Persistan AF ablasyonunda zor alanlar: Substrat modifikasyonu

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Kardiyoloji Anabilim Dalı

Giriş

- Semptomatik PAF hastalarında PVI genellikle yeterli olmaktadır.
- PerAF/LS-PerAF hastalarında ise tek başına PVI yapılan hastalarda uzun dönemde AF nüks etmektedir.
- Bu nedenle PerAF hastalarında ilave ablasyon stratejileri üzerinde çalışmalar devam etmektedir.
- Kronik inflamasyon ve atriyal fibrozis atriyal remodeling ile AF için substrat oluşturmaktadır.

AF ablasyonu için hasta seçimi

Uygun hasta

- <70 y
- Semptomatik
- LA<45 mm
- PAF (özellikle <48 saat)
- Başka aritmi olmayan
- «Lone» AF
- Normal kalp fonksiyonları
- Normal BMI
- Normal solunum fonksiyonları
- Normal tiroid fonksiyonları
- Amiodarone kullanmayan hasta

Daha az uygun hasta!

- ≥70 y
- Asemptomatik/ hafif semptomatik
- LA≥45 mm
- PerAF/LS-PerAF
- Eşlik eden AT/AFL
- Yapısal kalp hastalığı varlığı
- Kalp yetersizliği
- KOAH
- Tirotoksikoz öyküsü
- Amiodarone ile başarı sağlanamamış hasta

Persistan AF ablasyonu

- PVI olmazsa olmaz!
- NonPV tetikleyiciler
- Lineer lezyonlar
- Kompleks fraksiyone elektrogram ablasyonu (CFAE) ablasyonu
- Rotor/driver ablasyonu
- LAA izolasyonu
- Düşük voltajlı alan ablasyonu

Persistan AF’de atriyal substrat hedefi

- Elektrogram temelli yaklaşım
  - Complex fractionated atrial electrograms
  - Dominant frequency
- AF mekanizmasının panaromik haritalaması (FIRM, ECGI)
- Atriyal fibrozis temelli yaklaşım
- AF risk faktörlerine yönelik yaklaşım (HT, diyabet, obezite, OSAS)

Use of Ablation Index-Guided Ablation Results in High Rates of Durable Pulmonary Vein Isolation and Freedom From Arrhythmia in Persistent Atrial Fibrillation Patients

$$AblationIndex = \left(K * \int_0^t CF^a(\tau) P^b(\tau) d\tau \right)^c$$

The PRAISE Study Results

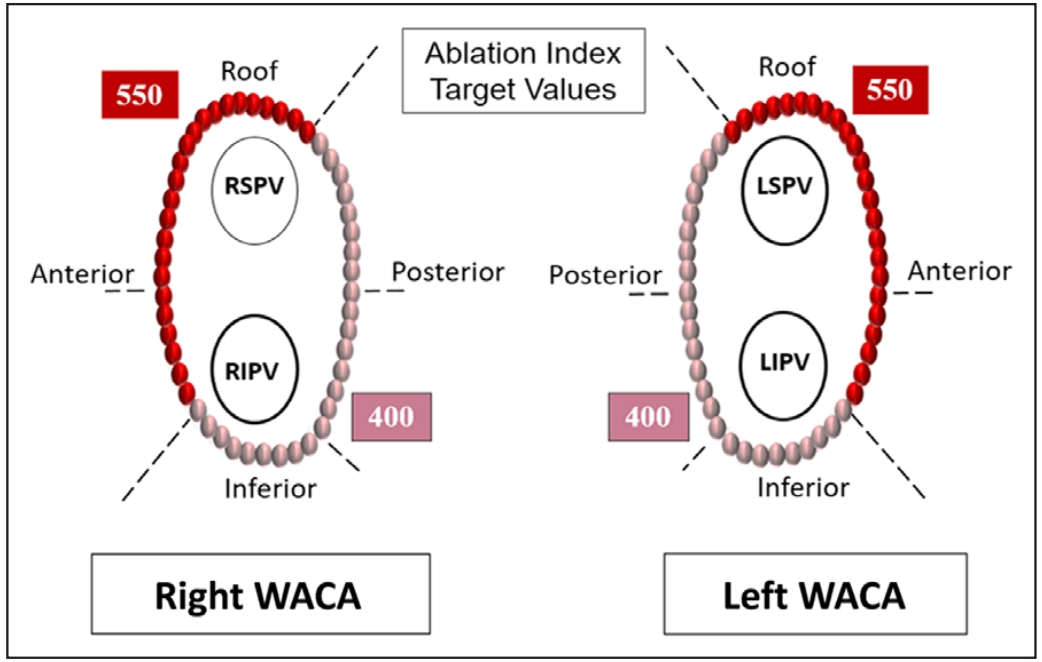
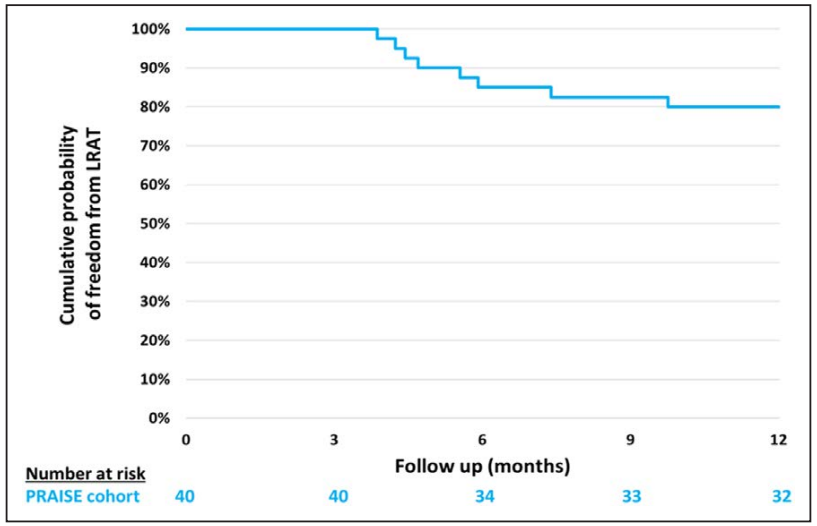


Table 4. Studies That Examined Late Pulmonary Vein Reconnection at Mandated Repeat Electrophysiology Study After PVI

	EFFICAS I[18]	EFFICAS II[4]	SUPIR[17]	Miyazaki et al[19]	PRESSURE[20]	PRAISE
Patients, n	46	26	21	32	40	40
Repeat EPS, n (%)	40 (86.9)	24 (92.3)	19 (91)	32 (100)	40 (100)	40 (100)
Population	PAF	PAF	PAF	PAF	PAF	PeAF
Ablation tools	Contact force/3D mapping	Contact force/3D mapping	Second-generation cryoballoon	Second-generation cryoballoon	Contact force/3D mapping	Contact force/3D mapping
Technique	Blinded to CF	CF and FTI targets	2×4-min freezes	Single 3-min freeze	CF and EGM targets	AI targets
Complications, n (%)	0	2 (7.7)	3 (14.3)	1 (3.1)	1 (2.5)	0
Late PV reconnection						
By patients, n (%)	26/40 (65%)	9/24 (38%)	4/19 (21%)	21 (66%)	25/40 (62%)	8/36 (22%)
By PVs, n (%)	44/160 (28%)	14/91 (15%)	7/75 (9%)	34 (27%)	41/160 (26%)	11/147 (7%)

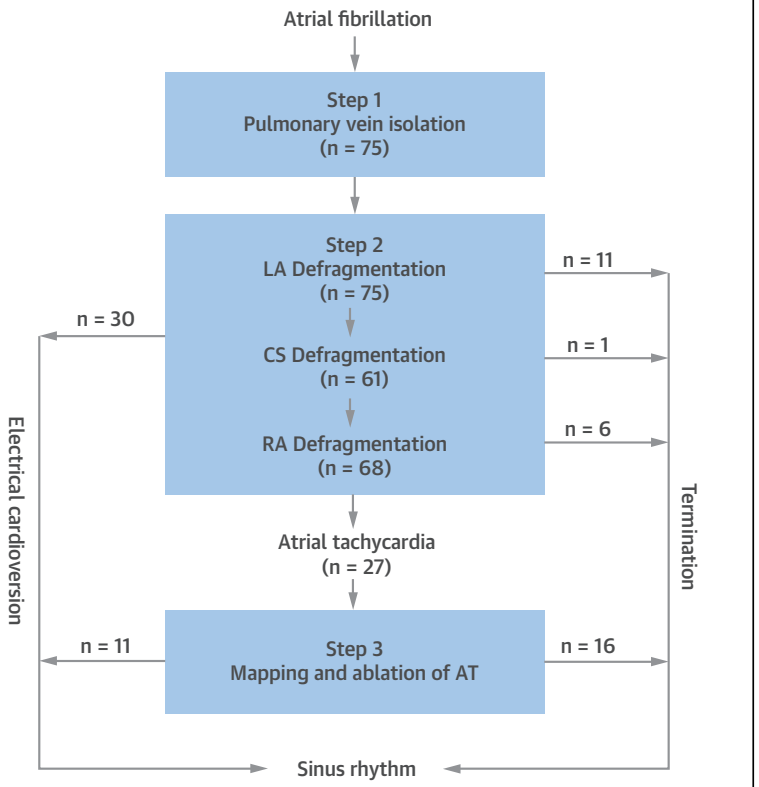


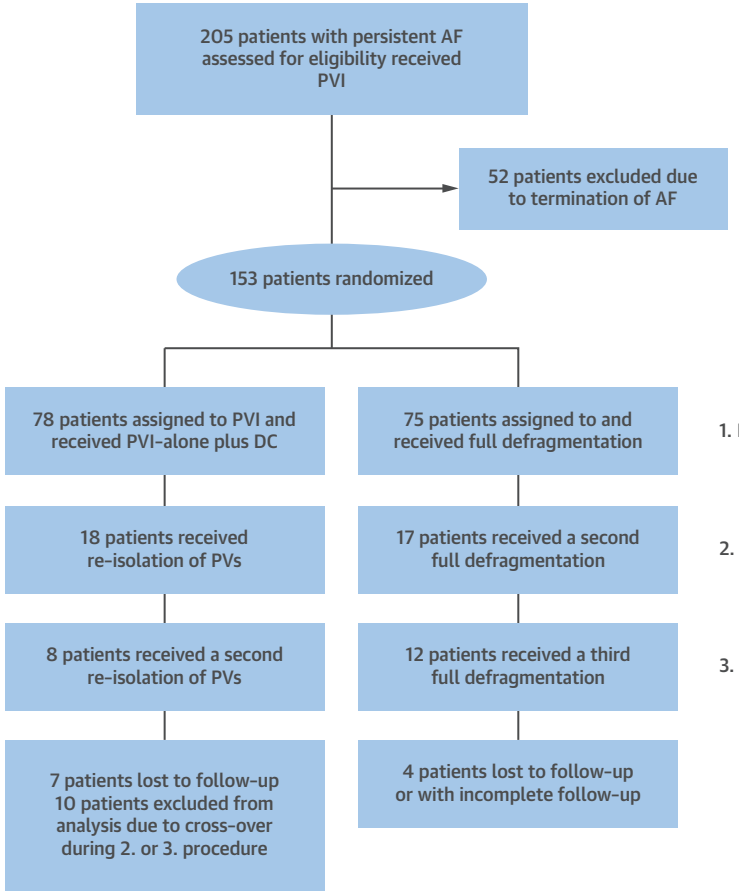
Circ Arrhythm Electrophysiol 2018;11:e006576

