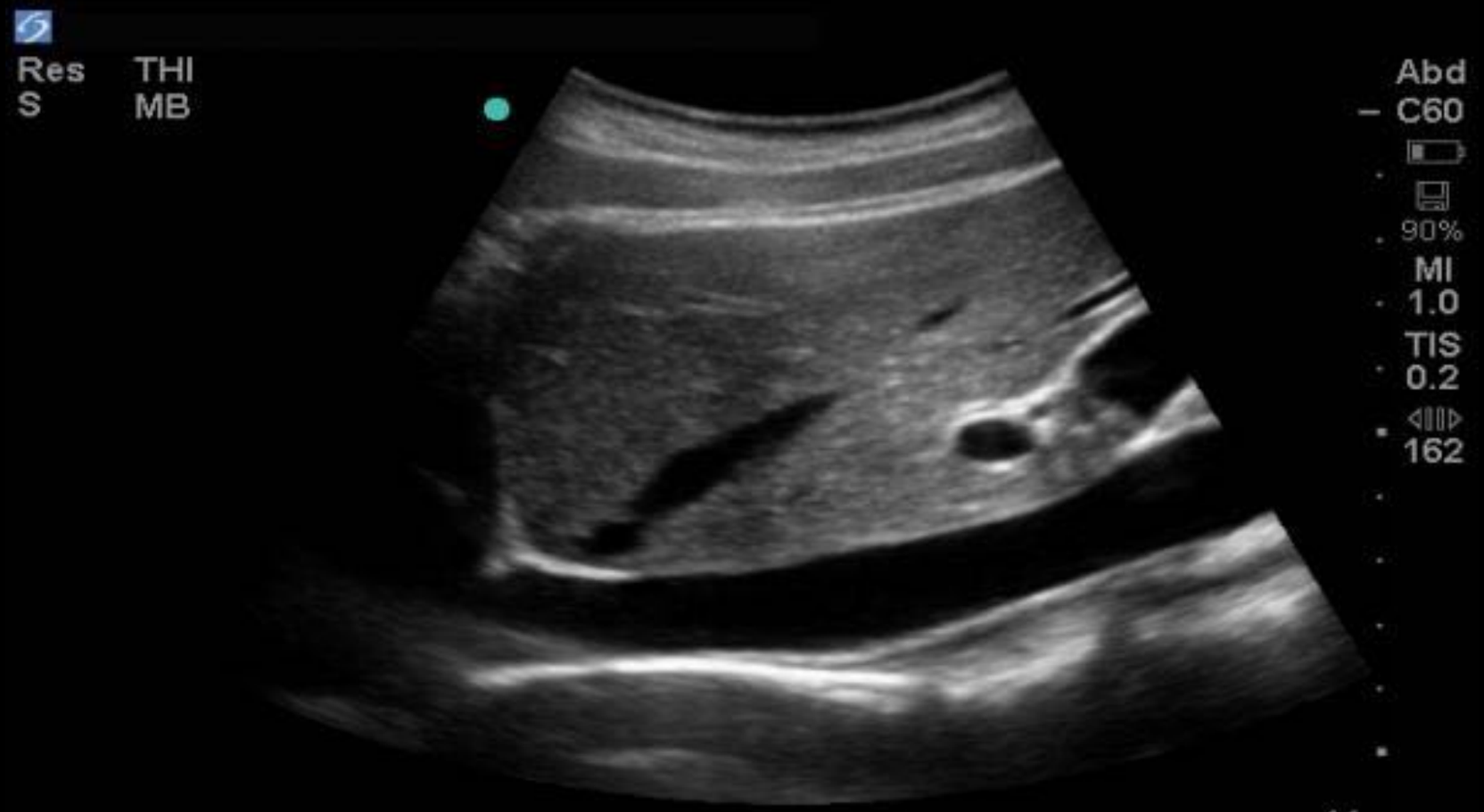
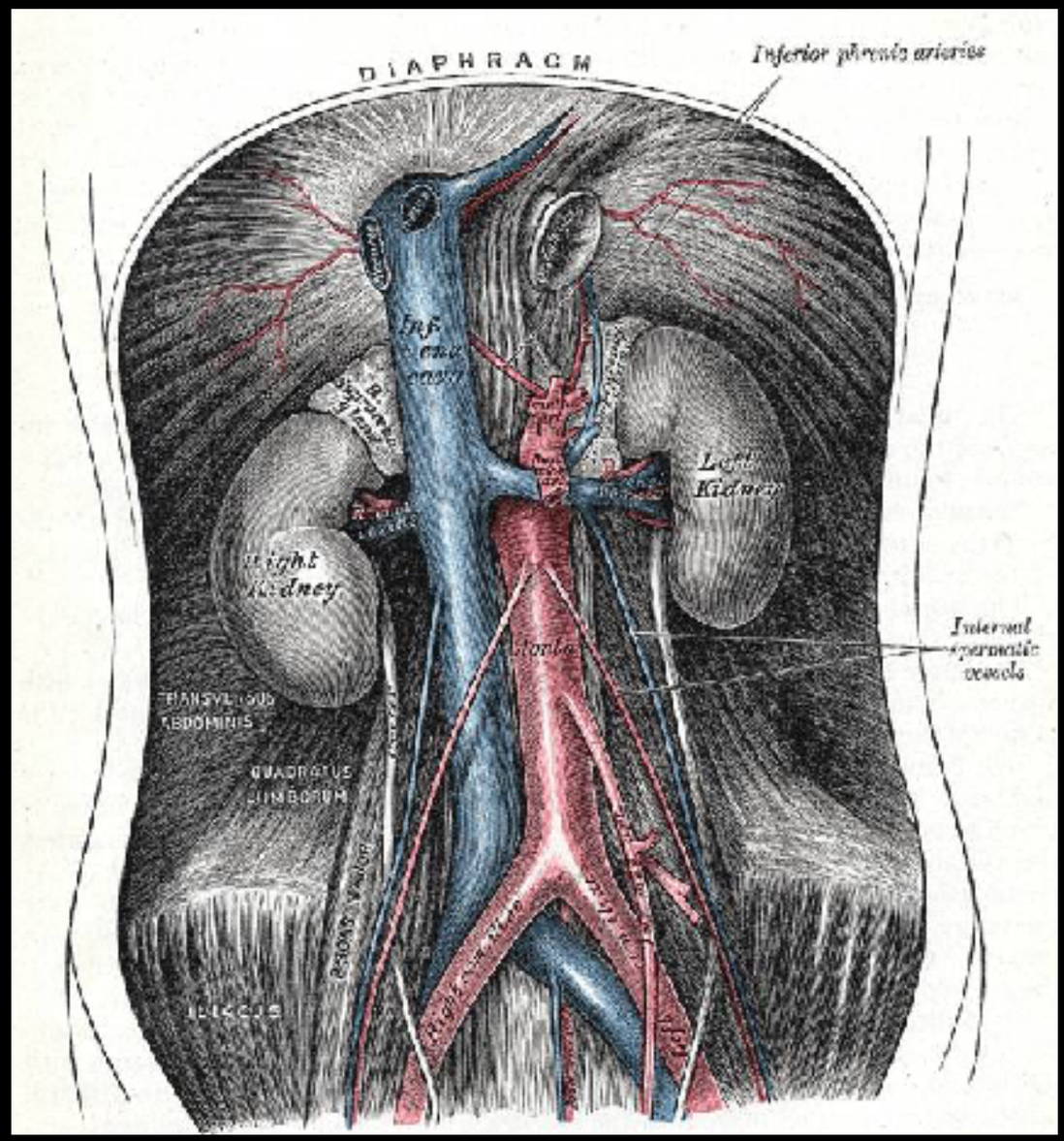


The Aorta And IVC

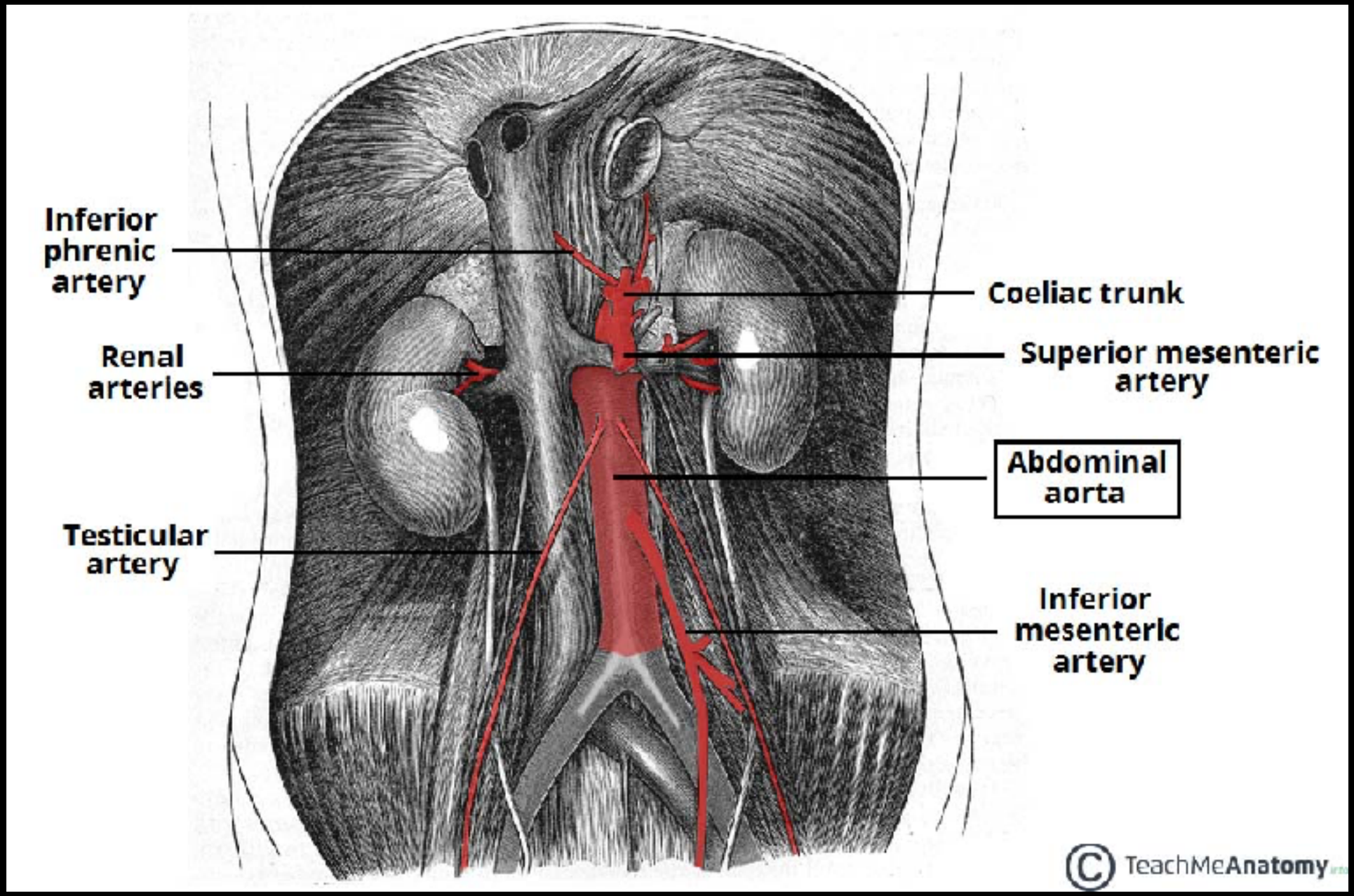
Charmiane Lieu, M.D.
Kaiser Oakland Medical Center
5/17/2017

Objectives

- Clinical application of each scan ultrasound
- Recognize the Anatomy: normal vs not normal
- Identify Pitfalls

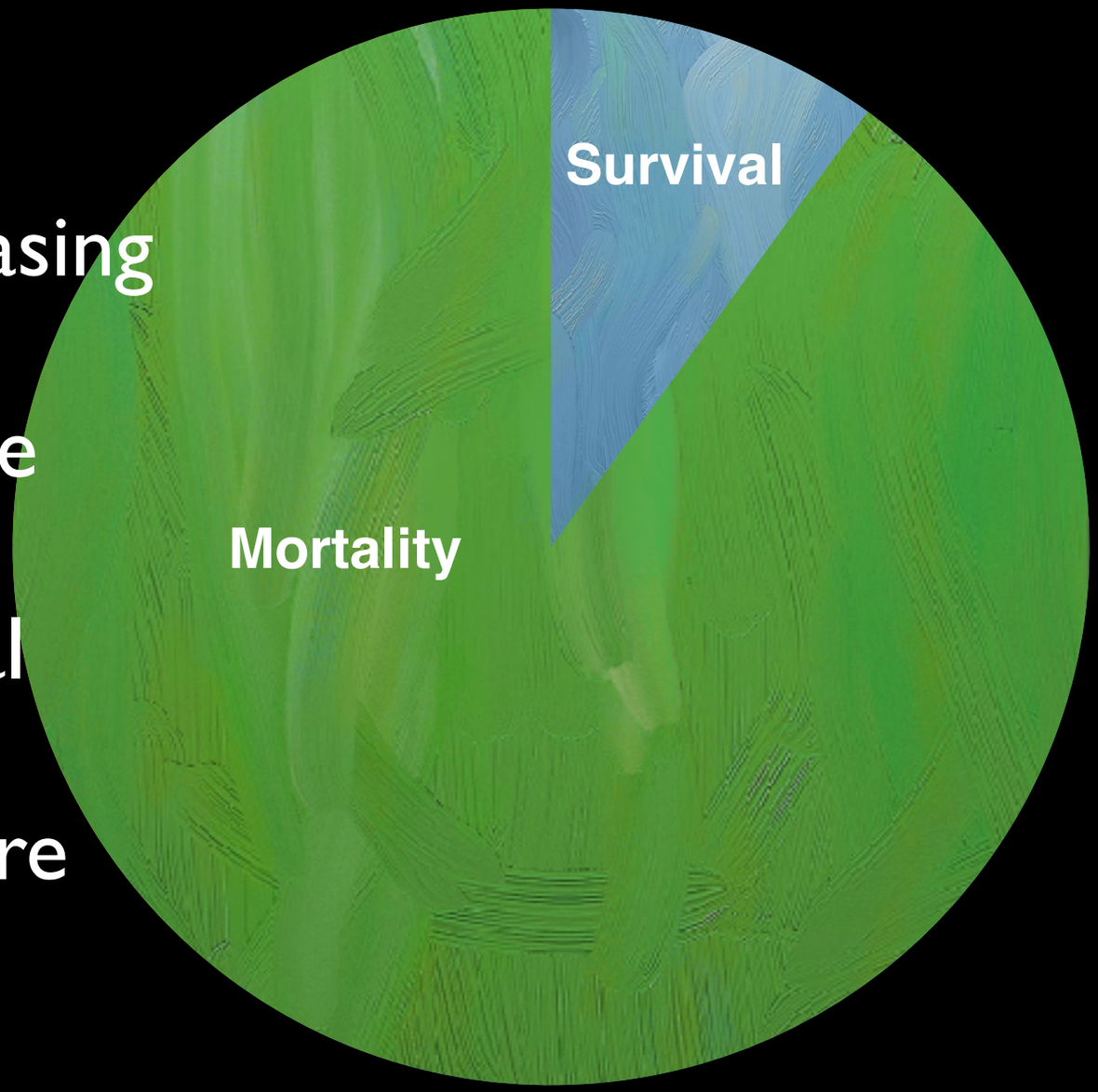


The Abdominal Aorta



Epidemiology of AAA

- Incidence 36.2/10000 and increasing
- Asymptomatic until they rupture
- 62% die before reaching hospital
- Mortality of 85-90% after rupture



