KRİYOABLASYON PERSİSTAN AF'DE İLK SEÇENEK OLMALIDIR

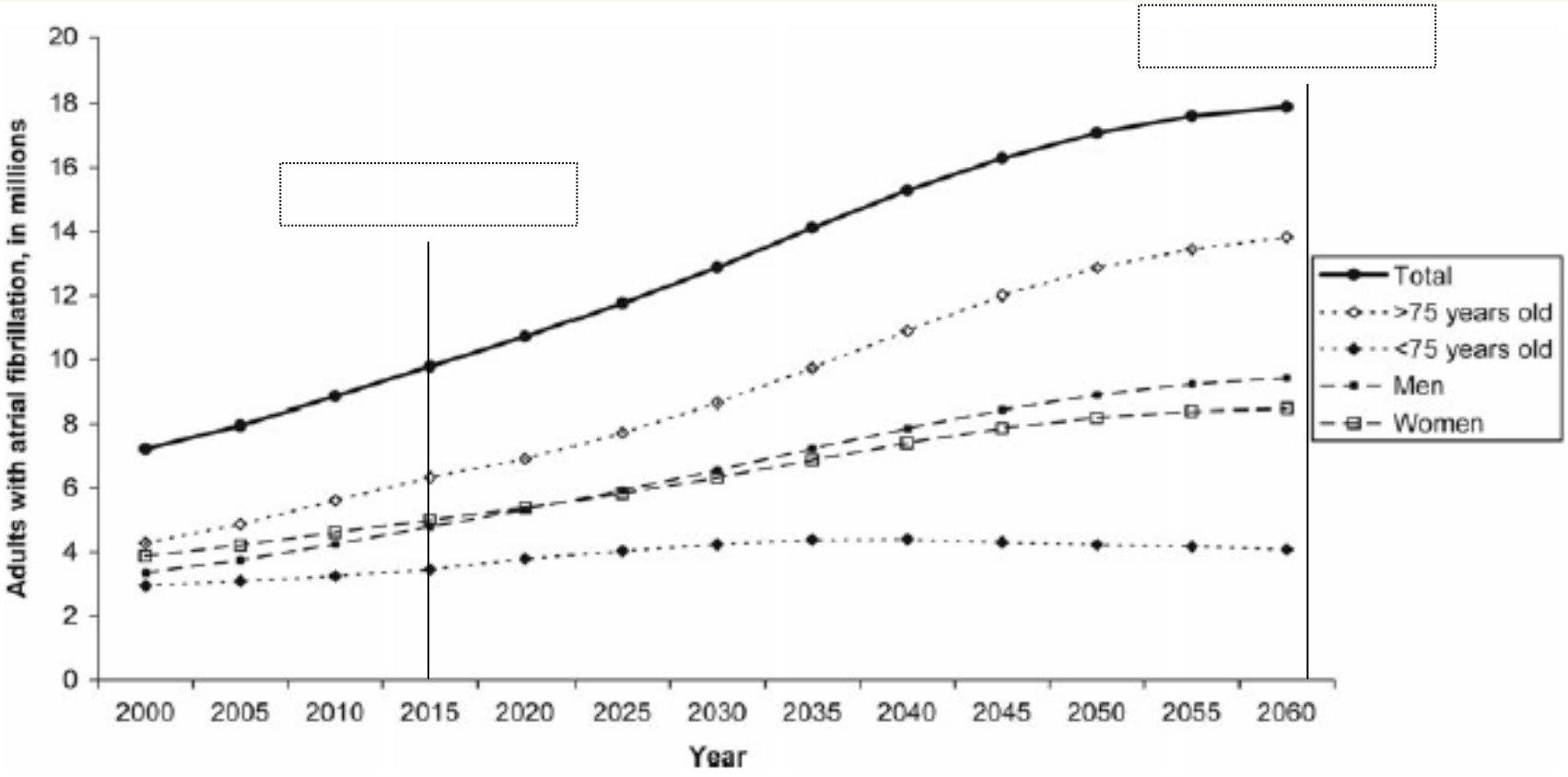
Prof. Dr. Nihal Akar Bayram

Ankara Atatürk Eğitim ve Araştırma Hastanesi

Ankara Yıldırım Beyazıt Üniversitesi Tıp Fakültesi

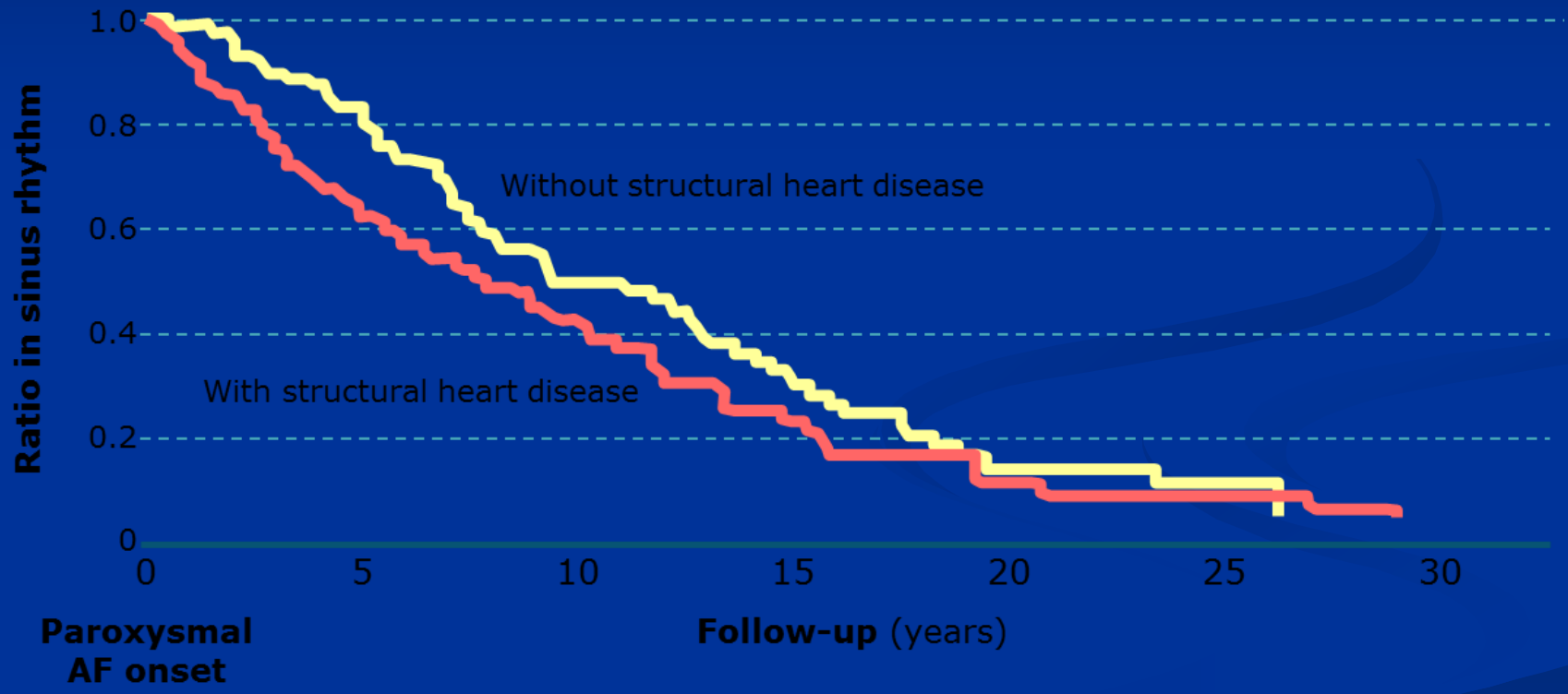
Kardiyoloji A.B.D.

AF Prevalansı



[1] B.P. Krijthe et al. *Euro Heart J* 2013 Sep;34(35):2746-51.[2] Zoni-Berisso, et al. *Clinical Epidemiology 2014:6 213–220*

Paroksismal AF'lerin her yıl %5,5'i persistan AF'ye döner

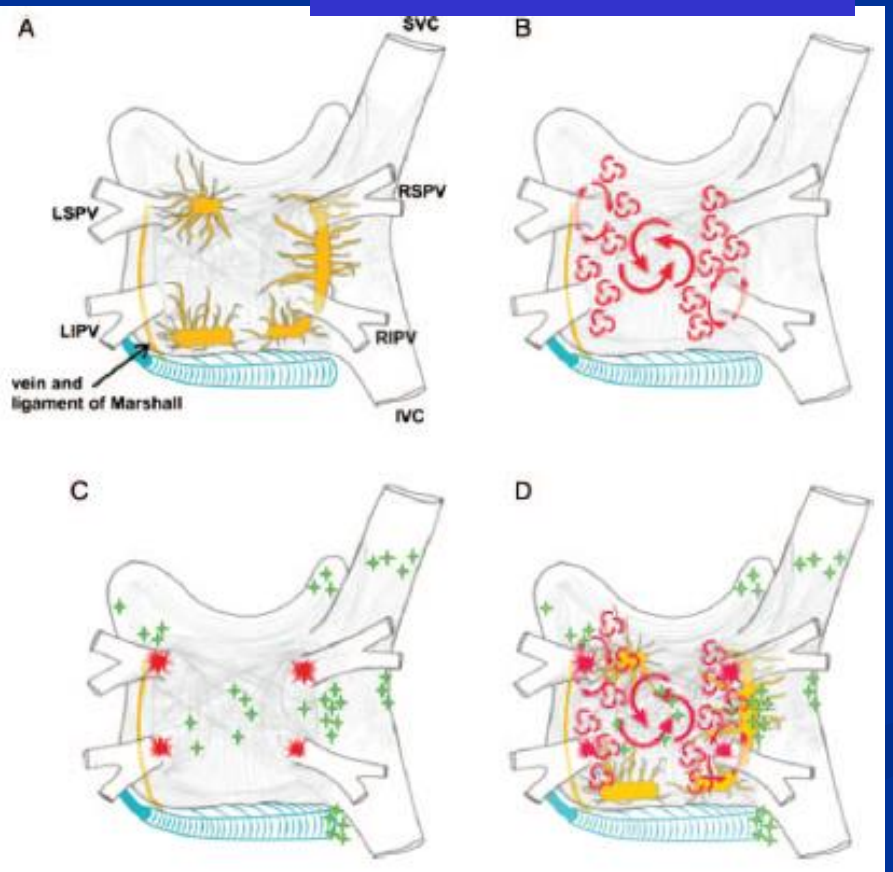


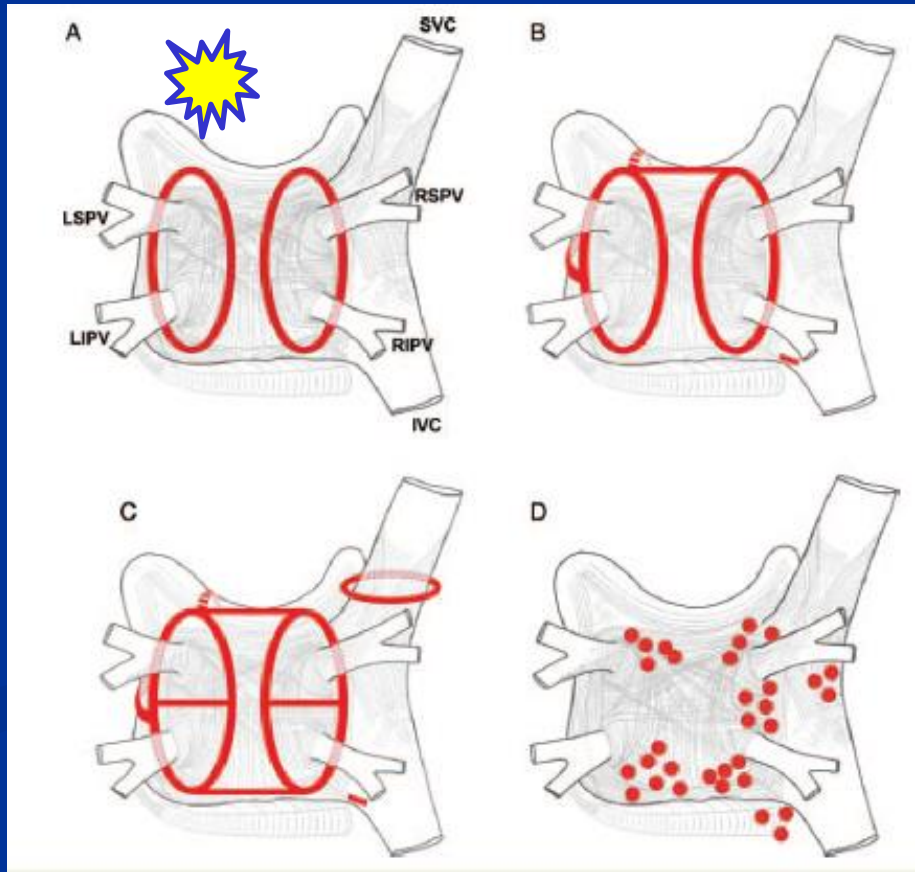
Kato T, et al. Circ J (2004) 68: 568

AF Mekanizmaları

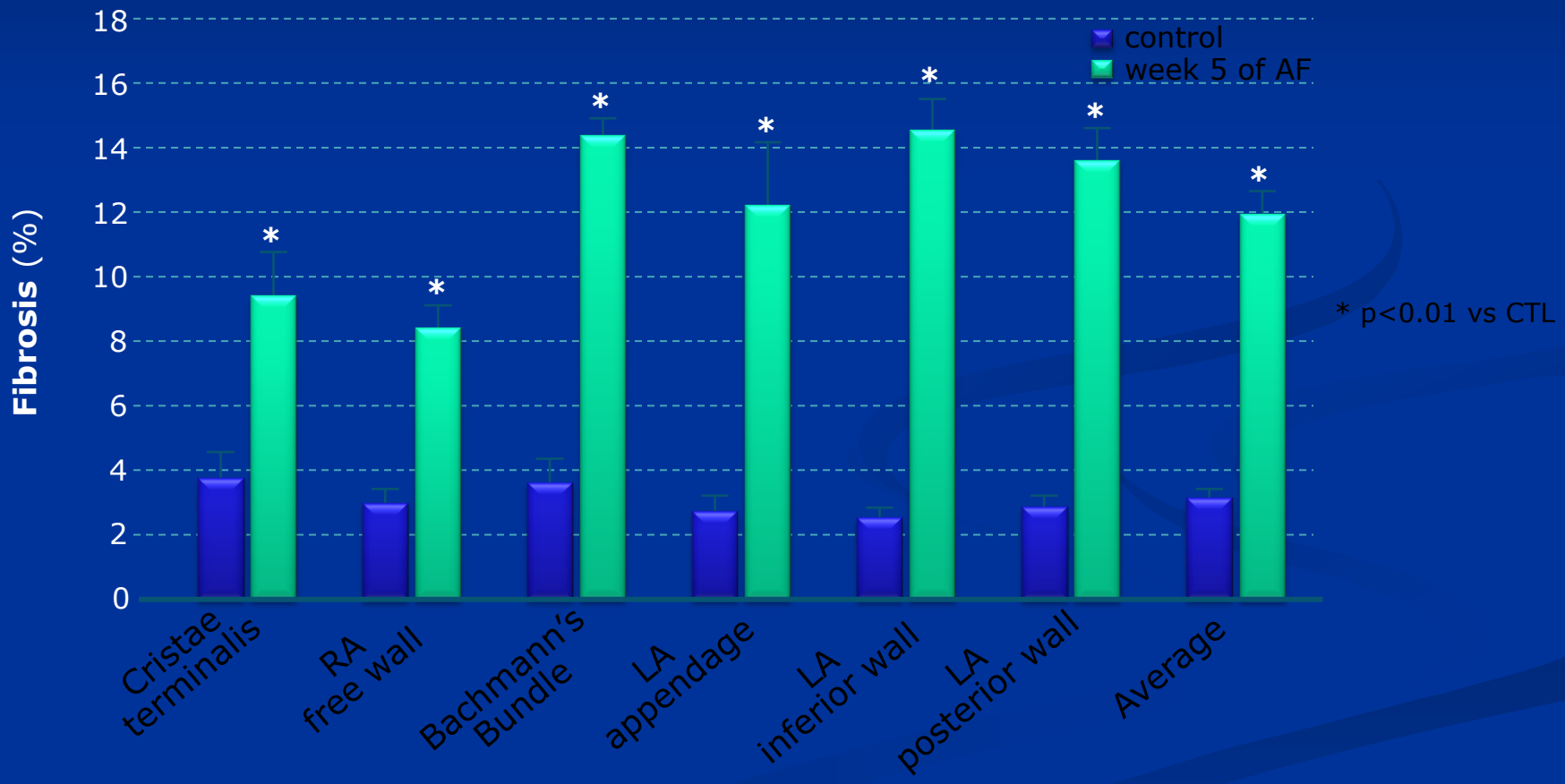
Trigger

Substrat





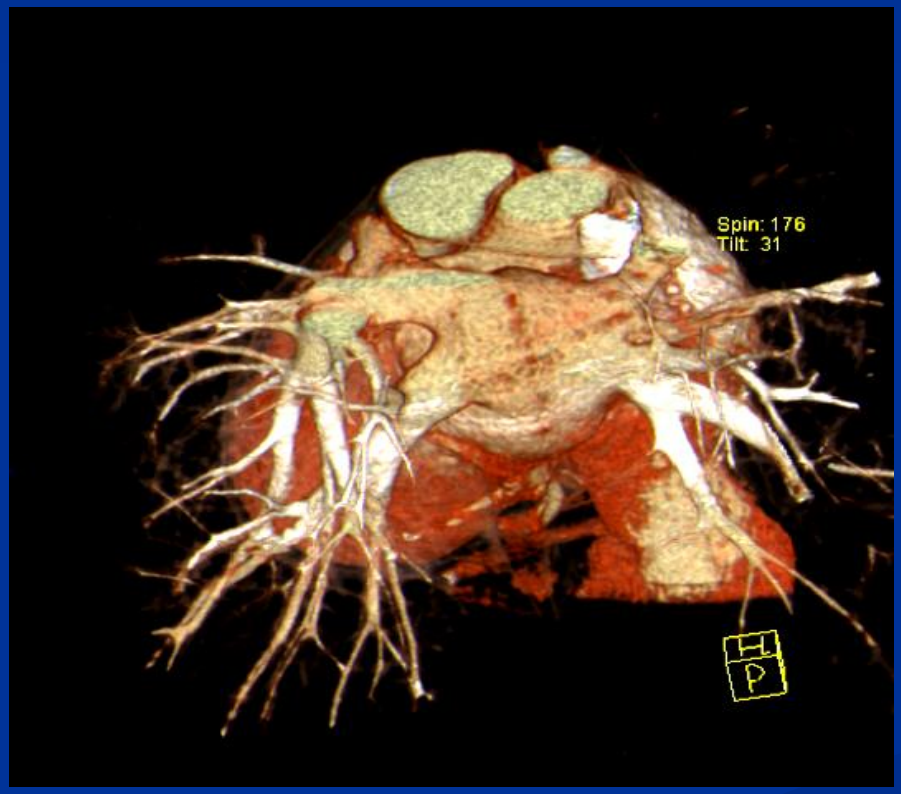
Atrial fibrilasyon irrevesibl fibrozisi tetikler

