Quando è corretto ablare la FA. Indicazioni e tecnica. Quando è corretto coinvolgere il cardiochirurgo?

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Centro Cardiologico Monzino, IRCCS

University of Milan, Milan, Italy

Centro Cardiologico Monzino

UNIVERSITÀ DEGLI STUDI DI MILANO

No Disclosure

Agenda

Background- indicazioni

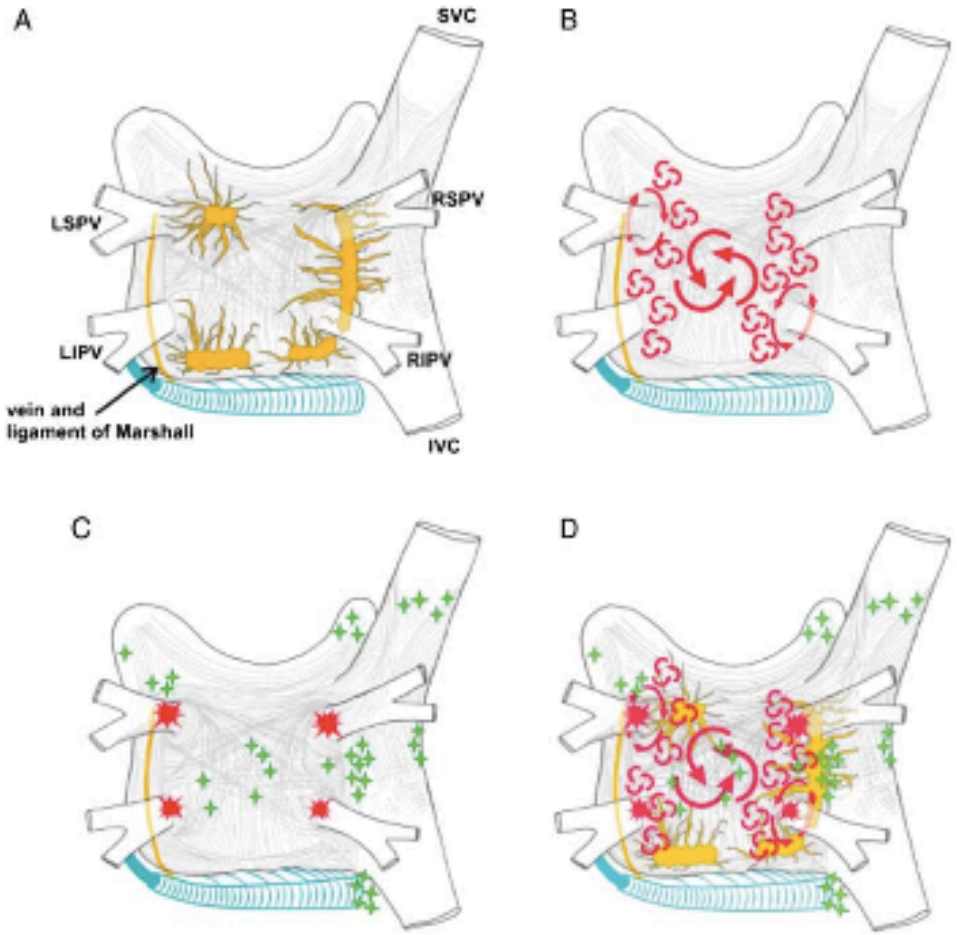
- Tecnologie PVI isolation one- shot
- Contact Force
- PV isolation e' sufficiente ?
- Coinvolgimento del cardiochirurgo

Meccanismi della FA

Europace (2012) 14, 528–606
doi:10.1093/europace/eus027

HRS/EHRA/ECAS EXPERT CONSENSUS STATEMENT

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



Indicazioni

Europace (2012) 14, 528–606
doi:10.1093/europace/eus027

HRS/EHRA/ECAS EXPERT CONSENSUS STATEMENT

2012 HRS/EHRA/ECAS Expert Consensus Sta… of … for Pat… En…

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

542 H. Calkins et al.

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
surgical approach		
INDICATIONS FOR CONCOMITANT SURGICAL ABLATION of AF		
Symptomatic AF refractory or intolerant to at least one Class 1 or 3 antiarrhythmic medication		
Paroxysmal: Surgical ablation is reasonable for patients undergoing surgery for other indications	IIa	C
Persistent: Surgical ablation is reasonable for patients undergoing surgery for other indications	IIa	C
Longstanding Persistent: Surgical ablation is reasonable for patients undergoing surgery for other indications	IIa	C
Symptomatic AF prior to initiation of antiarrhythmic drug therapy with a Class 1 or 3 antiarrhythmic agent		
Paroxysmal: Surgical ablation is reasonable for patients undergoing surgery for other indications	IIa	C
Persistent: Surgical ablation is reasonable for patients undergoing surgery for other indications	IIa	C
Longstanding Persistent: Surgical ablation may be considered for patients undergoing surgery for other indications	IIb	C

performing the procedure in an experienced center.

Background e Razionale

Europace (2012) 14, 528–606
doi:10.1093/europace/eus027

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Comparison between Cooled Tip and standard RF Ablation

Power: 50W Temperature:50°C Duration:60 sec. Flow rate:17ml/min

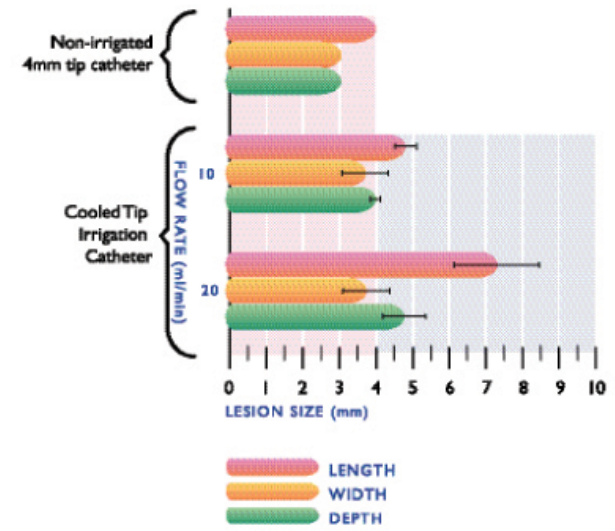
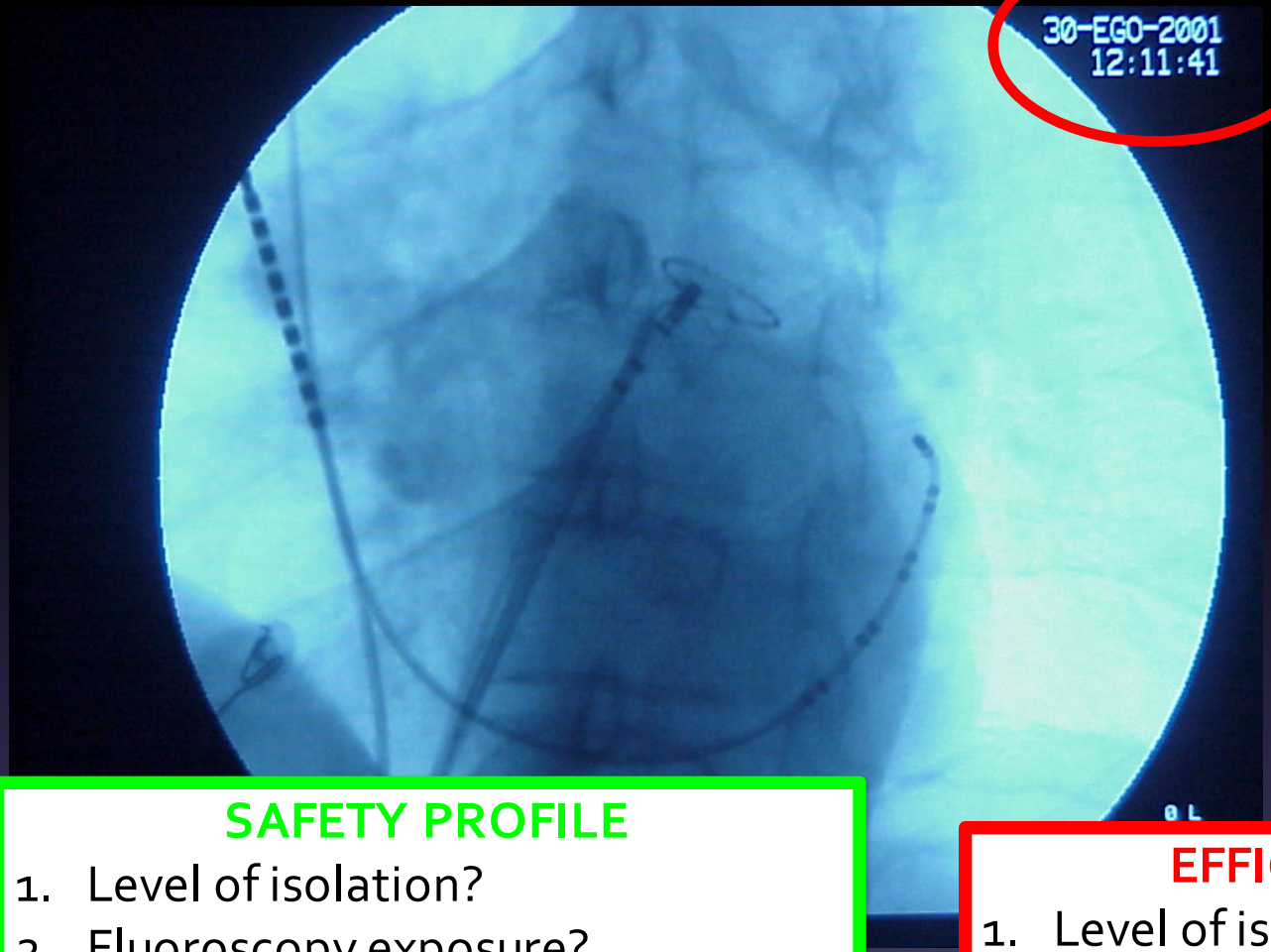
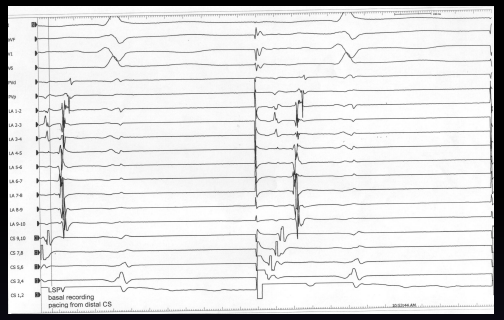


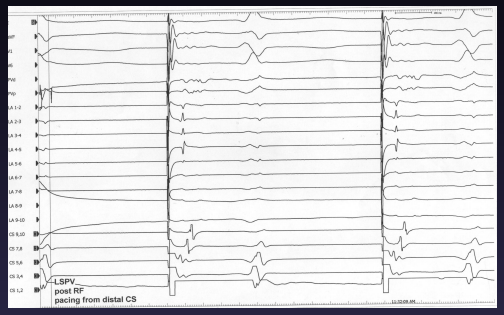
TABLE 3: RECOMMENDATIONS REGARDING ABLATION TECHNIQUE

- Ablation strategies that target the PVs and/or PV antrum are the cornerstone for most AF ablation procedures.
- If the PVs are targeted, electrical isolation should be the goal.
- Achievement of electrical isolation requires, at a minimum, assessment and demonstration of entrance block into the PV.
- Monitoring for PV reconduction for 20 minutes following initial PV isolation should be considered.
- For surgical PV isolation, entrance and/or exit block should be demonstrated.
- Careful identification of the PV ostia is mandatory to avoid ablation within the PVs.
- If a focal trigger is identified outside a PV at the time of an AF ablation procedure, ablation of that focal trigger should be considered.
- If additional linear lesions are applied, operators should consider using mapping and pacing maneuvers to assess for line completeness.
- Ablation of the cavotricuspid isthmus is recommended in patients with a history of typical atrial flutter or inducible cavotricuspid isthmus dependent atrial flutter.
- If patients with long standing persistent AF are approached, operators should consider more extensive ablation based on linear lesions or complex fractionated electrograms.
- It is recommended that RF power be reduced when creating lesions along the posterior wall near the esophagus.

History







SAFETY PROFILE

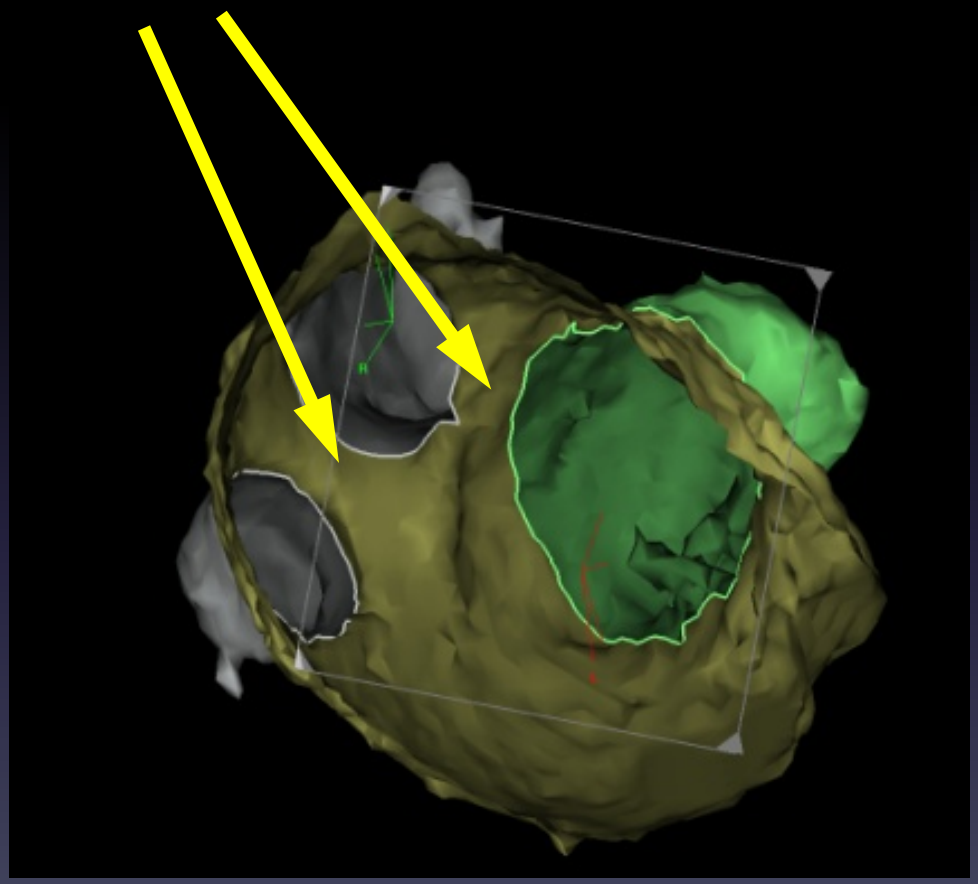
1. Level of isolation?
2. Fluoroscopy exposure?
3. Anatomical variants?
4. Esophageal collateral damage?
5. Procedural anticoagulation management?

EFFICACY PROFILE

1. Level of isolation?
2. Linearity of the lesion?
3. Tissue contact?
4. Lesion formation monitoring?

WHAT DO WE NEED FOR AFIB ABLATION

Stability

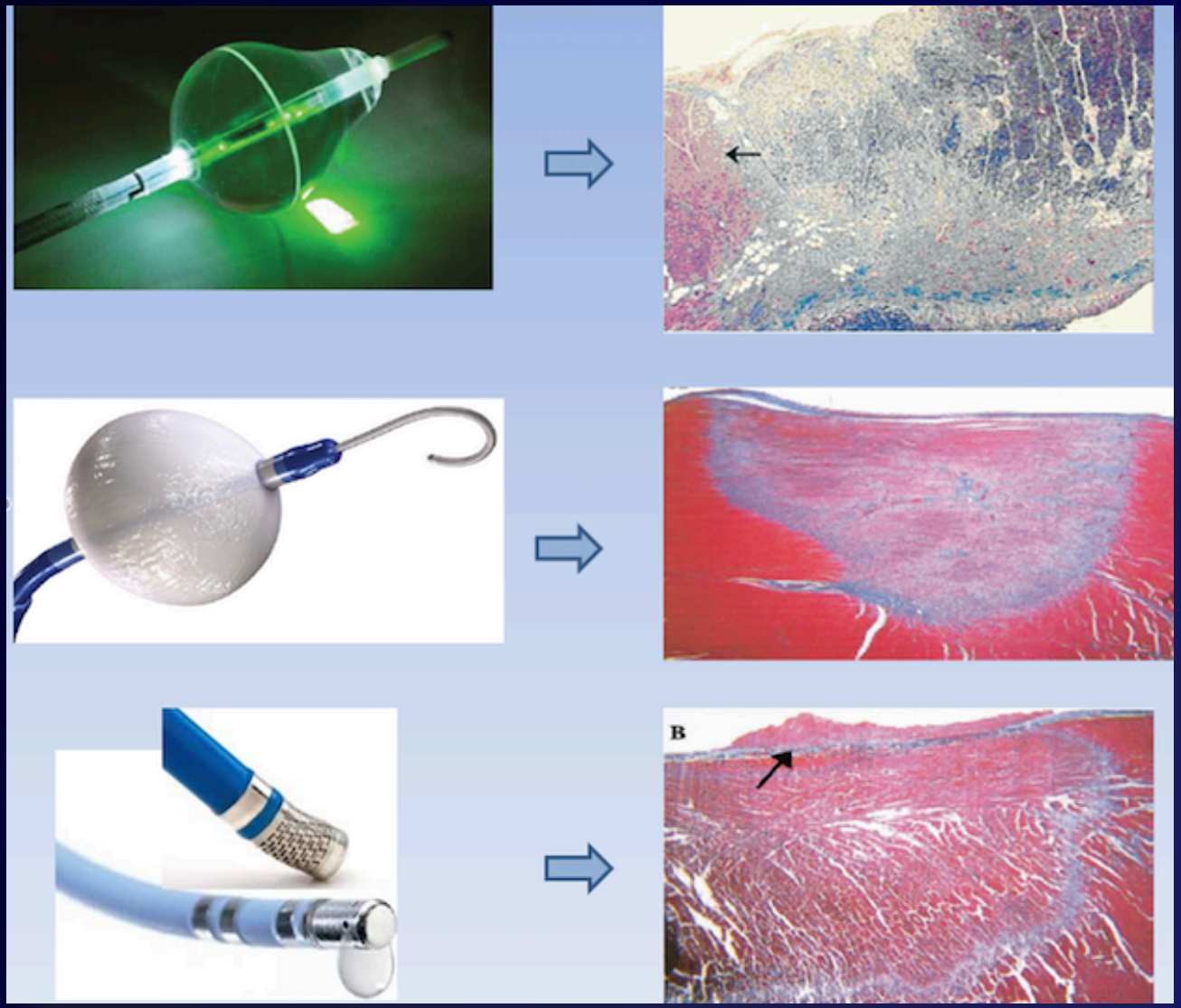


Continuous lesion

Balance between deeper lesion (transmurality) and safety

PERSISTENCE OF THE LESION OVER TIME

Varie sorgenti di energia: Caratteristiche della lesione



New Technologies in AF Ablation

Do we really need them?

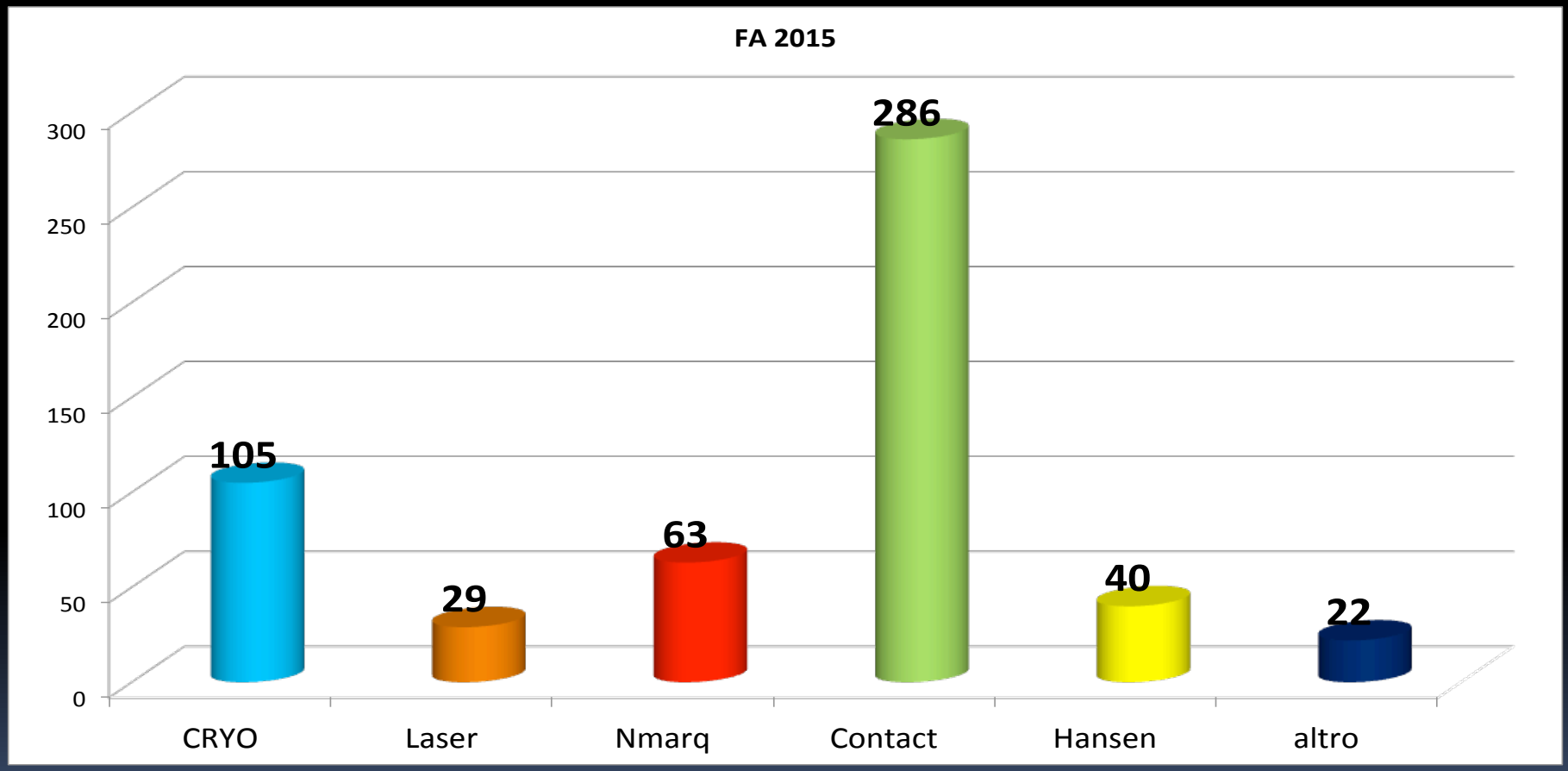
Why do we look for them ?

Are they more effective for PVI ?

Do they guarantee longer PVI durability ?

Do they provide higher safety profile ?

NEW TECHNOLOGIES UPDATE: 2015



Centro Cardiologico Monzino

Tecnologie One-shot PVI

2005

Journal of the American College of Cardiology
© 2005 by the American College of Cardiology Foundation
Published by Elsevier Inc.

Vol. 46, No. 10, 2005
ISSN 0735-1097/05/$30.00
doi:10.1016/j.jacc.2005.07.046

Efficacy and Safety of Circumferential Pulmonary Vein Isolation Using a Novel Cryothermal Balloon Ablation System

Alvaro V. Sarabanda, MD, PHD,*† T. Jared Bunch, MD,* Susan B. Johnson, BS,* Srijoy Mahapatra, MD,* Mark A. Milton, MD,* Luiz R. Leite, MD,* G. Keith Bruce, MD,* Douglas L. Packer, MD*

Rochester, Minnesota; and Ribeirão Preto, Brazil

Clinical implications. The efficacy of the novel cryoballoon ablation system for isolating PVs seen in the present study supports the utility of this technique in ablating PVs in the clinical electrophysiological laboratory. A cryoballoon approach to PV isolation is attractive because isolation of PVs can be quickly performed through a simple anatomical approach based on balloon positioning at the PV orifice. However, because of the variability of the PV anatomy, a family of balloon catheters with variable shapes and sizes will be required to fully implement this technique. The impact of this new technique on collateral injury remains to be elucidated completely.

J Interv Card Electrophysiol (2006) 15:79–81
DOI 10.1007/s10840-006-8519-5

2006

Cryoablation of the pulmonary veins using a novel balloon catheter

Arthur Garan · Amin Al-Ahmad · Teresa Mihalik · Catherine Cartier · Lea Capuano · David Holtan · Christopher Song · Munther K. Homoud · Mark S. Link · N. A. Mark Estes III · Paul J. Wang

- Transmural freezing can be created **circumferentially**
- If Balloon **occlusion > deeper lesions** (by limiting blood flow through the pulmonary vein).
- Transmural freezing occurred **rapidly** (Temperature-monitoring using thermocouples demonstrated)
- With freezing, tissue contact becomes more stable allowing for circumferential lesions and **reducing the potential for gaps** in the ablation line.

2012

Europace Advance Access published March 1, 2012

Europace
doi:10.1093/europace/eus027

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

and **Cryoballoon ablation** are the two **standard ablation systems** used for catheter ablation of AF today ….

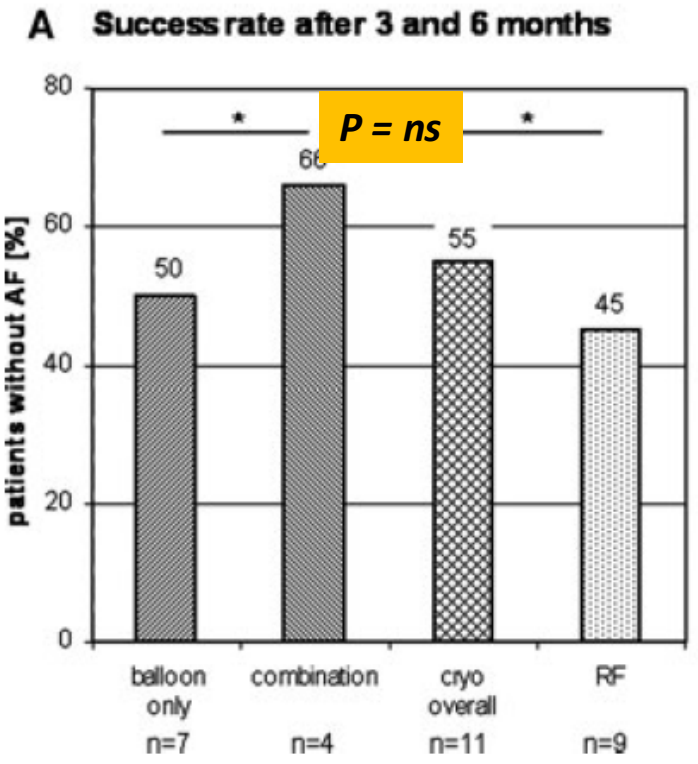
Kuck KH, Cappato R, Brugada J, et al.; Heart Rhythm Society Task Force on Catheter and Surgical Ablation of Atrial Fibrillation. *Heart Rhythm*, 2012 Apr;9(4):632-696.e21.

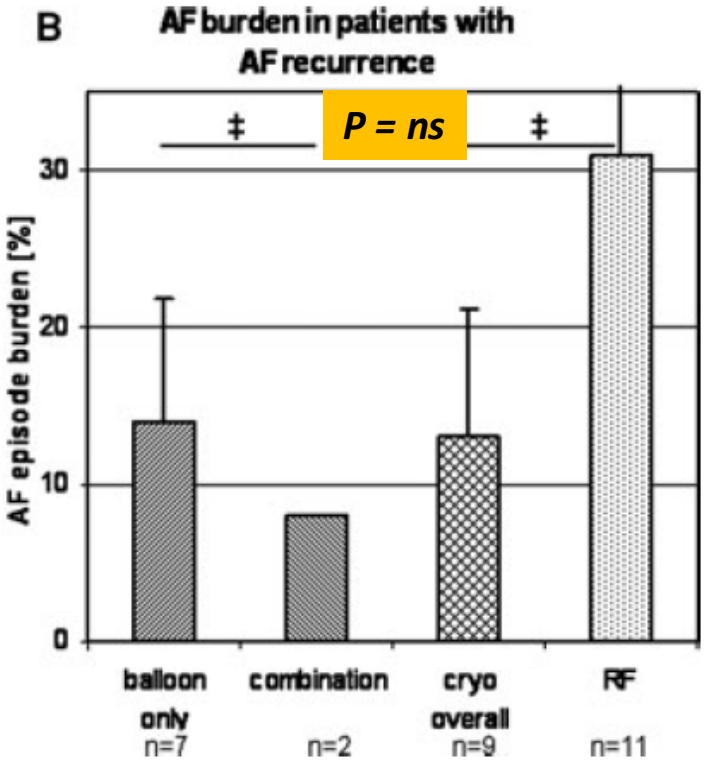
Cryo vs RF

Comparison of Cryoballoon and Radiofrequency Ablation of Pulmonary Veins in 40 Patients with Paroxysmal Atrial Fibrillation: A Case-Control Study

MARKUS LINHART, M.D., BARBARA BELLMANN, ERICA MITTMANN-BRAUN, M.D., JAN W. SCHRICKEL, M.D., ALEXANDER BITZEN, M.D., RENÉ ANDRIÉ, M.D., ALEXANDER YANG, M.D., GEORG NICKENIG, M.D., LARS LICKFETT, M.D., and THORSTEN LEWALTER, M.D.