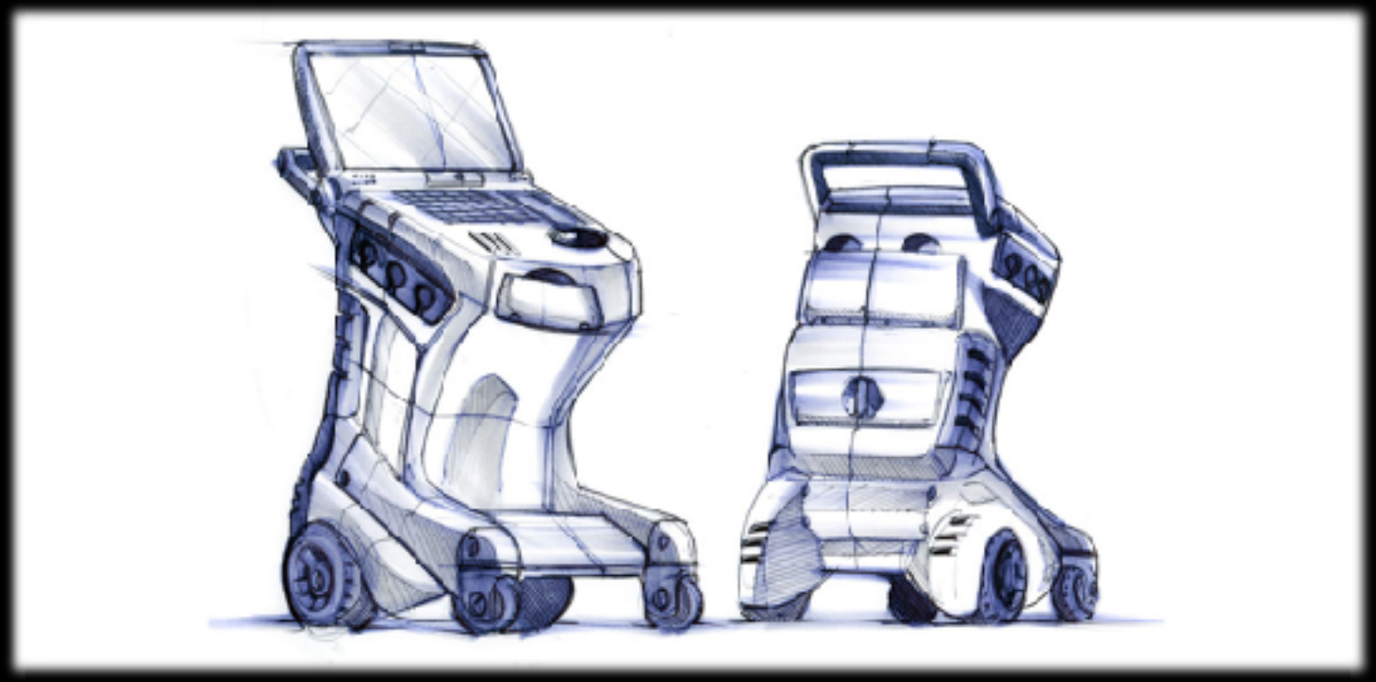
Powell JT, Greenhalgh RM. Small ab- dominal aortic aneurysms. N Engl J Med 2003;348:1895-901.
Brown LC, Powell JT. Risk factors for aneurysm rupture in patients kept under ultrasound surveillance. Ann Surg 1999; 230:289-96.

Epidemiology

- Risk Factors
  - Male
  - Smoker,
  - Hypertensive
  - Family History
- AAA must be on your ddx for
  - renal colic, ab pain
  - GI bleeding
  - Neurological complaints
  - Undifferentiated hypotension

Why ultrasound?

- Minimal delay
- No radiation
- Easy to learn
- Well substantiated by literature



How good is ultrasound for diagnosing AAA?

- 4 studies, n=535 Patients
- Sensitivity: 94-100%
- Specificity: 98-100%
- 0.5cm +/- compared to CT

Emergency Department Ultrasound Scanning for Abdominal Aortic Aneurysm: Accessible, Accurate, and Advantageous

Marie Kuhn, MD, FACEM*
Robert L. L. Bonnin, MBBS, FACEM*
Michael J. Davey, MBBS, FACEM*
Jane L. Rowland, MBBS*
Suzanne Le P. Langlois, MBBS, FRACR‡

SEPTEMBER 2000 36:3 ANNALS OF EMERGENCY MEDICINE

ACAD EMERG MED • August 2003, Vol. 10, No. 8 • www.aemj.org

Prospective Study of Accuracy and Outcome of Emergency Ultrasound for Abdominal Aortic Aneurysm over Two Years

Vivek S. Tayal, MD, Christian D. Graf, MD, Michael A. Gibbs, MD

The Journal of Emergency Medicine, Vol. 29, No. 4, pp. 455–460, 2005

ACCURACY OF EMERGENCY MEDICINE ULTRASOUND IN THE EVALUATION OF ABDOMINAL AORTIC ANEURYSM

Thomas G. Costantino, MD, Eric C. Bruno, MD, Neal Handly, MD, and Anthony J. Dean MD

Ultrasonographic measurement of aortic diameter by emergency physicians approximates results obtained by computed tomography

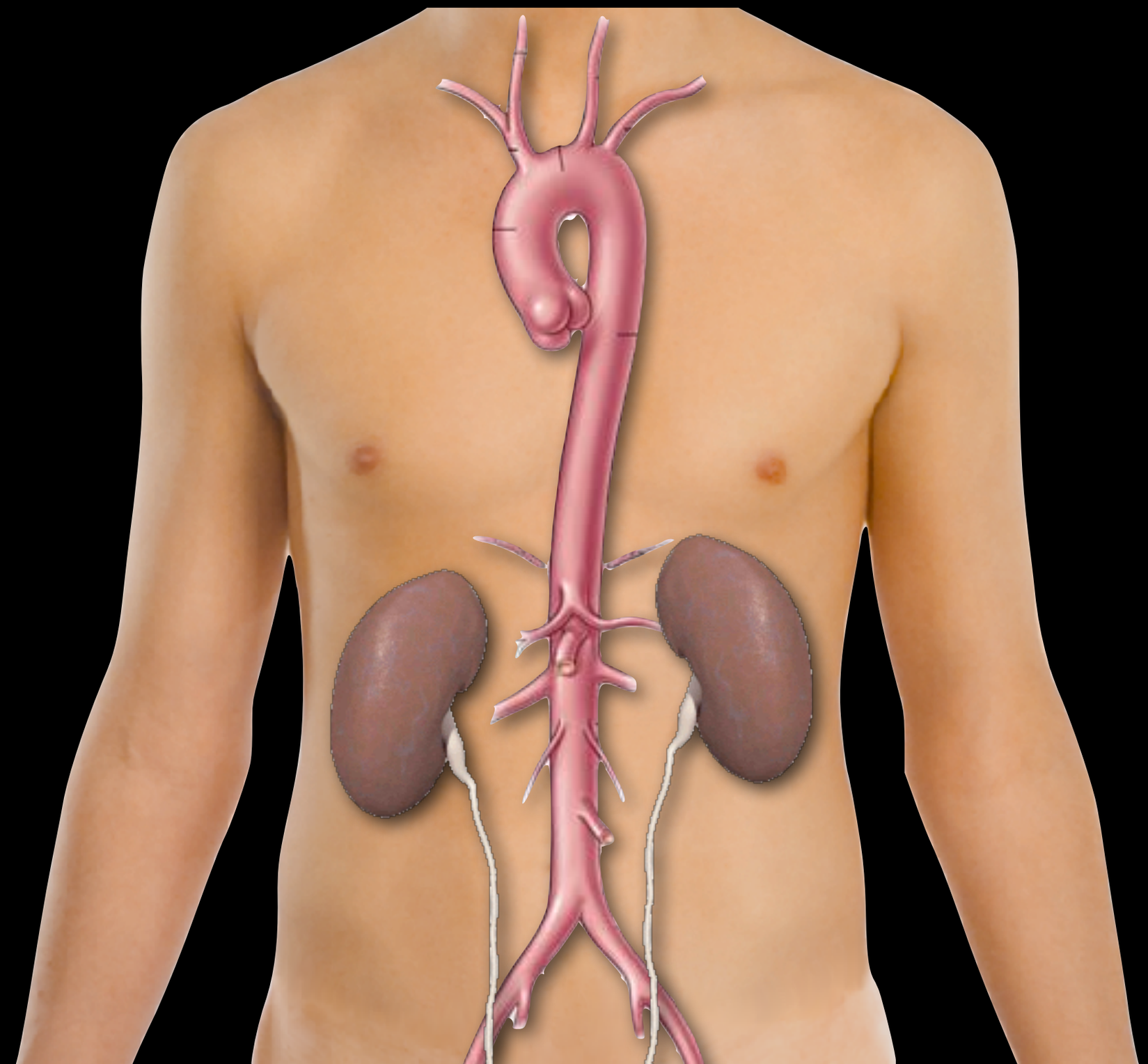
Journal of Emergency Medicine

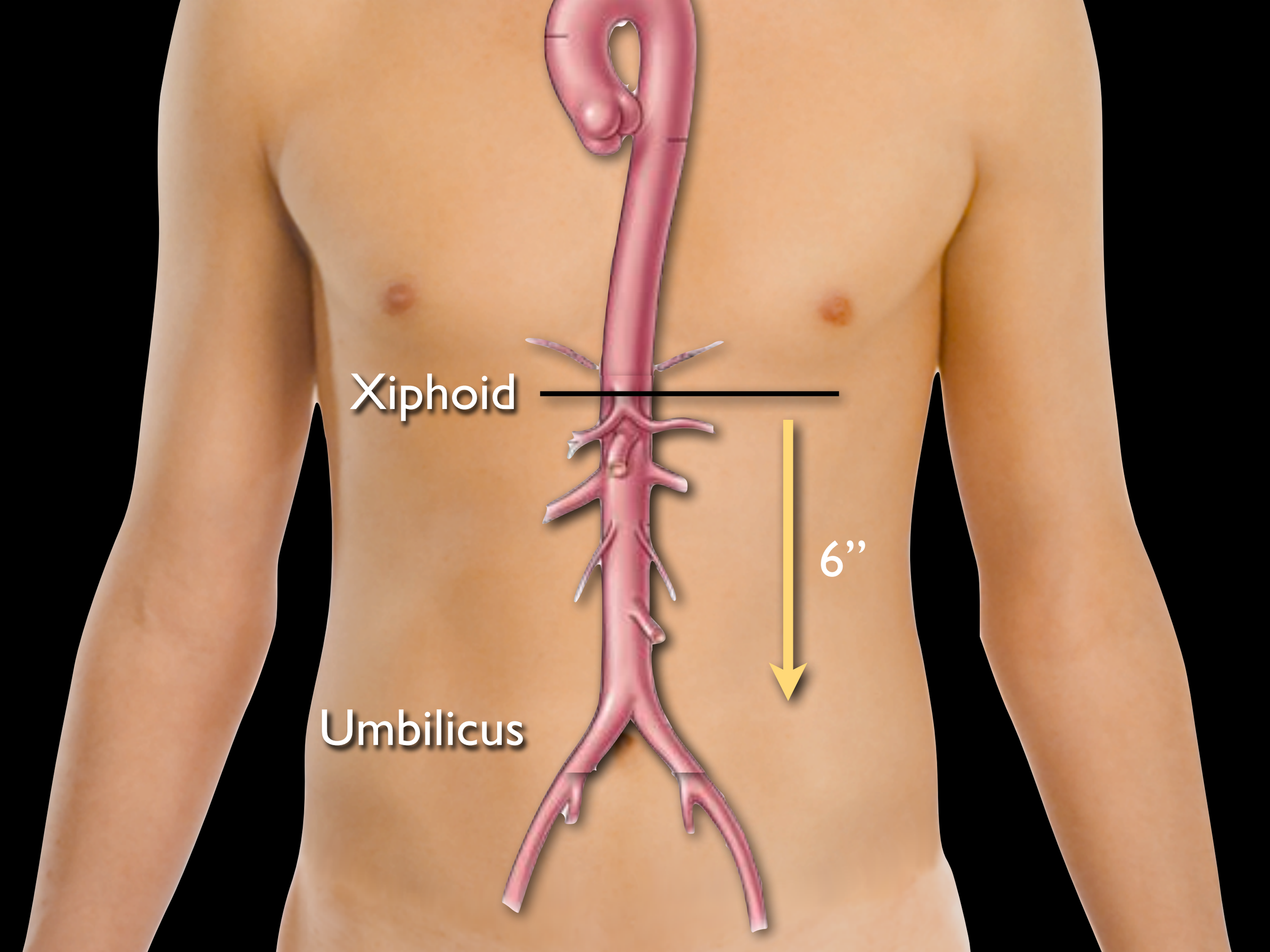
Andrew L. Knaut MD, PhD*, , John L. Kendall MD*, Randall Patten MD† and Charles Ray MD

Limitations to u/s AAA

- User experience matters
- 10% non-diagnostic
- DOES NOT diagnose rupture as it is retroperitoneal
- If you see peritoneal fluid- not a good sign

Anatomy




Xiphoid
6”
Umbilicus

“Celiac to Iliacs”

Celiac Axis

Superior Mesenteric Artery

95% aaa infrarenal

Iliac Bifurcation

“Celiac to Iliacs”

