What's New in Adult Electrophysiology?:

New ablation technologies

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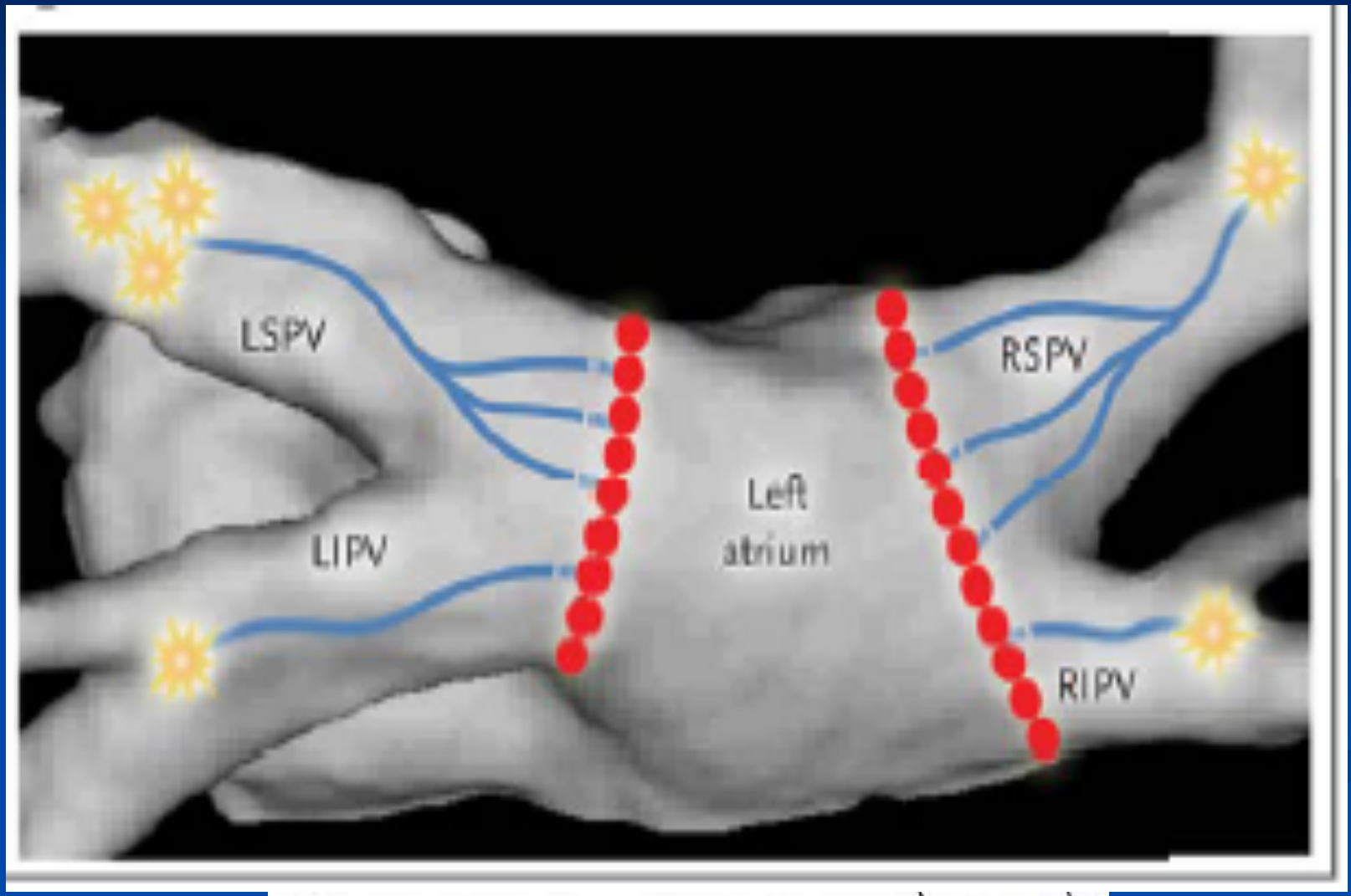
Istanbul Medipol University

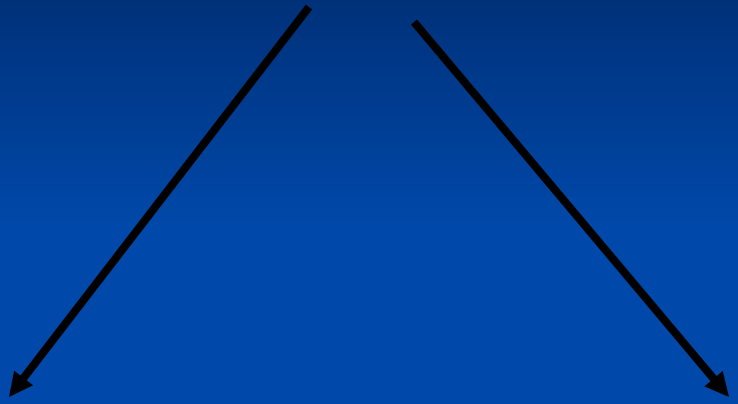
Outline of my presentation

1. AF ablation
    1. Cryoballoon,
    2. Hotballoon
2. Mapping technologies
    1. Rythmia
3. Catheter technologies
    1. Contact force

AF ablation=PVI



AF ABLATION



Conventional point-by-point RF ablation

- Ensite
- CARTO

Baloon based ablation

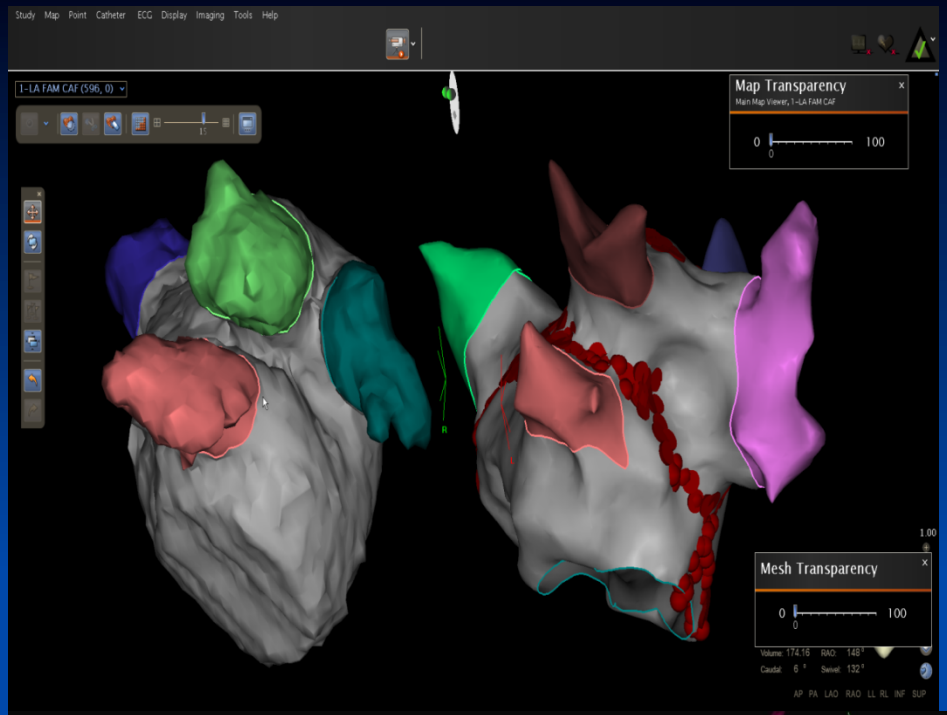
- CRYO ablation
- Hotballoon RF
- Ultrasound, Laser, HIFU

Burning or freezing for PVI?

FIRE AND ICE

Some say the world will end in fire,
Some say in ice.
From what I've tasted of desire
I hold with those who favor fire.
But if it had to perish twice,
I think I know enough of hate
To say that for destruction ice
Is also great
And would suffice.

By Robert Frost


Study Map Point Catheter ECG Display Imaging Tools Help
1-LA FAM CAF (596, 0)
Map Transparency
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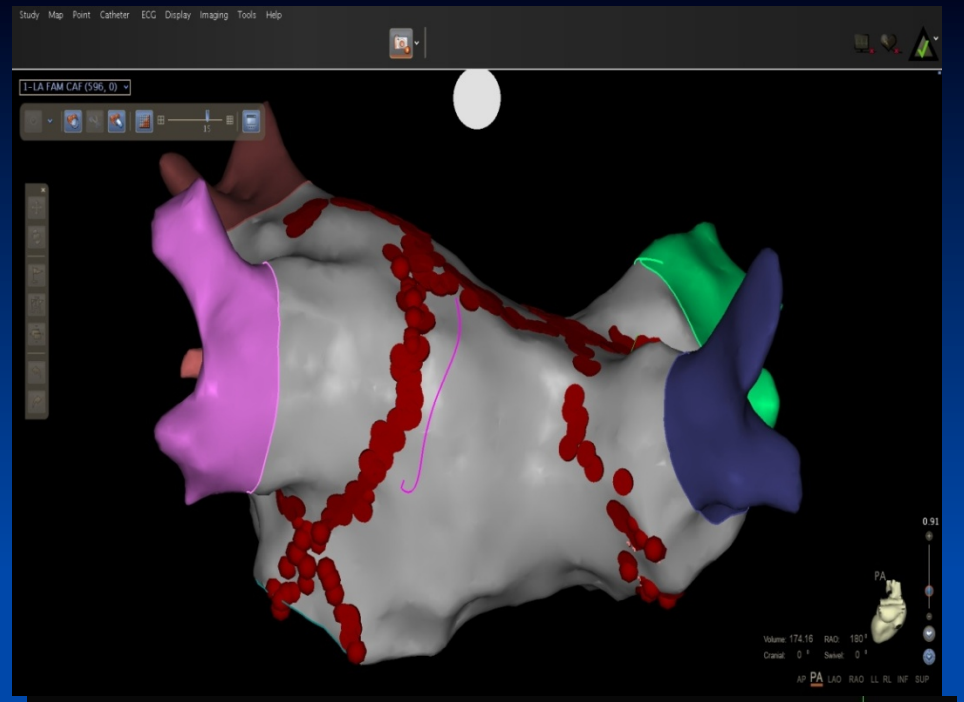
Study Map Point Catheter ECG Display Imaging Tools Help
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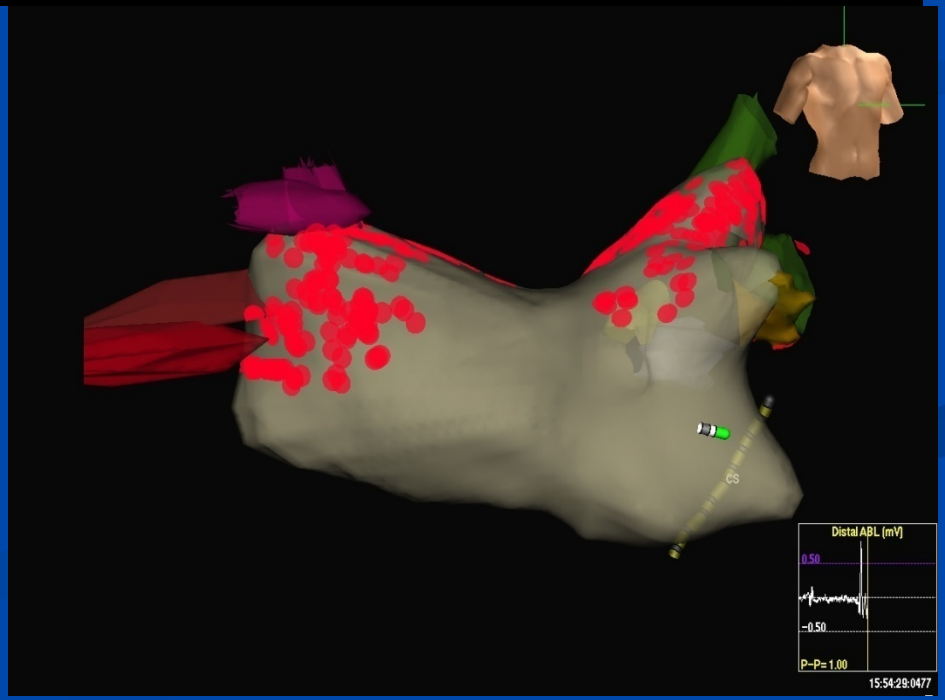
CS
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-0.50
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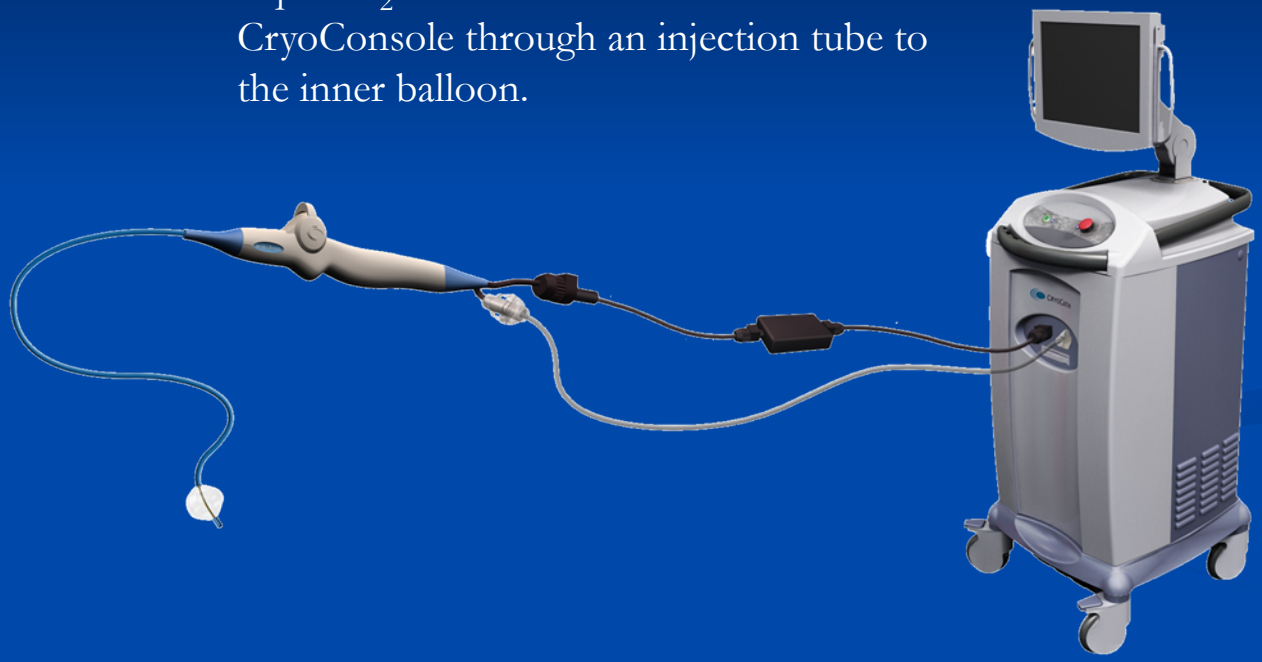
15:54:29:0477

CRYOBALLOON

- Success rates are similar to RF.
- Advantages:
  - Straightforward procedure: Easier to learn and to do, shorter procedure duration
  - Severe complication rate is lower
- Disanvantages:
  - Less or no substrate ablation
    - No CFAEs Mapping
    - No ablation lines: Roof, MV, CS etc.
  - PV anatomic variations
    - Accessory PV, small PV ostia, large PV ostia, etc.

CryoAblation System

1. Liquid N_2O is delivered from the CryoConsole through an injection tube to the inner balloon.



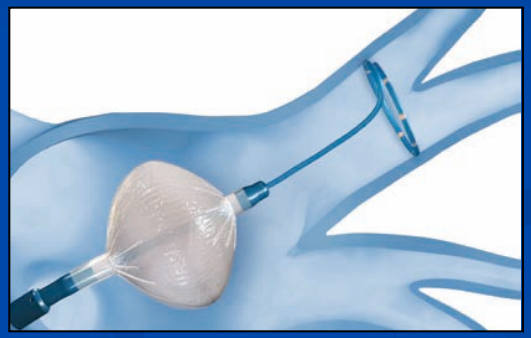
2. Inside the balloon the liquid N_2O vaporizes and absorbs heat from the surrounding tissue.

3. The vapor is returned to the console through a lumen maintained under vacuum.

4. The CryoConsole controls safe delivery of N_2O to the catheter and return of the vapor. Numerous safety systems mitigate potential hazards.

Arctic Front Advance™ Cryoballoon and Achieve™ Mapping Catheter

1. Access targeted vein



2. Inflate and position

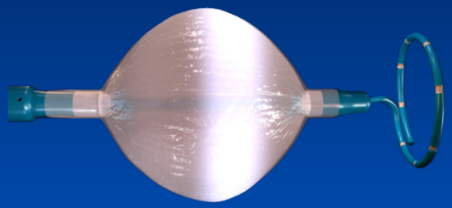
3. Occlude and ablate

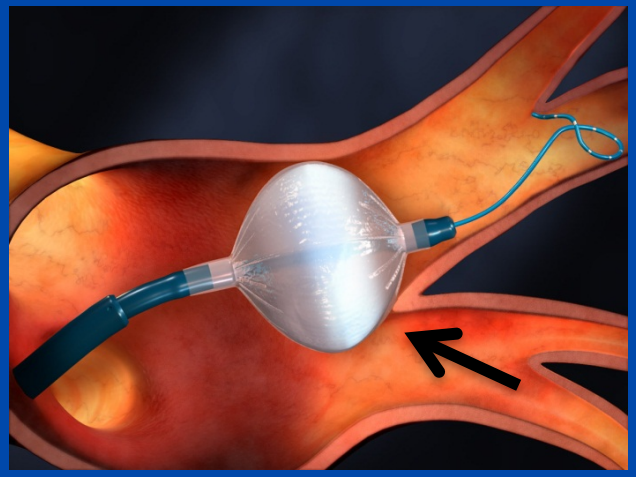
4. Assess PVI

CRYOBALLOON

1st generation

Arctic Front Cryoballoon

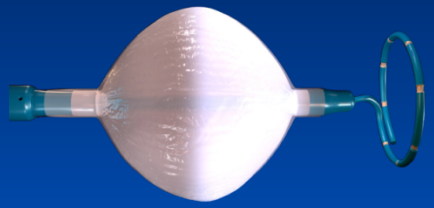


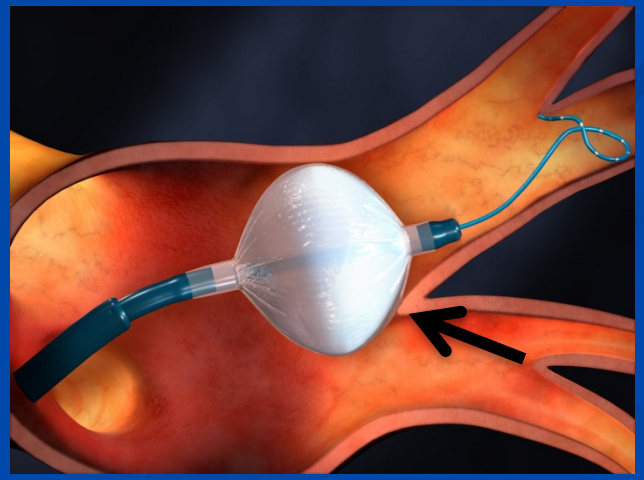


In Arctic Front Cryoballoon, the most concentrated cooling zone occurs near the equator of the balloon. Aligning the balloon coaxially with the PV may be an important factor, but may be difficult in some vein anatomies.