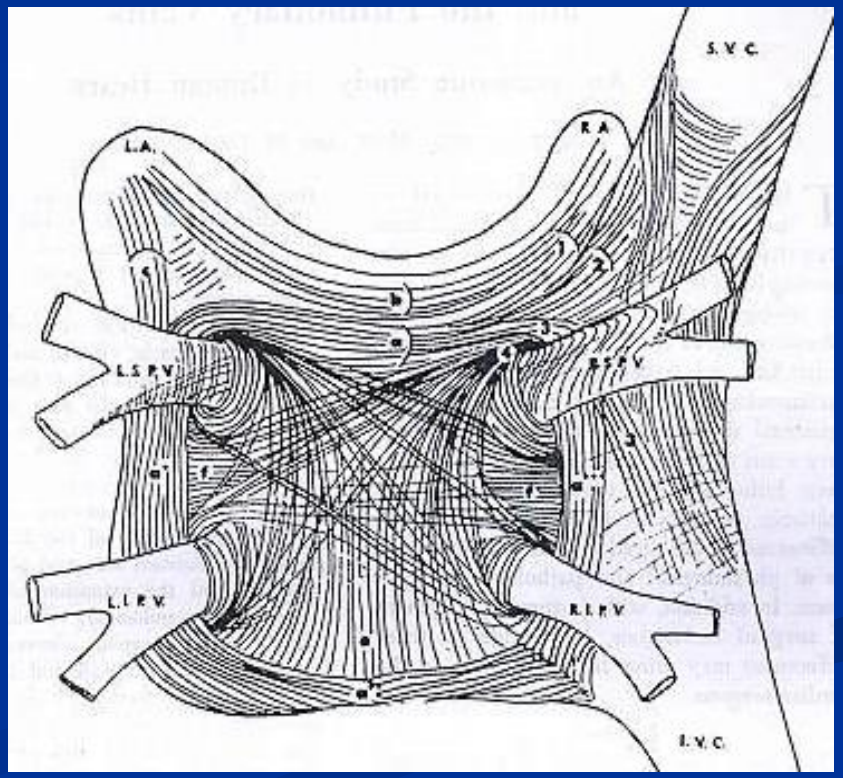


Shinagawa K, et al. Circulation (2002) 105: 2672

Pulmoner ven izolasyonu

- Pulmoner ven izolasyonu AF ablasyonunun temel taşıdır.
- Hedef PV ile LA'nın elektriksel izolasyonudur.



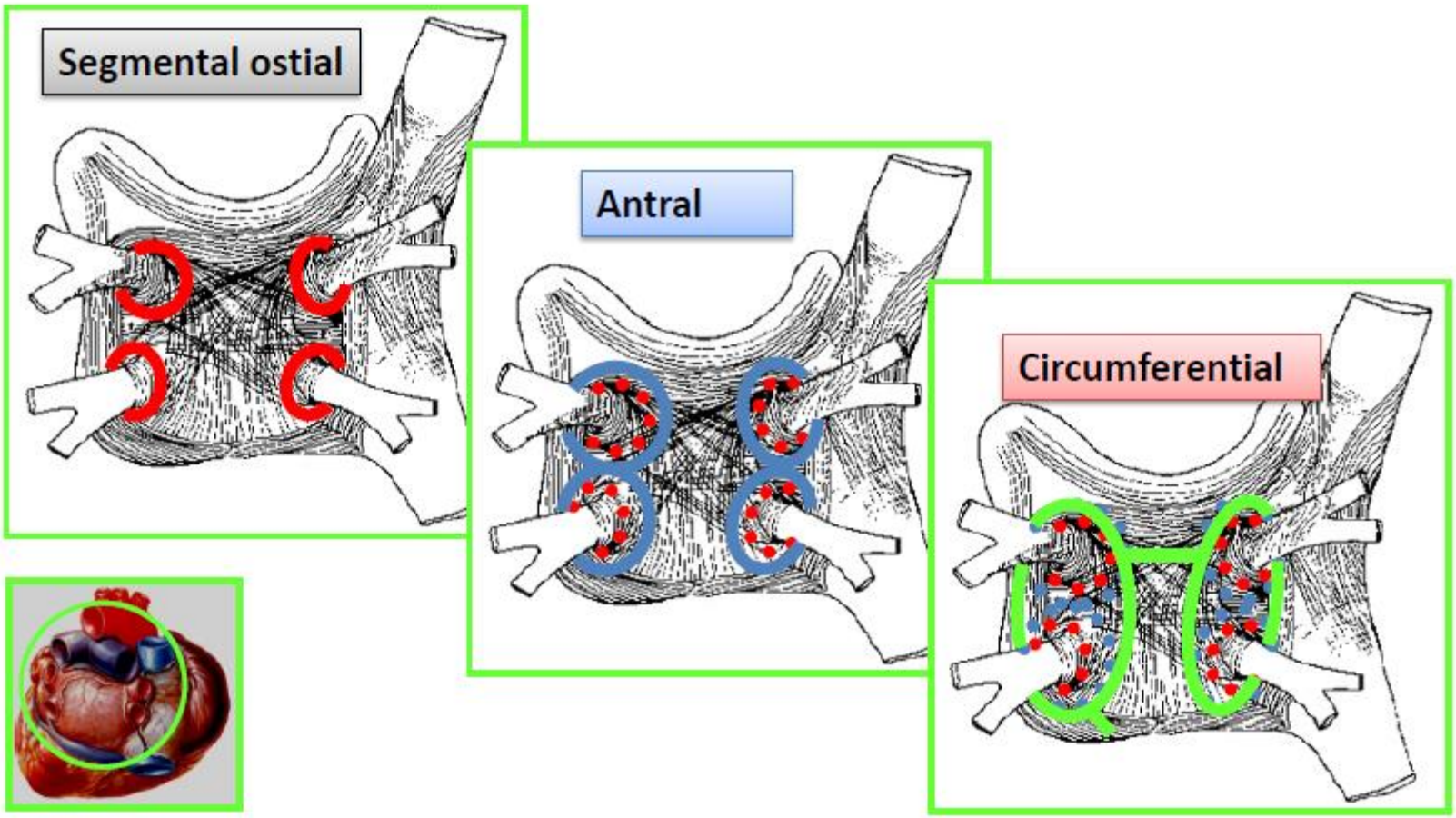


PV dışı tetikleyiciler

En sık odaklar:

- Vena kava superior
- Sol atrium arka duvarı
- Krista terminalis
- Koroner sinüs
- Marshall ligamenti
- İnteratrial septum
- Sol atrial apendiks

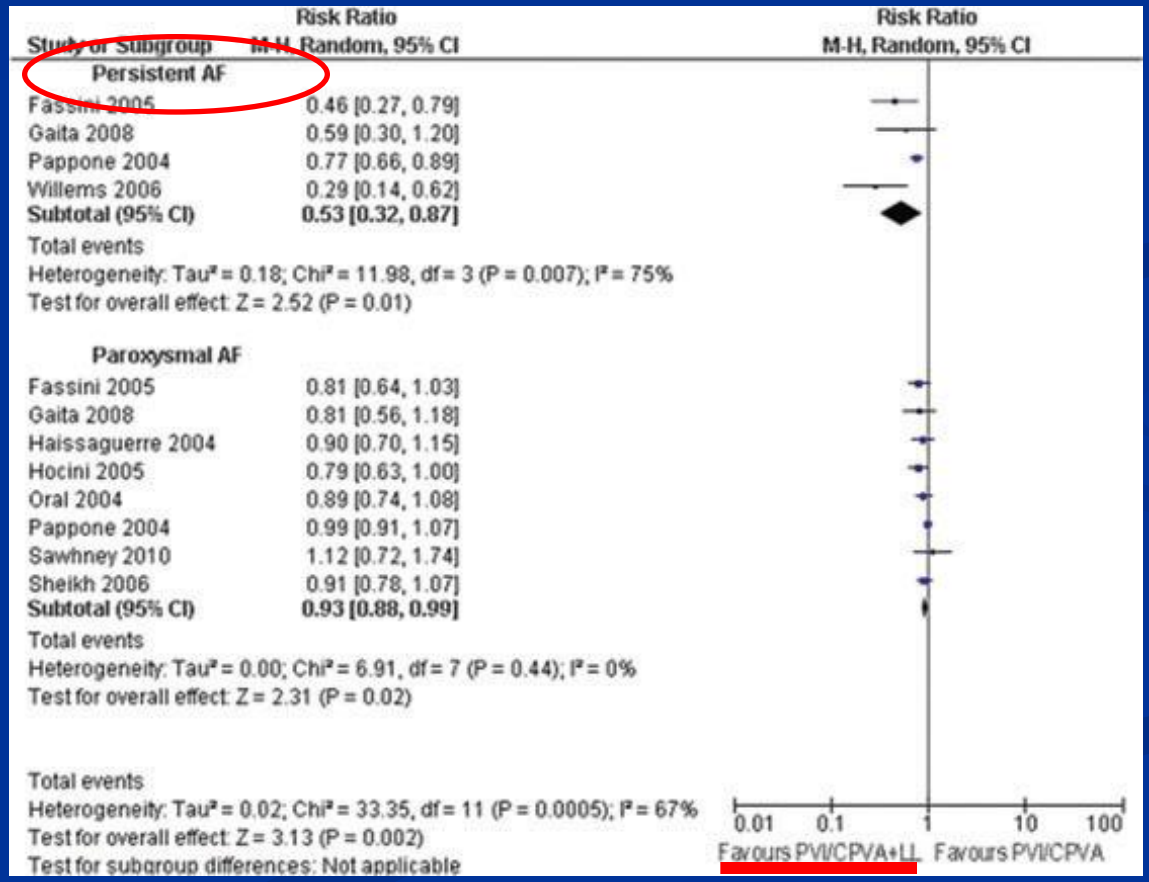
Hedef PV İzolasyonu



Approach to the Catheter Ablation Technique of Paroxysmal and Persistent Atrial Fibrillation:A Meta-Analysis of the Randomized Controlled Trials

RATIKA PARKASH, M.D., M.Sc.,* ANTHONY S.L. TANG, M.D.†
JOHN L. SAPP, M.D.,* and GEORGE WELLS, Ph.D.‡
From the *Queen Elizabeth II Health Sciences Centre, Halifax, Canada; †*Royal Jubilee Hospital, Victoria, Canada; and ‡University of* Ottawa Heart Institute, Ottawa, Canada

PVI vs PVI+ LL



(J Cardiovasc Electrophysiol, Vol. 22, pp. 729-738, July 2011)

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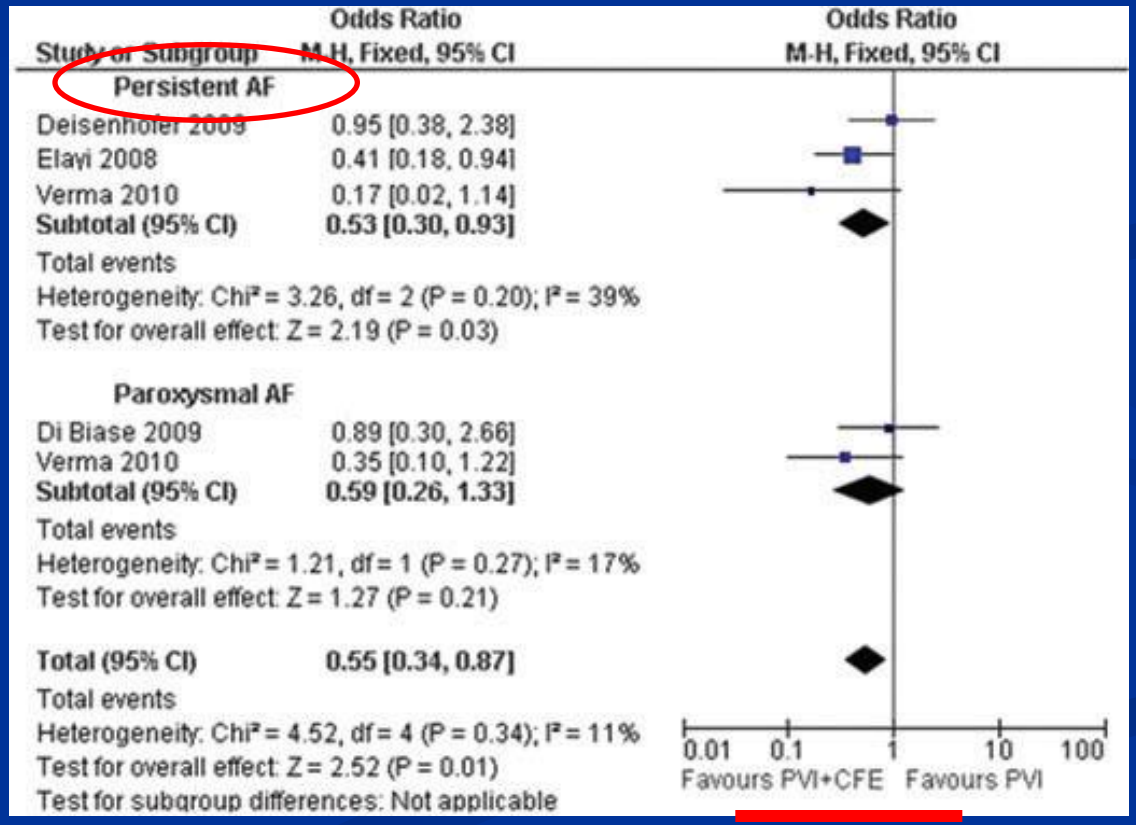
PVI vs PVI+ CFAE



(J Cardiovasc Electrophysiol, Vol. 22, pp. 729-738, July 2011)

2012 HRS/EHRA/ECAS Expert Consensus Statement on Catheter and Surgical Ablation of Atrial Fibrillation: Recommendations for Patient Selection, Procedural Techniques, Patient Management and Follow-up, Definitions, Endpoints, and Research Trial Design

AF Ablasyon İndikasyonları

TABLE 2: CONSENSUS INDICATIONS FOR CATHETER AND SURGICAL ABLATION of AF

	CLASS	LEVEL
INDICATIONS FOR CATHETER ABLATION of AF		
Symptomatic AF refractory or intolerant to at least one Class 1 or 3 antiarrhythmic medication		
Paroxysmal: Catheter ablation is recommended*	I	A
Persistent: Catheter ablation is reasonable	IIa	B
Longstanding Persistent: Catheter ablation may be considered	IIb	B
Symptomatic AF prior to initiation of antiarrhythmic drug therapy with a Class 1 or 3 antiarrhythmic agent		
Paroxysmal: Catheter ablation is reasonable	IIa	B
Persistent: Catheter ablation may be considered	IIb	C
Longstanding Persistent: Catheter ablation may be considered	IIb	C

2017 HRS/EHRA/ECAS/APHR/SOLAECE expert consensus statement on cathetert and surgical ablation of atrial fibrillation

Indications for catheter (A and B) and surgical (C, D, and E) ablation of atrial fibrillation

	Recommendation	Class	LOE
Indications for catheter ablation of atrial fibrillation			
A. Indications for catheter ablation of atrial fibrillation			
Symptomatic AF refractory or intolerant to at least one Class I or III antiarrhythmic medication	Paroxysmal: Catheter ablation is recommended.	I	A
	Persistent: Catheter ablation is reasonable.	IIa	B-NR
	Long-standing persistent: Catheter ablation may be considered.	IIb	C-LD
Symptomatic AF prior to initiation of antiarrhythmic therapy with a Class I or III antiarrhythmic medication	Paroxysmal: Catheter ablation is reasonable.	IIa	B-R
	Persistent: Catheter ablation is reasonable.	IIa	C-EO
	Long-standing persistent: Catheter ablation may be considered.	IIb	C-EO

2017 HRS/EHRA/ECAS/APHR/SOLAECE expert consensus statement on cathetert and surgical ablation of atrial fibrillation

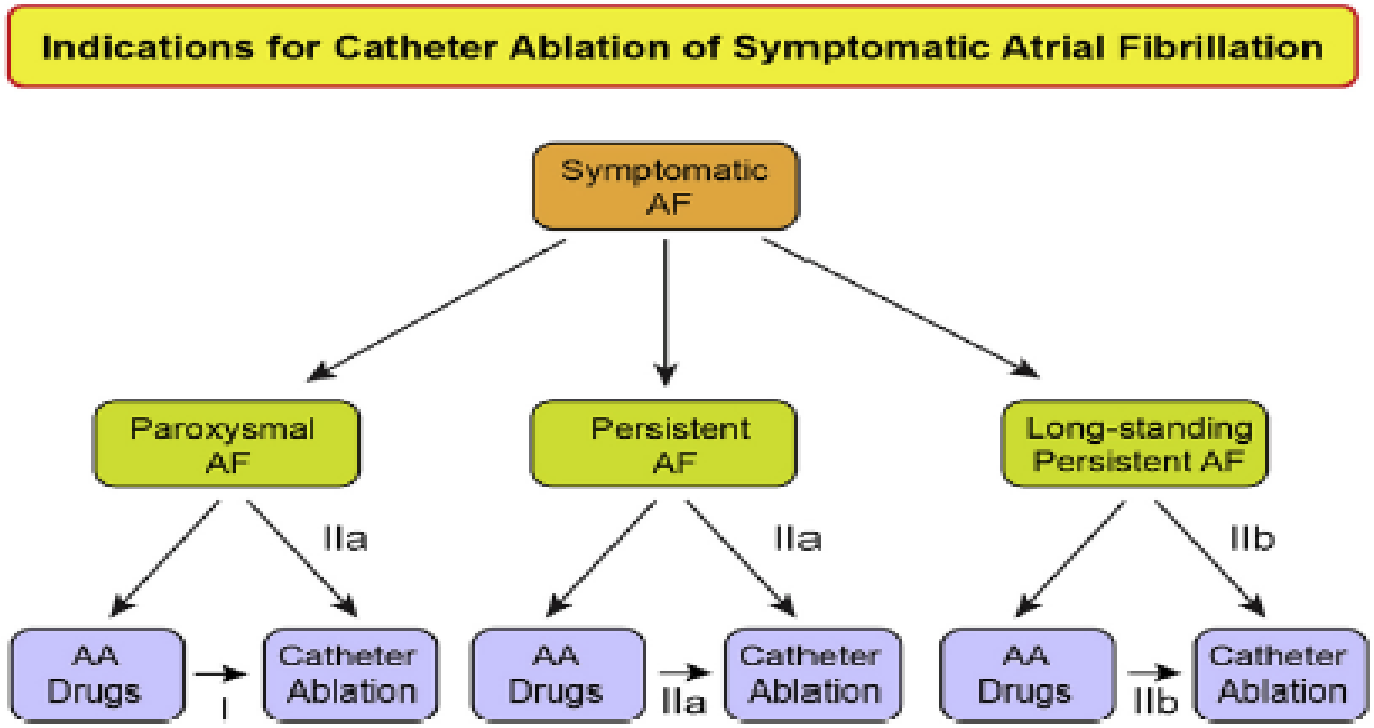


Figure 7. Indications for catheter ablation of symptomatic atrial fibrillation. Shown in this figure are the indications for catheter ablation of symptomatic paroxysmal, persistent, and long-standing persistent AF. The Class for each indication based on whether ablation is performed after failure of antiarrhythmic drug therapy or as first-line therapy is shown. Please refer to Table 2B and the text for the indications for catheter ablation of asymptomatic AF.

