# Outcomes of Ablation of Multiple PVC Morphologies

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# Korean Heart Rhythm Society
## COI Disclosure

*Ji Hyun Lee*

The authors have no financial conflicts of interest
to disclose concerning the presentation

# Contents

1. **Clinical significance of PVCs with multiple morphologies**
2. **Ablation treatment of multiple PVCs**

# What do PVCs with multiple morphologies indicate ?

1. Higher likelihood of PVC induced cardiomyopathy

Predictors of PVC-induced CMP in univariable analysis (n=107)

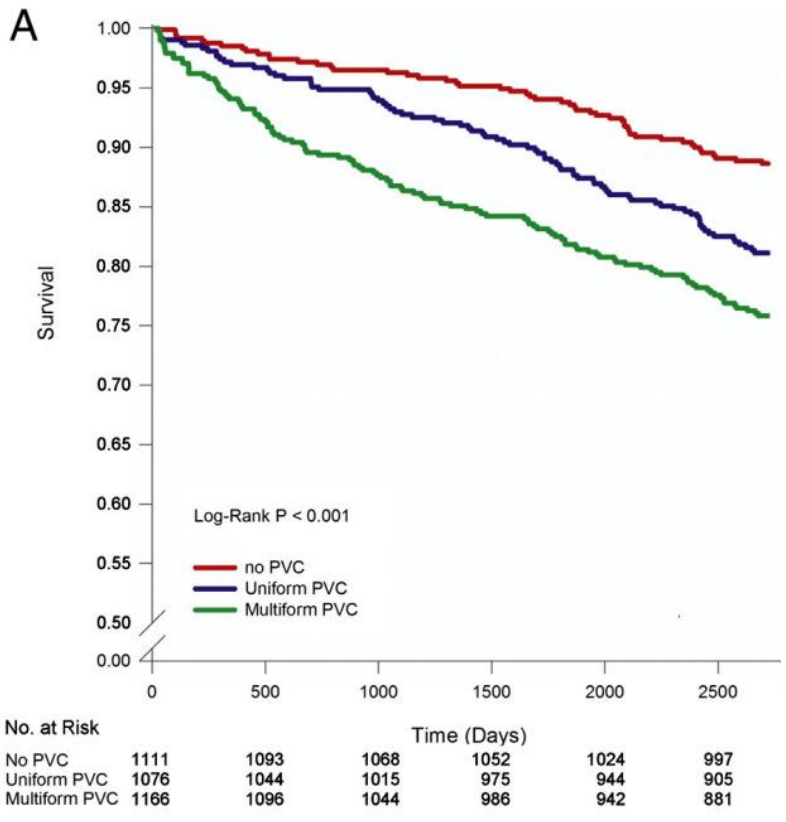
| Variable | *P* | Unadjusted odds ratio |
|---|---|---|
| Sex | .01 | 4.25 |
| Symptom duration | .008 | 1.01 |
| PVC burden | .0001 | 1.08 |
| Pleomorphic PVCs | .006 | 3.11 |
| Interpolation | .022 | 3.3 |
| Asymptomatic status | .0001 | 5.4 |
| QRS duration of PVCs | .0001 | 1.07 |
| Interquartile CoV $<31\%$ | .0001 | 8.3 |

Heart Rhythm 2016;13:98–102

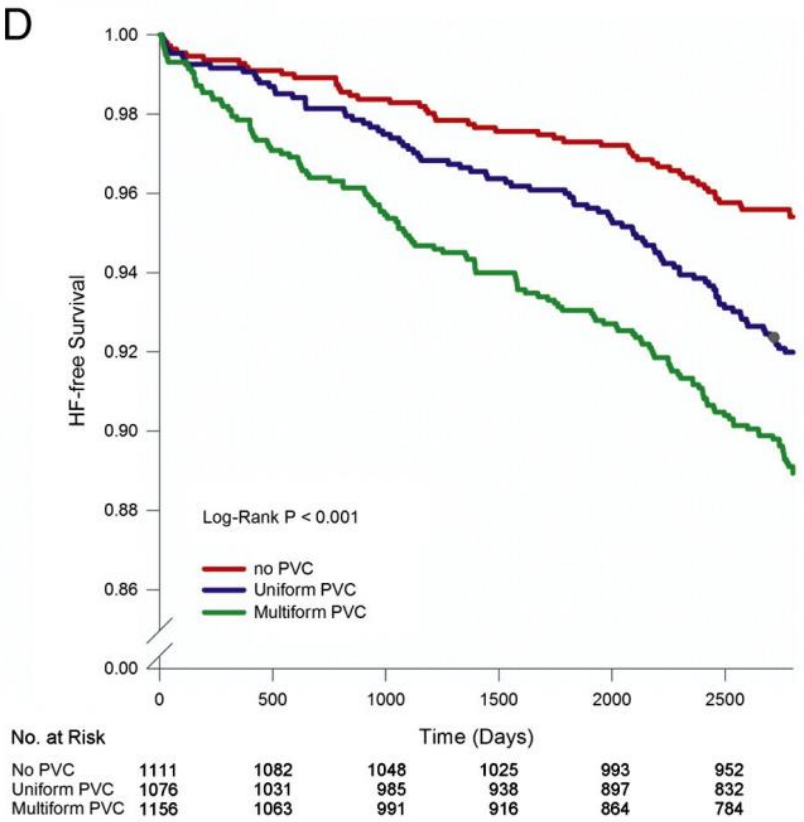
# What do PVCs with multiple morphologies indicate ?