2nd generation

Arctic Front Advance Cryoballoon



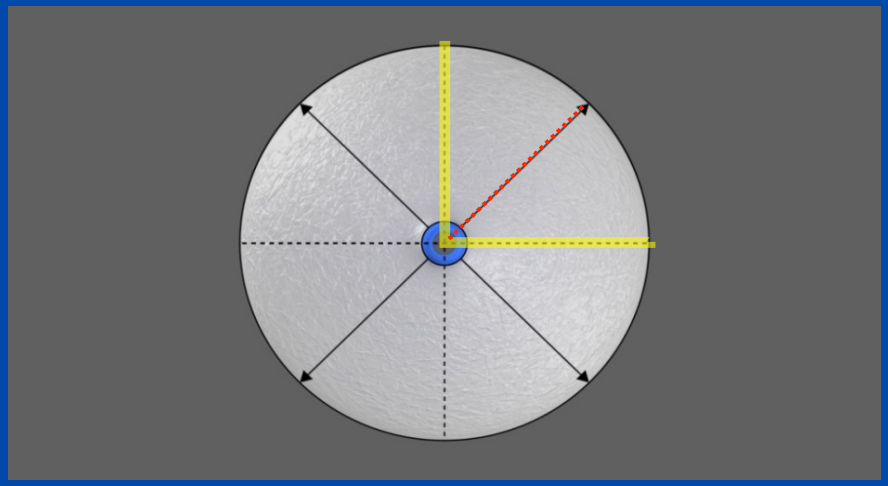


Arctic Front Advance Cryoballoon with EvenCool Cryo Technology is designed to allow more flexibility in balloon positioning to ablate the PVs.

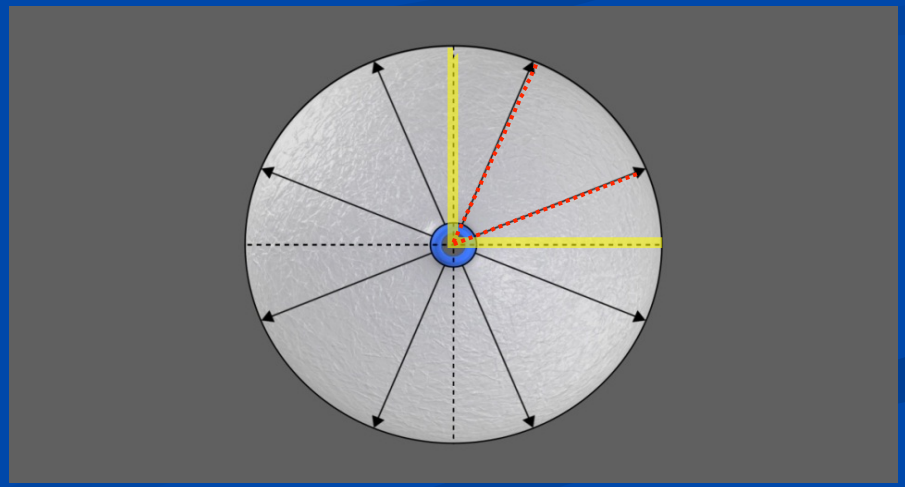
How Is More Uniform Cooling Achieved?

	Arctic Front Cryoballoon	Arctic Front Advance Cryoballoon
Injection tube ports	4	8

Arctic Front™

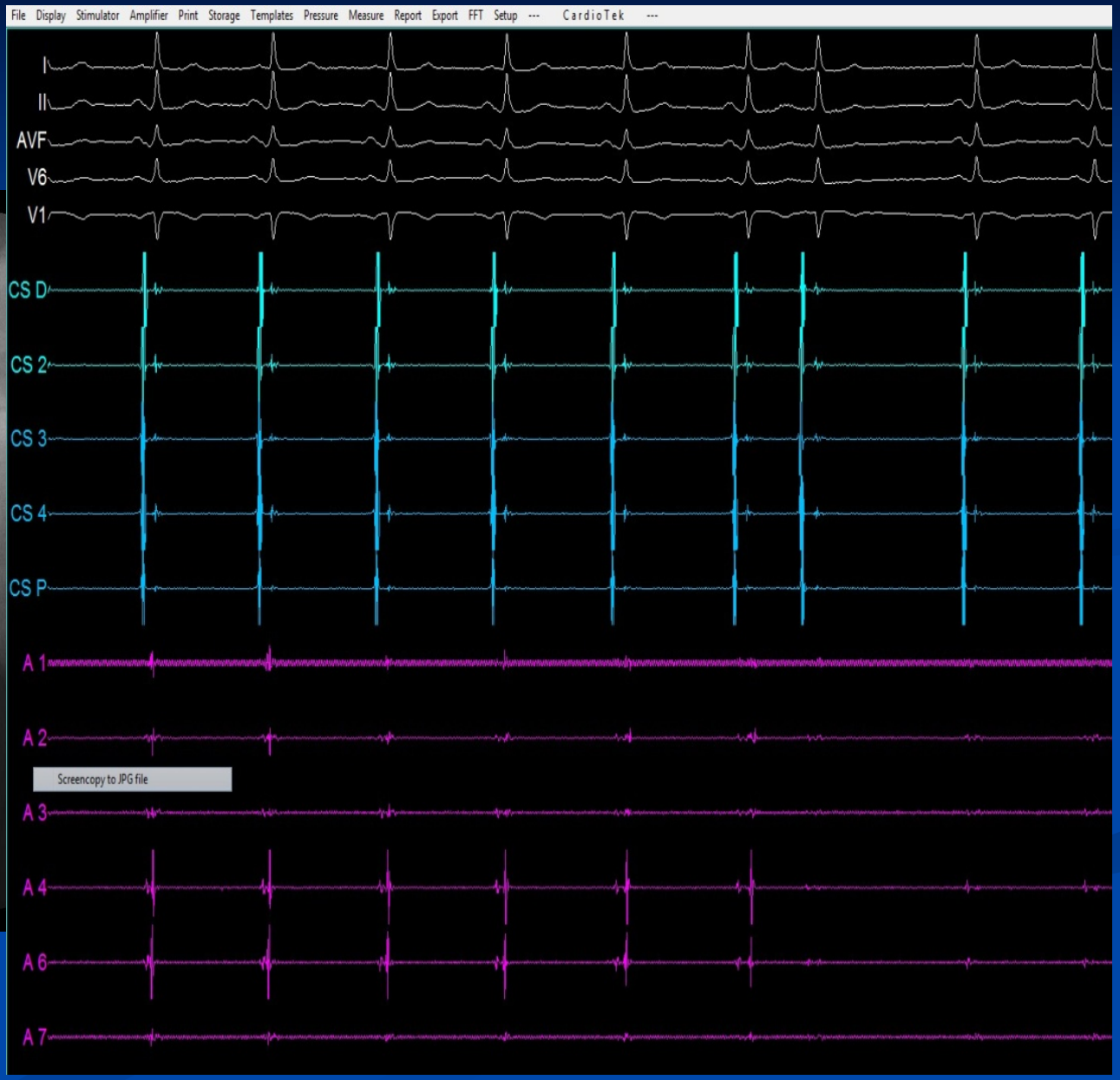


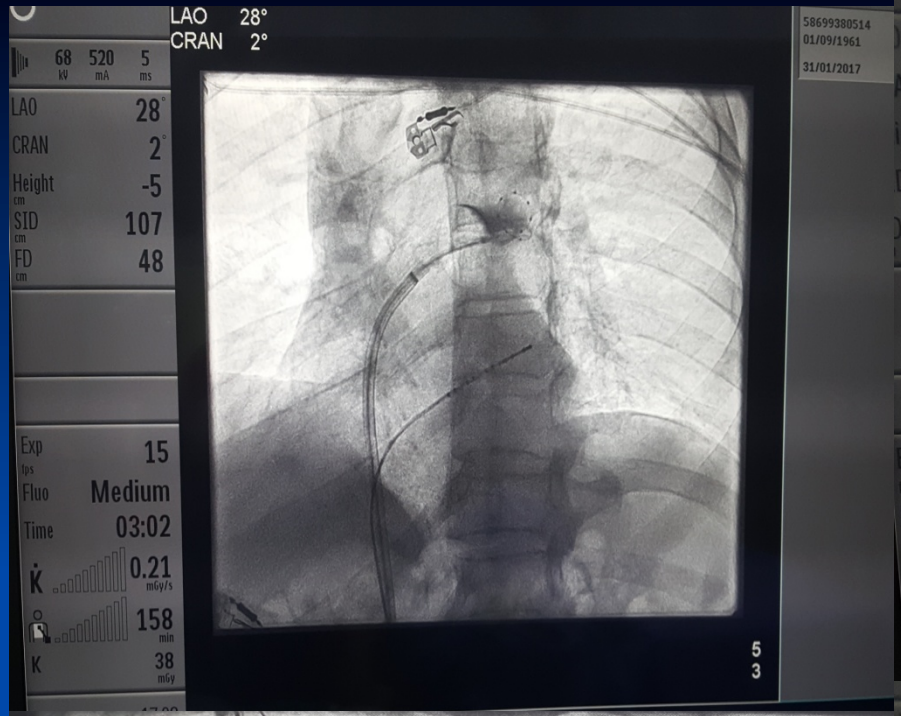
Arctic Front Advance™



Cryoballoon in the left upper PV

Cryoballoon in the right upper PV




LAO 28°
CRAN 2°
58699380514
01/09/1961
31/01/2017
68 kV 520 mA 5 ms
LAO 28°
CRAN 2°
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FD 48 cm
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Fluo Medium
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158 min
K 38 mGy
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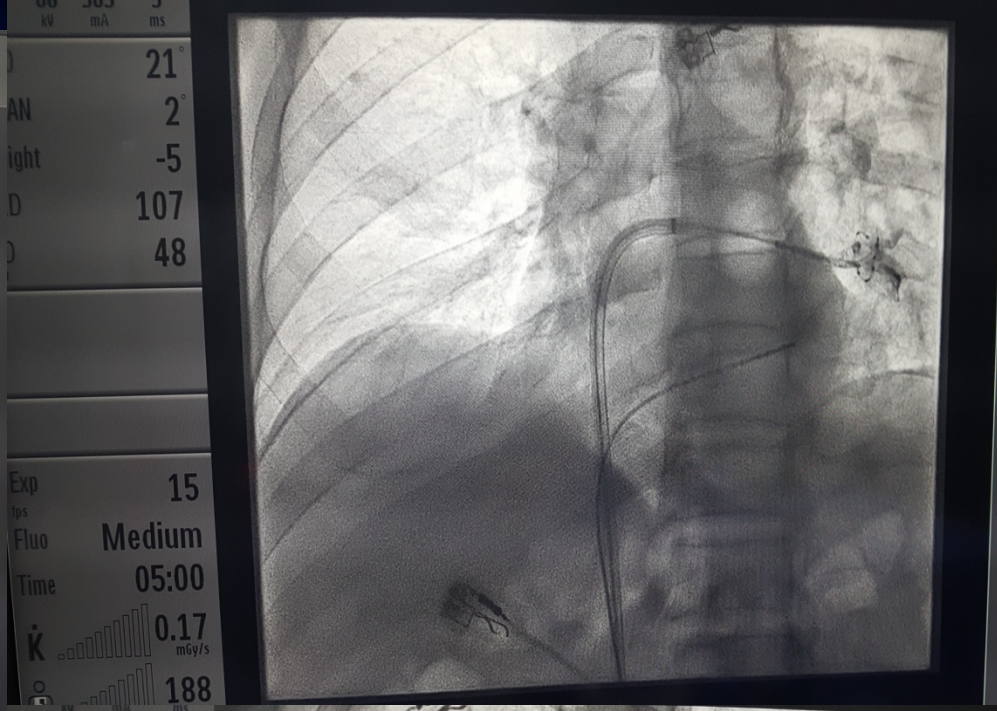
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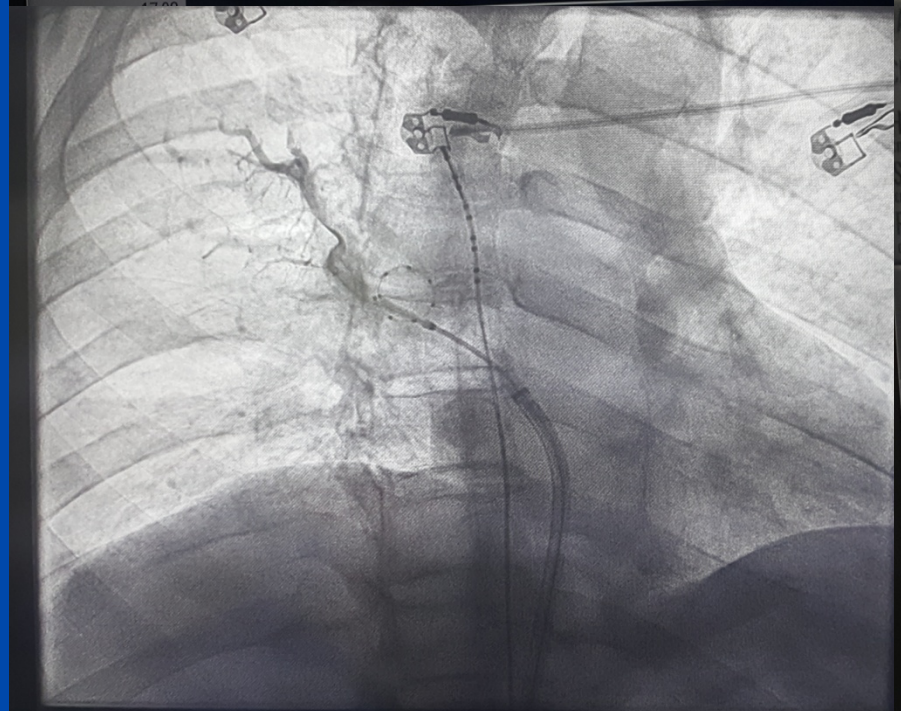