2017 HRS/EHRA/ECAS/APHR/SOLAECE expert consensus statement on cathetert and surgical ablation of atrial fibrillation

Atrial fibrillation ablation: strategies, techniques, and endpoints

	Recommendation	Class	LOE
PV isolation by catheter ablation	Electrical isolation of the PVs is recommended during all AF ablation procedures.	I	A
	Achievement of electrical isolation requires, at a minimum, assessment and demonstration of entrance block into the PV.	I	B-R
	Monitoring for PV reconnection for 20 minutes following initial PV isolation is reasonable.	IIa	B-R
	Administration of adenosine 20 minutes following initial PV isolation using RF energy with reablation if PV reconnection might be considered.	IIb	B-R
	Use of a pace-capture (pacing along the ablation line) ablation strategy may be considered.	IIb	B-R
	Demonstration of exit block may be considered.	IIb	B-NR

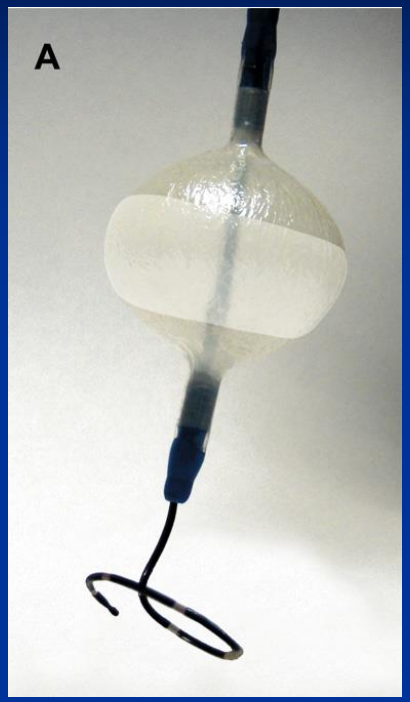
2017 HRS/EHRA/ECAS/APHR/SOLAECE expert consensus statement on cathetert and surgical ablation of atrial fibrillation

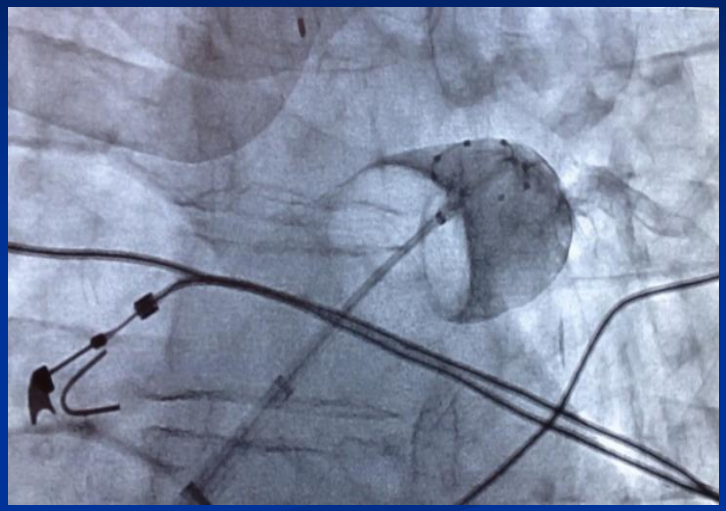
Ablation strategies to be considered for use in conjunction with PV isolation	If a patient has a history of typical atrial flutter or typical atrial flutter is induced at the time of AF ablation, delivery of a cavotricuspid isthmus linear lesion is recommended.	I	B-R
	If linear ablation lesions are applied, operators should use mapping and pacing maneuvers to assess for line completeness.	I	C-LD
	If a reproducible focal trigger that initiates AF is identified outside the PV ostia at the time of an AF ablation procedure, ablation of the focal trigger should be considered.	IIa	C-LD
	When performing AF ablation with a force-sensing RF ablation catheter, a minimal targeted contact force of 5 to 10 grams is reasonable.	IIa	C-LD
	Posterior wall isolation might be considered for initial or repeat ablation of persistent or long-standing persistent AF.	IIb	C-LD
	Administration of high-dose isoproterenol to screen for and then ablate non-PV triggers may be considered during initial or repeat AF ablation procedures in patients with paroxysmal, persistent, or long-standing persistent AF.	IIb	C-LD
	DF-based ablation strategy is of unknown usefulness for AF ablation.	IIb	C-LD
	The usefulness of creating linear ablation lesions in the right or left atrium as an initial or repeat ablation strategy for persistent or long-standing persistent AF is not well established.	IIb	B-NR
	The usefulness of linear ablation lesions in the absence of macroreentrant atrial flutter is not well established.	IIb	C-LD
	The usefulness of mapping and ablation of areas of abnormal myocardial tissue identified with voltage mapping or MRI as an initial or repeat ablation strategy for persistent or long-standing persistent AF is not well established.	IIb	B-R
	The usefulness of ablation of complex fractionated atrial electrograms as an initial or repeat ablation strategy for persistent and long-standing persistent AF is not well established.	IIb	B-R
	The usefulness of ablation of rotational activity as an initial or repeat ablation strategy for persistent and long-standing persistent AF is not well established.	IIb	B-NR
	The usefulness of ablation of autonomic ganglia as an initial or repeat ablation strategy for paroxysmal, persistent, and long-standing persistent AF is not well established.	IIb	B-NR

Persistan AF ‘de Ablasyon metodu

- RF ??
- Kriyobalon ??

Kriyobalon Teknolojisi





CB-1 (2010)

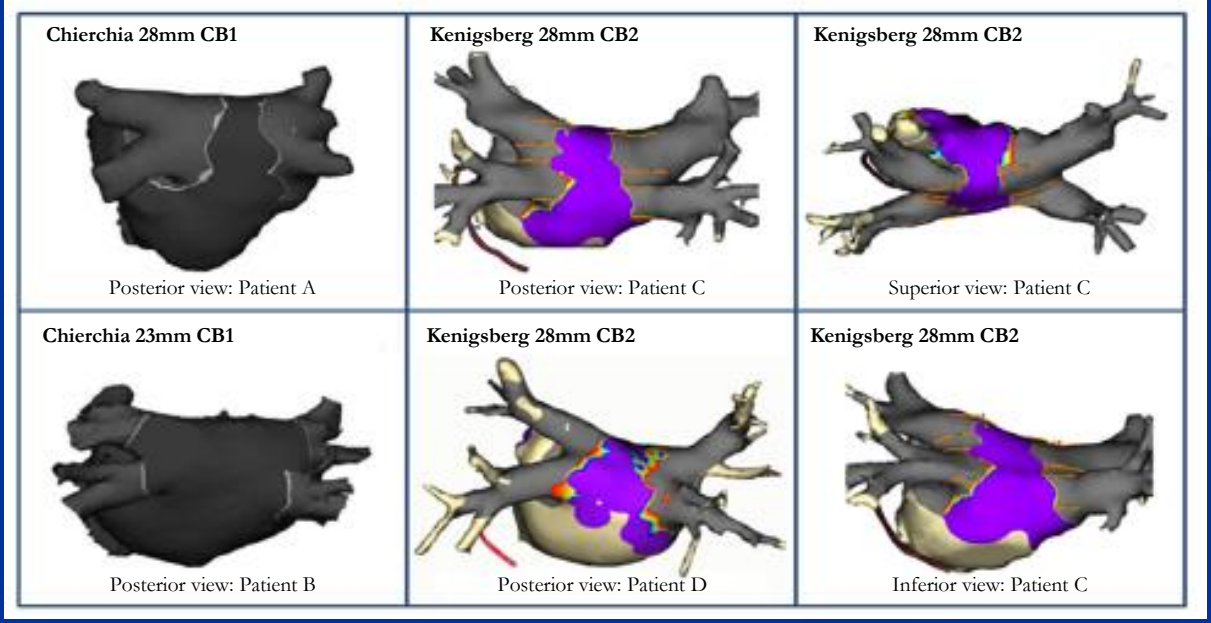
- Ekvatoral soğutma
- 4 injeksiyon tüpü

CB-2 (2012)

- Distal hemisfer
- 8 injeksiyon tüpü
- Daha hızlı ve etkili soğutma
- Daha geniş alanda (**28 mm**) (antral) soğutma

POST PROCEDURE VOLTAGE MAPS

	Chierchia, et al.	Kenigsberg, et al.
Patients	4	43
Balloon and Application Time	CB1 28 mm, 5 min	CB2 28 mm, 3 min
Extent of posterior wall ablation	40%	73%
6 month Freedom from AF	75%	95%

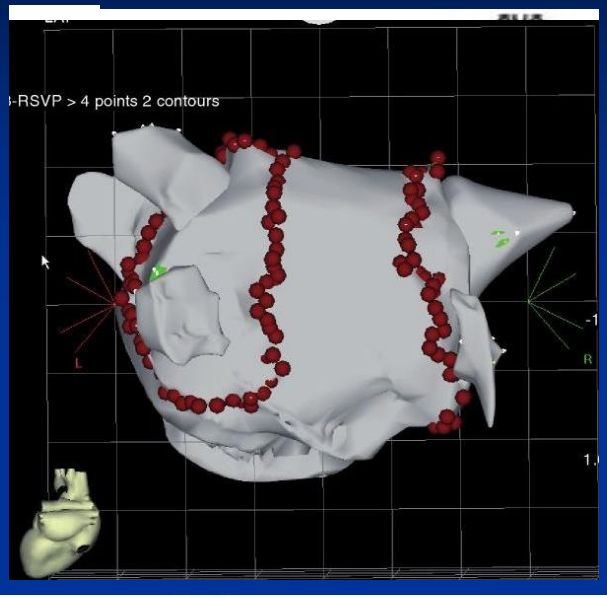


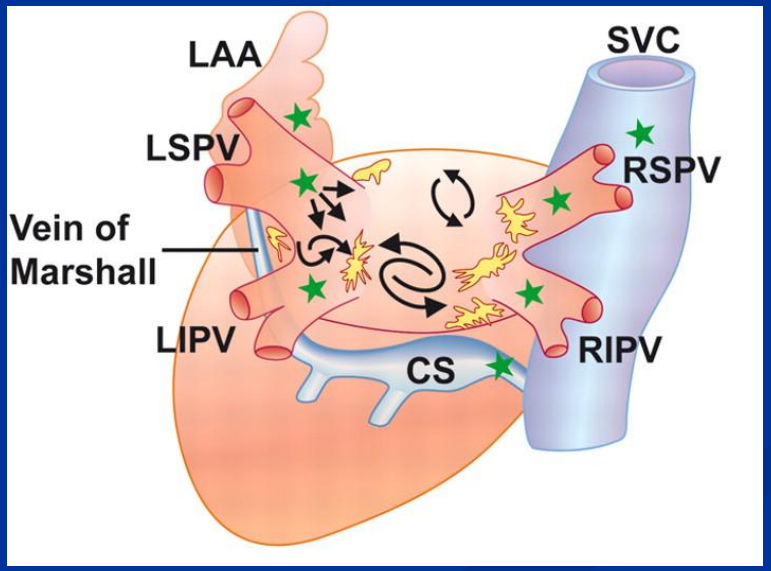
CB2. jenerasyon ile %73 posterior duvar ablate edilebilmektedir

Chierchia, et al. Cardiovasc Med (Hagerstown). 2011; 12(3): 162-166. Kenigsberg, et al. Heart Rhythm 2014; 12(2):283-90 12

RF

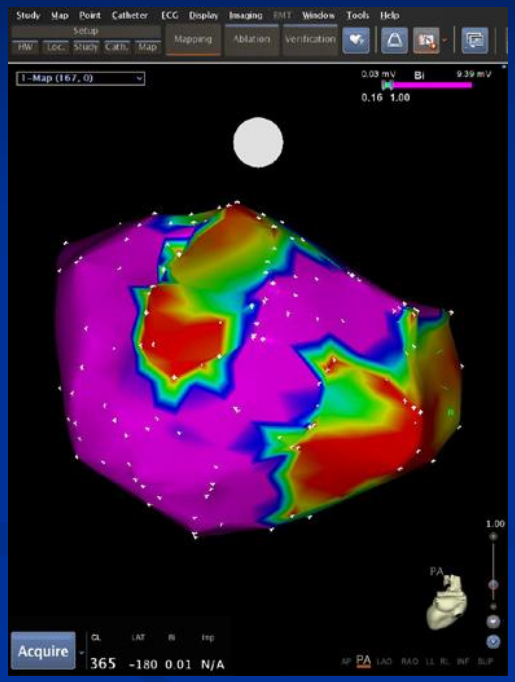
Antral PVI

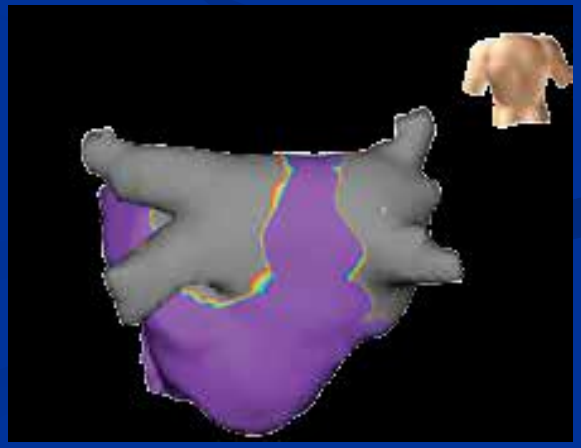




CB2 (Arctic Front Advance 28 mm)

Geniş, antral





PAF (CB VS RF)

Cryoballoon Versus Open Irrigated Radiofrequency Ablation in Patients With Paroxysmal Atrial Fibrillation

The Prospective, Randomized, Controlled, Noninferiority FreezeAF Study

Armin Luik, MD; Andrea Radzewitz, PsyD; Meinhard Kieser, ScD; Marlene Walter; Peter Bramlage, MD; Patrick Hörmann, MD; Kerstin Schmidt, MD; Nicolas Horn, MD; Maria Brinkmeier-Theofanopoulou, MD; Kevin Kunzmann, MSc; Tobias Riexinger, MD; Gerhard Schymik, MD; Matthias Merkel, MD; Claus Schmitt, MD

Circulation. 2015;132:1311-1319.

Point-by-Point Radiofrequency Ablation Versus the Cryoballoon or a Novel Combined Approach: A Randomized Trial Comparing 3 Methods of Pulmonary Vein Isolation for Paroxysmal Atrial Fibrillation (The Cryo Versus RF Trial)

ROSS J. HUNTER, PH.D., F.E.S.C., VICTORIA BAKER, M.SC., MALCOLM C. FINLAY, M.R.C.P., PH.D., EDWARD R. DUNCAN, M.R.C.P., PH.D., MATTHEW J. LOVELL, M.R.C.P., PH.D., MUZAHIR H. TAYEBJEE, M.D., M.R.C.P., WAQAS ULLAH, M.R.C.P., M. SHOAIB SIDDIQUI, M.R.C.P., AILSA MCLEAN, M.SC., LAURA RICHMOND, M.SC., CLAIRE KIRKBY, M.SC., MATTHEW R. GINKS, M.D., M.R.C.P., MEHUL DHINOJA, M.R.C.P., SIMON SPORTON, M.D., F.R.C.P., MARK J. EARLEY, M.D., F.R.C.P., and RICHARD J. SCHILLING, M.D., F.R.C.P.

From the Barts Heart Centre, St. Bartholomew's Hospital, Barts Health NHS Trust, London, UK

(J Cardiovasc Electrophysiol, Vol. 26, pp. 1307-1314, December 2015)

PERSİSTAN AF CB ?? RF ??

