78° CONVEGNO

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Left atrioventricular coupling index: an echocardiographic index of atrioventricular disfunction in dogs with myxomatous mitral valve disease

Federica Valeri

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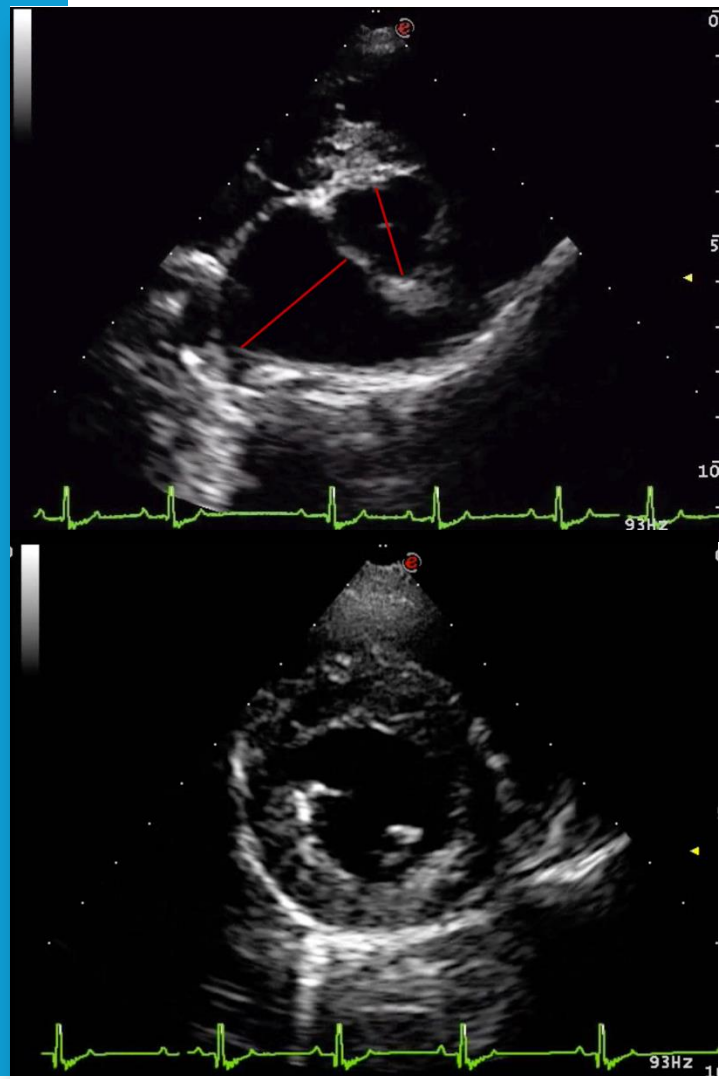
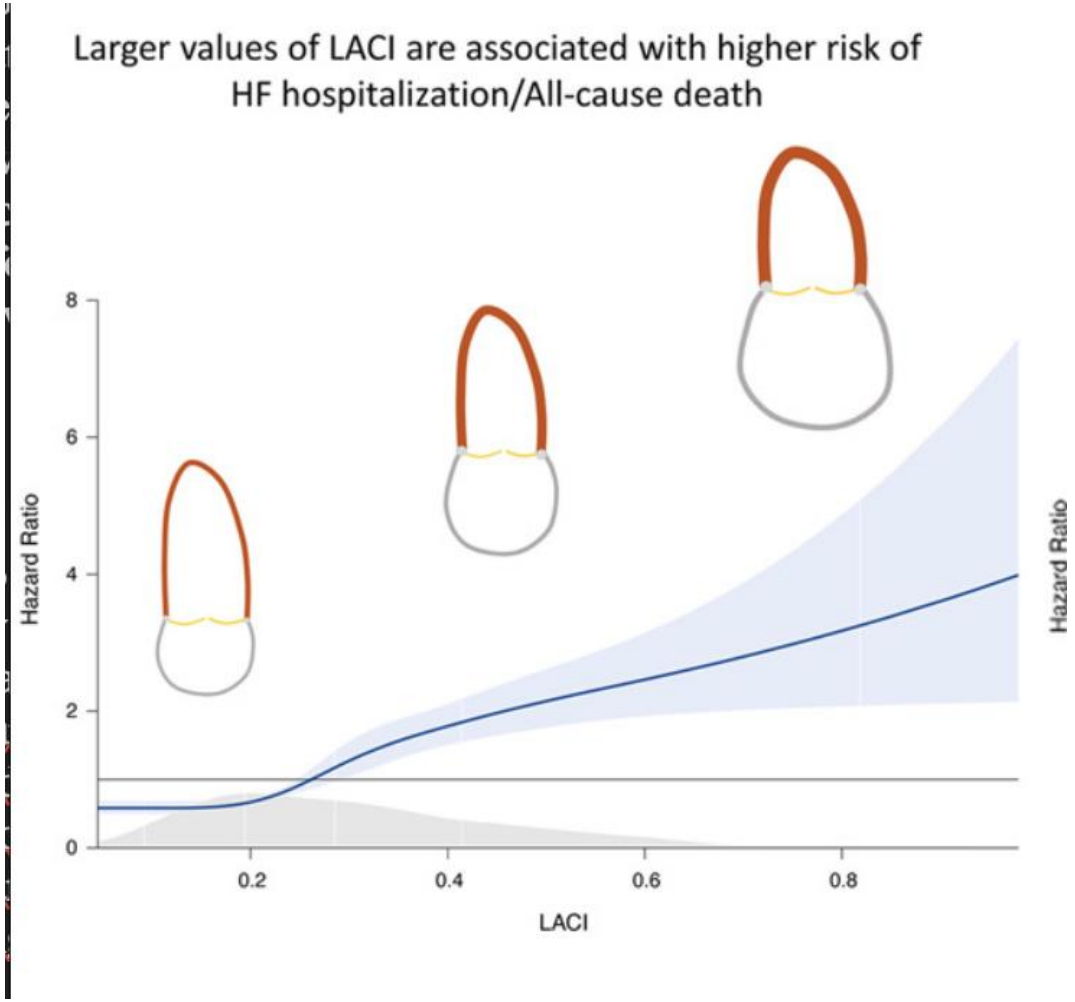


