Here are some of the preliminary findings from our study:

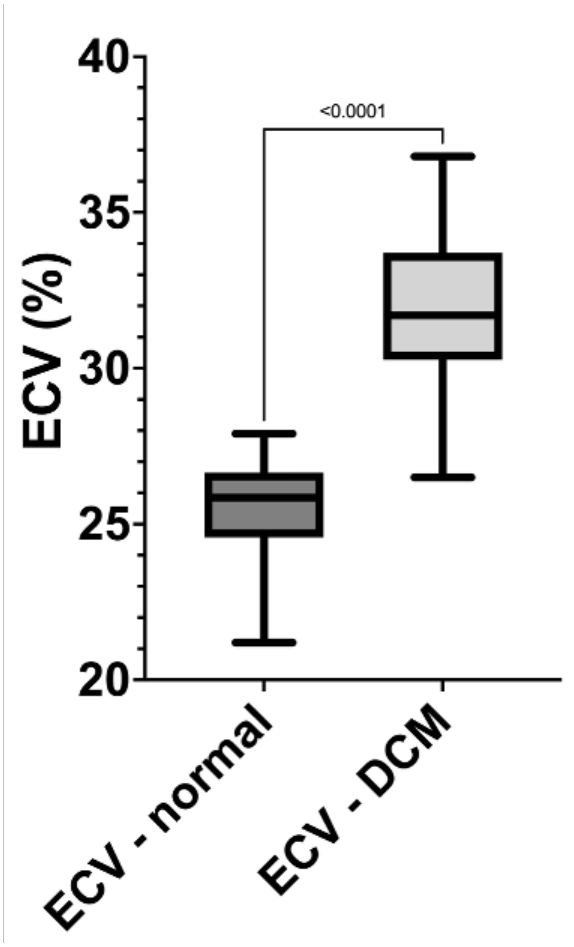
1. When comparing echocardiography to cardiac MRI in the Doberman, echocardiography underestimates the size of the left ventricle in both systole and diastole. This finding was true in both the normal and DCM affected dogs. Interestingly, the discrepancy became worse as the left ventricle becomes more dilated. This is likely because echocardiography cannot image the entire ventricle at once and the remodeling from DCM is not uniform, thus echocardiography assumes a uniform shape and misses some of the unique ways the ventricle changes during progression of DCM.

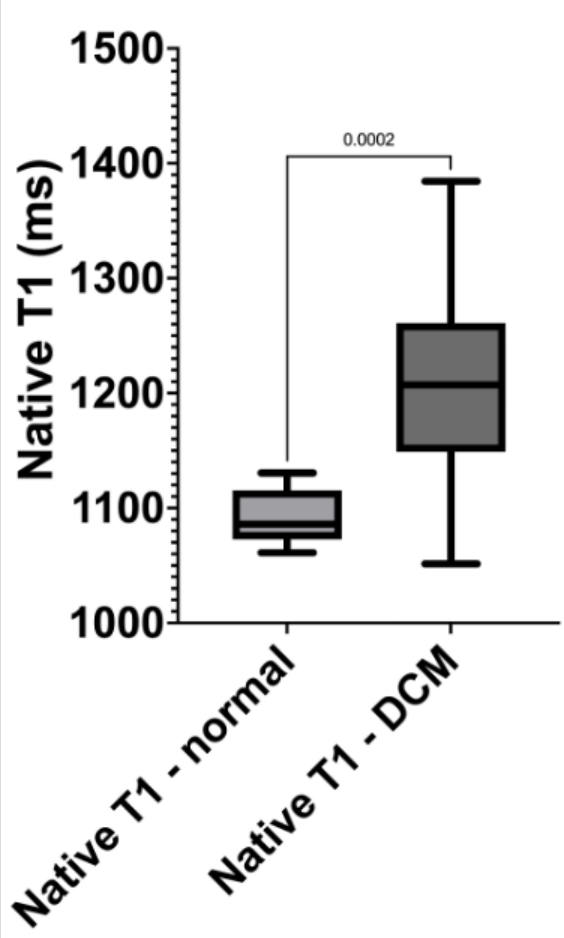
CMR for Cardiomyopathies

- Modality comparison
  - Echocardiography underestimates LV size
  - Underestimation increases with disease severity
    - LVEDV normal = -6.7%, DCM = -9.2%
    - LVEDS normal = -6.9%, DCM = -14.9%