> 3cm is abnormal

Celiac Axis

Prox

Superior Mesenteric Artery

Mid

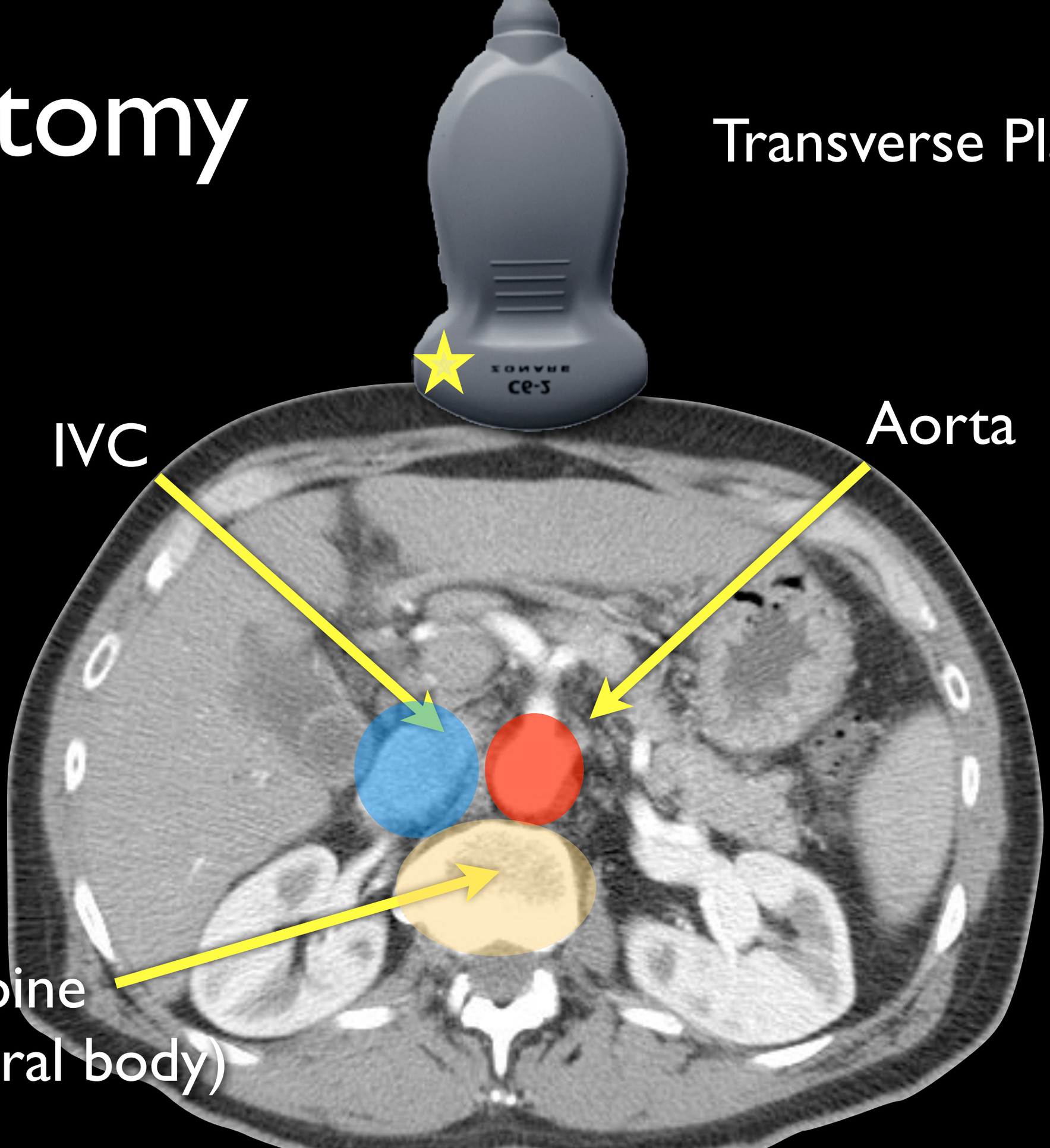
Distal

Iliac Bifurcation

Transverse Aorta

Anatomy

Transverse Plane



Proximal Aorta

Transverse

Celiac Trunk

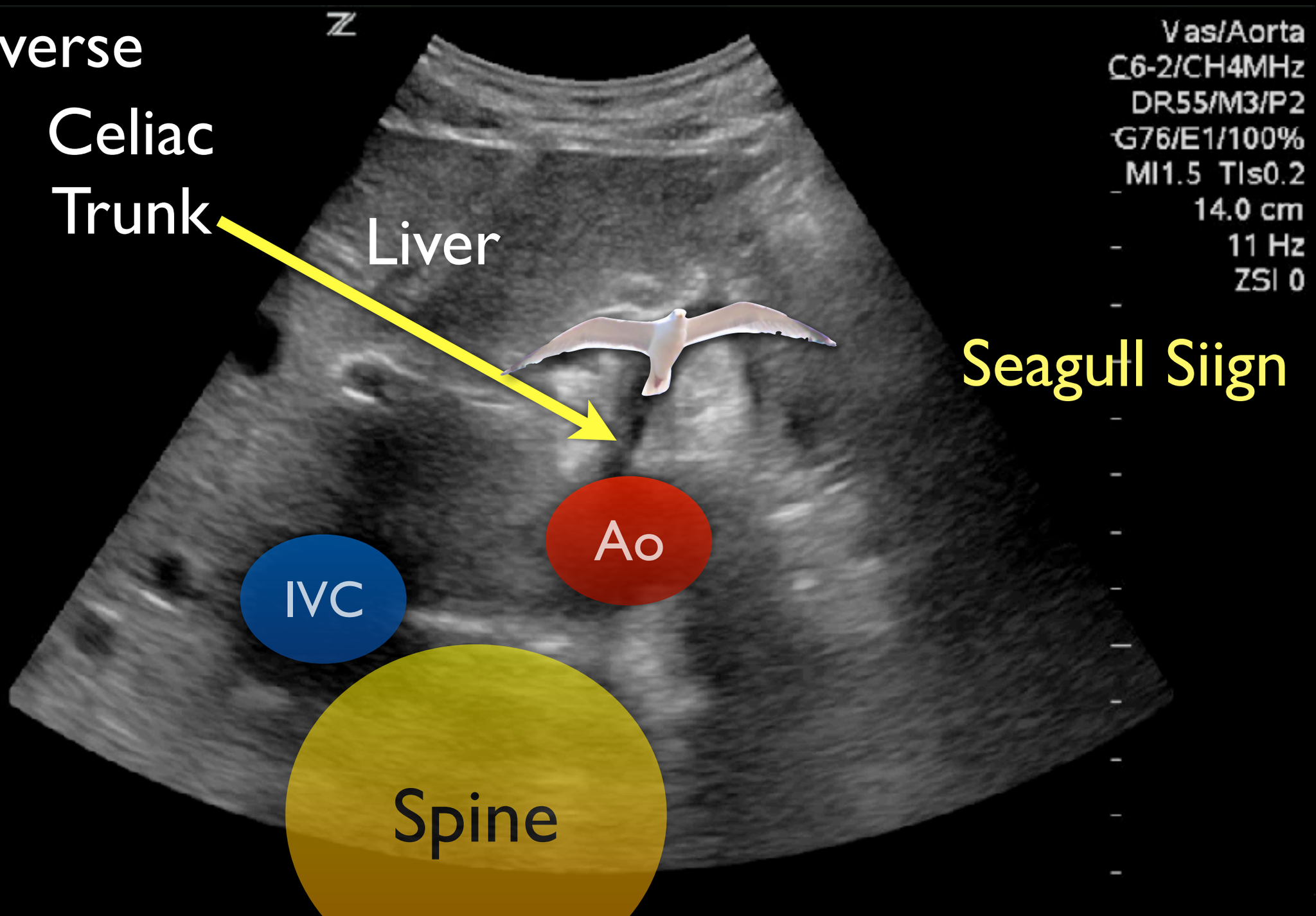
Liver

Seagull Siign

Ao

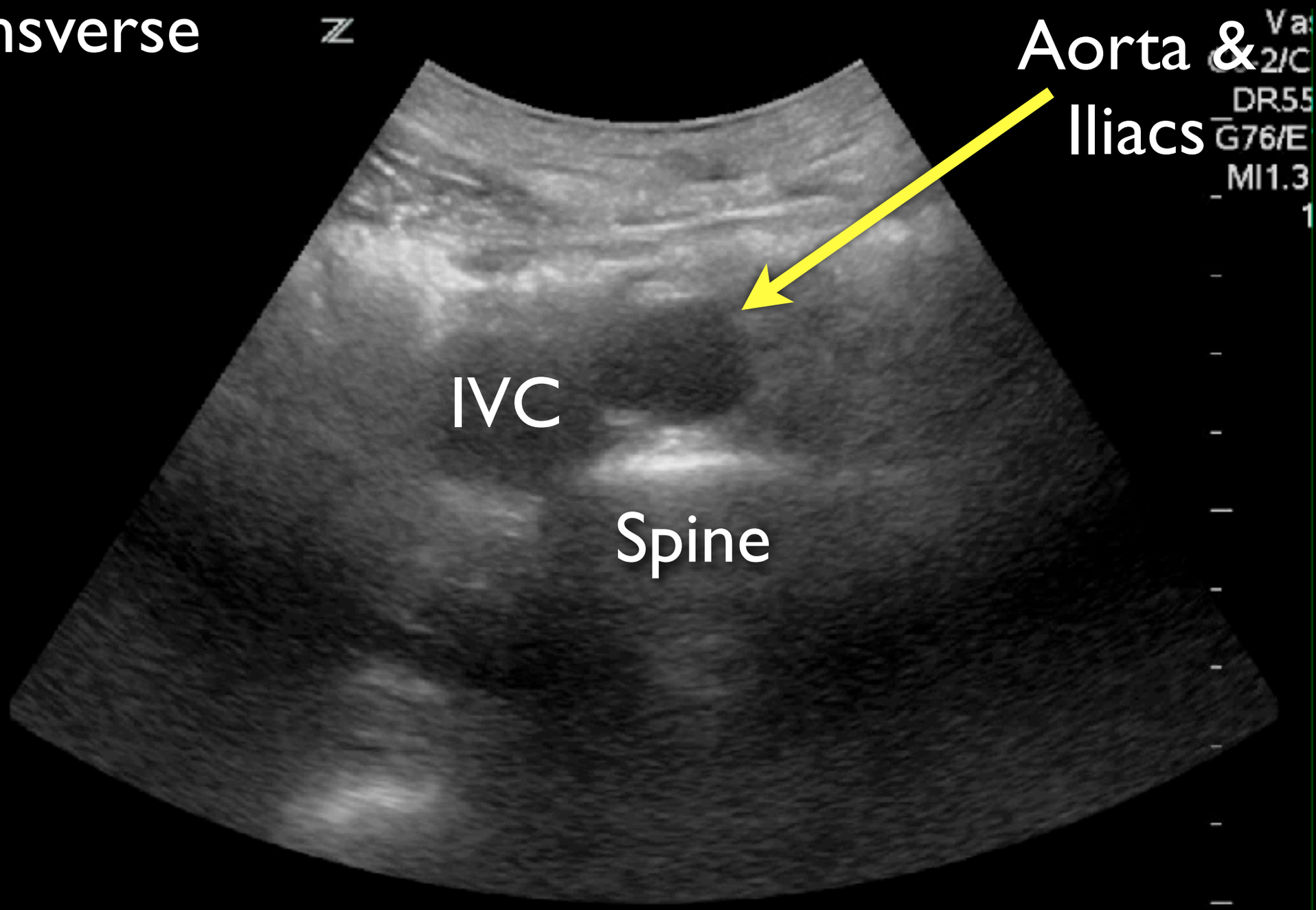
IVC

Spine



Distal Aorta

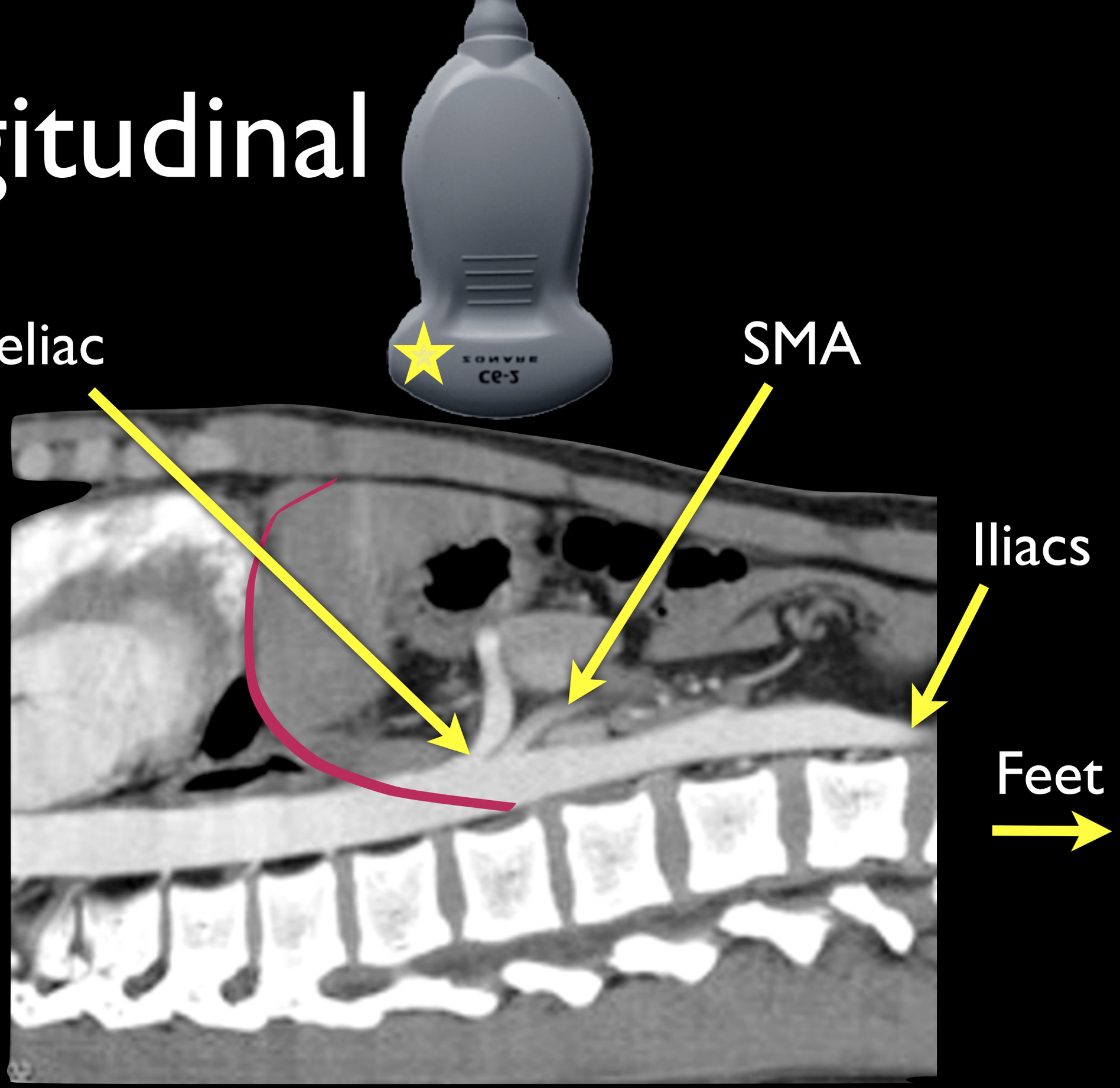
Transverse



Transverse Aorta