From the Medizinische Klinik und Poliklinik II, University of Bonn, Bonn, Germany





patients without any documented AF

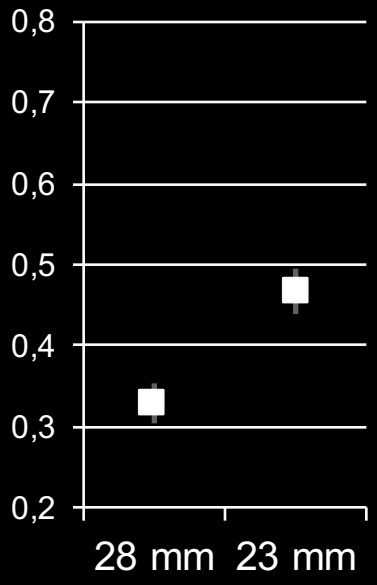
AF episode burden in patients with AF recurrence

Enha

Arctic Front Advance with EvenCool™

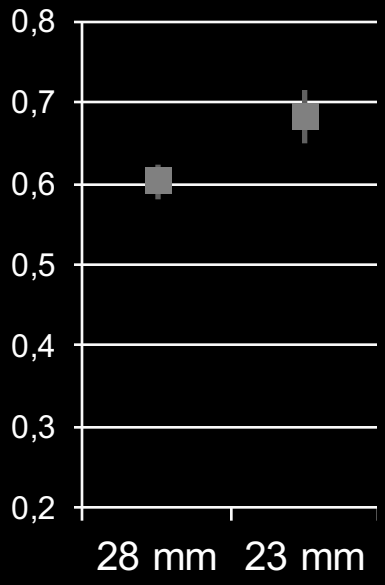
~47% increase in uniformity for the 23 mm
~83% increase in uniformity for the 28 mm

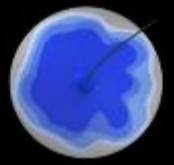
Arctic Front
Uniformity Score + STDev



Refrigerant distribution comes from 4 jets

Arctic Front Advance
Uniformity Score + STDev

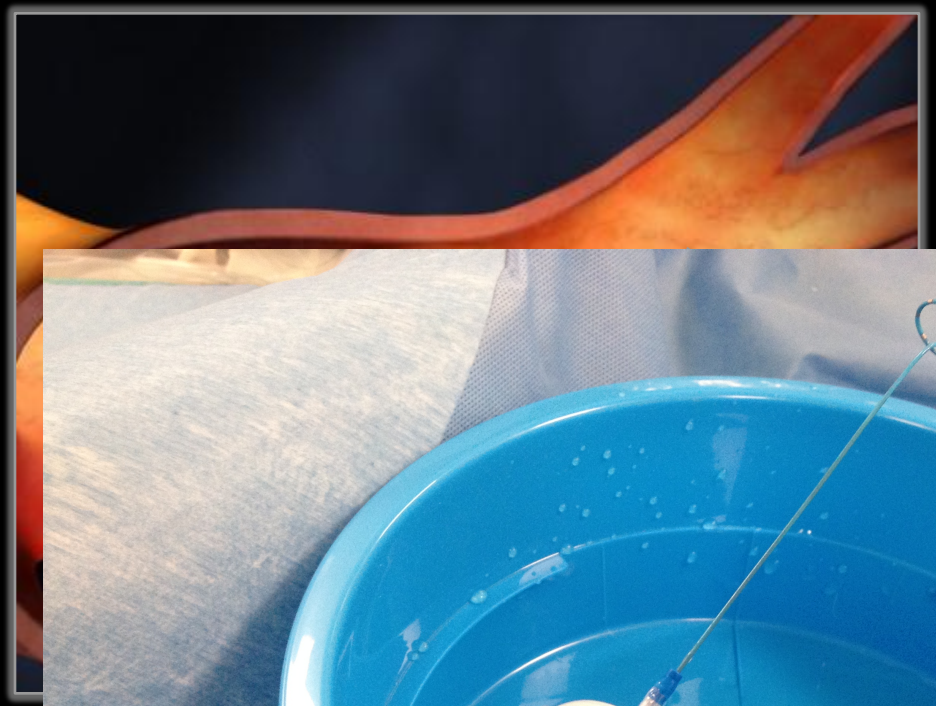


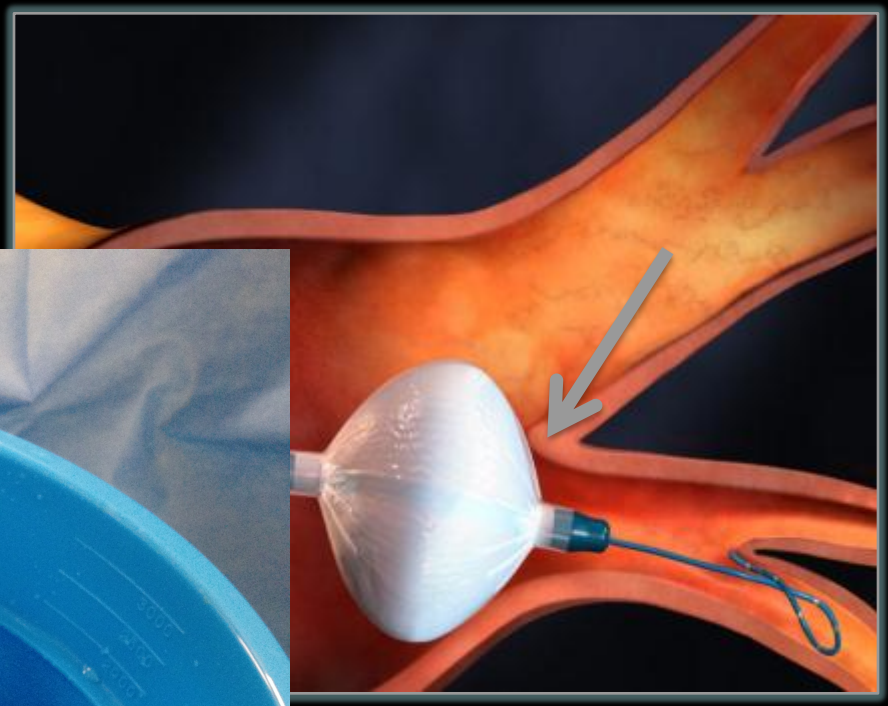


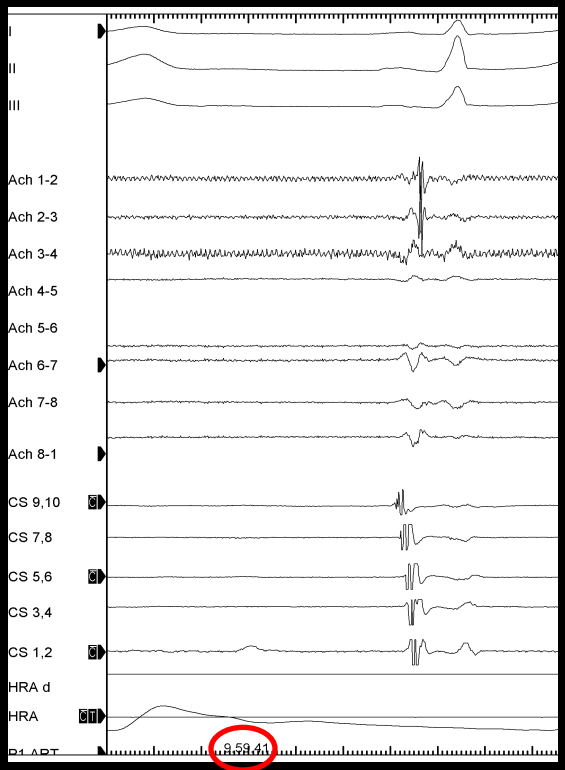
Improved surface temperature gradient

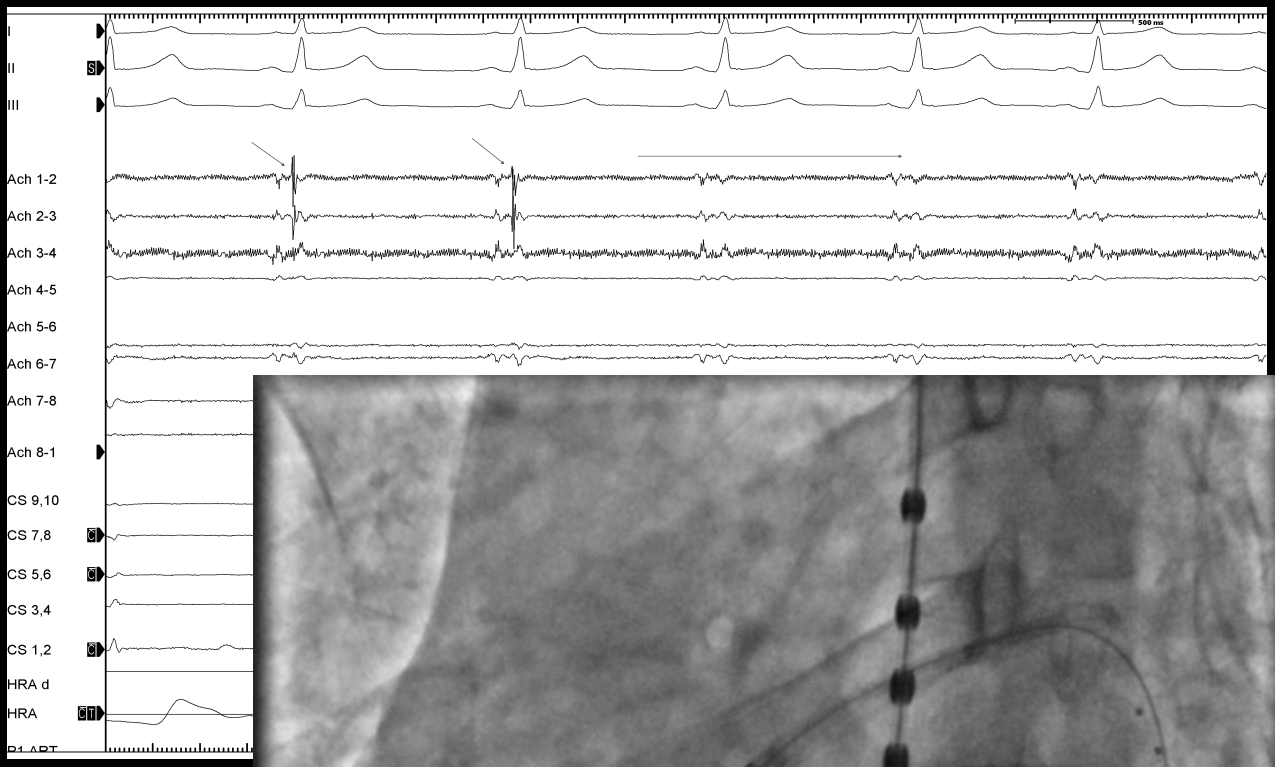
Arctic Front

Arctic Front Advance






I
II
III
Ach 1-2
Ach 2-3
Ach 3-4
Ach 4-5
Ach 5-6
Ach 6-7
Ach 7-8
Ach 8-1
CS 9,10
CS 7,8
CS 5,6
CS 3,4
CS 1,2
HRA d
HRA
P1 ART


I
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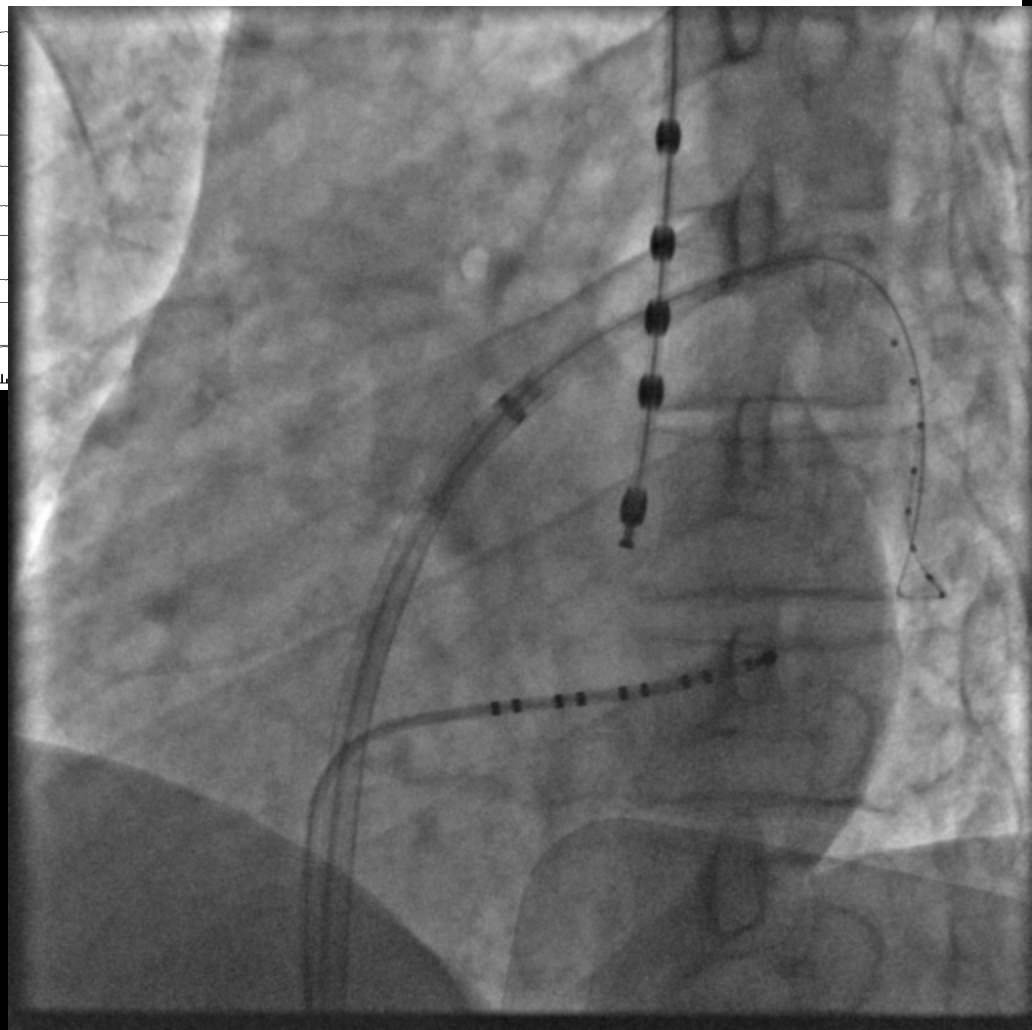
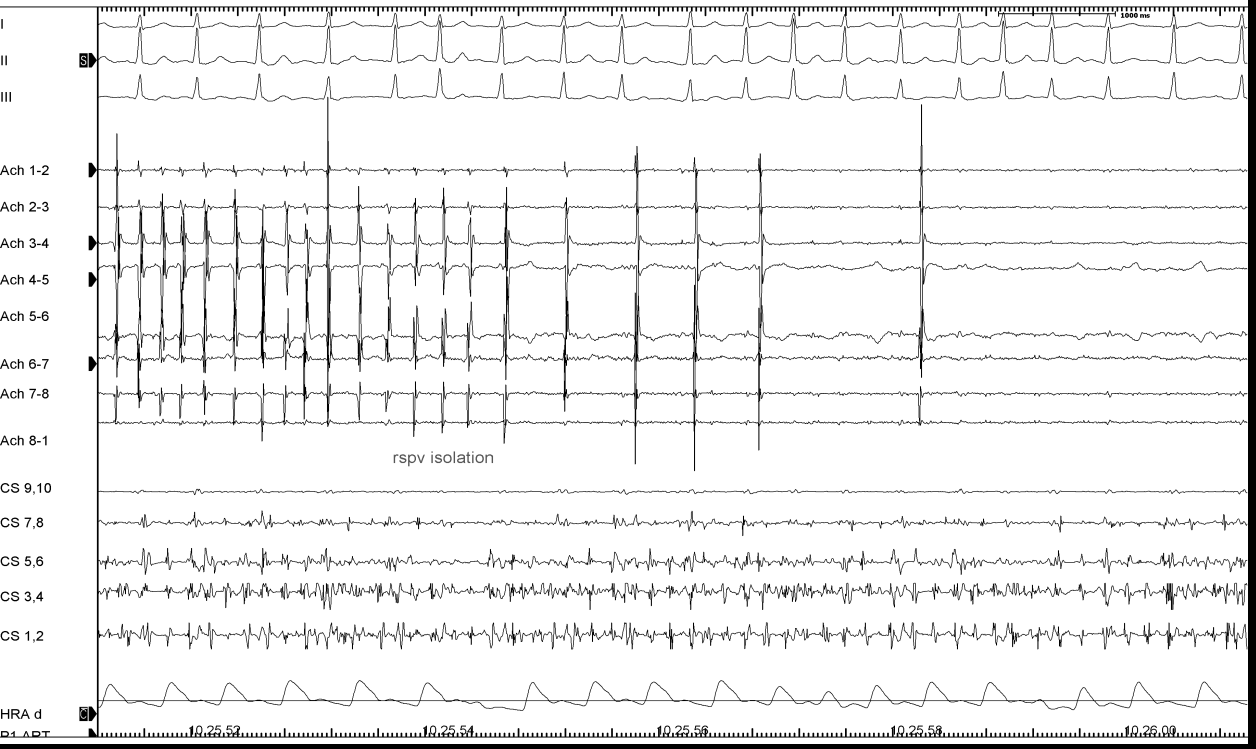
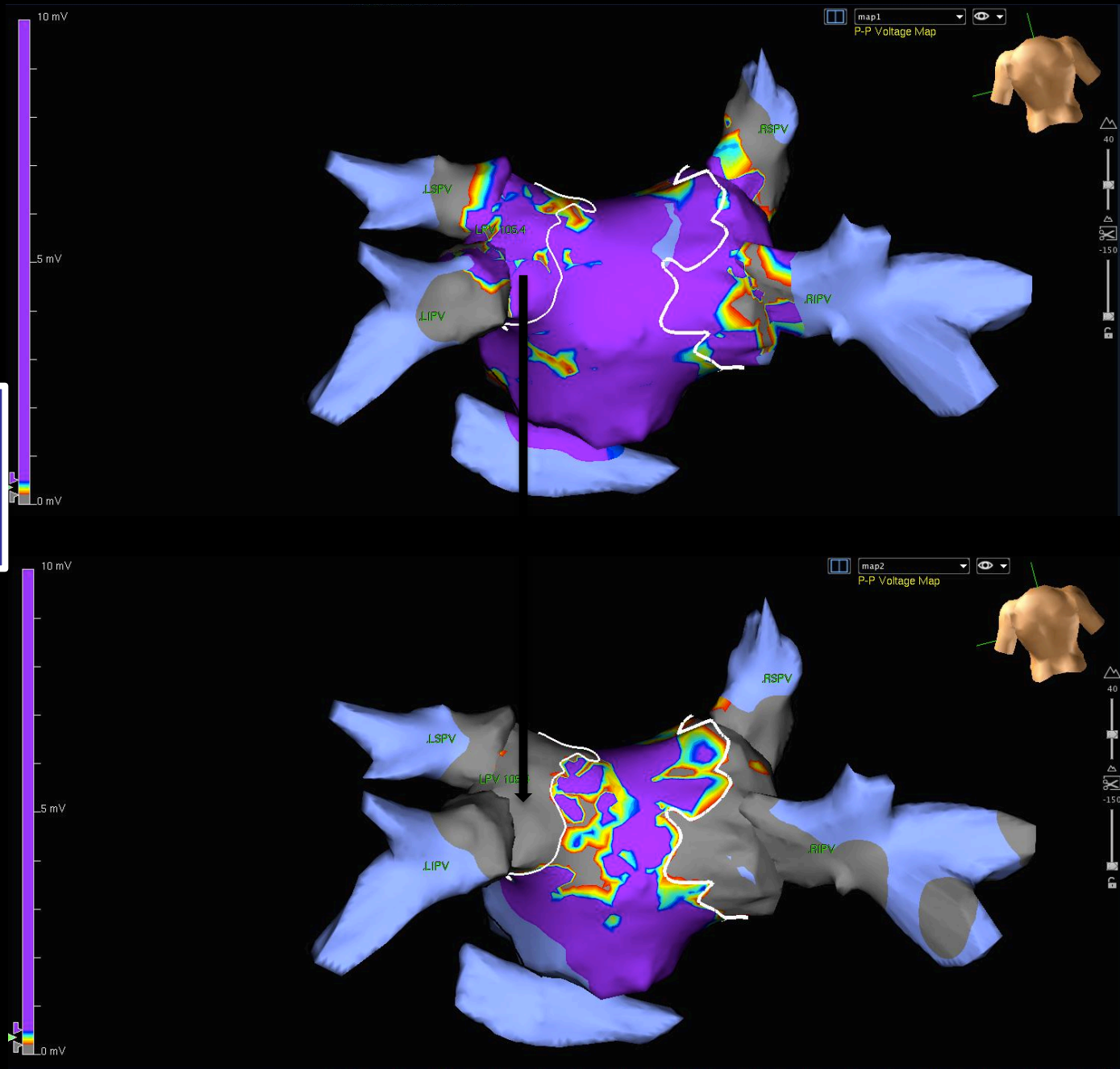
Ach 1-2
Ach 2-3
Ach 3-4
Ach 4-5
Ach 5-6
Ach 6-7
Ach 7-8
Ach 8-1
CS 9,10
CS 7,8
CS 5,6
CS 3,4
CS 1,2
HRA d
HRA
P1 ART


Temperatura
Distale
-52
Temperatura (°C)
40
20
0
-20
-40
-60
-80
0.0
88.2
176.5
264.8
Tempo (sec)
Tempo (sec)
Crioterapia
243
Sistema
F
E
Flusso
72
Pressione
556
Trattamento
1 di 5

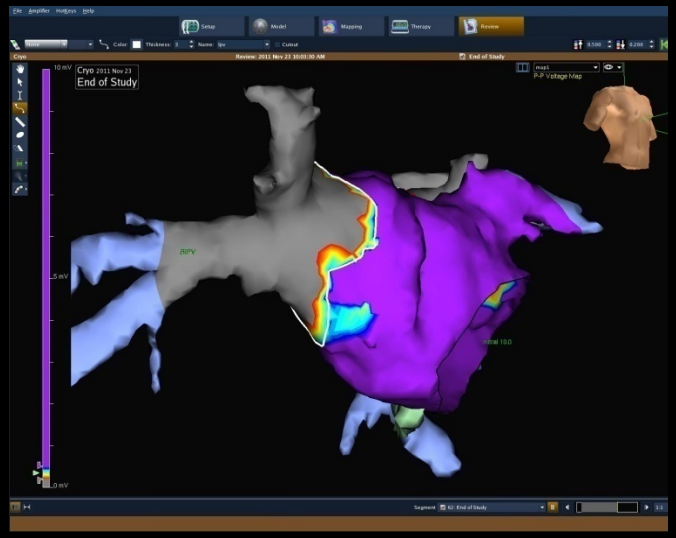


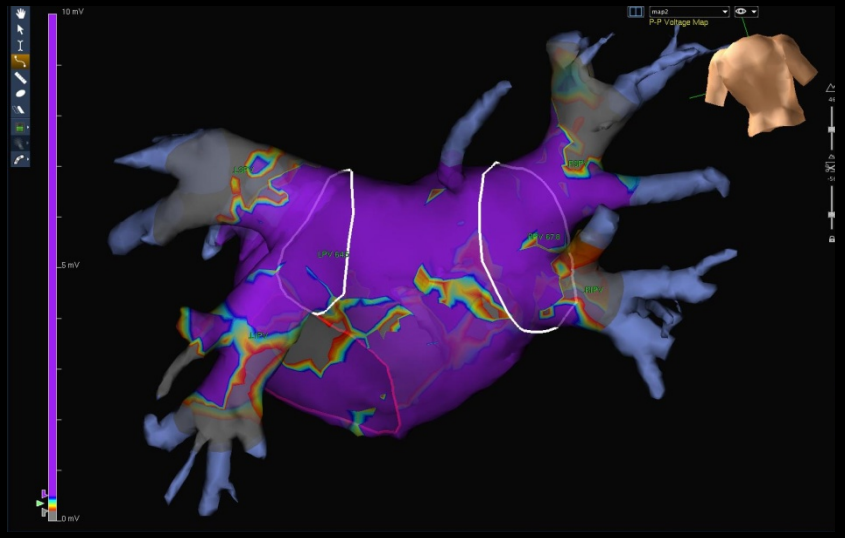

I
II
III
Ach 1-2
Ach 2-3
Ach 3-4
Ach 4-5
Ach 5-6
Ach 6-7
Ach 7-8
Ach 8-1
rspv isolation
CS 9,10
CS 7,8
CS 5,6
CS 3,4
CS 1,2
HRA d
10:25:52
10:25:54
10:25:56
10:25:58
10:26:00

Singol shot (LSPV)

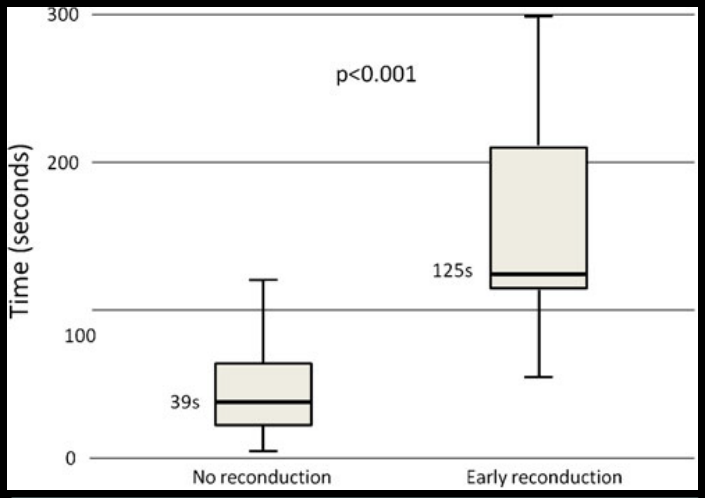


Lesion Area mm2	Cryo	Conventional
LPV	62.4	39.7
RPV	65.5	31.3

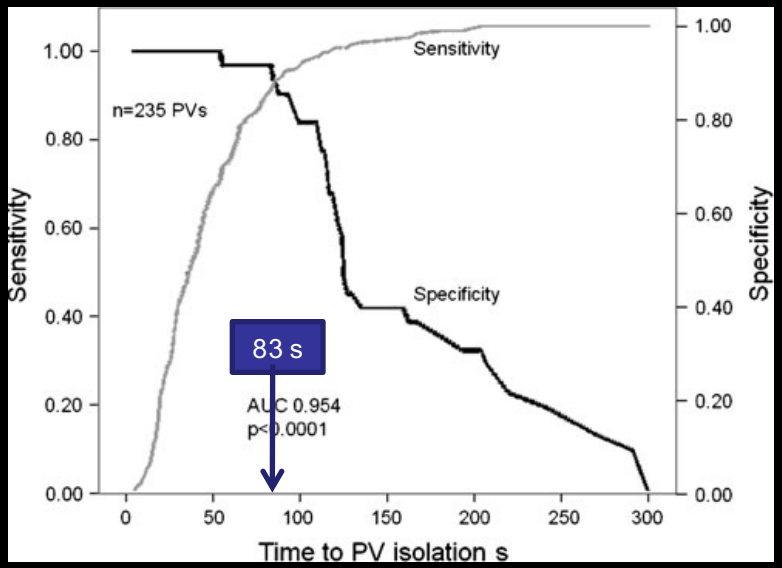




Cryoballoon: acute isolation ?



Dorwarth et al J card inter electrophysiol 2011



Laser Technology

L.A.S.E.R. "Light Amplification by Stimulated Emission of Radiation"

- Laser properties and use depends upon:

Monochromatic, Coherent and High Radiance Light beam

- Very high Radiance: high energy power concentrated in a small area
- Monochromatic and Coherence light: precise measurement devices

- Therapeutic effect depends on

1. wave length: 2. irradiation time: 3. laser power

Light energy transformed in :

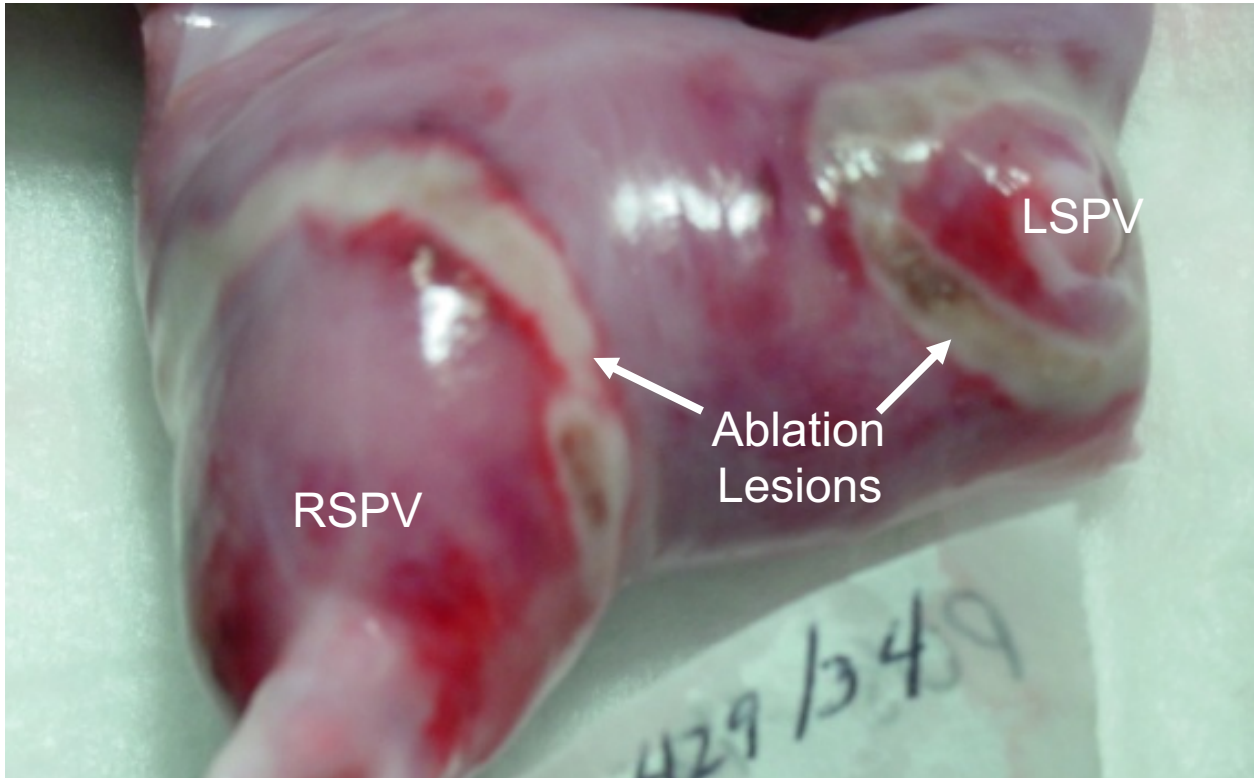
a. Mechanic energy
b. Thermal eenrgy
c. Chimical energy

Why Use Light Energy?

- Penetrates tissue and results in volume heating
- Energy is almost completely transferred through balloon and into tissue = efficient energy transfer
- Energy is easily and precisely directed *in vivo* with use of coincident visible aiming beams all under direct endoscopic, visual control
- 980 nm diode laser – small and efficient

Lesion Quality *in vivo*
Transmural, Contiguous, Circumferential Lesions

- **Chronic Histology**
  10 PVs/120 sections
- **100% Circumferential**
- **99% Transmural**
- **Excellent Tissue Contact**
- **Accurate Guidance**



Dukkipati SR, d'Avila A, Reddy VY et al.
Circ Arrhythm Electrophysiol. 2010,3:266-73

High Single-Procedure Chronic Success

*Superior **Clinical** Results with Higher Dose*

Energy titration strategies with the endoscopic ablation system: lessons from the high-dose vs. low-dose laser ablation study

Stefano Bordignon†, Kyoung-Ryul Julian Chun†, Melanie Gunawardene, Verena Urban, Mehmet Kulikoglu, Kristin Miehm, Beate Brzank, Britta Schulte-Hahn, Bernd Nowak, and Boris Schmidt*

Cardioangiologisches Centrum Bethanien, Markus-Krankenhaus, Wilhelm-Epstein Str. 4, 60431 Frankfurt/M, Germany

Received 16 July 2012; accepted after revision 26 September 2012

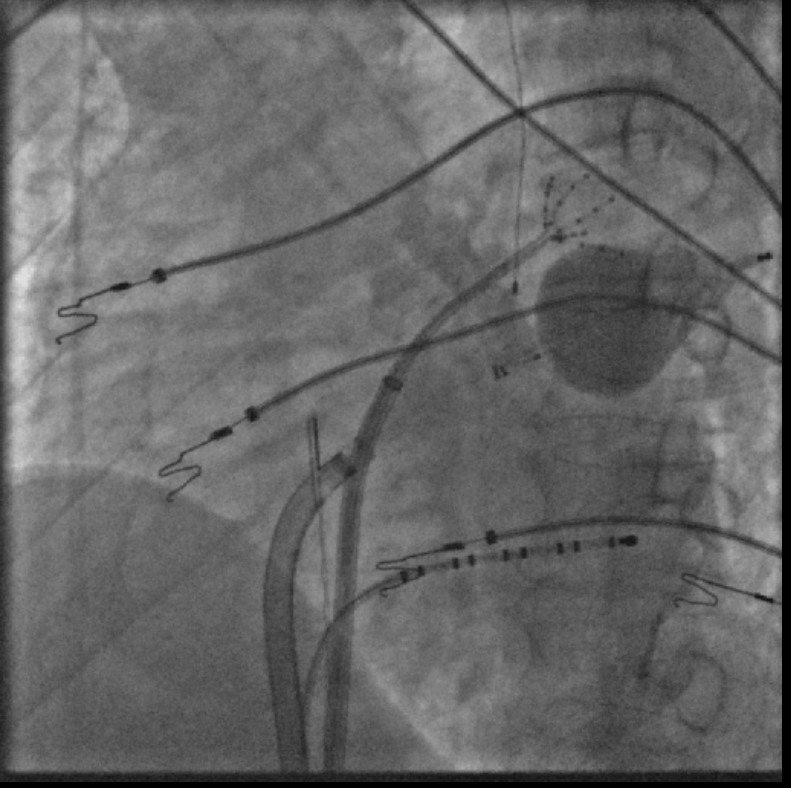
83% Long Term Patient Success

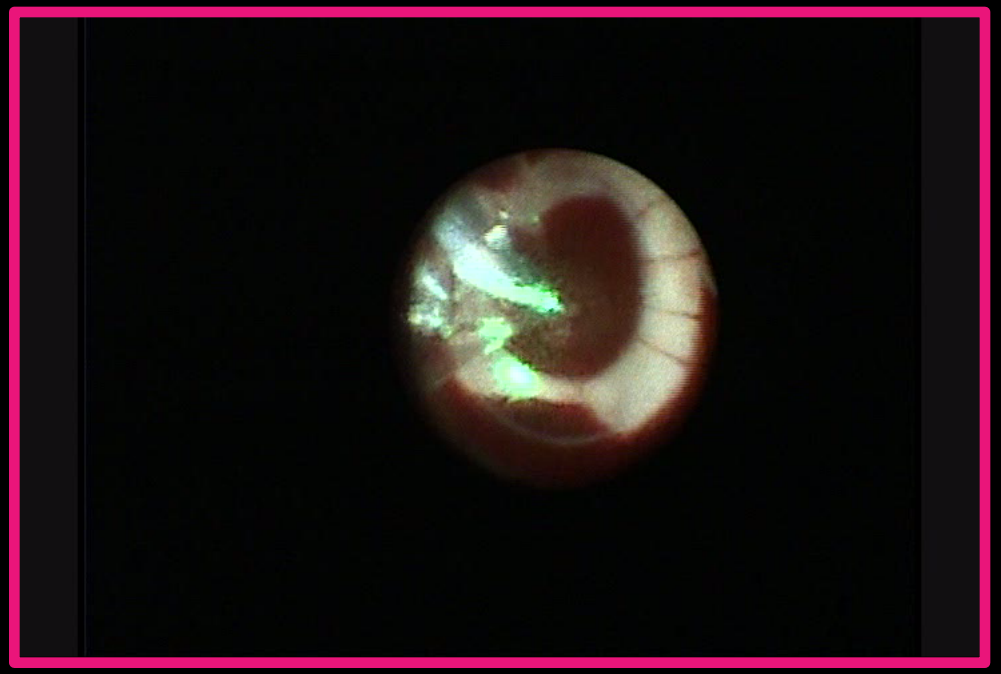
AF Free, Single Procedure, Off Drugs

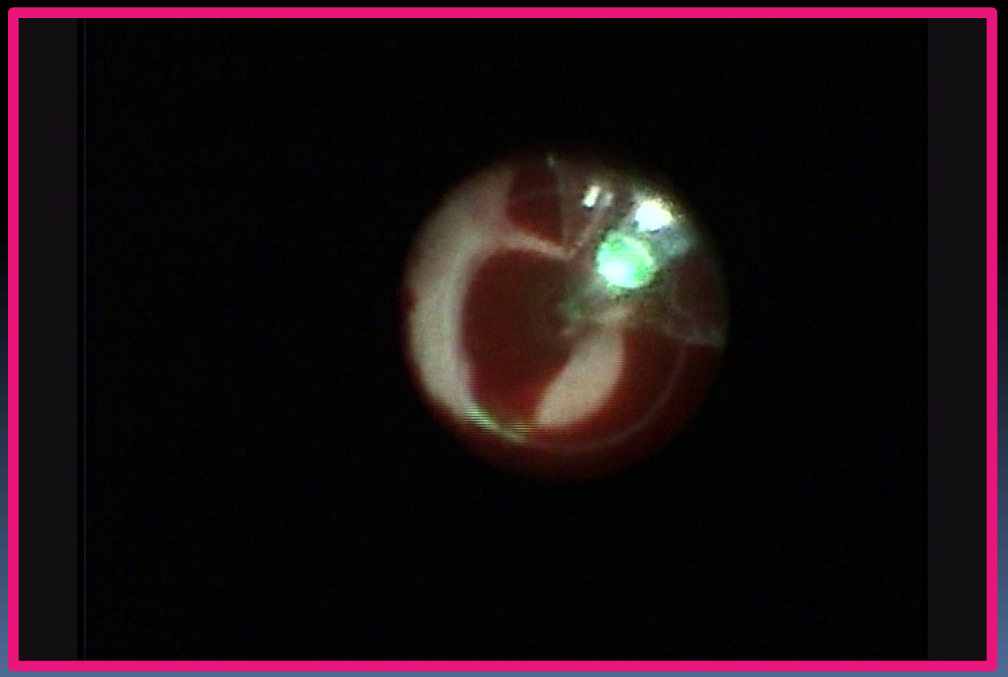
the HD group. Acute PVI after a single visually guided circular lesion set was achieved in 89% (HD) and 69% (LD), respectively, ($P = 0.0004$). In 70 and 39% of patients all PVs were isolated after a single ablation circle in the HD and LD group, respectively, ($P = 0.009$). After gap ablation all PVs were isolated with the EAS. More energy was deployed (6483 ± 1834 vs. 5306 ± 2258 Ws; $P \leq 0.0001$) with less applications (31.6 ± 8 vs. 35.2 ± 15 applications per PV; $P = 0.03$) leading to shorter procedure times (128 ± 17 vs. 154 ± 38 min; $P = 0.001$).

