

LPAF da Cryobalon

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İstanbul Medipol Üniversitesi



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AF Ablasyonu

PVI

Cryobalון



PVI dışı stratejiler

Cryobalון

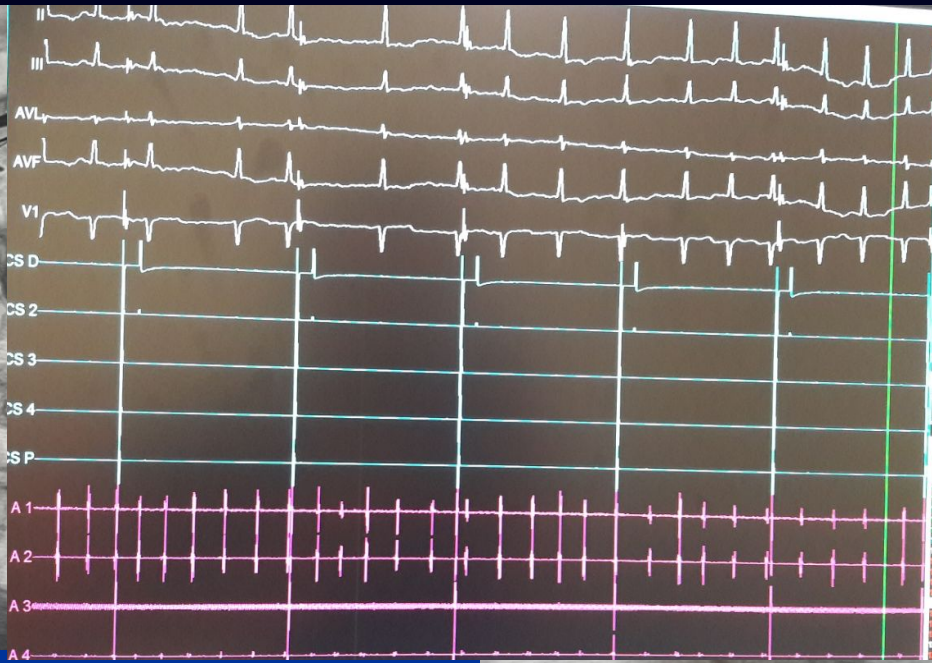


- Rotor ablasyonu
- Skar temelli ablasyon

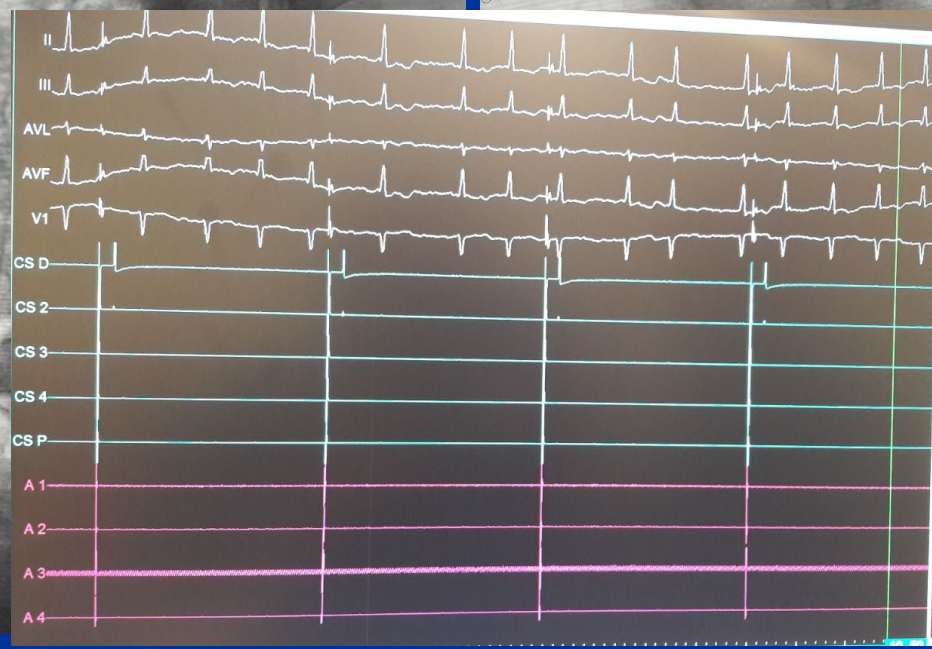
Cryobalon

- Nispeten yeni ve gelişen bir teknoloji
- Cryobalon ile PVI daha sade ve basit
- Öğrenilmesi ve yapılması daha kolay
- Tek transseptal
- 3-D mapping sistemine ihtiyaç yok
- İşlem süresi daha kısa
- AF ablasyonunda başarı RF ile benzer
- Önemli komplikasyonların sayısı daha az

Rot -27°
Ang -3°



-27°
-3°



RF ile karşılaştırıldığında

- Redo AF ablasyonu yapılan hastalarda daha yüksek PV izolasyon oranı görülmüştür*.
- Cryobalon daha uniform/homojen lezyon oluşturabilir **.

•Yokokawa M, Chugh A, Latchamsetty R, et al. Cryoballoon Antral Pulmonary Vein Isolation vs. Force-Sensing Radiofrequency Catheter Ablation for Pulmonary Vein and Posterior Left Atrial Isolation in Patients with Persistent Atrial Fibrillation. *Heart Rhythm*. 2018.

** Heeger CH, Wissner E, Mathew S, et. al. Once isolated, always isolated? Incidence and characteristics of pulmonary vein reconnection after second-generation cryoballoon-based pulmonary vein isolation. *Circ Arrhythm Electrophysiol*. 2015;8:1088-1094.

** Ciconte G, Velagic V, Mugnai G, et al. Electrophysiological findings following pulmonary vein isolation using radiofrequency catheter guided by contact-force and second-generation cryoballoon: Lessons from repeat ablation procedures. *Europace*. 2016;18:71-77.

Cryobalon limitasyonları

- Anatomik kısıtlılıklar
 - PV ostiumu dar veya çok geniş veya açılı
 - PV varyasyonları: Aksesuar PV, Common os
- Voltaj ve aktivasyon mapping yapılamaması
- PV antrumu dışında ablasyon kısıtlıdır ?
 - Lineer ablasyon, CFAE ablasyonu , non-PV tetikleyicilerin ablasyonu, fokal impulse ve rotor modülasyonu (FIRM), sağ atriyal ablasyon yapılamaması
- Nüks vakalarda farklı bir ablasyon metodolojisine imkan vermemesi ?

Cryoballoon versus Radiofrequency Catheter Ablation in Atrial Fibrillation: A Meta-Analysis

RHANDERSON CARDOSO, M.D., RODRIGO MENDIRICHAGA, M.D., GILSON FERNANDES, M.D., CHRIS HEALY, M.D., LITSA K. LAMBRAKOS, M.D., JUAN F. VILES-GONZALEZ, M.D., JEFFREY J. GOLDBERGER, M.D., and RAUL D. MITRANI, M.D.

From the Division of Cardiology, Department of Medicine, University of Miami, Jackson Memorial Hospital, Miami, Florida, USA

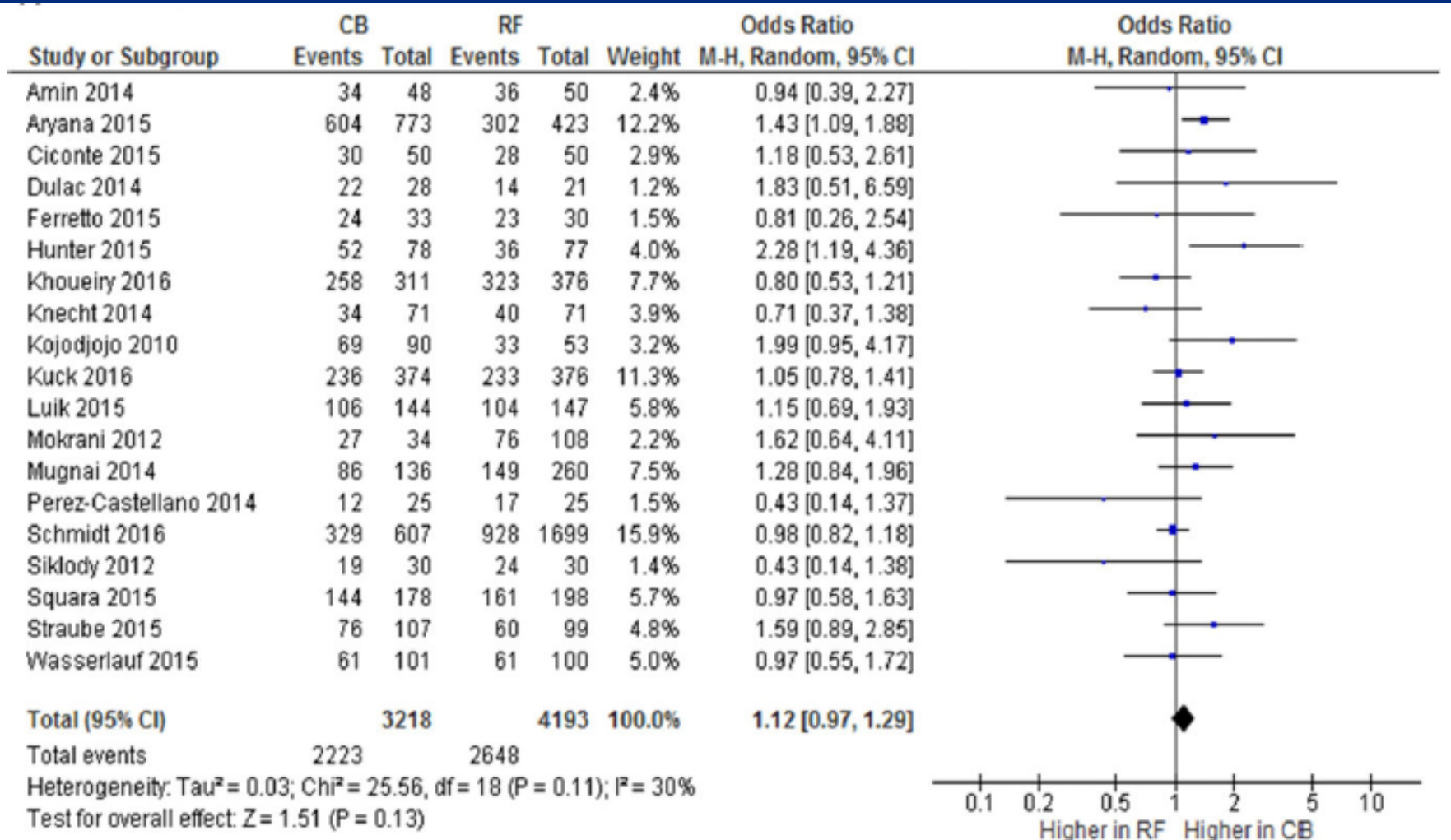
Cryoballoon vs. Radiofrequency AF Ablation. *Introduction:* Radiofrequency (RF) and cryoballoon (CB) catheter ablation are effective for pulmonary vein isolation (PVI) in atrial fibrillation (AF). This report presents an updated meta-analysis comparing the efficacy and safety of CB versus RF ablations in AF.

Methods: Databases and conference abstracts were systematically searched for studies that directly compared CB and RF PVI, and reported safety or efficacy outcomes in follow-up ≥ 12 months. Recurrent atrial tachyarrhythmias (AT) were defined as AF, atrial flutter, or atrial tachycardia.

