Fundamental knowledge of ultrasound physics



Thin crystals	Thick crystals
High frequency	Low frequency

How image is generated





A mode

brighter

B mode

Image artifacts

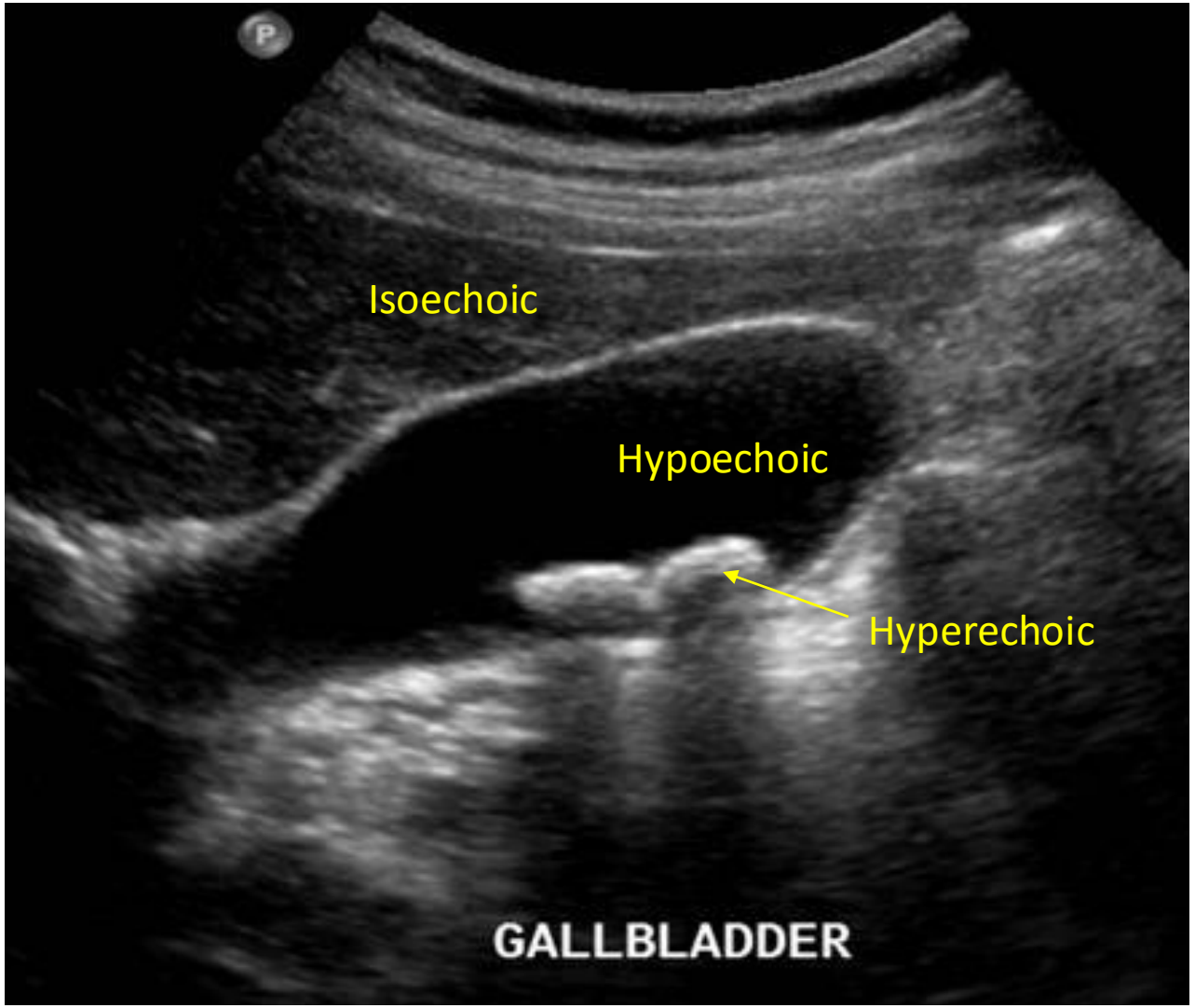
Optimizing image

- Focus
- Resolution

Fluid -> transmission

Soft tissues -> reflection, transmission

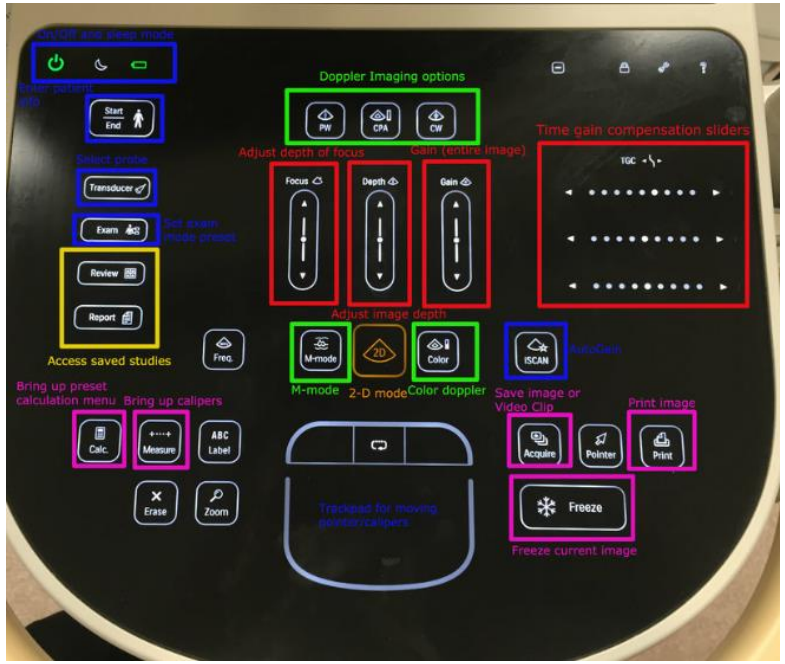
Stones-> reflection, scatter, absorption



How do we ensure high quality pocus?