During median follow-up of 311 days (261–346) recurrence rate was 17 and 40% in the HD and LD group, respectively. In both groups one phrenic nerve palsy was observed.

Conclusion For the first time, it was demonstrated that high ablation power affects acute and chronic outcomes. High-dose laser balloon ablation allows for an acute PVI rate of 89% solely by visually guided circular ablation and is associated with a chronic success rate of 83% after a single procedure.







- Physician can choose distal vs. proximal area for lesion location
- Less reported stenosis than cryo balloon because ostial contact can be visually selected
- Less reported phrenic nerve injury than cryo balloon due to not delivering energy distally into RSPV based on visual control of energy delivery location

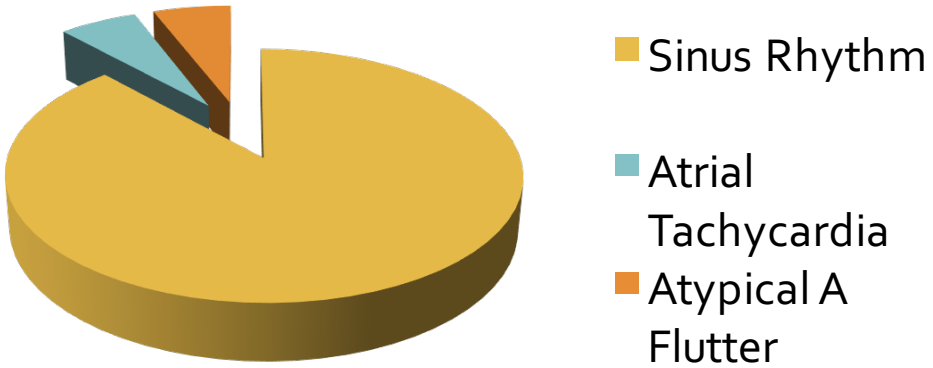
PVI-Laser Technology (42 pts)
Centro Cardiologico - Milan

42 consecutive pts with paroxysmal AF

Inclusion criteria: pts with drug refractory paroxysmal AF

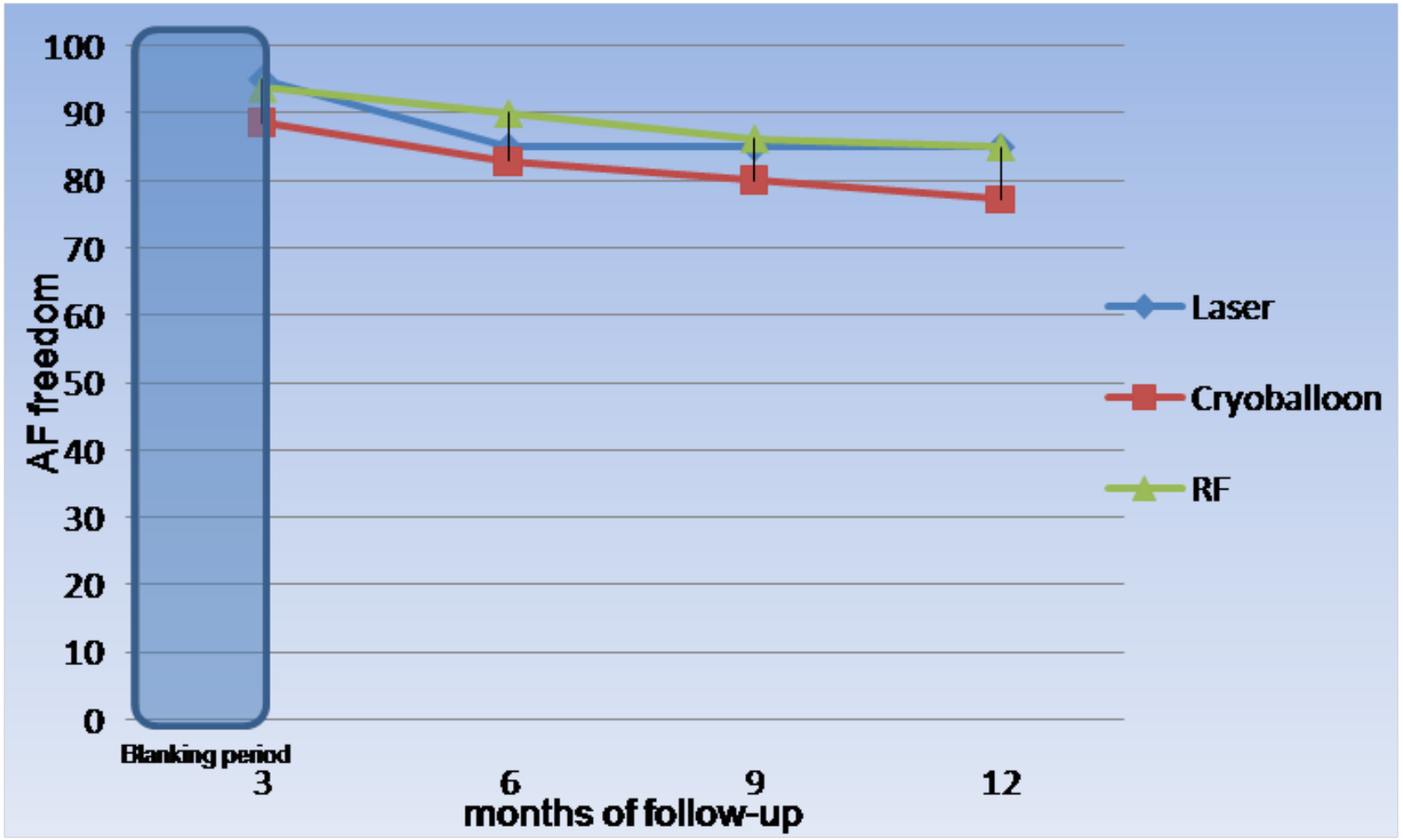
All pts underwent follow up with 7-day Holter and clinic evaluation every 2 months for the first 8 months after CA procedure.

3 to 22 months follow up



Success = 88.4%

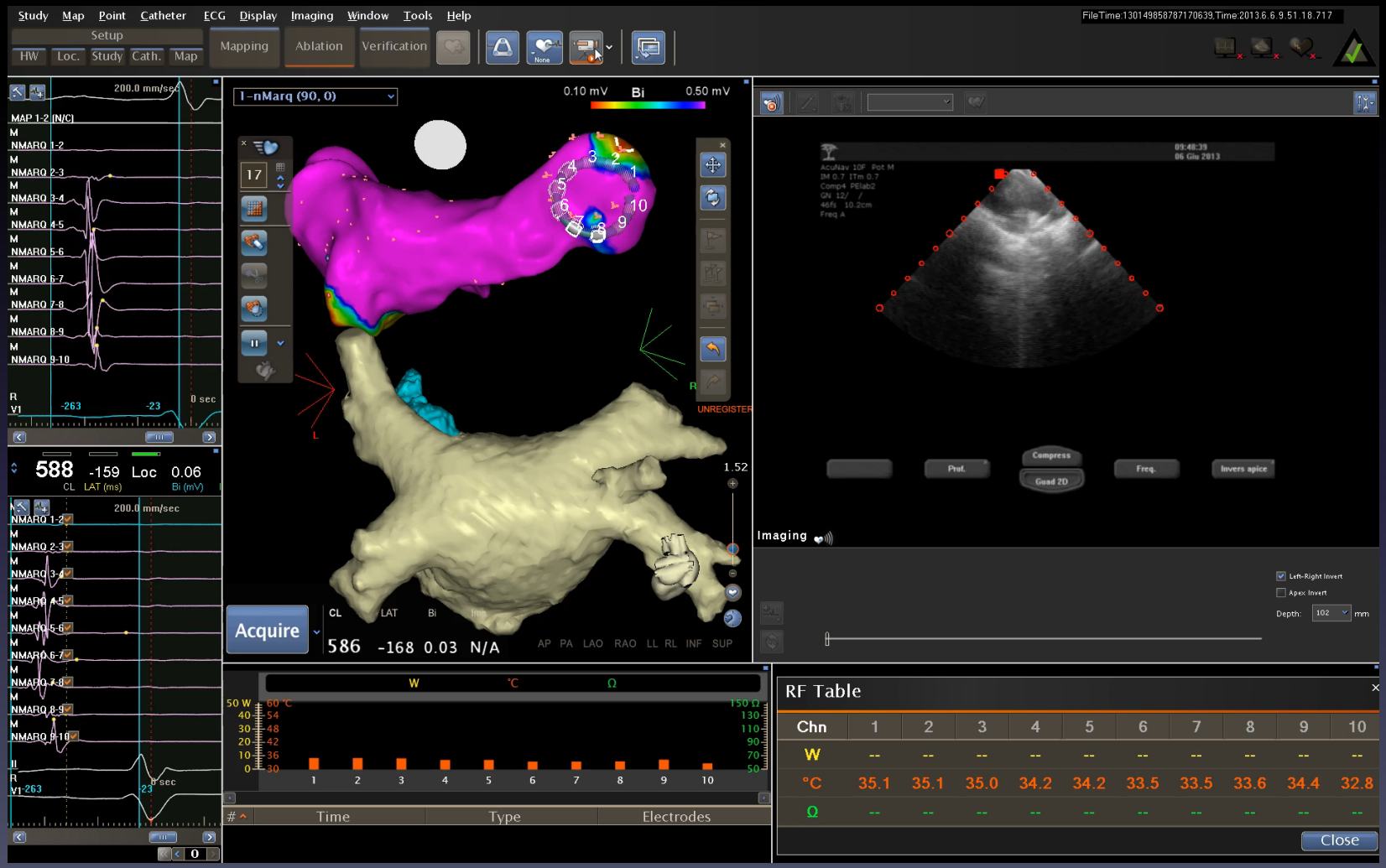
AF ablation Technologies: Centro Cardiologico Monzino Experience 2011-2012 (n= 566)



Biosense Webster nMarq™ Catheter Design

- Centered helical design
- Improved contact and stability
- PEBAX Shaft for improved torque-ability

2. FAM&bipolar mapping



nMARQ Circular: PV mapping techniques

Ostial

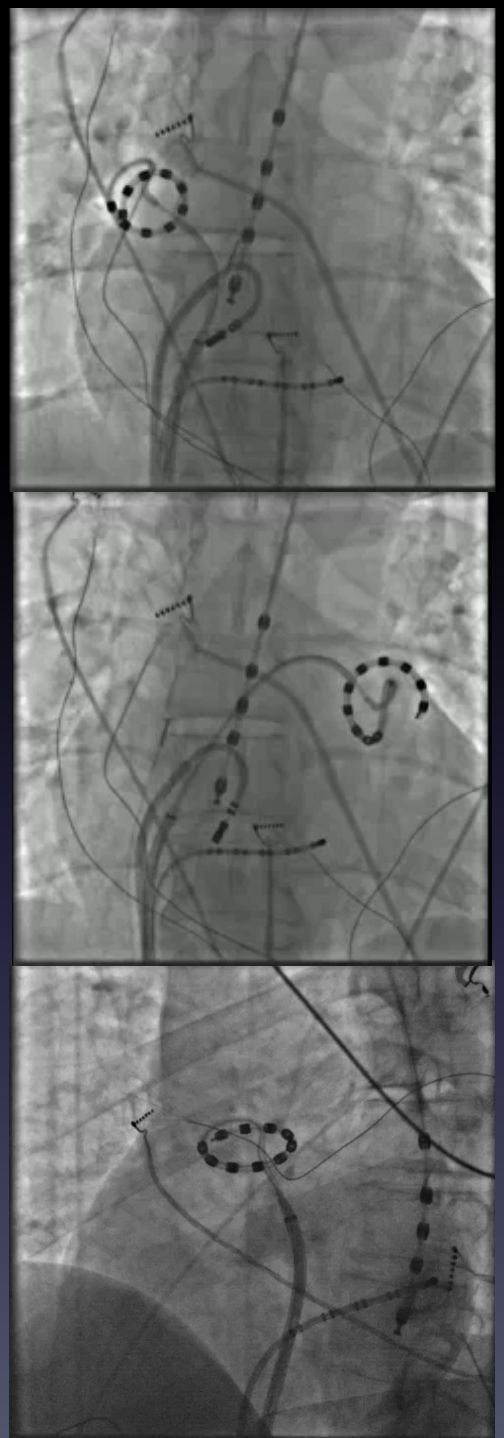
- Too much distal for ablation
- Optimal during FAM

Segmental

- Precise evaluation for segmental targeting
- PV carena ideal targetting/avoid Esophagus

Antral

- Ideal for small veins
- Extensive Lesion but requires stability



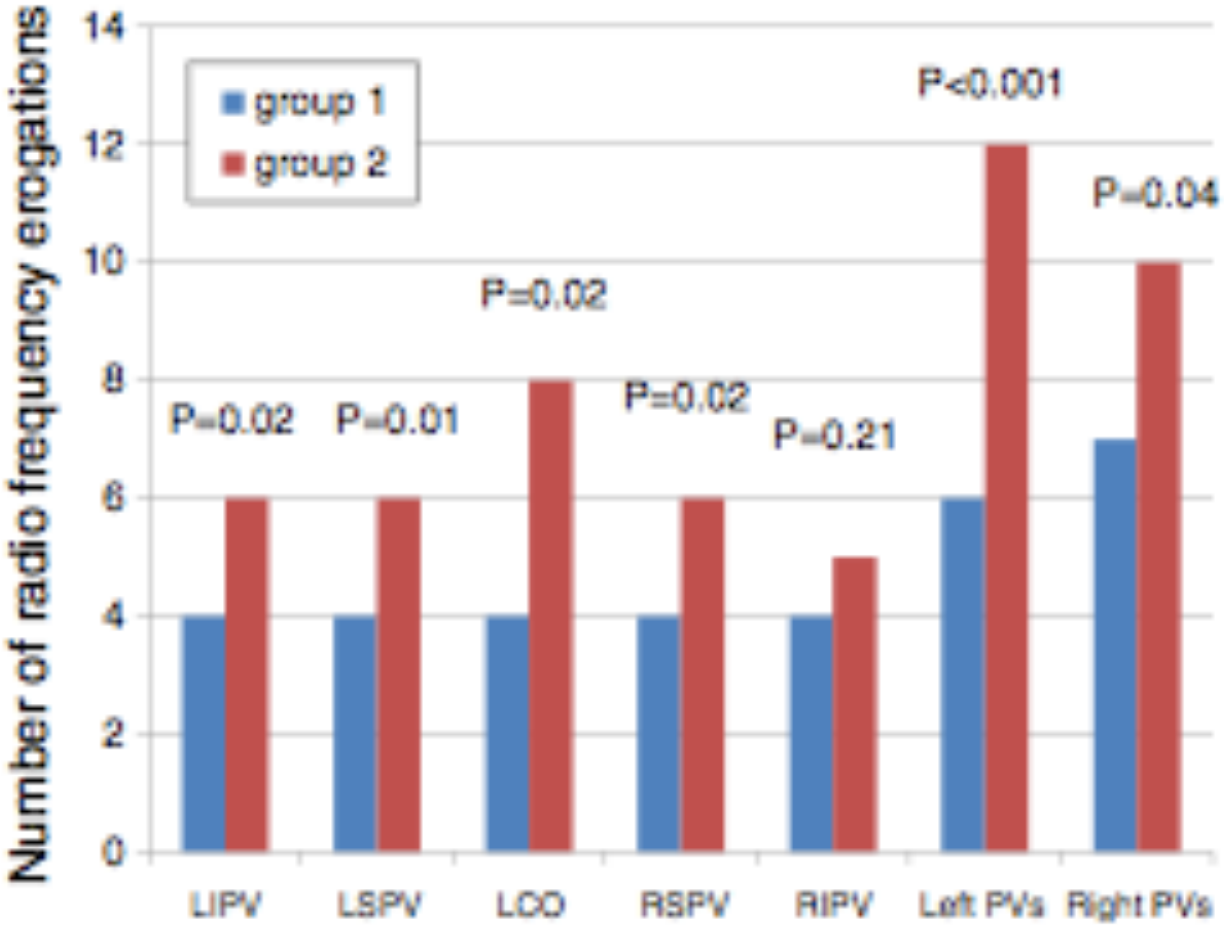
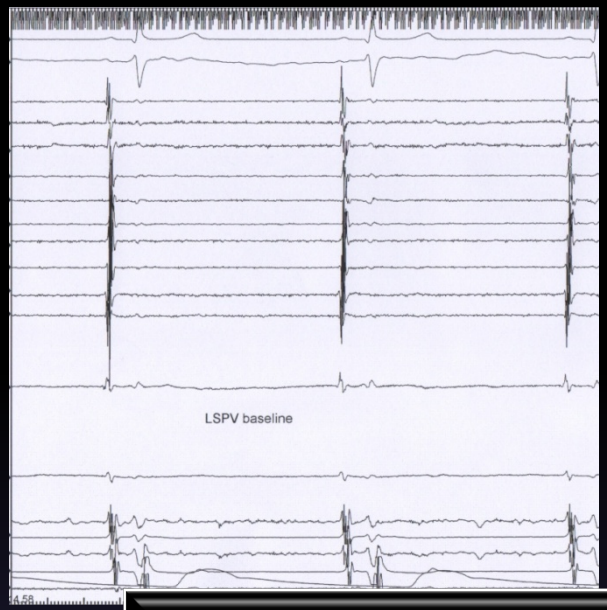
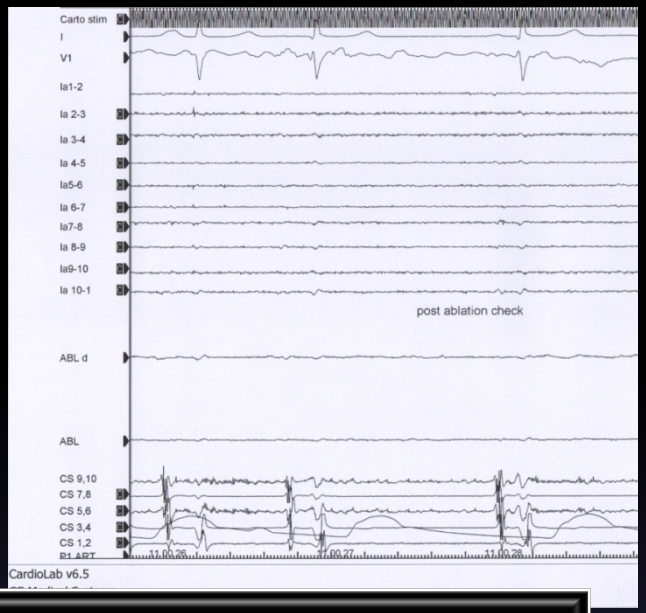


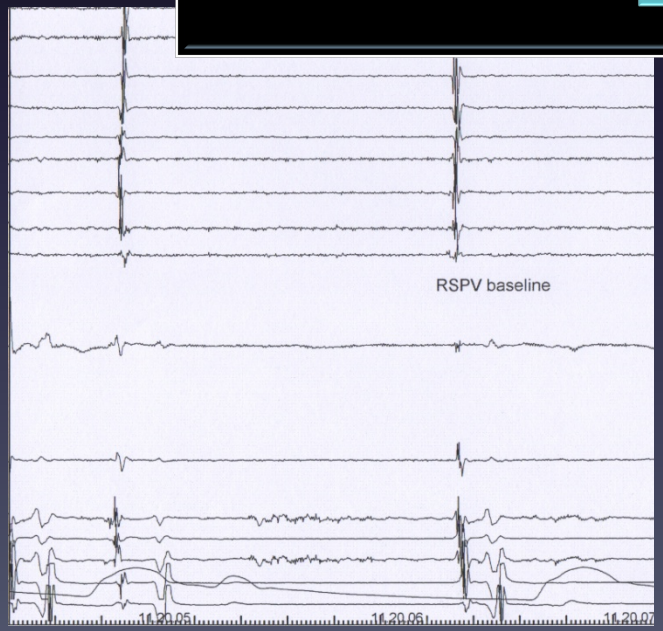
Fig. 2 Number of radiofrequency erogations on the pulmonary veins in the two study groups. *LSPV* left superior pulmonary vein, *LIPV* left inferior pulmonary vein, *RSPV* right superior pulmonary vein, *RIPV* right inferior pulmonary vein, *LCO* left common ostium