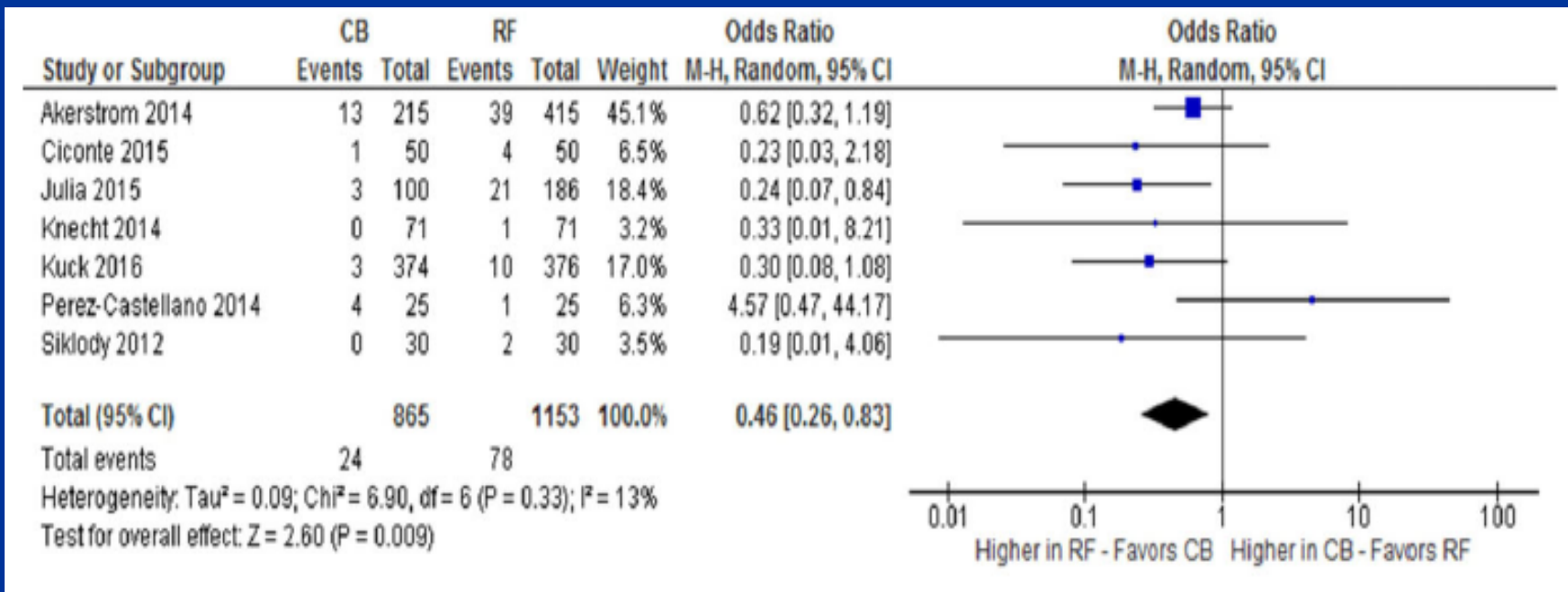
Results: Twenty-two studies and 8,668 patients were included. Freedom from AT was not significantly different between CB and RF ablations in the pooled population (OR 1.12; 95% CI 0.97–1.29; P = 0.13) and in randomized trials (OR 1.0; 95% CI 0.65–1.56; P = 0.99). Second-generation CB (CB2; 78.1%) and contact-force (CF) sensing RF (78.2%) have improved procedure success rate as compared to first-generation technology (57.9% CB, 58.1% RF). As compared to CF-RF, CB2 demonstrated similar freedom from recurrent AT (OR 1.04; 95% CI 0.71–1.51; P = 0.84). The incidence of pericardial effusions (OR 0.44; 95% CI 0.28–0.69; P < 0.01), tamponade (OR 0.31; 95% CI 0.15–0.64; P < 0.01), and non-AF AT (OR 0.46; 95% CI 0.26–0.83; P < 0.01) were significantly lower with CB ablation, whereas transient phrenic nerve palsy was more incident after CB (OR 7.40; 95% CI 2.56–21.34; P < 0.01).

Conclusion: There was comparable freedom from AT between CB and RF in patients with AF undergoing PVI. Additionally, freedom from AT was similar between CB2 and CF-RF. However, CB was associated with a lower incidence of pericardial effusions or tamponade, albeit with a higher rate of transient phrenic nerve palsies. (*J Cardiovasc Electrophysiol*, Vol. 27, pp. 1151-1159, October 2016)

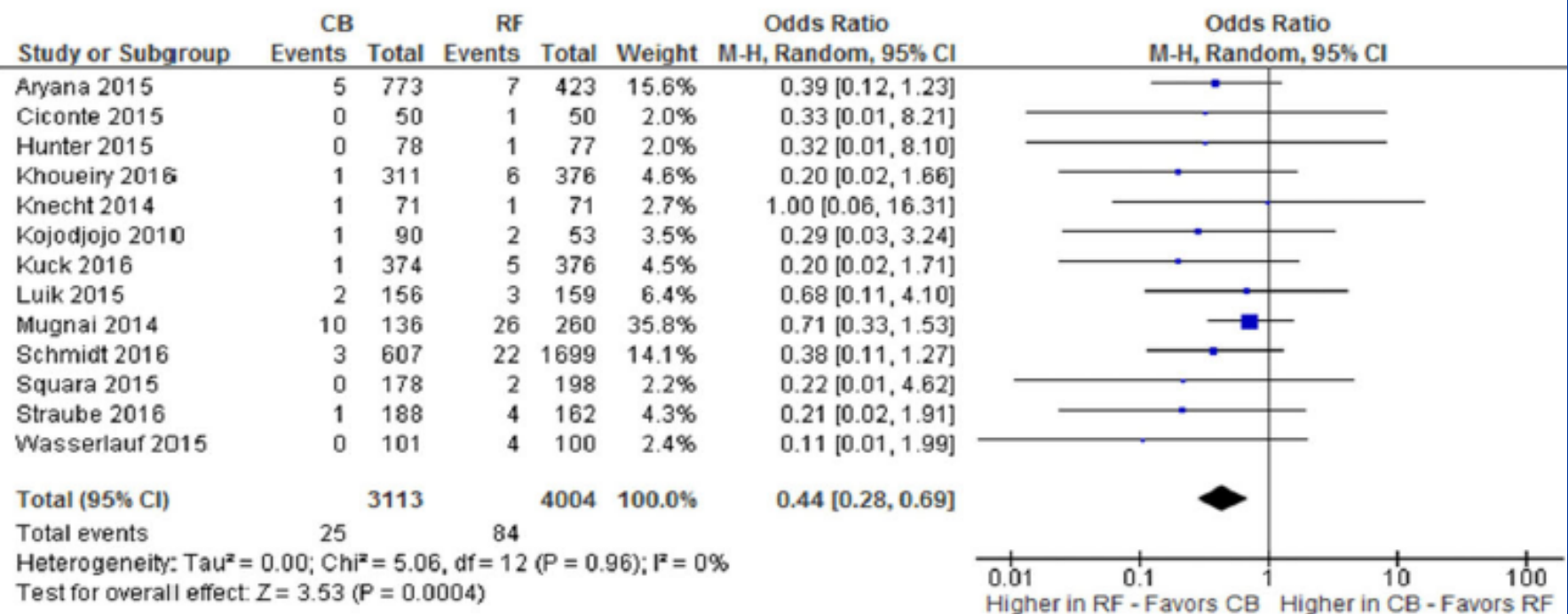
Atrial taşiaritmi (AF, AFL, AT) olmaması



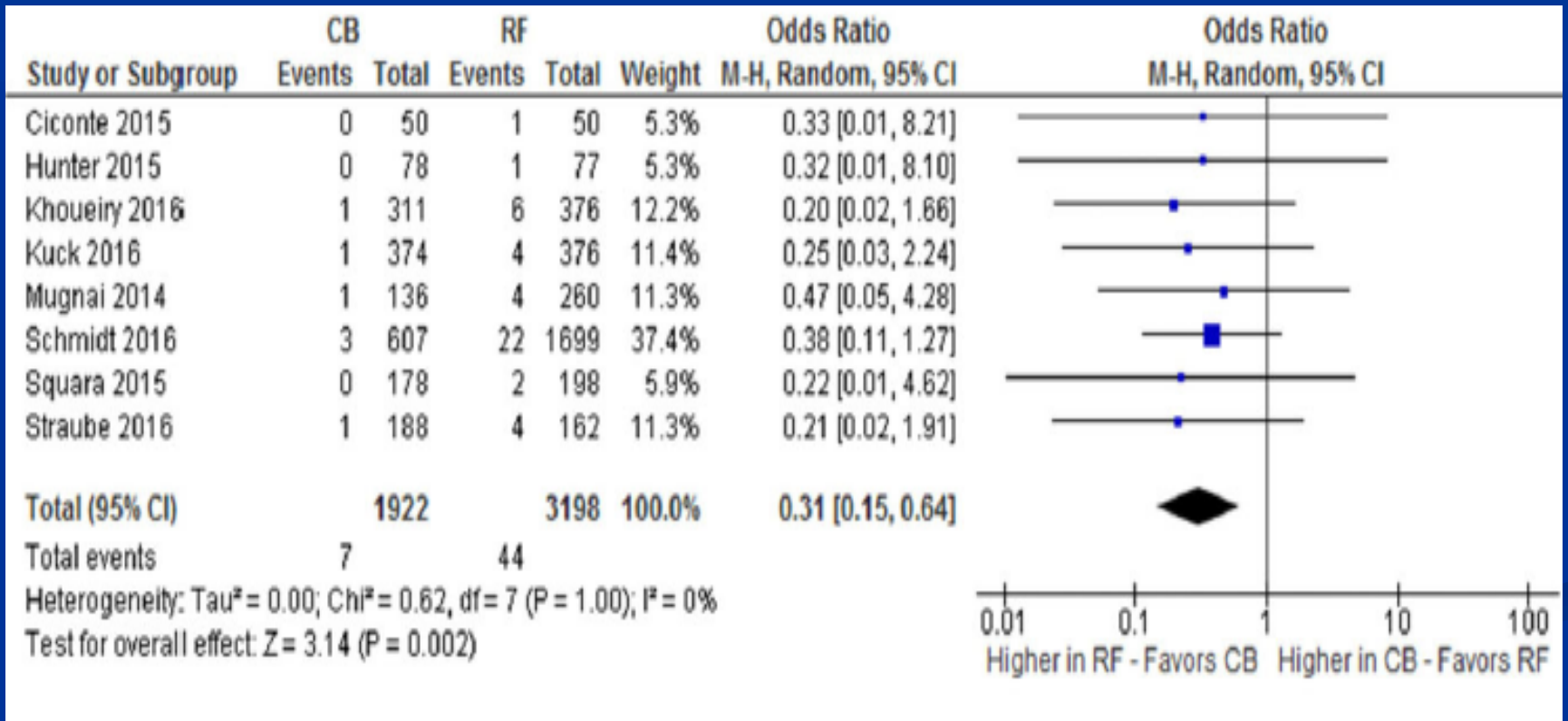
Non-AF AT



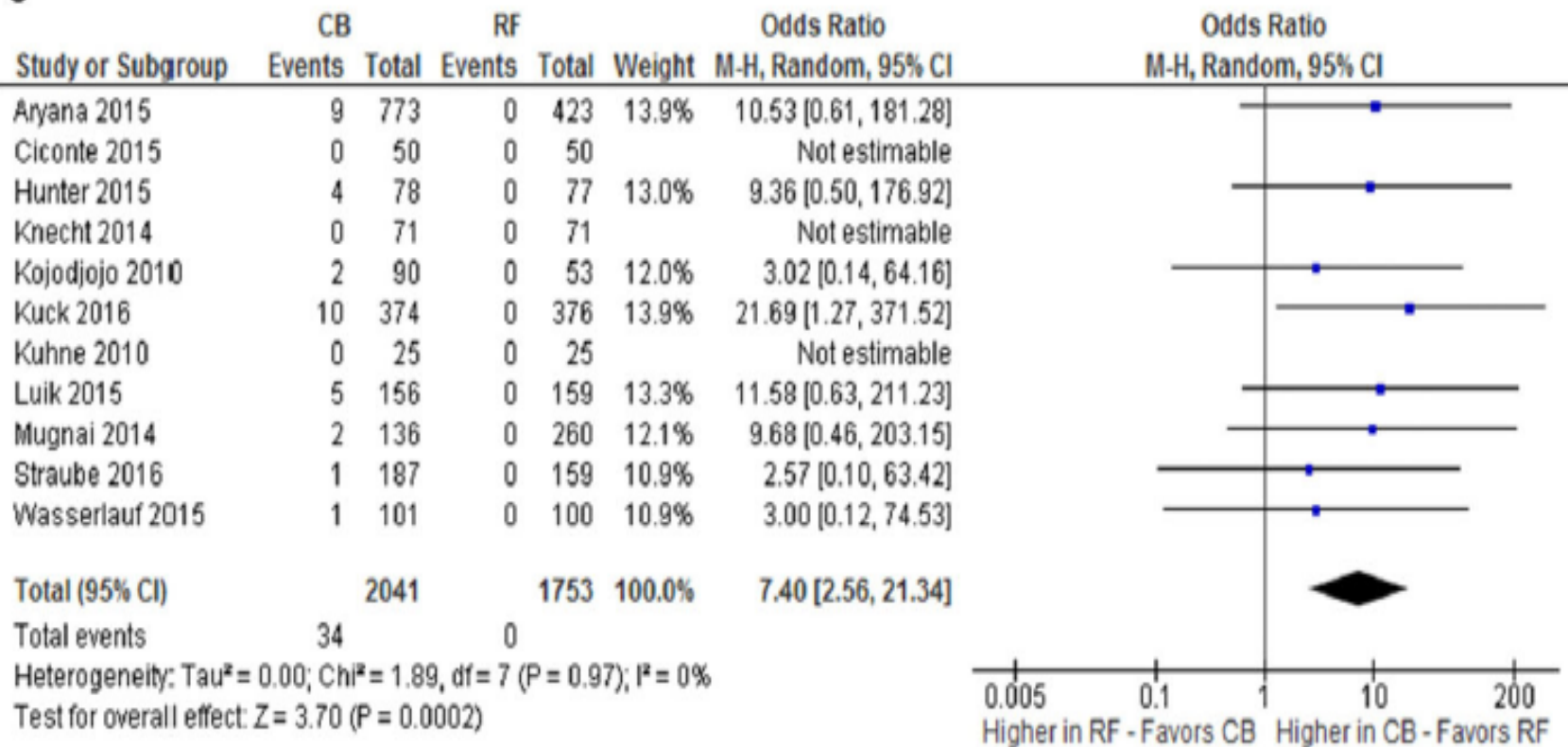
Perikardial Efüzyon



Perikardial Tamponad



Frenik sinir paralizi



İşlem and Fluoro süresi*

- İşlem süresi Cryoablasyonda daha kısa
- Fluoroskopi Cryoablasyonda süresi daha kısa

