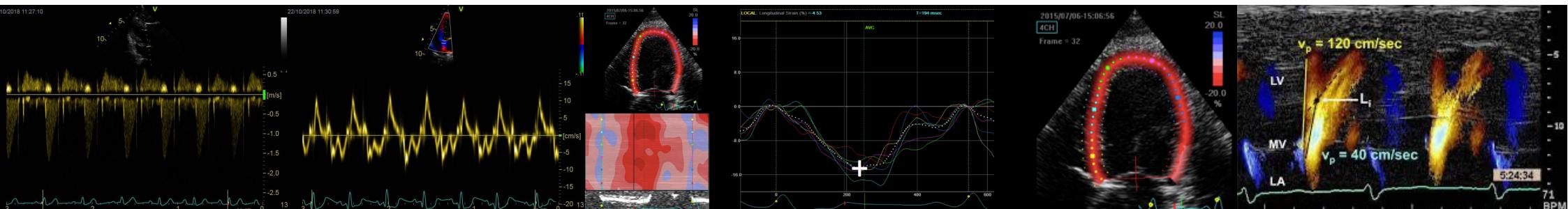


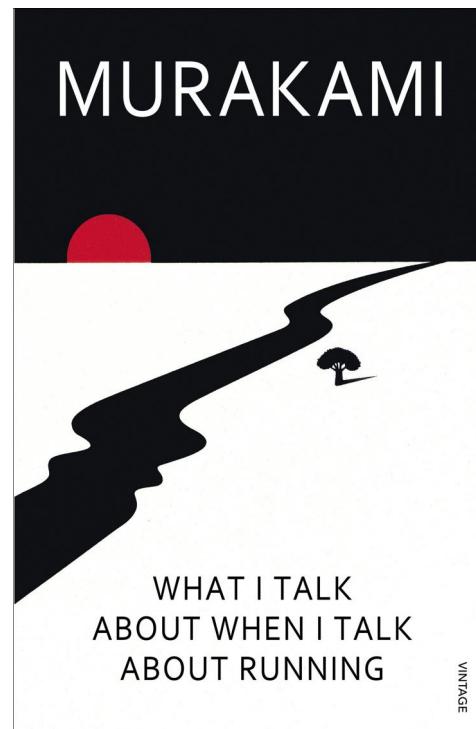
# Echossential or Echorrhoea?

Idle thoughts on some more advanced echocardiographic techniques

Dave Dickson

BVetMed DVC MRCVS  
RCVS Specialist in Cardiology





•  HeartVets

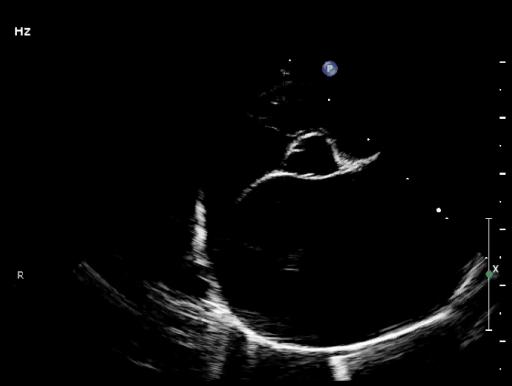
DICKSON



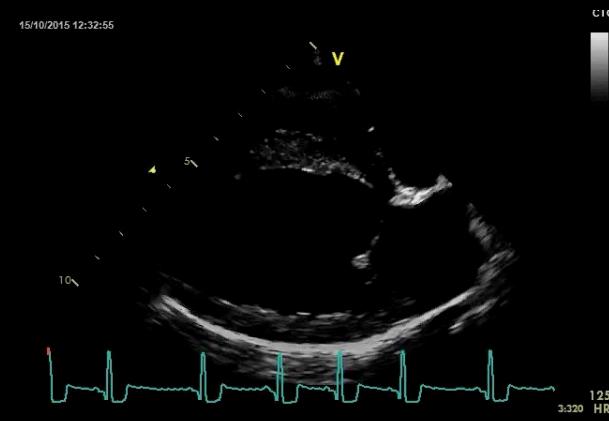
WHAT I TALK  
ABOUT WHEN I TALK  
ABOUT ECHO

VINTAGE

•  HeartVets

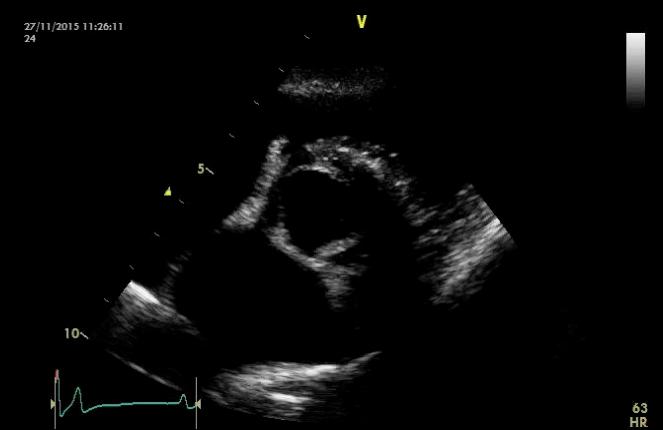
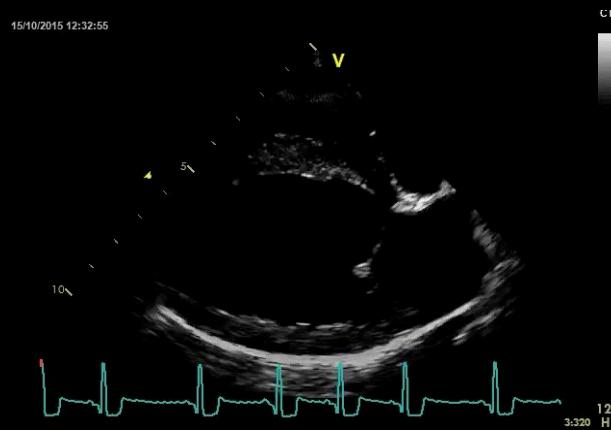


Echo courtesy of Liva Vatne

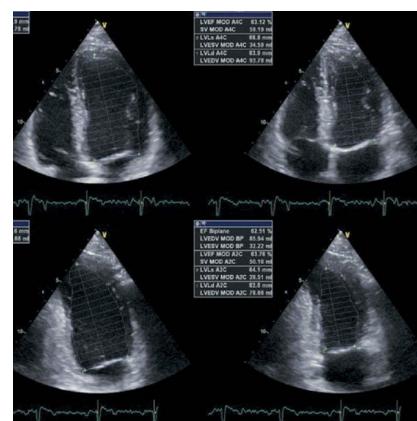


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# Can I be getting more from my echo?



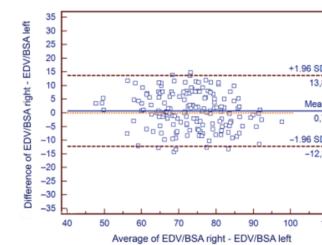
# Left ventricular systolic function



J Vet Intern Med 2010;24:1069–1076

## Use of Simpson's Method of Disc to Detect Early Echocardiographic Changes in Doberman Pinschers with Dilated Cardiomyopathy

G. Wess, J. Mäurer, J. Simak, and K. Hartmann

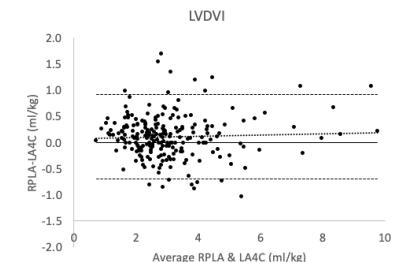
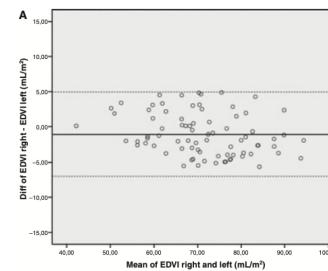


Bourguignon, Dickson, Vatne, Harris, Caivano & Rishniw  
*JVC In Press*

J Vet Intern Med 2014;28:116–122

## Simpson's Method of Discs for Measurement of Echocardiographic End-Diastolic and End-Systolic Left Ventricular Volumes: Breed-Specific Reference Ranges in Boxer Dogs

P. Smets, S. Daminet, and G. Wess



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# Left ventricular systolic function

J Vet Intern Med 2010;24:1069–1076

## Use of Simpson's Method of Disc to Detect Early Echocardiographic Changes in Doberman Pinschers with Dilated Cardiomyopathy

G. Wess, J. Mäurer, J. Simak, and K. Hartmann

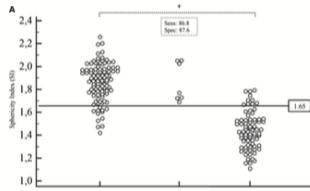


SMOD superior to MM  
at detecting early DCM

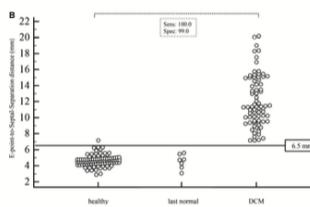
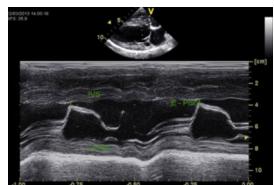
J Vet Intern Med 2014;28:123–129

## Sphericity Index and E-Point-to-Septal-Separation (EPSS) to Diagnose Dilated Cardiomyopathy in Doberman Pinschers

P.J. Holler and G. Wess



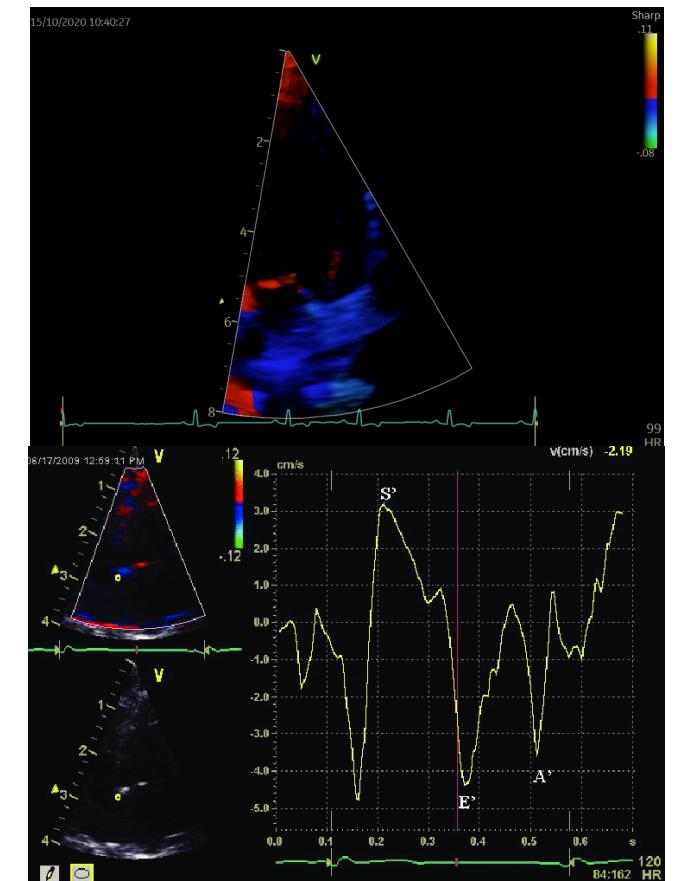
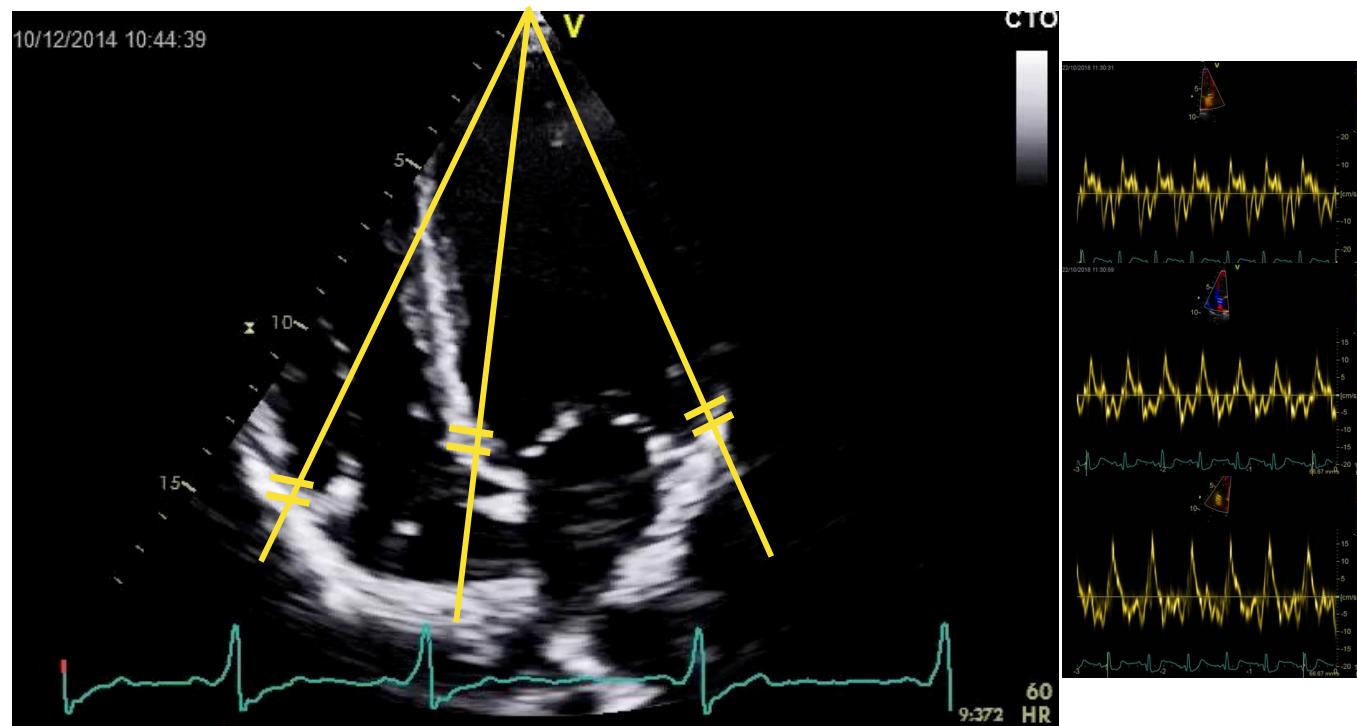
Sphericity index doesn't improve upon MM