- Küçük çaplı, tek merkezli çalışmalar
- Metaanaliz (Karşılaştırmalı değil)
- Karşılaştırmalı çalışma az.

Persistan AF'da sadece PVI?

- SARA çalışması*

Sadece PVI'ın yeterli olabileceği hasta gruplarında Cryoablasyon tercih edilebilir.

* Mont L, Bisbal F, Hernandez-Madrid A, Perez-Castellano N, Vinolas X, Arenal A et al. Catheter ablativo vs antiarrhtyhmic drug treatment of persistant atriyal fibrillation: a multicentre, randomized, controller trial (SARA study).
Eur Heart J 2014;35:501-7.

Pulmonary vein isolation as index procedure for persistent atrial fibrillation: One-year clinical outcome after ablation using the second-generation cryoballoon

Giuseppe Ciconte, MD,* Luca Ottaviano, MD,† Carlo de Asmundis, MD, PhD, FHRS,* Giannis Baltogiannis, MD, PhD,* Giulio Conte, MD,* Juan Sieira, MD,* Giacomo Di Giovanni, MD,* Yukio Saitoh, MD,* Ghazala Irfan, MD,* Giacomo Mugnai, MD,* Cesare Storti, MD,‡ Annibale Sandro Montenero, MD, PhD,† Gian-Battista Chierchia, MD, PhD,* Pedro Brugada, MD, PhD*

n=63 hasta; ort AF süresi: 7,2 ay

CB2 1 YILLIK DEĞERLENDİREN İLK ÇALIŞMA*

	Overall (n = 63)
Procedural time (minutes)	87.1 ± 38.2
Fluoroscopy time (minutes)	14.9 ± 6.1
Mean number of freeze–thaw cycles	1.7 ± 0.4
Left superior PV	
Temperature at isolation (°C)	−33.0 ± 8.9
Nadir temperature (°C)	−50.3 ± 4.5
Left inferior PV	
Temperature at isolation (°C)	−26.2 ± 5.3
Nadir temperature (°C)	−46.5 ± 8.6
Right superior PV	
Temperature at isolation (°C)	−29.4 ± 9.4
Nadir temperature (°C)	−53.5 ± 4.6
Right inferior PV	
Temperature at isolation (°C)	−30.7 ± 7.1
Nadir temperature (°C)	−47.5 ± 11.2
Complications	6 (9.5)
Phrenic nerve palsy	4 (6.3)

Data are given as mean ± SD or n (%).
PV = pulmonary vein.

Heart Rhythm 2015;12:60–66

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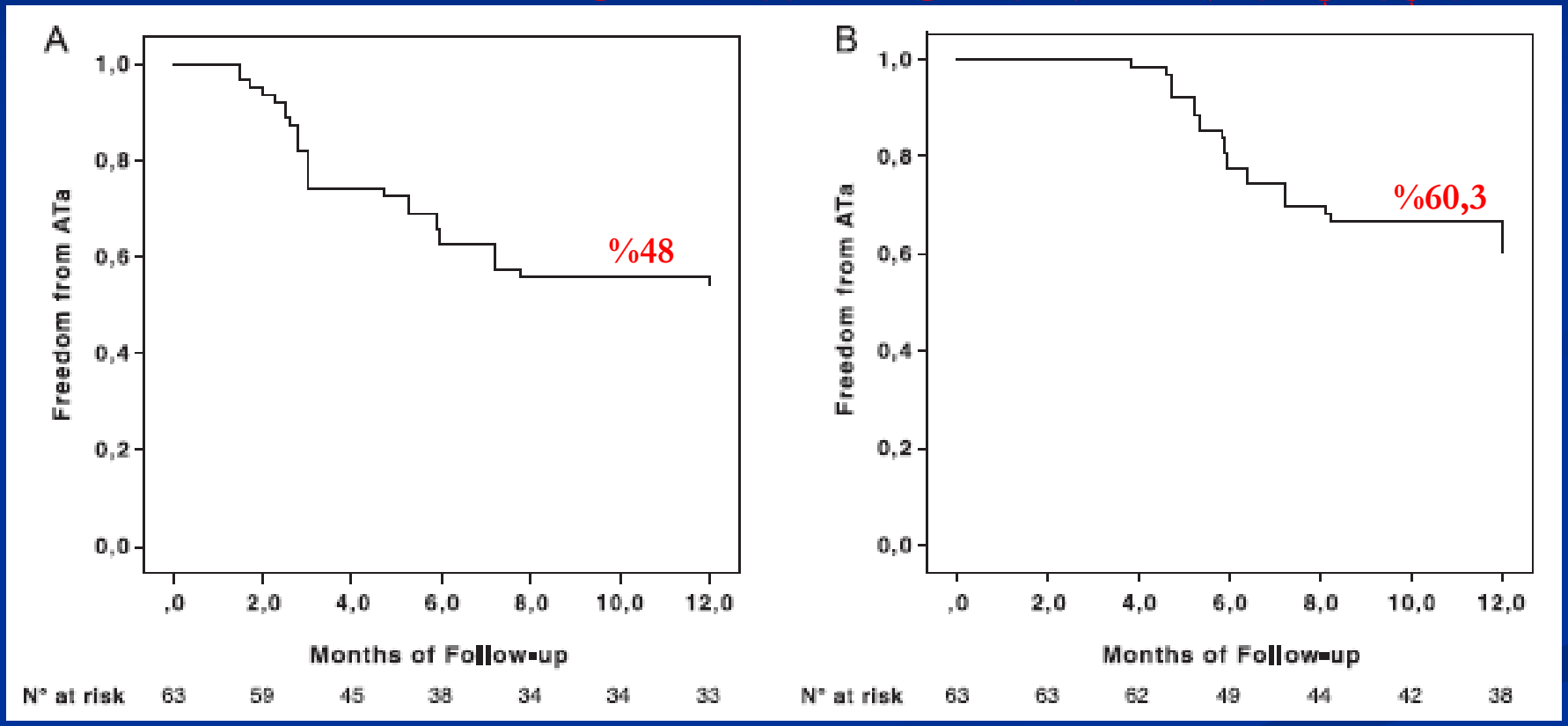
****CB2** 1 YILLIK DEĞERLENDİREN İLK ÇALIŞMA***



BP (<3 ay) dahil

BP (<3 ay) hariç

[Heart Rhythm 2015;12:60–66]

Europace
doi:10.1093/europace/euu350

CLINICAL RESEARCH

Circumferential pulmonary vein isolation as index procedure for persistent atrial fibrillation: a comparison between radiofrequency catheter ablation and second-generation cryoballoon ablation

Giuseppe Ciconte*†, Giannis Baltogiannis†, Carlo de Asmundis, Juan Sieira, Giulio Conte, Giacomo Di Giovanni, Yukio Saitoh, Ghazala Irfan, Giacomo Mugnai, Burak Hunuk, Gian-Battista Chierchia‡, and Pedro Brugada‡

Heart Rhythm Management Centre, UZ Brussel-VUB, Vrije Universiteit Brussel, 101 Laarbeeklaan, 1090 Brussels, Belgium

****CB2** CF-RF KARŞILAŞTIRAN
İLK ÇALIŞMA***

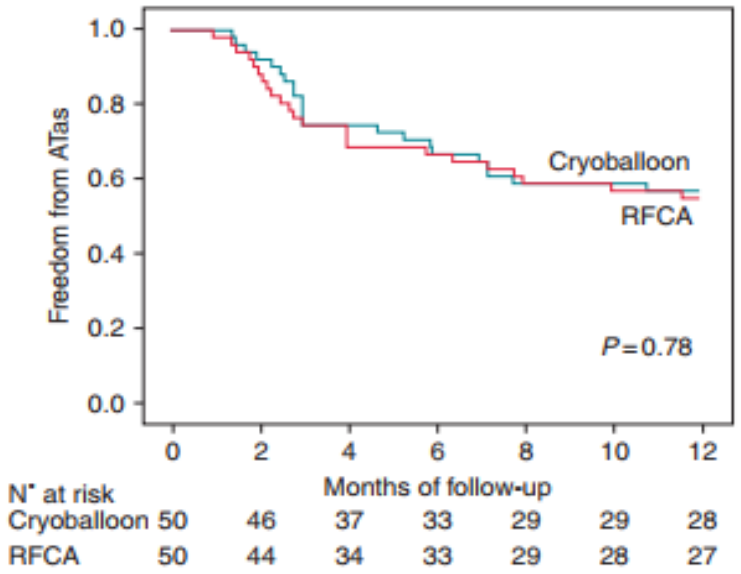
	CB-Adv (n = 50)	RFCA (n = 50)	P value
Age, years	62.4 ± 9.8	62.4 ± 9.5	0.98
Male, n	36 (72%)	38 (76%)	0.82
BMI	27.5 ± 3.4	28.7 ± 4.0	0.12
Hypertension, n	26 (52%)	34 (68%)	0.15
Dyslipidemia, n	9 (18.8%)	14 (28%)	0.34
Diabetes, n	4 (8%)	7 (14%)	0.52
HF, n	1 (2%)	3 (6%)	0.62
CAD, n	2 (4%)	5 (10%)	0.44
LVEF, %	57.5 ± 3.7	56.3 ± 4.1	0.21
LA size, mm	46.0 ± 7.2	47.2 ± 6.2	0.36
CHA2DS2-Vasc score, n	1.4 ± 1.3	1.8 ± 1.2	0.11
Total AF duration, months	32.7 ± 37.6	26.7 ± 23.7	0.35
Persistent AF duration, months	7.2 ± 2.2	7.6 ± 1.8	0.33
Procedure duration, minutes	90.5 ± 41.7	140.2 ± 46.9	<0.01
Fluoroscopy duration, minutes	14.5 ± 6.6	19.8 ± 6.8	<0.01

Europace
doi:10.1093/europace/euu350

Circumferential pulmonary vein isolation as index procedure for persistent atrial fibrillation: a comparison between radiofrequency catheter ablation and second-generation cryoballoon ablation

Giuseppe Ciconte*†, Giannis Baltogiannis†, Carlo de Asmundis, Juan Sieira, Giulio Conte, Giacomo Di Giovanni, Yukio Saitoh, Ghazala Irfan, Giacomo Mugnai, Burak Hunuk, Gian-Battista Chierchia‡, and Pedro Brugada‡

Heart Rhythm Management Centre, UZ Brussel-VUB, Vrije Universiteit Brussel, 101 Laarbeeklaan, 1090 Brussels, Belgium



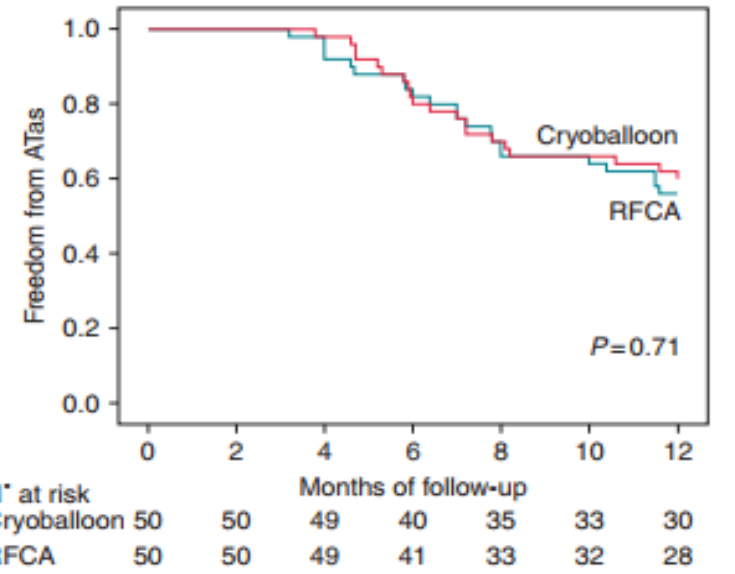


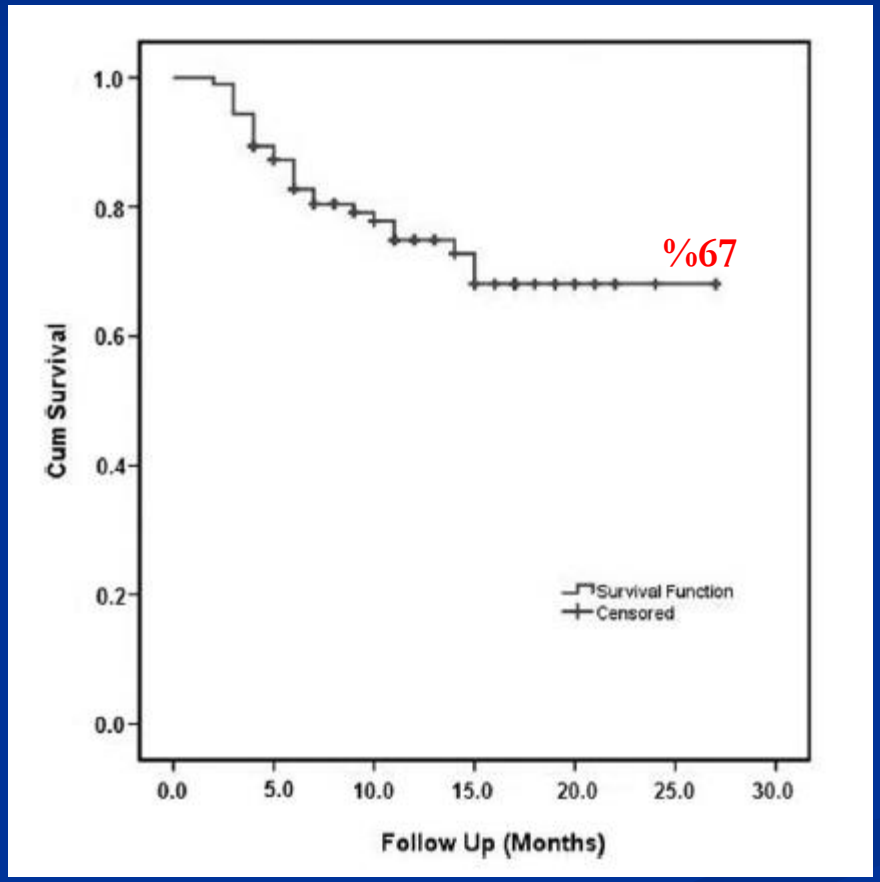
Figure 2 Freedom from ATa recurrences after 1 year follow-up according to ablation strategy (RFCA turquoise line; CB-AdvA red line) off drugs, considering (right panel) or not (left panel) a 3 months blanking period.

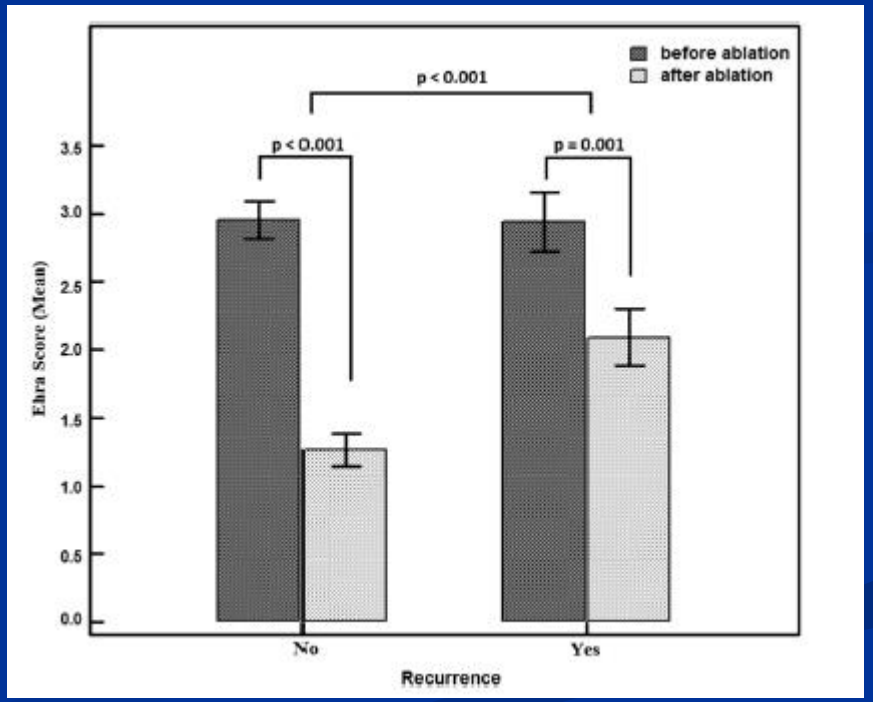
Cryoballoon Ablation for Pulmonary Vein Isolation in Patients With Persistent Atrial Fibrillation

One-Year Outcome Using Second Generation Cryoballoon

Buelent Koektuerk, MD; Hikmet Yorgun, MD; Oezlem Hengeoez, MD; Cem H. Turan, MD; Alina Dahmen, MD; Alexander Yang, MD; Paul M. Bansmann, MD; Eduard Gorr, MD; Christian Hoppe, MD; Ramazan G. Turan, MD; Marc Horlitz, MD

n= 100 hasta, ort AF süresi: 5,5 ay



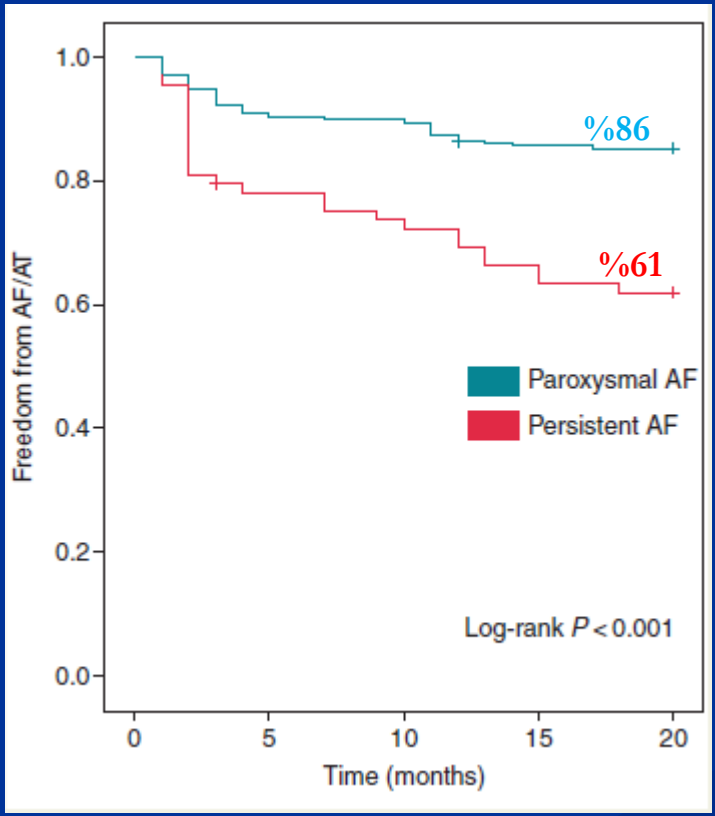


Circ Arrhythm Electrophysiol. 2015;8:1073-1079

One-year follow-up after second-generation cryoballoon ablation for atrial fibrillation in a large cohort of patients: a single-centre experience

