

VT Symposium 2019_191102

How to Predict and Prevent SCD in Patients With Cardiac Sarcoidosis?

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Disclosure

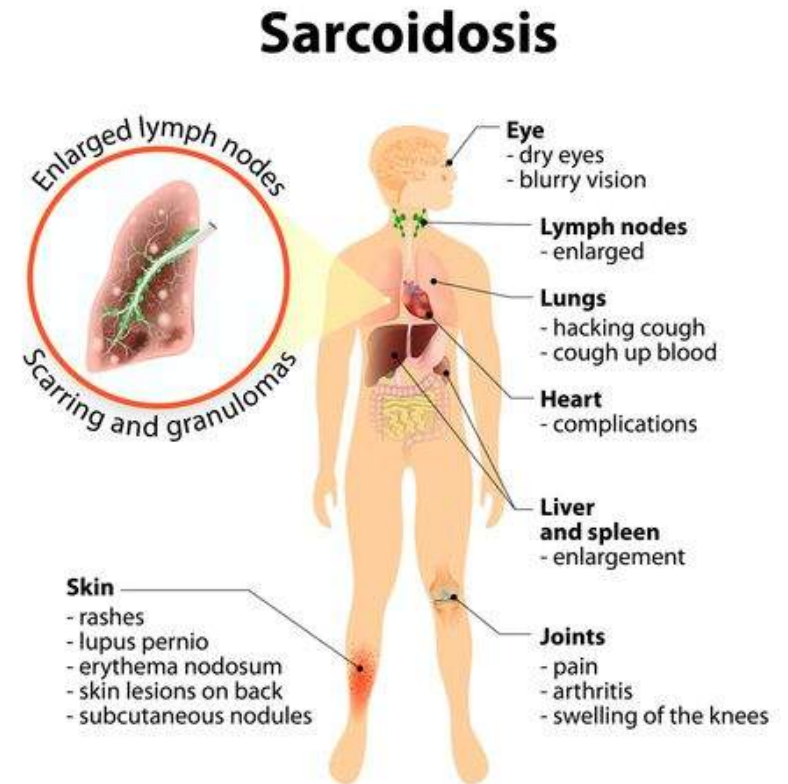
- Abbott Inc.
- J&J Biosense-Webster Inc.
- Boston Scientific Inc.
- Medtronic Inc.

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Cardiac Sarcoidosis

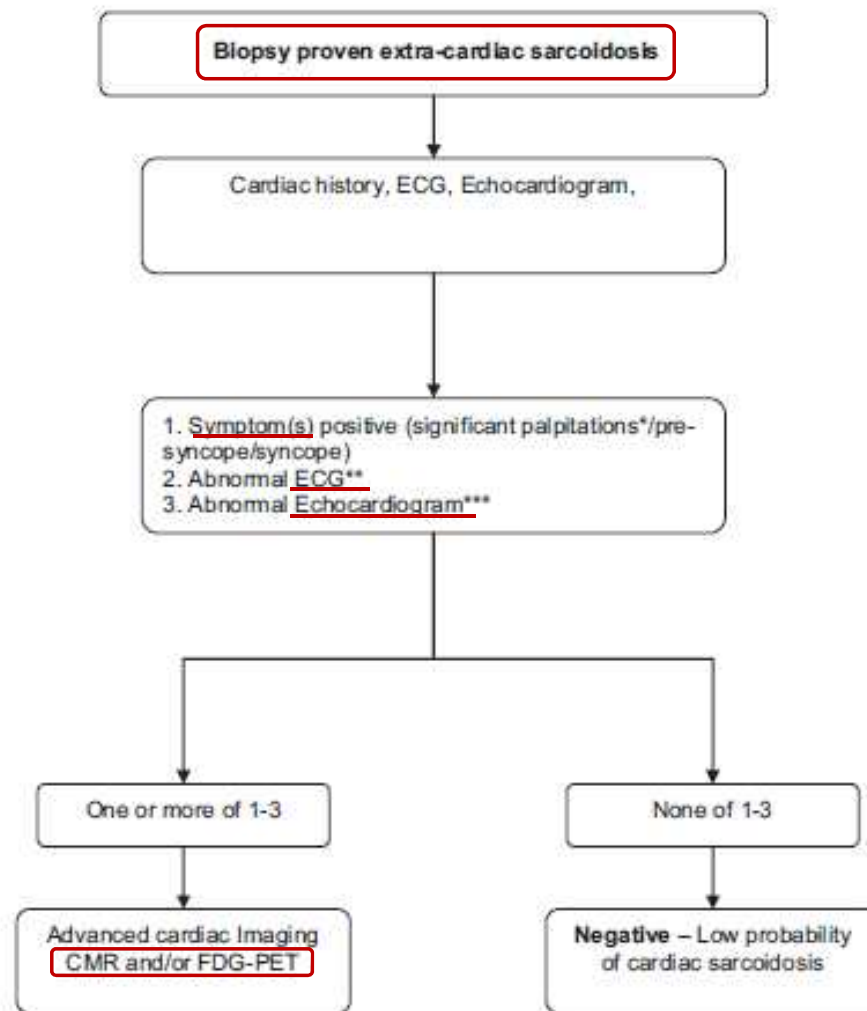
Okada et al. Circulation. 2018;138:1253-64.

- ✚ Immune reaction to the uncharacterized antigen
- ✚ Clinically 5~10% & Pathologically 20~27% of Sarcoidosis (CIRC1978;58:1204-11.)
- ✚ Isolated Cardiac Sarcoidosis: Rare (4) 3% Prevalence (Okada et al. J Nucl Cardiol.2016)



2014 HRS Expert Consensus Statement for CS

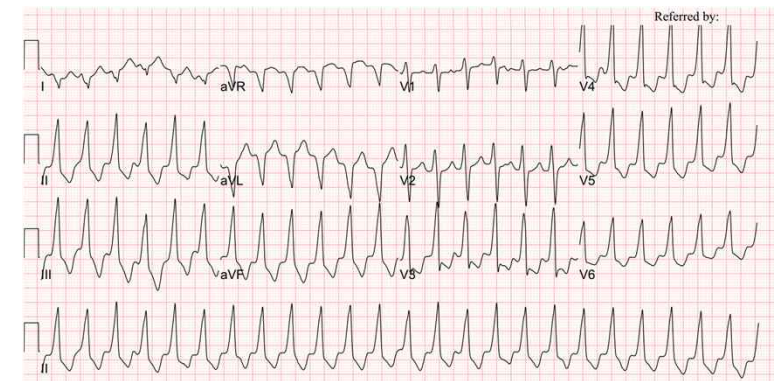
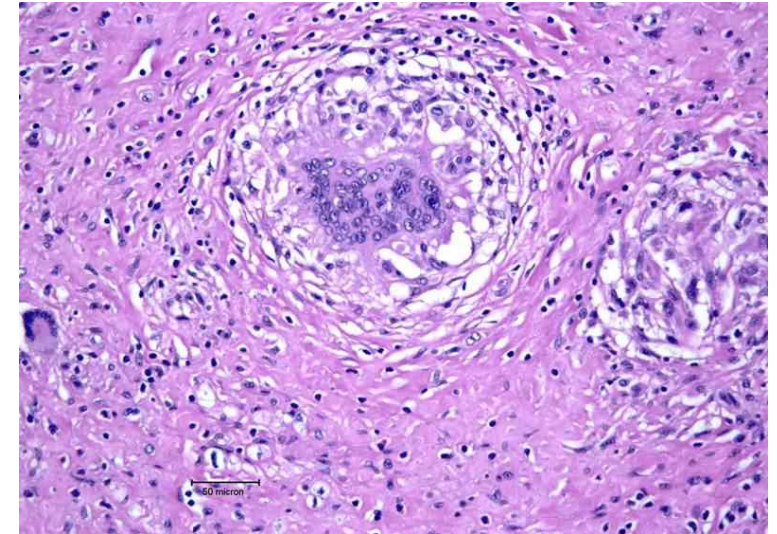
Birnie et al. Heart Rhythm 2014;11:1305-23.



- ✚ Patch & Dynamic nature: low sensitivity of (voltage guided) EMB
- ✚ CMR and PET