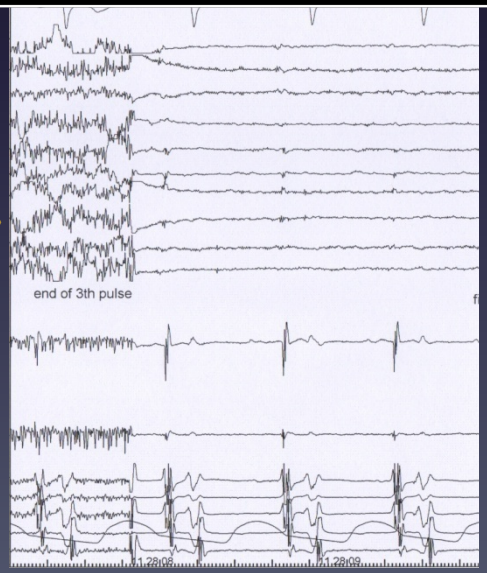
Unipolar ablation

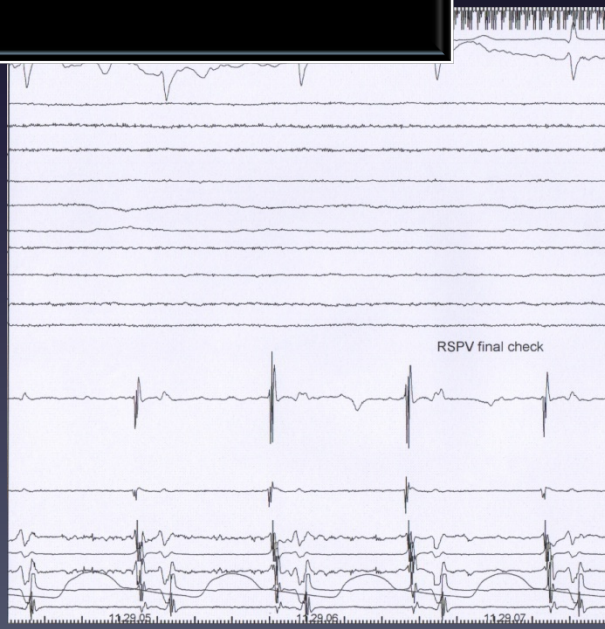




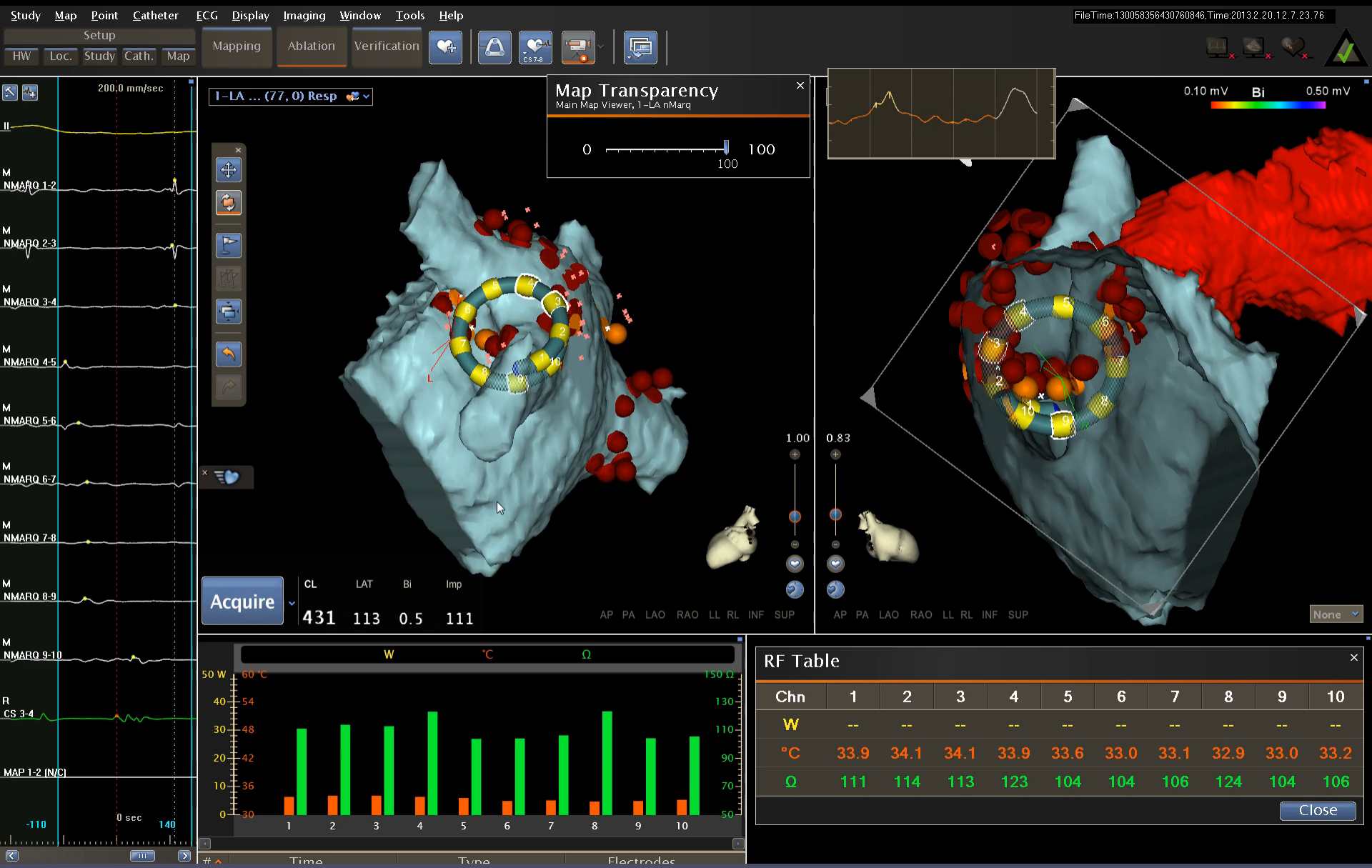
4. Start PVI



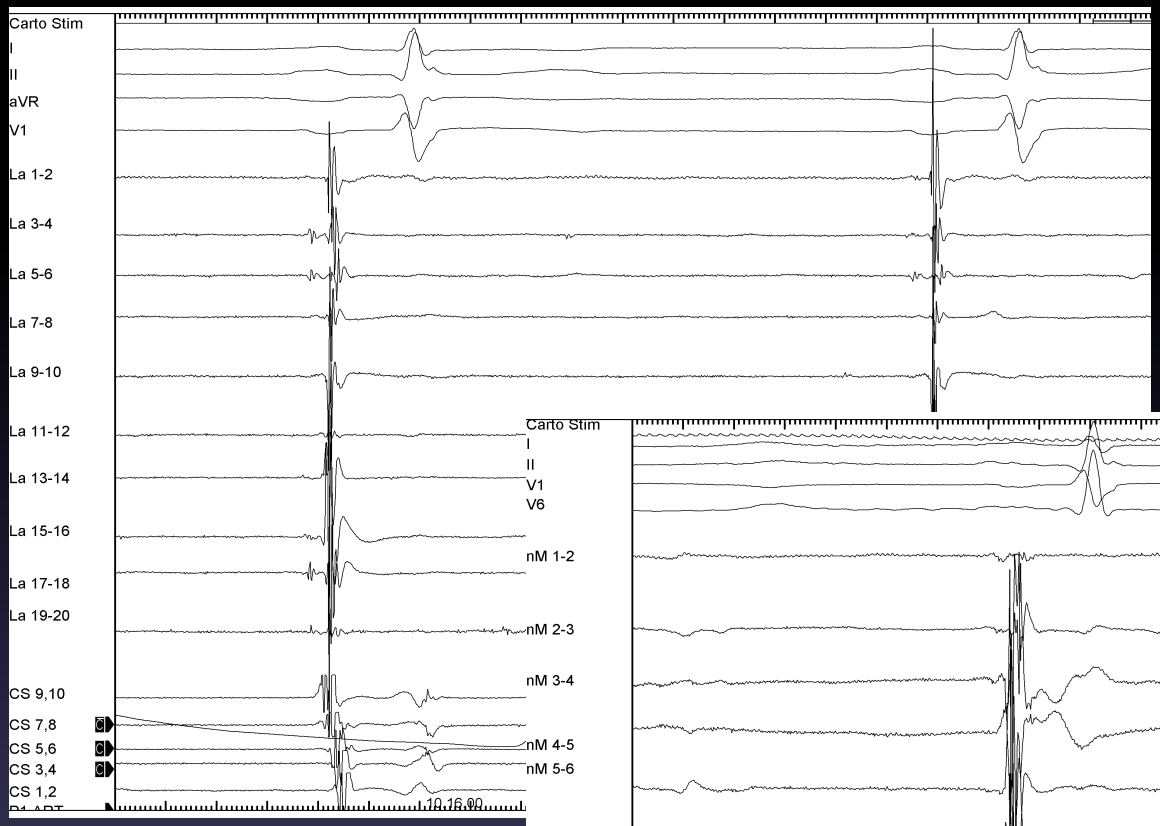


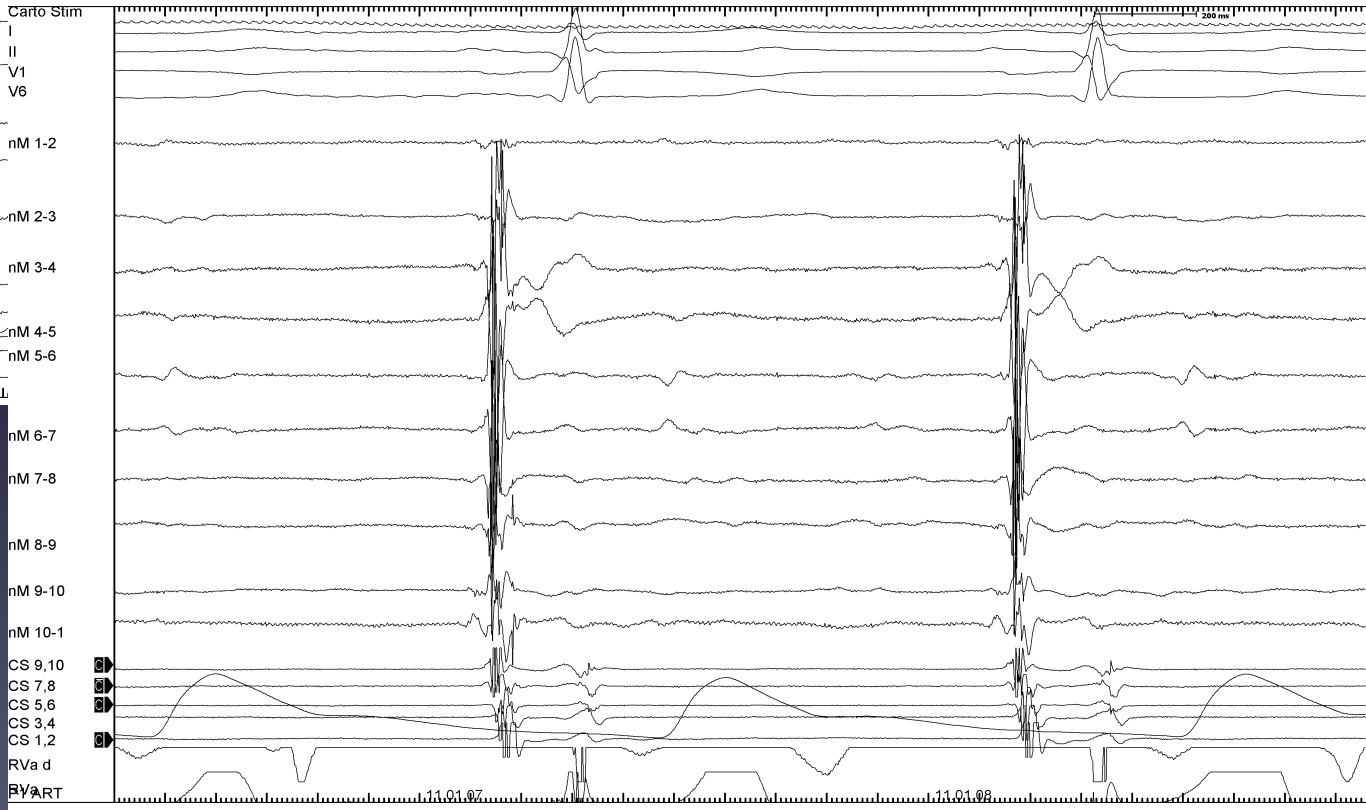


Bipolar

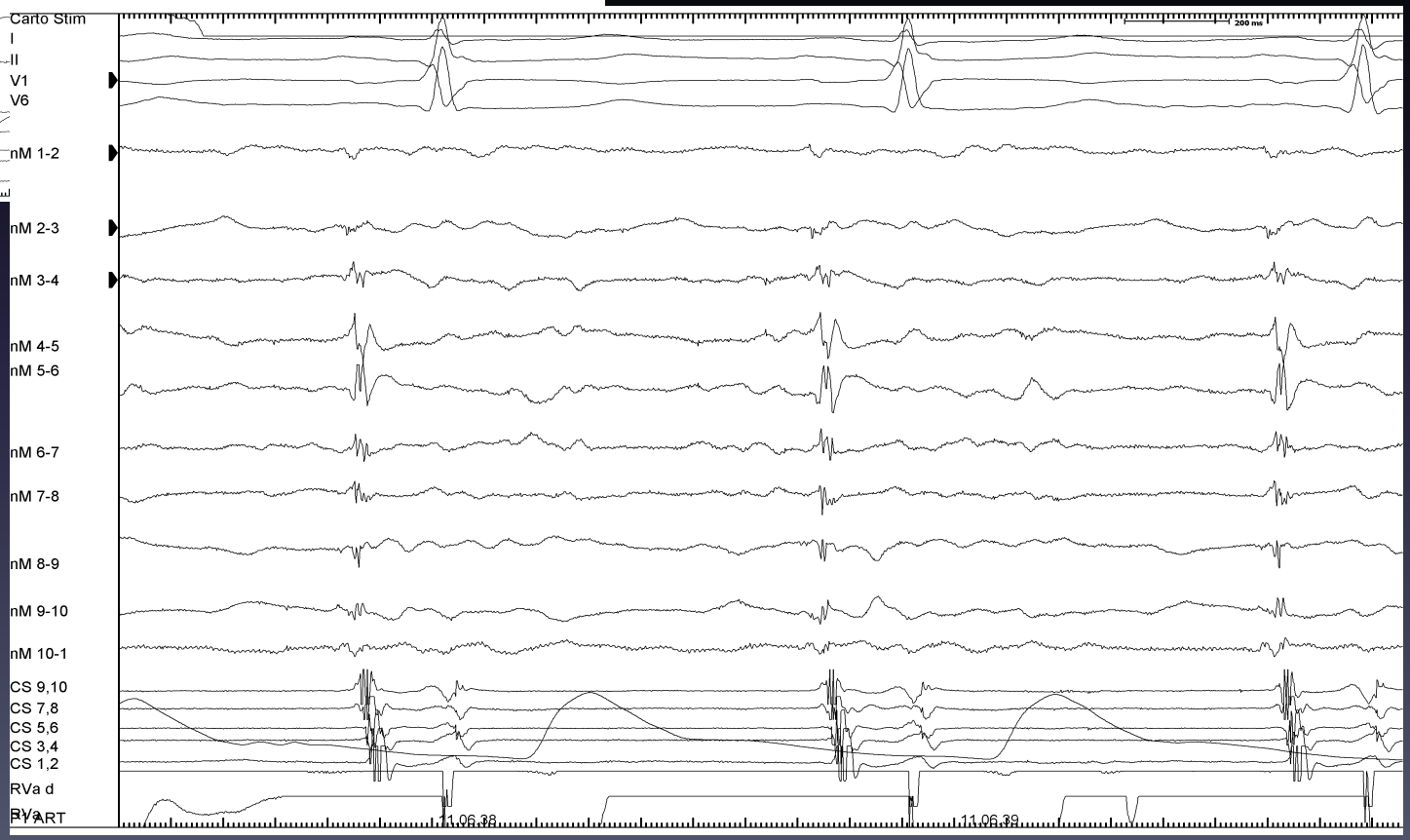

Study Map Point Catheter ECG Display Imaging Window Tools Help
Setup
HW Loc. Study Cath. Map
Mapping
Ablation
Verification
Map Transparency
Main Map Viewer, 1-LA nMarq
0
100
100
1-LA ... (77, 0) Resp
200.0 mm/sec
II
NMARQ 1-2
NMARQ 2-3
NMARQ 3-4
NMARQ 4-5
NMARQ 5-6
NMARQ 6-7
NMARQ 7-8
NMARQ 8-9
NMARQ 9-10
CS 3-4
MAP 1-2 (N/C)
-110
0 sec
140
0.10 mV
Bi
0.50 mV
1.00
0.83
Acquire
CL LAT Bi Imp
431 113 0.5 111
AP PA LAO RAO LL RL INF SUP
None
W °C Ω
50 W 60 °C 150 Ω
40 54 130
30 48 110
20 42 90
10 36 70
0 30 50
1 2 3 4 5 6 7 8 9 10
Time Type Electrodes
RF Table
Chn 1 2 3 4 5 6 7 8 9 10
W -- -- -- -- -- -- -- -- -- --
°C 33.9 34.1 34.1 33.9 33.6 33.0 33.1 32.9 33.0 33.2
Ω 111 114 113 123 104 104 106 124 104 106
Close

RSPV baseline





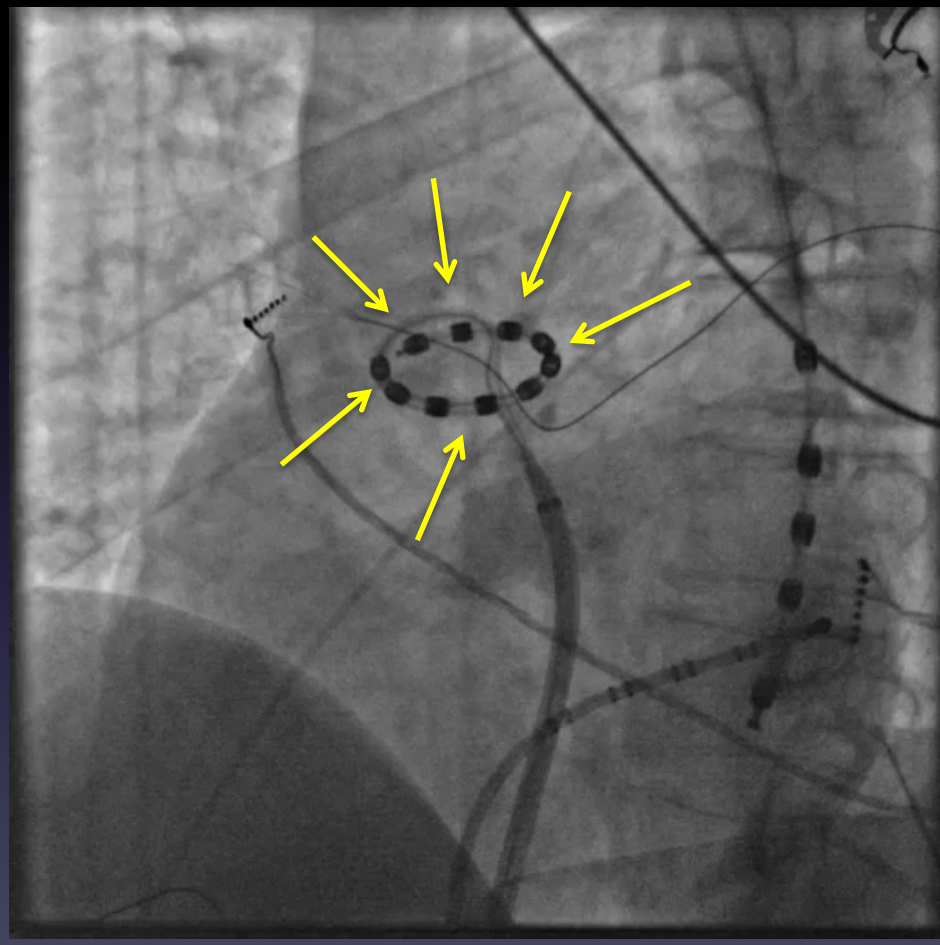
RSPV isolated



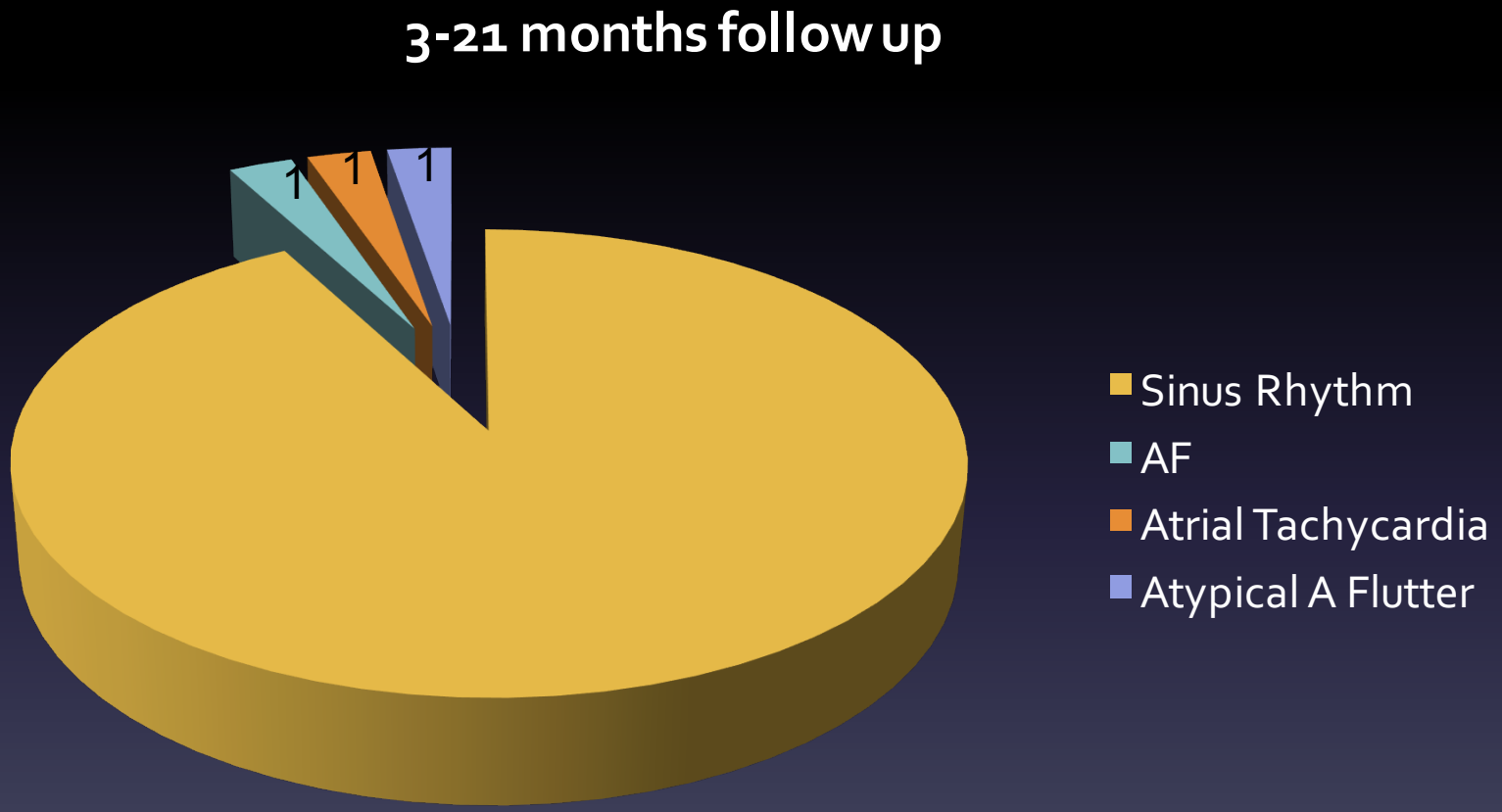
5. Safety key points:

- Esophageal monitoring
- Phrenic nerve mapping

Pacemapping of phrenic nerve

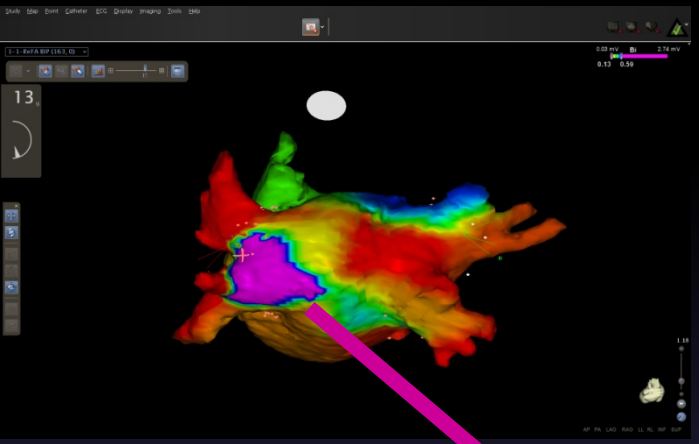


All Patients (38 pts)



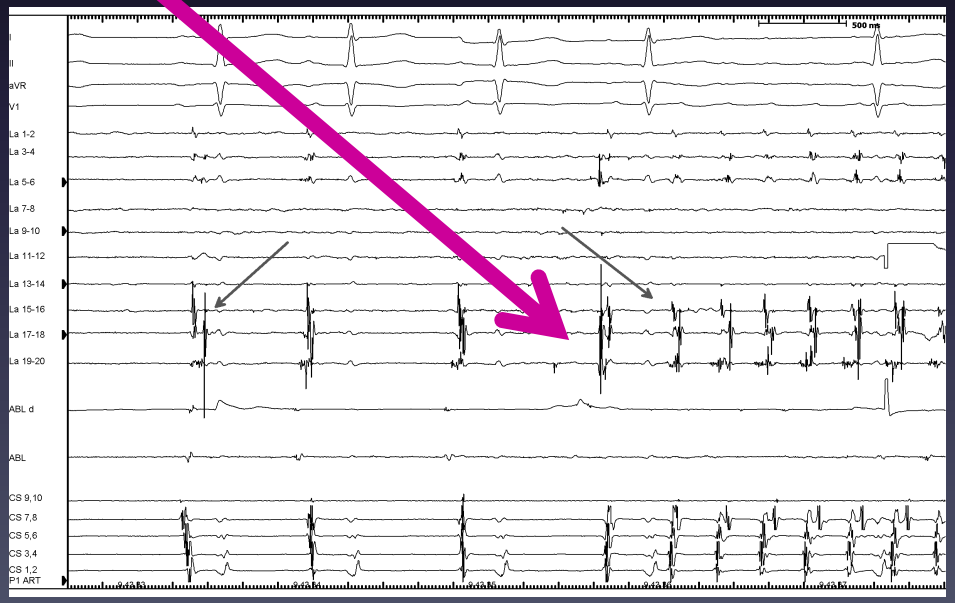
Success = 92.1%

Recurrences and Redo (range F.U. 1-18 months) :



4/32 Pts (12%)

- 2/4 limited to blanking period
- 2/4 deemed to undergo repeat ablation
  - 1 left atrial flutter (left common ostium)
  - 1 Afib



Tecnologie Contact force

Contact: new strategies

More recently, sensors are being incorporated into catheter systems to measure the force applied between the catheter tip and tissue.

- EnSite ContactTM System: impedance based catheter tip-to tissues contact
- Tachticath Endosense CF
- Carto Smart Touch CF
- Robotic Hansen CF system
- ICE-3D electroanatomic mapping integration

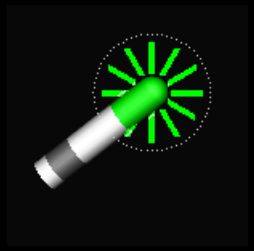
EnSite Contact™ Technology

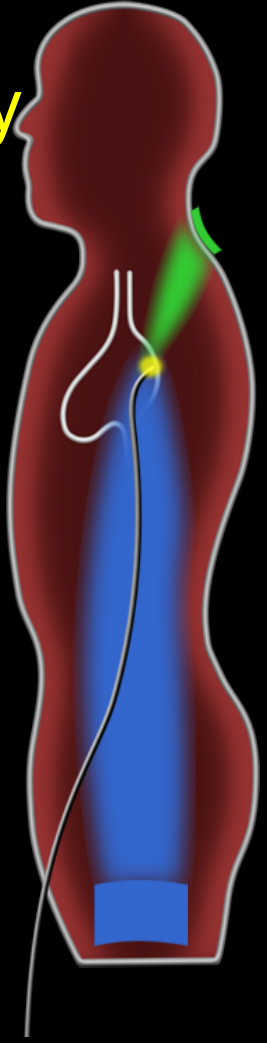
- Uses EnSite NavX™ patches and EnSite Contact-enable catheters to execute measurements.

- ECI is displayed on EnSite Velocity™ System screen by a Coupling Wave, Meter and color coded Beacon.

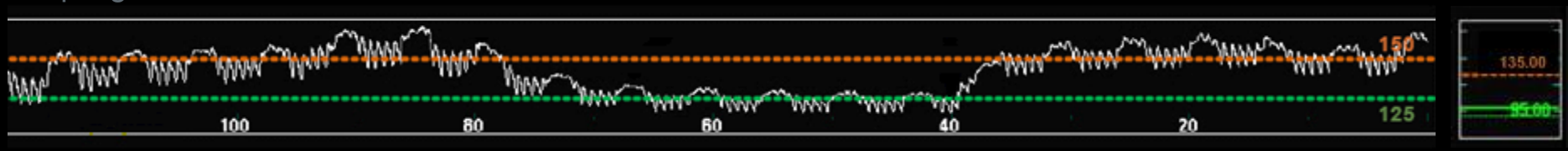
Meter:

Beacon:





Coupling Wave:



▪LESION ASSESSMENT

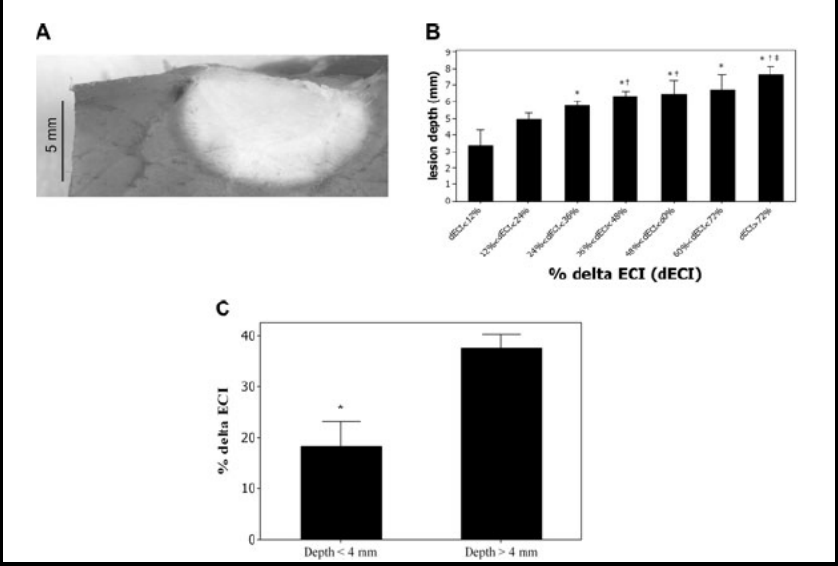
Potential Lesion detector:

"Contact Sensing Provides a Highly Accurate Means to Titrate Radiofrequency Ablation Lesion Depth"

DOUGLAS HOLMES, M.D.,

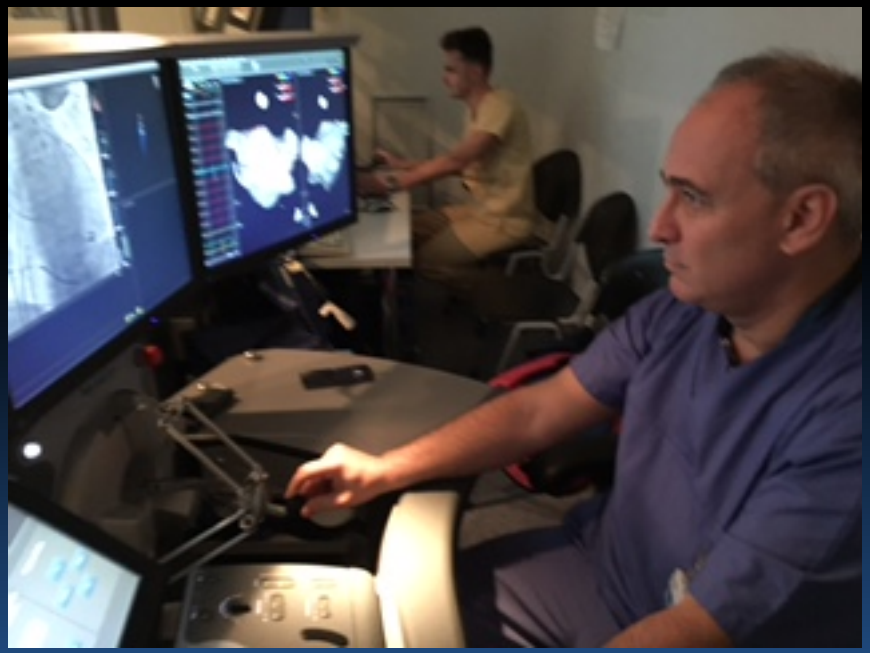
(J Cardiovasc Electrophysiol, Vol. pp. 1-7)

▪Intracardiac, lesions with ≥12% reduction in ECI were more likely to be transmural



▪The ability to detect the tissue's electrical properties (via the ECI index) before, during and after the ablation, could be a predictor of the lesion success.

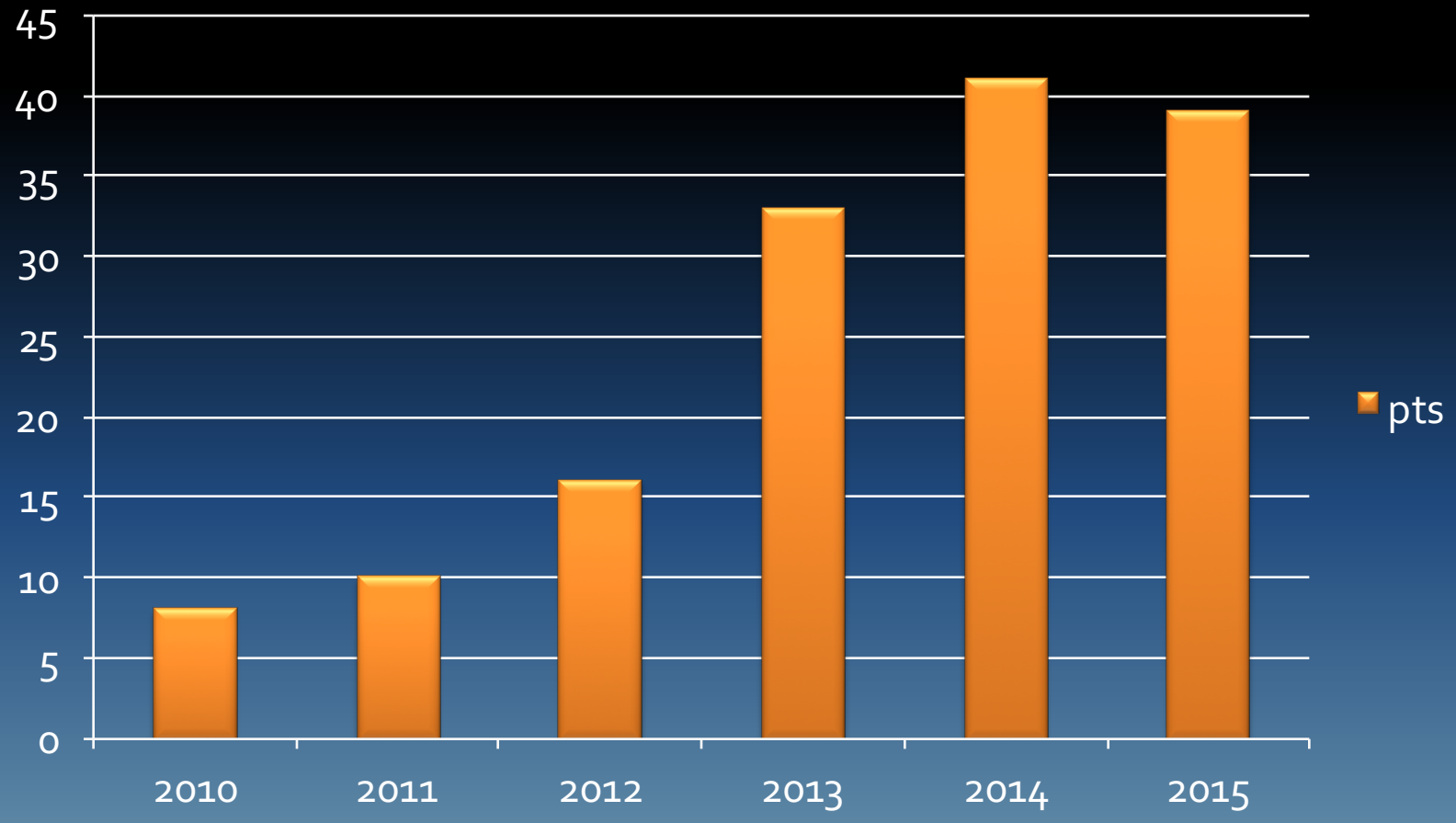
Robotic Navigation System



- 3D Joystick
- Software Interface

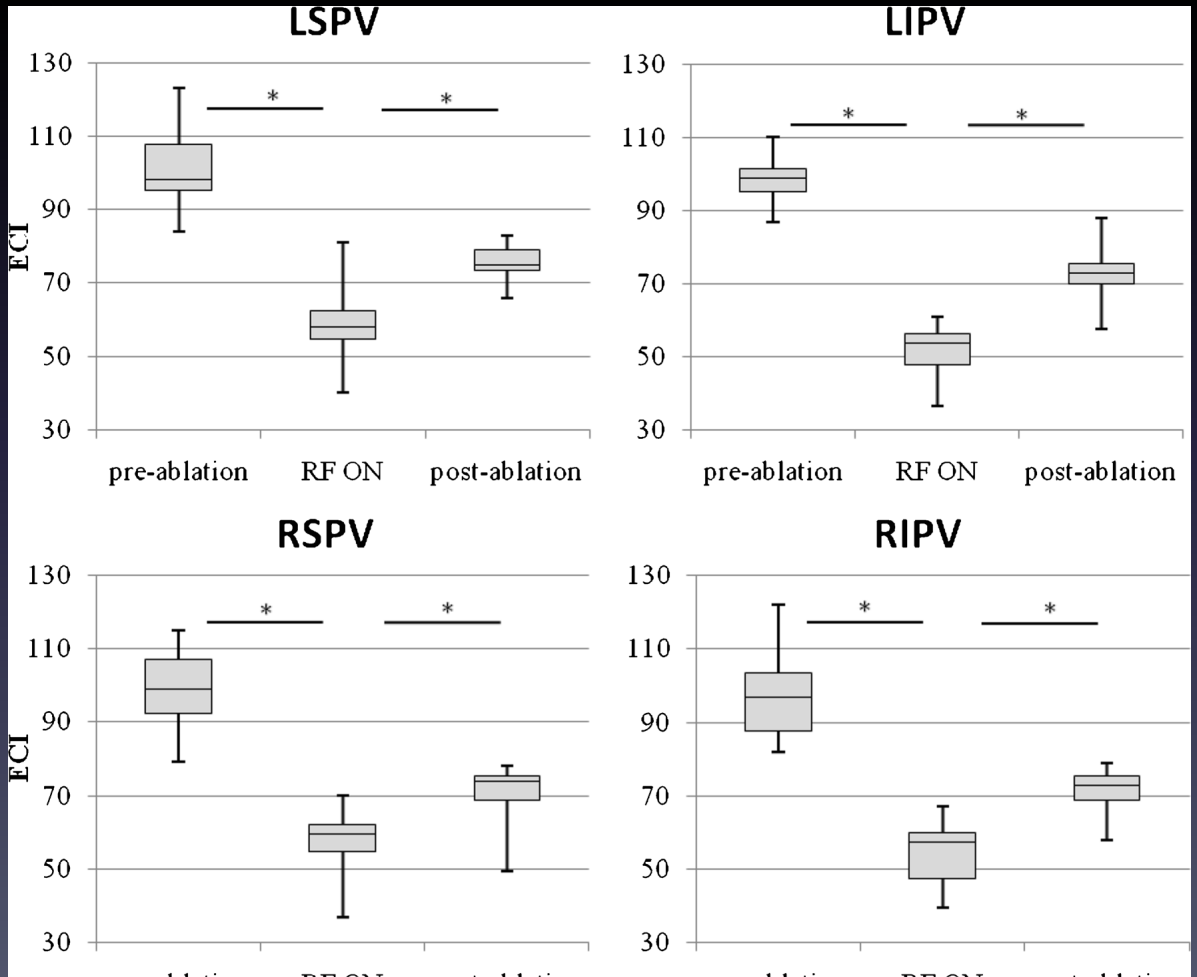
- Catheter tip replicates the hand movements of the physician at the instinctive motion controller
- Any standard ablation catheter can be manipulated

Trend of robotic cases performed at CCM since 2010



Simultaneous assessment of contact pressure and local electrical coupling index using robotic navigation

Antonio Dello Russo · Gaetano Fassini · Michela Casella · Fabrizio Bologna · Osama Al-Nono · Daniele Colombo · Viviana Biagioli · Pasquale Santangeli · Luigi Di Biase · Martina Zucchetti · Benedetta Majocchi · Vittoria Marino · Joseph J. Gallinghouse · Andrea Natale · Claudio Tondo



The main findings of our work is both, the evidence, in vivo, that ECI is a marker of tissue characteristics and, the identification of a cut-ff in ECI decrease able to predict the formation of a transmural and stable atrial tissue lesion. Thus, ECI monitoring during RF delivery may provide the clinician with valuable feedback regarding lesion depth. This may increase the efficacy and safety of AF catheter ablation procedures.

