



Eskişehir Osmangazi Üniversitesi



Eskişehir Osmangazi Üniversitesi



# Güncel Çalışmalar Işığında VT Ablasyon Sonuçları

Doç. Dr. Muhammet DURAL

| Recommendations for catheter ablation of VAs in patients with IHD |      |   |                 |
|---|------|---|-----------------|
| COR   | LOE  | Recommendations   | References      |
| I   | B-R  | 1. In patients with IHD who experience recurrent monomorphic VT despite chronic amiodarone therapy, catheter ablation is recommended in preference to escalating AAD therapy.   | S4.4.1          |
| I   | B-NR | 2. In patients with IHD and recurrent symptomatic monomorphic VT despite AAD therapy, or when AAD therapy is contraindicated or not tolerated, catheter ablation is recommended to reduce recurrent VT.   | S4.4.2–S4.4.4   |
| I   | B-NR | 3. In patients with IHD and VT storm refractory to AAD therapy, catheter ablation is recommended.   | S4.4.5–S4.4.9   |
| IIa   | C-EO | 4. In patients with IHD and recurrent monomorphic VT, in whom AADs are not desired, catheter ablation can be useful.  |                 |
| IIb   | A    | 5. In patients with IHD and an ICD who experience a first episode of monomorphic VT, catheter ablation may be considered to reduce the risk of recurrent VT or ICD therapies.   | S4.4.10–S4.4.14 |
| IIb   | C-LD | 6. In patients with prior MI and recurrent episodes of symptomatic sustained VT for whom prior endocardial catheter ablation has not been successful and who have ECG, endocardial mapping, or imaging evidence of a subepicardial VT substrate, epicardial ablation may be considered. | S4.4.15–S4.4.19 |

#### 4.5. Nonischemic Cardiomyopathy

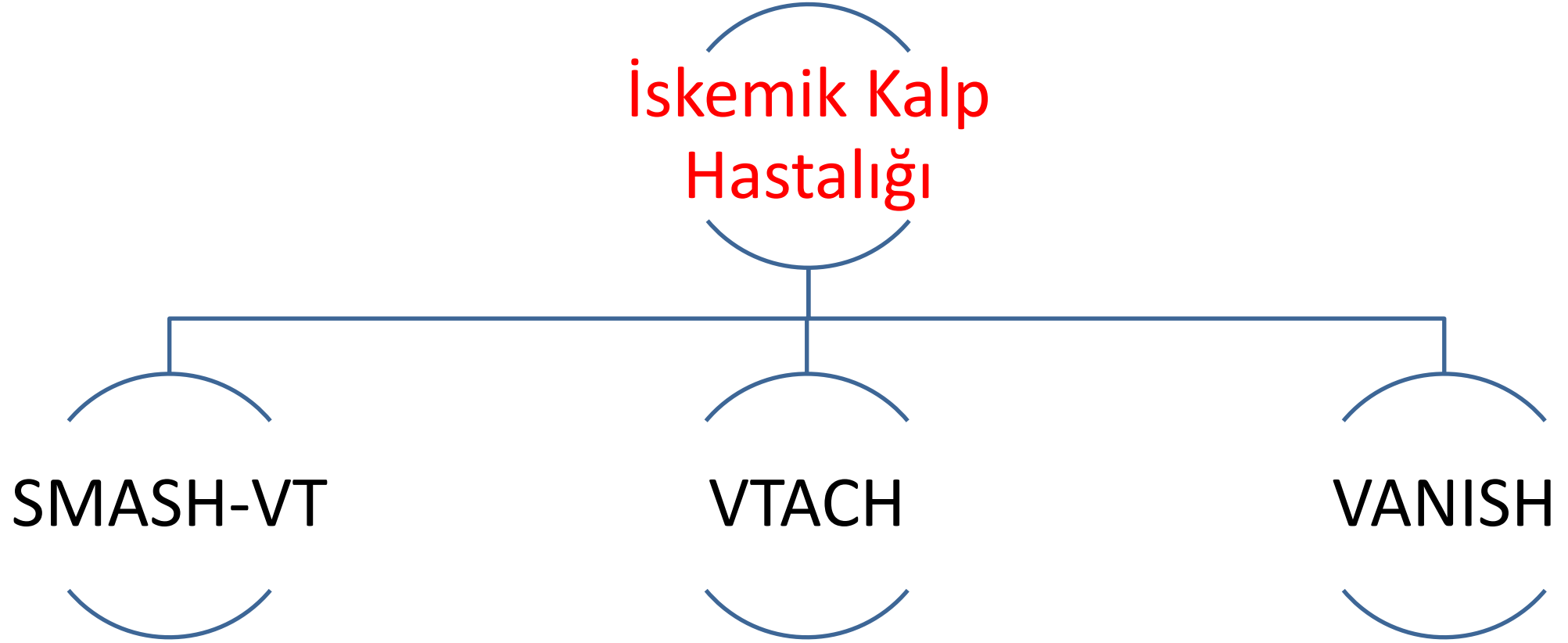
| Recommendations for catheter ablation of VT in NICM |      |   |                         |
|---|------|---|-------------------------|
| COR   | LOE  | Recommendations   | References              |
| I   | B-NR | 1. In patients with NICM and recurrent sustained monomorphic VT for whom antiarrhythmic medications are ineffective, contraindicated, or not tolerated, catheter ablation is useful for reducing recurrent VT and ICD shocks. | S4.5.1–S4.5.6           |
| I   | B-NR | 2. In patients with NICM and electrical storm refractory to AAD therapy, catheter ablation is useful for reducing recurrent VT and ICD shocks.  | S4.5.7–S4.5.9           |
| IIa   | B-NR | 3. In patients with NICM, epicardial catheter ablation of VT can be useful after failure of endocardial ablation or as the initial ablation approach when there is a suspicion of an epicardial substrate or circuit.         | S4.5.4, S4.5.10–S4.5.13 |
| IIa   | B-NR | 4. In patients with cardiac sarcoidosis and recurrent VT despite medical therapy, catheter ablation can be useful to reduce the risk of VT recurrence and ICD shocks.   | S4.5.14–S4.5.18         |
| IIa   | C-EO | 5. In patients with NICM and recurrent sustained monomorphic VT for whom antiarrhythmic medications are not desired, catheter ablation can be useful for reducing recurrent VT and ICD shocks.                                |                         |
| IIb   | B-NR | 6. In patients with NICM related to lamin A/C ( <i>LMNA</i> ) mutations and recurrent VT, catheter ablation may be considered as a palliative strategy for short-term arrhythmia control.                                     | S4.5.19                 |

İskemik Kalp Hastalığı

SMASH-VT

VTACH

VANISH



# Substrate Mapping and Ablation in Sinus Rhythm to Halt Ventricular Tachycardia (SMASH-VT)

*The* NEW ENGLAND  
JOURNAL *of* MEDICINE

ESTABLISHED IN 1812

DECEMBER 27, 2007

VOL. 357 NO. 26

## Prophylactic Catheter Ablation for the Prevention of Defibrillator Therapy

Vivek Y. Reddy, M.D., Matthew R. Reynolds, M.D., Petr Neuzil, M.D., Ph.D., Allison W. Richardson, M.D.,  
Milos Taborsky, M.D., Ph.D., Krit Jongnarangsin, M.D., Stepan Kralovec, Lucie Sediva, M.D.,  
Jeremy N. Ruskin, M.D., and Mark E. Josephson, M.D.



# SMASH-VT

**Table 1. Baseline Characteristics of the Patients.\***

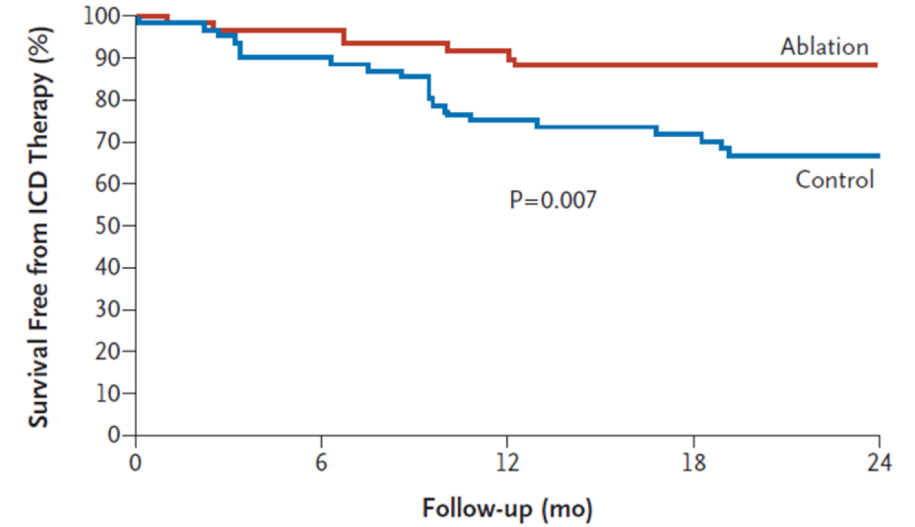
| Characteristic   | Ablation Group<br>(N=64) | Control Group<br>(N=64) | P Value |
|--|--------------------------|-------------------------|---------|
| Age — yr   | 67±9                     | 66±10                   | 0.65†   |
| Male sex — no. (%)   | 59 (92)                  | 52 (81)                 | 0.12‡   |
| Interval between myocardial infarction and enrollment — yr‡                          | 8.8±8.5                  | 7.9±7.8                 | 0.66¶   |
| Index arrhythmia — no. (%)   |                          |                         | 0.38‡   |
| Ventricular fibrillation   | 13 (20)                  | 10 (16)                 |         |
| Ventricular tachycardia  | 30 (47)                  | 33 (52)                 |         |
| Syncope with inducible ventricular tachycardia                                       | 11 (17)                  | 16 (25)                 |         |
| Recent ventricular fibrillation or tachycardia treated by a previously implanted ICD | 10 (16)                  | 5 (8)                   |         |
| Left ventricular ejection fraction — %   | 30.7±9.5                 | 32.9±8.5                | 0.16†   |
| Left ventricular ejection fraction ≤30% — no. (%)                                    | 37 (58)                  | 30 (47)                 | 0.29‡   |
| Left ventricular ejection fraction ≤20% — no. (%)                                    | 16 (25)                  | 7 (11)                  | 0.06‡   |
| New York Heart Association functional class — no. (%)                                |                          |                         | 0.37‡   |
| I or II  | 54 (84)                  | 49 (77)                 |         |
| III or IV  | 10 (16)                  | 15 (23)                 |         |
| Hypertension — no. (%)   | 47 (73)                  | 43 (67)                 | 0.35‡   |
| Diabetes — no. (%)   | 24 (38)                  | 32 (50)                 | 0.21‡   |
| Previous revascularization (PTCA or CABG) — no. (%)                                  | 46 (72)                  | 40 (62)                 | 0.35‡   |
| Previous stroke — no. (%)  | 3 (5)                    | 8 (12)                  | 0.21‡   |
| Medication — no. (%)   |                          |                         |         |
| Class I or class III drugs   | 0                        | 0                       | —       |
| Beta-blockers  | 60 (94)                  | 63 (98)                 | 0.37‡   |
| ACE inhibitors or angiotensin-receptor blockers                                      | 59 (92)                  | 59 (92)                 | 1.0‡    |
| Statins  | 37 (58)                  | 38 (59)                 | 1.0‡    |
| Aspirin  | 52 (81)                  | 39 (61)                 | 0.02‡   |
| Type of ICD — no. (%)  |                          |                         | 0.21‡   |
| Single chamber   | 23 (36)                  | 31 (48)                 |         |
| Dual-chamber   | 41 (64)                  | 33 (52)                 |         |

- En az 1 ay öncesinde MI
- VT/VF veya EPS'de sustained VT
- ICD planlanan

# SMASH-VT

**Table 2. End Points.\***

| Variable                      | Ablation Group<br>(N=64)<br><i>no. of patients (%)</i> | Control Group<br>(N=64)<br><i>no. of patients (%)</i> | Hazard Ratio<br>(95% CI) | P Value |
|-------------------------------|--|---|--------------------------|---------|
| ICD events*                   | 8 (12)   | 21 (33)   | 0.35 (0.15–0.78)         | 0.007†  |
| ICD shocks                    | 6 (9)  | 20 (31)   | 0.27 (0.11–0.67)         | 0.003†  |
| ICD storms                    | 4 (6)  | 12 (19)   | 0.30 (0.09–1.00)         | 0.06‡   |
| Death                         | 6 (9)  | 11 (17)   | 0.59 (0.22–1.59)         | 0.29†   |
| Congestive heart failure      | 3 (5)  | 6 (9)   |                          |         |
| Ventricular tachycardia storm | 0  | 1 (2)   |                          |         |
| Cancer                        | 1 (2)  | 0   |                          |         |
| Pulmonary embolism            | 1 (2)  | 0   |                          |         |
| Unknown                       | 1 (2)  | 4 (6)   |                          |         |

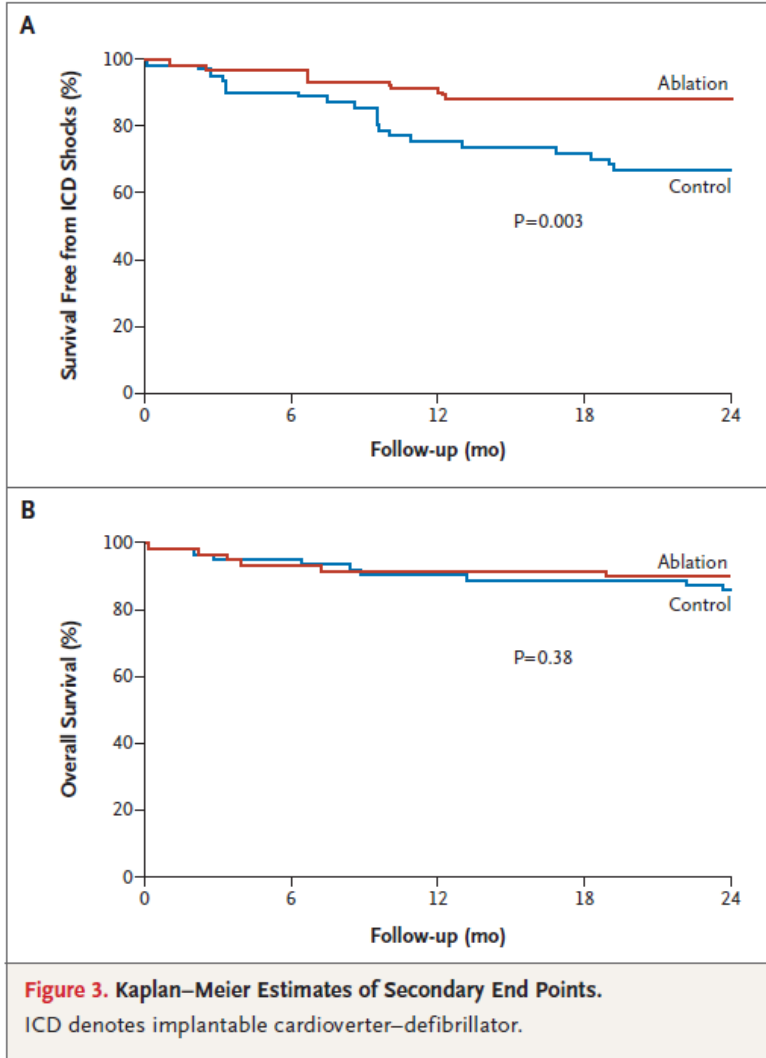


**Figure 1. Kaplan–Meier Estimate of the Primary End Point of Survival Free from ICD Therapy.**

ICD denotes implantable cardioverter–defibrillator.