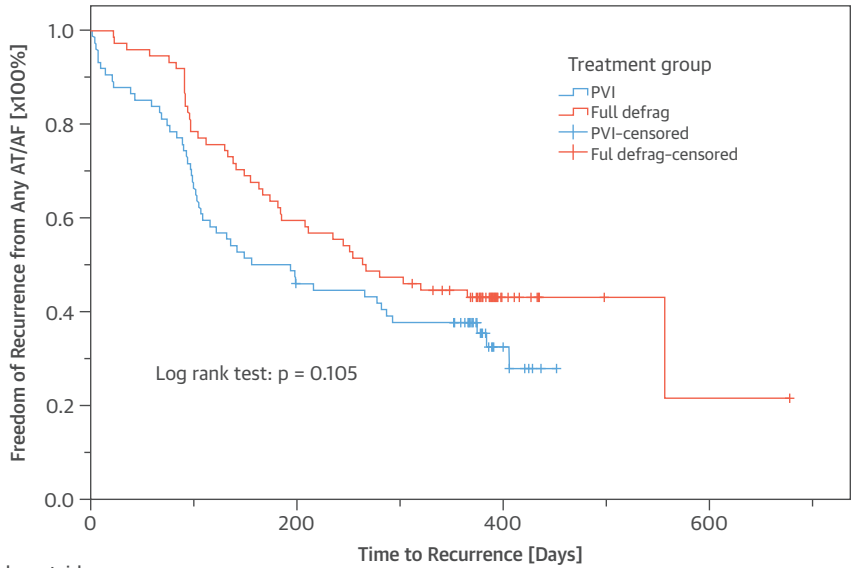
Pulmonary Vein Isolation Versus Defragmentation

The CHASE-AF Clinical Trial

FIGURE 1 Stepwise Ablation Approach

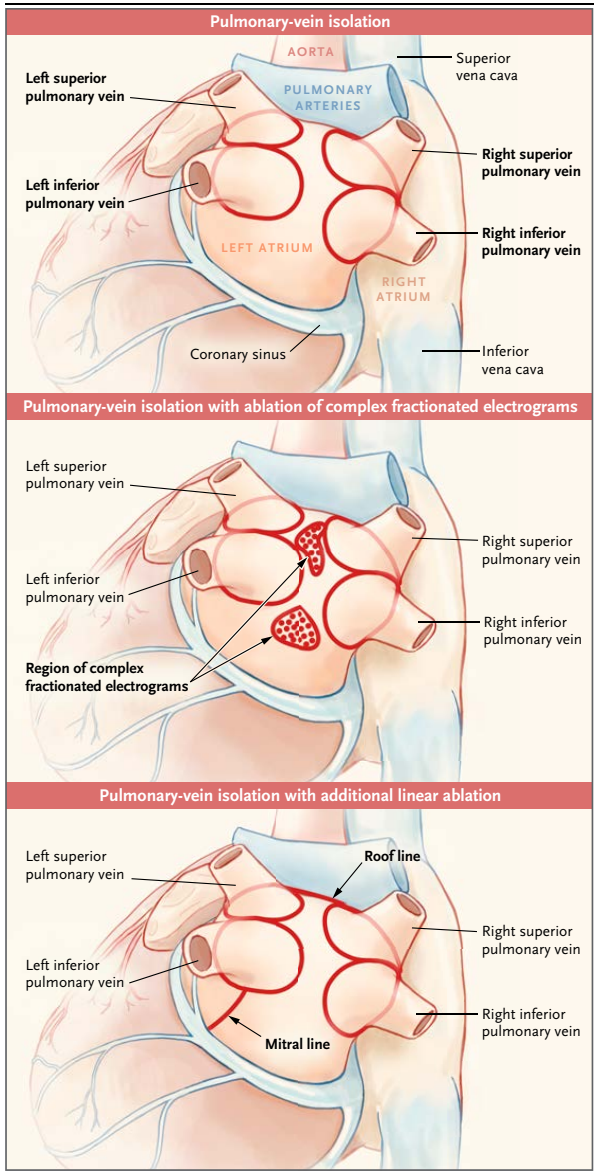






J Am Coll Cardiol 2015;66:2743–52

Approaches to Catheter Ablation for Persistent Atrial Fibrillation



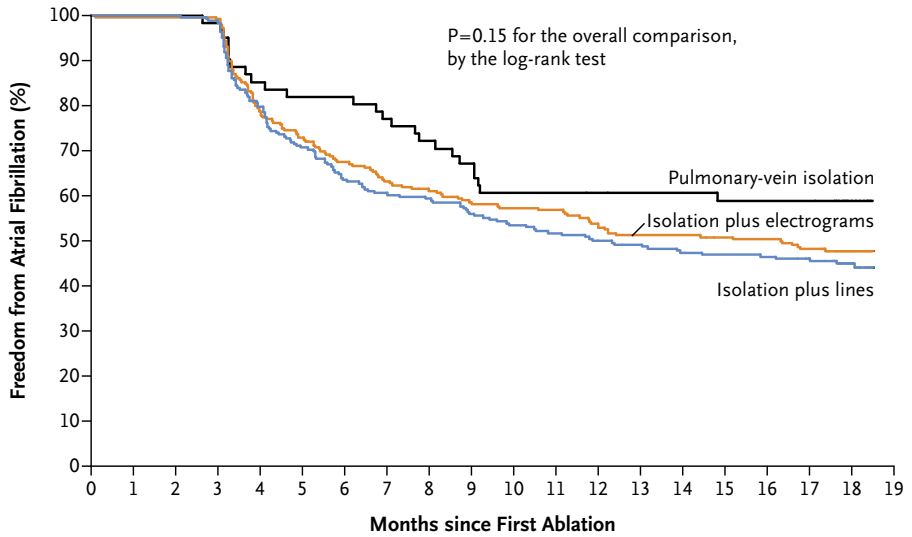
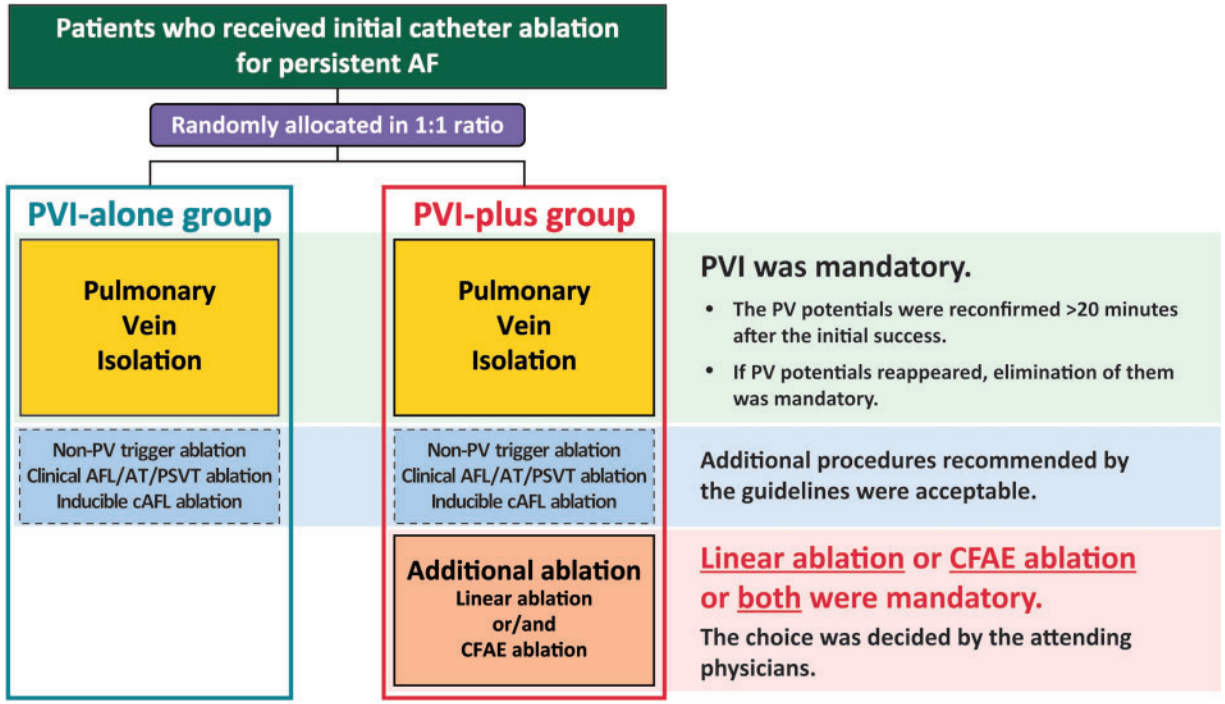