- Competency
  - Ultrasound physics
  - Knobology and equipment

Knobology

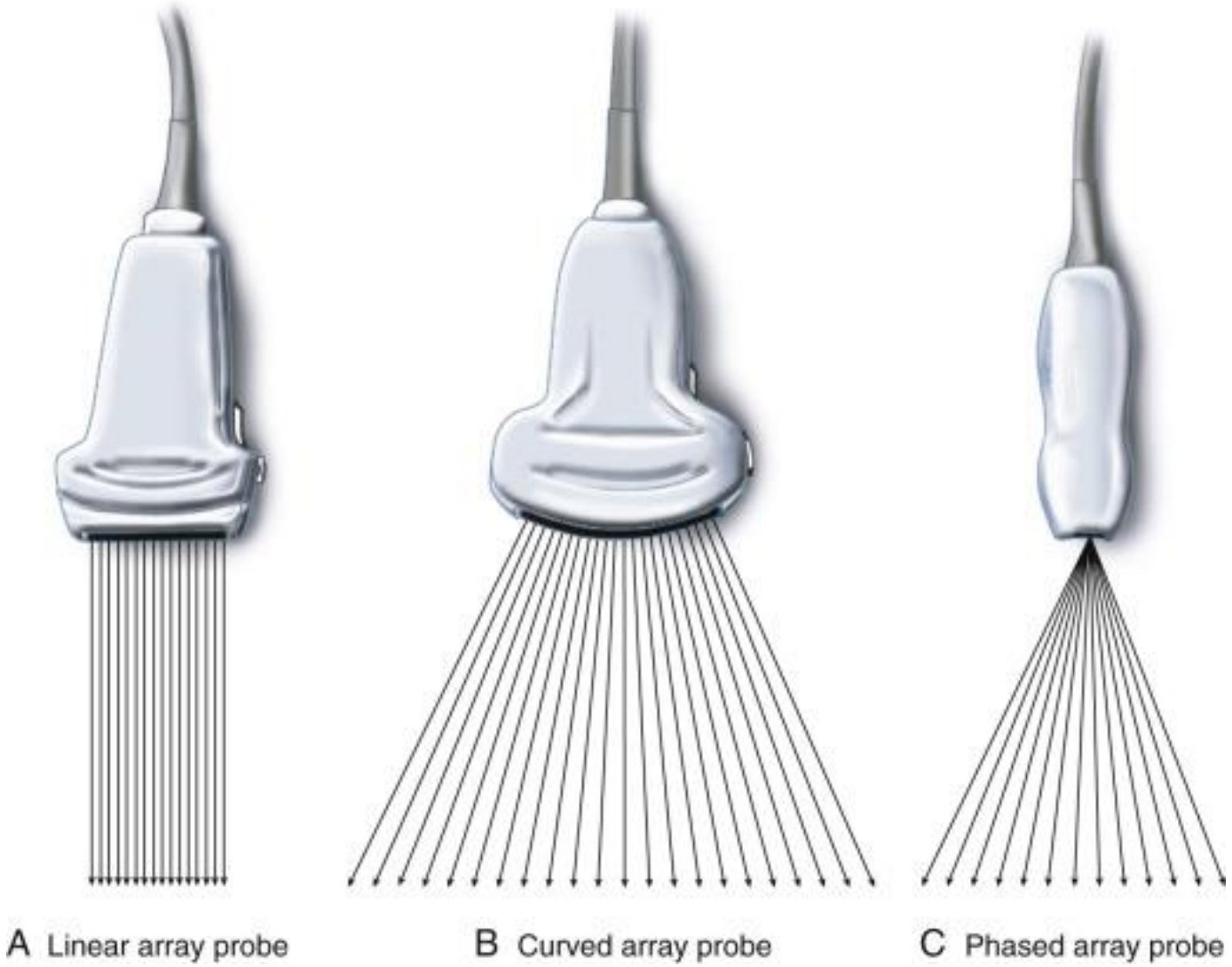

Doppler Imaging options
PW
CPA
CW
Time gain compensation sliders
Adjust depth of focus
Gain (entire image)
Focus
Depth
Gain
TGC
Start
End
Transducer
Exam
Review
Report
Access saved studies
Freq.
Adjust image depth
M-mode
2D
Color
iSCAN
AutoGain
M-mode
2-D mode
Color doppler
Save image or
Video Clip
Print image
Bring up preset
calculation menu
Bring up calipers
Calc.
Measure
ABC
Label
Erase
Zoom
Acquire
Pointer
Print
Freeze
Freeze current image

Selecting the appropriate machine for the evaluation:

- Qualitative assessment versus quantitative measurements
- Resolution
- Portability

https://www.ultrasoundportables.com
https://todopocus.com

High quality POCUS requires appropriate selection of transducer (“probe”)



Each piezoelectric crystal section is made of many small individual elements.

Each crystal element is in its own partition, isolated

“Sequential” = crystals aligned sequentially in linear or curvilinear fashion

“Phased” = individual elements activated in phases, effectively steers the beam

Proper care, maintenance and cleaning

- Care, maintenance and disinfectant
- Recognition of damage

How do we ensure high quality pocus?

- Competency
  - Ultrasound physics
  - Knobology and equipment
  - Documentation and image archiving practices

ASE elements required for documentation

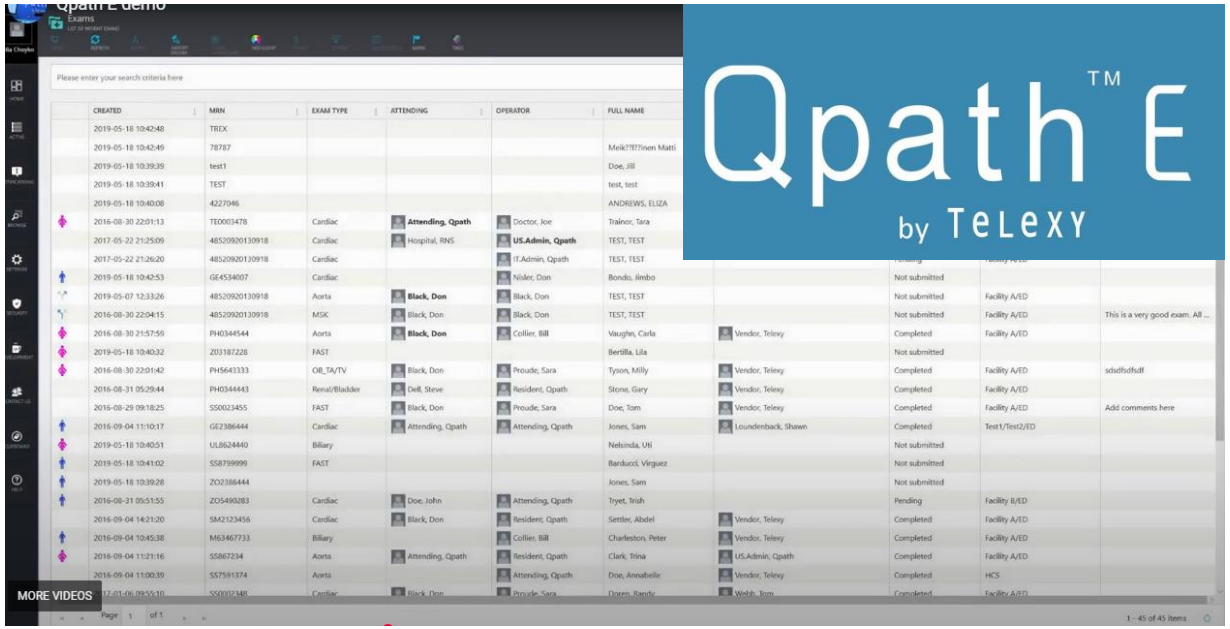
Demographic information:

- Name
- Age
- Biological sex
- Medical record number
- Date of birth

Exam information:

- Date and time of exam
- Exam performed by
- Exam interpreted by
- Indication for exam
- Clinical assessment/impression
- Main findings
- Detailed findings
- Limitations
- Recommendation for additional studies
- **Mode of archiving**

Qpath (Telexy) image archiving server (QA review)



Medical record

How do we ensure high quality pocus and patient safety?