- ICD terapilerinde ve VT'de anlamlı azalma
- Mortalitede fark yok

# SMASH-VT



- Profilaktik substrat bazlı VT ablasyonu ICD terapilerini azaltıyor
- Antiaritmik ilaçlarla karşılaştırma yok

# VTACH

**Catheter ablation of stable ventricular tachycardia before defibrillator implantation in patients with coronary heart disease (VTACH): a multicentre randomised controlled trial**

*Karl-Heinz Kuck, Anselm Schaumann, Lars Eckardt, Stephan Willems, Rodolfo Ventura, Etienne Delacrétaz, Heinz-Friedrich Pitschner, Josef Kautzner, Burghard Schumacher, Peter S Hansen, for the VTACH study group\**

**Lancet 2010; 375: 31-40**

# VTACH

|   | Ablation (n=52)   | Control (n=55)   | Total (n=107)    |
|---|-------------------|------------------|------------------|
| Age (years)   | 67.7 (8.3)        | 64.4 (8.2)       | 66.0 (8.3)       |
| Male  | 50 (96%)          | 50 (91%)         | 100 (93%)        |
| LVEF (%)  | 34.0% (9.6)       | 34.1% (8.8)      | 34.0% (9.2)      |
| LVEF ≤30%   | 20 (38%)          | 23 (42%)         | 43 (40%)         |
| LVEF >30%   | 32 (62%)          | 32 (58%)         | 64 (60%)         |
| LVEDD (cm)  | 5.8 (1.0)         | 6.1 (0.9)        | 6.0 (1.0)        |
| Previous PTCA   | 26 (50%)          | 24 (44%)         | 50 (47%)         |
| Previous surgical revascularisation                         | 26 (50%)          | 22 (40%)         | 48 (45%)         |
| Time since last myocardial infarction (years)               | 12.6 (8.0)        | 13.3 (8.6)       | 12.9 (8.2)       |
| Heart rate of clinical VT (beats per min, mean [SD; range]) | 169 (25; 132–240) | 173 (30; 98–250) | 171 (28; 98–250) |
| Time between LVEF assessment and randomisation (days)       | 4 (1–7)           | 1 (0–6)          | 3 (0–7)          |
| Method used for LVEF assessment                             |                   |                  |                  |
| Echocardiography  | 24 (46%)          | 32 (58%)         | 56 (52%)         |
| Ventriculography  | 28 (54%)          | 23 (42%)         | 51 (48%)         |
| Time between EPS* and ICD placement (days)                  | 3 (1–5)           | 3 (1–5)          | 3 (1–5)          |
| Use of amiodarone at randomisation                          | 18 (35%)          | 19 (35%)         | 37 (35%)         |
| Use of β blocker at randomisation                           | 39 (75%)          | 41 (75%)         | 80 (75%)         |
| ICD type: single chamber                                    | 34 (65%)          | 37 (67%)         | 71 (66%)         |

Data are n (%), mean (SD), or median (IQR), unless otherwise indicated. LVEF=left-ventricular ejection fraction. LVEDD=left-ventricular end diastolic diameter. PTCA=percutaneous transluminal coronary angioplasty. VT=ventricular tachycardia. EPS=electrophysiological study. ICD=implantable cardioverter defibrillator. \*Or ablation procedure, whichever was the later.

**Table 1: Patient demographics and baseline characteristics**

- MI öyküsü bulunan LVEF≤%50 olup VT'si olan
- Kateter ablasyonu+ICD vs. ICD

# VTACH

|   | Ablation (n=52)         | Control (n=55)             | Hazard ratio (95% CI) | p value |
|---|-------------------------|----------------------------|-----------------------|---------|
| Time to first VT or VF (months, mean [SD]; median [IQR])                                  | 15.9 (1.7); 18.6 (2.4*) | 11.3 (1.5); 5.9 (0.8-26.7) | 0.61 (0.37-0.99)      | 0.045†  |
| 24-month event-free survival estimates (%)‡   |                         |                            |                       |         |
| VT recurrence (category 1)  | 46.6%                   | 28.8%                      | 0.61 (0.37-0.99)      | 0.045†  |
| VT recurrence (all categories)  | 46.4%                   | 28.8%                      | 0.61 (0.38-1.01)      | 0.051†  |
| Hospital admission for cardiac reasons  | 67.4%                   | 45.4%                      | 0.55 (0.30-0.99)      | 0.044†  |
| VT storm  | 75.0%                   | 69.7%                      | 0.73 (0.36-1.50)      | 0.395†  |
| Syncope   | 96.2%                   | 85.4%                      | 0.36 (0.07-1.81)      | 0.197†  |
| Death   | 91.5%                   | 91.4%                      | 1.32 (0.35-4.94)      | 0.677†  |
| Appropriate ICD intervention (n [%])  | 26 (50.0%)              | 38 (69.1%)                 | ..                    | 0.051§  |
| ICD shock (n [%])   | 17 (32.7%)              | 29 (52.7%)                 | ..                    | 0.051§  |
| Appropriate ICD shock (n [%])   | 14 (26.9%)              | 26 (47.3%)                 | ..                    | 0.045§  |
| Inappropriate ICD shock (n [%])   | 4 (7.7%)                | 6 (10.9%)                  | ..                    | 0.743§  |
| ≥2 shocks per year (n [%])  | 6 (11.5%)               | 15 (27.3%)                 | ..                    | 0.021§  |
| ≥2 appropriate shocks per year (n [%])  | 4 (7.7%)                | 12 (21.8%)                 | ..                    | 0.018§  |
| Number of appropriate ICD interventions per patient per year¶ (mean [SD]; median [range]) | 7.1 (16.3); 0.2 (0-91)  | 58.3 (263.5); 3.0 (0-1940) | ..                    | 0.013   |
| Number of appropriate ICD shocks per patient per year§ (mean [SD]; median [range])        | 0.6 (2.1); 0 (0-14.2)   | 3.4 (9.2); 0 (0-48.4)      | ..                    | 0.018   |

VT=ventricular tachycardia. VF=ventricular fibrillation. ICD=implantable cardioverter defibrillator. \*Lower quartile shown (upper quartile not determinable because, at the end of the observation period, 37% of the patients were still event-free). †Calculated by log-rank test. ‡Kaplan-Meier survival estimates. §Calculated by Fisher's exact test.

¶Analysis done on all event categories. ||Calculated by Wilcoxon test.

Table 3: Endpoints in ablation and control groups

- İlk VT'nin görülme zamanı ablasyon grubunda anlamlı olarak daha geç
- ICD terapilerinde ablasyon grubunda anlamlı azalma var



# VTACH

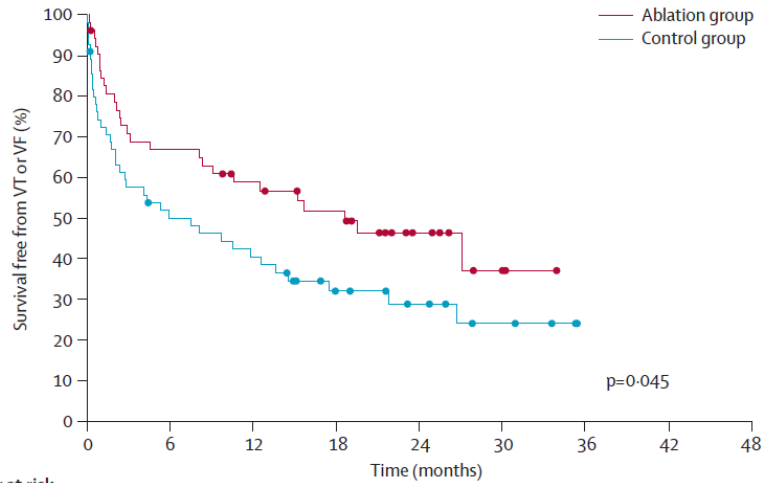


Figure 2: Kaplan-Meier curves for the primary endpoint

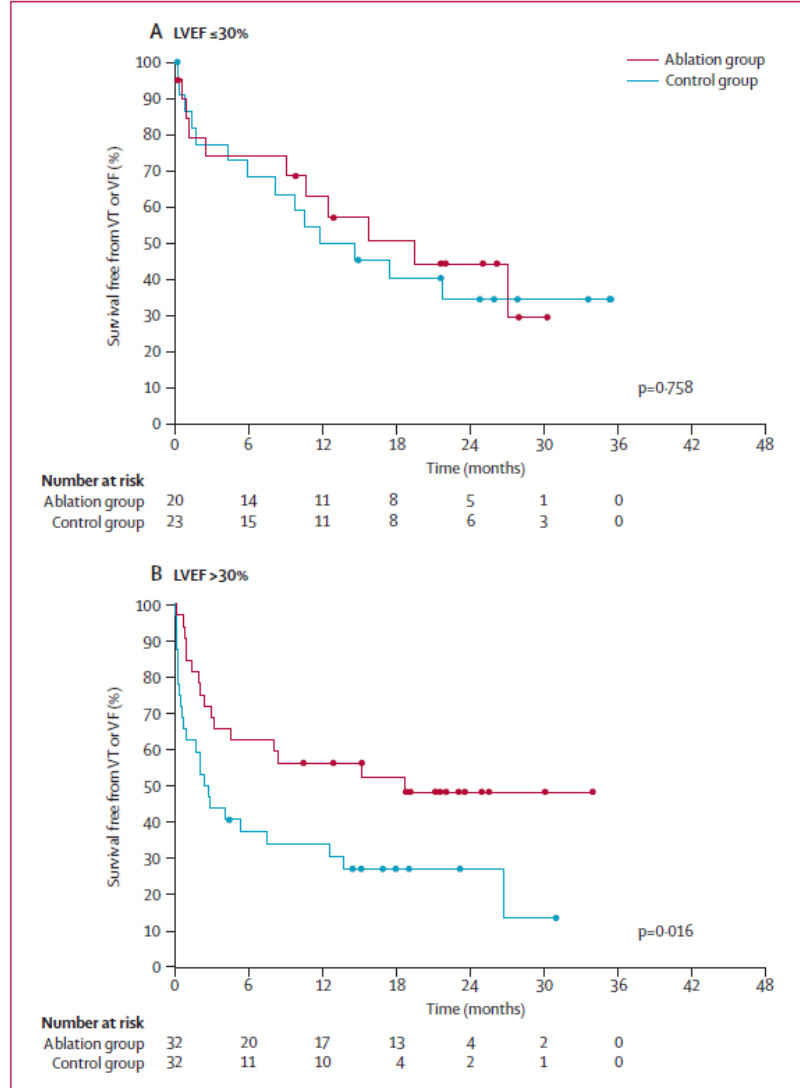


Figure 3: Kaplan-Meier curves for the primary endpoint by left-ventricular function

- 2. yılda ablasyon grubunda VA'siz sağkalım oranı %47, kontrol grubunda %29
- EF >%30 olanlarda bu fark daha anlamlı

