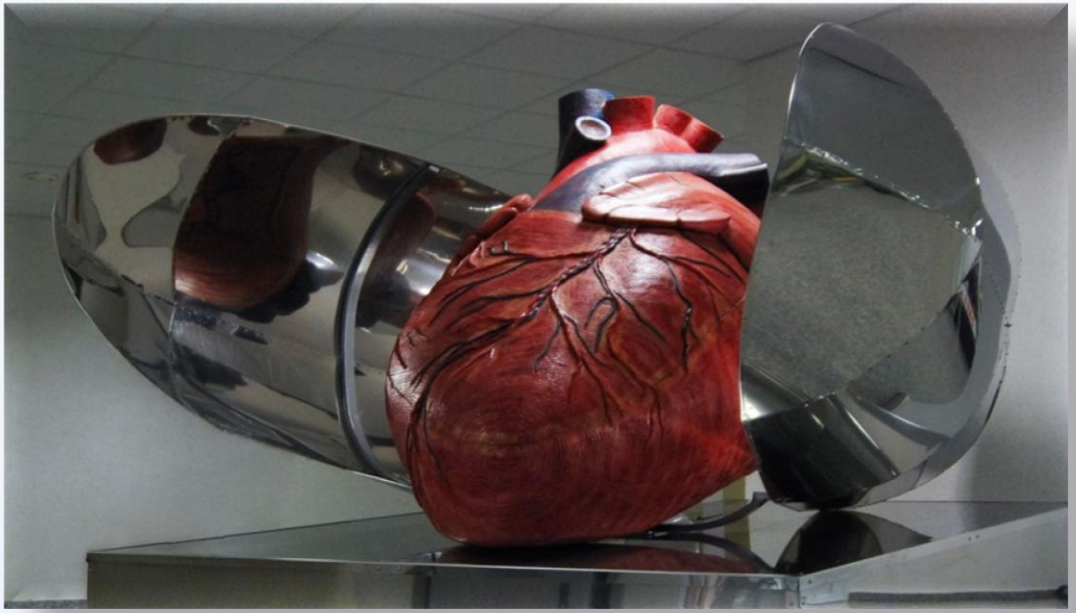
Co můžeme dnes nabídnout pacientům s fibrilací síní?



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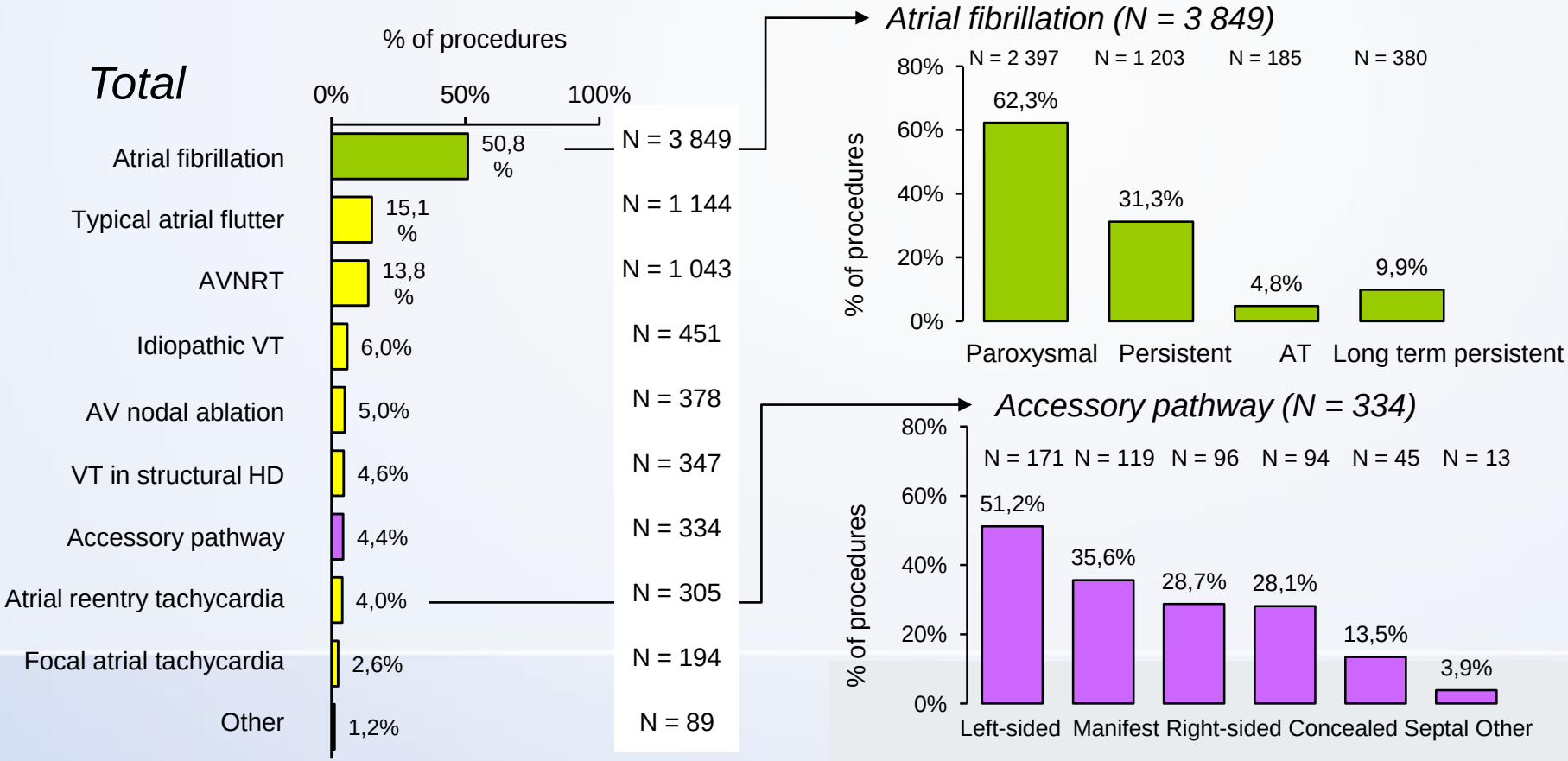
www.ikem.cz