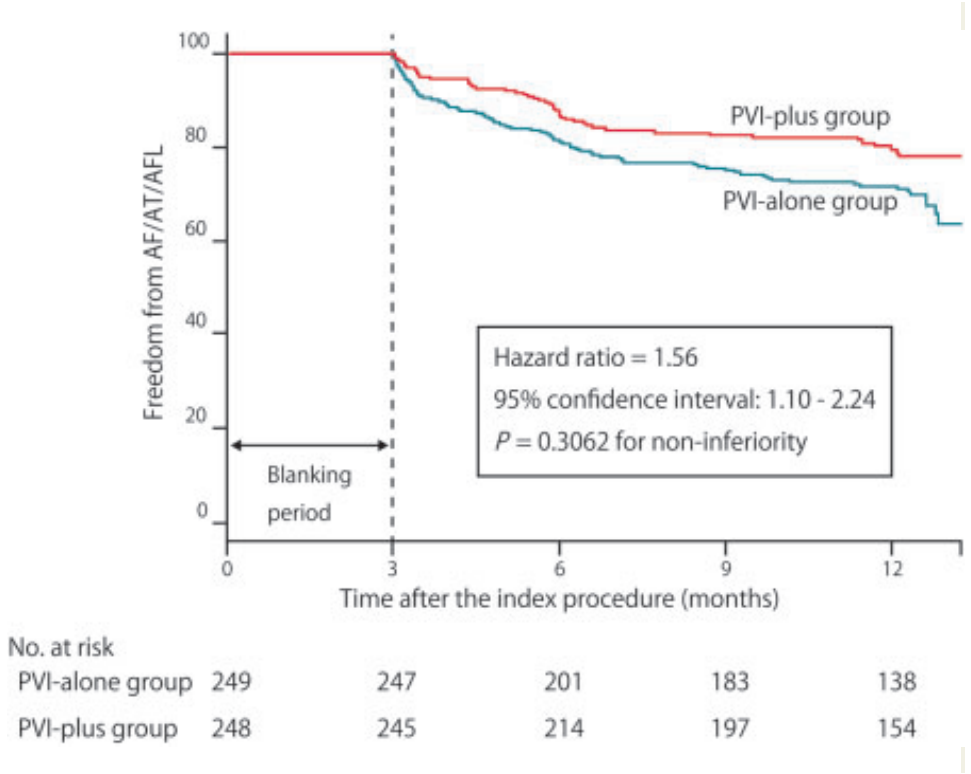
Table 3. Procedural Adverse Events.*

Adverse Event	Isolation Alone (N=64)	Isolation plus Electrograms (N=254)	Isolation plus Lines (N=250)	Total (N=568)
		number of events		
Hematoma at access site	2	0	3	5
Arteriovenous fistula or pseudo-aneurysm at access site	0	3	3	6
Pericarditis	0	1	2	3
Fluid overload	0	1	3	4
Sedation-related complication	0	3	5	8
Skin burn	1	0	0	1
Cardiac tamponade	1	0	2	3
Transient ischemic attack or stroke	0	2	1	3
Death due to atrioesophageal fistula	0	1	0	1

N Engl J Med 2015;372:1812-22

Pulmonary vein isolation alone vs. more extensive ablation with defragmentation and linear ablation of persistent atrial fibrillation: the EARNEST-PVI trial



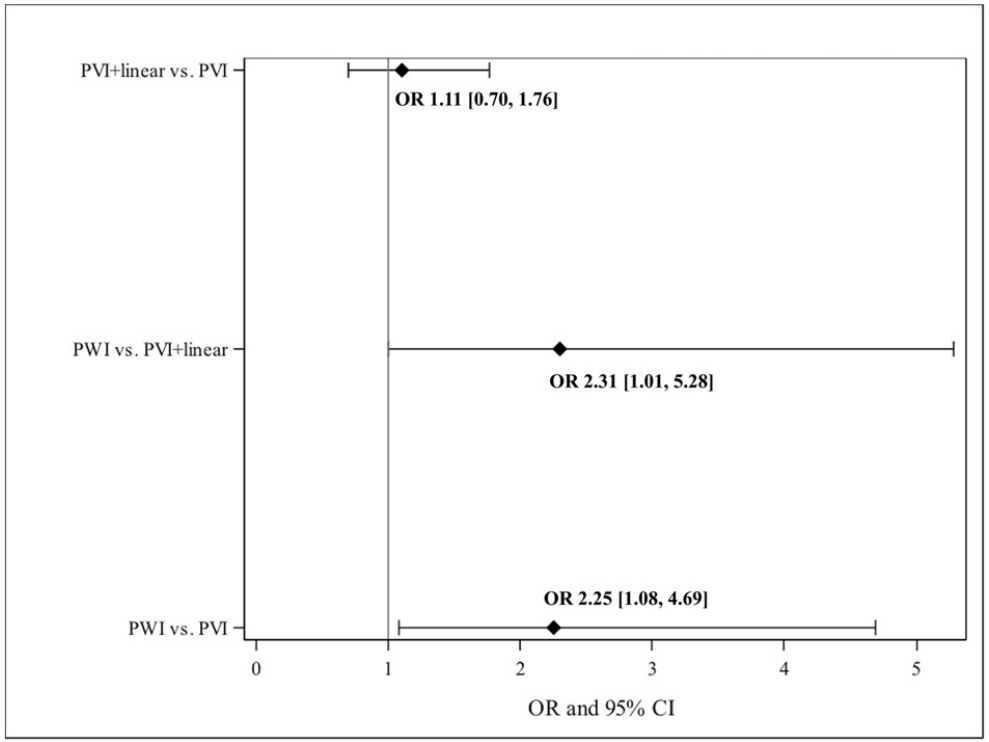


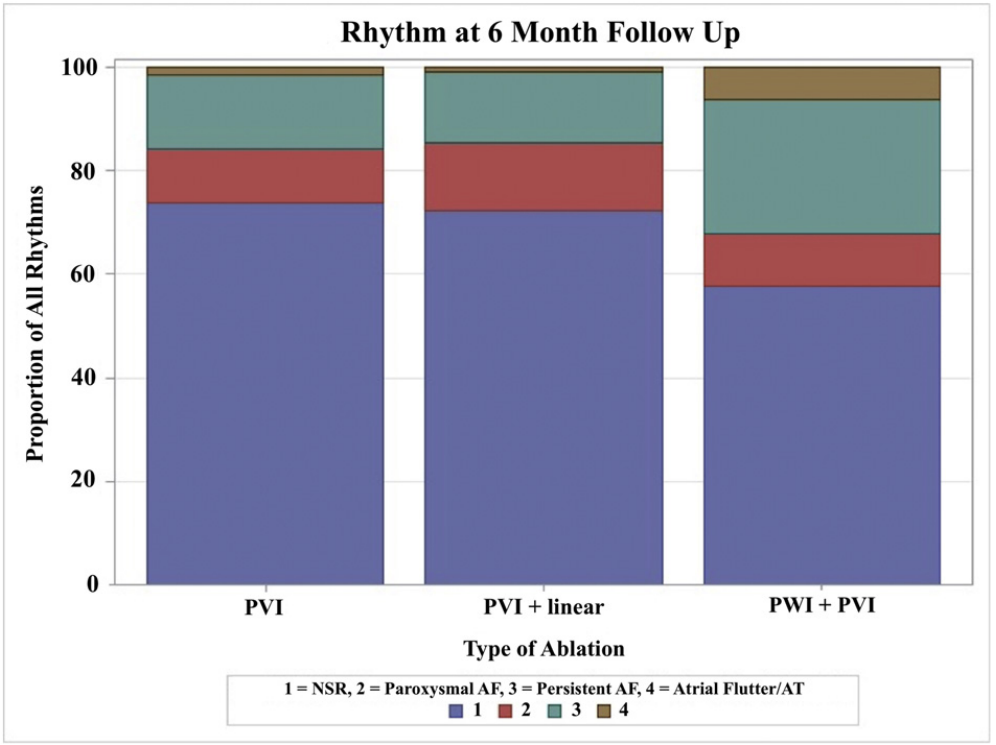
512 perAF, ilk işlem, randomize çalışma

Europace (2021) 23, 565–574

Safety and efficacy outcomes of left atrial posterior wall isolation compared to pulmonary vein isolation and pulmonary vein isolation with linear ablation for the treatment of persistent atrial fibrillation

558 hasta,retrospektif analiz
İlk veya tekrarlayan perAF ablasyonu
Lineer lezyon: Mitral istmus line, roof line, CTI line





6 aylık izlemde AT/AFL/AF

Am Heart J 2020;220:89-96

Biatrial linear ablation in sustained nonpermanent AF: Results of the substrate modification with ablation and antiarrhythmic drugs in nonpermanent atrial fibrillation (SMAN-PAF) trial

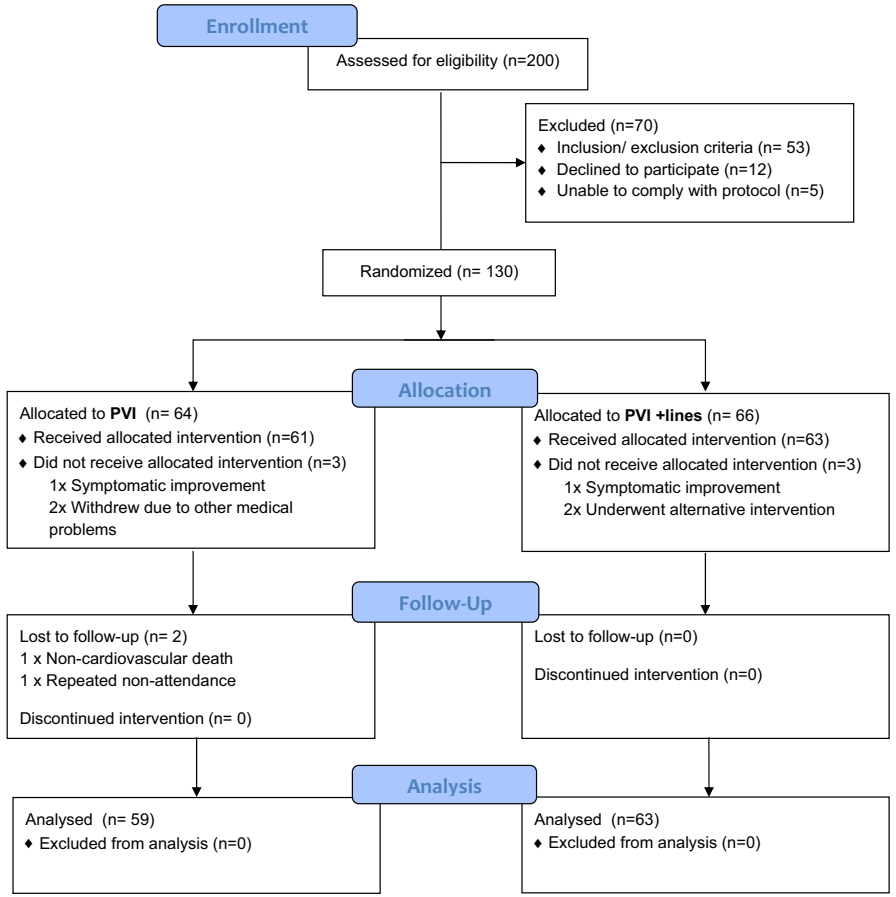


Table 2 Details of the index procedure

Variable	Total(n = 124)	PVI(n = 61)	PVI + lines(n = 63)	*P*
Procedure time (min)	191 ± 51	172 ± 44	209 ± 52	<.001
Ablation time (s)	3435 ± 1415	2503 ± 1061	4352 ± 1084	<.001
DAP ($Gy \cdot cm^2$)	3065 ± 4853	2106 ± 1679	3992 ± 6496	.03
Fluoroscopy time (s)	1356 ± 764	1079 ± 527	1610 ± 858	<.001
Wait time after PVI (min)	62 ± 33	43 ± 16	80 ± 35	<.001
Use of contact force sensing catheter	104 (83.9)	48 (78.7)	56 (88.9)	.12
CT/MR merge	84 (68)	39 (64)	45 (71)	.37
Sinus rhythm at the start	89 (72)	43 (71)	46 (73)	.75
Incomplete lesions	19 (15)	2 (3)	17 (27)	<.001

Conclusion

For patients with possible substrate-based AF, the addition of linear ablation lesions to PVI with WACA prolongs procedure duration and significantly increases radiation dose, but provides no additional clinical benefit in terms of freedom from arrhythmia or improvement in quality of life.