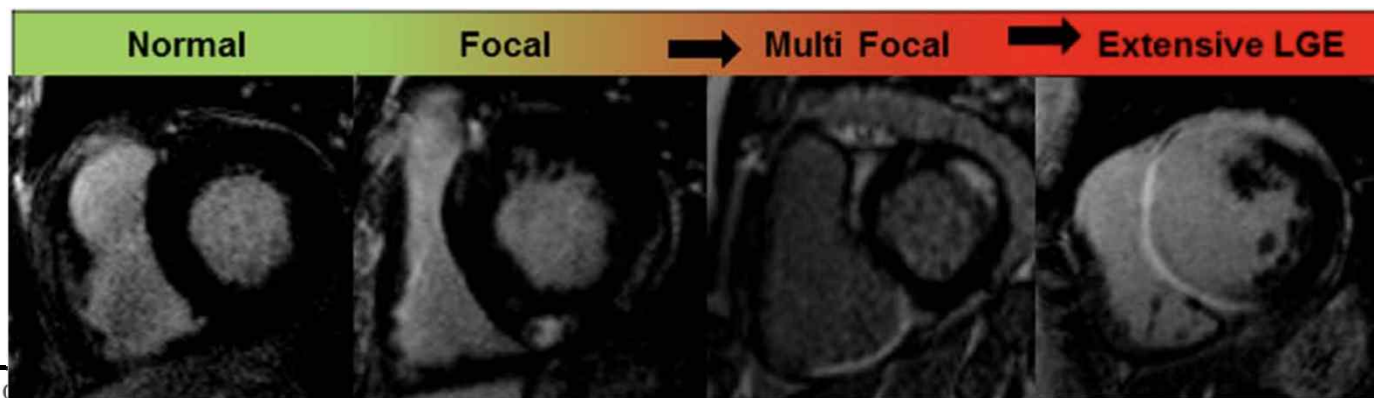
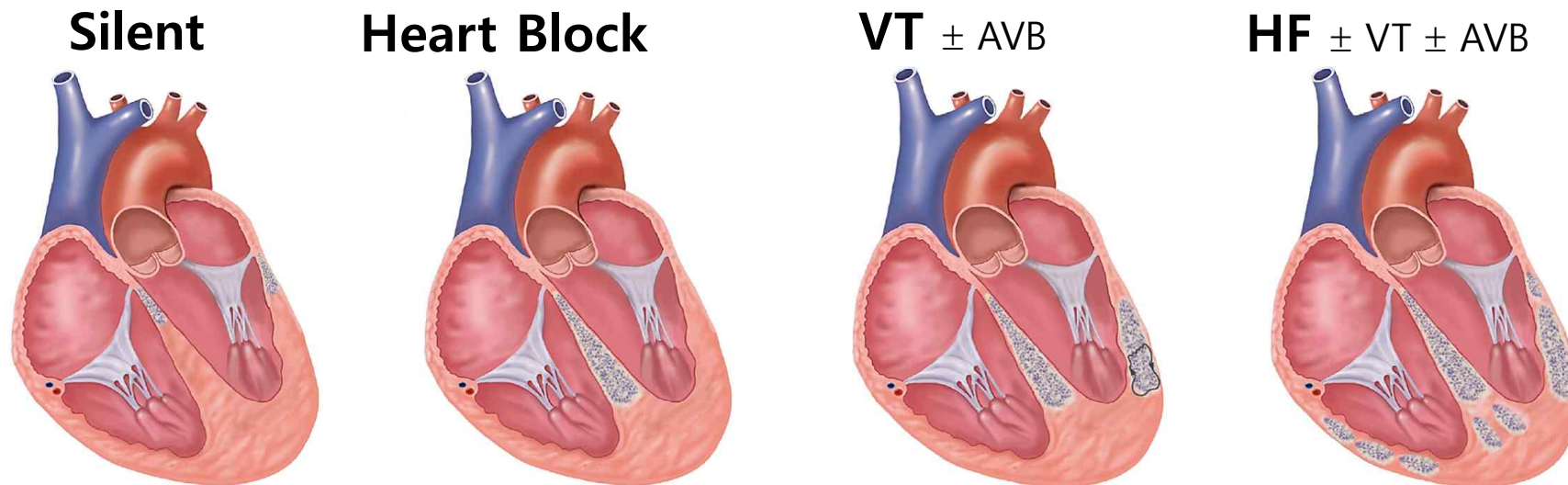
Cardiac Sarcoidosis

- ✚ AV Block (m/c)
- ✚ Ventricular Arrhythmias (23%)
 - ✚ SCA can be the 1st manifestation.
- ✚ Atrial arrhythmias (19%)
- ✚ Heart Failure
- ✚ D/Dx: ARVC
 - ✚ 62.5% of CS fulfills the criteria for ARVC (Heart Rhythm 2013;10:158-164.)



Clinical Features of Cardiac Sarcoidosis

Birnie DH, et al. JACC 2016; 68: 411-21.
Blankstein et al. Circ CV Imaging. 2016



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Diagnosis of Sarcoidosis

2014 HRS Expert Consensus Recommendations for CS

Birnie et al. Heart Rhythm 2014;11:1305-23.

- ✦ Histological Pathway: **EMB** (non-caseating granuloma)
- ✦ Clinical Pathway (Probable Dx)
 - ✦ Histology of **extracardiac sarcoidosis**
 - ✦ + ≥ 1 of Followings
 - ✦ Immunosuppressant responsiveness of CM or AVB
 - ✦ Unexplained EF < 40%
 - ✦ Sustained VT
 - ✦ FDG uptake (sensitivity 89%, specificity 78%)
 - ✦ LGE in CMR
 - ✦ ⁶⁷Gallium scan
 - ✦ No other cause of CM

2006 Japanese Guidelines for CS Diagnosis

Birnie et al. Heart Rhythm 2014;11:1305-23.

✦ Histological Pathway: **EMB** (non-caseating granuloma)

✦ Clinical Pathway (Probable Dx)

✦ **Histology is not mandatory**

✦ ≥ 2 Major or 1 Major+ ≥ 2 minor criteria

✦ Major Criteria

- ✦ Advanced AVB
- ✦ Basal thinning of IVS
- ✦ Positive ^{67}Ga Scan
- ✦ LVEF < 50%

✦ Minor Criteria

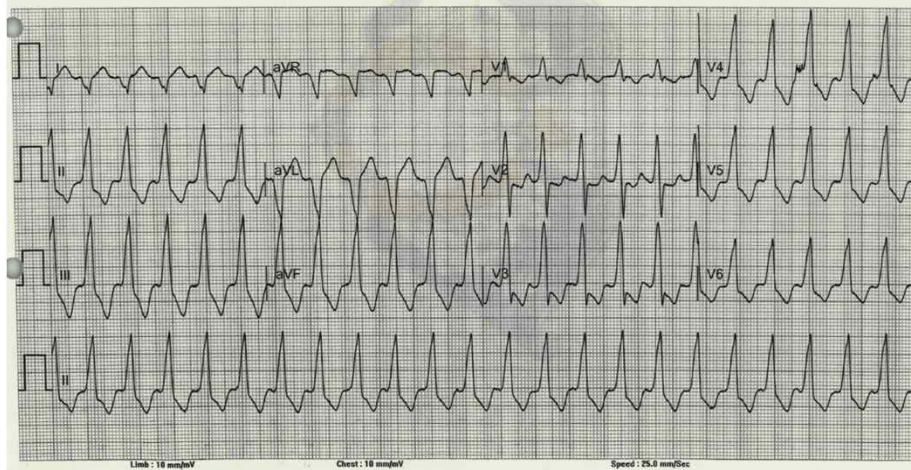
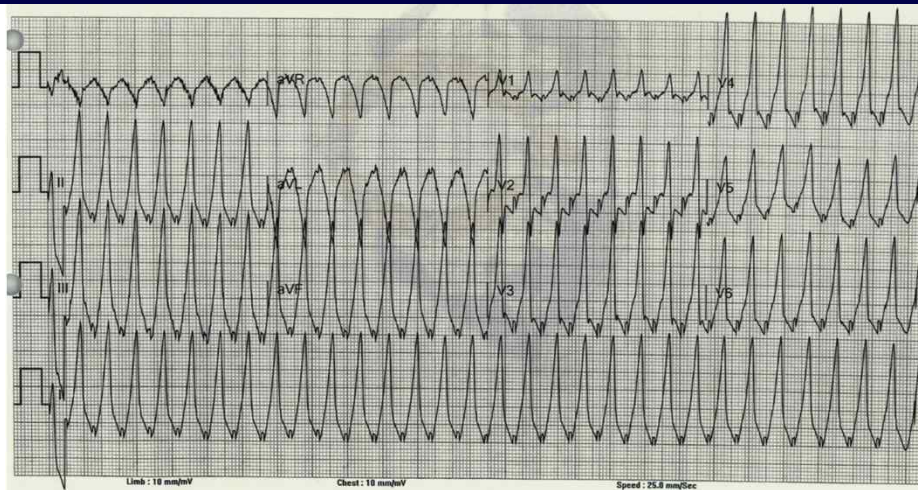
- ✦ Abnormal ECG
- ✦ Regional wall motion in Echo
- ✦ Perfusion defects in ^{201}Tl or ^{99}Tc
- ✦ LGE in CMR
- ✦ EMB: fibrosis and monocytic infiltration