Background

- Common echocardiographic indices assess single cardiac chamber dimension and function
- Atrial and ventricular chambers operate as a tightly coordinated unit during the cardiac cycle

Background

- Left atrioventricular coupling index (LACi)
  - *LAVmin/LV end-diastolic volume*
- Early marker of cardiovascular dysfunction in human medicine (HF, AMI, HCM/AF, atherosclerosis, diabetes)
- What about veterinary medicine?



«Left Atrioventricular Coupling Index: A Novel Diastolic Parameter to Refine Prognosis in Heart Failure. F. Fortuni et al.»

Aim

To investigate the LACi in healthy and MMVD dogs

Materials and Methods

- Retrospective study (Jan. 2017 - Feb. 2025)
- University Teaching Hospital, Perugia
- 233 dogs:
  - 105 healthy
  - 128 with MMVD (ACVIM B1 = 38, B2 = 52, C = 38) *ACVIM Consensus guidelines*

Inclusion criteria

- Complete medical records
- Adequate image quality (A4C view)
- Sinus rhythm (no persistent arrhythmias)
- All breeds, ages (>1 y) , sexes, body weights

Materials and Methods

Volume Measurements

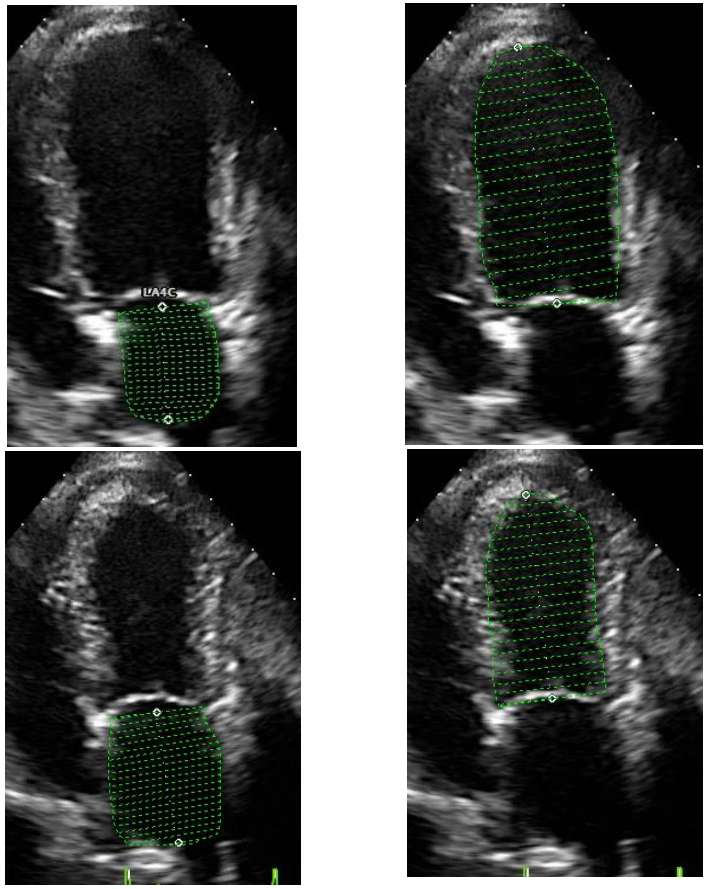
- LA & LV volumes measured (Simpson's method):
  - **End-diastole**: frame after mitral valve closure (~QRS onset)
  - **End-systole**: frame before mitral valve opening (~end of T wave)
  - Manual tracing excluding pulmonary veins (LA), including papillary muscles (LV)

LACi Formulas

- **LACi-ED (%)** = (LAEDV / LVEDV) × 100
- **LACi-ES (%)** = (LAESV / LVESV) × 100

Additional Parameters

- LA:Ao, LVIDDn
- Composite severity score: LA:Ao + LVIDDn

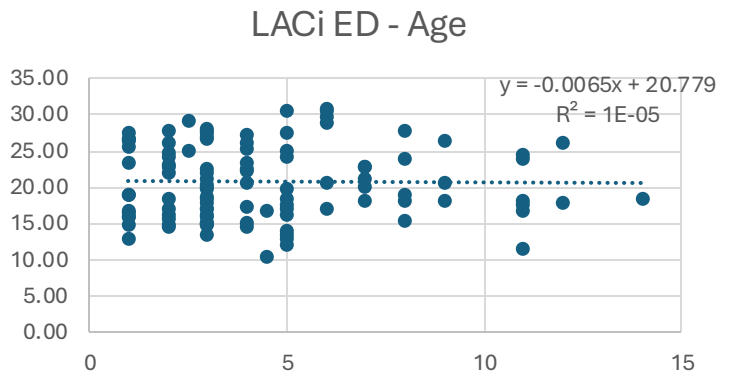


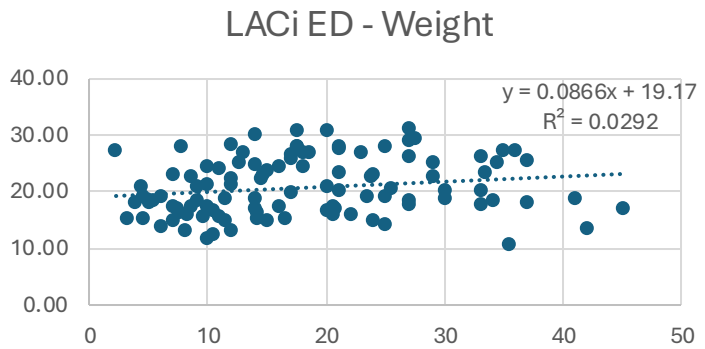
Results

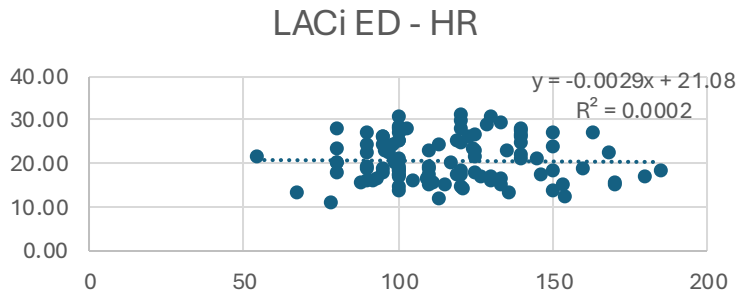
LACi-ED and LACi-ES were **not correlated** with:

- Age
- Bodyweight
- Heart rate

Coefficient of determination (R^2) < 0.03 for all variables







linear regression analysis

Results

Reference Values for healthy dogs

RefValAdvisor 2.3

Method	Untransformed data Standard	Untransformed data Robust	Box-Cox transformed data Standard	Box-Cox transformed data Robust	Nonparametric
N	105	105	105	105	105
Mean	20,7		7,1		
Median	20,0	20,6	6,9	7,1	
SD	5,1	5,2	2,6	2,6	
Mininum	10,68	10,68	1,2	1,2	
Maximum	31,01	31,01	12,0	12,0	
λ_1 coefficient Box-Cox			-8,291	-8,291	
λ_2 coefficient Box-Cox			0,727	0,727	
P-Value Anderson-Darling/	0,001		0,009		
Symmetry test for Robust		0,140		0,312	
Outliers Dixon					
Outliers Tukey	0	0	0	0	
Suspect data Tukey	0	0	0	0	
Lower limit of reference interval	10,6	10,4	11,7	11,6	12,1
Upper limit of reference interval	30,9	30,8	31,6	31,7	30,8
90% CI for lower limit	9,7	8,9	10,9	10,7	10,7
	11,7	11,6	12,6	12,5	13,4
90% CI for upper limit	29,4	29,4	30,2	30,1	29,0
	32,0	32,0	33,1	33,3	31,0

LACi-ED

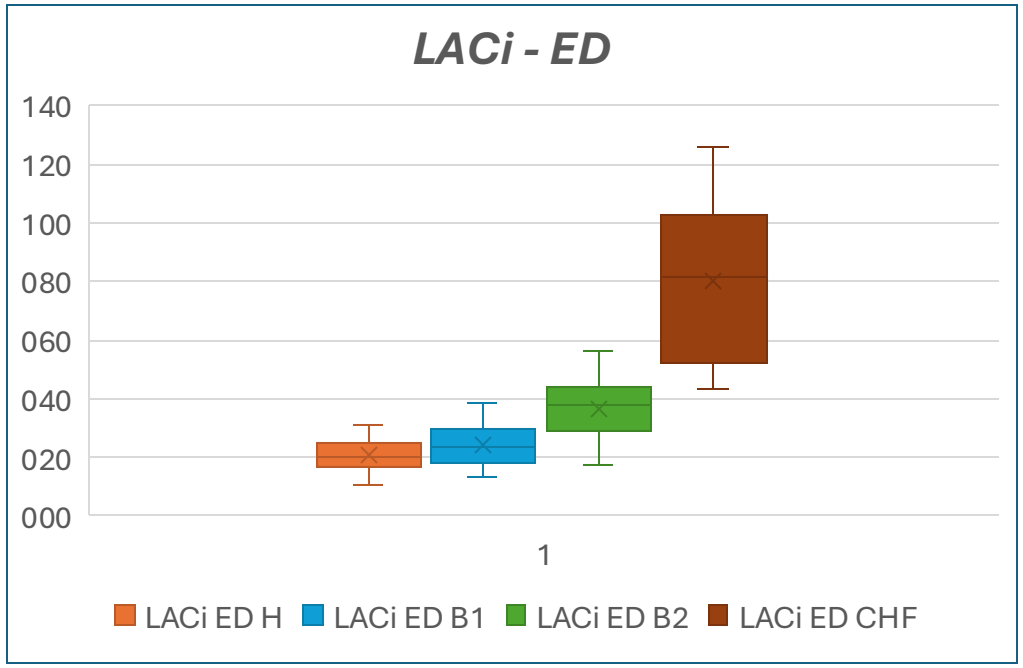
Method	Untransformed data Standard	Untransformed data Robust	Box-Cox transformed data Standard	Box-Cox transformed data Robust	Nonparametric
N	105	105	105	105	105
Mean	70,5		18,7		
Median	67,7	68,9	18,2	18,6	
SD	19,6	19,9	6,5	6,6	
Mininum	27,81	27,81	0,4	0,4	
Maximum	116,83	116,83	32,7	32,7	
λ_1 coefficient Box-Cox			-26,365	-26,365	
λ_2 coefficient Box-Cox			0,706	0,706	
P-Value Anderson-Darling/	0,058		0,683		
Symmetry test for Robust		0,539		0,860	
Outliers Dixon					
Outliers Tukey	0	0	0	0	
Suspect data Tukey	0	0	1	1	
Lower limit of reference interval	31,5	29,5	36,1	35,9	34,9
Upper limit of reference interval	109,5	108,3	113,1	113,0	115,3
90% CI for lower limit	26,5	24,5	33,1	32,9	27,8
	37,3	34,8	39,9	39,7	42,1
90% CI for upper limit	104,0	101,9	106,6	106,2	106,6
	115,3	114,5	120,1	120,5	116,8