Heart Rhythm 2016;13:399–406

Stand-Alone Pulmonary Vein Isolation Versus Pulmonary Vein Isolation With Additional Substrate Modification as Index Ablation Procedures in Patients With Persistent and Long-Standing Persistent Atrial Fibrillation

The Randomized Alster-Lost-AF Trial (Ablation at St. Georg Hospital for Long-Standing Persistent Atrial Fibrillation)

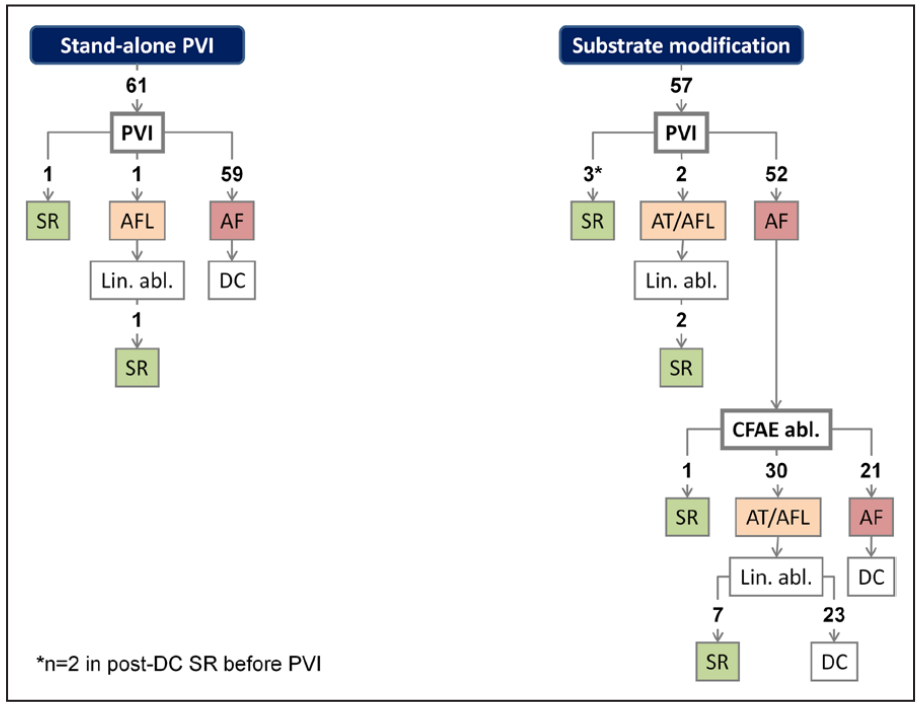
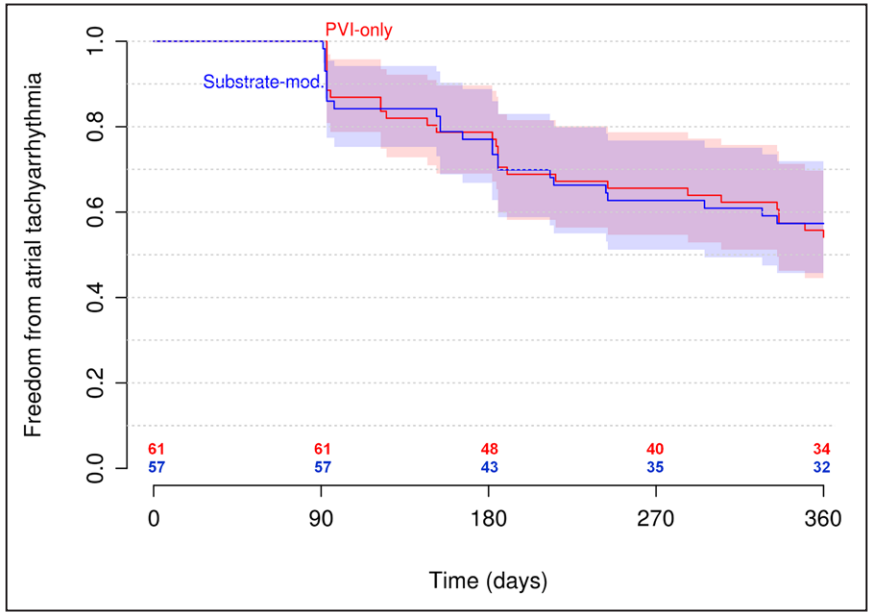


Table 3. Procedural Data

	PVI-Only (n=61)	Substrate Modification (n=57)	*P* Value
Ablation time, min	39 [31, 52]	82 [60, 99]	<0.0001
Procedure duration, min	162±56	218±53	<0.0001
Fluoroscopy time, min	19.5±8.9	23.5±8.5	0.0151
Radiation dose, cGy·cm^2	2918±2005	3976±2641	0.0162
Major complications	3 (5)	7 (12)	0.19
Cardiac tamponade	0 (0)	2 (4)	
Stroke	1 (2)	1 (2)	
Transient ischemic attack	1 (2)	0 (0)	
Groin bleeding requiring transfusion	1 (2)	2 (4)	
Groin bleeding requiring surgical therapy	0 (0)	2 (4)	
Minor complications	8 (13)	5 (9)	0.56
Minor groin complication	8 (13)	4 (7)	
Mediastinal hematoma, conservative treatment	0 (0)	1 (2)	



Circ Arrhythm Electrophysiol 2017;10:e005114

Outcomes of persistent and long-standing persistent atrial fibrillation ablation: a systematic review and meta-analysis

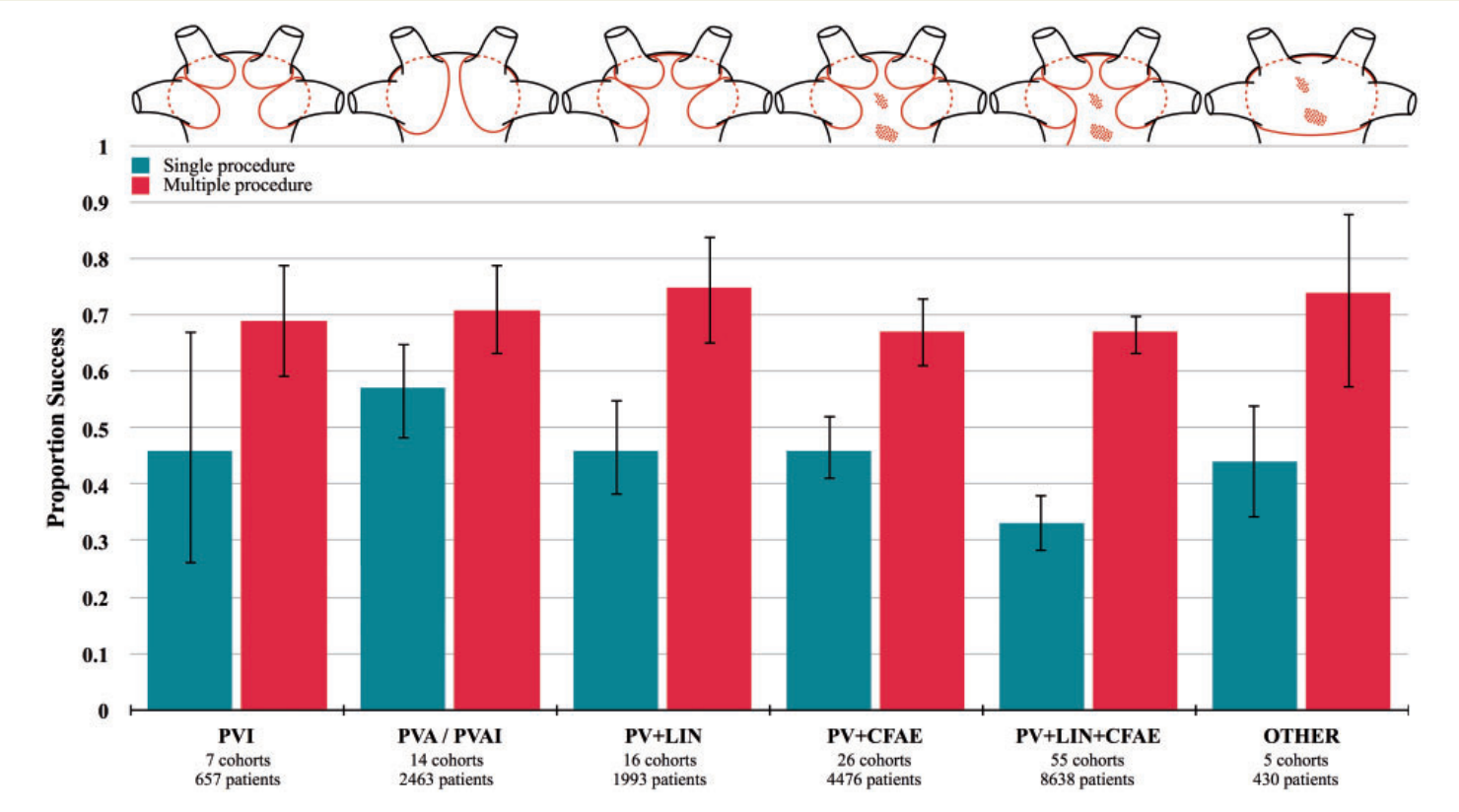


Figure 2 Combined point estimates and 95% CI for single-procedure and multiple-procedure cohorts across all six ablation approaches.