EPSS is sens and spec and comparable to SMOD

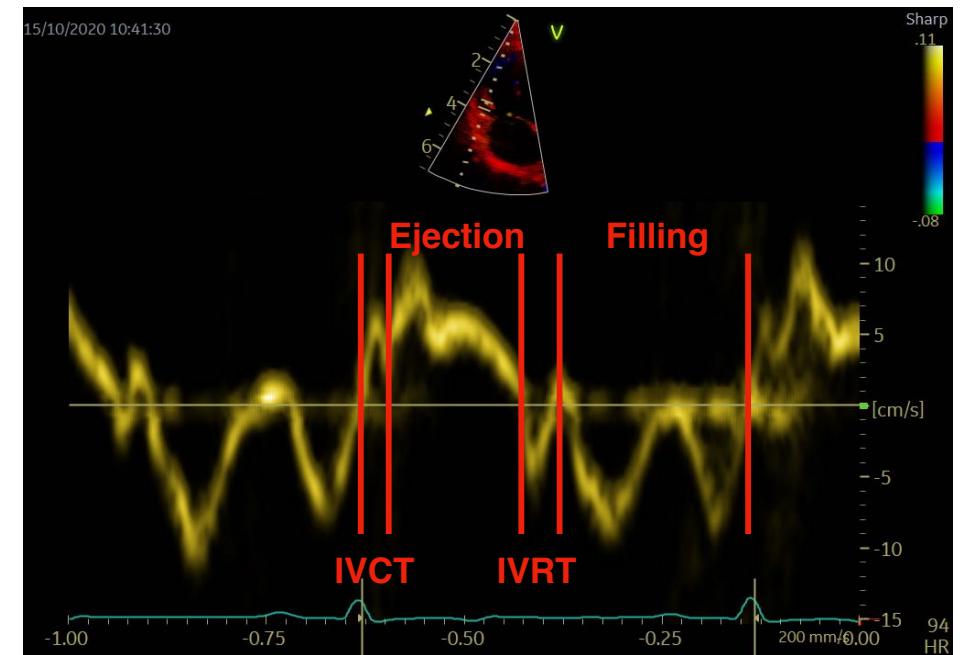
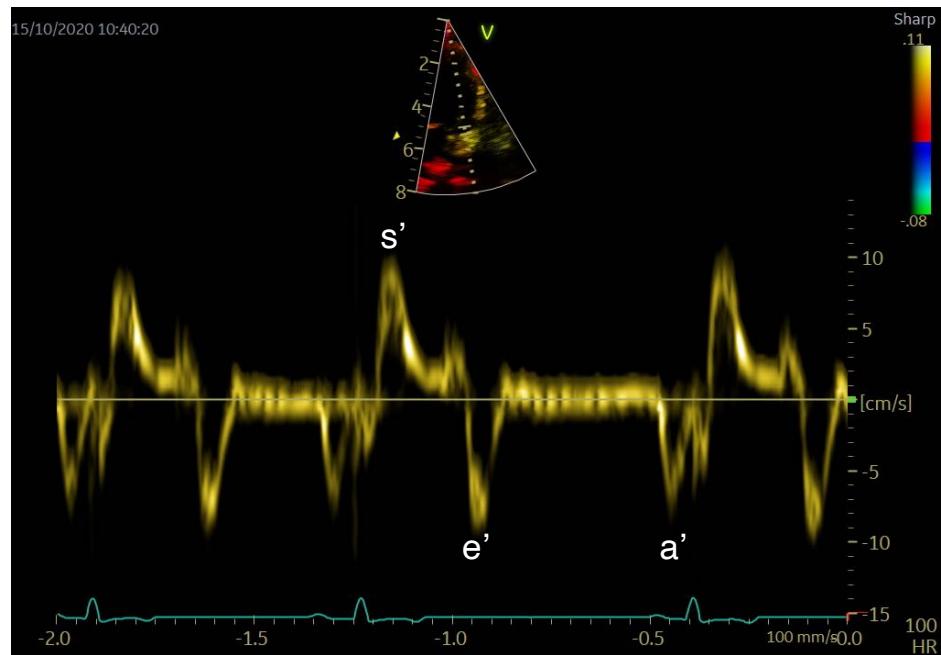


# Tissue Doppler Imaging

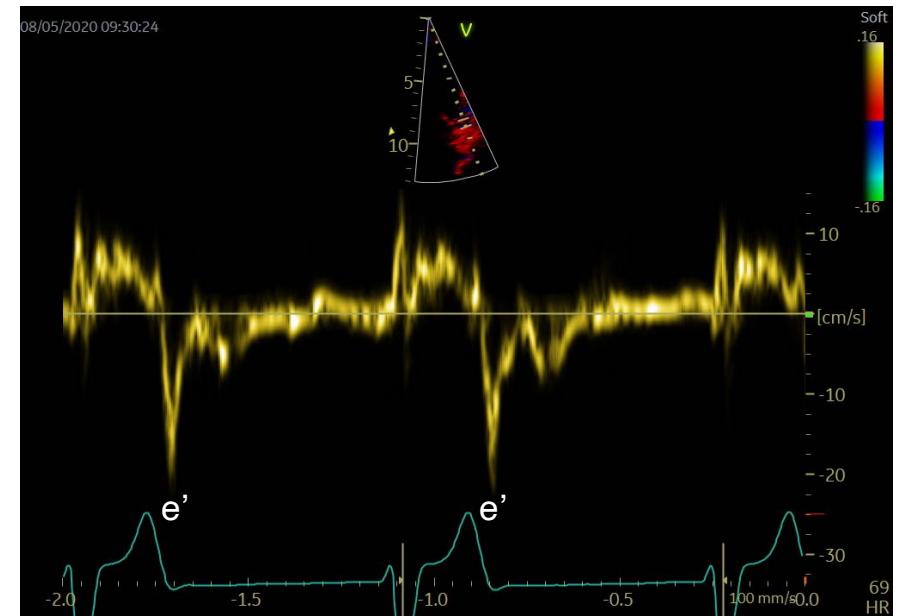
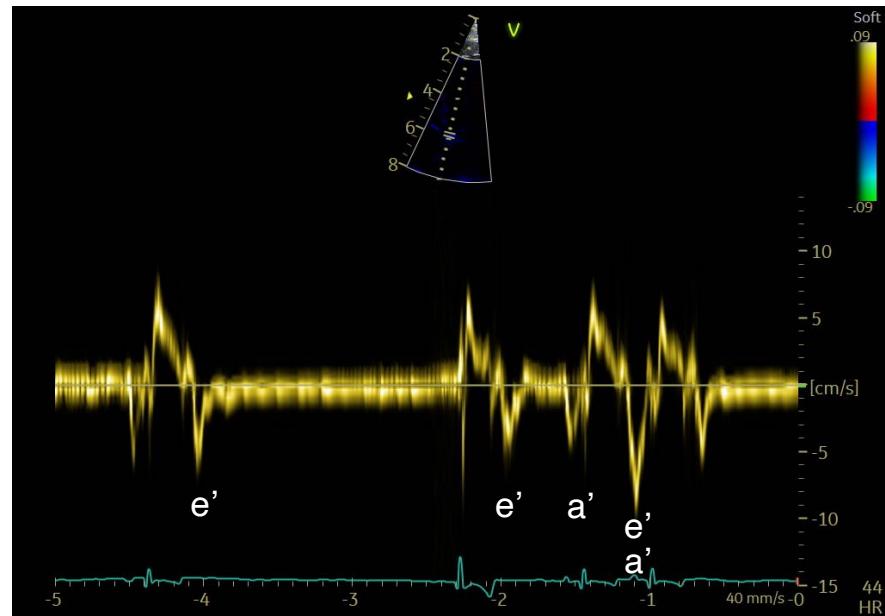


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# Tissue Doppler Imaging



# Tissue Doppler Imaging



# Tissue Doppler Imaging

Research | Open Access | Published: 28 November 2012

## Mitral annular systolic velocity as a marker of preclinical systolic dysfunction among patients with arterial hypertension

Ivaylo Rilkov Daskalov✉, Plamen Dimitrov Petrovsky & Lilia Davidkova Demirevska

*Cardiovascular Ultrasound* 10, Article number: 46 (2012) | Cite this article

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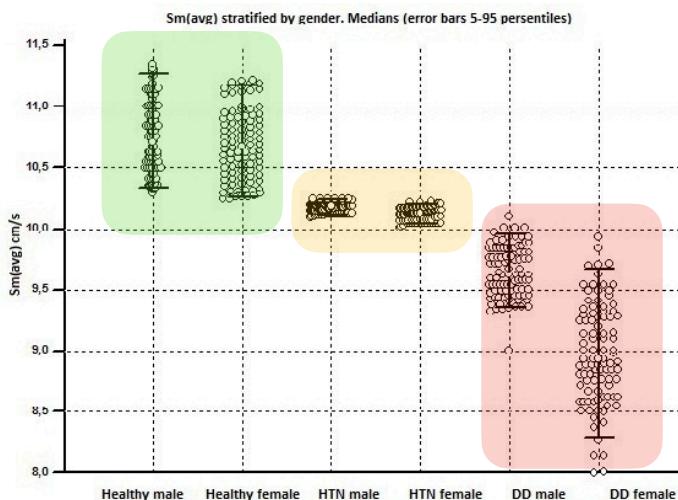
### STATE-OF-THE-ART PAPER

## Tissue Doppler Imaging

### A New Prognosticator for Cardiovascular Diseases

Cheuk-Man Yu, MD, FRCP, FRACP,\* John E. Sanderson, MD, FRCP, FACC,†  
Thomas H. Marwick, MD, PhD, FACC,‡ Jae K. Oh, FACC§

*Hong Kong, China; Stoke-on-Trent, United Kingdom; Brisbane, Australia; and Rochester, Minnesota*



### CARDIOVASCULAR MEDICINE

Pulsed tissue Doppler imaging detects early myocardial dysfunction in asymptomatic patients with severe mitral regurgitation

E Agricola, M Galderisi, M Oppizzi, A F L Schinkel, F Maisano, M De Bonis, A Margonato, A Maseri, O Alfieri

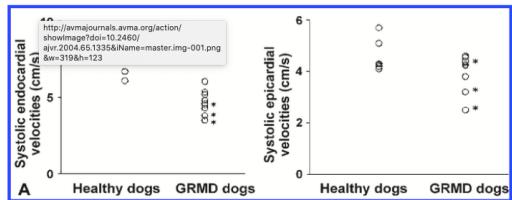
*Heart* 2004;90:406–410. doi: 10.1136/heart.2002.009621



# Tissue Doppler Imaging

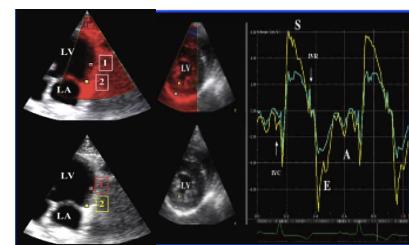
## Tissue Doppler assessment of diastolic and systolic alterations of radial and longitudinal left ventricular motions in Golden Retrievers during the preclinical phase of cardiomyopathy associated with muscular dystrophy

Valerie Chetboul, DVM, PhD; Carolina Carlos, DVM; Stephane Blot, DVM, PhD; Jean Laurent Thibaud, DVM; Catherine Escriou, DVM, PhD; Renaud Tissier, DVM, PhD; Jose Luis Retorillo, DVM; Jean-Louis Pouchelon, DVM, PhD



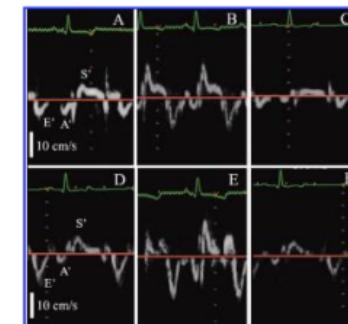
## Assessment of repeatability, reproducibility, and effect of anesthesia on determination of radial and longitudinal left ventricular velocities via tissue Doppler imaging in dogs

Valerie Chetboul, DVM, PhD; Nicolas Athanasiadis, DVM; Carolina Carlos, DVM; Audrey Nicolle, DVM; Luca Zilberman, DVM, PhD; Jean-Louis Pouchelon, DVM, PhD; Herve P Lefebvre, DVM, PhD; Didier Concordet, DVM, PhD

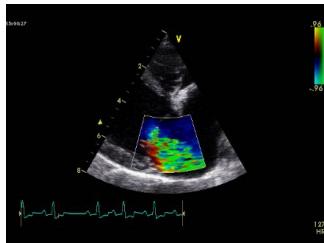


## Assessment of longitudinal tissue Doppler imaging of the left ventricular septum and free wall as an indicator of left ventricular systolic function in dogs

Yasutomo Hori, DVM; Shingo Sato, DVM; Fumio Hoshi, DVM, PhD; Sei-ichi Higuchi, DVM, PhD



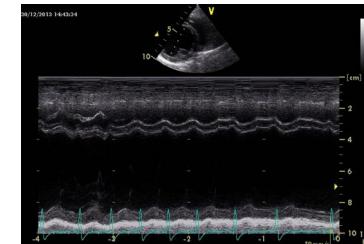
# Tissue Doppler Imaging in DMVD and DCM



*J Vet Intern Med* 2009;23:1197–1207

## Tissue Doppler and Strain Imaging in Dogs with Myxomatous Mitral Valve Disease in Different Stages of Congestive Heart Failure

A. Tidholm, I. Ljungvall, K. Höglund, A.B. Westling, and J. Häggström



*J Vet Intern Med* 2007;21:719–730

## Assessment of Regional Systolic and Diastolic Myocardial Function Using Tissue Doppler and Strain Imaging in Dogs with Dilated Cardiomyopathy

Valérie Chetboul, Vassiliki Gouni, Carolina Carlos Sampedrano, Renaud Tissier, François Serres, and Jean-Louis Pouchelon

*J Vet Intern Med* 2015;29:132–140

## Usefulness of Conventional and Tissue Doppler Echocardiography to Predict Congestive Heart Failure in Dogs with Myxomatous Mitral Valve Disease