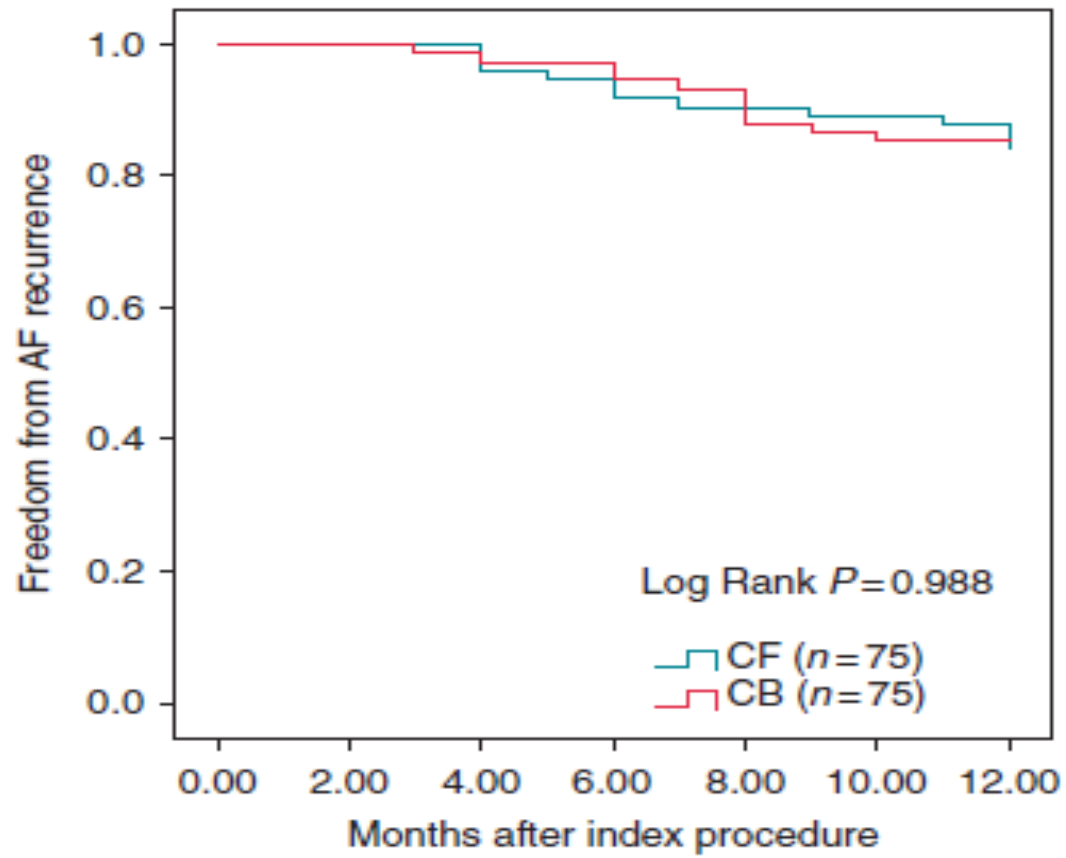
* İşlem ve Fluoro süresi bakımından çalışmalar arasında ciddi heterojenite vardı (I2 95%).

Paroksizmal AF - PVI

- PV'ler sıklıkla tek tetikleyici
- Tek PVI ile;
 - Bir yılda yaklaşık %80 başarı
 - Beş yılda yaklaşık %50 başarı

Conta
gener
vein is
fibrilla

second-
nary
atrial



	3 months	6 months	9 months	12 months
CF	75	69	67	66
CB	74	71	63	62

Figure 3 Kaplan–Meier survival curve—proportion of patients free of AF during the 12-month follow-up (3-month blanking period).

term outcome of patients radiofrequency (RF) vs.

comparing CF radiofrequency Arctic Front Advance™ well as recurrence at 12 months of patients of both the groups with a CHA₂DS₂-VASc score <2. The mean time to AF recurrence was lower in the CF group (18.5 ± 8.5 vs. 25.3 ± 9.9 min, $P=0.002$). In contrast, no significant difference was observed in the CB groups, respectively; 11 patients (14.7%) had AF recurrence (Log Rank $P=0.682$).

similar performances in

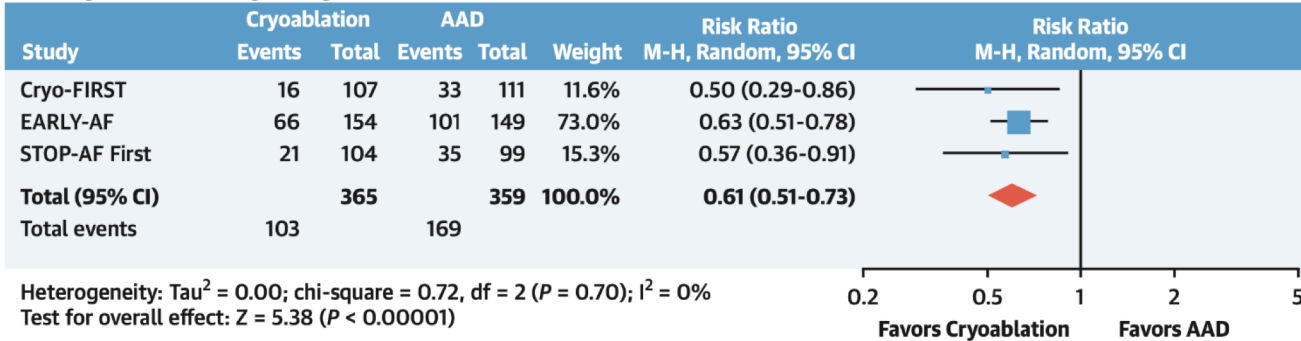
Aims

Methods and results

Conclusions

FIGURE 2 Atrial Tachyarrhythmia Recurrence

A Any Atrial Tachyarrhythmia



B Symptomatic Atrial Tachyarrhythmia

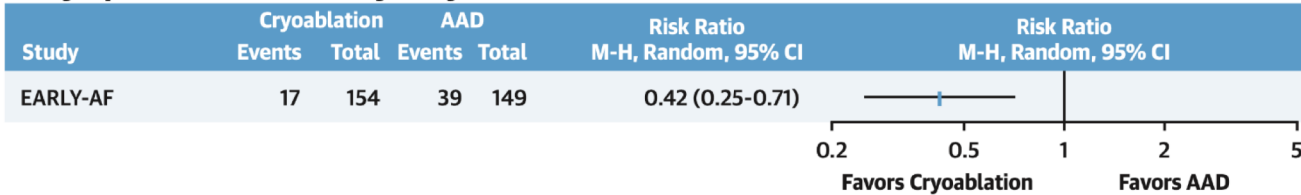
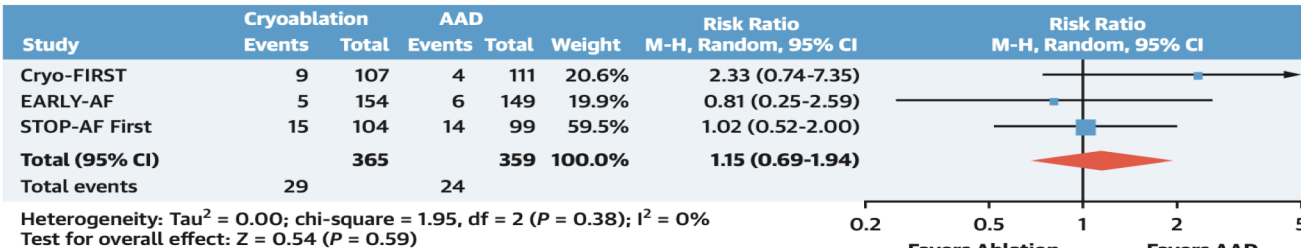
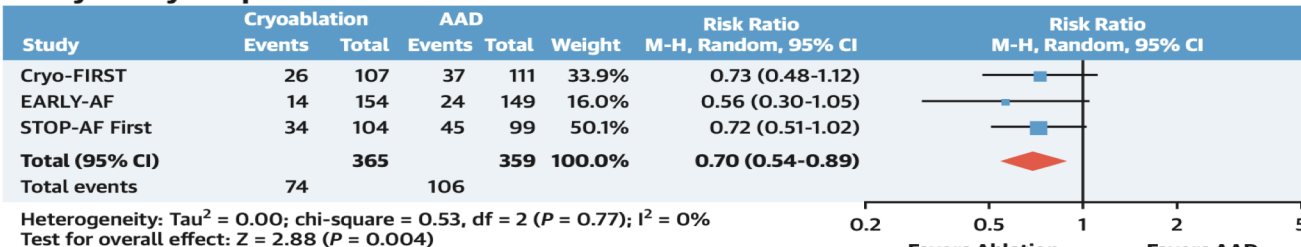


FIGURE 5 Safety Outcomes

A Serious Adverse Event



B Any Safety Endpoint



CLINICAL RESEARCH

...hythmic drugs:
...n paroxysmal

...an Sylvain Hermida⁴,
...ristian Meyer⁸,
...uglas L. Packer¹²,
...h Willems¹⁴,
...erchia¹³, for the

Non-paroksizmal AF Ablasyonu

- Tek PVI ile;
 - Bir yılda yaklaşık %50 başarı
 - Beş yılda yaklaşık %25 başarı

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

Nikolaos Dagres^{1*}, Maria Grazia Bongiorni², Torben Bjerregaard Larsen³, Antonio Hernandez-Madrid⁴, Laurent Pison⁵, and Carina Blomström-Lundqvist⁶
Conducted by the Scientific Initiatives Committee, European Heart Rhythm Association

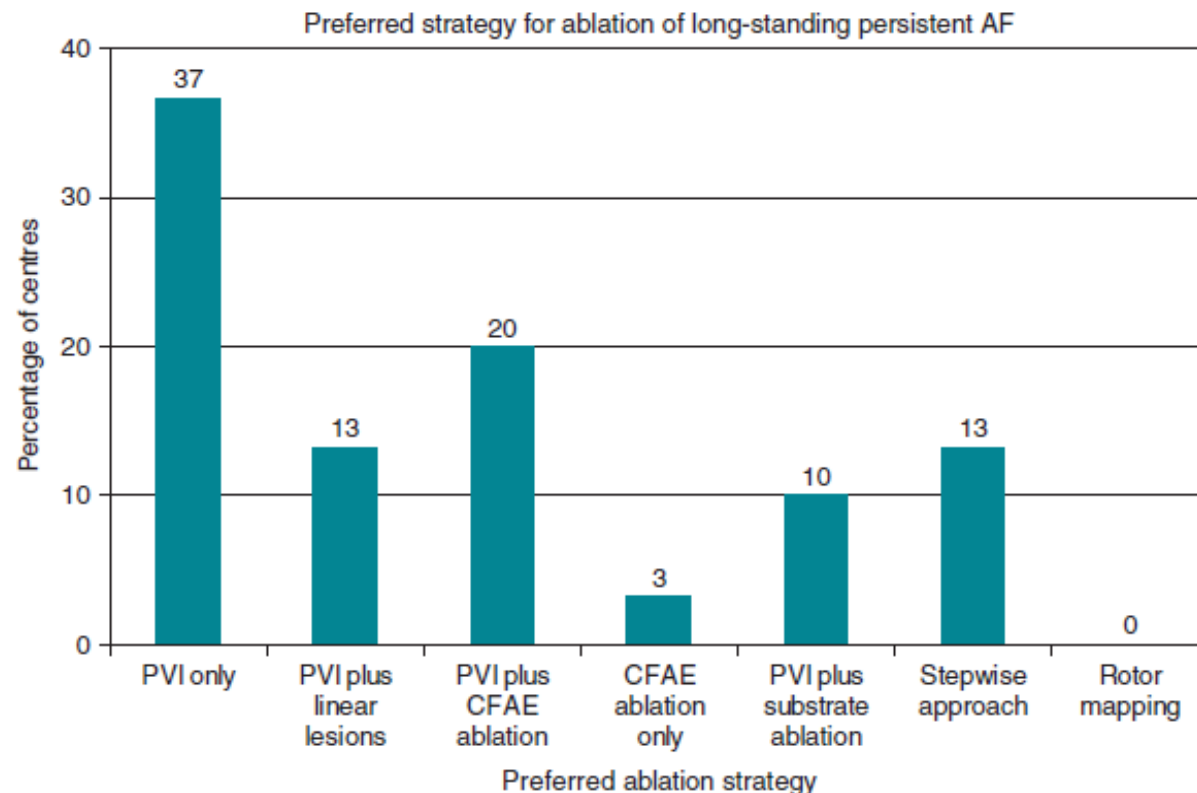


Figure 2 Preferred strategy for first ablation of long-standing persistent AF. CFAE, complex fractionated atrial electrograms; PVI, pulmonary vein isolation; stepwise approach, stepwise approach until termination of AF; substrate ablation, substrate mapping and isolation of low-voltage areas.