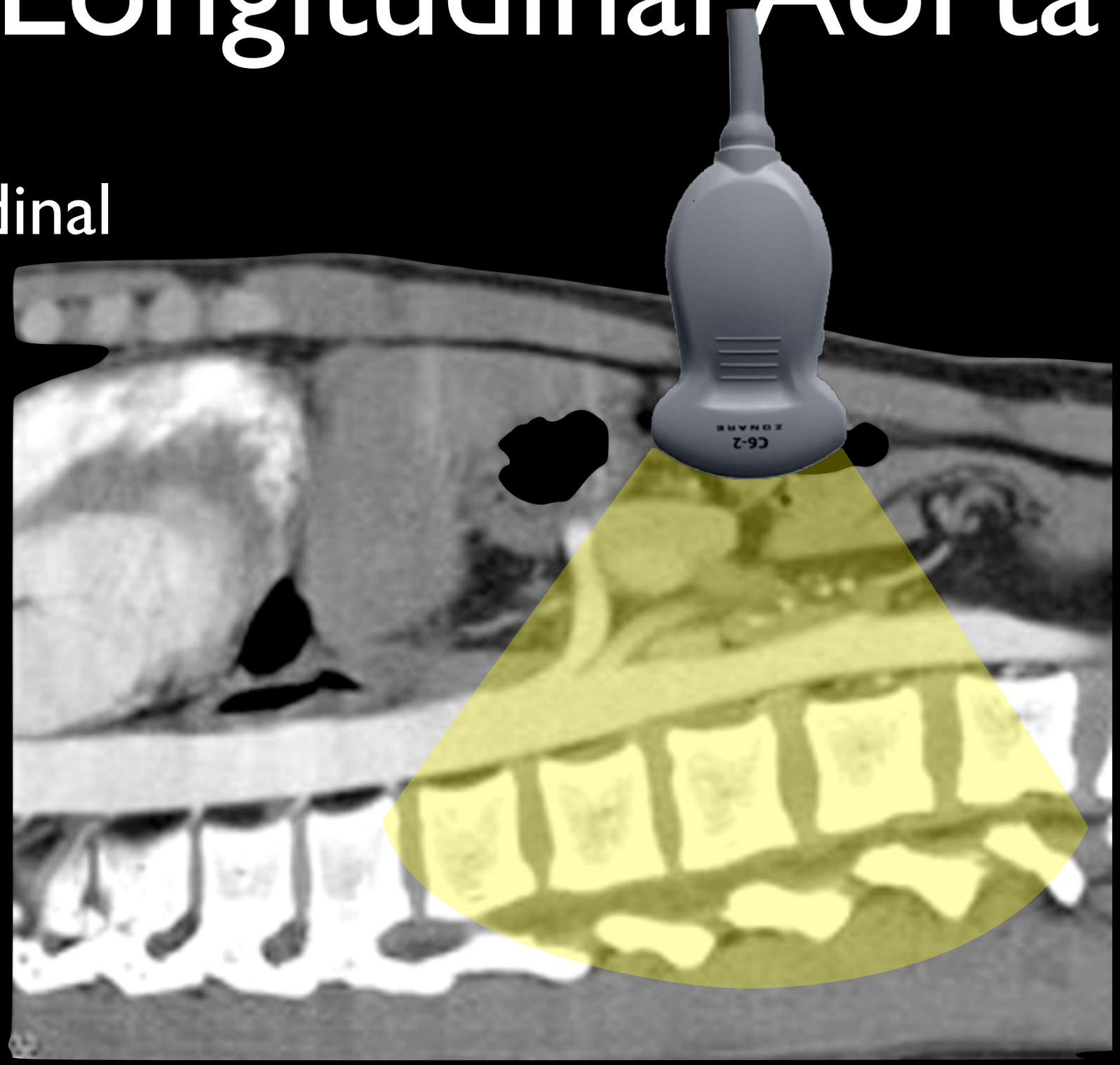
Longitudinal Aorta

Longitudinal



Longitudinal Aorta

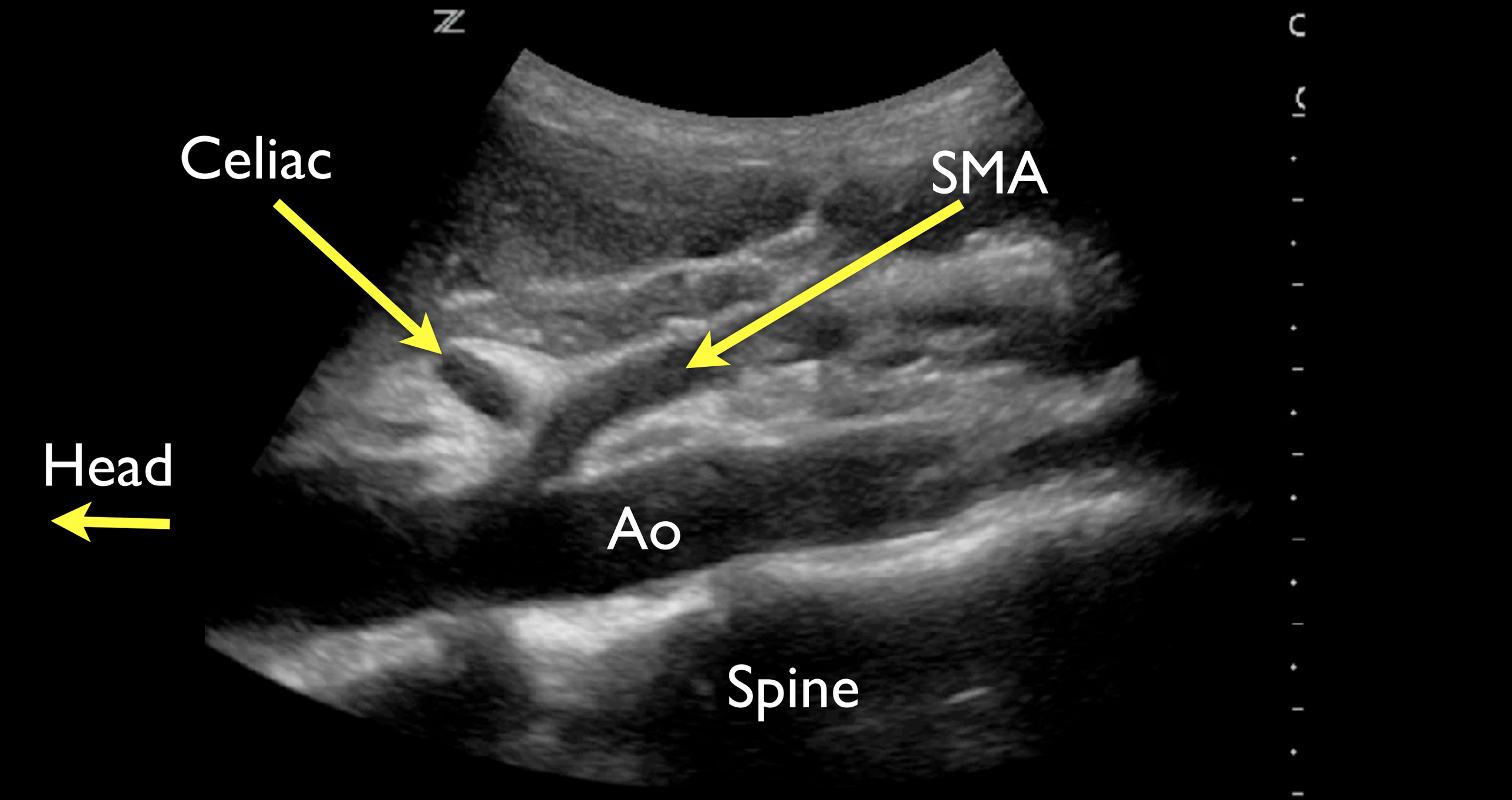
Longitudinal



Head

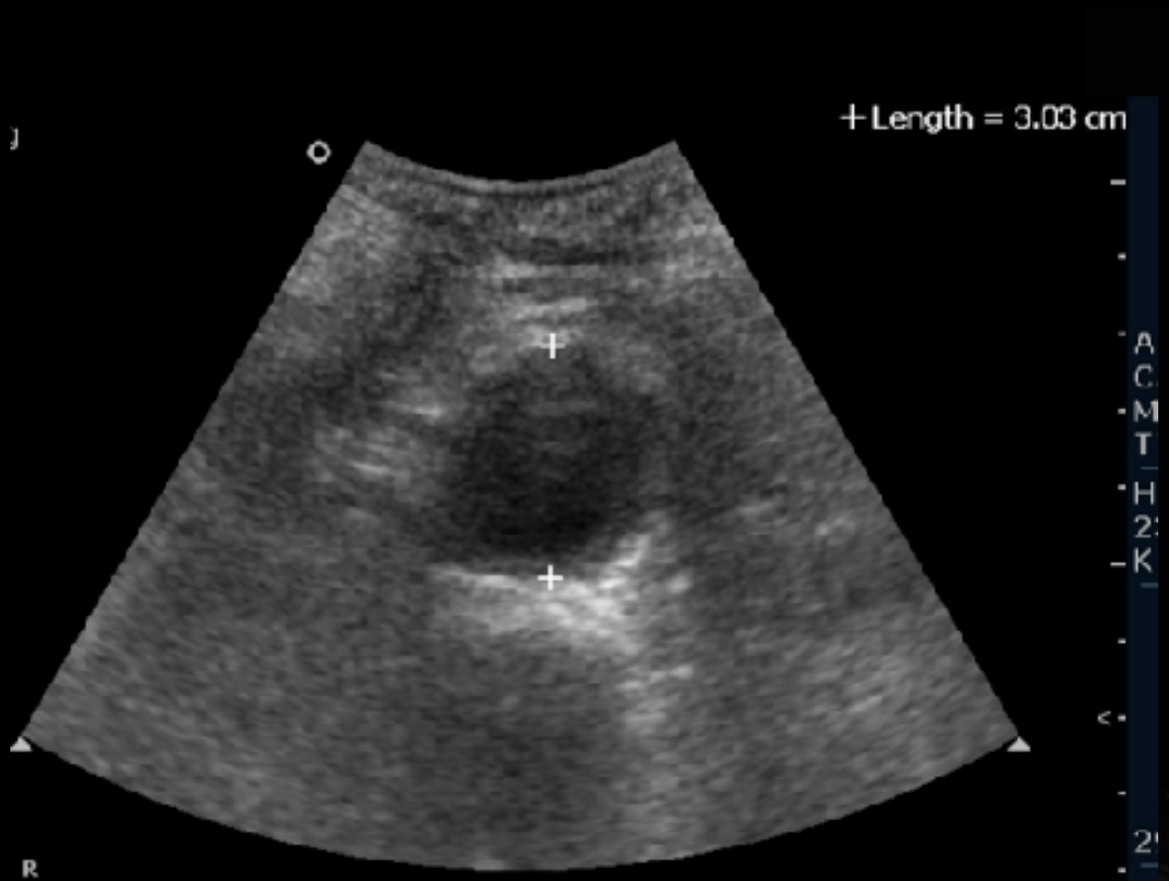
Feet

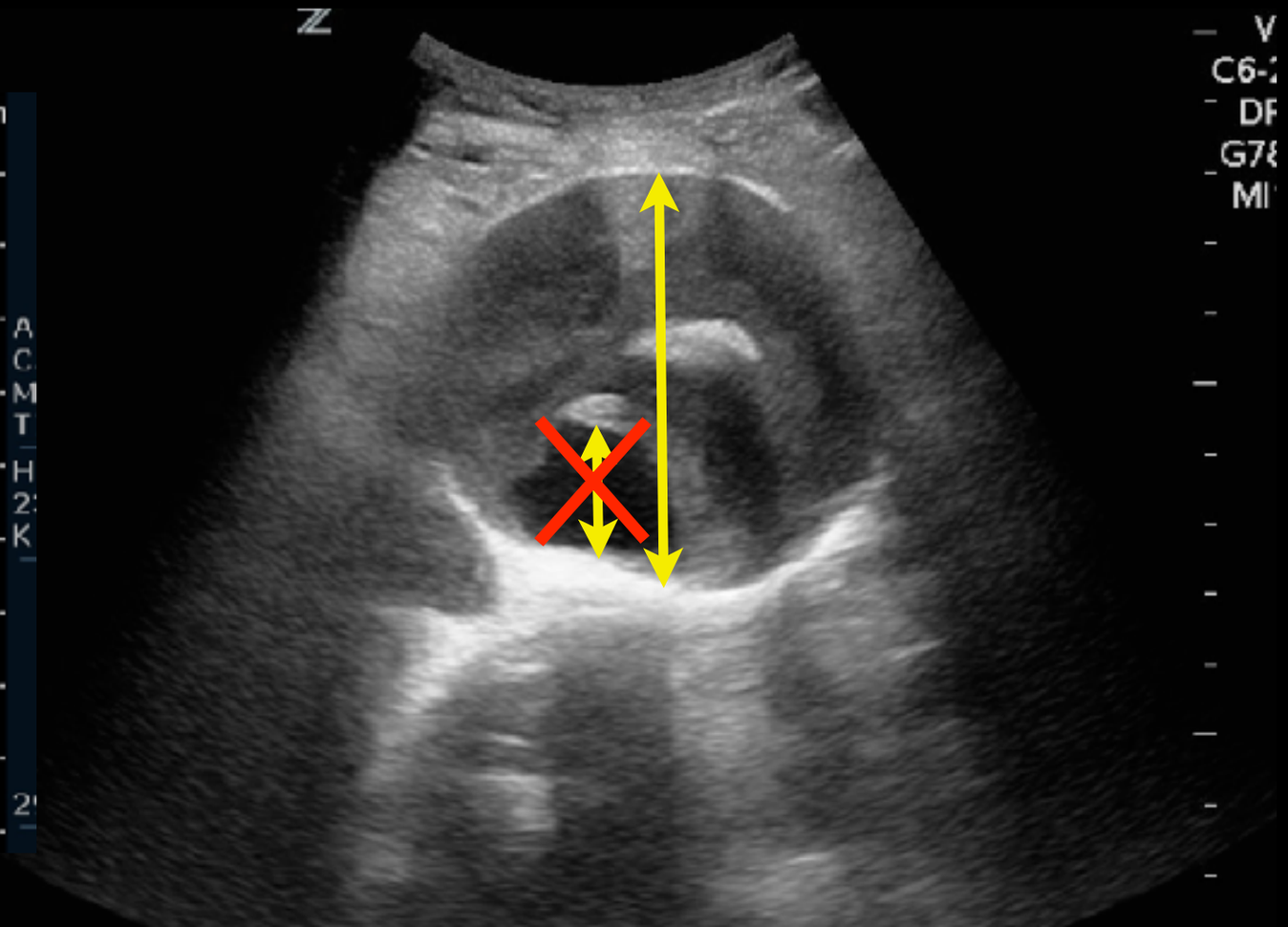
Longitudinal Aorta



Measuring the Aorta

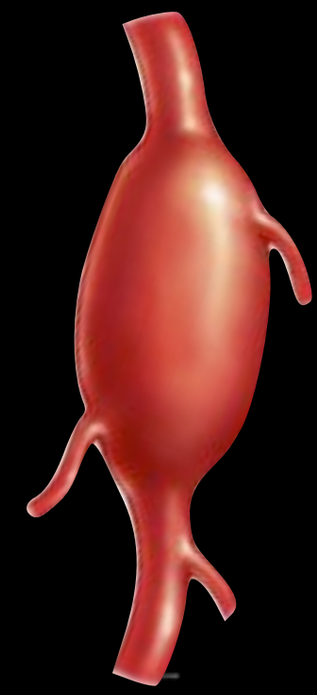
- Abnormal **> 3cm**
- 3 measurements: proximal, mid, distal aorta
- Outside wall to outside wall!! Always Overestimate





