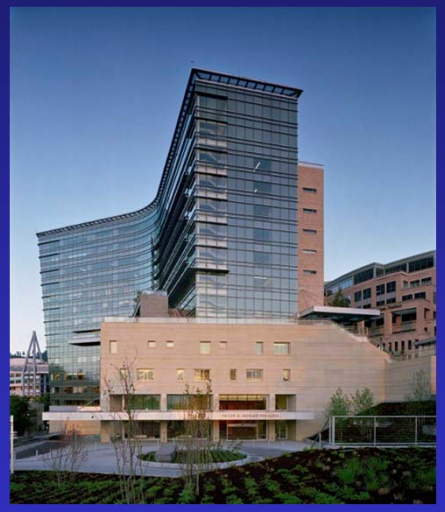
Contrast Use in Stress Echocardiography: Adding Value to Wall Motion



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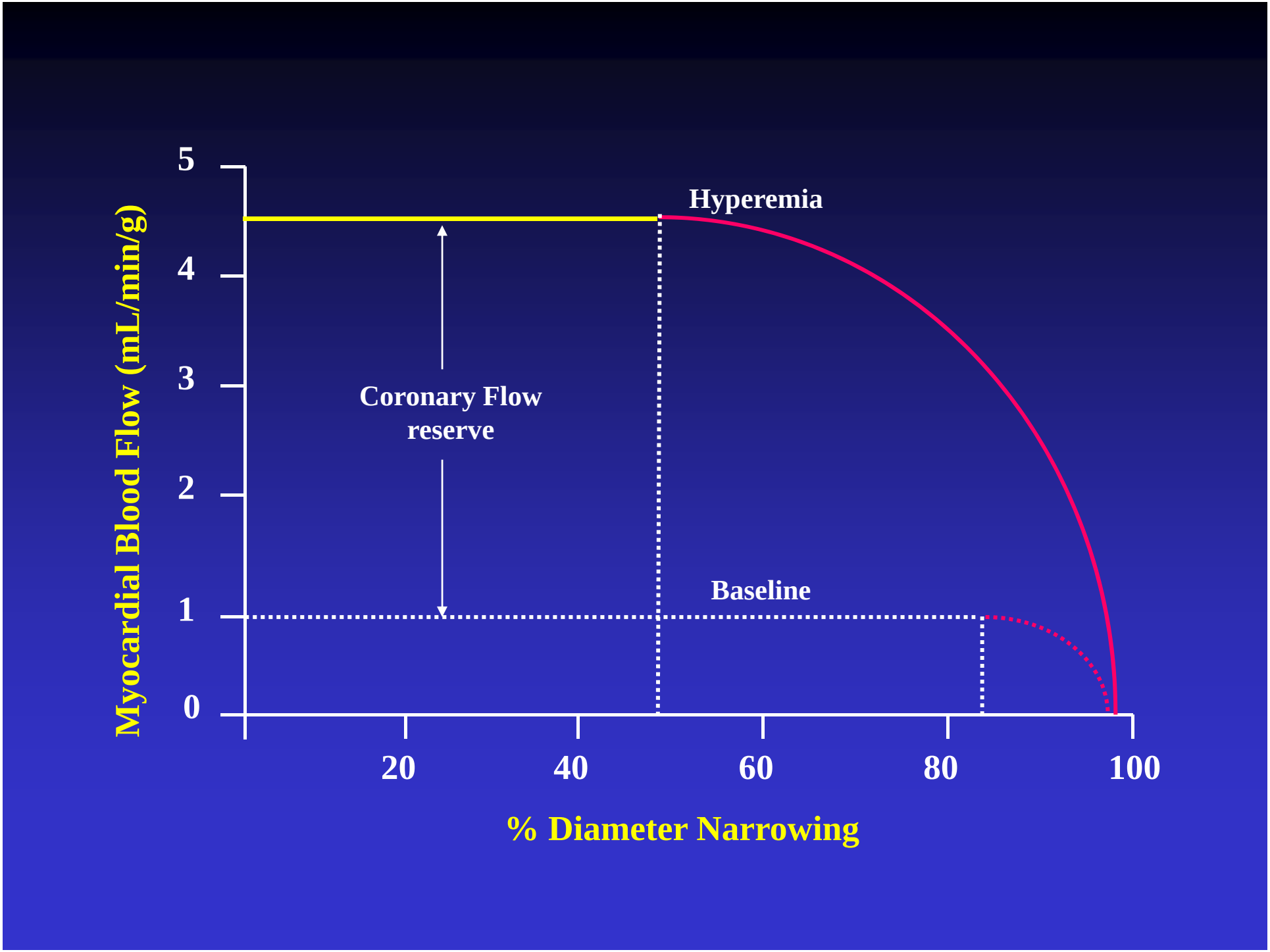
Synopsis

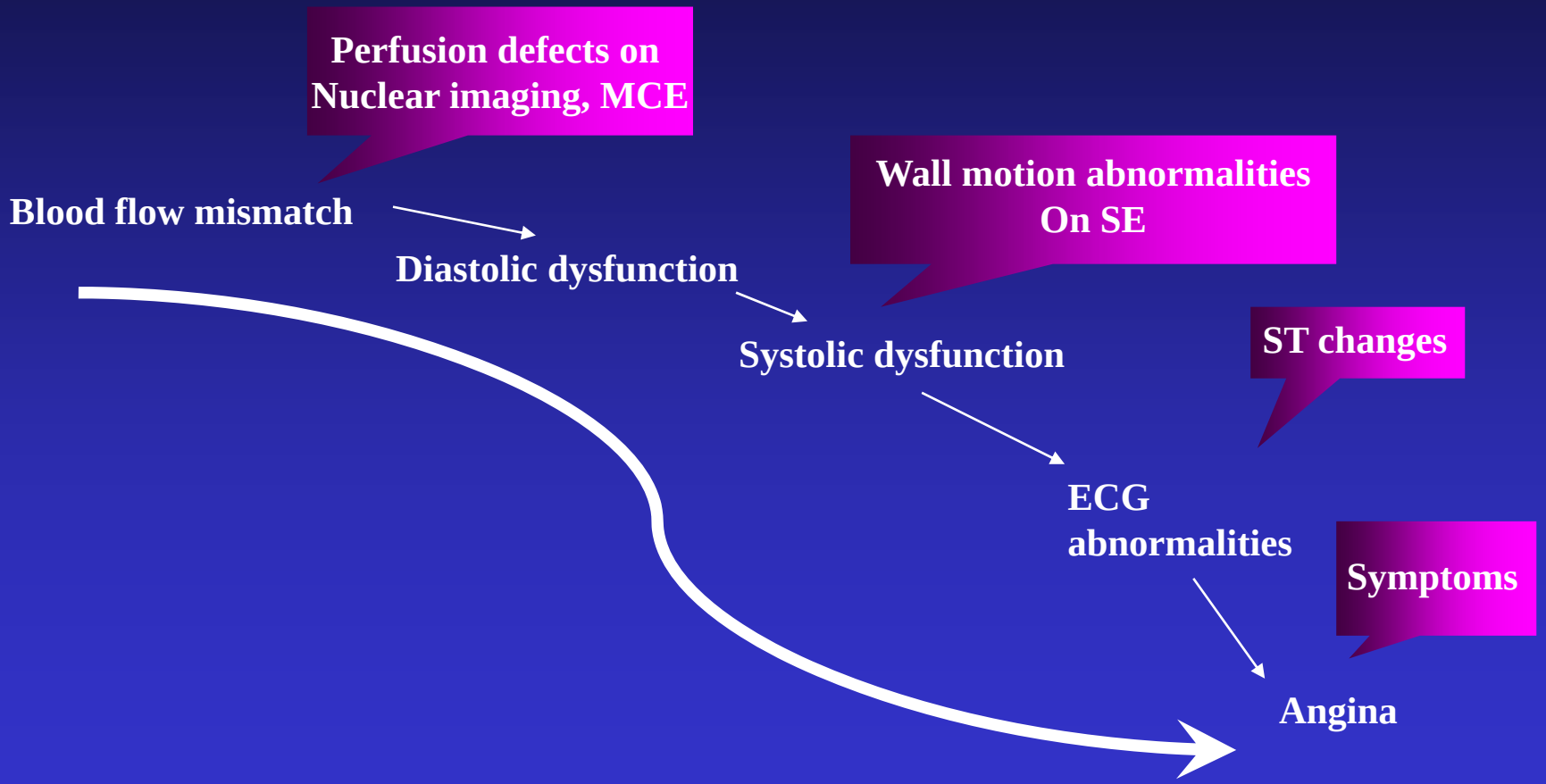
- Discuss the physiologic basis for the use of wall thickening to detect ischemia during stress echo and its limitations
- How to evaluate myocardial perfusion during stress MCE
- Advantages of combining perfusion imaging with WT during stress echo