2. Might be associated with underlying subclinical heart disease

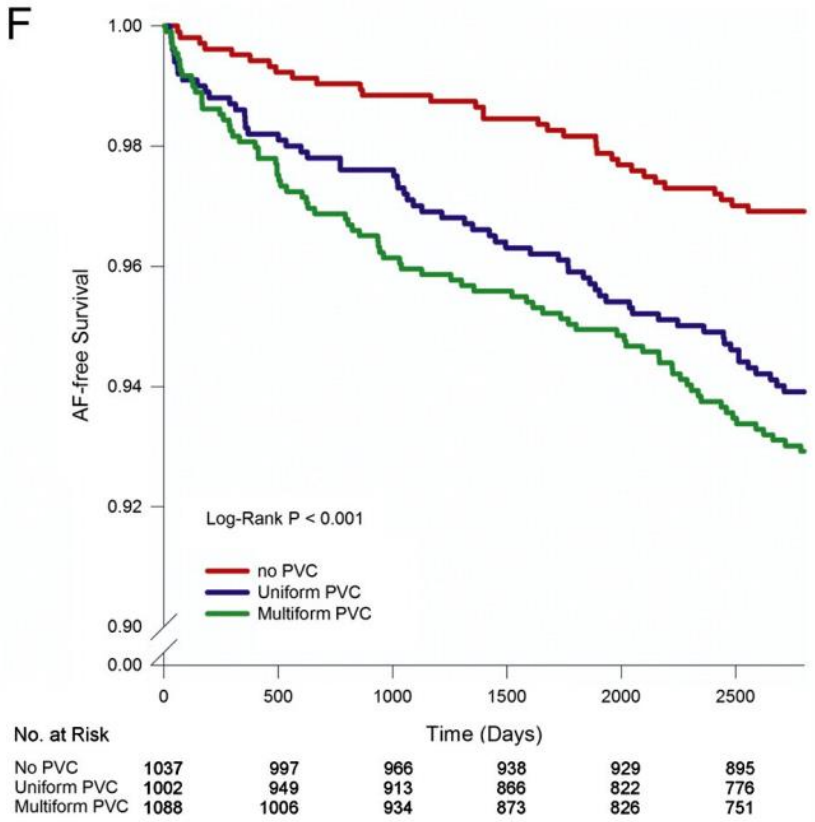
Survival




HF-free survival




AF-free survival

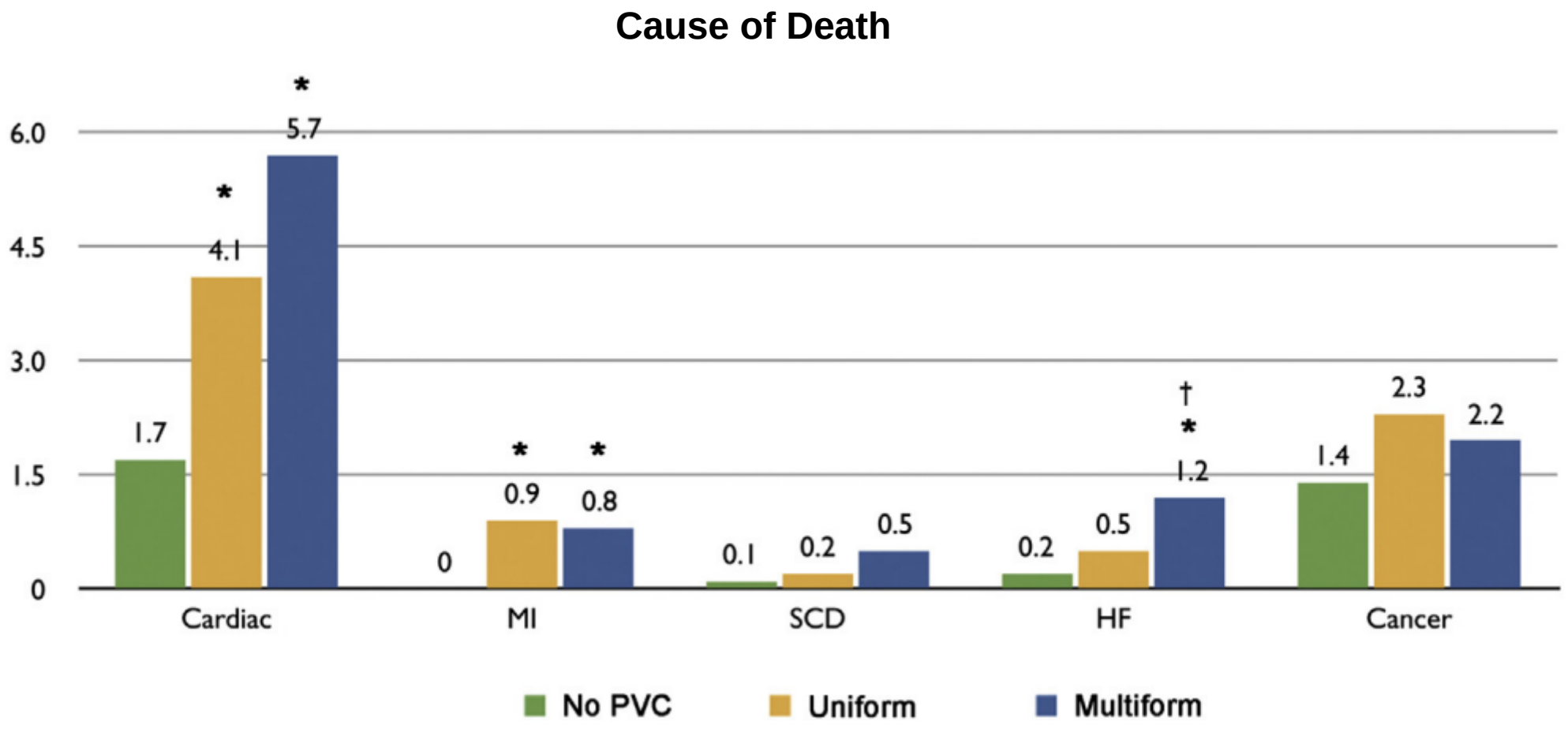



International Journal of Cardiology 180 (2015) 80–85

KHRS 2023

# What do PVCs with multiple morphologies indicate ?

2. Might be associated with underlying subclinical heart disease