- Competency
  - Ultrasound physics
  - Knobology and equipment
  - Documentation and image archiving practices
  - Anatomy and standardized images
  - Hands-on practice

POCUS Training

- To date, no universally accepted standards for POCUS curriculum and training

POCUS Training

- To date, no universally accepted standards for POCUS curriculum and training
  - Residency and fellowship trainings vary
  - Society trainings and recommendations vary

- Best programs contain these elements:
  - Didactics
  - Image review
  - Hands-on proctored practice
  - Portfolio of mentored exams
  - Annual CME / maintenance

American Society of Anesthesiologists

ABA

Diagnostic POCUS Certificate Program

The only program created by anesthesiologists for anesthesiologists.

New in 2024: Increased CME, enhanced cardiac learning, new cases, and more!

BUY NOW >

https://www.asahq.org

YOU'LL ACHIEVE YOUR DIAGNOSTIC POCUS CERTIFICATE OF COMPLETION

Part 1:
Complete a QI Action Plan.

Part 2:
Provide evidence of past POCUS education/training.

Part 3:
Identify and interpret online cases.

176

16 basic POCUS
100 cardiac
20 lung
20 gastric
20 AFFBU exam cases

Part 4:
Perform and acquire images for mentor review.

140

30 lung ultrasounds
30 gastric ultrasounds
50 focused cardiac ultrasounds
30 AFFBU exam

Part 5:
Take the final exam.

Gastric Point-of-Care Ultrasound (POCUS) Certificate

American Society of Anesthesiologists

ABA

Part 1: Quality Improvement (QI) Action Plan (optional)

Part 2: Diagnostic POCUS Gastric Training

Part 3: Interpretation Training

Part 4: Image Acquisition

Part 5: Take the Final Exam

50th ANNIVERSARY ASRA PAIN MEDICINE
HONORING OUR LEGACY, BUILDING OUR FUTURE

https://asra.com/events-education/courses/pocus/program

Related certificates / trainings - high quality

chestnet.org

- Critical Care Ultrasonography Certificate of Completion

sccm.org

- Critical Care Ultrasound: Adult
- Critical Care Ultrasound: Advanced Echocardiography

How do we ensure high quality pocus?

- Competency
  - Ultrasound physics
  - Knobology and equipment
  - Documentation and image archiving practices
  - Anatomy and standardized images
  - Hands-on practice
  - Repetition – mentored portfolio and deliberate practice

Requirements for Competence in Critical Care Ultrasound Core Applications – SCCM

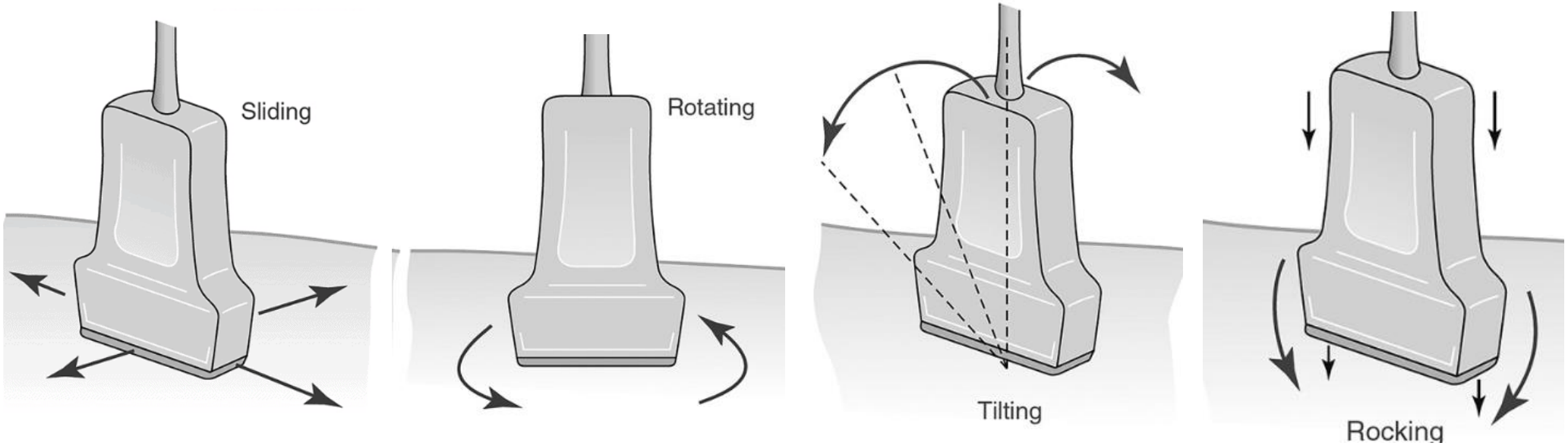
Type of Ultrasound	Application	Minimum Number Interpreted	Minimum Number Personally Performed
Diagnostic	Basic Critical Care Echo	50	30
	Pleural/pulmonary ultrasound	30	20
	Focused abdominal ultrasound	30	20
	Vascular ultrasound	30	20

Mastery of two cognitive processes

Physical manipulation of the probe to generate the desired image
Ability to interpret the image in the clinical context

www.sonosite.com

High Quality POCUs requires stereotactic skillset to appropriately maneuver the Transducer



AIUM Technical Bulletin

American Institute of Ultrasound Medicine: J Ultrasound Med 1999

Image interpretation

Mentored feedback:

- Optimal image orientations “windows” that allow appropriate assessment
- Interpretation in clinical context

Trainee self assessment form

Parasternal Long Axis View

***** Please set US Machine to probe selection screen prior to starting exam prompt *****

Doctor,

Please position the patient for a cardiac scan in the parasternal long axis view and then select the appropriate ultrasound probe. Please let me know when you are ready and you will have 3 minutes to complete the exam once your probe touches the patient.

- Please obtain a parasternal long axis view and when you are happy with your view I will freeze the image for you. ***(SAVE IMAGE HERE)***

- Please identify the right ventricle.

- Please identify the anterior leaflet of the mitral valve.

- Please indicate where you would place M-Mode to determine fractional shortening.