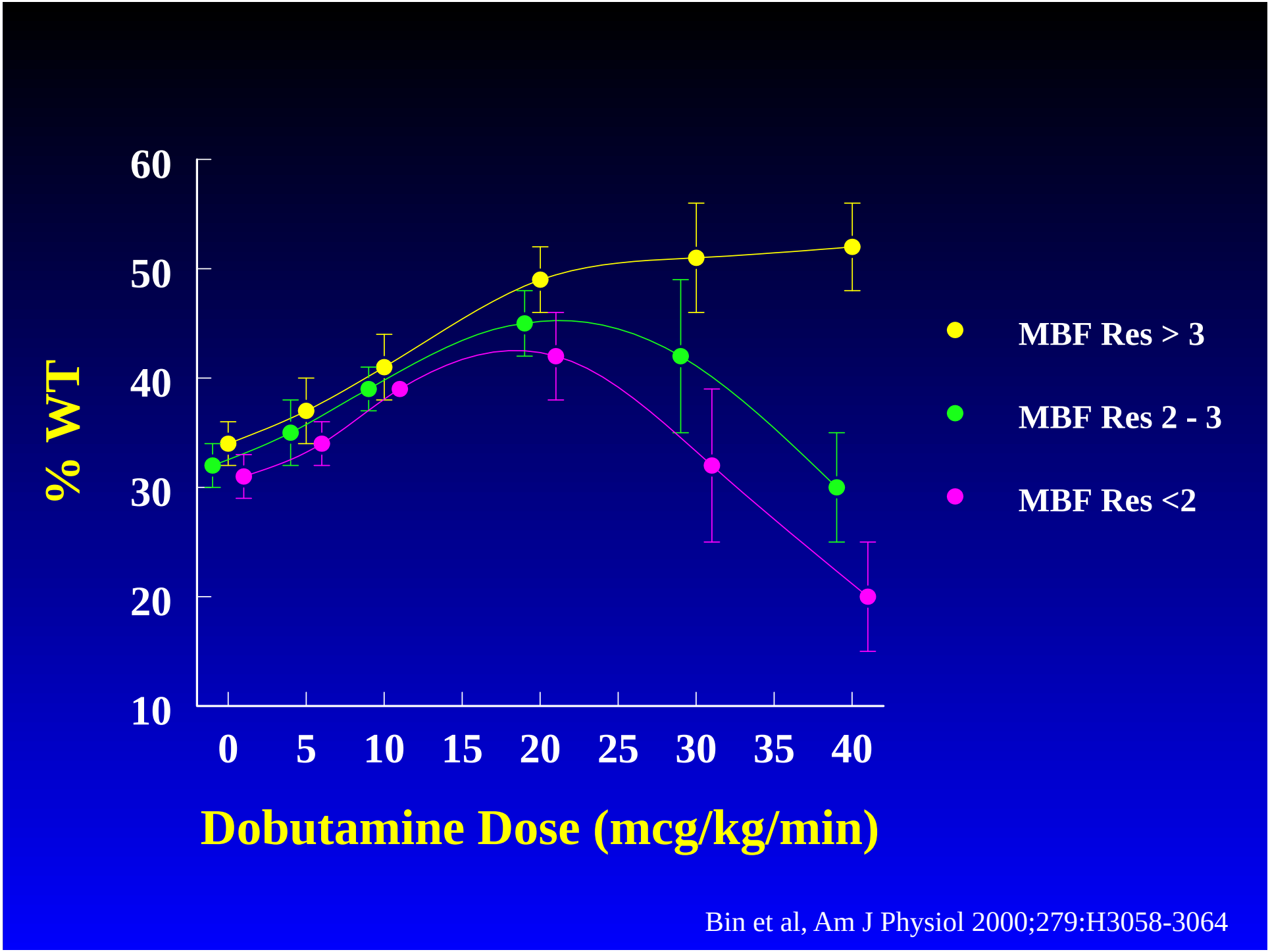
Limitations of Visual Wall Motion Evaluation

- Relies on the development of ischemia, lower sensitivity in submaximal stress
- Less sensitivity for SVD
- May underestimate extent of CAD in MVD
- Dependent on Image Quality
- Subjective Interpretation
  - Skill and expertise of the reader
  - Interobserver variability
  - Intraobserver variability

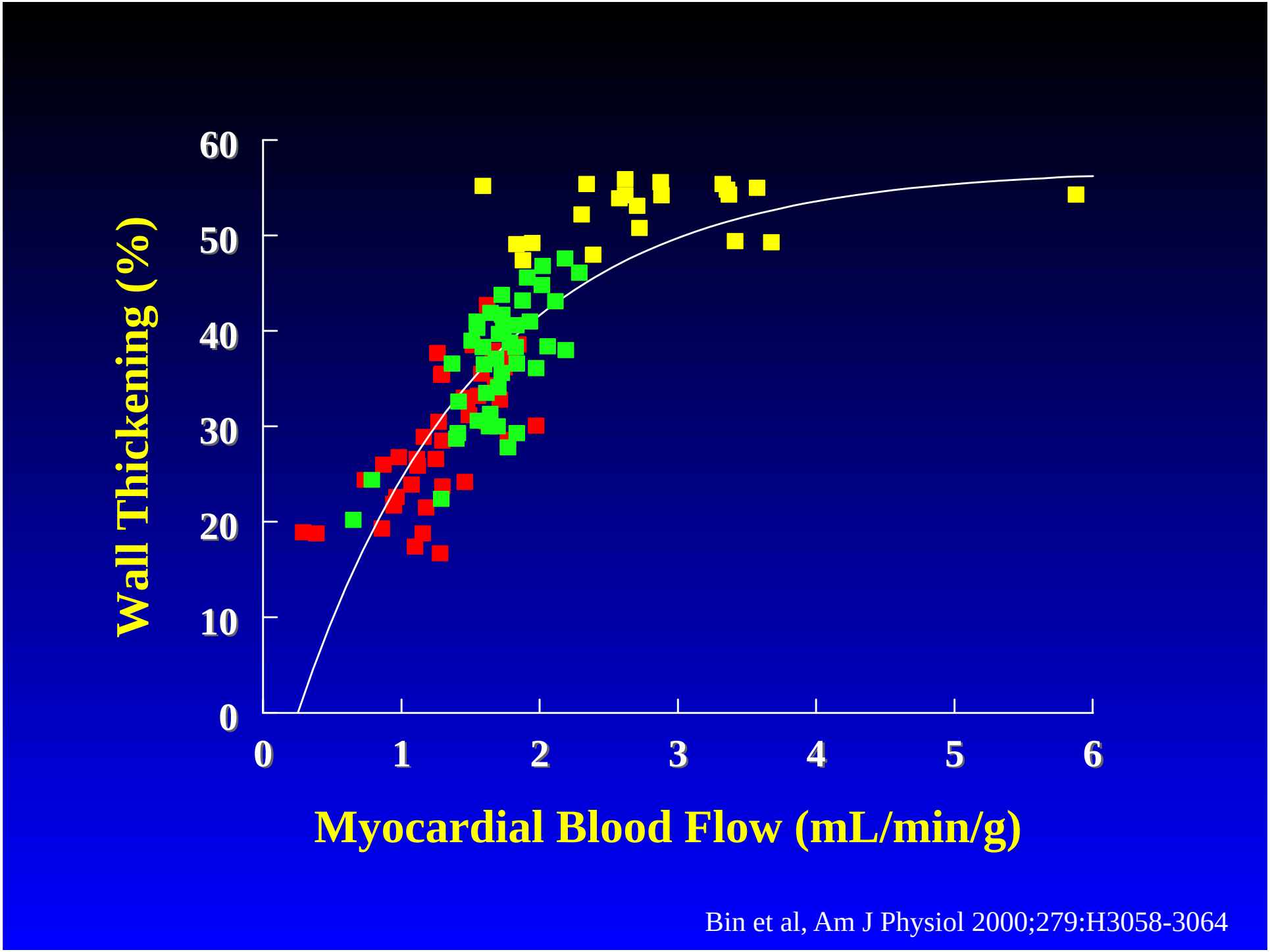

Myocardial Blood Flow (mL/min/g)
5
4
3
2
1
0
Hyperemia
Coronary Flow reserve
Baseline
20
40
60
80
100
% Diameter Narrowing