# VTACH

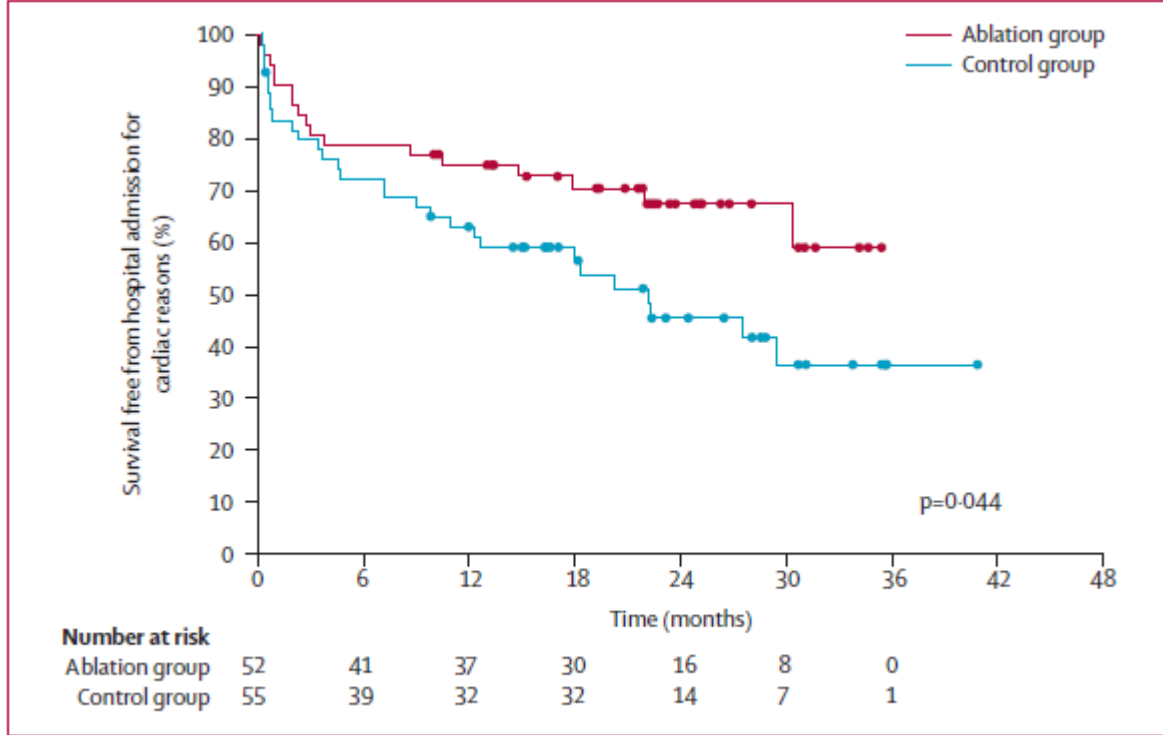


Figure 4: Kaplan-Meier curves for the secondary endpoint of hospital admission

- Kardiyak nedenli hastaneye yatış oranı ablasyon grubunda daha az

- Profilaktik VT ablasyonu VA'siz sağkalım süresini uzatıyor
- ICD terapilerini ve hastaneye yatışları azaltıyor
- Antiaritmik ile karşılaştırma yok

# VANISH

*The* NEW ENGLAND  
JOURNAL *of* MEDICINE

ESTABLISHED IN 1812

JULY 14, 2016

VOL. 375 NO. 2

## Ventricular Tachycardia Ablation versus Escalation of Antiarrhythmic Drugs

John L. Sapp, M.D., George A. Wells, Ph.D., Ratika Parkash, M.D., William G. Stevenson, M.D.,  
Louis Blier, M.D., Jean-Francois Sarrazin, M.D., Bernard Thibault, M.D., Lena Rivard, M.D.,  
Lorne Gula, M.D., Peter Leong-Sit, M.D., Vidal Essebag, M.D., Ph.D., Pablo B. Nery, M.D., Stanley K. Tung, M.D.,  
Jean-Marc Raymond, M.D., Laurence D. Sterns, M.D., George D. Veenhuizen, M.D., Jeff S. Healey, M.D.,  
Damian Redfearn, M.D., Jean-Francois Roux, M.D., and Anthony S.L. Tang, M.D.

# VANISH

**Table 1. Characteristics of the Patients at Baseline.\***

| Characteristic  | Escalated Therapy (N=127) | Catheter Ablation (N=132) |
|---|---------------------------|---------------------------|
| Age—yr  | 70.3±7.3                  | 67.0±8.6                  |
| Male sex—no. (%)  | 118 (92.9)                | 123 (93.2)                |
| Time since last myocardial infarction—yr                      | 15.7±9.8                  | 15.7±9.4                  |
| Previous PCI—no. (%)  | 62 (48.8)                 | 50 (37.9)                 |
| Previous CABG—no. (%)   | 55 (43.3)                 | 63 (47.7)                 |
| Diabetes—no. (%)  | 40 (31.5)                 | 37 (28.0)                 |
| Hypertension—no. (%)  | 88 (69.3)                 | 92 (69.7)                 |
| Renal insufficiency—no. (%)                                   | 26 (20.5)                 | 23 (17.4)                 |
| Atrial fibrillation or flutter—no. (%)                        | 47 (37.0)                 | 52 (39.4)                 |
| NYHA functional class—no. (%)                                 |                           |                           |
| I   | 28 (22.0)                 | 33 (25.0)                 |
| II  | 68 (53.5)                 | 69 (52.3)                 |
| III   | 31 (24.4)                 | 30 (22.7)                 |
| Ejection fraction—%   | 31.2±10.7                 | 31.1±10.4                 |
| Implantable cardioverter-defibrillator—no. (%)                |                           |                           |
| Single-chamber  | 44 (34.6)                 | 43 (32.6)                 |
| Dual-chamber  | 61 (48.0)                 | 60 (45.5)                 |
| CRT defibrillator—no. (%)                                     | 22 (17.3)                 | 29 (22.0)                 |
| Antiarrhythmic drug received at time of qualification—no. (%) |                           |                           |
| Amiodarone  | 84 (66.1)                 | 85 (64.4)                 |
| Dose <300 mg/day  | 73 (57.5)                 | 77 (58.3)                 |
| Dose ≥300 mg/day  | 11 (8.7)                  | 8 (6.1)                   |
| Other medication  | 43 (33.9)                 | 47 (35.6)                 |
| Sotalol   | 43 (33.9)                 | 46 (34.8)                 |
| Procainamide  | 0                         | 1 (0.8)                   |
| Other medications—no./total no. (%)                           |                           |                           |
| Beta-blocker  | 122/127 (96.1)            | 124/132 (93.9)            |
| Angiotensin-converting-enzyme inhibitor                       | 83/127 (65.4)             | 85/132 (64.4)             |
| Angiotensin-receptor blocker                                  | 28/127 (22.0)             | 31/132 (23.5)             |
| Diuretic  | 89/127 (70.1)             | 90/132 (68.2)             |
| Digoxin   | 25/127 (19.7)             | 27/132 (20.5)             |
| Aspirin   | 85/112 (75.9)             | 99/118 (83.9)             |
| Calcium-channel blocker                                       | 19/127 (15.0)             | 14/132 (10.6)             |
| Warfarin  | 42/112 (37.5)             | 47/119 (39.5)             |
| Non-warfarin anticoagulant                                    | 12/127 (9.4)              | 11/132 (8.3)              |
| Estimated GFR†  | 70.2±26.4                 | 75.8±29.0                 |
| Sodium—mmol/liter   | 138.4±3.4                 | 138.5±3.0                 |
| Potassium—mmol/liter  | 4.3±0.4                   | 4.3±0.4                   |
| NT-proBNP—pg/ml   | 937.3±895.5               | 1010.3±1252.7             |

İskemik KMP+ICD

Antiarritmik tedavinin artırılması

Kateter ablasyonu+mevcut antiarritmik

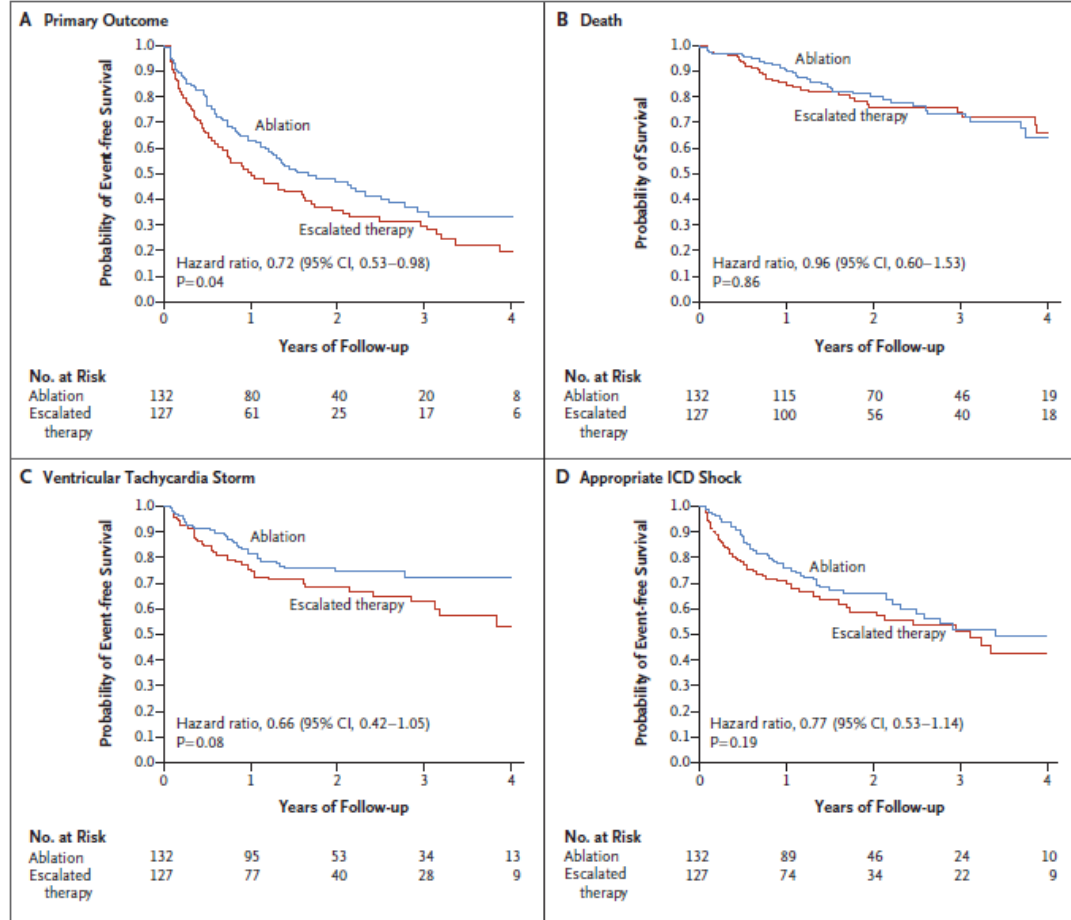
Amiodaron eklenmesi

Amiodaron dozunun artırılması veya meksiletin eklenmesi

# VANISH

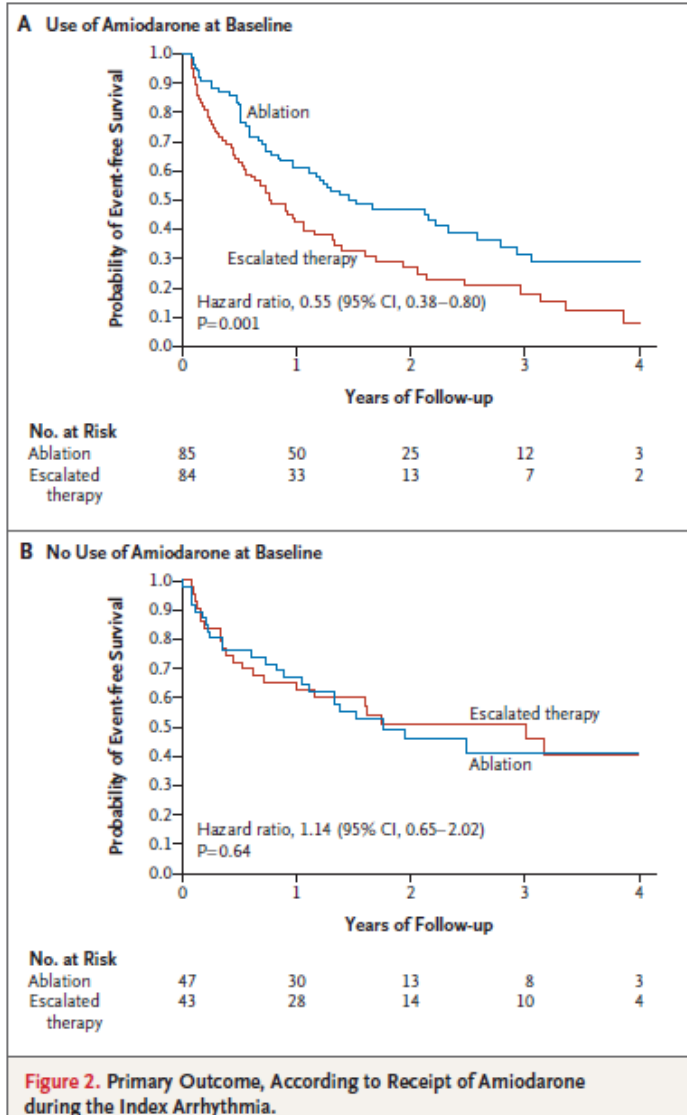
**Table 2. Trial Outcomes.\***

| Outcome   | Escalated Therapy (N=127)       | Catheter Ablation (N=132) | Hazard Ratio (95% CI)   | P Value     |
|---|---------------------------------|---------------------------|-------------------------|-------------|
|   | <i>no. (%)</i>                  |                           |                         |             |
| <b>Primary outcome†</b>                                     | <b>87 (68.5)</b>                | <b>78 (59.1)</b>          | <b>0.72 (0.53–0.98)</b> | <b>0.04</b> |
| <b>Death</b>  | <b>35 (27.6)</b>                | <b>36 (27.3)</b>          | <b>0.96 (0.60–1.53)</b> | <b>0.86</b> |
| From cardiovascular causes‡                                 | 26                              | 24                        |                         |             |
| From noncardiovascular causes                               | 8                               | 12                        |                         |             |
| From unknown cause  | 1                               | 0                         |                         |             |
| Appropriate ICD shock after 30 days                         | 54 (42.5)                       | 50 (37.9)                 | 0.77 (0.53–1.14)        | 0.19        |
| Ventricular tachycardia storm after 30 days                 | 42 (33.1)                       | 32 (24.2)                 | 0.66 (0.42–1.05)        | 0.08        |
| <b>Other outcomes</b>                                       |                                 |                           |                         |             |
| Appropriate ICD shock at any time                           | 54 (42.5)                       | 56 (42.4)                 | 0.97 (0.66–1.40)        | 0.85        |
| Ventricular tachycardia storm at any time                   | 46 (36.2)                       | 38 (28.8)                 | 0.74 (0.48–1.14)        | 0.17        |
| Sustained ventricular tachycardia below ICD detection limit |                                 |                           |                         |             |
| At any time   | 13 (10.2)                       | 4 (3.0)                   | 0.27 (0.09–0.84)        | 0.02        |
| After 30 days   | 8 (6.3)                         | 3 (2.3)                   | 0.33 (0.09–1.25)        | 0.09        |
| Cardioversion for ventricular tachycardia§                  | 14 (11.0)                       | 8 (6.1)                   | 0.52 (0.22–1.23)        | 0.13        |
| Appropriate ATP   |                                 |                           |                         |             |
| At any time   | 79 (62.2)                       | 84 (63.6)                 | 0.97 (0.71–1.32)        | 0.83        |
| After 30 days   | 78 (61.4)                       | 77 (58.3)                 | 0.87 (0.63–1.19)        | 0.37        |
| Inappropriate ICD shock                                     |                                 |                           |                         |             |
| At any time   | 11 (8.7)                        | 13 (9.8)                  | 1.08 (0.48–2.41)        | 0.86        |
| After 30 days   | 11 (8.7)                        | 13 (9.8)                  | 1.08 (0.48–2.42)        | 0.85        |
| Hospital admission for cardiac causes                       | 39 (30.7)                       | 33 (25.0)                 | 0.76 (0.48–1.21)        | 0.25        |
|   | <i>no. (mean no./person-yr)</i> |                           |                         |             |
| <b>Total shocks or arrhythmia events¶</b>                   |                                 |                           |                         |             |
| ICD shock   |                                 |                           |                         |             |
| Appropriate   | 266 (2.09)                      | 169 (1.28)                | NA                      | 0.28        |
| Inappropriate   | 85 (0.67)                       | 66 (0.50)                 | NA                      | 0.46        |
| Appropriate ATP   | 2453 (19.2)                     | 1711 (13.0)               | NA                      | 0.27        |
| Sustained ventricular tachycardia below ICD detection       | 18 (0.14)                       | 4 (0.03)                  | NA                      | 0.02        |



- Primer sonlanım ablasyon grubunda %59.1, eskalasyon grubunda %68.5
- Mortalitede fark yok

# VANISH



- Başlangıçta amiodaron alanlarda ablasyon grubundaki olaysız sağkalım artmakta
- Başlangıçta amiodaron almayanlarda olaysız sağ-kalımda fark yok
- İskemik KMP+ICD'si olup antiaritmik tedaviye dirençli VT si olanlarda ablasyon primer sonlanımları azaltıyor.





