11. Atriyal Fibrilasyon Zirvesi 2022
9 - 10 Aralık 2022
Spice Kongre Merkezi, Antalya

Sol Atriyal Appendiks İzolasyonu

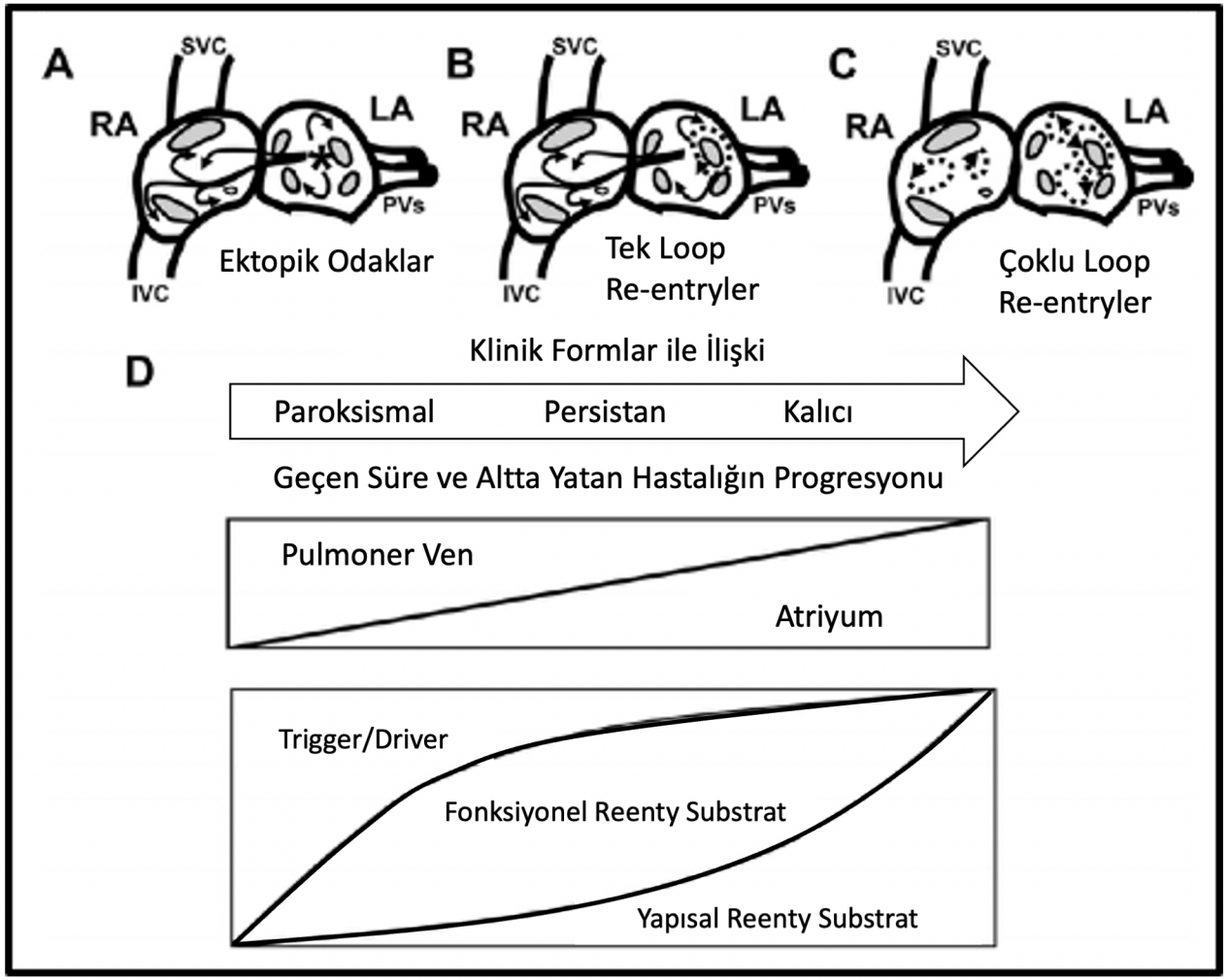
Dr. Cem ÇÖTELİ

Hacettepe Üniversitesi Tıp Fakültesi

Kardiyoloji Anabilim Dalı

Persistan AF; Patofizyoloji-mekanizma

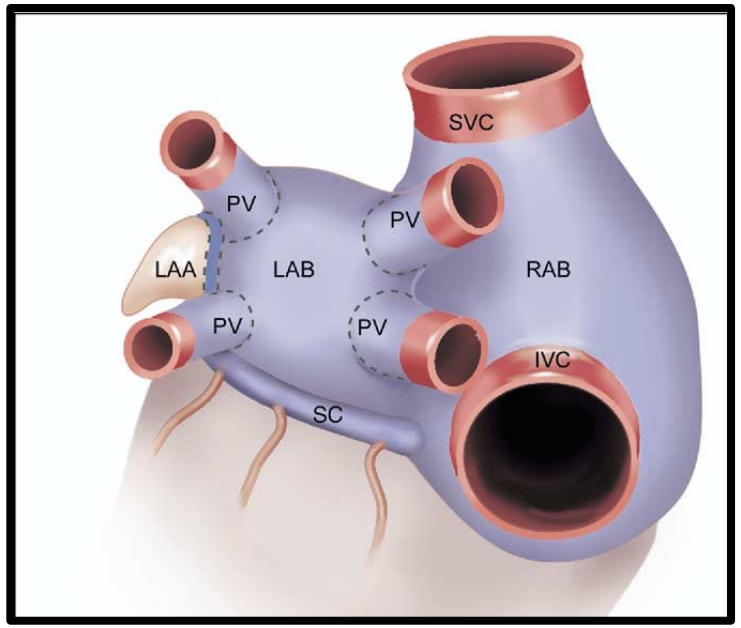
- Tetiklenmiş aktivite
  - PV ilişkili
  - PV dışı odaklar
- Atriyal dokuda değişiklikler
  - ECM'de değişiklikler
  - Atriyal fibrozis
  - "Gap jxn'da azalma
  - İyon kanal içeriği ve sayısında değişim
  - ….

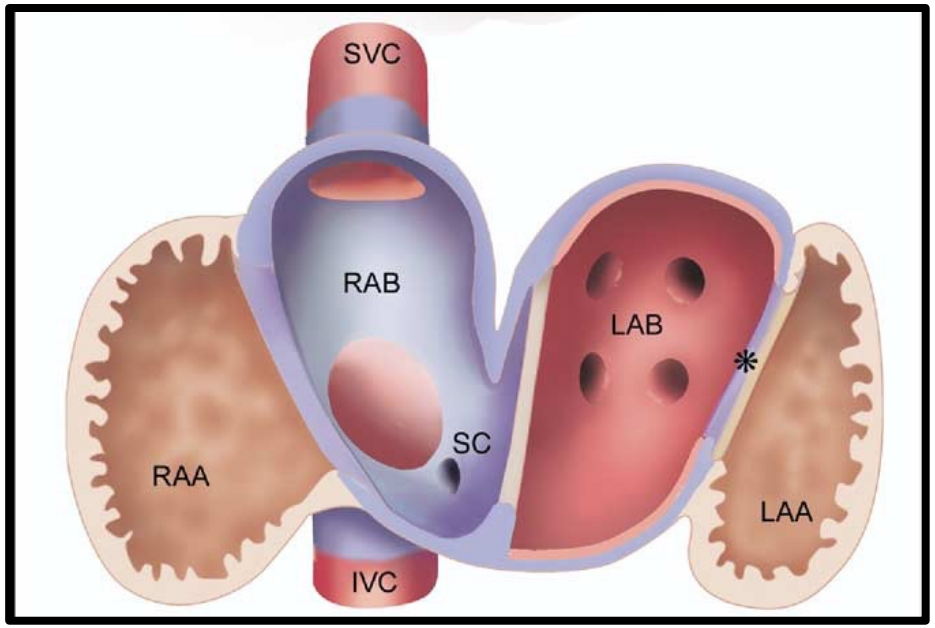


Circulation. 2011; 124:2264-2274

Sol Atriyumun Embriyolojik Kökeni ve AF

- Primordiyal pulmoner ven – LA birleşmesi
- Pulmoner venlerin ayrı ostiumlara ayrılması
- LA – LAA bileşkesi ile sinus venozus arasındaki benzerlik

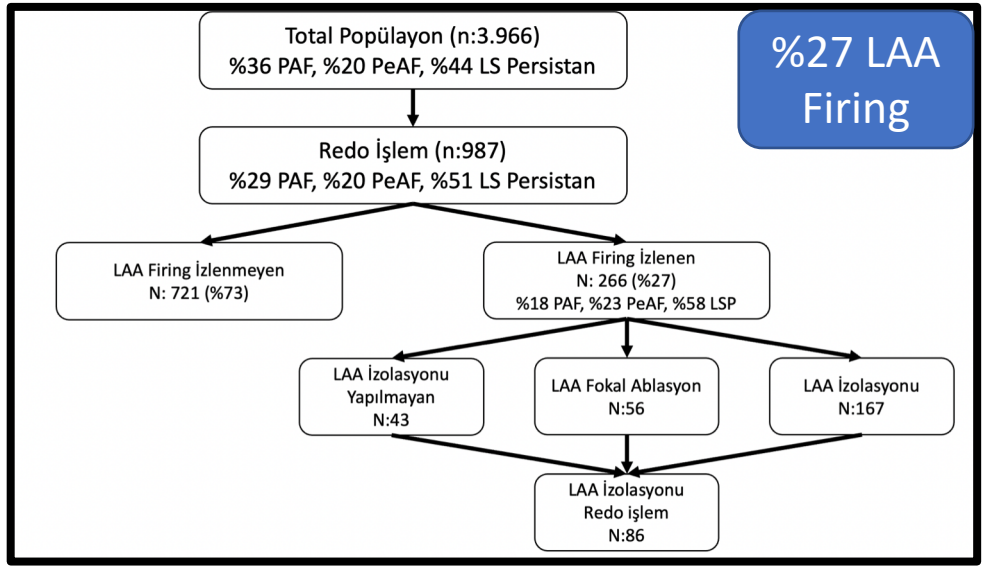


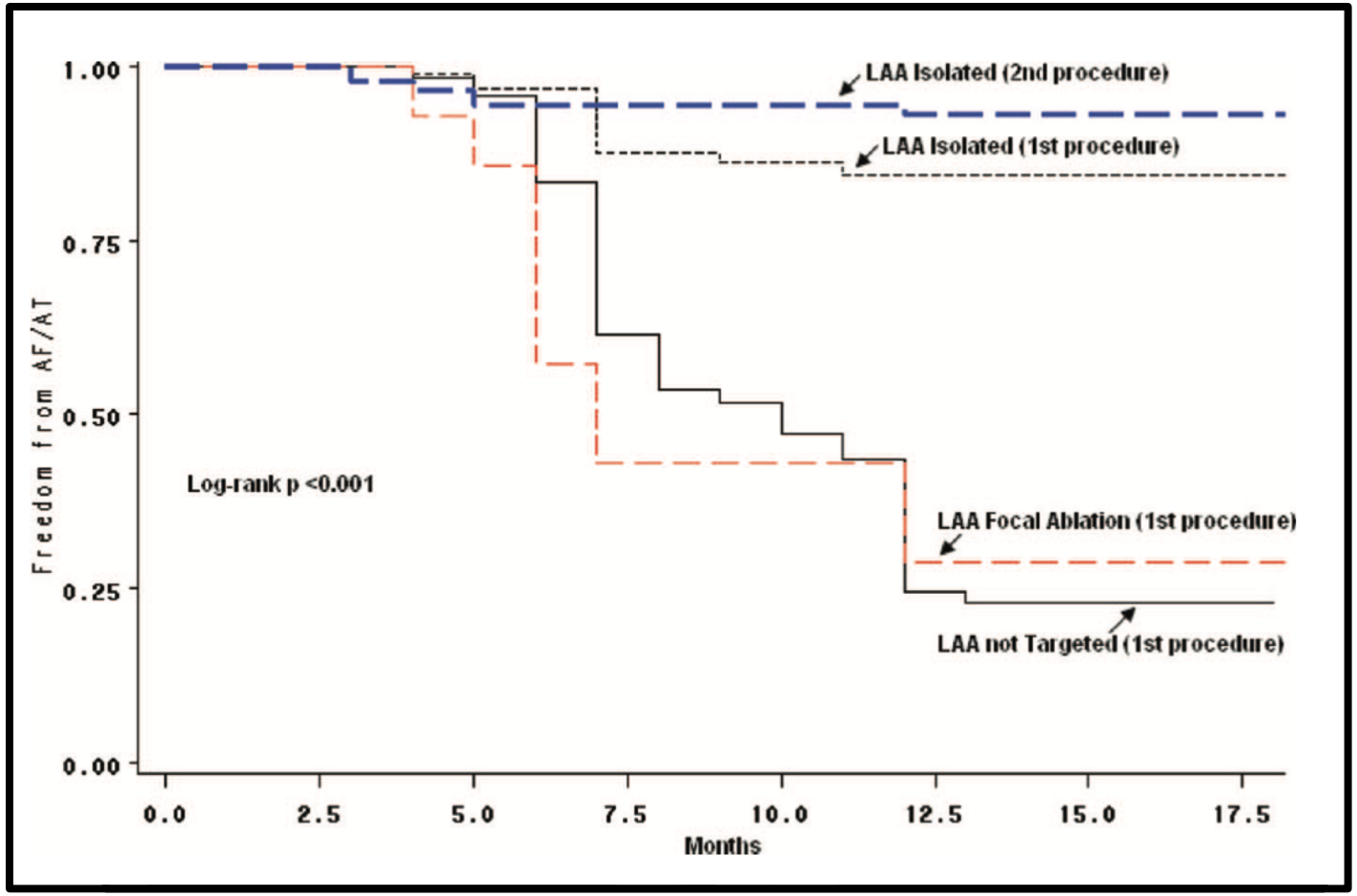


LAA Gerçekten AF İçin Öncülük Edebilir mi?

Left Atrial Appendage
An Underrecognized Trigger Site of Atrial Fibrillation

Luigi Di Biase, MD; J. David Burkhardt, MD; Prasant Mohanty, MBBS, MPH; Javier Sanchez, MD; Sanghamitra Mohanty, MD; Rodney Horton, MD; G. Joseph Gallinghouse, MD; Shane M. Bailey, MD; Jason D. Zagrodzky, MD; Pasquale Santangeli, MD; Steven Hao, MD; Richard Hongo, MD; Salwa Beheiry, MD; Sakis Themistoclakis, MD; Aldo Bonso, MD; Antonio Rossillo, MD; Andrea Corrado, MD; Antonio Raviele, MD; Amin Al-Ahmad, MD; Paul Wang, MD; Jennifer E. Cummings, MD; Robert A. Schweikert, MD; Gemma Pelargonio, MD; Antonio Dello Russo, MD; Michela Casella, MD; Pietro Santarelli, MD; William R. Lewis, MD; Andrea Natale, MD, FHRS

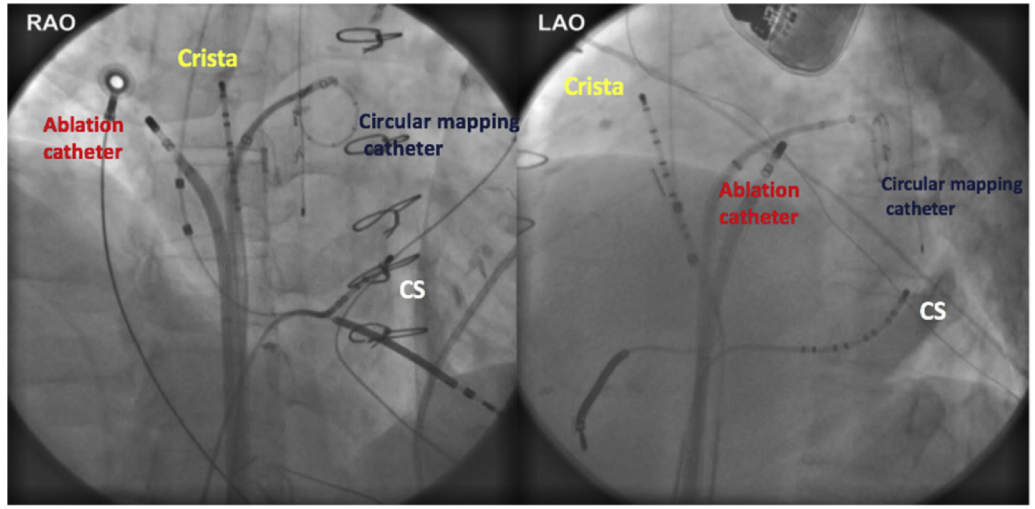


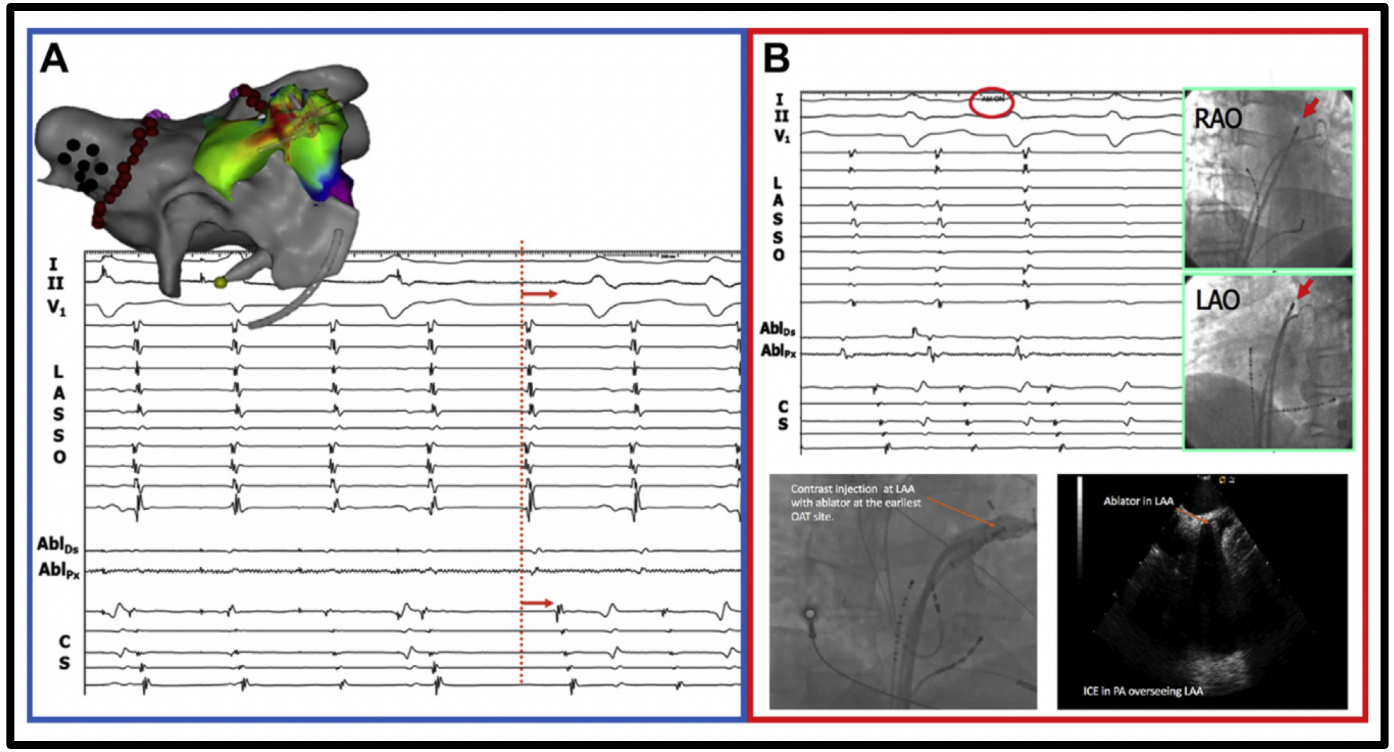


LAA Gerçekten AF İçin Öncülük Edebilir mi?