International Journal of Cardiology 180 (2015) 80–85

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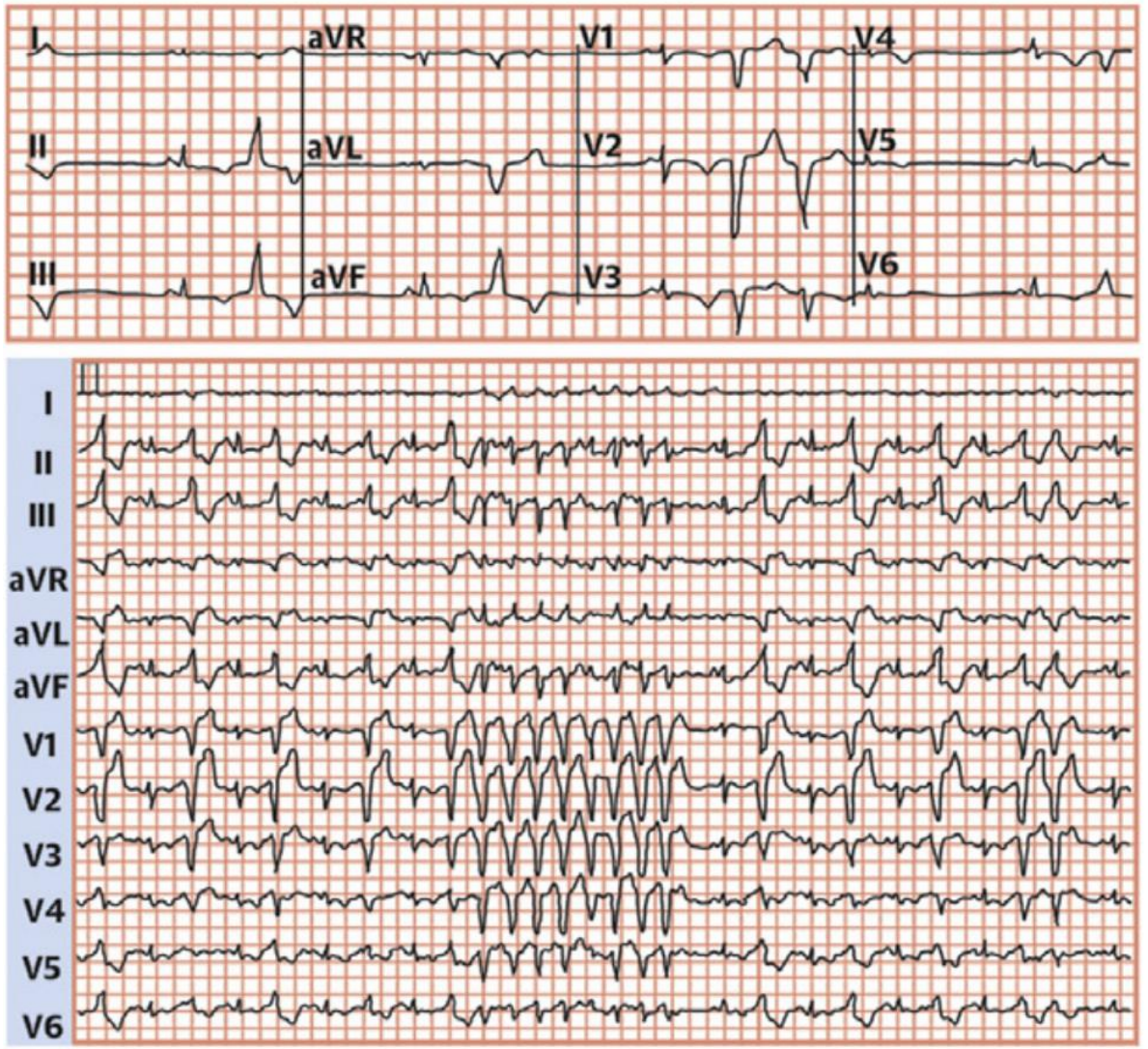
# What do PVCs with multiple morphologies indicate ?

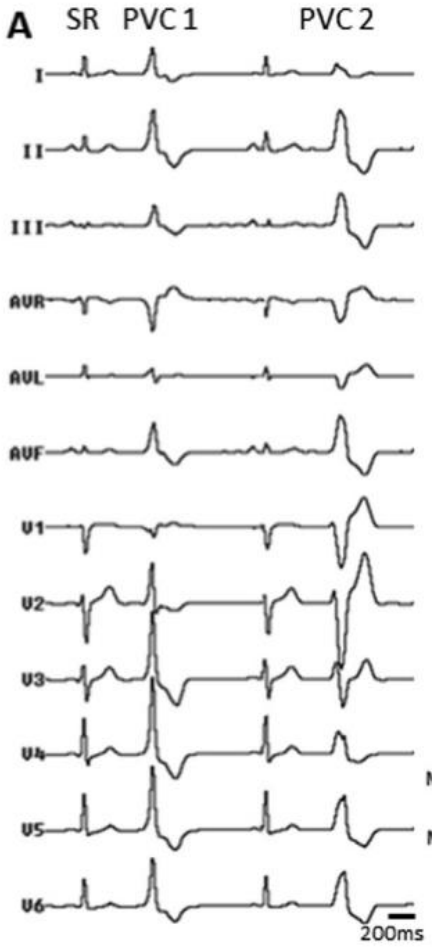
3. Increase the pretest probability for larger arrhythmic substrate as ARVD/C,