# Early Versus Late Referral for Catheter Ablation of Ventricular Tachycardia in Patients With Structural Heart Disease



## A Systematic Review and Meta-Analysis of Clinical Outcomes

Jorge Romero, MD,<sup>a</sup> Luigi Di Biase, MD, PhD,<sup>a</sup> Juan Carlos Diaz, MD,<sup>a</sup> Renato Quispe, MD, MHS,<sup>a</sup> Xianfeng Du, MD,<sup>b</sup> David Briceno, MD,<sup>a</sup> Ricardo Avendano, MD,<sup>a</sup> Usha Tedrow, MD, MS,<sup>c</sup> Roy M. John, MD,<sup>d</sup> Gregory F. Michaud, MD,<sup>d</sup> Andrea Natale, MD,<sup>a</sup> William G. Stevenson, MD,<sup>c,d</sup> Saurabh Kumar, BSc(MED)/MBBS, PhD<sup>c,e</sup>

# 'Erken-Geç'

**TABLE 2** Methodological and Procedural Characteristics of Studies Evaluating the Referral Timing of VT Ablation

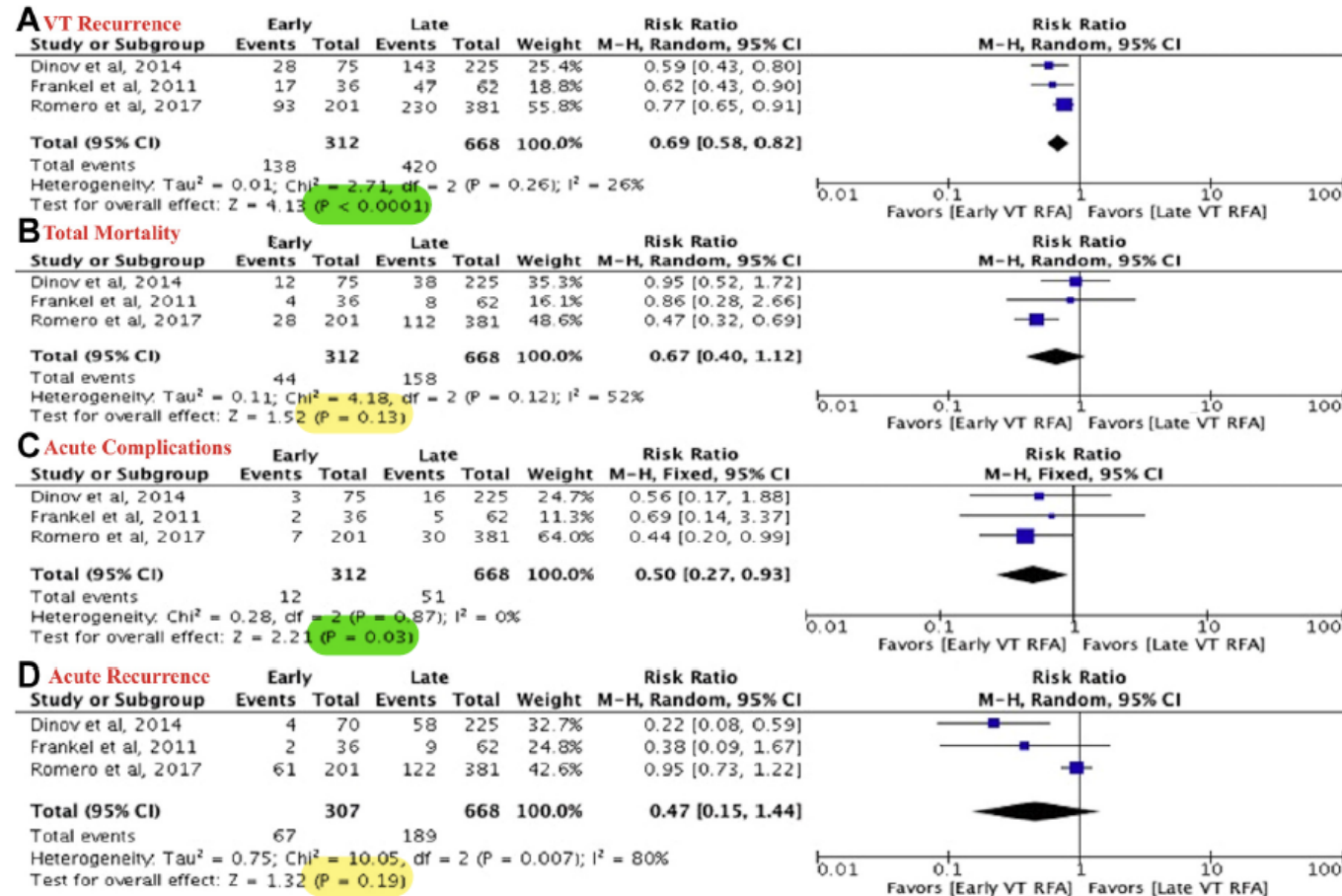
| First Author, Year (Ref. #) | Inclusion Criteria                                    | Definition of Timing Referrals   | Inducible VTs | VT Storm   | Mapping and Ablation Strategy  | Procedural Endpoints  | Complications Rate | Acute Success Rate* | Long-term Success Rate |
|-----------------------------|---|--|---------------|------------|--|---|--------------------|---------------------|------------------------|
| Frankel, 2011 (13)          | Patients with sustained VT and SHD for CA             | Late: experience of 2 or more VTs prior to CA; all others considered early referrals | 2.6 ± 1.7     | 57 (58.2)  | Endocardial and/or epicardial activation mapping and ablation of VT, otherwise pace mapping and substrate modification | Failure to induce VT after ablation   | 7 (7.1)            | 11 (11.2)           | 64 (65.3)              |
| Dinov, 2014 (14)            | Patients with ICM and DCM ablated for sustained VT    | Early: ablation within 30 days after first documented VT; Late: ablation >30 days    | 2.1 ± 1.3     | 119 (39.7) | Endocardial and/or epicardial mapping and ablation   | Noninducibility of any clinical or nonclinical monomorphic sustained VT/clinical VT | 19 (6.3)           | 62 (20.7)           | 171 (57)               |
| Romero, 2017 (21)           | Present for episode of CA of sustained monomorphic VT | Early: failure of a single AAD or no AAD; Late: failure of >1 AAD                    | 2.5 ± 1.6     | 179 (30.8) | Endocardial and/or epicardial substrate mapping and activation/entrainment mapping when hemodynamically tolerated      | Noninducibility of any VT/at least 1 spontaneous VT                                 | 37 (6.4)           | 183 (31.4)          | 323 (93.4)             |

Values are mean ± SD or n (%). \*Acute success includes complete success (defined as elimination of any inducible VT) and partial success (elimination of clinical VT). AAD = antiarrhythmic drug; CA = catheter ablation; SHD = structural heart disease; VT = ventricular tachycardia; other abbreviations as in Table 1.

- 3 çalışma, 980 hasta, 29 ay takip
- İskemik ve non-iskemik KMP'li hastalar
- İlk defa kateter ablasyonu yapılacak hastalar
- Primer sonlanım VT rekürrensi ve total mortalite
- Sekonder sonlanım akut başarı ve akut komplikasyonlar

# 'Erken-Geç'

**FIGURE 2** Forest Plot Reporting the M-H Risk Ratio for Outcomes in Early Versus Late VT Ablation



Diamond indicates overall summary estimate for the analysis (width of the diamond represents the 95% CI); width of the shaded square indicates size of the population. (A) VT recurrence. (B) Total mortality. (C) Acute complications. (D) Acute success. CI = confidence interval; M-H = Mantel-Haenszel; RFA = radiofrequency ablation; VT = ventricular tachycardia.

# Long-term outcomes after catheter ablation of ventricular tachycardia in patients with and without structural heart disease

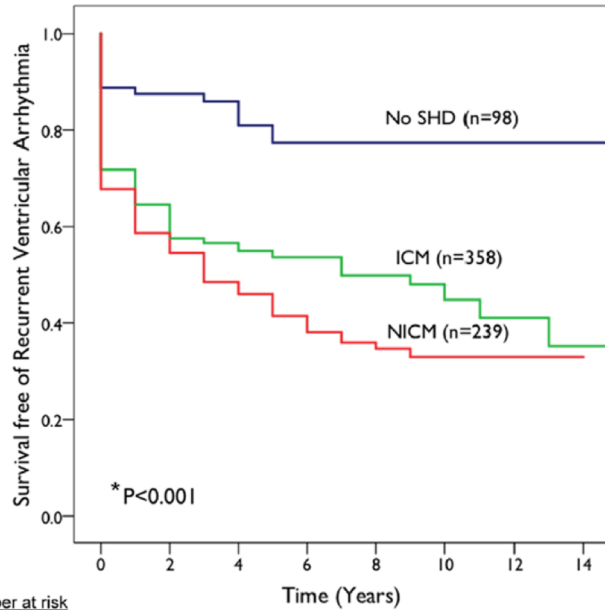
Saurabh Kumar, BSc(Med)/MBBS, PhD, Jorge Romero, MD, Nishaki K. Mehta, MD, Akira Fujii, MD, Sunil Kapur, MD, Samuel H. Baldinger, MD, Chirag R. Barbhaiya, MD, Bruce A. Koplan, MD, Roy M. John, MD, PhD, Laurence M. Epstein, MD, Gregory F. Michaud, MD, Usha B. Tedrow, MD, William G. Stevenson, MD

*From the Cardiovascular Division, Brigham and Women's Hospital, Boston, Massachusetts.*

Heart Rhythm 2016;13:1957–1963

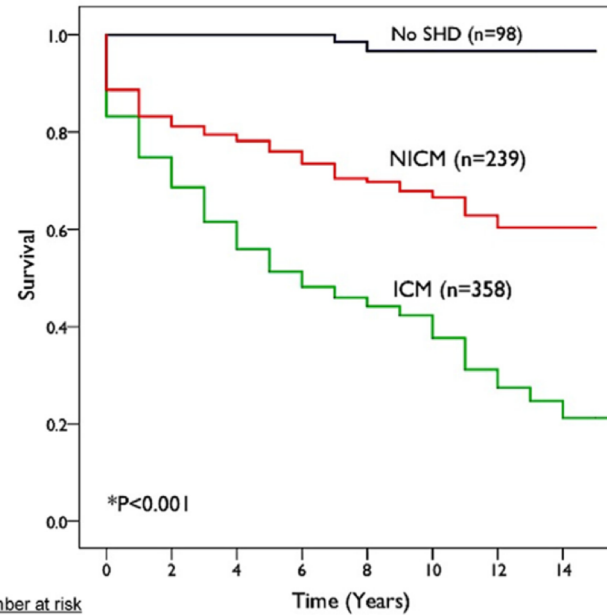
- 3 grup hasta (695) (yapısal kalp hastalığı olmayan (98), iskemik KMP (358), noniskemik KMP (239))
- Median 6 yıllık takip

# 'Uzun dönem sonuçlarımlar'



| Number at risk | Time (Years) |     |    |    |    |    |    |    |  |
|----------------|--------------|-----|----|----|----|----|----|----|--|
|                | 0            | 2   | 4  | 6  | 8  | 10 | 12 | 14 |  |
| No SHD         | 98           | 55  | 45 | 33 | 23 | 14 | 8  | 3  |  |
| ICM            | 358          | 117 | 81 | 43 | 27 | 12 | 8  | 3  |  |
| NICM           | 239          | 90  | 71 | 36 | 20 | 6  | 3  | 0  |  |

**Figure 1** Survival free of recurrent ventricular arrhythmia in the no structural heart disease (no SHD), ischemic cardiomyopathy (ICM), and nonischemic cardiomyopathy (NICM) groups. \* $P < .001$ , no SHD vs ICM;  $P < .001$ , no SHD vs NICM;  $P = .03$ , ICM vs NICM.



| Number at risk | Time (Years) |     |     |     |    |    |    |    |  |
|----------------|--------------|-----|-----|-----|----|----|----|----|--|
|                | 0            | 2   | 4   | 6   | 8  | 10 | 12 | 14 |  |
| No SHD         | 98           | 97  | 95  | 70  | 42 | 23 | 15 | 6  |  |
| NICM           | 239          | 192 | 180 | 121 | 73 | 36 | 16 | 3  |  |
| ICM            | 358          | 244 | 195 | 131 | 71 | 29 | 10 | 5  |  |

**Figure 2** Overall survival in the no structural heart disease (no SHD), ischemic cardiomyopathy (ICM), and nonischemic cardiomyopathy (NICM) groups. \* $P < .001$  for all 3 groups.

