Ventricular Arrhythmia

Presented by Society for Cardiovascular Magnetic Resonance

1 Background

Ventricular arrhythmia (VA) can be a lethal condition. VA can be caused by various etiologies: ventricular tachycardia, ventricular fibrillation, and frequent premature ventricular contractions. Identifying the cause is important for risk stratification and proper treatment to improve survival.

2 Why CMR

- High diagnostic accuracy due to excellent image resolution.
- Good image quality independent of body habitus.
- One-stop shop: morphology, function, and tissue characterization.
- No ionizing radiation.

3 Appropriate Use Criteria

Evaluate etiology of ventricular arrhythmia	Class 2a*
Myocardial infiltrative cardiomyopathy	
Assessment of LGE to establish diagnosis.	Class 1*
Assessment of LGE to evaluate risk for SCA/SCD	Class 2a*
Hypertrophic cardiomyopathy	
Establish diagnosis	Class 1†
No major SCD risk, and ICD implantation is clinically not certain	Class 2b†
Arrhythmogenic cardiomyopathy	
establish diagnosis and risk stratification	Class 1‡

2017 AHA/ACC/HRS Guideline for Management of Patients With Ventricular Arrhythmias and the Prevention of Sudden Cardiac Death. Circulation. 2018;138:e272-e391.

† 2020 AHA/ACC Guideline for the Diagnosis and Treatment of Patients With Hypertrophic Cardiomyopathy. J Am Coll Cardiol. 2020;76:e159–e240.

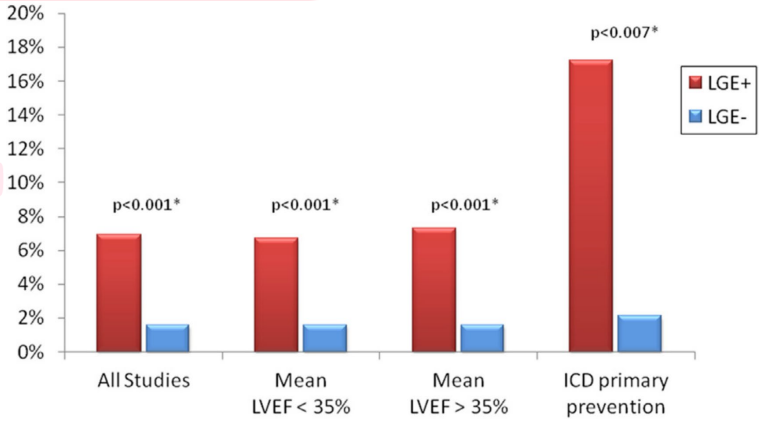
‡ Leiner T, et al. SCMR Position Paper (2020) on clinical indications for CMR. J Cardiovasc Magn Reson. 2020;22:76.

4 Reference

Annual Rate of SCD, VF, Sustained VT, and Appropriate ICD Therapies According to LGE Status among Patients with DCM

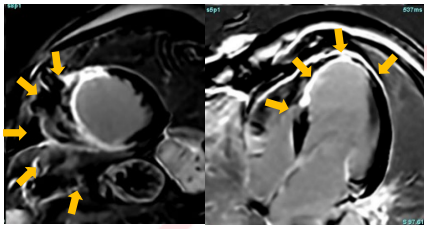
This meta-analysis assessed 2,948 patients in 29 studies. Regardless of LVEF, patients with LGE had significantly higher arrhythmia endpoint compared to patients without LGE ($p < 0.001$).

Marco AD, et al. J Am Coll Cardiol HF 2017;5:28–38.



5 Etiologies

Ischemic Heart Disease

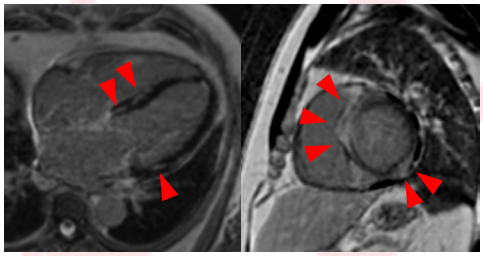


MI represented by subendocardial LGE.

Images provided courtesy of: Vidya Nadig[1], Michael Klein[2]
[1]Hartford Hospital, CT, USA; [2]BJC Medical Group, MO, USA

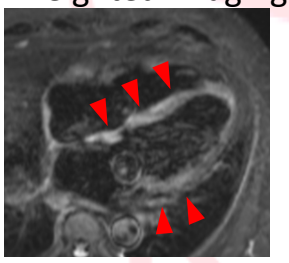
Sarcoidosis

LGE



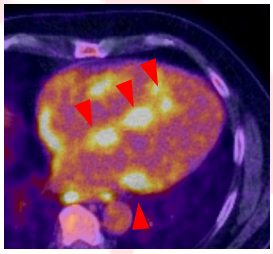
Nodular epicardial and midwall enhancement in the *in the basal anterior, septal, inferior, and anterolateral segments.*

T2-weighted imaging



High signal intensity in the segments with LGE, indicating edema.

PET FDG

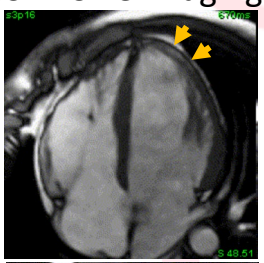


FDG uptake correlated to LGE, confirming active inflammation.

