Valvular Stenosis

Presented by
Society for Cardiovascular Magnetic Resonance

1 Background

While echocardiography is the first-line test to assess valvular heart disease, studies can be limited by image quality, discrepant findings, or poor correlation with clinical picture. CMR may provide better answers.

2 Why CMR

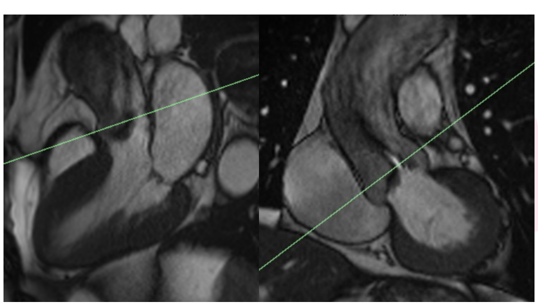
- High diagnostic accuracy due to excellent image resolution.
- Good image quality independent of body habitus.
- One-stop shop:
  - Aortic stenosis – morphology, valve area, velocity
  - Left ventricle – morphology, function, and tissue characterization.
  - Ascending aorta – diameter measurement
- CMR can assess valve at desired position and angle.
- No ionizing radiation.

3 Appropriate Use Criteria

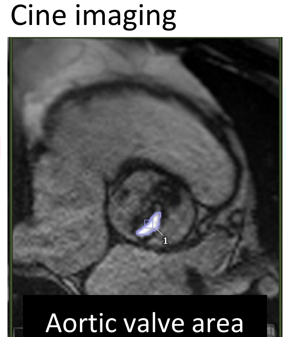
Aortic stenosis	Class II
Identification of sub-and supra-valvular stenosis	Class I
Pulmonary stenosis	Class I
Mitral stenosis	Class III
Tricuspid stenosis	Class III

Leiner T, et al. SCMR Position Paper (2020) on clinical indications for CMR. J Cardiovasc Magn Reson. 2020;22:76.

4 Images

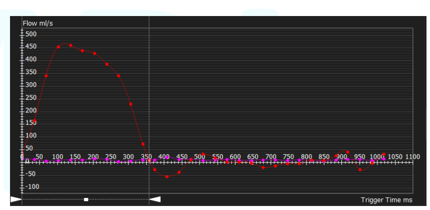


Cine imaging



Aortic valve area = 0.54 sq cm

Analyzed using phase-contrast velocity encoded imaging



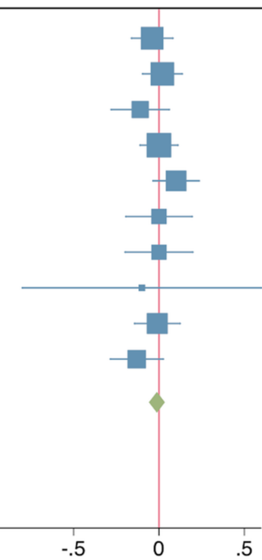
Maximum velocity = 5.4 m/s
Mean pressure gradient = 60 mmHg

Images provided courtesy of: *Kana Fujikura; St. Francis Hospital & Heart Center, NY USA.*

5 References

AVA measurements are similar between CMR and TEE

Study	CMR N	CMR Mean	CMR SD	TEE N	TEE Mean	TEE SD	Mean Diff. with 95% CI	Weight (%)
Buchner 2015	8	.75	.09	8	.79	.15	-0.04 [-0.16, 0.08]	14.67
John 2003	40	.91	.25	40	.89	.28	0.02 [-0.10, 0.14]	15.93
Knobelsdorff-Brenkenhoff 2009	65	1.71	.46	65	1.82	.53	-0.11 [-0.28, 0.06]	7.40
Kupfahl 2003	44	.8	.25	44	.8	.28	0.00 [-0.11, 0.11]	17.52
Malyar 2008	26	.97	.3	38	.87	.25	0.10 [-0.04, 0.24]	11.77
O'Brien	15	.85	.3	15	.85	.24	0.00 [-0.19, 0.19]	5.70
Paelinck 2011	24	.6	.35	24	.6	.35	0.00 [-0.20, 0.20]	5.50
Pouleur 2007	48	2.4	1.8	48	2.5	1.7	-0.10 [-0.80, 0.60]	0.44
Reant 2006	39	.92	.29	39	.93	.31	-0.01 [-0.14, 0.12]	12.14
Weininger 2011	22	.65	.34	22	.78	.15	-0.13 [-0.29, 0.03]	8.94
Overall							-0.01 [-0.06, 0.03]	