Persistan AF Ablasyonu

- Persistan AF ablasyonunda tek başına PVI yeterli değil
- Tekrarlı uygulamalarda sadece PVI yapıldığında başarı artmıyor
- PV dışı tetikleyiciler persistan AF'da daha sık ve önemli
- PVI yanında SVC, CS, LAA, septum ve LA posterior duvar izolasyonu başarıyı artırmaktadır.
- Redo vakalarda tekrarlı işlemlerle PV ve non-PV tetikleyicilerin ablasyonu uzun dönem başarıyı artırıyor (>%80)

Abstract

Background Pulmonary vein ablation (PVA) is a recently developed technique for the treatment of atrial fibrillation (AF) with acceptable success and safety. The aim of this study was to evaluate the success and safety of PVA and the periprocedural complications. We also evaluated the predictors of recurrence at long-term follow-up.

Method A total of 236 patients with AF underwent PVA with a median follow-up of 10.45 years and 79.6% of patients were free from AF at follow-up.

Results Acute procedural success was 95.8%. The mean procedural and fluoroscopy time was 35.5 min. At a median of 10.45 years of follow-up, 79.6% of paroxysmal AF patients and 70.0% of persistent AF patients were free from AF. In multivariate analysis, body mass index (BMI) (HR, 1.35; 95% confidence interval (CI), 1.05–1.72, $p=0.019$), smoking (HR, 2.12; 95% CI, 1.12–3.98, $p=0.021$), paroxysmal AF (HR, 1.24; 95% CI, 1.05–1.46, $p=0.009$), duration of AF (HR, 1.42; 95% CI, 1.18–2.61, $p=0.015$), left atrium (LA) diameter (HR, 2.42; 95% CI, 1.64–5.88, $p<0.001$) and early AF recurrence (HR, 4.88; 95% CI, 2.86–8.28, $p=0.001$) were predictors of AF recurrence.

Conclusion PVA is a safe and effective procedure for the treatment of AF. The predictors of AF recurrence are BMI, smoking, paroxysmal AF, duration of AF, LA diameter and early AF recurrence. PVA is a safe and effective procedure for the treatment of AF. The predictors of AF recurrence are BMI, smoking, paroxysmal AF, duration of AF, LA diameter and early AF recurrence.

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8.28) were predictors of AF recurrence.

It is concluded that AF ablation with PVA is a safe and effective procedure for the treatment of AF. The predictors of AF recurrence are BMI, smoking, paroxysmal AF, duration of AF, LA diameter and early recurrence. PVA is a safe and effective procedure for the treatment of AF. The predictors of AF recurrence are BMI, smoking, paroxysmal AF, duration of AF, LA diameter and early recurrence.

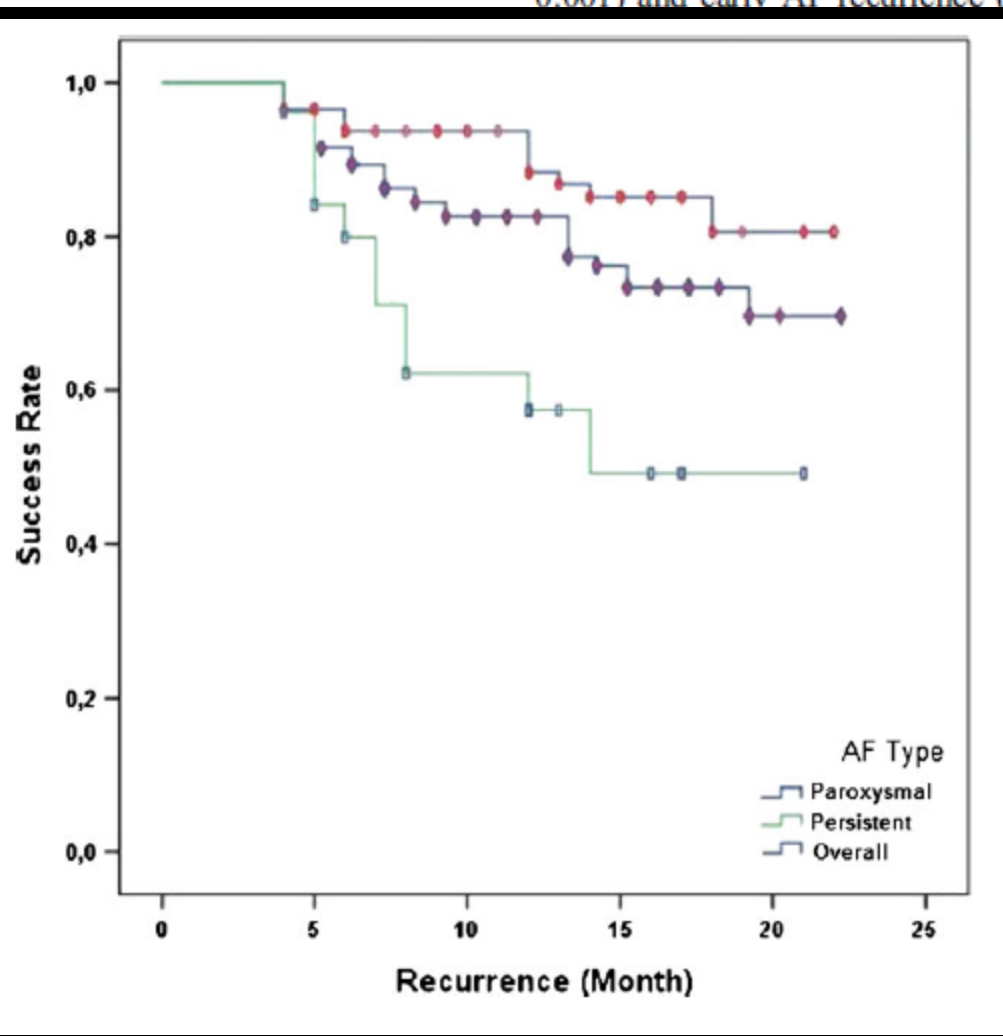
Conclusion

Pulmonary vein isolation (PVI) is a safe and effective procedure for atrial fibrillation (AF) with acceptable success and safety. The aim of this study was to evaluate the success and safety of PVI and the periprocedural complications. We also evaluated the predictors of recurrence at long-term follow-up.

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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[‡]

Aims

To assess the 1 year efficacy of pulmonary vein isolation (PVI) as index procedure for persistent atrial fibrillation (PersAF) comparing conventional radiofrequency irrigated-tip catheter ablation (RFCA) using contact-force technology and ablation using the second-generation cryoballoon (CB-AdvA).

Methods and results

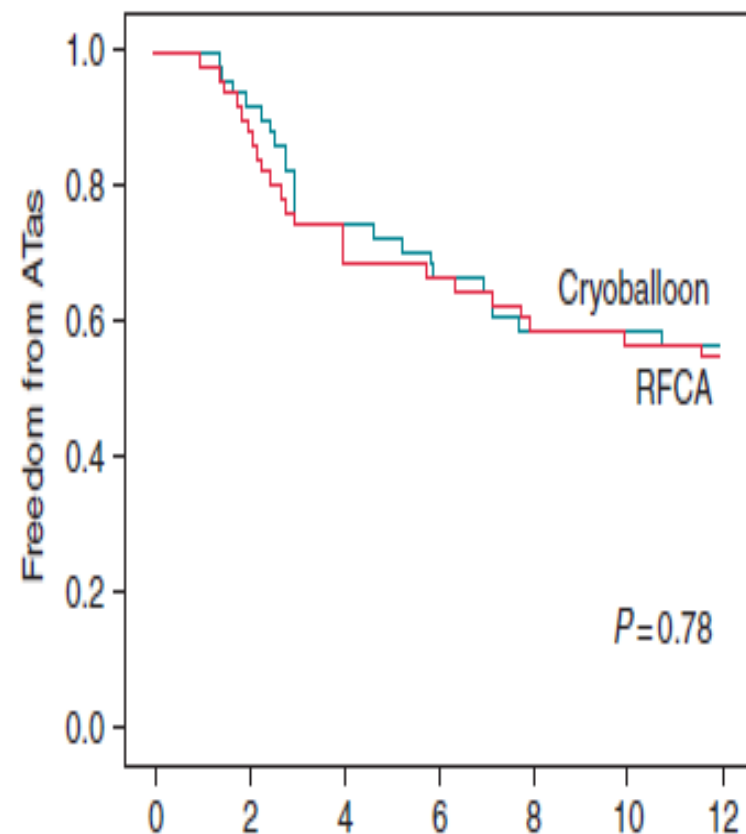
One hundred consecutive patients (74 male, 74%; mean age 62.4 ± 9.6 years) with drug-refractory PersAF undergoing PVI using RFCA and CB-AdvA were enrolled. Follow-up was based on outpatient clinic visits including Holter-electrocardiograms. Recurrence of atrial tachyarrhythmias (ATas) was defined as a symptomatic or documented episode >30 s. Among 100 patients, 50 underwent RFCA whereas 50 CB-AdvA. Mean procedure and fluoroscopy times were 90.5 ± 41.7 vs. 140.2 ± 46.9 min and 14.5 ± 6.6 vs. 19.8 ± 6.8 min in the CB-Adv and in the RFCA group, respectively ($P < 0.01$). At 1 year follow-up, after a 3 months blanking period (BP), freedom from ATas off-drugs after a single procedure was 60% (28/50 patients) in the CB-Adv and 56% (27/50 patients) in the RFCA group ($P = 0.71$). Multivariate analysis demonstrated that PersAF duration ($P = 0.01$) and relapses during BP ($P = 0.02$) were independent predictors of ATa recurrences following the index procedure.

Conclusion

Freedom from ATas following PersAF ablation with RFCA and CB-Adv is comparable at 1 year follow-up after a single procedure. Ablation with the CB-Adv is associated with shorter procedure time and radiation exposure as compared with RFCA. Atrial tachyarrhythmias occurrence during BP and longer time of PersAF seem to be significant predictors of arrhythmia recurrences after the index procedure.

Table 1 Clinical and procedural characteristics of the study population

	CB-Adv (n = 50)	RFCA (n = 50)	Pvalue
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



	Months of follow-up						
N [*] at risk	0	2	4	6	8	10	12
Cryoballoon	50	46	37	33	29	29	28
RFCA	50	44	34	33	29	28	27

BACKGROUND Early studies demonstrated relatively low success rates for pulmonary vein isolation (PVI) alone in patients with persistent atrial fibrillation (PeAF). However, the advent of new technologies and the observation that additional substrate ablation does not improve outcomes have created a new focus on PVI alone for treatment of PeAF.

OBJECTIVE The purpose of this study was to systematically review the recent medical literature to determine current medium-term outcomes when a PVI-only approach is used for PeAF.

METHODS An electronic database search (MEDLINE, Embase, Web of Science, PubMed, Cochrane) was performed in August 2016. Only studies of PeAF patients undergoing a "PVI only" ablation strategy using contemporary radiofrequency (RF) technology or second-generation cryoballoon (CB2) were included. A random-effects model was used to assess the primary outcome of pooled single-procedure 12-month arrhythmia-free survival. Predictors of recurrence were also examined and a meta-analysis performed if ≥ 4 studies examined the parameter.

RESULTS Fourteen studies of 956 patients, of whom 45.2% underwent PVI only with RF and 54.8% with CB2, were included. Pooled single-procedure 12-month arrhythmia-free survival was 66.7% (95% confidence interval [CI] 60.8%–72.2%), with the majority of patients (80.5%) off antiarrhythmic drugs. Complication rates were very low, with cardiac tamponade occurring in 5 patients (0.6%) and persistent phrenic nerve palsy in 5 CB2 patients (0.9% of CB2). Blanking period recurrence (hazard ratio 4.68, 95% CI 1.70–12.9) was the only significant predictor of recurrence.

CONCLUSION A PVI-only strategy in PeAF patients with a low prevalence of structural heart disease using contemporary technology yields excellent outcomes comparable to those for paroxysmal AF ablation.

KEYWORDS Atrial fibrillation; Arrhythmia; Ablation; Pulmonary vein isolation; Cryoballoon

(Heart Rhythm 2017;14:661–667) © 2017 Heart Rhythm Society. All rights reserved.