Aim of the Study

In our study we have compared for the first time an impedance–based system with the robotic navigation contact system by simultaneously measuring ECI local impedence and IntelliSense® force affecting the ablation catheter.

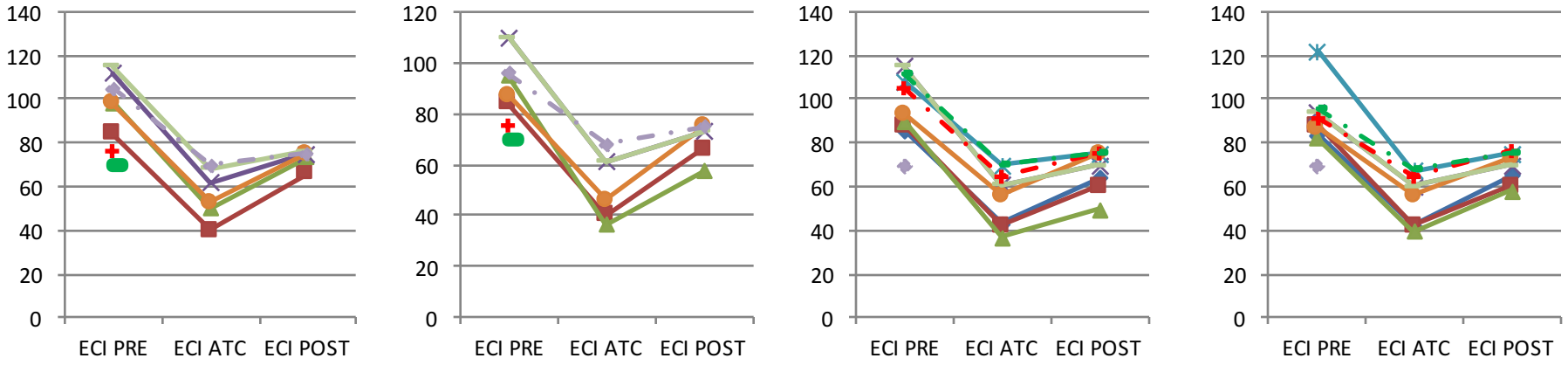
Centro Cardiologico Monzino

Study Populations

Patients Findings	
Sex	12 M – 3 F
Age	59 ± 12 yrs
AF	9 Parox
AF Redo	3 pz.
Dystiroidism	0 pz.
Area LA	19,8 cm^2
LVEF	61,1 %

Results

VP Isolation: 100%



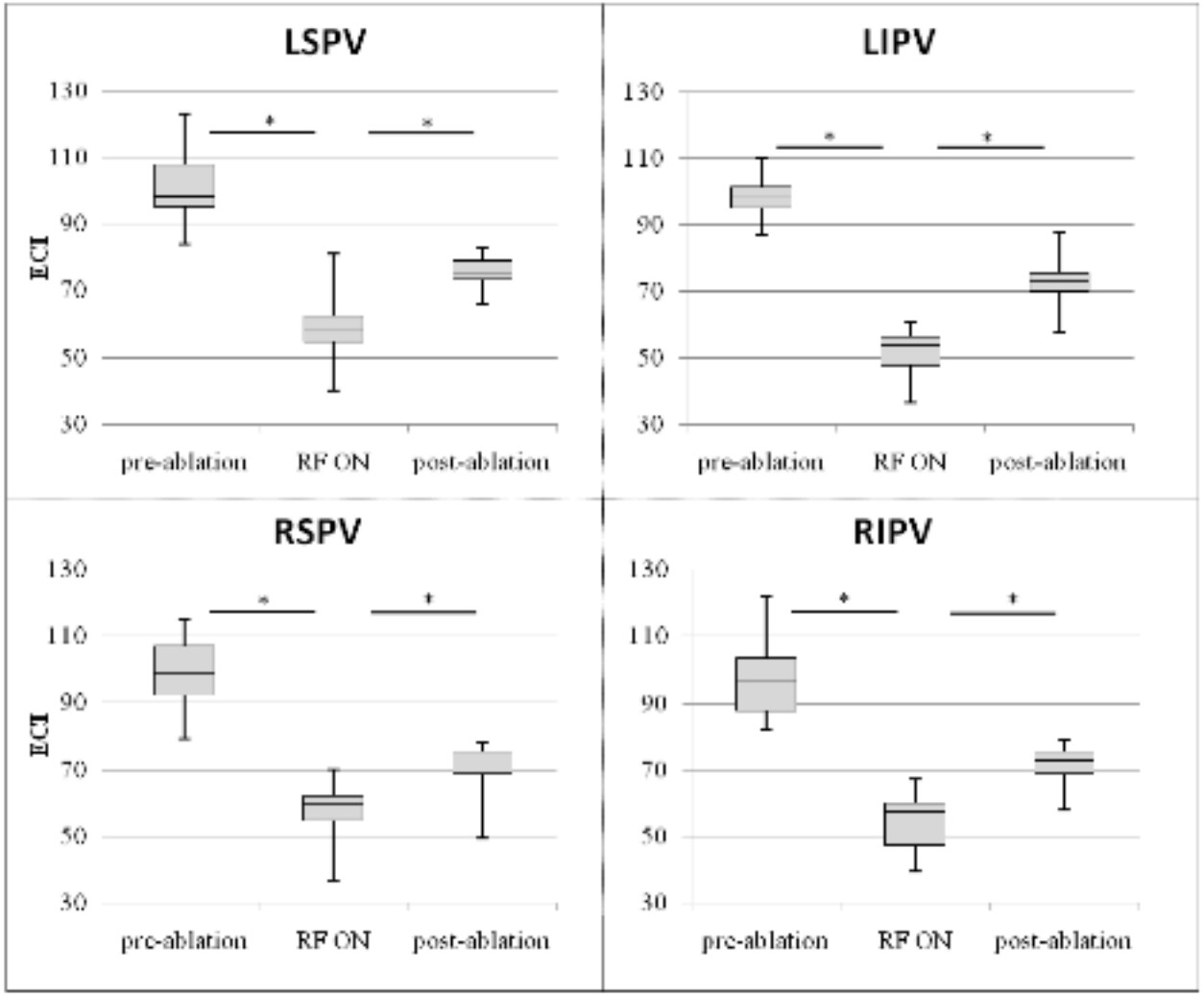
LSVP	
ECI Pre ATC	102.0 ± 11.3
ECI Post ATC	72.1 ± 6.6
p	0.0003

LIVP	
ECI Pre ATC	98.7 ± 7.1
ECI Post ATC	73.1 ± 9.4
p	0.0005

RSVP	
ECI Pre ATC	99.0 ± 10.8
ECI Post ATC	72.1 ± 8.6
p	0.0001

RIVP	
ECI Pre ATC	98.3 ± 11.9
ECI Post ATC	72.1 ± 7.0
p	0.0001

Figure 2: Trend of ECI features for each of the four veins.



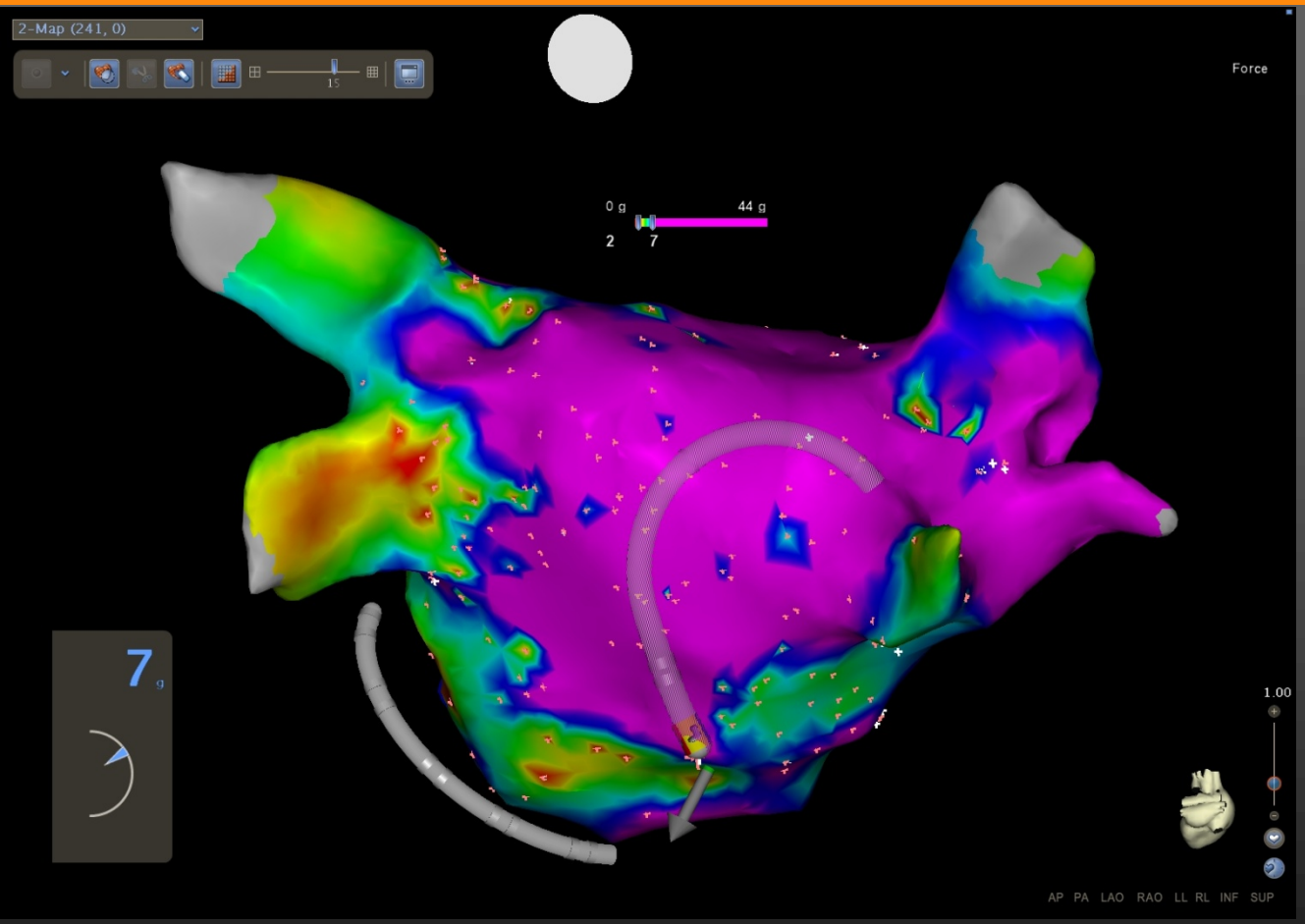
Asterisk indicates a statistically significant difference.

Centro Cardiologico Monzino

Conclusions of the Study

- The main findings of our work is both, the evidence, in vivo, that ECI is a marker of tissue characteristics and, the identification of a cut-off in ECI decrease might predict the formation of a transmural and stable atrial tissue lesion.
- Thus, ECI monitoring during RF delivery may provide the clinician with valuable feedback regarding lesion depth. This may increase the efficacy and safety of AF catheter ablation procedures.

ThermoCool® SmartTouch™ Catheter Design

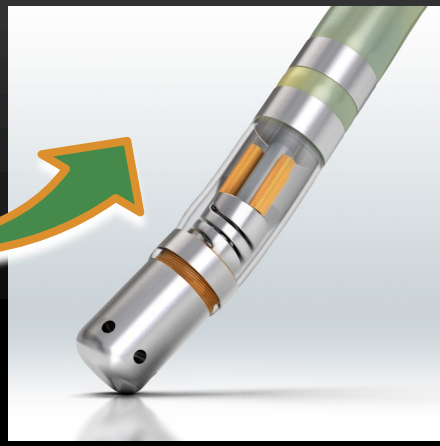


Features:

Force map

Features:

Possibility to create homogenous maps

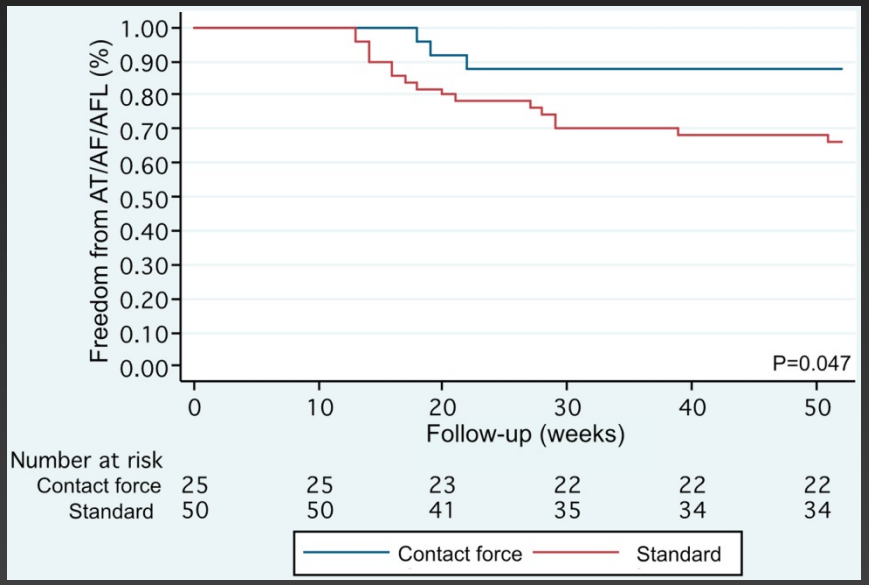


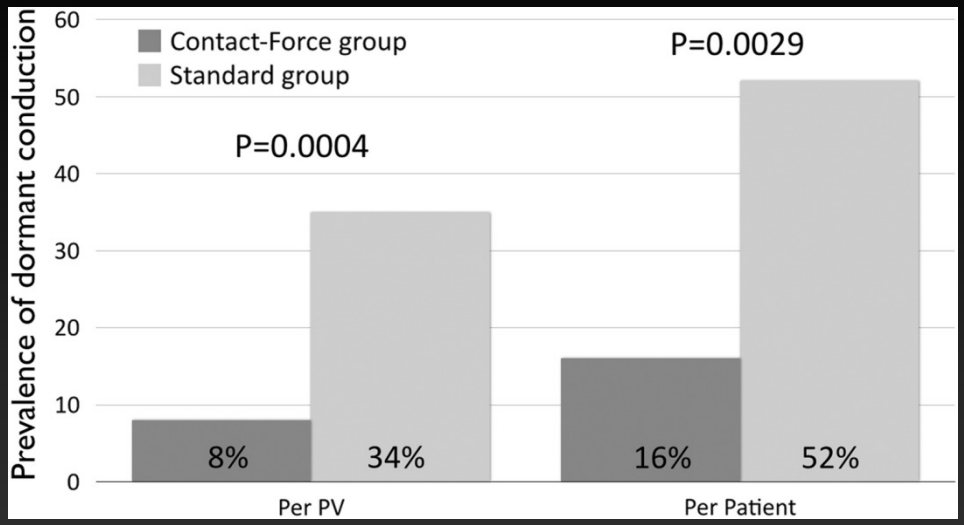
3 sensors receive transmitter coil's location signal proportional to the micro-movements of the spring. This movement is proportional to the force exerted on the spring

Pulmonary vein isolation using "contact force" ablation: The effect on dormant conduction and long-term freedom from recurrent atrial fibrillation—A prospective study

Jason G. Andrade, MD, George Monir, MD, Scott J. Pollak, MD, Paul Khairy, MD, PhD, Marc Dubuc, MD, FHRS, Denis Roy, MD, FHRS, Mario Talajic, MD, FHRS, Marc Deyell, MD, MSc, Léna Rivard, MD, Bernard Thibault, MD, FHRS, Peter G. Guerra, MD, Stanley Nattel, MD, Laurent Macle, MD

Demonstrated the short- and long-term effects of contact force–guided ablation on the acute prevalence of adenosine-provoked dormant conduction as well as the longer-term procedural efficacy





Contact force–guided ablation not only decreased the prevalence of dormant conduction provoked by adenosine but also demonstrated superior clinical outcomes at 1 year compared to standard noncontact force–guided ablation.

Optimal tissue contact force facilitates the delivery of an ideal radiofrequency ablation lesion at the first attempt

Heart Rhythm Volume 11, Issue 11, Pages 1919-1924 (November 2014) DOI: 10.1016/j.hrthm.2014.07.033

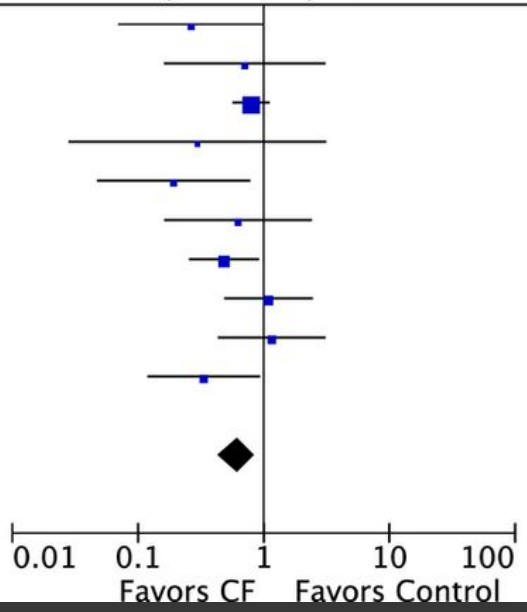
Impact of Contact Force Technology on Atrial Fibrillation Ablation: A Meta-Analysis

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

	CF		Control			Odds Ratio	Odds Ratio
Study or Subgroup	**Events**	**Total**	**Events**	**Total**	**Weight**	**M-H, Random, 95% CI**	**M-H, Random, 95% CI**
Andrade	3	25	17	50	5.3%	0.26 [0.07, 1.01]	
Casella	3	20	7	35	4.5%	0.71 [0.16, 3.10]	
Jarman	100	200	223	400	31.5%	0.79 [0.56, 1.12]	
Kimura	1	19	3	19	1.9%	0.30 [0.03, 3.14]	
Marijon	3	30	11	30	4.9%	0.19 [0.05, 0.78]	
Sciarra	5	21	7	21	5.3%	0.63 [0.16, 2.42]	
Sigmund	20	99	34	99	16.9%	0.48 [0.25, 0.92]	
Ullah	32	50	31	50	12.2%	1.09 [0.48, 2.45]	
Wakili	13	32	13	35	9.1%	1.16 [0.43, 3.10]	
Wutzler	5	31	41	112	8.4%	0.33 [0.12, 0.93]	
Total (95% CI)		**527**		**851**	**100.0%**	**0.62 [0.45, 0.86]**	
Total events	185		387				

Heterogeneity: $Tau^2 = 0.06$; $Chi^2 = 11.66$, df = 9 (P = 0.23); $I^2 = 23\%$

Test for overall effect: Z = 2.85 (P = 0.004)



Forest plot of the individual and combined rates of recurrence. CF indicates contact force; M-H, Mantel-Haenszel test.

In comparing CF and CC groups, a significantly lower recurrence rate was noted with CF (35.1% versus 45.5%, OR 0.62 [95% CI 0.45–0.86], P=0.004)

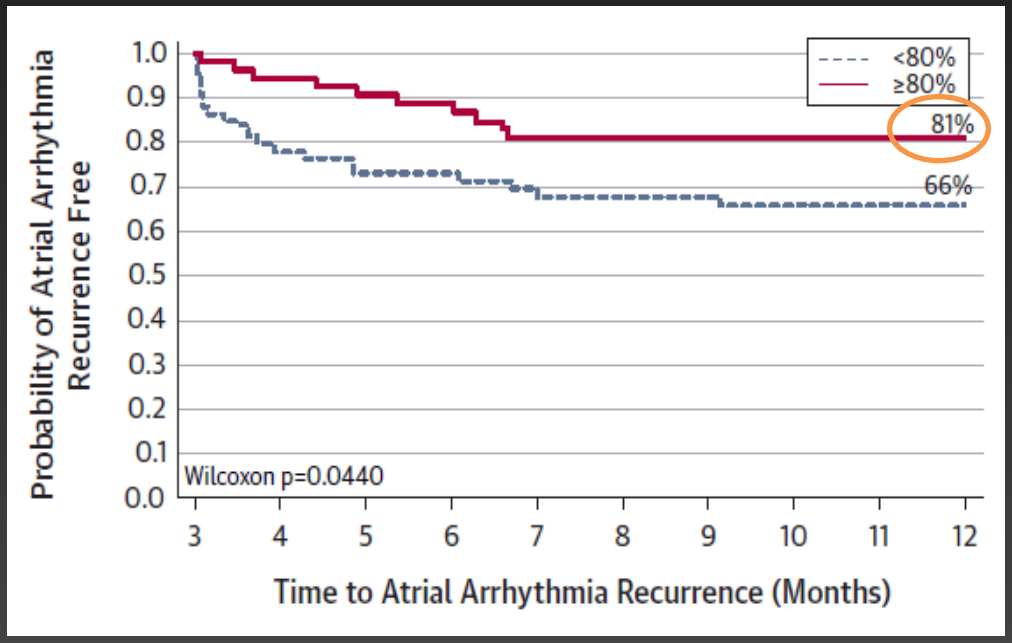
Efficacia a 12 mesi con ST

Paroxysmal AF Catheter Ablation With a Contact Force Sensing Catheter

Results of the Prospective, Multicenter SMART-AF Trial

Andrea Natale, MD,*†‡§‖¶ Vivek Y. Reddy, MD,# George Monir, MD,** David J. Wilber, MD,†† Bruce D. Lindsay, MD,‡‡ H. Thomas McElderry, MD,§§ Charan Kantipudi, MD,‖‖ Moussa C. Mansour, MD,¶¶ Daniel P. Melby, MD,## Douglas L. Packer, MD,*** Hiroshi Nakagawa, MD,††† Baohui Zhang, MS, SM,‡‡‡ Robert B. Stagg, PhD,‡‡‡ Lee Ming Boo, PharmD,‡‡‡ Francis E. Marchlinski, MD§§§

- A **prospective, multicenter, nonrandomized**
- **160 patients** underwent RF catheter ablation
- CF ranged from 3-10g to 25-60g and 67% of cases used a range of 5-40g
- The overall success rate is higher (**74%**) than previously reported with traditional non-contact force sensing ThermoCool® Catheter (66%).



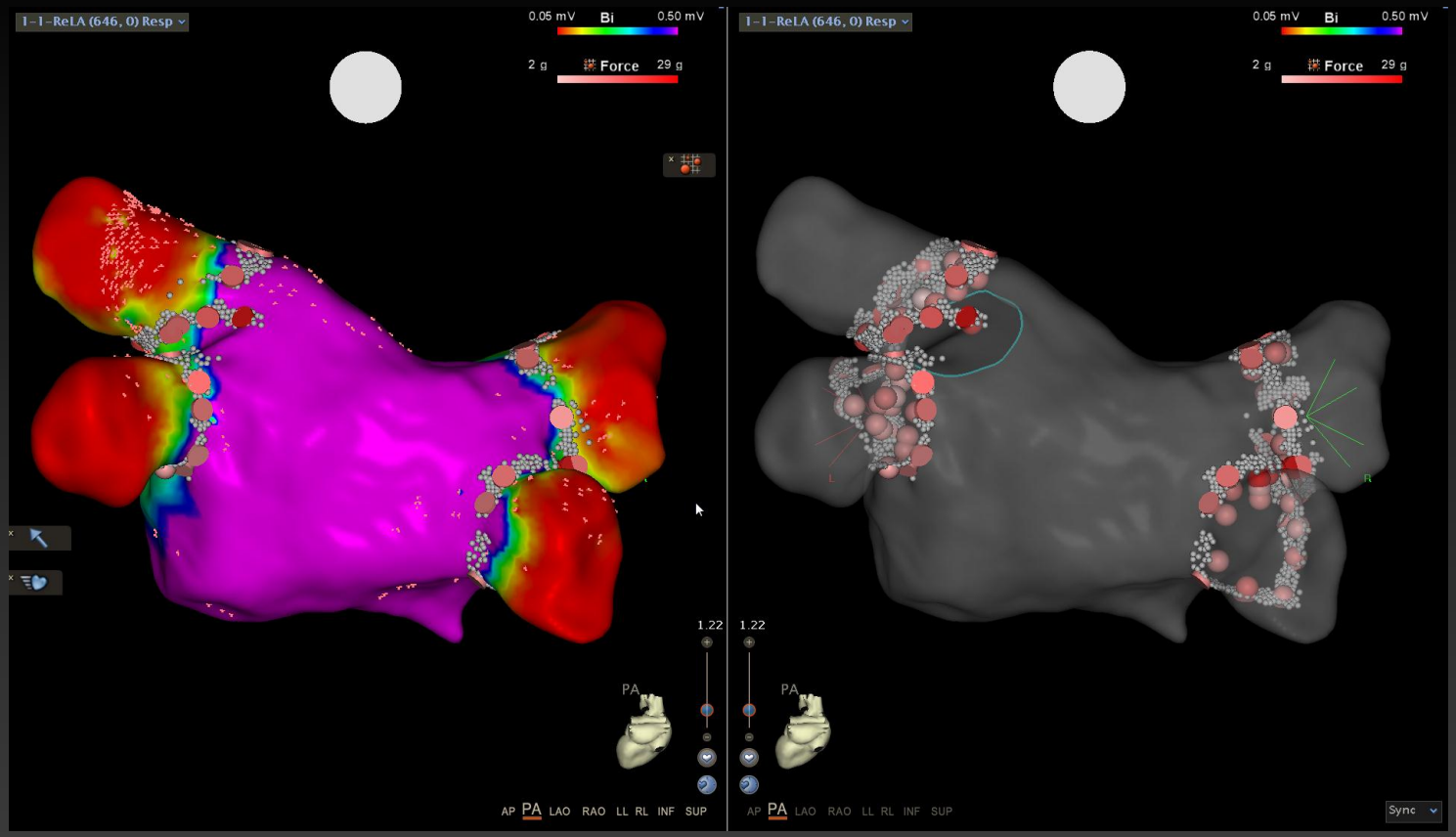
RESULTS

The success rate improved to 81% (from 74%) when the investigator stayed within their pre-selected CF range ≥80% of the time

This suggests that consistent and stable catheter-tissue contact is important in optimizing long-term ablation outcome.

Further sub-analysis showed that the longer the physician stayed within their selected CF range (i.e. representing more stable catheter-tissue contact), the success rate further improved to 88%. You should understand that

Valutazione del Substrato: analisi mediante CONFIDENSE



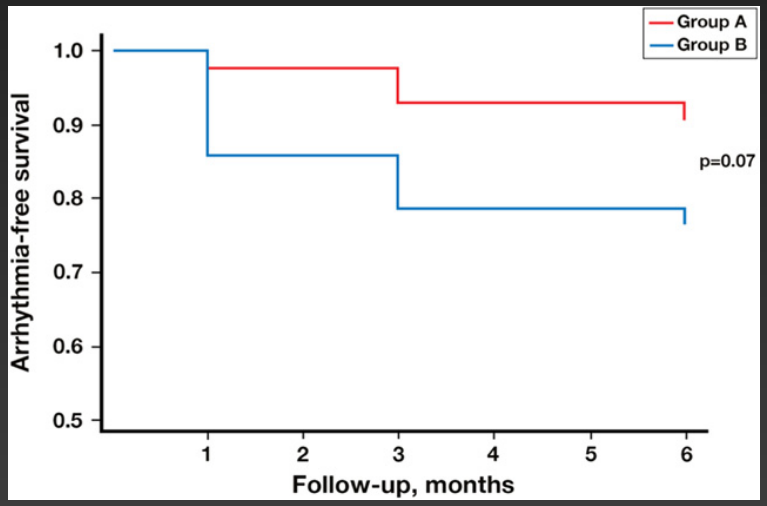
FA parox: Mappa substrato post-ablazione e valutazione della lesione tramite Visitag

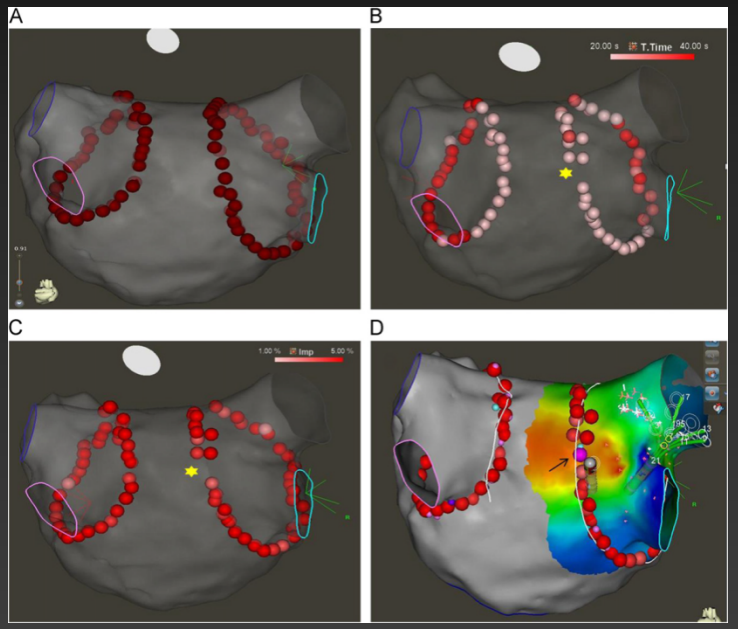
Stabilità e consistenza durante ablazione

Radiofrequency ablation annotation algorithm reduces the incidence of linear gaps and reconnection after pulmonary vein isolation

Elad Anter, MD, Cory M. Tschabrunn, CEPS, Fernando M. Contreras-Valdes, MD, Alfred E. Buxton, MD, Mark E. Josephson, MD

- A **prospective, single-center, nonrandomized**
- **84 patients** underwent RF catheter ablation
- Group A (42) Visitag-guided; Group B (42) non Visitag-guided
- The overall success rate is higher (**90%**) for Group A than Group B (76%).





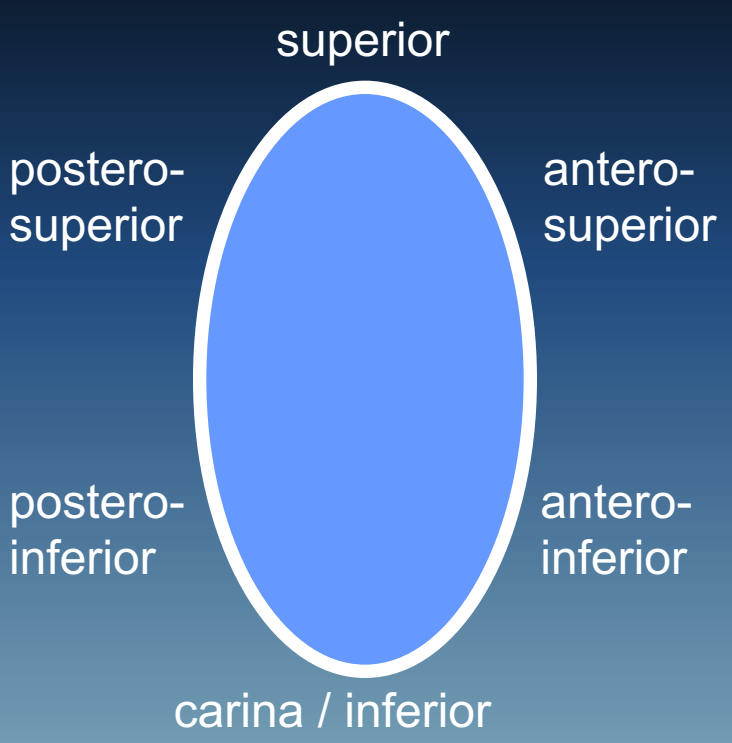
Correlation between linear gap and conduction recovery. A: A contiguous line of ablation in a patient who underwent circumferential pulmonary vein isolation as annotated by the standard method. B and C: A linear gap in the right posterior carina (R3, yellow star) as noted by the lack of catheter stability and inadequate impedance decrease, respectively. D: Following the initial successful isolation, acute pulmonary vein reconnection occurred at this site. A single ablation lesion (pink tag) resulted in the re-isolation of the vein.

