



*Committed to excellence in cardiovascular ultrasound
and its application to patient care.*

ASCeXAM / ReASCE

Practice Board Exam Questions

Monday Morning

- **Ultrasound Physics**
- **Artifacts**
- **Doppler Physics**
- **Imaging, Knobology, and Artifacts**
- **Echocardiographic Evaluation of the RV**
- **Tricuspid and Pulmonary Valve Disease**



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Artifacts: Theory and Illustrative Examples

Robert A. Levine, MD

This patient shows:

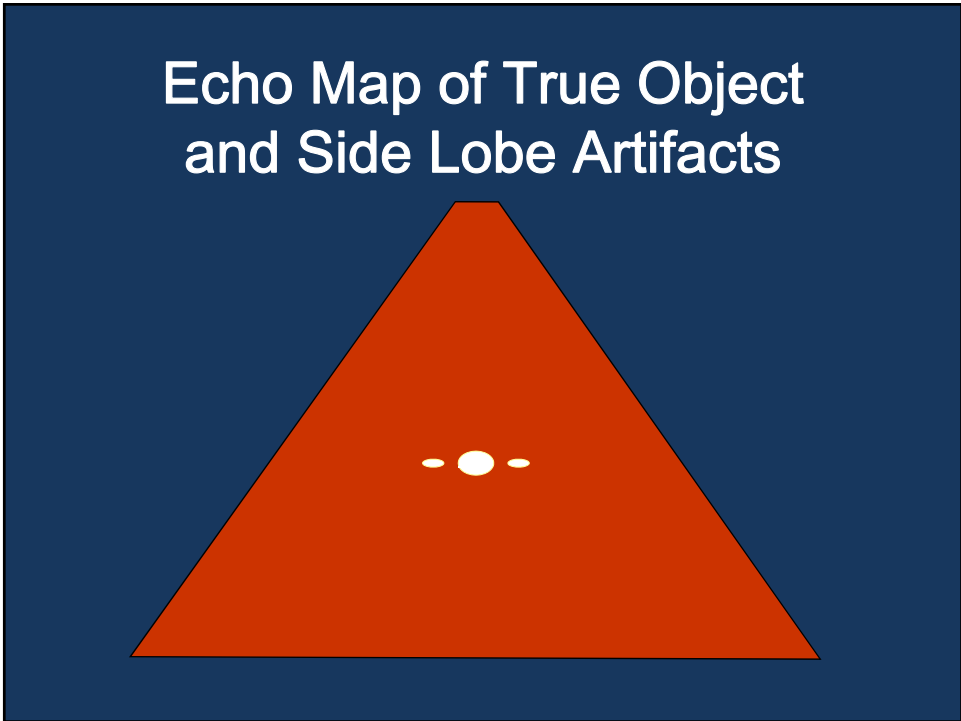
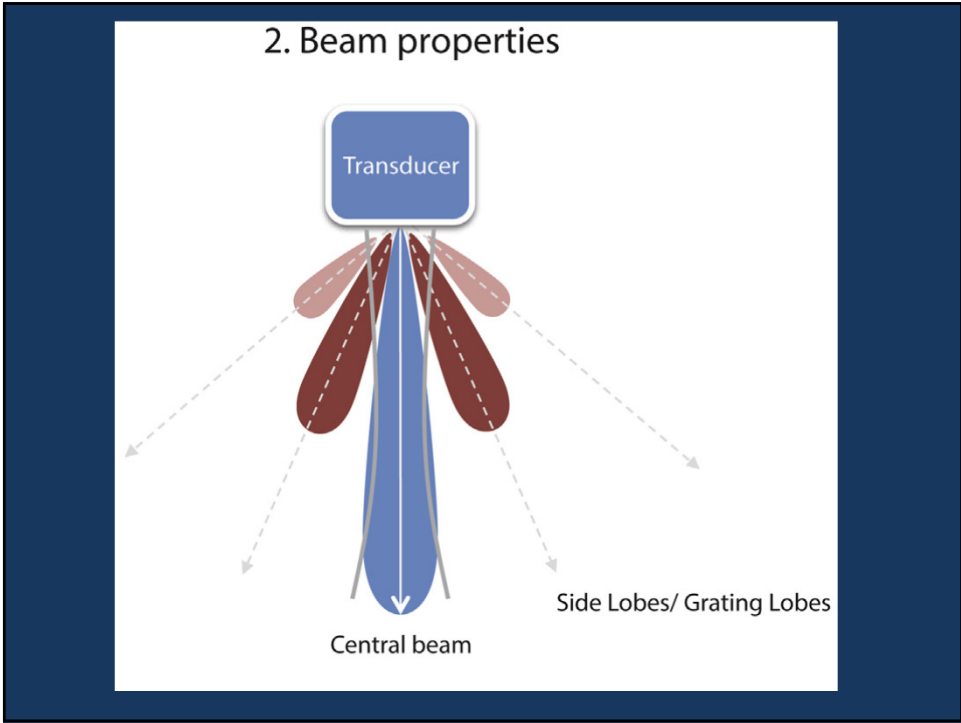
1. Biventricular Wires
2. Reverberation
3. Mirror Image
4. Side Lobes