Ischemic cascade



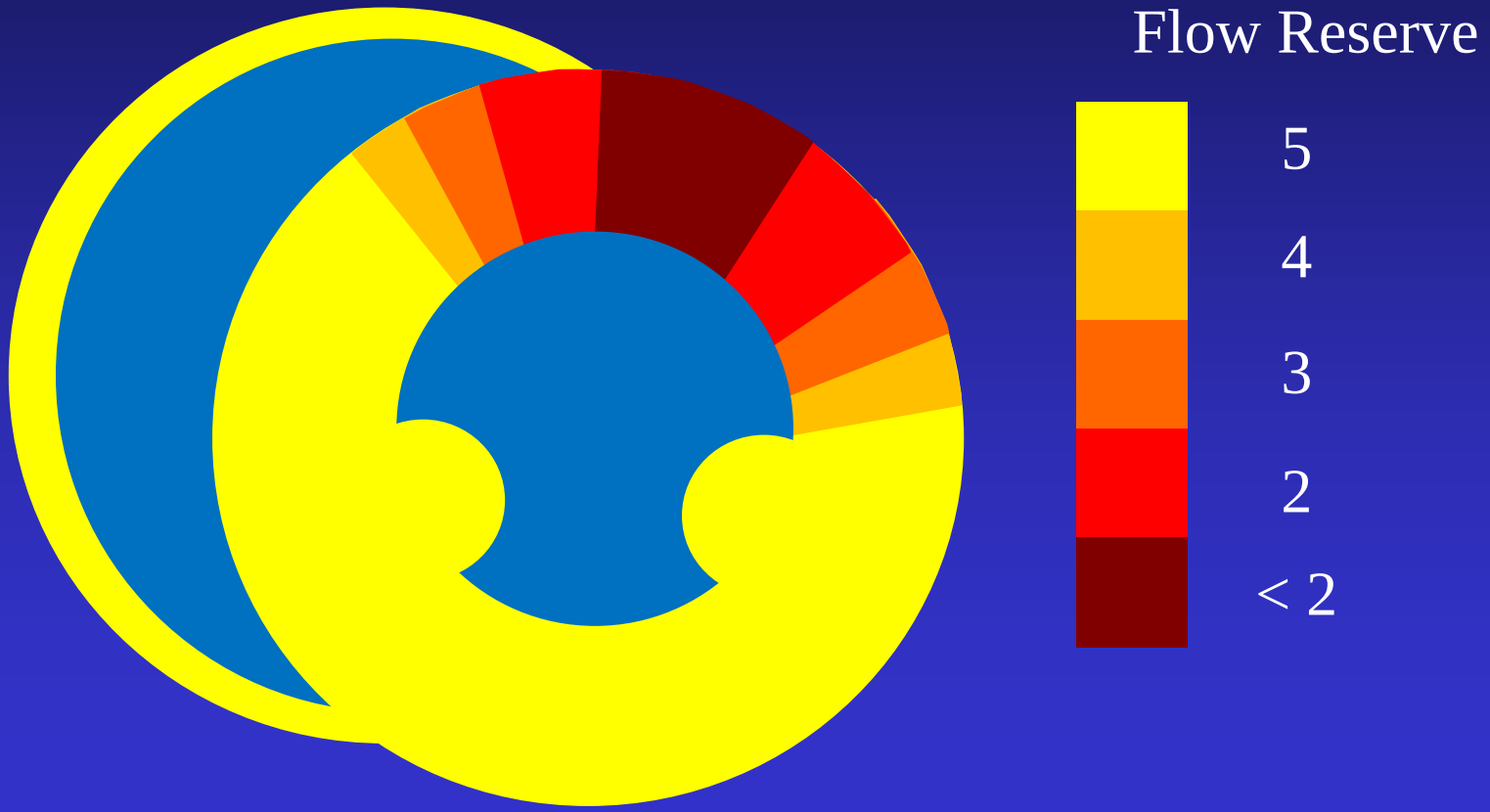


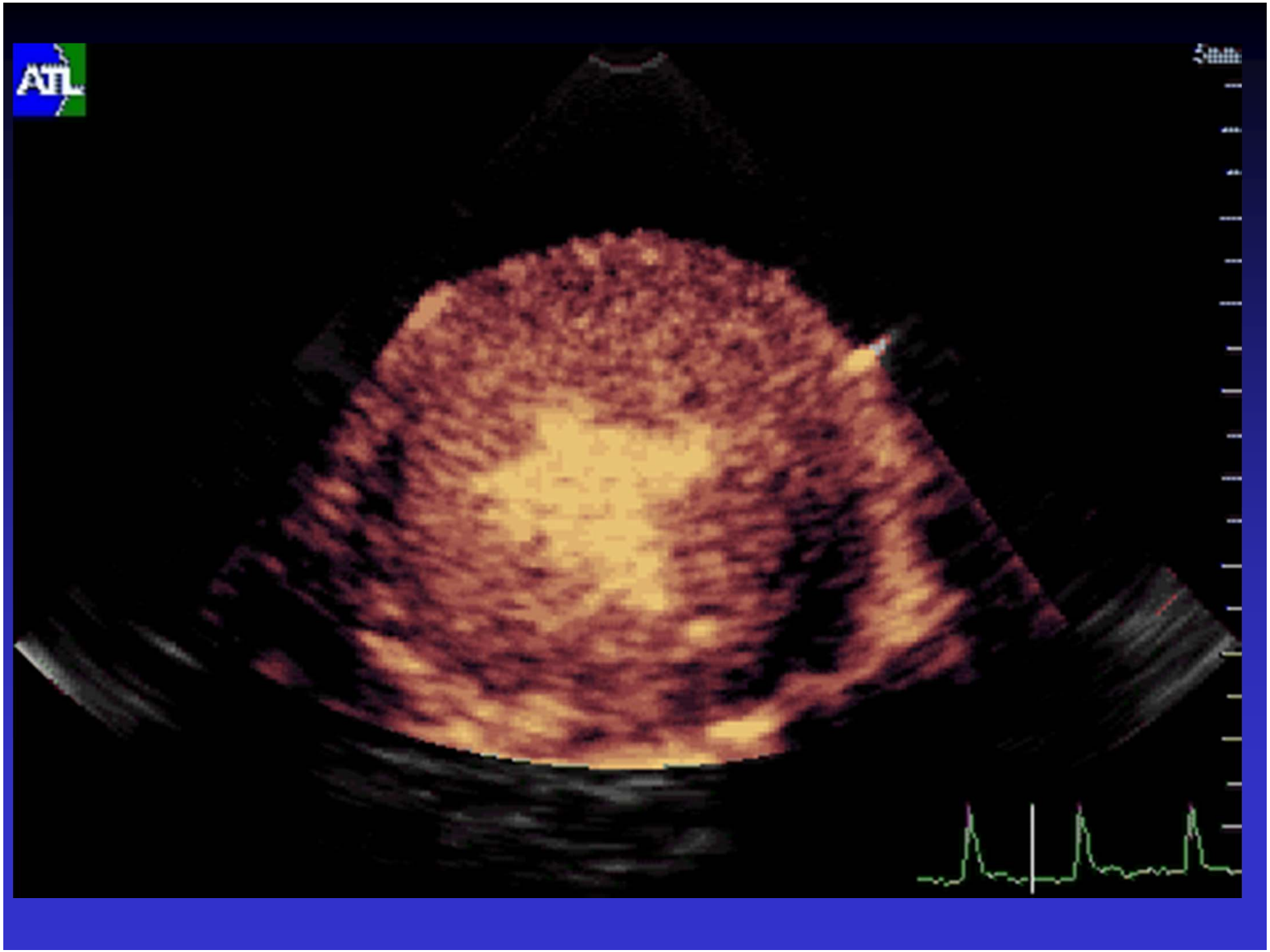
Bin et al, Am J Physiol 2000;279:H3058-3064