Persistent AF'de Cryo

TABLE 3 Efficacy and safety of PVI using cryoballoon in persistent AF

Study	N	Ablation strategy	Acute PV isolation	Mean procedure time, min	Mean fluoroscopy	Transient PN palsy	Freedom from AF (mean follow-up)
Koektuerk ³⁴	100	PVI	100%	96	19.7	3%	67% at 10 months
Ciconte ³⁵	63	PVI	100%	87	14.9	6.3%	60.3% at 12 months
Lemes ³⁶	49	PVI	100%	113	21	0%	69% at 12 months
Straube ³⁷	173	PVI	100%	155	27	1%	67% at 12 months
Tscholl ³⁸	50	PVI	100%	146	25.8	0%	56% at 22 months
Akkaya ³⁹	101	PVI+roof line	100%	120	20	2%	70.3% at 37 months

Chen S. et.al. Atrial fibrillation ablation using cryoballoon technology: Recent advances and practical techniques. *J Cardiovasc Electrophysiol.* 2018;29:932–943.

Abstract

Background Catheter ablation is an established treatment option for patients with symptomatic atrial fibrillation (AF). The cornerstone of AF ablation is pulmonary vein isolation (PVI). The second-generation cryoballoon (2G-CB) has shown non-inferiority to radiofrequency (RF) ablation in paroxysmal AF in several trials. Growing evidence suggests that 2G-CB is also effective in patients with persistent AF (perAF). The aim of this study was to summarize and analyze available data on safety and mid-term (≥ 12 months) efficacy of PVI using 2G-CB in patients with perAF.

Methods We did a search in PubMed, Web of Science, Cochrane Library, and clinicaltrials.gov in December 2016 for studies of 2G-CB ablation for perAF. Studies reporting clinical success rates at a follow-up (FU) of ≥ 12 months were included. Success was defined as freedom from any atrial arrhythmia lasting > 30 s after an initial blanking period of 3 months. Acute success and complication rates were also assessed. Data were analyzed applying random-effects model.

Results A total of 917 patients from 11 studies meeting study inclusion criteria were analyzed. After a mean FU of 16.7 ± 3.0 months, 68.9% were free from recurrences [95% confidence interval (CI) 63.4–74.7%]. Overall acute success rate was 99.7% (95% CI 99.2–100%). Complications

occurred in 5.5% (95% CI 2.4–9.6%). Vascular access complications were the most frequent 3.3% (95% CI 1.5–5.6%). The rate of phrenic nerve palsy/injury was 2.09% (95% CI 0.8–3.9%). No death, stroke or myocardial infarction was reported.

Conclusion The 2G-CB seems to be safe and effective in the treatment of perAF in the mid-term.

Keywords Meta-analysis · Second-generation cryoballoon · Persistent atrial fibrillation

Abbreviations

2G-CB	Second-generation cryoballoon
AAD	Antiarrhythmic drugs
AF	Atrial fibrillation
BP	Blanking period
CB	Cryoballoon
FU	Follow-up
Pts	Patients
PxAF	Paroxysmal AF
PerAF	Persistent AF
PNP	Phrenic nerve palsy/injury
PV	Pulmonary vein
PVI	Pulmonary vein isolation
RF	Radiofrequency

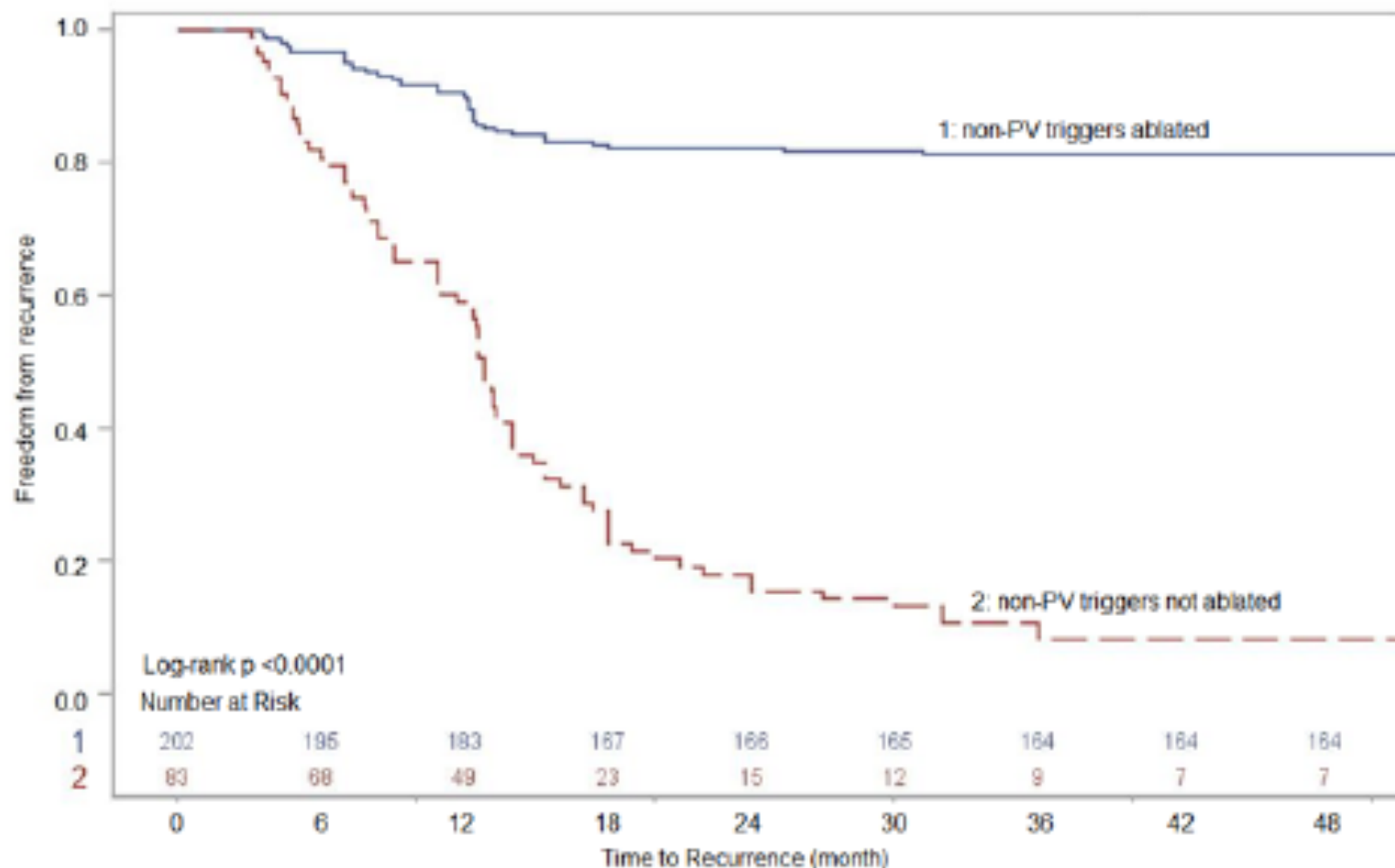
Non-PV Tetikleyiciler

- Sıklık: %14-40
- En sık: PW, LAA, CS, SVC, IVC, Marshall Ligameni, Krista Terminalis, IAS.
- Özellikle redo olgularda ve non-paroksizmal AF'da bunların ablasyonu öneriliyor.

Procedural findings and ablation outcome in patients with atrial fibrillation referred after two or more failed catheter ablations

Short Title: AF recurrence after multiple procedures

Sanghamitra Mohanty, MD MS¹, Chintan Trivedi, MD MPH¹, Carola Gianni, MD¹, Domenico Giovanni Della Rocca, MD¹, Eli Hamilton Morris, BS², J. David Burkhardt, MD¹, Javier E. Sanchez, MD¹, Rodney Horton, MD¹, G. Joseph Gallinghouse, MD¹, Richard Hongo, MD², Salwa Beheiry, RN², Amin Al-Ahmad, MD¹, Luigi Di Biase, MD PhD^{1,3}, Andrea Natale, MD^{1,2,4,5}



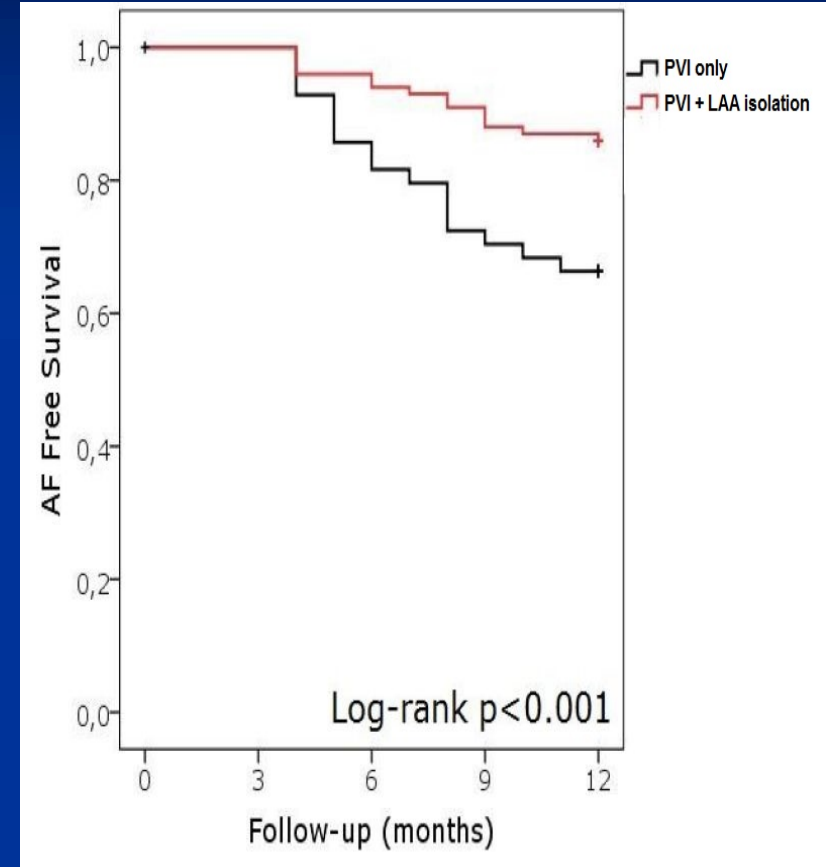
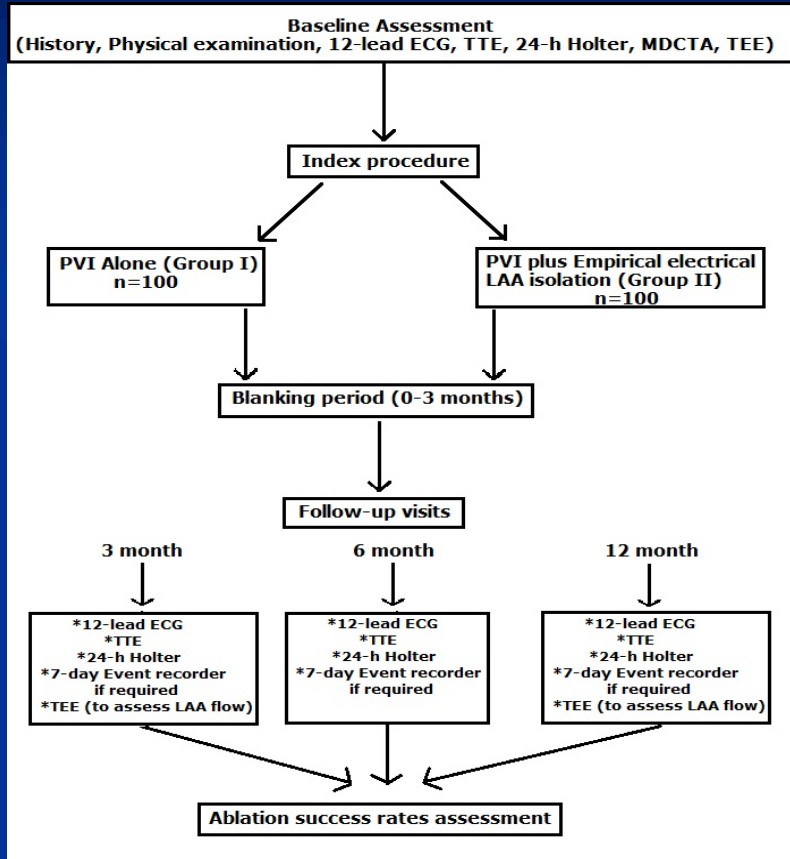
LAA isolation

“To isolate or not to isolate the left atrial appendage, that is the question”

- LAA özellikle non-paroksizmal AF’de önemli bir non-PV tetikleyici odağıdır .
- Bir çalışmadan redo AF ablasyonu yapılan ve PV izole olan hastaların %27’sinde LAA’da firing bulunmuştur. Bu hastaların %8’inde LAA AF tetikleyen tek non-PV odak olarak tespit edilmiştir.