This patient shows:

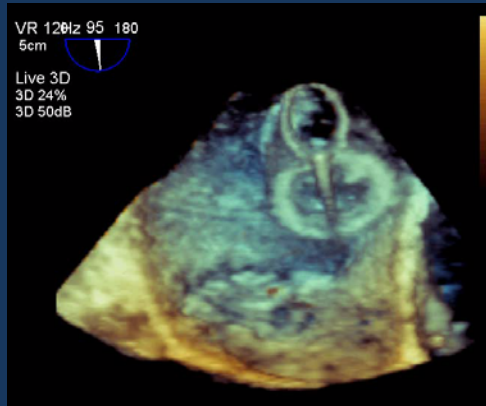
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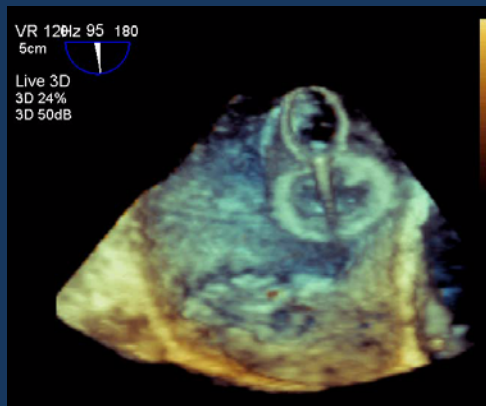
Apical TEE: What type of occluder device is in the atrial septum?

1. Helical
2. Figure of 8
3. Circular
4. Conical

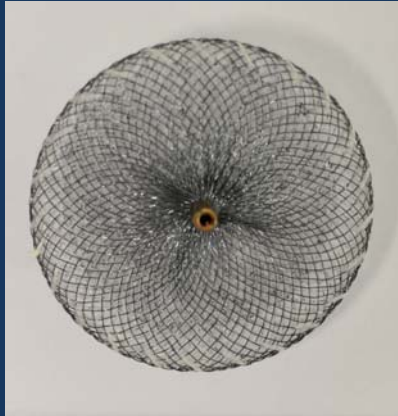


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AMPLATZER DEVICE AND ECHO



This change in apparent shape is caused by which physical effect?

1. Scattering
2. Refraction
3. Reflection
4. Acoustic Shadowing

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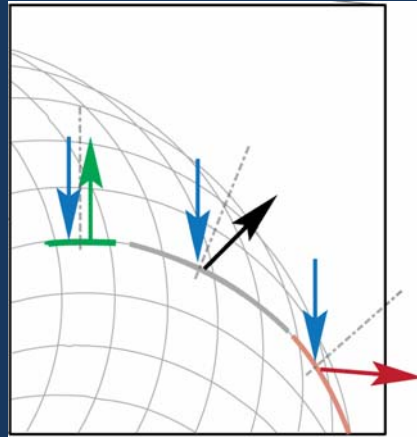
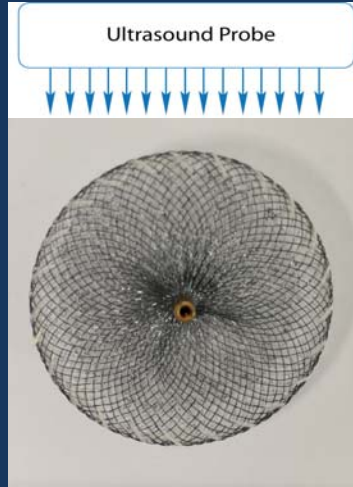
ECHOCARDIOGRAPHY IN LA APPENDAGE CLOSURE