Aim of this study was to investigate the effect of RNS on CF using information provided by ThermoCool SmartTouch ablation catheter and to assess if CF values are increased when compared to manual approach. We sought also to determine if increased CF values could affect clinical follow-up.

Pts randomized 1:1 in 2 groups

- **Hansen + SmartTouch (40 pts)**
- **Manual + SmartTouch (40 pts)**

Assessment of catheter CF on different PVs segment



J Interv Card Electrophysiol
DOI 10.1007/s10840-016-0102-0

Analysis of catheter contact force during atrial fibrillation ablation using the robotic navigation system: results from a randomized study

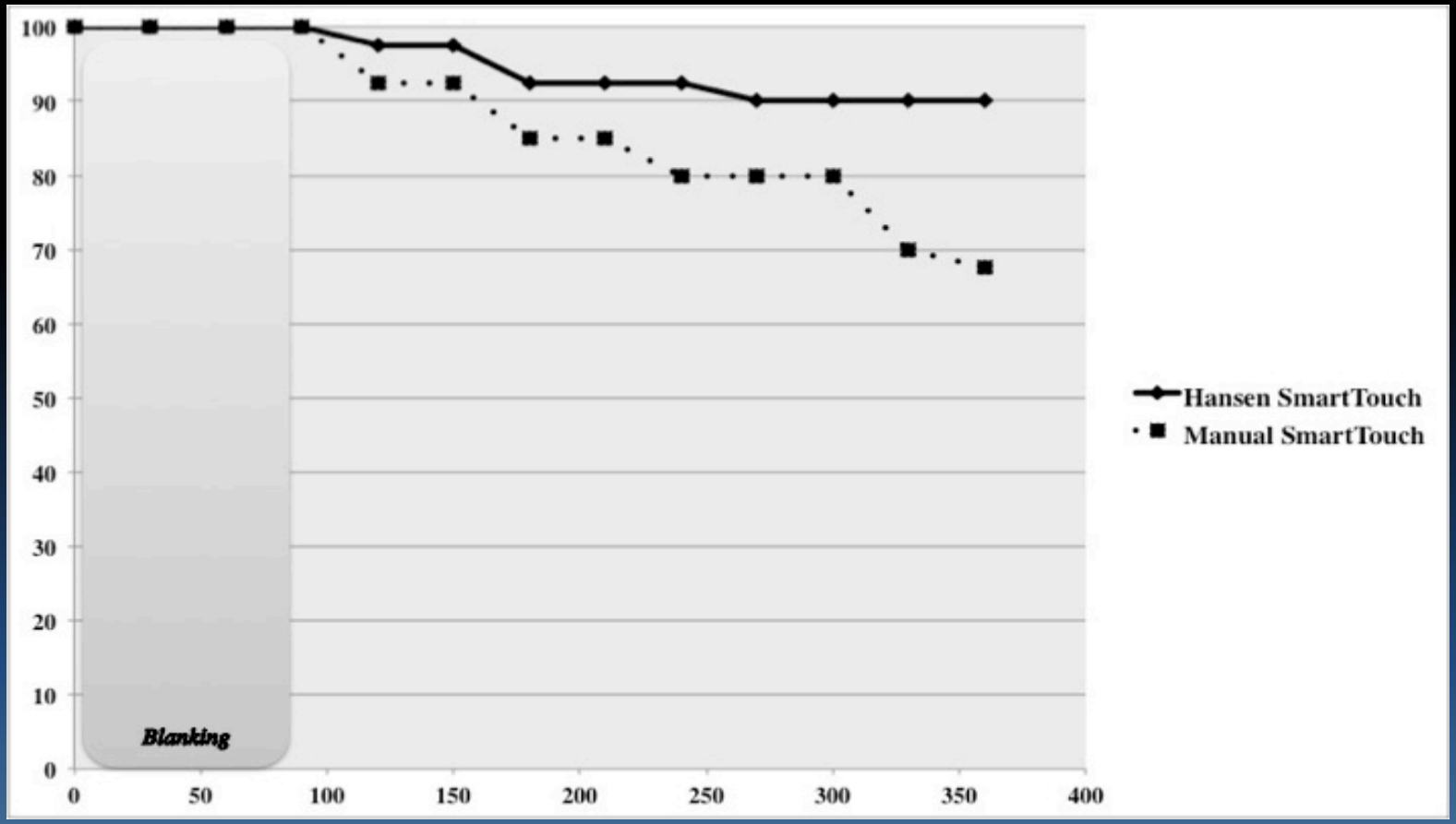
Antonio Dello Russo[1] · Gaetano Fassini[1] · Sergio Conti[1] · Michela Casella[1] · Antonio Di Monaco[2] · Eleonora Russo[1] · Stefania Riva[1] · Massimo Moltrasio[1] · Fabrizio Tundo[1] · Giuseppe De Martino[3] · G. Joseph Gallinghouse[4] · Luigi Di Biase[4,5,6,7] · Andrea Natale[4,7,8,9,10,11] · Claudio Tondo[1,4]

Results: Contacgt Force data

	Contact force on Left Pulmonary veins			Contact force on Right Pulmonary veins		
	Hansen (n=40)	manual (n=40)	*p*	Hansen (n=40)	manual (n=40)	*p*
Superior	26 (14-31)	18 (11-21)	0.004	26 (13-30)	18 (9-21)	0.002
Antero-superior	26 (14-32)	12 (9-14)	<0.001	23 (12-28)	10 (7-15)	<0.001
Postero-superior	23 (13-29)	15 (7-25)	0.001	24 (10-30)	13 (7-21)	<0.001
Carina	25 (12-28)	10 (7-15)	<0.001	26 (10-30)	12 (8-18)	<0.001
Antero-inferior	24 (16-28)	10 (8-13)	0.001	24 (11-28)	11 (8-17)	<0.001
Postero-inferior	23 (17-29)	11 (7-15)	0.02	23 (12-30)	10 (8-15)	<0.001
Inferior	21 (14-30)	10 (6-12)	<0.001	25 (11-28)	11 (8-14)	<0.001

Personal data [under review]

Results: Fredoom from AF recurrence



In this randomized study, concerning a mixed population of paroxysmal and persistent AF patients, we demonstrated that the use of ThermoCool SmartTouch ablation catheter with the RNS is associated with increased contact between the ablation catheter and myocardial tissue and to a lower AF recurrence rate at clinical follow-up.

Personal data [under review]

FUTURE STEP: ABLATION INDEX

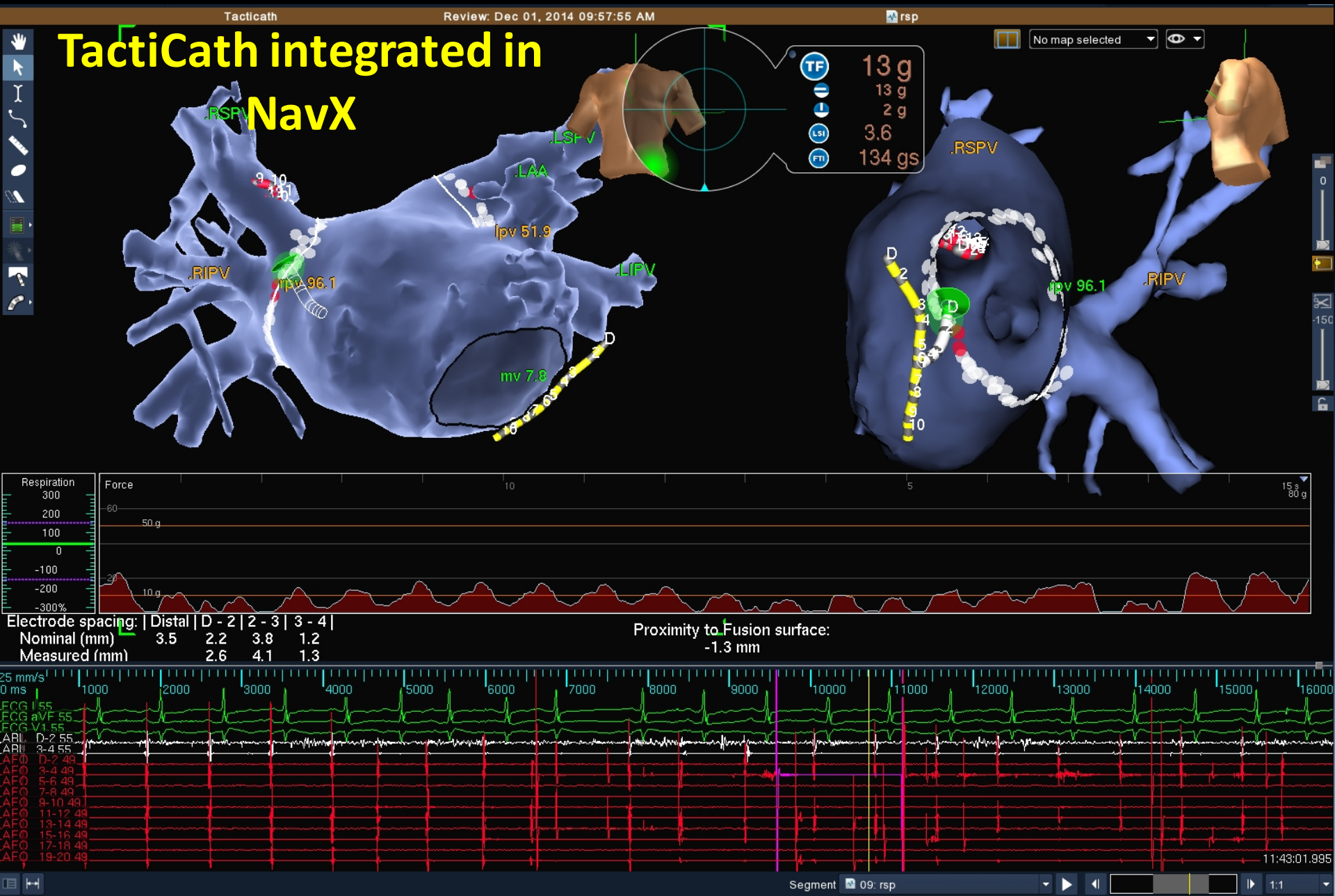
$$Index = \left(k * \int_0^t CF^a(\tau) P^b(\tau) d\tau \right)^c$$

CF: Contact Force, P: RF Power, *t*: Application Time

1. Formula pesata sviluppata da **Nakagawa** basata sulla biofisica della formazione della lesione.
2. I parametri nella formula opportunamente pesati sono: **Forza, Tempo, Potenza**
3. Formula basata su analisi retrospettiva sulla proforndità di lesione
4. Integrato con il **CARTO3®** e i **VISITAG™**

Centro Cardiologico Monzino

Force Time Integral (FTI) and Lesion Index (LSI™)



Contact Force Guidelines

applicate nello studio EFFICAS II

TactiCath è la **prima** ed **unica** tecnologia a fornire linee guida sui valori della forza di contatto per ottimizzare la qualità della lesione

TOCCATA

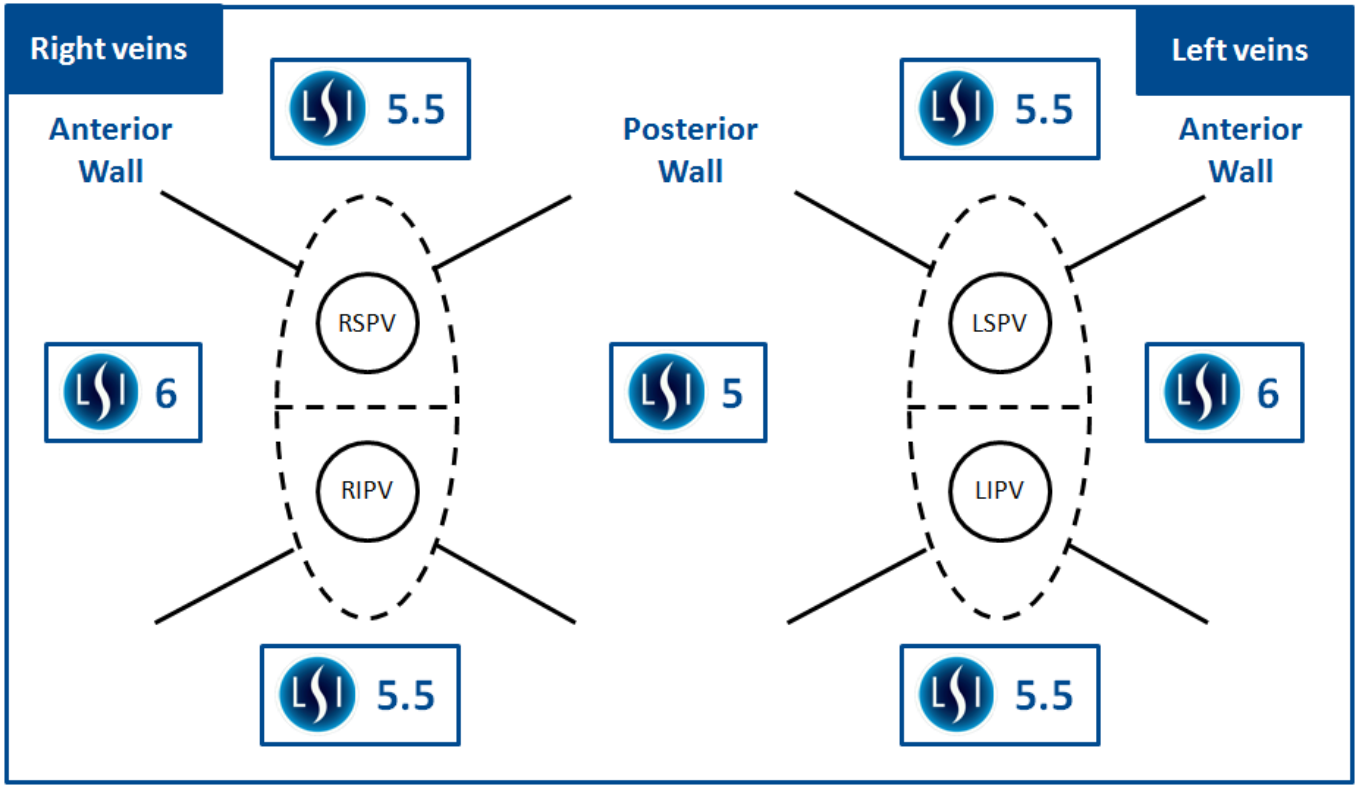
EFFICAS I

- TARGET CF 20 g con range [10g, 30g]
- Min CF > 10 g per ogni punto d'ablazione
- Min FTI > 400 gs per ogni punto d'ablazione
- ONE SHOT → Trasmuralità va raggiunta in one shot

Neuzil et al. Electrical reconnection after pulmonary vein isolation is contingent on contact force during initial treatment: results from the EFFICAS I study. Circ Arrhythm Electrophysiol. 2013 Apr;6(2):327-33.

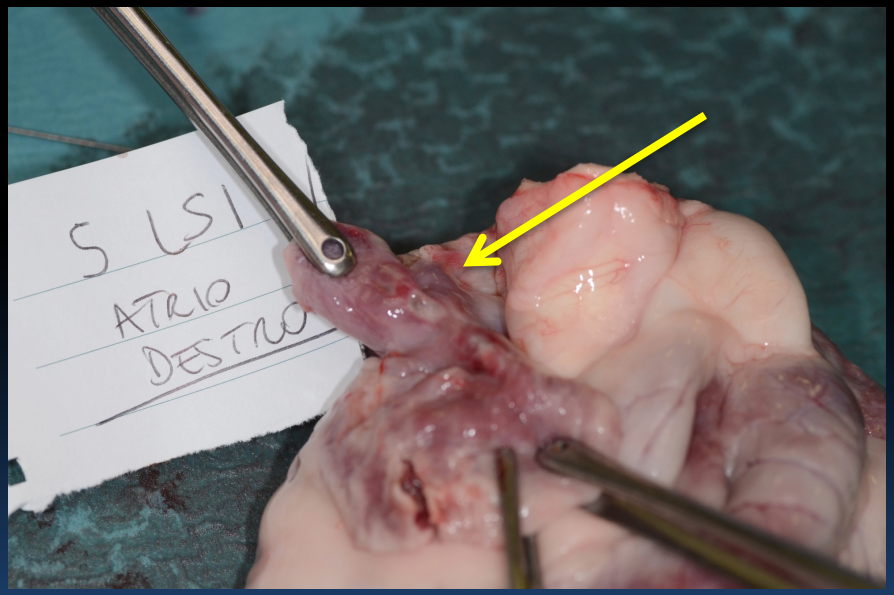
Lesion Index (LSI)

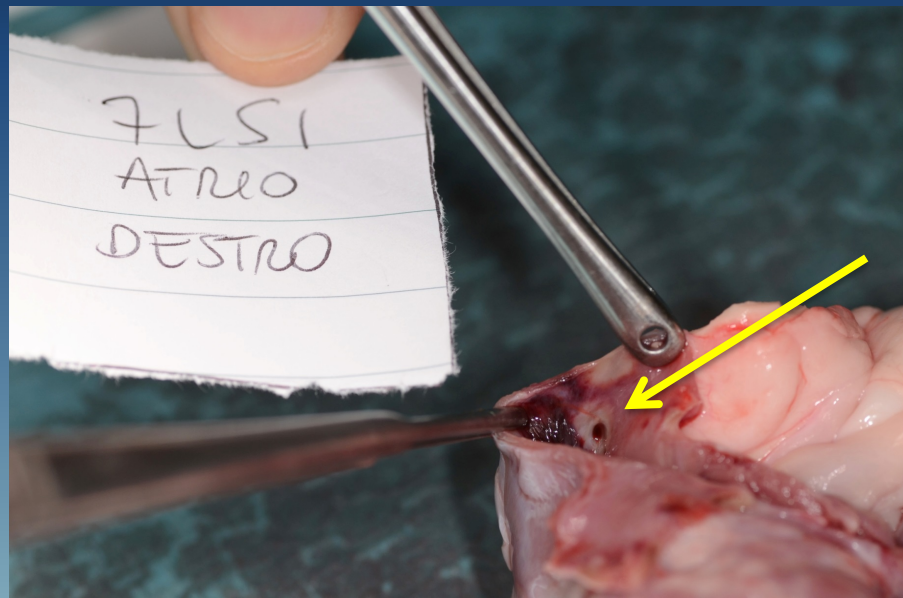
I dati di EFFICAS I suggeriscono di raggiungere un valore minimo di LSI, anche se già ottenuto l'isolamento elettrico



Animal Lab CCFM
Rivolta d'Adda

Atrio dx:LSI



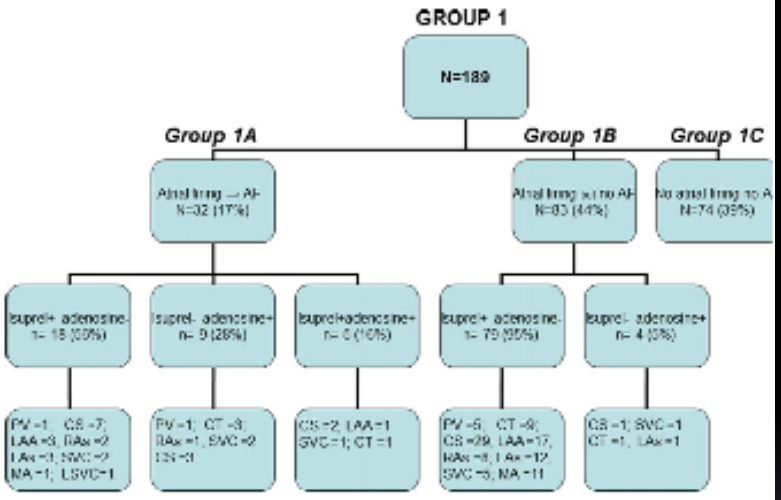


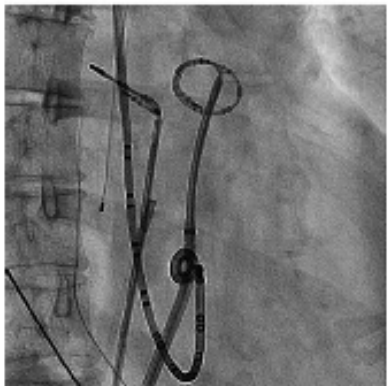
PVI e' sufficiente?

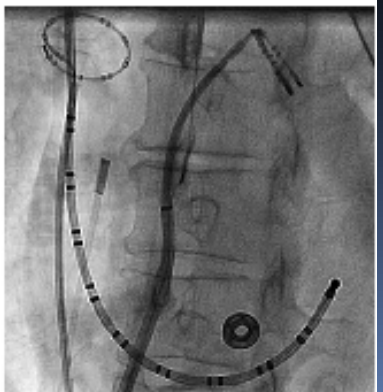
Administration of Isoproterenol and Adenosine to Guide Supplemental Ablation After Pulmonary Vein Antrum Isolation

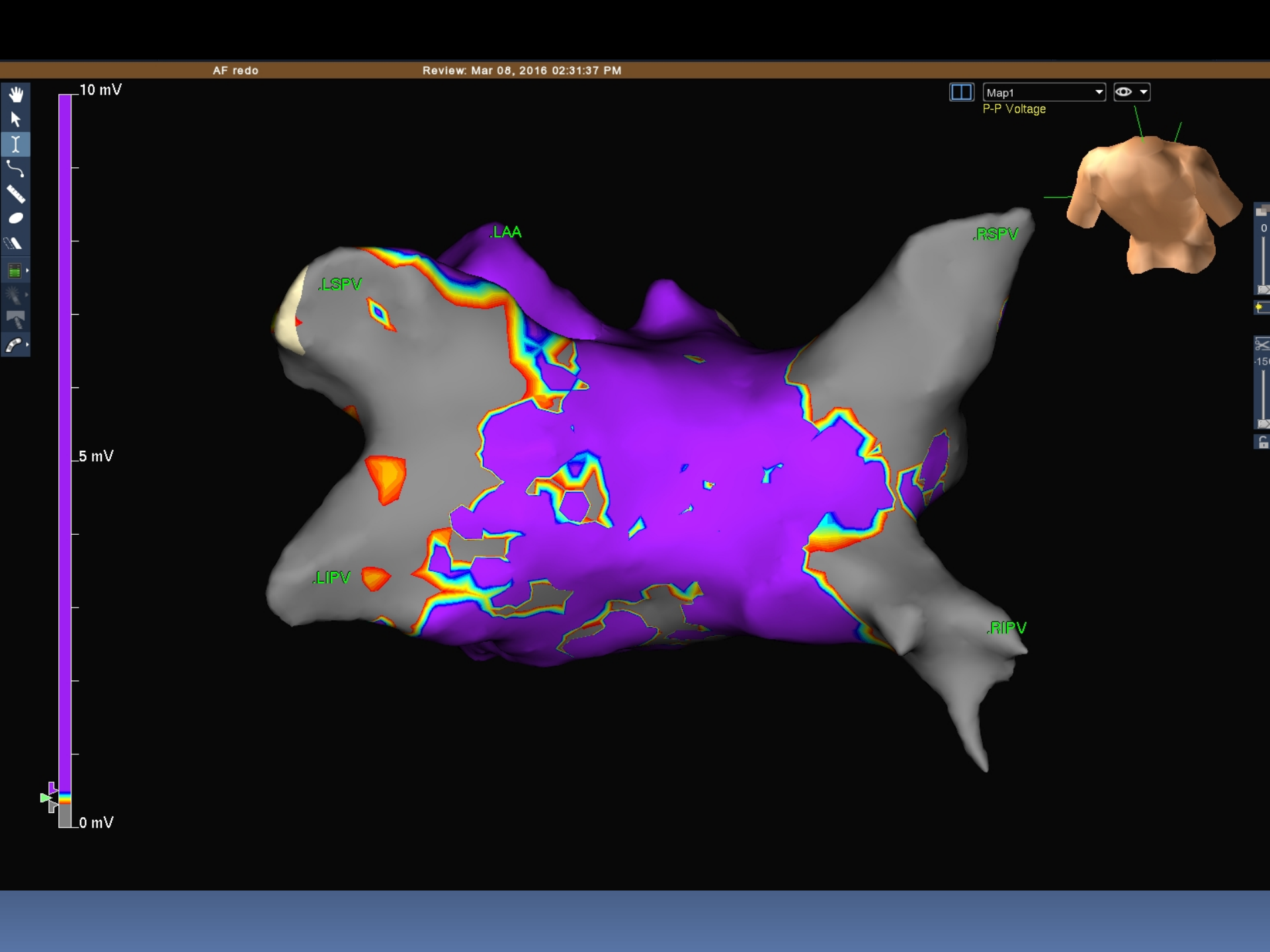
CLAUDE S. ELAYI, M.D.,* LUIGI DI BIASE, M.D., PH.D.,†,‡,§ RONG BAI, M.D.,†
J. DAVID BURKHARDT, M.D.,† PRASANT MOHANTY, M.B.B.S., M.P.H.,†
PASQUALE SANTANGELI, M.D.,† JAVIER SANCHEZ, M.D.,† RICHARD HONGO, M.D.,¶
G. JOSEPH GALLINGHOUSE, M.D.,† RODNEY HORTON, M.D.,† SHANE BAILEY, M.D.,†
SALWA BEHEIRY, R.N.,¶ and ANDREA NATALE, M.D., F.A.C.C., F.H.R.S., F.E.S.C.†,§,¶

From the *Department of Cardiovascular Medicine, University of Kentucky, Lexington, Kentucky, USA; †Texas Cardiac Arrhythmia Institute at St. David's Medical Center, Austin, Texas, USA; ‡Department of Cardiology, University of Foggia, Foggia, Italy; §Department of Biomedical Engineering, University of Texas, Austin, Texas, USA; and ¶California Pacific Medical Center, California, San Francisco, USA



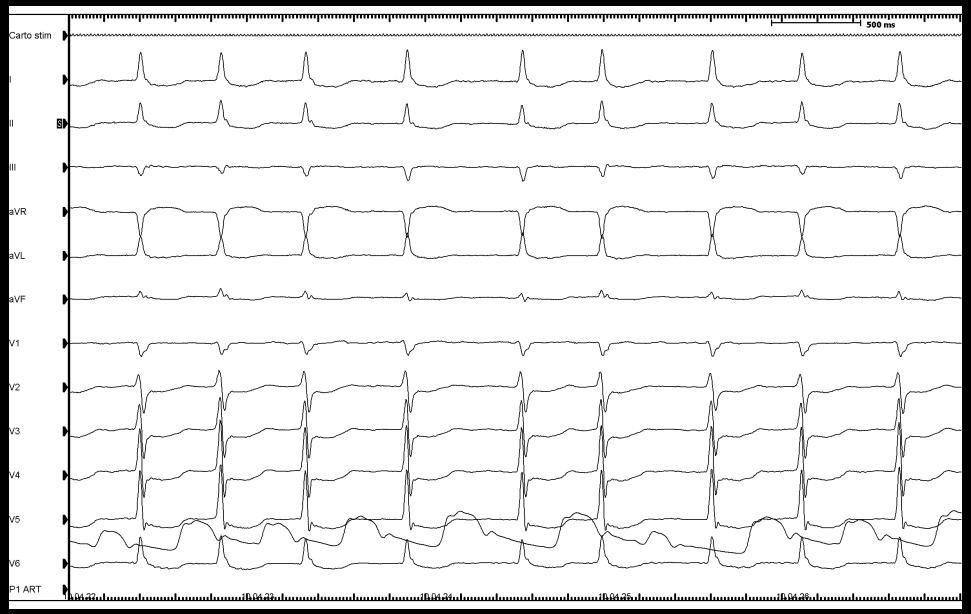


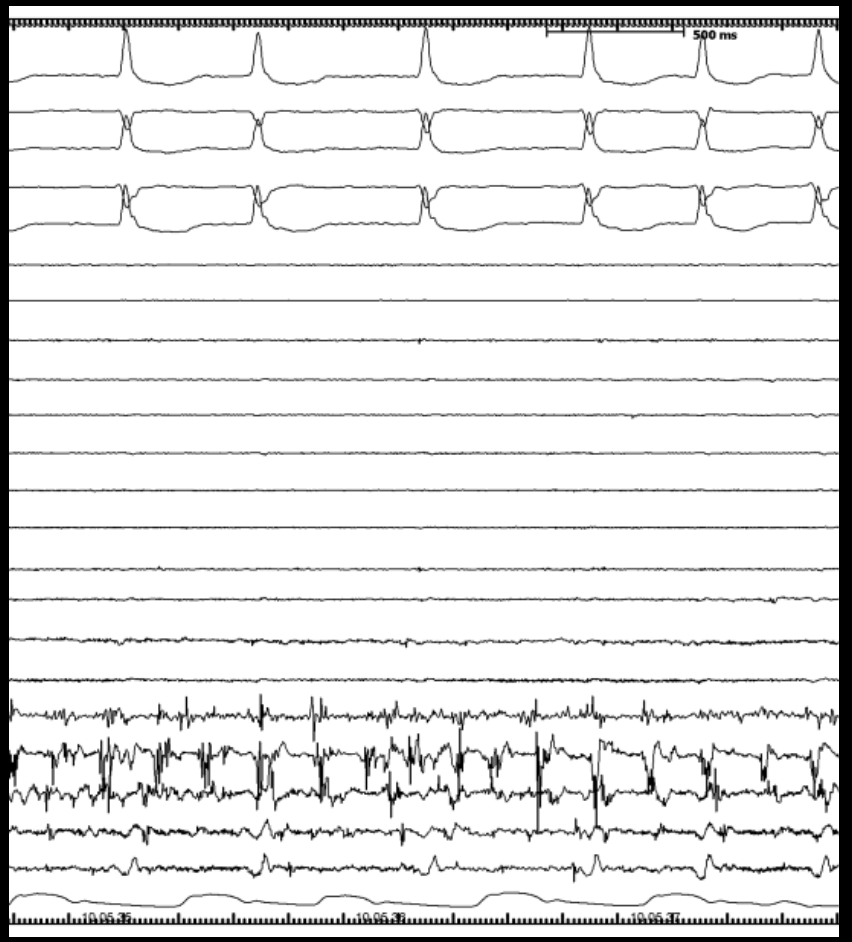



AF redo
Review: Mar 08, 2016 02:31:37 PM
10 mV
5 mV
0 mV
Map1
P-P Voltage
LAA
RSPV
LSPV
LIPV
RIPV