Case of Isolated CS

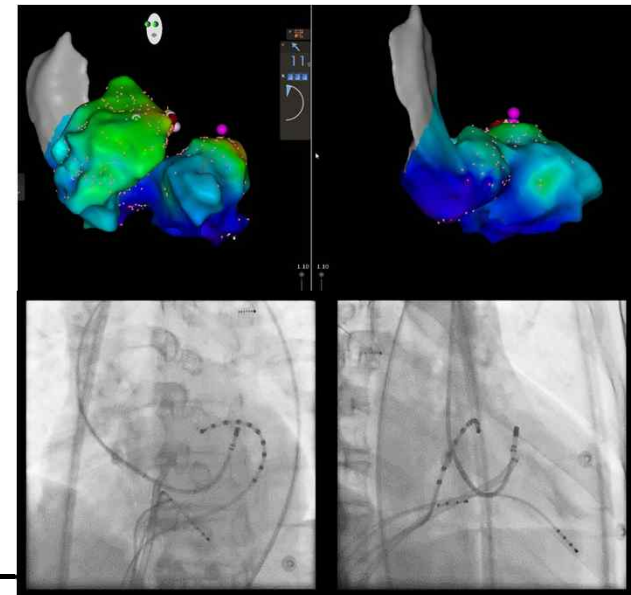
M/68 Referred for Recurrent VT

Yu JG. ID 3078593

Courtesy by Dr. JS Uhm

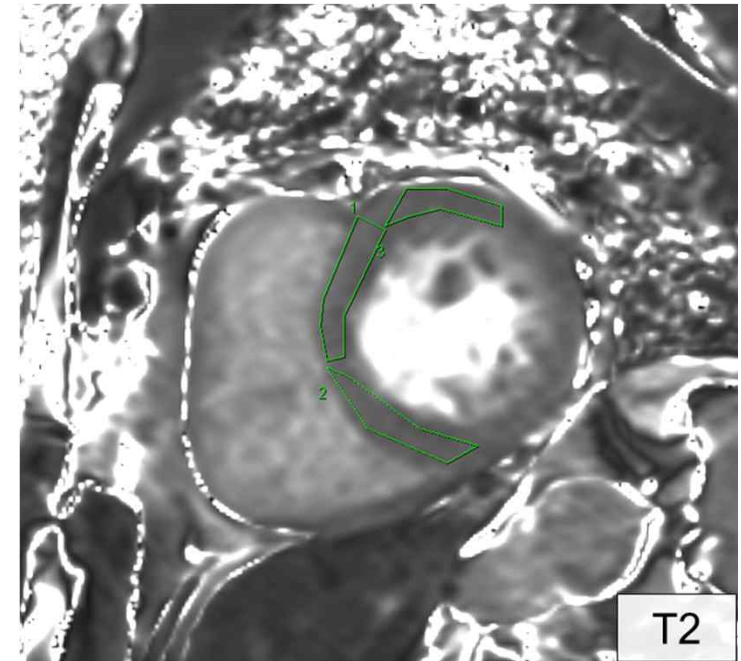
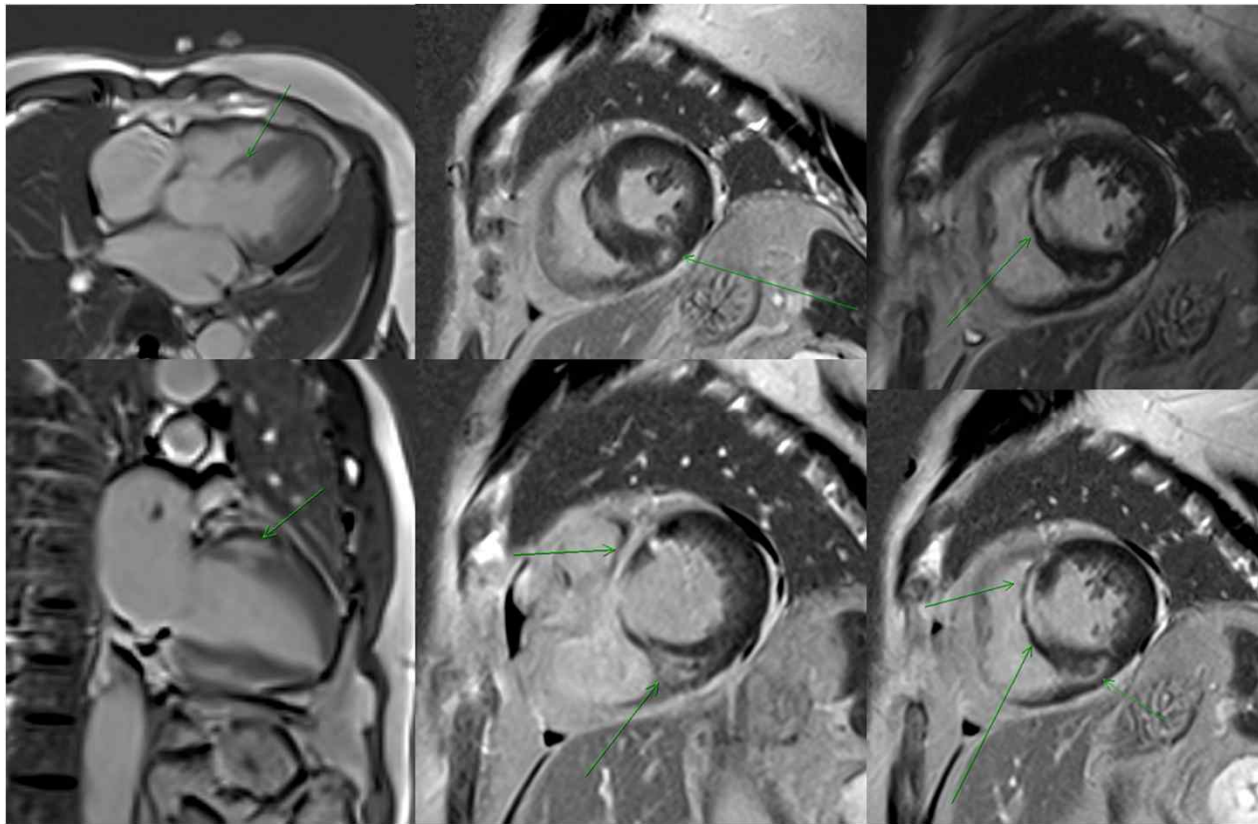


- 2009. The 1st VT event
- 2019.2. RFCA
- 2019.5. Recurrent VT
- PHx: Hypertension, PAF,
- Echo: EF 45%
- Coronary CT: WNL
- NT-pro BNP 2131 pg/mL



CMR

M/68 Recurrent VT

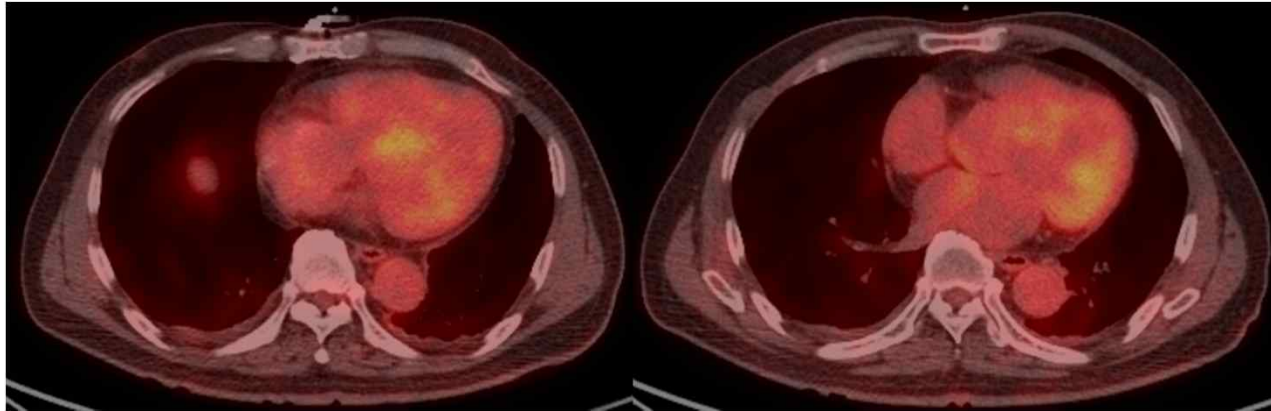


Increased native T1 and T2 values

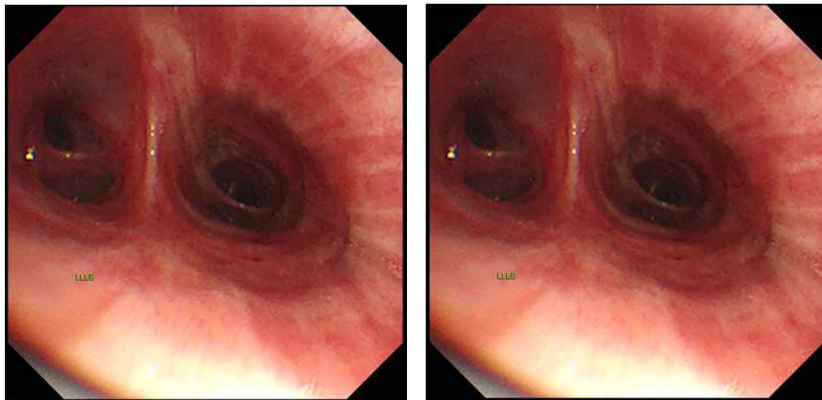
LGE with subepicardial and mid-myocardial portion of basal septum and anterior segment.

FDG-PET

M/68 Recurrent VT



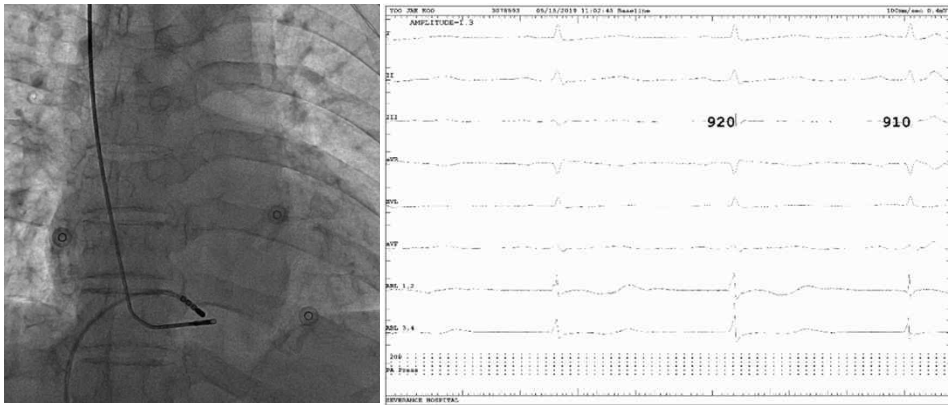
FDG uptakes on LV basal septum and lateral wall and anterior papillary muscle area