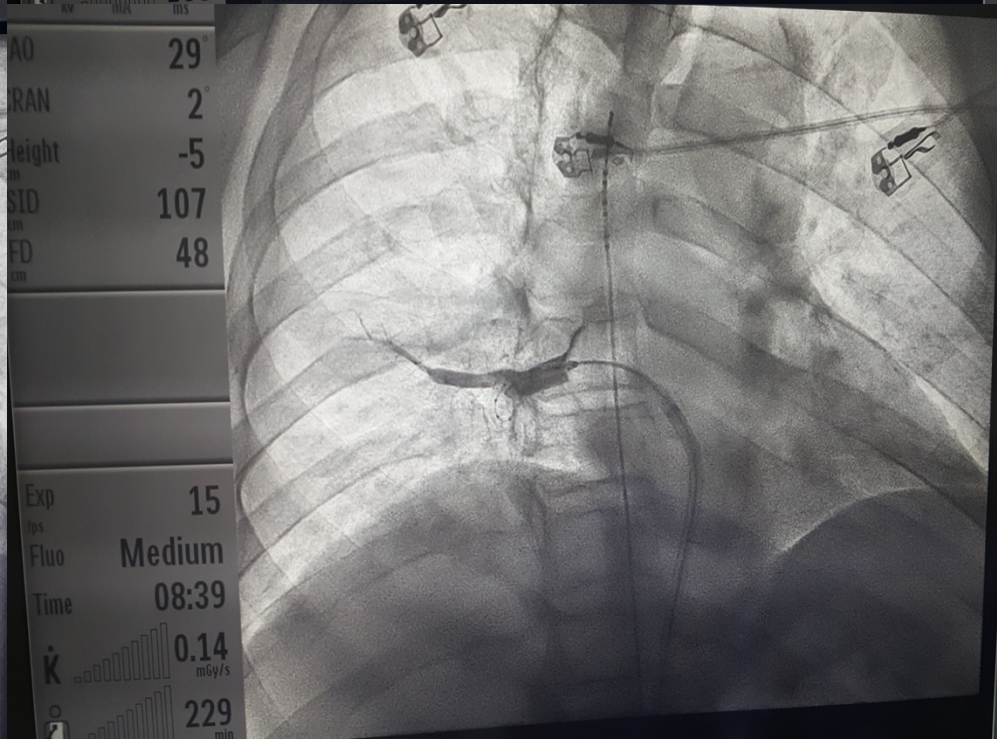
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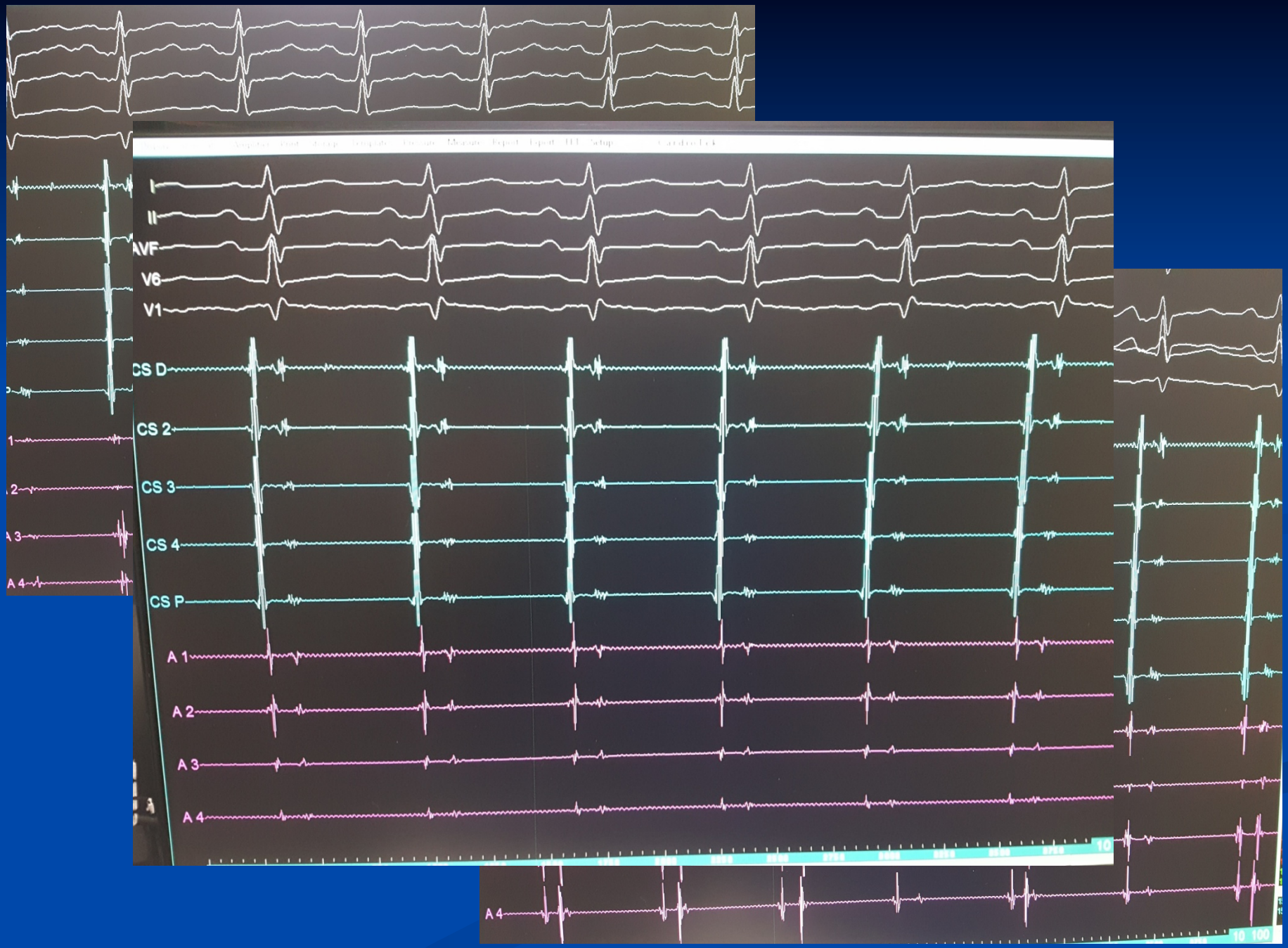
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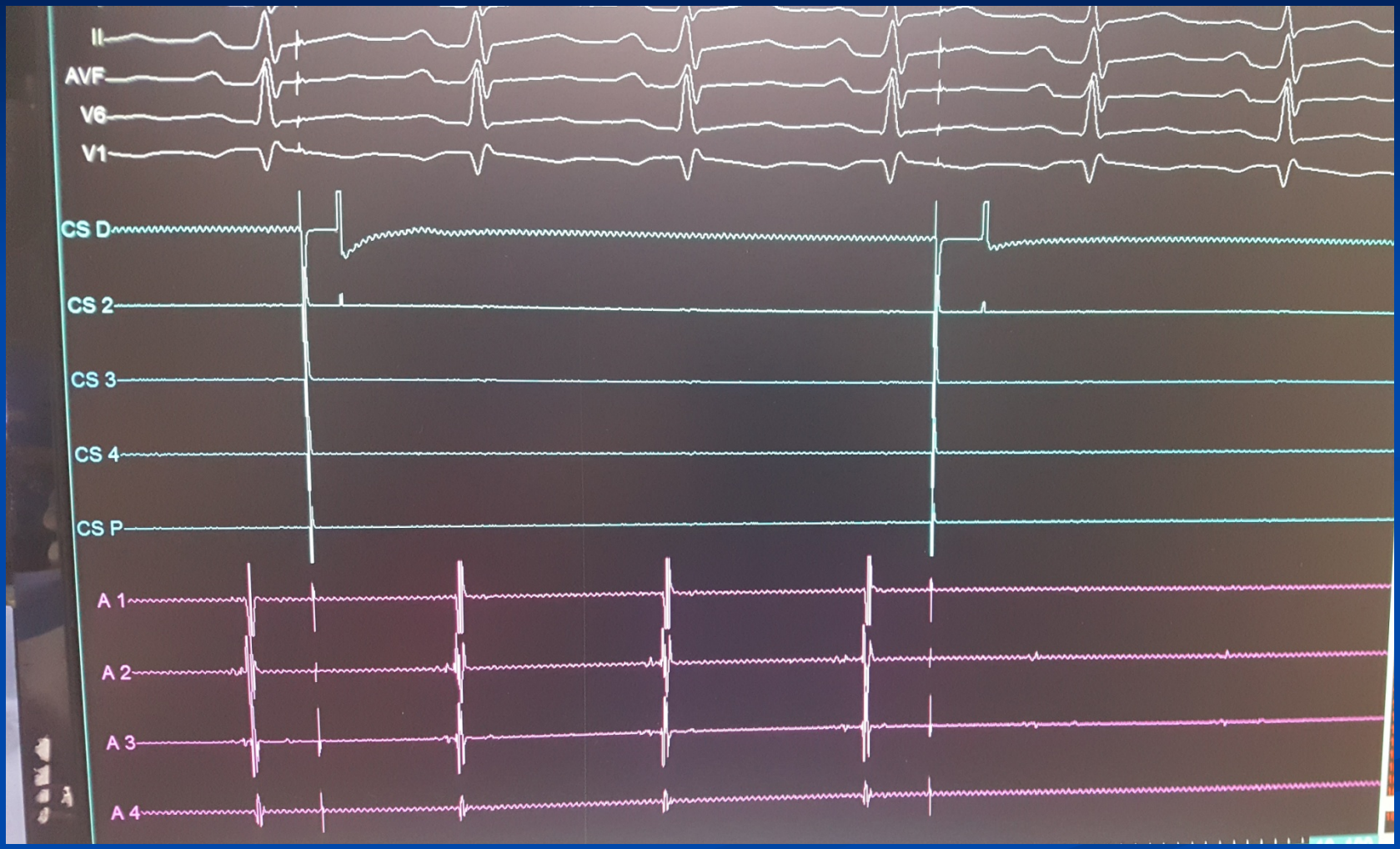
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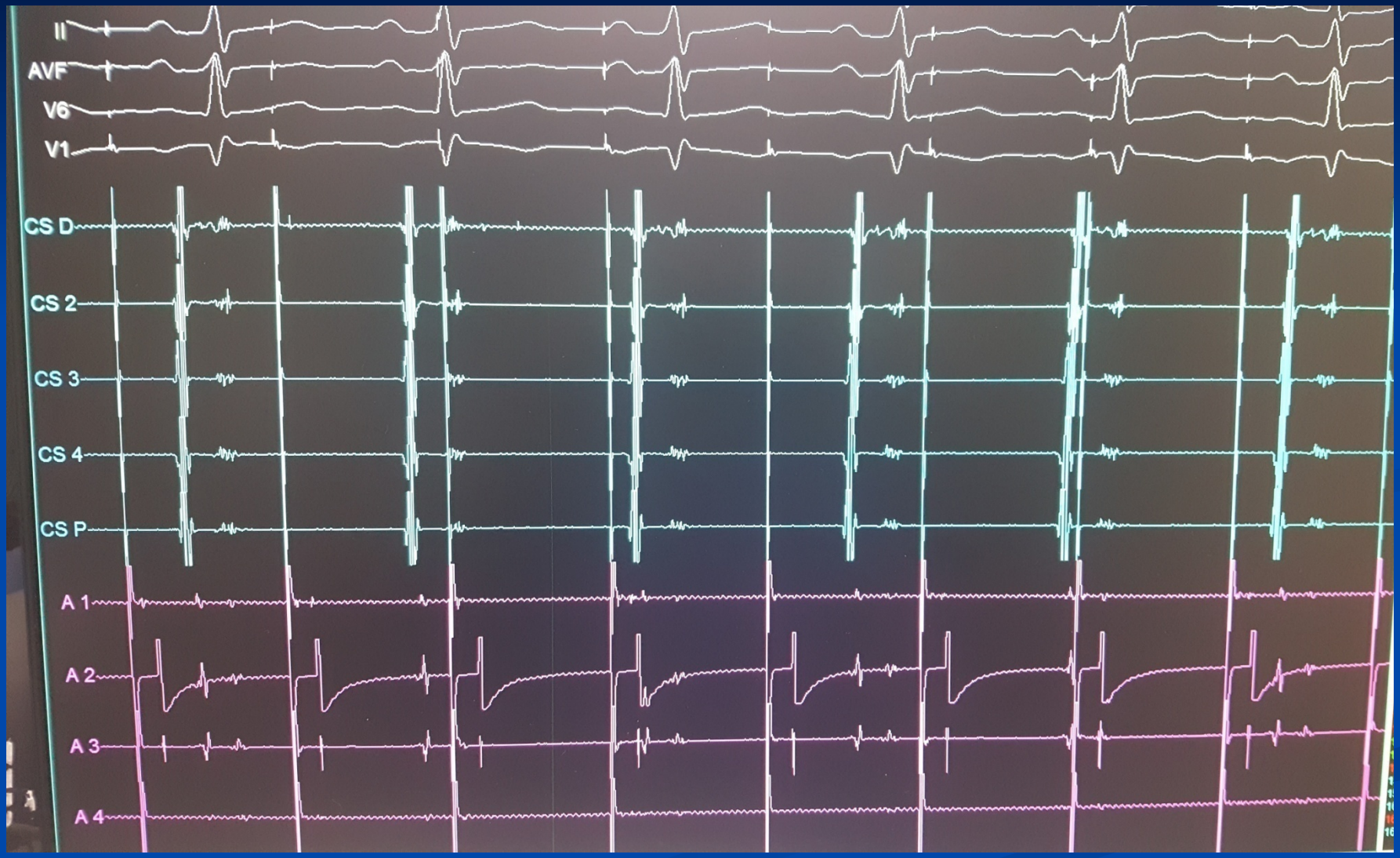
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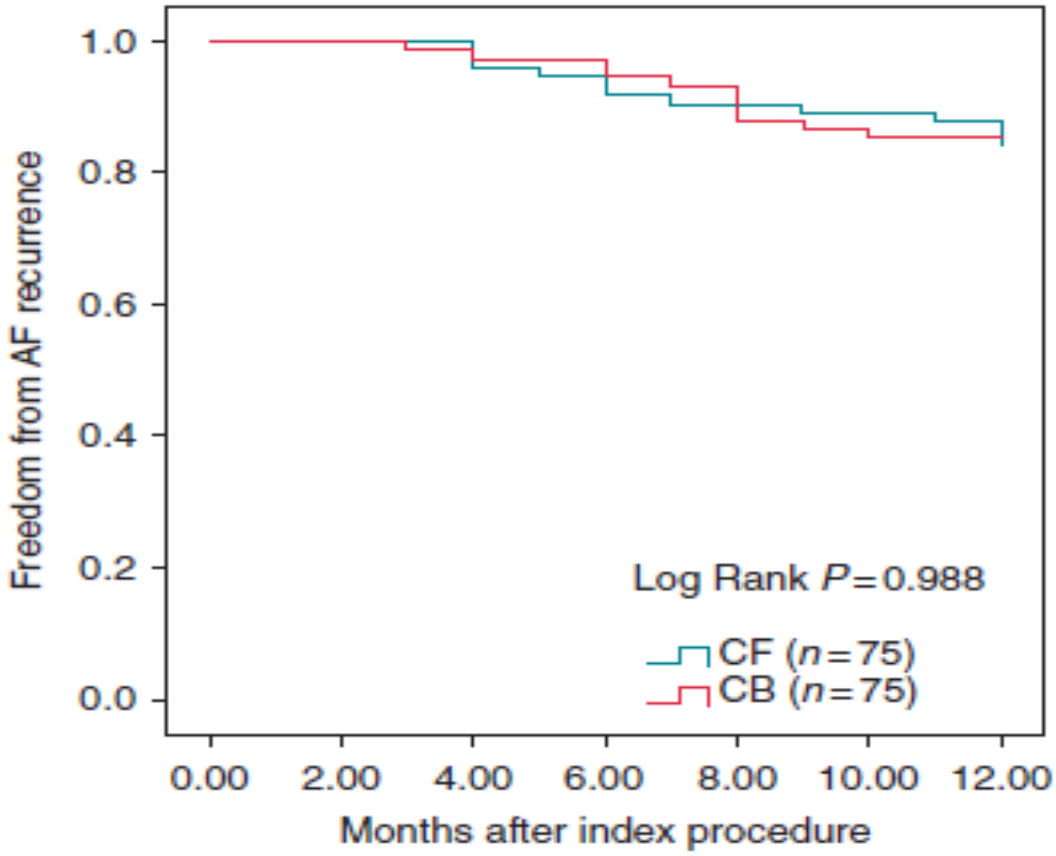
Europace (2015) **17**, 225–231
doi:10.1093/europace/euu215

Contact-force guided radiofrequency vs. second-generation balloon cryotherapy for pulmonary vein isolation in patients with paroxysmal atrial fibrillation—a prospective evaluation

Aims In the setting of paroxysmal atrial fibrillation (AF), there are no available data comparing the mid-term outcome of patients undergoing pulmonary vein isolation (PVI) catheter ablation using contact-force (CF)-guided radiofrequency (RF) vs. second-generation balloon cryotherapy.

Methods and results Prospective single-centre evaluation, carried out from March 2011 to February 2013, comparing CF radiofrequency (Thermocool® SmartTouch™, Biosense Webster, Inc.) (CF group) with cryoballoon ablation (Arctic Front Advance™ 28 mm cryoballoon, Medtronic, Inc.) (CB group), in regards to procedural safety and efficacy, as well as recurrence at 12 months. Overall, 150 consecutive patients were enrolled (75 in each group). The characteristics of patients of both the groups were similar (61.2 ± 9.9 years, women 25.3%, mean AF duration 4.1 ± 4.0 years, mean CHA_2DS_2-VASc score 1.4 ± 1.3, mean HAS-BLED 1.4 ± 0.6). Duration of the procedure was significantly lower in the CF group (110.7 ± 32.5 vs. 134.5 ± 48.3 min, $P = 0.001$), with a lower duration of fluoroscopy (21.5 ± 8.5 vs. 25.3 ± 9.9 min, $P = 0.017$) and X-ray exposure (4748 ± 2411 cGy cm^2 vs. 7734 ± 5361 cGy cm^2, $P = 0.001$). In contrast, no significant difference was found regarding significant procedural complication (2.7 vs. 1.3% in CF and CB groups, respectively; $P = 0.56$), and PVI was eventually achieved in all cases. At 12 months, AF recurrence occurred in 11 patients (14.7%) in the CB group and in 9 patients (12.0%) in the CF group (HR = 1.20 95% CI 0.50–2.90; log rank $P = 0.682$).

Conclusions Our preliminary findings suggest that CF-guided radiofrequency and cryotherapy present very similar performances in the setting of paroxysmal AF catheter ablation.

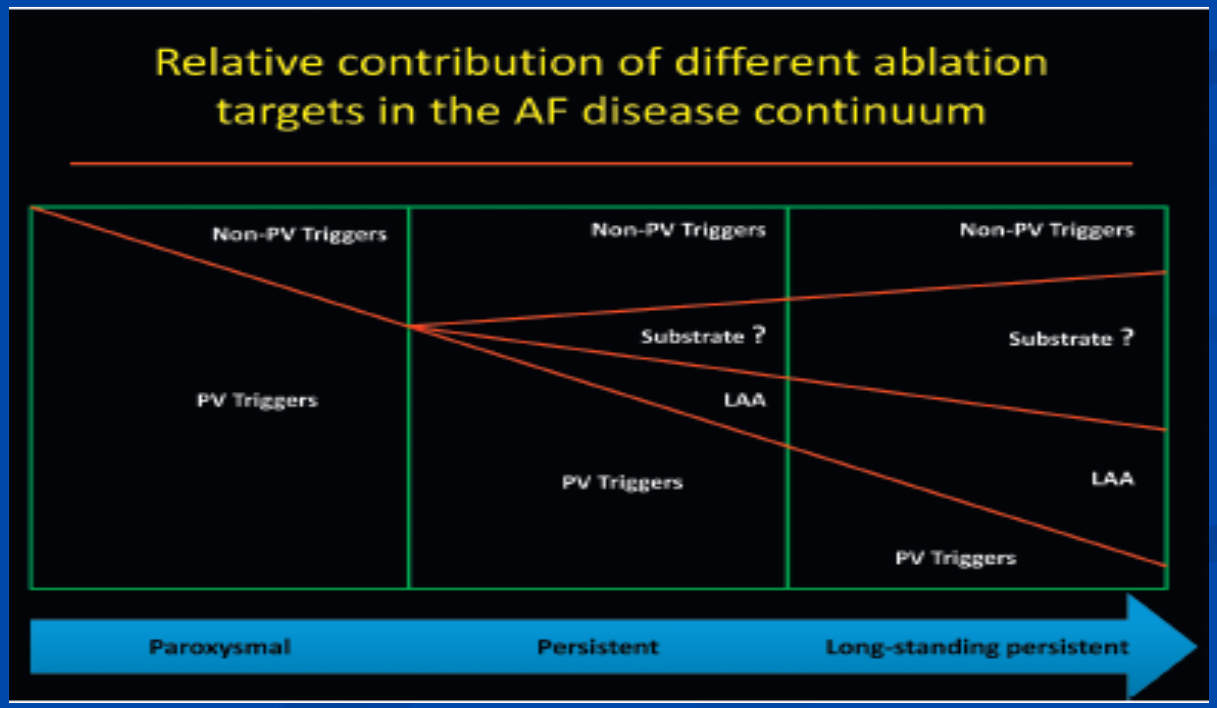


	3 months	6 months	9 months	12 months
CF	75	69	67	66
CB	74	71	63	62

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

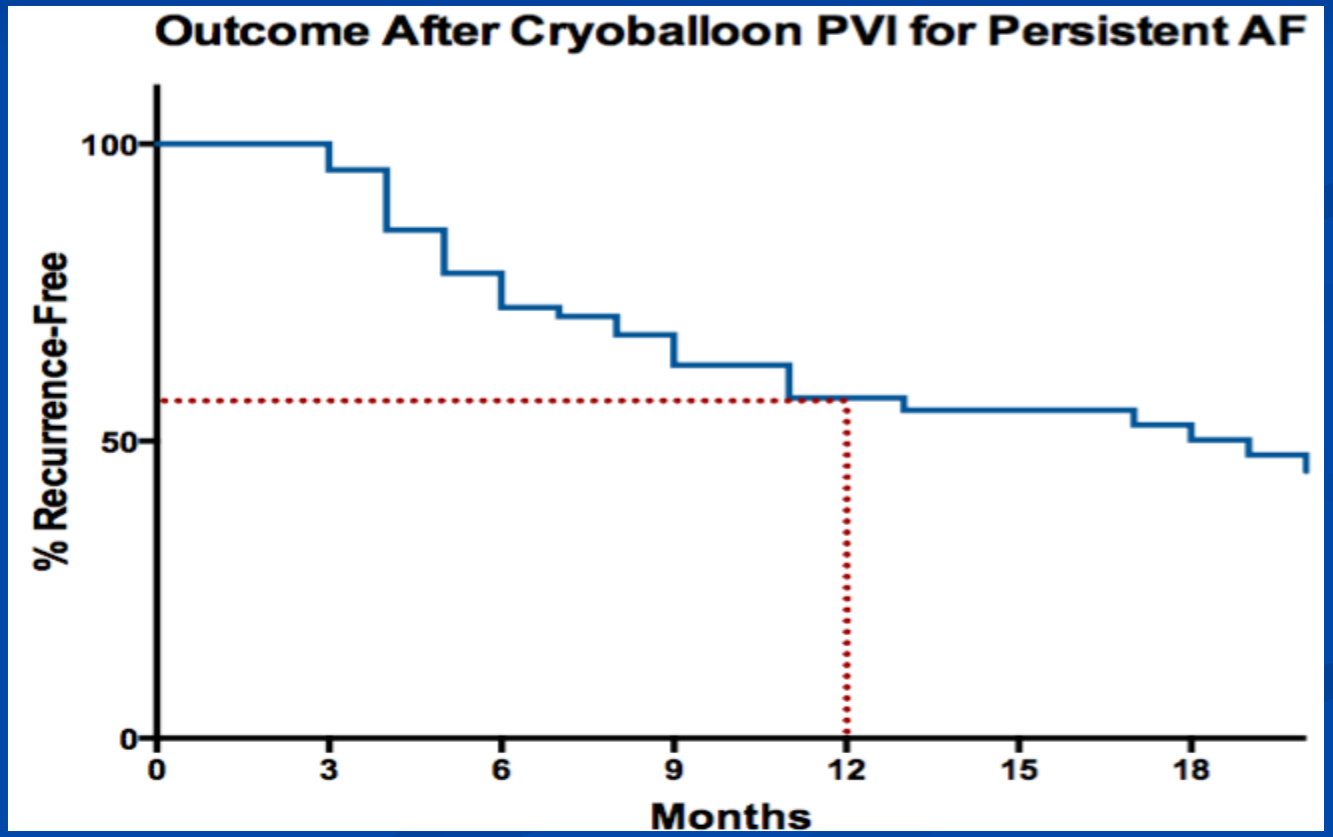
Persistan AF ablation

- Guidelines for AF ablation
  - For persistent AF: IIa
  - For long term persistent AF: IIb *
- 1 year success rate is %50-60.

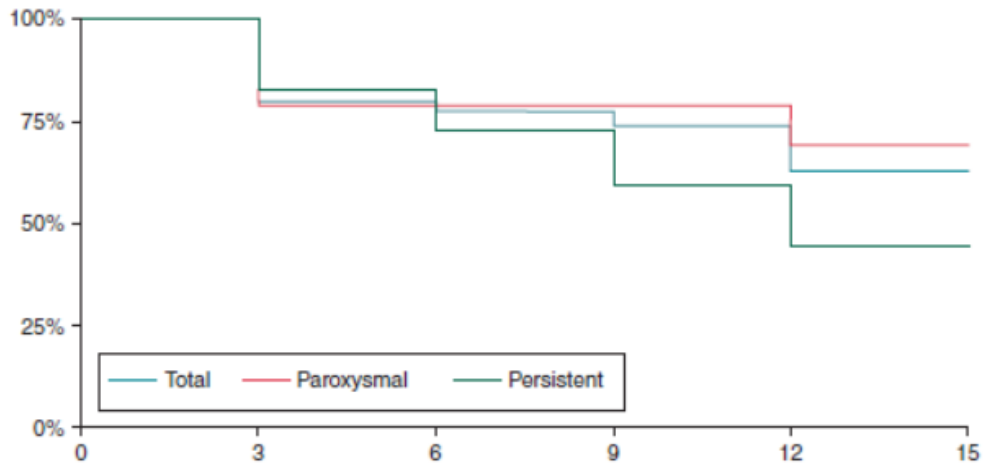


Efficacy of Cryoballoon Pulmonary Vein Isolation in Patients with Persistent Atrial Fibrillation

Guhl EN, Siddoway D, Adelstein E, Voigt A, Saba S, Jain SK.