Incidence of Left Atrial Appendage Triggers in Patients With Atrial Fibrillation Undergoing Catheter Ablation

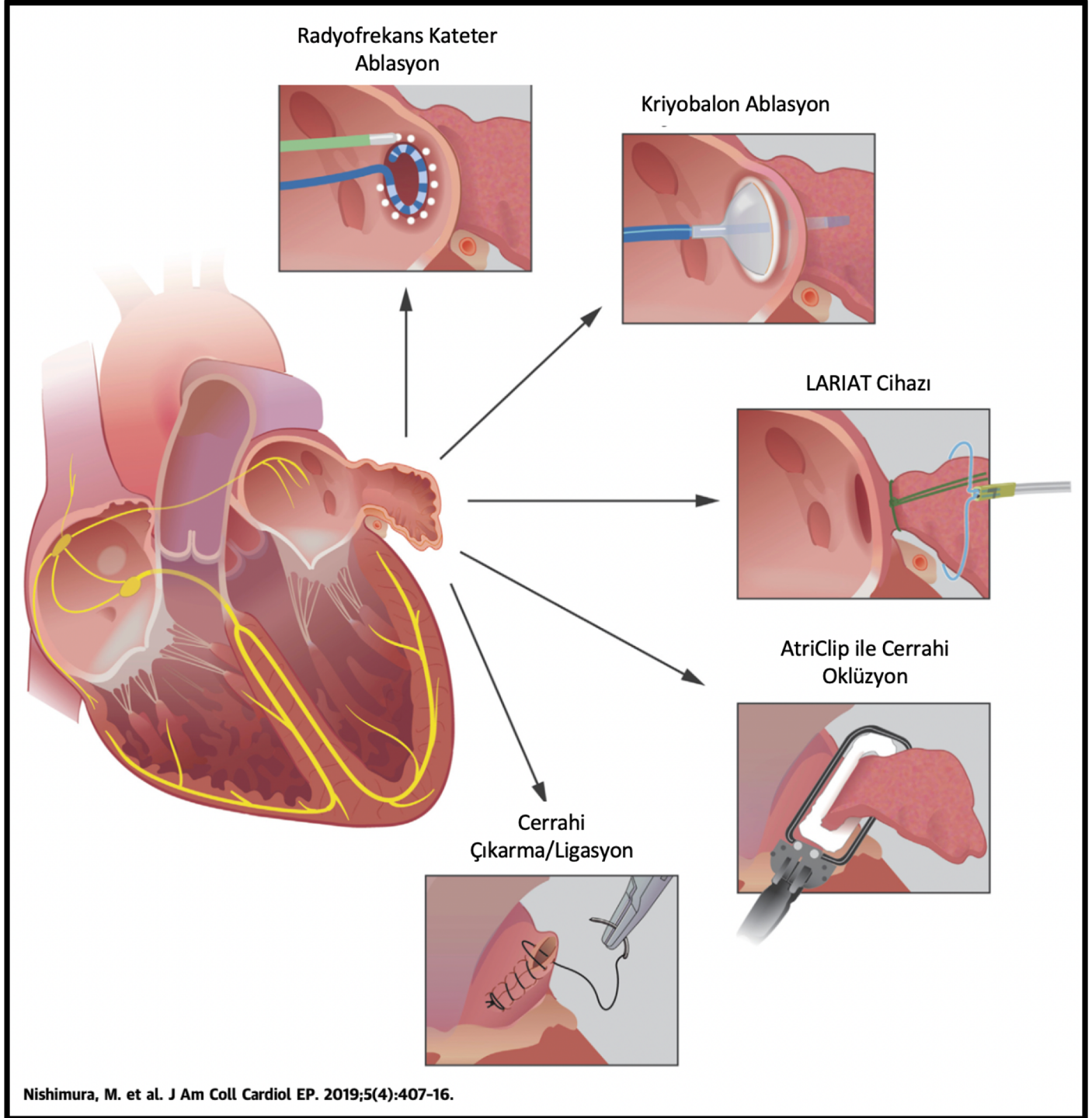
Mohamed Al Rawahi, MD,[a,*] Jackson J. Liang, DO,[a,b,*] Suraj Kapa, MD,[c] Aung Lin, MD,[a] Yasuhiro Shirai, MD,[a] Ling Kuo, MD,[a] Erica S. Zado, PA-C,[a] Matthew C. Hyman, MD, PHD,[a] Michael P. Riley, MD, PHD,[a] Saman Nazarian, MD, PHD,[a] Fermin C. Garcia, MD,[a] David Lin, MD,[a] Robert D. Schaller, DO,[a] Jeffery S. Arkles, MD,[a] David S. Frankel, MD,[a] Gregory E. Supple, MD,[a] Ramanan Kumareswaran, MD,[a] David J. Callans, MD,[a] Francis E. Marchlinski, MD,[a] Sanjay Dixit, MD[a]





Gerçek LAA firing çok nadirdir: 21/7.129 (%0,3)
LAA firinge eşlik eden ek non-pv odaklar da mevcuttur.

Hangi Yöntem ile İzole Edebiliriz?



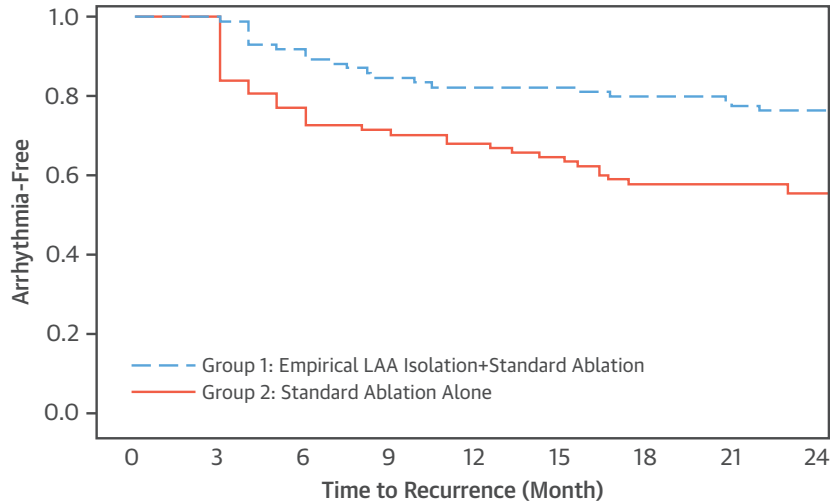
RF Enerjisi ile LAA İzolasyonu

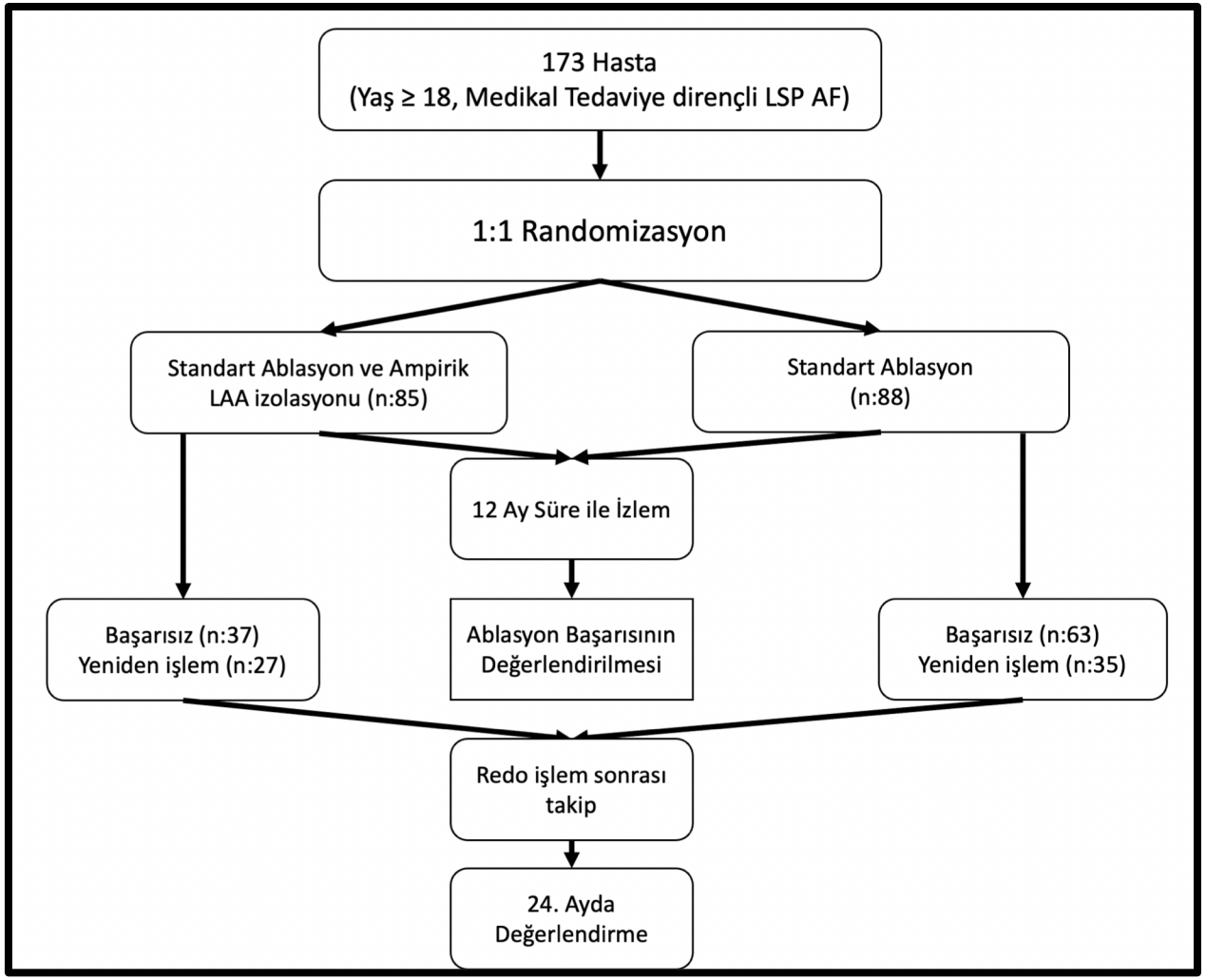
Left Atrial Appendage Isolation in Patients With Longstanding Persistent AF Undergoing Catheter Ablation

BELIEF Trial

Luigi Di Biase, MD, PhD,[a,b,c,d] J. David Burkhardt, MD,[a] Prasant Mohanty, MBBS, MPH,[a] Sanghamitra Mohanty, MD,[a] Javier E. Sanchez, MD,[a] Chintan Trivedi, MD, MPH,[a] Mahmut Güneş, MD,[a] Yalçın Gökoğlan, MD,[a] Carola Gianni, MD,[a] Rodney P. Horton, MD,[a] Sakis Themistoclakis, MD,[e] G. Joseph Gallinghouse, MD,[a] Shane Bailey, MD,[a] Jason D. Zagrodzky, MD,[a] Richard H. Hongo, MD,[f] Salwa Beheiry, RN,[f] Pasquale Santangeli, MD,[a,d] Michela Casella, MD,[g] Antonio Dello Russo, MD,[g] Amin Al-Ahmad, MD,[a] Patrick Hranitzky, MD,[a] Dhanunjaya Lakkireddy, MD,[h] Claudio Tondo, MD,[g] Andrea Natale, MD[a,c,i,j,k,l]

FIGURE 4 Ablation Success After Multiple Procedures





CB ile LAA İzolasyonu

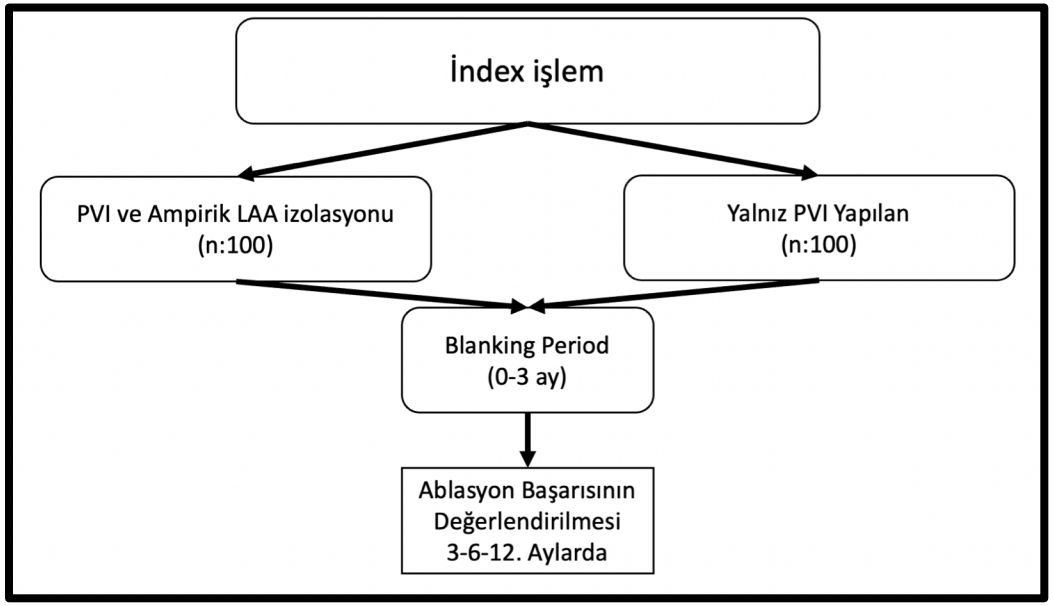
Europace (2017) **19**, 758–768
doi:10.1093/europace/eux005

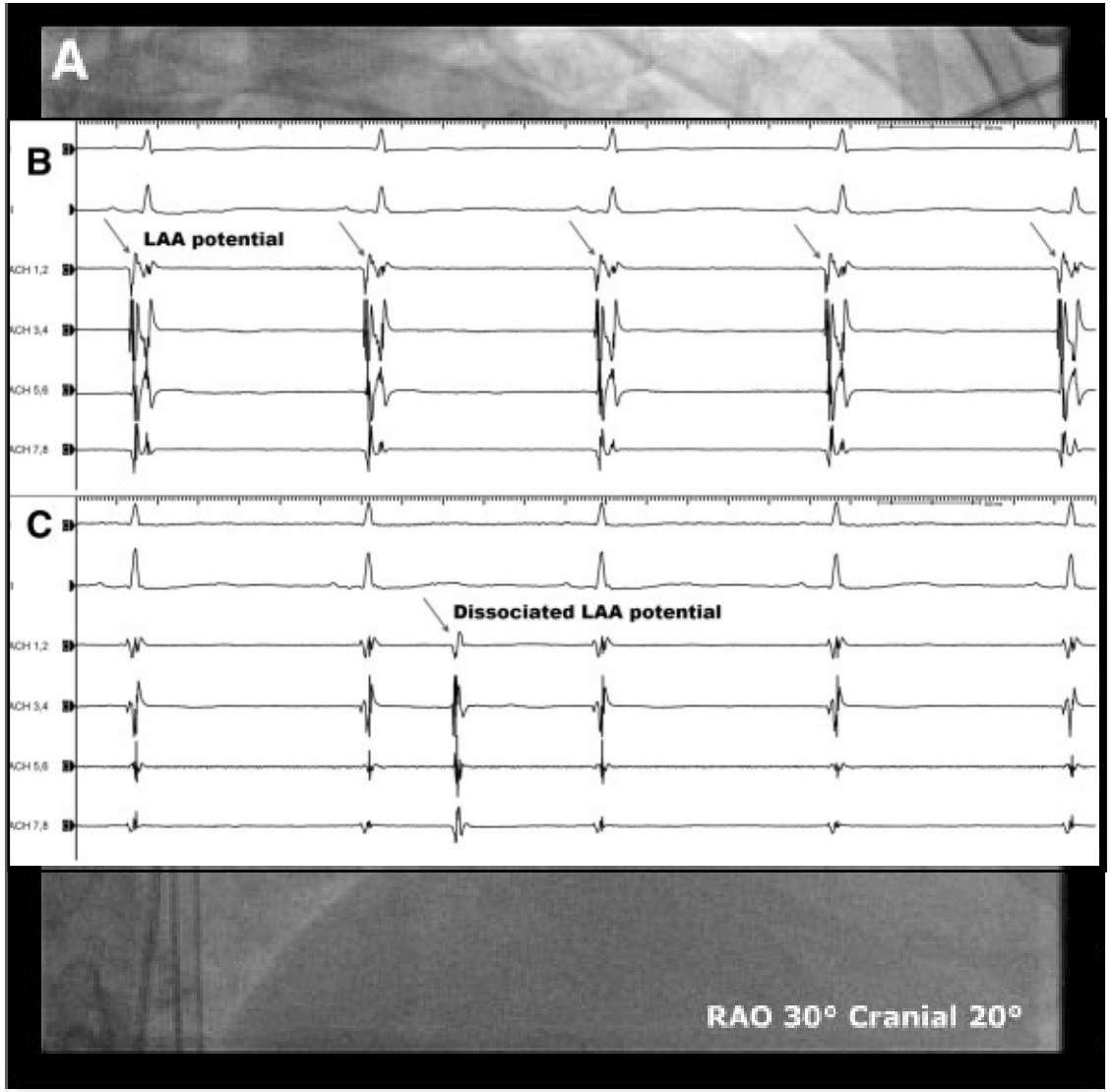
CLINICAL RESEARCH
Ablation for atrial fibrillation