Ghazala Irfan[1†], Carlo de Asmundis[1†], Giacomo Mugnai[1], Jan Poelaert[2], Christian Verborgh[2], Vincent Umbrain[2], Stefan Beckers[2], Ebru Hacioglu[1], Burak Hunuk[1], Vedran Velagic[1], Erwin Stroker[1], Pedro Brugada[1], and Gian-Battista Chierchia[1*]

n=393; 62 HASTA (%16) PERSİSTAN AF



Komplikasyonlar

	Total procedures (*n* = 393)
Death related to the procedure	0
Atrial-oesophageal fistula	0
Neurologic complications	0
Transient ST elevation	1 (0.25%)
Cardiac tamponade	1 (0.25%)*
Severe PV stenosis	0
Retroperitoneal haematoma	1 (0.25%)
Groin complications	
Femoral pseudoaneurysm	5 (1.27%)**
Symptomatic persisting PNP	1 (0.25%)
Total	9 (2.29%)

Efficacy of Cryoballoon Pulmonary Vein Isolation in Patients With Persistent Atrial Fibrillation

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Cryoballoon Ablation for Persistent Atrial Fibrillation. *Introduction:* **Cryoballoon PVI has emerged as an alternative to radiofrequency PVI for the treatment of paroxysmal AF. The optimal strategy for patients with persistent AF is unclear as data are limited.**

Methods: **We analyzed a prospective registry of consecutive patients with persistent AF who underwent Cryoballoon PVI at a single center between 2011 and 2014. Patients were assessed for atrial arrhythmia recurrence after a 3-month blanking period at 6 months, 1 year, and 2 years postprocedure. Recurrence was based on typical symptoms, ECG, or event monitor evidence of AF. Kaplan–Meier analysis was used to estimate arrhythmia-free survival.**

Results: **Final analysis included 69 patients who underwent Cryoballoon PVI with a mean age 59.4 ± 8.1 years, 85.5% male, 53.6% HTN patients, CHA2DS2-VASC score 1.6 ± 1.2, and LA size 4.5 ± 0.6 cm. The single procedure atrial arrhythmia recurrence-free rate at 1-year postprocedure after a 3-month blanking period was 59% and 50% at a mean follow-up of 607 days. Of the recurrence-free group, 17% were taking previously ineffective antiarrhythmic medications. In comparing patients with persistent AF duration <1 year versus >1 year, there was a trend toward greater AF recurrence-free rates in the <1 year group (66% vs. 55%, P = 0.09).**

Conclusion: **Cryoballoon PVI appears to be an effective initial strategy in treating persistent AF, with an AF recurrence-free rate of 59% at 1 year.** *(J Cardiovasc Electrophysiol, Vol. 27, pp. 423-427, April 2016)*

Tab. 2 Cryoablation studies (published as full papers) exclusively in persistent AF patients: methodological characteristics and acute procedural outcomes

Study	N	Balloon type	Procedure duration (min)	Fluoroscopy time (min)	Acute PVI/PNP rate in %	Comments
Ciconte et al. [33]	63	28 mm-CB2 (100 %)	87.1 ± 38.2	14.9 ± 6.1	100/6.3	First study on persistent AF No CMAP
Lemes et al. [34]	49	28 mm-CB2 (100 %)	113.6 ± 33.5	21.3 ± 6.7	100/0	Post-blanking continuation of AAD in 33 % of patients
Koektuerk et al. [36]	100	28 mm-CB2 (100 %)	96.2 ± 21.3	19.7 ± 6.7	100/3	Bonus 240-sec freeze post-PVI in all patients
Guhl et al. [37]	69	CB2 (88.4 %)	147 ± 45	45.0 ± 20.2	100/9	17 % of AF-free patients at one year were still on AADs CMAP in a subset of patients
Ciconte et al. [38]	100[a]	28 mm-CB2 (100 %)	90.5 ± 41.7	14.5 ± 6.6	100/4	First comparison of cryo vs. RF in persistent AF patients

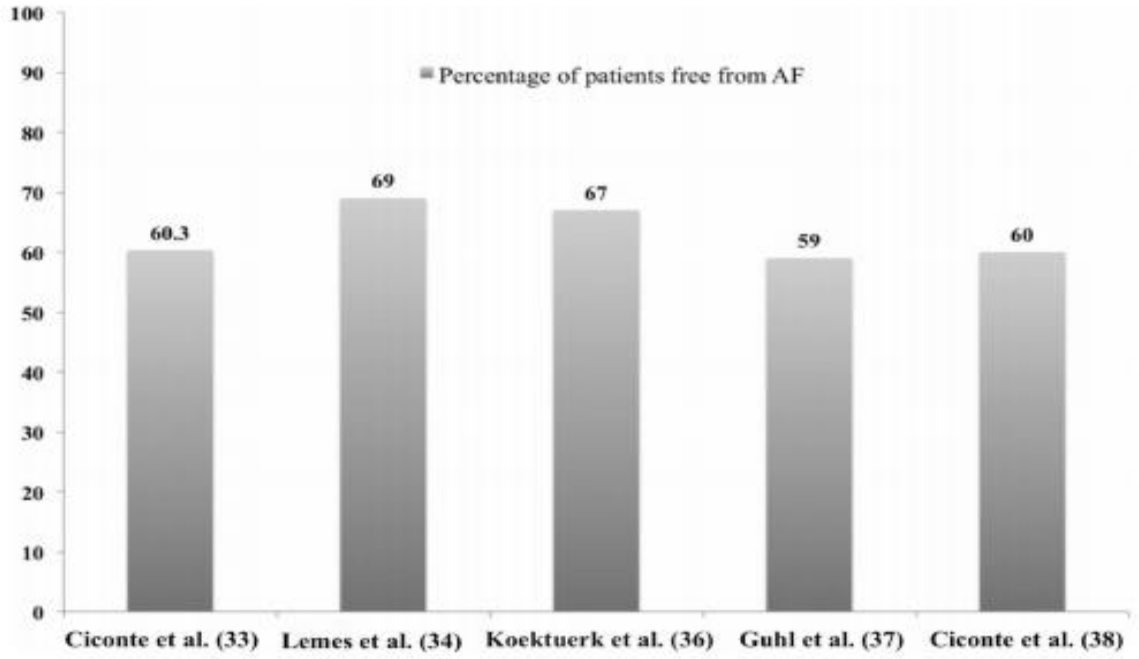


Fig. 3 Reported freedom from atrial fibrillation during a follow-up period of 12 months following cryoablation of persistent atrial fibrillation (taking into account a 3-month blanking period). The reported percentage of the study by Koektuerk et al. pertains to a follow-up period of 10.6 ± 6.3 months

İşlem ve Floroskopi Süreleri

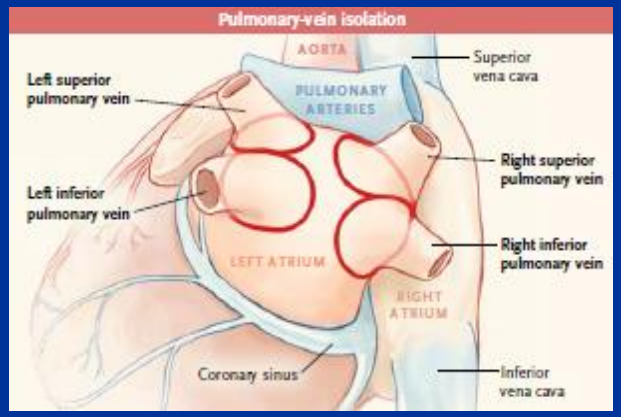
	İşlem süresi	Floroskopi süresi
Ciconte ve ark, 2015	87,1±38,2	14,9±6,1
Ciconte ve ark, 2015	90,5±41,7	14,5±6,6
Kokturk ve ark, 2015	96,2±21,3	19,7±6,7
Irfan ve ark, 2015	87,1±38,2	14,9±6,1
Guhl ve ark, 2016	**147±45**	**45±2,2**

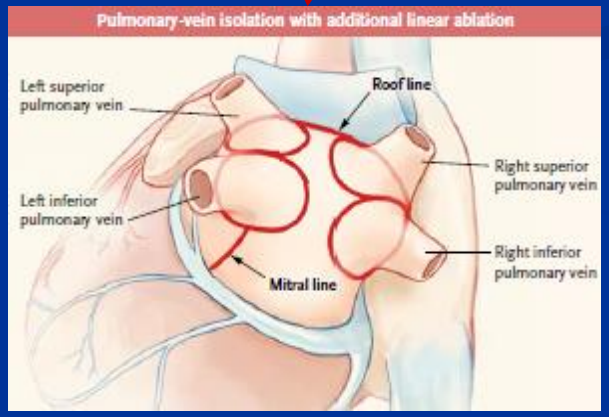
The NEW ENGLAND JOURNAL of MEDICINE

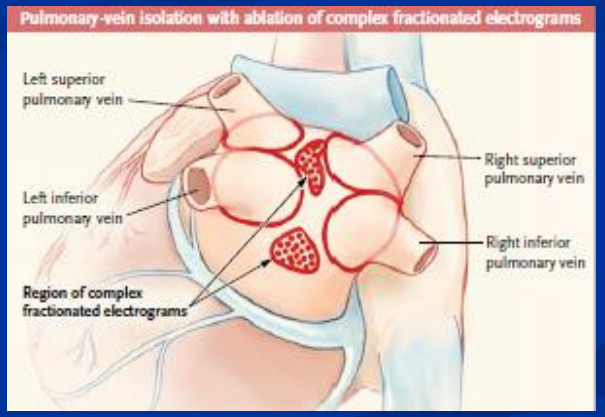
ORIGINAL ARTICLE

Approaches to Catheter Ablation for Persistent Atrial Fibrillation

Atul Verma, M.D., Chen-yang Jiang, M.D., Timothy R. Betts, M.D., M.B., Ch.B., Jian Chen, M.D., Isabel Deisenhofer, M.D., Roberto Mantovan, M.D., Ph.D., Laurent Macle, M.D., Carlos A. Morillo, M.D., Wilhelm Haverkamp, M.D., Ph.D., Rukshen Weerasooriya, M.D., Jean-Paul Albenque, M.D., Stefano Nardi, M.D., Endrj Menardi, M.D., Paul Novak, M.D., and Prashanthan Sanders, M.B., B.S., Ph.D., for the STAR AF II Investigators*

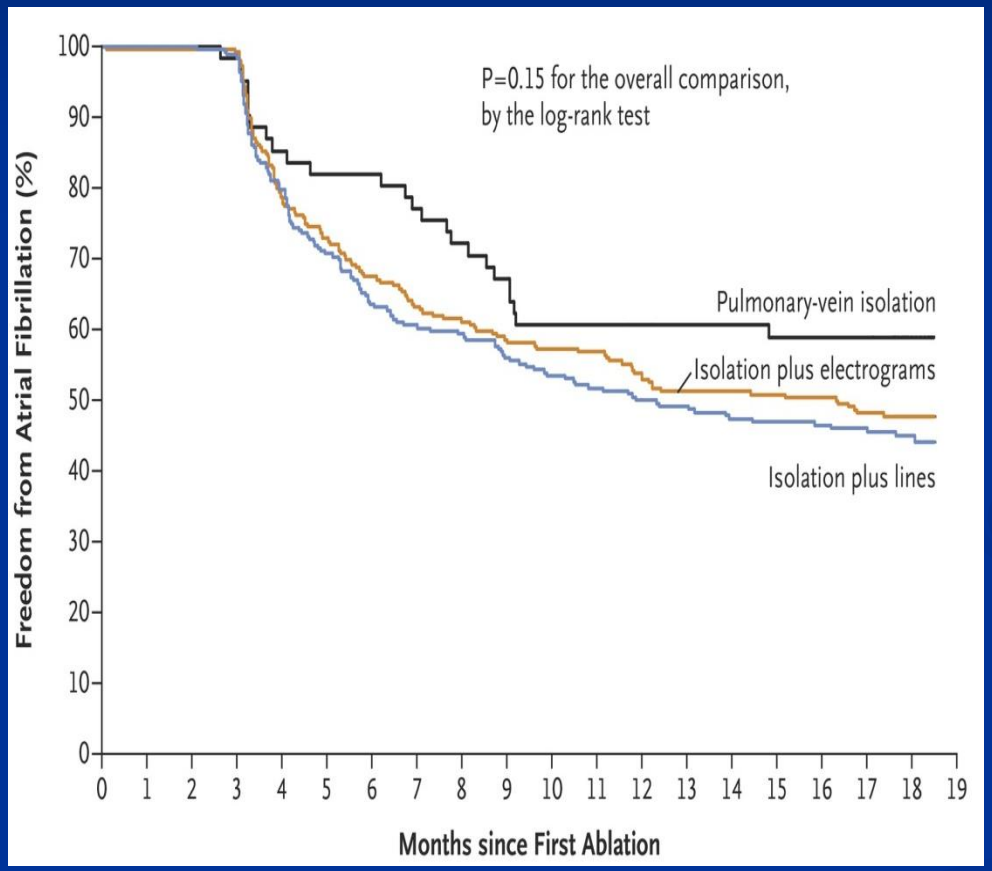






STAR AF-II

Freedom from Atrial Fibrillation.



- 12 ülkeden 589 hasta
- 1:4:4 oranında PVI, PVI+CFE, PVI+Lineer lezyon şeklinde randomizasyon

- <u>Dahil olma kriteri</u>:
  - Persistent AF (>7 days < 3 yıl)
  - AAİ'a refrakter
  - İlk ablasyon
  - LA < 60mm

Verma A et al. N Engl J Med 2015;372:1812-1822

STARAF II Primary and Secondary Outcomes

	PVI	PVI+CFE	PVI+LINES	p value
Freedom from AF after 2 procedures	72 %	60 %	58 %	0.18
Freedom from AF/AFL/AT after 2 procedures	60 %	50 %	48 %	0.24
Percentage of patients still on AAD at 18 mo	11 %	12 %	12 %	0.35

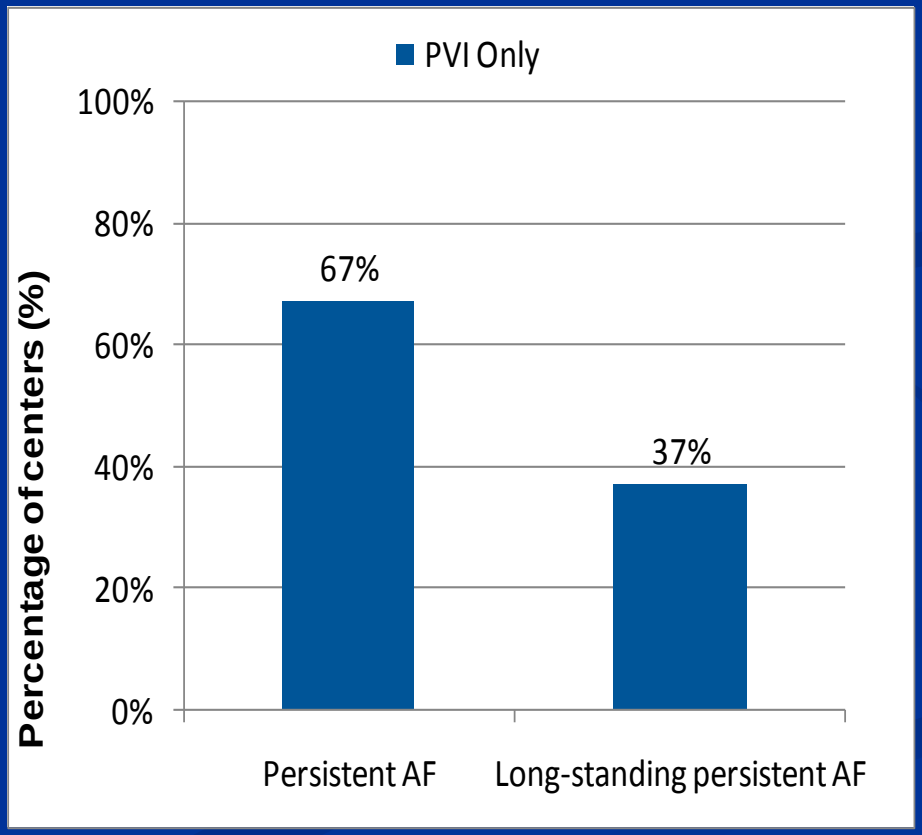
* AAD = antiarrhythmic drugs

	PVI	PVI+CFE	PVI+LINES	p value
Procedure time (min)	166.95 ± 54.83	229.16 ± 83.20	222.56 ± 89.37	<0.0001
Mapping time (min)	13.89 ± 6.64	18.75 ± 14.01	14.38 ± 7.68	<0.0001
Fluoroscopy time (min)	29.35 ± 16.21	42.11 ± 21.70	40.91 ± 24.97	0.0003

Current ablation techniques for persistent atrial fibrillation: results of the European Heart Rhythm Association Survey

Nikolaos Dagres[1]*, Maria Grazia Bongiorni[2], Torben Bjerregaard Larsen[3], Antonio Hernandez-Madrid[4], Laurent Pison[5], and Carina Blomström-Lundqvist[6]
Conducted by the Scientific Initiatives Committee, European Heart Rhythm Association