Etiology and Relevance of the Figure-of-Eight Artifact on Echocardiography after Percutaneous Left Atrial Appendage Closure with the Amplatzer Cardiac Plug

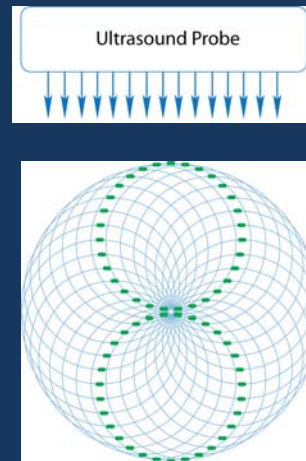
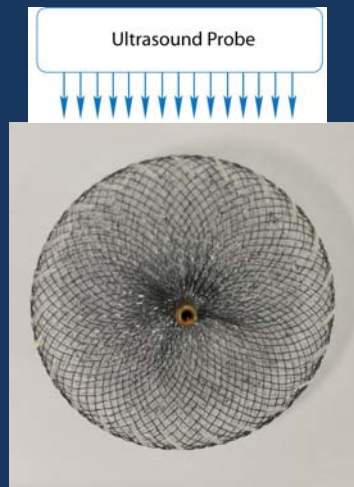
Philippe B. Bertrand, MD, MSc, Lars Grieten, MSc, PhD, Pieter De Meester, MD, Frederik H. Verbrugge, MD, Wilfried Mullens, MD, PhD, David Verhaert, MD, Maximo Rivero-Ayerza, MD, PhD, Werner Budts, MD, PhD, and Pieter M. Vandervoort, MD, *Genk, Hasselt, and Leuven, Belgium*

JASE 2014; 27:323-8

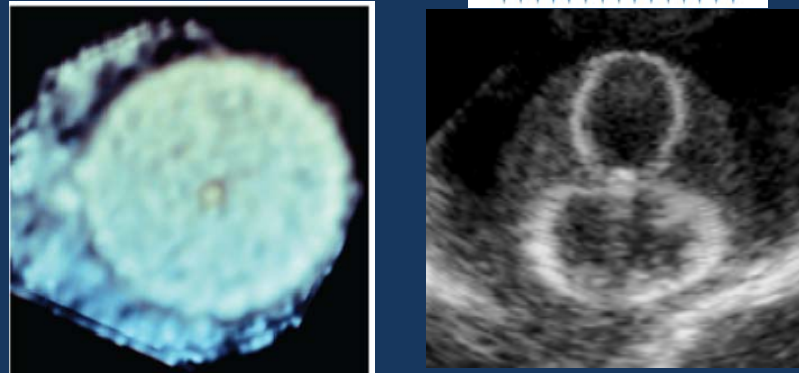
Physics principle: Angle of reflection = angle of incidence for a specular reflector



Result: Figure-of-8 artifact



Result: Figure-of-8 artifact versus true shape when beam views device en face



Artifactual echoes :

1. Always Move Parallel To A Real Object
2. Create Turbulent Color Flow In Their Vicinity
3. Are Infrequent By TEE
4. Can Appear To Pass Through Real Objects

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Concepts of Imaging, Knobology, and Artifacts

David B. Adams, RCS, RDCS, FASE

Which standard 2D TTE view typically allows viewing of the LAA?

