Friday 15 October
08:50 am

Diastolic Function

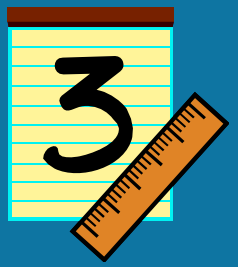
Commonly Encountered Technical Pitfalls and How to Avoid These

Bonita Anderson

Echo Australia 2010

Technique

"High PRF"



Mid-diastolic flow

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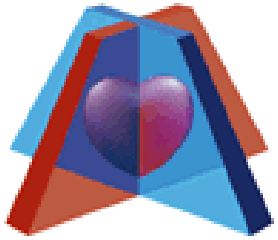

ASE American Society of Echocardiography
Heart & Circulation Ultrasound Specialists

J Am Soc Echocardiogr; 2009 22: 107-133

GUIDELINES AND STANDARDS

Recommendations for the Evaluation of Left Ventricular Diastolic Function by Echocardiography

Sherif F. Nagueh, MD, Chair,† Christopher P. Appleton, MD,† Thierry C. Gillebert, MD,*
Paolo N. Marino, MD,* Jae K. Oh, MD,† Otto A. Smiseth, MD, PhD,*
Alan D. Waggoner, MHS,† Frank A. Flachskampf, MD, Co-Chair,*
Patricia A. Pellikka, MD,† and Arturo Evangelista, MD,* *Houston, Texas; Phoenix, Arizona; Ghent, Belgium; Novara, Italy; Rochester, Minnesota; Oslo, Norway; St. Louis, Missouri; Erlangen, Germany; Barcelona, Spain*

Keywords: Diastole , Echocardiography, Doppler, Heart failure

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Primary Technical Limitations:

1. PW Doppler sample volume size
2. PW Doppler sample volume position
3. Measurement technique

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Question

When measuring the mitral A duration the sample volume should be moved to the mitral annulus

1. True
2. False

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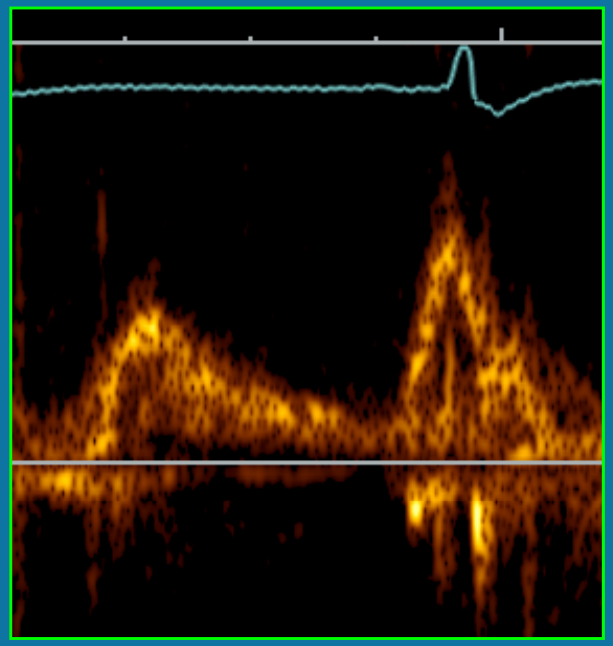
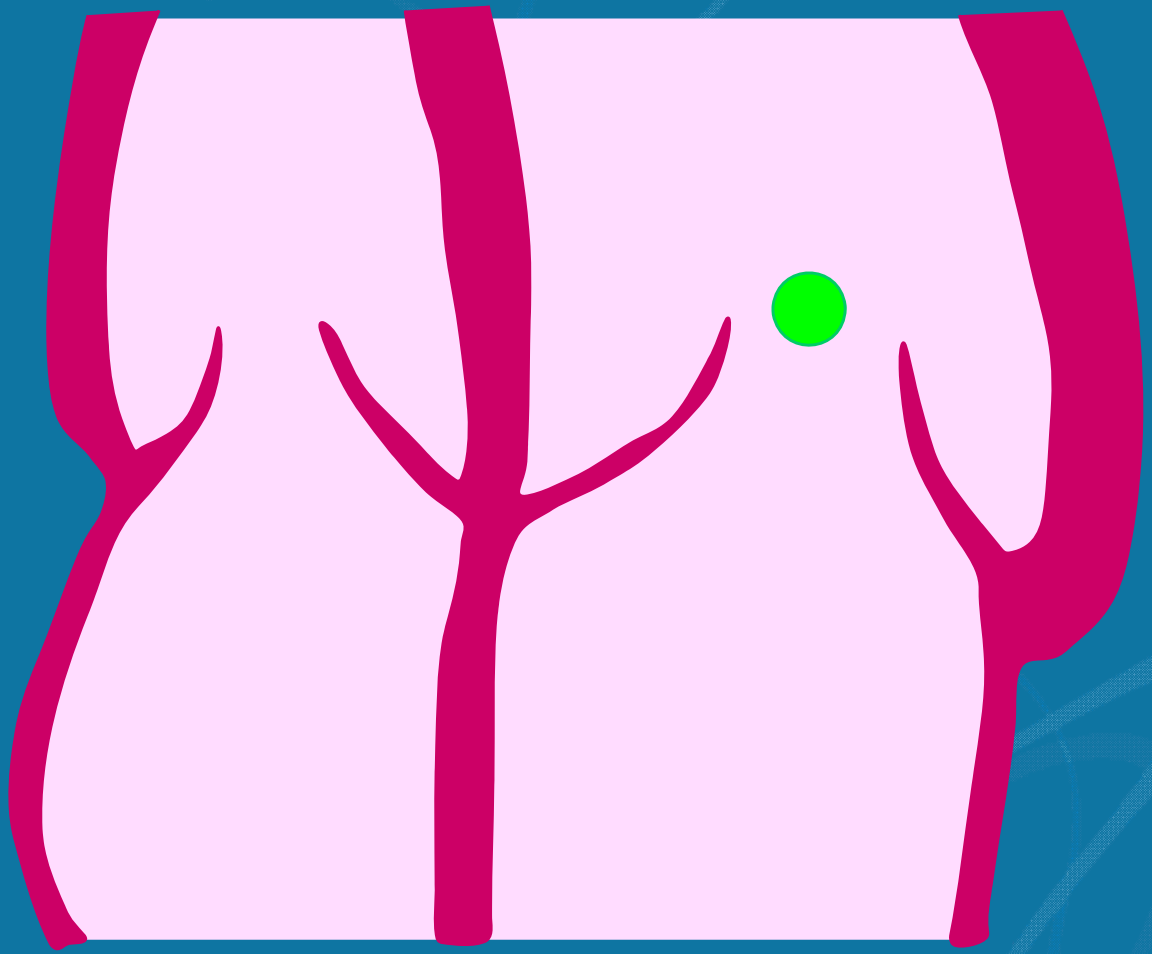
A Wave Duration





Adapted from Appleton,CP et al: J Am Soc Echocardiogr 10: 271-292, 1997

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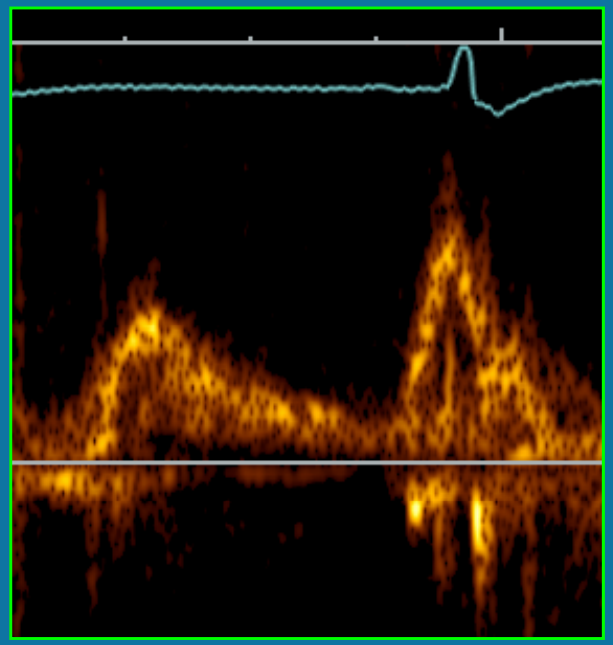
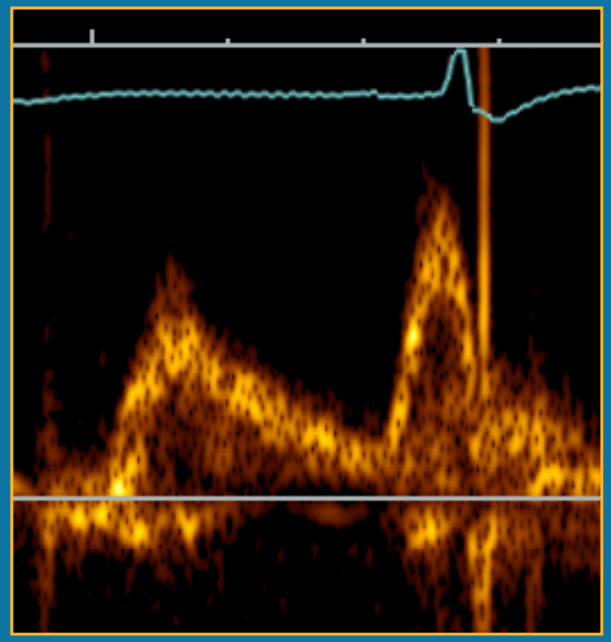
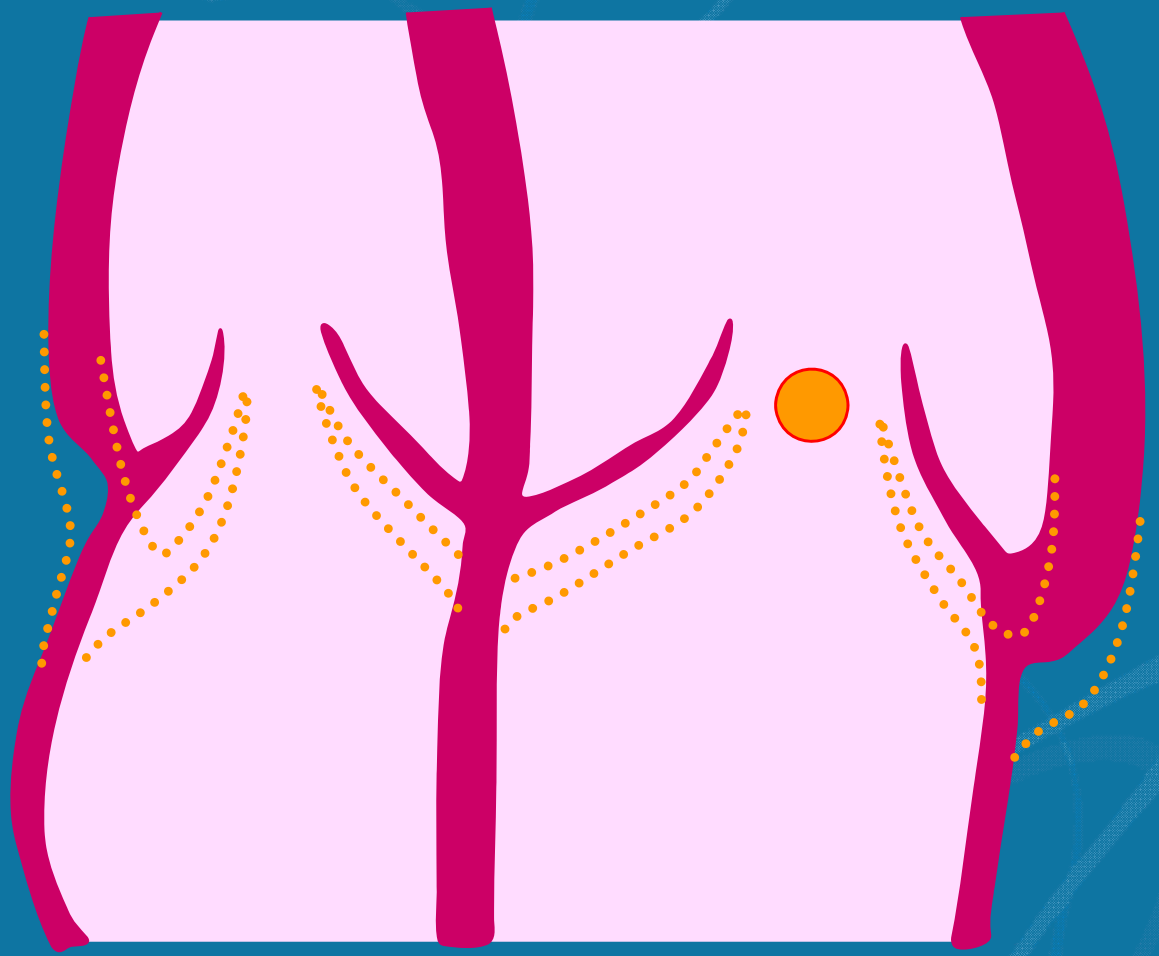
A Wave Duration