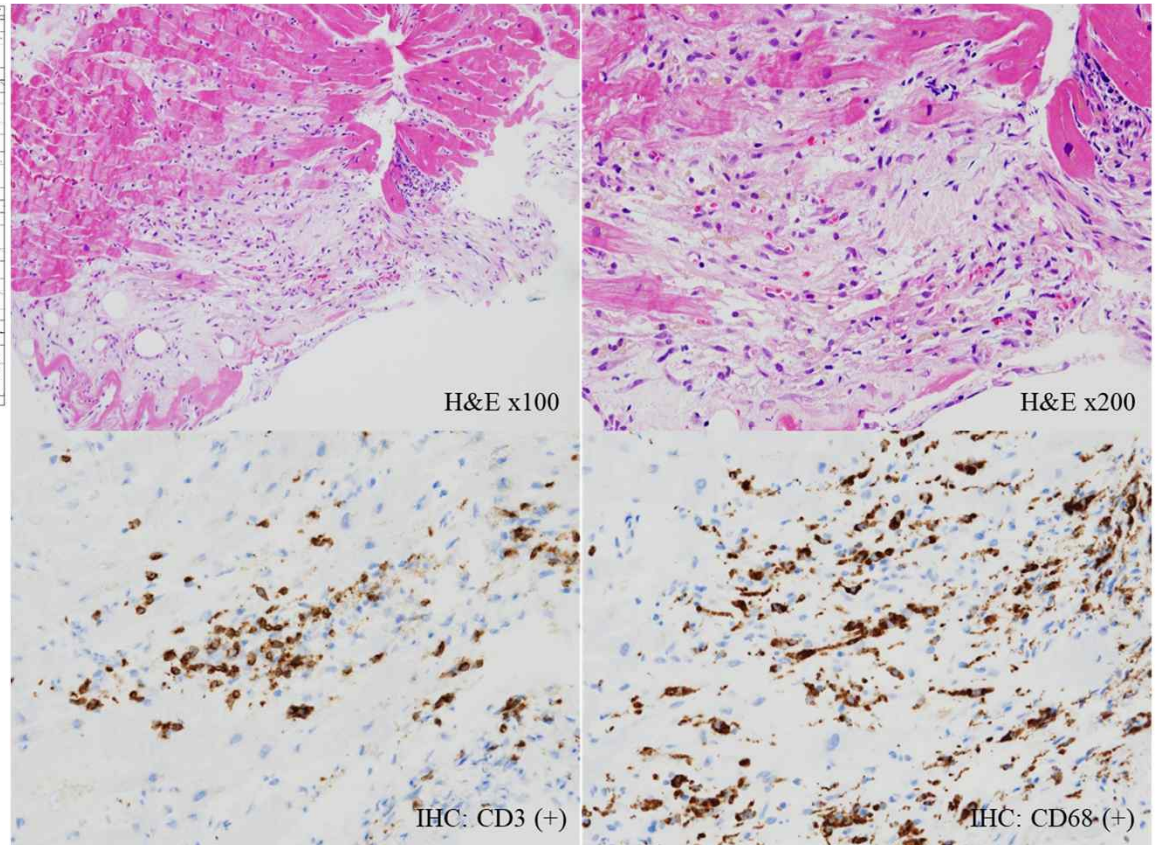
EGM-Guided EMB

M/68 Recurrent VT

✚ Patch & Dynamic nature of pathology (low sensitivity)



Bipolar voltage 1.3mV Area

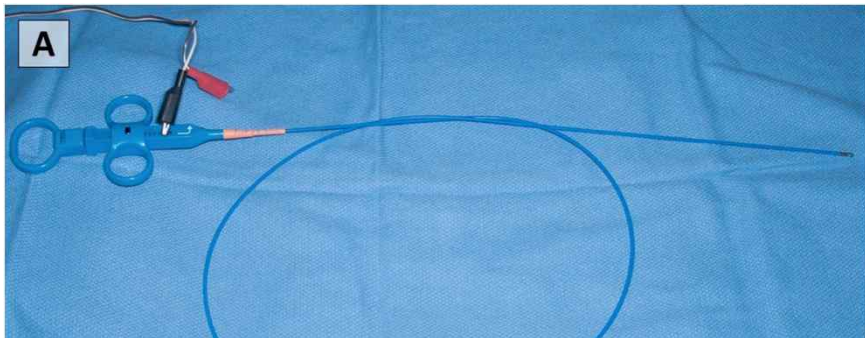


H&E x100

H&E x200

IHC: CD3 (+)

IHC: CD68 (+)

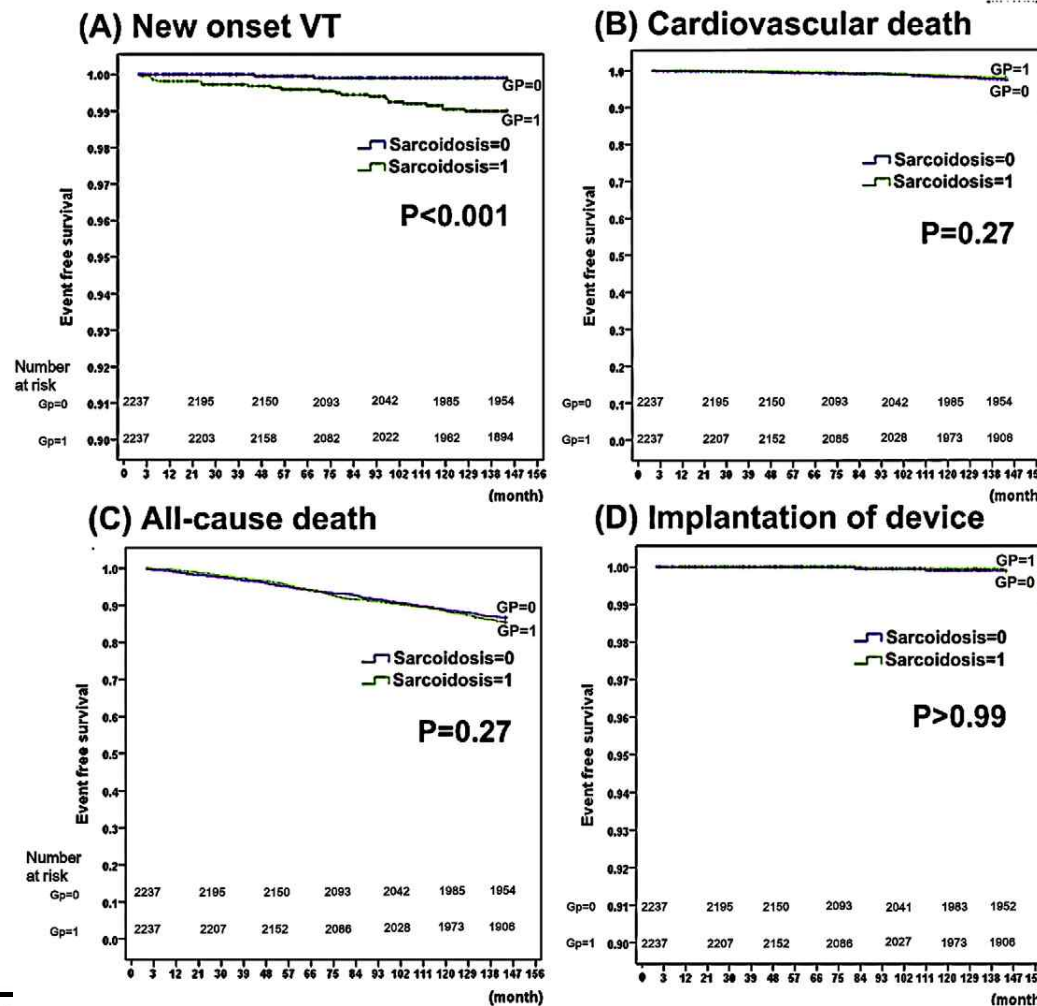


Konecny et al. Ther Adv Cardiovasc Dis 2015;9(3):6609.

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Risk Stratification of SCA in Patients With Sarcoidosis

Risk of VT in Overall Sarcoid Patients

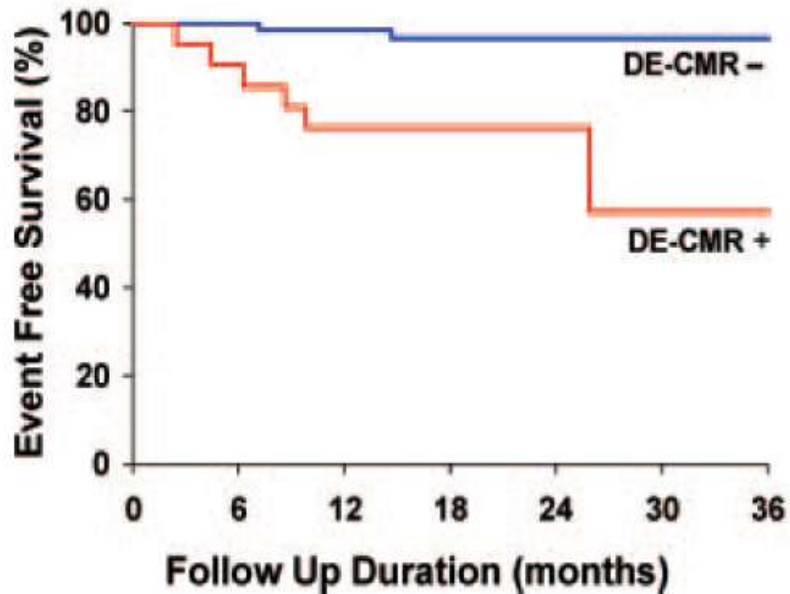


Louise, Chen SA et al. Int J Cardiol. 2017;228:68-73.
 Nagai et al. Chest 2014;146(6):1064-72.