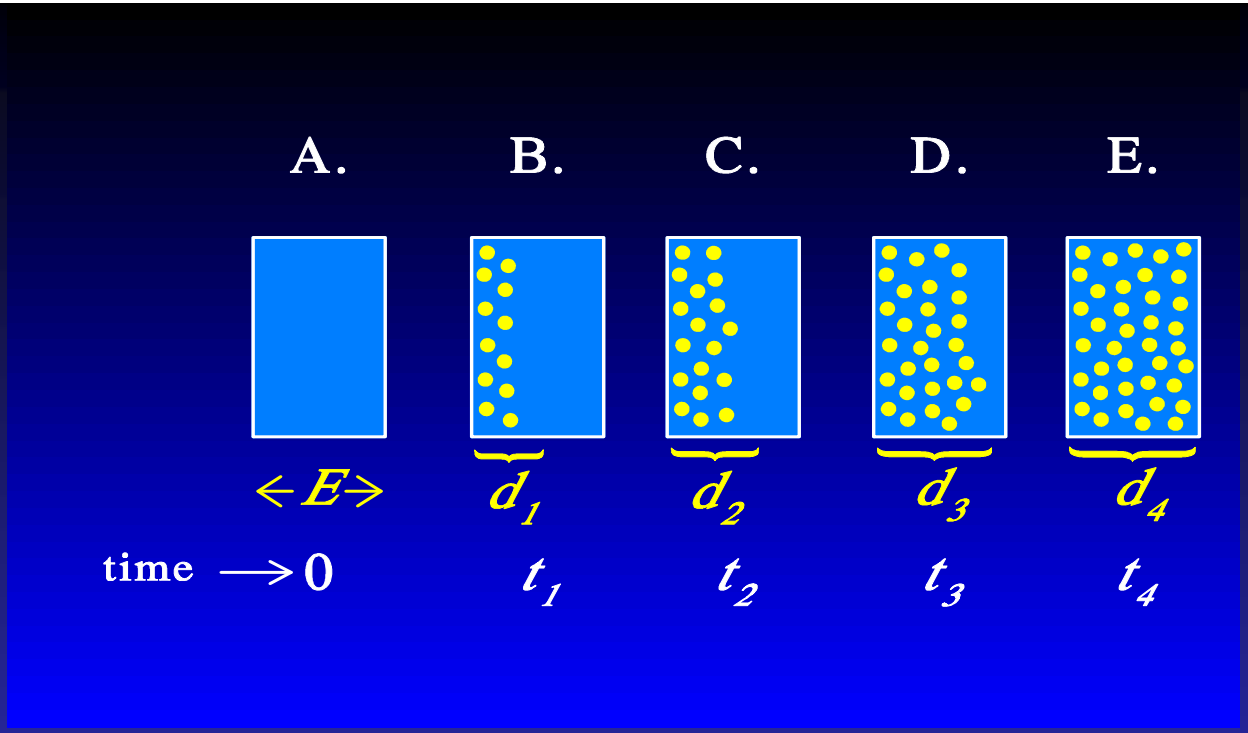


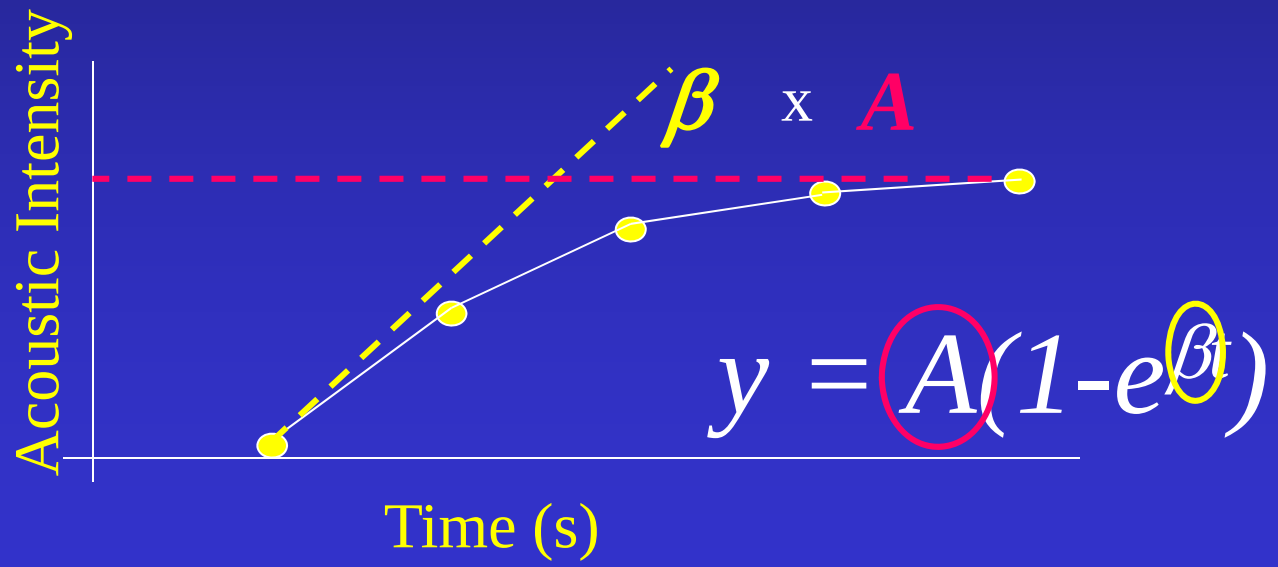
Bin et al, Am J Physiol 2000;279:H3058-3064