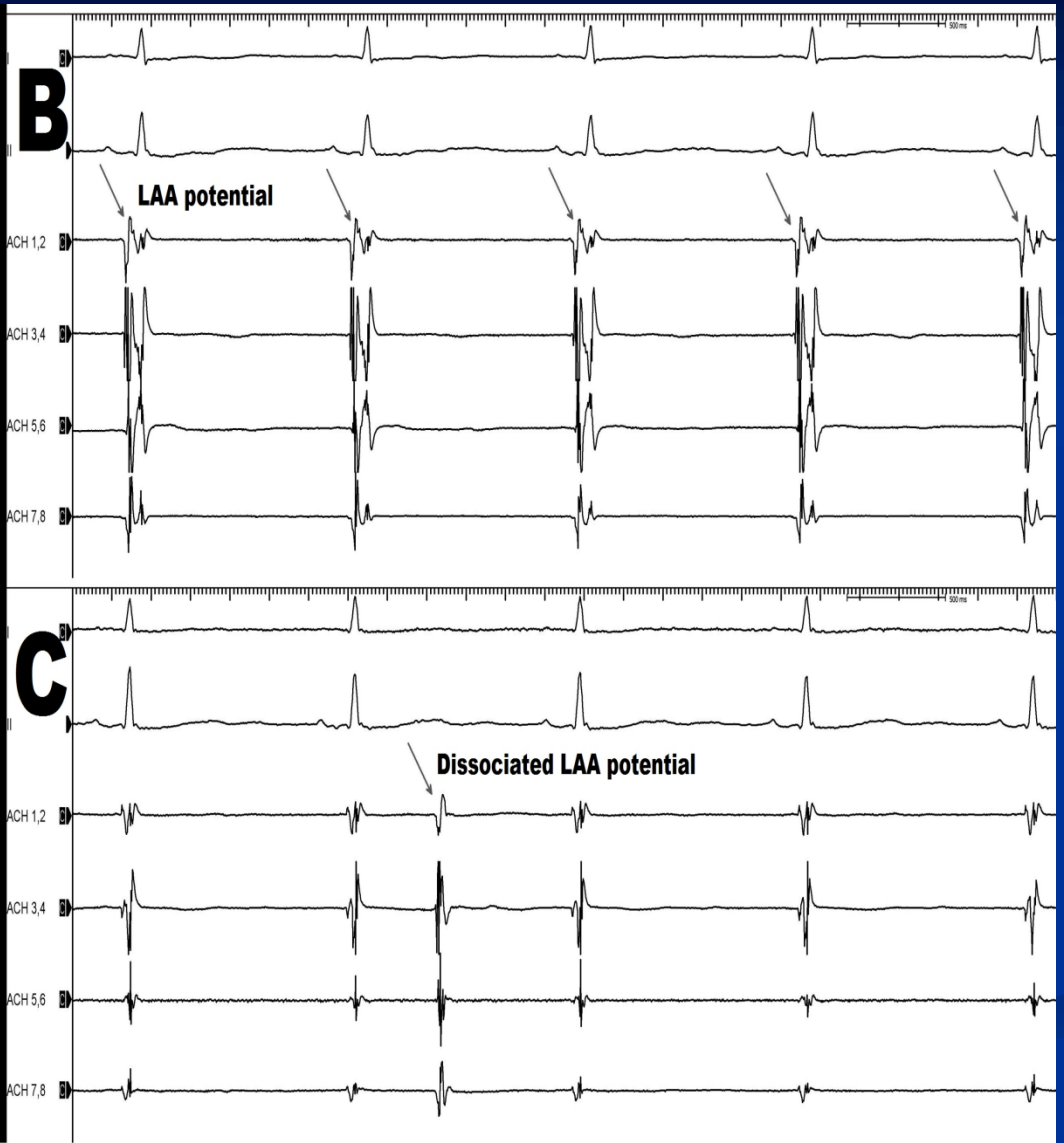
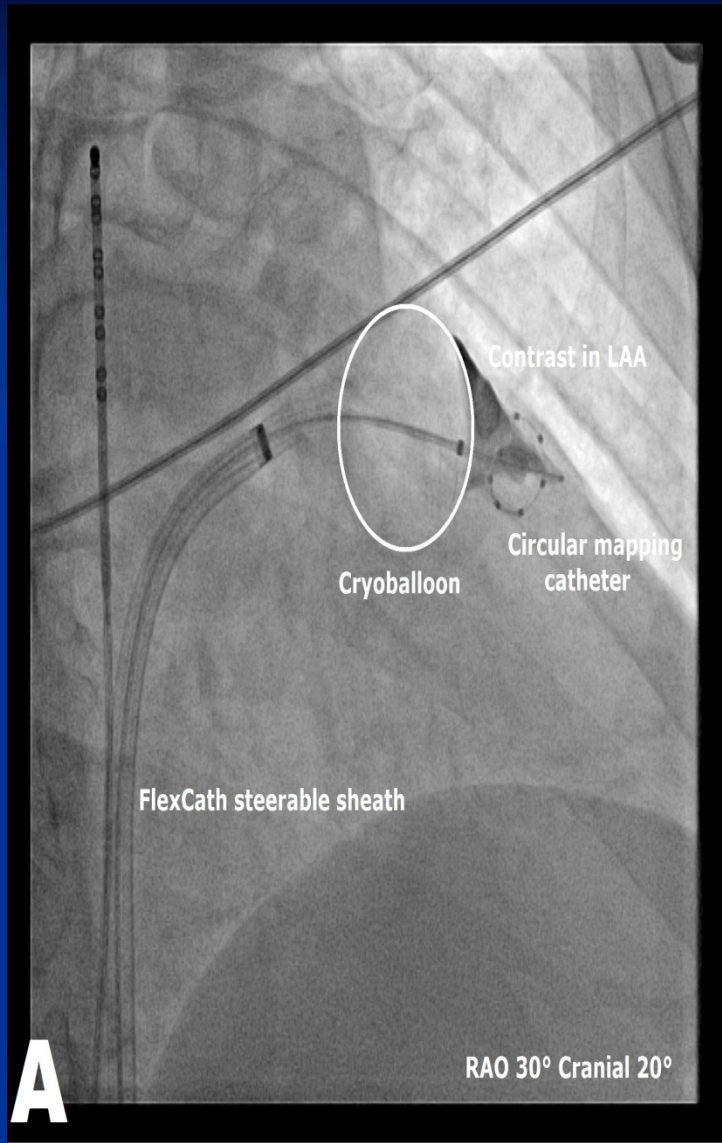
* Di Biase L, et al. Left atrial appendage: an underrecognized trigger site of atrial fibrillation. Circulation. 2010;122:109–18.

CRYObalon ile LAA izolasyonu



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

Yorgun H, Canpolat U, Kocyigit, D, Çöteli C, Evranos, B, Aytemir K.



Abstract

Background The cryoballoon catheter has proven to be both safe and effective when used for pulmonary vein (PV) isolation in patients with paroxysmal atrial fibrillation (AF). More recently, the cryoballoon catheter has demonstrated the ability to create durable, transmural, and large areas of PV ablation. However, persistent and long-standing persistent AF can require additional cardiac substrate modification(s) before a patient is returned to normal sinus rhythm. Yet, no study has reported the techniques necessary to achieve extra-PV lesion sets using the cryoballoon catheter.

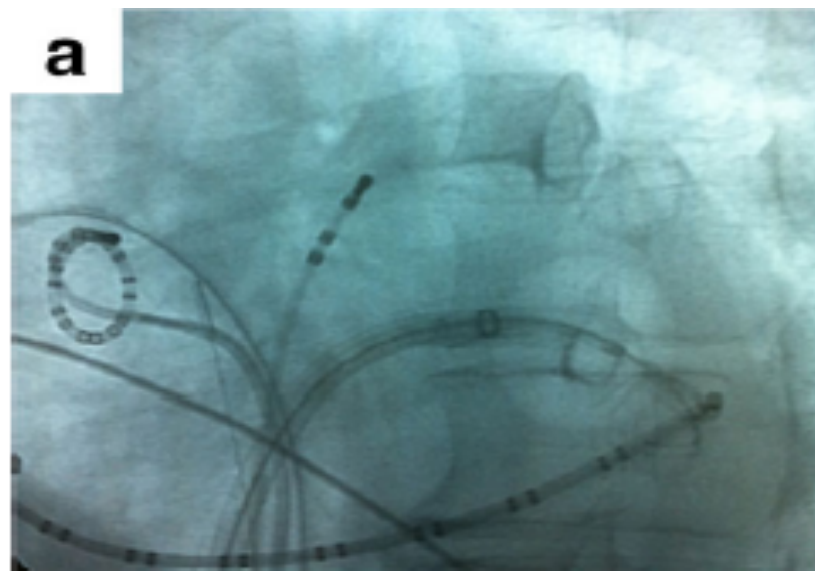
Methods Cryoballoon ablation was completed in 225 patients with varying degrees of AF disease. In several cases, the balloon was used for more than PV isolation. This study examines the 11 anatomical cardiac locations where extra-PV lesion sets were utilized.

Results This study demonstrates that these extra-PV ablations can be done safely with the balloon catheter (3.6 % total complication rate). The 12-month efficacy (freedom from all atrial arrhythmia) using these techniques was 88 % in 88 patients with paroxysmal AF, 71 % in 75 patients with persistent AF, and 55 % in 62 patients with long-standing persistent AF.

While using this protocol, mean procedure time was 2.2 ± 0.6 h, and average fluoroscopy time was 4.2 ± 2.2 min.

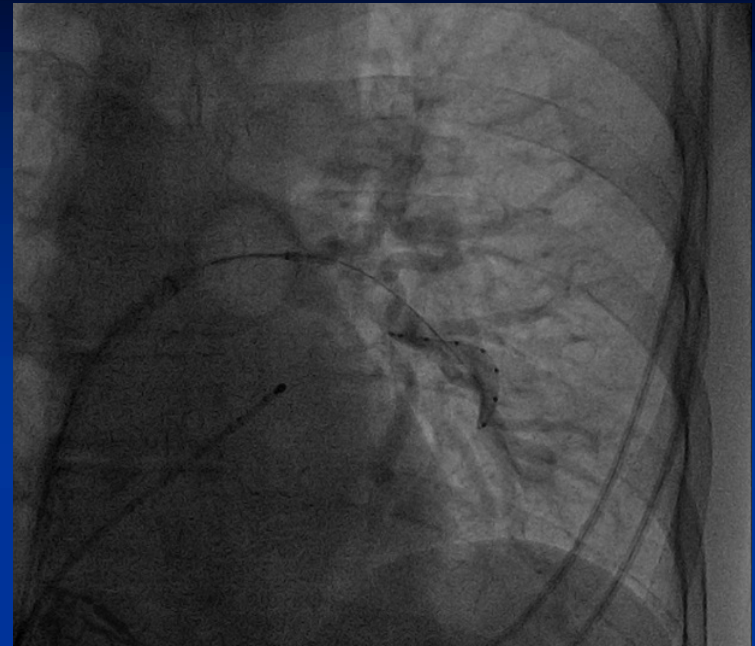
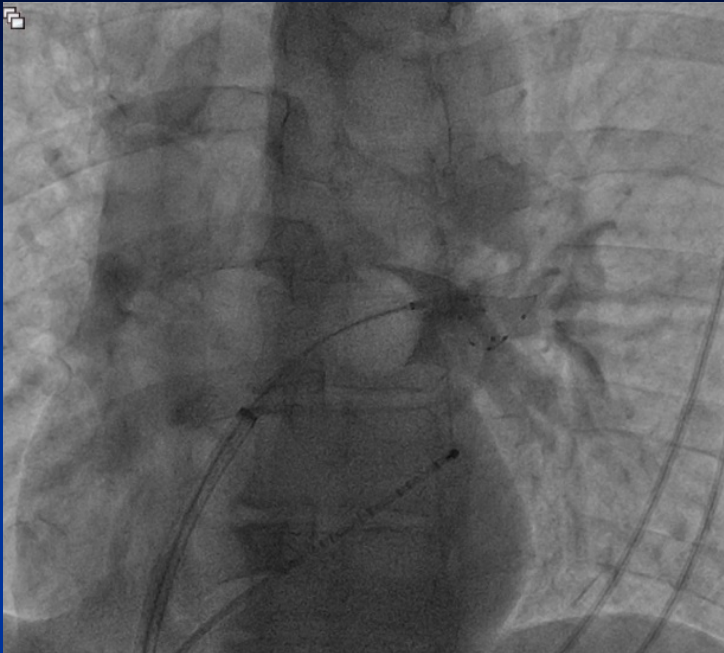
Conclusions The cryoballoon catheter can be used to make effective and safe extra-PV lesions. However, these techniques will need to be validated in more multi-center studies with review of complication rates and long-term freedom from AF.