- Akut komplet başarı oranları %79, %56 ve %60
- VA'siz sağ kalım oranları %77, %54 ve %38
- Toplam sağkalım oranları %100, %48, %74



Zor veya 'redo' olgular

ILAM

EGM süresi

İnfüzyon iğne  
ablasyonu

Bipolar  
ablasyon

Düşük iyonik  
irrigasyon

Transapikal  
yaklaşım

Stereotaxic  
radiotherapy

Sempatik  
denervasyon

# Original Article

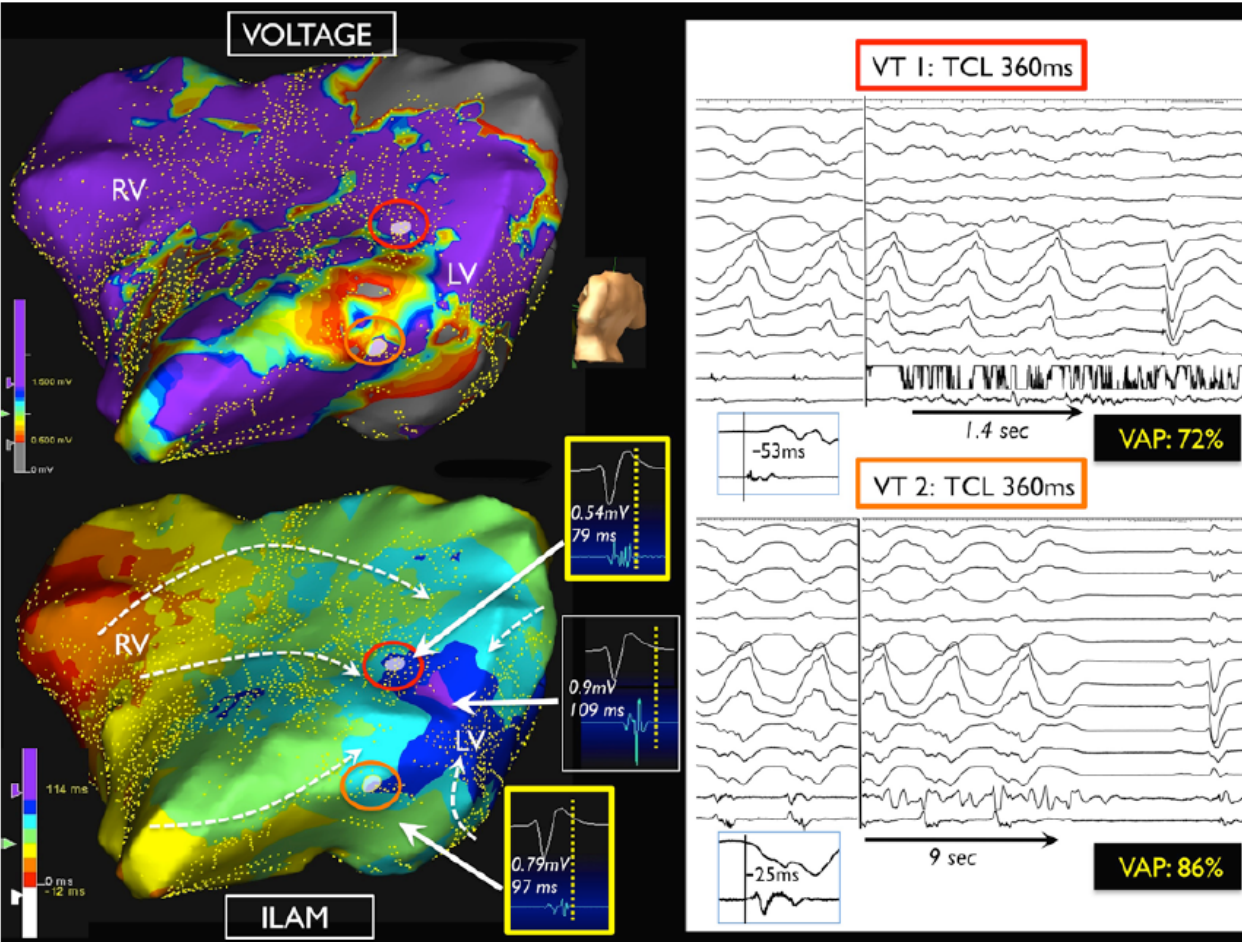
## Relationship Between Sinus Rhythm Late Activation Zones and Critical Sites for Scar-Related Ventricular Tachycardia Systematic Analysis of Isochronal Late Activation Mapping

Tadanobu Irie, MD; Ricky Yu, MD; Jason S. Bradfield, MD; Marmar Vaseghi, MD, MS;  
Eric F. Buch, MD; Olujimi Ajijola, MD, PhD; Carlos Macias, MD; Osamu Fujimura, MD;  
Ravi Mandapati, MD; Noel G. Boyle, MD, PhD; Kalyanam Shivkumar, MD, PhD;  
Roderick Tung, MD

**Circ Arrhythm Electrophysiol. 2015;8:390-399**

- Hipotez: en gecikmiş geç potansiyel reentrinin en fonksiyonel parçası olmayabilir
- Amaç: en geç ventriküler aktivasyon izokronunun dışındaki yavaş iletim velositeye sahip bölgeleri hedeflemek

# ILAM



- 43 hasta, skar iliřli VT (iskemik-noniskemik KMP ve ARVC)
- Reentrinin kritik bölgesi %89 oranında en ge izokron bölgesinin dıřında
- Sonu: en ge aktivasyon zonunun evresindeki iletimin yavřaladıėı izokronal kalabalıklařmanın olduėu blgeler hedeflenebilir.

# A novel Ventricular map of Electrograms DURATION as a Method to identify areas of slow conduction for ventricular tachycardia ablation: The VEDUM pilot study

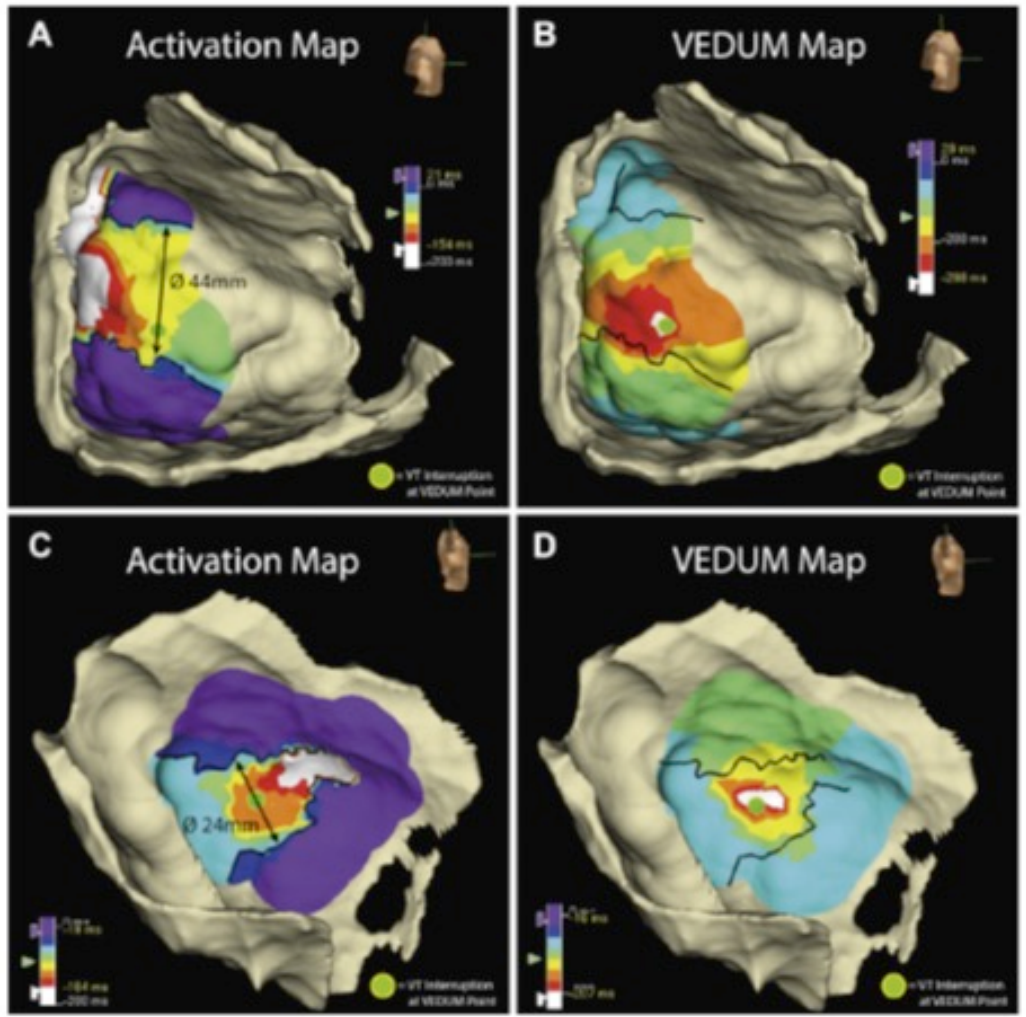
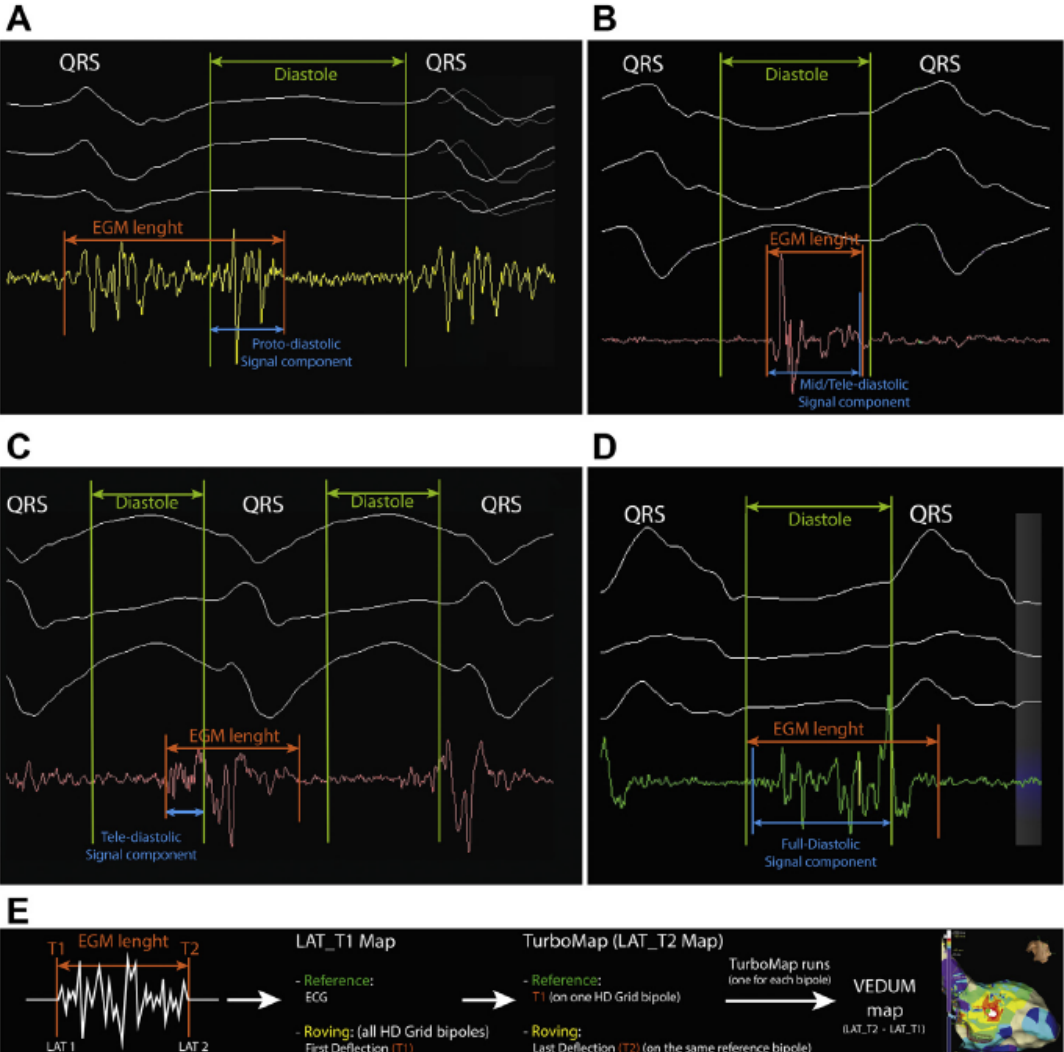
Pietro Rossi, MD, PhD,<sup>\*1</sup> Filippo M. Cauti, MD,<sup>\*1</sup> Marta Niscola, MSc,<sup>†</sup>  
Federico Calore, MSc,<sup>†</sup> Veronica Fanti, MSc,<sup>†</sup> Marco Polselli, MD,<sup>\*</sup>  
Antonio Di Pastena, MD,<sup>\*</sup> Luigi Iaia, MD,<sup>\*</sup> Stefano Bianchi, MD<sup>\*</sup>

*From the <sup>\*</sup>Arrhythmology Unit, Ospedale San Giovanni Calibita, Fatebenefratelli Isola Tiberina, Rome, Italy, and <sup>†</sup>Abbott Medical Italy, Sesto San Giovanni, Milan, Italy.*

**Heart Rhythm 2021;18:1253–1260**

- 21 hasta 24 skar ilişkili VT
- Amaç: VT istmusundaki en yavaş aktivasyon alanını bulmak
- En uzun bipolar EGM süresi

# EGM süresi (VEDUM)





# EGM süresi (VEDUM)

**Table 3** VT and mapping data: qualitative variables

|   |                 |                |          |            |
|---|-----------------|----------------|----------|------------|
| Longest bipolar EGM component in the diastolic phase  | Proto 12.5%     | Mid 33.3%      | Tele 25% | Full 20.8% |
| Myocardium voltage characteristics at the VEDUM point | Healthy 29%     | Transition 29% | Scar 42% |            |
| VEDUM point spatial location inside the isthmus       | Entrance 37%    | Mid 33%        | Exit 30% |            |
| VT interruption during RF at the VEDUM point          | Yes 92%         | No 8%          |          |            |
| Mapping approach                                      | Endocardial 67% | Epicardial 33% |          |            |

**Heart Rhythm 2021;18:1253–1260**

- VEDUM bölgesinden yapılan ablasyonla 22/24 (%92) VT ilk RF aplikasyonunda başarılı bir şekilde sonlandırılmış.
- Sonuç: istmus bölgesindeki en uzun EGM süresi olan bölge (VEDUM point) VT sonlanmasında etkilidir.