INSTITUT KLINICKÉ A EXPERIMENTÁLNÍ MEDICÍNY
KLINIKA KARDIOLOGIE

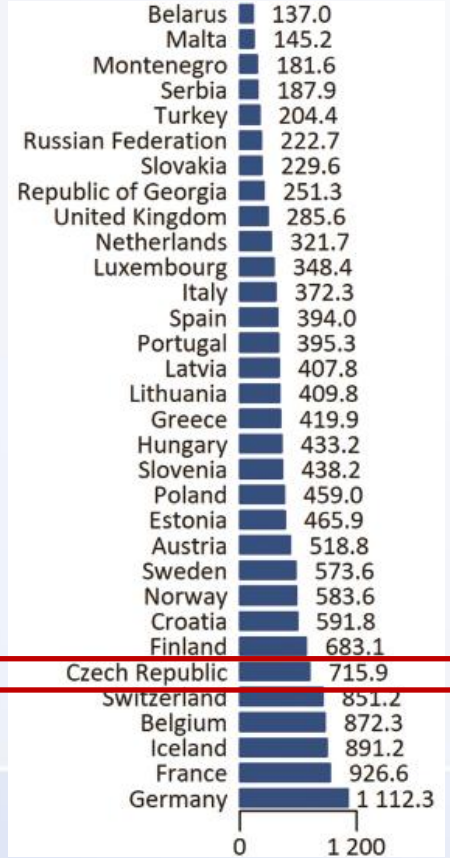
IK+E M

Ablace FS je nejčastější ablační procedurou v ČR: Czech Ablation Registry 2020



Czech registry on catheter ablation

Number of catheter ablation procedures per milion people in ESC member countries, 2021



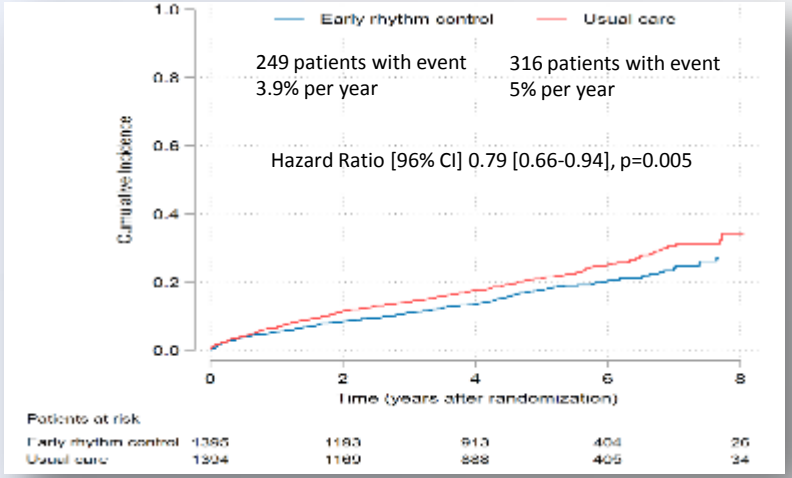
Ablation procedures per milion inhabitants in the European Society of Cardiology
member countries, 2021

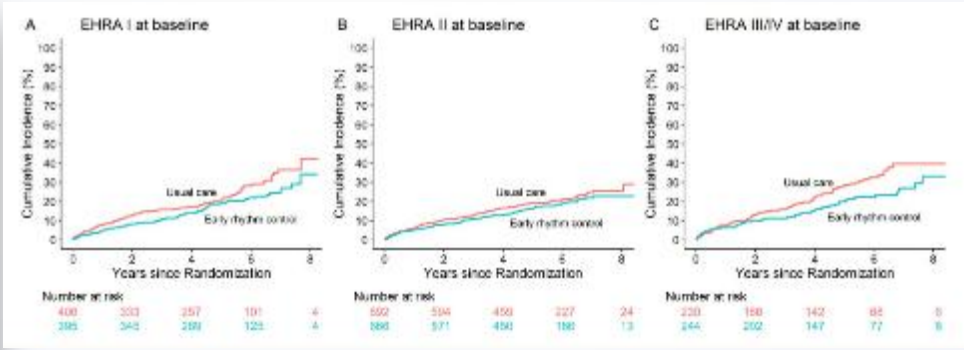
* In CR - number for 2020

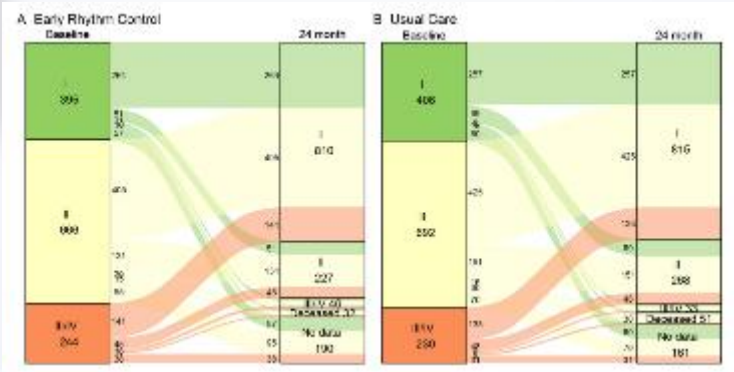
European Heart Journal, Volume 43, Issue 8, 21 February 2022, Pages 716–799,
https://doi.org/10.1093/eurheartj/ehab892
Published: 06 January 2022 Article history

Nová data ukazují, že snaha o udržení sinusového rytmu přináší lepší prognózu (bez ohledu na symptomy)

EAST – AFNET 4 study: časná vs obvyklá léčba FS







2789 pts, 135 míst, 11 zemí

Pacienti s rizikem KV událostí (≈ CHA_2DS_2VASc skore ≥ 2)
a recentně vzniklou FS (***'časná FS'***, ≤ 1 rok trvání dle EKG dokumentace)

Kirchhof P, et al. NEJM, doi: 10.1056/NEJMoa2019422
Willems S, et al. Eur Heart J 2022;43:1219-1230