Europace (2018) 20, f366–f376

Original Investigation

Association of Atrial Tissue Fibrosis Identified by Delayed Enhancement MRI and Atrial Fibrillation Catheter Ablation

The DECAAF Study

Figure 2. Four Stages of Left Atrial Tissue Fibrosis Based on 3D Delayed Enhancement Magnetic Resonance Imaging Scans

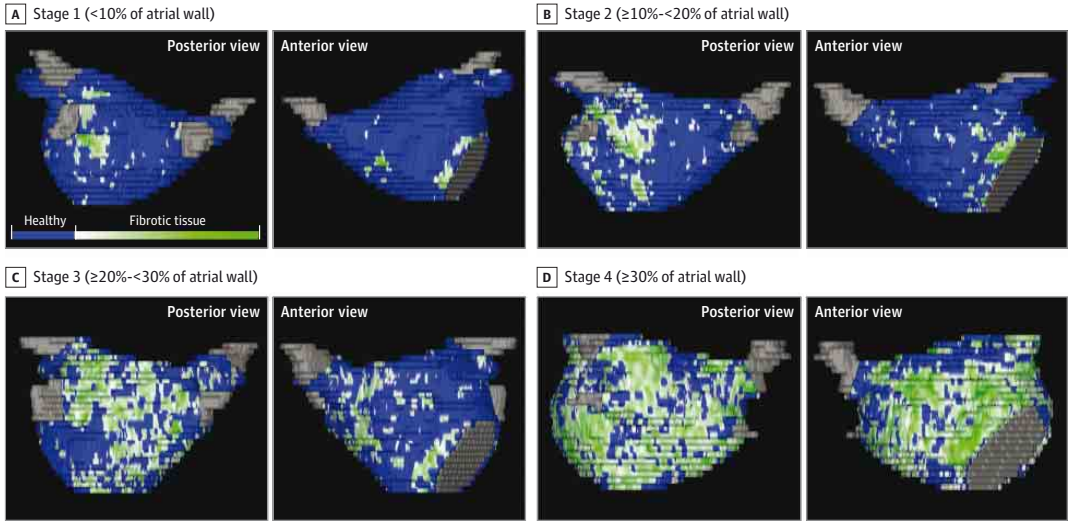


Figure 3. Relationship of Atrial Fibrillation Recurrence With Percent Fibrosis

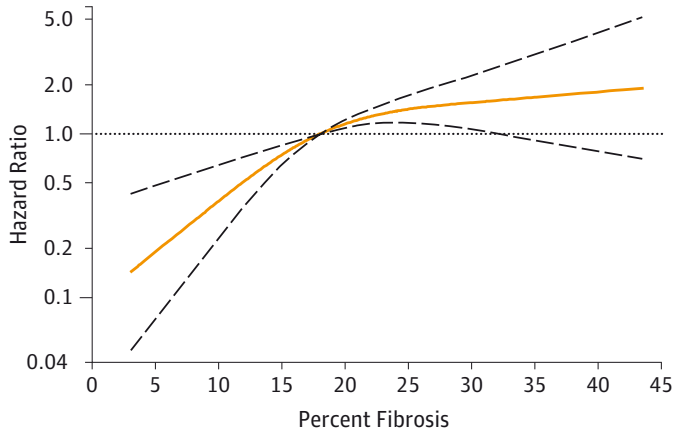
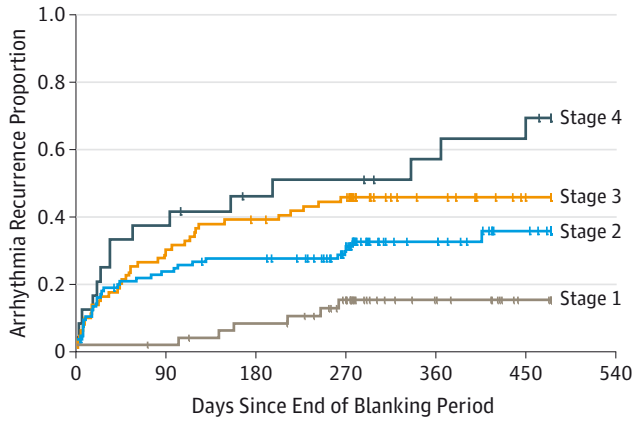


Figure 4. Cumulative Incidence of Arrhythmia Recurrence Without Covariate Adjustment Through Day 475 After the Blanking Period

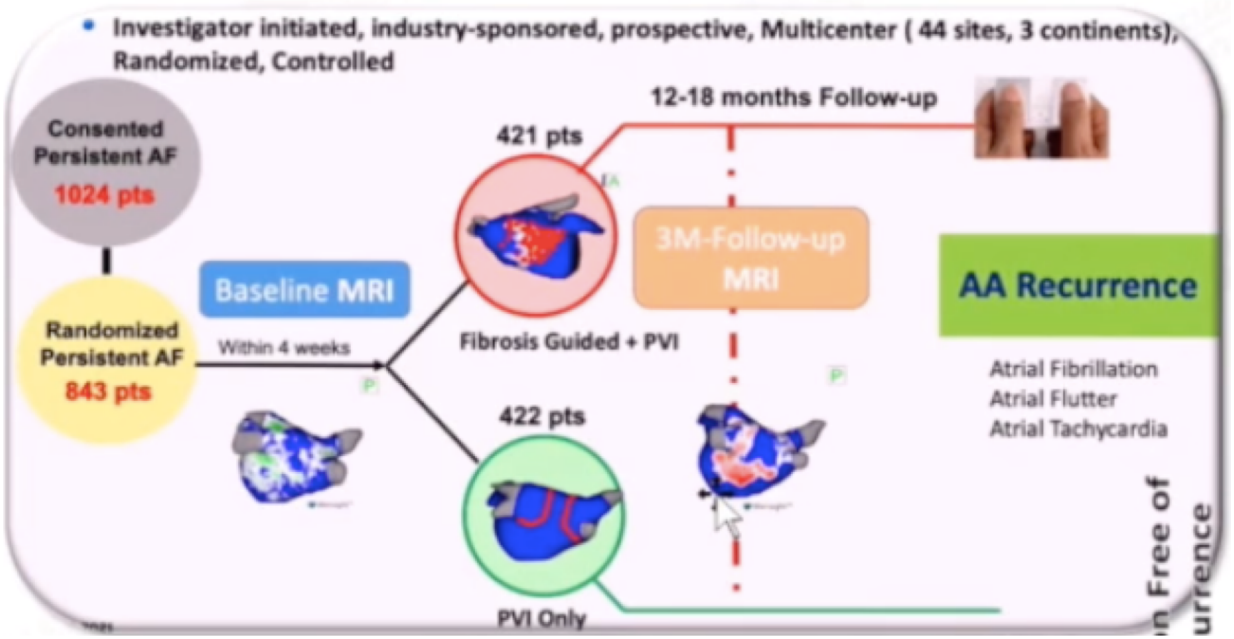


JAMA 2014;311(5):498-506

JAMA | Original Investigation

Effect of MRI-Guided Fibrosis Ablation vs Conventional Catheter Ablation on Atrial Arrhythmia Recurrence in Patients With Persistent Atrial Fibrillation

The DECAAF II Randomized Clinical Trial

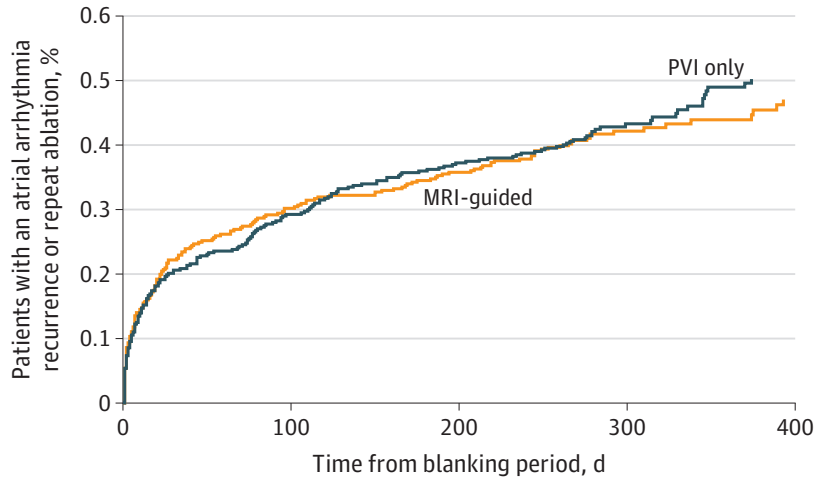


Baseline fibrosis levels		
<10%	48 (11.4)	50 (11.8)
10%-<20%	198 (47)	196 (46.4)
20%-<30%	144 (34.2)	137 (32.5)
≥30%	31 (7.4)	39 (9.2)

Table 3. Safety Outcomes in Total Population[a]

	No. (%)	
	MRI-guided (N = 403)	PVI alone (N = 428)
Safety outcomes		
Bleeding requiring transfusion	1 (0.2)	0
Heart failure	1 (0.2)	0
Pulmonary vein stenosis	0 (0)	0
Stroke or transient ischemic attack	6 (1.5)	0
Death	2 (0.5)	0
Primary composite safety outcome, defined as ≥1 of the above events[b]	9 (2.2)	0
Esophageal injury[c]	5 (1.2)	1 (0.2)
Perforation or tamponade[c]	5 (1.2)	5 (1.2)