Efficacy and safety of pulmonary veins isolation by cryoablation for the treatment of paroxysmal and persistent atrial fibrillation



	3	6	9	12
Numbers at risk				
All patients	104	62	45	20
Paroxysmal AF	81	46	34	16
Persistent AF	23	16	11	4

Figure 3 Cumulative atrial fibrillation-free survivals of patients who underwent cryoablation for paroxysmal vs. persistent atrial fibrillation. $P = 0.167$.

Europace (2015) **17**, 559–565
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‡

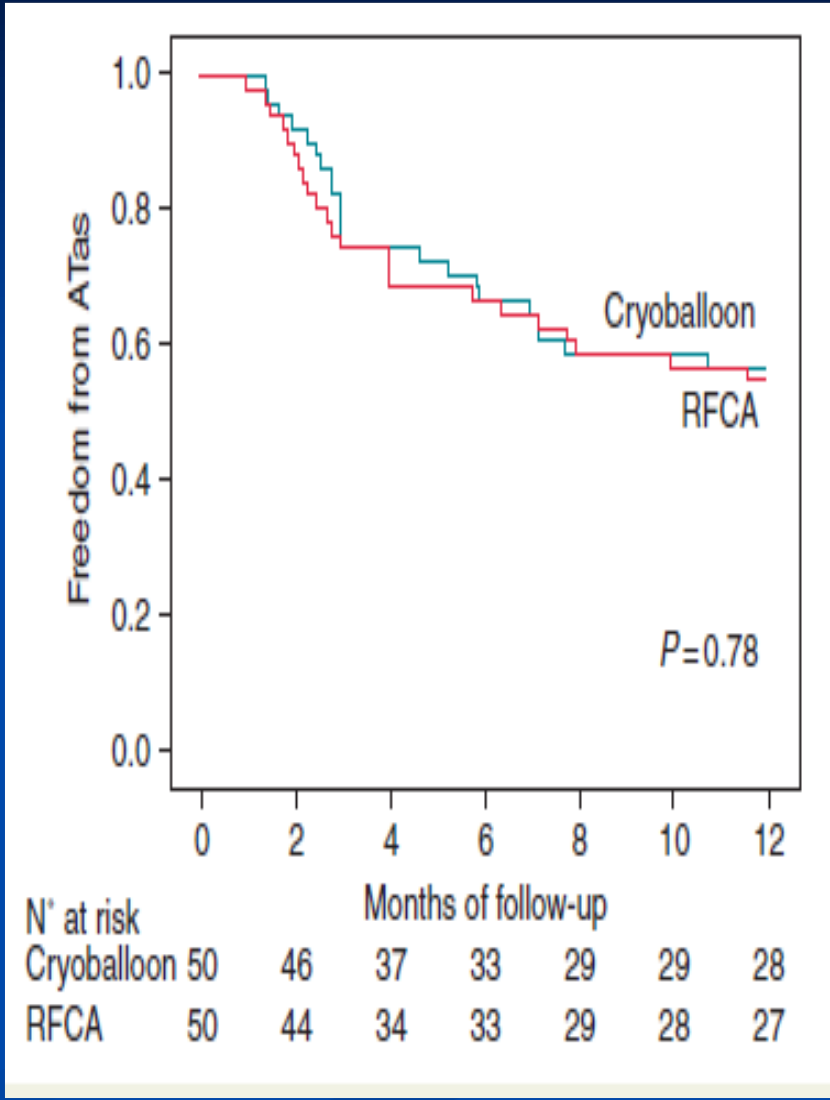
Aims To assess the 1 year efficacy of pulmonary vein isolation (PVI) as index procedure for persistent atrial fibrillation (PersAF) comparing conventional radiofrequency irrigated-tip catheter ablation (RFCA) using contact-force technology and ablation using the second-generation cryoballoon (CB-AdvA).

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



Combined use of cryoballoon and focal open-irrigation radiofrequency ablation for treatment of persistent atrial fibrillation: Results from a pilot study

Moussa Mansour, MD,*† Giovanni B. Forleo, MD, PhD,† Augusto Pappalardo, MD,† Conor Barrett, MD,* E. Kevin Heist, MD,* Andrea Avella, MD,† Gianluigi Bencardino, MD,† Antonio Dello Russo, MD, PhD,† Michela Casella, MD, PhD,† Jeremy N. Ruskin, MD,* Claudio Tondo, MD, PhD*†

*From *Massachusetts General Hospital, Heart Center, Boston, Massachusetts, and †Cardiac Arrhythmia and Heart Failure Research Institute, St. Camillo-Forlanini Hospital, Catholic University of Sacred Heart, Rome, Italy.*

BACKGROUND Pulmonary vein isolation (PVI) achieved using a cryoballoon has been shown to be safe and effective. This treatment modality has limited effectiveness for treatment of persistent atrial fibrillation (AF).

OBJECTIVE The purpose of this study was to evaluate a combined approach using a cryoballoon for treatment of PVI and focal radiofrequency (RF) left atrial substrate ablation for treatment of persistent AF.

METHODS Twenty-two consecutive patients with persistent AF were included in the study. PVI initially was performed with a cryoballoon. Left atrial complex fractionated atrial electrograms (CFAEs) then were ablated using an RF catheter. Finally, linear ablations using the RF catheter were performed.

RESULTS Eighty-three PVs, including five with left common ostia, were targeted and isolated (100%). Seventy-seven (94%) of 82 PVs targeted with the cryoballoon were isolated, and 5 (6%) required use of RF energy to complete isolation. A mean of 9.7 ± 2.6 cryoablation applications per patient was needed to achieve PVI. Median time required for cryoablation per vein was 600 seconds, and mean number of balloon applications per vein was 2.5 ± 1.0. In 19 (86%) patients in whom AF persisted after PVI, CFAE areas were ablated using the RF catheter. Two cases of transient phrenic nerve paralysis occurred. After a single procedure and mean follow-up of 6.0 ± 2.9 months, 86.4% of patients were AF-free without antiarrhythmic drugs.

CONCLUSION A combined approach of cryoablation and RF ablation for treatment of persistent AF is feasible and is associated with a favorable short-term outcome.

KEYWORDS Atrial fibrillation; Balloon catheter; Catheter ablation; Cryoablation; Pulmonary vein isolation

ABBREVIATIONS **AF** = atrial fibrillation; **CFAE** = complex fractionated atrial electrogram; **CS** = coronary sinus; **LA** = left atrium; **PV** = pulmonary vein; **PVI** = pulmonary vein isolation; **RF** = radiofrequency

(Heart Rhythm 2010;7:452–458)

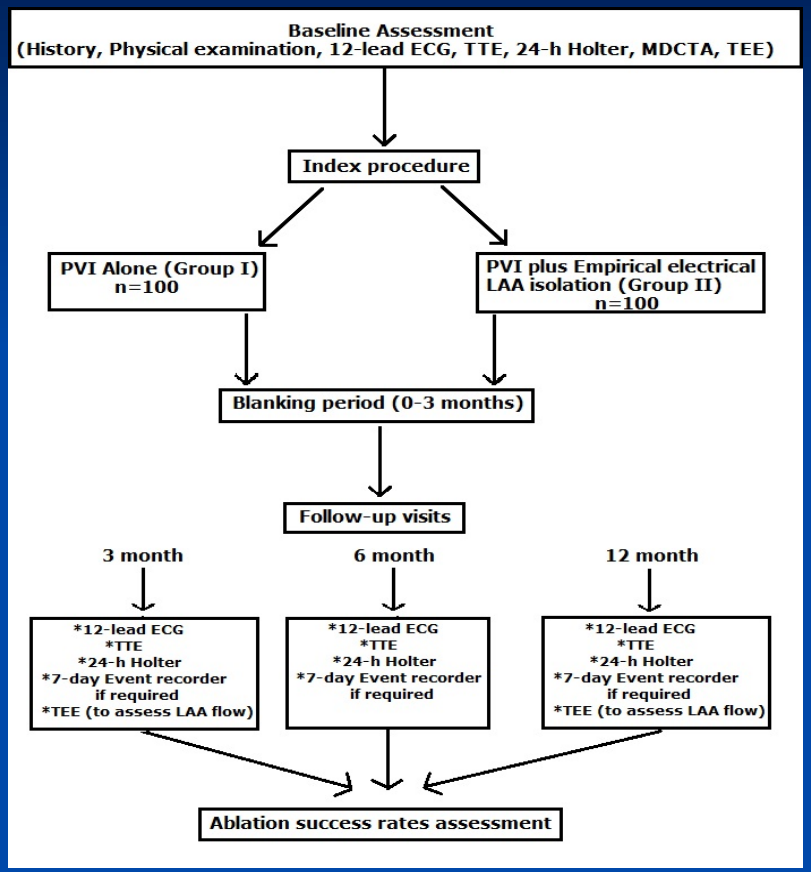
LAA isolation

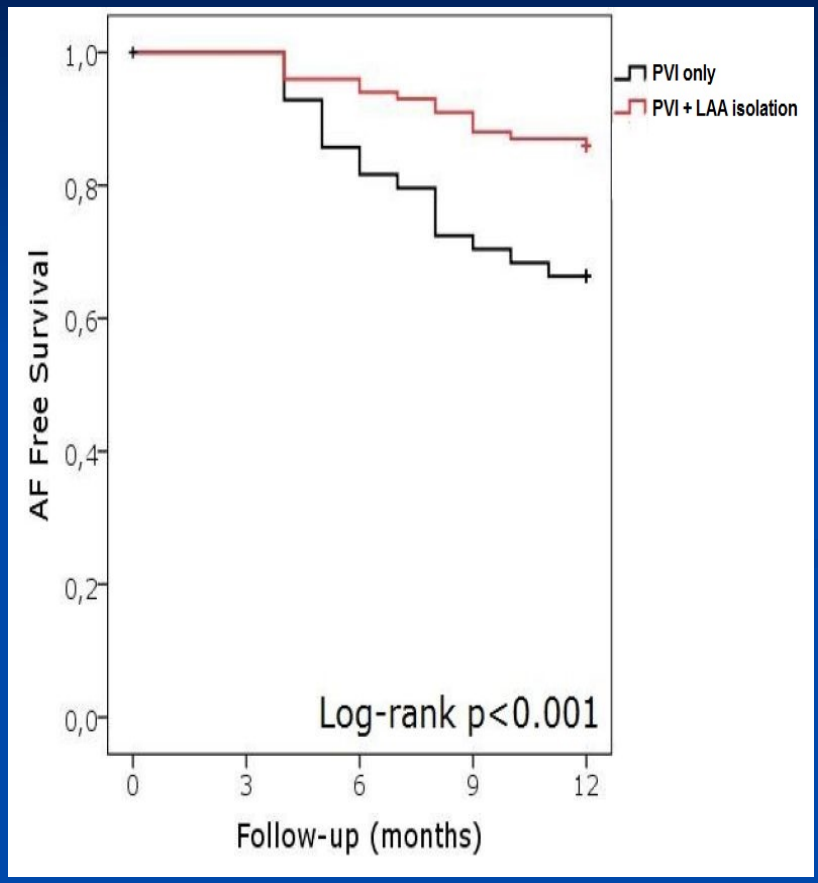
"To isolate or not to isolate the left atrial appendage, that is the question"

- LAA has been reported as an unrecognized trigger site of AF in all subtype of AF and especially in patients with non-paroxysmal AF.
- It has been reported that, in 27 % of patients in a series of 266 patients undergoing redo AF ablation procedures with demonstrated silent PVs, there was a firing from the LAA. In 8 % of these patients, the LAAwas the only site responsible for AF*.

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

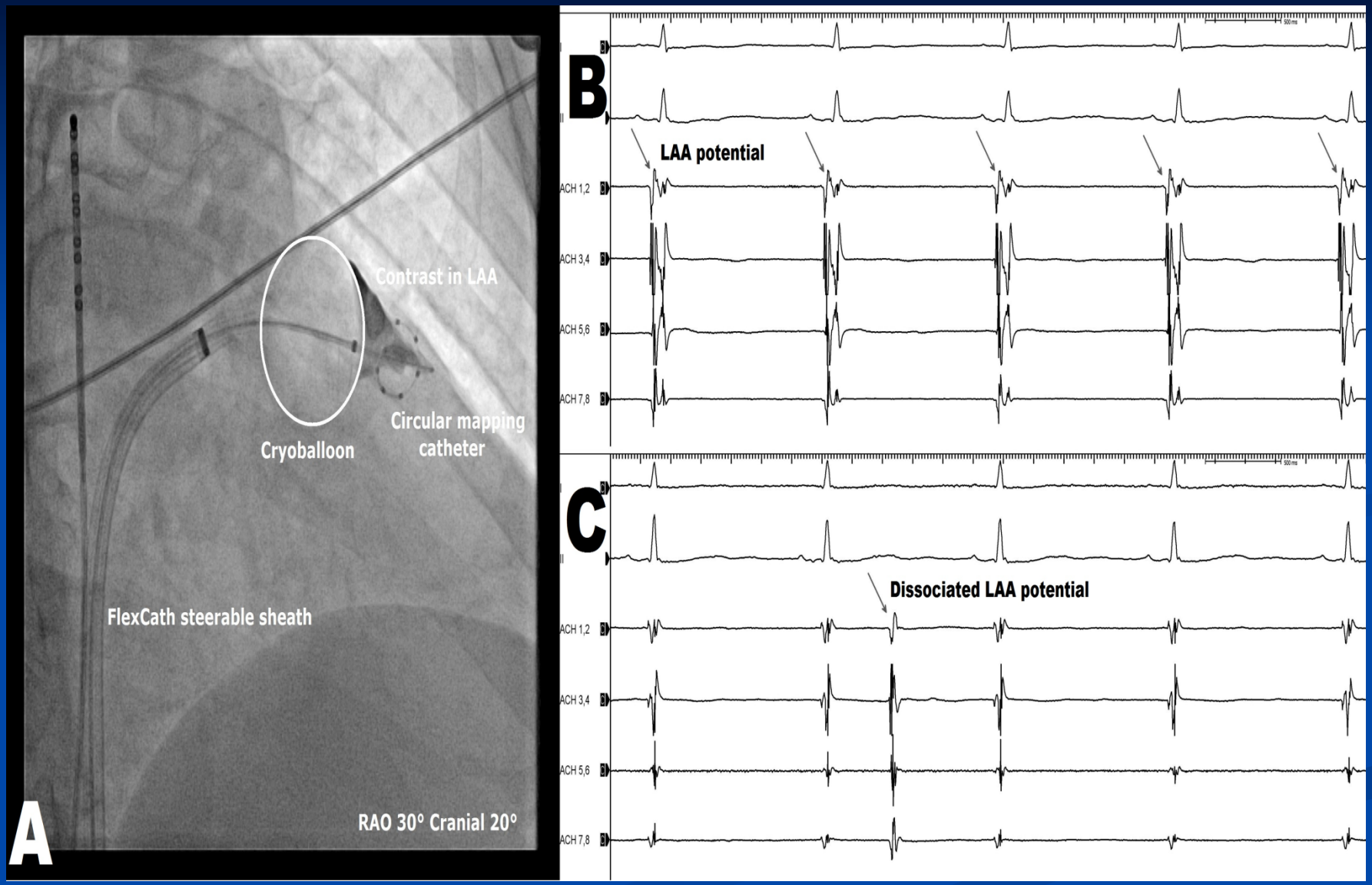
LAA isolation by CRYOballoon



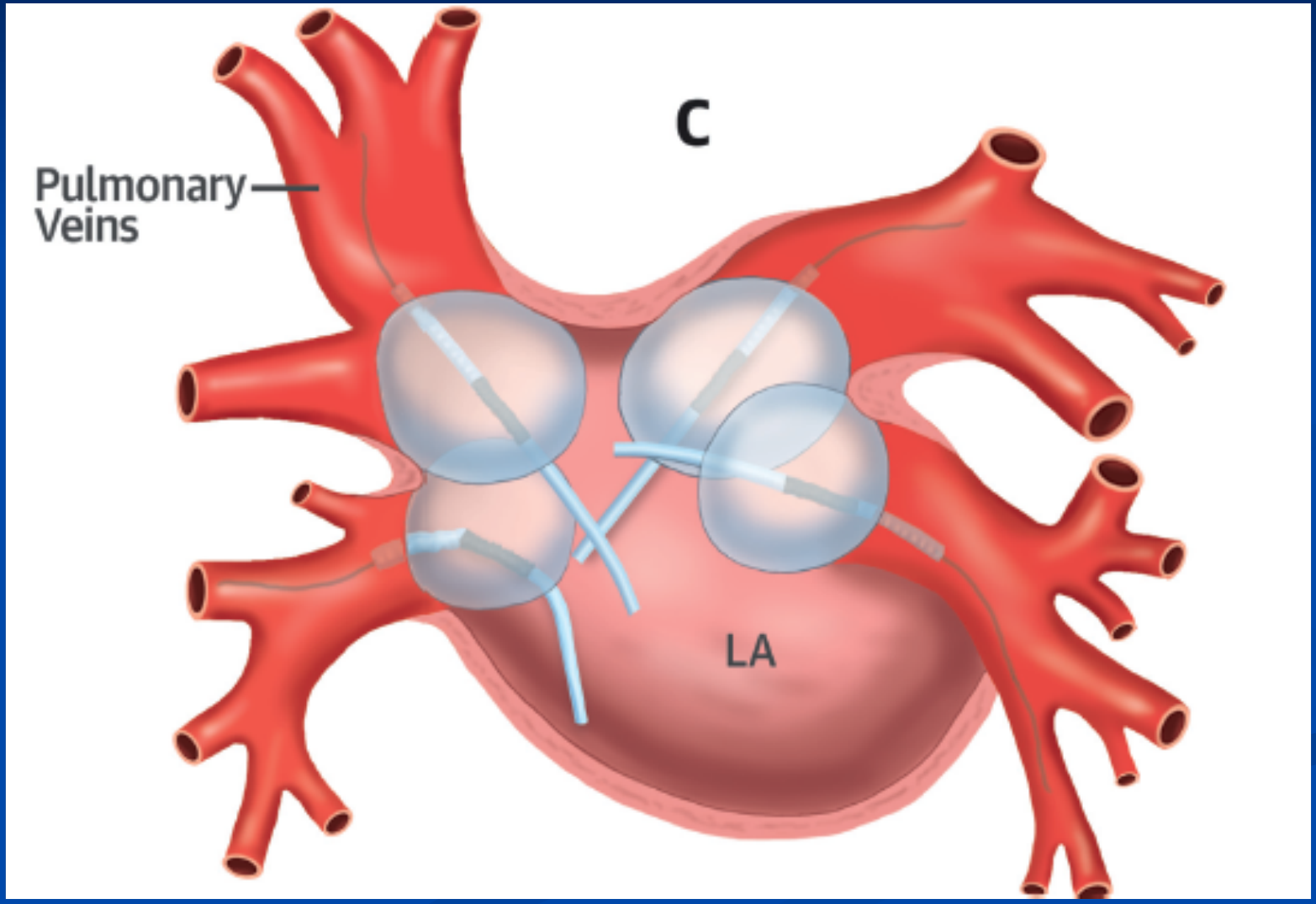


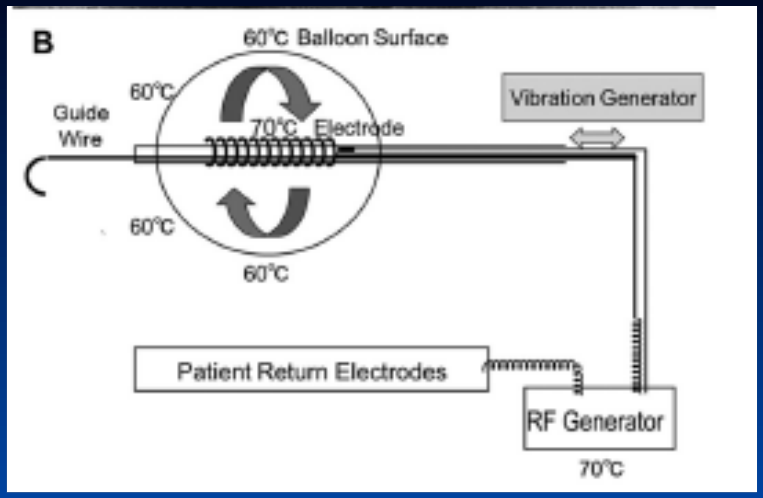
* **Left atrial appendage isolation in addition to pulmonary vein isolation in persistent atrial fibrillation: One-year clinical outcome after cryoballoon based ablation.**