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

Hikmet Yorgun, Uğur Canpolat*, Duygu Kocyigit, Cem Çöteli, Banu Evranos, and Kudret Aytemir

Faculty of Medicine, Department of Cardiology, Hacettepe University, Sihhiye, 06100 Ankara, Turkey

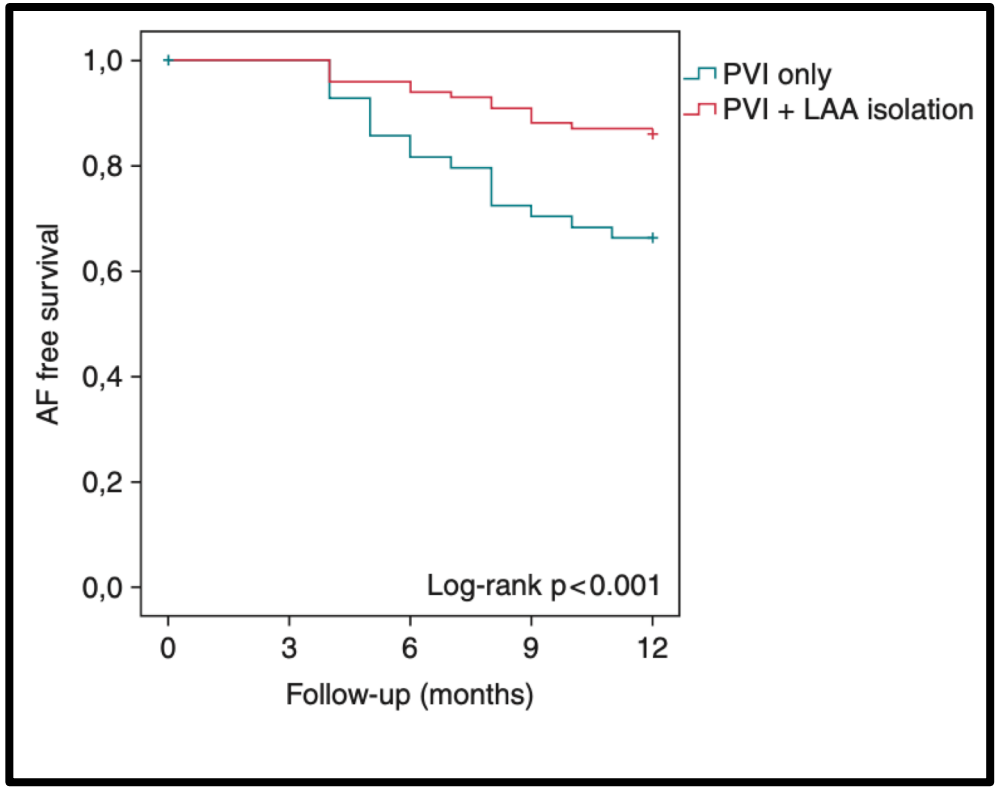




CB ile LAA İzolasyonu

Table 2 Procedural and ablation characteristics of the study groups (n = 200)

Parameters	Group I (PVI-only) (n = 100)	Group II (PVI + LAA isolation) (n = 100)	P
Total procedure time (min)	55.4 ± 10.5	74.9 ± 10.8	<0.001
Fluoroscopy time (min)	6.8 ± 2.4	9.1 ± 2.5	<0.001
CB model			
Second generation	74 (74.0%)	70 (70.0%)	0.637
Third generation	26 (26.0%)	30 (30.0%)	
Mean number of freeze–thaw cycles	1.5 ± 0.5	1.6 ± 0.5	0.319
AF presenting rhythm at the procedure	15 (15.0%)	12 (12.0%)	0.680
Left atrial appendage			
Mean number of freeze–thaw cycles	–	1.1 ± 0.3 (1–2)	NA
Time-to-isolation (s)	–	115.5 (37–370)	NA
Temperature at isolation (°C)	–	-42.9 ± 6.2 (30–56)	NA
Nadir temperature (°C)	–	-50 (-33 to 62)	NA
Total freezing time (s)	–	240 (180–450)	NA
Complications			
Femoral haematoma	2 (2.0%)	1 (1.0%)	1.000
Femoral pseudoaneurysm	1 (1.0%)	0 (0.0%)	1.000
Right phrenic nerve palsy	3 (3.0%)	2 (2.0%)	1.000
Left phrenic nerve palsy	0 (0.0%)	1 (1.0%)	1.000
Left circumflex artery spasm	0 (0.0%)	4 (4.0%)	0.061



1 yılık izlemde AF'siz sağ kalım: Yalnızca PVI: 67%
PVI + LAA izolasyonu: 86%

CB ile LAA İzolasyonu

ESC European Society of Cardiology
Europace (2019) 21, 1653–1662
doi:10.1093/europace/euz232

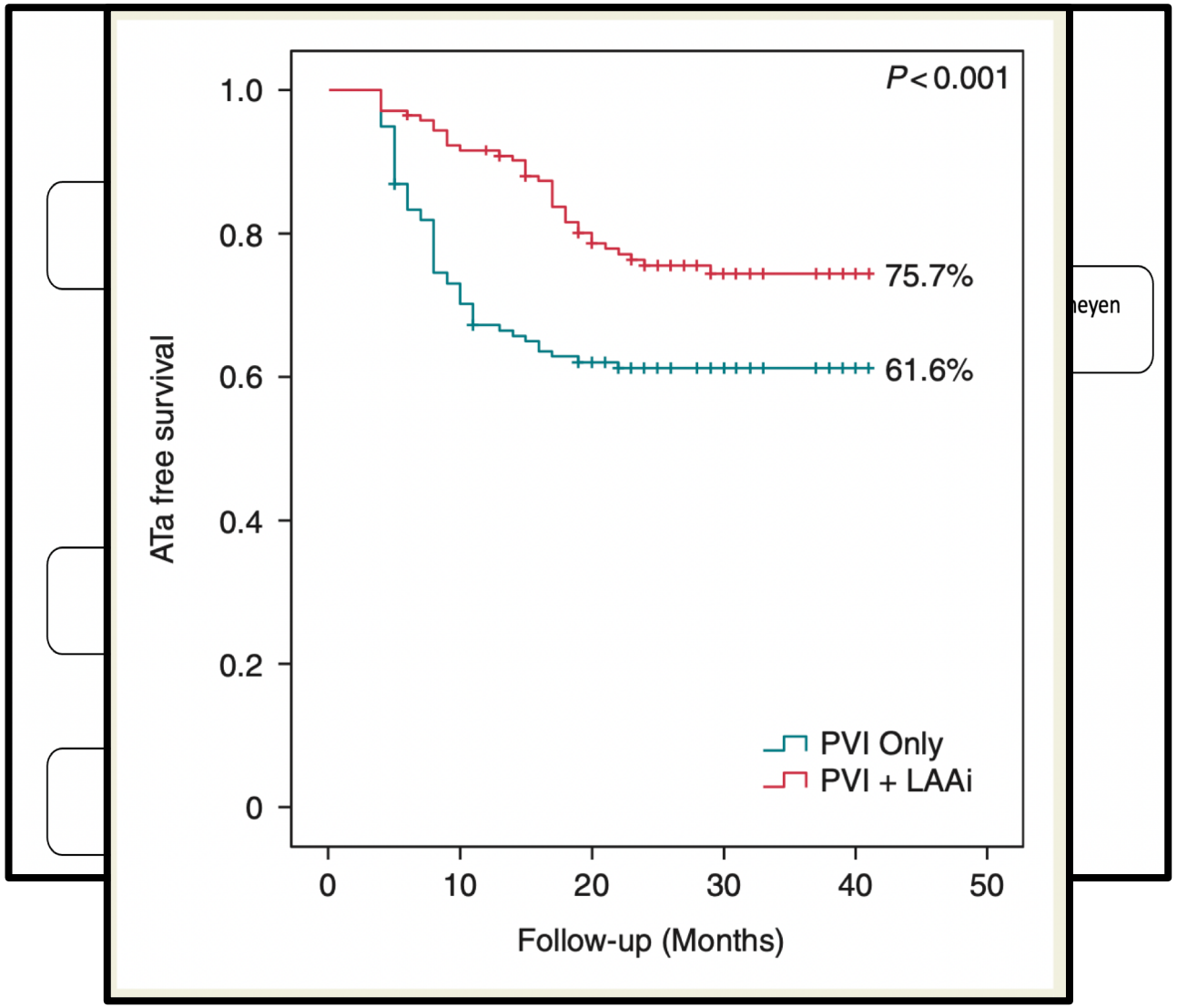
CLINICAL RESEARCH
Ablation for atrial fibrillation

Long-term outcomes of cryoballoon-based left atrial appendage isolation in addition to pulmonary vein isolation in persistent atrial fibrillation

Hikmet Yorgun [1,2]*, Uğur Canpolat[1], Metin Okşul[1], Yusuf Ziya Şener[1], Ahmet Hakan Ateş[1], Harry J.G.M. Crijns[2], and Kudret Aytemir[1]

Table 4 Outcomes during long-term follow-up of the study groups ($n = 282$)

Parameters	Group I (PVI-only) ($n = 138$)	Group II (PVI + LAAi) ($n = 144$)	*P*-value
Follow-up (months)	30.5 ± 5.6 (19–41)	30.5 ± 5.6 (19–41)	0.642
Early recurrence	34 (24.6%)	13 (9.0%)	0.001
Late recurrence	53 (38.4)	35 (24.3%)	0.008
TIA/ischaemic stroke	4 (2.9%)	5 (3.5%)	0.784
Haemorrhagic stroke	0 (0%)	1 (0.7%)	0.511
All-cause mortality	5 (3.6%)	5 (3.5%)	0.945
Time to stroke (Months)	**16 (11–25)**	**13 (6–23)**	



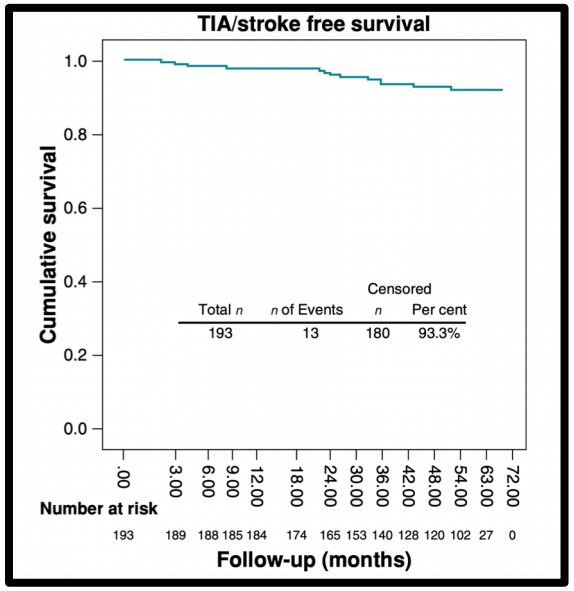
CB ile LAA İzolasyonu

ESC European Society of Cardiology
Europace (2022) **00**, 1–8
https://doi.org/10.1093/europace/euac167

CLINICAL RESEARCH

Long-term outcomes of left atrial appendage isolation using cryoballoon in persistent atrial fibrillation

Hikmet Yorgun [1,2]*, Yusuf Ziya Şener [1], Nikita Tanese[3], Ahmet Keresteci [1], Burak Sezenöz [4], Cem Çöteli [1], Ahmet Hakan Ateş[1], Serge Boveda [3], and Kudret Aytemir[1]



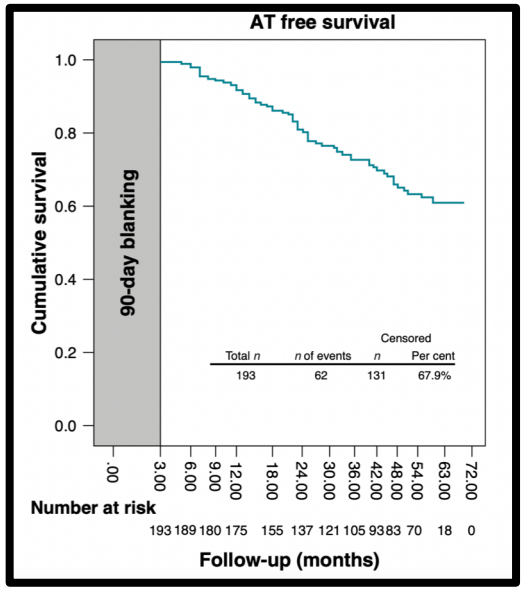


Table 3 Outcomes of LAAi and PVI during long-term follow-up ($n = 193$)

Parameters	PVI and LAAi group ($n = 193$)
Median follow-up (months)	55 (36.5–60.0)
Early recurrence	14 (7.2%)
Late recurrence	62 (32.1%)
Thrombo-embolic events, *n* (%)	
Stroke	11 (5.6%)
TIA	2 (1.0%)
Retinal artery embolism	1 (0.05%)
Bleeding events	
Major bleeding	5 (2.6%)
CRNM bleeding	9 (4.7%)
All-cause mortality	10 (5.2%)

Cerrahi

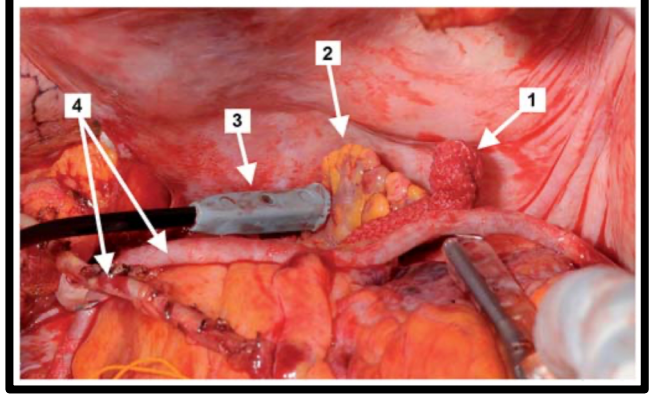
Interactive CardioVascular and Thoracic Surgery 15 (2012) 416–419
doi:10.1093/icvts/ivs136 Advance Access publication 30 May 2012

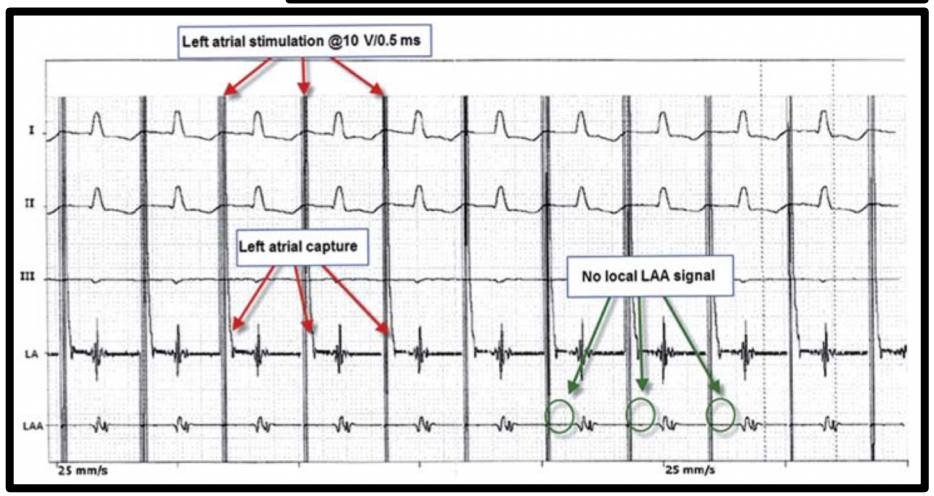
ORIGINAL ARTICLE - ADULT CARDIAC

Epicardial left atrial appendage clip occlusion also provides the electrical isolation of the left atrial appendage

Christoph T. Starck[a], Jan Steffel[b], Maximilian Y. Emmert[a], Andre Plass[a], Srijoy Mahapatra[c], Volkmar Falk[a] and Sacha P. Salzberg[a,*]