OSCE EVALUATOR'S CHECKLIST:

	Skill / Keywords	Yes (1)	Somewhat (0.5)	No (0)
1.	Demonstrated appropriate patient positioning (supine or left lateral acceptable)			
2.	Obtained an acceptable parasternal long axis view(See Grading Rubric)			
3.	Identified the right ventricle		[redacted]	
4.	Identified the anterior leaflet of the mitral valve		[redacted]	
5.	Identified correct location for M-Mode for Fractional Shortening (mid-pap)		[redacted]	

OSCE Total Score: ( )
Total Score Possible (5)
Time it took to complete exam: >1min left <1min left Did not finish

In my overall opinion, this resident demonstrated competency in this exam.

1 2 3 4 5

Point of Care Ultrasound- Image Quality Peer Review

Focused Echocardiography Exam

Clinician reviewed: _____ **Date of review:** _____

Reviewer: _____

Exam information: MRN_____ **Date of exam**_____ **Archiving system**_____

Note: This is a subjective assessment. As a general rule, most or all quality criteria should be met to deem study quality adequate, however, there may be extenuating factors that preclude attaining some quality criteria in a study that is otherwise deemed to be of adequate quality.

I. APICAL 4-CHAMBER (A4C)

Quality Criterion	Present?
1. All 4 chambers are visible	☐
2. Opening/closing of both Tricuspid and Mitral valves is visible and on-plane	☐
3. The apex of the left ventricle (LV) is visible, and is not foreshortened	☐
4. The septum is vertical (the lines of the crux of the heart are horizontal and vertical, with the intersection point in the middle of the image)	☐
5. Descending aorta is visible	☐
6. Appropriate depth	☐
7. Appropriate gain	☐

Is the quality of this A4C view adequate? **Yes/ No**

Monthly POCUS presentation by fellows providing image review, QA review and literature reference – fellows and faculty

Case Presentation

- 73 y/o M with hx/o prostate Ca, DM, paroxysmal AF, end-stage NICM s/p HVAD (!) placement in 2012 with known severe chronic RV dysfunction
- Admitted to CVICU with mixed septic & cardiogenic shock 2/2 *E. colic* UTI
- Bedside POCUS performed to eval right heart function in setting of mixed shock requiring levophed

How do we ensure high quality pocus?

- Competency
  - Ultrasound physics
  - Knobology and equipment
  - Documentation and image archiving practices
  - Anatomy and standardized images
  - Hands-on practice
  - Repetition – mentored portfolio and deliberate practice
  - Scope of practice

UM Policy defines scope of practice

- The cardiac portion of core POCUS application, also referred to as Focused Cardiac Ultrasound (FoCUS), is not a substitute for a formal diagnostic echocardiogram performed by the consulting echocardiography service. The perioperative POCUS exam is limited in scope and does NOT include:
  - Detailed qualitative or quantitative valvular pathology
  - Confirmation of the presence or absence of vegetations or intracardiac/valvular masses
  - Evaluation for congenital abnormalities
  - Quantitative assessment of systolic or diastolic function

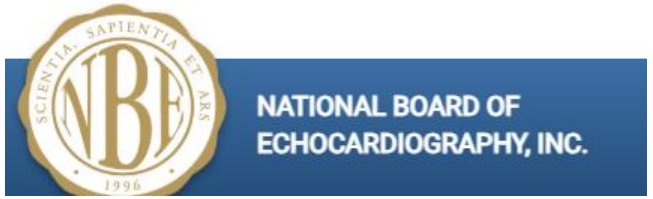
Competency vs certification vs credentialing

- Competency: having knowledge, skills, judgment to perform.

Competency vs certification vs credentialing

- Competency: having knowledge, skills, judgment to perform.
- Certification: regulatory body recognition of competence.

Certificate vs certification vs credentialing



- Certification:
  - Special Competency in Critical Care Echocardiography exam (CCEeXAM)
    - National Board of Echocardiography (NBE).
    - January, 2019, the first formal exam
    - Passing this exam leads to Testamur status, a prerequisite for certification.
    - Certification requires:
      - 150 full TTE exams w/ all obtainable elements
      - Supervised Training vs Practice Experience Pathway

Competency vs certification vs credentialing

- Competency: having knowledge, skills, judgment to perform.
- Certification: regulatory body recognition of competence.
- Credentialing: assessment of qualifications to practice.

UM Credentialing

- ABA board certification – basic POCUS is core privilege
- Recommend all Anesthesiologists obtain ASA POCUS certificate to improve skill set given the variability and challenges within residency and fellowship programs.
- Critical care divisions in some institutions requiring NBE Critical Care Echo certification to practice.

Quality and Safety concerns

Lack of standardization

- Terminology
- Training and competency standards
- Workflow and documentation practices

Diverse terminologies

- 1999 American Medical Association policy statement H-230.960
- ultrasound imaging within the scope of practice of appropriately trained physicians – not a specific specialty

Hospitals

Privileging for Ultrasound Imaging H-230.960

Topic: Hospitals
Meeting Type: Annual
Action: Reaffirmed
Council & Committees: Council on Medical Service

Policy Subtopic: Medical Staff - Credentialing and Privileges
Year Last Modified: 2020
Type: Health Policies

(1) AMA affirms that ultrasound imaging is within the scope of practice of appropriately trained physicians;

(2) AMA policy on ultrasound acknowledges that broad and diverse use and application of ultrasound imaging technologies exist in medical practice;

(3) AMA policy on ultrasound imaging affirms that privileging of the physician to perform ultrasound imaging procedures in a hospital setting should be a function of hospital medical staffs and should be specifically delineated on the Department's Delineation of Privileges form; and

(4) AMA policy on ultrasound imaging states that each hospital medical staff should review and approve criteria for granting ultrasound privileges based upon background and training for the use of ultrasound technology and strongly recommends that these criteria are in accordance with recommended training and education standards developed by each physician's respective specialty.