Yorgun H, Canpolat U, Kocyigit, D , Çöteli C, Evranos, B, Aytemir K.
*Hacettepe University Faculty of Medicine, Department of Cardiology, Ankara, Turkey

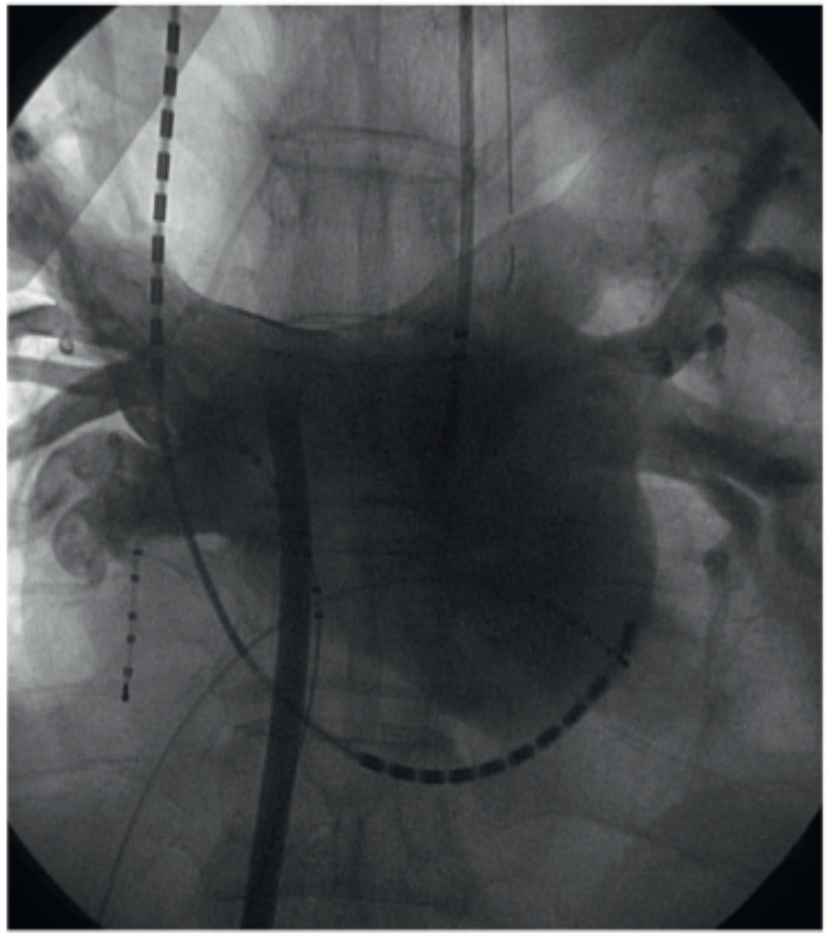

A
Contrast in LAA
Cryoballoon
Circular mapping catheter
FlexCath steerable sheath
RAO 30° Cranial 20°
B
LAA potential
ACH 1,2
ACH 3,4
ACH 5,6
ACH 7,8
C
Dissociated LAA potential
ACH 1,2
ACH 3,4
ACH 5,6
ACH 7,8

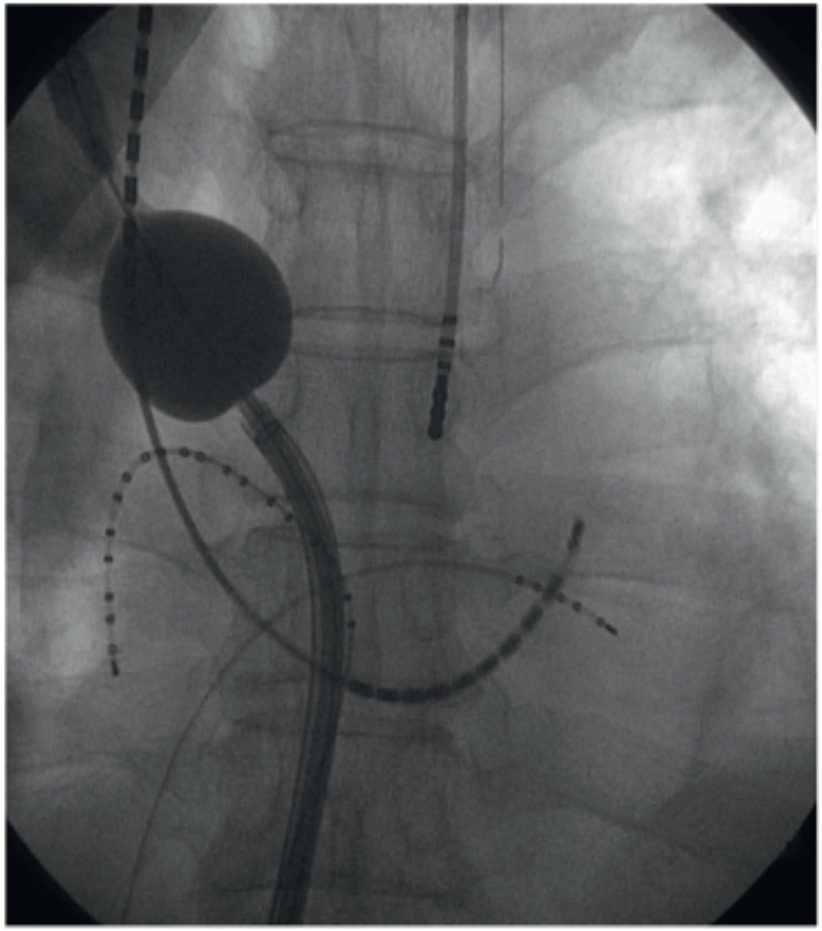
HOTBALLOON





- *An agitation device designed to "stir" the fluid within the balloon to achieve a uniform temperature at the tissue interface, and a RF generator with a maximum output of 200 W.*
- *The balloon can be inflated to 25–35 mm in diameter using an ionized contrast medium diluted 1:1 with physiologic saline.*
- *RF is delivered between the coil electrode inside the balloon and the 4 cutaneous electrode patches placed on the patient's back.*
- *Tissue is heated thermally at the interface to the balloon membrane, and that thermal transfer is the primary mechanism for ablation, not RF current flow.*





HotBalloon Ablation of the Pulmonary Veins for Paroxysmal AF. A Multicenter Randomized Trial in Japan
Sohara M et al., J Am Coll Cardiol 2016;68:2747–57.

FIGURE 2 Kaplan-Meier Plot of Time to the Events

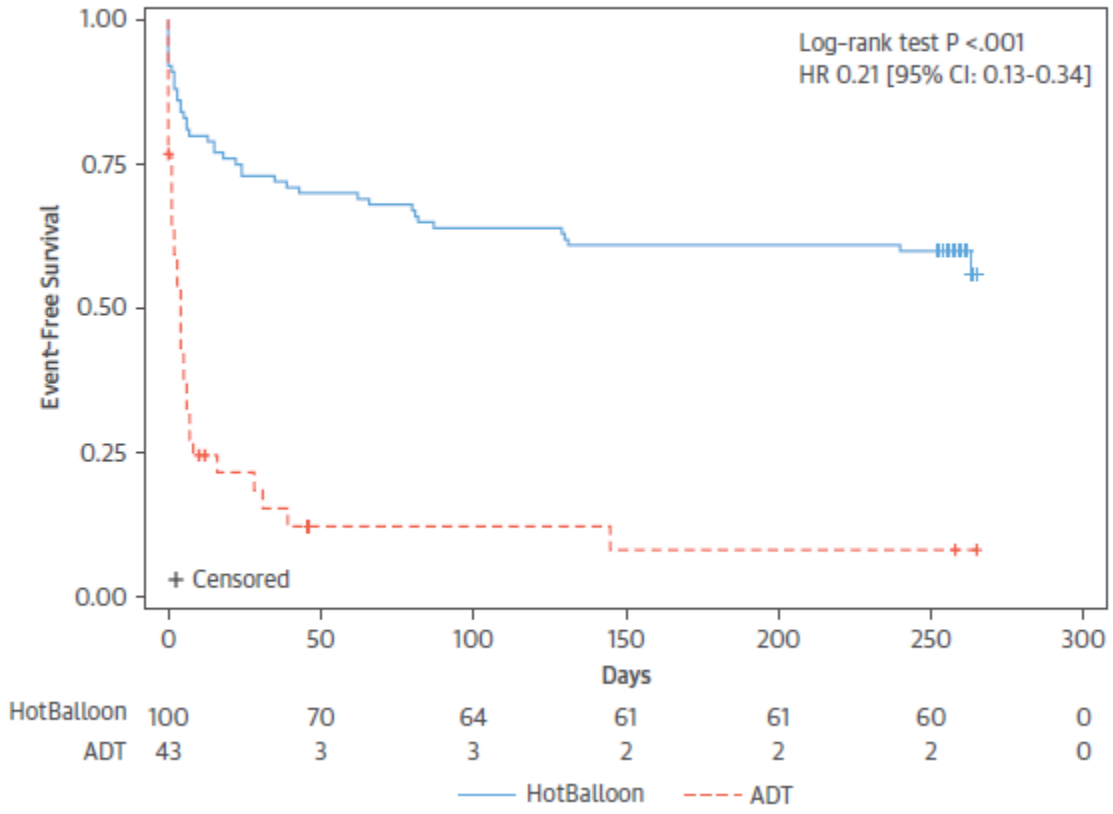


TABLE 5 Tabulation of Major Complications

Category	Type of Adverse Events	HBA and Crossover (n = 134)
1	Serious adverse events within 7 days of the ablation procedure (day 0-7)	
	Cerebral infarction	1.5 (2)
	Complete atrioventricular block	0.7 (1)
	Sick sinus syndrome aggravated	0.7 (1)
	Pseudoaneurysm	0.7 (1)
2	PV stenosis (>70%)	5.2 (7)
	Esophageal perforation	0
	Cardiac tamponade	0
	Phrenic nerve paralysis	3.7 (5)
	Cerebral infarction accompanied with apparent neurological symptom	0
3	PV stenosis (≤70%) that meets 1 of the following criteria: requires an invasive intervention, such as PV stenting; results in clinically significant symptoms	0
Total MJCs rate*		11.2 (15 patients, 17 events)

Values are % (number of events). *Total MJCs rate means the number of patients experiencing MJC.

MJCs = major complications; other abbreviations as in Tables 1 and 2.

Long-Term Results of Radiofrequency Hot Balloon Ablation in Patients With Paroxysmal Atrial Fibrillation:
Safety and Rhythm Outcomes

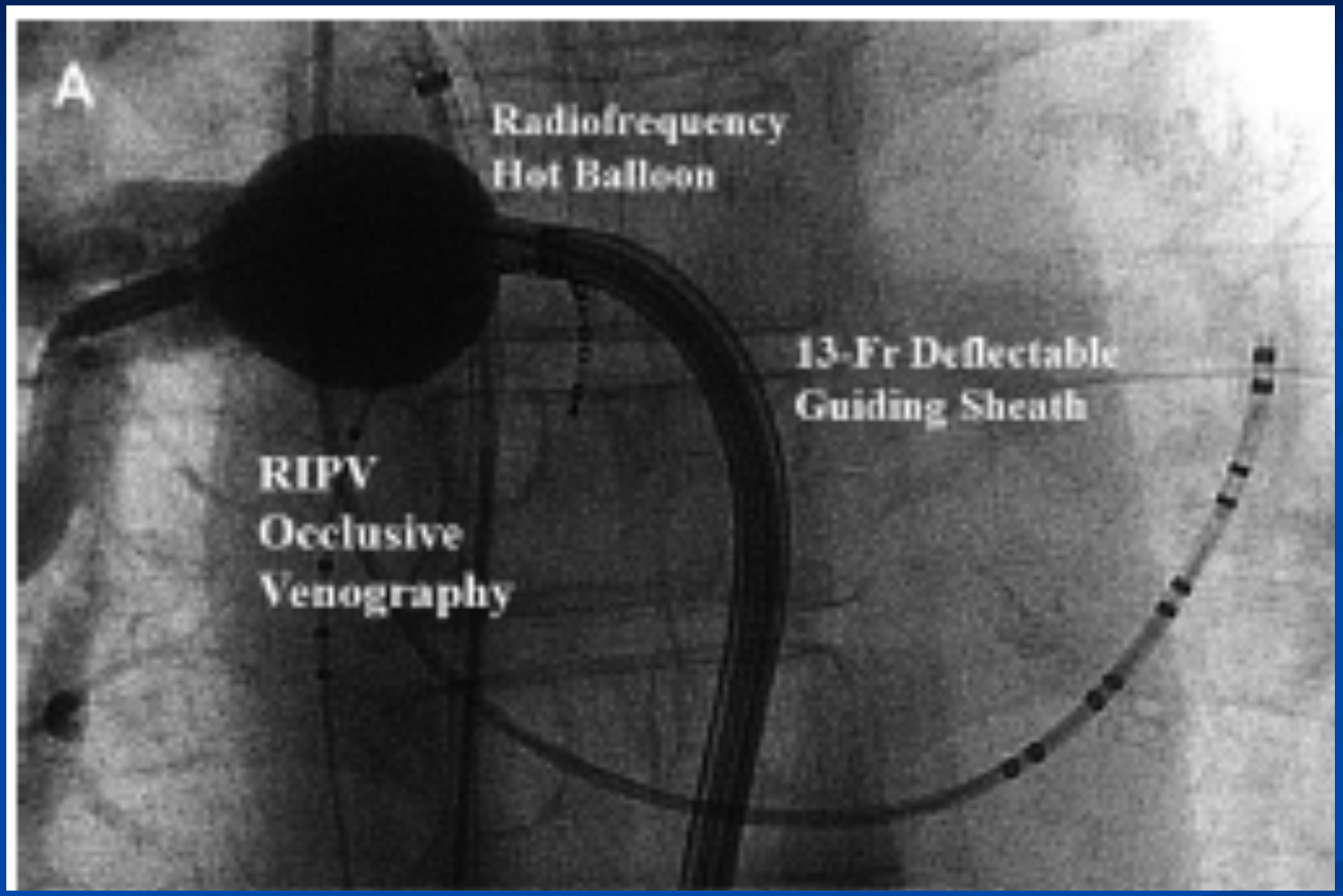
YOSHIO YAMAGUCHI, M.D., HIROSHI SOHARA, M.D., HIROSHI TAKEDA, M.D., YOSHINORI NAKAMURA, M.D., MINORU IHARA, M.D., SATOSHI HIGUCHI, M.D., and SHUTARO SATAKE, M.D.

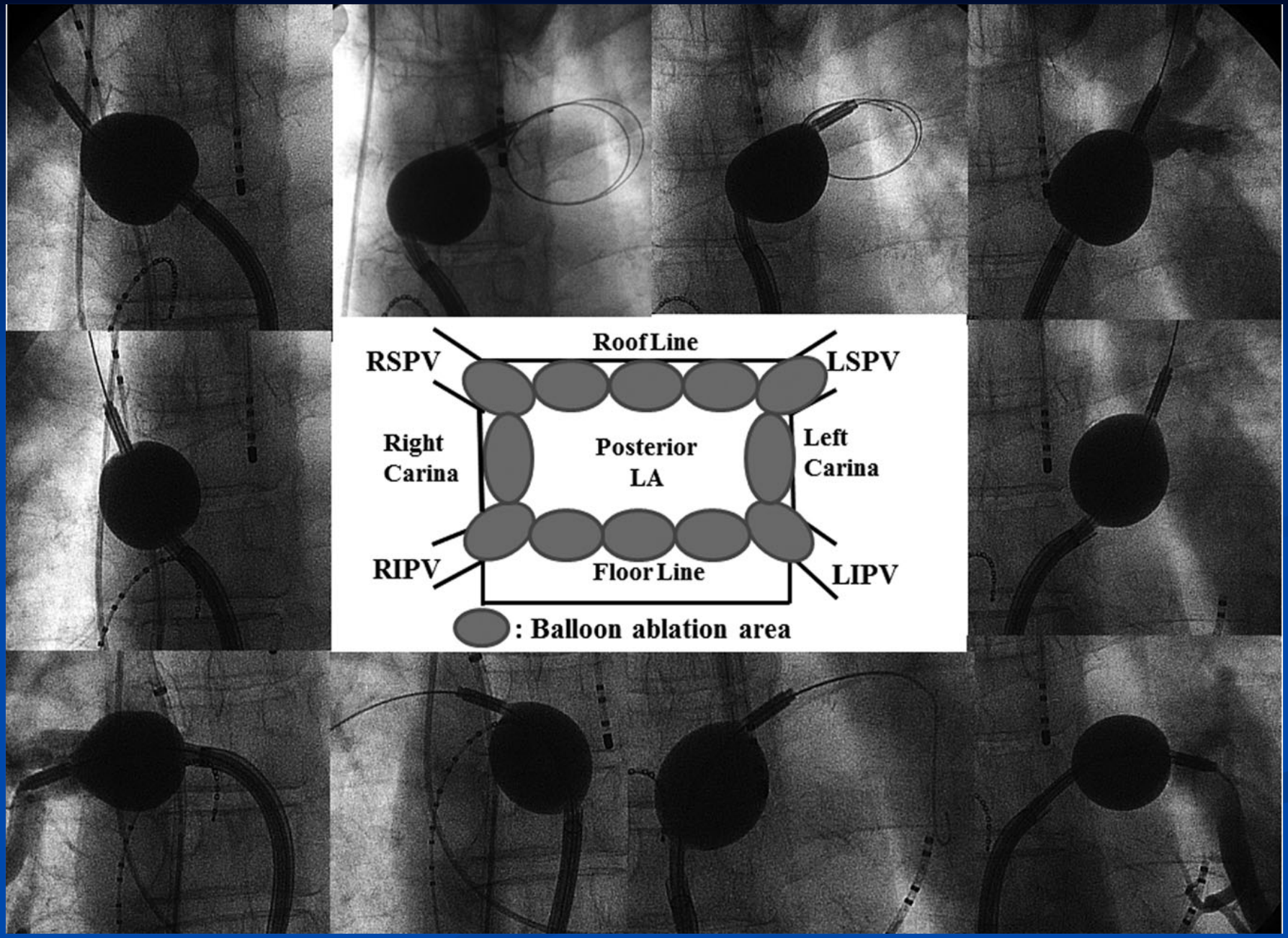
From the Heart Rhythm Center, Hayama Heart Center, Kanagawa, Japan