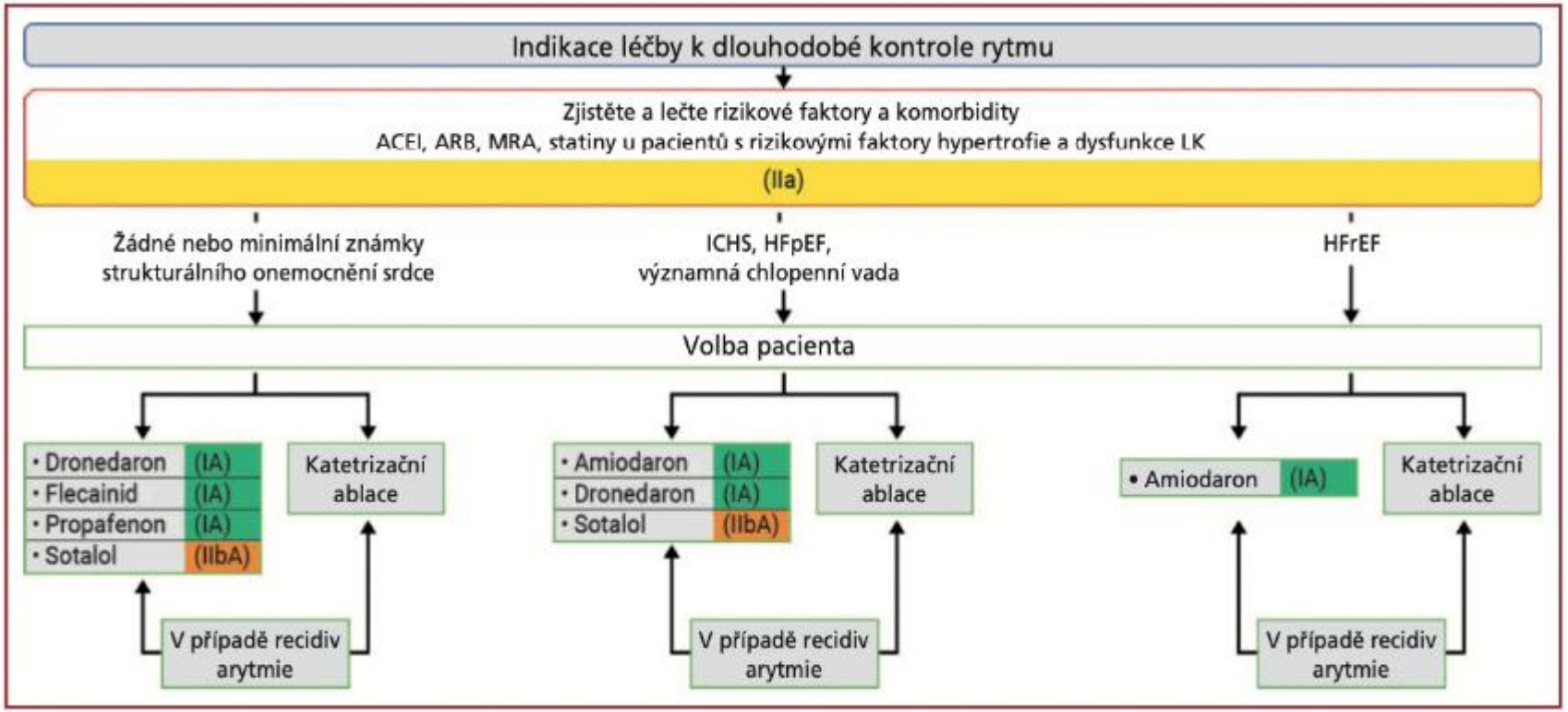
EAST – AFNET 4 – komponenty primárního endpointu

	Patients with event in Early Rhythm Control (n=1395)	Patients with event in Usual Care (n=1394)	Uncorrected Hazard Ratio [95% CI]
Cardiovascular death	67 / 6915 (1.0)	94 / 6988 (1.3)	0.72 [0.52-0.98]
Stroke	40 / 6813 (0.6)	62 / 6856 (0.9)	0.65 [0.44-0.97]
Hospitalization with worsening of heart failure	139 / 6620 (2.1)	169 / 6558 (2.6)	0.81 [0.65-1.02]
Hospitalization with acute coronary syndrome	53 / 6762 (0.8)	65 / 6816 (1.0)	0.83 [0.58-1.19]

Kirchhof P, et al. NEJM, doi: 10.1056/NEJMoa2019422

Jak toho dosáhnout?

Dlouhodobá kontrola rytmu

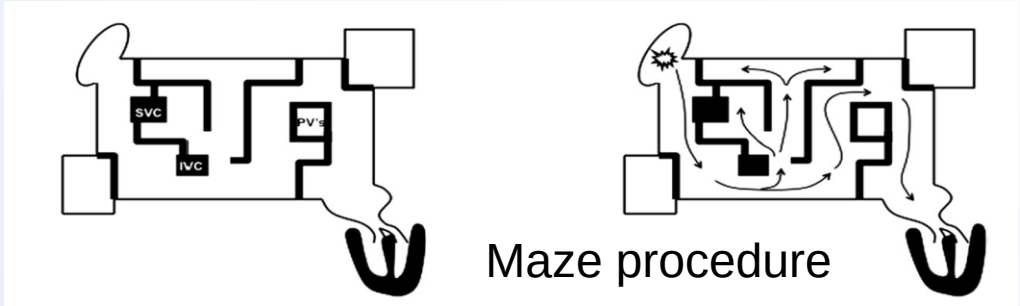


Fiala M, et al. Cor Vasa 2021;63:135–161.

Revoluční metoda léčby FS – časná 90. léta

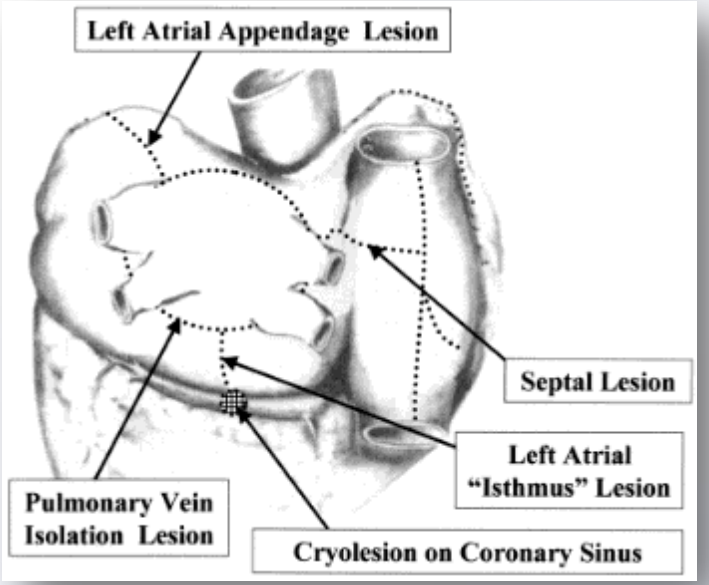
If we were going to treat atrial fibrillation surgically, it was now apparent that we had to develop a procedure that made it impossible for the atrium to fibrillate at all.