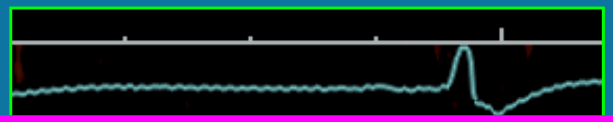




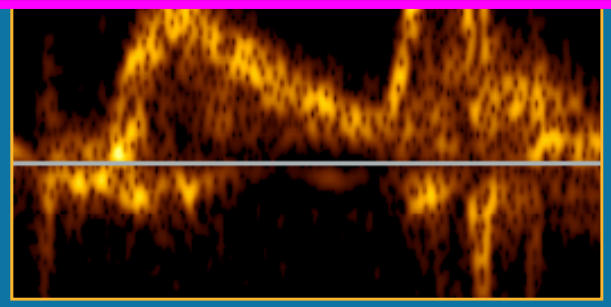


Adapted from Appleton,CP et al: J Am Soc Echocardiogr 10: 271-292, 1997

A Wave Duration

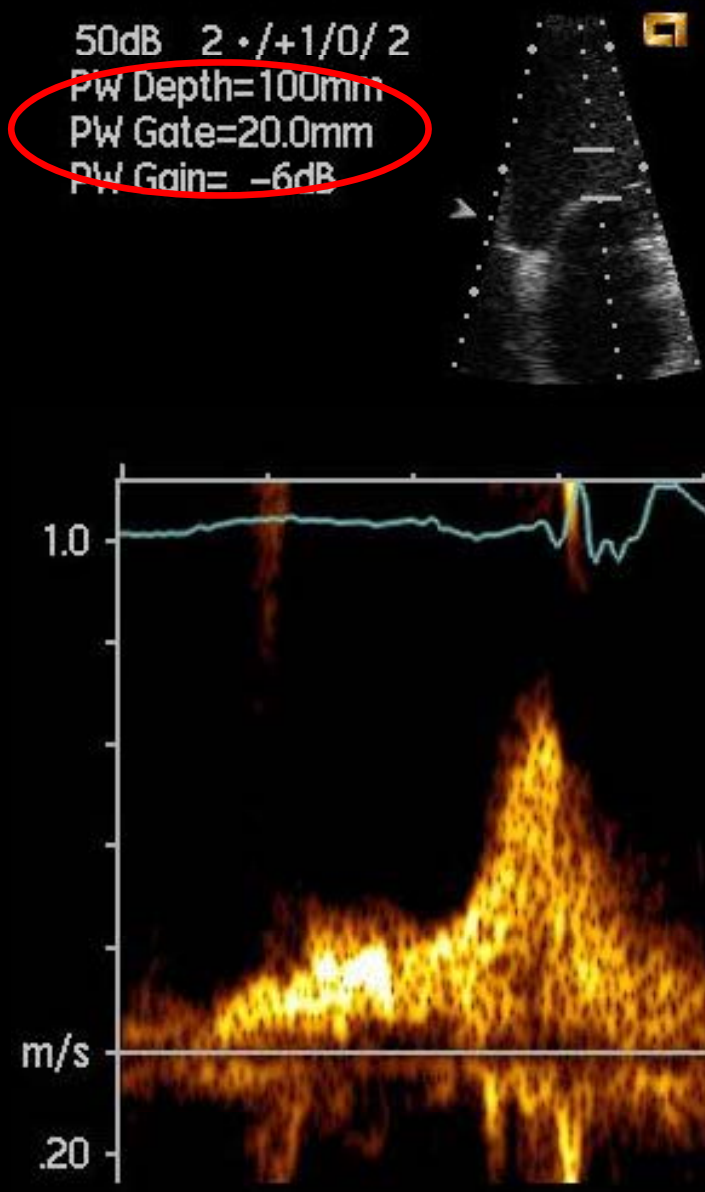


"However, moving the sample volume further toward the anulus should be avoided because the mitral A wave duration can be shorter than that measured more toward the leaflet tips."

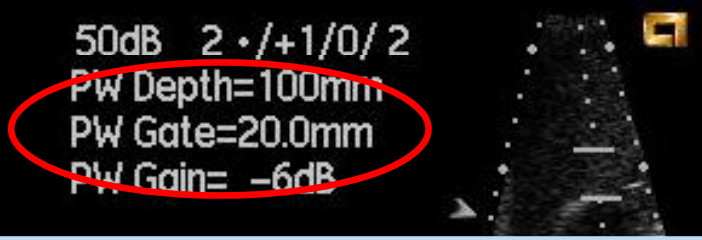


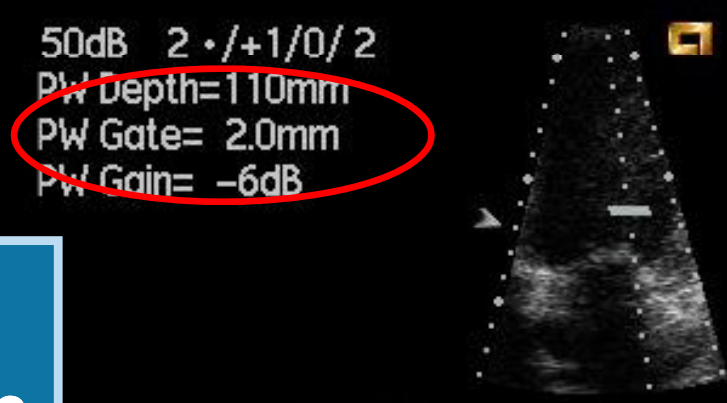
Adapted from Appleton,CP et al: J Am Soc Echocardiogr 10: 271-292, 1997

Sample Volume Size



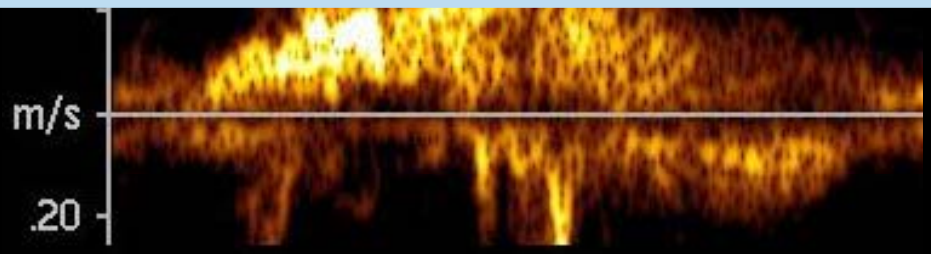
Sample Volume Size

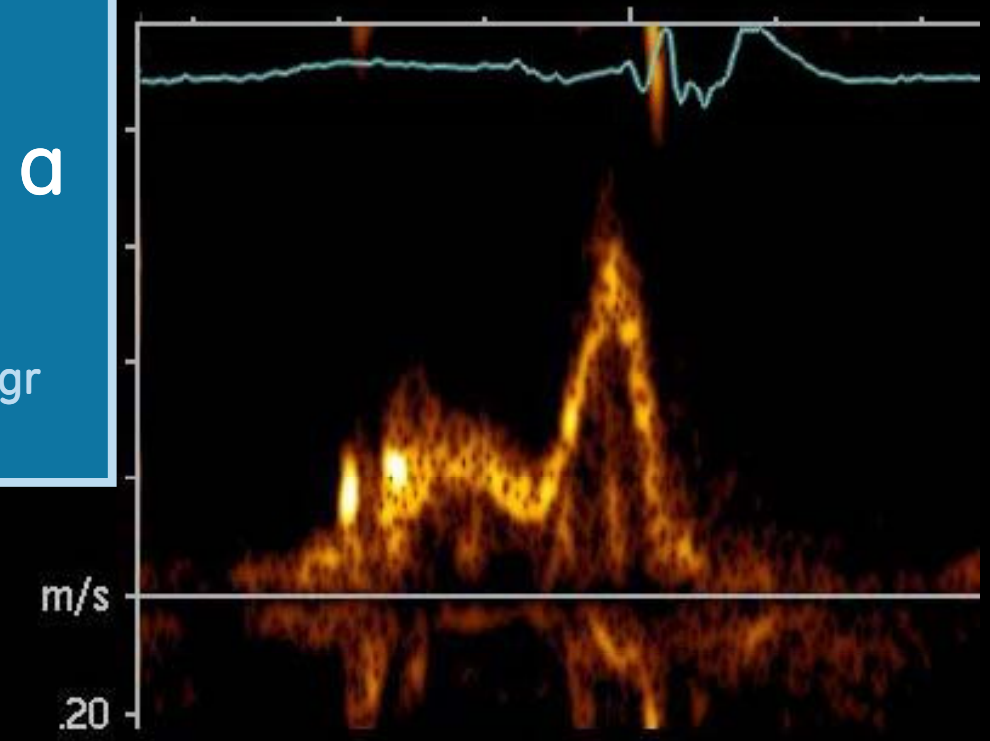




"A 1-mm to 3-mm sample volume is .. placed between the mitral leaflet tips during diastole to record a crisp velocity profile"

ASE Recommendations. J Am Soc Echocardiogr 2009; 22:107- 133





Measurement Technique

THE PRINCE CHARLES HOSPITAL
DEPARTMENT OF CARDIOLOGY

Queensland Government
Queensland Health

Doppler: Mitral

Mitral E Point Velocity	0.85 m/s	MV Deceleration Time	157 ms
Mitral A Point Velocity	0.57 m/s	E Prime Velocity	9 cm/s
Mitral E to A Ratio	1.5	E to E Prime Ratio	9.4
MV A Duration	133 ms		

Doppler: Pulmonary Veins

Pulmonary Vein Systolic Velocity	47 cm/s	Pulm Vein Atrial Reversal Velocity	19 cm/s
Pulmonary Vein Diastolic Velocity	49 cm/s	Pulm Vein Atrial Duration	123 ms
Pulm Vein S/D Ratio	0.96		