Example: “Cardiac POCUS”

- Focused-assessed transthoracic echocardiography
- Focused cardiac ultrasound
- cardiopulmonary limited ultrasound
- informal transthoracic echocardiogram
- limited transthoracic echocardiogram
- bedside echocardiogram
- basic echocardiography

UM QA event

- “bedside echocardiogram” performed on patient with infectious signs in the ED
- Qualitative exam
- “Echo was done” in progress note.
- Interpreted by providers as formal comprehensive echocardiogram
- Delayed evaluation of endocarditis and appropriate management

UM – Department specific solution

Point of Care Ultrasound Study

Department of Anesthesia

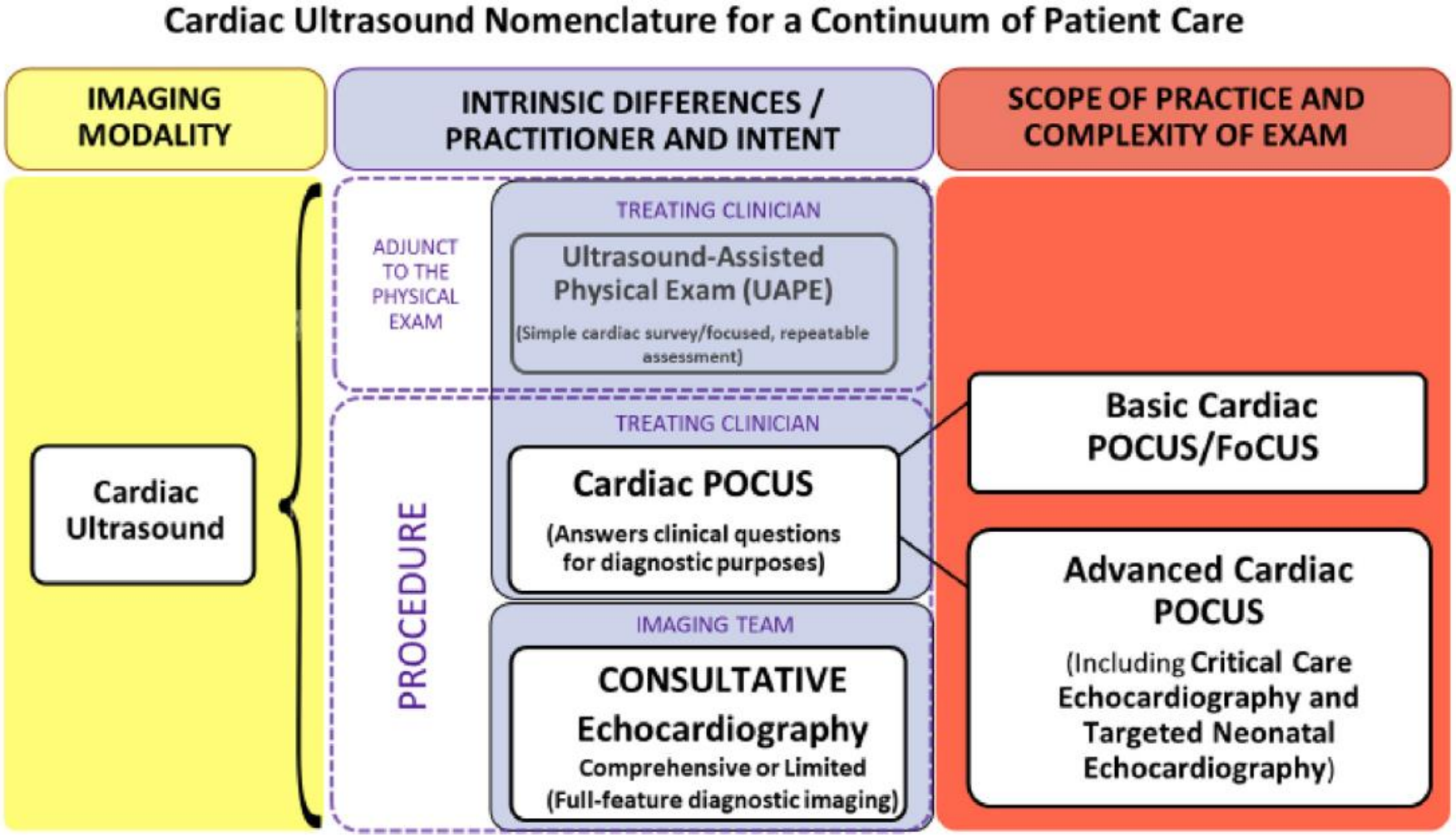
- Disclaimer: This study may contain a focused cardiac ultrasound performed by a clinician to guide management at the bedside. This study should NOT be considered definitive- please order a comprehensive echocardiography study if appropriate, especially for (but not limited to) questions related to the following-
  - Valvular pathology
  - Presence of vegetations or intracardiac/ valvular masses
  - Mechanical and bioprosthetic valves, other devices and foreign bodies
  - Quantification of systolic or diastolic chamber function
  - Hemodynamic measurements
  - Chamber size
  - Congenital abnormalities

2024 ASE consensus recommendation

- American College of Chest Physicians (CHEST)
- American College of Emergency Physicians (ACEP)
- American Institute of Ultrasound in Medicine (AIUM)
- American Society of Anesthesiologists (ASA)
- American Thoracic Society (ATS)
- Society of Cardiovascular Anesthesiologists (SCA)
- Society of Critical Care Medicine (SCCM)
- Society of Critical Care Anesthesiology (SCCA)
- World Interactive Network Focused on Critical Ultrasound (WINFOCUS)

Journal of the American Society of Echocardiography
September 2024

2024 ASE consensus recommendation



Patient Safety related to training

Should we practice on patients?

QA events:

1. Practice exam performed in PACU
2. Ask patients to look “for fun” or “to practice”

UM solution:

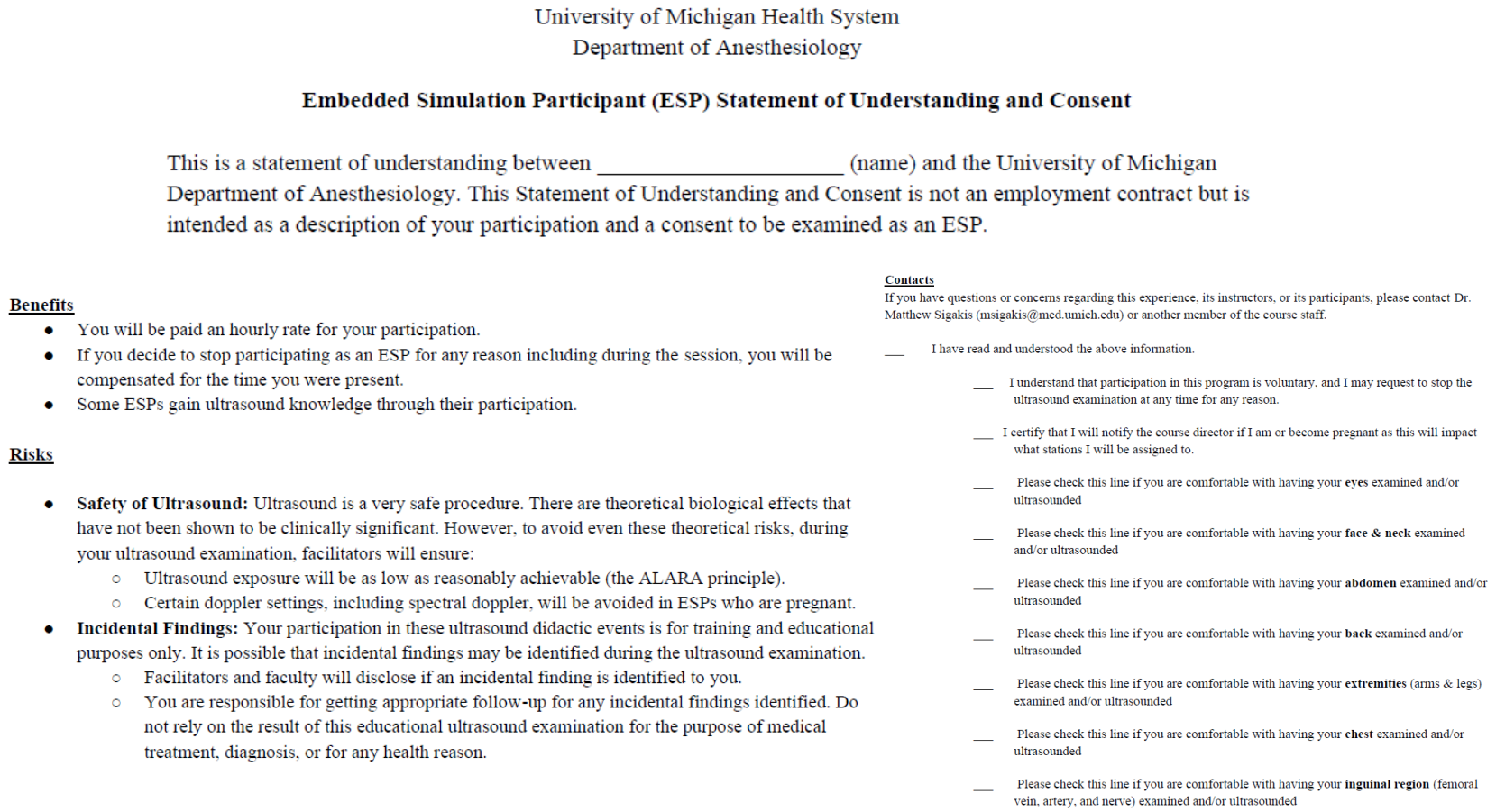
1. Only true practice exams are on a model
2. If performing POCUS on patients, always have a clinical question in mind and perform exams with more experienced faculty

Patient Safety related to training

POCUS practice on models:

Signed agreement:
- Benefits
- Risks – ALARA principle, pregnancy
- Incidental findings
- Exposure
- Ability to stop

Chaperone policy:
- Never 1:1
- Always 3rd person



University of Michigan Health System
Department of Anesthesiology

Embedded Simulation Participant (ESP) Statement of Understanding and Consent

This is a statement of understanding between _____ (name) and the University of Michigan Department of Anesthesiology. This Statement of Understanding and Consent is not an employment contract but is intended as a description of your participation and a consent to be examined as an ESP.

Benefits

- You will be paid an hourly rate for your participation.
- If you decide to stop participating as an ESP for any reason including during the session, you will be compensated for the time you were present.
- Some ESPs gain ultrasound knowledge through their participation.

Risks

- **Safety of Ultrasound:** Ultrasound is a very safe procedure. There are theoretical biological effects that have not been shown to be clinically significant. However, to avoid even these theoretical risks, during your ultrasound examination, facilitators will ensure:
  - Ultrasound exposure will be as low as reasonably achievable (the ALARA principle).
  - Certain doppler settings, including spectral doppler, will be avoided in ESPs who are pregnant.
- **Incidental Findings:** Your participation in these ultrasound didactic events is for training and educational purposes only. It is possible that incidental findings may be identified during the ultrasound examination.
  - Facilitators and faculty will disclose if an incidental finding is identified to you.
  - You are responsible for getting appropriate follow-up for any incidental findings identified. Do not rely on the result of this educational ultrasound examination for the purpose of medical treatment, diagnosis, or for any health reason.

Contacts

If you have questions or concerns regarding this experience, its instructors, or its participants, please contact Dr. Matthew Sigakis (msigakis@med.umich.edu) or another member of the course staff.

___ I have read and understood the above information.

___ I understand that participation in this program is voluntary, and I may request to stop the ultrasound examination at any time for any reason.

___ I certify that I will notify the course director if I am or become pregnant as this will impact what stations I will be assigned to.

___ Please check this line if you are comfortable with having your **eyes** examined and/or ultrasounded

___ Please check this line if you are comfortable with having your **face & neck** examined and/or ultrasounded

___ Please check this line if you are comfortable with having your **abdomen** examined and/or ultrasounded

___ Please check this line if you are comfortable with having your **back** examined and/or ultrasounded

___ Please check this line if you are comfortable with having your **extremities** (arms & legs) examined and/or ultrasounded

___ Please check this line if you are comfortable with having your **chest** examined and/or ultrasounded

___ Please check this line if you are comfortable with having your **inguinal region** (femoral vein, artery, and nerve) examined and/or ultrasounded

Quality events

- Phantom exams: exams performed that influence clinical decision making without documentation or image archiving

- Risk: Unable to confirm exam accuracy or perform QA review

UM solution and ASE recommendation:

- Structured image archiving system
- Formal reporting requirements – document in medical record
- Cultural expectations with dedicated departmental oversight
- Engage established vendors and a hospital level appointed gate-keeper

Emerging technology

- Real-time / off-site virtual support
- Artificial intelligence
- Wearable sonography

Emerging technology

- Extensive video tutorials and real-time virtual support on vendor machines and websites (Sonosite, Philips)
- Voice-assist / hands-free knobology (Sonosite)

Sonosite.com

Emerging technology

- Artificial intelligence- Deep learning algorithms and automated calculations
- Current limitations:
  - insufficient datasets for training AI systems
  - limited generalizability
  - lack of standardized POCUS protocols, algorithms, and devices