JL Cox



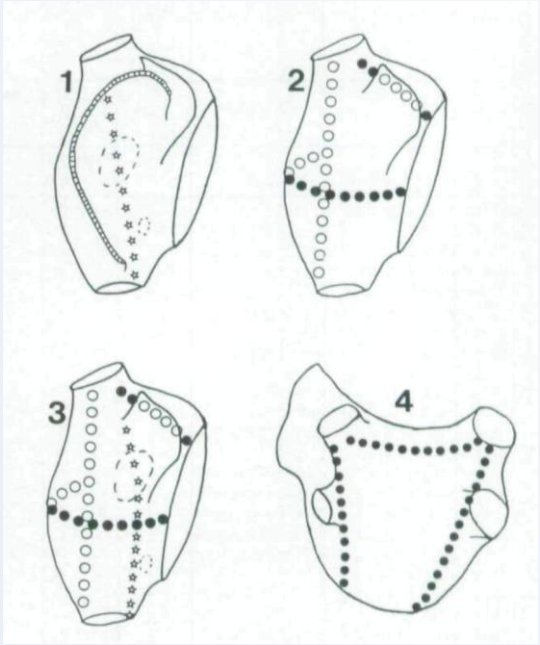
Maze procedure

Maze I-III, 168 pts,
93 % úspěšnost

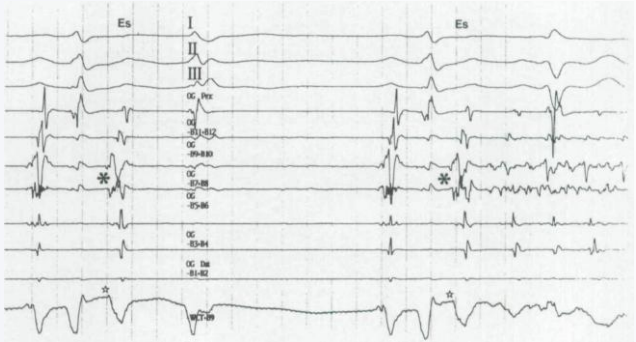


Cox JL, et al. J Thorac Cardiovasc Surg 1991;101:….
Cox JL, et al. Ann Surg 1996;224:267-275
Cox JL. J Thorac Cardiovasc Surg 2011;141:1093-7

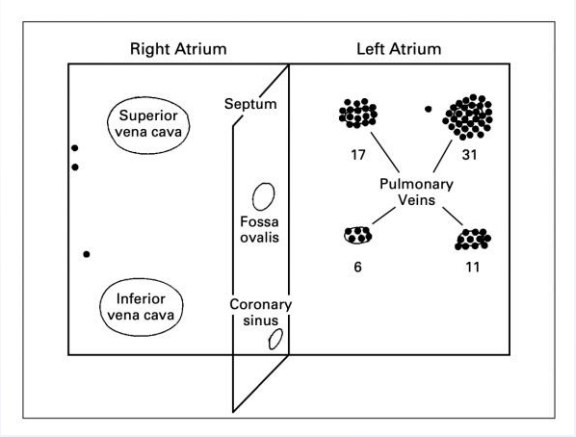
Snahy replikovat tento výkon Maze vedly k objevu fokálních spouštěčů v plicních žílách



Progressive Anatomically Directed Ablation



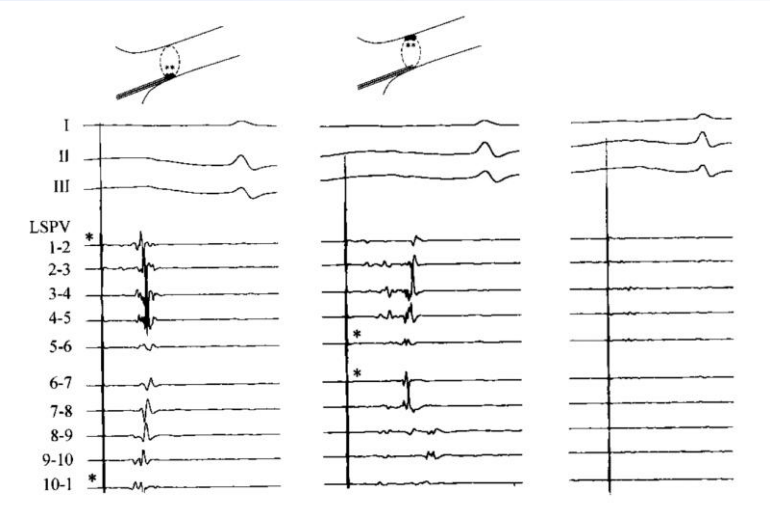
Triggering foci unmasked during linear ablations



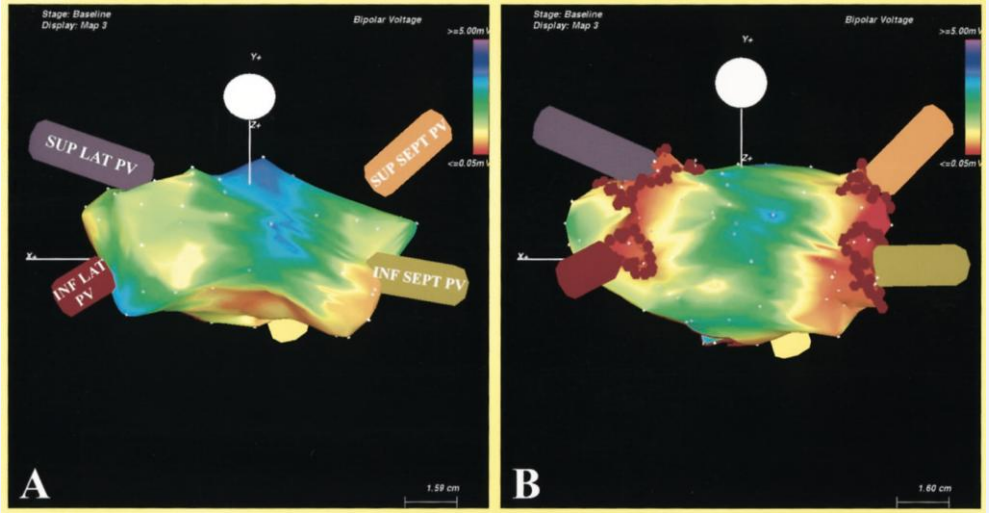
Predominant location in PVs

Haissaguerre M, et al. JCE 1996;7:1132-44
Haissaguerre M, et al. N Engl J Med 1998;339:659-66