Longitudinal Aorta

Fusiform



Celiac

SMA

Head

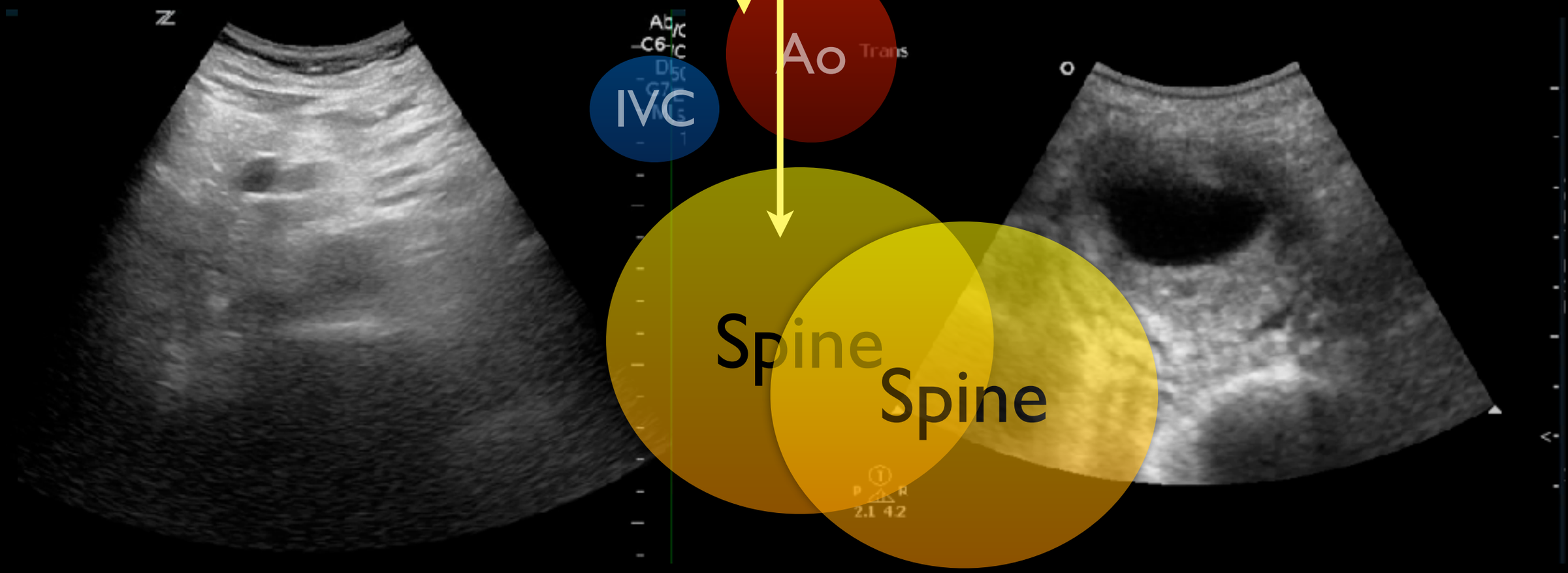
Ao

Spine

Pitfalls

Pitfalls Measuring the Aorta

- Mistaking IVC or SMA as aorta
  (Always identify the spine landmark)
- Failing to measure full aorta including clot

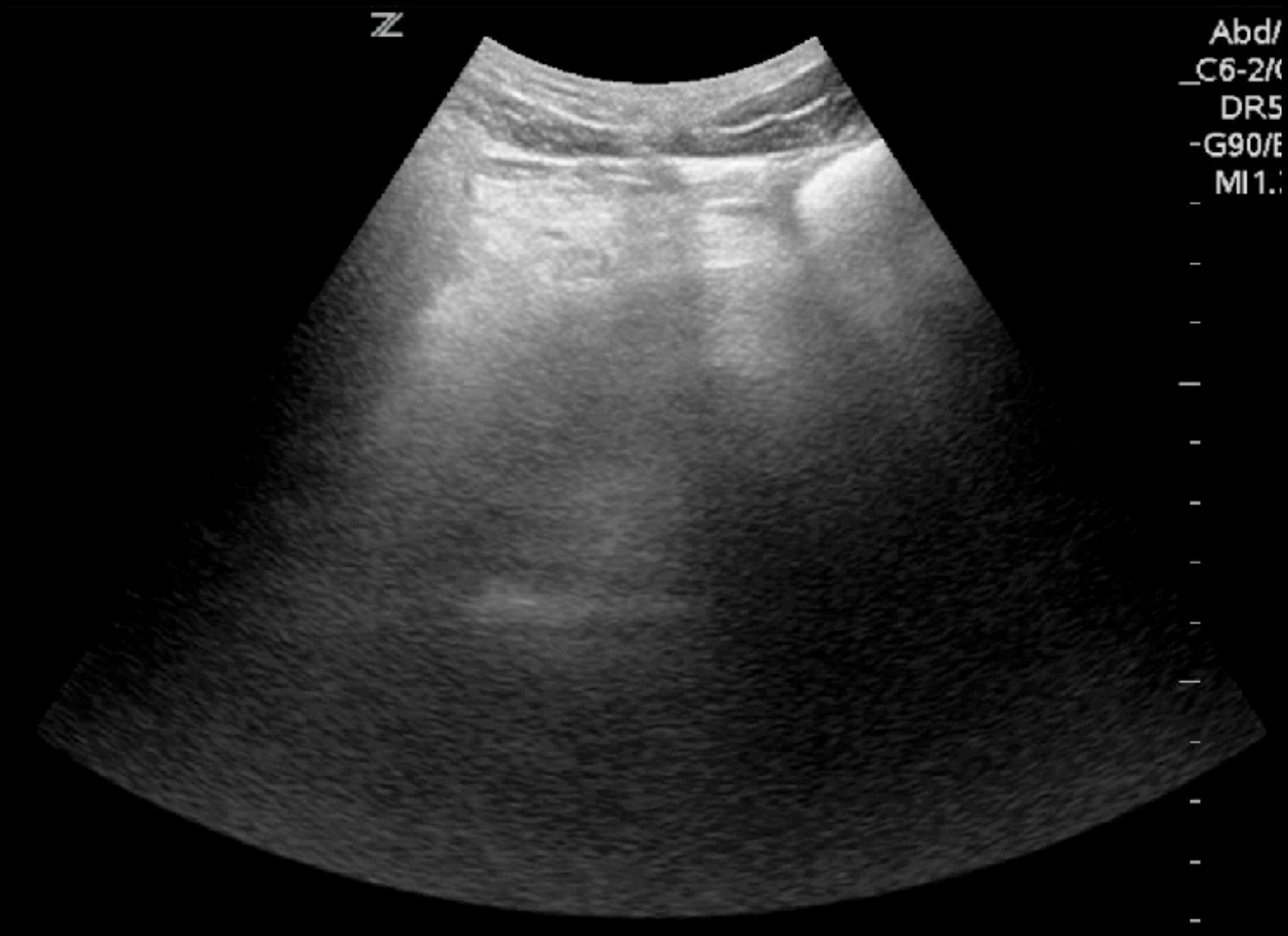


Troubleshooting AAA Scans

Bowel Gas

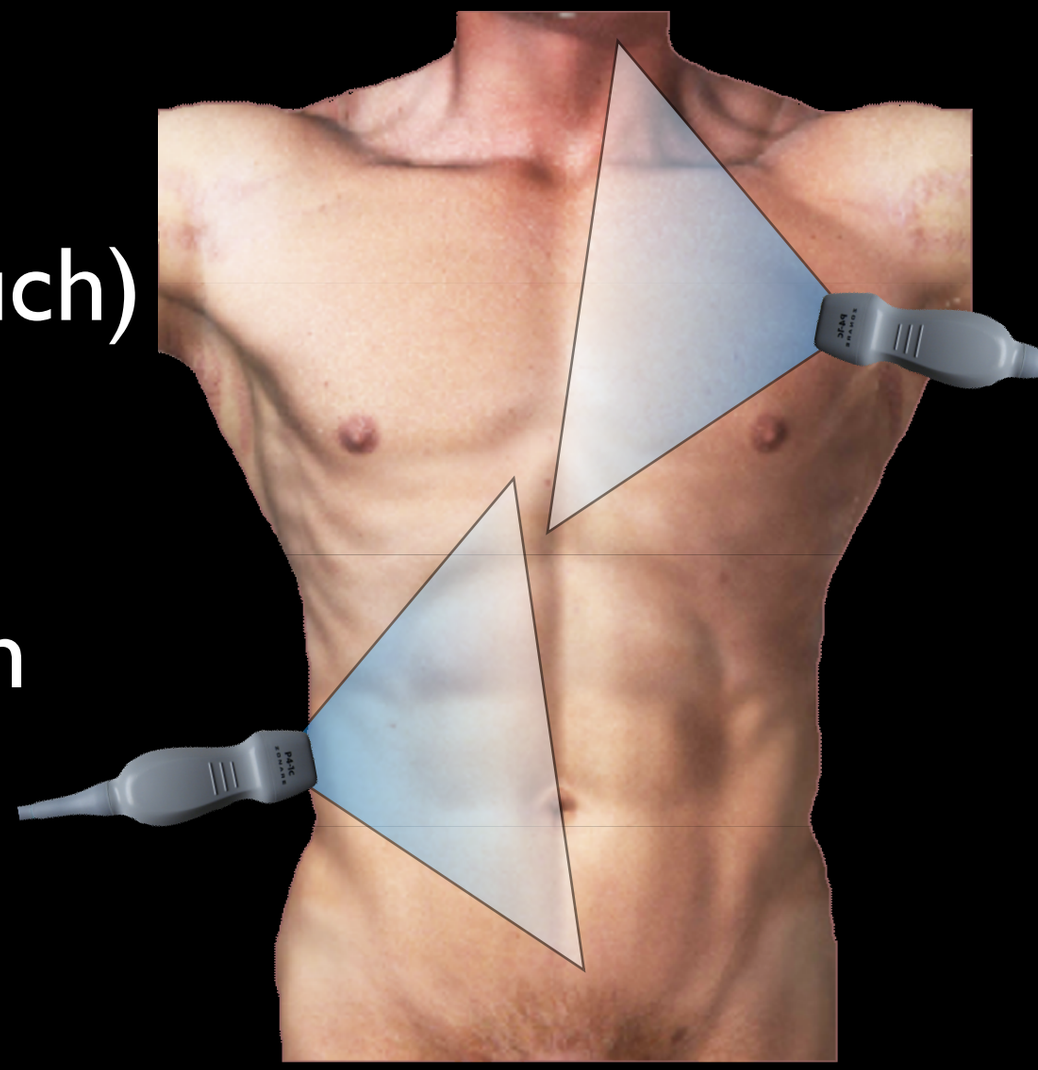
Obesity

Abdominal Aorta Pressure & Time



Abdominal Aorta Pearls

- Additional views to try:
  - Liver window (Morison's pouch)
  - Splenic/renal window
  - Left lateral decubitus position



Abdominal Aorta Liver Window

Abdominal Aortic Dissection

- How good is bedside ultrasound?
- No good studies, but experience shows poor sensitivity, good specificity

Volume 32, Issue 2, Pages 191-196 (February 2007) Journal of Emergency Medicine

The diagnosis of aortic dissection by emergency medicine ultrasound

Presented at the First AAEM International Conference of Emergency Medicine, Stresa, Italyk, September 2001.

John P. Fojtik, MD, Thomas G. Costantino, MD[1], Anthony J. Dean, MD[1]

IMAGES IN EMERGENCY MEDICINE

Aortic Dissection Diagnosed by Ultrasound

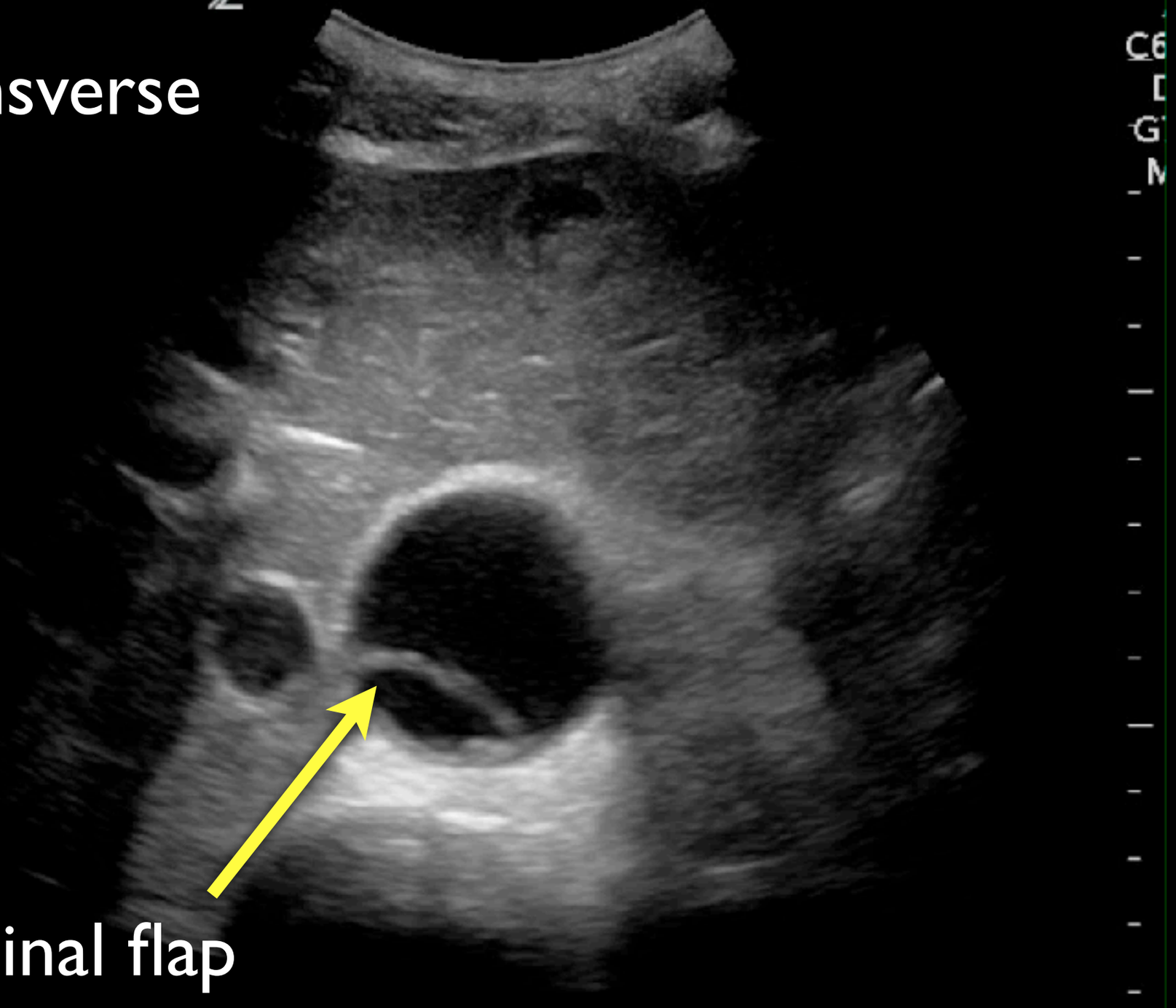
Jessa Williams, DO
Jason D. Heiner, MD
Michael D. Perreault, MD
Todd J. McArthur, MD