- 2237 overall sarcoidosis
- 61 cardiac sarcoidosis
- LGE-CMR (13%)
- Mean 50 mo FU
- Pacemaker (1/16; 1.6%)
- No other event

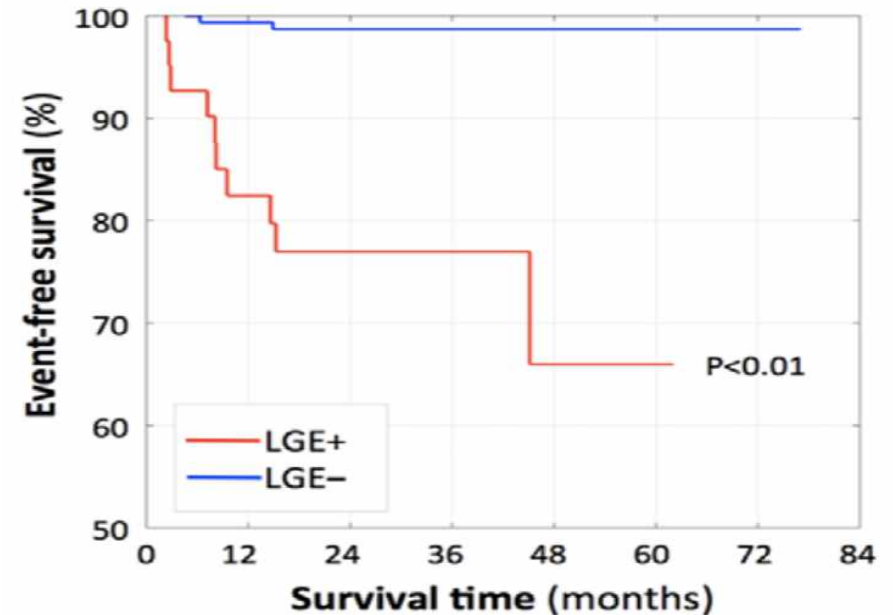
Asymptomatic CS with Normal EF

Patel et al. Circulation 2009;120:1969-77.



- ✚ N=81, 5-Yr FU
- ✚ LGE-CMR (26%)
- ✚ VT or SCA (75% with LGE-CMR+)
- ✚ Lower EF in LGE-CMR+ group

Smedema JP, et al. J Am Coll Cardiol. 2005;45:1683-1690.
 Greulich S, et al. JACC Cardiovasc Imaging. 2013;6:501-511.
 Murtagh et al. Circ Cardiovasc Imaging. 2016;9.

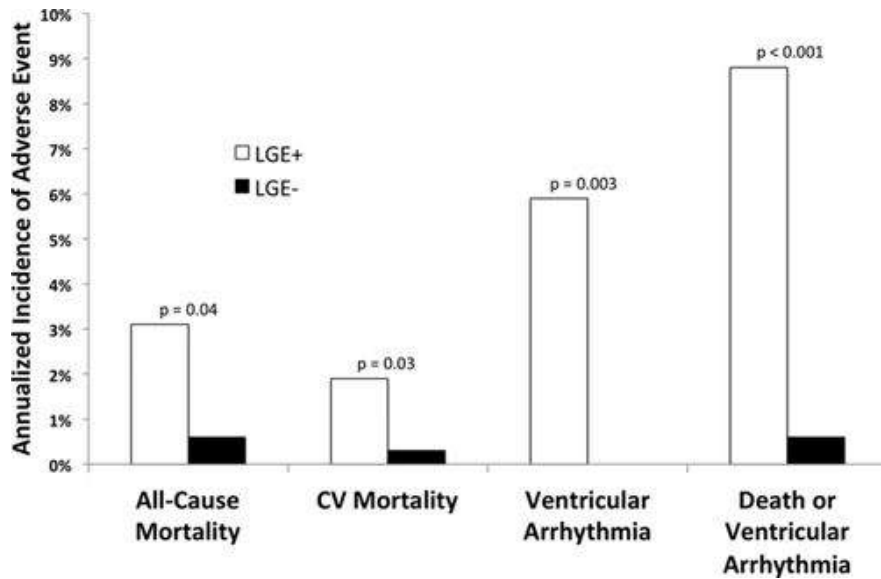


- ✚ Major CV Event
- ✚ Sensitivity 100%, Specificity 78%
- ✚ SCD HR 32

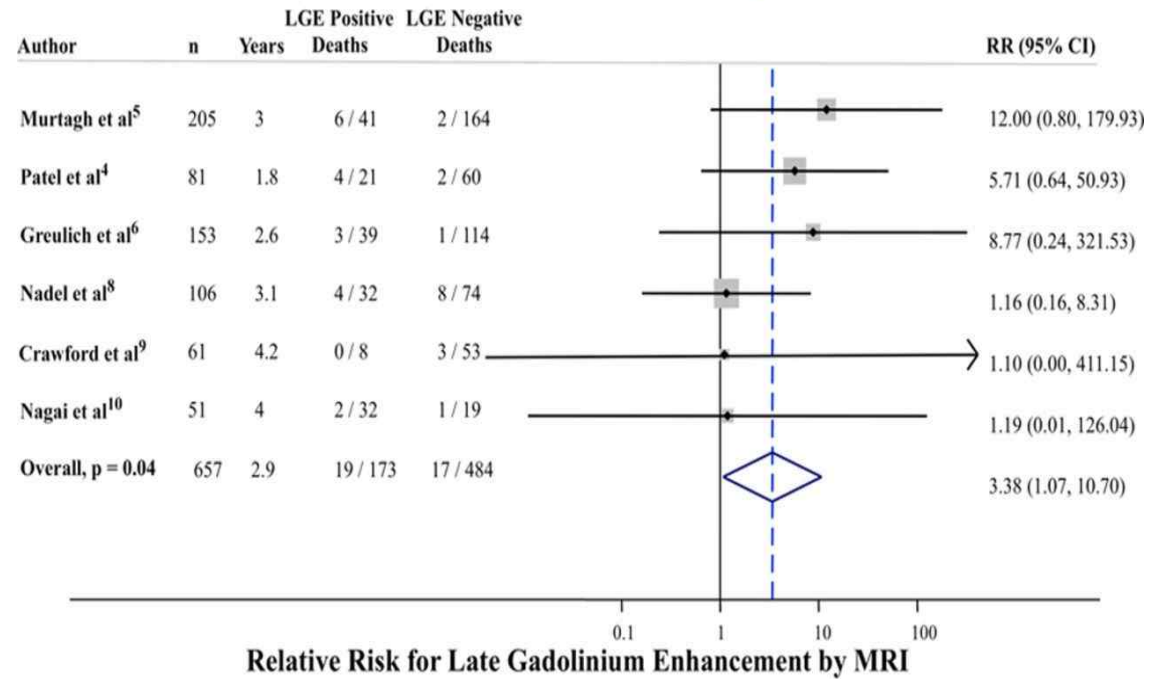
Prognostic Value of CMR in CS

Meta-analyses, n=694 in 7 Studies

Hulten et al. CIRCIMAGING 2016;9:e005001.



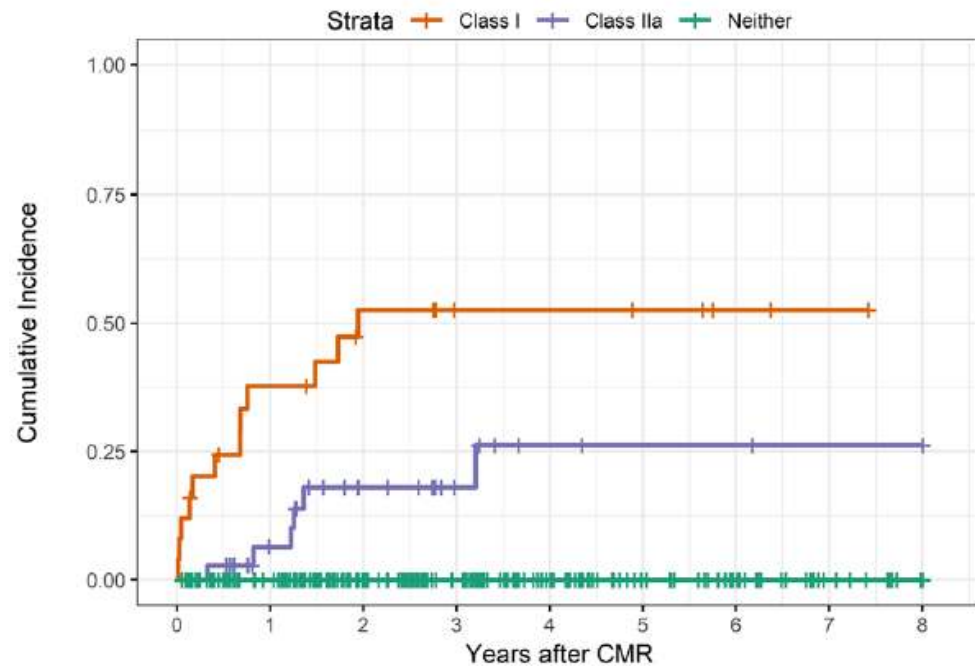
All Cause Mortality



Chi-squared = 2.79, p = 0.7; I-squared = 0%

EF > 35% & LGE > 5.7% or Needs Pacemaker (2017 ACC/AHA/HRS Class IIA Indication)