J.-H. Kim and H.-M. Park

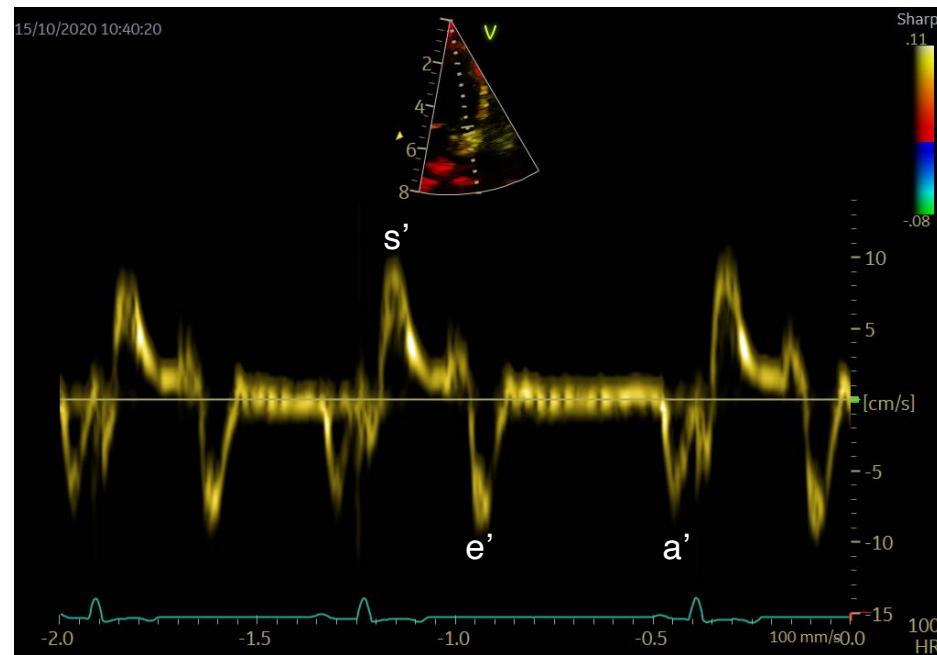
*J Vet Intern Med* 2007;21:81–91

## Assessment of Diastolic Function by Doppler Echocardiography in Normal Doberman Pinschers and Doberman Pinschers with Dilated Cardiomyopathy

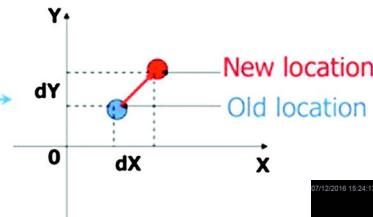
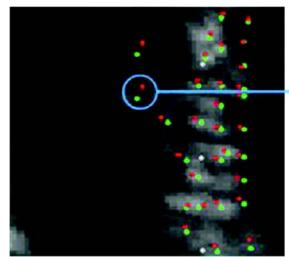
M. Lynne O'Sullivan, Michael R. O'Grady, and Sandra L. Minors



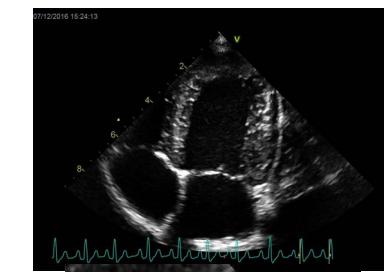
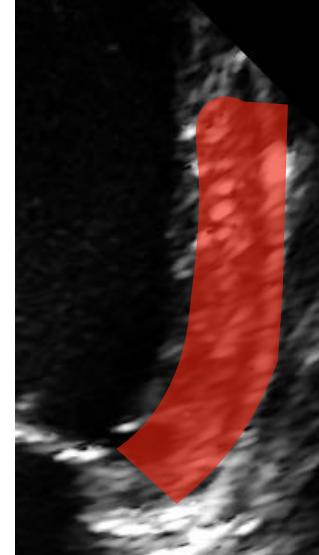
# Tissue Doppler Imaging



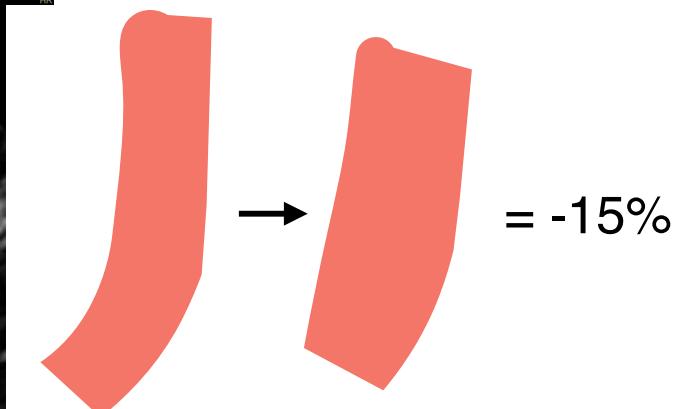
# Speckle Tracking Echocardiography



$t_0$

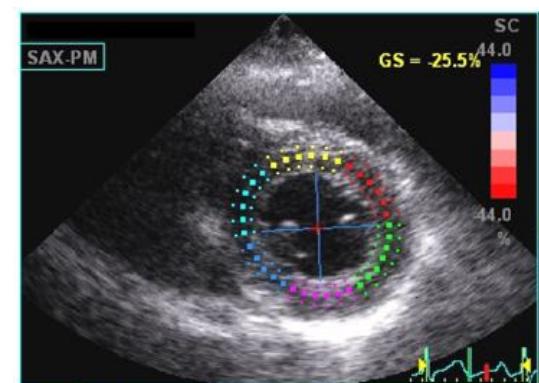
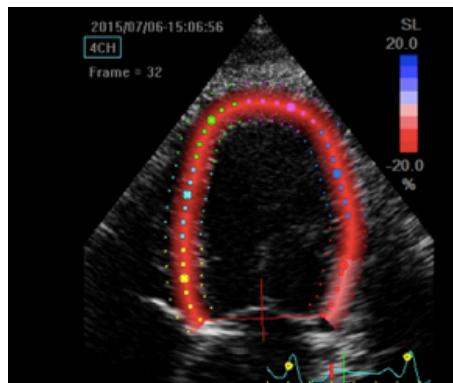


$t_1$

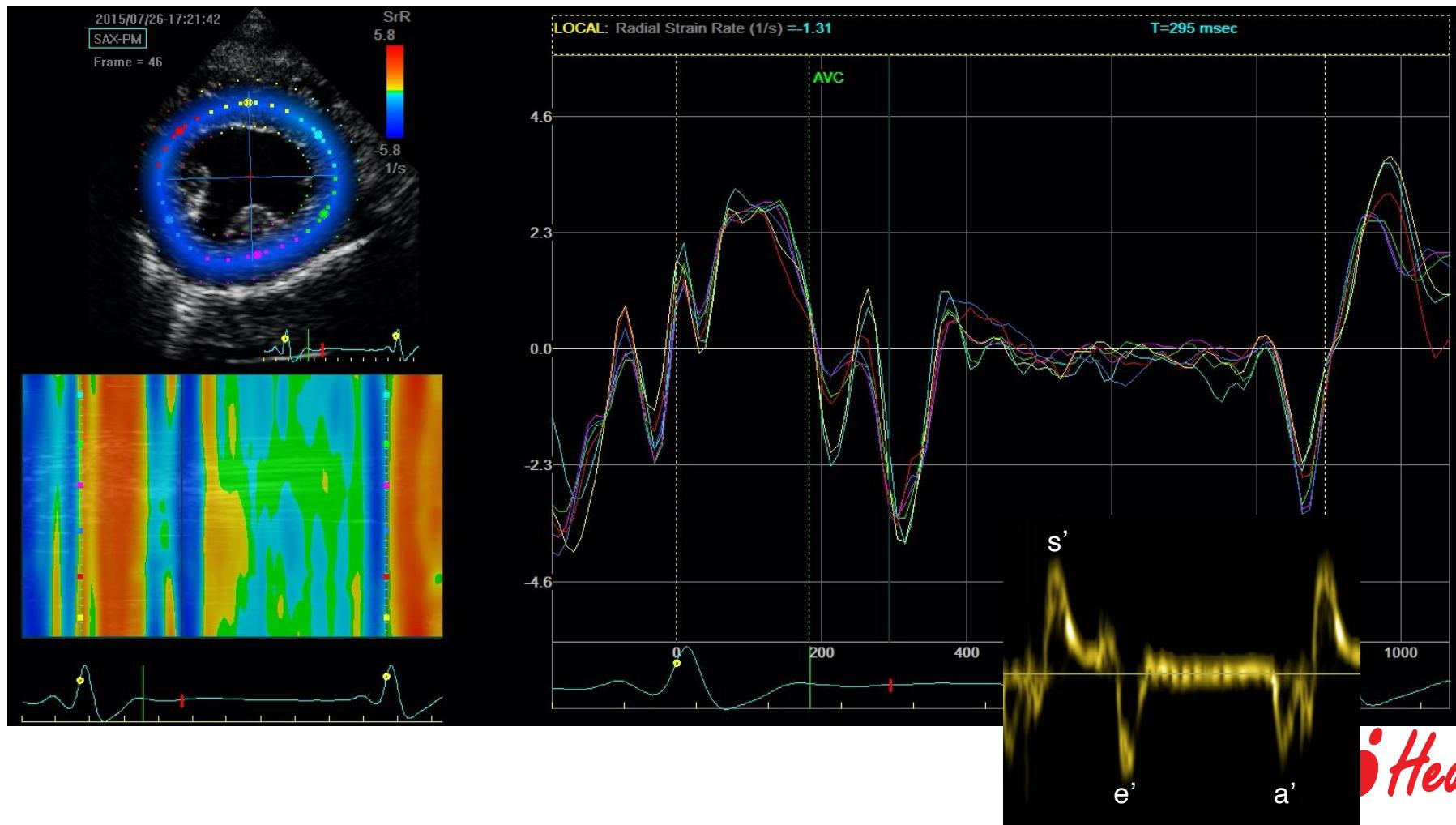


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# Speckle Tracking Echocardiography