EHRA SURVEY: Avrupa'da PVI ilk ablasyon stratejisi olarak uygulayan merkez oranları



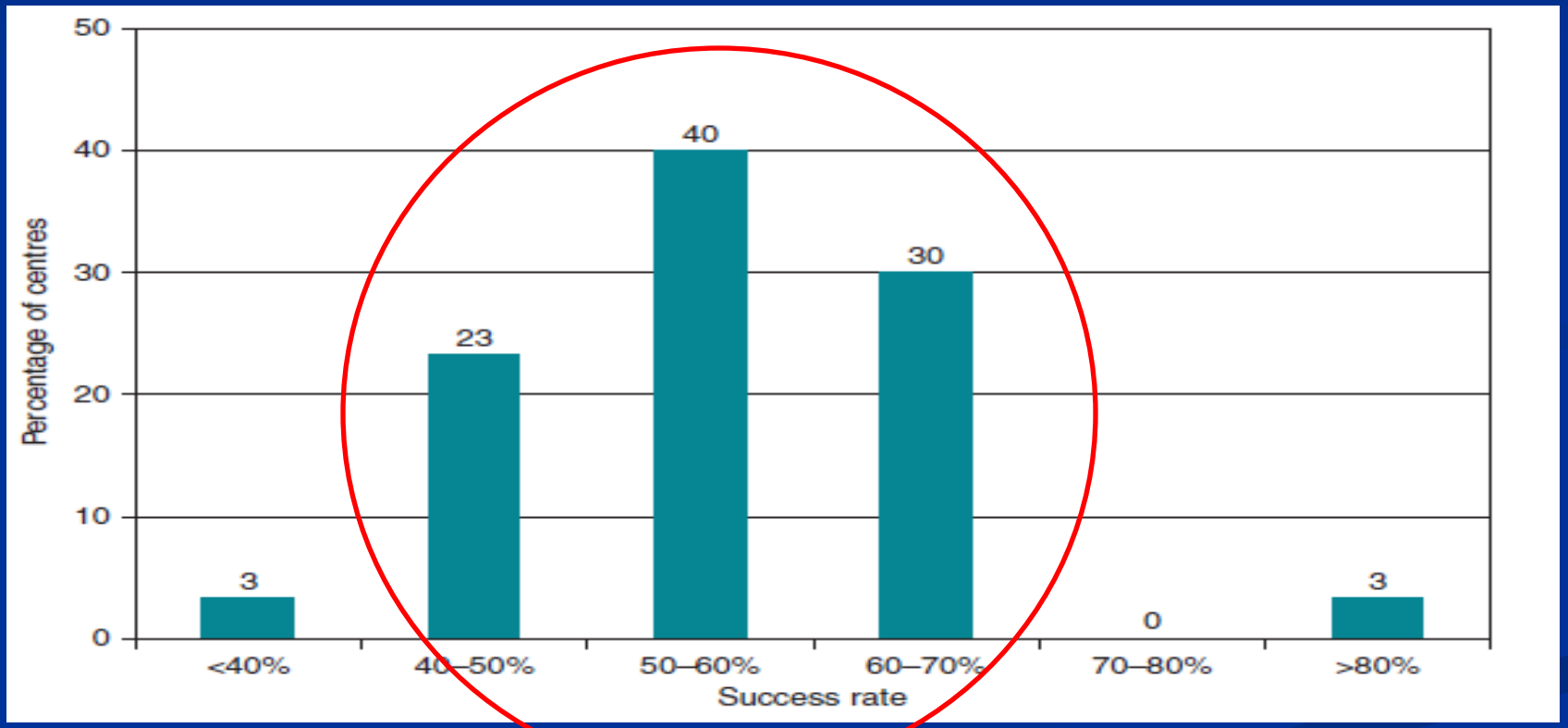
Europace (2015) 17, 1596–1600

Current ablation techniques for persistent atrial fibrillation: results of the European Heart Rhythm Association Survey

Nikolaos Dagres[1]*, Maria Grazia Bongiorni[2], Torben Bjerregaard Larsen[3], Antonio Hernandez-Madrid[4], Laurent Pison[5], and Carina Blomström-Lundqvist[6] Conducted by the Scientific Initiatives Committee, European Heart Rhythm Association

[1]Second Department of Cardiology, University of Athens, Greece; [2]CardioThoracic and Vascular Department, University Hospital-Pisa, Italy; [3]Department of Cardiology, Aalborg University Hospital, Aalborg, Denmark; [4]Cardiology Department, Ramon y Cajal Hospital, Alcalá University, Madrid, Spain; [5]Department of Cardiology, Maastricht University Medical Center, Maastricht, The Netherlands; and [6]Department of Cardiology, Institution of Medical Science, Uppsala University, Uppsala 75185, Sweden

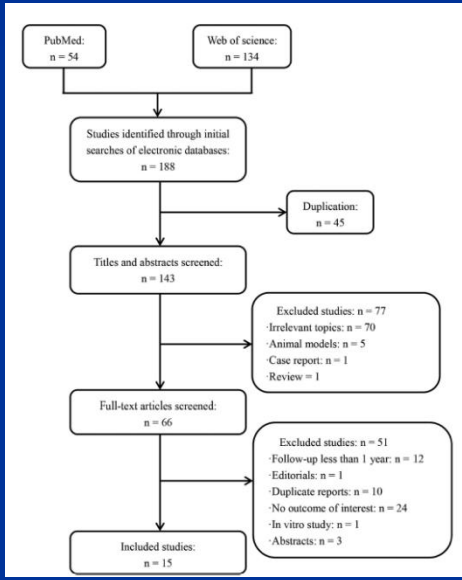
Received 26 August 2015; accepted after revision 27 August 2015



One-Year Clinical Outcome of Pulmonary Vein Isolation Using the Second-Generation Cryoballoon: A Meta-Analysis

XIN HE, M.D.,* YILI CHEN, PH.D.,* YUE ZHOU, M.S.,* YIYI HUANG, M.S.,† and JIANGUI HE, PH.D.*

n=2563 hasta,
54 hasta PERSİSTAN AF***



Study	Year	Location	Number of Patients	Follow-Up, Months	AF Type	Ablation Strategy
Aytemir et al.[17]	2015	Turkey	109	10 (8–13)†	Mixed	"Bonus"
Kumar et al.[19]	2015	Netherlands	90	12.4†	Mixed	"Bonus"
Metzner et al.[7]	2014	Germany	49	14.7 ± 1.3†	Mixed	"Bonus"
Ciconte et al.[18]	2015	Belgium	143	12.1 ± 4.4†	Mixed	"No-bonus"
Wissner et al.[22]	2015	Germany	44	13.1 ± 1.9†	Mixed	"No-bonus"
Aryana et al.[16]	2015	United States	773	12‡	Mixed	Unknown
Liu et al.[20]	2015	Germany	68	12 ± 4†	Mixed	Unknown
Tebbenjohanns et al.[21]	2015	Germany	192	15.3 ± 3.6†	Mixed	Mixed
Furnkranz et al.[6]	2014	Germany	55	13.9 ± 2.5†	Paroxysmal	"Bonus"
Greiss et al.[11]	2015	Germany	188	15‡	Paroxysmal	"Bonus"
Jourda et al.[12]	2015	France	75	12‡	Paroxysmal	"Bonus"
Squara et al.[13]	2015	France	178	12 (10–18)†	Paroxysmal	"Bonus"
Chierchia et al.[10]	2015	Belgium	287	11.5 ± 3.9†	Paroxysmal	Mixed
Ciconte et al.[14]	2015	Belgium	63	12‡	Persistent	"Bonus"
Lemes et al.[15]	2015	Germany	49	13.9 ± 5.9†	Persistent	Mixed

†Mean or median.
‡Maximum; Mixed, both paroxysmal and persistent AF were included or both the "no-bonus" strategy and the "bonus" strategy were adopted; Unknown, ablation strategies were not reported.
AF = atrial fibrillation.

PACE 2016;39:1-8

One-Year Clinical Outcome of Pulmonary Vein Isolation Using the Second-Generation Cryoballoon: A Meta-Analysis

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n=2563 hasta,
54 hasta PERSİSTAN AF***

CB2 - Persistan AF		
	Bonus	**No-Bonus**
1. Yıl AF'siz oran	% 63	%73 ***
Frenik sinir paralizi	%6,5	%4,6 ***

PACE 2016;39:1-8

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Original article

Cryoballoon ablation for persistent atrial fibrillation – Large single-center experience

Florian Straube (MD)[1,*], Stefan Hartl (MD)[1], Uwe Dorwarth (MD), Michael Wankerl (MD), Benedikt Bunz (MD), Ullrich Ebersberger (MD), Ellen Hoffmann (MD)

Department of Cardiology and Internal Intensive Care Medicine, Heart Center Munich-Bogenhausen, Munich Municipal Hospital Group, Munich, Germany

Procedural data. Data are presented as mean ± SD, median (IQR) or % of pulmonary veins and patients.

	Overall (n = 173 patients)
Total procedure time, min	155 ± 37
LA time, min	112 ± 30
Fluoroscopy time, min	27 ± 11
Dose area product, cGy cm^2	3230 (1870–5297)
Acute PVI with CB only	673/673 (100)
Focal touch-ups per vein	0/673 (0)
Cryoballoon usage	
23-mm CB only	32/173 (19)
28-mm CB only	97/173 (56)
28-mm + 23-mm CB	44/173 (25)
Ablation duration per PV, s	198 ± 40
Ablation duration per patient, s	808 ± 166
Applications per patient	12.39 ± 2.78
Applications per PV	3.02 ± 1.19
Number of applications until PVI	1.26 ± 0.62
Time to isolation, s	44 ± 37
Feasibility to determine the TTI (veins, %)	292/673 (43)
Single-shot PVI (% of veins)	82

LA, left atrium; PVI, pulmonary vein isolation; CB, cryoballoon; PV, pulmonary vein; TTI, time to isolation.

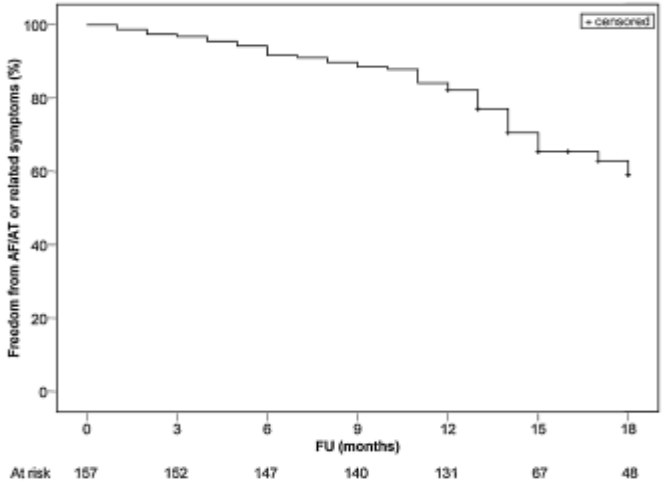

Fig. 1. Primary composite endpoint after a single cryoballoon procedure: freedom from AF/AT or AF symptoms. The graph shows Kaplan–Meier estimates of freedom from arrhythmia with or without the use of antiarrhythmic medications. A 3-month blanking period was considered. Five patients were re-ablated during the blanking period and therefore calculated as failure. Median follow-up was 14 months. AF, atrial fibrillation; AT, atrial tachycardia; FU, follow-up.

Europace
doi:10.1093/europace/euv351

CLINICAL RESEARCH

The impact of adjunctive complex fractionated atrial electrogram ablation and linear lesions on outcomes in persistent atrial fibrillation: a meta-analysis

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Aims In persistent atrial fibrillation (PsAF), success rates for pulmonary vein isolation (PVI) alone are limited and additional substrate modification is often performed. The two most widely used substrate-based strategies are the ablation of complex fractionated atrial electrograms (CFAE) and left atrial linear ablation (LALA) at the roof and mitral isthmus. However, it is unclear whether adjunctive CFAE ablation or LALA add significant benefit to PVI alone. We performed a meta-analysis to better gauge the benefit of adjunctive CFAE ablation and LALA in PsAF.

Methods and results Electronic databases were systematically searched. We included studies that examined the impact of CFAE ablation or LALA in addition to a PVI-based strategy on clinical outcomes in PsAF. We included both randomized and non-randomized studies. Totally 10 studies ($n = 1821$) were included: 6 evaluating CFAE ablation, 3 LALA, and 1 both approaches. In comparison with PVI alone, the addition of CFAE ablation [RR 0.86; 95% confidence intervals (CI) 0.64, 1.16; $P = 0.32$] or LALA (RR 0.64; 95% CI 0.37, 1.09; $P = 0.10$) offered no significant improvement in arrhythmia-free survival. However, adjunctive CFAE ablation was associated with significant increases ($P < 0.05$) and LALA non-significant increases in procedure and fluoroscopy times.

Conclusion In PsAF, the addition of CFAE ablation or LALA, in comparison with PVI alone, offers no significant improvement in arrhythmia-free survival. Furthermore, they are associated with increases in both procedural and fluoroscopy times. The optimal ablation strategy for PsAF is currently unclear and needs further refinement.

Uzun Dönem Takip - Kriyo

Long Term Follow-up of Pulmonary Vein Isolation using Cryoballoon Ablation

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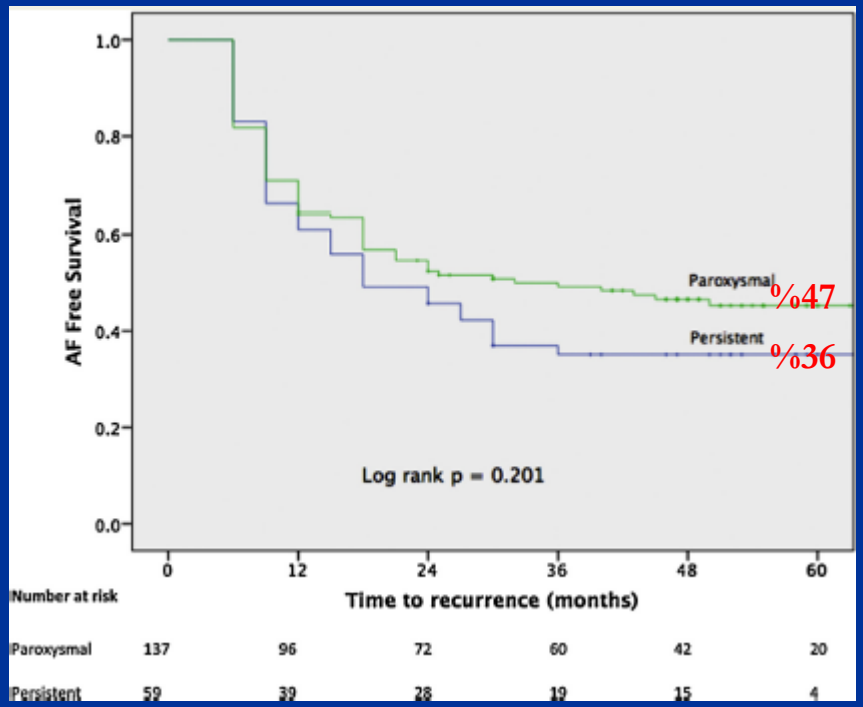
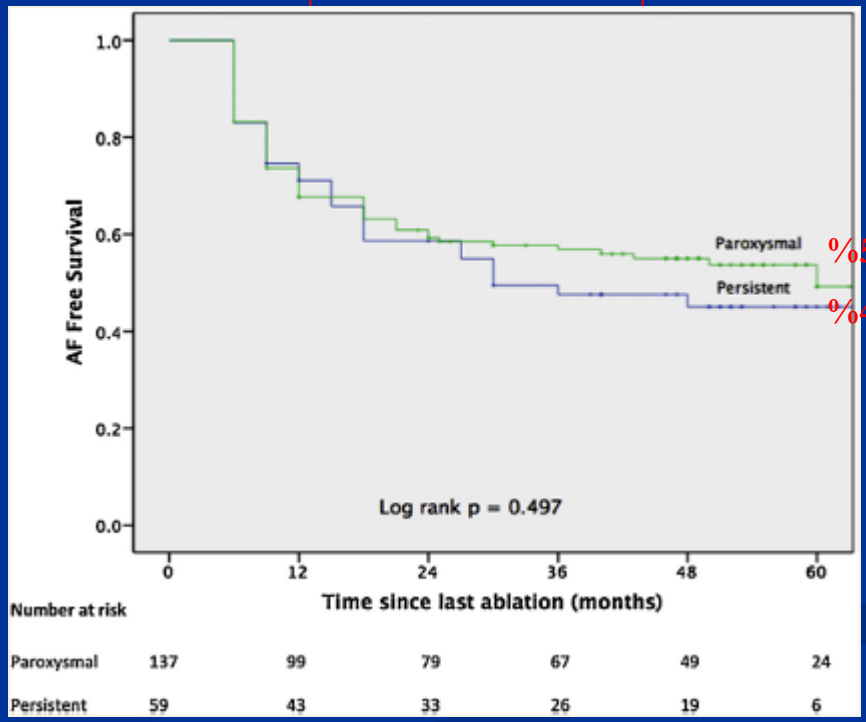
[a]Cardiovascular Department, John Hunter Hospital, Newcastle, NSW, Australia
[b]Toronto General Hospital, Toronto, Ontario, Canada

Tek işlem



Multipl işlem



Heart, Lung and Circulation (2015) xx, 1–6

Uzun Dönem Takip - RF Ablasyon

Catheter Ablation for Atrial Fibrillation

Are Results Maintained at 5 Years of Follow-Up?