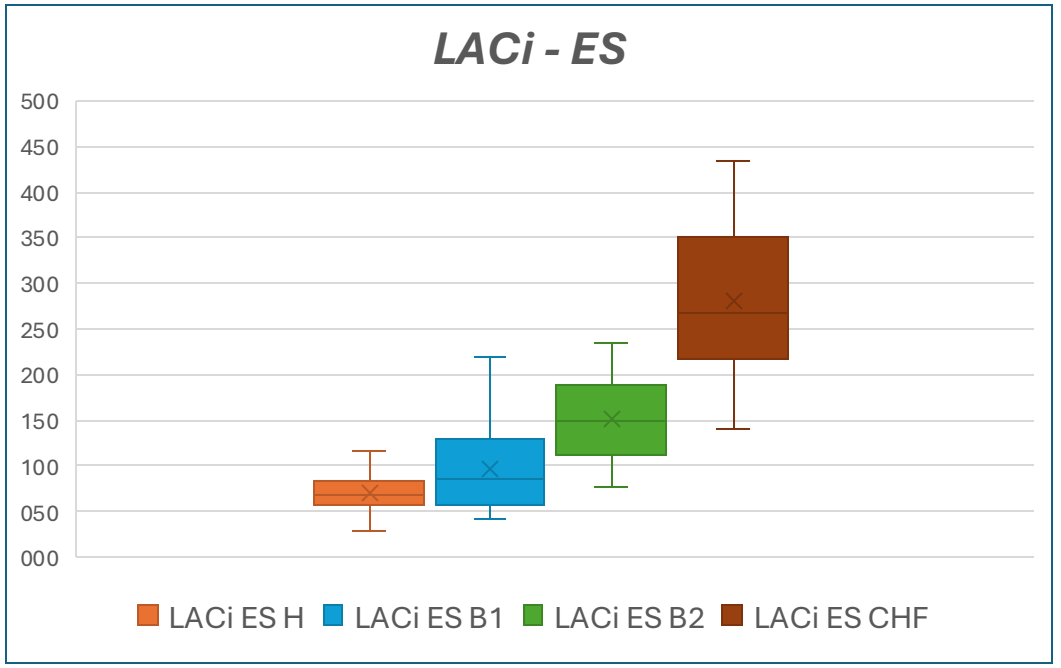
LACi-ES

Results

LACi and ACVIM stages

Kruskal-Wallis test





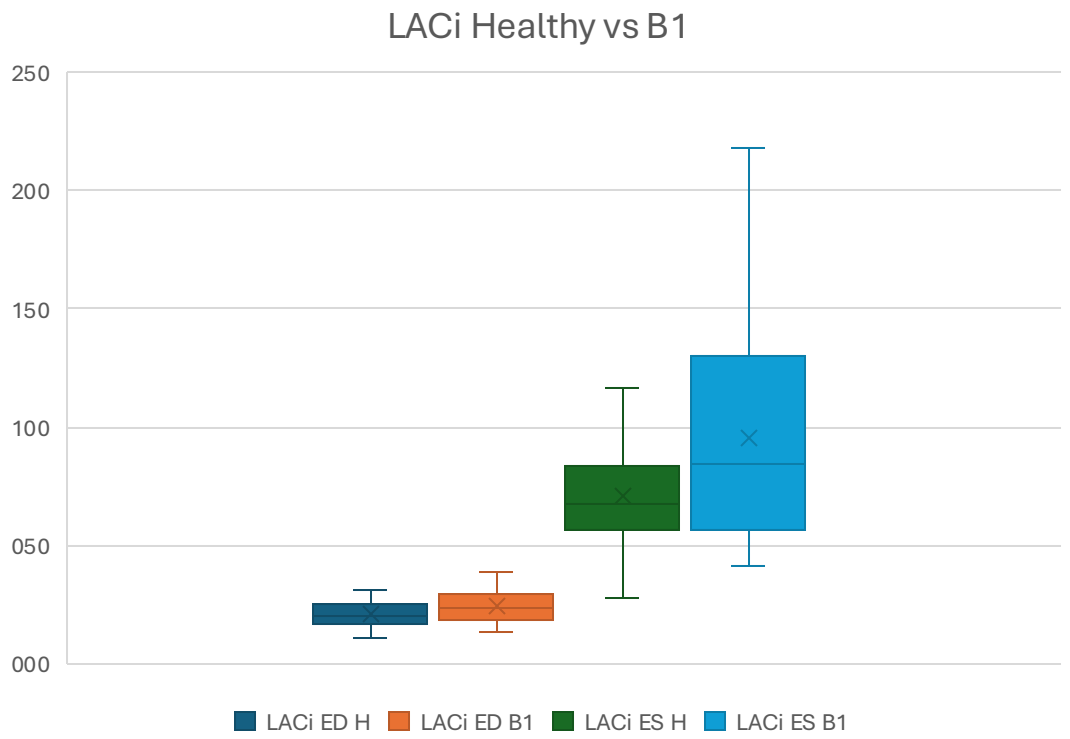
- Significant difference in both LACi-ED and LACi-ES between ACVIM stages
- **P < 0.00** (LACi-ED) and **P < 0.02** (LACi-ES) for all pairwise comparisons

Results

Healthy vs B1 stage dogs

No significant difference in LACi-ED and LACi-ES between healthy dogs and ACVIM B1