Figure 2. Primary Composite of Atrial Arrhythmia Recurrence or Repeat Ablation



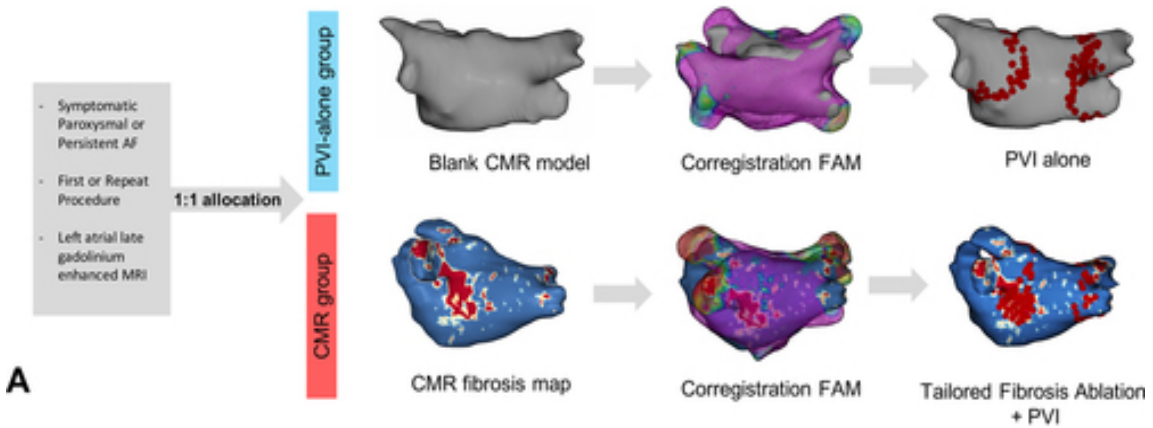
JAMA 2022;327(23):2296-2305

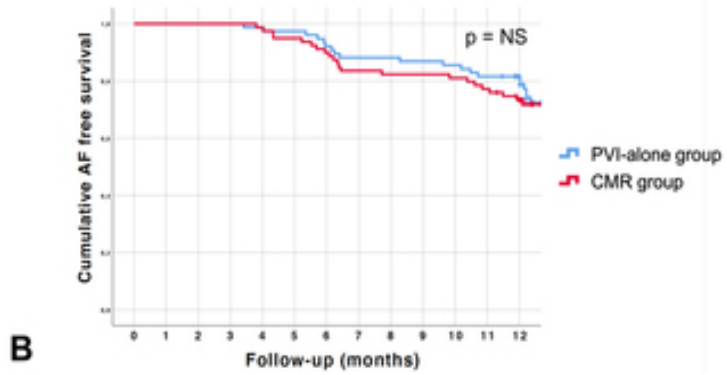
ORIGINAL ARTICLE

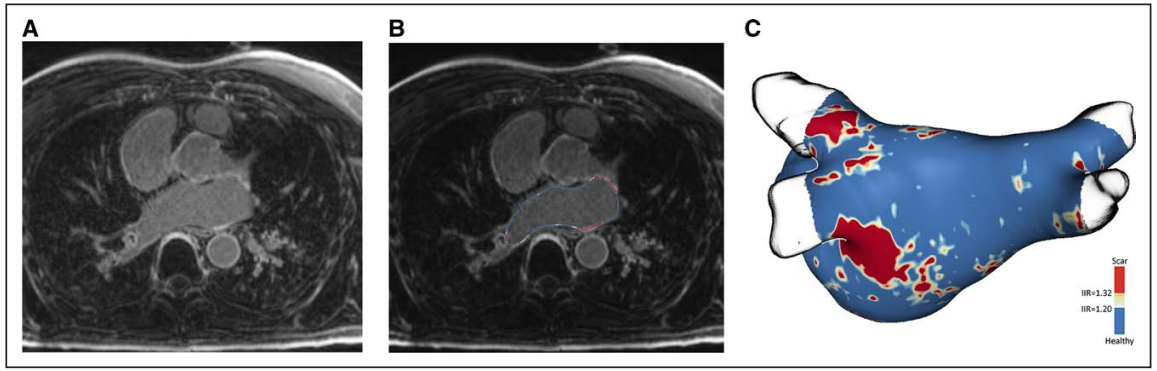
Magnetic Resonance Imaging-Guided Fibrosis Ablation for the Treatment of Atrial Fibrillation

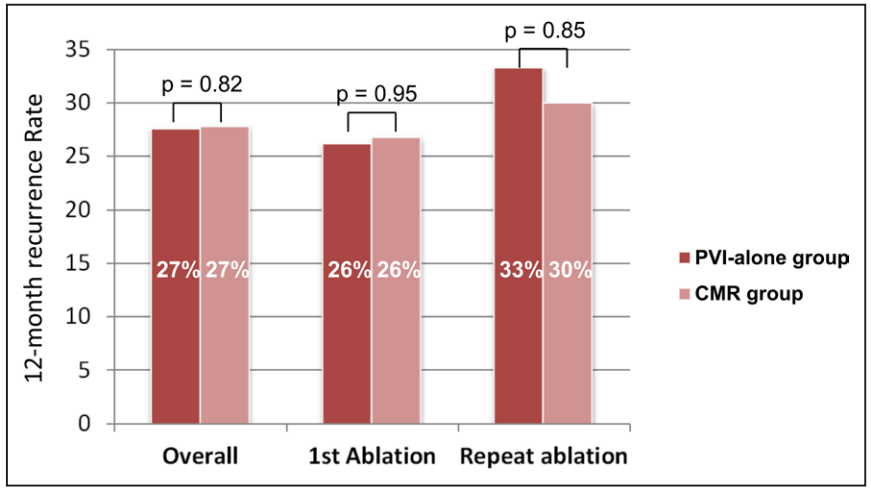
The ALICIA Trial

N=155
2 merkez
%54 PAF/ %46 PerAF
%80 ilk ablasyon







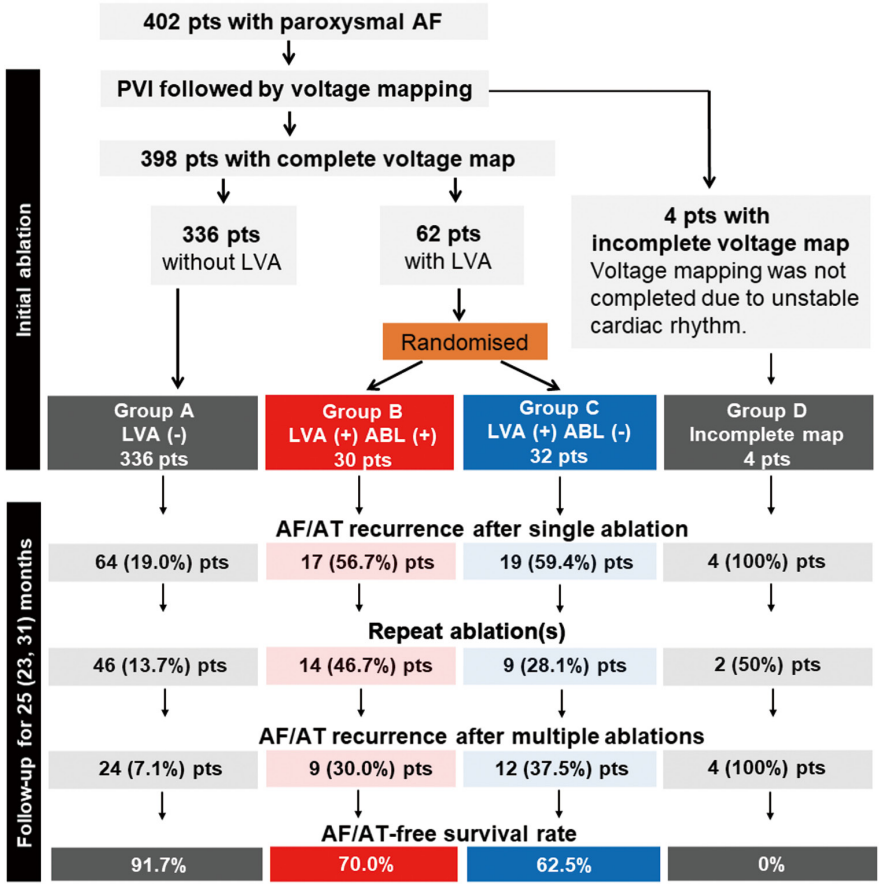


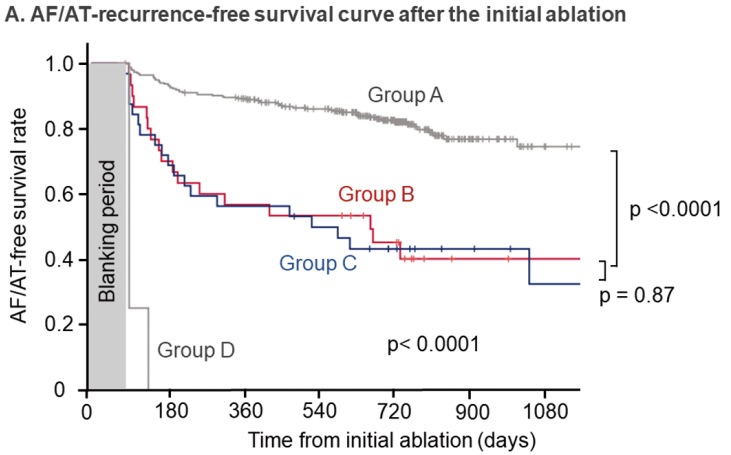
Circ Arrhythm Electrophysiol 2020;13:e008707

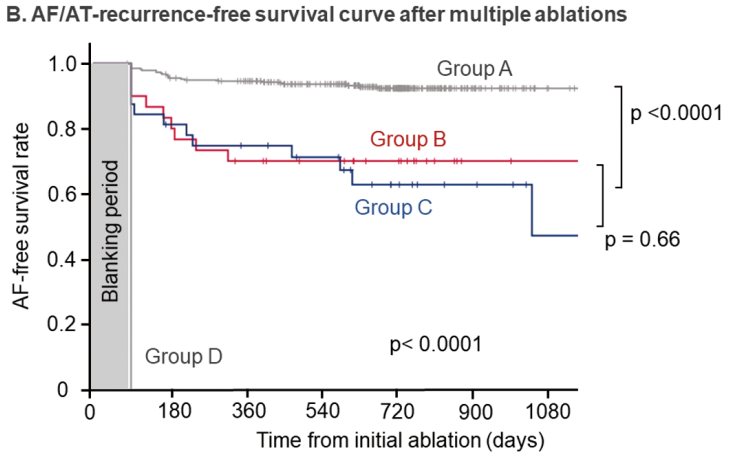
Circulation Journal
Circ J 2022; 86: 245–252
doi:10.1253/circj.CJ-21-0476