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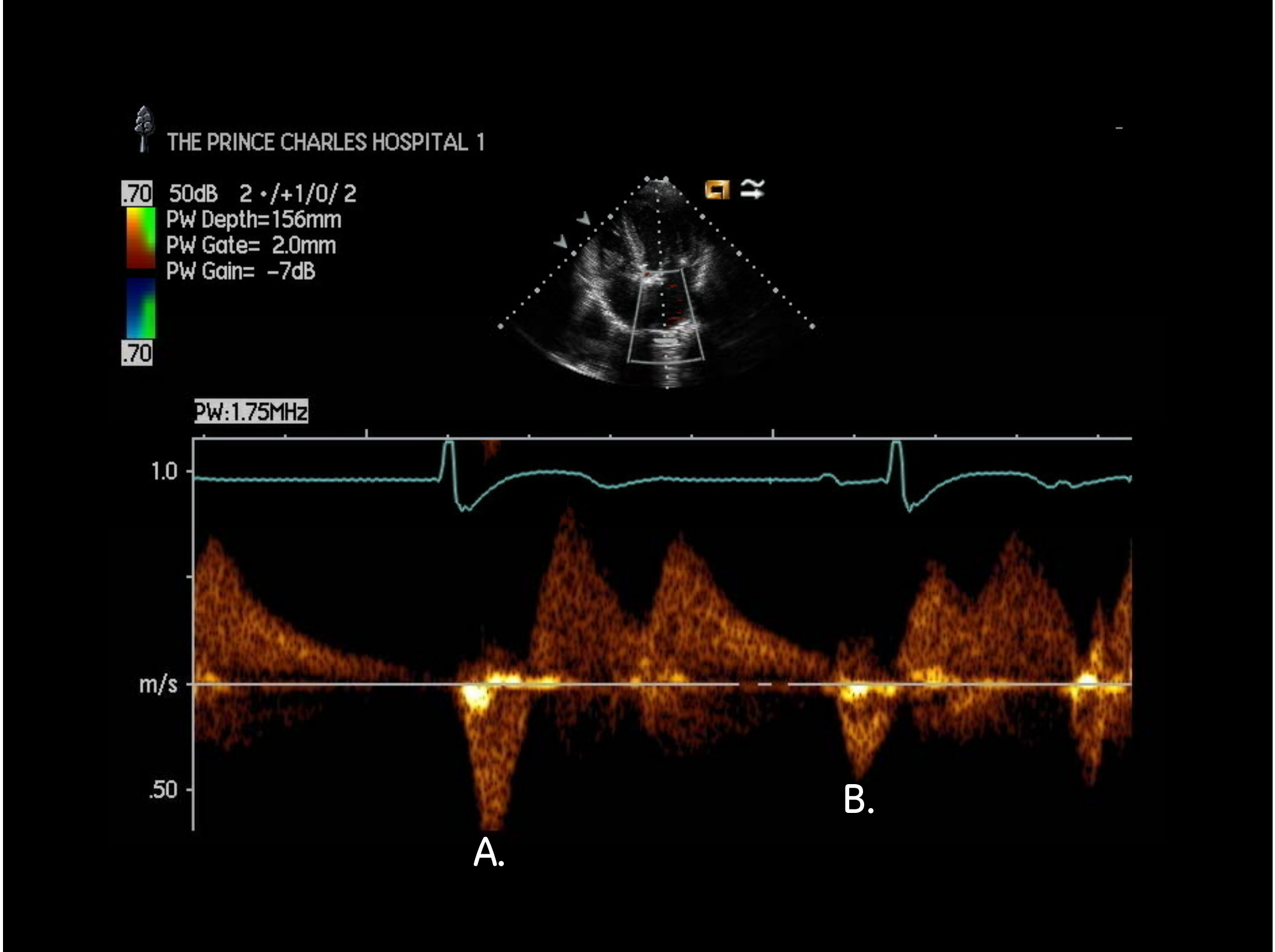
THE PRINCE CHARLES HOSPITAL 1
.70
50dB 2 •/+1/0/ 2
PW Depth=156mm
PW Gate= 2.0mm
PW Gain= -7dB
.70
PW:1.75MHz
1.0
m/s
.50
A.
B.

Question

Which AR velocity/duration should be measured:

1. A
2. B
3. Average of A and B
4. Neither A or B

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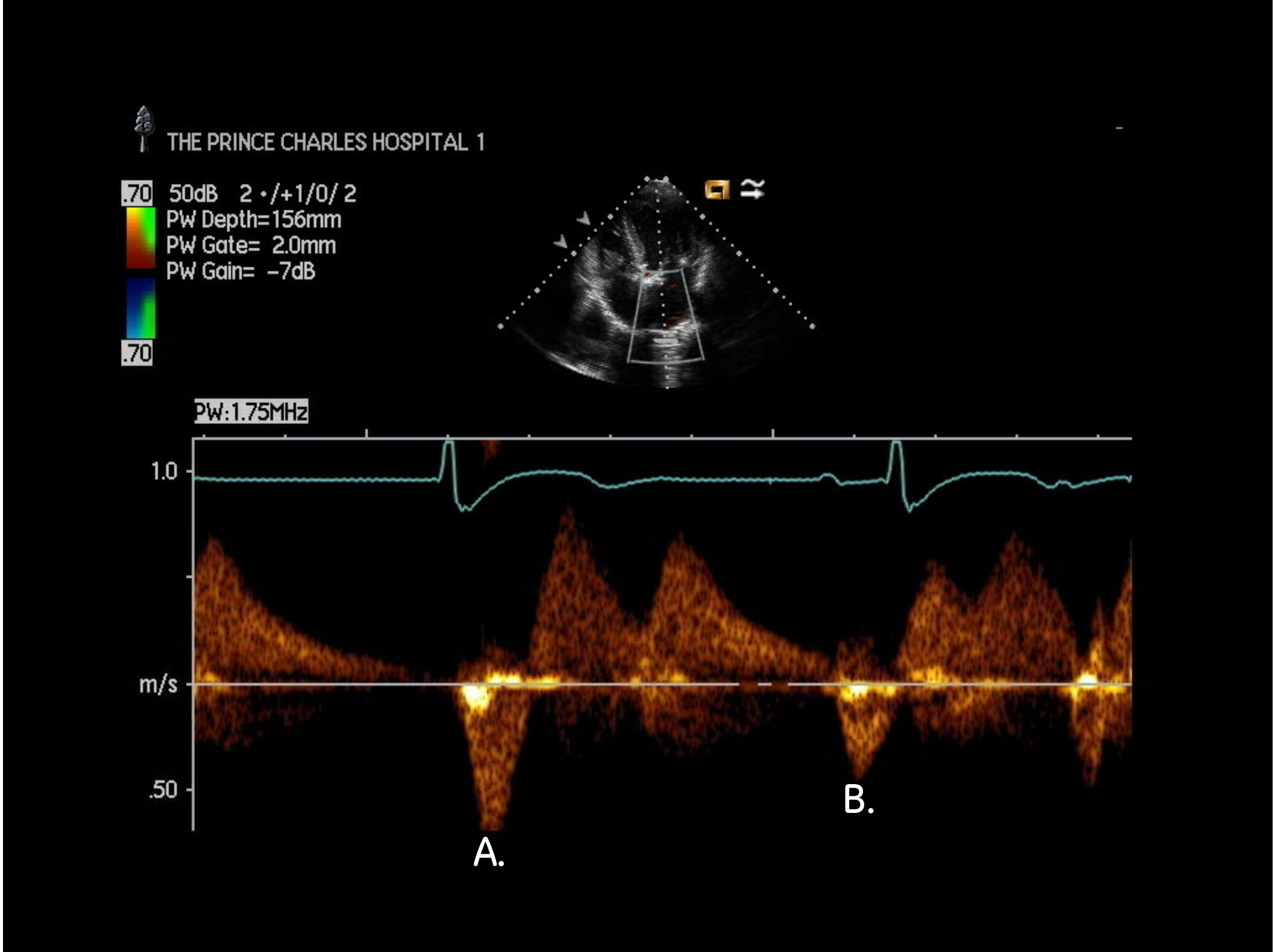
THE PRINCE CHARLES HOSPITAL 1
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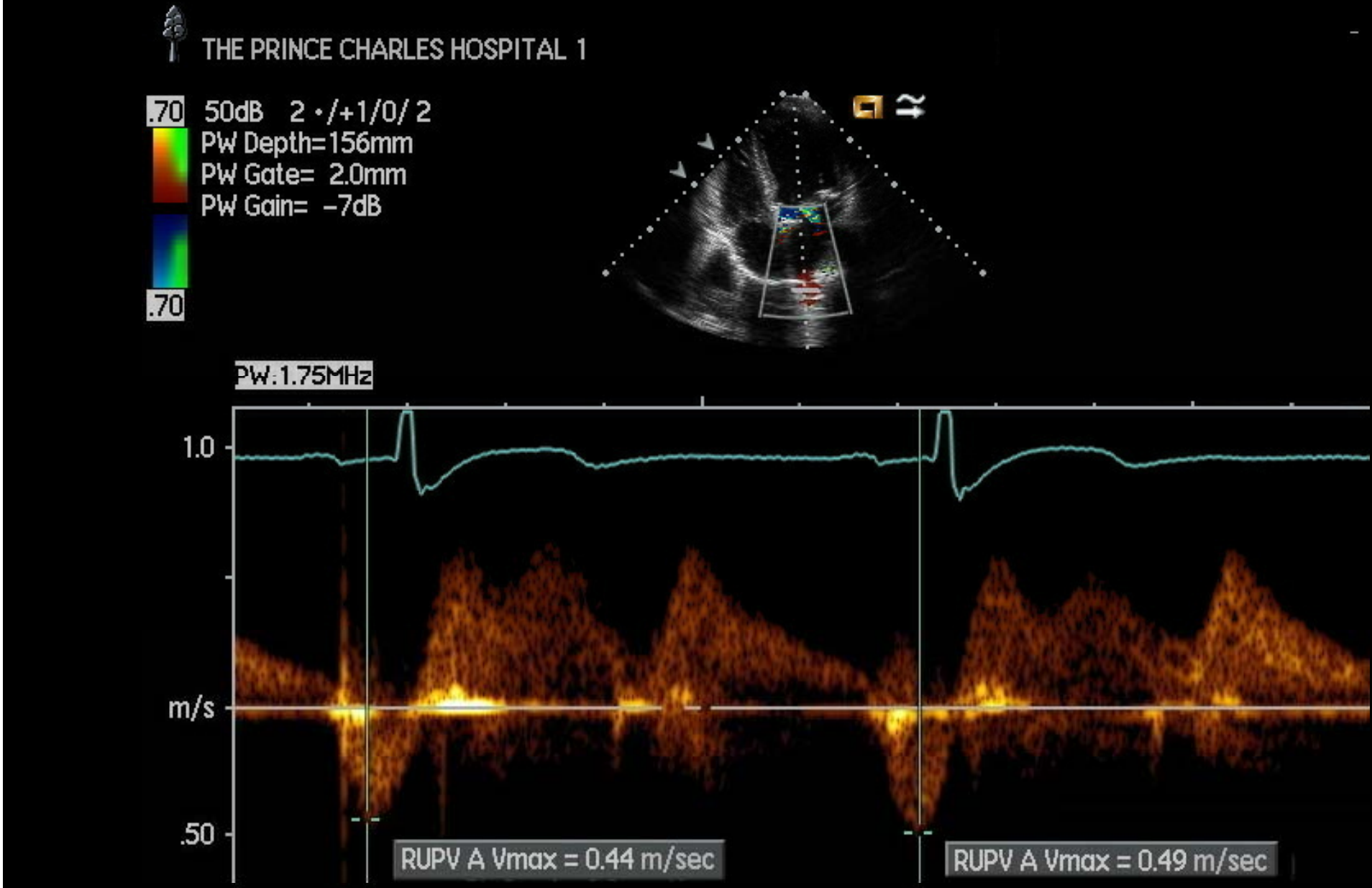
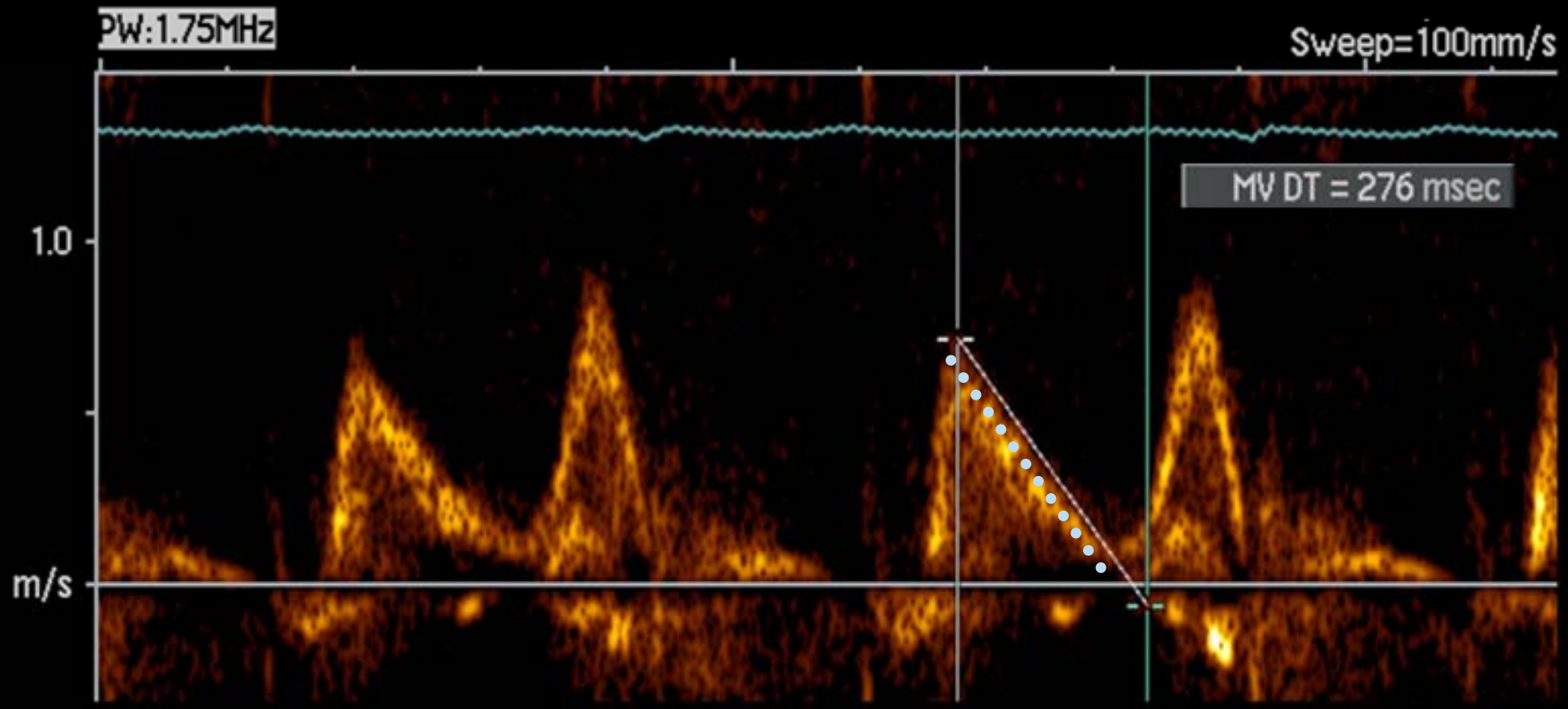
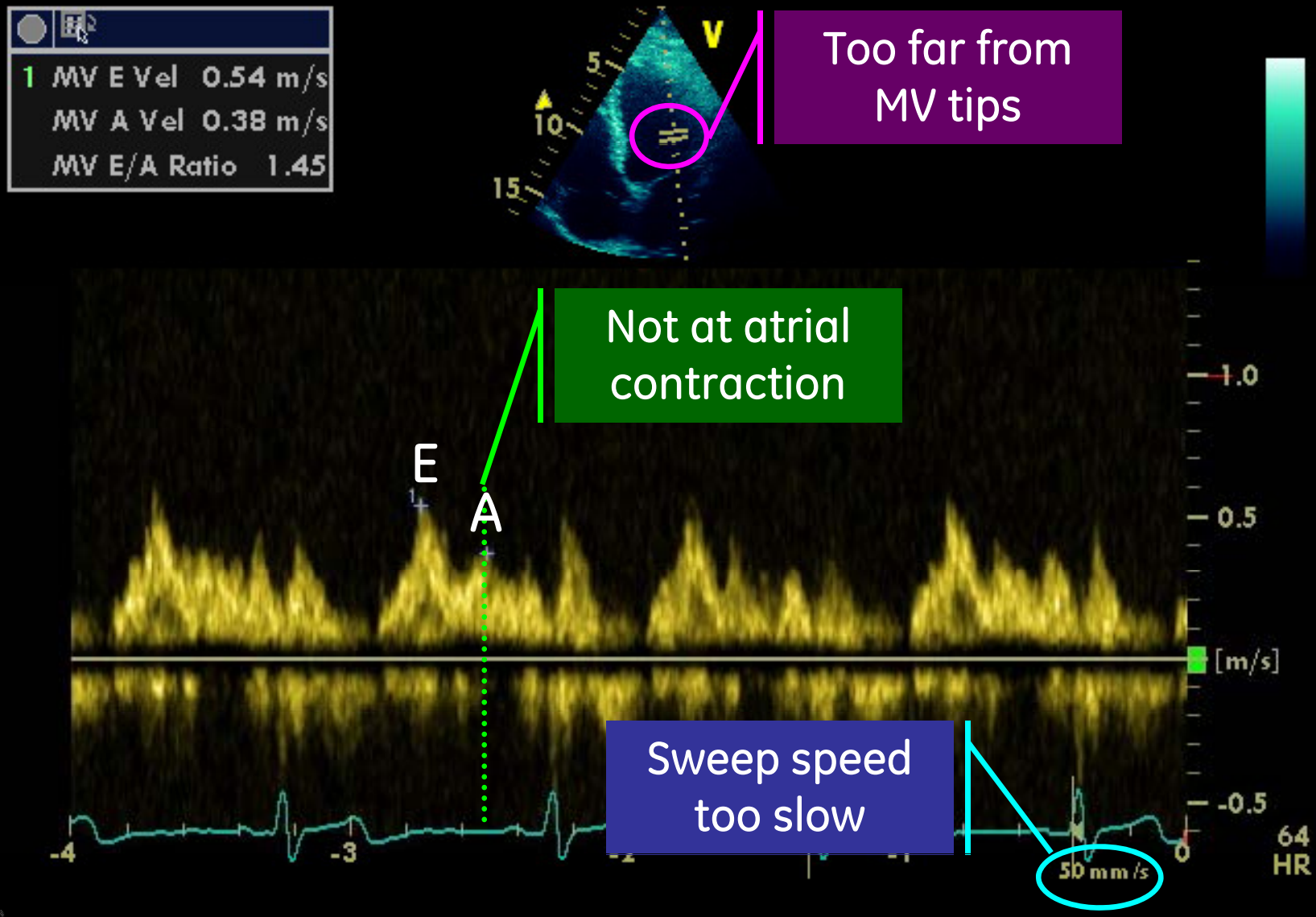
PW Depth=156mm
PW Gate= 2.0mm
PW Gain= -7dB
.70
PW:1.75MHz
1.0
m/s
.50
A.
B.