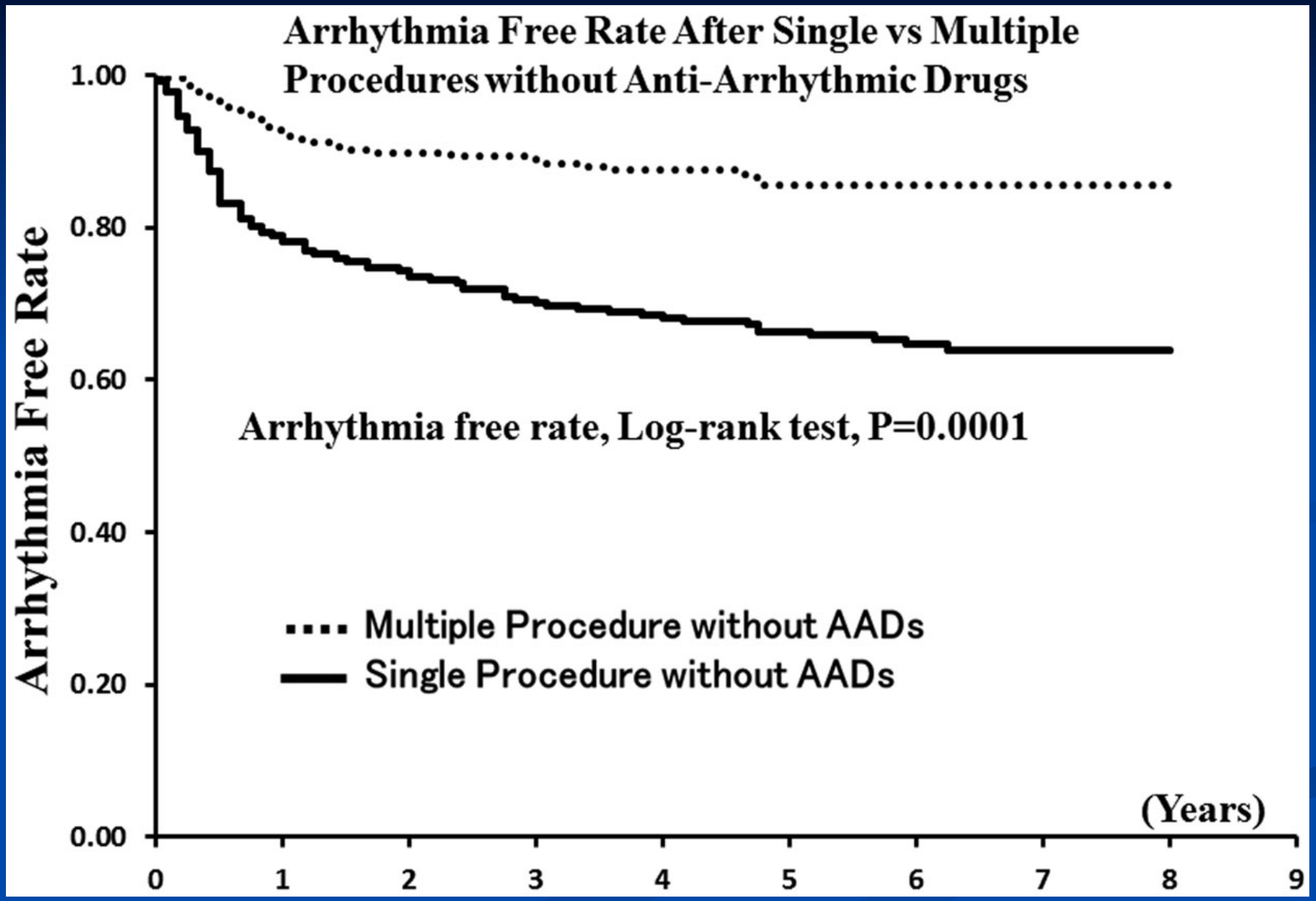
Long-Term Outcomes Following Hot Balloon Ablation. ***Introduction:*** **Isolation of pulmonary veins (PVs) and the posterior left atrium (LA) can be safely performed by radiofrequency hot balloon (RHB)-based box isolation. However, data on long-term effects for the treatment of atrial fibrillation (AF) by the use of this method remain limited.**

Methods and Results: **We treated 238 patients with paroxysmal AF (194 male; age. 62.6 ± 9.4 years) by RHB ablation. During 6.2-year (75 months) follow-up, 154 (64.7%) patients were free from atrial tachyarrhythmias (ATAs) without antiarrhythmic-drugs (AADs). We performed re-ablation in 69 of 84 patients with ATA recurrence (average 1.3 ± 0.6; median 1, total 91 procedures) using a 3D-mapping system and a conventional catheter. The sites of reconnection were observed at the PV in 61 of 69 (88.4%) patients and at the posterior LA in 58 of 69 (84.1%) patients. Finally, during mean follow-up of 4.6 ± 1.6 years, no-ATA episodes were detected in 201 (84.5%) patients without AADs. Independent predictors of ATA recurrence following a single procedure were heart failure with preserved ejection fraction (HR: 2.67, 95% CI: 1.40–5.10, P = 0.003) and low estimated glomerular filtration rate (HR: 1.81, 95% CI: 1.11–2.93, P = 0.03; cut-off of 62.0 mL/min/1.73 m^2). During the follow-up period, there were 4 (1.7%) patients with PV stenosis (>70% reduction in PV diameter); however, none of these cases required intervention. Phrenic nerve palsy was detected in 8 patients (3.4%), but resolved during 3 months in all cases.**

Conclusion: **RHB ablation can be effective during a long-term follow-up for patients with paroxysmal AF. Safety outcomes were within an acceptable range.** *(J Cardiovasc Electrophysiol, Vol. 26, pp. 1298-1306, December 2015)*


A
Radiofrequency
Hot Balloon
13-Fr Deflectable
Guiding Sheath
RIPV
Occlusive
Venography


Roof Line
RSPV
LSPV
Right Carina
Posterior LA
Left Carina
RIPV
Floor Line
LIPV
: Balloon ablation area


Arrhythmia Free Rate After Single vs Multiple Procedures without Anti-Arrhythmic Drugs
Arrhythmia Free Rate
1.00
0.80
0.60
0.40
0.20
0.00
Arrhythmia free rate, Log-rank test, P=0.0001
Multiple Procedure without AADs
Single Procedure without AADs
(Years)
0
1
2
3
4
5
6
7
8
9

The Rhythmia mapping system

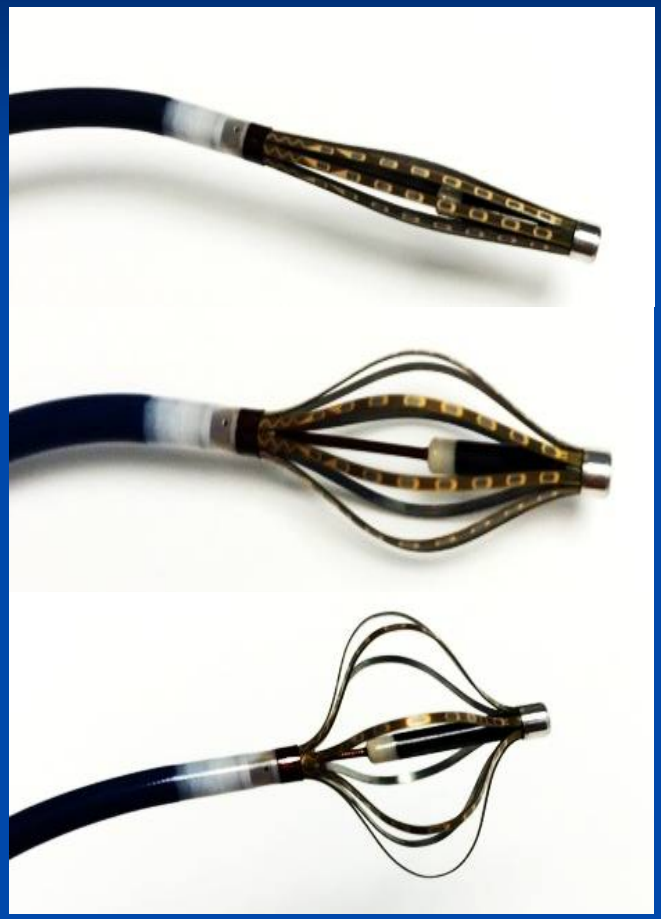
- The Rhythmia mapping system is a new system capable of rapid and high-resolution electroanatomic and activation mapping.
- Recent publications have reported the feasibility to use this technology for mapping arrhythmias, including for PVI.

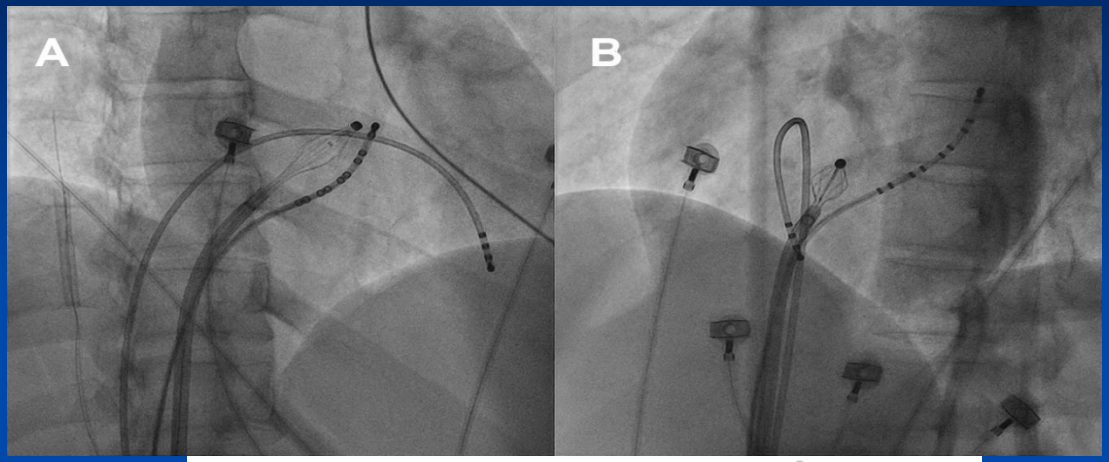
The Rhythmia mapping system

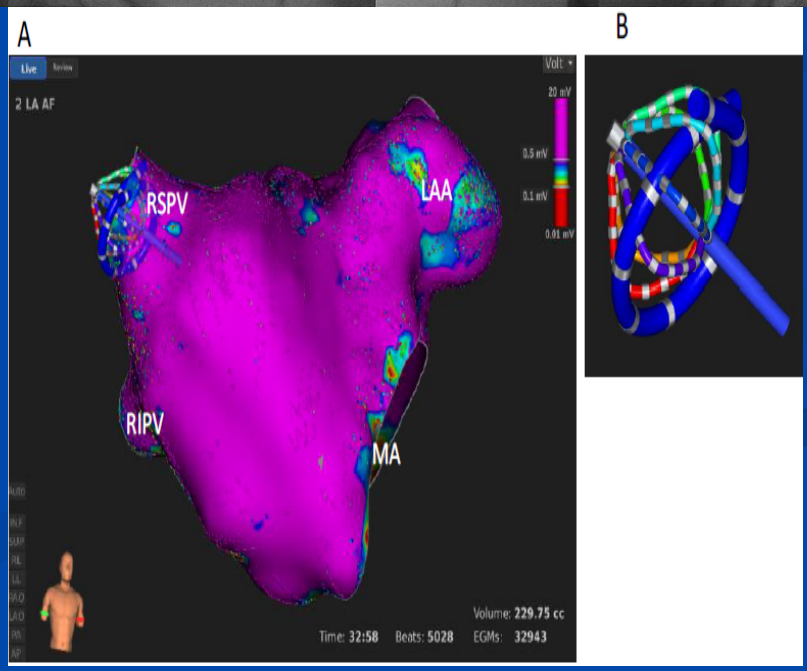
- A mini-basket (1.8 cmdiameter), containing eight splines of eight electrodes (total 64 electrodes, 2.5 mm spacing) is used to collect mapping data.
- The system automatically acquires electrograms and location information based on a predefined set of beat acceptance criteria.
- Beats are included in the map based on cycle length stability, relative timing of reference electrograms,electrode location stability, and respiratory gating. The criteria are selected by the operator before beginning the map.
- An activation map is obtained without the need for manual annotation.

Mini-basket (Orion) catheter

- 2.5 mm center to center spacing
- 0.9 x 0.45mm electrodes
- 0.4mm^2 surface area



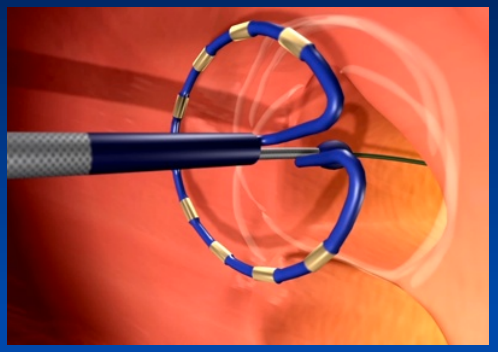




8 splines with 8 mini electrodes
64 electrodes in total

Orion vs Lasso

- Basket, 64 poles
- 0,4 mm^2 Surface Area (MEs)
- Printed in one side of spline
- 2.5 mm center to center
- Steerable bidirectional
- Diameter adjustable: 3-22 mm (18 mm nominal)



- Circumferential, 10 poles
- 2,33 mm^2 Surface Area (MEs)
- Ring electrodes
- 1-2 mm spacing (??)
- Steerable unidirectional
- Adjustable diameter 15-25 mm

Pulmonary vein isolation using the Rhythmia mapping system: Verification of intracardiac signals using the Orion mini-basket catheter

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From the Cardiovascular Division, Department of Medicine, Harvard-Thorndike Electrophysiology Institute, Beth Israel Deaconess Medical Center, Harvard Medical School, Boston, Massachusetts.

BACKGROUND During pulmonary vein isolation (PVI), a circular lasso catheter is positioned at the junction between the left atrium (LA) and the pulmonary vein (PV) to confirm PVI. The Rhythmia mapping system uses the Orion mini-basket catheter with 64 electrodes instead of the lasso catheter. However, its feasibility to determine PVI has not been studied.

OBJECTIVE The purpose of this study was to compare signals between the mini-basket and lasso catheters at the LA-PV junction.

METHODS In 12 patients undergoing PVI using Rhythmia, the mini-basket and lasso catheters were placed simultaneously at the LA-PV junction for baseline and post-PVI signal assessment. Pacing from both catheters was performed to examine the presence of exit block.

RESULTS At baseline, recordings of LA and PV potentials were concordant in all PVs. However, after PVI, concordance between the catheters was only 68%. Discordance in all cases resulted from loss of PV potentials on the lasso catheter with persistence of PV potentials on the mini-basket catheter. In 9 of 13 PVs (69%), these potentials represented true PV potentials that were exclusively recorded with the smaller and closely spaced mini-basket electrodes. In the other 4 PVs (31%), these potentials originated from neighboring structures and resulted in underestimation of PVI.

CONCLUSION The use of the mini-basket catheter alone is sufficient to determine PVI. While it improves recording of PV potentials after incomplete ablation, it is also associated with frequent recording of "PV-like" potentials originating from neighboring structures. In these cases, pacing maneuvers are helpful to determine PVI and avoid excessive ablation.

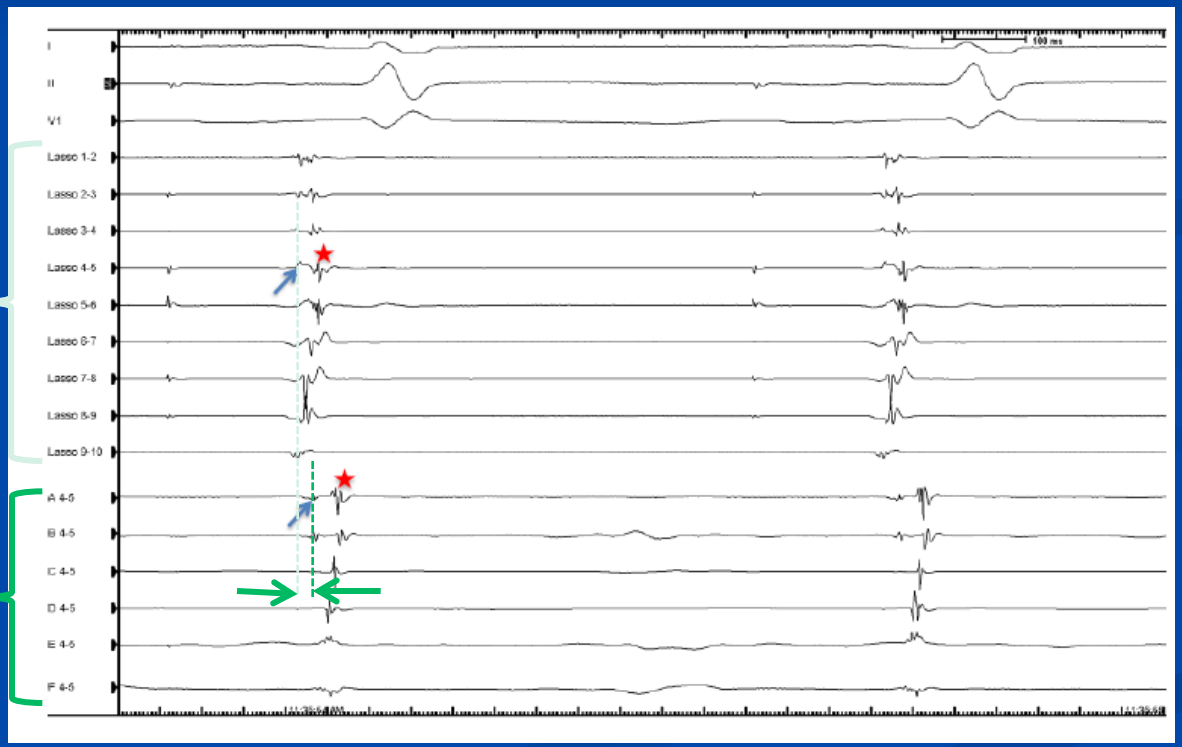
KEYWORDS Atrial fibrillation; Pulmonary vein isolation; Rhythmia; Orion; Lasso; Basket catheter

ABBREVIATIONS **AF** = atrial fibrillation; **LA** = left atrium/atrial; **LIPV** = left inferior pulmonary vein; **LSPV** = left superior pulmonary vein; **PV** = pulmonary vein; **PVI** = pulmonary vein isolation; **RF** = radiofrequency; **RIPV** = right inferior pulmonary vein; **RSPV** = right superior pulmonary vein

(Heart Rhythm 2015;12:1927–1934)

Signal comparison

- LA and PV potentials were consistent (concordant 100%) in all PV's between Orion and Lasso

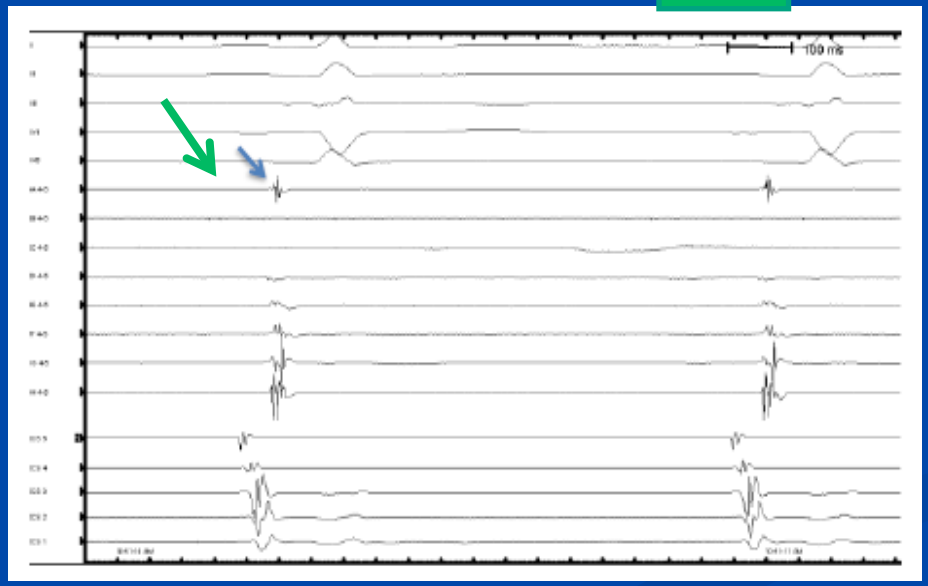


Signal comparison

- After ablation: There is poor signal concordance between Lasso and Orion (low and fragmented PV signals not visible to Lasso)