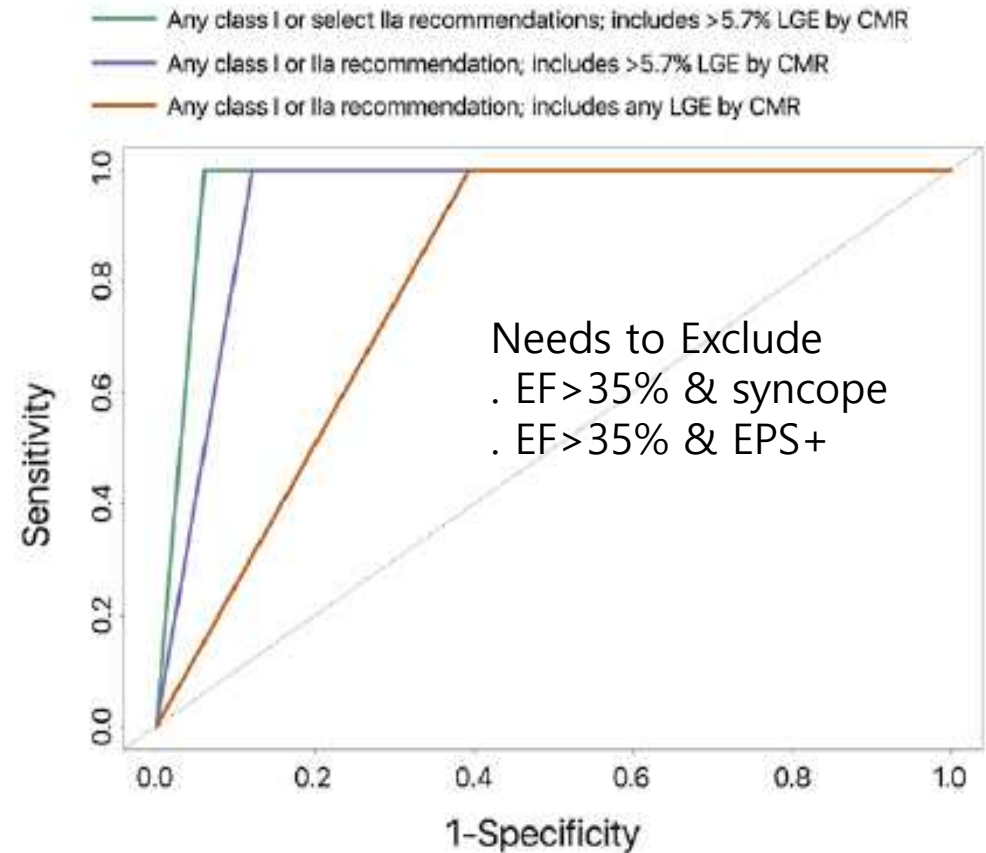
Kazmirczak, et al CIRCEP.2019;12:e007488.



Number at risk

Strata	0	1	2	3	4	5	6	7	8
Class I	25	14	9	5	5	4	2	1	0
Class IIA	35	25	16	10	6	5	5	4	4
Neither	230	200	162	129	96	70	53	38	29

Years after CMR



Prognostic Value of FDG-PET in CS

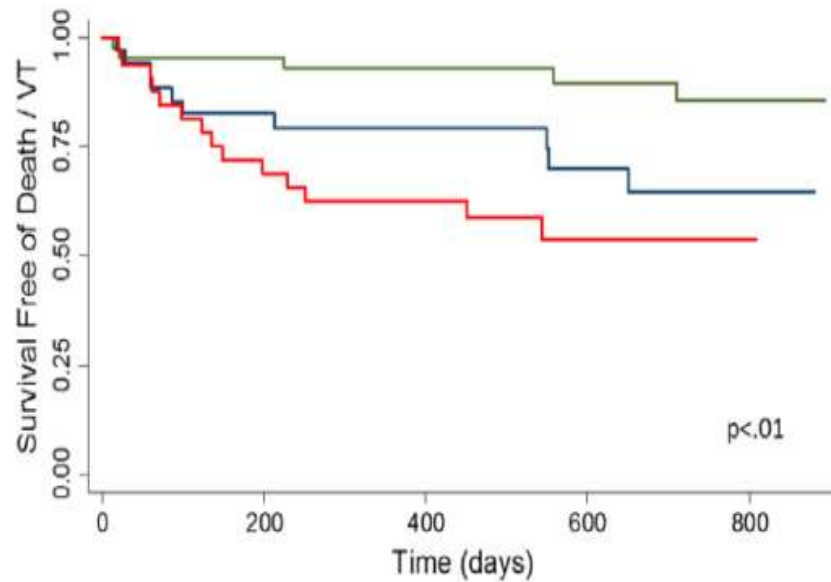
(n=118)

Blankstein et al. JACC2014;63:329-36.

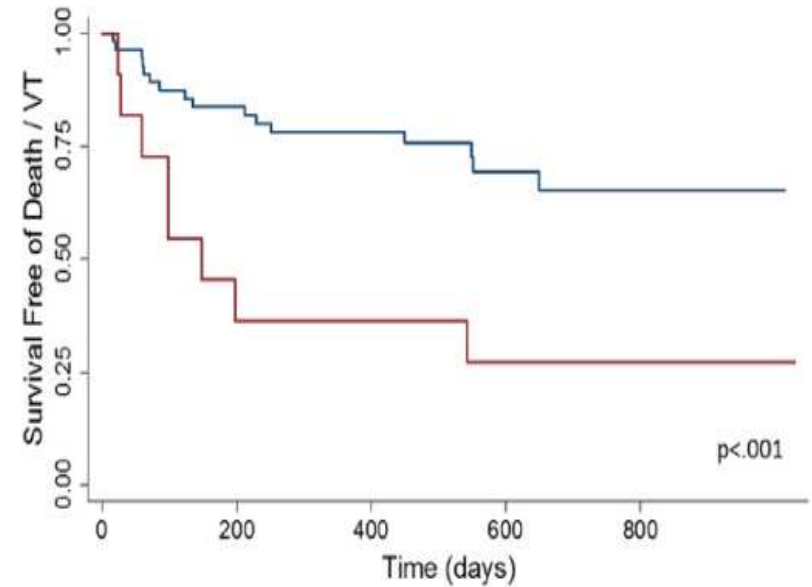
Table 2 Predictors of Death or Ventricular Tachycardia

Abnormal perfusion AND metabolism	2.87 (1.05-7.85)	0.039
Right ventricular uptake of FDG*	2.82 (1.03-7.60)	0.042

- ✚ N=118
- ✚ ¹⁸F DG to assess inflammation
- ✚ ⁸²Rubidium to evaluate perfusion



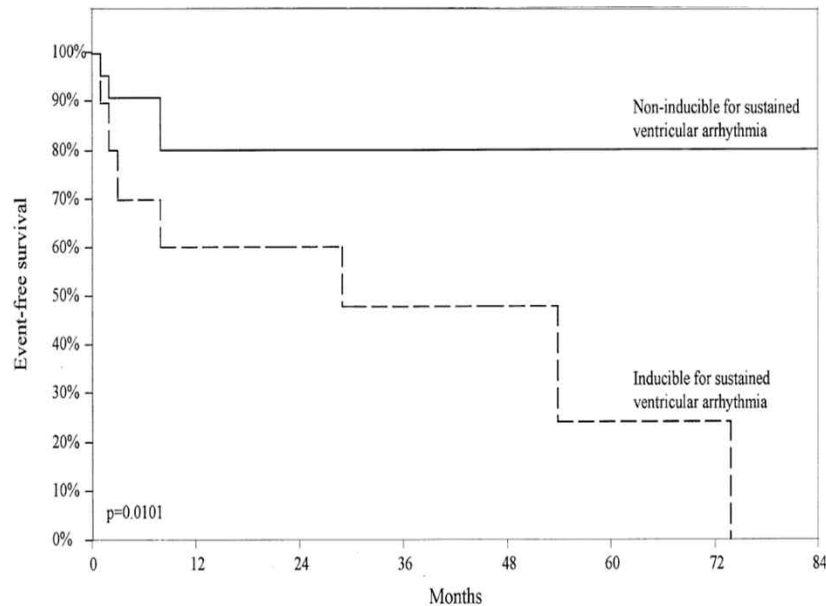
— Normal perfusion and FDG
 — Abnormal perfusion or FDG
 — Abnormal perfusion and FDG



— No RV FDG Uptake
 — Focal RV FDG Uptake

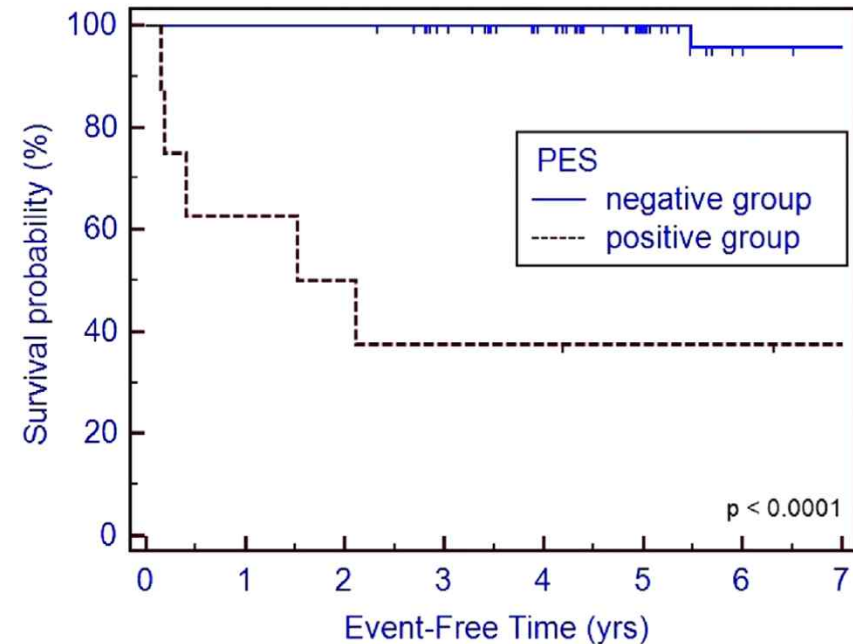
Prognostic Value of EPS in CS

Aizer A et al, Am J Cardiol 2005;96(2):276-82.



✚ N=32
✚ PPV of 75%, NPV of 90%

Mehta D et al, Circ AE, 2011;4(1):43-8.