1. Parasternal Long Axis
2. Apical 4 Chamber
3. Subcostal 4 Chamber
4. Apical 2 Chamber

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The problem with this image can be corrected using:

1. Overall Gain
2. TGC Controls
3. LGC Controls
4. Another View



DUKE: Adams

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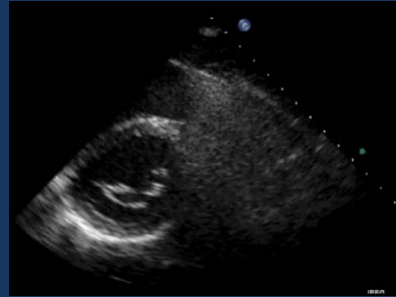
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DUKE: Adams

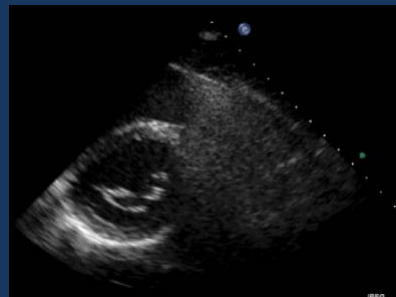
To correct this view the transducer beam should be angled:

1. Laterally
2. Medially
3. Cranially-up an interspace
4. Caudally-down an interspace



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Where should you position the pulsed wave Doppler sample volume for mitral inflow?

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The best view to measure the RVOT, pulmonic valve and PA flow is:

1. Right sternal border
2. Subcostal short axis
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1. Aliasing
2. Range resolution
3. Detection of high velocities
4. Assessing the severity of regurgitation

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1. Aortic Stenosis
2. Pulmonary Veins
3. Mitral Regurgitation
4. Tricuspid Regurgitation

DUKE: Adams

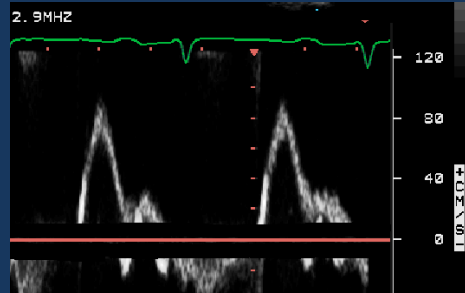
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DUKE: Adams

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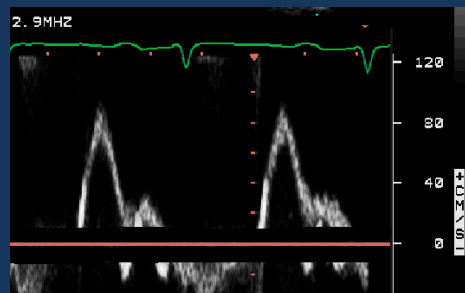
1. Increase the gain
2. Find a better window
3. Decrease the wall filter
4. Increase the wall filter



DUKE: Adams

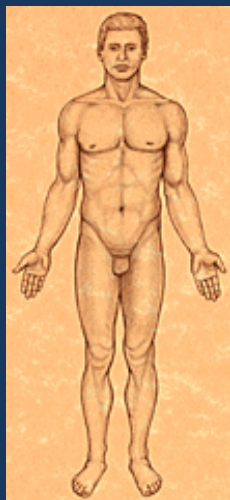
What should be done in order to measure the E wave duration?

1. Increase the gain
2. Find a better window
3. Decrease the wall filter
4. Increase the wall filter



DUKE: Adams

Duke ER



The End

DUKE: Adams



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Echocardiography Evaluation of the Right Ventricle

Lawrence G. Rudski, MD, FASE

Question 1

- A 35 year old woman is referred for an echocardiogram to evaluate progressive dyspnea on exertion. There is insufficient tricuspid and pulmonic regurgitation to estimate pulmonary artery pressure. Which of the following echocardiographic signs is most suggestive of pulmonary arterial hypertension:

- 1) IVC measuring 25 mm with 30% collapse with respiration
- 2) D-shaped interventricular septum configuration in systole
- 3) D-shaped interventricular septum configuration in diastole
- 4) RV measuring 50 mm at base, with TAPSE of 23 mm

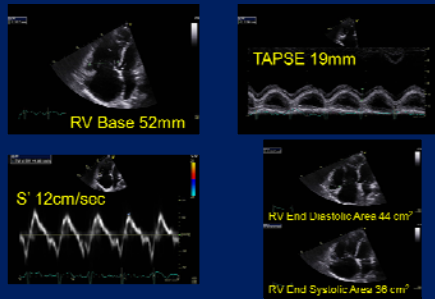
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Question 2

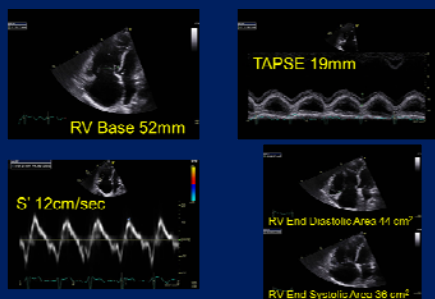
Regarding the following echo images. The RV size and systolic function can best be described as:



- 1) Normal size and systolic function
- 2) Normal size with reduced systolic function
- 3) Increased size with normal systolic function
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Question 3

Which view is used to determine RV size in the described condition?