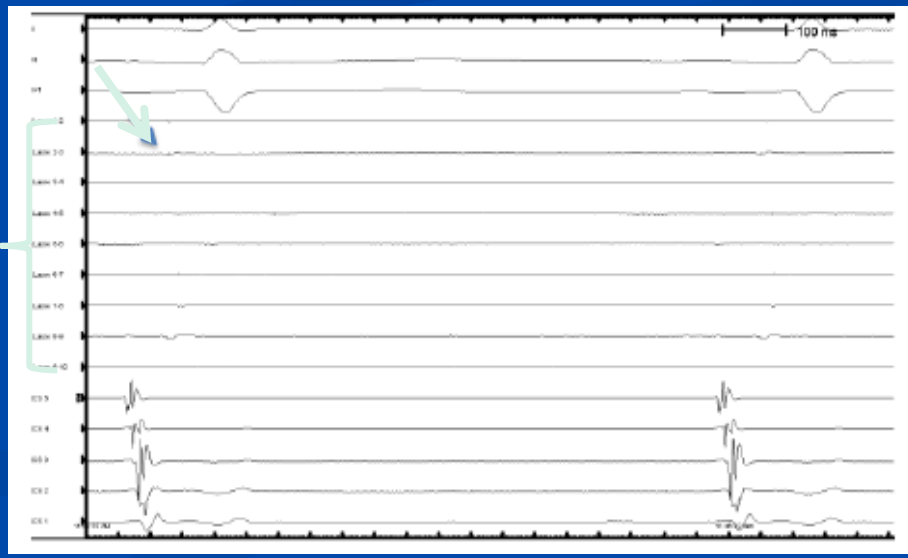
Orion

ORION



Lasso

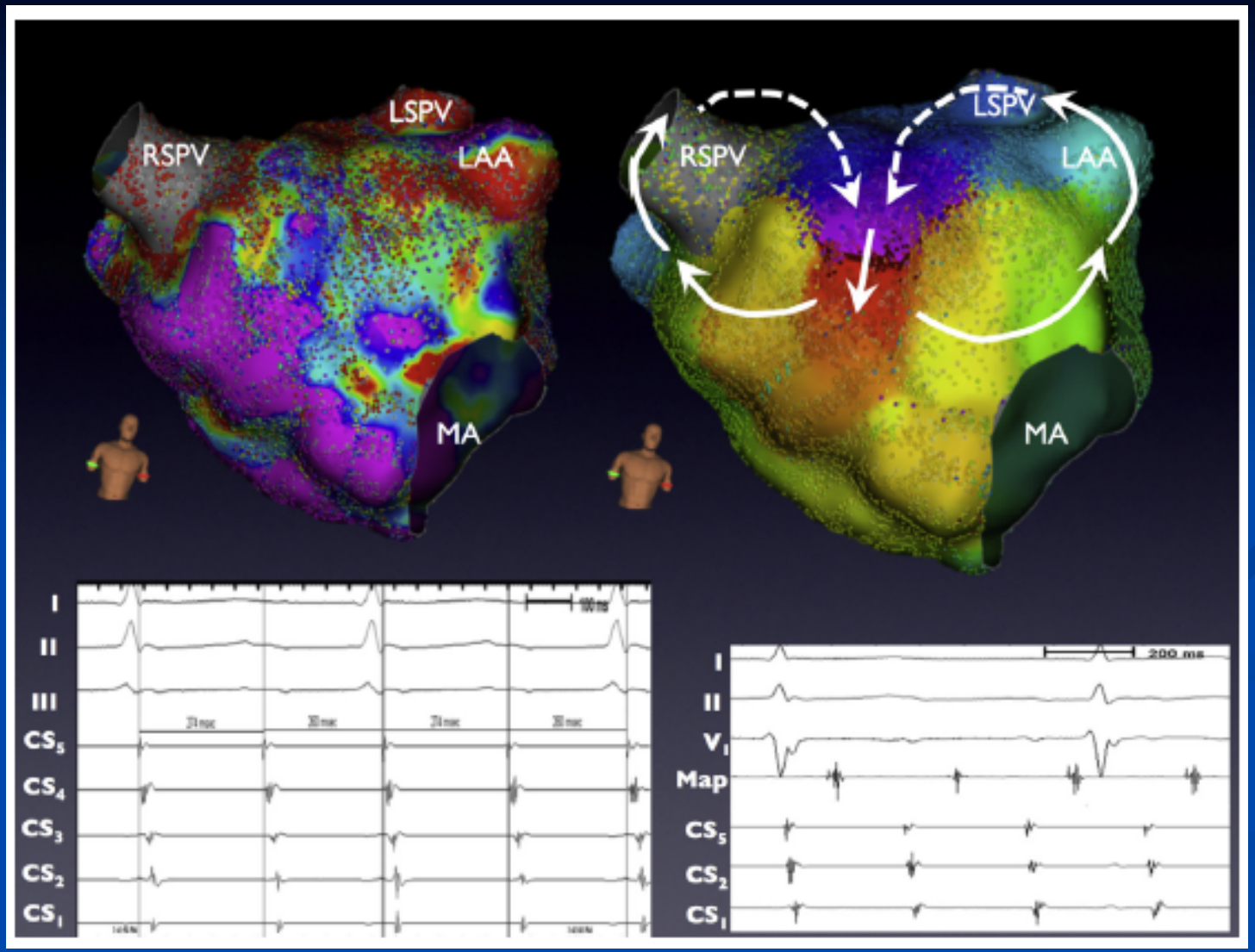
Lasso overestimation of PVI



- The Orion catheter ‘is **sufficient alone** to determine PVI’

- The Orion catheter ‘**improves recording of PV potentials** after incomplete ablation’: low amplitude & fractionated signals not detected with Lasso
- The Orion catheter ‘is associated with frequent ‘PV-like’ potentials originating from neighbouring structures. In these cases **pacing manoeuvres** are helpful to determine pulmonary vein isolation and avoid excessive ablation’.
  - Orion catheter position **more distal** in the pulmonary vein then the Lasso (9mm)

	Lasso	Orion
Underestimation of PVI	0/48 (0%)	4/48 (8.3%)
Overestimation of PVI	10/48 (20.8%)	0/48 (0%)



* Evaluation of a novel high-resolution mapping technology for ablation of recurrent scar-related atrial tachycardias.
Anter, E et.al. (Heart Rhythm2016;13:2048–2055

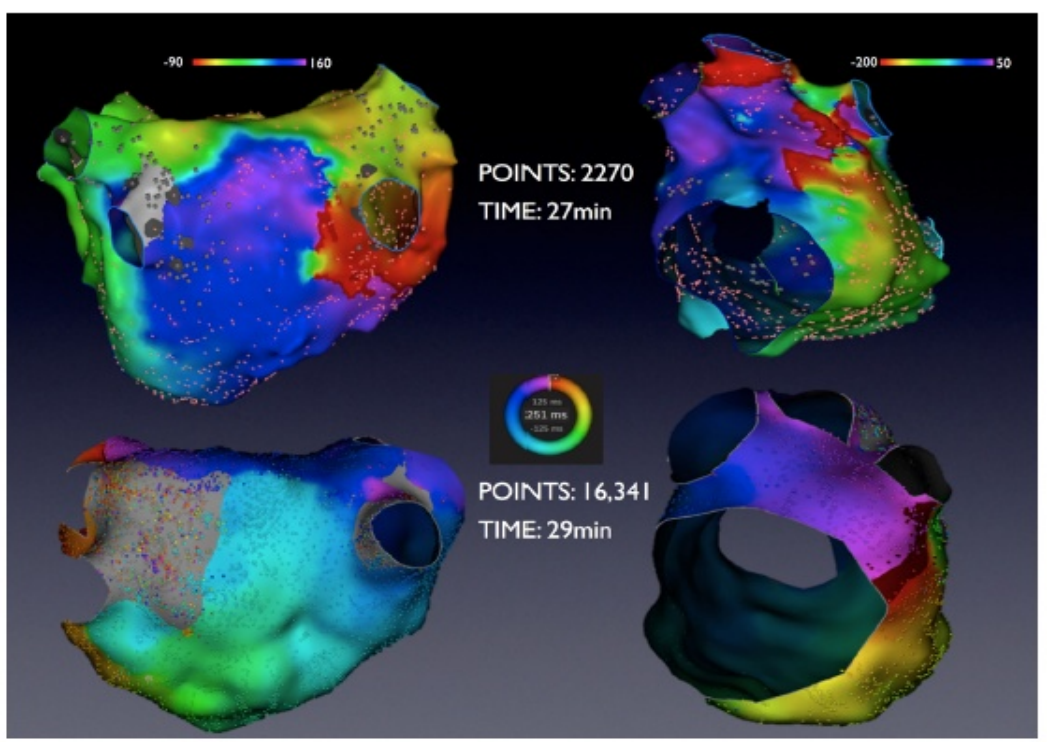
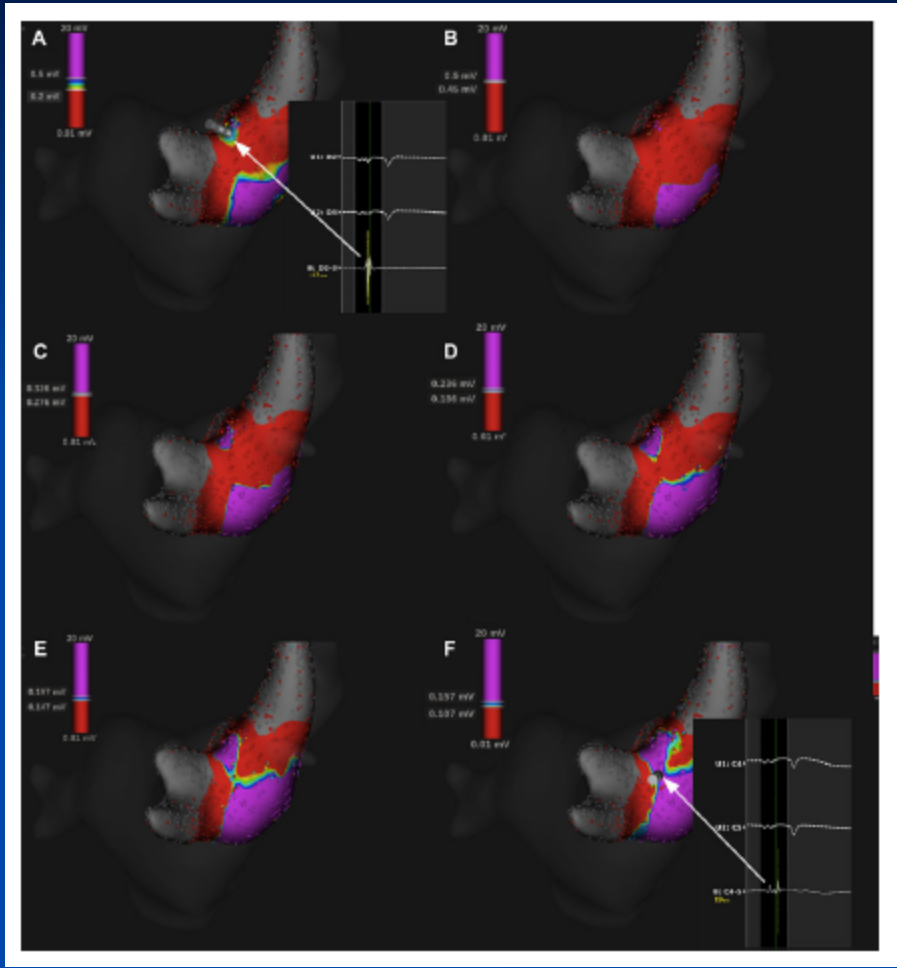


Figure 3 Activation map of scar-related atrial tachycardia. Activation map of scar-related reentrant atypical left atrial flutter. The patient underwent sequential mapping with CARTO 3 and Rhythmia during the same procedure. The upper panel shows an activation map created using CARTO 3 and a PentaRay catheter. The entire tachycardia cycle length was mapped with acquisition of 2270 points. The left upper panel is suggestive of a reentrant circuit around the right inferior pulmonary vein, demonstrating a site of "early meet late." However, entrainment from this site showed manifest P-wave fusion with a post-pacing interval that was 60 ms longer than the tachycardia cycle length, inconsistent with a reentrant circuit at this site. The mapping window (100% tachycardia cycle length) was then shifted from P-wave onset to mid P wave and led to a shift in the activation map with multiple sites of "early meet late" in and around the ridge between the left pulmonary vein and the appendage (right upper panel). The lower panel shows an activation map created using Rhythmia. The entire tachycardia cycle length was mapped to the left atrium with acquisition of 16,341 points. The activation map was consistent with a clockwise mitral annular flutter. Entrainment from the mitral annulus demonstrated concealed P-wave fusion and a post-pacing interval that was 2 ms longer than the tachycardia cycle length. Ablation at the mitral annulus terminated the tachycardia (patient 17).

* Evaluation of a novel high-resolution mapping technology for ablation of recurrent scar-related atrial tachycardias.
Anter, E et.al. (Heart Rhythm2016;13:2048–2055

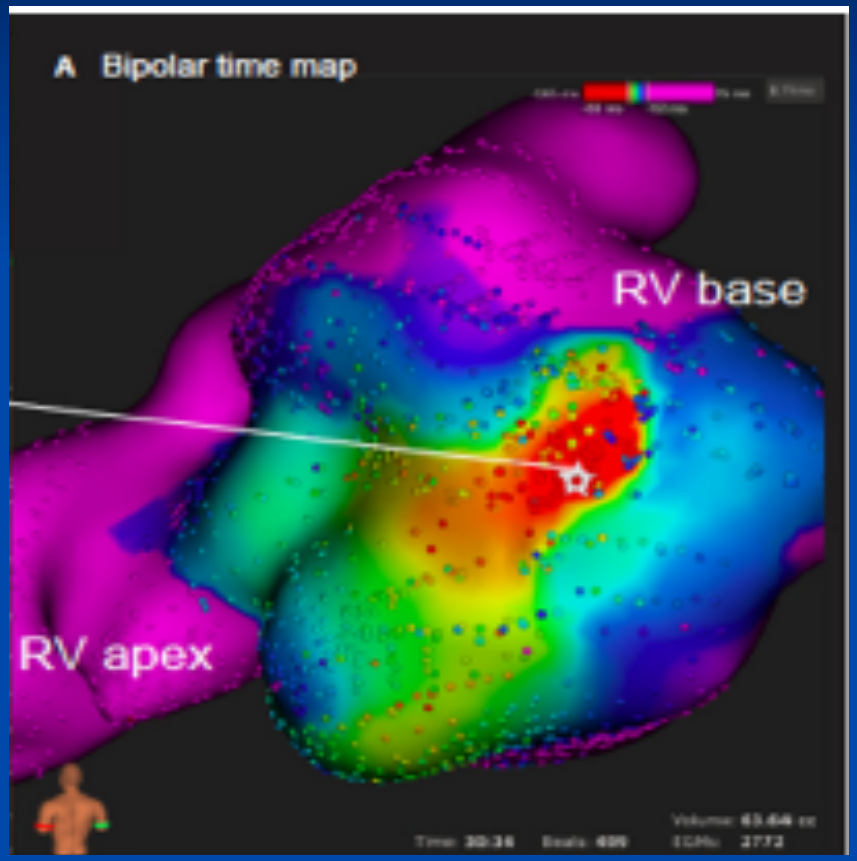
• Voltage map with Orion catheter after PVI (Fig. A).
•A high-voltage area in the carina region of the right PVs. .

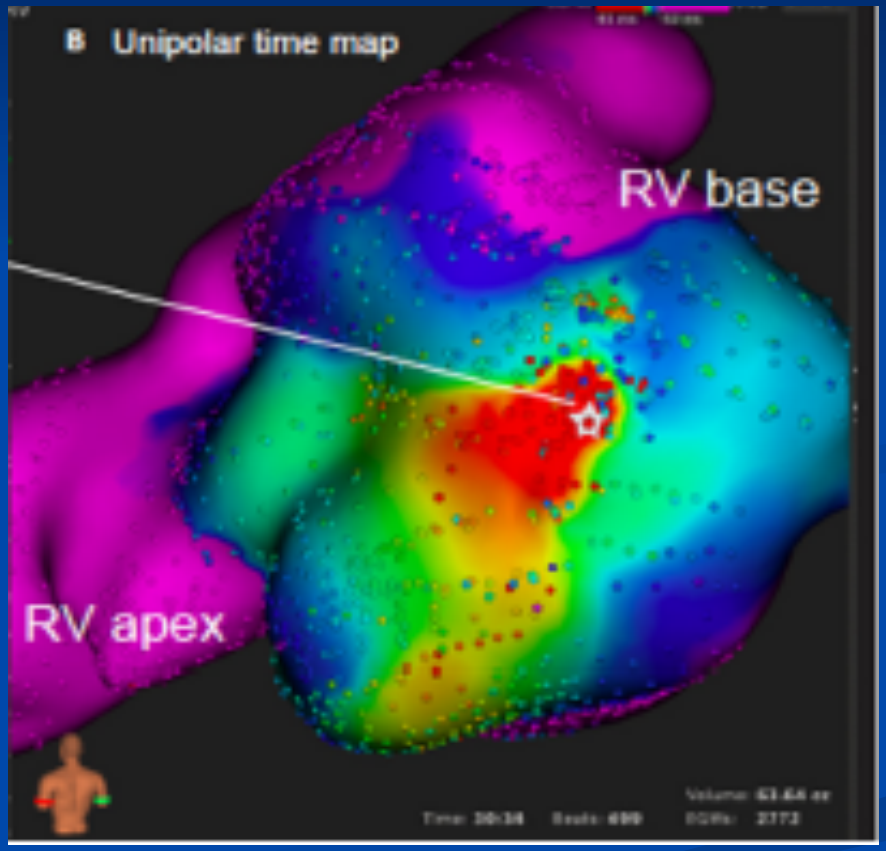
• Gradual reduction of the voltage scale with a decrement of 0.05 mV resulted in a progressive merging of the proximal and distal high-voltage region (Fig. B-E).
• At the point of 0.157-0.107 mV, a confluence of both areas can be observed (Fig. F) and the conducting hannel can be identified



*** Channel-Based Gap Mapping for Pulmonary Vein Isolation**
KOSIUK J et. al. J Cardiovasc Electrophysiol, Vol. 27, pp. 488-489, April 2016