Ablace fokálních zdrojů vedla k rozvoji strategií izolace plicních žil



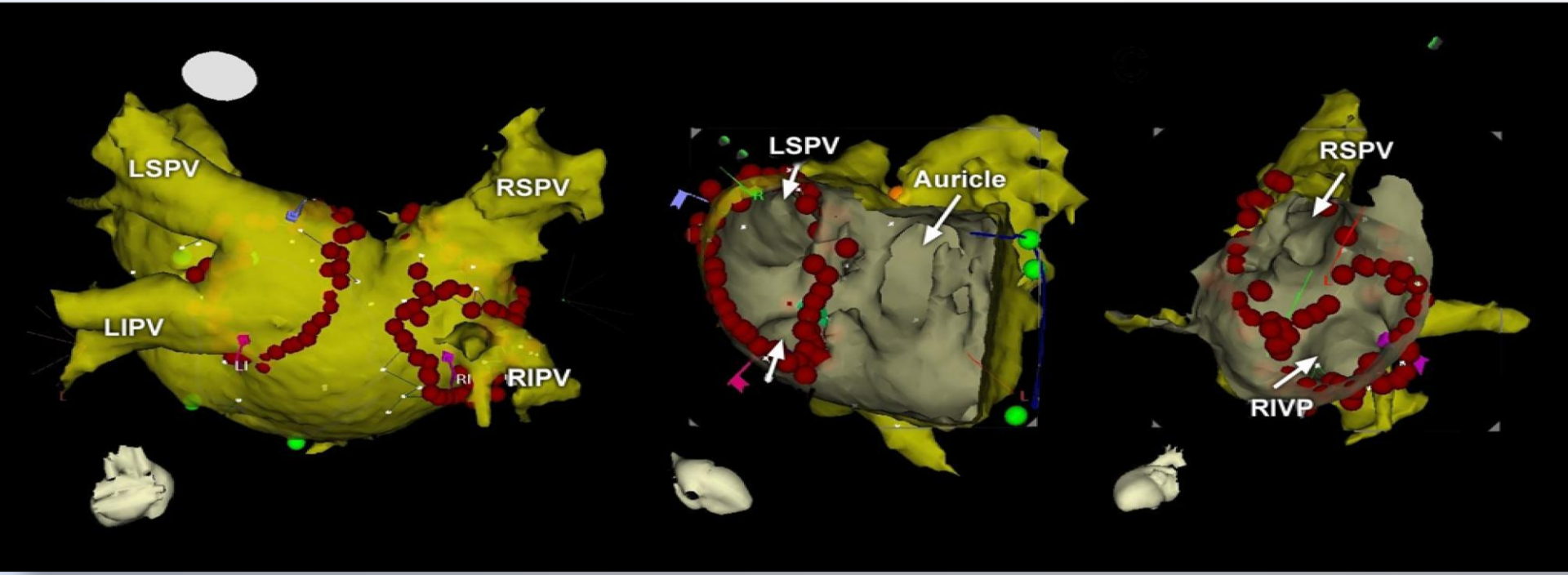
Lasso-guided segmental isolation



EAM-guided circumferential ablation

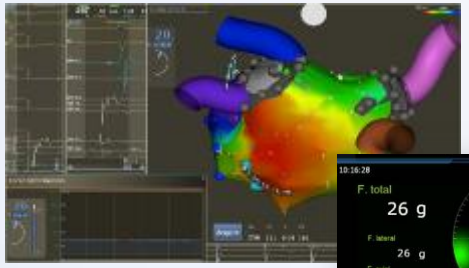
Haissaguerre M, et al. Circulation. 2000;102:2463–2465
Pappone C, et al. Circulation. 2000;102:2619-2628.)

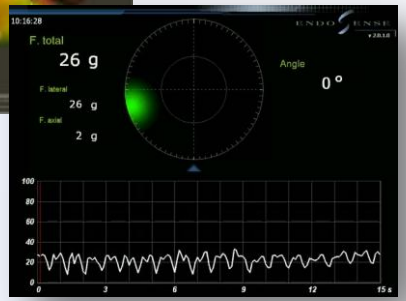
Izolace plicních žil = základ katetrizační ablace FS



Do současnosti bylo testováno mnoho technologií a strategií

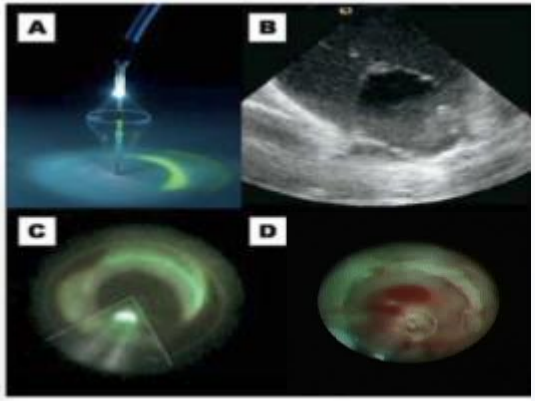
CF catheter,
Smart Touch, Biosense Webster