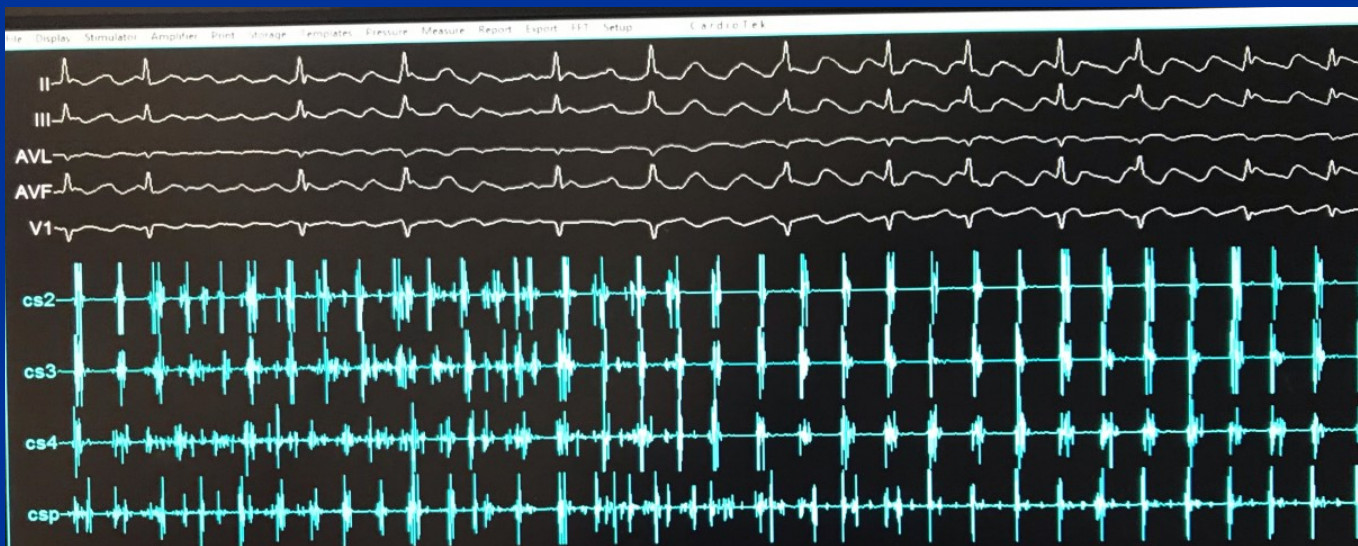
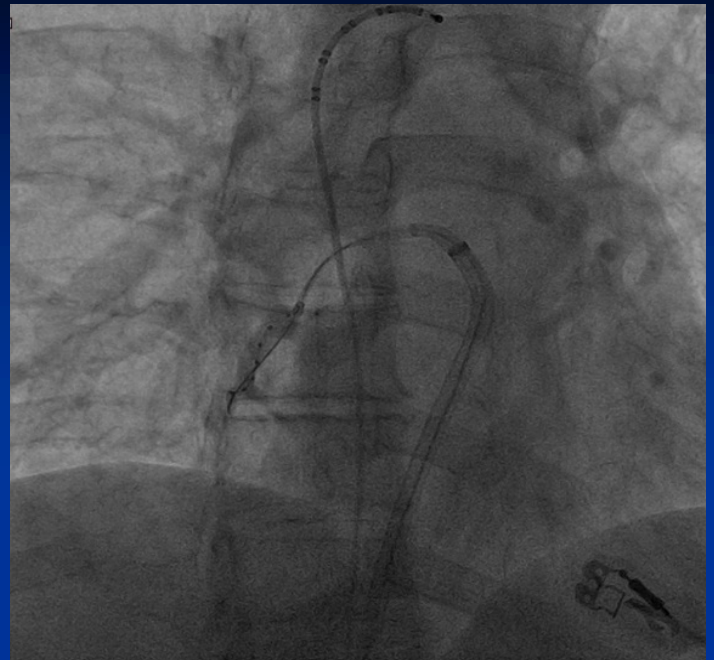
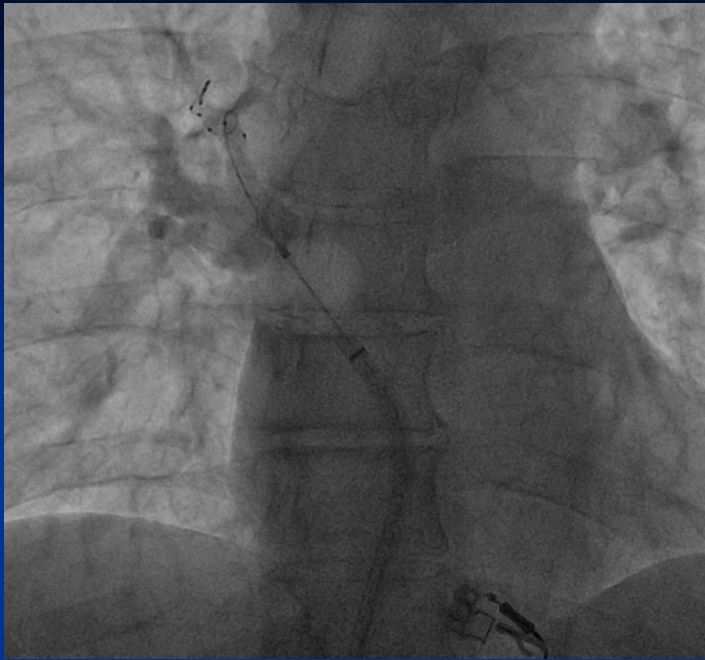
Keywords Arrhythmia · Atrial fibrillation · Cryoablation · Cryoballoon · Pulmonary vein isolation

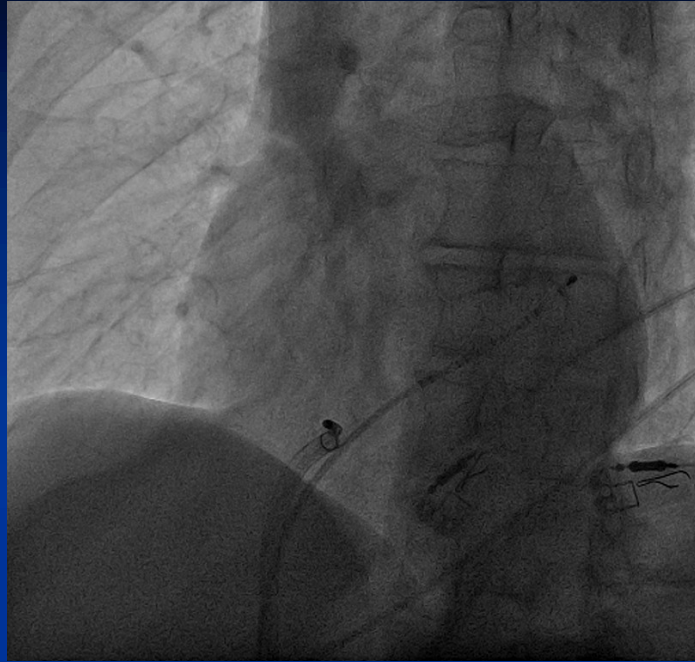


Olgu

- 62 yaş, Erkek
- FM: Nabız düzensiz
- EKG: Atriyal fibrilasyon
- EKO: EF:%65, LA:35.
- KAG : Non-kritik darlıklar





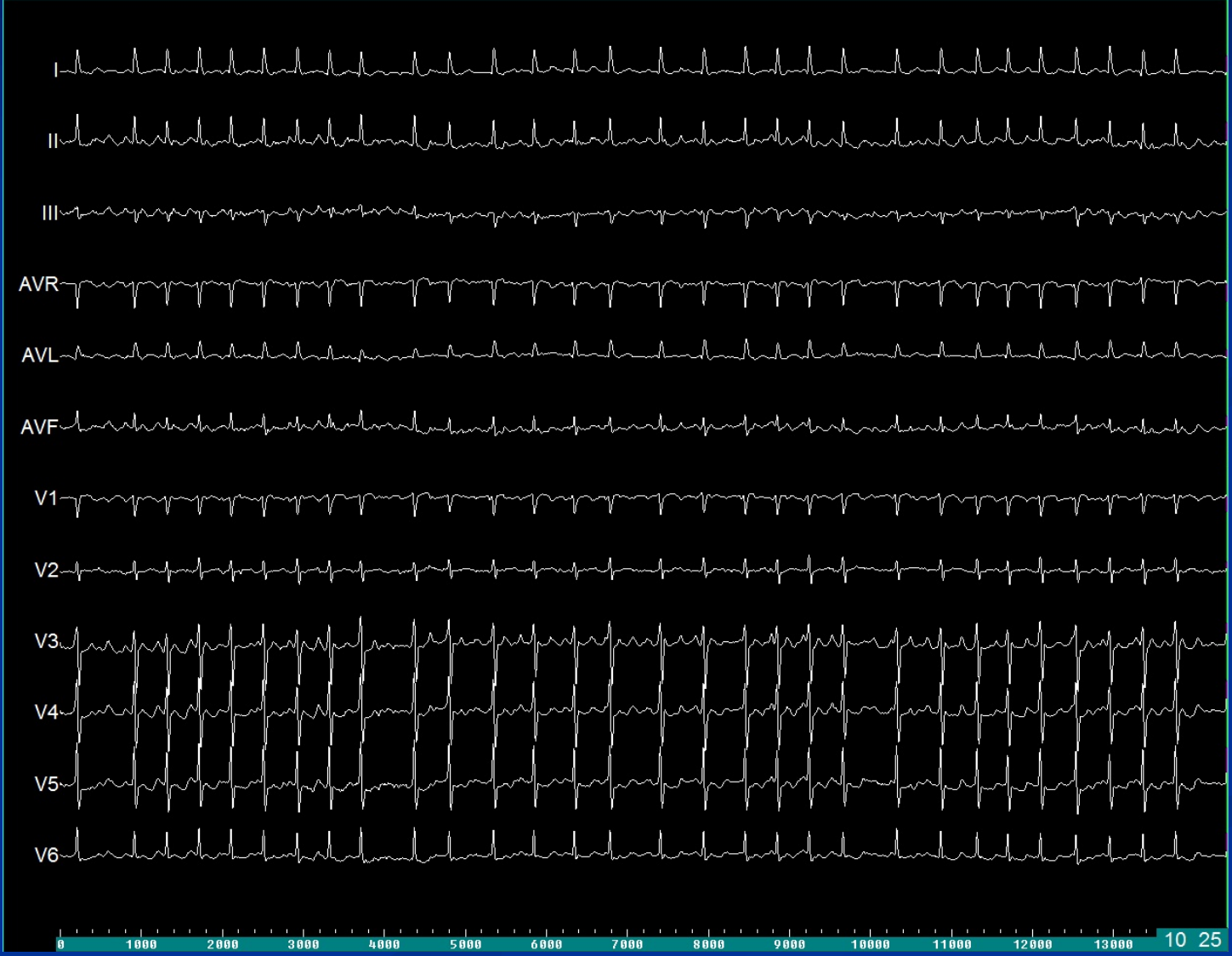


Redo ablasyon

- PVI kontrolü
 - Rekonneksiyon varsa re-izolasyon
- İlave ablasyon
 - Non-PV odak ablasyonu
 - Substrat ablasyonu
 - Atriyal aritmi indüksiyonu (AT, AFL, AT) ve ablasyonu