Spatial Distribution of Flow Reserve

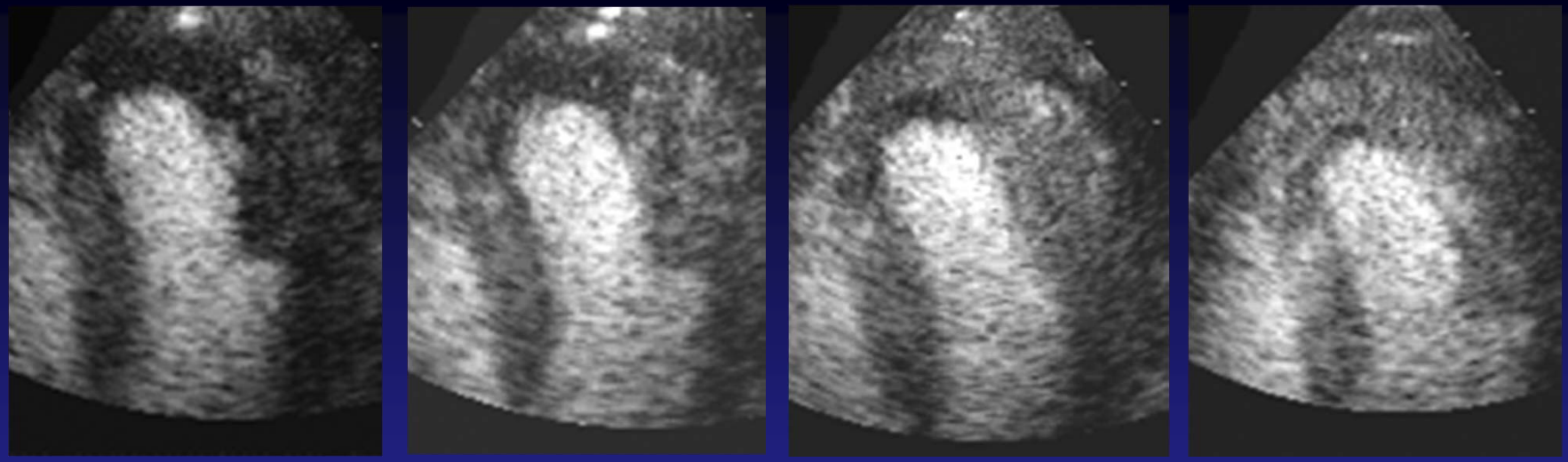



ATL

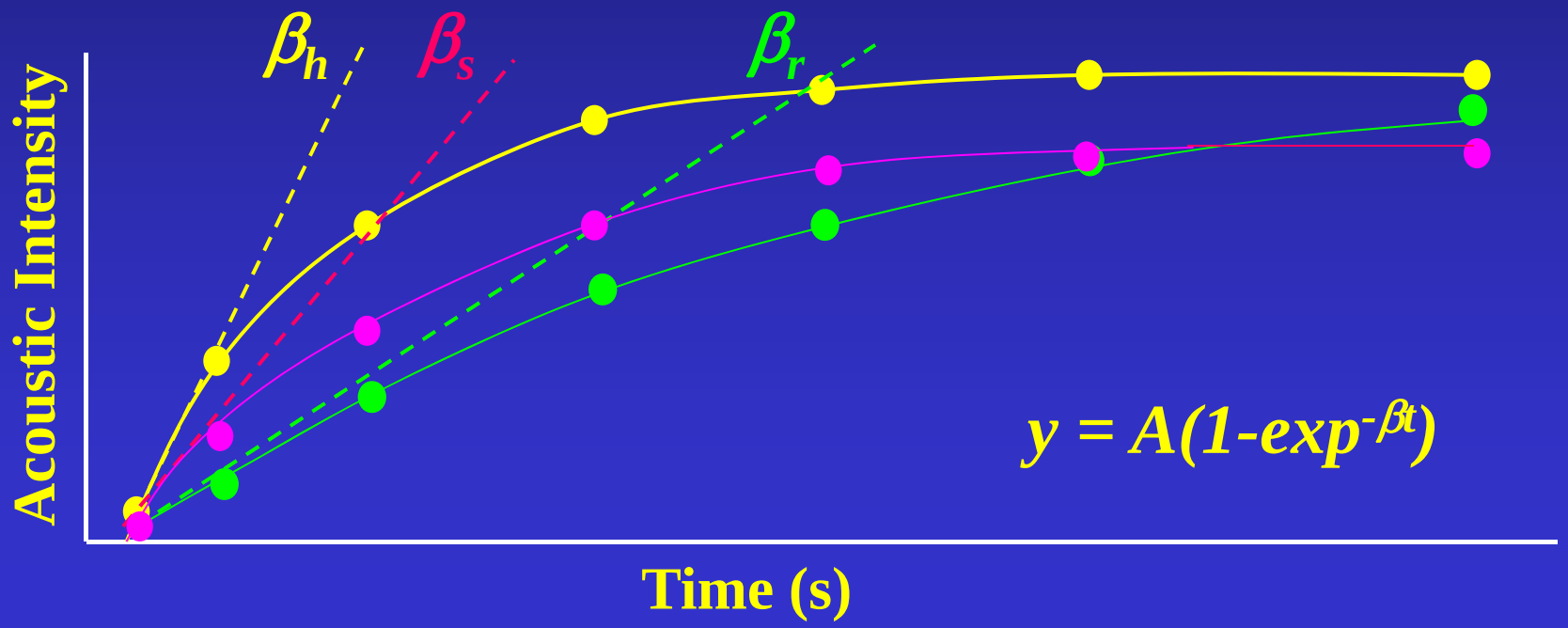




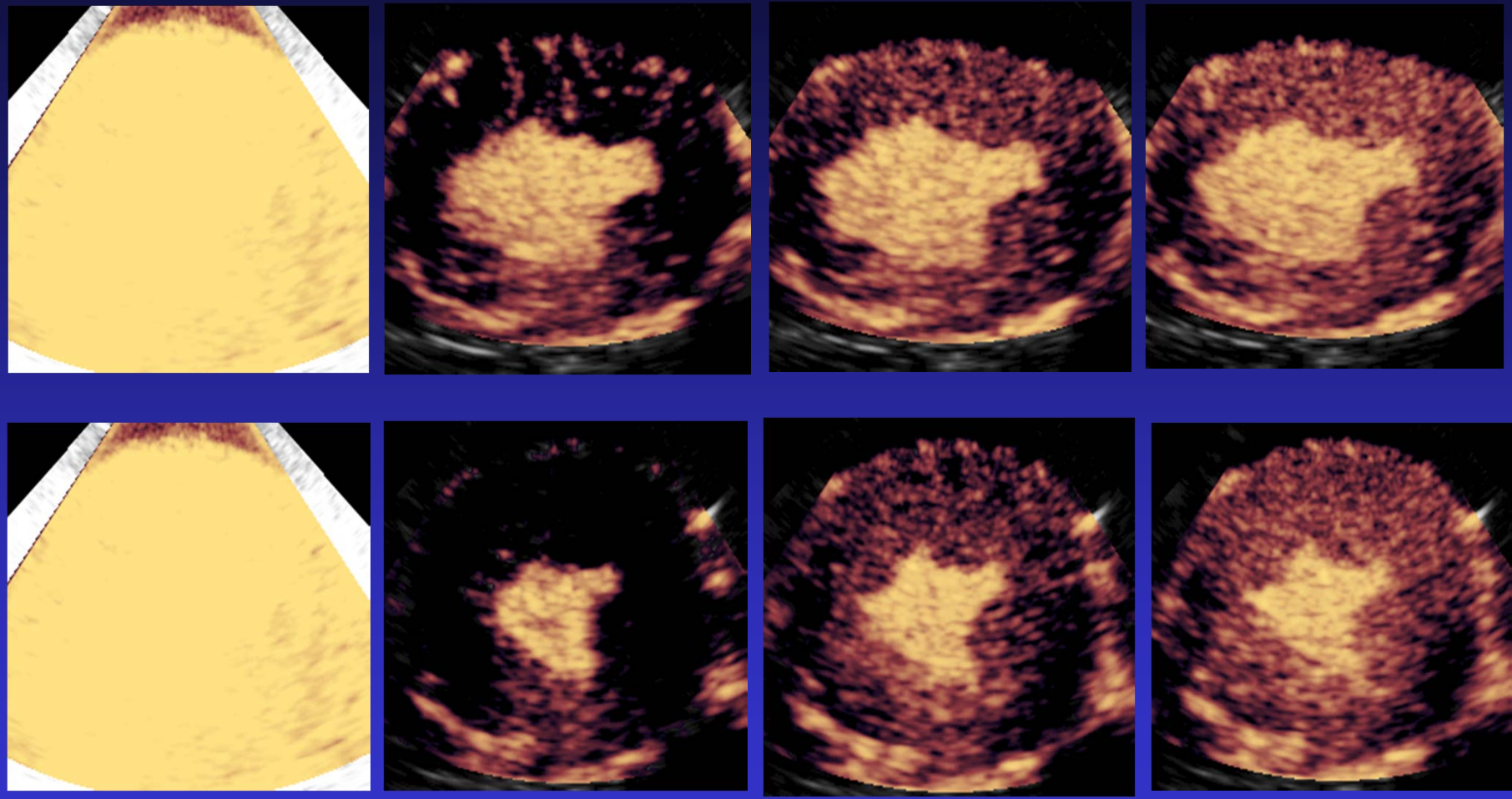
Wei et al, *Circulation* 1998;97:473-483