Diagnostics 2024 Aug 1;14(15):1669

AI-assisted FoCUS

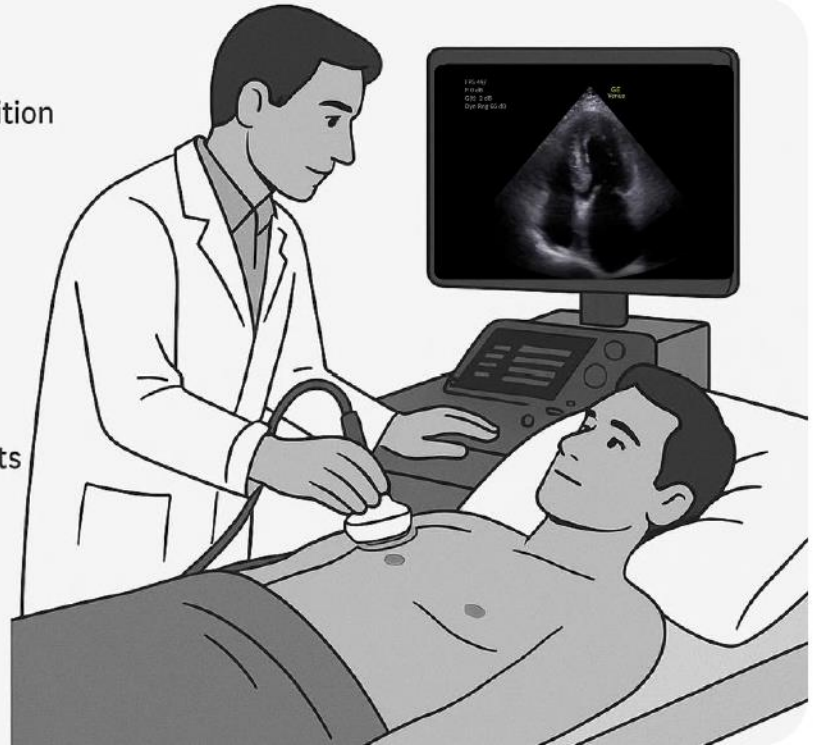
AI Streamlining The FoCUS Workflow

Scan
AI-assisted image acquisition for optimal FoCUS views

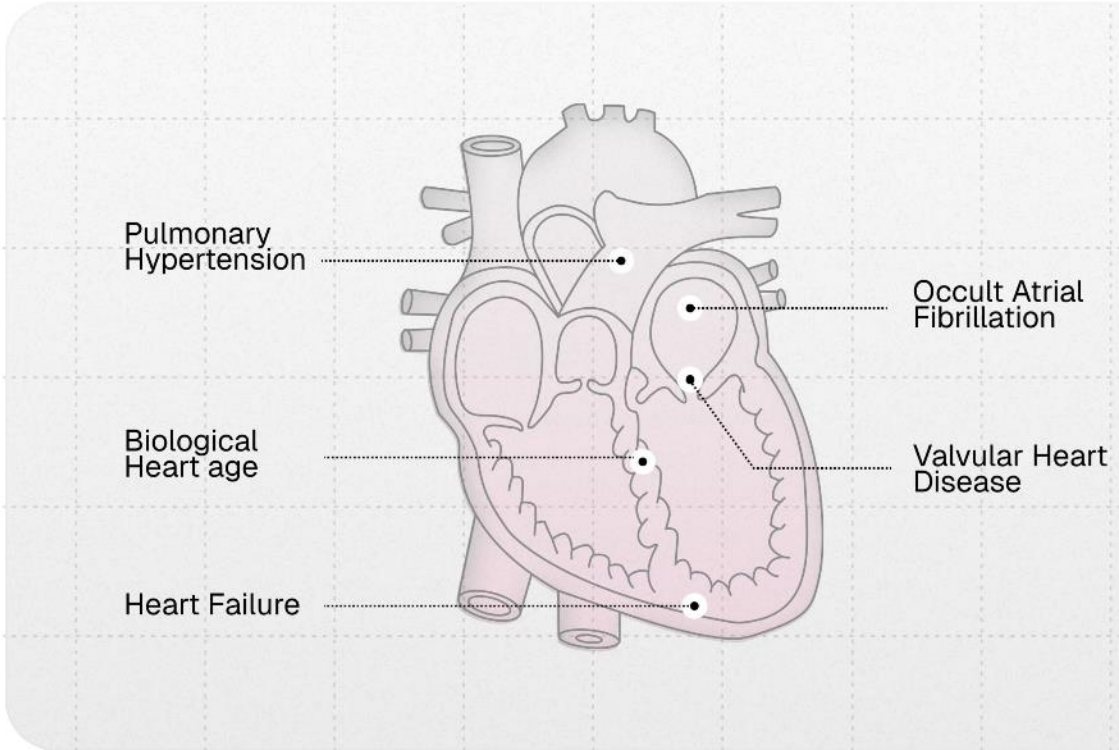
Diagnose
Automated detection of hidden risk factors and early pathologies

Report
Standardized result reports with reference samples

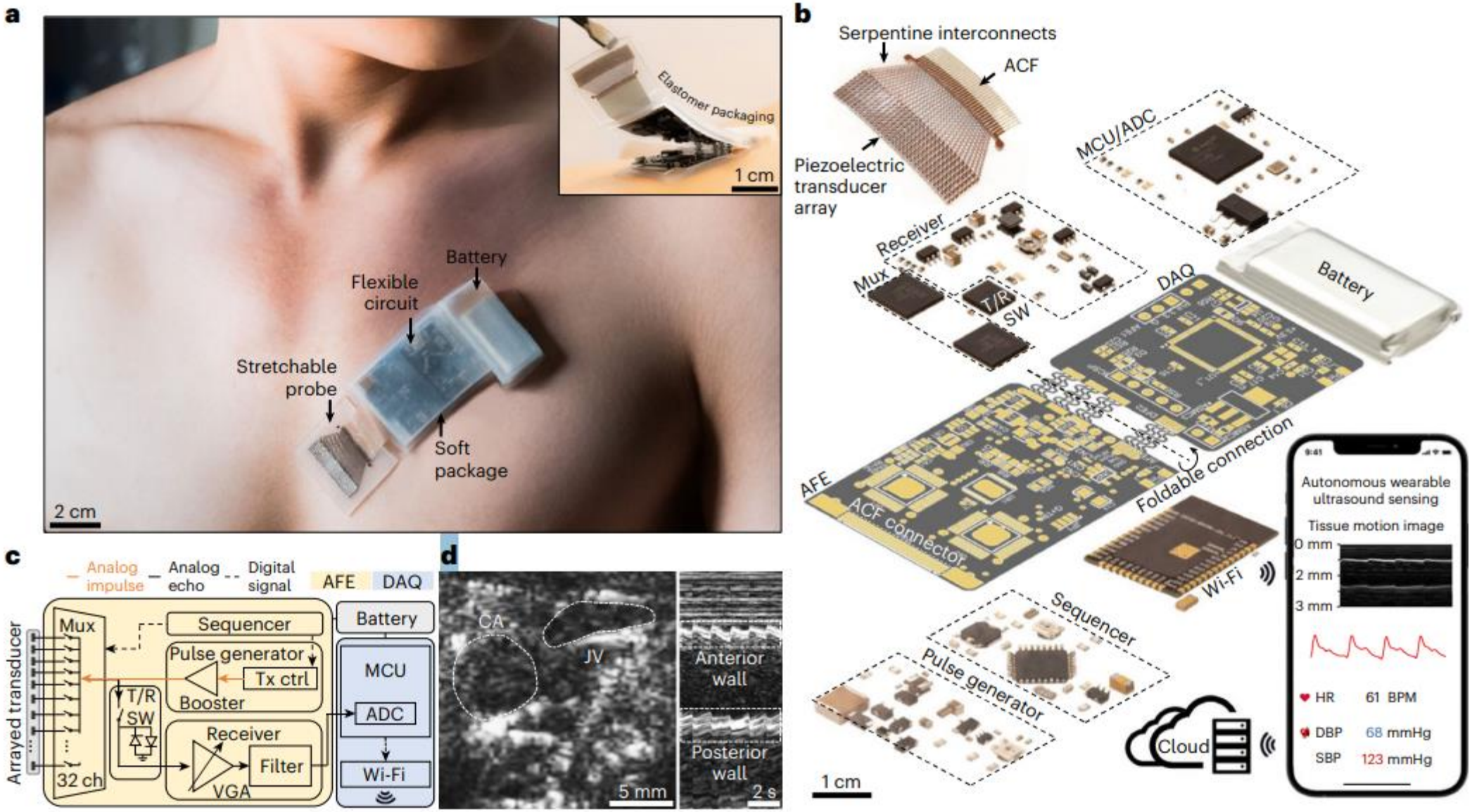
Prevent
Risk-based stratification, further diagnostics and early treatment