# Infusion Needle Radiofrequency Ablation for Treatment of Refractory Ventricular Arrhythmias

William G. Stevenson, MD,<sup>a</sup> Usha B. Tedrow, MD, MSc,<sup>b</sup> Vivek Reddy, MD,<sup>d</sup> Amir AbdelWahab, MD,<sup>c</sup> Srinivas Dukkipati, MD,<sup>d</sup> Roy M. John, MD, PhD,<sup>a</sup> Akira Fujii, MD,<sup>b</sup> Benjamin Schaeffer, MD,<sup>b</sup> Shinichi Tanigawa, MD,<sup>b</sup> Ihab Elsokkari, MD,<sup>c</sup> Jacob Koruth, MD,<sup>d</sup> Tomofumi Nakamura, MD, PhD,<sup>b</sup> Aditi Naniwadekar, MD,<sup>c</sup> Daniele Ghidoli,<sup>e</sup> Christine Pellegrini,<sup>b</sup> John L. Sapp, MD<sup>c</sup>

- Önceden en az 1 kez VA ablasyonu öyküsü olan, antiaritmik tedaviye dirençli VA'si olan 31 hasta (%71 NIKMP)



FIGURE 2 Workflow for Ablation

## Irrigated Needle Ablation Procedure

Initial substrate / VT map with standard multielectrode catheter: exchanged for needle catheter

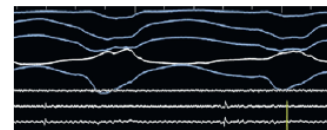
Endocardial site overlying potential VT substrate identified



Needle inserted for recording and pacing

Saline:Contrast injection for tissue staining

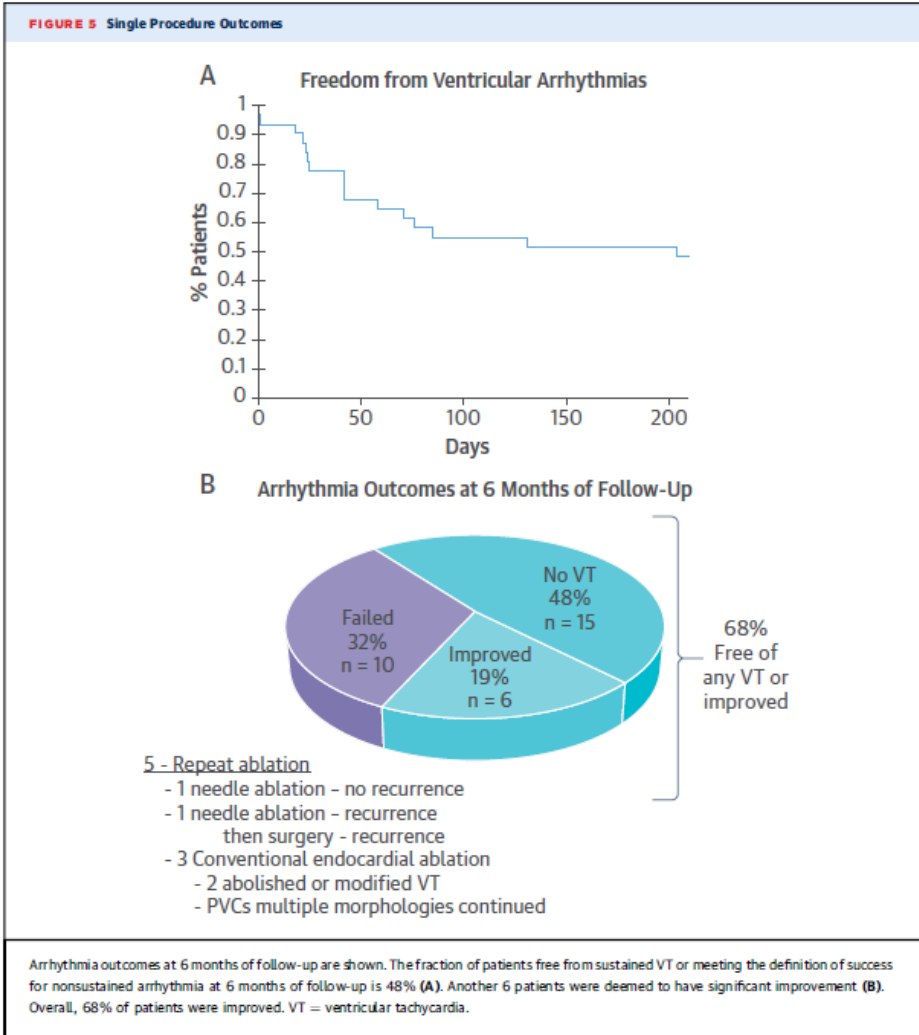
Saline infusion RF ablation to 60° C



Pause irrigation Reassess needle pacing

Withdraw needle resume mapping

# Needle Radiofrequency Ablation



- VT'lerin %73'ü sonlandırılmış
- 6. ayda hastaların %48'inde VT yok, %19'unda azalma var (6 ayda 1-6 epizot)
- Sonuç: medikal tedaviye ve konvansiyonel kateter ablasyonuna dirençli vakalarda intramural iğne RF ablasyonu uygulanabilir.

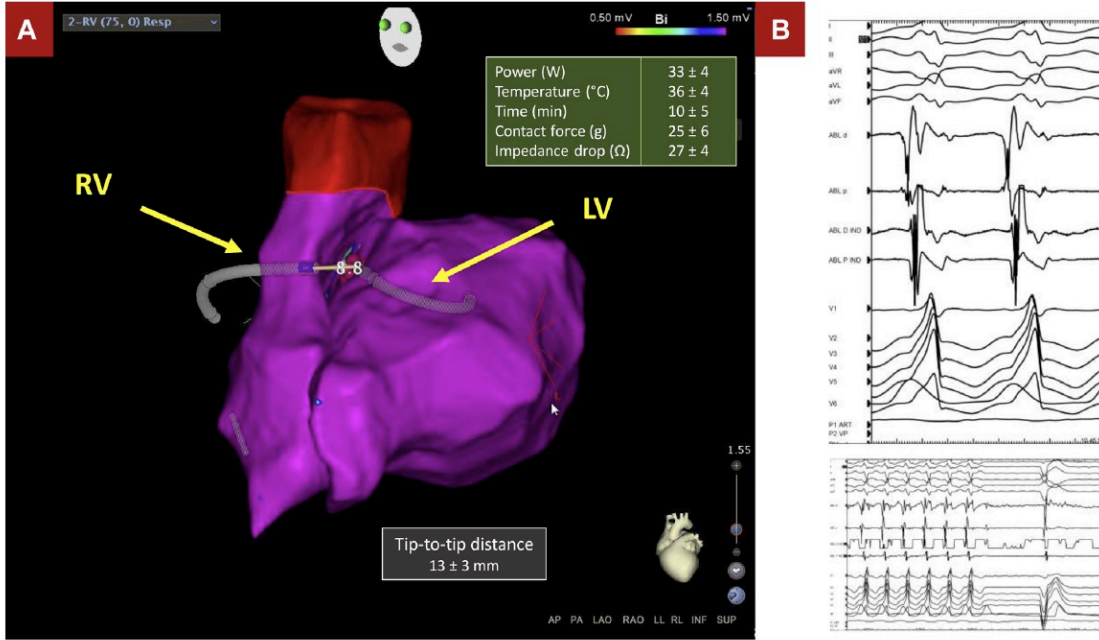
# Bipolar radiofrequency ablation for ventricular tachycardias originating from the interventricular septum: Safety and efficacy in a pilot cohort study

Paolo Della Bella, MD, FHRS,<sup>1</sup> Giovanni Peretto, MD,<sup>1</sup> Gabriele Paglino, MD, Caterina Bisceglia, MD, Andrea Radinovic, MD, Simone Sala, MD, Francesca Baratto, MD, Luca Rosario Limite, MD, Manuela Cireddu, MD, Alessandra Marzi, MD, Giuseppe D'Angelo, MD, Pasquale Vergara, MD, Simone Gulletta, MD, Patrizio Mazzone, MD, Antonio Frontera, MD, PhD

**Heart Rhythm 2020;17:2111–2118**

- 21 NIKMP, ilaca dirençli, interventriküler septum kökenli olduğu düşünülen redo olgular
- Ortalama takip süresi 25 ay

# Bipolar RF ablasyonu



**Figure 4** B-RFA. Typical findings during B-RFA are shown. **A:** Example of the “kissing” between ablation catheters across the interventricular septum (active catheter in the LV; ground catheter in the RV). Average parameters during VT B-RFA are also reported, as documented in our study. **B:** Example of VT interruption during B-RFA in a patient with monomorphic VT (cycle length 340 ms; right bundle branch block morphology). B-RFA = bipolar radiofrequency ablation; LV = left ventricle; RV = right ventricle; VT = ventricular tachycardia.

- 20/21 (%95) hastada başarılı bir şekilde VT sonlandırılmış
- Takipte 7 hastada major VA görülmüş (non-IVS kaynaklı)
- 1 hastada perikardiyosentez gerektiren efüzyon
- Sonuç: Bipolar RF ablasyon IVS kökenli VT de etkin ve güvenilir.

# Prospective Multicenter Experience With Cooled Radiofrequency Ablation Using High Impedance Irrigant to Target Deep Myocardial Substrate Refractory to Standard Ablation



Duy T. Nguyen, MD,<sup>a,\*</sup> Wendy S. Tzou, MD,<sup>a,\*</sup> Amneet Sandhu, MD,<sup>a</sup> Carola Gianni, MD,<sup>b</sup> Elad Anter, MD,<sup>c</sup>  
Roderick Tung, MD,<sup>d</sup> Miguel Valderrábano, MD,<sup>e</sup> Patrick Hranitzky, MD,<sup>b,f</sup> Kyoko Soejima, MD, PhD,<sup>g</sup>  
Luis Saenz, MD,<sup>h</sup> Fermin C. Garcia, MD,<sup>i</sup> Usha B. Tedrow, MD,<sup>j</sup> John M. Miller, MD,<sup>k</sup> Edward P. Gerstenfeld, MD,<sup>l</sup>  
J. David Burkhardt, MD,<sup>b</sup> Andrea Natale, MD,<sup>b</sup> William H. Sauer, MD<sup>a</sup>

- Standart ablasyona dirençli 94 PVC/VT
- Yarı-normal salin

# Yüksek impedans ve düşük iyonik irrigasyon solusyonu

**TABLE 2** Procedural Characteristics Based on Arrhythmia Targeted

|                                     | Total<br>(N = 94) | Ventricular<br>Tachycardia<br>(n = 57) | Frequent<br>PVCs<br>(n = 37) | p Value |
|-------------------------------------|-------------------|--|------------------------------|---------|
| Total ablation time using NS (min)  | 33.8 ± 20.3       | 33.8 ± 24.7                            | 33.7 ± 13.3                  | 0.91    |
| Total ablation time using HNS (min) | 23.66 ± 13.4      | 28.8 ± 22.8                            | 11.4 ± 8.3                   | 0.01    |
| Epicardial access                   | 24 (25.3)         | 21 (36.8)                              | 3 (8.1)                      | <0.01   |
| Bipolar ablation                    | 16 (16.8)         | 9 (16.7)                               | 7 (22.6)                     | 0.57    |
| Low-volume RFA catheter*            | 59 (62.1)         | 39 (69.6)                              | 20 (54.1)                    | 0.19    |
| Acute success                       |                   |  |                              |         |
| Complete success                    | 78 (83)           | 43 (75.4)                              | 35 (94.6)                    | 0.02    |
| Acute failure                       | 4 (4.2)           | 3 (5.3)                                | 1 (2.7)                      | 1.00    |
| Partial success or not tested       | 12 (12.6)         | 11 (19.3)                              | 1 (2.7)                      | 0.03    |
| Complications                       | 2 (2.1)           | 2 (3.5)                                | 0 (0)                        | 0.52    |
| Steam pops                          | 12 (12.6)         | 9 (15.8)                               | 3 (8.1)                      | 0.28    |
| Pericarditis                        | 1 (1.1)           | 1 (1.8)                                | 0 (0)                        | 1.00    |

Values are mean ± SD or n (%). \*Low-volume catheters: Thermocool SurroundFlow and St. Jude FlexAblit.

HNS = half normal saline; NS = normal saline; RFA = radiofrequency ablation; other abbreviation as in Table 1.