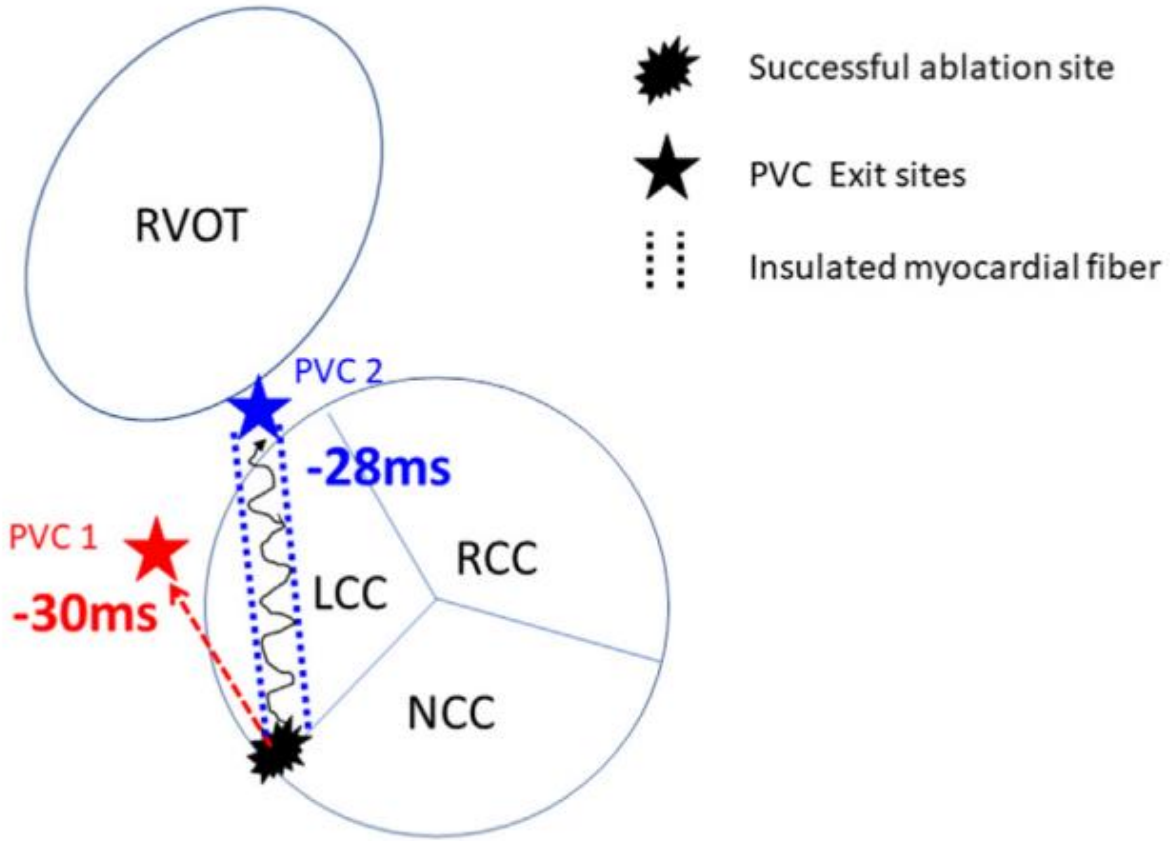



Heart Rhythm 2013;10:477–482

# What do PVCs with multiple morphologies indicate ?

4. Occasionally, single focus generating different morphology (OT, papillary m, moderate band etc)




Indian Pacing and Electrophysiology Journal 21 (2021) 169-173

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# PVCs with multiple morphologies

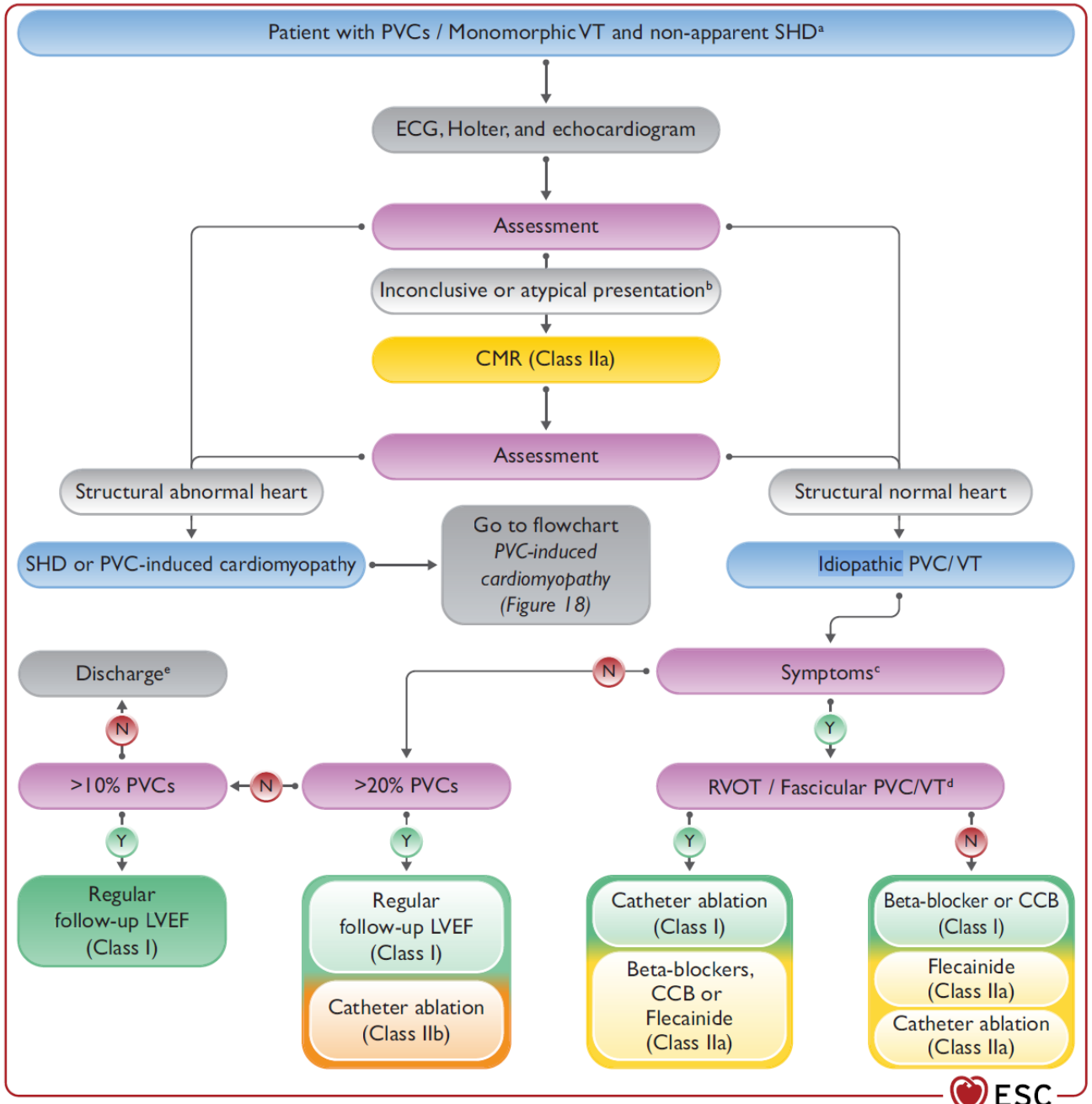
Have higher likelihood of incident AF, HF and cardiac death.

PVCs with multiple morphologies are bad in every way.

# Contents

1. Clinical significance of multiple PVCs
2. **Ablation treatment of multiple PVCs**

# ESC guideline




European Heart Journal (2022) 43, 3997–4126

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# ESC guideline recommendation for idiopathic PVC/VT

| | Ablation | Beta-blocker | CCB | Flecainide | Amiodarone |
|---|---|---|---|---|---|
| RVOT/fascicular PVC/VT:<br>Symptomatic, normal LV function | Class I | Class IIa | Class IIa | Class IIa | Class III |
| PVC/VT other than RVOT/fascicular:<br>Symptomatic, normal LV function | Class IIa | Class I | Class I | Class IIa | Class III |
| RVOT/fascicular PVC/VT:<br>LV dysfunction | Class I | Class IIa | Class III[a] | Class IIa[b] | Class IIa |
| PVC/VT other than RVOT/fascicular:<br>LV dysfunction | Class I | Class IIa | Class III[a] | Class IIa[b] | Class IIa |
| PVC:<br>Burden >20%, asymptomatic, normal LV function | Class IIb | | | | Class III |