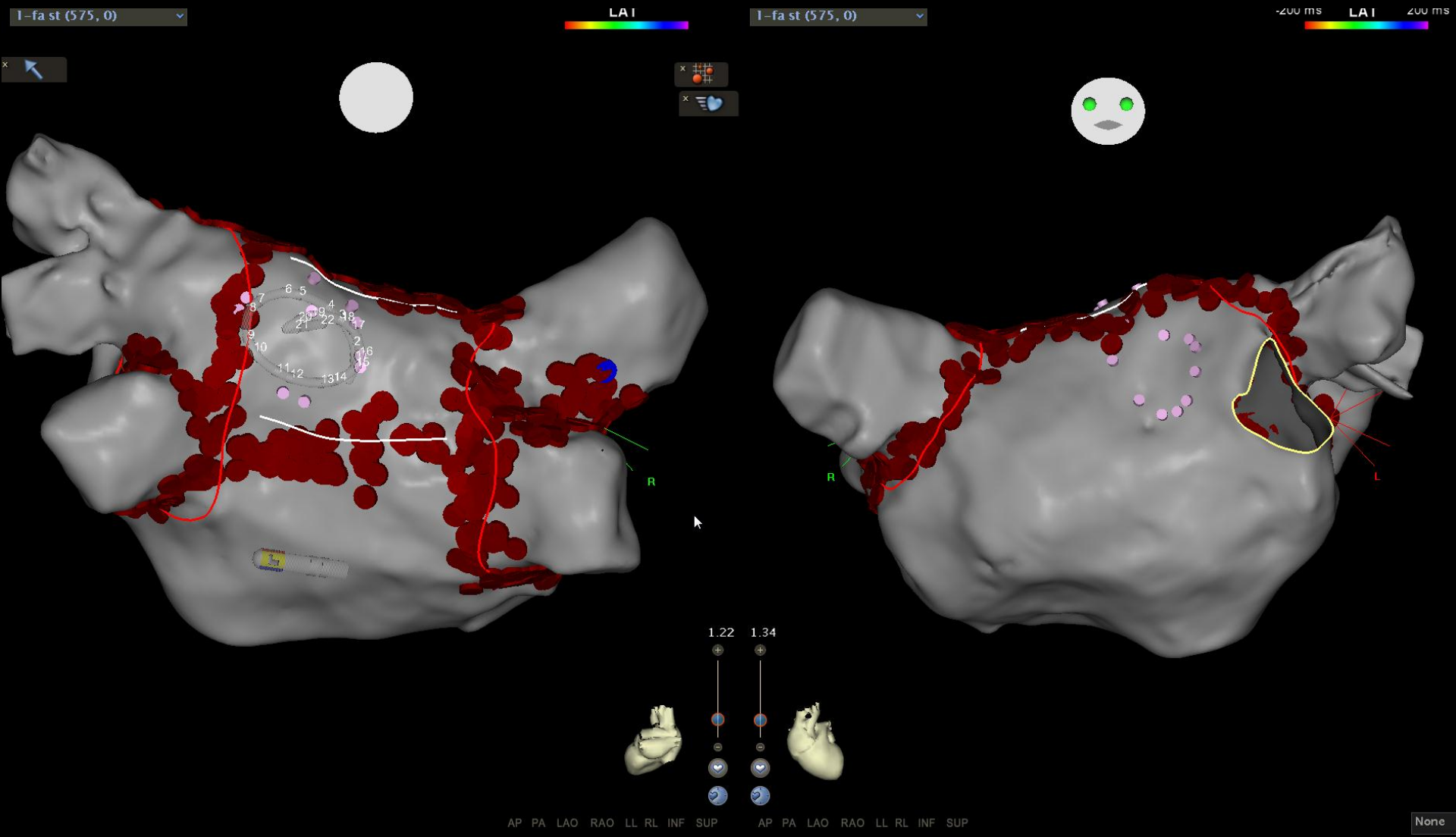

AF redo
Review: Mar 08, 2016 02:31:37 PM
Seg 00005
No map selected
Respiration
300
200
100
0
-100
-200
-300%
Electrode spacing: | Distal | D - 2 | 2 - 3 | 3 - 4 |
Nominal (mm) 4.0 1.0 4.0 1.0
Measured (mm) 0.9 5.9 1.1
Proximity to EnSite surface:
0.9 mm
100 mm/s
0 ms
200
400
600
800
1000
1200
1400
1600
1800
2000
2200
2400
2600
2800
3000
3200
3400
3600
3800
4000
ECG I 55
ECG aVF 55
ECG V1 55
CS D-2 55
CS 3-4 55
CS 5-6 55
CS 7-8 55
CS 9-10 55
5 D-2 55
5 3-4 55
5 5-6 55
5 7-8 55
5 9-10 55
5 11-12 55
5 13-14 55
5 15-16 55
5 17-18 55
5 19-20 55
17:15:00.223

Basal ECG

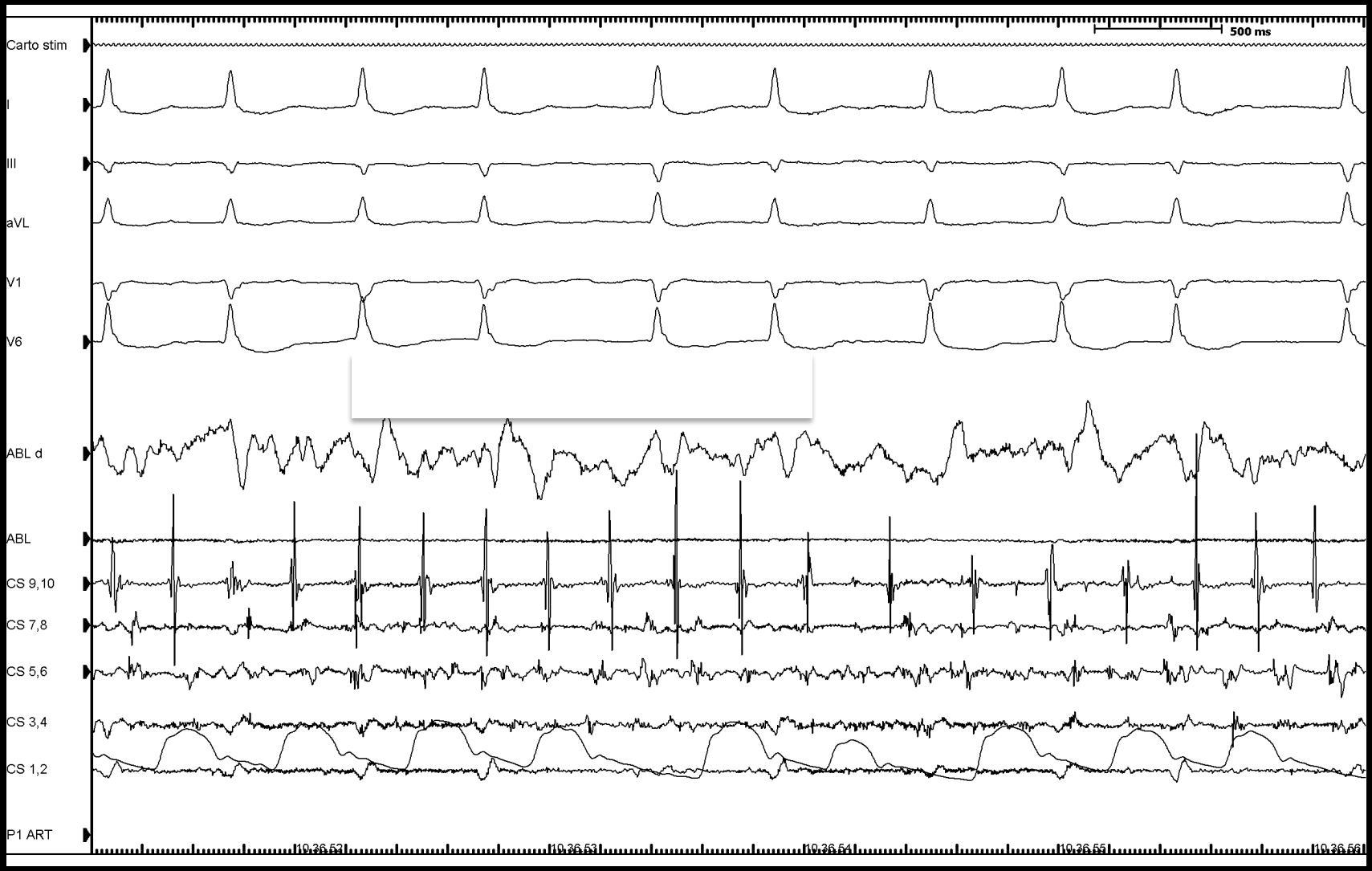

500 ms
Carto stim
I
II
III
aVR
aVL
aVF
V1
V2
V3
V4
V5
V6
P1 ART


500 ms

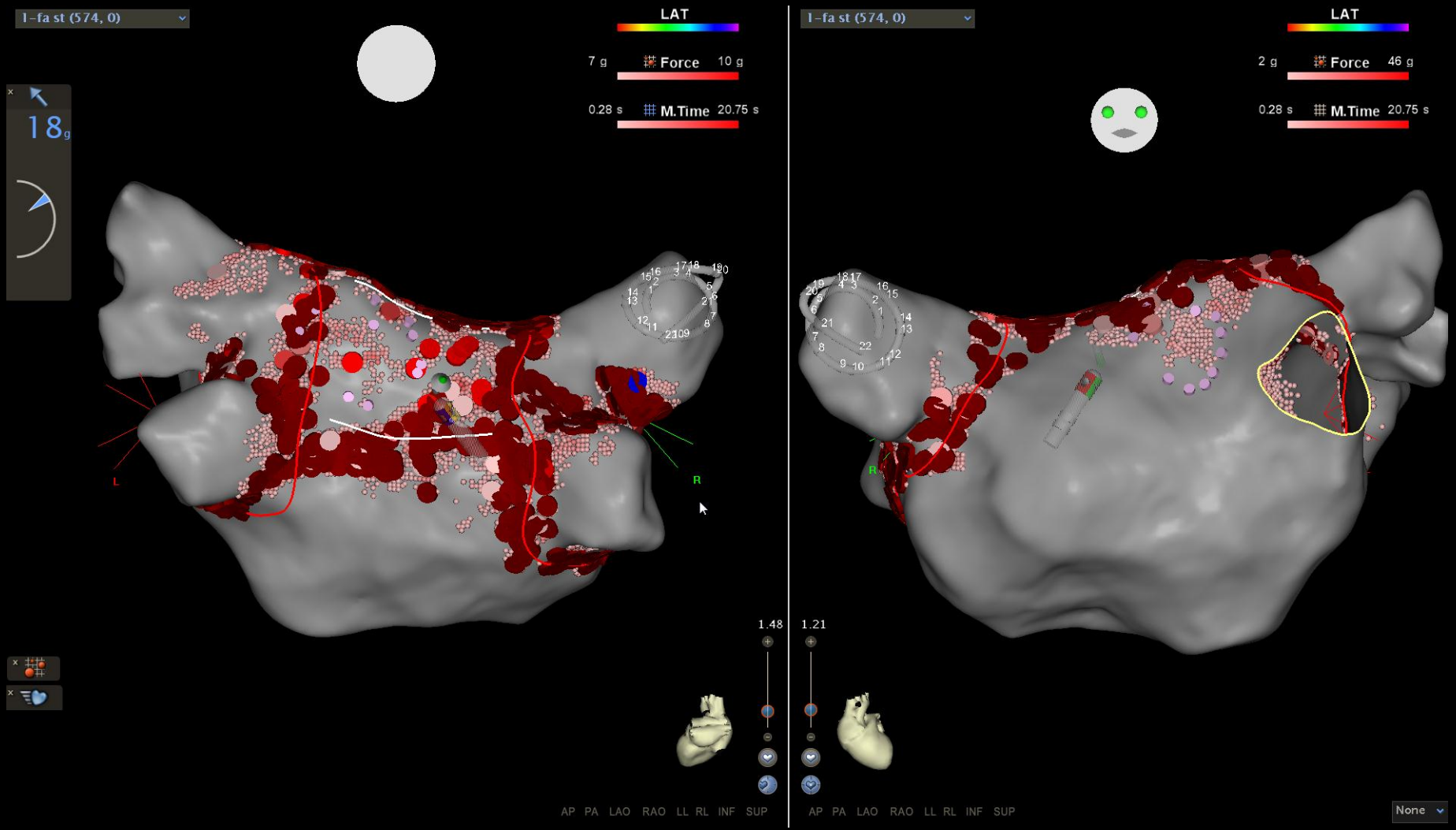
Box lesion


1-fa st (575, 0)
LAT
1-fa st (575, 0)
-200 ms
LAT
200 ms
R
R
L
1.22
1.34
AP PA LAO RAO LL RL INF SUP
AP PA LAO RAO LL RL INF SUP
None

Atrial Tachycardia



LAPW ablation

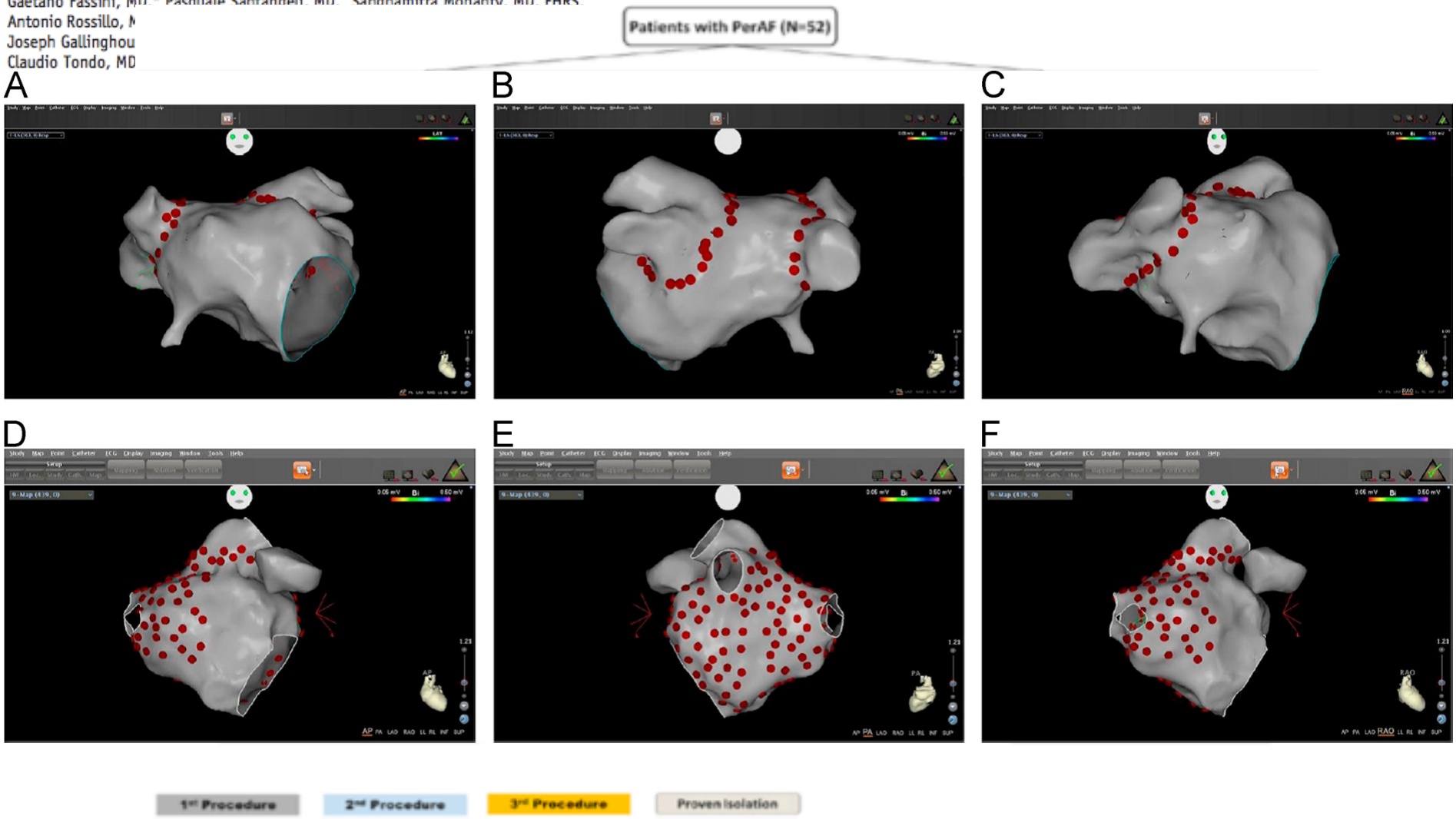


Atrial Fibrillation Interruption

Proven isolation of the pulmonary vein antrum with or without left atrial posterior wall isolation in patients with persistent atrial fibrillation

Rong Bai, MD, FHRS, FESC,[*†] Luigi Di Biase, MD, PhD, FHRS, FACC,[*‡§‖]
Prasant Mohanty, MBBS, MPH,[*] Chintan Trivedi, MD,[*] Antonio Dello Russo, MD,[¶]
Sakis Themistoclakis, MD,[#] Michela Casella, MD,[¶] Pietro Santarelli, MD,[**]
Gaetano Fassini, MD,[¶] Pasquale Santangeli, MD,[*] Sanghamitra Mohanty, MD, FHRS,[*]
Antonio Rossillo, M
Joseph Gallinghou
Claudio Tondo, MD

(Heart Rhythm 2015;0:1–9)



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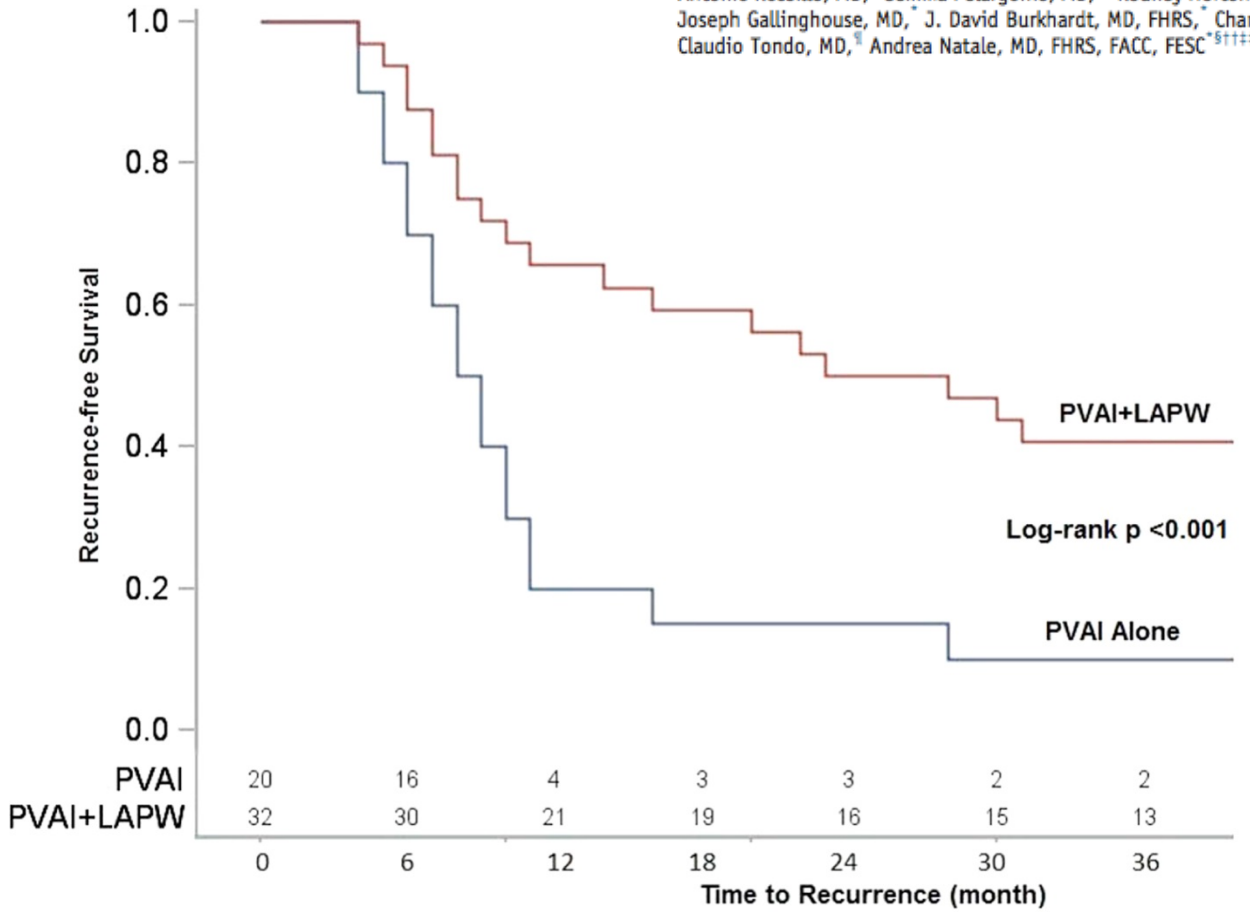
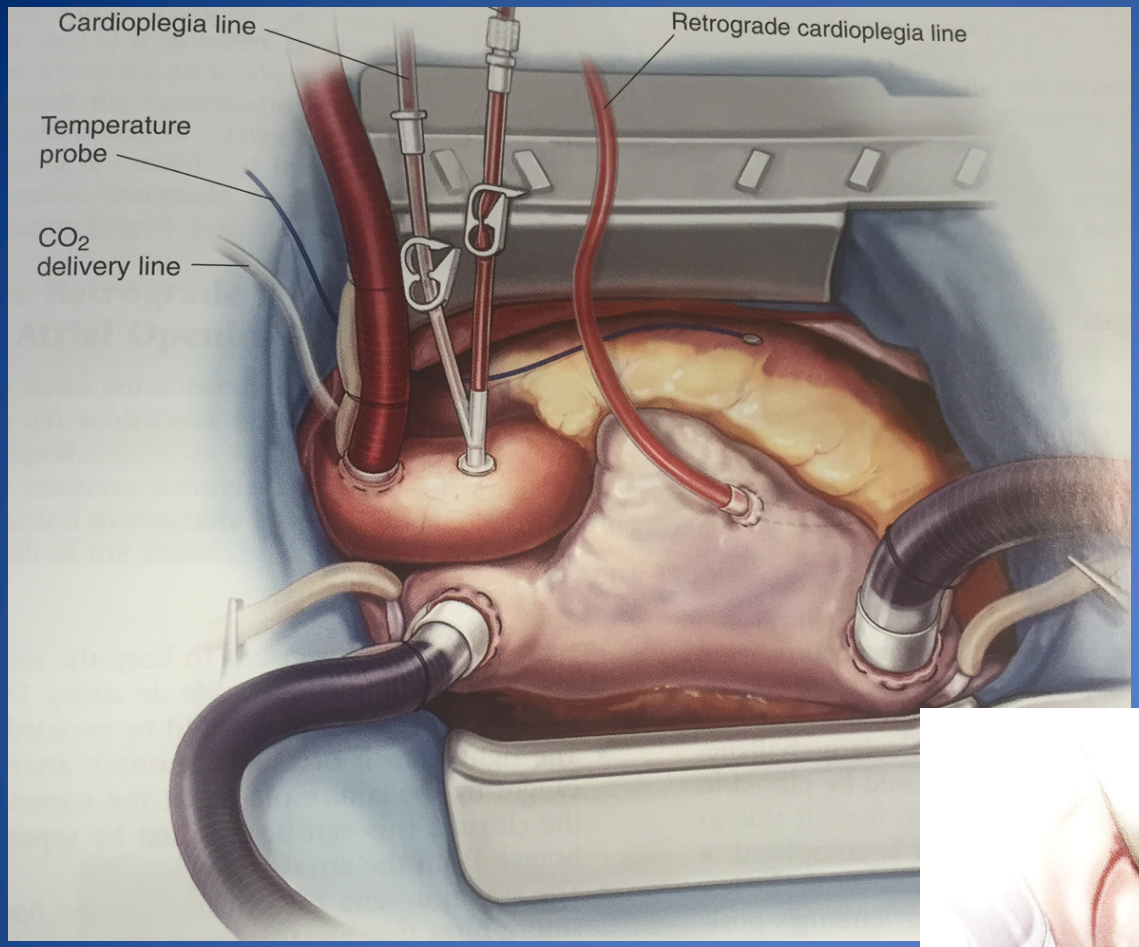
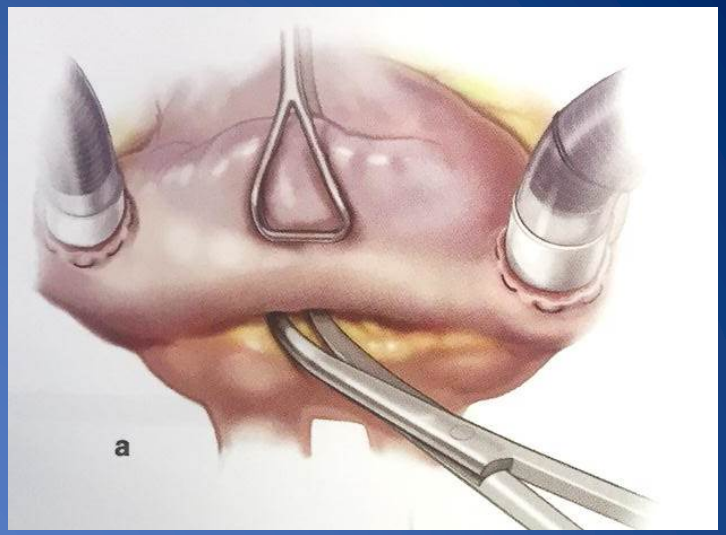
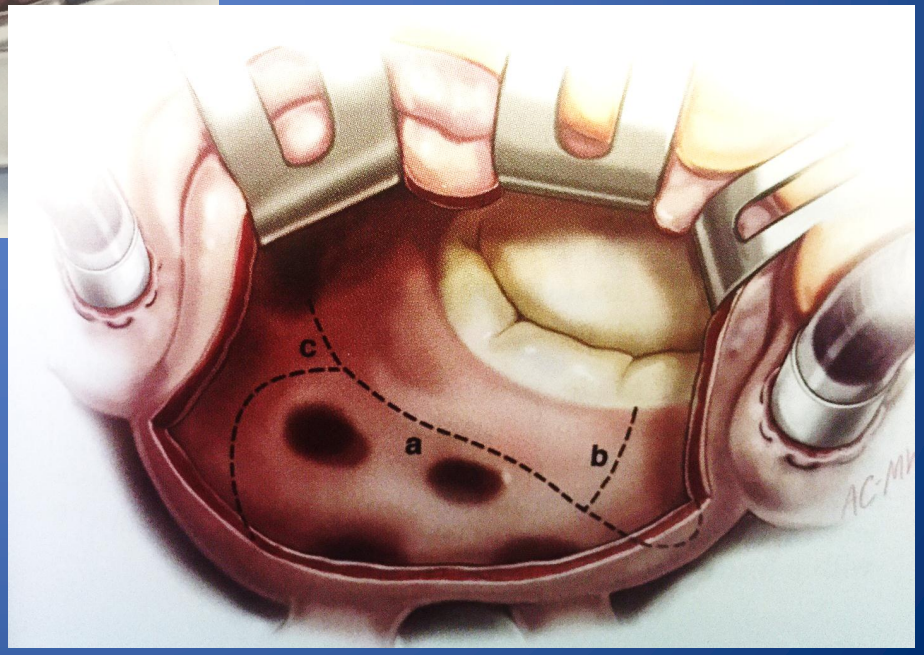


Recurrence-free Survival (95% CI)	1 Year	2 Year	3 Year
PVAI+LAPW	0.65 (0.46 - 0.79)	0.50 (0.32 - 0.65)	0.40 (0.24 - 0.57)
PVAI Alone	0.20 (0.06 - 0.39)	0.15 (0.04 - 0.33)	0.10 (0.01 - 0.27)

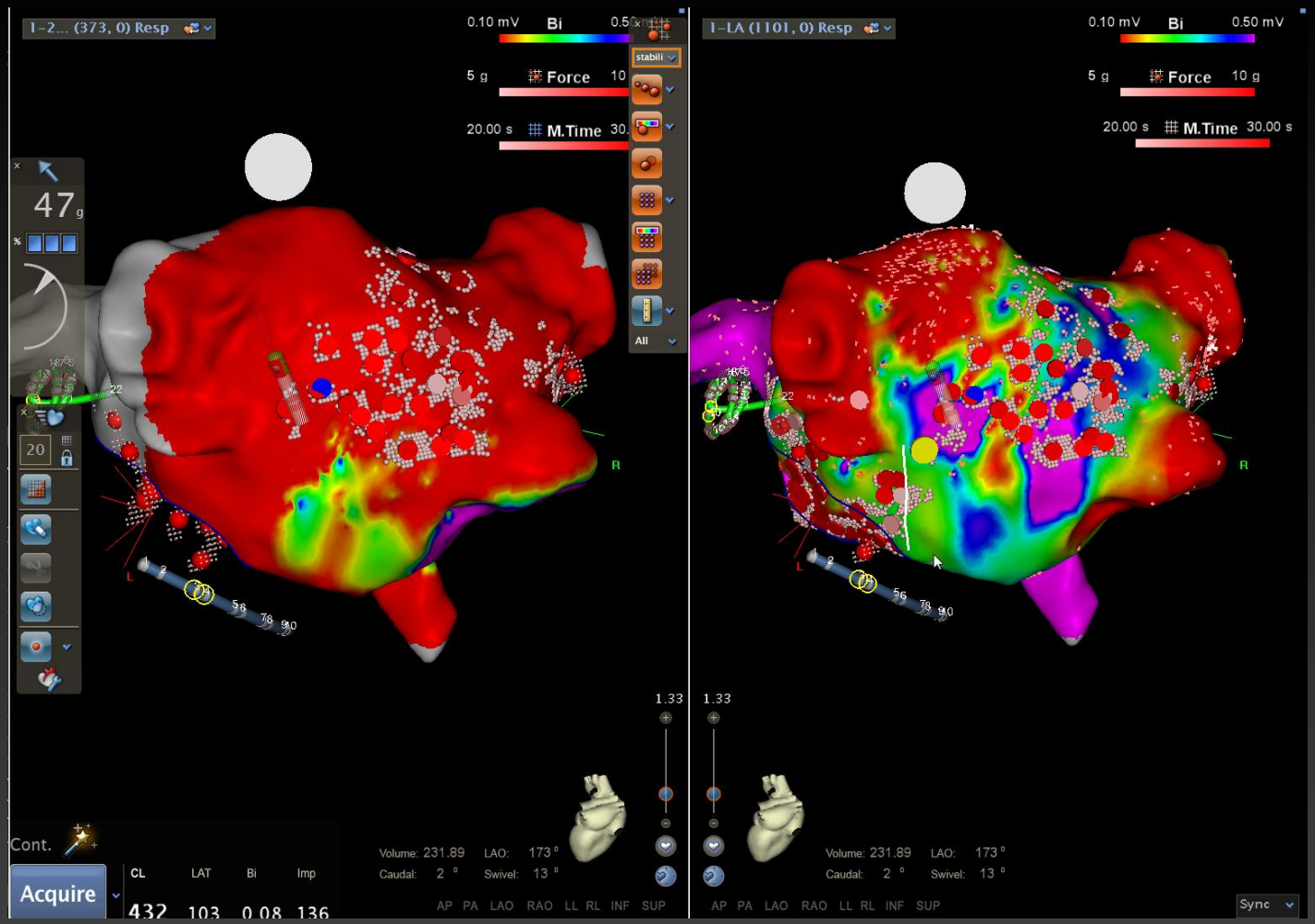
Coinvolgimento del cardiochirurgo


Cardioplegia line
Retrograde cardioplegia line
Temperature probe
CO_2 delivery line


a

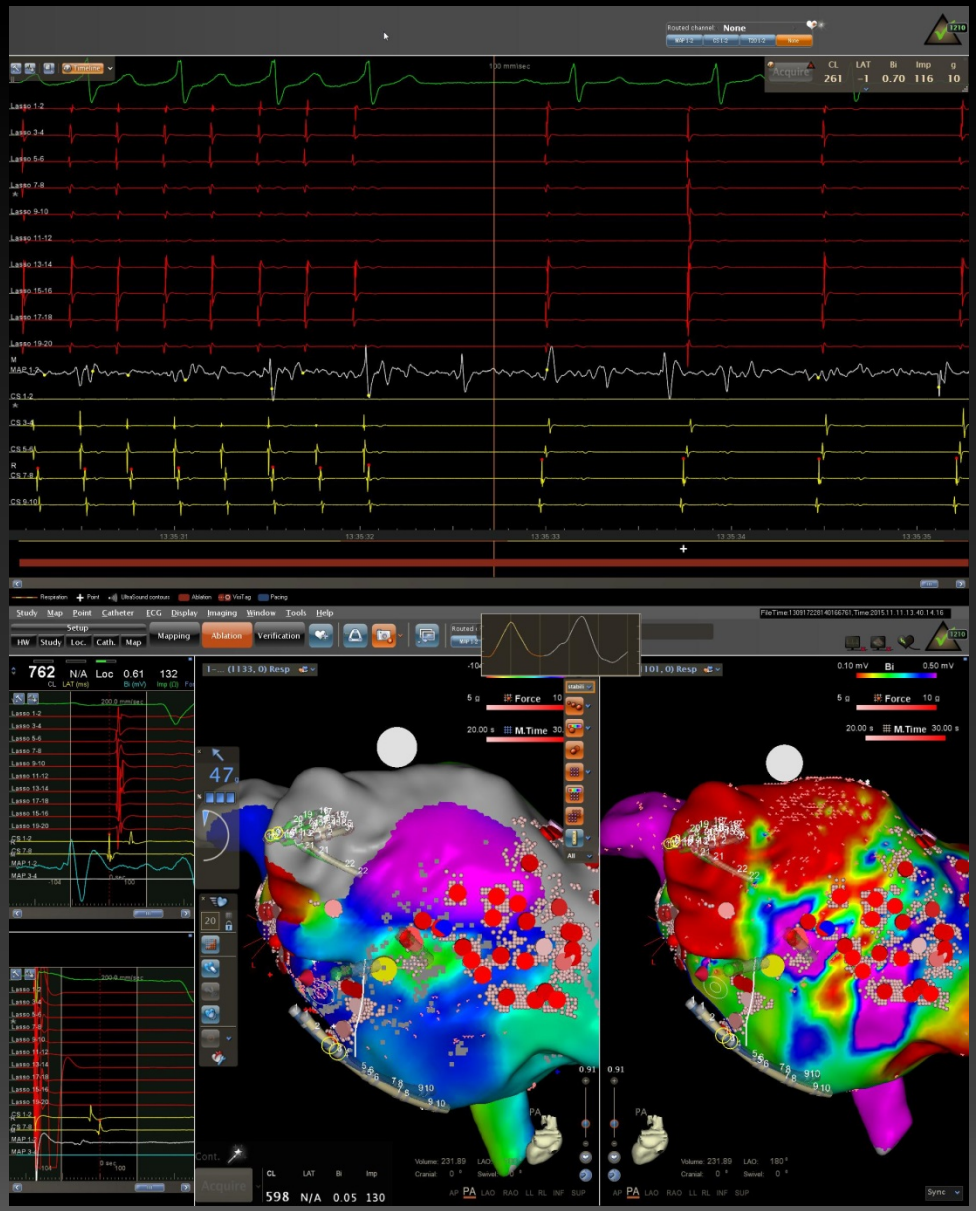

c
a
b

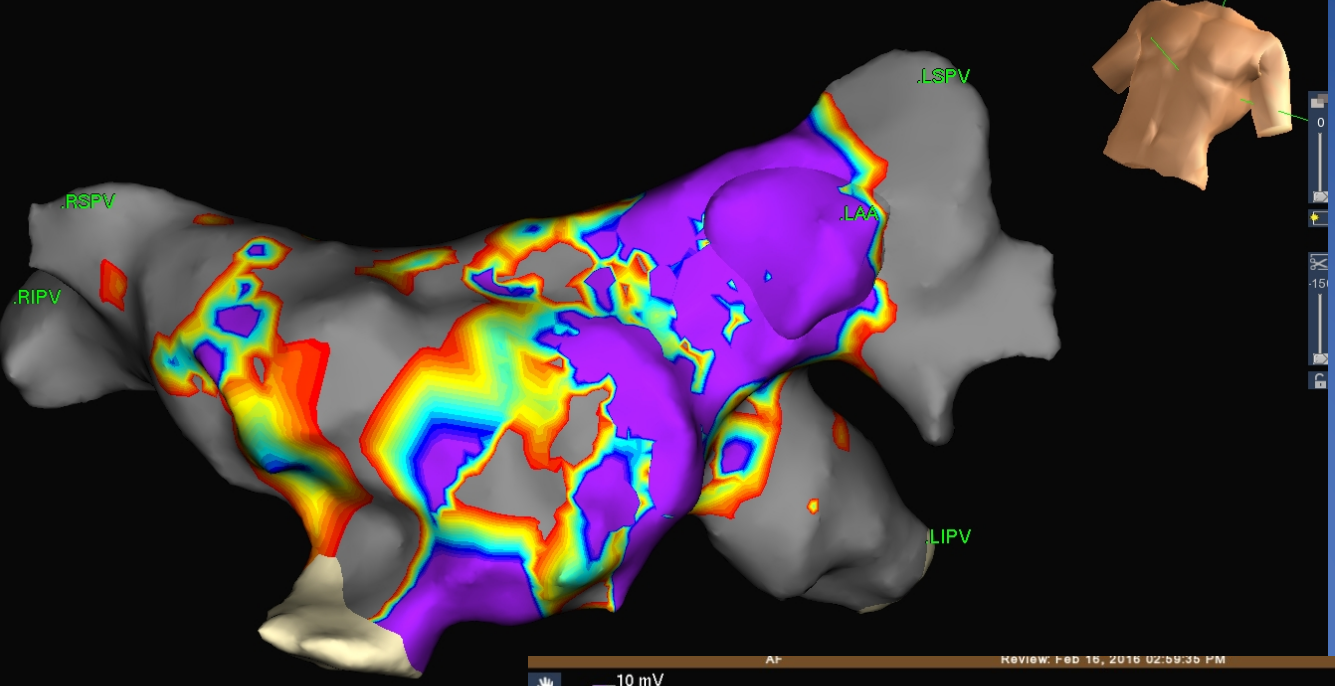
ATC FA redo: mappaggio di substrato Confidense