- 1) Apical 4-chamber view to measure RV basal dimension in Normal Subjects
- 2) RV focused view to determine relative RV:LV size in patients with pulmonary hypertension
- 3) Subcostal view to determine RV size in the setting of pulmonary embolism
- 4) RVOT dimension in parasternal long-axis view to determine RV size in Arrhythmogenic Right Ventricular Cardiomyopathy

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Question 4

A 50 year old patient presents with to the ER 2 weeks after a knee replacement. The following image is obtained.



What additional echo findings would you expect?

- 1) Moderate tricuspid regurgitation, sPAP 60 mmHg, dilated IVC
- 2) Moderate TR, clot in transit, small IVC
- 3) Mild to moderate TR, sPAP 47 mmHg, LVEF 70%
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Question 5: A patient presents with dilated neck veins and peripheral edema. His echo images demonstrate the following:

From the information provided, please calculate the EOA

Aliasing Velocity: 35 cm/s
 TR Vmax: 3.5 m/s
 PISA height 1 cm
 Blood pressure 120/80 mmHg
 Heart Rate 60

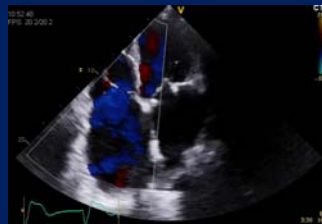


- 1) $< 0.2 \text{ cm}^2$
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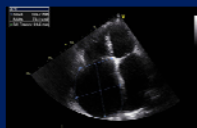
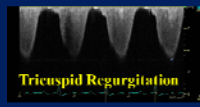
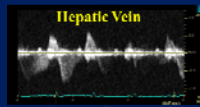
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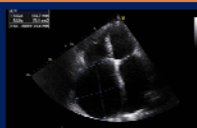
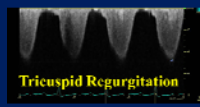
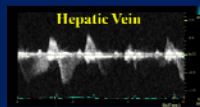


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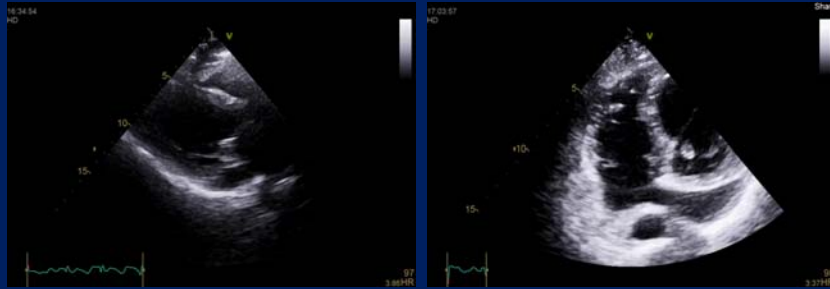
Question 7: Which technical parameters are, in general, important in considering affecting quantification of TR severity and not MR severity?

1. Eccentricity of jet and Coanda effect
2. Color gain and scale setting
3. Compliance of the atrium
4. Phase of respiratory cycle

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2. Color gain and scale setting
3. Compliance of the atrium
4. Phase of respiratory cycle

Question 8: A 78 year old patient presents with syncope and is found to have transient complete heart block. He is referred for an echocardiogram pre- pacemaker insertion. You obtain the following images:



Question 8: What is the most appropriate next procedure?