✚ N=76
✚ PPV of 75%, NPV of 98.5%

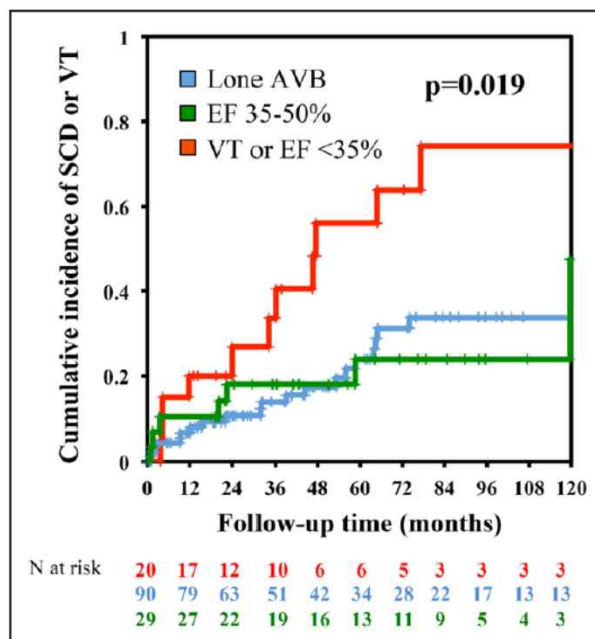
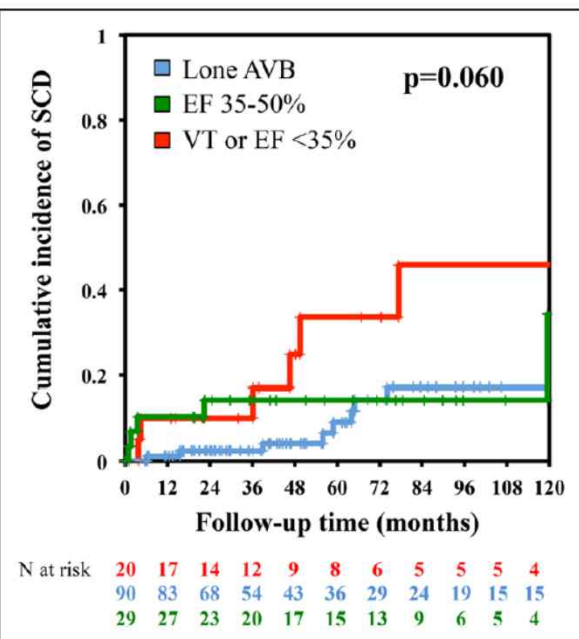
However, CS is a progressive disease and Long-term NPV is unknown.

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Immunosuppressive Therapy and CIED

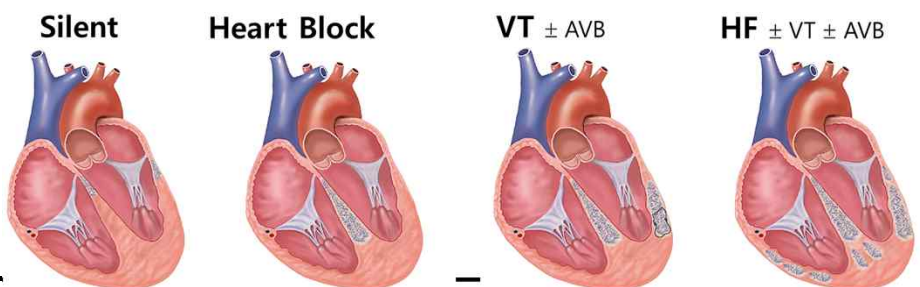
Prognostic Value of AVB in CS

Nordenswan et al. CIRCEP 2018;11:e006145.



Part of Study Population	Incidence (95% CI) of SCD		Incidence (95% CI) of SCD or VT	
	1 Year, %	5 Years, %	1 Year, %	5 Years, %
All patients (n=143)	4 (2-9)	17 (11-27)	9 (6-16)	31 (23-42)
AVB+VT and EF <35% (n=20)	10 (3-37)	34 (16-71)	20 (8-48)	56 (36-88)
AVB+EF 35%-50% (n=29)	10 (4-30)	14 (6-35)	10 (4-30)	24 (12-49)
Lone AVB (n=90)	1 (0-8)	9 (4-22)	7 (3-15)	24 (15-38)

- ✚ High degree AVB is not a benign condition in patients with CS.
- ✚ ICD IIa Indication (2017 AHA/ACC/HRS Guidelines)
- ✚ Unexplained AVB younger than 60yo needs to be investigated for CS.



Indications for Permanent Pacemaker in CS

2014 HRS Expert Consensus Recommendations for CS

Birnie et al. Heart Rhythm 2014;11:1305-23.

- ✚ Class IIA. Immunosuppression can be useful in CS patients with Mobitz II or 3rd degree heart block.
- ✚ Class IIA. Device implantation can be useful in CS patients with an indication for pacing even if the AV block reverses transiently.
- ✚ Immunosuppression may increase the risk of device infection.
- ✚ If possible, the device should be implanted first and immunosuppression started once the wound is healed.

Indications for ICD in CS

2014 HRS Expert Consensus Recommendations for CS

Birnie et al. Heart Rhythm 2014;11:1305-23.

- ✚ Class I. Sustained VT and/or LVEF \leq 35% on immunosuppression
- ✚ Class IIA. Indication for permanent PMI and/or syncope/
near-syncope and/or inducible sustained VA
- ✚ Class IIB. LVEF=36-49% and /or RVEF<40% on immunosuppression.
- ✚ Class III. No syncope, normal LVEF/RVEF, no LGE on CMR, negative EPS, and no indication of permanent PMI.

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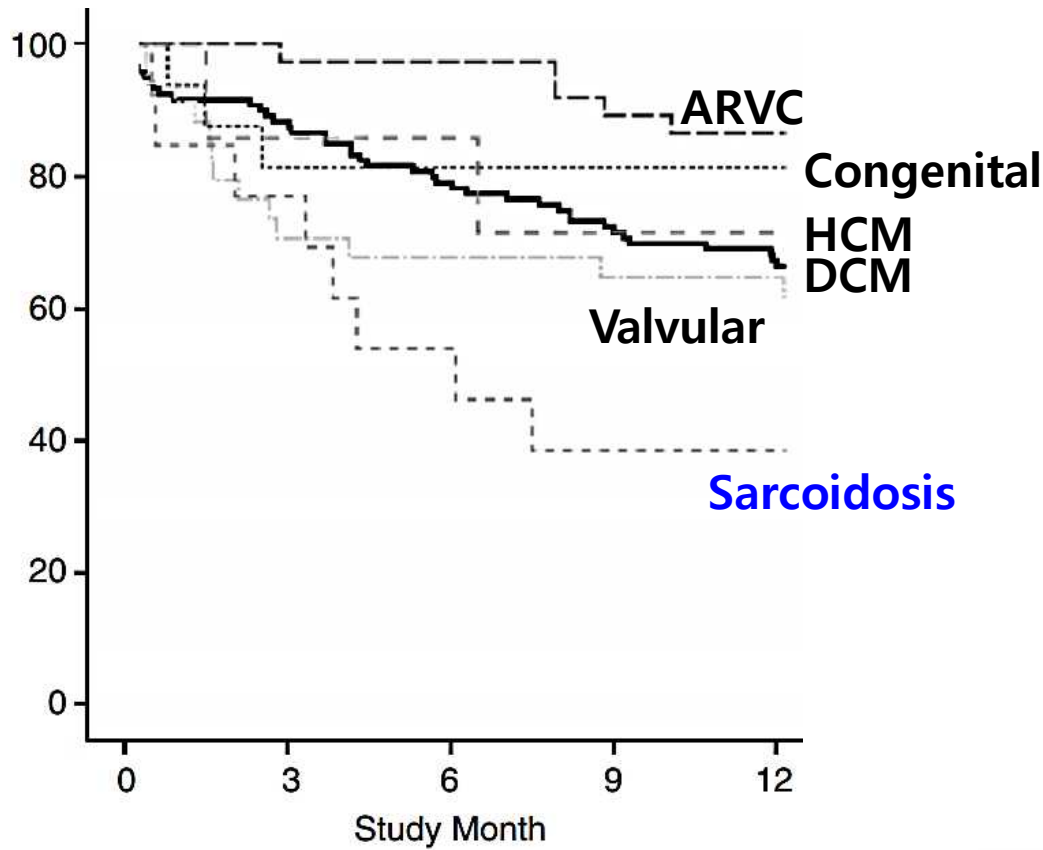
Catheter Ablation

The background of the slide features a green ECG tracing on a dark green grid. The tracing shows a regular rhythm with distinct P waves, QRS complexes, and T waves. The text 'Catheter Ablation' is overlaid in the center in a bright yellow-green color.