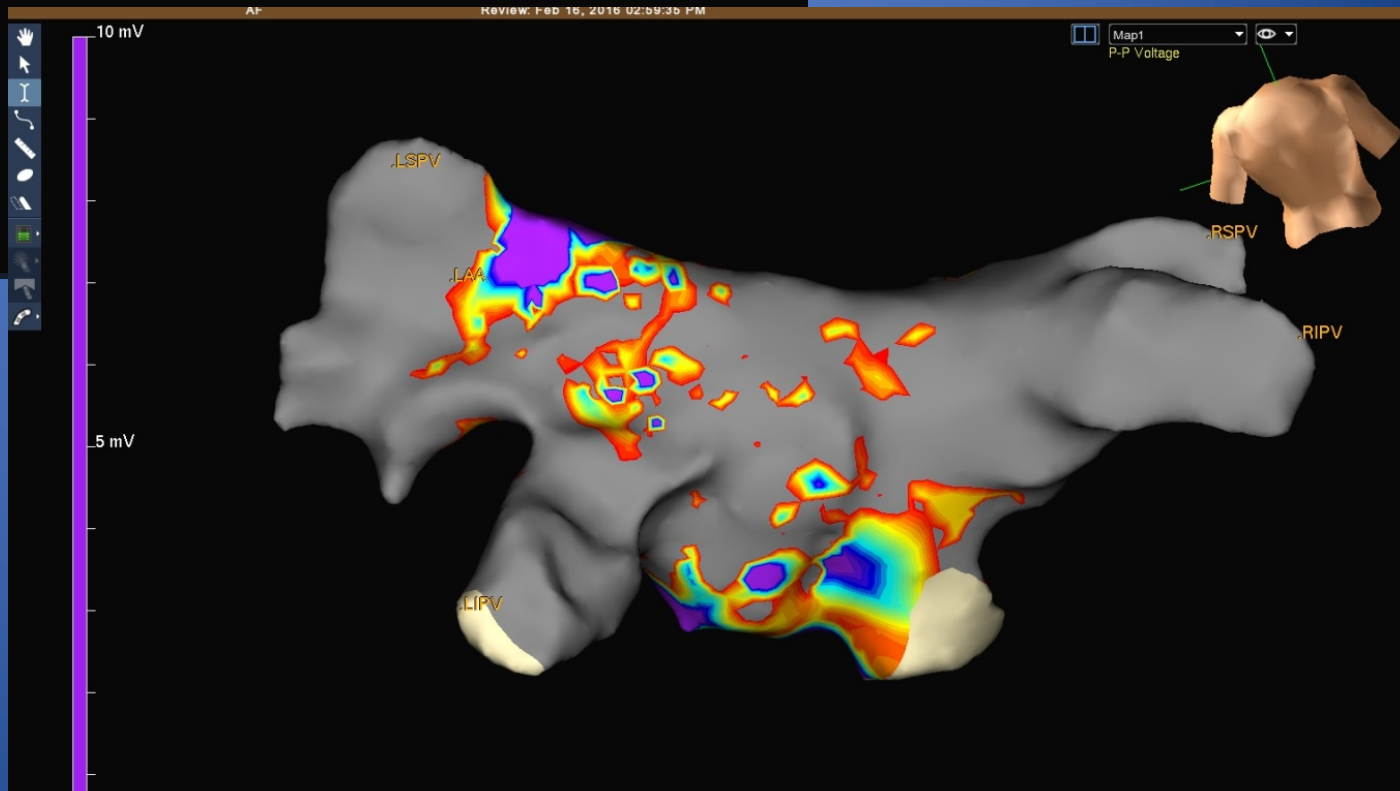


Omogeneizzazzione parete posteriore con Hansen Sensei + CF e Visitag

Interruzione Flutter atriale atipico




LSPV
RSPV
LAA
RIPV
LIPV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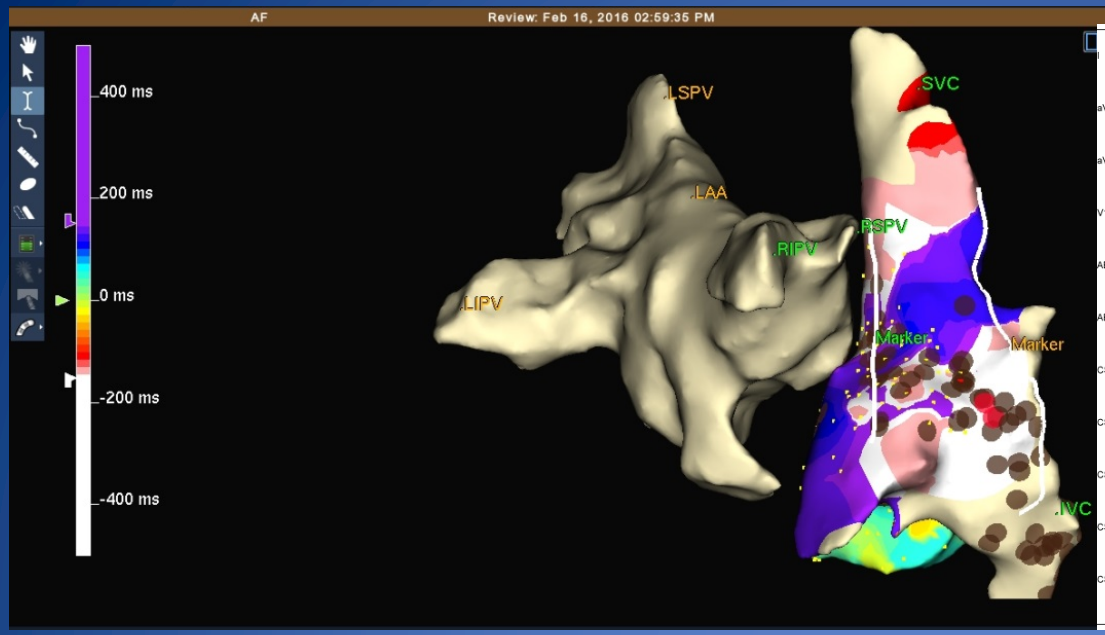
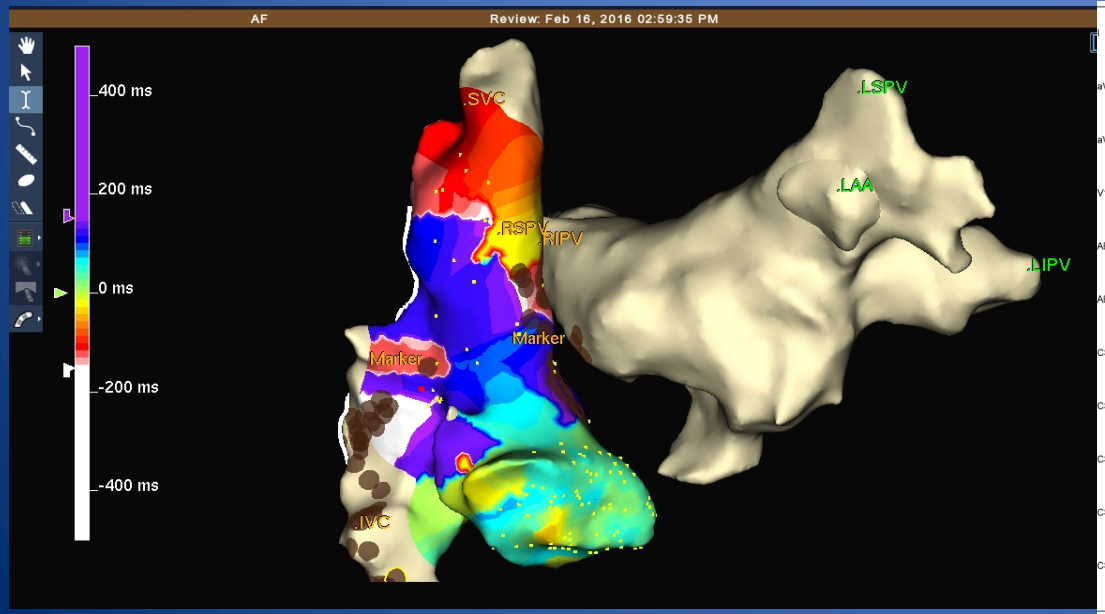
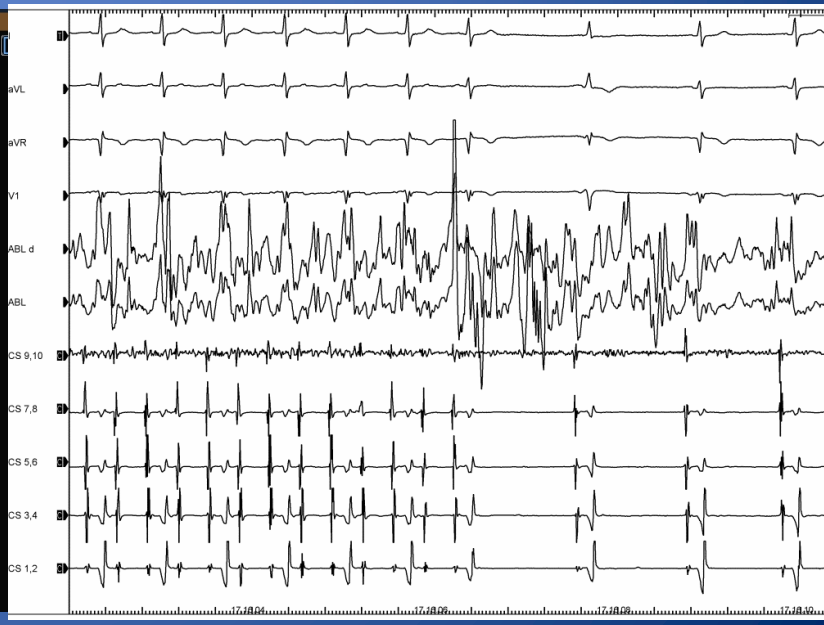
10 mV
5 mV
Map1
P-P Voltage
LSPV
LAA
RSPV
RIPV
LIPV


AF
Review: Feb 16, 2016 02:59:35 PM
400 ms
200 ms
0 ms
-200 ms
-400 ms
LSPV
SVC
LAA
RSPV
RIPV
LIPV
Marker
Marker
IVC


aVL
aVR
V1
ABL d
ABL
CS 9,10
CS 7,8
CS 5,6
CS 3,4
CS 1,2


AF
Review: Feb 16, 2016 02:59:35 PM
400 ms
200 ms
0 ms
-200 ms
-400 ms
SVC
LSPV
LAA
RSPV
RIPV
LIPV
Marker
Marker
IVC

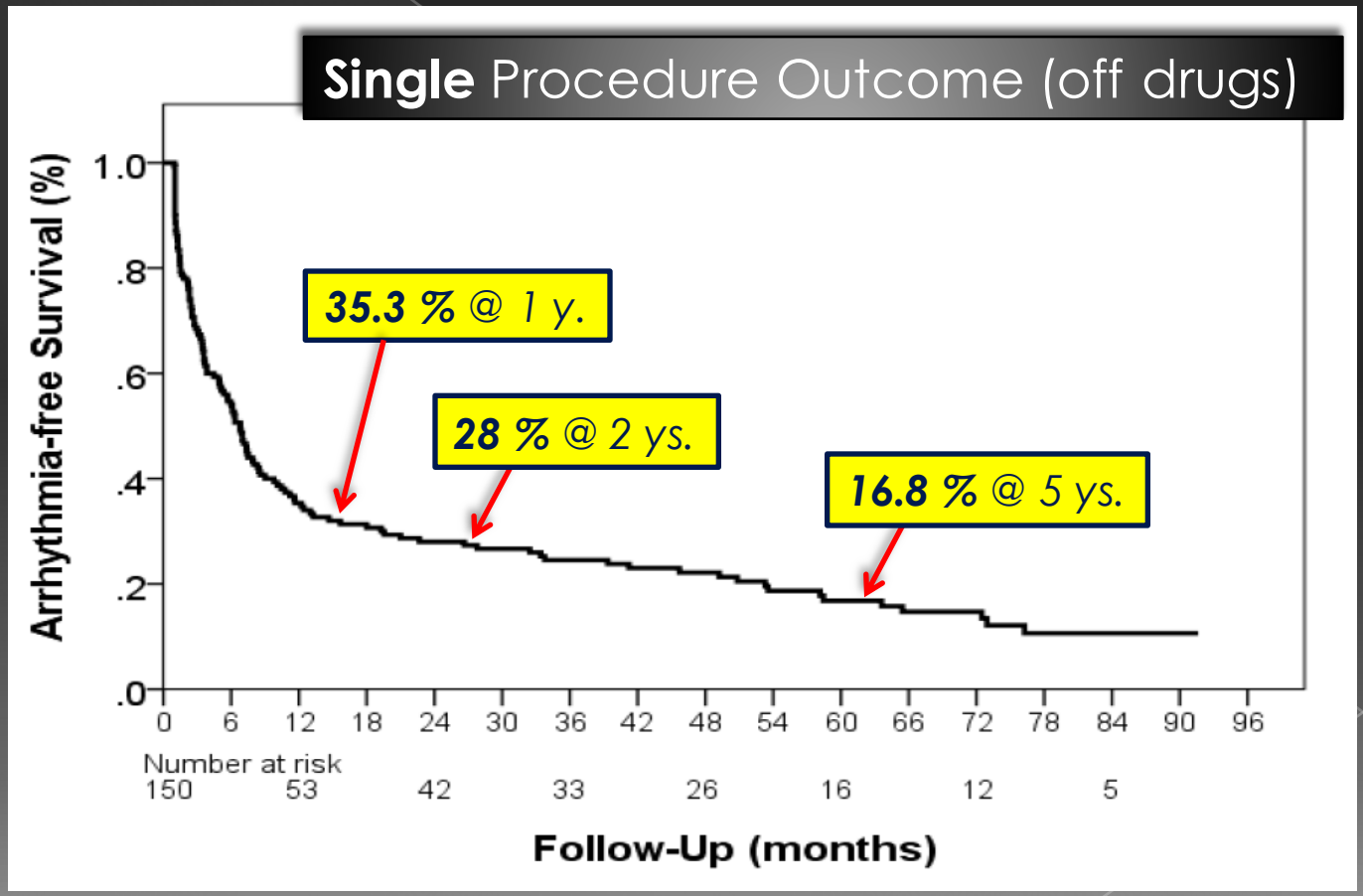

aVL
aVR
V1
ABL d
ABL
CS 9,10
CS 7,8
CS 5,6
CS 3,4
CS 1,2

BREAKING NEWS

Five-Year Outcome of Catheter Ablation of Persistent Atrial Fibrillation Using Termination of Atrial Fibrillation as a Procedural Endpoint

Daniel Scherr, MD; Paul Khairy, MD, PhD; Shinsuke Miyazaki, MD; Valerie Aurillac-Lavignolle, BSc; Patrizio Pascale, MD; Stephen B. Wilton, MD; Khaled Ramoul, MD; Yuki Komatsu, MD; Laurent Roten, MD; Amir Jadidi, MD; Nick Linton, MD, PhD; Michala Pedersen, MD; Matthew Daly, MD; Mark O'Neill, MD; Sebastien Knecht, MD, PhD; Rukshen Weerasooriya, MD; Thomas Rostock, MD; Martin Manninger, MD; Hubert Cochet, MD; Ashok J. Shah, MD; Sunthareth Yeim, MD; Arnaud Denis, MD; Nicolas Derval, MD; Meleze Hocini, MD; Frederic Sacher, MD; Michel Haissaguerre, MD; Pierre Jais, MD

(*Circ Arrhythm Electrophysiol.* 2015;8:18-24.



Five-Year Outcome of Catheter Ablation of Persistent Atrial Fibrillation Using Termination of Atrial Fibrillation as a Procedural Endpoint

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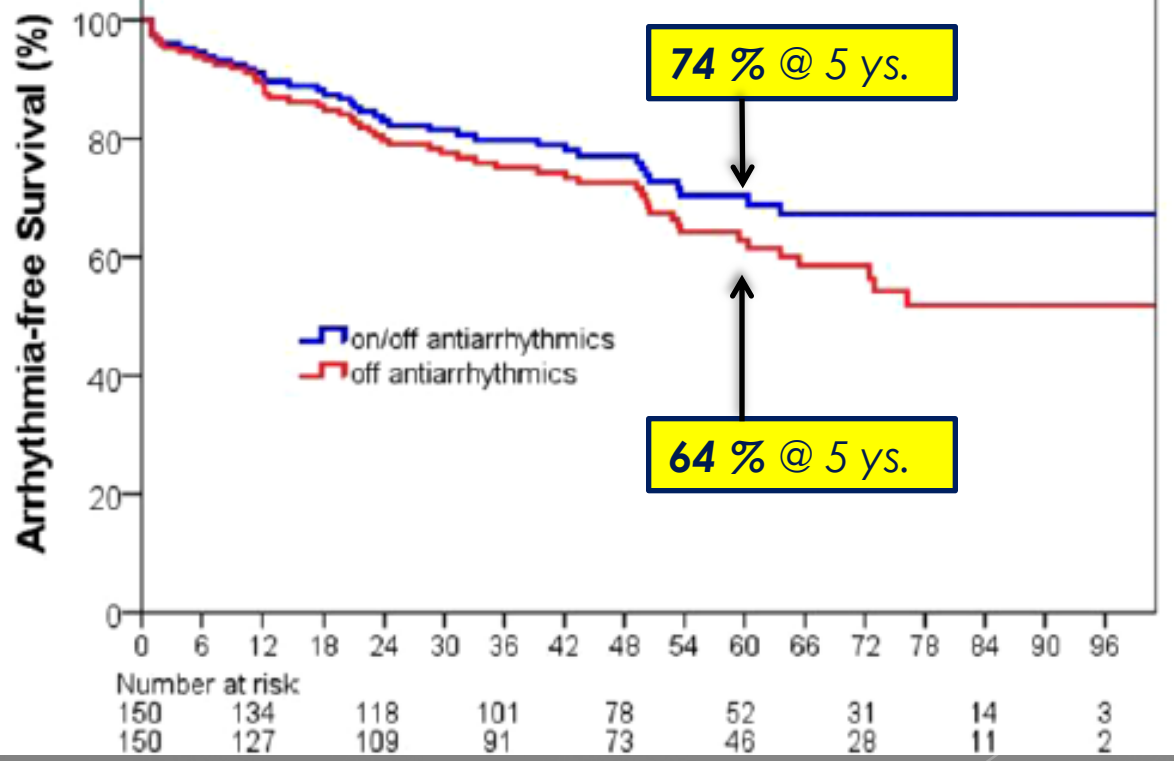
Multiple Procedure Outcome



Hybrid ablation in persistent AF: why?

- ✓ *Limited success of isolated catheter-based ablations (20-55%)*
- ✓ *In most cases need for redo PV isolation*
- ✓ *Key role of wide, permanent PV antral ablation and posterior wall isolation*
- ✓ *Importance of early gaps identification and treatment*
- ✓ *Combined procedures feasible in accetable time*

Hybrid treatment of AF by surgical PV isolation
+ trans-catheter ablation

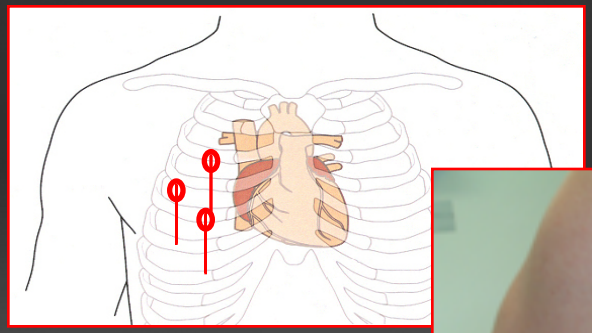
Innovative Monolateral Approach for Closed-Chest Atrial Fibrillation Surgery

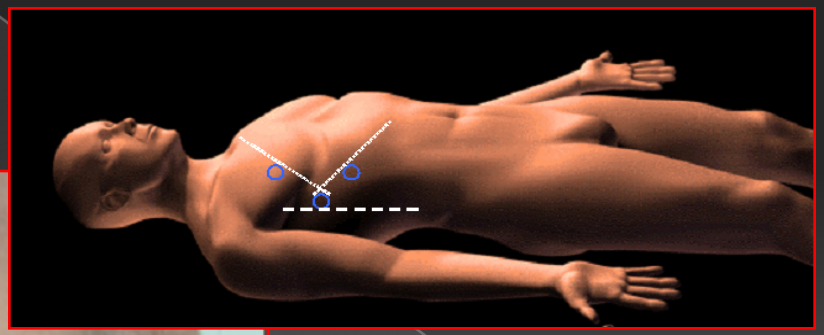
Gianluigi Bisleri, MD, and Claudio Muneretto, MD

Division of Cardiac Surgery, University of Brescia Medical School, Brescia, Italy

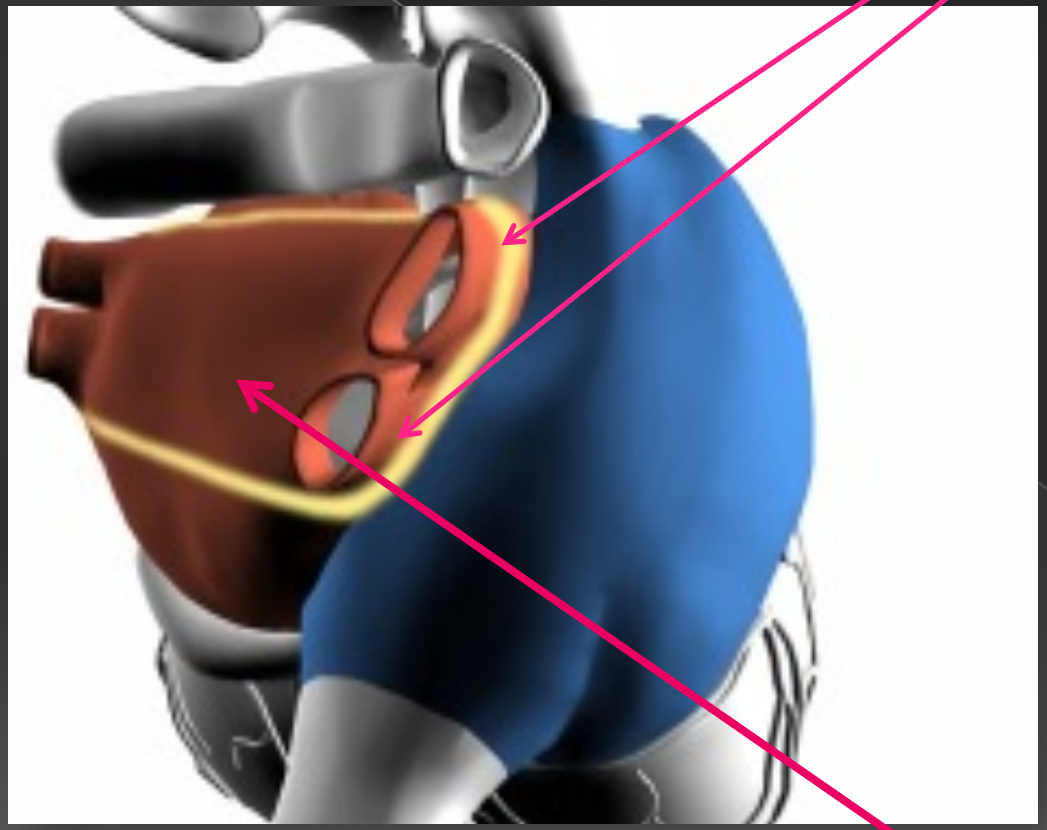
Surgical treatment of atrial fibrillation recently gained new popularity since the introduction of different energy sources as an alternative to the original cut-and-sew technique. Recently an innovative approach for closed-chest thoracoscopic epicardial pulmonary veins isolation has been described for patients suffering from lone atrial fibrillation. Nevertheless in an effort to further reduce the invasiveness of closed-chest atrial fibrillation surgery, we developed a novel monolateral approach for thoracoscopic arrhythmia surgery.

(Ann Thorac Surg 2005;80:e22–5)





Goal(s) OF THE SURGICAL LESION



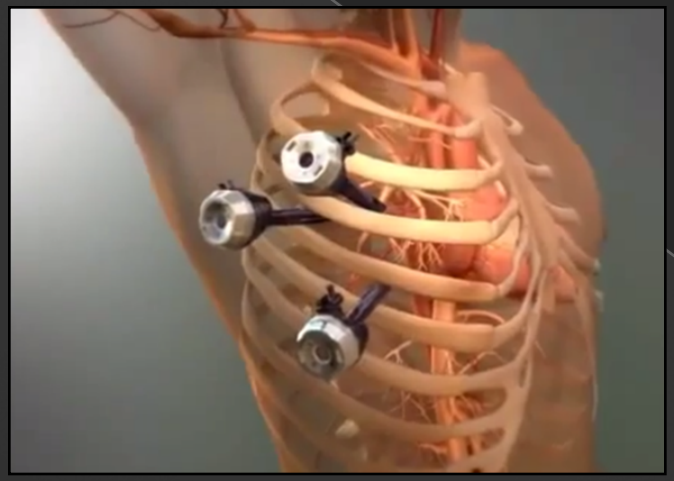
PVs antral isolation

Wide ablation area

Transmurality warranted by the technology itself (less need for redos?)

Concomitant treatment (isolation) of LPW

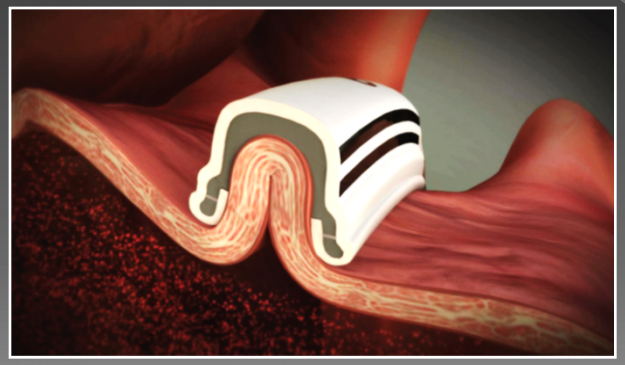
Surgical Technique



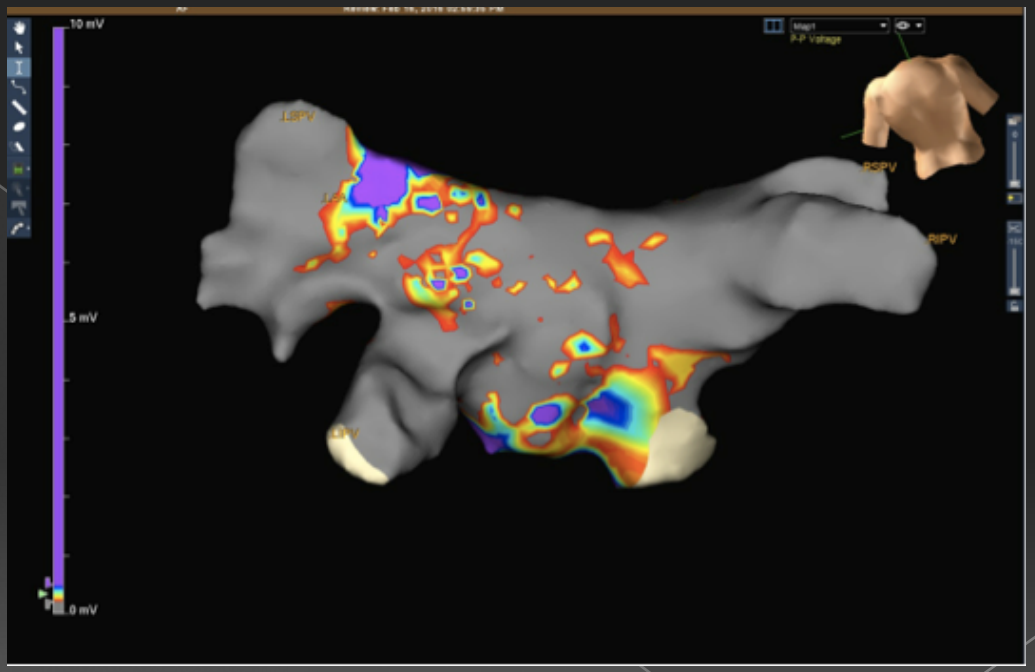
Mini-invasive technique
Right monolateral approach
Thoracoscopy

Mono/bipolar ablation
Stable temperature 70°C
«Suction» Mechanism

TRANSMURALITY



Mappaggio dopo ablazione chirurgica



Torace chiuso

Torace aperto

Conclusioni

- PV isolation e'sicuramento il corner stone nella ATC FA parossistica
- Le tecnologie One–shot sono una strategia sicuramente percorribile per questa ablazione.
- Una strategia piu'massiva e'sicuramente utile nella cura delle Redo e della FA persistente.
- Le tecnologie a contatto favoriscono l'efficacia dell'ATC.
- Il ricorso ad una strategia ibrida e utile nei pazienti con failure con atri molto dilatati.