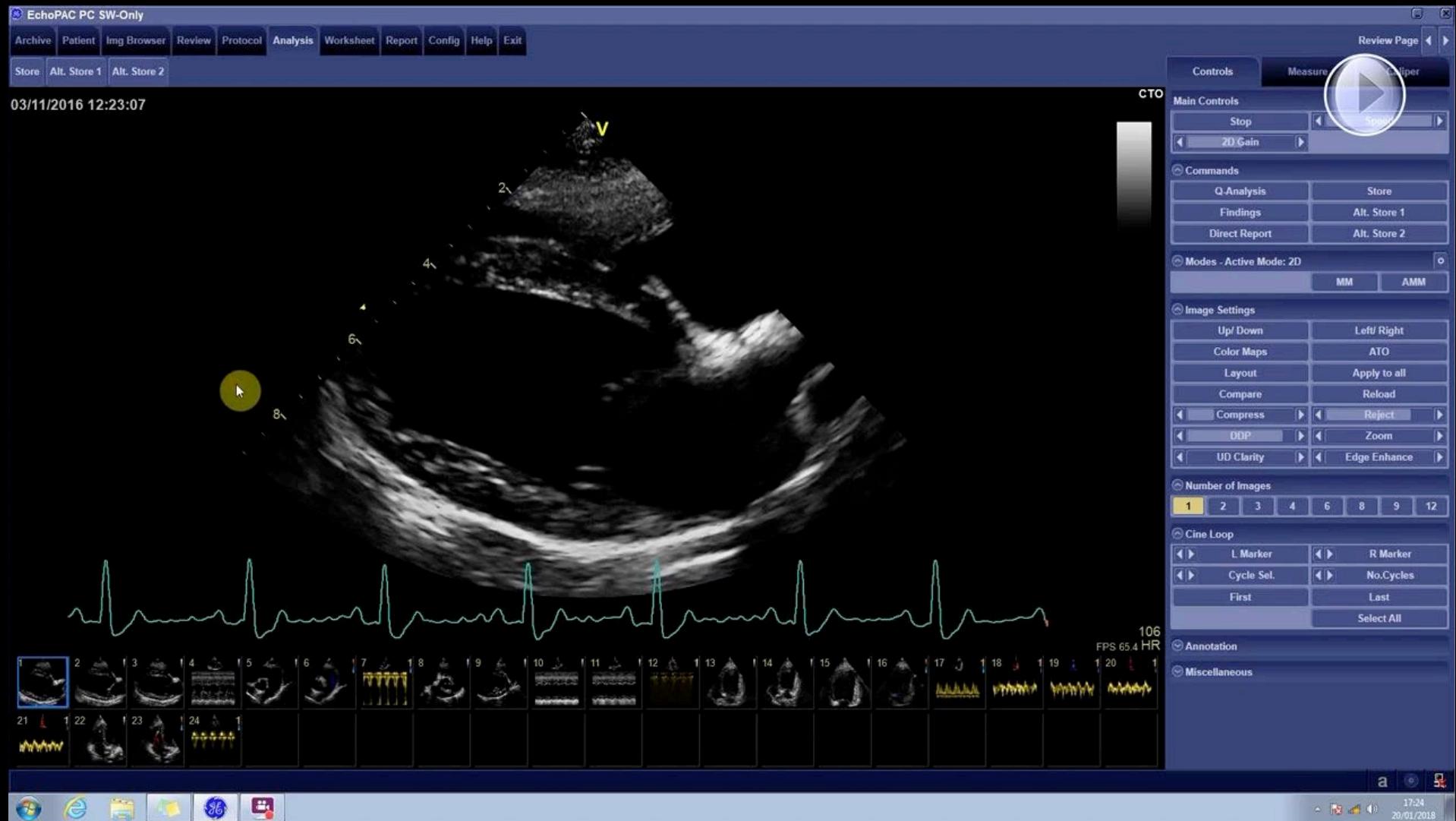


# Speckle Tracking Echocardiography

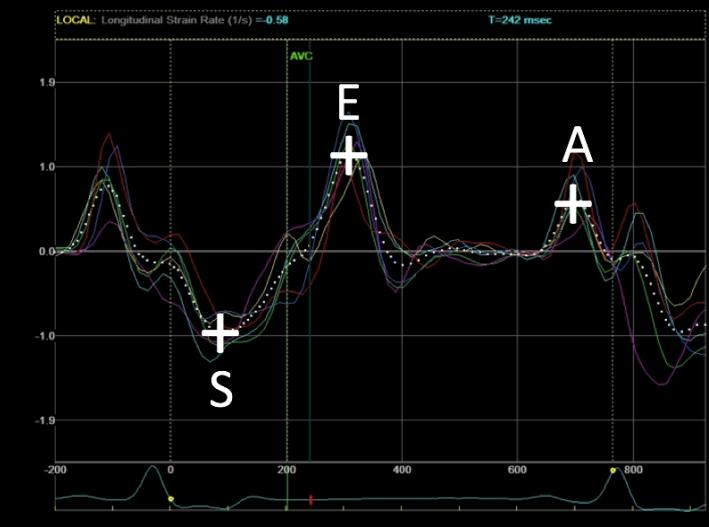
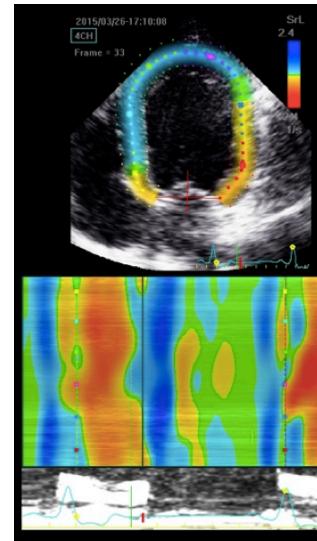
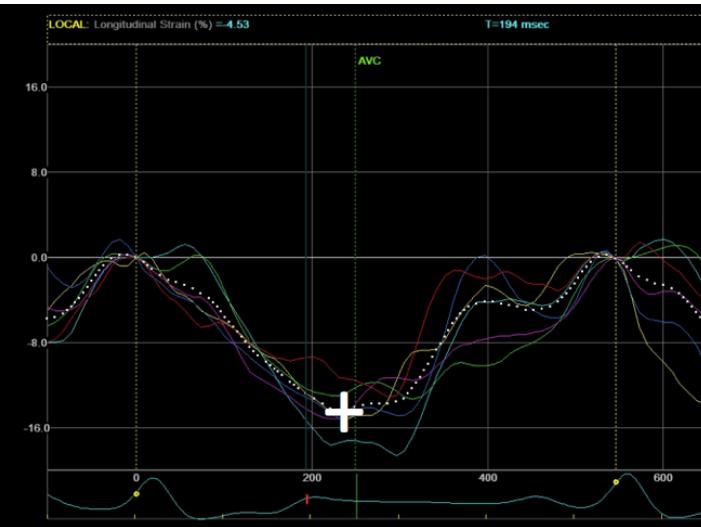
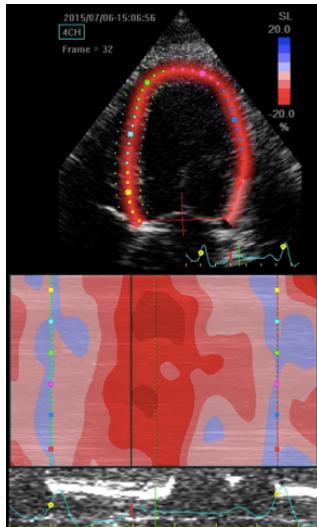


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# Measuring STE



# Speckle Tracking Echocardiography



GLS

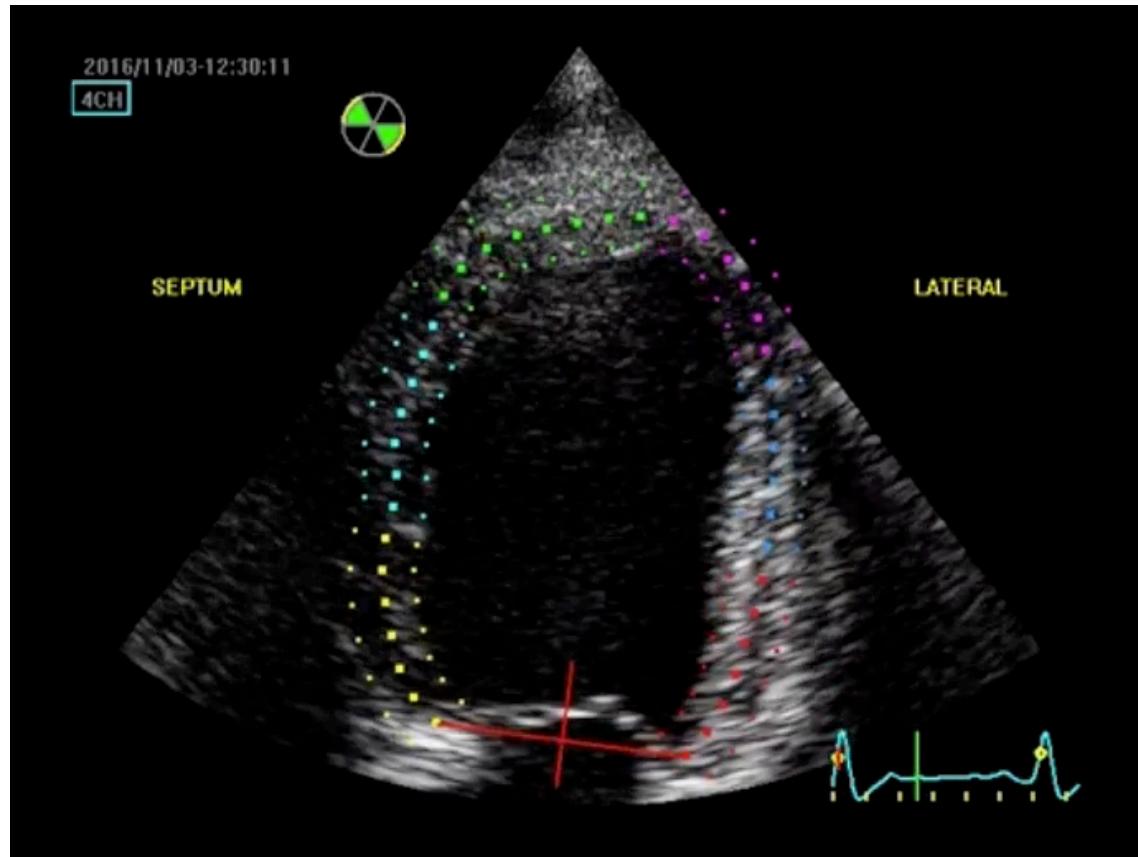
GLSRs

GLSRe

GLSRA

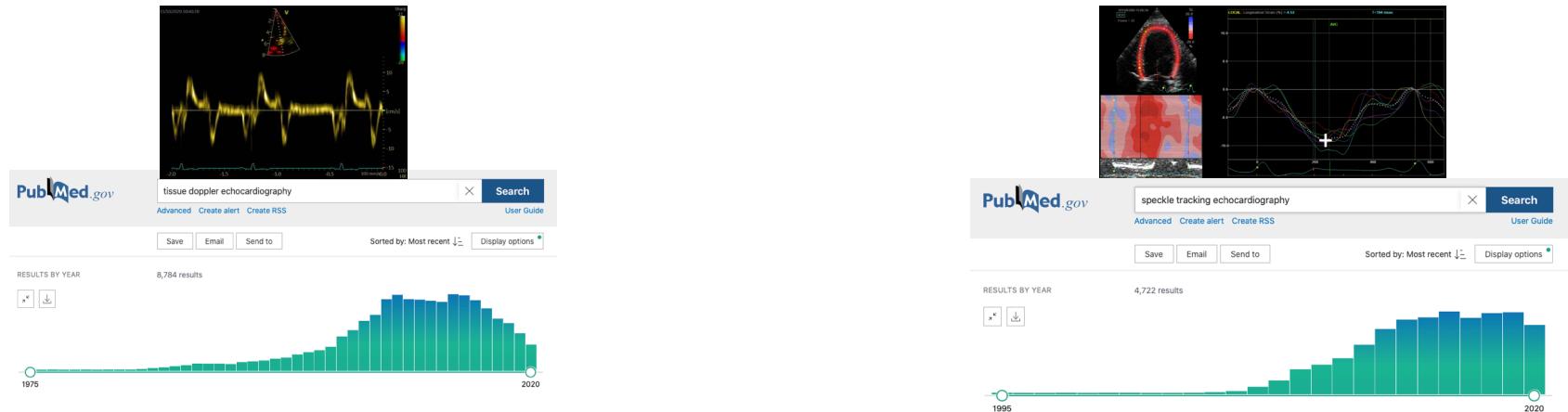
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# Speckle Tracking Echocardiography



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# Speckle Tracking Echocardiography



## Abnormal left ventricular global longitudinal strain by speckle tracking echocardiography in COVID-19 patients.

Croft LB, Krishnamoorthy P, Ro R, Anastasius M, Zhao W, Buckley S, Goldman M, Argulian E, Sharma SK, Kini A, Lerakis S.

### GUIDELINES AND STANDARDS

#### Recommendations for Cardiac Chamber Quantification by Echocardiography in Adults: An Update from the American Society of Echocardiography and the European Association of Cardiovascular Imaging

Roberto M. Lang, MD, FASE, FESC, Luigi P. Badano, MD, PhD, FESC, Victor Mor-Avi, PhD, FASE, Jonathan Afifalo, MD, MSc, Anderson Armstrong, MD, MSc, Laura Ernande, MD, PhD, Frank A. Flachskampf, MD, FESC, Elyse Foster, MD, FASE, Steven A. Goldstein, MD, Tatiana Kuznetsova, MD, PhD, Patrizio Lancellotti, MD, PhD, FESC, Denisa Muraru, MD, PhD, Michael H. Picard, MD, FASE, Ernst R. Rietzschel, MD, PhD, Lawrence Rudski, MD, FASE, Kirk T. Spencer, MD, FASE, Wendy Tsang, MD, and Jens-Uwe Voigt, MD, PhD, FESC, Chicago, Illinois; Padua, Italy; Montreal, Quebec and Toronto, Ontario, Canada; Baltimore, Maryland; Créteil, France; Uppsala, Sweden; San Francisco, California; Washington, District of Columbia; Leuven, Lége and Ghent, Belgium; Boston, Massachusetts

2217/fca-2020-0121.

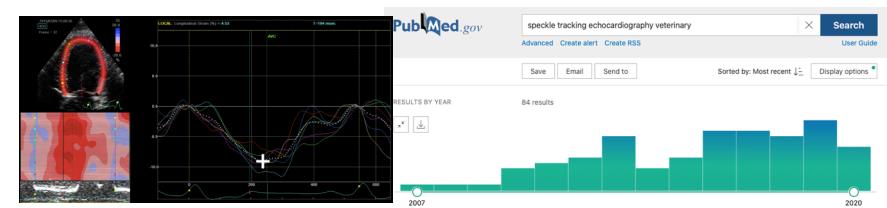
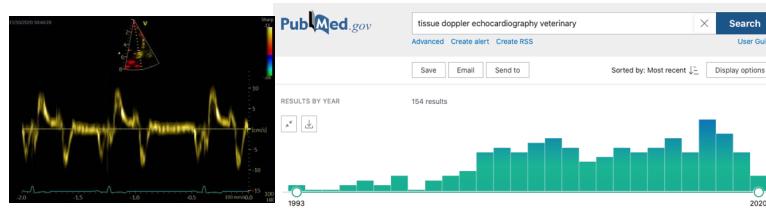
### GUIDELINES AND STANDARDS

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

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



# Speckle Tracking Echocardiography

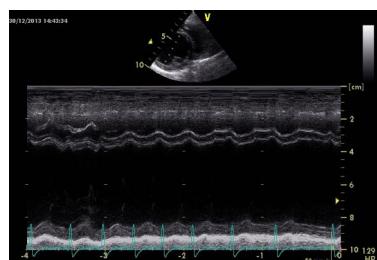


PRE-CLINICAL INVESTIGATION | VOLUME 33, ISSUE 1, P120-129.E1, JANUARY 01, 2020

Alteration in Left Ventricular Contractile Function Develops in Puppies With Duchenne Muscular Dystrophy

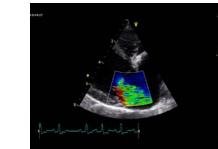
Bijan Ghaleh, PhD • Inès Barthélémy, DVM, PhD • Lucien Sambin, BSc • ... Luc Hittinger, MD, PhD • Stéphane Blot, DVM, PhD • Jin Bo Su, PhD Show all authors

Published: October 11, 2019 • DOI: <https://doi.org/10.1016/j.echo.2019.08.003> •



Assessment of left ventricular function in healthy Great Danes and in Great Danes with dilated cardiomyopathy using speckle tracking echocardiography

B. Pedro, MSc <sup>a,b,\*</sup>, H. Stephenson, BVMS <sup>a</sup>, C. Linney, BVSc <sup>a</sup>, P. Cripps, BVSc, PhD <sup>a</sup>, J. Dukes-McEwan, BVMS, MVM, PhD <sup>a</sup>



Clinical assessment of systolic myocardial deformations in dogs with chronic mitral valve insufficiency using two-dimensional speckle-tracking echocardiography

Ryohei Suzuki, DVM\*, Hirotaka Matsumoto, DVM, PhD, Takahiro Teshima, DVM, PhD, Hidekazu Koyama, DVM, PhD

> *J Vet Cardiol.* 2012 Mar;14(1):231-42. doi: 10.1016/j.jvc.2011.11.002. Epub 2012 Feb 22.