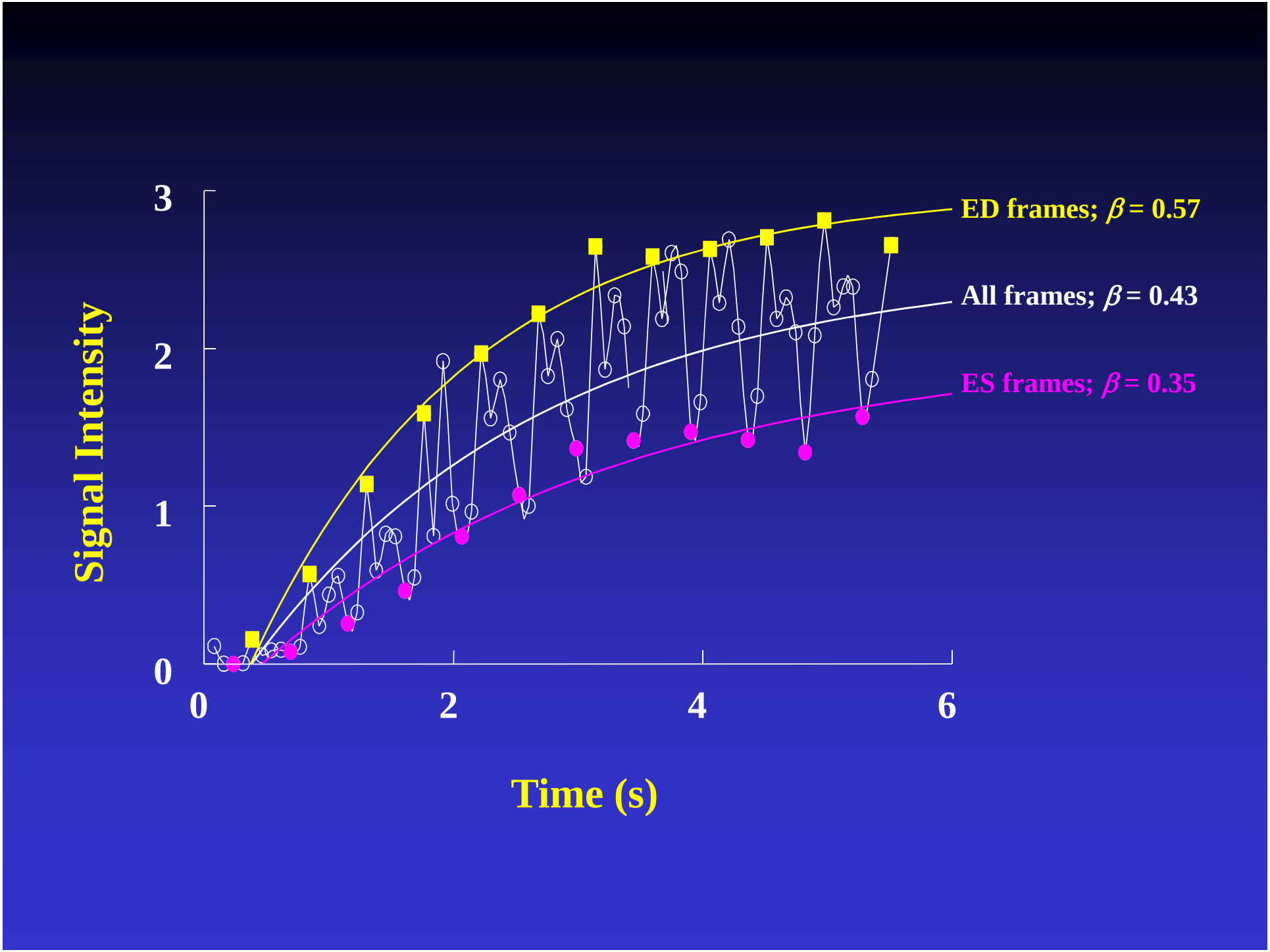


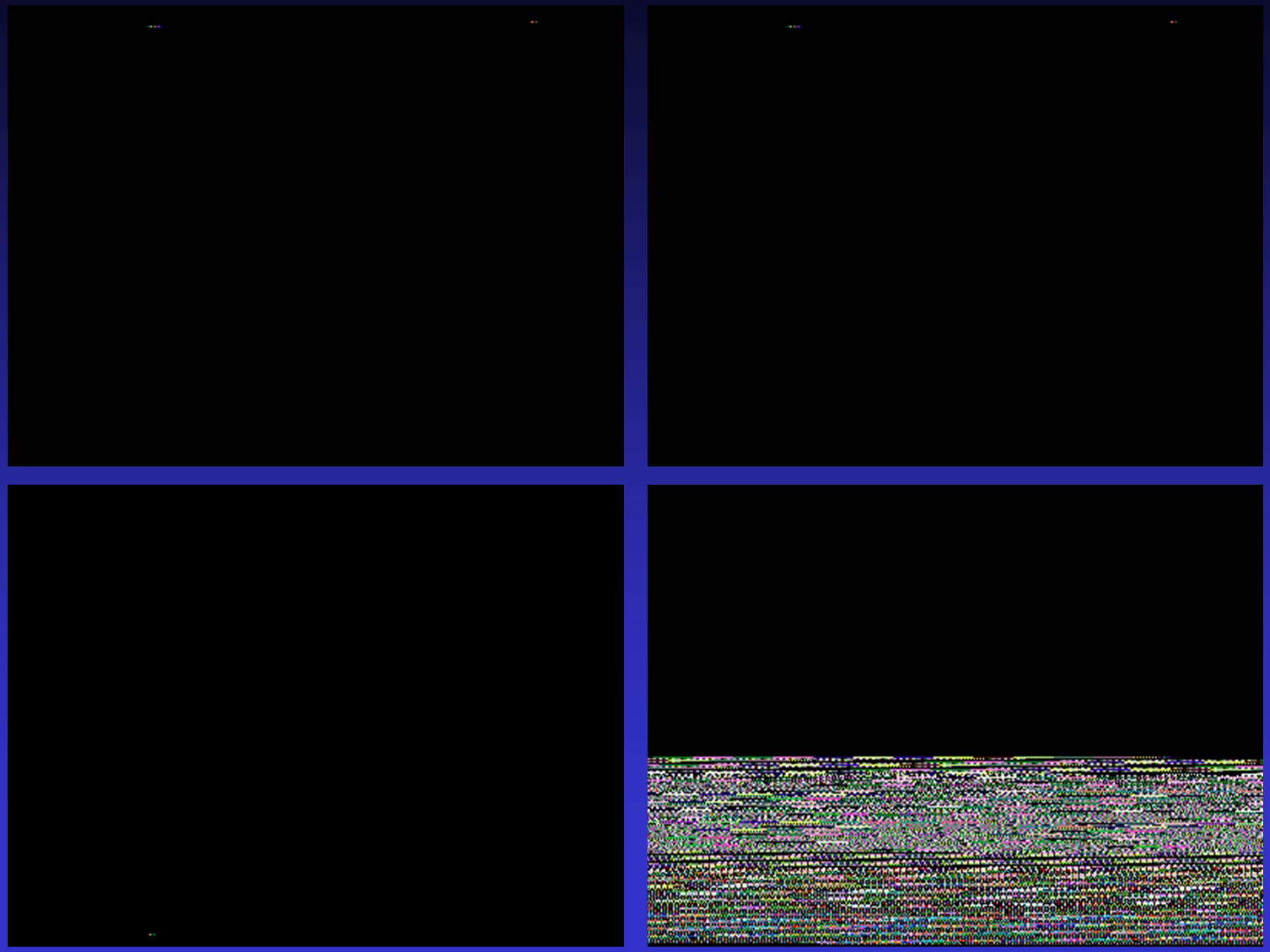
PI 300 ms 800 ms 2400 ms 5000 ms

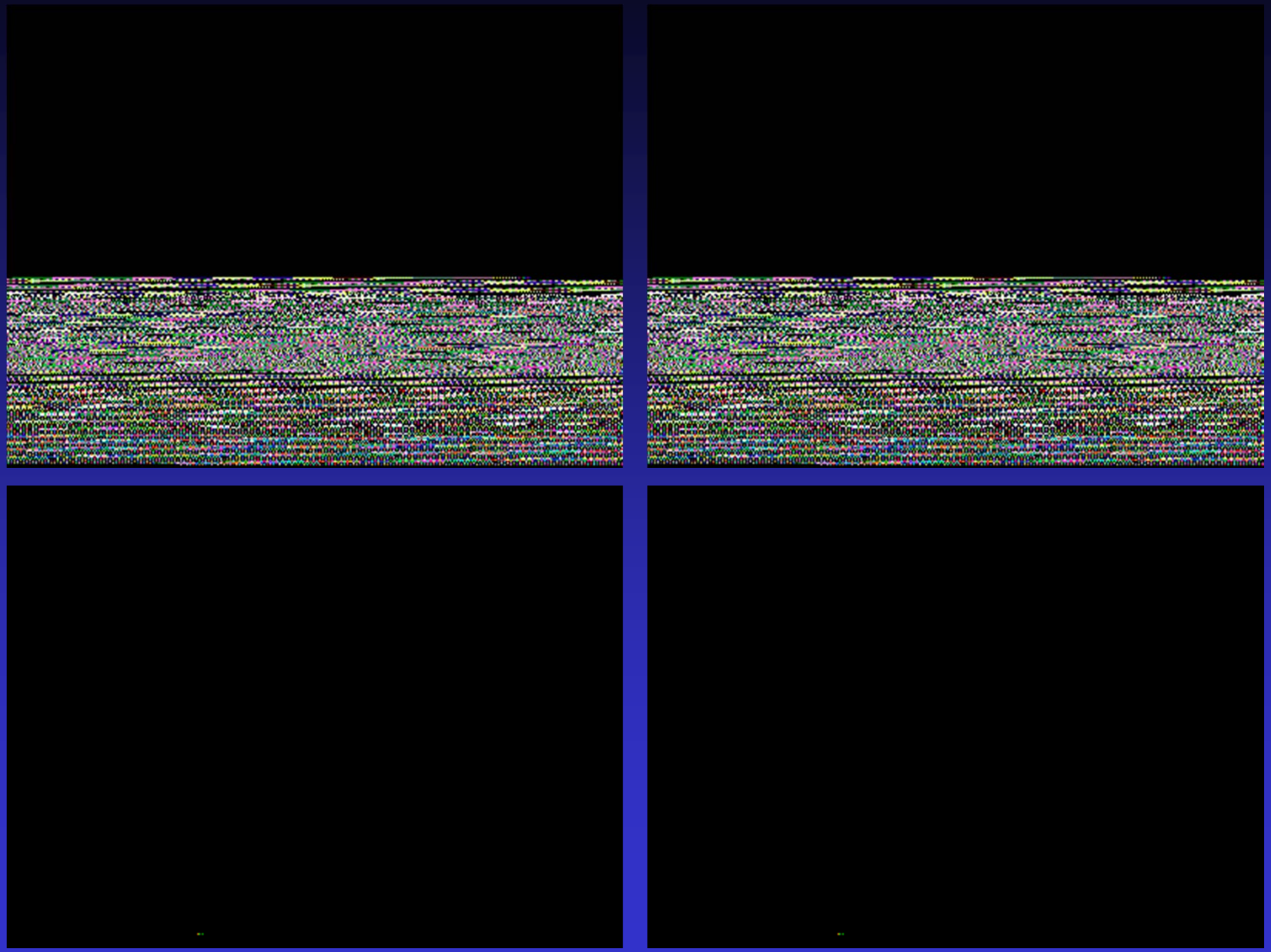


Wei et al, *J Am Coll Cardiol* 1997;29:1081-1088




Signal Intensity
3
2
1
0
0
2
4
6
Time (s)
ED frames; β = 0.57
All frames; β = 0.43
ES frames; β = 0.35






Lossy compression - not intended for diagnosis

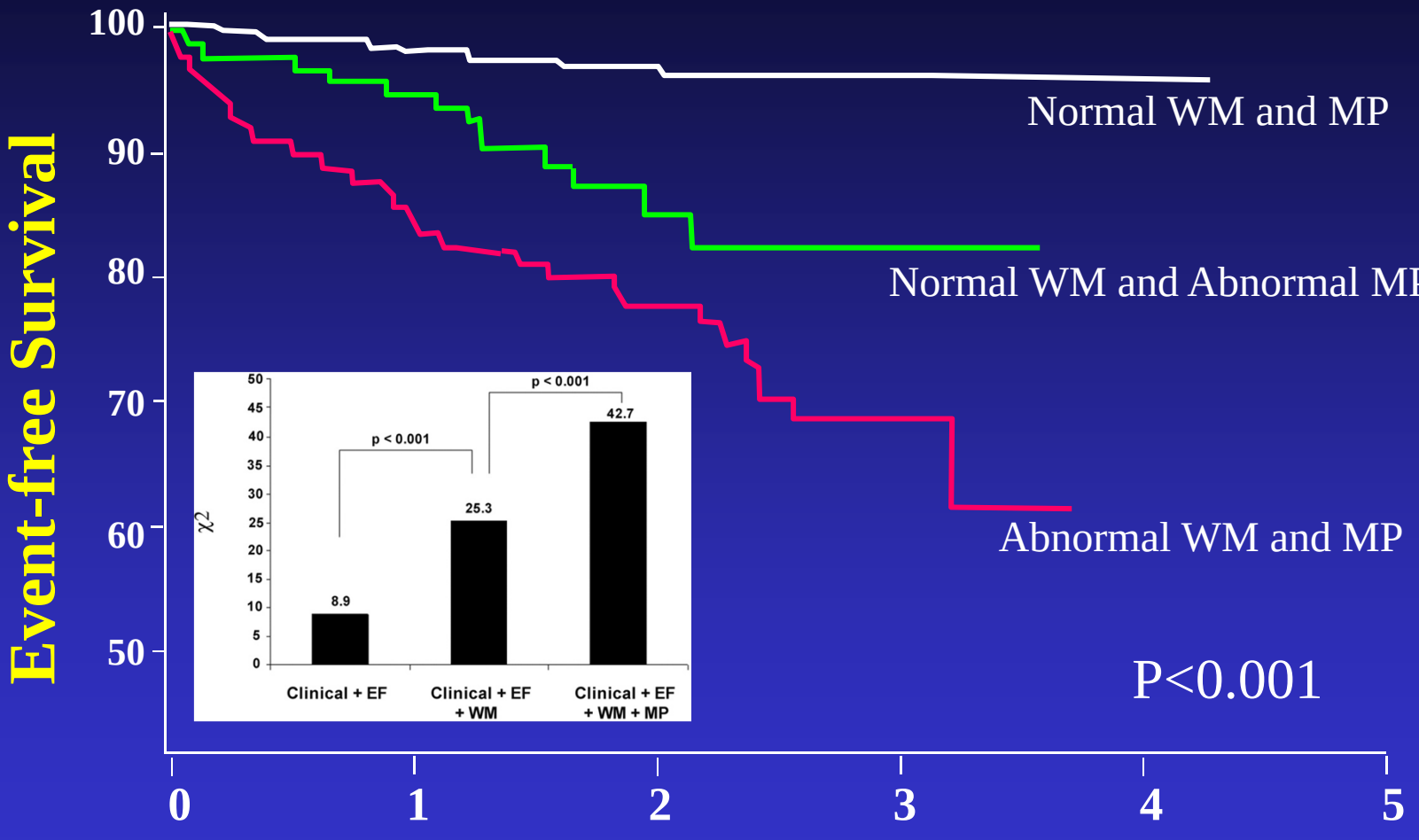
WM versus WM+Perfusion for Detection of SVD

	Year	n	Stress	Gold standard	WM Sens	WM+MCE Sens	P-value
Elhendy, et al	2004	170	Dob	Cath (>50%)	53%	81%	0.001
Moir, et al	2004	85	Ex + DP	Cath (>50%)	67%	88%	0.09

WM versus WM+Perfusion for Detection of CAD

	Year	n	Stress	Gold Standard	WM Sens	WM Spec	WM Acc	WM+ MCE Sens	WM+ MCE Spec	WM+ MCE Acc
Cwajg, et al	2000	45	Ex/Dob	Cath	56%			87%		
Porter, et al	2001	117	Dob	Cath			72% Conc.			83% Conc.
Elhendy, et al	2004	170	Dob	Cath (>50%)	70%	74%	71%	91%	51%	81%
Moir, et al	2004	85	Ex + DP	Cath (>50%)	74%	81%		91%	70%	
Gaibazzi, et al	2010	150	DP + Atropine	Cath (>50%)	66%	83%	71%	96%	69%	87%