10 Hasta
Atriclip

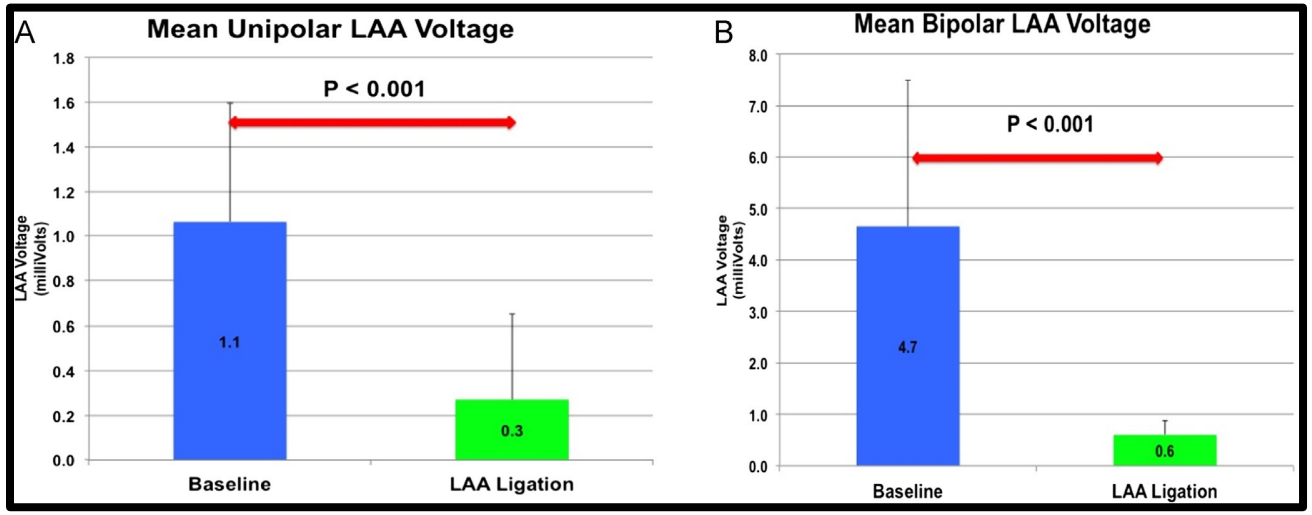




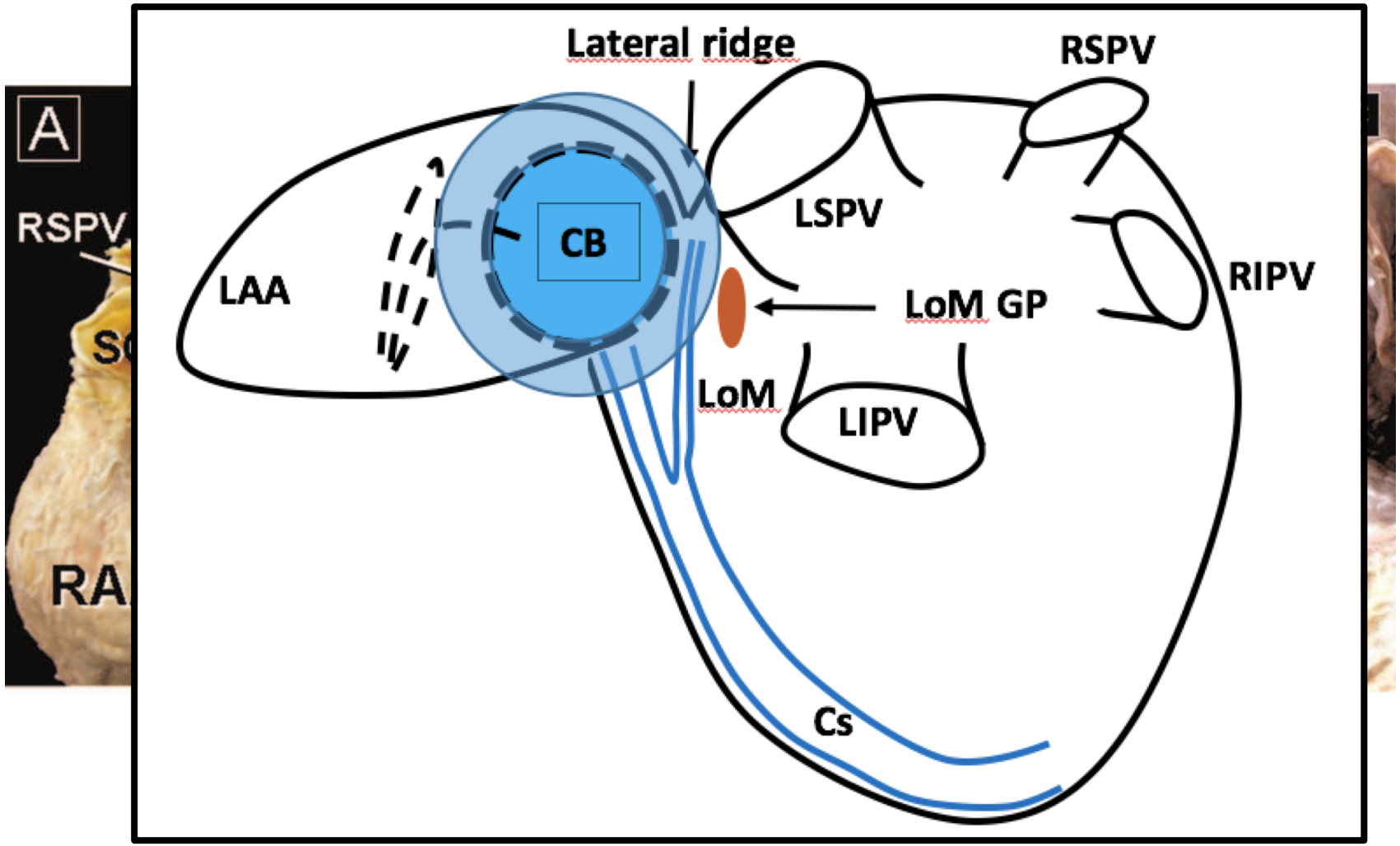
The effects of LAA ligation on LAA electrical activity

Frederick T. Han, MD,[*] Krzysztof Bartus, MD, PhD,[†] Dhanunjaya Lakkireddy, MD,[‡] Francia Rojas, MD,[§] Jacek Bednarek, MD, PhD,[‖] Boguslaw Kapelak, MD, PhD,[†] Magdalena Bartus, PhD,[¶] Jerzy Sadowski, MD, PhD,[†] Nitish Badhwar, MBBS, FHRS,[#] Mathew Earnest, MD,[‡] Miguel Valderrabano, MD,[§] Randall J. Lee, MD, PhD[#**††]

68 Hasta - LARIAT Cihazı



LAA İzolasyonu Yalnızca LAA İzolasyonu mu?



-LAA
-Ridge bölgesi
-Marshall ligament
-Anterior LA

Cabrera J, et al. Heart. 2014

Nasıl İzole Edelim?

Left Atrial Appendage Isolation in Patients With Longstanding Persistent AF Undergoing Catheter Ablation

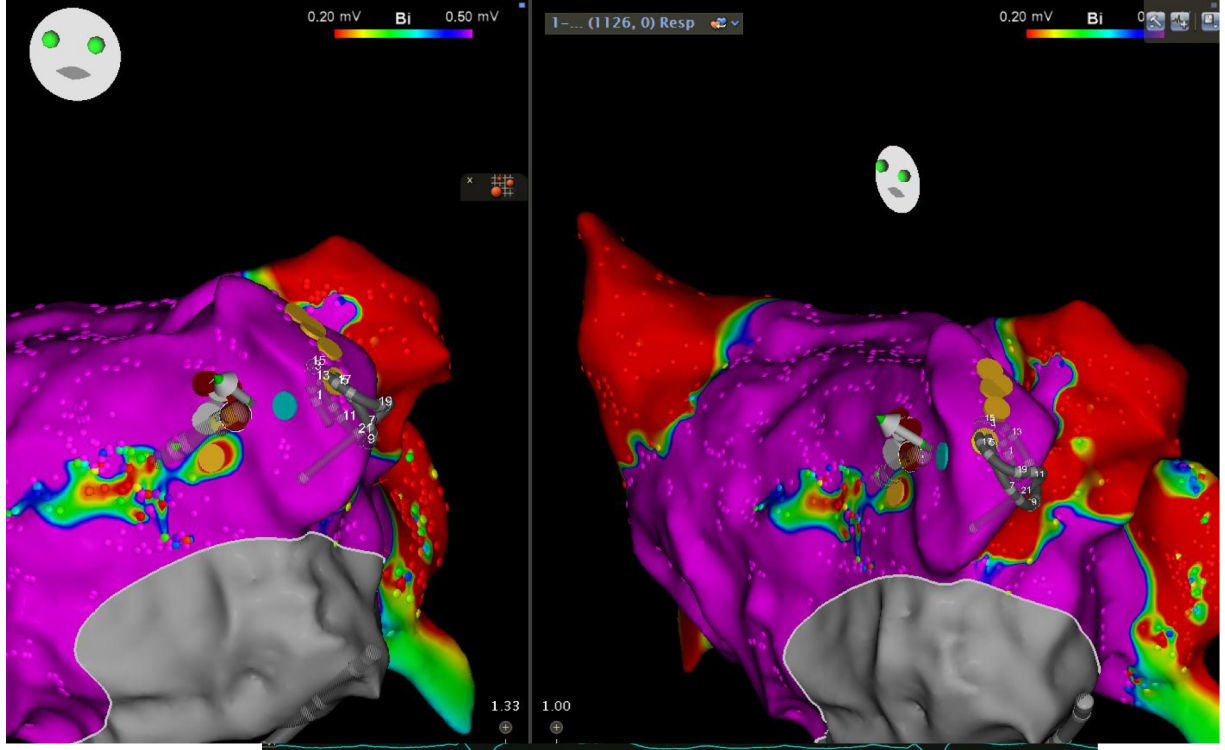
BELIEF Trial

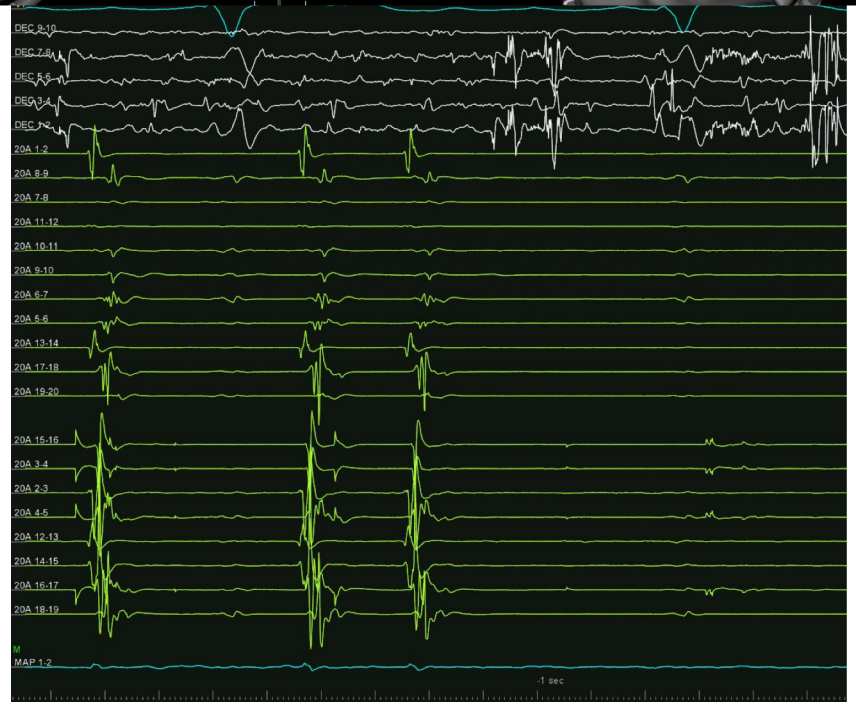
Luigi Di Biase, MD, PhD,[a,b,c,d] J. David Burkhardt, MD,[a] Prasant Mohanty, MBBS, MPH,[a] Sanghamitra Mohanty, MD,[a] Javier E. Sanchez, MD,[a] Chintan Trivedi, MD, MPH,[a] Mahmut Güneş, MD,[a] Yalçın Gökoğlan, MD,[a] Carola Gianni, MD,[a] Rodney P. Horton, MD,[a] Sakis Themistoclakis, MD,[e] G. Joseph Gallinghouse, MD,[a] Shane Bailey, MD,[a] Jason D. Zagrodzky, MD,[a] Richard H. Hongo, MD,[f] Salwa Beheiry, RN,[f] Pasquale Santangeli, MD,[a,d] Michela Casella, MD,[g] Antonio Dello Russo, MD,[g] Amin Al-Ahmad, MD,[a] Patrick Hranitzky, MD,[a] Dhanunjaya Lakkireddy, MD,[h] Claudio Tondo, MD,[g] Andrea Natale, MD[a,c,i,j,k,l]

LAA izolasyonu intrakardiyak ekokardiyografi ve 3D haritalama sistemleri yardımları ile yapılmış.

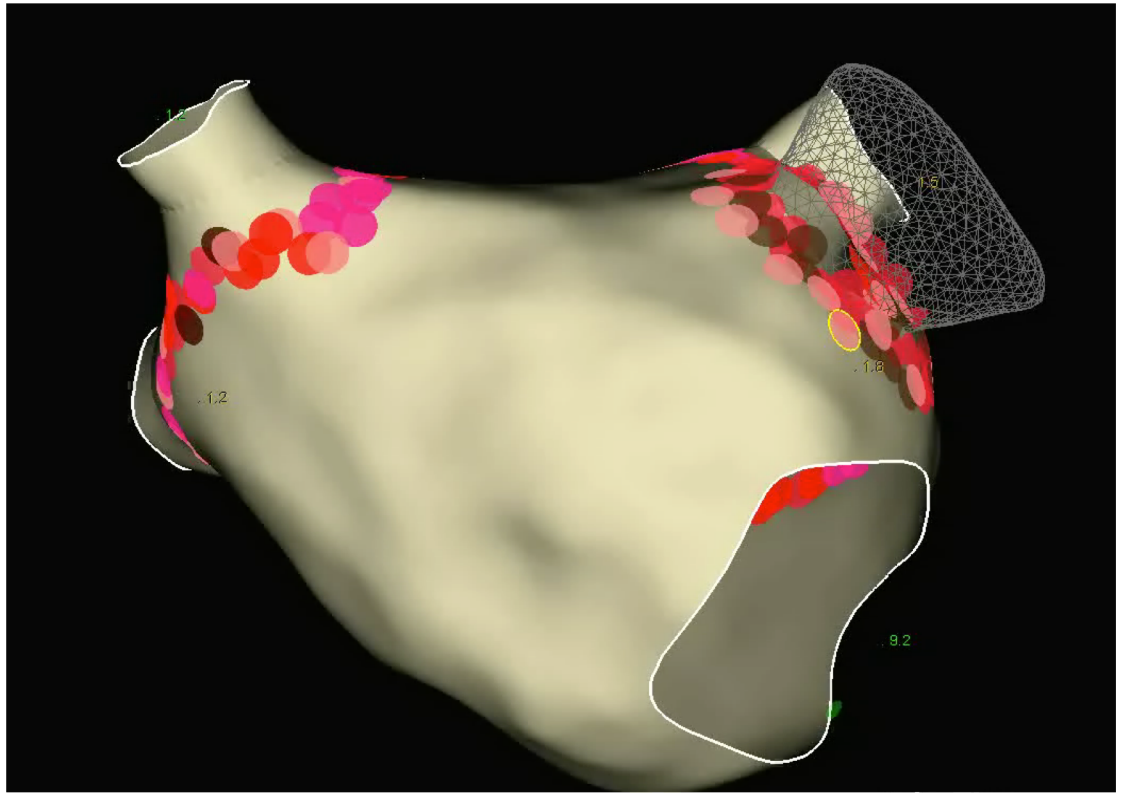
- RF enerji ayarları
- 40 W'a kadar
- kateter uç ısısı 42^0C olacak şekilde
- max 20 sn süre ile