Left ventricular function quantified by myocardial strain imaging in small-breed dogs with chronic mitral regurgitation

Danielle N Smith <sup>1</sup>, John D Bonagura, Nicole M Culwell, Karsten E Schober

*J Vet Intern Med* 2012;26:1309-1319

Radial and Longitudinal Strain and Strain Rate Assessed by Speckle-Tracking Echocardiography in Dogs with Myxomatous Mitral Valve Disease

N.E. Zois, A. Tidholm, K.M. Nitgaard, S.G. Moesgaard, C.E. Rasmussen, T. Falk, J. Häggström, H.D. Pedersen, B. Åblad, H.Y. Nilsen, and L.H. Olsen

# Right Ventricular Function

03/08/2016 14:36:43



103  
2:283HR

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# Right Ventricular Function

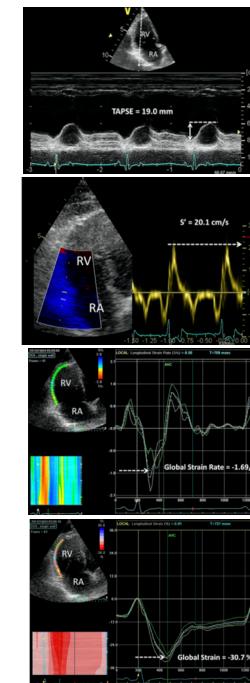
## GUIDELINES AND STANDARDS

Recommendations for Cardiac Chamber Quantification by Echocardiography in Adults:  
An Update from the American Society  
of Echocardiography and the European Association  
of Cardiovascular Imaging

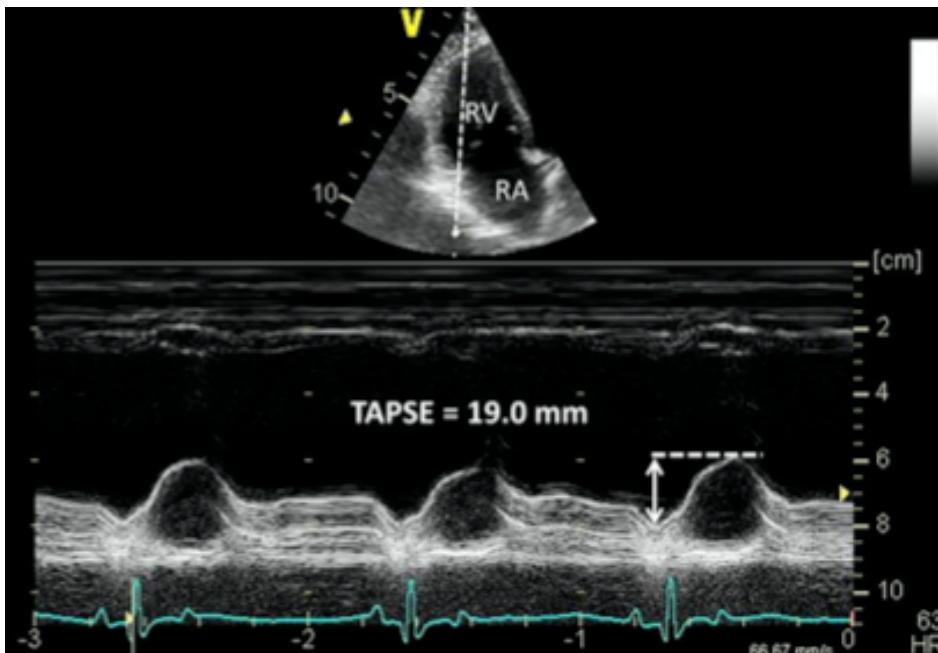
Roberto M. Lang, MD, FASE, FESC, Luigi P. Badano, MD, PhD, FESC, Victor Mor-Avi, PhD, FASE,

**Echocardiographic assessment of right ventricular systolic function in conscious healthy dogs: Repeatability and reference intervals**

Lance C. Visser, DVM, MS , Brian A. Scansen, DVM, MS\*,  
Karsten E. Schober, DVM, PhD , John D. Bonagura, DVM, MS



# Tricuspid Annular Plane Systolic Excursion



Bodyweight (kg)	TAPSE (mm) <sup>a</sup>
3	6.6–10.6
4	7.2–11.5
5	7.7–12.3
7	8.5–13.6
9	9.2–14.7
12	10.0–16.0
15	10.7–17.1
20	11.6–18.6
25	12.4–19.9
30	13.1–21.0
35	13.7–22.0
40	14.3–22.8
45	14.8–23.7

$Y = 4.777 \text{ to } 7.640 \times M^{0.297}$

Tricuspid annular plane systolic excursion-to-aortic ratio provides a bodyweight-independent measure of right ventricular systolic function in dogs

D. Caivano DVM, PhD<sup>a</sup>, D. Dickson BVetMed<sup>b</sup>, R. Pariaut DVM<sup>c</sup>, M. Stillman PhD<sup>d</sup>, M. Rishniw DVM, PhD<sup>e</sup>.

TAPSE:Ao >0.65



CRAPSE





Tricuspid annular plane systolic excursion-to-aortic ratio provides a bodyweight-independent measure of right ventricular systolic function in dogs

D. Caivano DVM, PhD<sup>a</sup>, D. Dickson BVetMed<sup>b</sup>, R. Pariaut DVM<sup>c</sup>, M. Stillman PhD<sup>d</sup>, M. Rishniw DVM, PhD<sup>e</sup>.

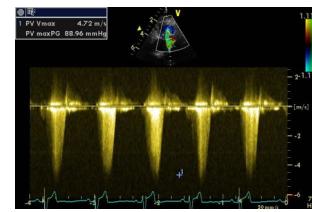
**TAPSE:Ao <0.65**

**Survival characteristics and prognostic importance of echocardiographic measurements of right heart size and function in dogs with pulmonary hypertension**

Lance C. Visser | James E. Wood | Lynelle R. Johnson

**nTAPSE<3.2mm/kg<sup>0.3</sup>**

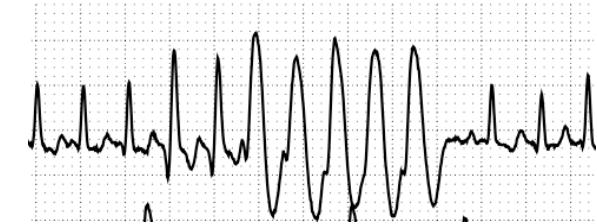
# TAPSE



Echocardiographic assessment of right heart size and function in dogs with pulmonary valve stenosis

L.C. Visser DVM, MS , S. Nishimura DVM, M.S. Oldach DVM, C. Bélanger DMV, C.T. Gunther-Harrington DVM, J.A. Stern DVM, PhD, W. Hsue DVM

**iTAPSE <3.3mm/kg<sup>0.3</sup>**



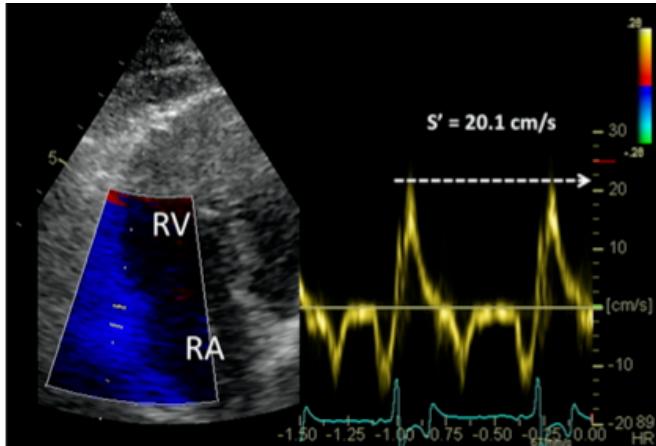
Echocardiographic assessment of right ventricular systolic function in Boxers with arrhythmogenic right ventricular cardiomyopathy

S.M. Cunningham DVM , B.D. Aona DVM<sup>b</sup>, K. Antoon CVT, VTS<sup>a</sup>, J.E. Rush DVM, MS<sup>a</sup>, B.A. Barton Ph.D.<sup>c</sup>

*J Vet Intern Med* 2015;29:582–588

**Association of Tricuspid Annular Plane Systolic Excursion with Survival Time in Boxer Dogs with Ventricular Arrhythmias**

B.M. Kaye, K. Borgeat, P.F. Mötsküla, V. Luis Fuentes, and D.J. Connolly

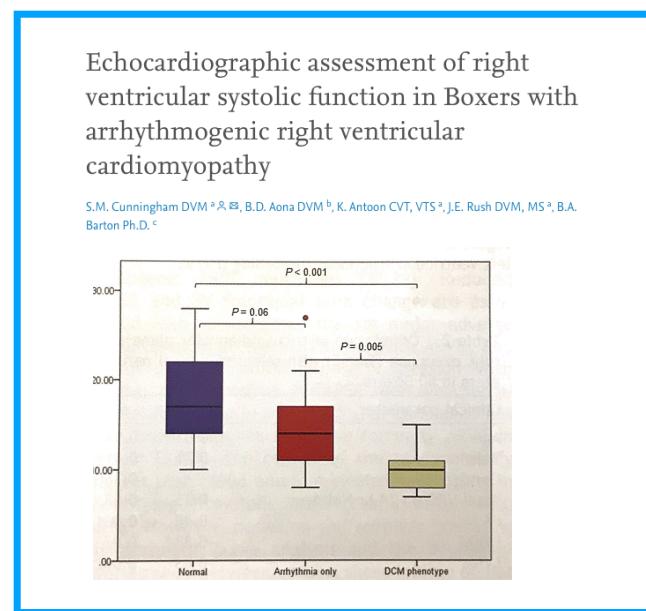


Bodyweight (kg)	RV function S' (cm/s) <sup>c</sup>
3	5.5–14.4
4	5.9–15.4
5	6.2–16.3
7	6.7–17.6
9	7.1–18.7
12	7.6–19.9
15	8.0–21.0
20	8.6–22.5
25	9.0–23.7
30	9.4–27.4
35	9.8–25.6
40	10.1–26.4
45	10.3–27.1

Visser 2015

S' min > 4.26 cm/s/kg

$$S'N = 4.262 \times BW^{0.233}$$



## TDI S'

### Echocardiographic assessment of right heart size and function in dogs with pulmonary valve stenosis\*

L.C. Visser, DVM, MS\*, S. Nishimura, DVM, M.S. Oldach, DVM, C. Bélanger, DMV, C.T. Gunther-Harrington, DVM, J.A. Stern, DVM, PhD, W. Hsue, DVM

J Vet Intern Med 2007;21:719–730

### Assessment of Regional Systolic and Diastolic Myocardial Function Using Tissue Doppler and Strain Imaging in Dogs with Dilated Cardiomyopathy

Valérie Chetboul, Vassiliki Gouni, Carolina Carlos Sampedrano, Renaud Tissier, François Serres, and Jean-Louis Pouchelon

## Echocardiographic assessment of right ventricular systolic function in conscious healthy dogs: Repeatability and reference intervals

Lance C. Visser, DVM, MS\*, Brian A. Scansen, DVM, MS\*, Karsten E. Schober, DVM, PhD, John D. Bonagura, DVM, MS

Bodyweight (kg)	Strain $\times -1$ (%) <sup>d</sup>	Strain rate $\times -1$ ( $s^{-1}$ ) <sup>e</sup>
3	24.7–41.2	3.2–7.2
4	24.2–40.4	3.0–6.7
5	23.8–39.7	2.8–6.3
7	23.2–38.7	2.6–5.8
9	22.8–38.0	2.4–5.4
12	22.3–37.2	2.2–5.0
15	21.9–36.5	2.1–4.7
20	21.4–35.8	2.0–4.4
25	21.1–35.2	1.8–4.1
30	20.8–34.7	1.8–3.9
35	20.6–34.3	1.7–3.8
40	20.4–34.0	1.6–3.6
45	20.2–33.7	1.6–3.5

### Original Article

J Vet Sci 2018; 19(5): 683-692 - <https://doi.org/10.4142/jvs.2018.19.5.683>

JVS

### Quantitative assessment of systolic and diastolic right ventricular function by echocardiography and speckle-tracking imaging: a prospective study in 104 dogs

Valérie Chetboul<sup>1,2,\*</sup>, Cécile Damoiseaux<sup>1</sup>, Hervé P. Lefebvre<sup>2</sup>, Didier Concorde<sup>4</sup>, Loïc Desquibert<sup>5</sup>, Vassiliki Gouli<sup>1,2</sup>, Camille Poissonnier<sup>6</sup>, Jean-Louis Pouchelon<sup>1,2</sup>, Renaud Tissier<sup>2,6</sup>

	Lower limit (90% CI)	Upper limit (90% CI)
<b>Speckle-tracking echocardiography</b>		
Systolic RV variable		
RVFW systolic strain $\times -1$	21.4 (20.3–23.2)	47.9 (42.6–55.0)
RVFW systolic strain rate ( $sec^{-1}$ ) $\times -1$	1.6 (1.4–2.0)	7.5 (6.3–9.6)
Global RV systolic strain $\times -1$	19.2 (17.7–20.5)	37.8 (33.7–40.4)
Diastric RV variable		
RVFW SRE:SRA ratio	1.0 (1.0–1.0)	9.8 (6.3–14.0)
Systolic LV variable		
Global LV systolic strain $\times -1$	13.5 (12.0–14.4)	25.6 (24.6–26.0)

# Speckle of the RV

J Vet Intern Med 2018;32:64–71

> Am J Vet Res. 2019 Jan;80(1):51–60. doi: 10.2460/ajvr.80.1.51.