Madigan Army Medical Center, Department of Emergency Medicine, Fort Lewis, WA

Western Journal *of* Emergency Medicine Volume XI, NO. 1 : February 2010

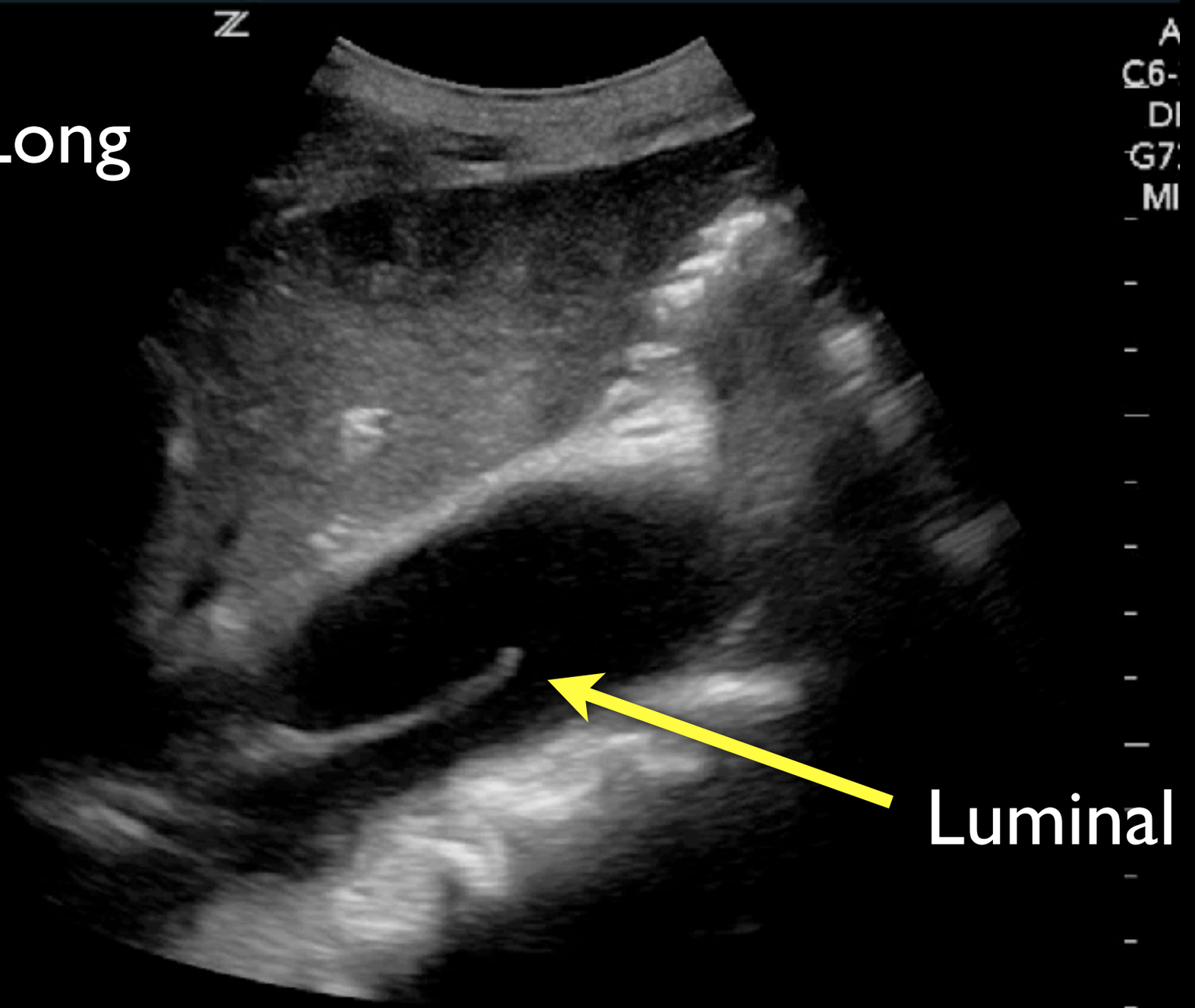
Abdominal Aortic Dissection

Transverse



Abdominal Aortic Dissection

Long



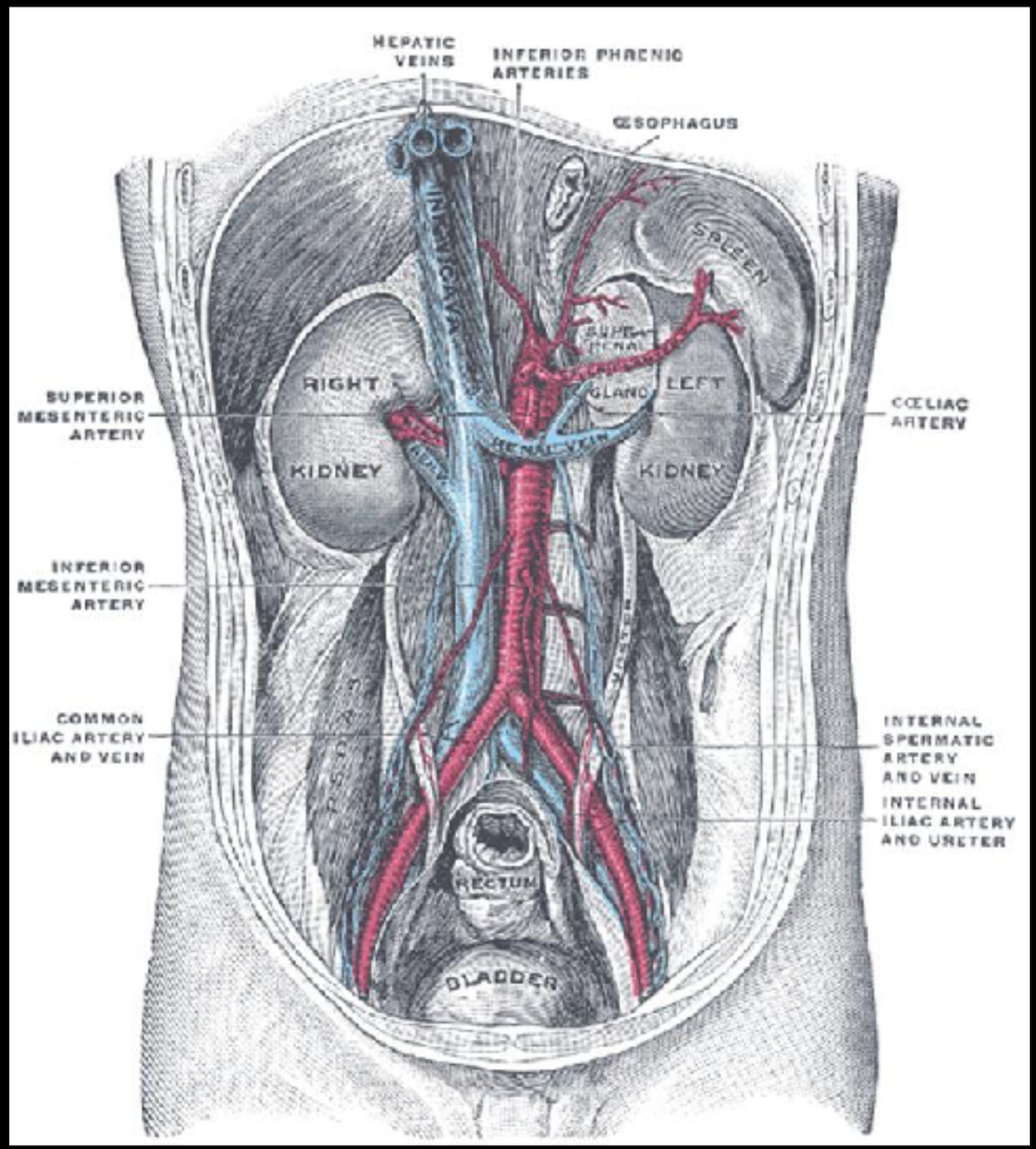
One case- LUQ view with pleural effusion

Take Home Points

- High level of suspicion for >50yo back pain, abdominal pain, neuro complaints
- Find the spine first (use appropriate depth)
- Outside wall to outside well
- Celiac to Iliacs
- >3cm is NOT NORMAL

Questions?

The IVC


HEPATIC VEINS
INFERIOR PHRENIC ARTERIES
ŒSOPHAGUS
INFERIOR VENA CAVA
SPLEEN
SUPRARENAL GLAND
RIGHT
LEFT
SUPERIOR MESENTERIC ARTERY
CŒLIAC ARTERY
RENAL VEIN
KIDNEY
KIDNEY
INFERIOR MESENTERIC ARTERY
COMMON ILIAC ARTERY AND VEIN
INTERNAL SPERMATIC ARTERY AND VEIN
INTERNAL ILIAC ARTERY AND URETER
RECTUM
BLADDER

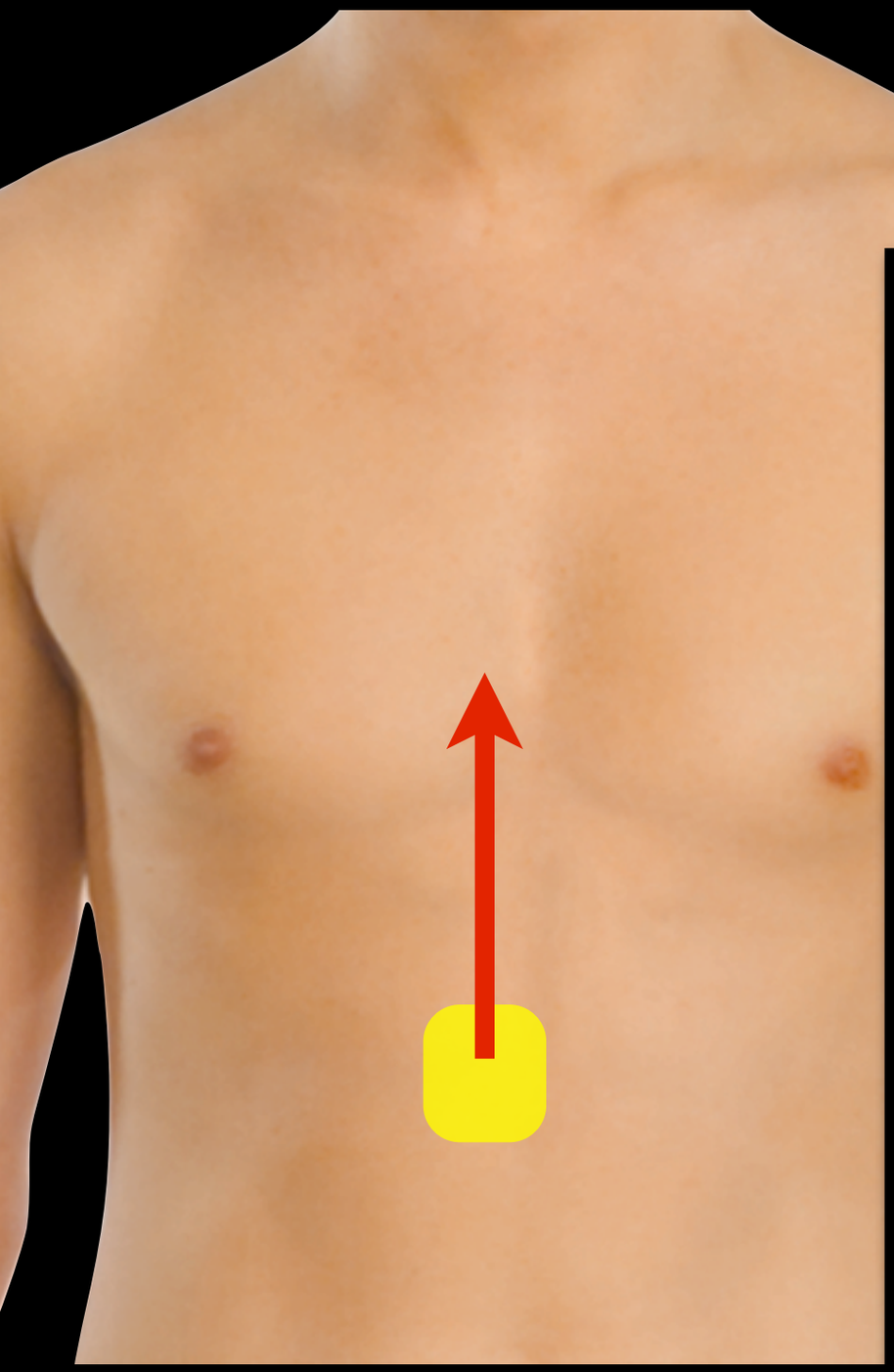
Background: IVC

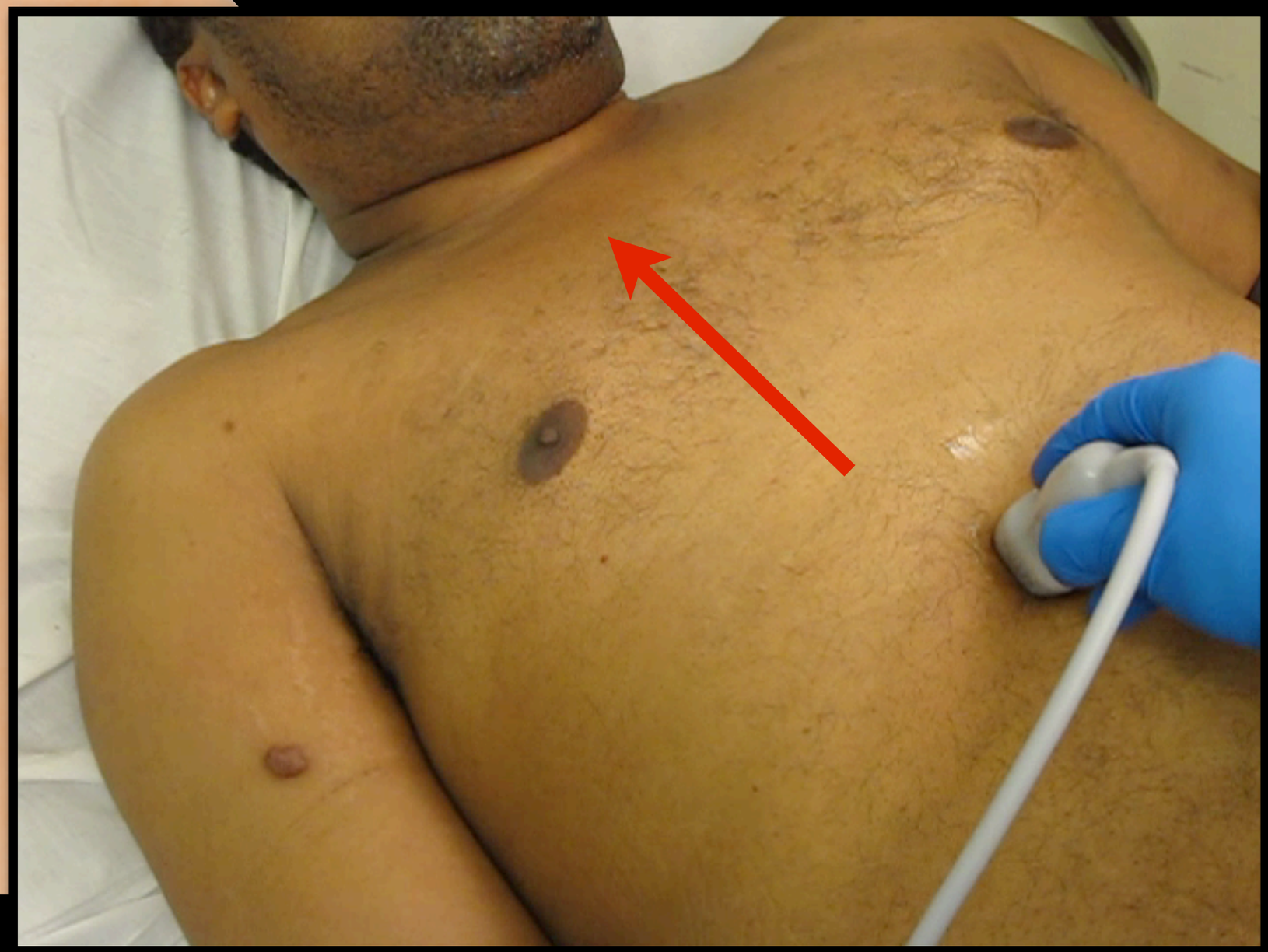
- Use similar technics in finding the aorta to locate the IVC
- IVC used as *part of exam* to evaluate fluid status
- Don’t use the IVC alone, put in clinical scenario