Elektriksel izolasyon sonrası isoprotenol ile test

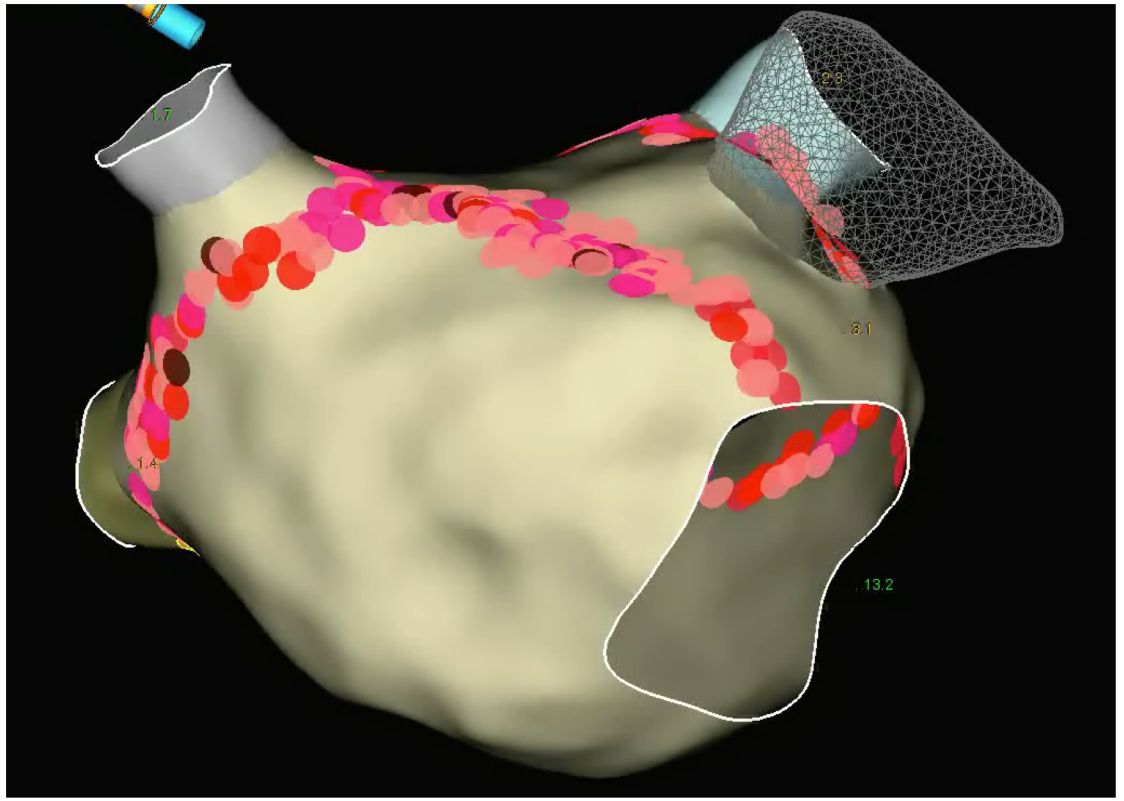




Nasıl İzole Edelim? – RF ile

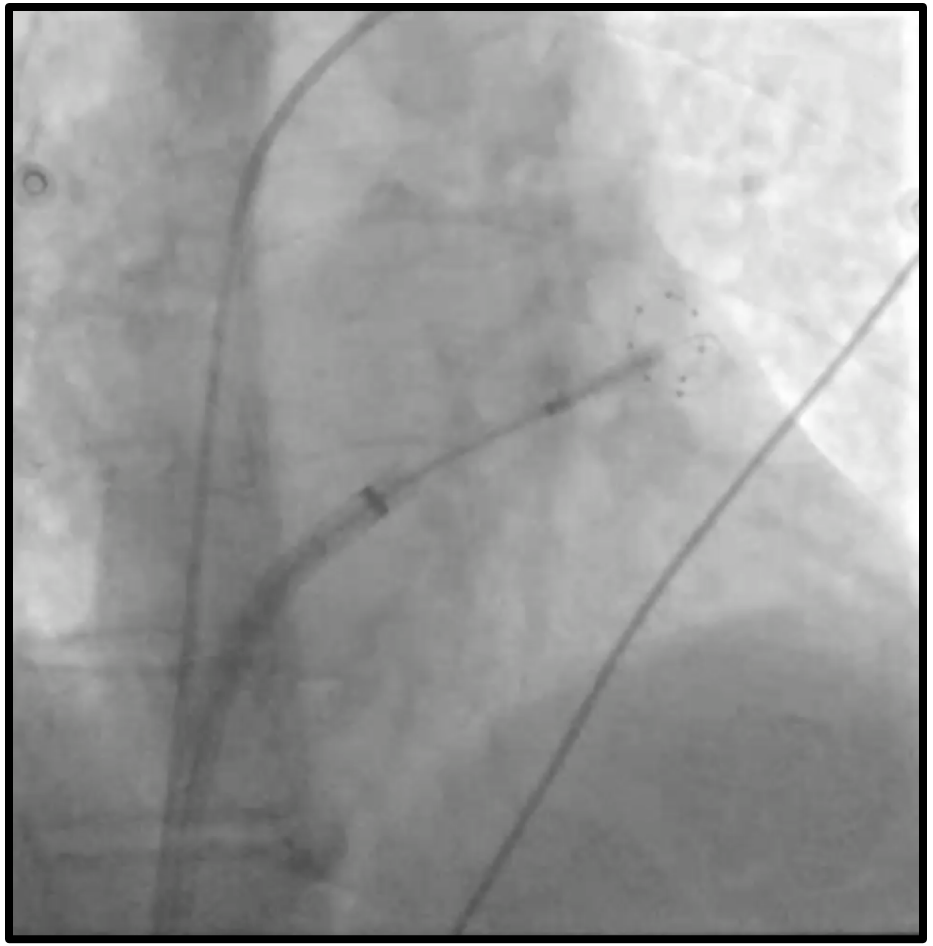


Osteal Lezyonlar ile



Lineer Lezyonlar ile

Nasıl İzole Edelim? – CB ile



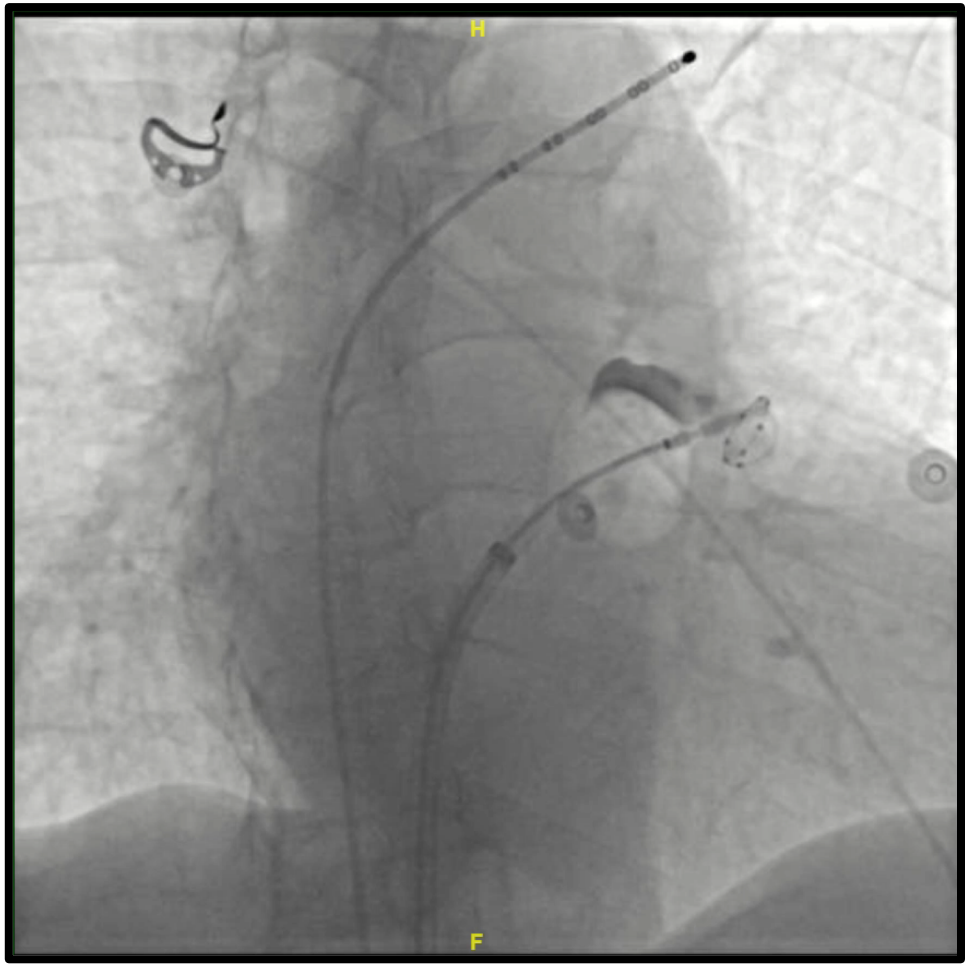
- RAO 30^0 – Cranial 20^0
- Achieve kateter LAA içerisine ilerletilir
  - Sinyaller kontrol edilmeli
- Balon şişilir
- Osteal oklüzyon sağlanınca kontrast

- Dondurma süresi: 300 sn
  - İlk 150 sn'de izolasyon olmazsa bonus

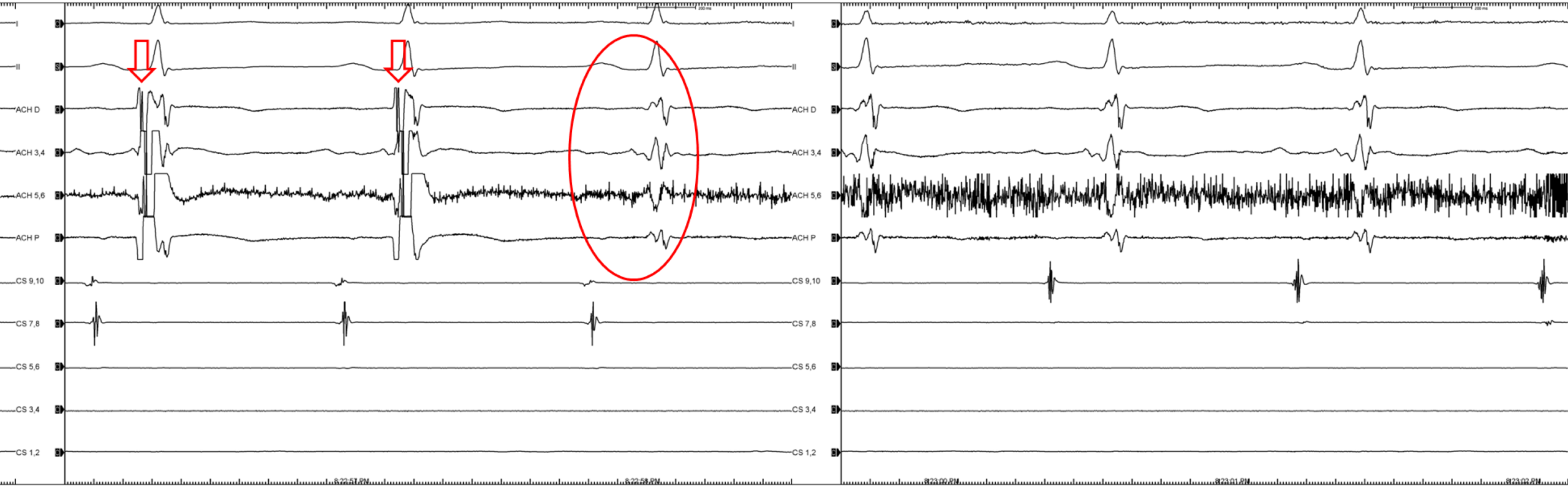
- Frenik sinir hasarı için monitorizasyon

- İzolasyon sonrası veya izolasyon sırasında Cx vazospazmı için koroner anjiyografi