Low-Voltage-Area Ablation in Paroxysmal Atrial Fibrillation

— Extended Follow-up Results of the VOLCANO Trial —





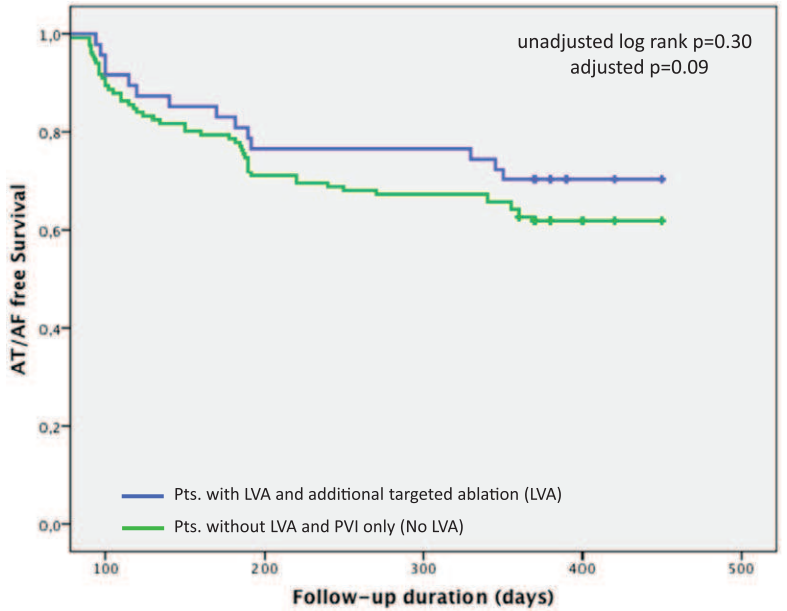


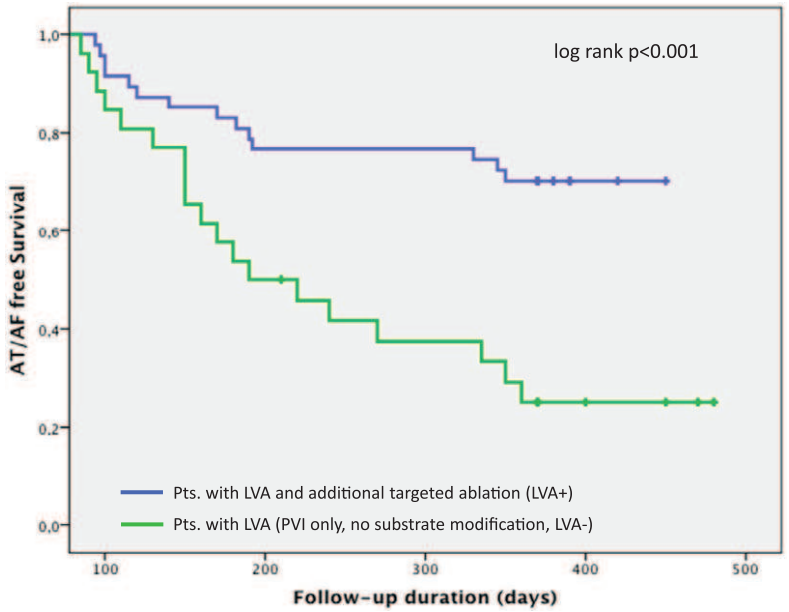
Circ J 2022 86: 245–252

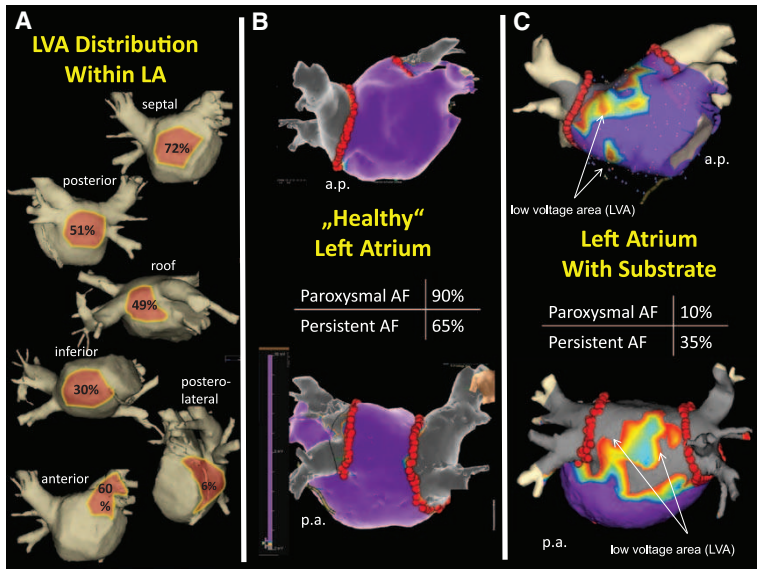
Tailored Atrial Substrate Modification Based on Low-Voltage Areas in Catheter Ablation of Atrial Fibrillation

Table 1. Baseline Characteristics

	All Patients (N=178)	LVA Group (N=47)	No-LVA Group (N=131)	*P* Value
Age, y	61±10*	67±8*	59±9*	<0.001*
Men	121 (68%)*	25 (53%)*	96 (73%)*	0.017*
Arterial hypertension	131 (74%)	40 (85%)	91 (70%)	0.053
Diabetes mellitus	29 (16%)	12 (26%)	17 (13%)	0.064
Structural heart disease	41 (23%)	12 (26%)	29 (22%)	0.69
Body mass index	29±5	29±5	29±5	0.90
Left atrial diameter, mm	44±7	45±8	43±6	0.26
LVEF, %	60 (54,62)	60 (50,63)	60 (55,62)	0.73
LAA flow velocity, m/s†	0.53±0.20*	0.35±0.14*	0.55±0.20*	0.002*
Persistent AF	116 (65%)*	41 (87%)*	75 (57%)*	<0.001*
History of AF, mo	49 (24,109)	35 (16,90)	66 (24,110)	0.048
Medication				
β-blockers	129 (73%)	36 (77%)	93 (71%)	0.57
ACEI and ARB	105 (59%)	32 (68%)	17 (56%)	0.17
Statins	21 (12%)	7 (15%)	14 (11%)	0.44



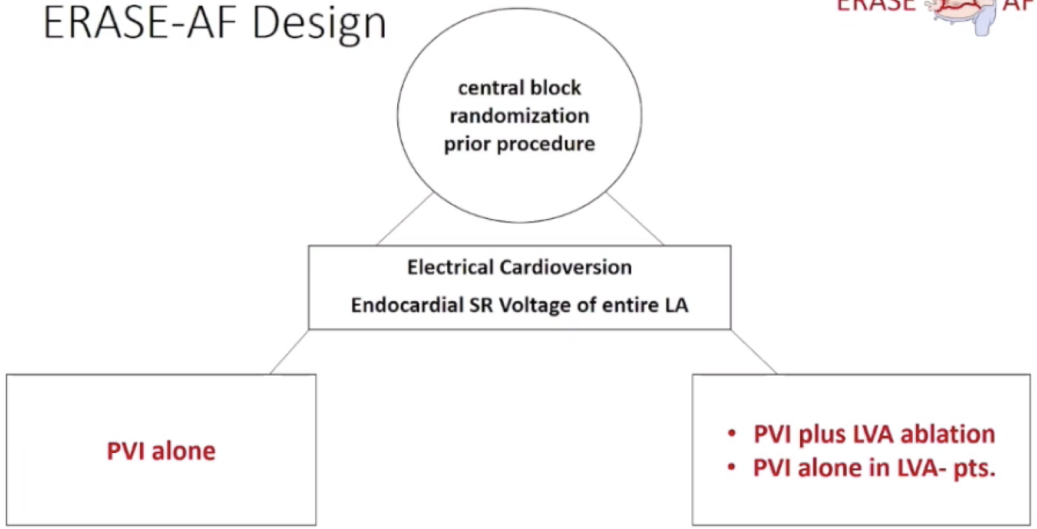




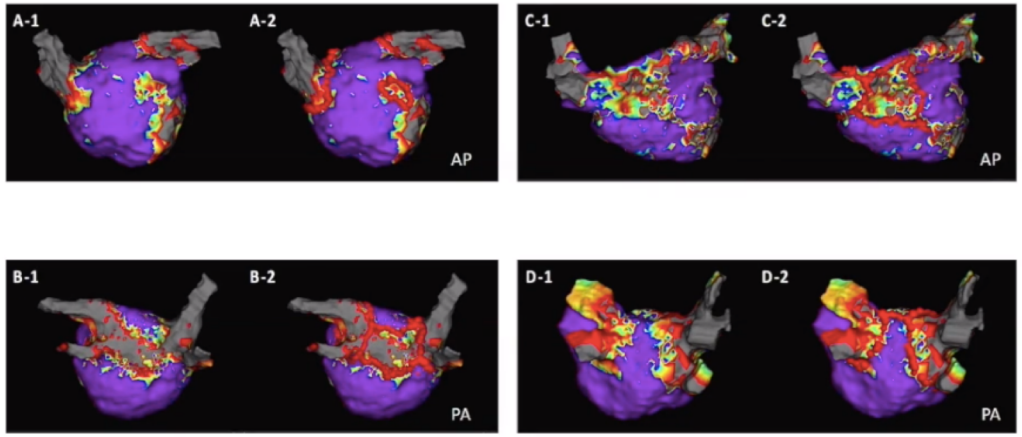
Circ Arrhythm Electrophysiol 2014;7:825-833

Low-Voltage Myocardium-Guided Ablation Trial of Persistent Atrial Fibrillation

ERASE-AF Design

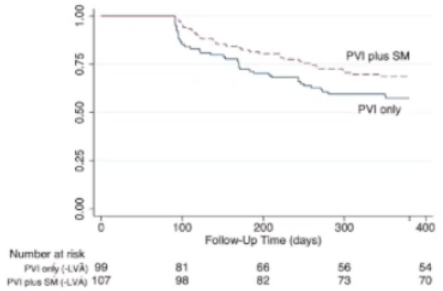


Mapping & Ablation Examples



Subgroup Analysis

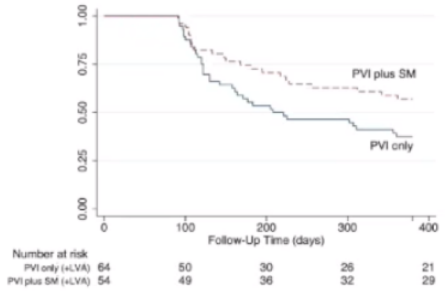
LVA- subgroup



95%CI 0.42-1.05

	Between LVA-
Δ Procedure (min)	0 (-10,15)
Δ Ablation (min)	0.8 (-2.7,4.4)

LVA+ subgroup



95%CI 0.34-0.99

Ls-pers. AF subgroup

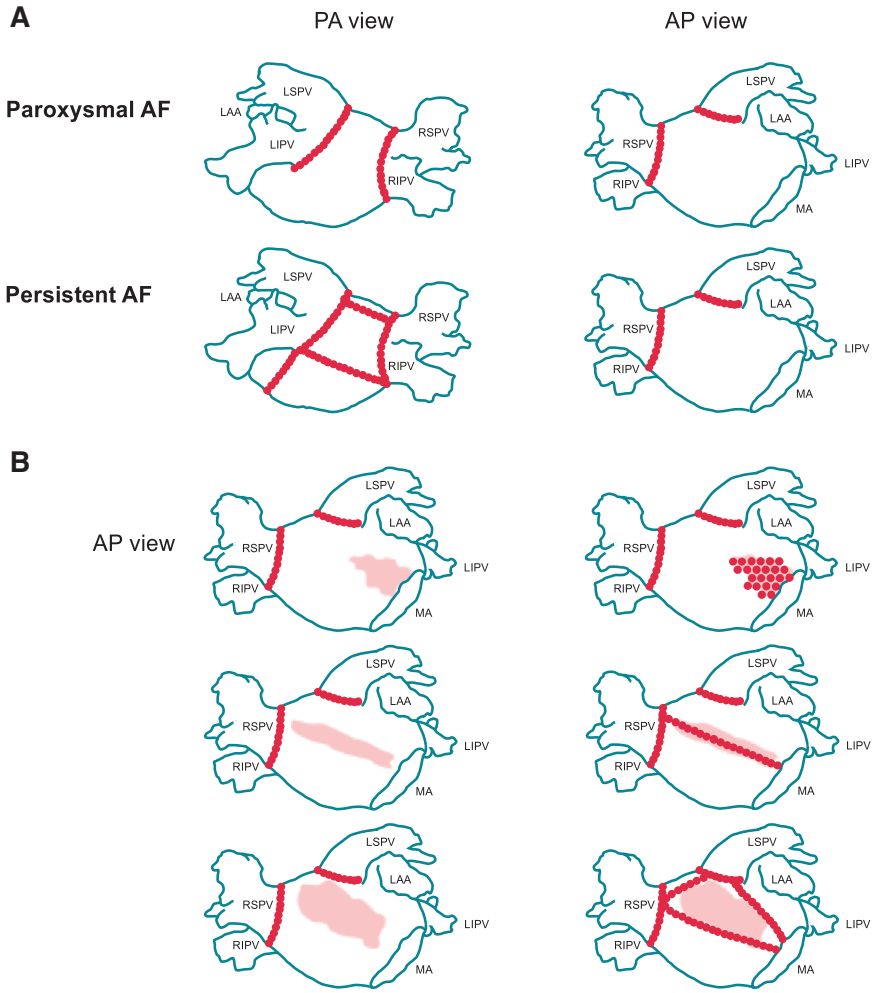
	PVI only	PVI plus SM
Longstanding pers. AF	13/163 (8%)	11/161 (7%)
LVA+	7/13 (54%)	7/11 (64%)
Primary Endpoint	10/13 (77%)	3/11 (27%)