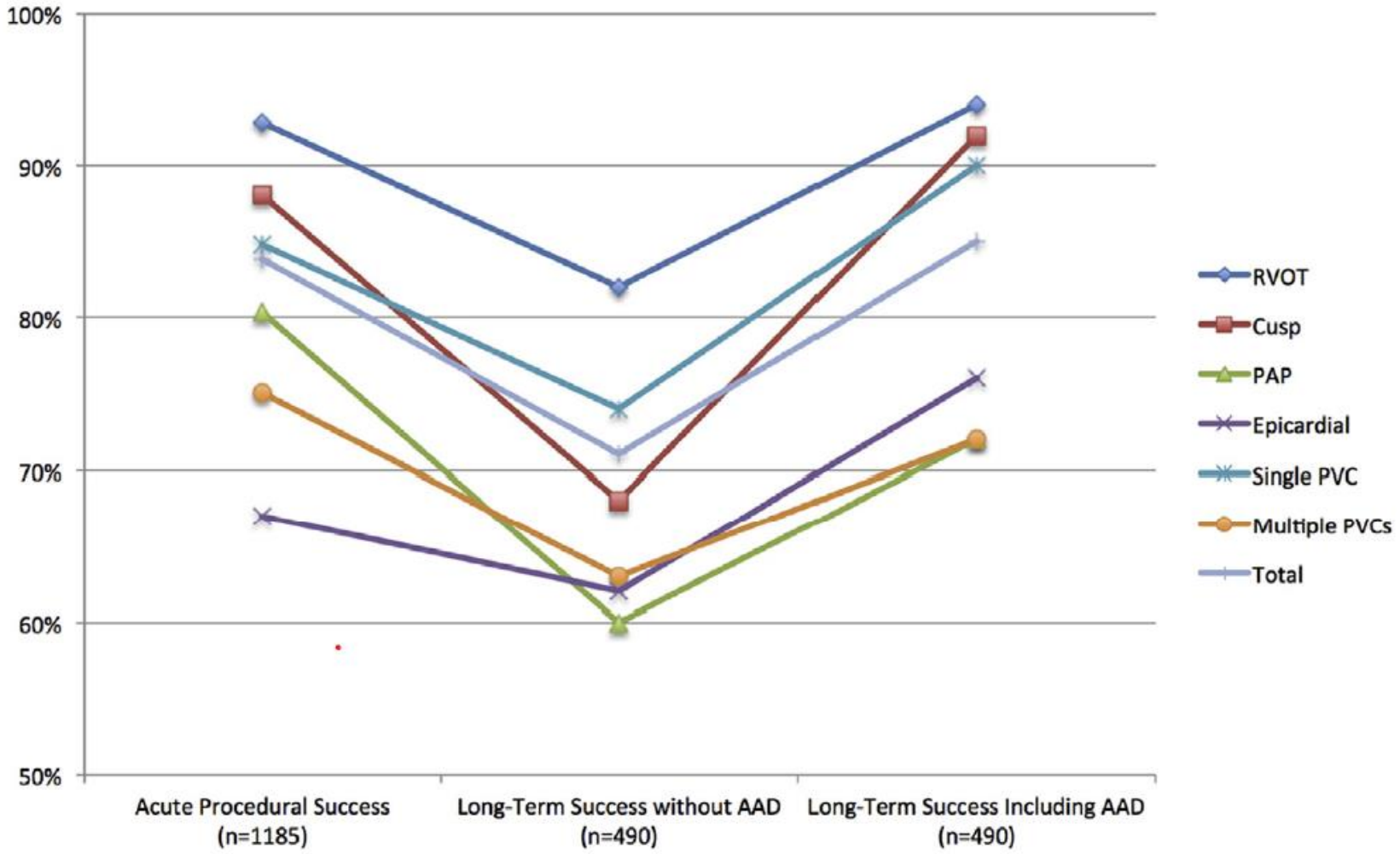
European Heart Journal (2022) 43, 3997–4126

# Outcomes of Ablation of PVC

N= 1,185 from 8 centers in the US and Europe

Acute procedure success: Elimination of the target PVCs ≥ 30 min after ablation

Long-term success:
80% decrease of PVC burden.




J Am Coll Cardiol EP 2015;1:116–23

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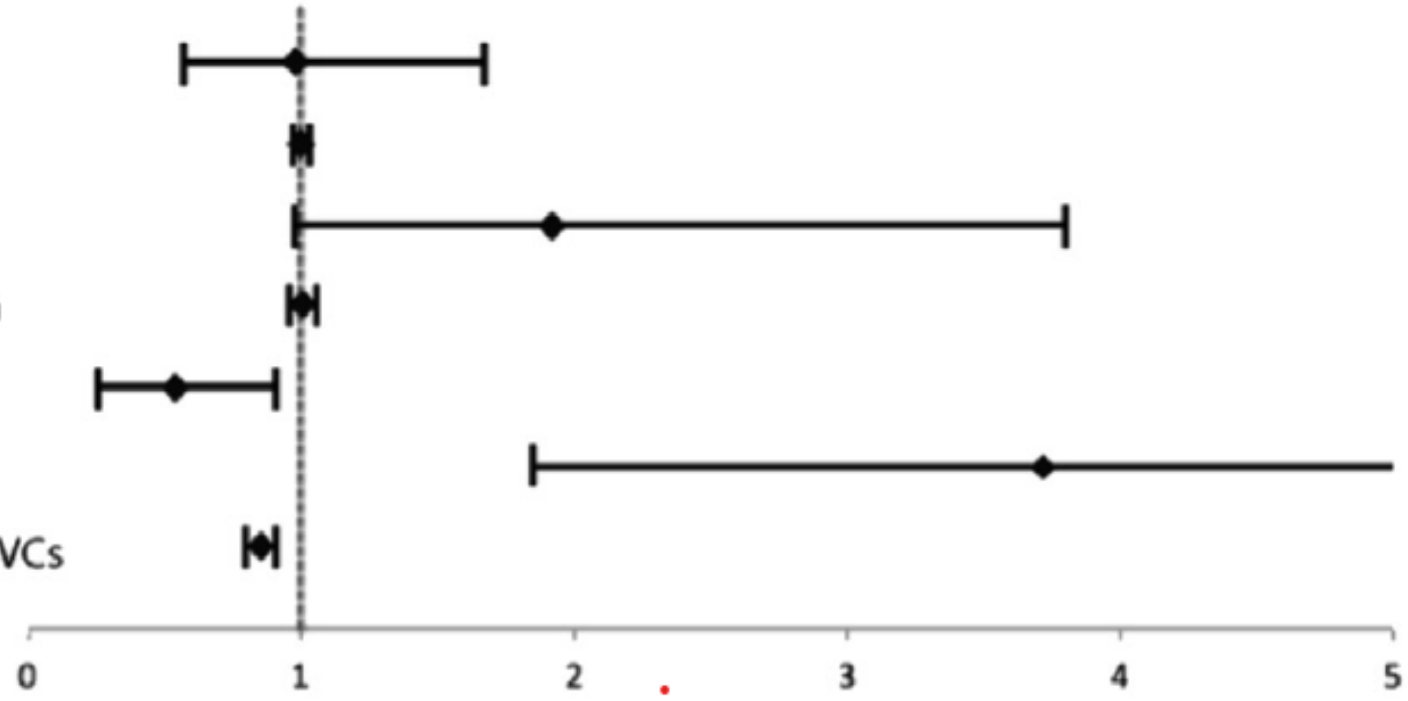
# Predictor of acute procedural success