Nasıl İzole Edelim? - CB ile

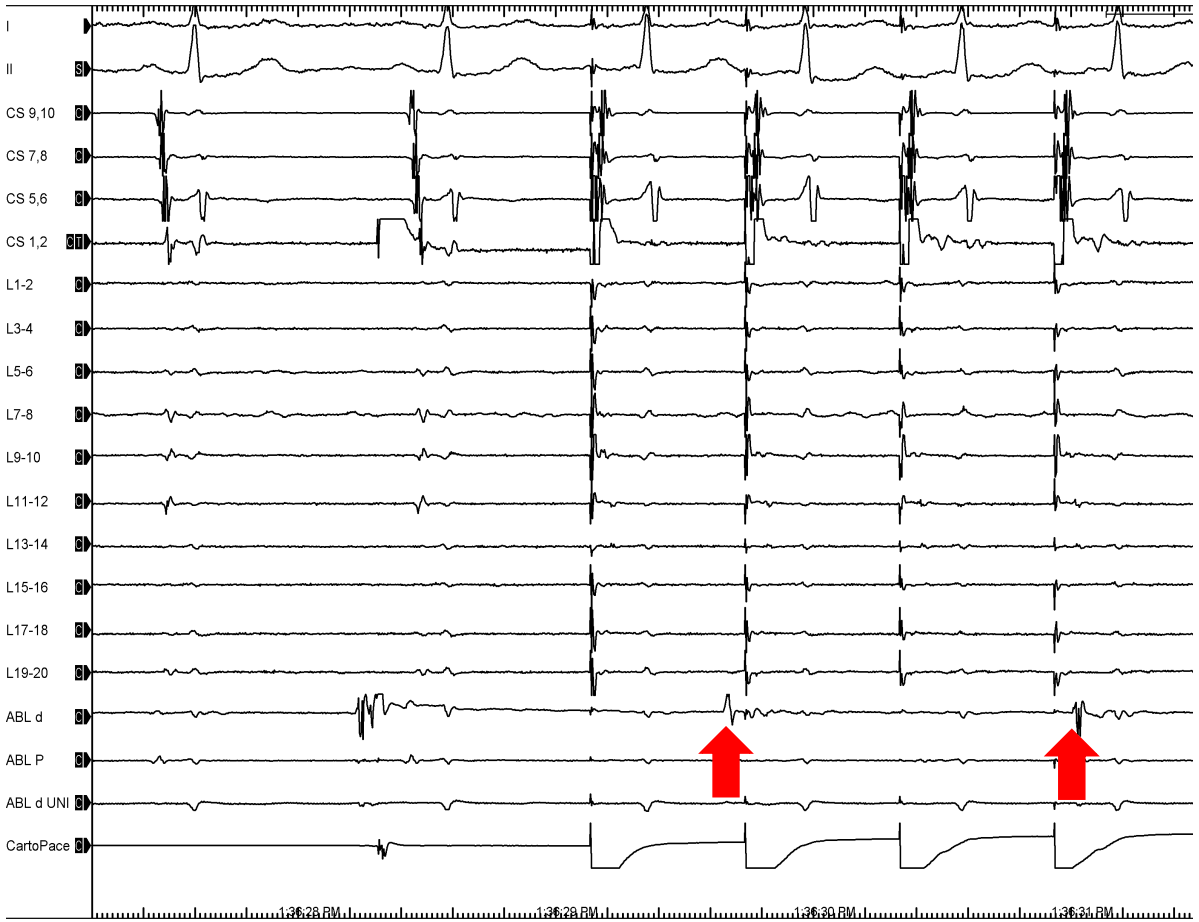


İzolasyonu Nasıl Takip Ediyoruz? İntrakardiyak Kayıtlar



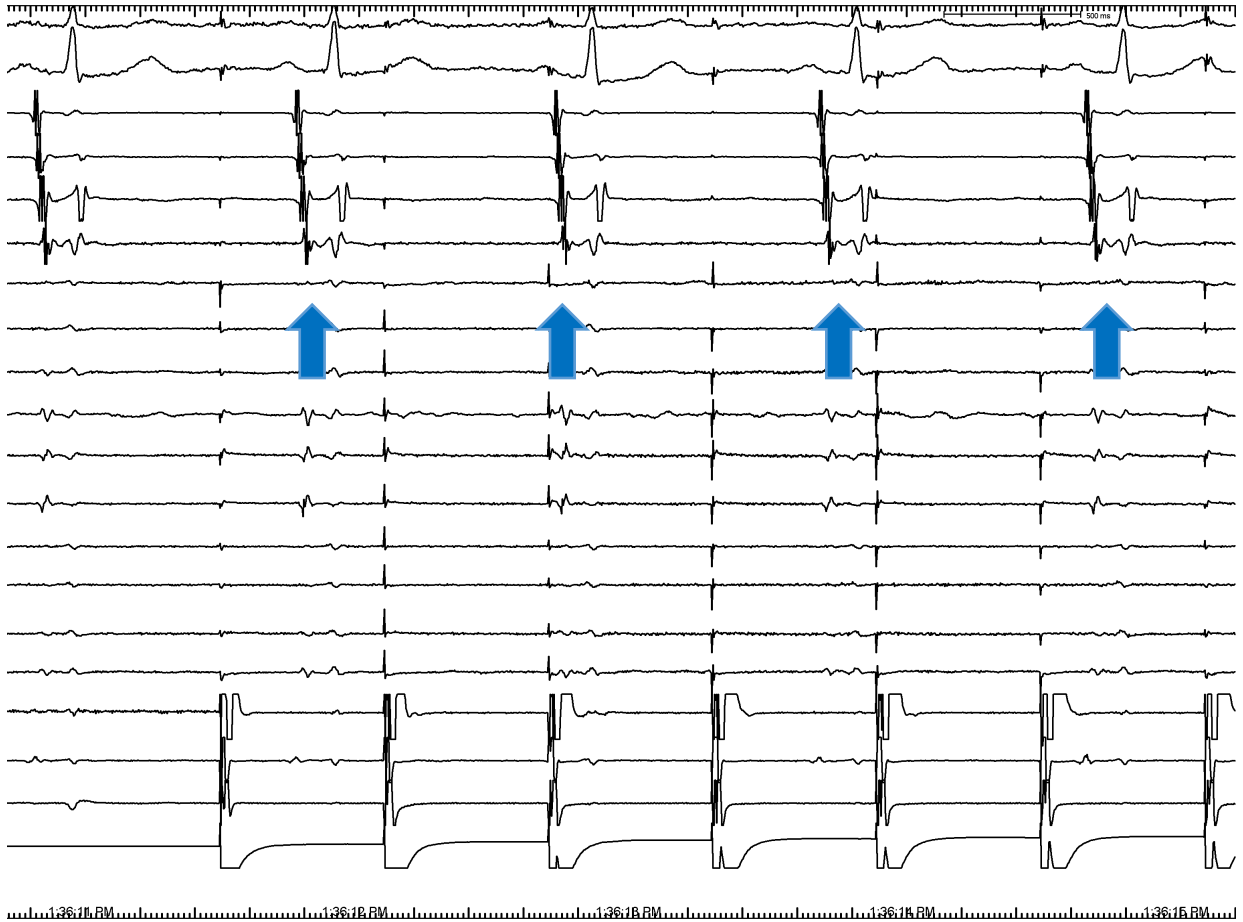
İzolasyonu Nasıl Takip Ediyoruz? - Blok

CS pacing



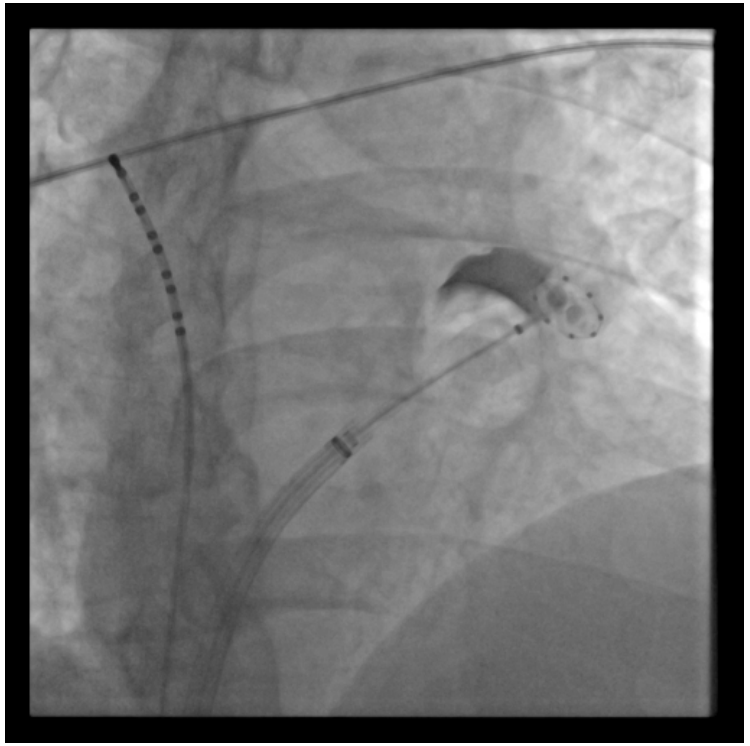
Disosiye LAA Aktivestesi

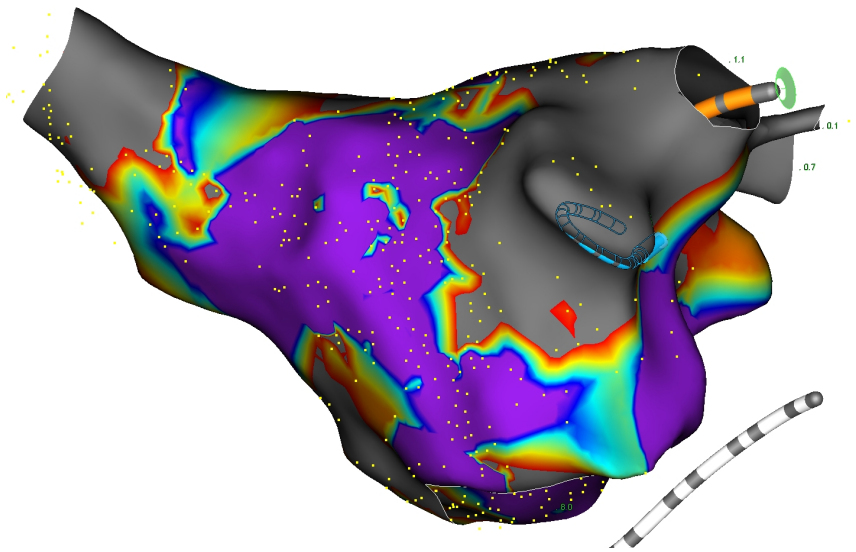
LAA pacing



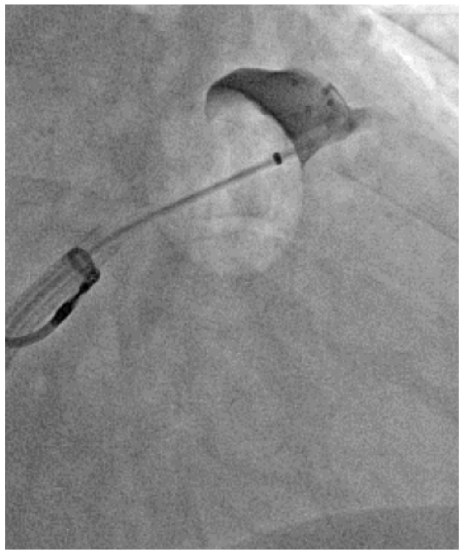
Disosiye LA Aktivitesi

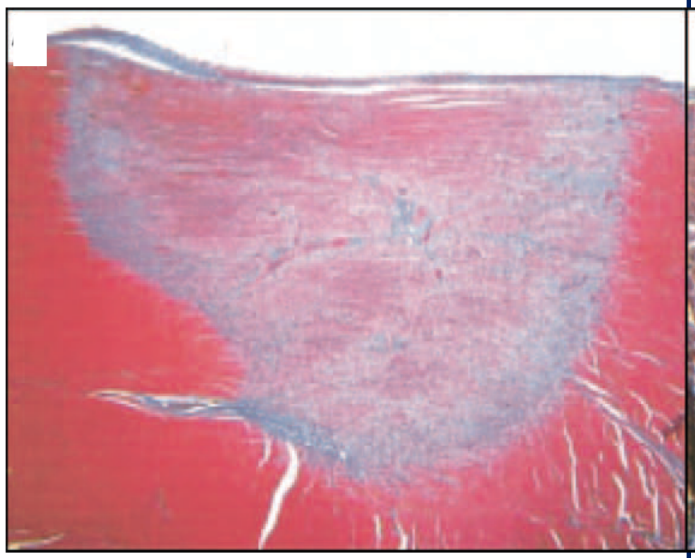
İzolasyonu Nasıl Takip Ediyoruz?
LAA'da Otomatisite

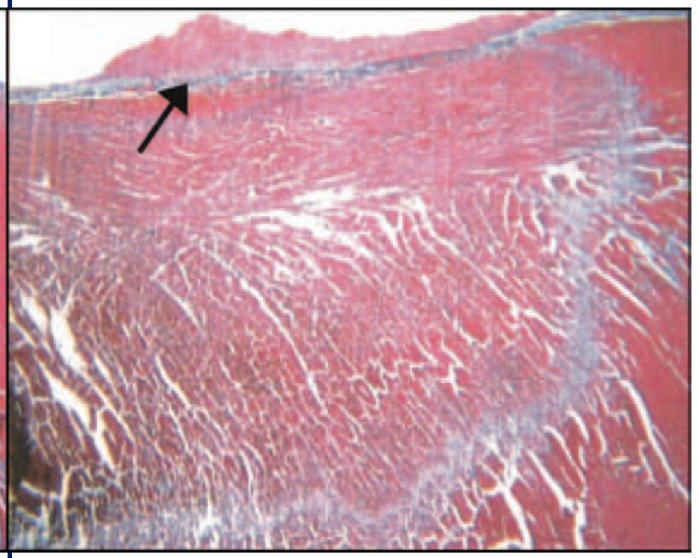


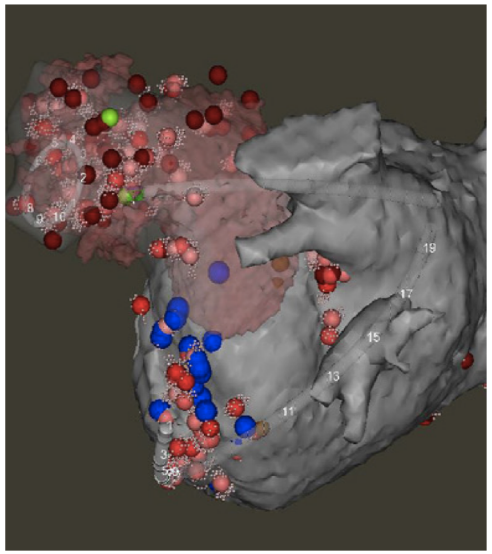


CB ve RF ile LAA İzolasyonu Arasında Fark Var mı?









Daha homojen lezyonlar
Daha düz ve keskin bir demarkasyon hattı

Heterojen lezyonlar
Sınırlarda daha az belirgin
Lezyon hattında trombüs oluşumu

Andrade JG, et al. CIRCEP. 2013;6:218-227

LAA İzolasyonu Durabilitesi

Çalışma	LAA İzolasyon Tekniği	Remap zamanı (Median)	LAAi Durabilitesi
2019, Bordignon S, et al.	RF (wide area)	Median 70 gün	58%
…. Reissmann, et al.	RF (wide area)	Median 105 gün	73%
2019, Bordignon S, et al.	CB	43 gün (33-398)	73%
2019, Chen S,et al. 10 pts	CB	6 hafta	100%
2019, Zender N, et al.	RF (78%) CB (22%)	48 gün (42-70)	80%

Olası Komplikasyonlar

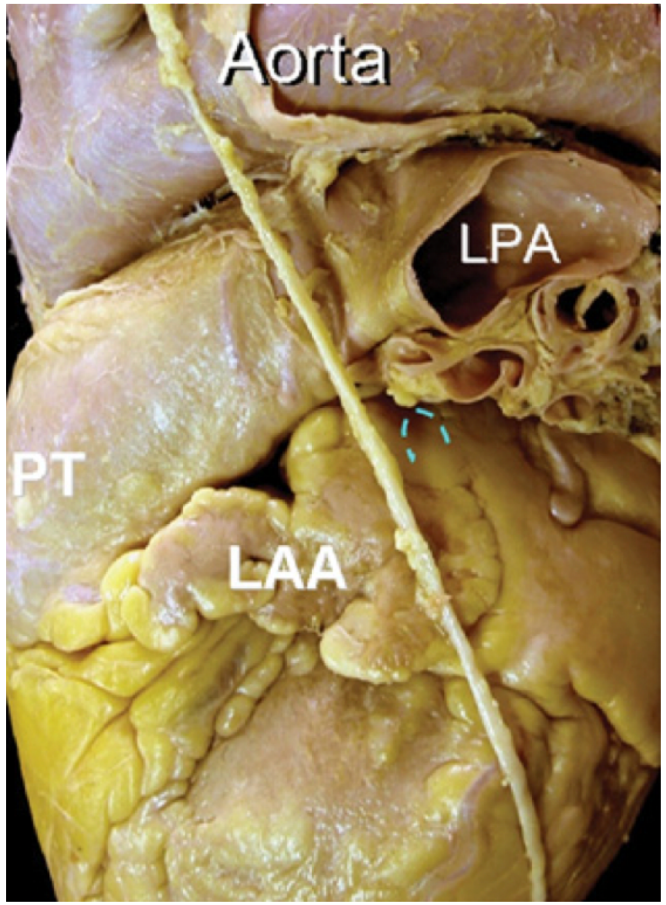
Teorik olarak

- Rüptür
- Perikardiyal tamponad
- Sol atriyum disseksiyonu
- Tromboembolik olay
- Frenik sinir paralizisi
- Koroner hasar

ÇALIŞMALARDA

Çalışma	PVI + LAAI	PVI
Di Biase (2010)	4 (%1,8) perikardiyosentez gereken perikardiyal effüzyon	-
Di Biase (2016)	1 perikardiyal effüzyon	4 iskemik inme 1 perikardiyal effüzyon 1 GİS kanama
Lakkireddy (2015)	-	3 TİA
Panikker (2016)	-	-
Yorgun (2017)	1 iskemik inme	2 iskemik inme

Frenik Sinir Paralizisi



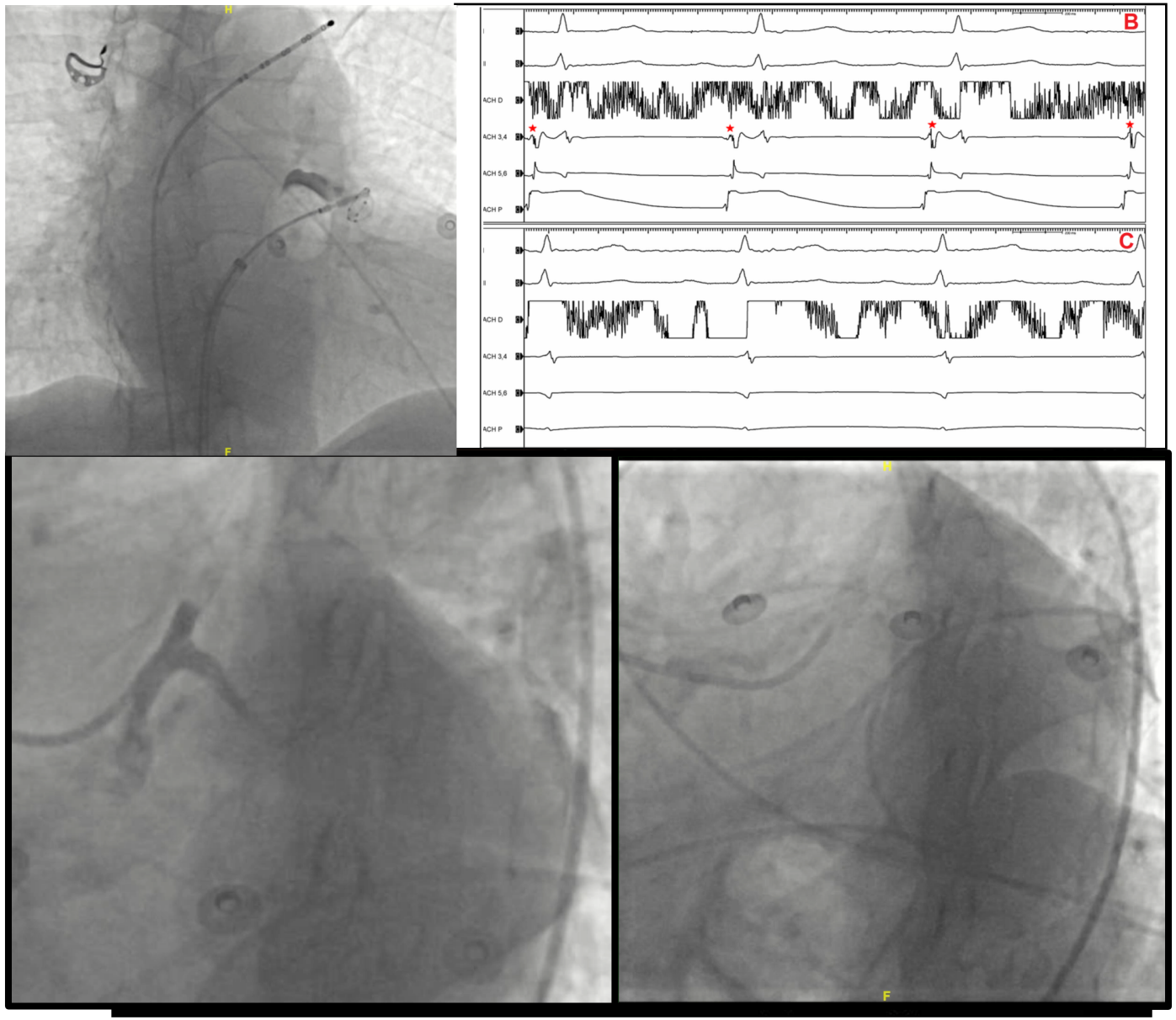
Achive aracılığı ile pace

İstemli derin inspirasyon

Sol subclavien ven üzerinden pace

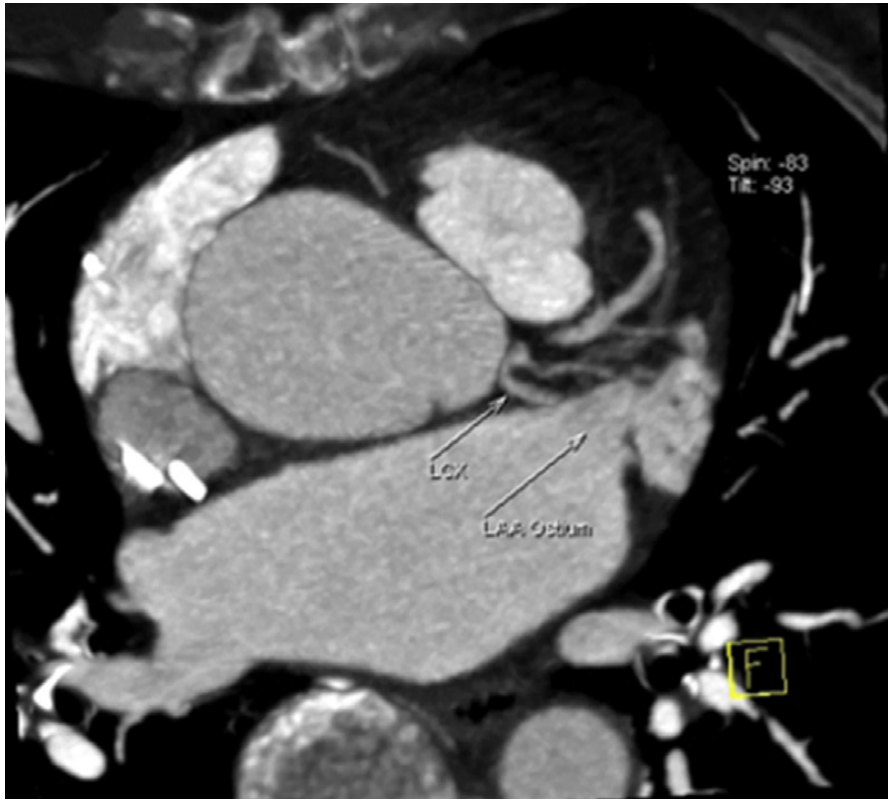
Heart Rhythm. 2009 Jun;6(6):764-8.