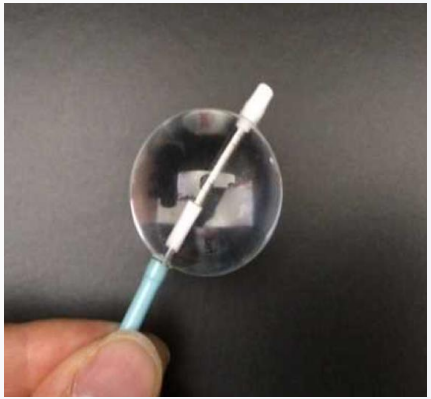




CF catheter,
TActicath,
Abbott

Laser baloon, Cardiofocus





Hot balloon Toray

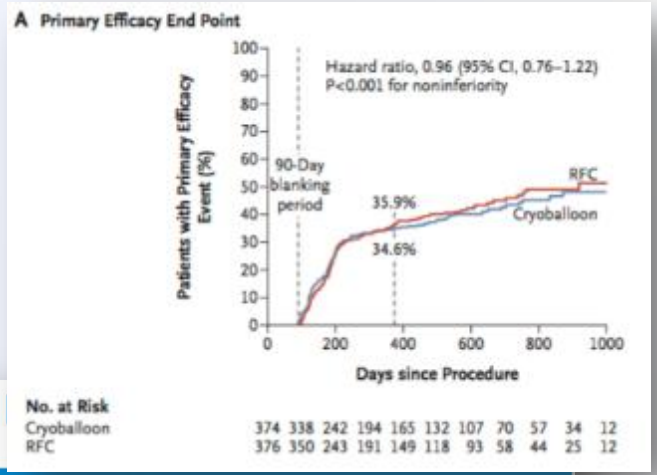
RF balloon,
Apama
Medical

RF balloon, Helios
Biosense Webster

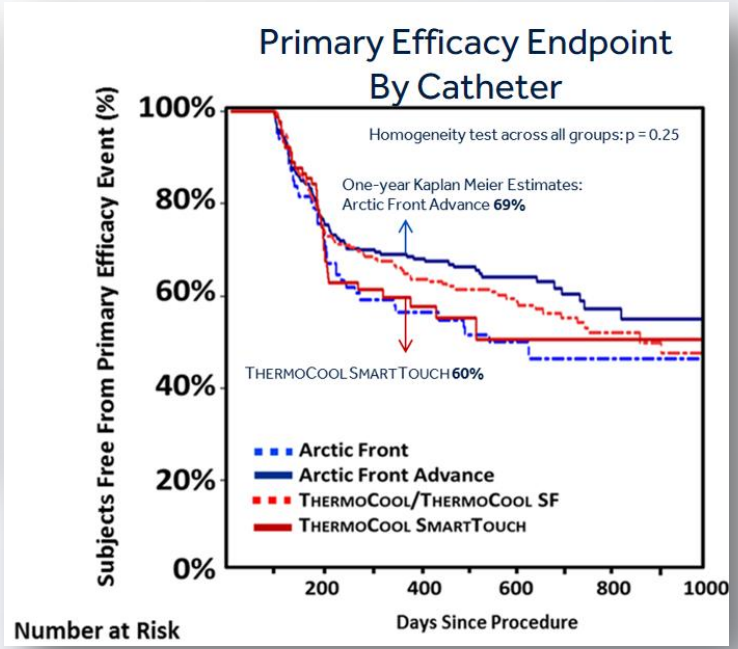
Cryoballoon
Cryocath,
Medtronic

Studie FIRE and ICE
Primární endpointy (recidiva FS, AADs, re-ablace)

376 RF
374 CR

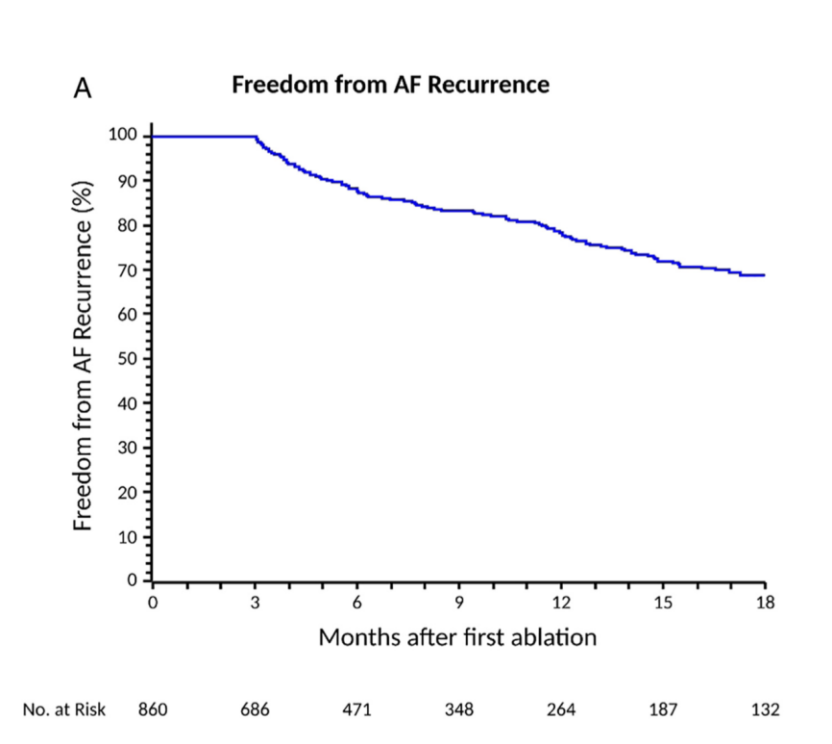


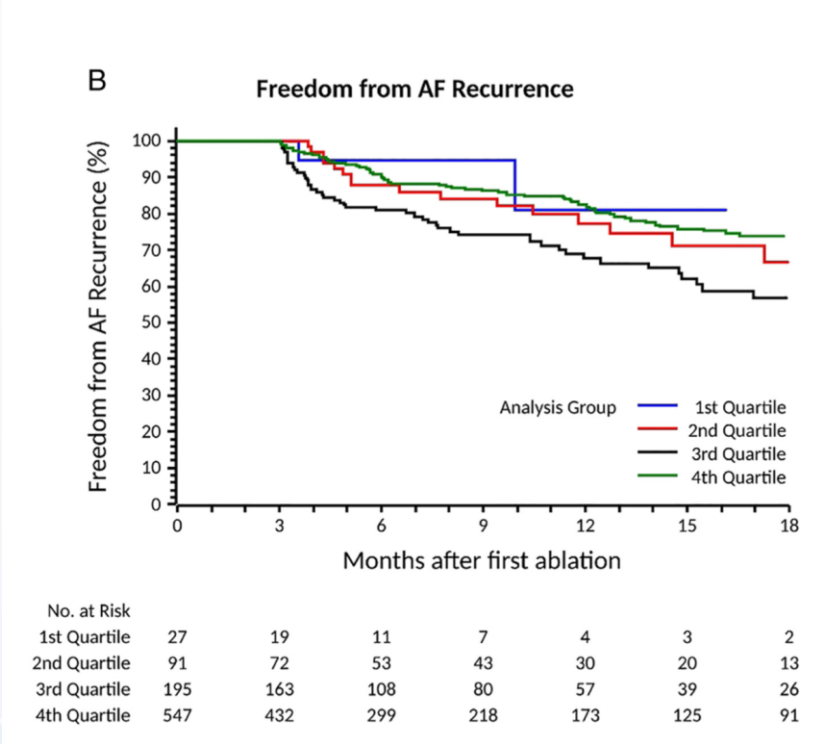
Time Measurement (minutes)	RFC (n=376)	Cryoballoon (n=374)	p-value**
Procedure Time***	140.9 ± 54.9	124.4 ± 39.0	<0.0001
LA Dwell Time***	108.6 ± 44.9	92.3 ± 31.4	<0.0001
Fluoroscopy Time	16.6 ± 17.8	21.7 ± 13.9	<0.0001



Kuck KH, et al. *N Engl J Med*. 2016; 374(23): 2235-45.