| Variable | OR | CI | P-Value |
|---|---|---|---|
| Male | 0.98 | 0.58-1.65 | 0.98 |
| PVC Burden | 0.99 | 0.97-1.00 | 0.18 |
| Symptomatic | 1.92 | 0.98-3.79 | 0.06 |
| EF Pre Ablation | 1.00 | 0.97-1.02 | 0.75 |
| Epicardial | 0.49 | 0.27-0.91 | 0.02 |
| RVOT | 3.78 | 1.87-7.6 | <0.01 |
| # of Different PVCs | 0.89 | 0.82-0.98 | 0.01 |

J Am Coll Cardiol EP 2015;1:116–23

# Idiopathic PVC with high recurrence

1. Papillary muscle PVCs
2. Epicardial PVCs
3. Aortic cusp PVCs
4. Para-Hisian PVC
5. Moderate band PVC

# Characteristics of patients with monomorphic vs pleomorphic PVCs

100 consecutive patients referred for ablation of idiopathic PVCs

| | Monomorphic (n = 69) | Pleomorphic (n = 31) | *P* value |
|---|---|---|---|
| Age, y, mean ± SD | 51 ± 14 | 54 ± 17 | .29 |
| Male sex, n (%) | 41 (59) | 12 (39) | .055 |
| Comorbidities | | | |
| Coronary artery disease, n (%) | 2 (3) | 3 (10) | .15 |
| Hypertension, n (%) | 29 (42) | 12 (39) | .75 |
| Diabetes mellitus, n (%) | 3 (4) | 5 (16) | .045 |
| Stroke, n (%) | 5 (7) | 0 (0) | .12 |
| Hyperlipidemia, n (%) | 22 (32) | 8 (26) | .54 |
| Valve disease, n (%) | 2 (3) | 1 (3) | .95 |
| Pacemaker, n (%) | 2 (3) | 0 (0) | .34 |
| ICD, n (%) | 2 (3) | 1 (3) | .93 |
| PVC burden | | | |
| Overall burden, %, mean ± SD | 17.6 ± 12.5 | 19.9 ± 11.3 | .80 |
| Site of predominant PVC site of origin | | | |
| Endocardial, n (%) | 51 (74) | 16 (52) | .028 |
| Intramural, n (%) | 12 (17) | 6 (19) | .81 |
| Epicardial, n (%) | 6 (9) | 9 (29) | .008 |
| Predominant PVC region | | | |
| Outflow tract, n (%) | 53 (77) | 20 (65) | .20 |
| Papillary muscle, n (%) | 3 (4) | 4 (13) | .12 |
| Para-Hisian, n (%) | 5 (7) | 2 (6) | .89 |
| Mitral annulus, n (%) | 4 (6) | 1 (3) | .59 |
| Fascicular, n (%) | 1 (1) | 2 (6) | .18 |
| Other, n (%) | 3 (4) | 2 (6) | .66 |
| Procedural details | | | |
| Repeat procedure, n (%) | 14 (20) | 6 (19) | .91 |
| Successful ablation, n (%) | 62 (90) | 22 (71) | .017 |
| Echocardiographic data | | | |
| Baseline LV end-diastolic diameter, mm, mean ± SD | 51 ± 7 | 52 ± 6 | .80 |
| Baseline LVEF, %, mean ± SD | 57 ± 10 | 55 ± 29 | .32 |

ICD = implantable cardioverter-defibrillator; LV = left ventricle; LVEF = left ventricle ejection fraction; PVC = premature ventricular complex; SD = standard deviation.

Heart Rhythm 2017;14:1623–1628

# Characteristics of patients with monomorphic vs pleomorphic PVCs

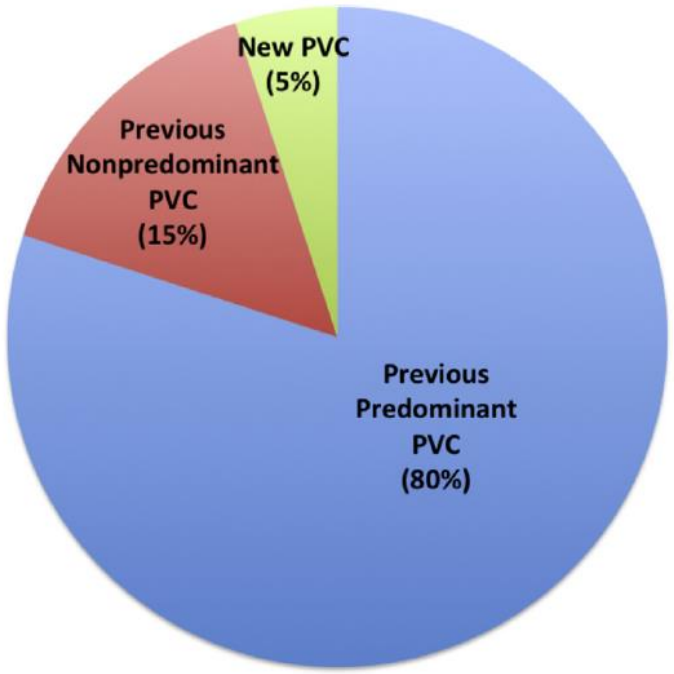
100 consecutive patients referred for ablation of idiopathic PVCs

| | Preablation, %, mean ± SD | Follow-up, %, mean ± SD | *P* value |
|---|---|---|---|
| Overall PVC burden | 19.8 ± 9.8 | 3.1 ± 4.6 | <.0001 |
| Predominant PVC | 18.0 ± 9.6 | 0.6 ± 1.3 | <.0001 |
| Nonpredominant PVCs | 1.8 ± 2.6 | 2.1 ± 4.6 | .77 |
| Nonpredominant 1 | 1.0 ± 1.1 | 2.0 ± 4.6 | .31 |
| Nonpredominant 2 | 0.7 ± 2.2 | 0.04 ± 0.1 | .14 |
| New PVCs | N/A | 0.5 ± 1.6 | N/A |

N/A = not applicable; PVC = premature ventricular contraction; SD = standard deviation.