LAA İzolasyonu Esnasında Koroner Vazospazm



Coronary Vasospasm After Isolation of Left Atrial Appendage Using a Second-Generation Cryoballoon

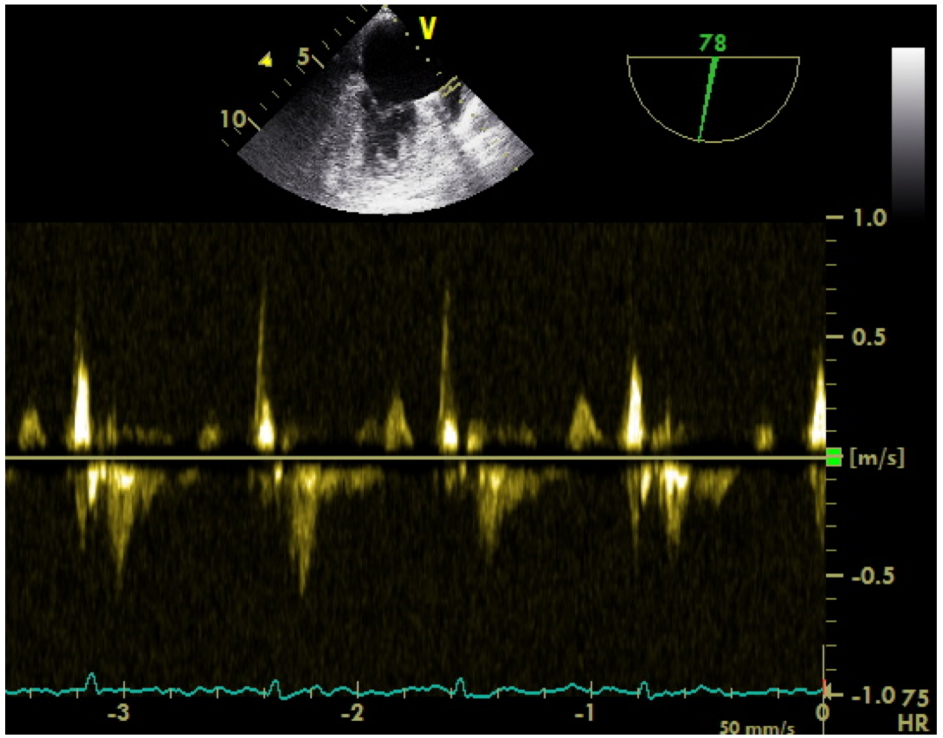
Uğur Canpolat, MD,[a] Ahmet Kivrak, MD,[a] Tuncay Hazirolan, MD,[b] Kudret Aytemir, MD[a]



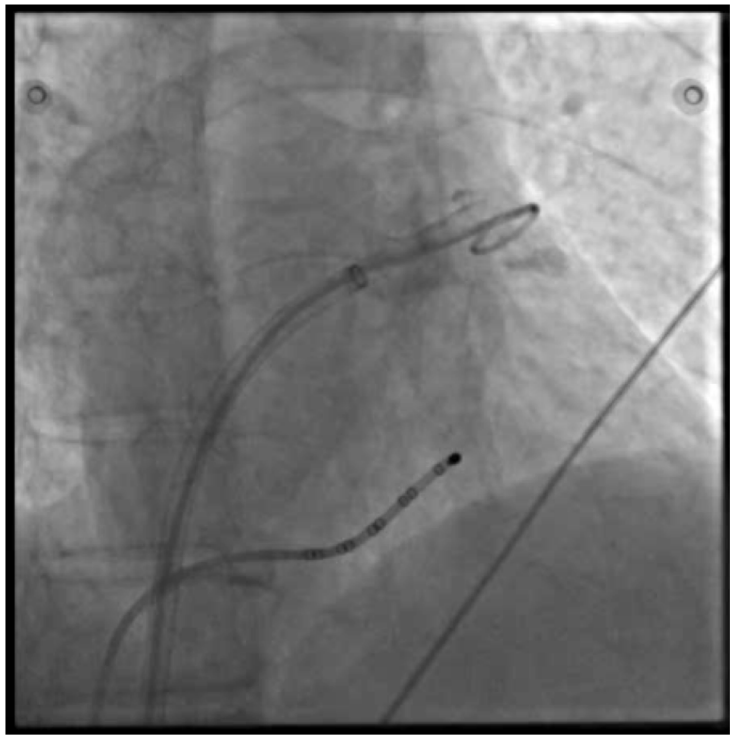
JACC: CLINICAL ELECTROPHYSIOLOGY, 2016

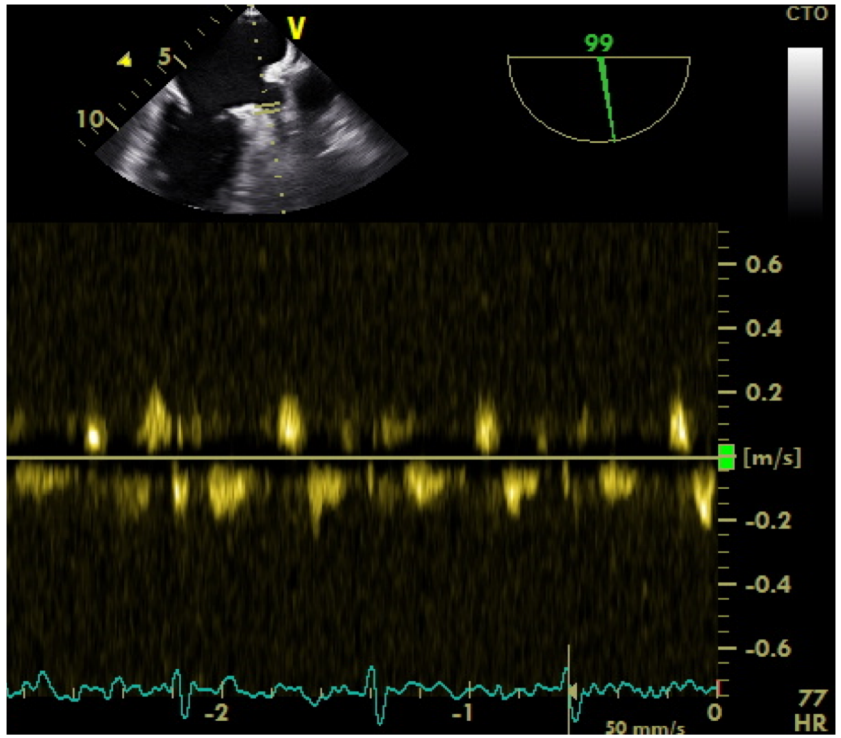
LAA İzolasyonu Sonrası Komplikasyonlar;
LAA Akım Hızlarında Azalma

İşlem öncesi



İşlem sonrası





LAA Akım Hızlarında Azalma

Parameters	Group I (PVI-only)	Group II (PVI+ LAAi)					
	Before ablation	Before ablation	Post-ablation 12-m visit	Post-ablation last visit (median 30-m)	*P*-value[a]	*P*-value[b]	*P*-value[c]
	n = 138	*n* = 144	*n* = 144	*n* = 106			
Any smoke in LAA	26 (18.8%)	31 (21.5%)	47 (32.7%)	47 (44.3%)	0.541	<0.001	<0.001
Degree of smoke in LAA	0.25 ± 0.59	0.32 ± 0.67	0.38 ± 0.60	0.57 ± 0.74	0.386	0.181	0.004
Smoke absent	112 (81.2%)	113 (78.5)	97 (67.4%)	59 (55.7%)	0.541	<0.001	<0.001
Grade I	19 (13.8%)	18 (12.5%)	40 (27.8%)	35 (33%)			
Grade II	5 (3.6)	11 (7.6%)	6 (4.2%)	10 (9.4%)			
Grade III	2 (1.4)	2 (1.4%)	1 (0.7%)	2 (1.9%)			
Grade IV	–	–	–	–			
LAA flow velocity (m/s)	0.53 ± 0.19	0.52 ± 0.19	0.46 ± 0.15	0.47 ± 0.17	0.775	<0.001	0.01
LAA flow velocity <0.4 m/s	36 (26.1%)	39 (27.1%)	52 (36.1%)	43 (40.6%)	0.850	<0.001	<0.001
Thrombus in LAA after ablation	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1.000	1.000	1.000

Yorgun,H et al. 2019;Europace

LAA İzolasyonu Sonrası Trombüs Oluşumu

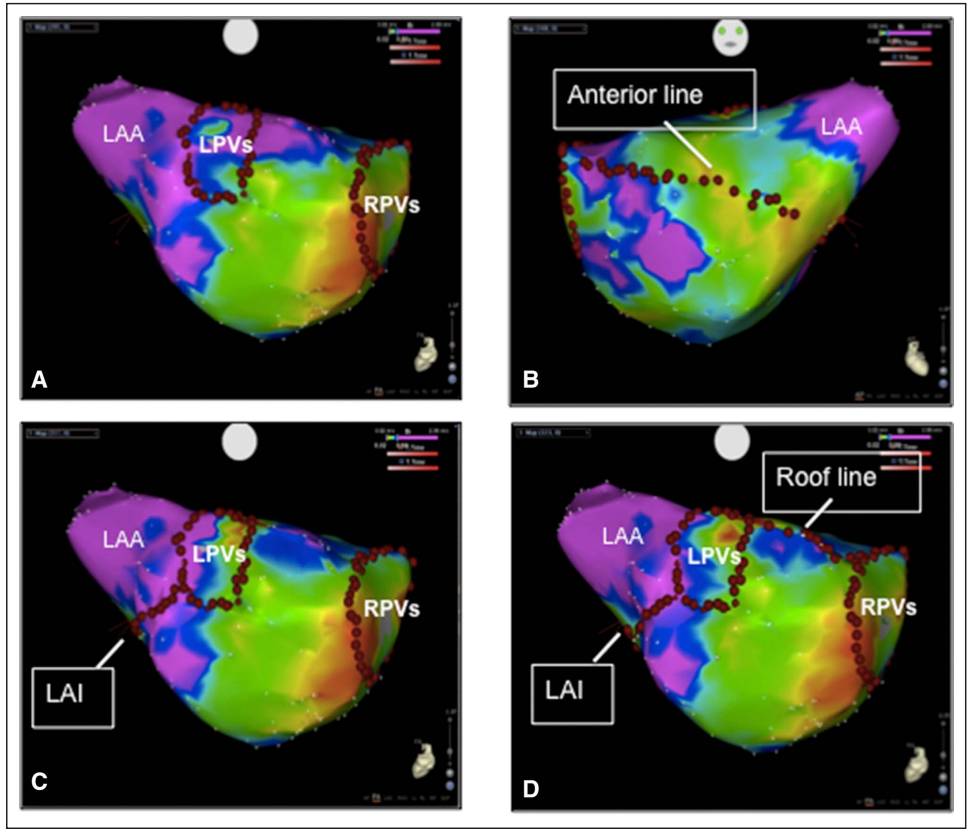


Table 2. Comparison of Patients With LAA Thrombus (n=10) or Stroke/TIA (n=3) During Follow-Up With Patients Without LAA Thrombus or Cerebral Event (n=37)

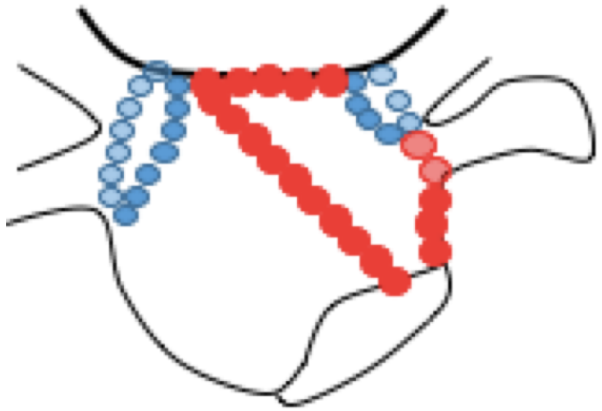
	Patients With LAA Thrombus (n=10) or Thrombembolic Event (n=3)	Patients Without LAA Thrombus or Stroke/TIA (n=37)	*P* Value
Overall number of patients	13	37	
Male, n (%)	8 (61.5)	14 (37.8)	0.20
Age, y	71 (66–74)	71 (67–73)	0.89
Hypertension, n (%)	8 (61.5)	23 (62.2)	1.0
Diabetes mellitus, n (%)	2 (15.4)	2 (5.4)	0.27
CAD, n (%)	2 (15.4)	7 (18.9)	1.0
LA diameter, mm	48 (46–50)	45 (43–48)	0.16
TIA before LAA isolation, n (%)	1 (7.7)	5* (13.5)	1.0
Stroke before LAA isolation (%)	1 (7.7)	1* (2.7)	0.45
CHA_2DS_2-VASc score†	3 (2–3)	3 (2–3)	0.63
Anticoagulation with Phenprocoumon, n (%)	4 (30.8)	20 (54.1)	0.2
Anticoagulation with NOAC, n (%)	7 (53.8)	14 (37.8)	0.34

Circ Arrhythm Electrophysiol. 2016;9:e003461

LAA İzolasyonu Sonrası Trombüs Oluşumu

Left Atrial Appendage Isolation in Patients Not Responding to Pulmonary Vein Isolation

Benefit and Risks

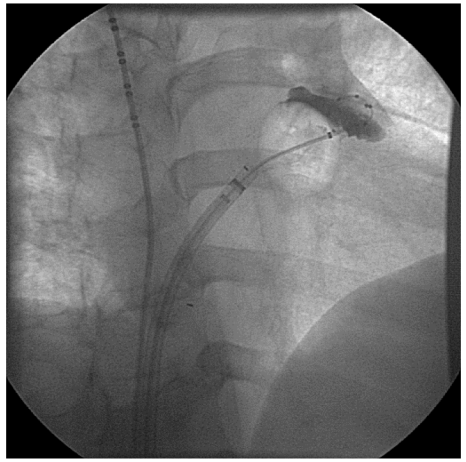


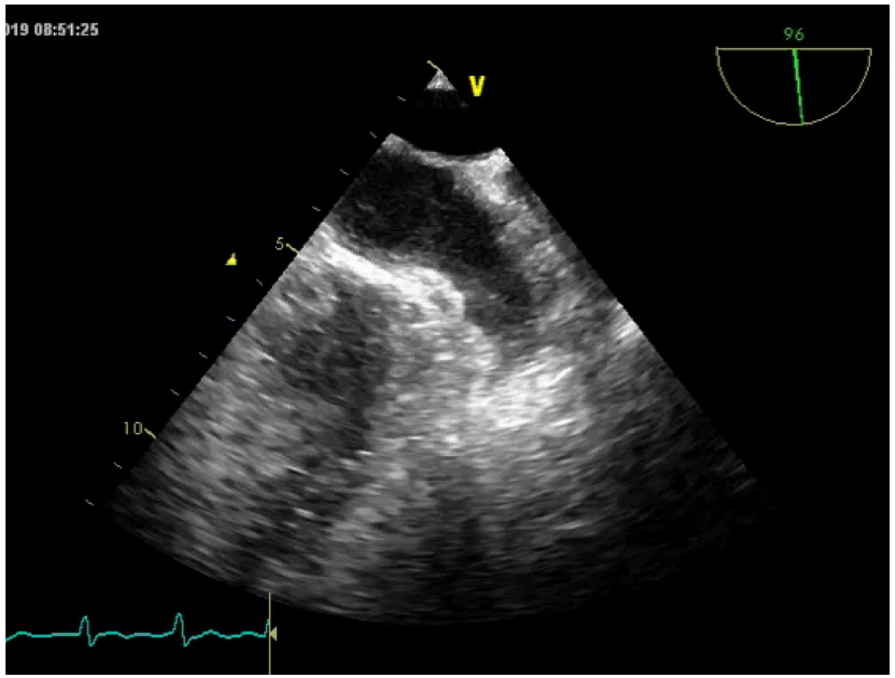
	Control Group	LAAI Group	*P* Value
Patients, n	116	116	
Echocardiographic details after index procedure assessed by TEE			
Availability of postprocedural TEE, n (%)	89 (77)	95 (82)	0.418†
Smoke in LAA, n (%)	10 (11.2)	36 (37.8)	<0.0001†
Degree of smoke in LAA	1 (1, 2.8)	3 (2, 3)	0.003‡
LAA flow velocity, m/s	0.50±0.2	0.22±0.2	<0.0001‡
Thrombus formation within LAA, n (%)	2 (2.2)	22 (23.2)	<0.0001†
Appropriate OAC at time of detected thrombus, n (%)	1 (50)	20 (91)	0.239†
Adverse events			
Follow-up duration, y	4.3 (3.7, 5.6)	4.0 (2.5, 6.4)	0.222‡
Thromboembolism (stroke or TIA), n (%)	3 (2.6)	17 (14.7)	0.002†
Embolic stroke, n (%)	1 (0.9)	15 (12.9)	…
TIA, n (%)	2 (1.7)	2 (1.7)	…
Patients with 2 thromboembolic events, n (%)	0 (0)	3 (2.6)	0.247†
Time point of thromboembolism, mo	25 (18, 55)	16 (7, 47)	0.461‡
Thromboembolism under appropriate OAC, n (%)	1 (33.3)	15 (88)	0.088†
OAC: vitamin K antagonists (INR, 2–3)	1	10	…
OAC: rivaroxaban	0	4	…

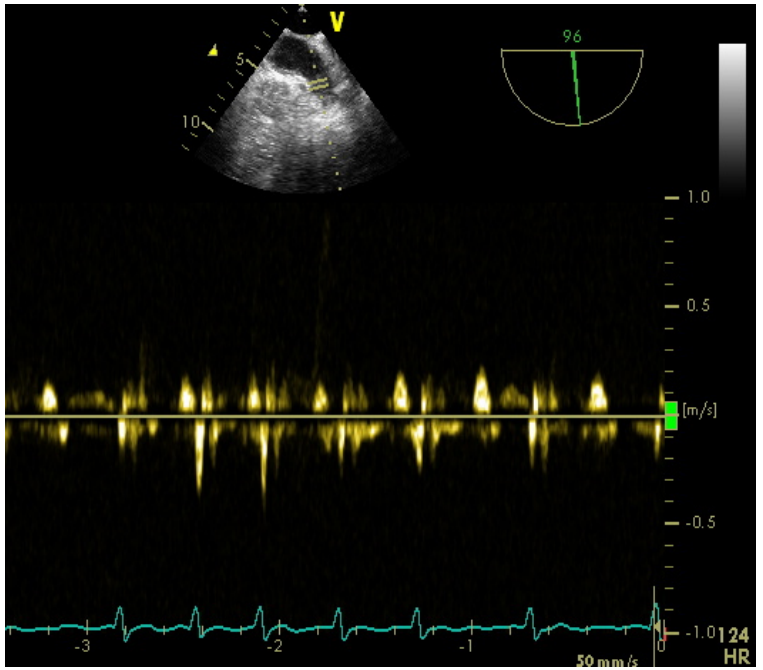
Heeger C, et al. Circulation. 2019;139:712–715.