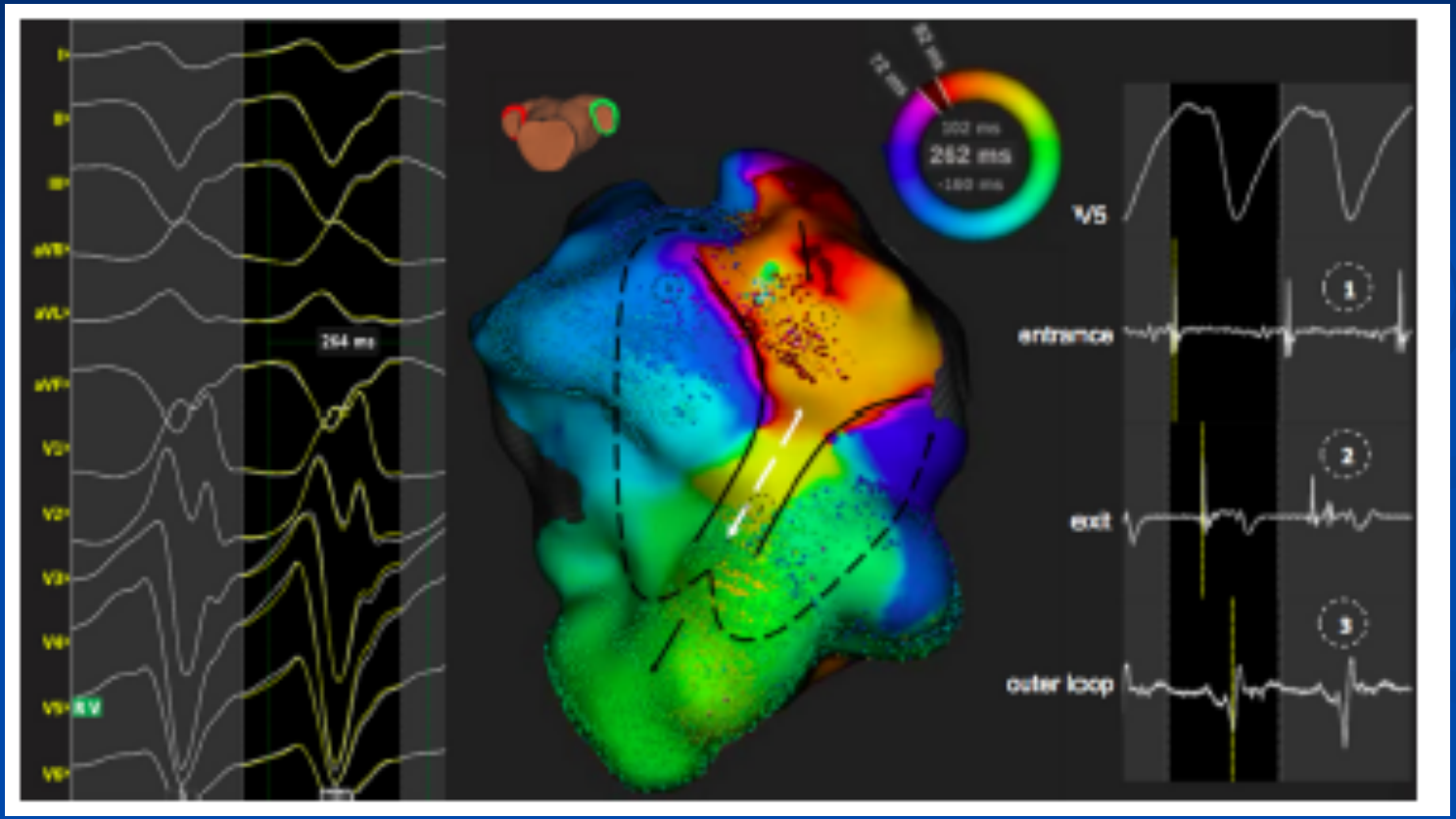
Mapping of PVC from RV





- Evaluation of a novel high-resolution mapping system for catheter ablation of ventricular arrhythmias. Viswanathan K et al, Heart Rhythm2016;0:1–8

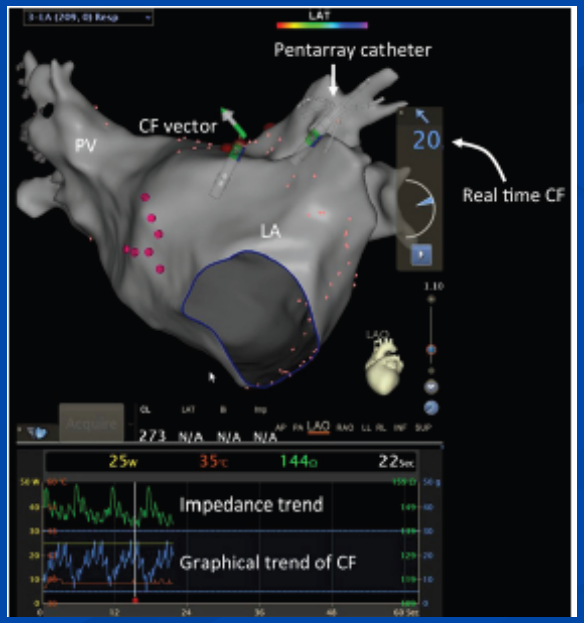
Mapping of VT



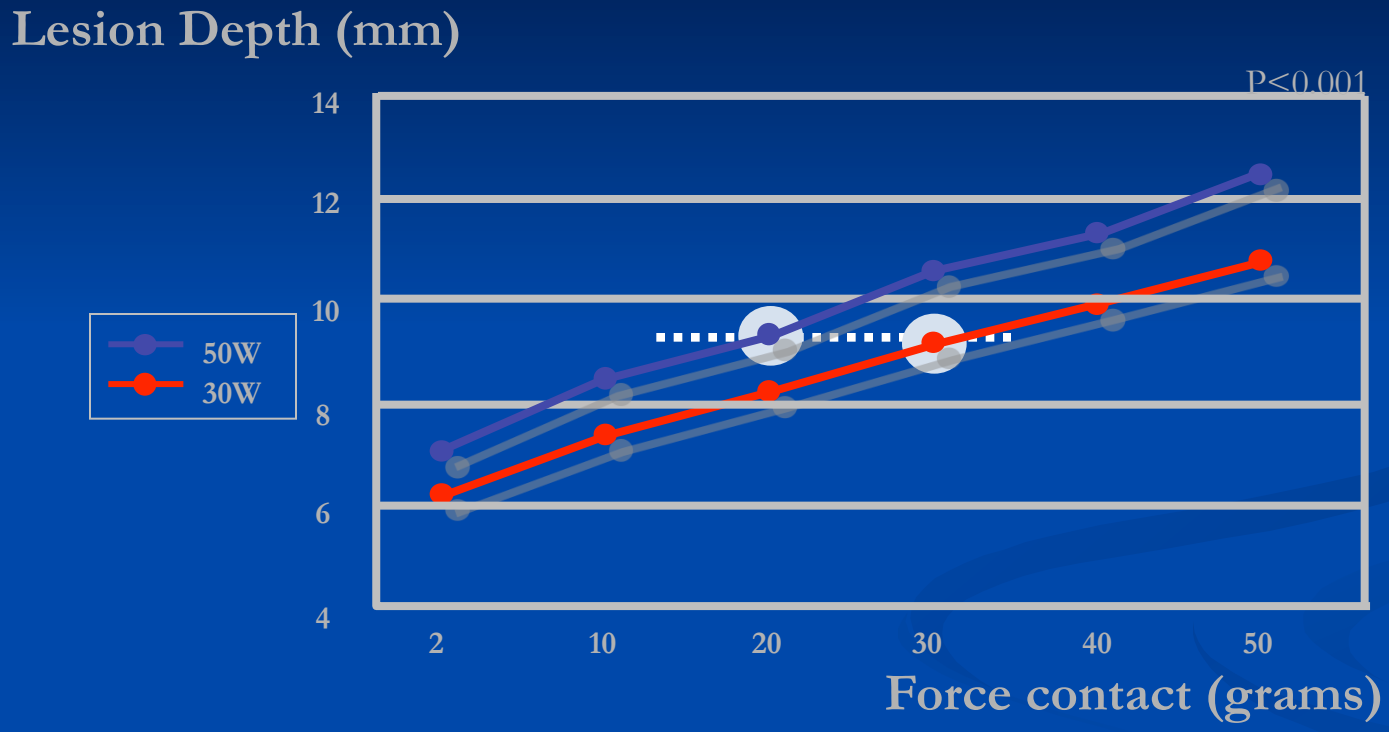
Contact Force Sensing

- CF sensing catheters allow real-time measurement of the catheter tip-to-tissue CF during catheter ablation.
- Two new CF sensing catheters are available,
  - TactiCath (St. Jude Medical, St. Paul, MN, USA): 7 Fr, open irrigation catheter (6 holes at the distal tip) with a 3.5-mm tip electrode.
  - SmartTouch Thermocool (Biosense Webster, Diamond Bar, CA, USA): a steerable, 3.5-mm six-hole open-irrigated tip ablation catheter.

- Contact force measurement has the potential to:
  - Improve predictability of lesion size
  - Increase consistency of lesions
  - Improve ablation process (faster/better)
  - Ultimately improve procedure



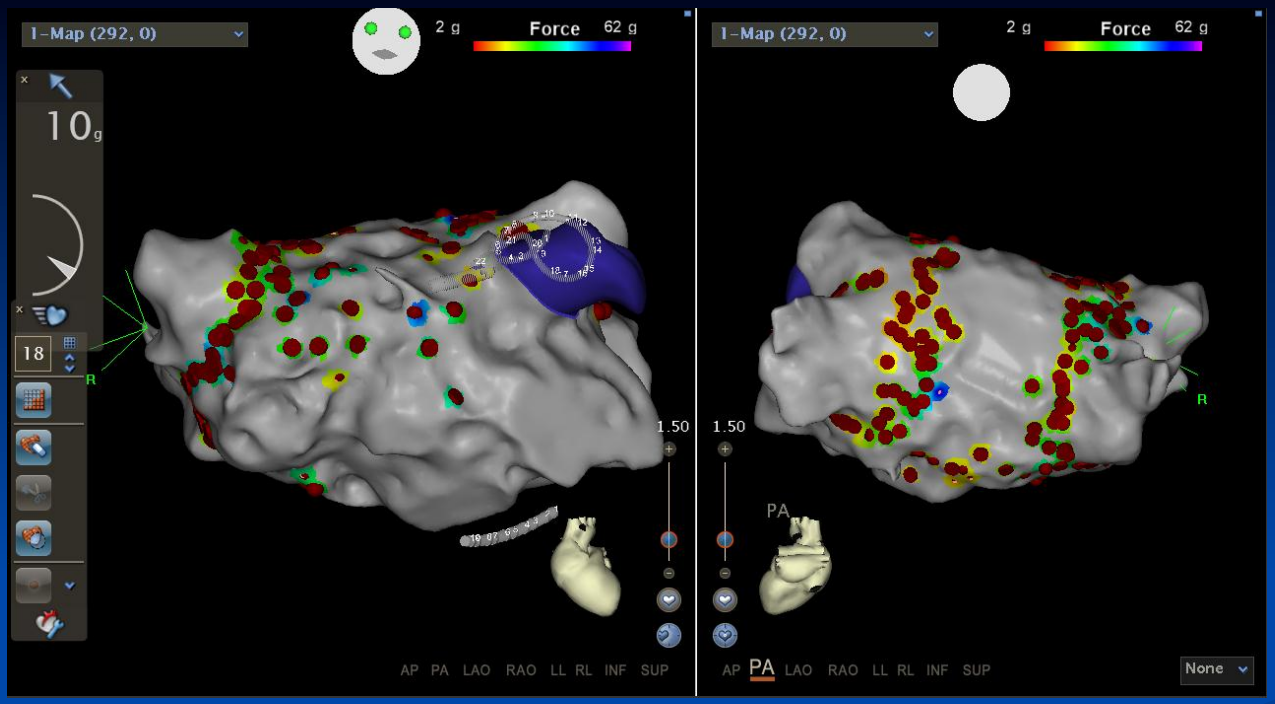
Contact Force and Ablation

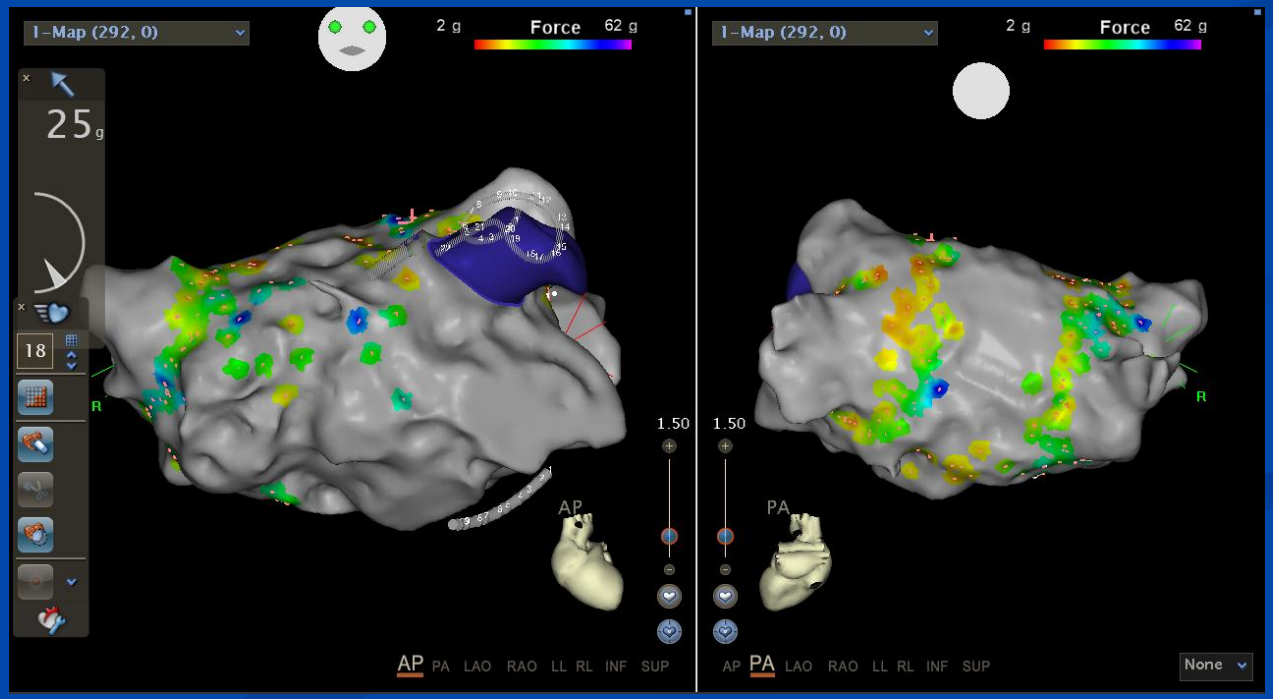


More Force = Larger lesions at a given power

More Force = Increased risks of pops/perforations…

Circ Arrhythm Electrophysiol 2008;1;354-362;.


1-Map (292, 0)
2 g
Force
62 g
10 g
18
R
1.50
AP PA LAO RAO LL RL INF SUP
PA
None


1-Map (292, 0)
2 g
Force
62 g
25 g
18
R
1.50
AP PA LAO RAO LL RL INF SUP
AP
PA
None

Impact of Contact Force Technology on Atrial Fibrillation Ablation: A Meta-Analysis

Mohammed Shurrab, MD, MSc; Luigi Di Biase, MD, PhD; David F. Briceno, MD; Anna Kaoutskaia, BSc; Saleem Haj-Yahia, MD; David Newman, MD; Ilan Lashevsky, MD; Hiroshi Nakagawa, MD, PhD; Eugene Crystal, MD

Background—Catheter–tissue contact is essential for effective lesion formation, thus there is growing usage of contact force (CF) technology in atrial fibrillation ablation. We conducted a meta-analysis to assess the impact of CF on clinical outcomes and procedural parameters in comparison to conventional catheter for atrial fibrillation ablation.

Methods and Results—An electronic search was performed using major databases. Outcomes of interest were recurrence rate, major complications, total procedure, and fluoroscopic times. Continuous variables were reported as standardized mean difference; odds ratios were reported for dichotomous variables. Eleven studies (2 randomized controlled studies and 9 cohorts) involving 1428 adult patients were identified. CF was deployed in 552 patients. The range of CF used was between 2 to 60 gram-force. The follow-up period ranged between 10 and 53 weeks. In comparing CF and conventional catheter groups, the recurrence rate was lower with CF (35.1% versus 45.5%, odds ratio 0.62 [95% CI 0.45–0.86], P=0.004). Shorter procedure and fluoroscopic times were achieved with CF (procedure time: 156 versus 173 minutes, standardized mean difference −0.85 [95% CI −1.48 to −0.21], P=0.009; fluoroscopic time: 28 versus 36 minutes, standardized mean difference −0.94 [95% CI −1.66; −0.21], P=0.01). Major complication rate was lower numerically in the CF group but not statistically significant (1.3% versus 1.9%, odds ratio 0.71 [95% CI 0.29–1.73], P=0.45).

Conclusions—The use of CF technology results in significant reduction of the atrial fibrillation recurrence rate after atrial fibrillation ablation in comparison to the conventional catheter group. CF technology is able to significantly reduce procedure and fluoroscopic times without compromising complication rate. (***J Am Heart Assoc*. 2015;4:e002476 doi: 10.1161/JAHA.115.002476**)

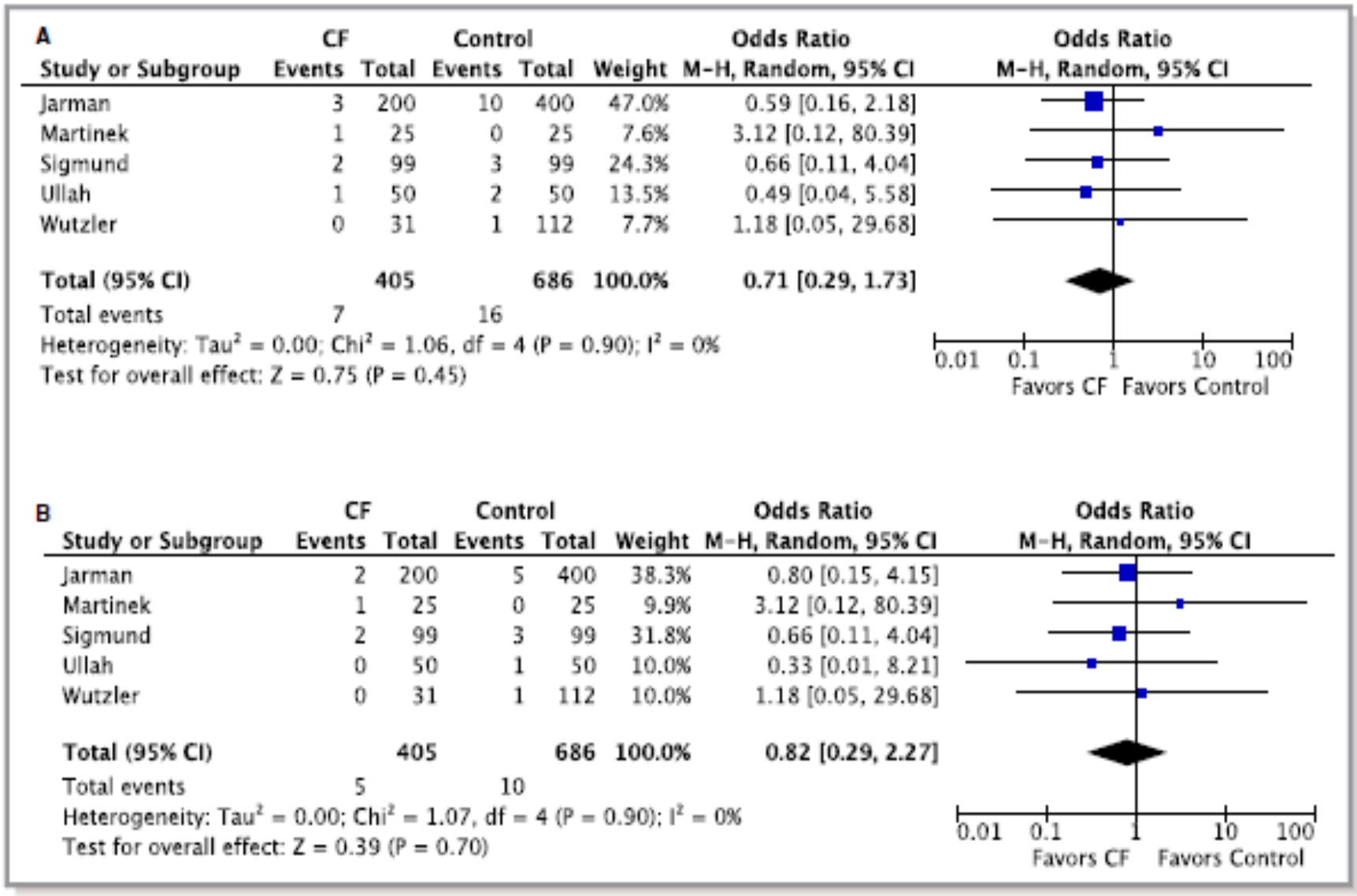


Figure 5. Forest plots of the individual and combined rates of (A) major complications and (B) cardiac tamponade. CF indicates contact force; M-H, Mantel-Haenszel test.