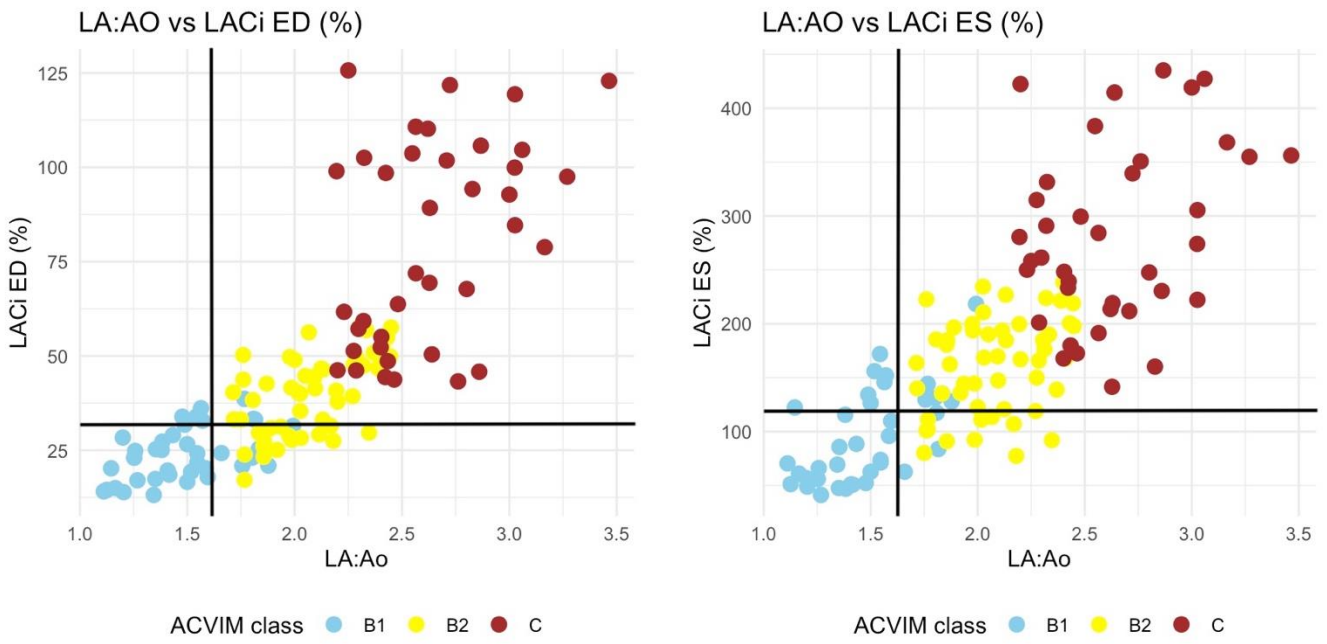
P > 0.20 *for both*



Results

LA:Ao vs LACi

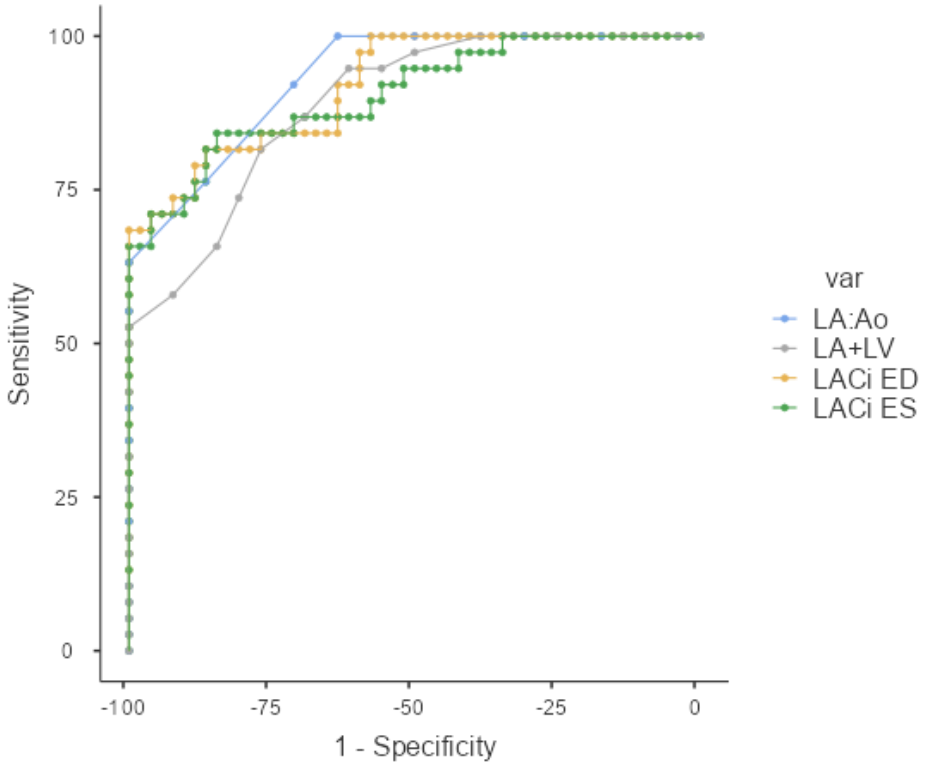
- **Few** dogs in ACVIM stage B1 show impaired AV coupling
- **Many** dogs in ACVIM stage B2 show impaired AV coupling
- **All** dogs in ACVIM stage C show impaired AV coupling



Results

Diagnostic accuracy of CHF

	Cutpoint	*Sensitivity*	*Specificity*	*PPV*	*NPV*	*Youden's index*	*AUC*	*Metric Score*
LACi ED	51.33	78.95%	88.46%	83.33%	85.19%	0.674	0.92	1.67
LACi ES	201.09	84.21%	84.62%	80%	88%	0.688	0.906	1.69
LA:Ao	2.2	100%	63.46%	66.67%	100%	0.635	0.932	1.63
LA:Ao + LVIDDn	4.3	81.58%	76.92%	72.09%	85.11%	0.585	0.89	1.59



ROC analysis

Discussion

- **Progressive impairment of AV coupling** with increasing MMVD severity
- No significant difference **healthy vs stage B1** dogs - as in ACVIM guidelines
  - Few dogs show impaired AV coupling
- **Stage B2 dogs** show heterogeneity
  - Preserved AV coupling in some dogs - impaired AV coupling in others
  - Many B2 dogs show **early signs of AV dysfunction**
  - Emphasizes the need for better stratification for dogs in stage B2
- **Stage C dogs** show consistent and marked **impaired AV coupling**
  - No better than conventional markers for identifying CHF

Conclusions

- Our study is the first study on LACi in dogs
- LACi is a novel, noninvasive and easily obtainable index for evaluating left AV coupling
- LACi could help in identifying disease severity in B2 dogs
- A prospective studies are needed to assess its prognostic value

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Thank you!

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