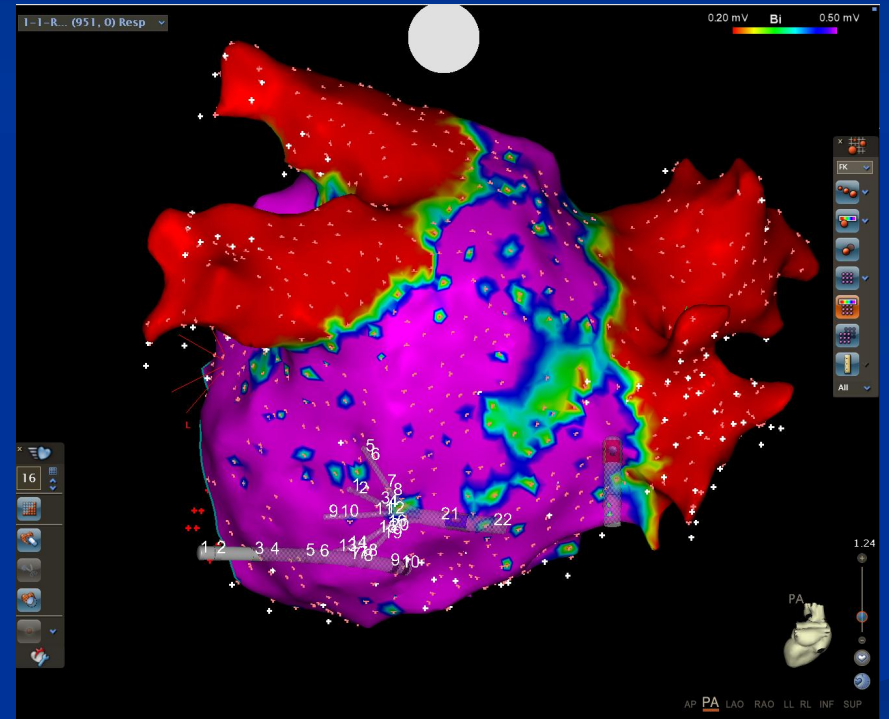
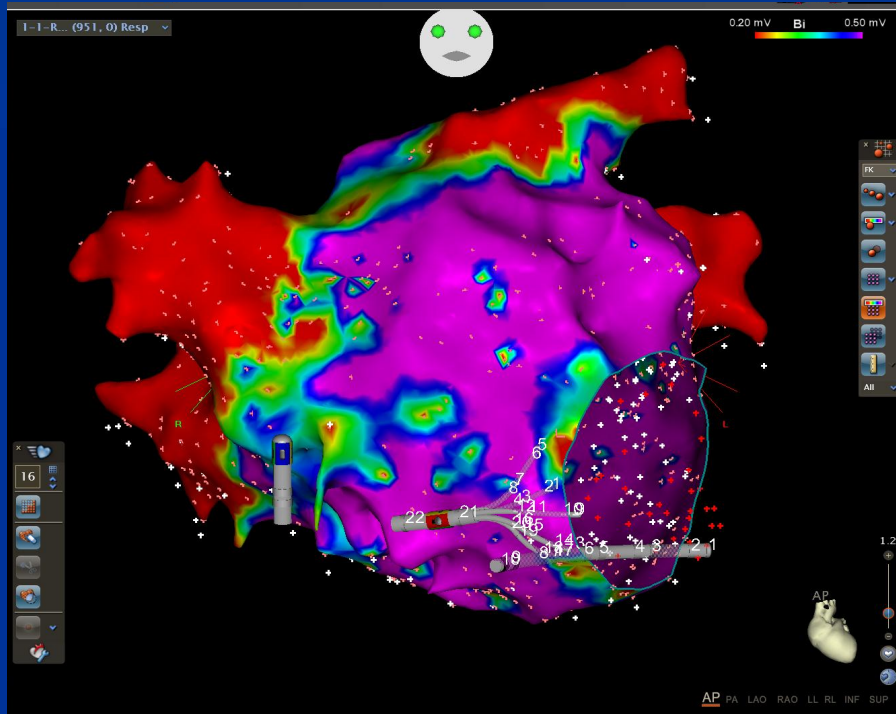
VAKA

- 58 yaşında erkek hasta
- Koroner arter hastalığı, HT, DM, HL, GUT
- 5/2014 Koroner arter stent
- 7/2014 AF CRYO (persistan AF için)
- 11/2018 Nüks
- EKG: Atriyal fibriloflutter
- EKO: EF:%50, LA:44, LV:54, 1 TY, 2-3 MY, IVS:13 mm

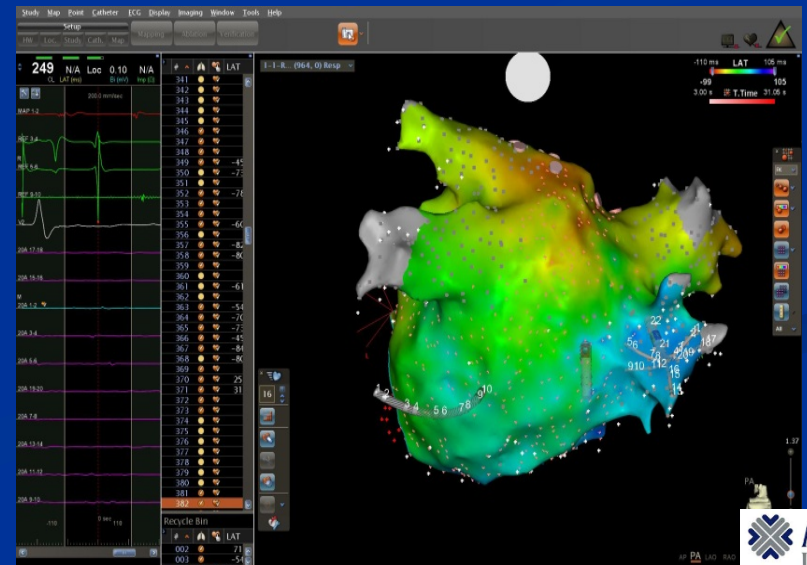
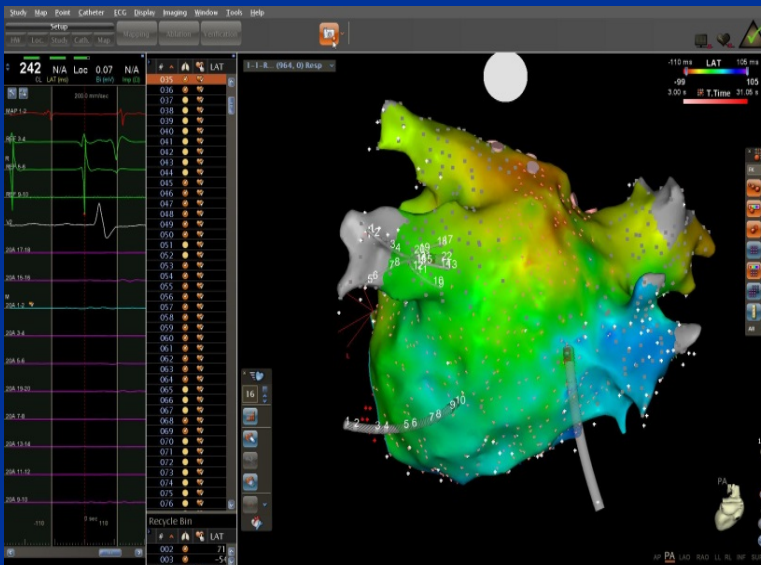
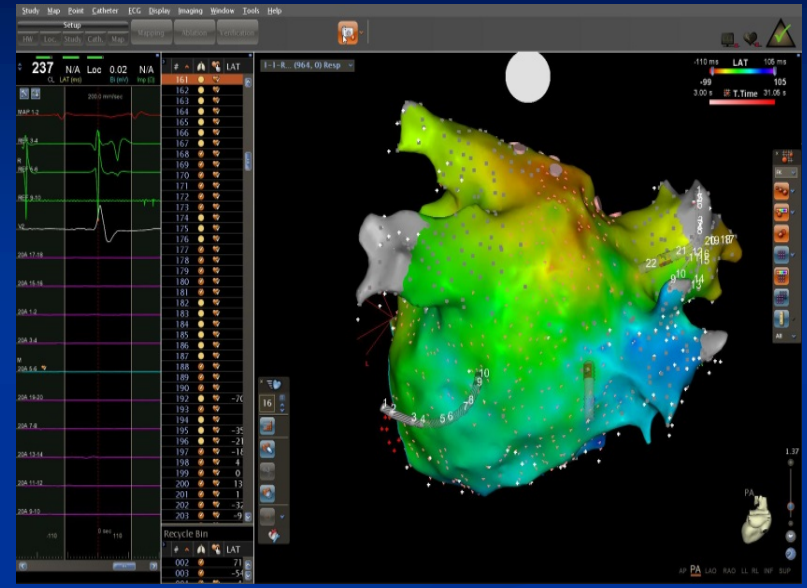
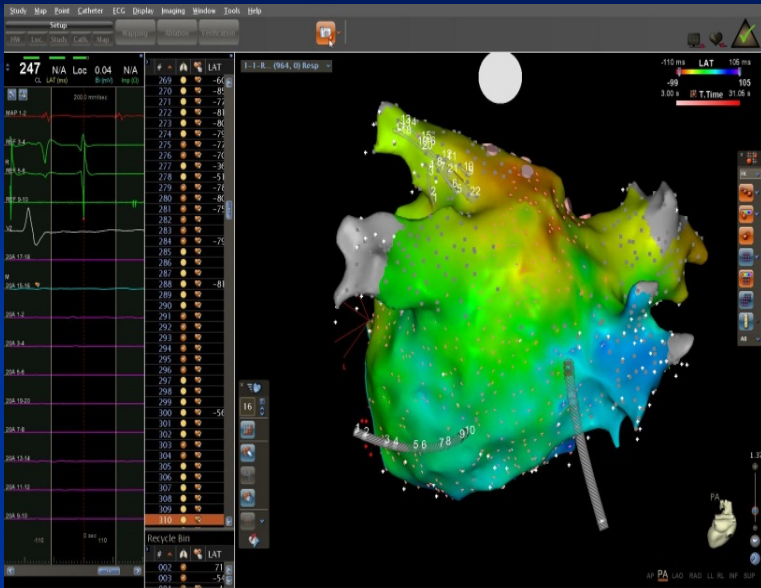




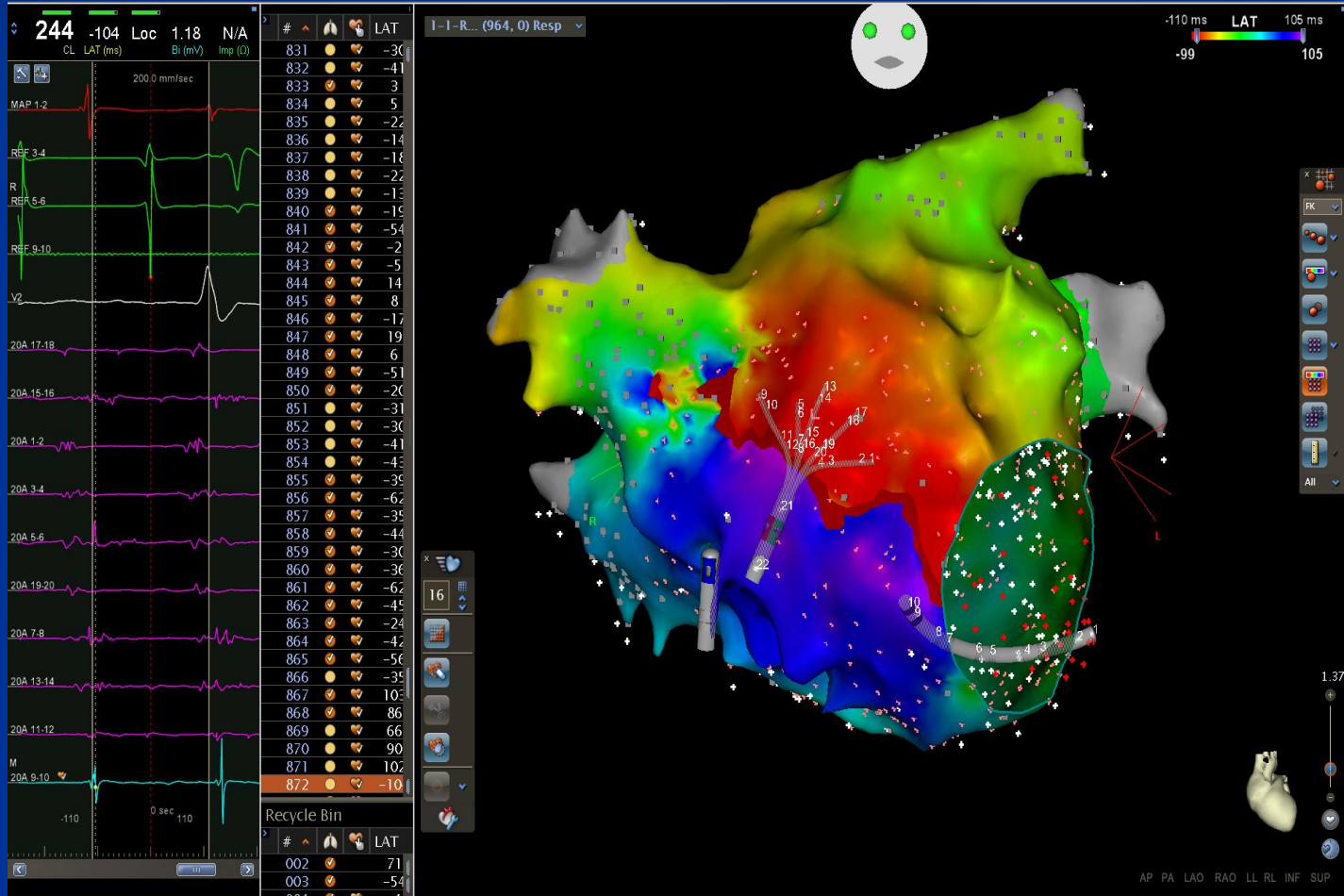
LA Bipolar Voltage Map



Pentaray ile PV izolasyon kontrolü



Pentaray'de fraksiyone sinyaller



NSR