### Effect of acute volume overload on echocardiographic indices of right ventricular function and dyssynchrony assessed by use of speckle tracking echocardiography in healthy dogs

Tomoya Morita, Kensuke Nakamura, Tatsuyuki Osuga, Nozomu Yokoyama, Keitaro Morishita, Noboru Sasaki, Hiroshi Ohta, Mitsuyshi Takiguchi

### Echocardiography

A Journal of Cardiovascular Ultrasound and Allied Techniques

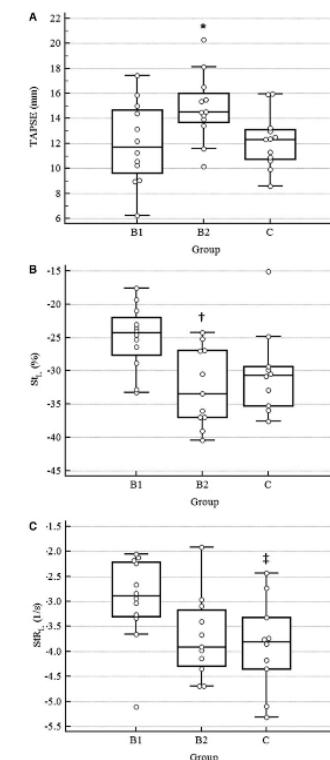
#### ORIGINAL INVESTIGATION

### Changes in right ventricular function assessed by echocardiography in dog models of mild RV pressure overload

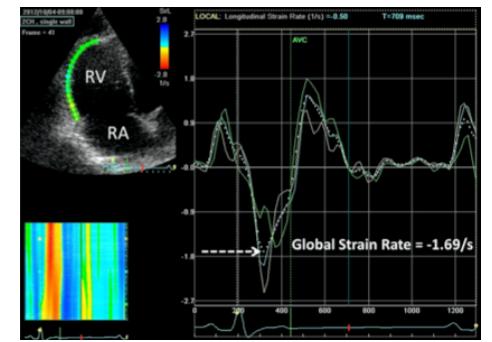
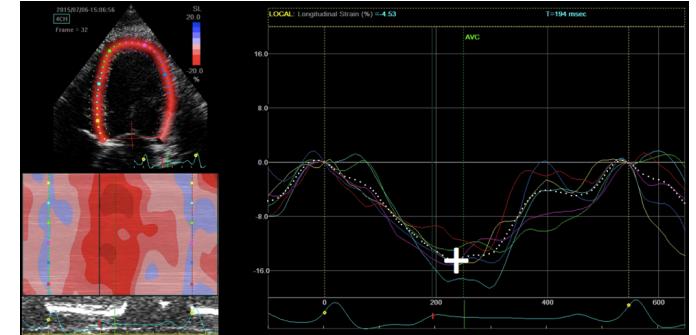
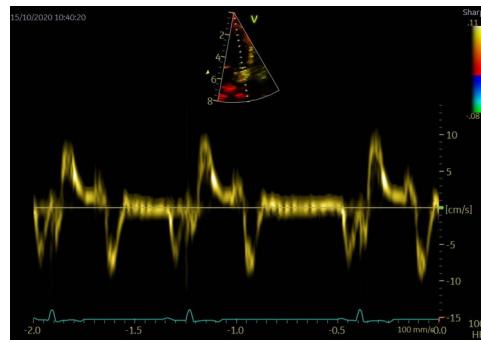
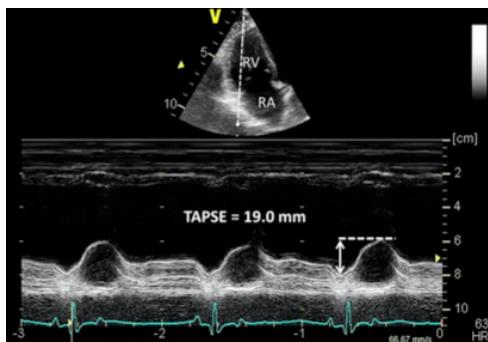
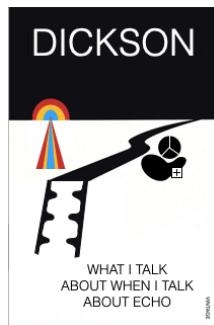
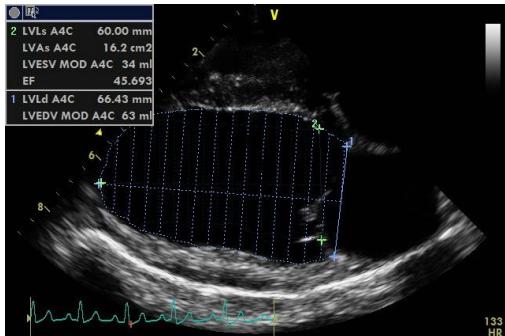
Tomoya Morita DVM, Kensuke Nakamura DVM PhD, Tatsuyuki Osuga DVM PhD ... See all authors ▾

Right ventricular function and dyssynchrony measured by echocardiography in dogs with precapillary pulmonary hypertension ☆

T. Morita DVM, PhD<sup>a</sup>, K. Nakamura DVM, PhD<sup>b</sup>, T. Osuga DVM, PhD<sup>c</sup>, K. Morishita DVM, PhD<sup>c</sup>, N. Sasaki DVM, PhD<sup>a</sup>, H. Ohta DVM, PhD<sup>a</sup>, M. Takiguchi DVM, PhD<sup>a</sup>

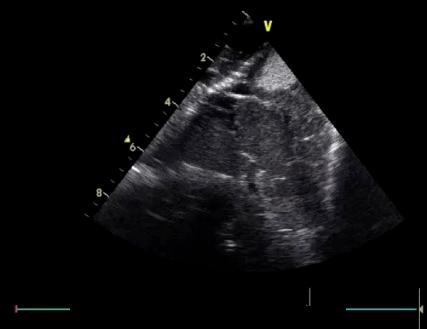
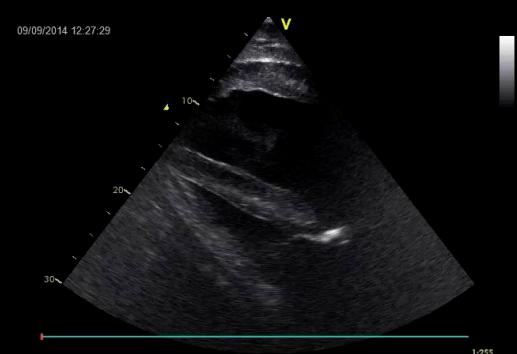
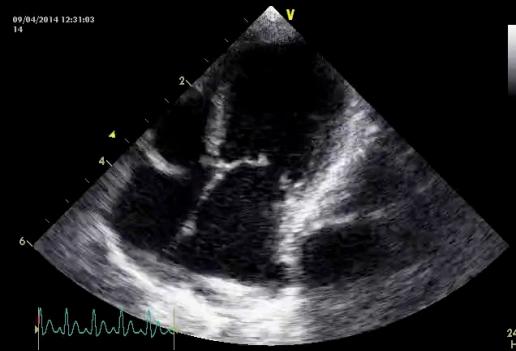
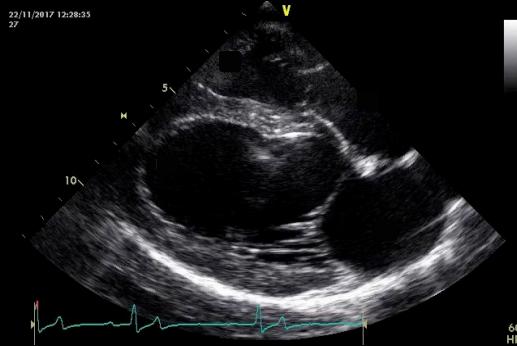


# Thoughts on all this fancy echo stuff

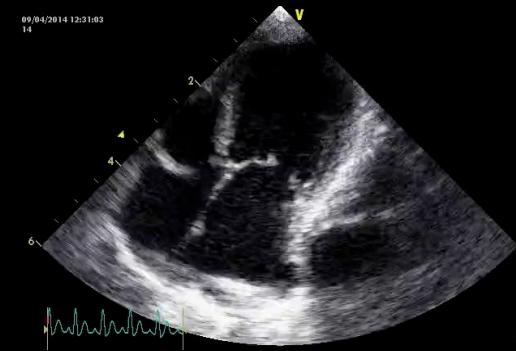
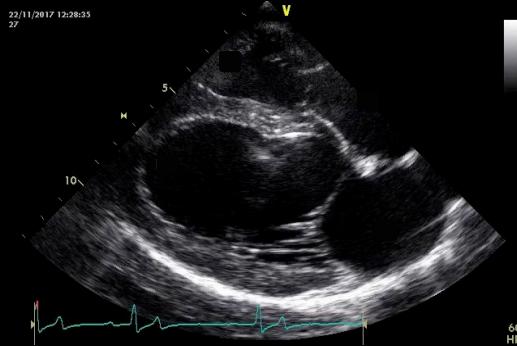


HeartVets

# Wake up, it's Quiz time!

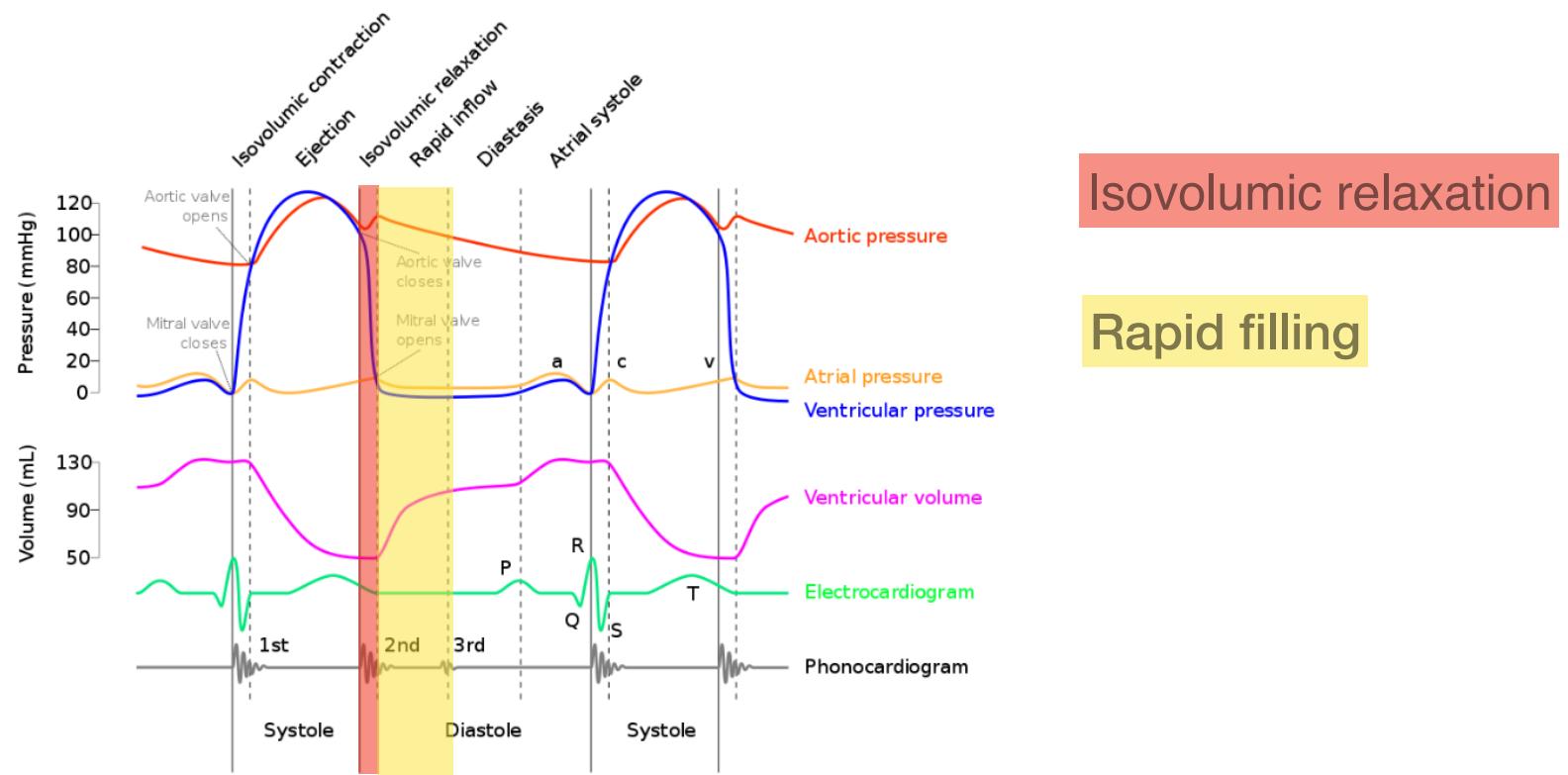


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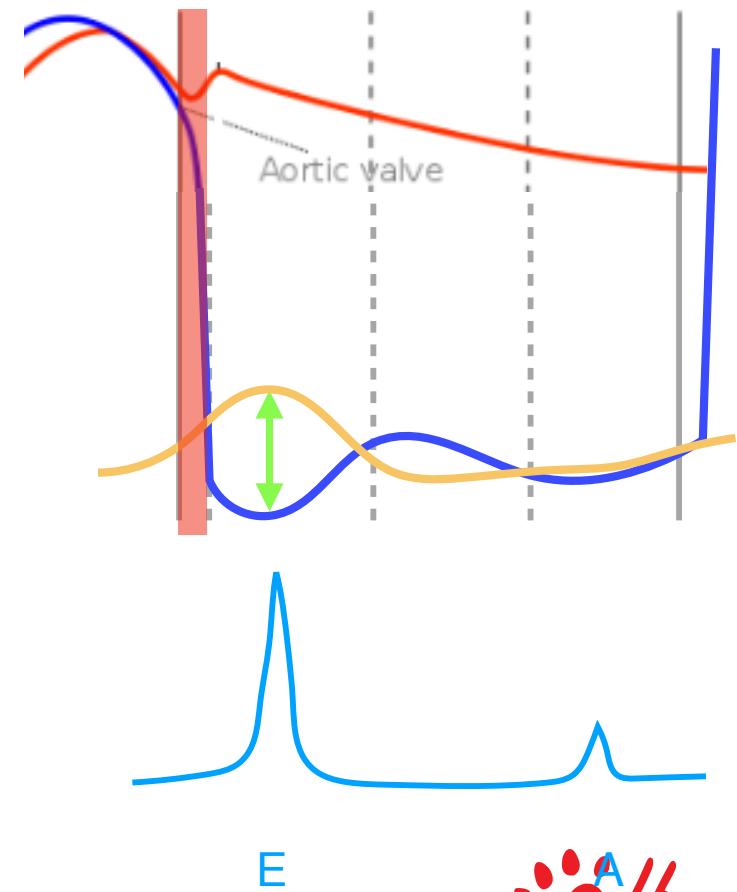
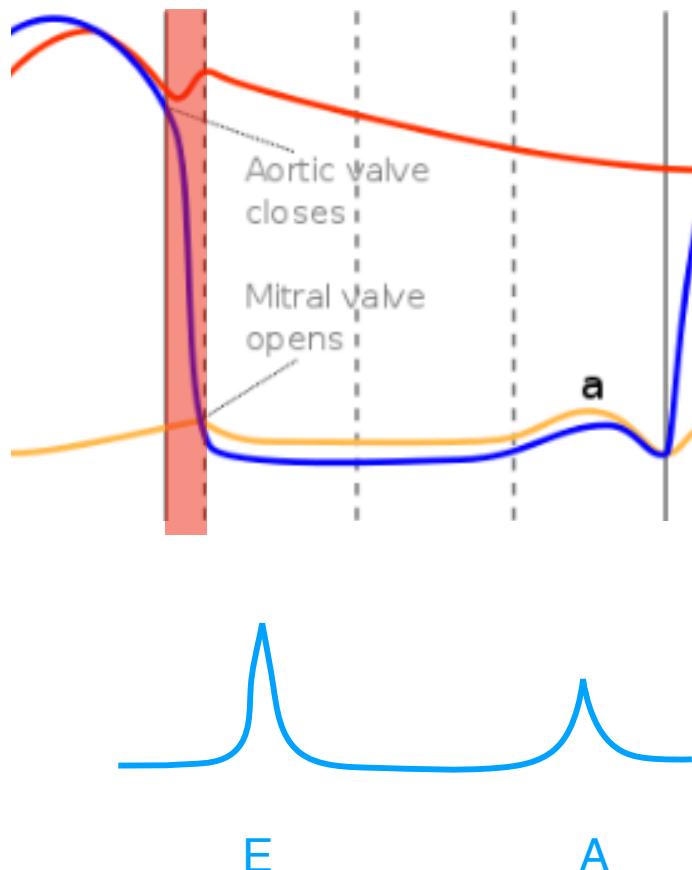