THE PRINCE CHARLES HOSPITAL 1
.70
50dB 2 •/+1/0/ 2
PW Depth=156mm
PW Gate= 2.0mm
PW Gain= -7dB
.70
PW:1.75MHz
1.0
m/s
.50
RUPV A Vmax = 0.44 m/sec
RUPV A Vmax = 0.49 m/sec

Trace along modal velocity (centre of brightest line)



Optimise Trace & Look at the ECG



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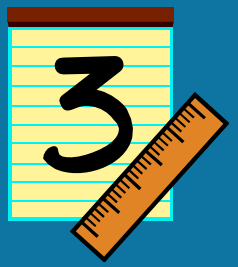
Technique

"High PRF"



Mid-diastolic flow

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Maximum Doppler Shift by PW Doppler

Referred to as

Nyquist limit

Determined by

PRF

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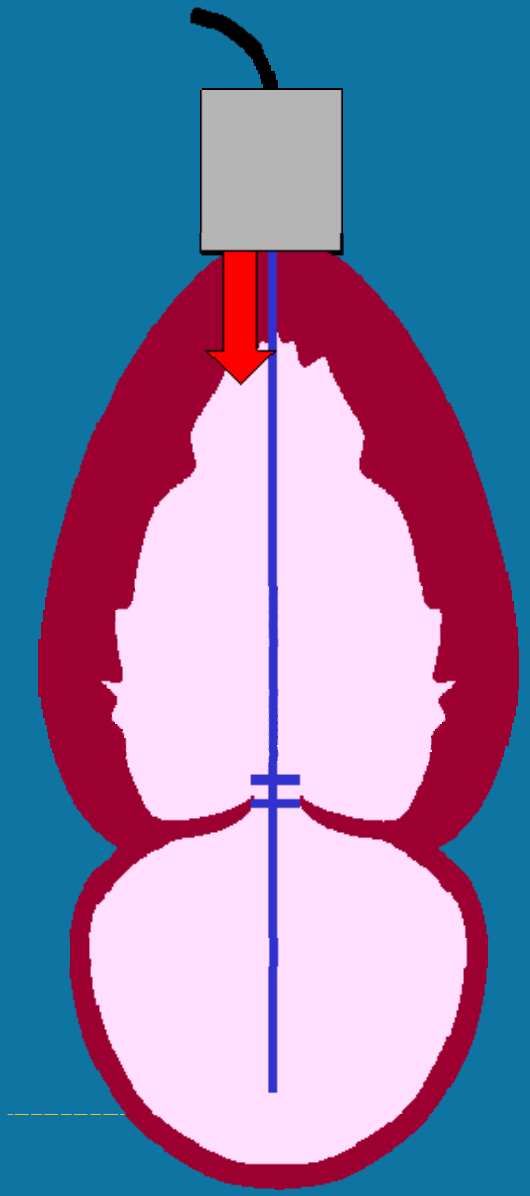
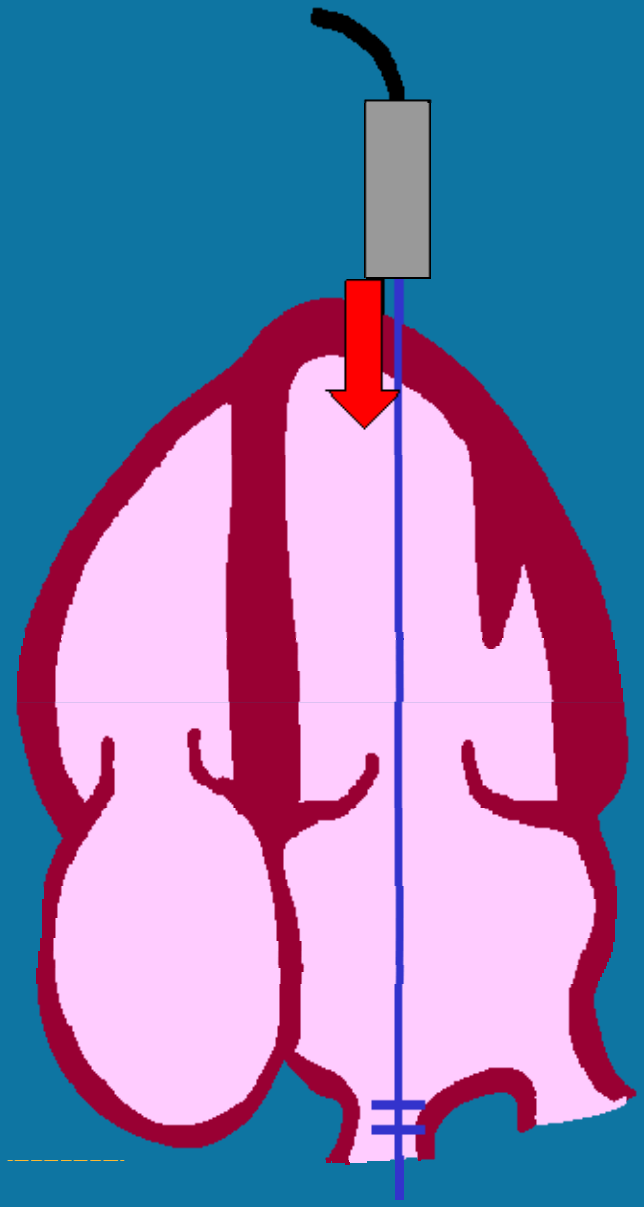
Determination of PRF



- signals are sent out in ***short pulses (PRF)***
- another pulse not sent, until 1st pulse received