Heterogeneity: $\tau^2 = 0.00$, $I^2 = 0.00\%$, $H^2 = 1.00$

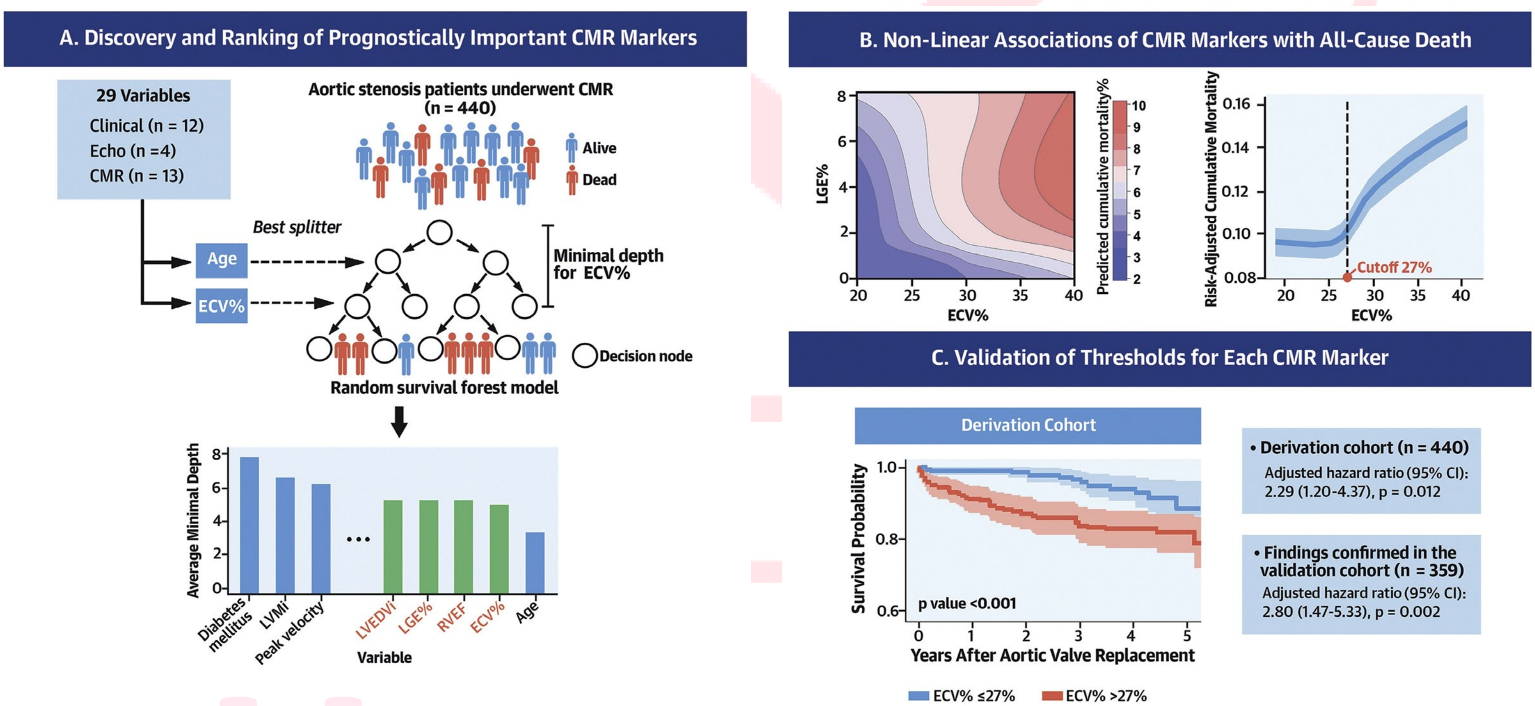
Test of $\theta_i = \theta_j$: $Q(9) = 6.75$, $p = 0.66$

Test of $\theta = 0$: $z = -0.52$, $p = 0.60$

Random-effects DerSimonian-Laird model

Woldendrop K, et al. J Cardiovasc Magn Reson. 2020;22:45.

CMR Markers of Myocardial Damage Predict Mortality in Patients With Aortic Stenosis.



(A) The random survival forest model for post–aortic valve replacement (AVR) death was constructed using 29 variables. Four myocardial CMR markers emerged as important markers (green bars). (B) The partial dependency plots showing association between CMR markers and mortality, which are generated by averaging out the effects of all other variables. A partial co-plot between ECV% and LGE% is depicted (left). A nonlinear effect of ECV% was identified, with a clear risk threshold (>27%) (right). (C) Threshold (ECV =27%) verified in Kaplan-Meier curves, confirming the generalizability and potential utility of ECV%.

Kwak S, et al. J Am Coll Cardiol. 2021;78:545-558.