Heart Rhythm 2017;14:1623–1628

# Repeat ablation (n=20)

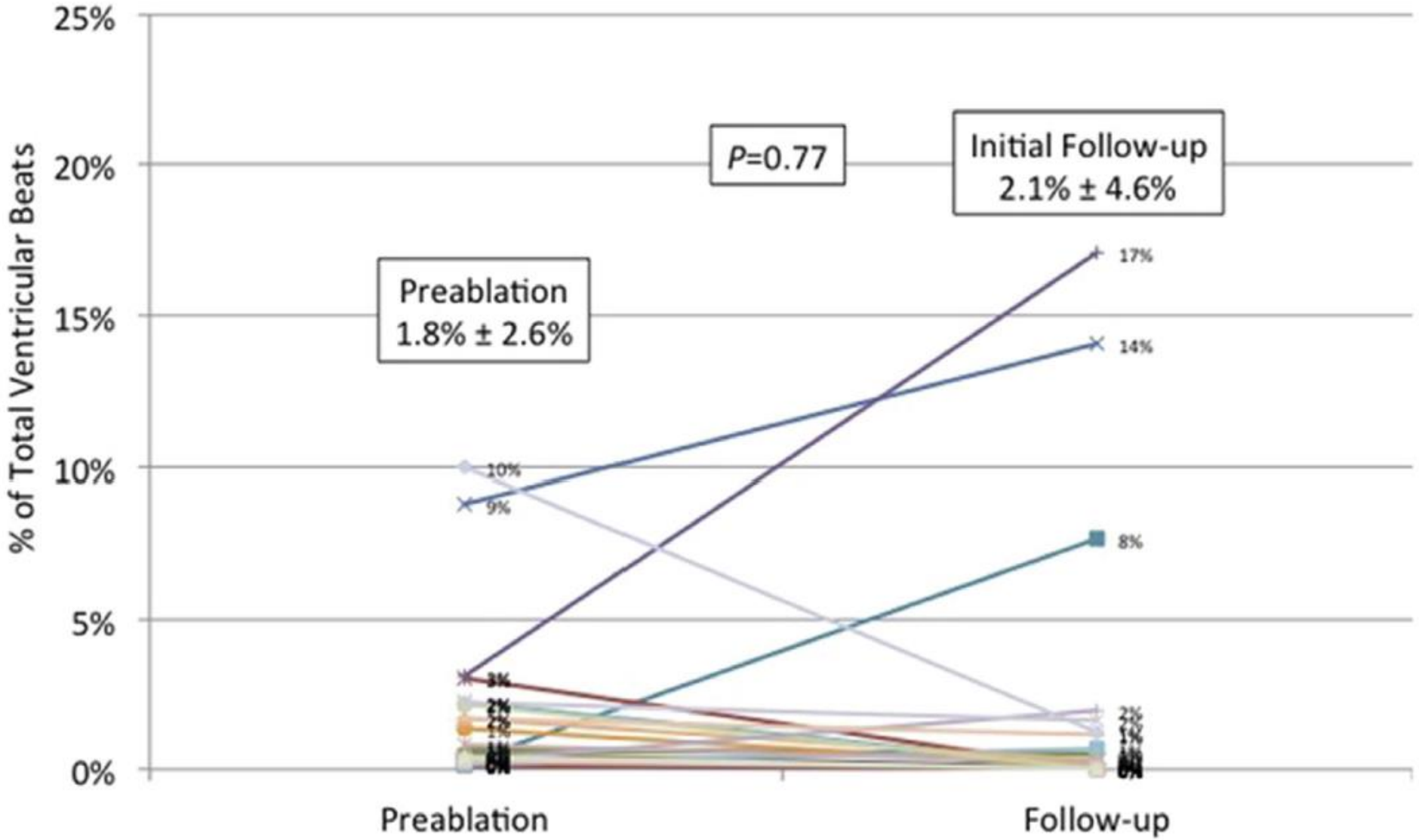



| Patient # | Initial procedure predominant origin | Pleomorphic PVCs, n | Procedure success | Interval between procedures, mo | 2nd procedure reason | 2nd procedure origin (if not same) |
|---|---|---|---|---|---|---|
| 1 | Tricuspid annulus | 0 | Yes | 7.7 | Return of previously predominant PVC | N/A |
| 2 | Intramural OFT | 0 | Yes | 45.9, 63.8, 68.2 | Return of previously predominant PVC | N/A |
| 3 | Epicardial OFT | 882 | No | 12.0 | Previously predominant PVC | N/A |
| 4 | Endocardial OFT | 7 | Yes | 16.3 | Return of previously predominant PVC | N/A |
| 5 | PMP | 207 | No | 38.6 | Nonpredominant | GCV (Epicardial OFT) |
| 6 | Endocardial OFT | 9 | Yes | 6.7 | Return of previously predominant PVC | N/A |
| 7 | Para-Hisian | 0 | Yes | 10.3 | Return of previously predominant PVC | N/A |
| 8 | Intramural OFT | 57 | Yes | 23.2, 23.7, and 37.1 | Return of previously predominant PVC | N/A |
| 9 | Epicardial OFT | 58 | Yes | 58.3 | Return of previously predominant PVC | N/A |
| 10 | ALP and PMP | 292 | Yes | 13.3 | Return of previously predominant PVC | N/A |
| 11 | ALP | 180 | No | 35.4 | Nonpredominant | PMP |
| 12 | Intramural OFT | 194 | No | 36.2 | Previously predominant PVC | N/A |
| 13 | Epicardial OFT | 0 | No | 69.3 | Previously predominant PVC | N/A |
| 14 | Epicardial OFT | 0 | Yes | 31.9 | Return of previously predominant PVC | N/A |
| 15 | Endocardial MA | 0 | Yes | 44.4 | New | Para-Hisian |
| 16 | Endocardial OFT | 0 | Yes | 95.1 | Return of previously predominant PVC | N/A |
| 17 | Endocardial OFT | 138 | Yes | 42.9 | Return of previously predominant PVC | N/A |
| 18 | Endocardial OFT | 13 | No | 42.0 | Nonpredominant | ALP |
| 19 | Para-Hisian | 134 | Yes | 6.6 | Return of previously predominant PVC | N/A |
| 20 | Epicardial OFT | 1805 | Yes | 15.0 | Return of previously predominant PVC | N/A |

ALP = anterolateral papillary muscle; GCV = great cardiac vein; MA = mitral annulus; N/A = not applicable; OFT = outflow tract; PMP = posteromedial papillary muscle; PVC = premature ventricular complex.