Determination of PRF



Further away sample volume

↓

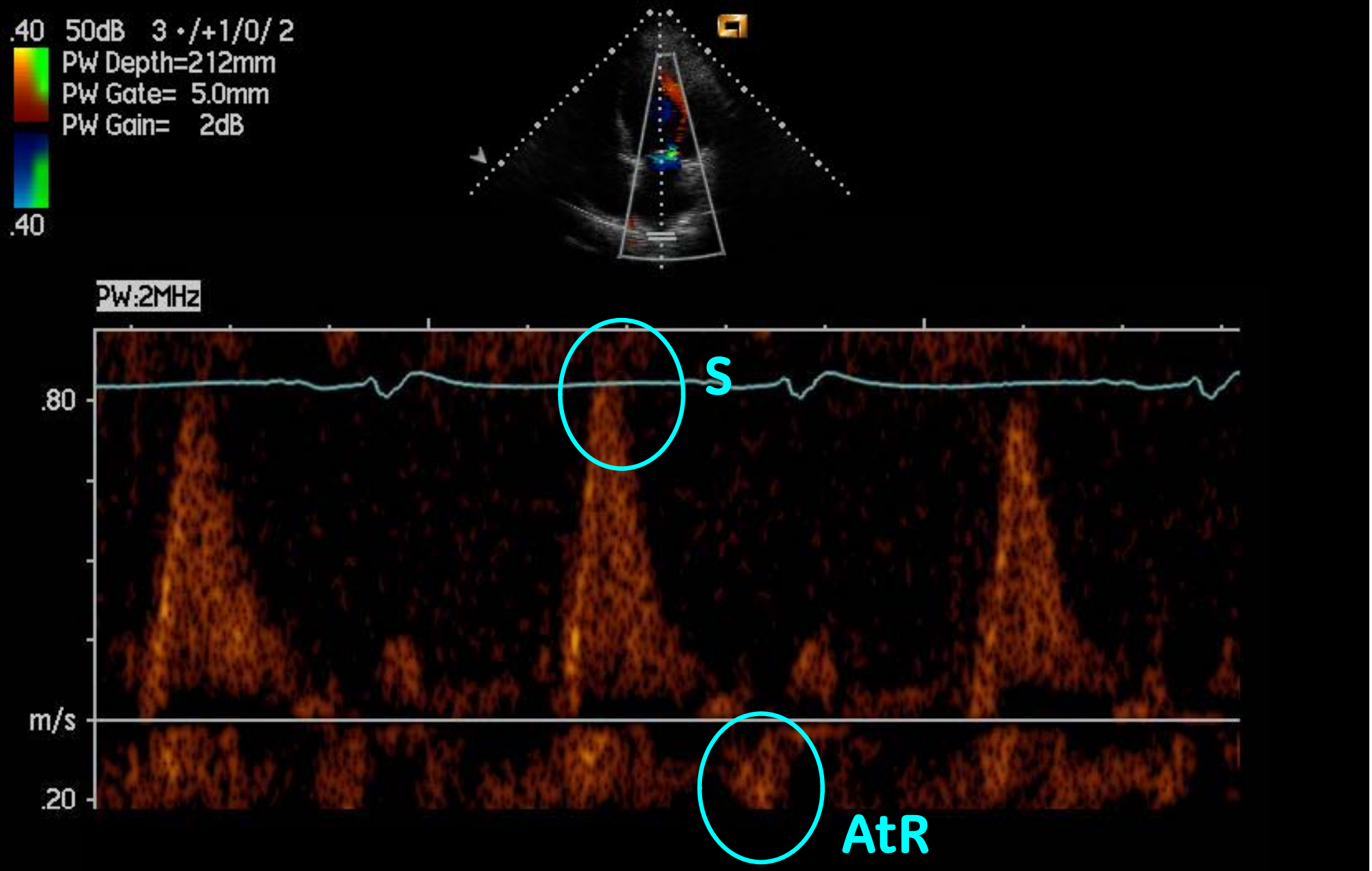
Lower the PRF

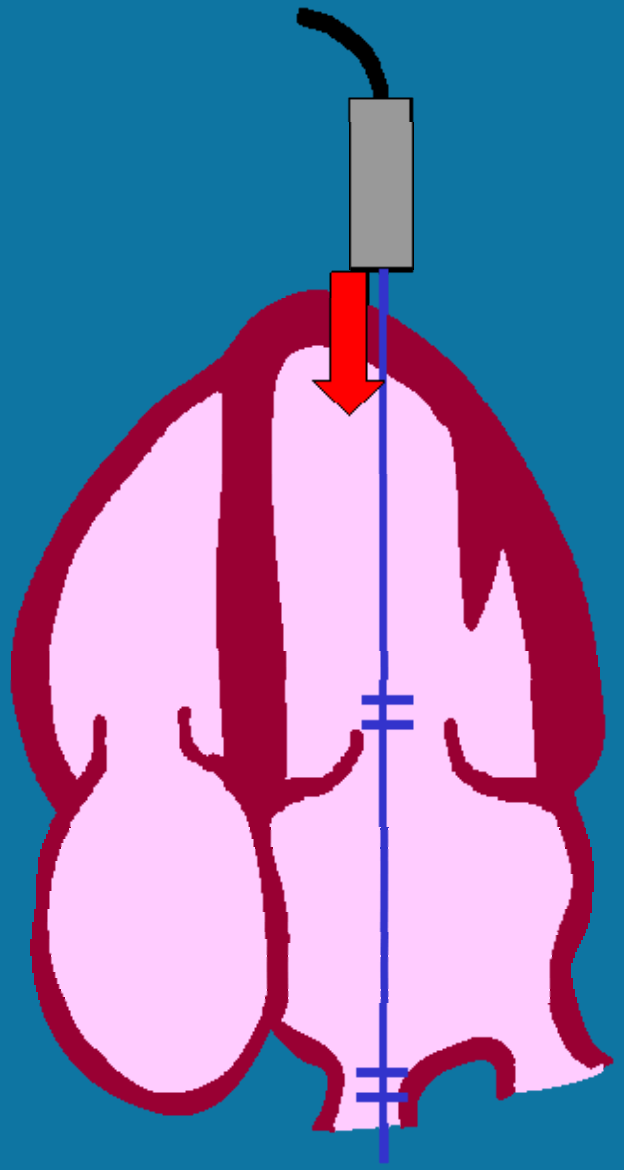
↓

Lower Nyquist Limit

↓

Lower maximum velocity


.40 50dB 3 •/+1/0/ 2
PW Depth=212mm
PW Gate= 5.0mm
PW Gain= 2dB
.40
PW:2MHz
.80
m/s
.20
S
AtR