• HeartVets

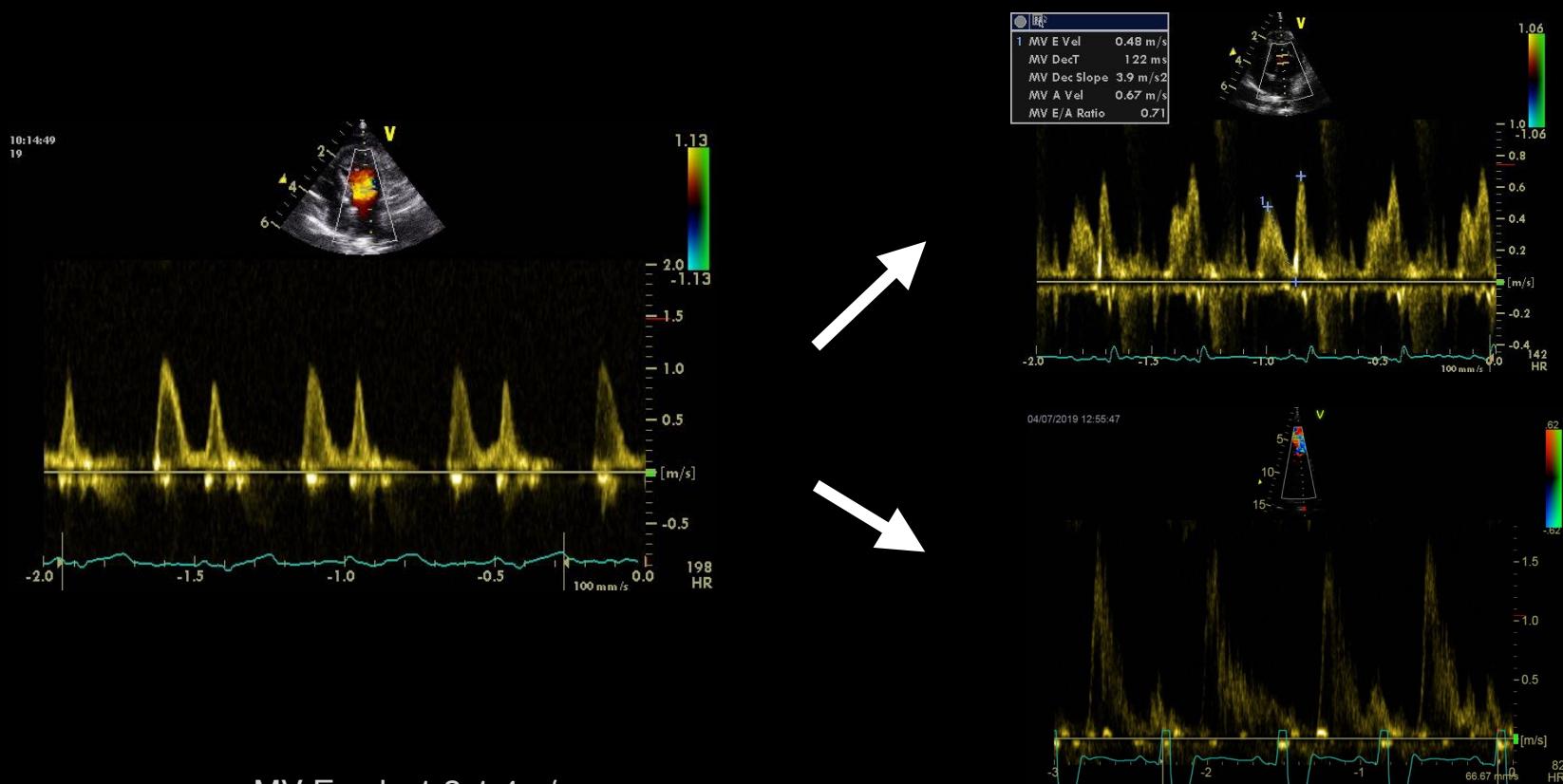
# Diastolic Function and Filling Pressures



# Diastolic Function and Filling Pressures



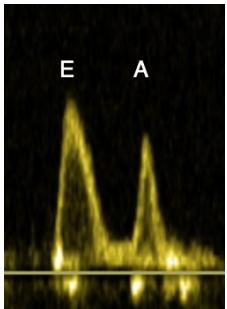
# Mitral inflow in CHF



Borgarelli JVIM 2008, Nakamura JVIM 2014, Sargent JVC 2015)

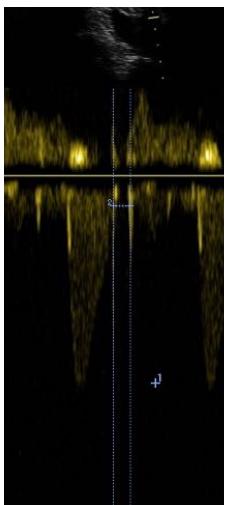


# Mitral inflow velocity



$MV\ E \propto LAP\ (LVFP)$

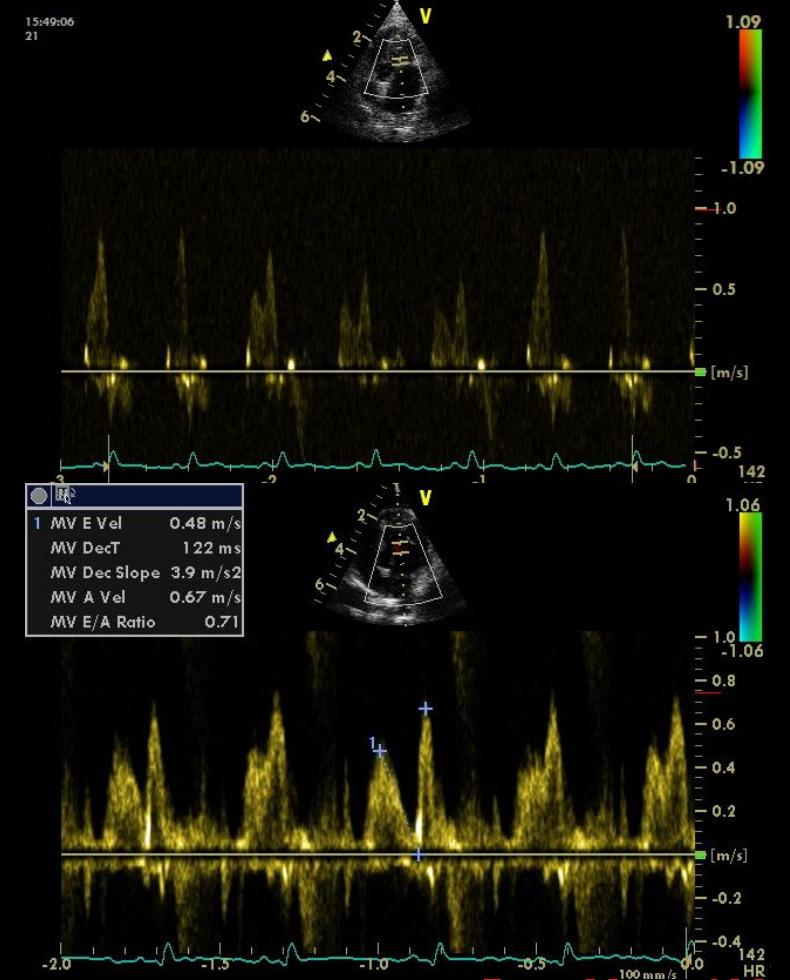
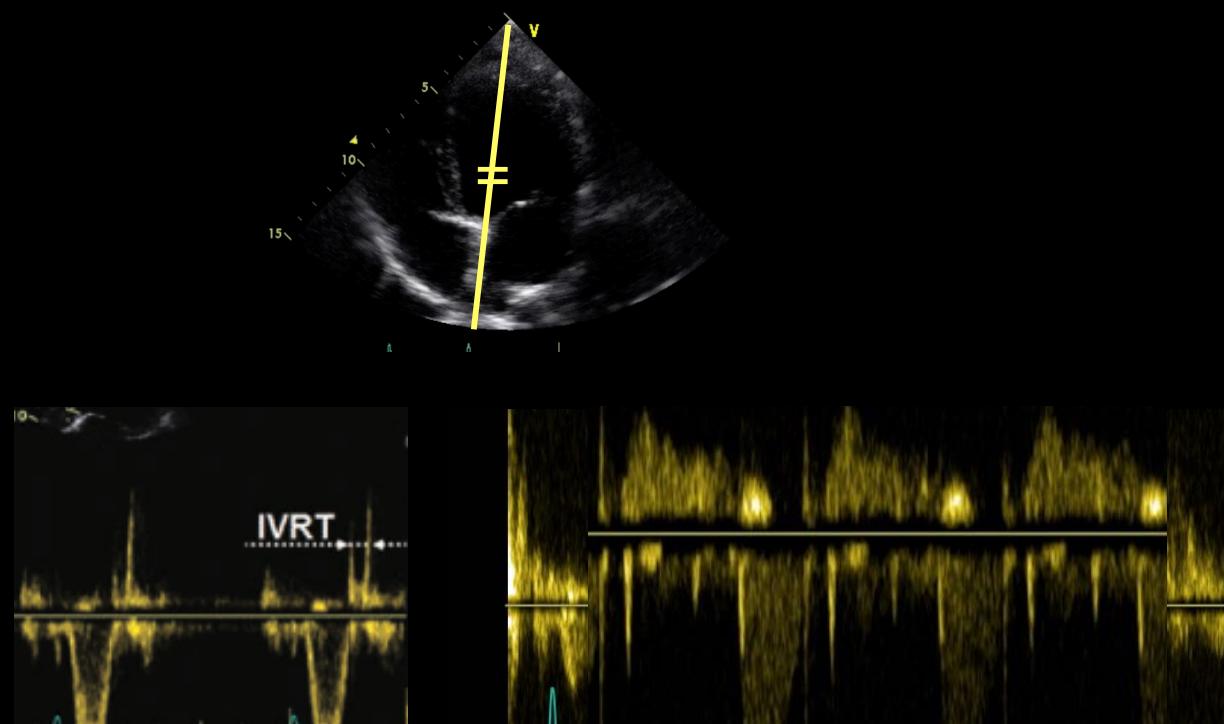
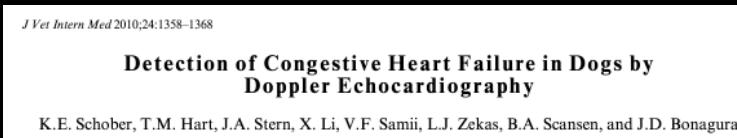
$MV\ E \propto LVFP \times LV\ relaxation\ (incl\ age\ &\ HR)$



$$\frac{MV\ E}{IVRT} \propto \frac{LVFP \times LV\ relaxation}{LV\ relaxation}$$

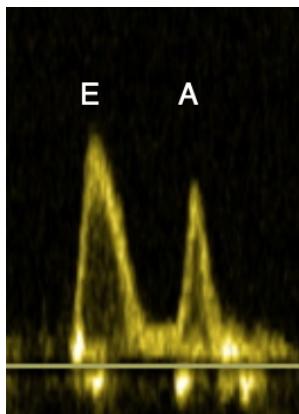
$$E/IVRT \propto LVFP$$

# E/IVRT

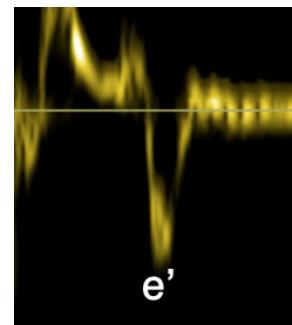


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# Tissue Doppler Imaging and diastolic function



$MV\ E \propto LVFP \times LV\ relaxation$



$TDI\ e' \propto 1/LV\ relaxation$

$$E/e' \propto LVFP$$

$$\frac{MV\ E}{TDI\ e'} \propto \frac{1 \times LVFP \times LV\ relaxation}{LV\ relaxation}$$

Table 1

Situations where the use of E/e' may be unreliable

Tachycardia with fusion of E and A velocities

Unreliable measurement of E velocity

Significant mitral regurgitation (>2+)

Unreliable measurement of e' velocity

- Mitral valve repair or replacement
- Severe mitral annular calcification
- Significant mitral stenosis
- Presence of left atrial fibrillation

J Cardiovasc Ultrasound. 2011 Dec; 19(4): 169–173.