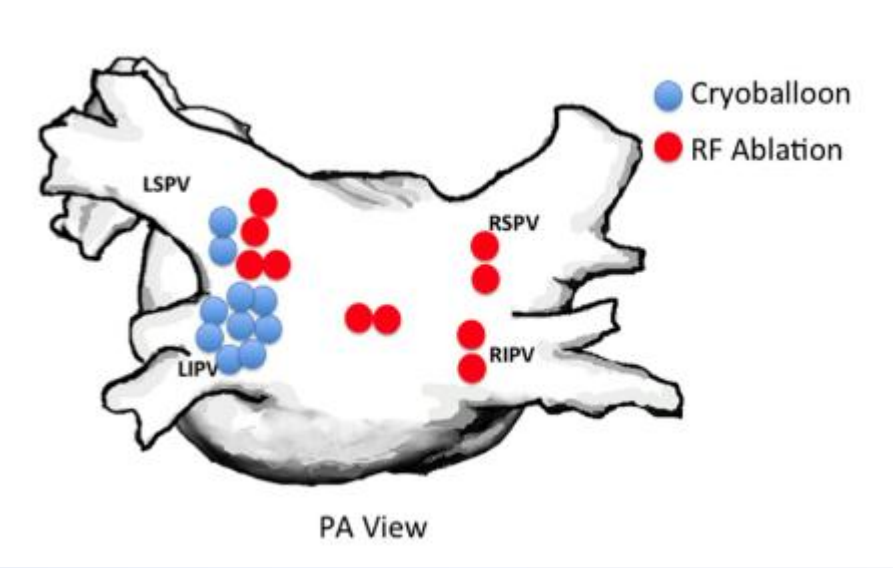
Kryoablace je jednodušší, rychlejší a méně závislá na zkušenostech centra (operatéra)





Landolina M, et al. Int J Cardiol 2018;272:130-136.

Riziko kolaterálního poškození je i u kryoablace



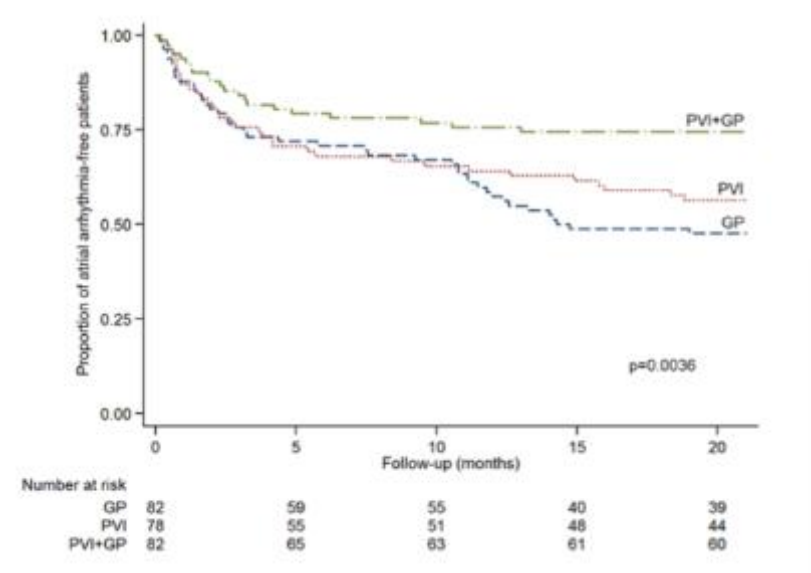
Atrioezofageální píštěl

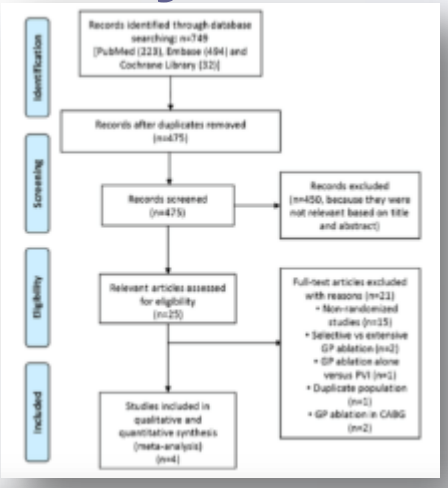
- AE píštěl u kryoablace (1 na 10 000 výkonů)
- častěji paréza freniku, která je přechodná
- Perzistující paréza při kryoablaci 1,41% (vzorek 7433 procedur z Holandska 2016-17)

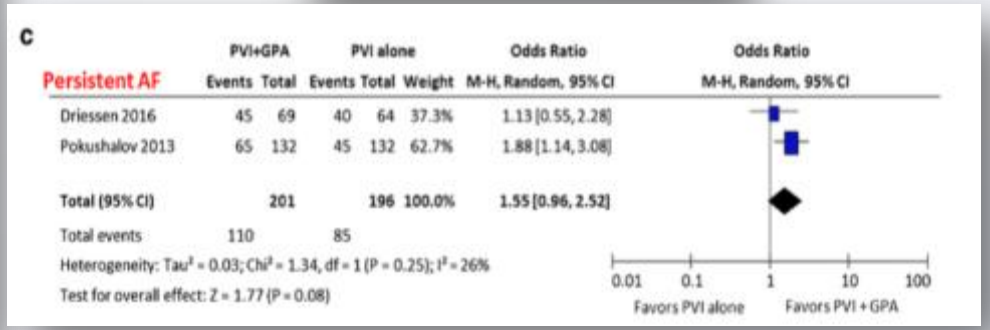
John RM, et al. Heart Rhythm 2017;14:184–189)
Mol D, et al. J Cardiovasc Electrophysiol 2022;33(3):559-564

Některé studie prokázaly zlepšení výsledků při ablaci autonomních plexů

- 242 pts, symptomatic paroxysmal AF
- Randomisaton: PVI, anatomic GP ablation, PVI plus anatomic GP ablation