Poor Prognosis of VT Ablation in CS

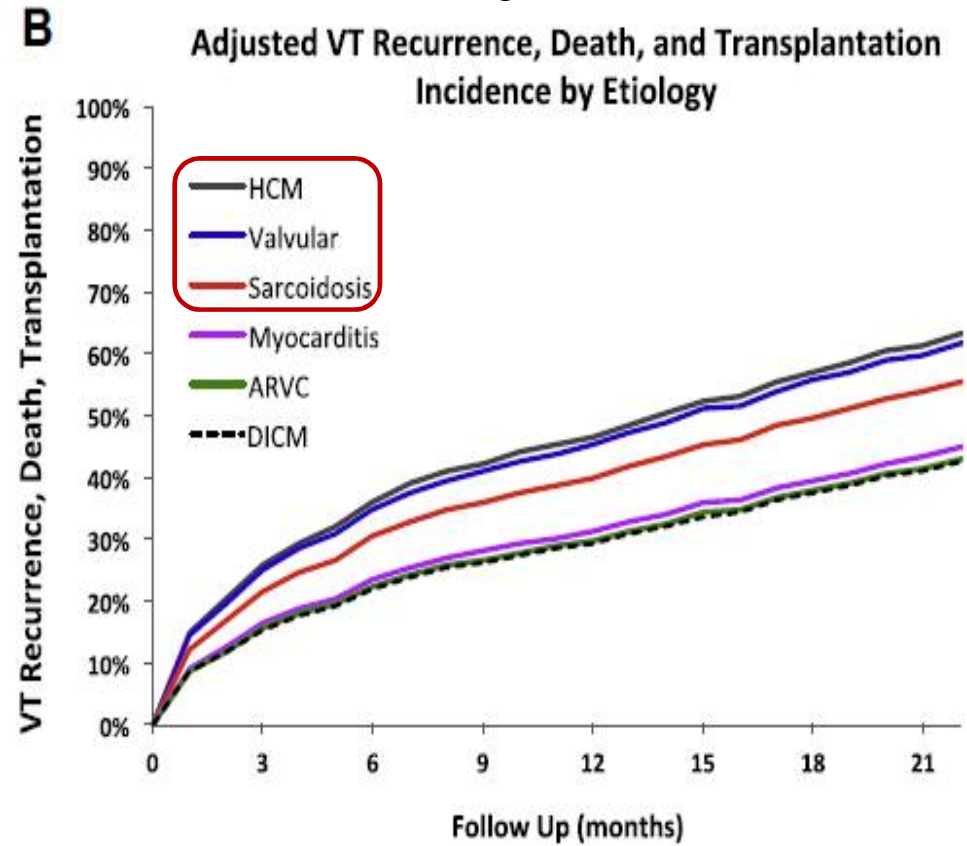
Death, Transplantation, or Hospitalization for VT

Tokuda M, Stevenson WG, et al. CIRCEP 2012;5:992-1000



International VT Ablation Collaborative Study

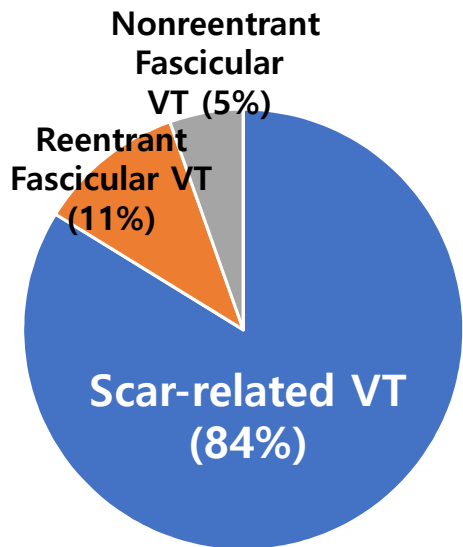
Vaseghi et al. JACC EP. 2018;4:1141-50.



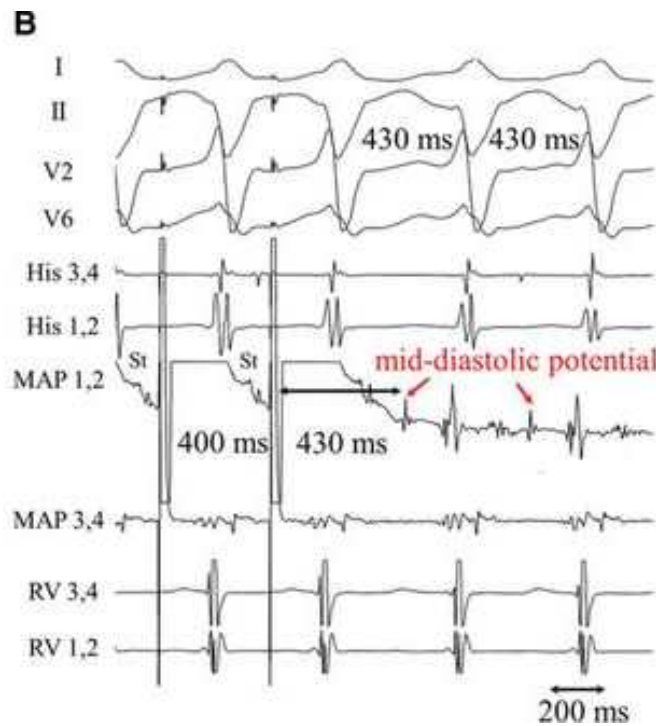
Mechanisms of VT in CS

(N=37)

Naruse, Nogami, et al. CIRCEP 2014;7:407-13.



Reentrant Mechanism



Non-reentrant Mechanism

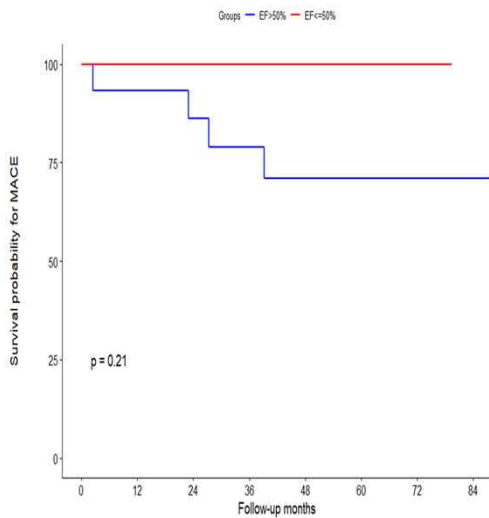


Yonsei Experience

Cardiac Sarcoidosis

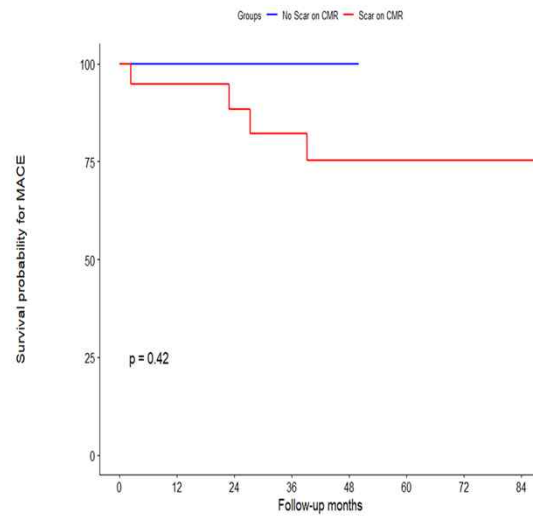
N=573 Overall Sarcoidosis, Cardiac Sarcoidosis: 3.8% (n=22), ICD implantation: 2.4% (n=14)

EF < 50% vs. EF ≥ 50%



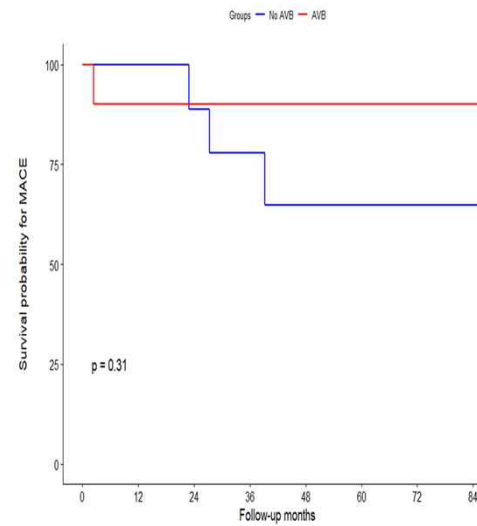
	0	12	24	36	48	60	72	84
EF > 50%	15	14	12	10	8	5	5	4
EF < 50%	7	6	5	4	3	2	2	0

LGE+ vs. LGE-



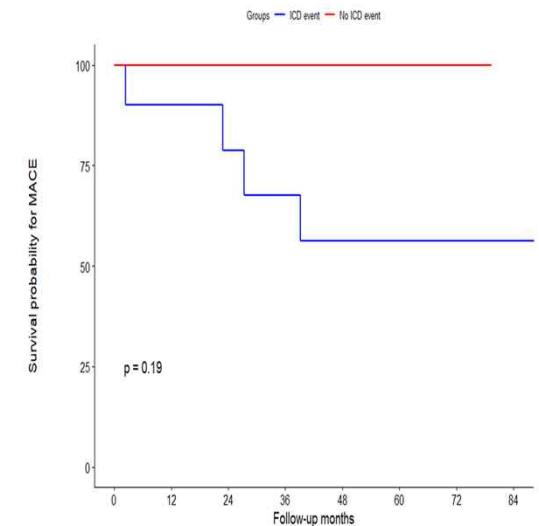
	0	12	24	36	48	60	72	84
No Scar on CMR	3	3	3	2	1	0	0	0
Scar on CMR	19	17	14	12	10	7	7	4

AVB+ vs. AVB-



	0	12	24	36	48	60	72	84
No AVB	12	11	8	6	4	2	2	1
AVB	10	9	9	8	7	5	5	3

ICD shock vs. No ICD shock



	0	12	24	36	48	60	72	84
ICD event	10	9	7	6	5	3	3	3
No ICD event	4	3	3	3	2	1	1	0

Take-Home Message

- ✦ CS is associated with AVB, VT, and HF.
- ✦ Generally pathology diagnosis is required, but LGE or PET scan provides prognostic values in patients with CS
- ✦ There are some overlapping of diagnosis between CS and ARVC.
- ✦ ICD should be considered in patients with high degree AVB in patients with CS.
- ✦ Systemic corticosteroid reverses AVB in some patients with CS, but response to VT is variable.
- ✦ Majority of VT mechanisms of CS are scar related reentry, but response to VT ablation is poor.

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