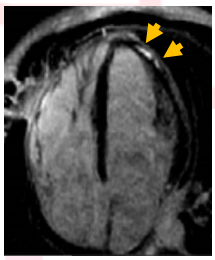
Cases of SCMR #23-04 Jonathan Hudson[1], Sorayya Kakhi[2], Yousef Daryani[3]
[1]King's College London British Heart Foundation Centre, London, UK; [2]King's College Hospital NHS Foundation Trust, London, UK; [3]Epsom & St. Heliers NHS University Hospitals Trust, London, UK

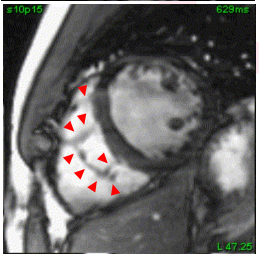
Arrhythmogenic Cardiomyopathy

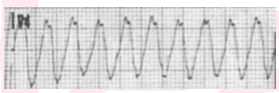
SSFP Cine Imaging



LGE



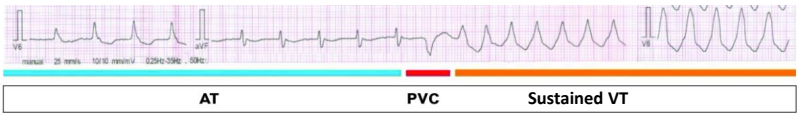


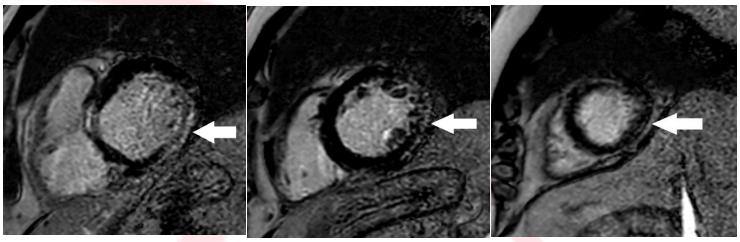


High signal intensity on SSFP (LU) and LGE (RU), representing fat infiltration. Increased trabeculation (LL) in the RV that is commonly seen in ARVC

Cases of SCMR #21-03 Vanessa Denny[1], Brian O'Connor[2], Saira Siddiqui[1]
[1]Goryeb Children's Hospital, NJ, USA; [2]Robert Wood Johnson University Hospital, NJ, USA

Myocarditis



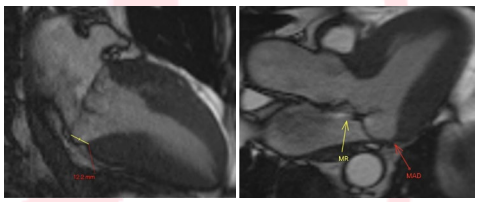


LGE showed epicardial enhancement on the basal/mid inferolateral and inferior segments extending to apical inferior segment, compatible with myocarditis.

Cases of SCMR #COVID20-03 Izabela Warchoł, Marcin Książczyk, Andrzej Lubiński
Medical University of Lodz, Lodz, Poland

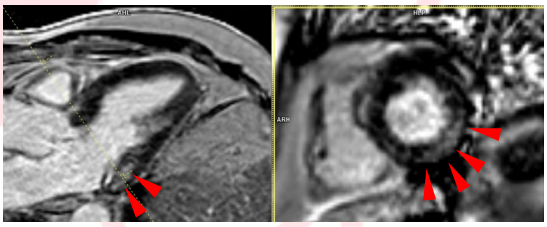
Mitral Annular Disjunction

SSFP Cine Imaging



There is mild hypertrophy of the basal septum. Additionally, there is bi-leaflet mitral valve prolapse and mitral annular disjunction, associated with mild to moderate mitral regurgitation.

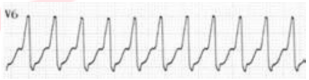
LGE



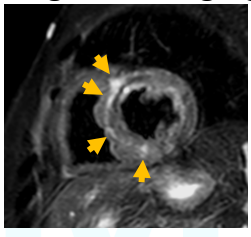
Fibrosis represented by patchy myocardial LGE in the lateral wall basal segment

Cases of SCMR #20-08
Ahmed Kharabish[1,2], Manuel Gutierrez[2], Monika Arzanauskaite[2,3]
[1]Cairo University Hospitals, Cairo, Egypt; [2]Liverpool Heart and Chest Hospital, Liverpool, UK; [3]Hospital de la Santa Creu i Sant Pau, IIB-Sant Pau, Barcelona, Spain

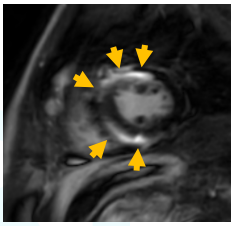
Acute Myocardial Injury in Hypertrophic Cardiomyopathy



T2-weighted imaging



LGE



LV hypertrophy with septal thickness up to 22 mm. T2-weighted imaging showed mid-wall edema in the antero-septal and inferoseptal segments, correlating with LGE.

Cases of SCMR #16-03 Tomas Zaremba[1], Katrine Mikala Müllertz[2], Steen Hvitfeldt Poulsen[2], Henning Mølgaard[2], Won Yong Kim[2]
[1]Aalborg University Hospital, Aalborg, Denmark; [2]Aarhus University Hospital, Aarhus, Denmark