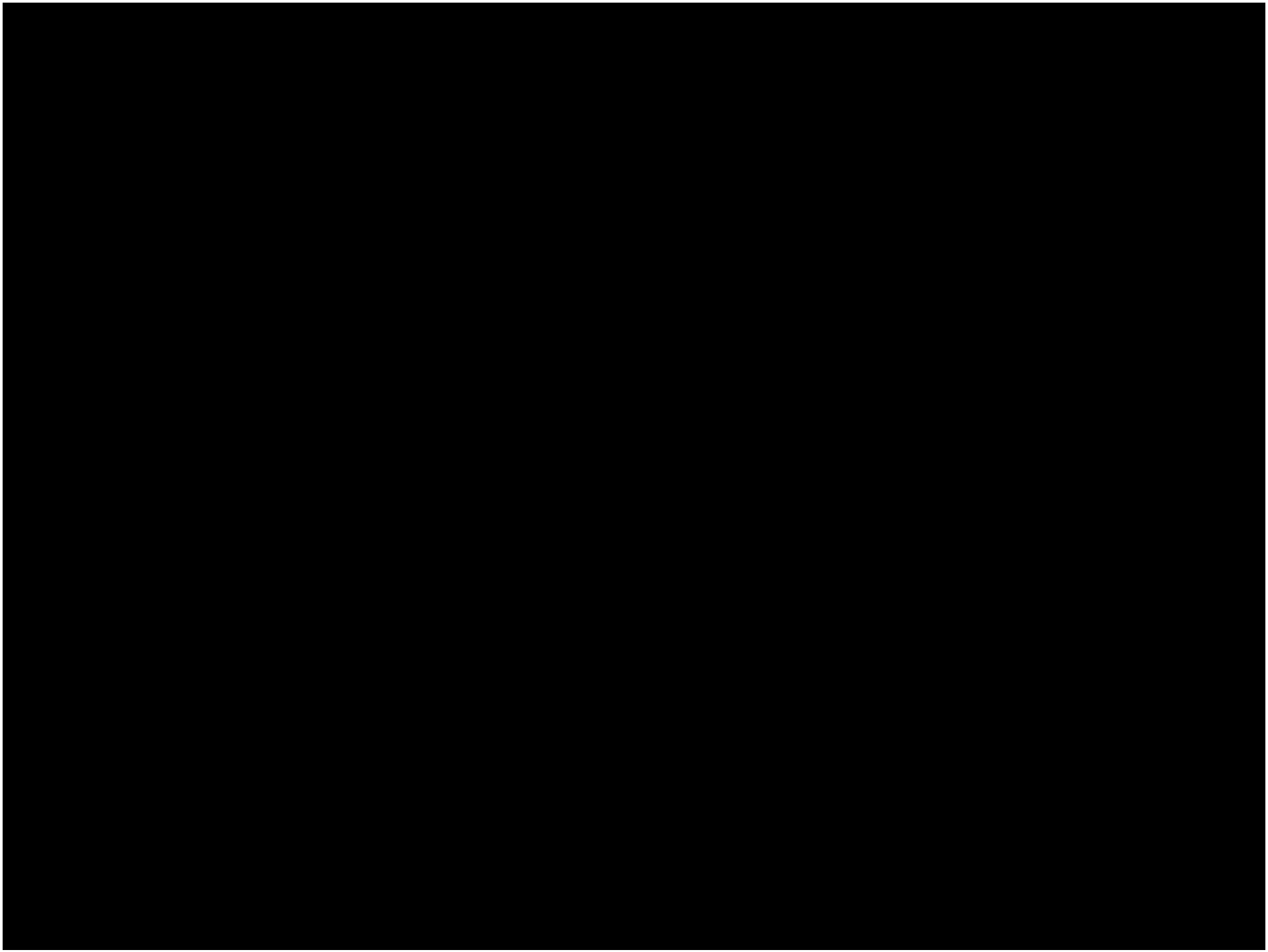
Prognostic Utility of MCE



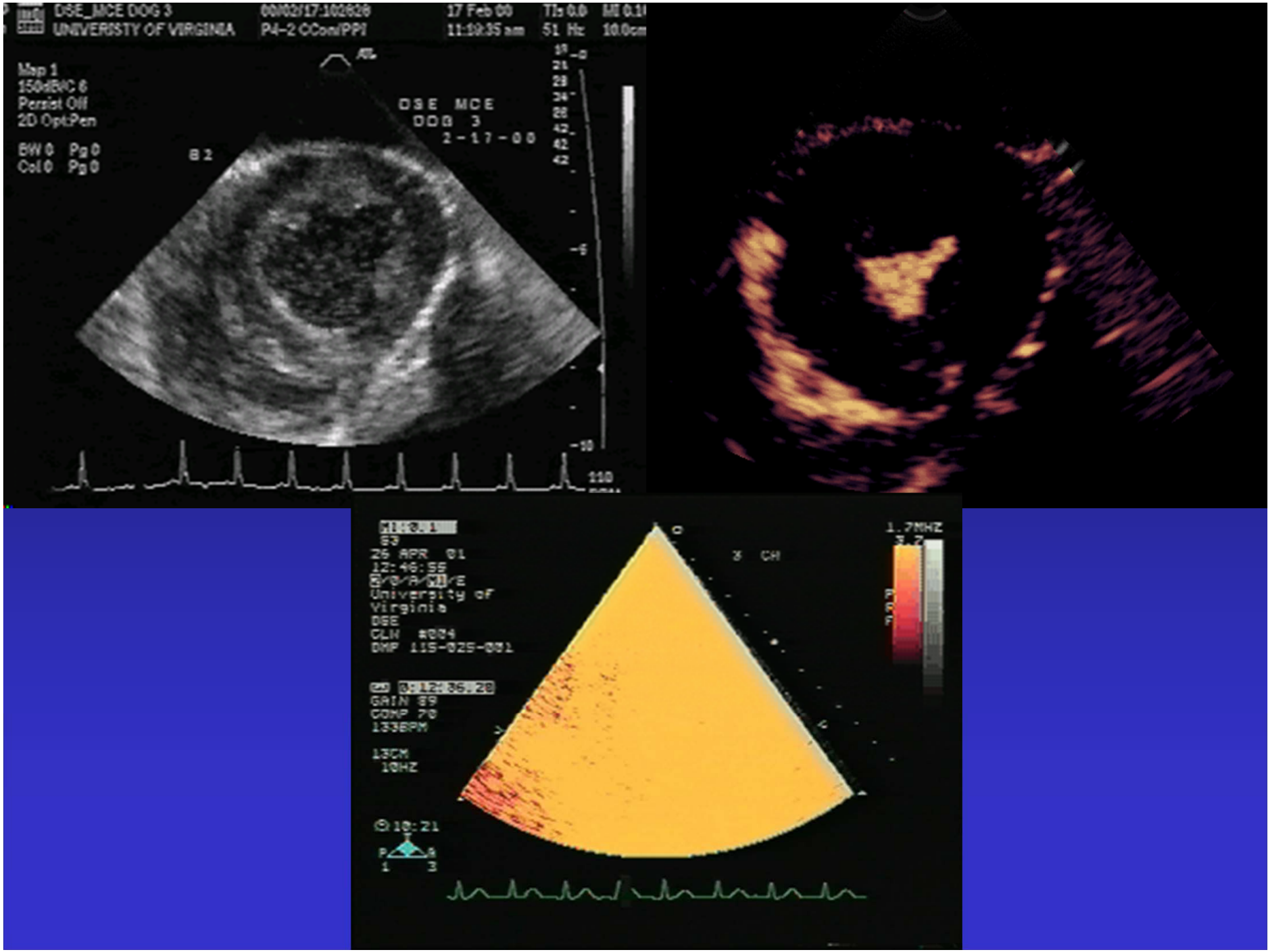
Tsutsui et al, Circulation 2005;112:1444-1450

Summary

- The evaluation of wall thickening during pharmacologic stress echo has limitations
- Perfusion defects during stress MCE are due to both the abnormal rate of replenishment of microbubbles and capillary derecruitment in the stenosed bed
- Perfusion imaging improves the sensitivity and accuracy of SE for the detection of CAD, allows more accurate assessment of the extent of disease, and more accurate identification of MVD
- Perfusion imaging adds incremental prognostic utility to SE



	Year	n	Stressor	Gold Std	Imaging Method	Sensitivity (%)	Specificity (%)	Concordance (%)	Kappa
Kaul, et al	1997	30	DP	SPECT	High MI			86	0.86
Porter, et al	1997	28	DP	SPECT	High MI	92	84	88	-
Heinle, et al	2000	123	Adenosine	SPECT	High MI			72-81	0.40 - 0.60
Cwajg, et al	2000	45	Ex or Dob	Cath	Low MI			77-83	0.53-0.66
Porter, et al	2001	117	Dob	Cath	Low MI			83	0.65
Shimoni, et al	2001	100	Ex	SPECT/ Cath	Low MI	86	88		
Olszowska, et al	2002	44	Dob	SPECT/ Cath	Low MI	97	93	89	0.81
Oraby, et al	2002	42	DP	SPECT	Low MI			82	0.64
Wei, et al	2003	64	DP	SPECT/ Cath	High MI	96	63	84	0.63
Rocchi, et al	2003	25	DP	Cath	High MI	94	100	84	0.76
Dubart, et al	2004	66	DP	SPECT	Low MI			65-83	
Peltier, et al	2004	35	DP	Cath	Low MI	78	80	79	0.53
Senior, et al	2004	55	DP	Cath	High MI	86	88		
Moir, et al	2004	85	Ex/DP	Cath	Low MI	91	70		
Elhendy, et al	2004	170	Dob	Cath	Low MI	81-95	51		
		1029				**90**	**72**	**76**	**0.4-0.9**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UNIVERSITY OF VIRGINIA
17 Feb 00
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Persist Off
2D Opt:Pen
BW 0 Pg 0
Col 0 Pg 0
B2
DSE MCE
DOG 3
2-17-00
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12:46:55
University of
Virginia
DSE
CLW #004
DMP 115-025-001
GAIN 59
COMP 70
1336PM
13CM
10HZ
10:21
1.7MHZ
3 CH