Published online 2011 Dec 27. doi: 10.4250/jcu.2011.19.4.169



PMCID: PMC3259539

PMID: 22259658

Use and Limitations of E/e' to Assess Left Ventricular Filling Pressure by Echocardiography

Jae-Hyeong Park, MD, PhD<sup>1,2</sup> and Thomas H. Marwick, MD, PhD<sup>3,4</sup>

# Doppler estimates of filling pressure

## **Estimation of left ventricular filling pressure by use of Doppler echocardiography in healthy anesthetized dogs subjected to acute volume loading**

Karsten E. Schober, Dr med vet, PhD; John D. Bonagura, DVM, MS; Brian A. Scansen, DVM, MS;  
Joshua A. Stern, DVM; Nicole M. Ponzio, DVM, MS

*J Vet Intern Med* 2008;22:578–585

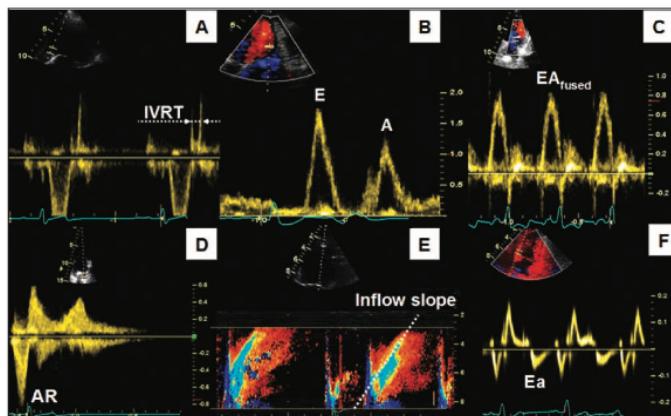
### **Estimation of Left Ventricular Filling Pressure by Doppler Echocardiography in Dogs with Pacing-Induced Heart Failure**

K.E. Schober, J.A. Stern, D.N.Q.T. DaCunha, A.M. Pedraza-Toscano, D. Shemanski, and R.L. Hamlin

*J Vet Intern Med* 2010;24:1358–1368

### **Detection of Congestive Heart Failure in Dogs by Doppler Echocardiography**

K.E. Schober, T.M. Hart, J.A. Stern, X. Li, V.F. Samii, L.J. Zekas, B.A. Scansen, and J.D. Bonagura



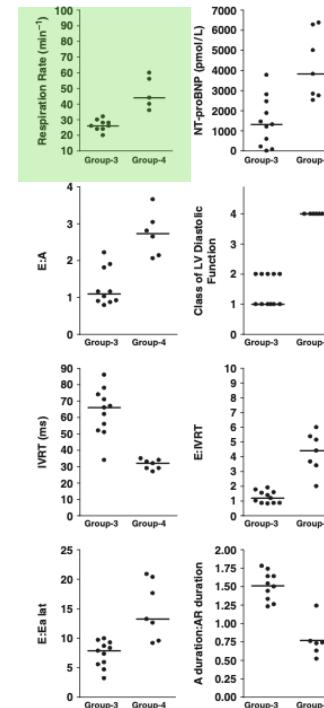
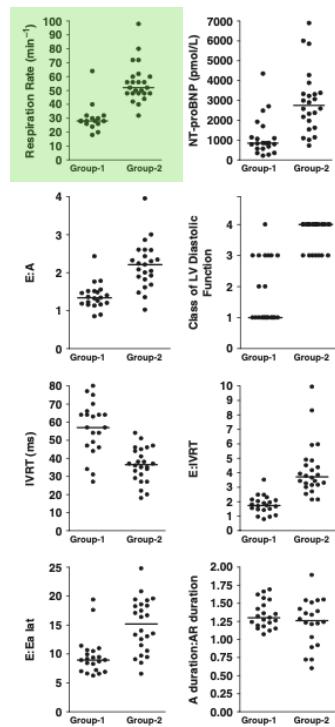
# Doppler estimates of filling pressure

J Vet Intern Med 2010;24:1358–1368

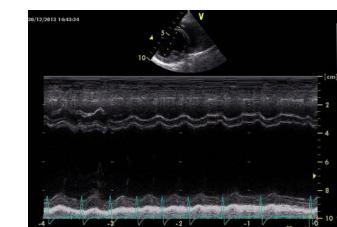
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K.E. Schober, T.M. Hart, J.A. Stern, X. Li, V.F. Samii, L.J. Zekas, B.A. Scansen, and J.D. Bonagura

E/IVRT



>2.5



>1.9

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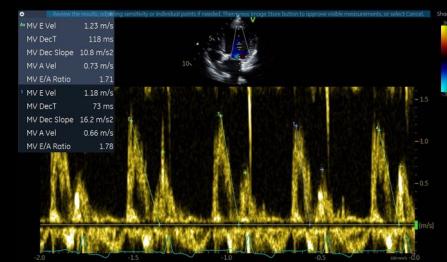
# Case Example



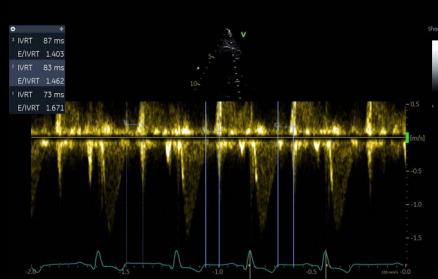
"lolo"



LVDDN 2.1  
LA:Ao 1.95



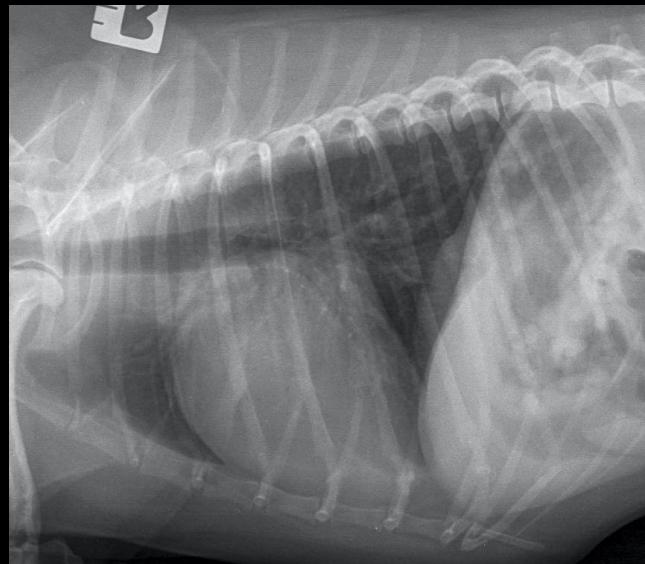
E/IVRT 1.5



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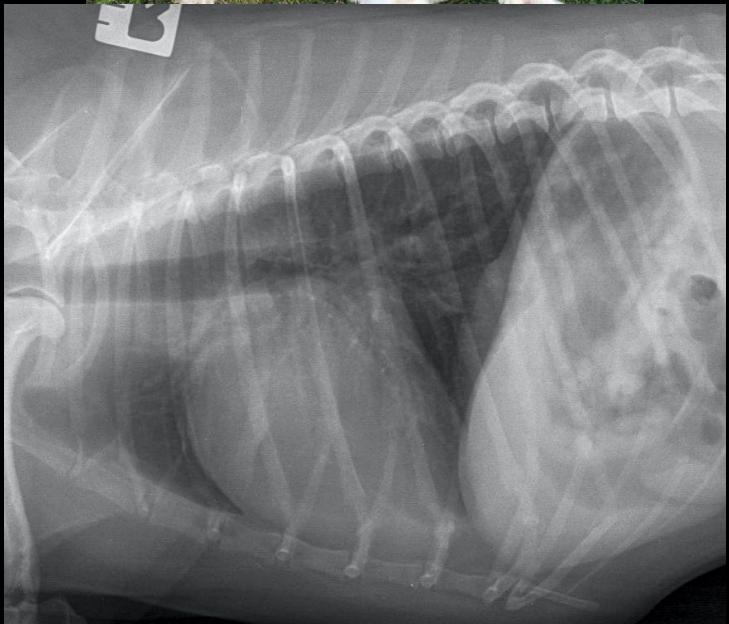
## Case Example



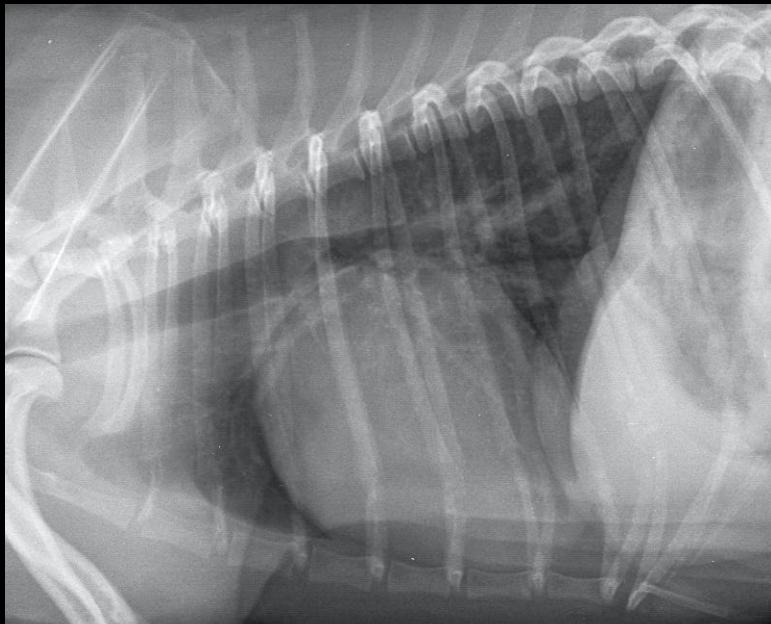
Dec 2019

LVDDN = 2  
LA:Ao = 1.85  
MV E = 1m/s  
IVRT = 78ms  
E/IVRT = 1.34

# Case Example



Dec 2019



July 2020



July 2020

 HeartVets

The logo for HeartVets, featuring a red paw print icon followed by the brand name in a stylized red font.



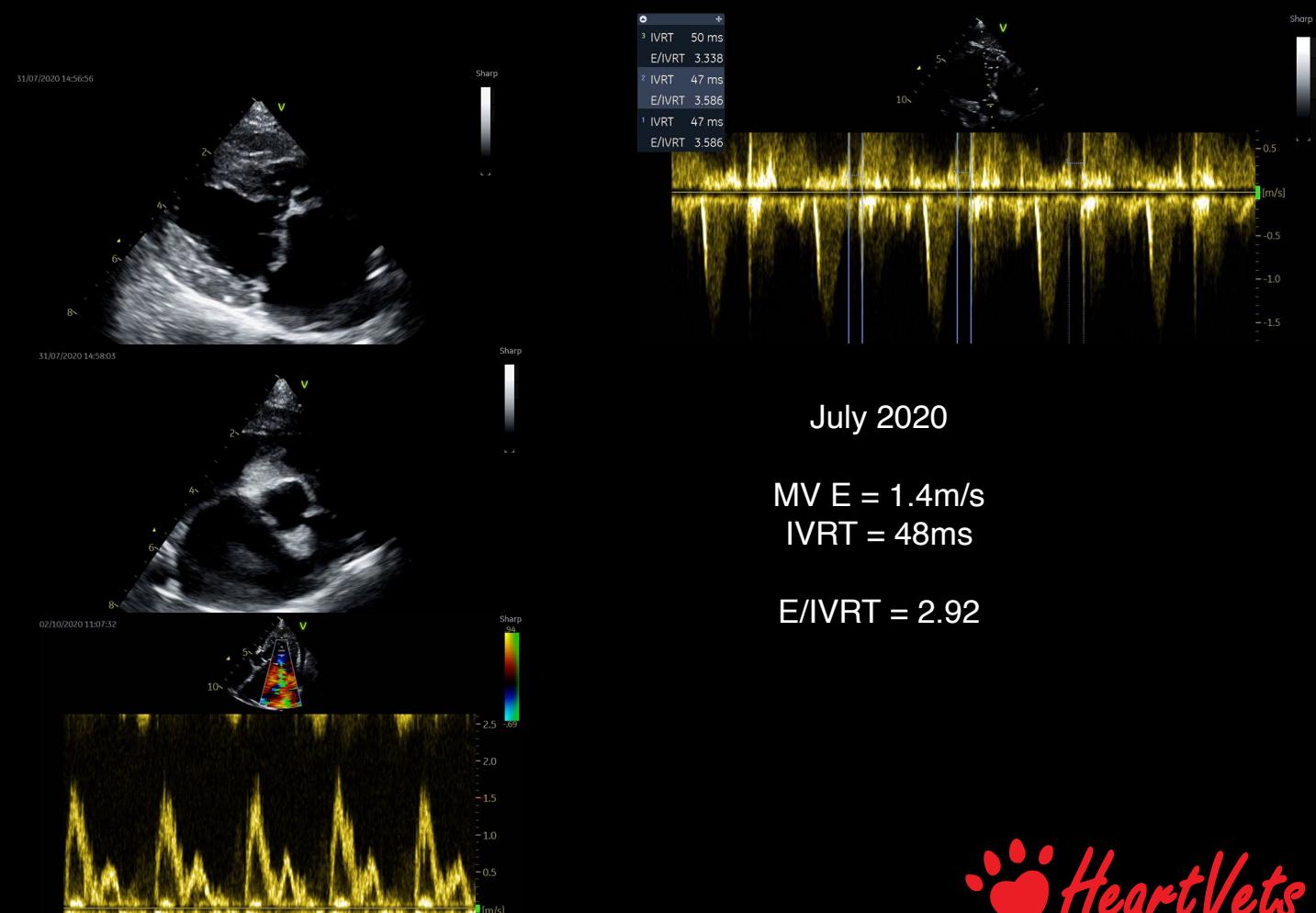
# Case Example

Dec 2019

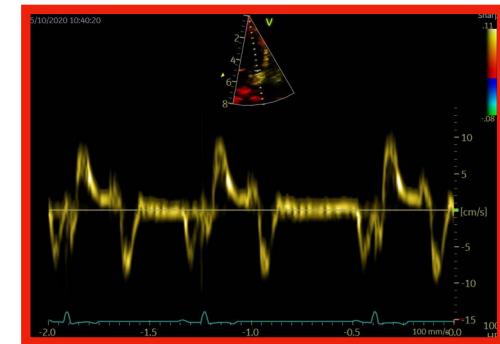
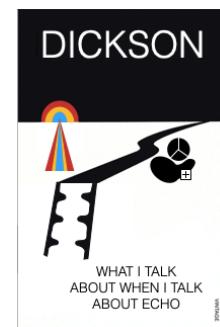
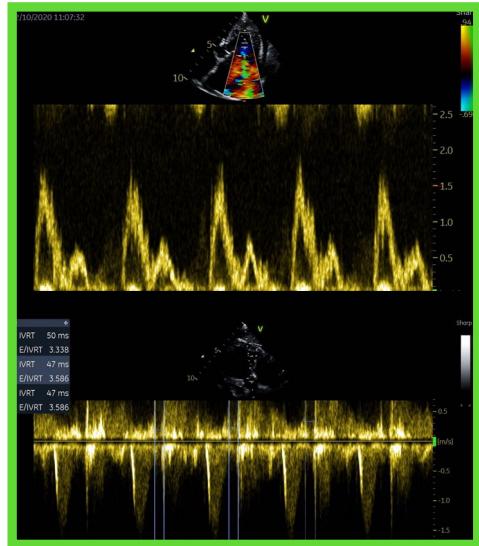
LVDDN = 2  
LA:Ao = 1.85  
MV E = 1m/s  
IVRT = 78ms  
E/IVRT = 1.34

July 2020

LVDDN 2  
LA:Ao 2.1



# Thoughts on all this fancy echo stuff



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