- 78/94 (%83) akut başarı oranı
- 1 yıllık PVC/VT'siz sağkalım oranı %89.4
- Sonuç: yarı-normal salin infüzyonu ile RF ablasyon güvenli ve efektif

Circulation: Arrhythmia and Electrophysiology

**RESEARCH LETTER**

---

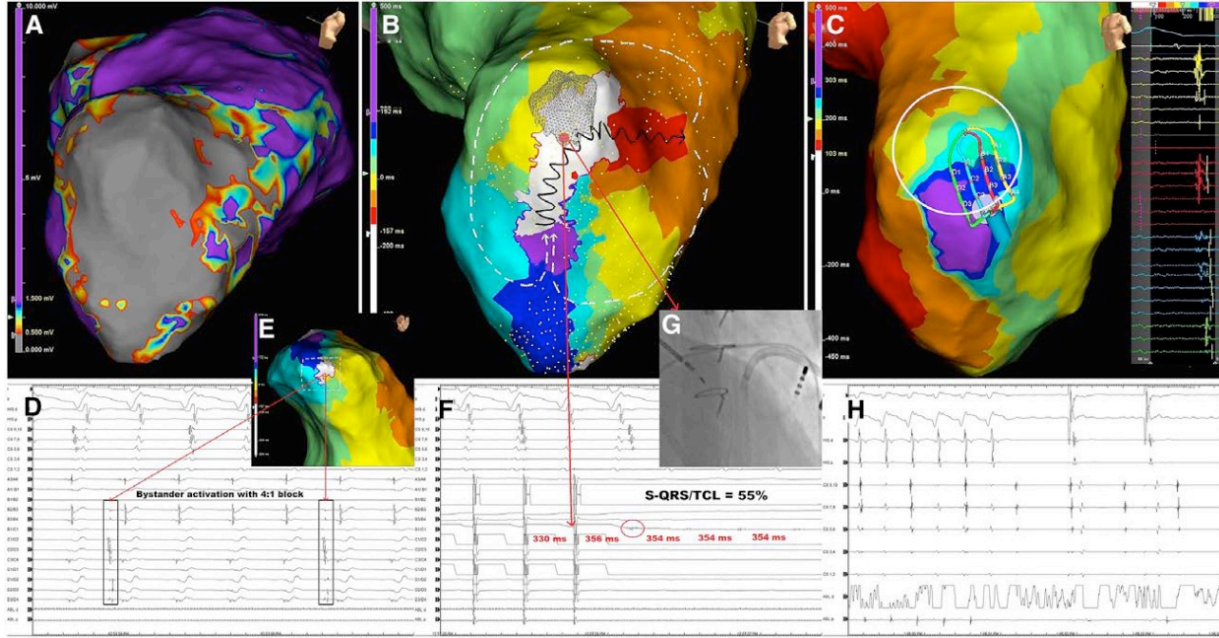
# Transapical Left Ventricular Access for Ventricular Tachycardia Ablation in Patients With Mechanical Aortic and Mitral Valve Prosthesis

Hikmet Yorgun<sup>1</sup>, MD; Uğur Canpolat<sup>2</sup>, MD; Eyal Nof<sup>3</sup>, MD; Roy Beinart<sup>4</sup>, MD; Ahmet Aydın<sup>5</sup>, MD; Timuçin Sabuncu<sup>6</sup>, MD; Kudret Aytemir, MD

Circ Arrhythm Electrophysiol. 2020;13:e008893



# Transapical LV Access



- AVR-MVR'li ilaca dirençli VT'si olan 7 hasta
- 6/7 hastada ablasyon sonrası indüklenmemiş
- Median 6 (1-13) aylık takipte VT rekürrensi yok



# Cardiac Sympathetic Denervation for Refractory Ventricular Arrhythmias



Marmar Vaseghi, MD, PhD,<sup>a,b</sup> Parag Barwad, MD, DM,<sup>c</sup> Federico J. Malavassi Corrales, MD,<sup>d</sup> Harikrishna Tandri, MD, MBBS,<sup>e</sup> Nilesh Mathuria, MD,<sup>f</sup> Rushil Shah, MBBS,<sup>c</sup> Julie M. Sorg, RN, MSN,<sup>a</sup> Jean Gima, RN, MSN, NP,<sup>a</sup> Kaushik Mandal, MD, MBBS,<sup>e</sup> Luis C. Sàenz Morales, MD,<sup>d</sup> Yash Lokhandwala, MD, DM,<sup>c</sup> Kalyanam Shivkumar, MD, PhD<sup>a,b</sup>

- Yapısal kalp hastalığı olup dirençli VT'si olan 121 hasta
- Sol taraflı ya da bilateral kardiyak sempatik denervasyon yapılmış

# Kardiyak Sempatik Denervasyon

FIGURE 2 Sustained Survival

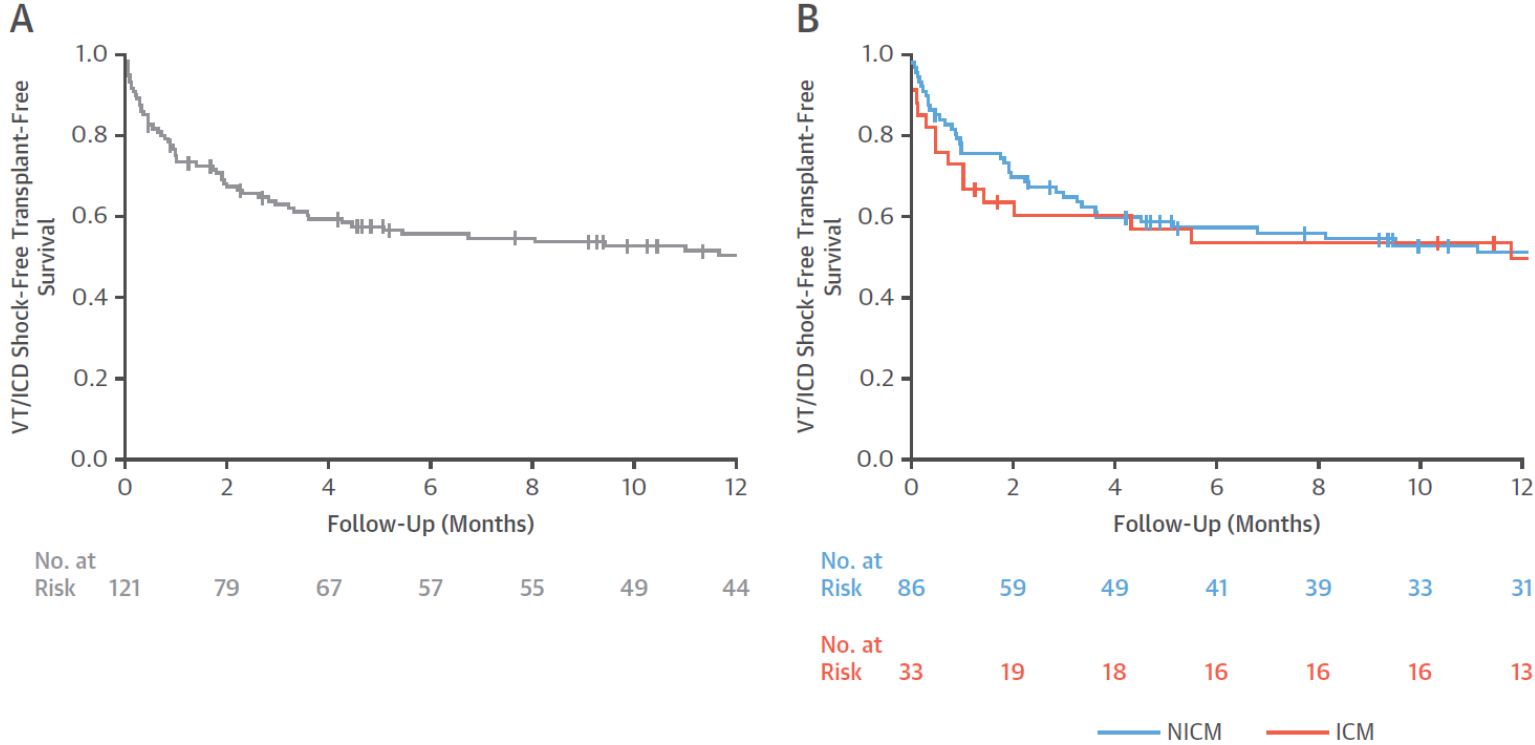
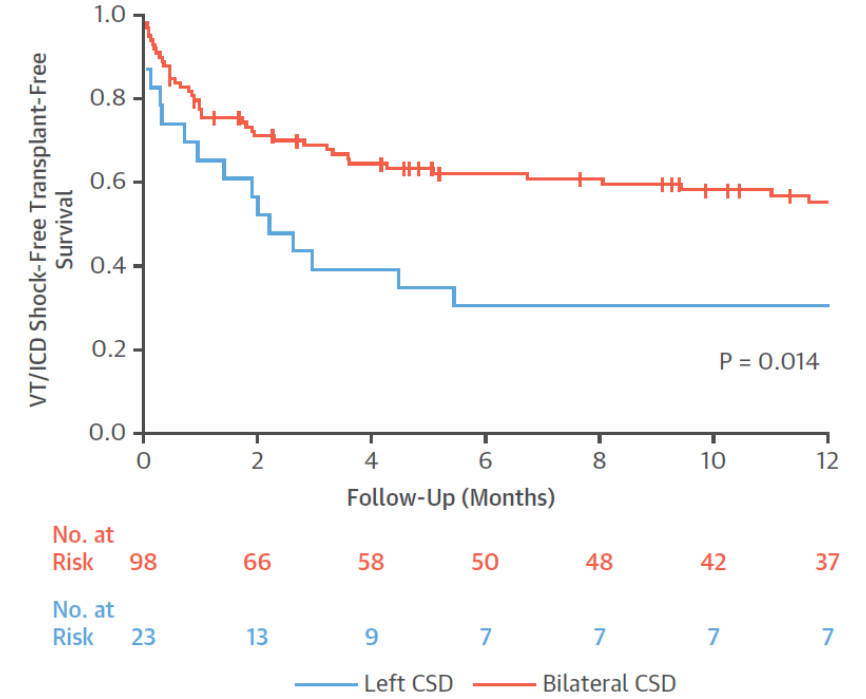


FIGURE 3 Bilateral Versus Left CSD



- VT ve ICD şok olmadan 1 yıllık sağkalım oranı %58
- Bilateral denervasyon yapılanlarda sonuçları daha iyi

ORIGINAL ARTICLE

# Noninvasive Cardiac Radiation for Ablation of Ventricular Tachycardia

Phillip S. Cuculich, M.D., Matthew R. Schill, M.D., Rojano Kashani, Ph.D., Sasa Mutic, Ph.D., Adam Lang, M.D., Daniel Cooper, M.D., Mitchell Faddis, M.D., Ph.D., Marye Gleva, M.D., Amit Noheria, M.B., B.S., Timothy W. Smith, M.D., D.Phil., Dennis Hallahan, M.D., Yoram Rudy, Ph.D., and Clifford G. Robinson, M.D.

**N Engl J Med 2017;377:2325-36**

- Yapısal kalp hastalığı olan, ICD'li,  
dirençli VT olan 5 hasta

# Stereotaxic radiotherapy

**Table 1. Demographic and Clinical Characteristics of the Patients and Treatment Details.\***

| Variable   | Patient 1                     | Patient 2                          | Patient 3                      | Patient 4                         | Patient 5                        |
|--|-------------------------------|------------------------------------|--------------------------------|-----------------------------------|----------------------------------|
| <b>Demographic or clinical characteristic</b>                            |                               |                                    |                                |                                   |                                  |
| Age (yr)   | 61                            | 60                                 | 65                             | 62                                | 83                               |
| Sex  | Male                          | Male                               | Male                           | Male                              | Female                           |
| Type of cardiomyopathy   | Nonischemic                   | Ischemic                           | Nonischemic                    | Nonischemic                       | Ischemic                         |
| NYHA class   | IV                            | III                                | IV                             | IV                                | IV                               |
| Left ventricular ejection fraction (%)                                   | 37                            | 17                                 | 22                             | 26                                | 15                               |
| No. of previous antiarrhythmic drugs                                     | 3                             | 3                                  | 3                              | 4                                 | 2                                |
| No. of previous catheter ablations                                       | 1                             | 0                                  | 2                              | 4                                 | 0                                |
| No. of induced episodes of ventricular tachycardia                       | 2                             | 1                                  | 0                              | 5                                 | 6                                |
| No. of episodes of ventricular tachycardia 3 mo before treatment         | 30                            | 20                                 | 5                              | 2210                              | 4312                             |
| <b>Treatment</b>   |                               |                                    |                                |                                   |                                  |
| Ablation target region   | Anterior basal left ventricle | Anterolateral basal left ventricle | Inferior left ventricle        | Left ventricle outflow and septum | Inferolateral mid left ventricle |
| Ablation volume (ml)   | 51.3                          | 17.3                               | 44.5                           | 53.0                              | 81.0                             |
| Treatment time (min)   | 12                            | 11                                 | 14                             | 12                                | 18                               |
| Length of hospital stay after treatment (days)                           | 2                             | 1                                  | 2                              | 2                                 | 1                                |
| Antiarrhythmic medication at discharge                                   | Amiodarone, mexiletine        | Amiodarone, mexiletine             | Amiodarone, mexiletine         | Amiodarone, mexiletine            | Amiodarone, mexiletine           |
| No. of episodes of ventricular tachycardia during 6-wk blanking period   | 0                             | 3                                  | 0                              | 355                               | 322                              |
| No. of episodes of ventricular tachycardia 10.5 mo after blanking period | 3                             | 0                                  | 1                              | 0                                 | NA                               |
| No. of additional ablation procedures performed by 1 yr                  | 0                             | 0                                  | 0                              | 1 at 4 wk                         | NA                               |
| Antiarrhythmic medication at 1 yr  | None                          | None                               | Amiodarone (restarted at 9 mo) | None                              | NA                               |

- 6 haftalık 'blanking' periyottan sonra 4 VT epizodu görülüyor (%99.9'luk azalma)
- Azalma 5 hastada da var
- EF'de azalma yok

# Görüntüleme yöntemleri

```
graph TD; A[Görüntüleme yöntemleri] --- B[Kardiyak MR (ADAS, MUSIC)]; A --- C[Kardiyak BT]
```

Kardiyak MR  
(ADAS, MUSIC)