IVC - Technique 1

Indicator toward chin

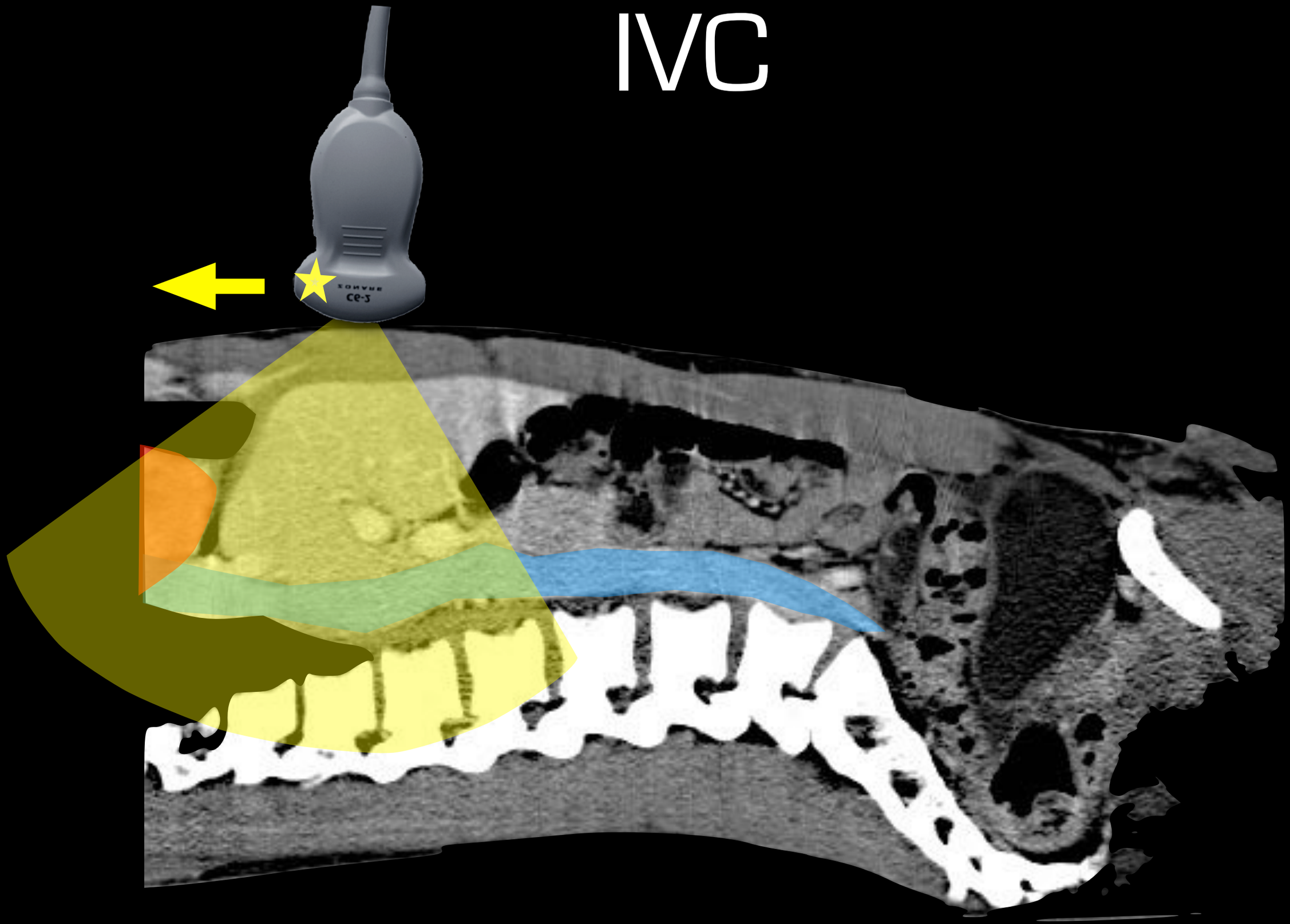
Aim towards BACK





IVC

IVC



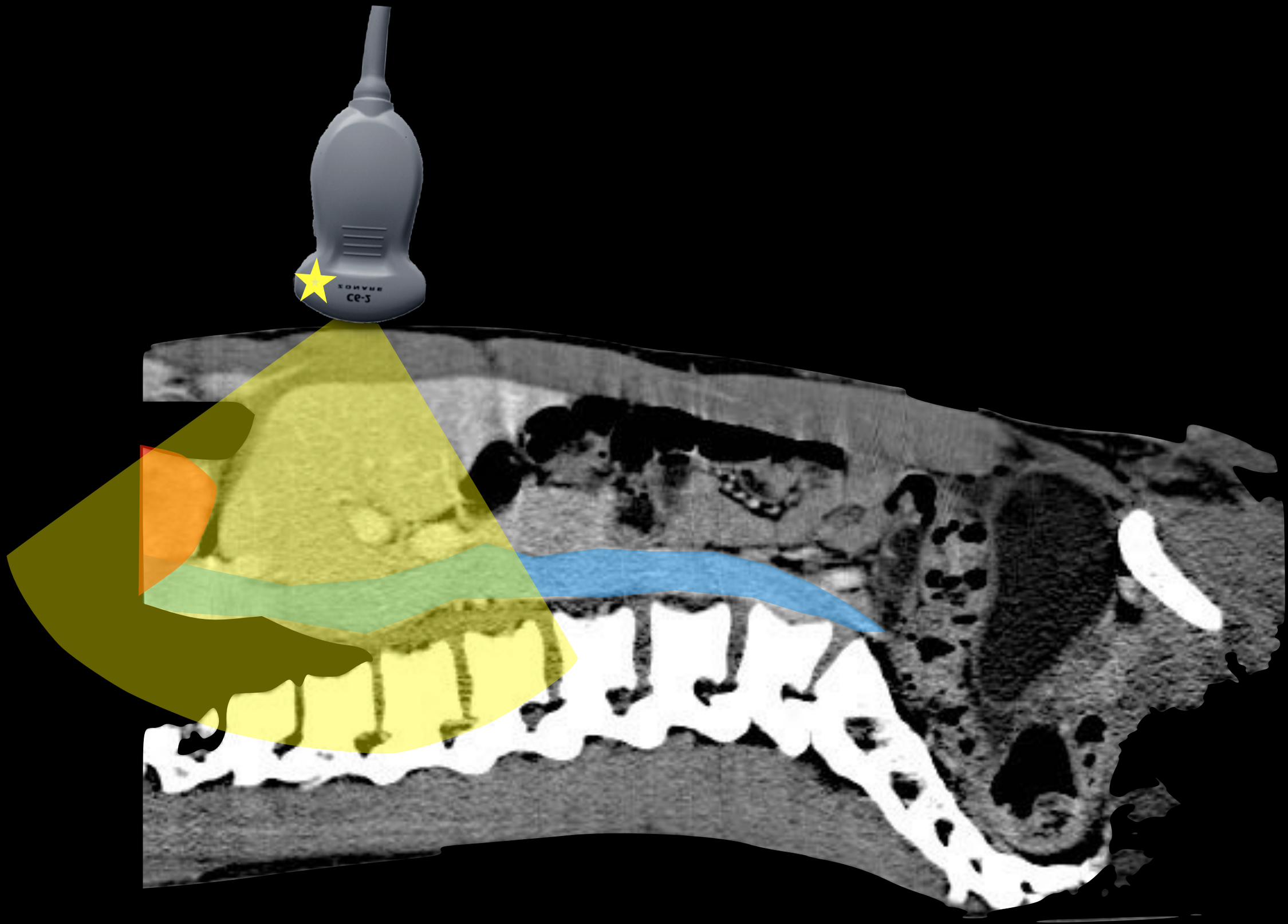
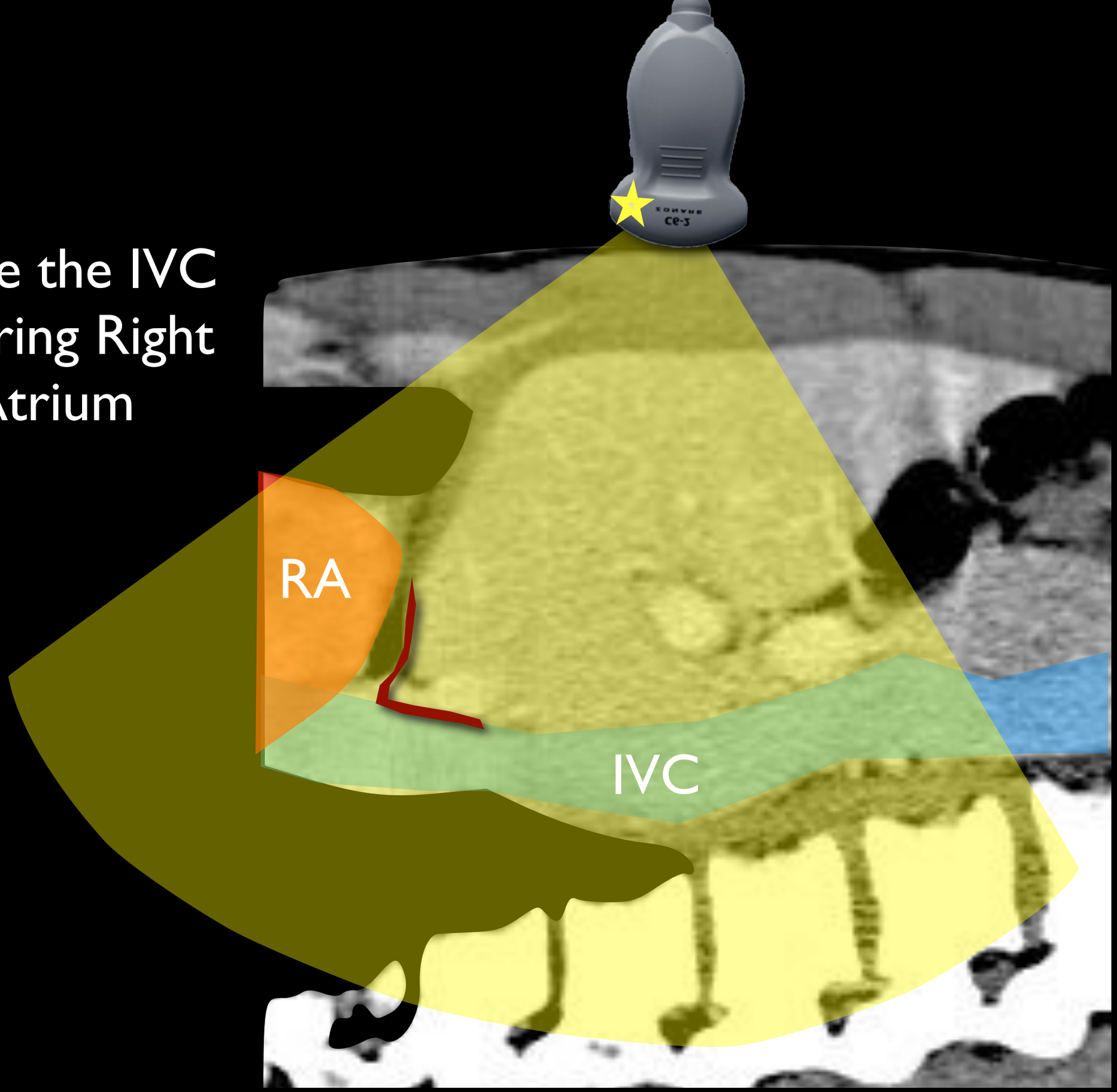
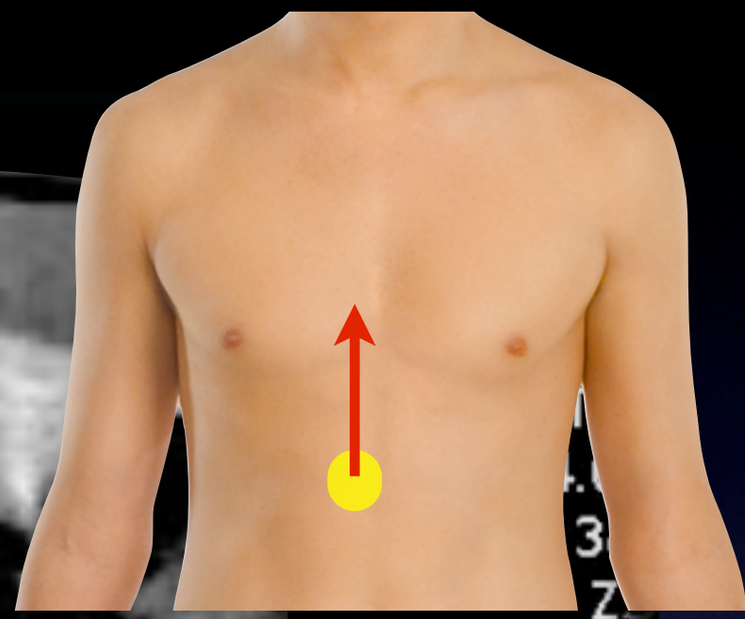