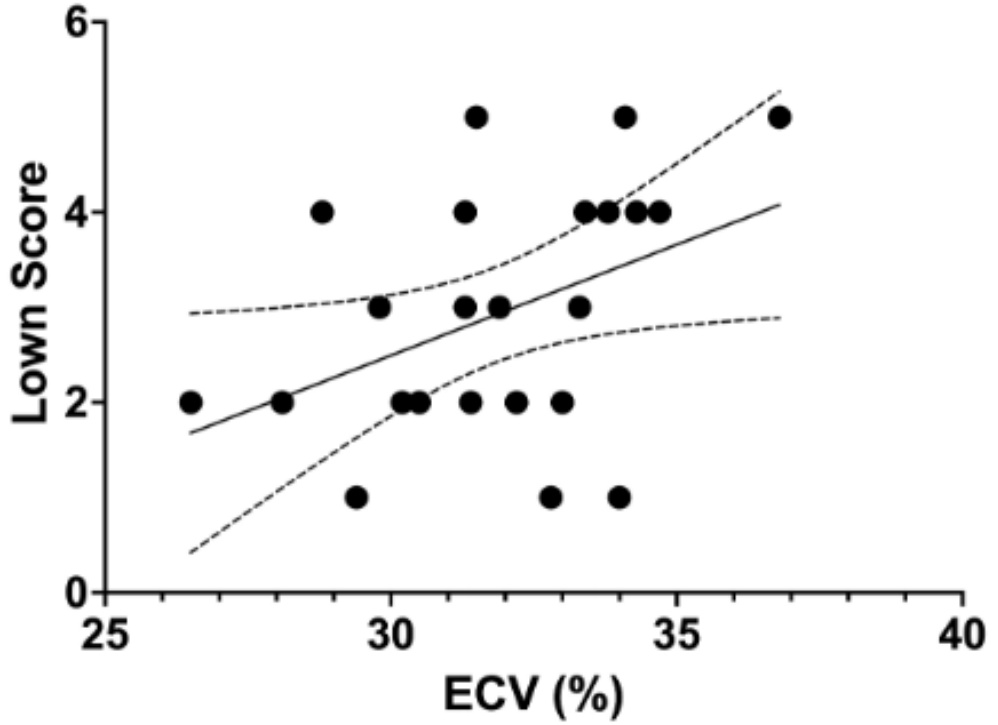
Group	Echo LVEDV (mL)	CMR LVEDV (mL)	Mean Difference (mL)	95% CI	Echo LVESV (mL)	CMR LVESV (mL)	Mean Difference (mL)	95% CI
Healthy	77.9 ± 14.3	83.5 ± 13.6	5.6 ± 3.7	3.0 – 8.2	39.0 ± 6.5	41.7 ± 7.0	2.7 ± 1.4	1.7 – 3.7
DCM	107.0 ± 12.7	117.8 ± 13.0	10.8 ± 5.7	8.4 – 13.2	58.4 ± 10.5	68.5 ± 12.0	10.2 ± 4.5	8.3 – 12.0

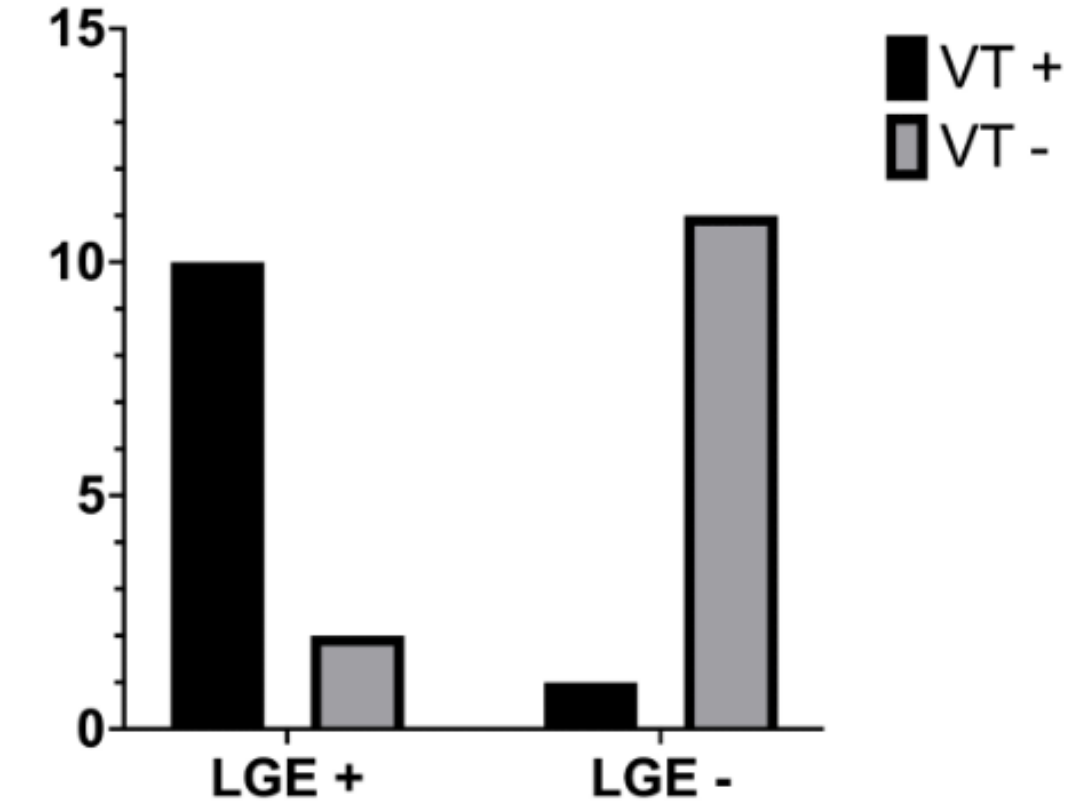
2. Our primary objective was to characterize myocardial fibrosis using MRI based on native T1 and ECV. Unsurprisingly, dogs with DCM have significantly higher measures of myocardial fibrosis than do healthy dogs.