High PRF

- uses multiple sample gates

↑ no. of sample gates

↓

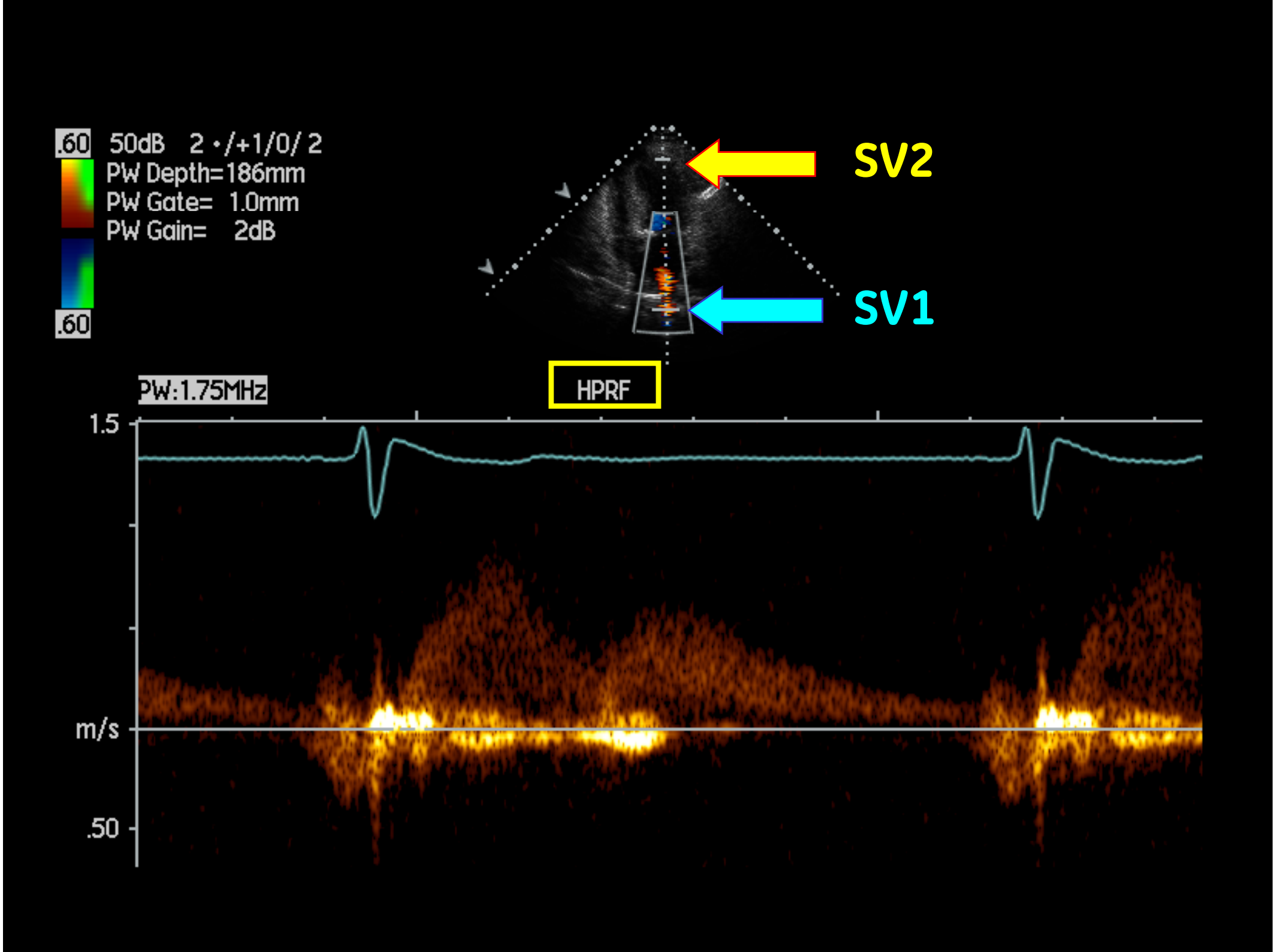
↑ PRF

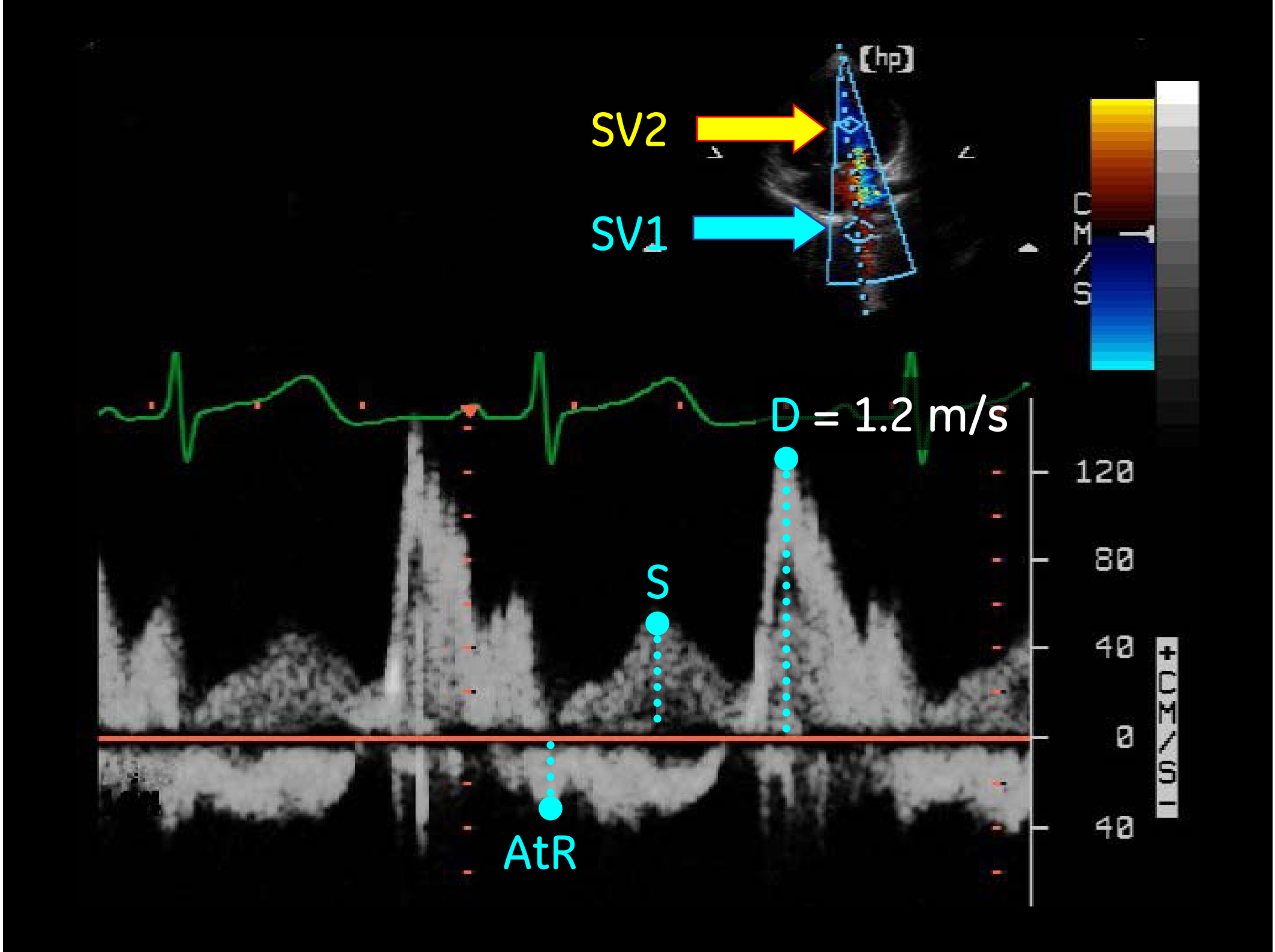
↓

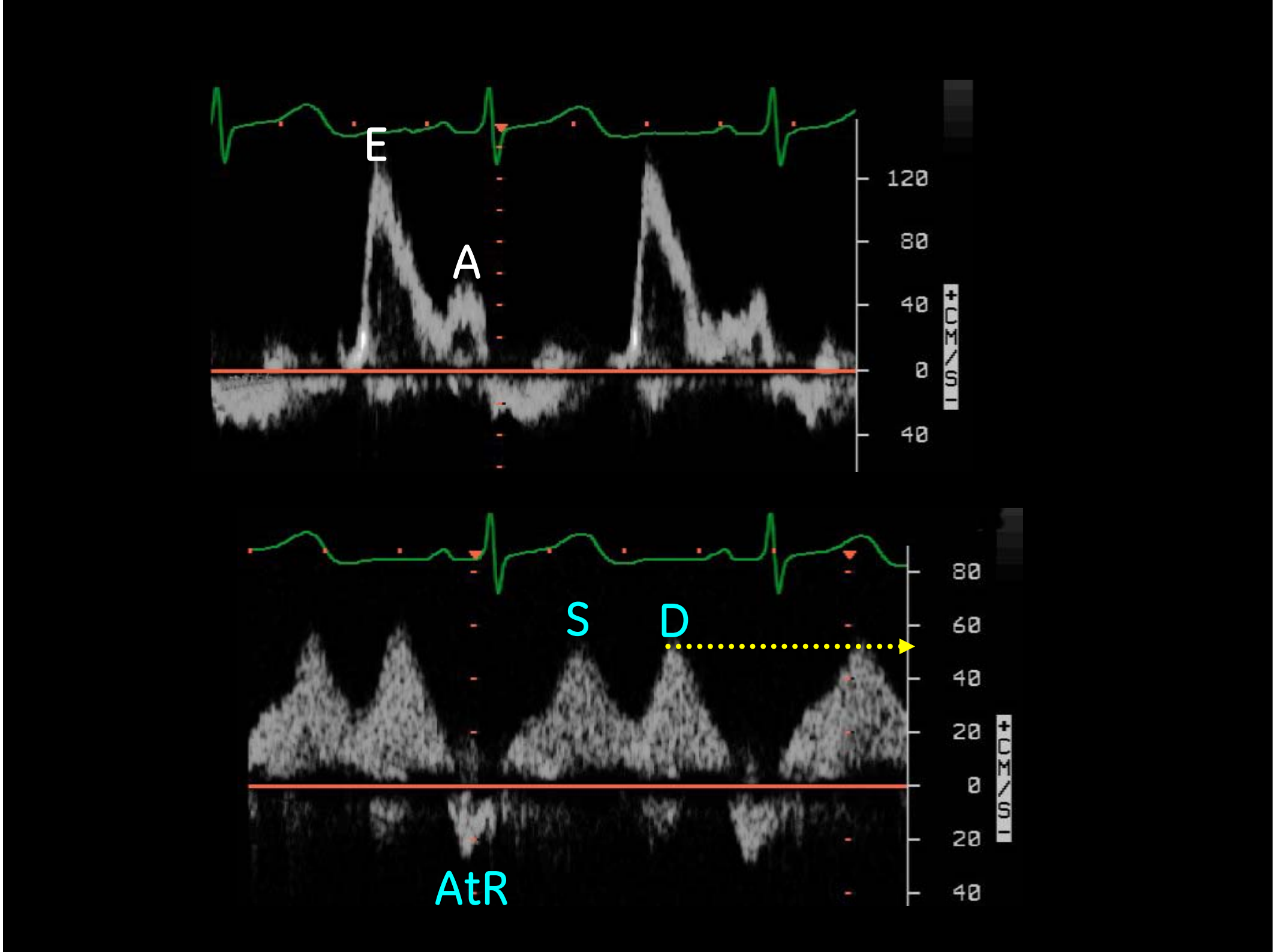
↑ Nyquist Limit

↓

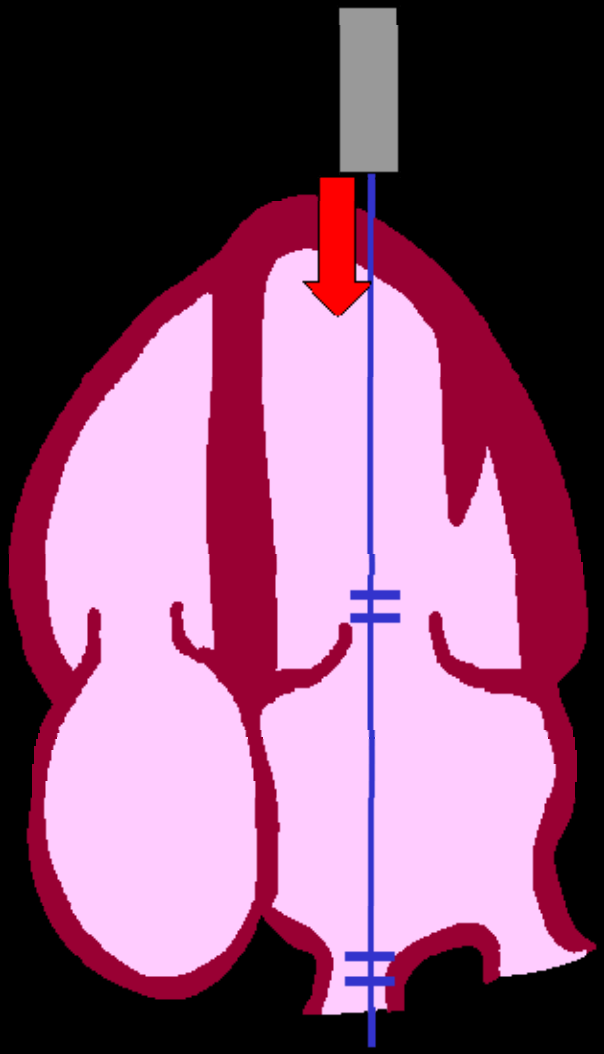
↑ maximum velocity displayed

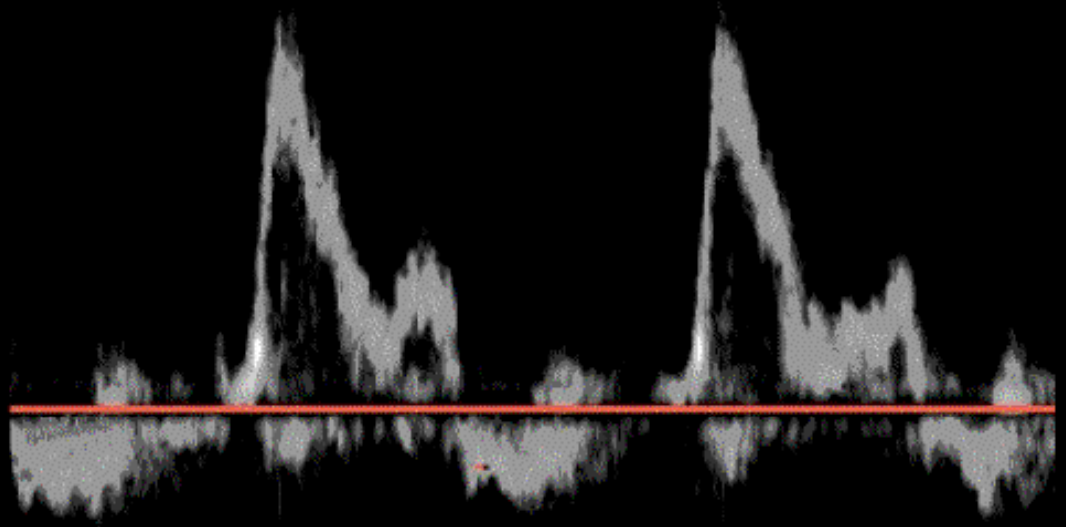

.60
50dB 2 •/+1/0/ 2
PW Depth=186mm
PW Gate= 1.0mm
PW Gain= 2dB
.60
SV2
SV1
HPRF
PW:1.75MHz
1.5
m/s
.50

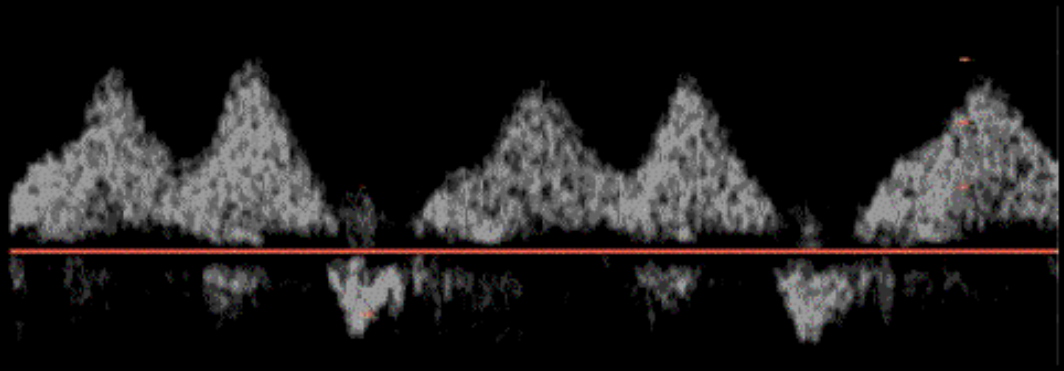

SV2
SV1
D = 1.2 m/s
S
AtR
120
80
40
0
40
CM/S


E
A
120
80
40
0
40
CM/S
S
D
AtR
80
60
40
20
0
20
40
CM/S

High PRF Mode

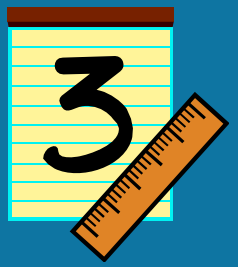






Technique

"High PRF"