Rukshen Weerasooriya, BMEDSC(HONS), MBBS,*† Paul Khairy, MD, PHD,‡ Jean Litalien, MD,* Laurent Macle, MD,‡ Meleze Hocini, MD,* Frederic Sacher, MD,* Nicolas Lellouche, MD,* Sebastien Knecht, MD,* Matthew Wright, PHD, MD,* Isabelle Nault, MD,* Shinsuke Miyazaki, MD,* Christophe Scavee, MD,* Jacques Clementy, MD,* Michel Haissaguerre, MD,* Pierre Jais, MD*

Bordeaux-Pessac, France; Crawley, Western Australia; and Montreal, Quebec, Canada

n: 100; 36'sı persistan AF**

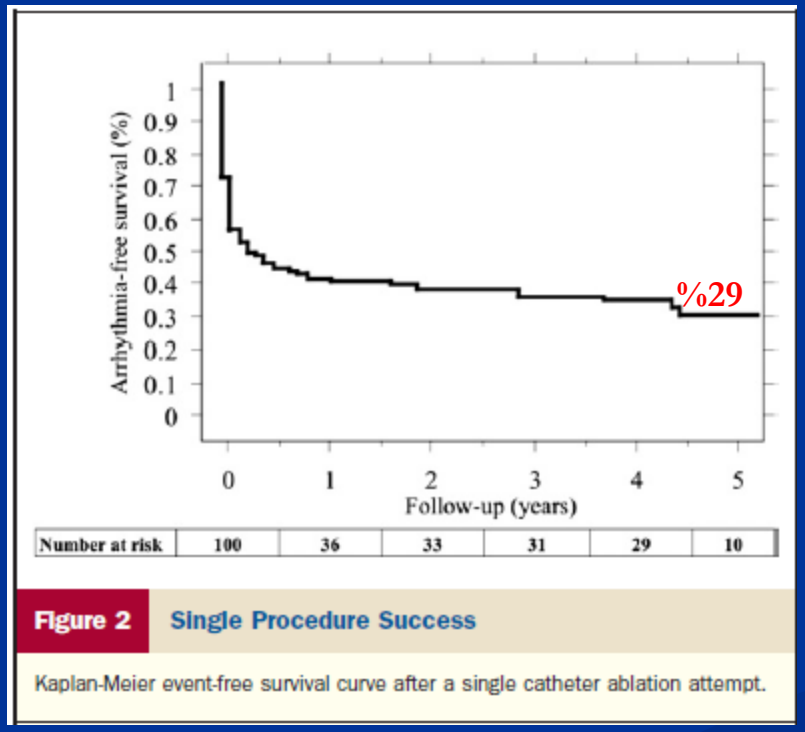


Figure 2 Single Procedure Success

Kaplan-Meier event-free survival curve after a single catheter ablation attempt.

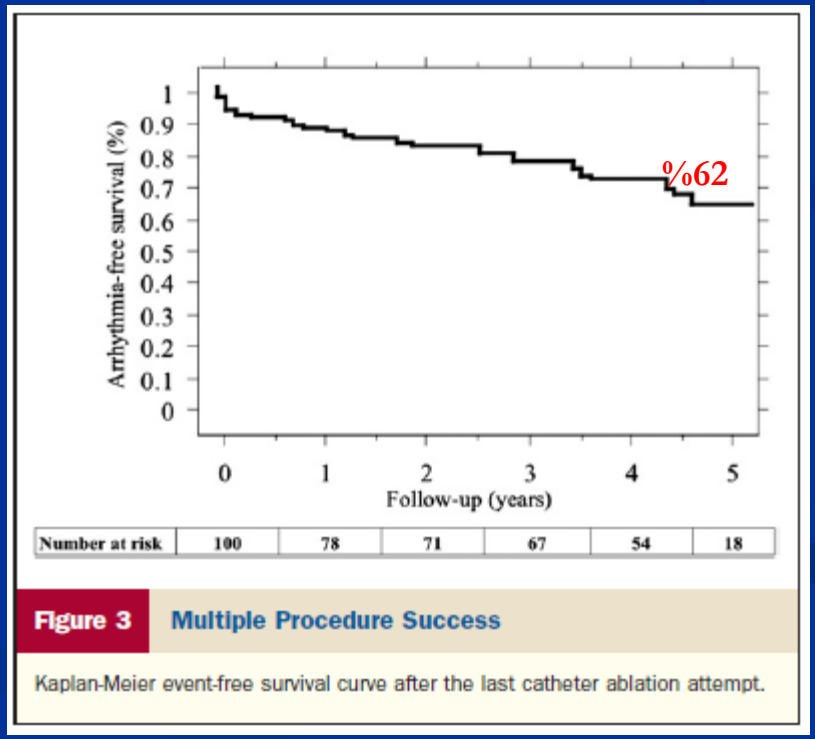


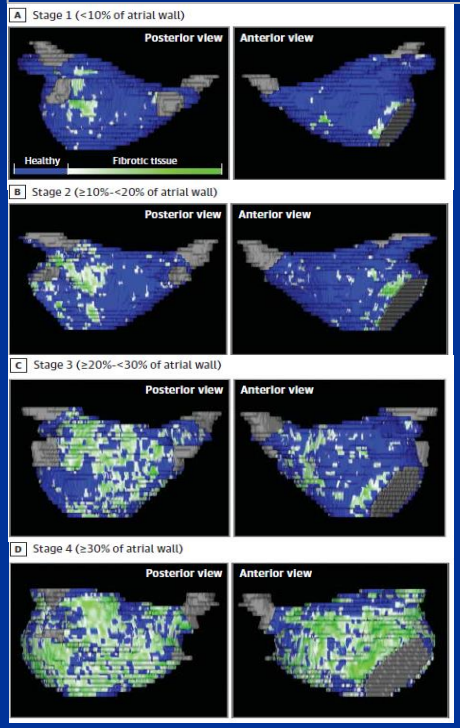
Figure 3 Multiple Procedure Success

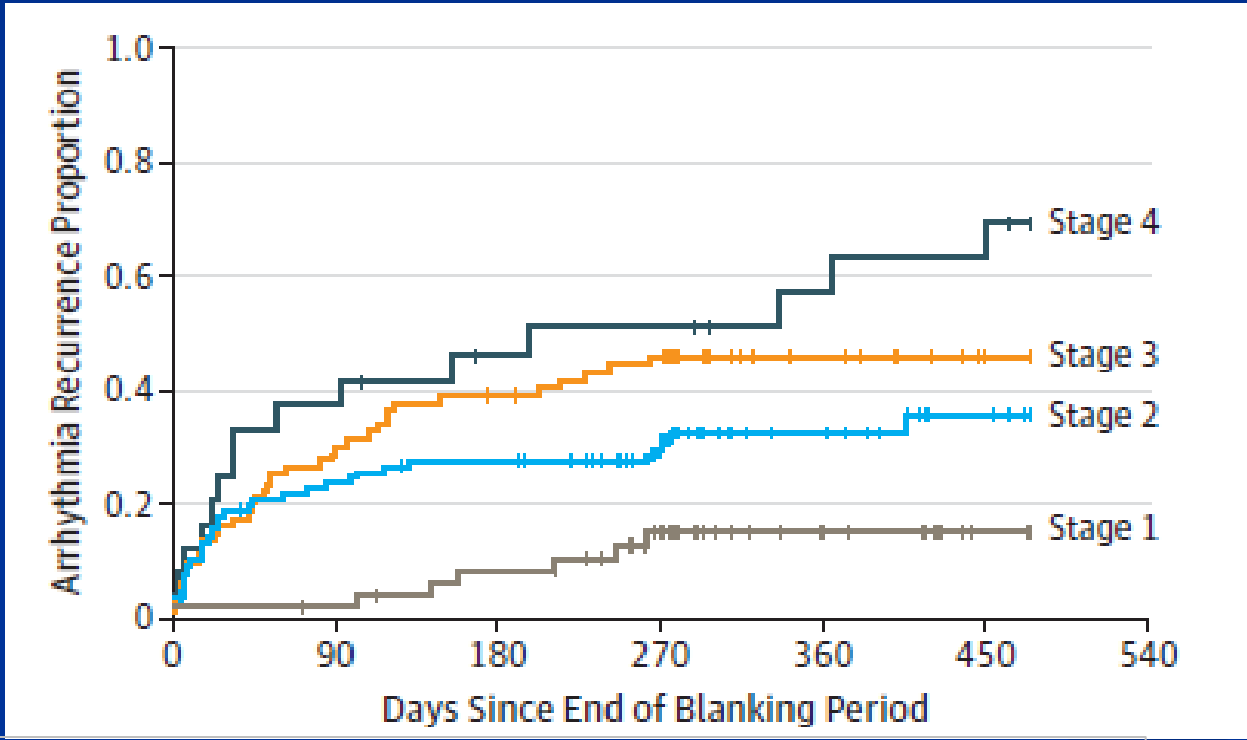
Kaplan-Meier event-free survival curve after the last catheter ablation attempt.

(J Am Coll Cardiol 2011;57:160–6)

Atrial fibrilasyonda sol atrial fibrozis derecesi artıkça ablasyon başarısı azalmaktadır

Stages of Left Atrial Fibrosis in 3D DE-MRIs





The clinical implications of this association warrant further investigation.

Marrouche et al. JAMA. 2014;311(5):498-506. doi:10.1001/jama.2014.3

- DE-MRI ile saptanan sol atrial yapısal yeniden şekillenmenin derecesi AF tipinden ve ilişkili komorbiditelerden bağımsızdır.
- Kateter ablasyonu için uygun hastaların seçiminde atrial fibrozisin niteliği ve niceliği işlem başarısını artırırken gereksiz işlem yapılmasını önleyecektir.

Complications in the setting of percutaneous atrial fibrillation ablation using radiofrequency and cryoballoon techniques: A single-center study in a large cohort of patients

Giacomo Mugnai [*,1], Ghazala Irfan [1], Carlo de Asmundis [1], Giuseppe Ciconte [1], Yukio Saitoh [1], Burak Hunuk [1], Vedran Velagic [1], Erwin Stroker [1], Paolo Rossi [1], Lucio Capulzini [1], Pedro Brugada [1], Gian-Battista Chierchia [1]

Heart Rhythm Management Centre, UZ Brussel—VUB, Brussels, Belgium

	Total procedures (n = 1233)	RF procedures (n = 642)	CB procedures (n = 591)	p value
Female gender	345 (28)	169 (26)	176 (30)	0.2
Age (years)	59 ± 11	60 ± 10	58 ± 13	0.5
Duration of symptoms (months)	29 ± 45	31 ± 47	28 ± 42	0.5
Persistent AF	383 (31)	287 (45)	96 (16)	<0.001
–Long-standing persistent AF	87 (7)	74 (12)	13 (2)	<0.001
Previous AF ablation	223 (18)	168 (26)	55 (9)	<0.001
Hypertension	506 (41)	271 (42)	235 (40)	0.4
Dyslipidemia	429 (35)	236 (37)	193 (33)	0.1
Diabetes mellitus	92 (7)	52 (8)	40 (7)	0.4
Coronary artery disease	105 (9)	61 (10)	44 (7)	0.2
Dilated cardiomyopathy	71 (6)	43 (7)	28 (5)	0.1
Valvular disease	30 (2)	12 (2)	18 (3)	0.2
Absence of cardiomyopathy	951 (77)	483 (75)	468 (79)	0.1
Hypothyroidism	45 (4)	29 (5)	16 (3)	0.09
Oral anticoagulation	857 (70)	443 (69)	414 (70)	0.7
IC class antiarrhythmic drugs	380 (31)	209 (33)	171 (29)	0.09
Beta blockers	455 (37)	248 (39)	207 (35)	0.2
III class antiarrhythmic drugs	393 (32)	217 (34)	176 (30)	0.1
Calcium channel blockers	46 (4)	30 (5)	16 (3)	0.07
Left ventricular ejection fraction (%)	58 ± 6	57 ± 6	59 ± 13	0.2
Left atrial size (mm)	44 ± 7	46 ± 7	42 ± 7	<0.001
CHA_2DS_2-VASc score	1.42 ± 1.3	1.45 ± 1.3	1.37 ± 1.3	0.2
CHADS score	0.82 ± 0.58	0.84 ± 0.68	0.78 ± 0.69	0.1
HAS-BLED score	1.16 ± 1.01	1.19 ± 1.05	1.12 ± 1.02	0.2
Body mass index (kg/m^2)	27 ± 4	28 ± 4	27 ± 4	0.4
Roof line	205 (17)	198 (31)	7 (1)	<0.001
Mitral line	108 (9)	105 (16)	3 (0.5)	<0.001
Ablation of complex electrograms	112 (9)	110 (17)	2 (0.3)	<0.001

RF: radiofrequency; CB: cryoballoon; AF: atrial fibrillation.

International Journal of Cardiology 196 (2015) 42–49

Complications in the setting of percutaneous atrial fibrillation ablation using radiofrequency and cryoballoon techniques: A single-center study in a large cohort of patients

Giacomo Mugnai [*,1], Ghazala Irfan [1], Carlo de Asmundis [1], Giuseppe Ciconte [1], Yukio Saitoh [1], Burak Hunuk [1], Vedran Velagic [1], Erwin Stroker [1], Paolo Rossi [1], Lucio Capulzini [1], Pedro Brugada [1], Gian-Battista Chierchia [1]

Heart Rhythm Management Centre, UZ Brussel—VUB, Brussels, Belgium

Procedural and fluoroscopy times in RF and CB ablation procedures.

	RF (PV isolation only)	RF (PV isolation + additional lines)	1st generation CB	2nd generation CB
Procedural time (min)	136.4 ± 51.8	169.7 ± 61.8	116.0 ± 36.9	65.2 ± 19.1
Fluoroscopy time (min)	28.4 ± 11.9	39.3 ± 20.2	24.3 ± 7.8	15.6 ± 6.5

International Journal of Cardiology 196 (2015) 42–49

Complications in the setting of percutaneous atrial fibrillation ablation using radiofrequency and cryoballoon techniques: A single-center study in a large cohort of patients

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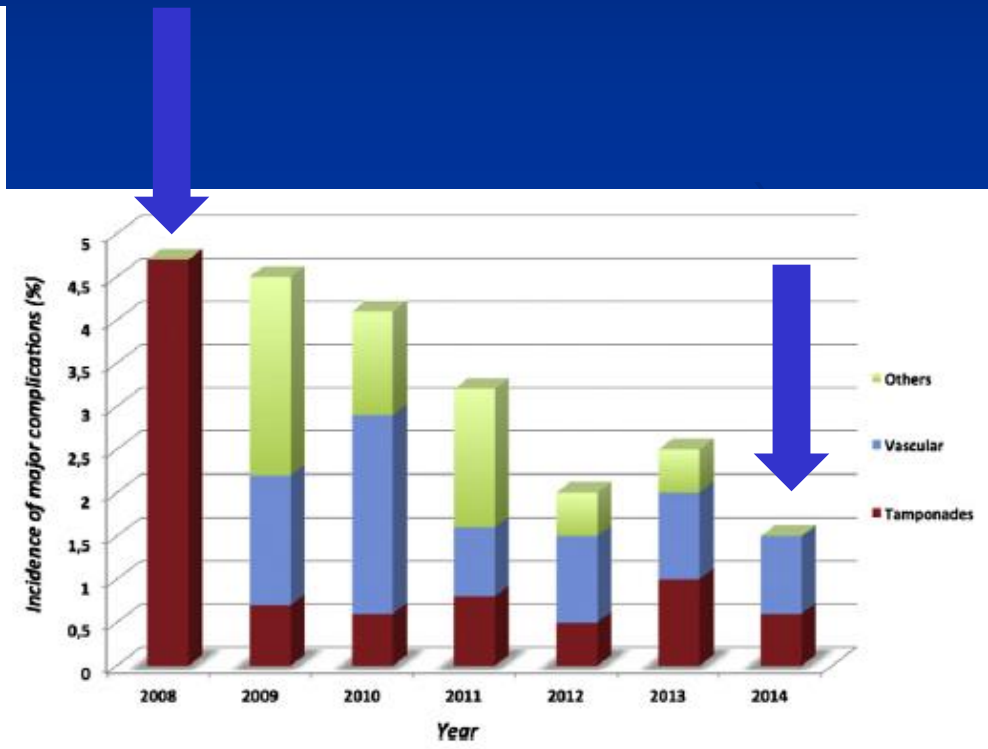
Adverse events in RF and CB ablation procedures.

	Total procedures (n = 1233)	RF procedures (n = 642)	CB procedures (n = 591)	p value
Serious adverse events				
Death related to the procedure	0	0	0	
Atrial–esophageal fistula	1 (0.08%)	1 (0.16%)	0	0.3
Thromboembolic complications				
– Stroke	1 (0.08%)	1 (0.16%)	0	0.3
– Transient ischemic attack	3 (0.24%)	2 (0.31%)	1 (0.17%)	0.6
Cardiac tamponade	13 (1.05%)	10 (1.56%)	3 (0.51%)	0.07
Severe PV stenosis	0	0	0	
PV intramural hematoma	1 (0.08%)	0	1 (0.17%)	0.3
Retroperitoneal hematoma	1 (0.08%)	0	1 (0.17%)	0.3
Groin complications				
– Femoral pseudoaneurysm	12 (0.97%)	8 (1.25%)[a]	4 (0.68%)	0.3
– Arteriovenous fistula	2 (0.16%)	1 (0.16%)	1 (0.17%)	0.9
Symptomatic persisting PNP	1 (0.08%)	0	1 (0.17%)	0.3
Pleural hematoma	1 (0.08%)	0	1 (0.17%)	0.3
Total	36 (2.92%)	23 (3.58%)	13 (2.20%)	0.1
Other adverse events				
Acute pericarditis	17 (1.38%)	12 (1.87%)	5 (0.85%)	0.12
Transient ST elevation	7 (0.57%)	4 (0.62%)	3 (0.51%)	0.79
Phrenic nerve palsy	48 (3.89%)	0	48 (8.12%)	0.0001
• Transient	37 (3.00%)	0	37 (6.26%)	0.0001
• Persistent	11 (0.89%)	0	11 (1.86%)	0.0003

RF: radiofrequency; CB: cryoballoon; PV: pulmonary vein; PNP: phrenic nerve palsy.

[a] 2 femoral pseudoaneurysms were related to the left femoral artery approach, used until October 2009 to monitor arterial pressure and to assess the radiological position of the aorta.