LAA Trombüsü ….CB ile LAA İzolasyonundan 21 ay sonra

01.2018 **09.2019**







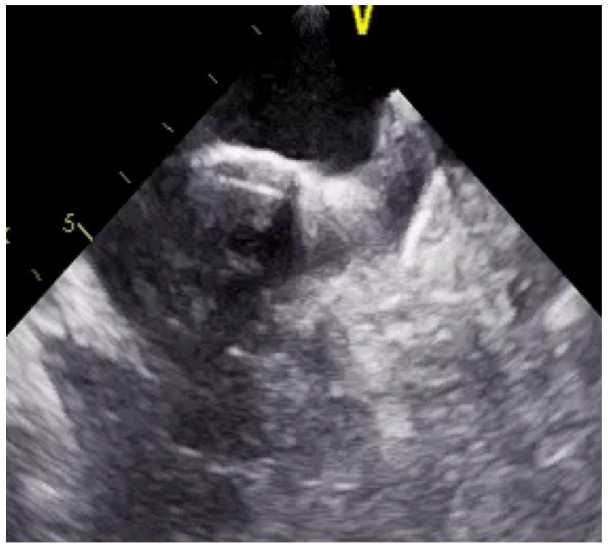
Apixaban 2 x 2.5 mg

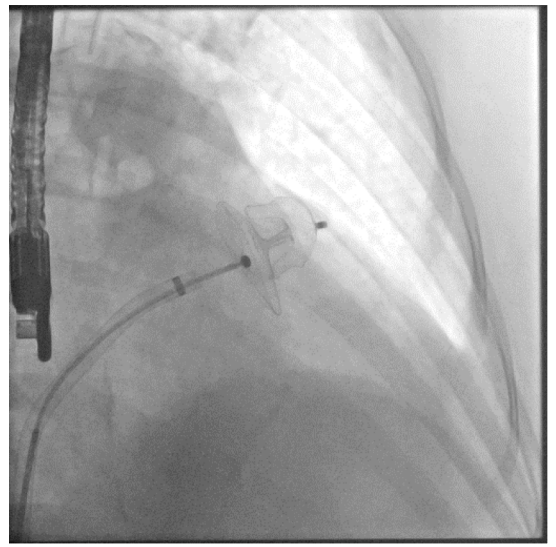
LAA İzolasyonu Sonrası Nasıl Takip Edelim ?

PVI + LAA izolasyonu

Antikoagulasyona devam edilmesi (NOAC)

LAA kapatılması





Kimde Düşünelim?

- Persistan AF
- LAA İçerisinden Firing
- LAA Kapatılması Planlanıyor ise
- Ömür Boyu Antikoagülan Uyumu Olacak ise
- Operatör tecrübeli ise
- ...

Avantaj & Dezavantaj

LAA izolasyonundaki başarısızlık
Uzamış prosedür zamanı
Prosedürde artmış komplikasyon riski

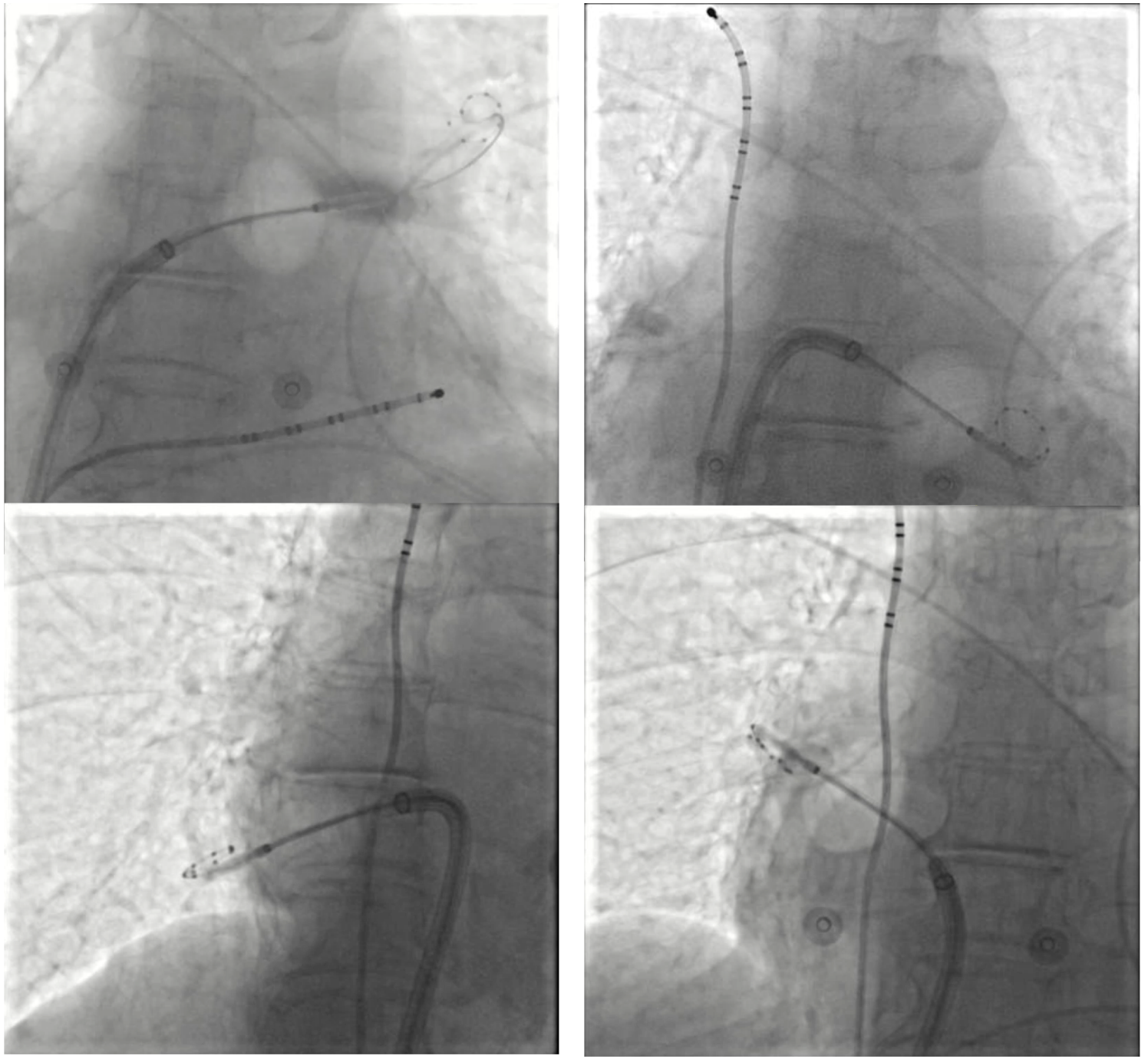
- *Frenik sinir pralizisi*
- *LAA perforasyonu*
- *CX hasarı*
- ***Artmış* tromboembolik olay**

ATa/AF rekürrensinde azalma

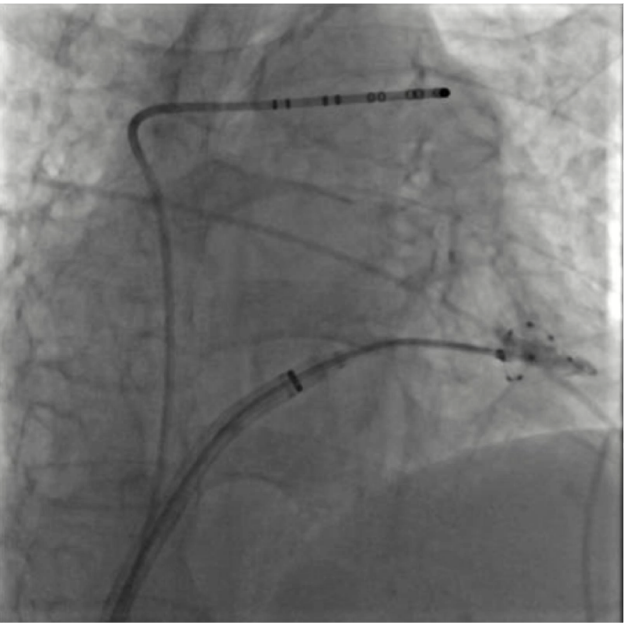
VAKA

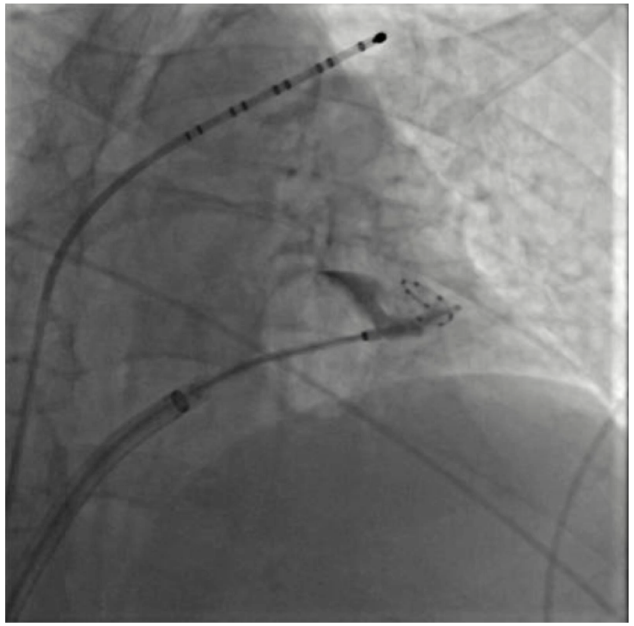
77 Yaşında Kadın
Persistan AF
CHA_2DS_2-VASc: 7

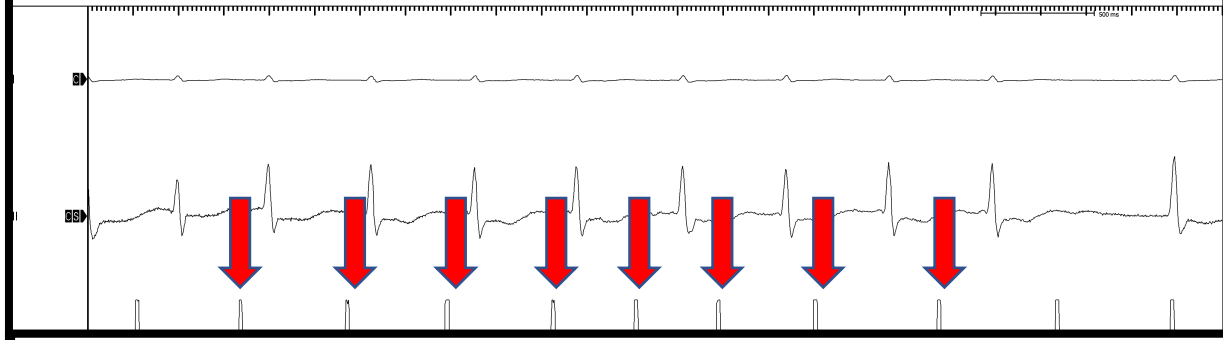
Terapötik doz OAK altında mükerrer GİS kanama

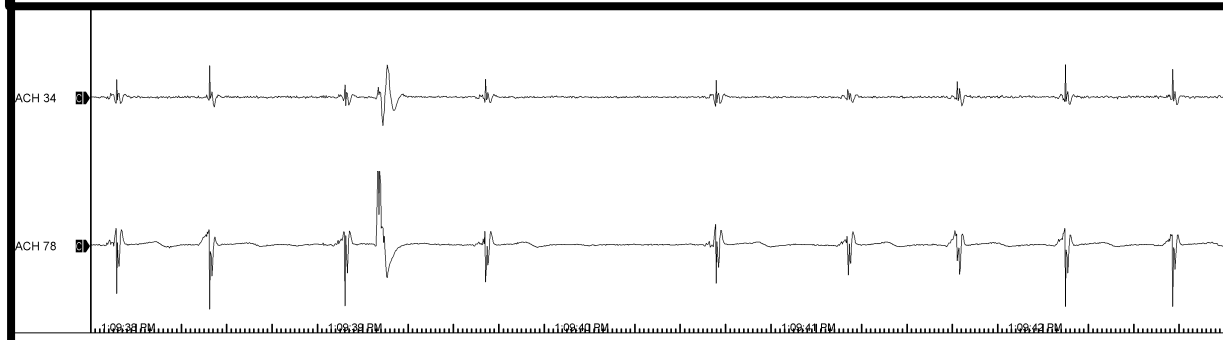


VAKA









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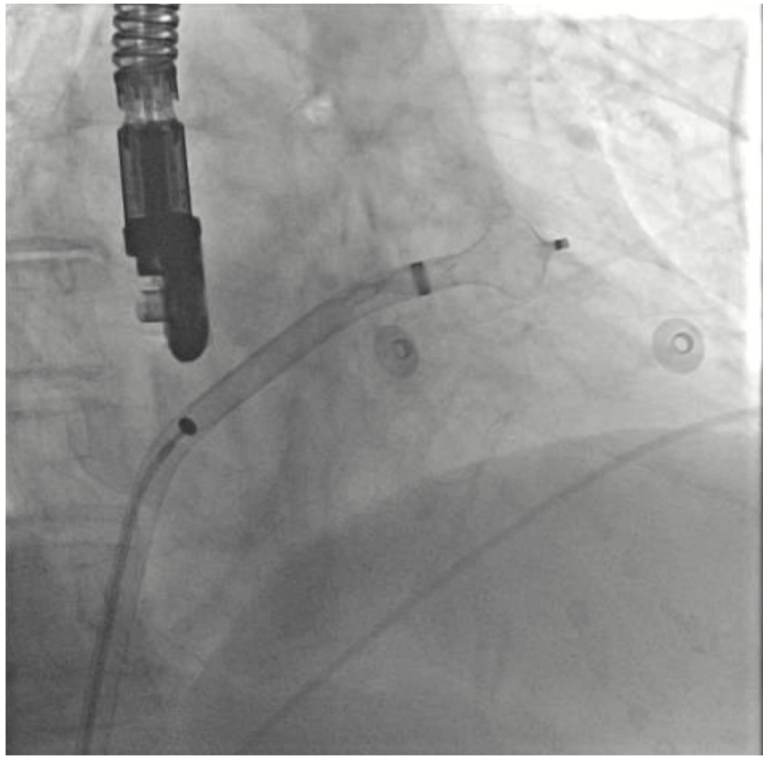

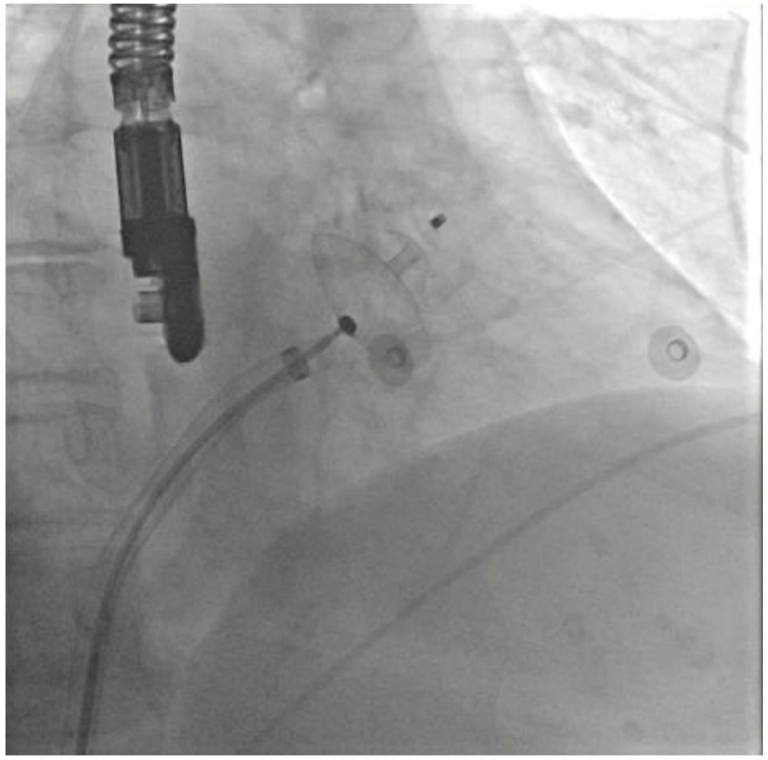

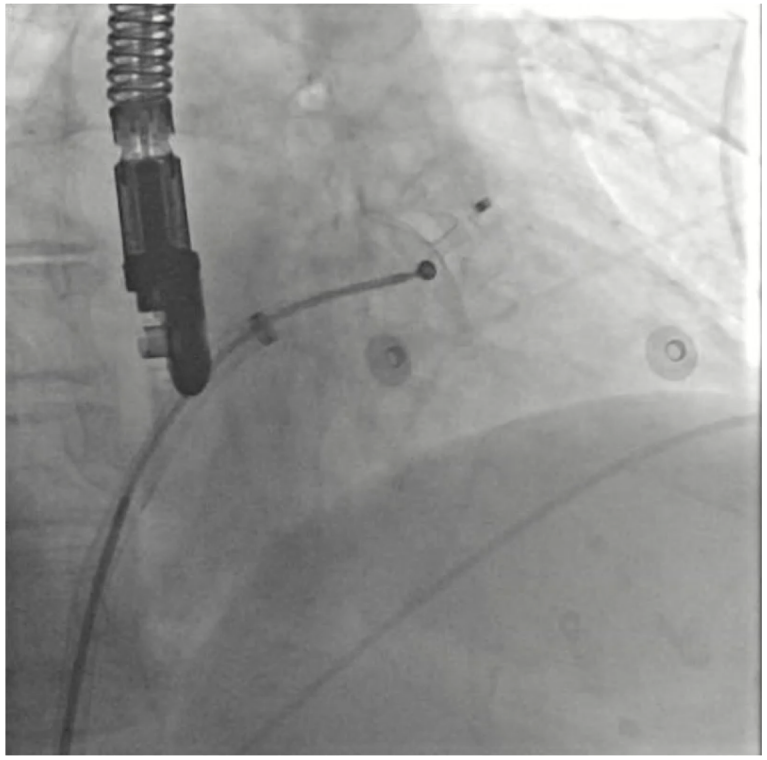

Teşekkürler