Image the IVC entering Right Atrium



IVC

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*research

IVC

Inspiration

2-3 cm


AN CR
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MI
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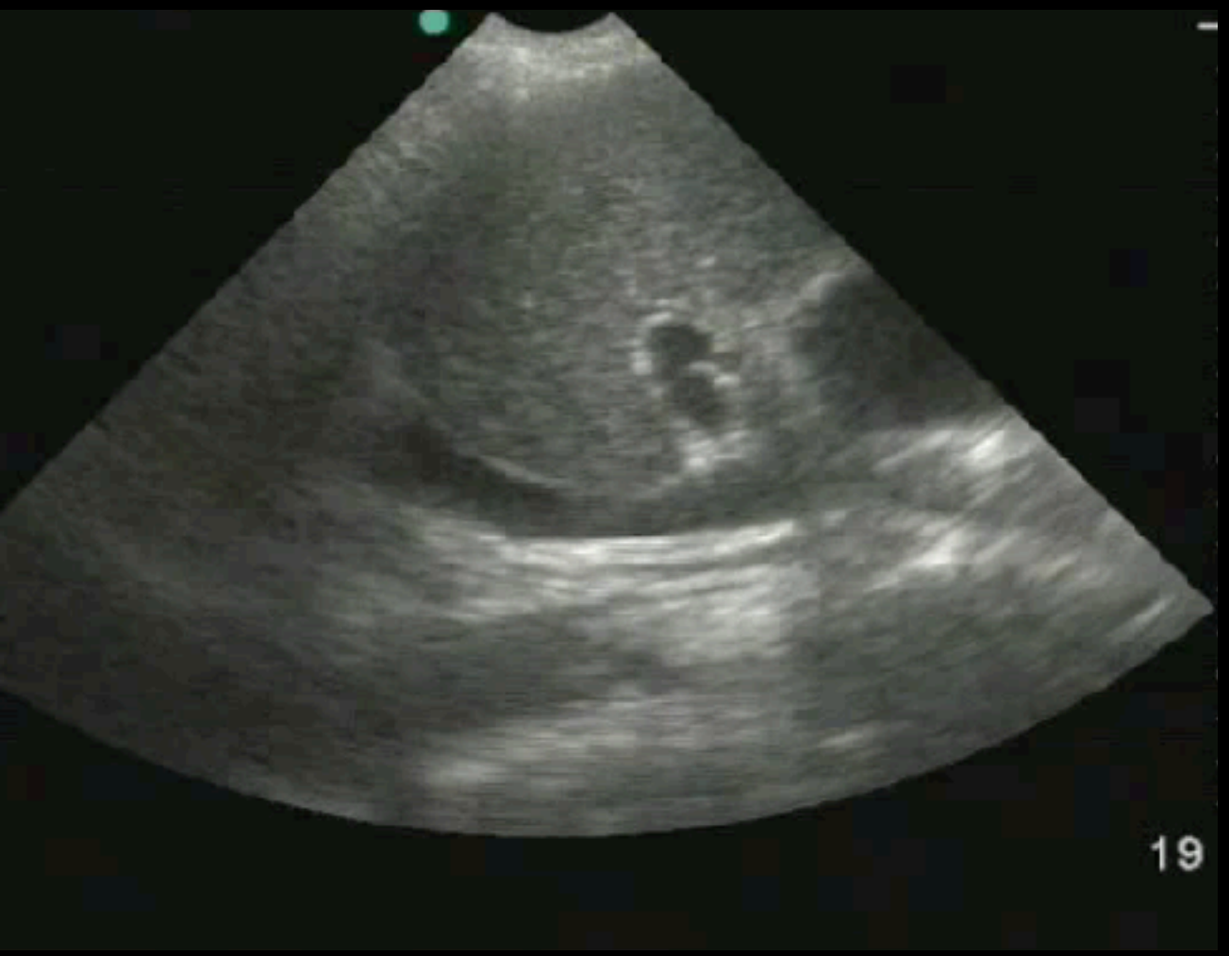
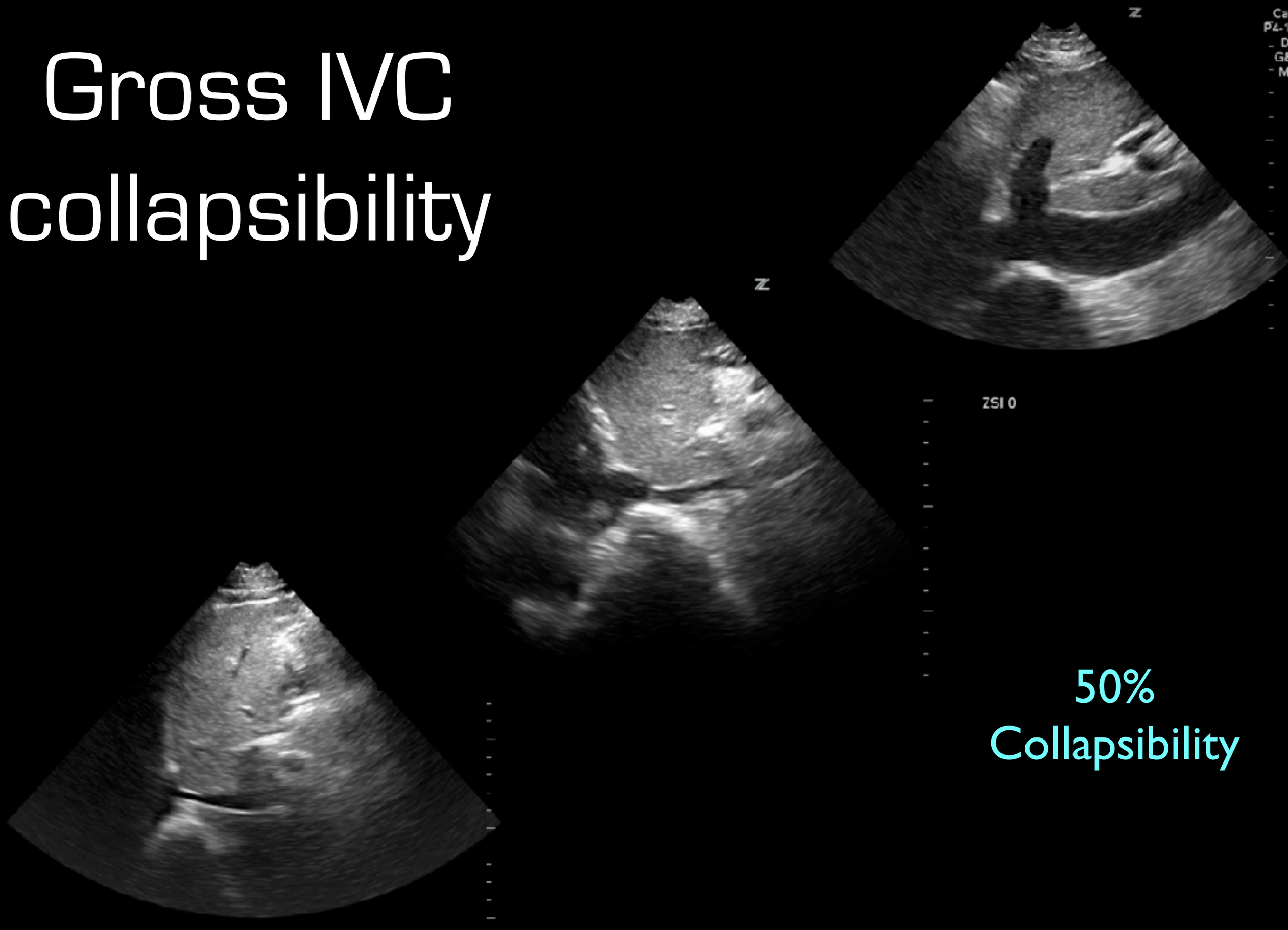
Page 1/2

Beginning of Resuscitation



2 L Normal Saline

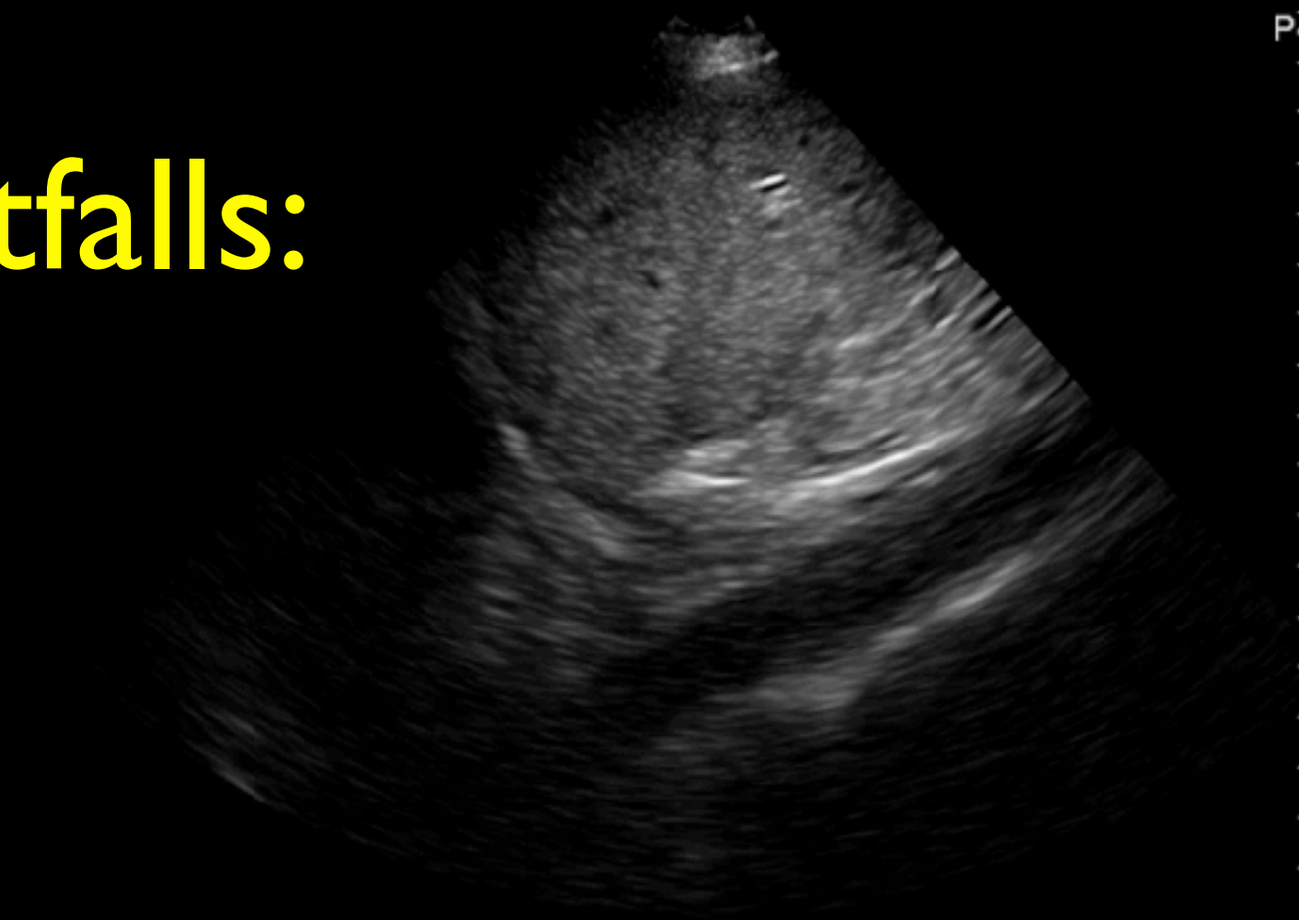
Gross IVC collapsibility



50%
Collapsibility

IVC vs Aorta

Pitfalls:

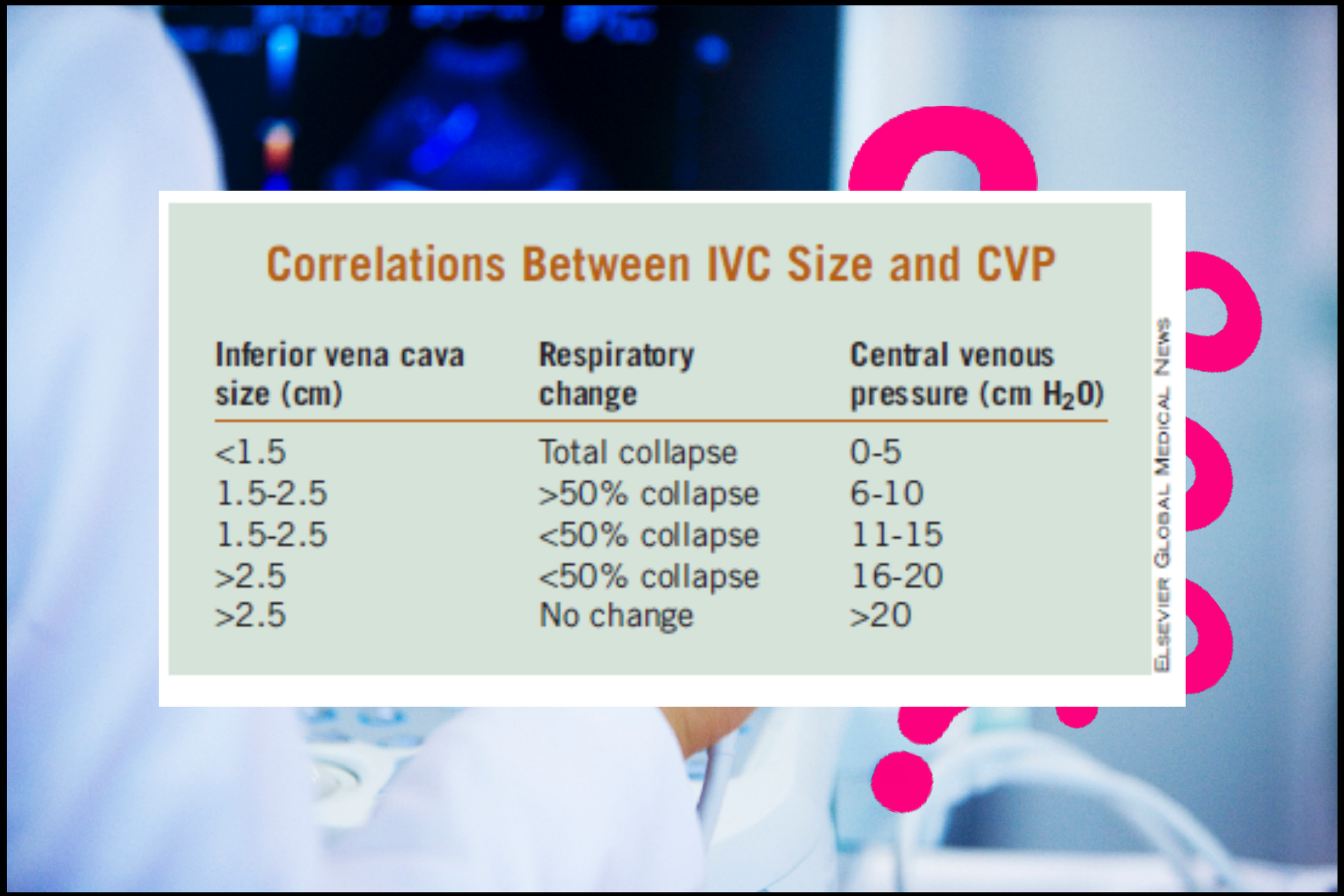


- Empties into heart
- Flows through liver
  - Hepatic Vein

- Flows deep to heart
- Flows deep to liver
- No Hepatic Vein

Fan IVC/Aorta/IVC

IVC and CVP…



Correlations Between IVC Size and CVP

Inferior vena cava size (cm)	Respiratory change	Central venous pressure (cm H_2O)
<1.5	Total collapse	0-5
1.5-2.5	>50% collapse	6-10
1.5-2.5	<50% collapse	11-15
>2.5	<50% collapse	16-20
>2.5	No change	>20

IVC and CVP

- Most accurate in extremes
- Use to track fluid resuscitation/determine whether someone is fluid responsive
- Don’t use the IVC alone to determine fluid status

IVC Take Home Points

- Measure 2-3 cm away from the Diaphragm
- Make sure it's not the aorta
- Track for dynamic changes
- Use IN CONJUNCTION with other clinical data

Questions?

References

1. Dipti A, Soucy Z, Surana A, Chandra S. Role of inferior vena cava diameter in assessment of volume status: A meta-analysis. Am J Emerg Med. 2012;30(8):1414-1419.e1. doi:10.1016/j.ajem.2011.10.017.
2. Nagdev AD, Merchant RC, Tirado-Gonzalez A, Sisson C a., Murphy MC. Emergency Department Bedside Ultrasonographic Measurement of the Caval Index for Noninvasive Determination of Low Central Venous Pressure. Ann Emerg Med. 2010;55(3):290-295. doi:10.1016/j.annemergmed.2009.04.021.
3. Ng, L; Khine, H; Taragin, BH; Avner, JR; Ushay, M; Nunez D. Does bedside sonographic measurement of the inferior vena cava diameter correlate with central venous pressure in the assessment of intravascular volume in children?. Pediatr Emerg Care. 2013;29(3):337-341. doi:10.1097/PEC.0b013e31828512a5.
4. Saul T, Lewiss RE, Langsfeld A, Radeos MS, Del Rios M. Inter-rater reliability of sonographic measurements of the inferior vena cava. J Emerg Med. 2012;42(5):600-605. doi:10.1016/j.jemermed.2011.05.095.
5. Wallace DJ, Allison M, Stone MB. Inferior vena cava percentage collapse during respiration is affected by the sampling location: An ultrasound study in healthy volunteers. Acad Emerg Med. 2010;17(1):96-99. doi:10.1111/j.1553-2712.2009.00627.x.