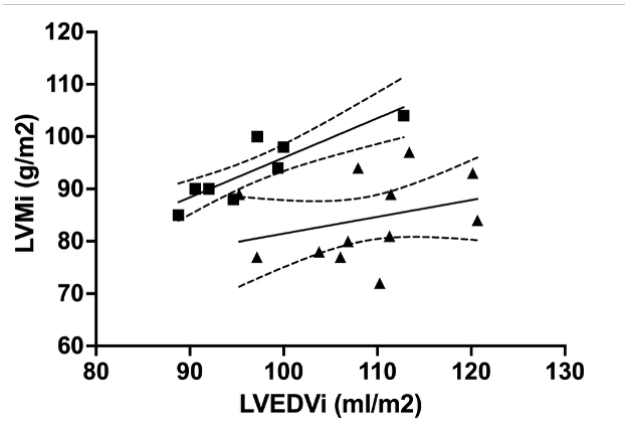


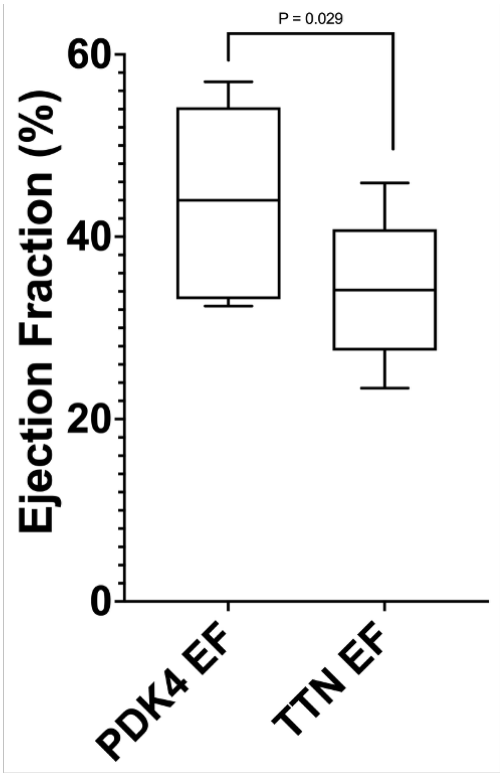
3. Interestingly, we found that ~50% of Doberman in our study had evidence of late gadolinium enhancement (LGE) on MRI. This is indicative of scar formation (not necessarily an infarct) and in people is a possible substrate for significant arrhythmia. When comparing dogs with and without LGE, we did in fact find a positive correlation with LGE and worse arrhythmia score ($R^2 = 0.18$, $P = 0.036$) and an increased likelihood of detecting ventricular tachycardia on a Holter monitor (Relative Risk = 2.5, 95% CI 1.5 - 7.3). 91% of LGE+ dogs had VT on Holter monitor.


Lown Score
6
4
2
0
25
30
35
40
ECV (%)


15
10
5
0
VT +
VT -
LGE +
LGE -

4. Finally, we have information on the influence of genotype with respect to phenotype expression in these dogs. All dogs had genetic data regarding the PDK4 and TTN mutations. Dogs with TTN mutations had significantly larger left ventricular dimensions in both diastole and systole compared with PDK4. And as a result, dogs with TTN mutations have worse myocardial function (ejection fraction, EF%) and their dilation to mass ratio was worse (i.e., they had more dilation with less increase in myocardial mass) when compared to PDK4 dogs.





5. After our final few enrollments, we intent to complete analysis of the data which will include assessment to MRI T2 data, which is a measure of myocardial inflammation. It is unknown if Doberman pinschers with DCM have active inflammation during the disease. We will quantify all of our blood biomarkers to determine the correlation of circulating troponin, NTproBNP, and galectin-3 with cardiac MRI and Holter monitoring findings. And finally, where applicable we intend to report any follow up endpoints which could include dogs who develop congestive heart failure, sudden cardiac death, and all-cause mortality.