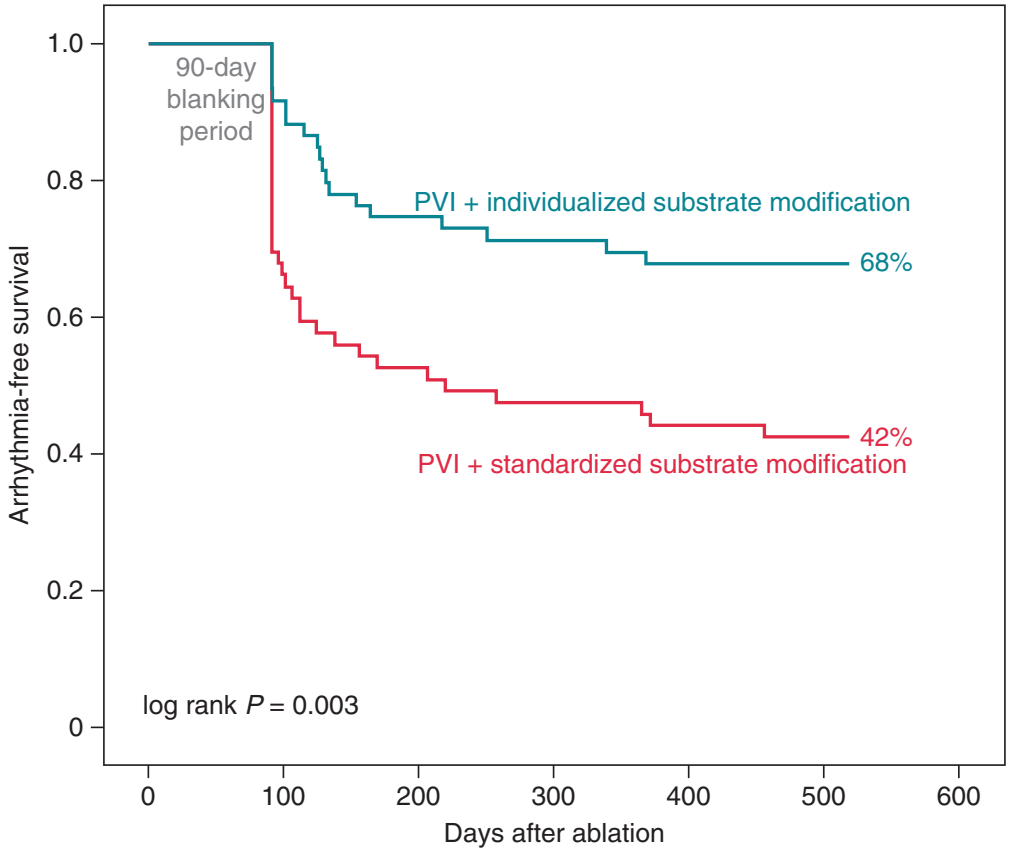
95%CI 0.12-0.84

NEJM Evid 2022; 1 (11)
DOI:https://doi.org/10.1056/EVIDoa2200141

	ERASE-AF	DECAAF-II	ALICIA	VOLCANO-AF
Hasta sayısı	324	843	155	62 (336'nın %18'i)
Yaş	66	63	58	75
Erkek/kadın	%67/%33	%79/%21	%72/%28	%29/%71
BMI	30	---	29	22
PAF/PerAF/LS-PerAF	%0/%93/%7	%0/%100/%0	%55/%45/%0	%100/%0/%0
Redo Ablasyon	%0	%0	%25	%0
% KY/LV disfonksiyonu	%23	%19	---	%18
Önceki başarısız AA tedavi	%98	%58	%96	---
LA çapı	45	---	43	39
Skar belirleme	EA mapping	DE-MRI	DE-MRI	EA mapping
Sonuç	**Pozitif**	Nötral	Nötral	Nötral

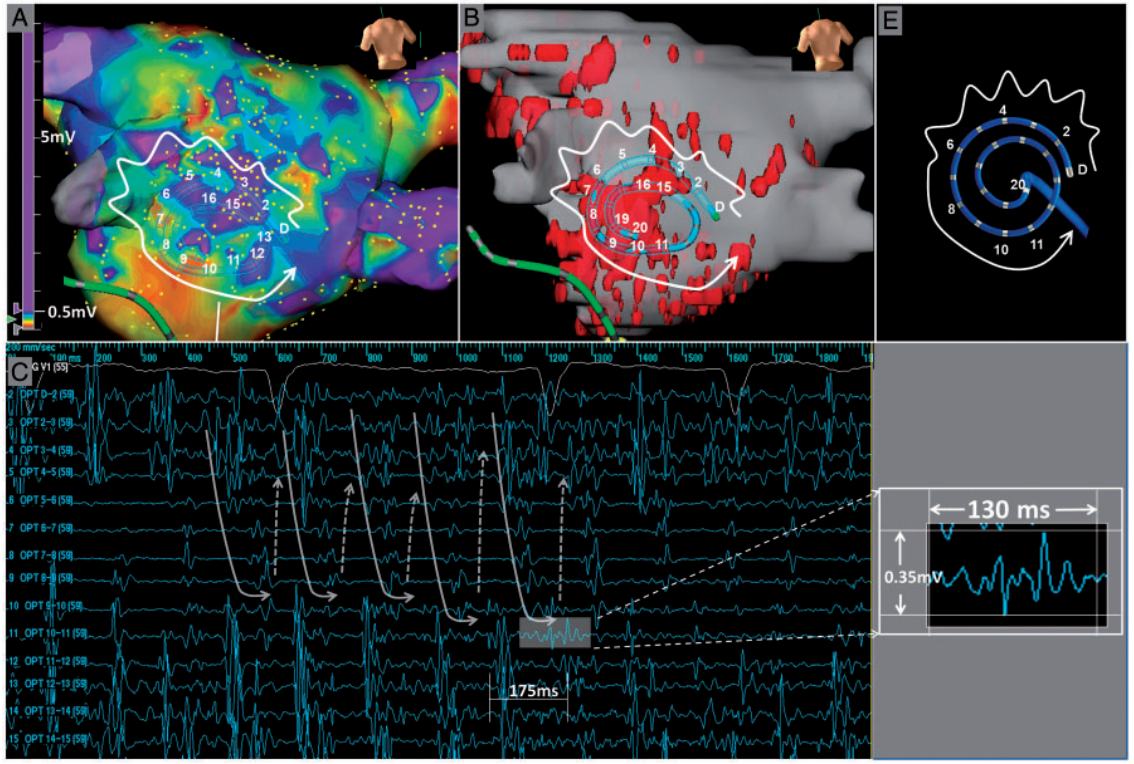
Individually tailored vs. standardized substrate modification during radiofrequency catheter ablation for atrial fibrillation: a randomized study

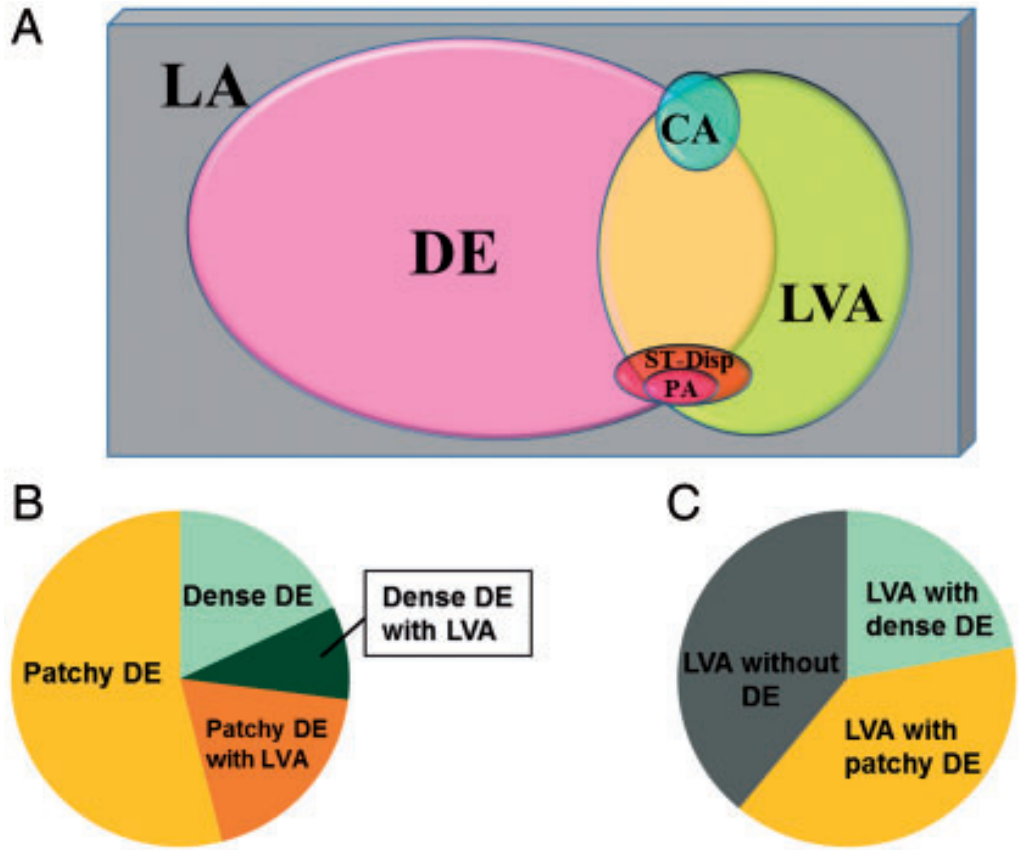




Europace (2018) 20, 1766–1775

Extent and spatial distribution of left atrial arrhythmogenic sites, late gadolinium enhancement at magnetic resonance imaging, and low-voltage areas in patients with persistent atrial fibrillation: comparison of imaging vs. electrical parameters of fibrosis and arrhythmogenesis





Europace (2019) 21, 1484–1493

Sonuç

- PerAF/LS-PerAF tedavisinde genellikle tek başına PVI yeterli olmamaktadır.
- PerAF/LS-PerAF'nin patofizyolojisinde atriyal substrattaki yeniden şekillenme önemli bir yer almaktadır.
- Buna karşın, atriyal substrata yönelik ablasyon stratejileri istenen sonuçları vermemiştir.
- Atriyal fibrozise yönelik yapılan ablasyon umut vadetmektedir.

Teşekkürler