Kardiyak BT



**ESC**

European Society  
of Cardiology


Europace (2020) 22, 598–606

doi:10.1093/europace/euaa021

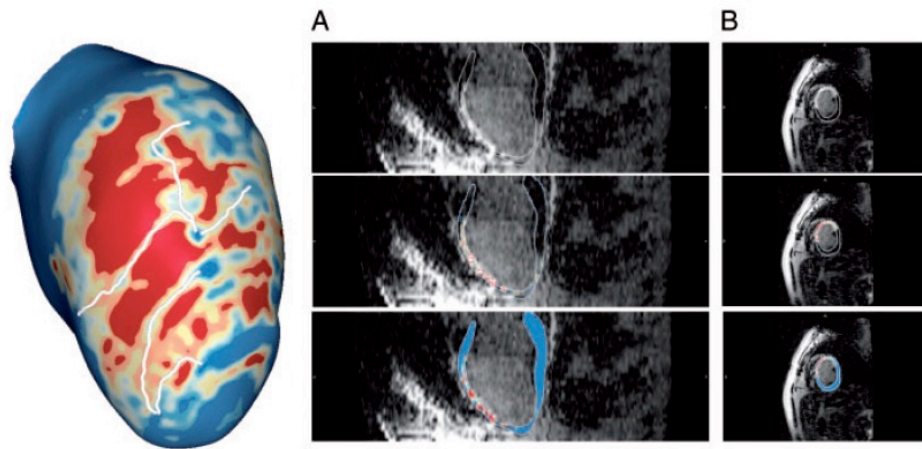
**CLINICAL RESEARCH**

*Ablation for ventricular tachycardia*

# Ventricular scar channel entrances identified by new wideband cardiac magnetic resonance sequence to guide ventricular tachycardia ablation in patients with cardiac defibrillators

Ivo Roca-Luque <sup>1,2\*</sup>, Ana Van Breukelen<sup>1,2</sup>, Francisco Alarcon<sup>1,2</sup>, Paz Garre<sup>1,2</sup>, Jose M. Tolosana<sup>1,2,3</sup>, Roger Borrás<sup>1,2</sup>, Paula Sanchez<sup>1,2</sup>, Fatima Zaraket<sup>1,2</sup>, Adelina Doltra<sup>1,2</sup>, Jose T. Ortiz-Perez<sup>1,2</sup>, Susanna Prat-Gonzalez<sup>1,2</sup>, Rosario J. Perea<sup>2,4</sup>, Eduard Guasch<sup>1,2</sup>, Elena Arbelo<sup>1,2,3</sup>, Antonio Berruezo<sup>1,2,3</sup>, Marta Sitges<sup>1,2,3</sup>, Josep Brugada<sup>1,2,3</sup>, and Lluís Mont<sup>1,2,3</sup>

# CMR



**Figure 1** Left panel: endocardial conducting channel (white line) crossing an anterior scar (red) through border zone tissue (light red and yellow) in a CMR reconstruction in a patient with ischaemic heart disease in 20% endocardial layer. Right panel: CMR raw images used by ADAS-3D software to detect scar, BZ, and CCs showed in left panel. The CMR images in long (A) and short (B) axis are shown in raw image (top image); automatic borders detection of core in red, border zone in yellow, and normal tissue in blue (middle image); and automatic reconstruction of these areas (bottom image).

**Table 3** Accuracy of WB-CMR group and conventional CMR group

|                               | WB-CMR     | CMR         | P-value |
|-------------------------------|------------|-------------|---------|
| CC entrances/pt.              | 7.76 ± 3.5 | 7.4 ± 2.7   | 0.38    |
| CC entrances EAM vs. CMR      | 101 vs. 93 | 179 vs. 179 | 0.84    |
| Concordance (%)               | 79         | 86.5        | 0.19    |
| False positive (%)            | 7.5        | 7.8         | 0.9     |
| False negative (%)            | 14.9       | 7.8         | 0.23    |
| Positive predictive value (%) | 92.5       | 92.2        | 0.9     |

CCs, conducting channel; CMR, cardiac magnetic resonance; EAM, magnetic resonance mapping; WB, wideband.

# Sonuç

- VT ablasyonu rekürrensi ve ICD terapilerini azaltıyor.
- Uzun dönem VA'siz sağkalım yapısal kalp hastalığı olmayanlarda %77, IKMP'de %54 ve NIKMP'de %38
- Mortaliteye olan etkisi henüz kanıtlanmadı.
- Alternatif teknikler başarı oranını artırabilir.





Teşekkürler

# VANISH

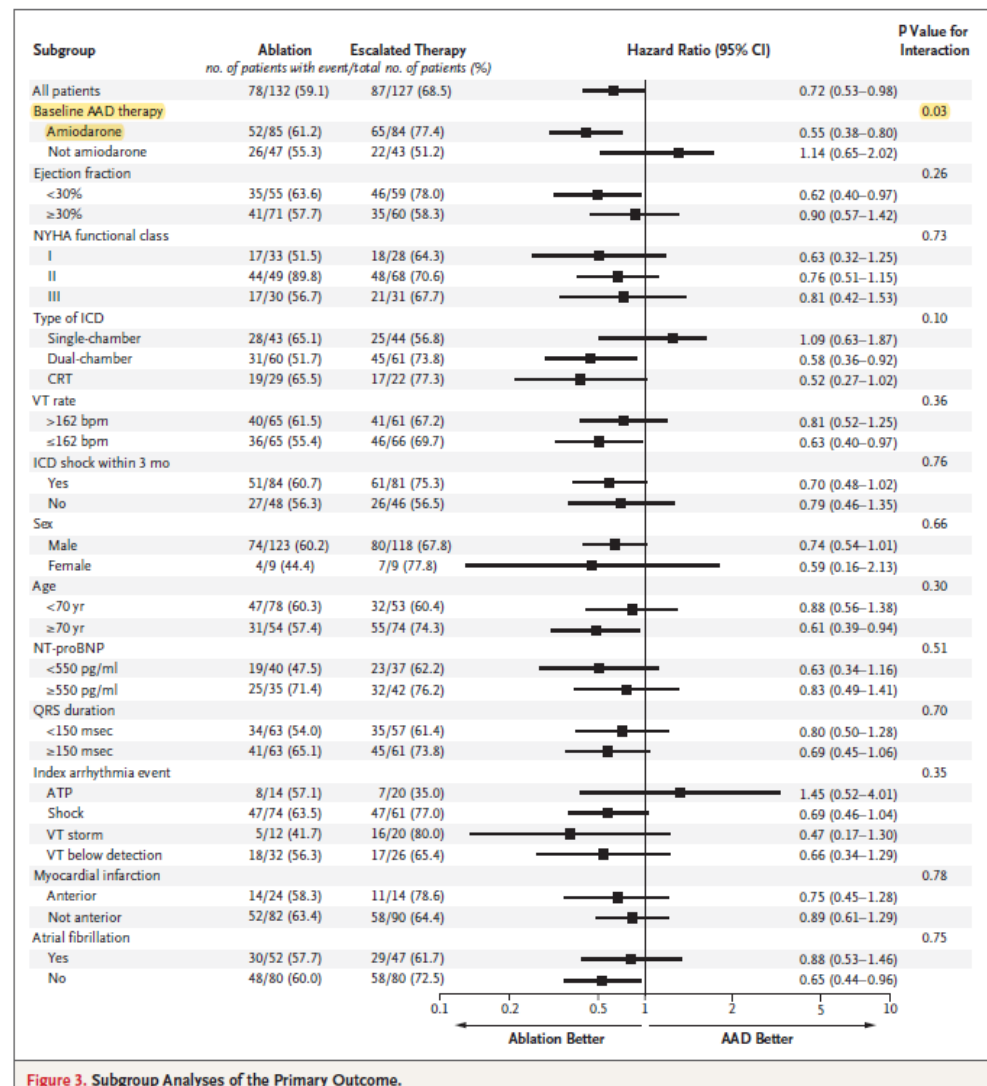


Figure 3. Subgroup Analyses of the Primary Outcome.

# 'Early Versus Late'

**TABLE 3** Clinical Endpoints of Studies Evaluating Referral Timing of VT Ablation

| First Author,<br>Year (Ref. #) | Group of Patients |            | Clinical Endpoints  | VT Recurrence |            | Total Mortality |            | Acute Complications |          | Acute Success |            |
|--------------------------------|-------------------|------------|---|---------------|------------|-----------------|------------|---------------------|----------|---------------|------------|
|                                | Early             | Late       |   | Early         | Late       | Early           | Late       | Early               | Late     | Early         | Late       |
| Frankel, 2011 (13)             | 36 (36.7)         | 62 (63.3)  | Recurrence of documented arrhythmias  | 17 (47.2)     | 47 (75.8)  | 4 (11.1)        | 8 (12.9)   | 2 (5.6)             | 5 (8.1)  | 2 (5.6)       | 9 (14.5)   |
| Dinov, 2014 (14)               | 75 (25)           | 225 (75)   | Recurrence of documented sustained VT; occurrence of cardiac death          | 28 (37.3)     | 143 (63.6) | 12 (16.0)       | 38 (16.9)  | 3 (4.0)             | 16 (7.1) | 4 (5.3)       | 58 (25.8)  |
| Romero, 2017 (21)              | 201 (34.5)        | 381 (65.5) | VT recurrence, overall survival, survival free from cardiac transplantation | 93 (46.3)     | 230 (60.4) | 41 (20.4)       | 120 (31.5) | 7 (3.5)             | 30 (7.9) | 61 (30.3)     | 122 (32.0) |

# 'Uzun dönem sonuçlarımlar'

**Table 3** Factors associated with VA recurrence and all-cause mortality

| Variable                              | Multivariable HR for VA recurrence (95% CI) | <i>P</i> | Multivariable HR for all-cause mortality (95% CI) | <i>P</i> |
|---------------------------------------|---|----------|---|----------|
| Age                                   | —   |          | 1.05 (1.04–1.06)                                  | <.001    |
| Male gender (%)                       | —   |          | —   | —        |
| LVEF (each 1% increase)               | 0.99 (0.98–0.99)                            | .01      | 0.96 (0.95–0.97)                                  | <.001    |
| Type of SHD                           |   |          |   |          |
| ICM (vs no SHD)*                      | 1.7 (0.9–2.9)                               | .09      | 15.5 (3.8–63.2)                                   | <.001    |
| NICM (vs no SHD)                      | 2.3 (1.3–3.9)                               | .003     | 13.8 (3.4–56.8)                                   | <.001    |
| Number of failed antiarrhythmic drugs | 1.1 (1.003–1.22)                            | <.001    | —   | —        |
| History of VT storm                   | —   | —        | —   | —        |
| Acute complete success                | 0.65 (0.52–0.82)                            | <.001    | 0.7 (0.58–0.94)                                   | .01      |
| Epicardial ablation                   | 1.5 (1.1–2.0)                               | .01      | —   | —        |
| Need for adjunctive non-RFA ablation  | —   | —        | 1.6 (1.04–2.4)                                    | .03      |
| Major complication                    | —   | —        | 1.6 (1.1–2.3)                                     | .03      |
| VA recurrence <sup>†</sup>            | Not entered                                 | —        | 1.8 (1.4–2.4)                                     | <.001    |



Contents lists available at ScienceDirect

## Computers in Biology and Medicine

journal homepage: [www.elsevier.com/locate/combiomed](http://www.elsevier.com/locate/combiomed)



### Automated isochronal late activation mapping to identify deceleration zones: Rationale and methodology of a practical electroanatomic mapping approach for ventricular tachycardia ablation

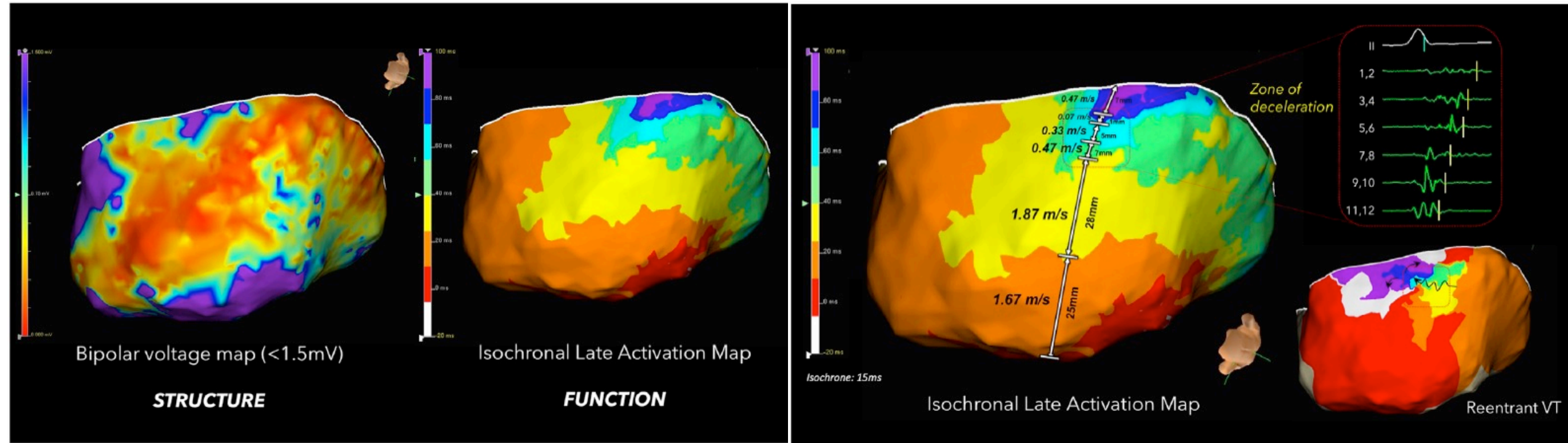
Michael Raiman<sup>b</sup>, Roderick Tung<sup>a,\*</sup>

<sup>a</sup> *The University of Chicago Medicine, Center for Arrhythmia Care | Heart and Vascular Center, Pritzker School of Medicine, Chicago, IL, USA*

<sup>b</sup> *Abbott Laboratories, Abbott Park, IL, USA*



# ILAM





# ILAM