1. Transesophageal Echocardiogram
2. Repeat image after ingestion of carbonated beverage
3. Agitated saline contrast through left arm
4. Agitated saline contrast through right arm

Answer : C – agitated saline contrast through left arm showing persistent LSVC.
Important pre-pacemaker implantation



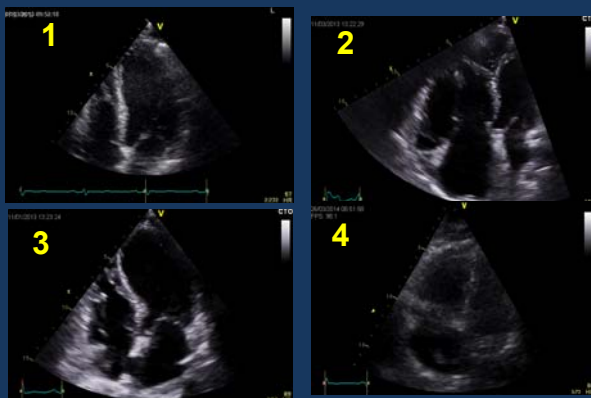
Question 9: A patient has the following quantitative measures of RV function. Which is NOT recommended to diagnose RV systolic dysfunction ASE guidelines?

1. Fractional area change of 30%
2. TAPSE 15mm
3. S' 8 cm/s
4. Free wall strain by speckle tracking -17%
5. MPI by pulsed Doppler of 0.5

Answer - 4

- All of the above indicate significant RV systolic dysfunction.
- Answer 4 – 2D strain by speckle tracking – is not one of the recommended methods to use in the routine exam owing to significant inter-vendor variability

Question 10: Of the clips below, which diagnosis is least likely to be represented?



1. Acute Pulmonary Embolism
2. Pulmonary Arteria Hypertension
3. Atrial Septal Defect
4. RV infarction
5. Takotsubo Cardiomyopathy

Answer- 3

Choice 3 – ASD – usually demonstrates RV volume overload seen in multiple views, usually with preserved systolic function. An exception is the rare form associated with abnormal BMPR2 haplotype and PH representing fewer than 5% of ASDs, or those that present VERY late.

- 1 – RV infarct associated with inferior MI
- 2 – PAH
- 3 - Takotsubo
- 4 – Acute PE

Question 11: All of the following are compatible with severe tricuspid regurgitation except:

- 1. RV basal dimension measuring 50mm
- 2. Flow reversal in the hepatic veins after the P wave
- 3. PISA radius of 10 mm at an aliasing velocity of 30 cm/s
- 4. Non-parabolic TR CW Doppler signal with an early peak

Answer - 2

- The flow reversal representing severe TR is after the QRS – i.E. In systole

Question 12: All of the following are true except:



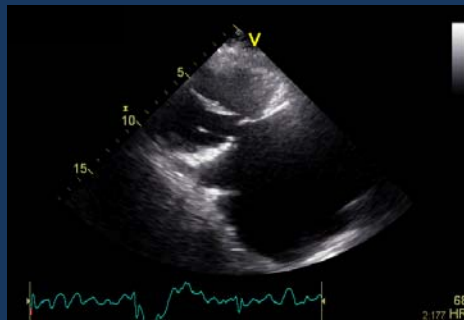
1. The simplified bernoulli equation is not valid
2. The septum is d-shaped in diastole
3. The PAP may be overestimated due to the presence of laminar flow
4. The RA pressure is likely > 15 mmhg

Answer - 3

- Laminar flow is likely to underestimate severity of TR. The simplified bernoulli equation is predicated on turbulent flow

Question 13

Which of the following is least likely?



1. A diastolic rumble will be heard over the apex
2. The IVC will be markedly dilated
3. Mitral inflow pulsed doppler will demonstrate E:A reversal
4. The RV systolic pressure will be significantly elevated

Answer - 3

- This patient has rheumatic TS, and therefore likely also has rheumatic mitral valve disease
- There is severe RA enlargement and therefore likely marked elevation of RA pressure
- The patient is in atrial fibrillation, so there will not be much of an A wave present



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Basic Ultrasound Physics

Sidney K. Edelman, PhD

What would you do to decrease aliasing?

1. image by decreasing the Nyquist limit
2. image with a higher frequency transducer
3. use pulsed rather than CW Doppler
4. image in a view with a shallower gate
5. decrease the gain

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2 MHz sound in soft tissue?

1. 0.31 m
2. 0.77 mm
3. 1.54 mm
4. 0.77 us

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1. specular reflections
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3. scattering
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Which of the following forms of resolution varies within the depth of an image?

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