Mid-diastolic flow

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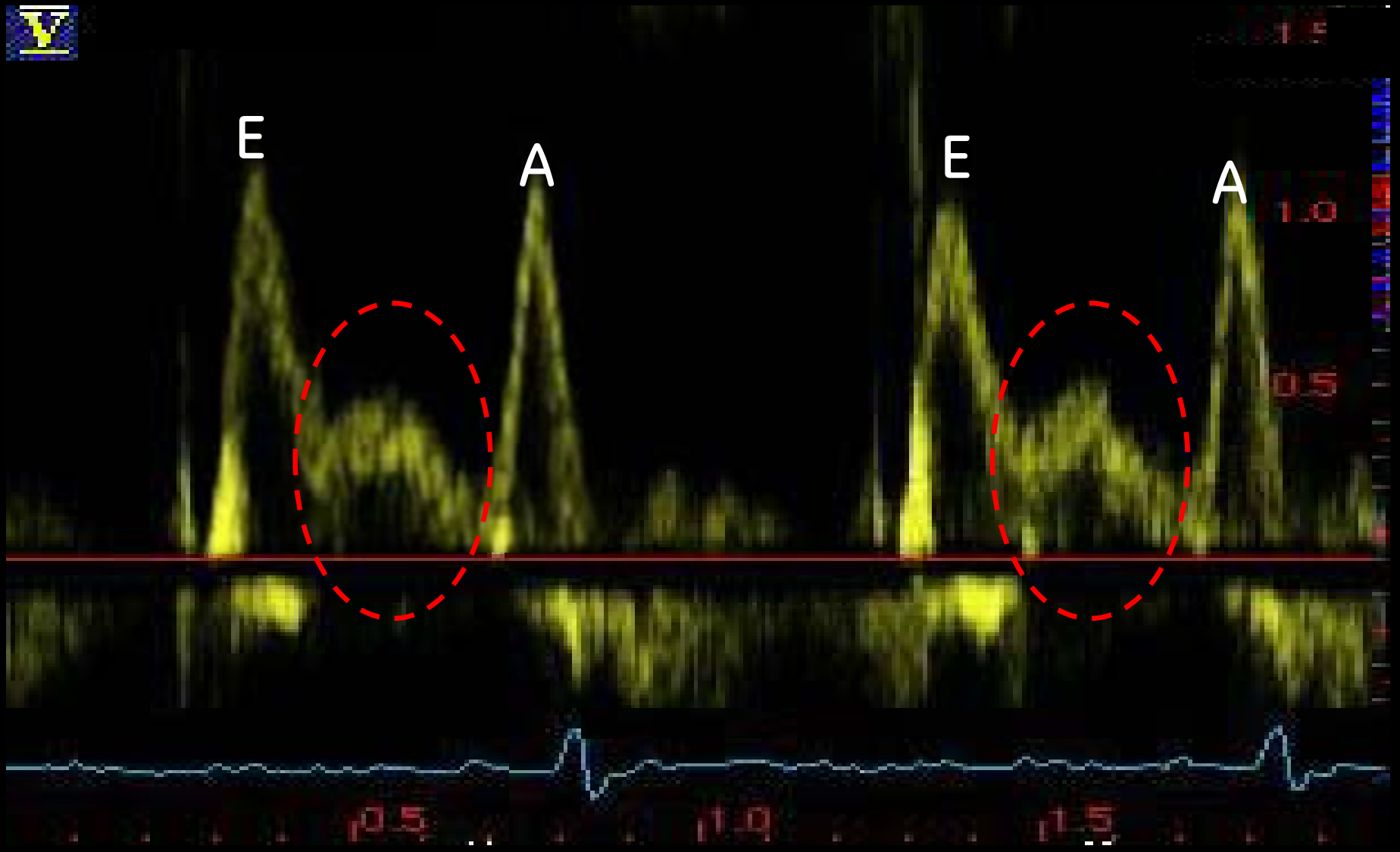
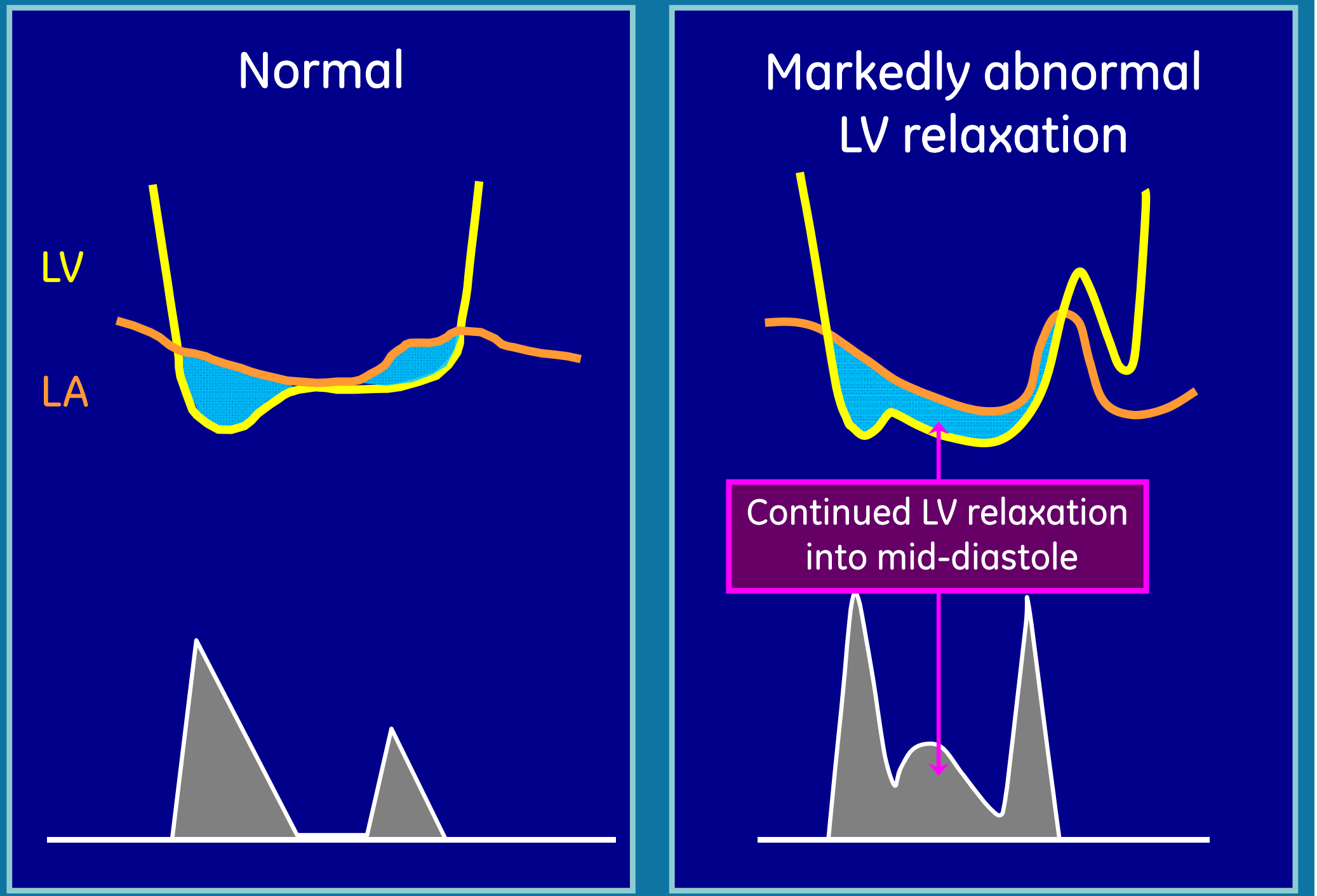
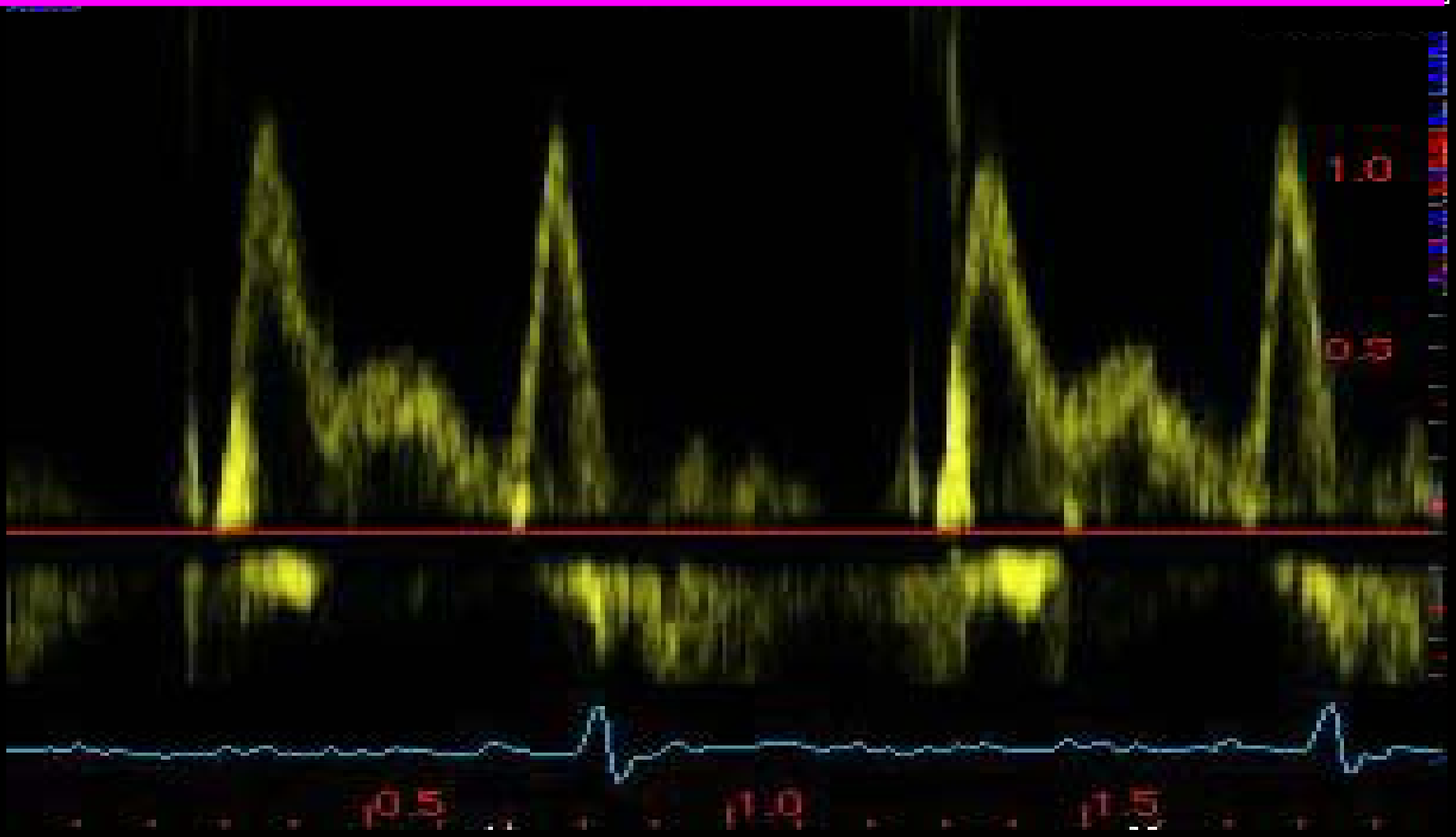
Mid-diastolic Flow



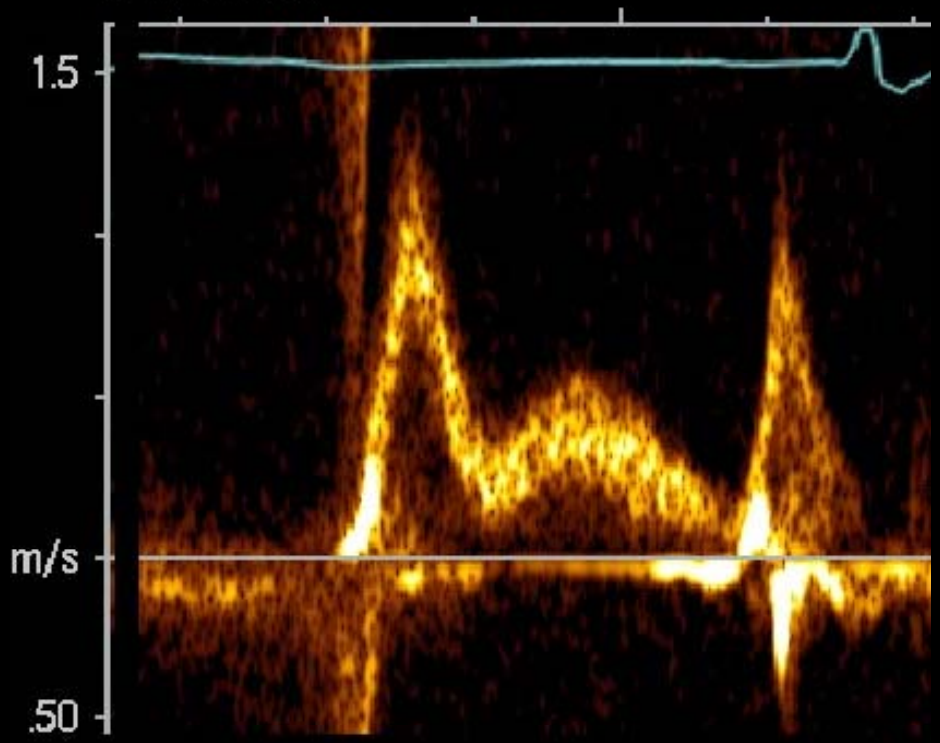

Normal
LV
LA
Markedly abnormal
LV relaxation
Continued LV relaxation
into mid-diastole