Preventive Cardiology - Key Areas of Interest



Nature, Cardiovasc Health **2**, 27 (2025).



Nature Biotechnology volume 42, pages448–457 (2024)

Summary

- POCUS is an impactful tool for clinical assessments
- Increased multidisciplinary engagement and consensus definitions will improve clarity around POCUS scope of practice and training standards
- Reduced operator dependence and AI assisted ultrasound will increase the opportunities for POCUS in patient care

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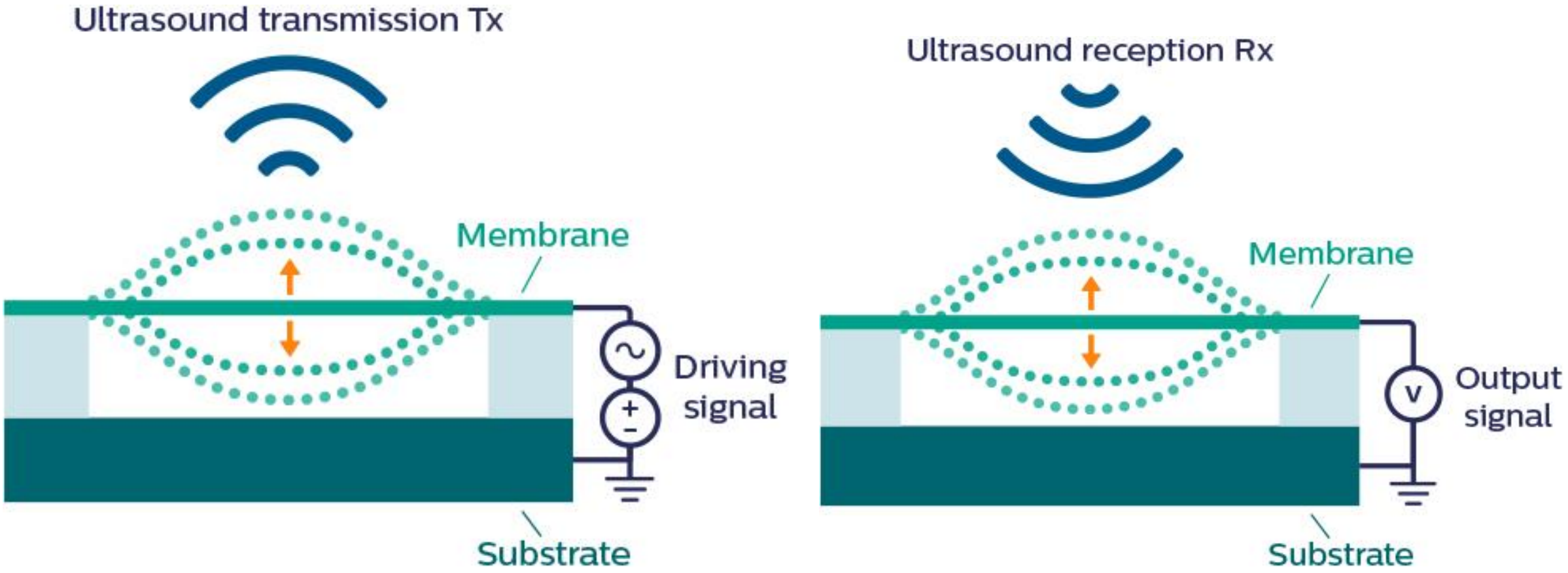
Supplements

CMUTs – capacitive micromachined ultrasonic transducers



Portable Point of Care Ultrasound (PPOCUS): An Emerging Technology for Improving Patient Safety

Anesthesia Patient Safety Foundation

- Discuss the indications and limitations of POCUS
- Barriers to adoption:
  - fear of missed diagnoses and medical/legal ramifications
  - lack of formal training or certification
- Utility demonstrated
  - Rapid assessments of acute conditions, before formal echo service mobilized
  - Avoiding transfer of patients to higher levels of care such as the ICU
- Describe approaches to learning and integration into practice

Circulation 122,210 • Volume 35, No. 1 • February 2020

Summary of "Role of Point-of-Care Ultrasound in Emergency Airway Management Outside the Operating Room"

- Non-OR intubations in critically ill patients
  - 42.6% hemodynamic instability, 9.3% severely hypoxic, 3.1% cardiac arrest
- POCUS pre-intubation to decrease severity of physiologic consequences of intubation
  - Screen for decreased LV or RV function and pericardial effusion
  - Intravascular volume status and screen for vascular abnormalities
  - Screen for pneumothorax and lung consolidation
  - Assess gastric volume
  - Predict difficult airway

Oct 21, 2023; Anesth Analg. 2023 Jul 1;137(1):124-136

Perioperative Patients With Hemodynamic Instability: Consensus Recommendations of the Anesthesia Patient Safety Foundation

- recommendations to guide the clinician in identifying risk, using essential monitoring, understanding thresholds for specific patients, and effective and timely interventions for improvement.
- Formalize teaching of new types of monitoring, including point of care ultrasound, in postgraduate training programs that enable early detection of hemodynamic instability and precise diagnosis of the underlying cause.
- Availability of point of care ultrasound

Anesthesia & Analgesia, April 2024.

Billing

93306	Echocardiography, transthoracic, real-time with image documentation (2D), includes M-mode recording, when performed, complete, with spectral Doppler echocardiography, and with color flow Doppler echocardiography
93307	Echocardiography, transthoracic, real-time with image documentation (2D), includes M-mode recording, when performed, complete, without spectral or color Doppler echocardiography
93308	Echocardiography, transthoracic, real-time with image documentation (2D), includes M-mode recording, when performed, follow-up or limited study