Heart Rhythm 2017;14:1623–1628

# Change in non-predominant PVC burden

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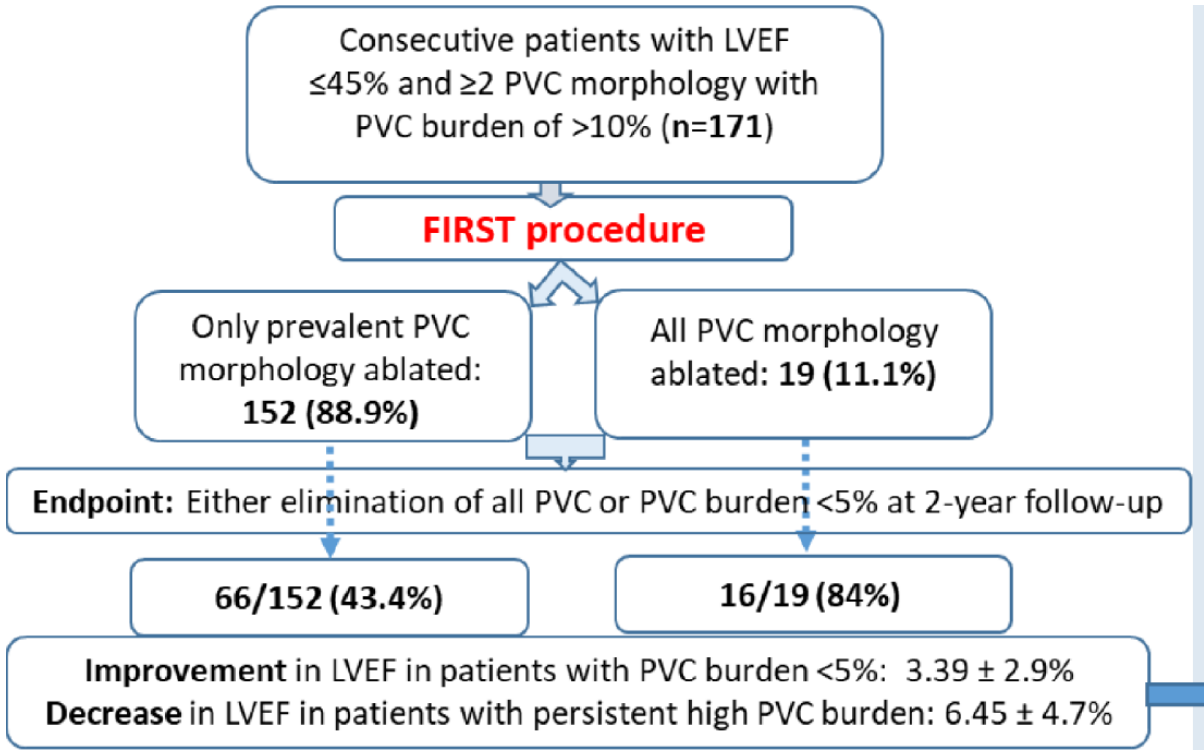
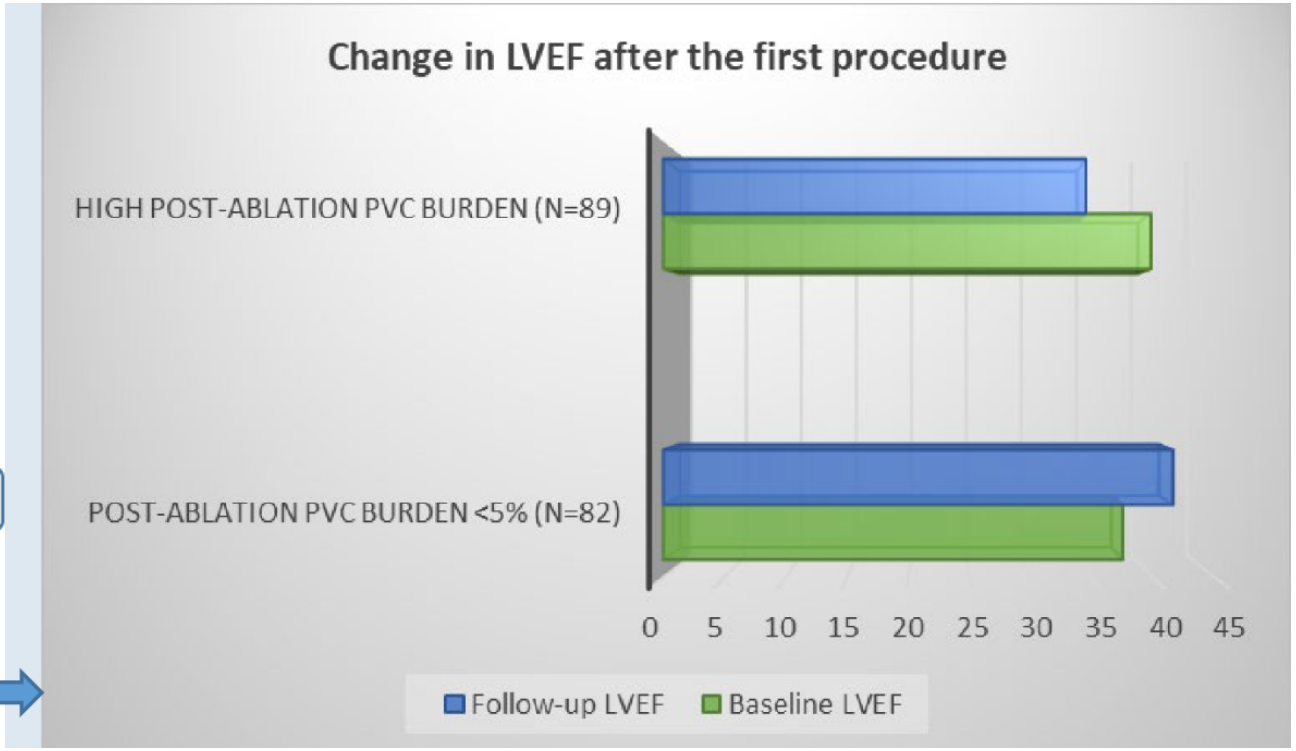
# Predominant PVC ablation alone vs all PVC ablation



# Outcomes of Ablation of Multiple PVC Morphologies

Depends on.

1. Individual PVC's location
2. Burden of non-predominant PVCs
3. Operator's experience

The burden of non-predominant PVCs does not change much after successful ablation of the predominant PVC.

Repeat ablation usually has been performed targeting previous predominant PVC.

Reduction of PVC burden is associated with increase of LV dysfunction in PVC induced CMP.

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