Mid-diastolic flow ≥ 20 cm/s ≈ markedly delayed LV relaxation + ↑ LVFP

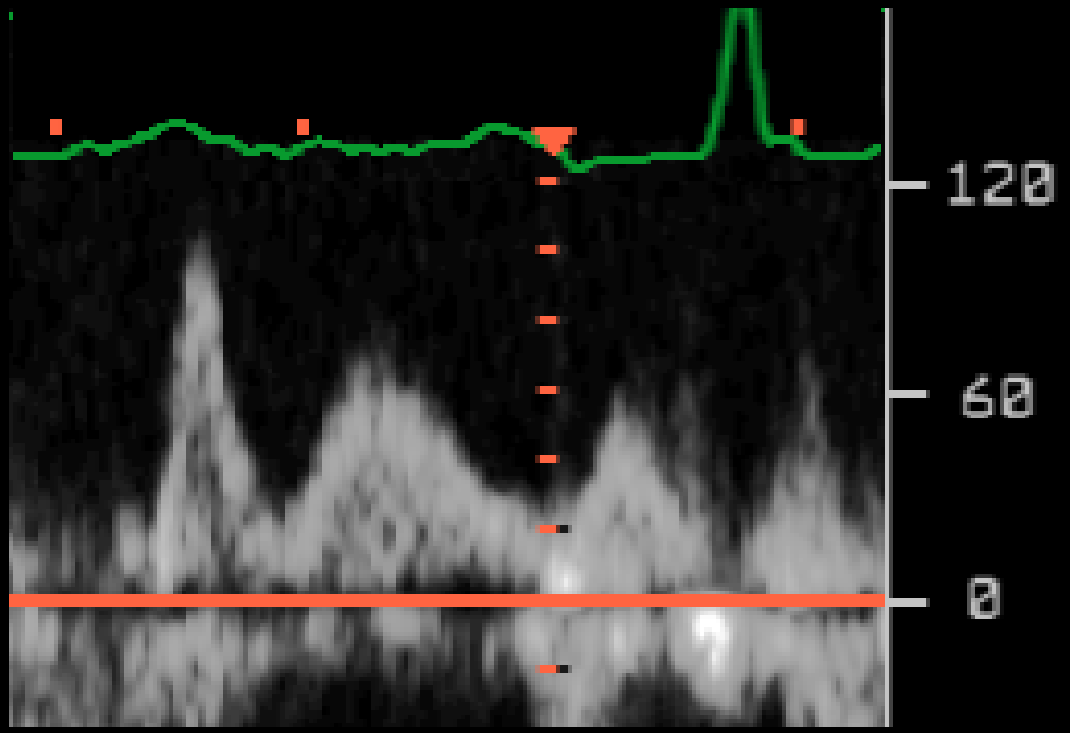
Ha J-W, eta l. J Am Soc Echocardiogr 2004; 17:428-431



Signal A



Signal B



Question

Which of the following is true?

1. Signal A & B both show mid-diastolic flow
2. Signal A shows mid-diastolic flow; signal B shows “something else”
3. Signal A shows “something else” & signal B shows mid-diastolic flow

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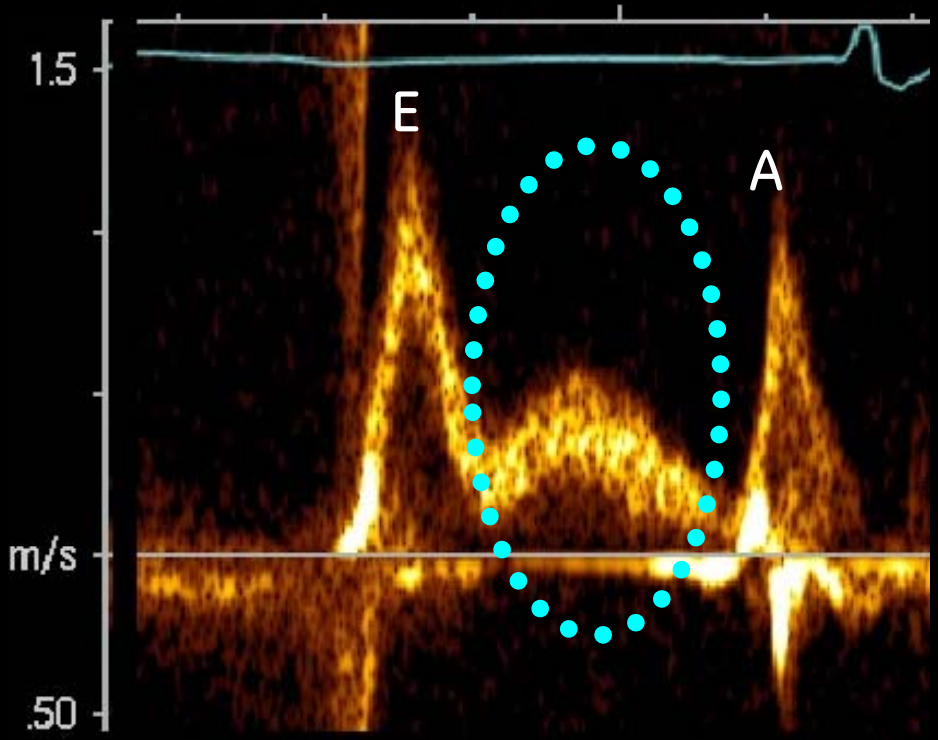
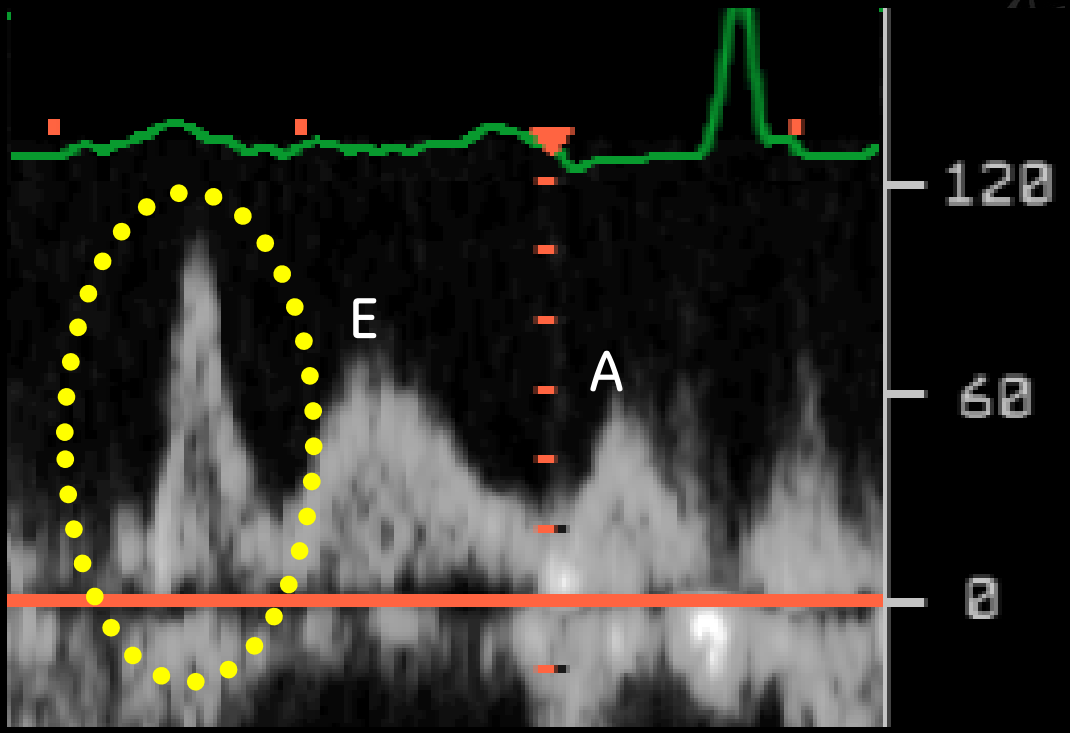
Mid-diastolic flow



IVR flow



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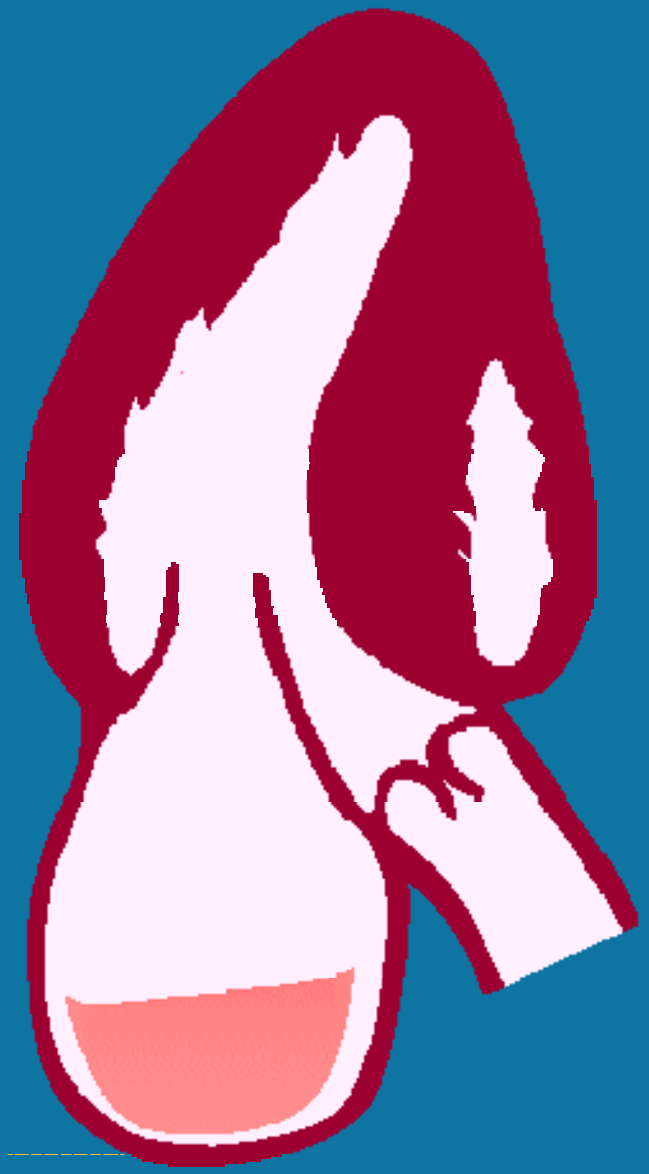
IVR "Flow"



Occurs due to dyssynchronous relaxation of LV

Earlier than normal apical relaxation compared with base

↓

ΔP between base & apex

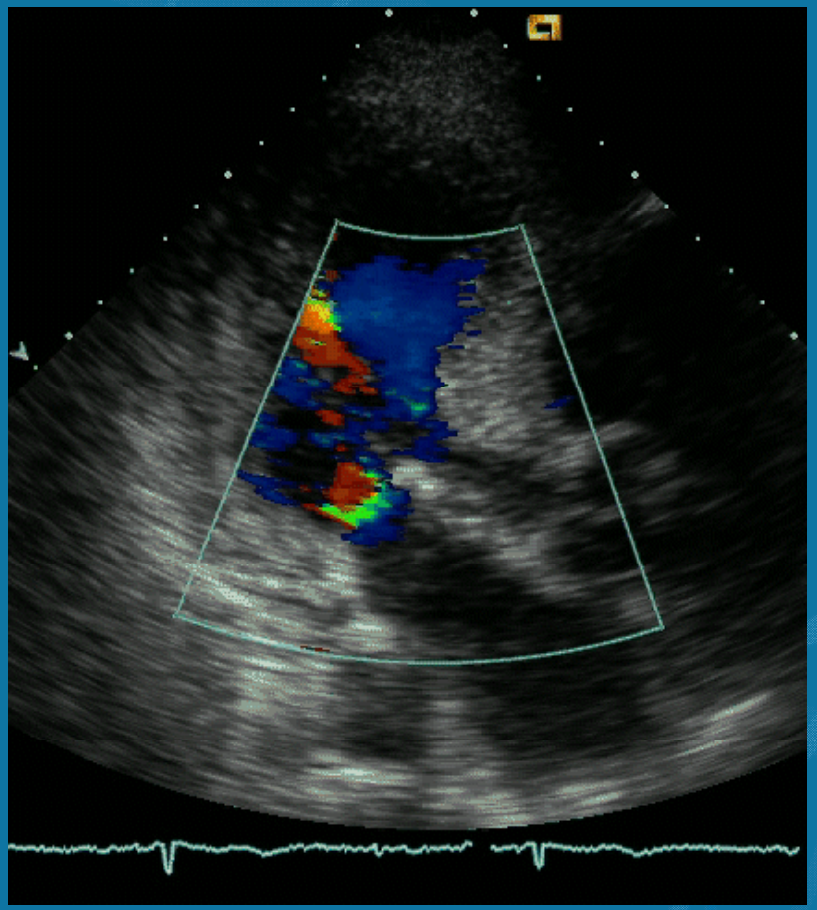
↓

Flow of blood from base → apex

IVR "Flow"

May be seen with:

- Intracavity gradients*:
  - LVH
  - Vigorous LV systolic fn
  - Near-cavitary obliteration
- Coronary artery disease #



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* Appleton,CP et al: J Am Soc Echocardiogr 10:271-292, 1997
# Tanaka,Y et al: J Am Coll Cardiol 21:1357-1364, 1993