International Journal of Cardiology 196 (2015) 42–49

Sessiz Serebral İskemi Sıklığı

	Kriyobalon	Radyofrekans
Gaita ve ark. J Cardiovasc Elect 2011	%5.6	%8.3
Herrara ve ark. J Am Coll Cardiol 2011	%4.3	%7.4

Heart Rhythm. 2016 Feb;13(2):374-82. doi: 10.1016/j.hrthm.2015.10.023. Epub 2015 Oct 23.

Prevalence and distribution of focal triggers in persistent and long-standing persistent atrial fibrillation.

Santangeli P[1], Zado ES[1], Hutchinson MD[1], Riley MP[1], Lin D[1], Frankel DS[1], Supple GE[1], Garcia FC[1], Dixit S[1], Callans DJ[1], Marchlinski FE[2].

2168 AF hastasının 1975'de (91%) indüklenmiş veya spontan PV trigger mevcut.

- PV triggerların prevelansları tüm gruplarda benzer bulunmuş. (p= .874):
  - Paroxysmal AF (1398 [91%]),
  - Persistent AF (449 [91%]), and
  - long-standing persistent AF (129 [91%])
- Bu sonuca göre persistan AF'de, kateter ablasyonunda AF tetikleyicilerini elimine etmede PV izolasyonu hala köşe taşıdır.

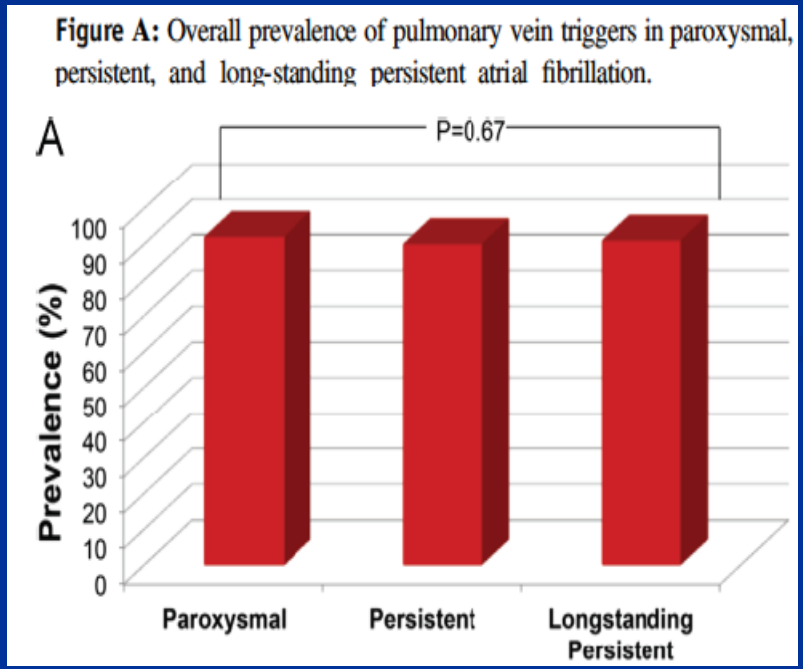


Figure A: Overall prevalence of pulmonary vein triggers in paroxysmal, persistent, and long-standing persistent atrial fibrillation.

Cryoballoon ablation of persistent atrial fibrillation: feasibility and safety of left atrial roof ablation with generation of conduction block in addition to antral pulmonary vein isolation

Malte Kuniss[1]*, Harald Greiß[1], Dmitri Pajitnev[1], Ersan Akkaya[1], Nikolas Deubner[1], Andreas Hain[1], Lars Bodammer[1], Alexander Berkowitsch[1], Gian-Battista Chierchia[2], Christian W. Hamm[1], and Thomas Neumann[1]

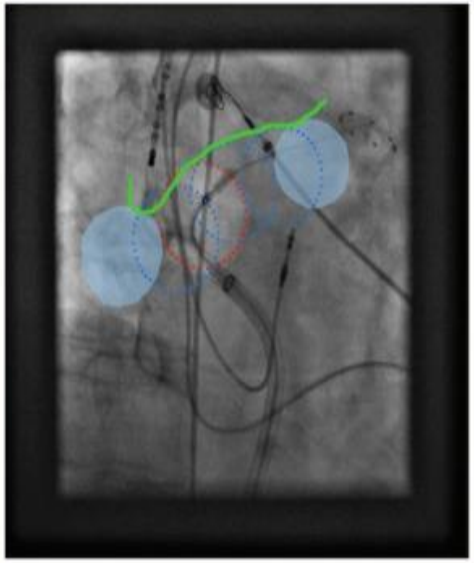


Figure 1 Fluoroscopic example of a representative case of successful linear ablation at the LA roof border (green line, determined by preceding LA angiography) with the second-generation cryoballoon. The circular mapping catheter is anchored in the LSPV. Blue coloured circles represent balloon positions during PV isolation of RSPV and LSPV. Dotted rings indicate balloon positions during generation of the roofline.

Aims Although the generation of linear lesions by ablation improves success rates in patients with persistent atrial fibrillation (AF), the procedure has been considered unsuitable for cryoablation balloon catheter technologies. We developed a technique for linear ablations, using second-generation cryoballoon technology.

Methods and results This was a single-arm, prospective study in 76 patients with persistent AF treated consecutively at our centre. Cryoablation was performed using a 28 mm second-generation cryoballoon. The first cryoenergy application was performed in close proximity to the position during isolation of the left superior pulmonary vein (PV). Sequential overlapping freezes were applied along the left atrial (LA) roof by slight clockwise rotation of the sheath in combination with slight retraction of the sheath and incremental advancement of the cryoballoon, until reaching the original position for right superior PV isolation. The acute endpoint was the creation of a roofline, defined as complete conduction block across the LA roof >120 ms and ascending activation across the posterior LA wall. Acute success in roofline generation was achieved in 88% of patients, applying on average five (median 4–6) freezes with nadir temperature of −40°C (−36 to −44°C). In five patients, conduction block could not be achieved. No phrenic nerve injuries occurred during roofline generation.

Conclusion Generation of linear roofline lesions is possible with the second-generation cryoballoon. The technique can be used in combination with PV isolation to treat persistent AF with good acute success rates, short procedure times, and acceptable safety concerns. If validated by further studies, the method would be an appealing alternative to radiofrequency ablation techniques.

Keywords Cryoballoon • Persistent atrial fibrillation • Left atrial linear lesions • Ablation procedure times

Left atrial appendage isolation in addition to pulmonary vein isolation in persistent atrial fibrillation: one-year clinical outcome after cryoballoon-based ablation

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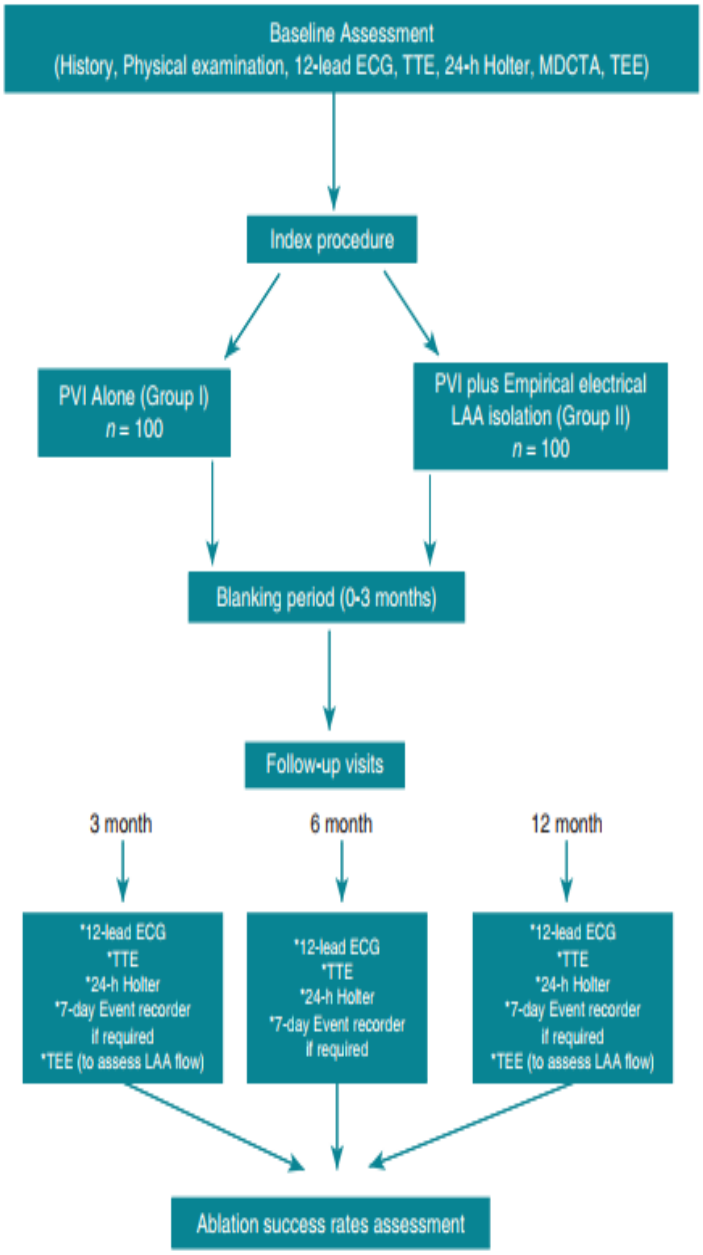
Aims In this study, we sought to evaluate the safety and efficacy of cryoballoon (CB) based empirical left atrial appendage (LAA) isolation as an adjunct to pulmonary vein isolation (PVI) compared to the PVI-only strategy in patients with persistent AF.

Objectives Clinical outcomes of catheter ablation were less beneficial for persistent atrial fibrillation (AF) than paroxysmal AF.

Methods and results A total of 100 consecutive patients with persistent AF underwent both PVI and additional LAA isolation using CB (Group II). As a control group (Group I), among persistent AF patients, we conducted a retrospective, propensity-score matched cohort, in whom only PVI was performed using CB. Recurrence of atrial tachyarrhythmia (Ata) at the 12th month follow-up was the primary endpoint. Baseline demographic and clinical characteristics were similar between two groups. At the 12th month follow-up, 67 (67%) patients in Group I and 86 (86%) patients in Group II were free of ATa after the index procedure ($P < 0.001$). As a unique complication of LAA isolation, left circumflex artery spasm was observed in 4% of the Group II. After adjusting for several baseline variables, PVI-only strategy was found as a significant predictor for recurrence (HR: 3.37; 95% CI: 1.73–6.56; $P < 0.001$). Transoesophageal echocardiography examination during the follow-up revealed no thrombus in the LAA.

Conclusion Our findings indicated that LAA isolation as an adjunct to PVI improved 1-year outcomes in persistent AF compared with the PVI-only strategy using CB without an increase in thromboembolic complications.

Keywords Atrial fibrillation • Cryoballoon • Left atrial appendage isolation



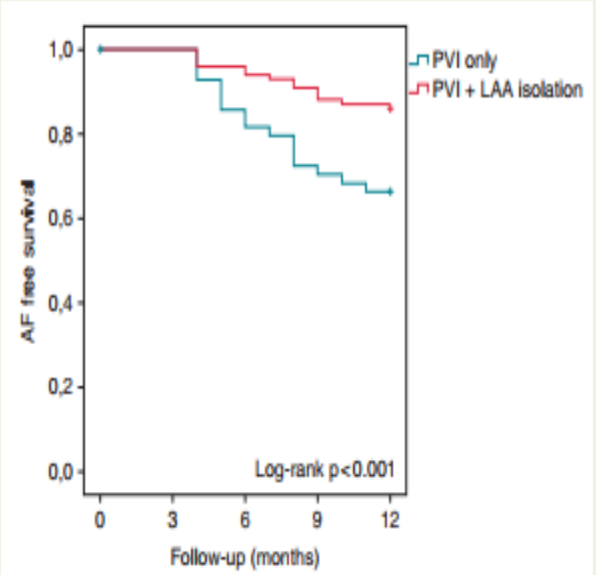
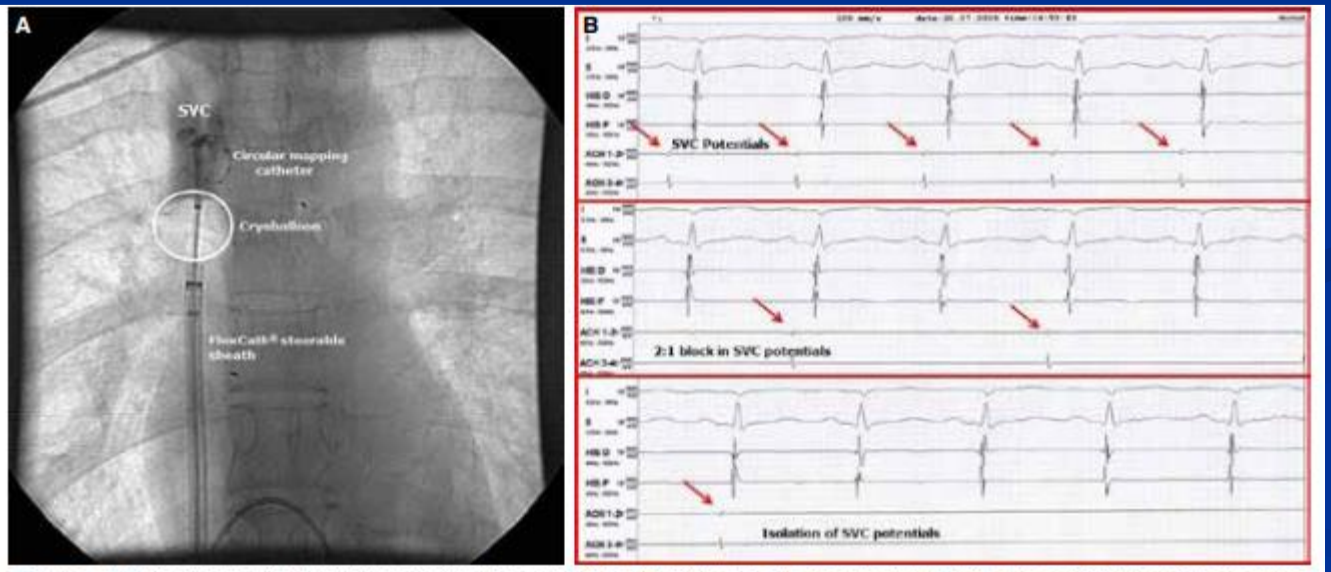


Figure 4 Kaplan–Meier curve illustrating the freedom from atrial arrhythmias at the end of 12-month follow-up in PVI alone group (67%) and PVI plus LAA isolation group (86%) after CB ablation when a 3-month blanking period considered ($P < 0.001$). CB, cryoballoon; LAA, left atrial appendage; PVI, pulmonary vein isolation.

Turk Kardiyol Dern Ars. 2017 Mar;45(2):208. doi: 10.5543/tkda.2016.96049.

Case images: Electrical isolation of superior vena cava as well as pulmonary vein isolation with cryoballoon technique in a young patient with persistent atrial fibrillation.

Canpolat U[1], Evranos B, Koçyiğit D, Yorgun H, Aytemir K.



Figures– (A) Occlusion of right atrium-superior vena cava junction with cryoballoon catheter. **(B)** Electrical isolation of superior vena cava potentials demonstrated on circular mapping catheter 1–2 and 3–4 recordings.

Özet

	Kriyobalon	Radyofrekans
İşlem Süresi	Daha kısa	Daha uzun
Operatör Deneyimi	Daha az deneyim	Ciddi deneyim gerektirir
İşlemin Güvenliği	Güvenli	Güvenli
Floroskopi süresi	Daha kısa	Daha uzun
Öğrenme eğrisi	Daha kısa	Daha uzun
İşlemin Başarısı	Etkin	Etkin

Tab. 3 Ongoing trials aiming to evaluate the role of catheter ablation with cryoballoon in persistent atrial fibrillation. (ClinicalTrials.gov April 2016)

Name of the trial	AF type studied	Identifier	Status
Cryoballoon Ablation in Patients With Longstanding Persistent Atrial Fibrillation (CRYO-LPAF)	Longstanding persistent	NCT02294929	Recruiting
Persistent Atrial Fibrillation Cryoballoon Ablation (PAFCA)	Persistent	NCT02166723	Active, not recruiting
A Prospective Study of Medical Therapy Against Cryoballoon Ablation in Symptomatic Recent Onset Persistent AF (METACSA)	Early onset persistent	NCT02389218	Not yet recruiting
Cryoballoon vs. Irrigated Radiofrequency Catheter Ablation: Double Short vs. Standard Exposure Duration (CIRCA-DOSE)	Paroxysmal or early persistent	NCT01913522	Recruiting
Catheter Ablation Compared With Pharmacological Therapy for Atrial Fibrillation (CAPTAF)	Paroxysmal/persistent	NCT02294955	Active, not recruiting
Cryoballoon Ablation for Early Persistent Atrial Fibrillation (Cryo4 Persistent AF)	Early persistent	NCT02213731	Recruiting
FREEZE Cohort Study	Paroxysmal/persistent	NCT01360008	Active, not recruiting
Prospective, Randomized Comparison of Hybrid Ablation vs. Catheter Ablation (PRHACA)	Persistent	NCT02344394	Recruiting

Cryo4 Persistent AF

Cryoballoon Ablation for Early Persistent Atrial Fibrillation

PI	Serge Boveda (Clinique Pasteur), Pascal Defaye (CHU Michallo)
Type	Medtronic sponsored
Design	Prospective, single arm
Status	Site Activations
Patients (n)	100
Sites (N)	10
Population	Early persistent AF (<1year)
Location	Europe (France, Germany)
Study Duration	24m
Primary Outcome	Single procedure success of cryoballoon ablation on patients with early persistent AF at 12 Months
Clinicaltrials.gov	NCT02213731

Objective:

- Evaluate the single procedure efficacy of using Arctic Front Advance® Cryoballoon ablation without additional empirical lesions and/or complex fractionated electrogram (CFE) ablations for patients with early persistent AF (<1 year).

Summary:

- Prospective, non-randomized, multi-center, post-market clinical study.

Estimated Completion Date:

- September 2016

Teşekkür Ederim