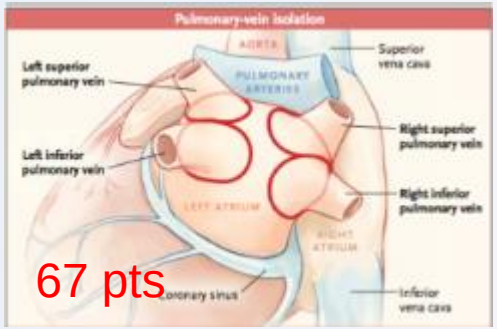


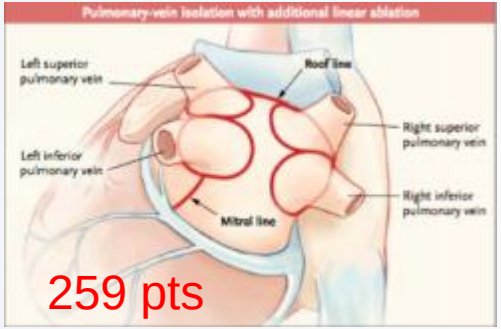


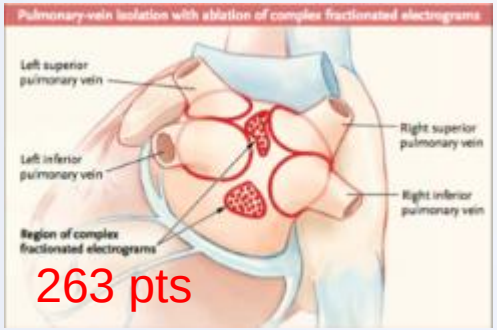
Kampaktsis PM, et al. JICE DOI 10.1007/s10840-017-0285-z

Katritsis D, et al. JACC 2013;62:2318–25

Mnoho ablačních strategií bylo testováno..

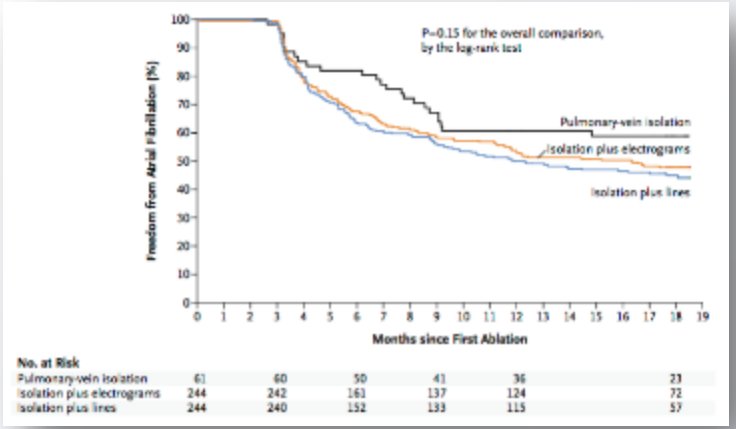






589 pts, 2010-2012
Vysoká zátěž FS (80-83 hod/měs)
Perzistence vice jak 6 měsíců (72-78 %)

Přežití bez FS



Verma A, et al. N Engl J Med 2015;372:1812-22

Dosud jsme nevěděli, zda jde o špatný koncept nebo o nedokonalost technologií provést to, co mělo být provedeno…

Nyní se doba mění…

- A disruptive technology – pulse field ablation (PFA)
- Historical excursion
- Two concepts of AF ablation (with PFA)

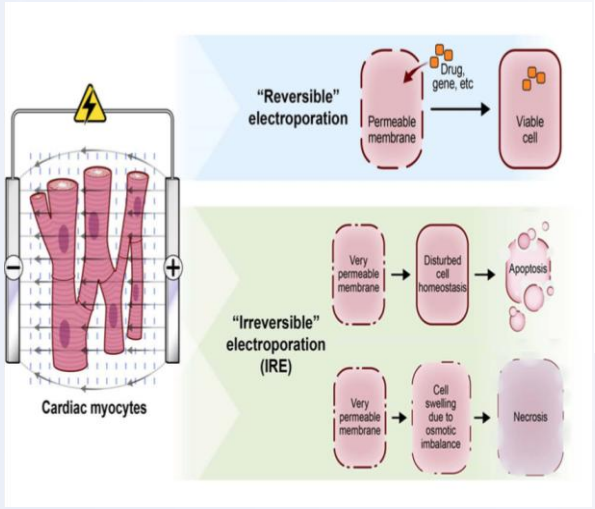
What Is Disruptive Technology?
Disruptive technology is an innovation that significantly alters the way that consumers, industries, or businesses operate.

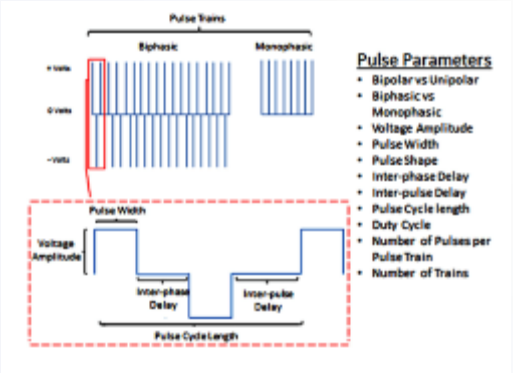
A disruptive technology sweeps away the systems or habits it replaces.

https://www.investopedia.com/terms/d/disruptive-technology.asp

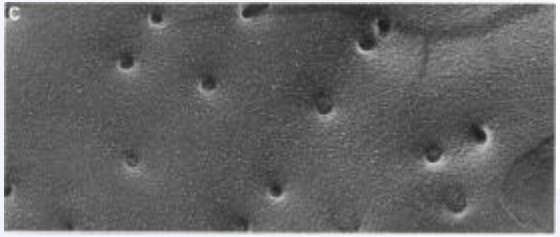
Ablace pomocí pulzního elektrického pole (PEFA nebo PFA)

- Elektroporace… ultrakrátké pulzy stejnosměrného proudu vedoucí k destabilizaci buněčných membrán (póry)



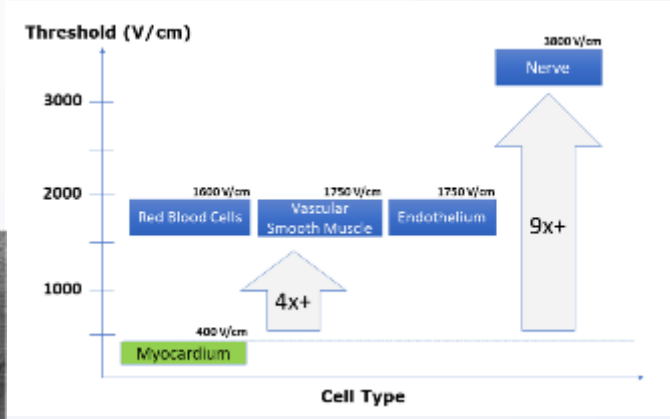


Bradley CJ, Haines DE. JCE 2020



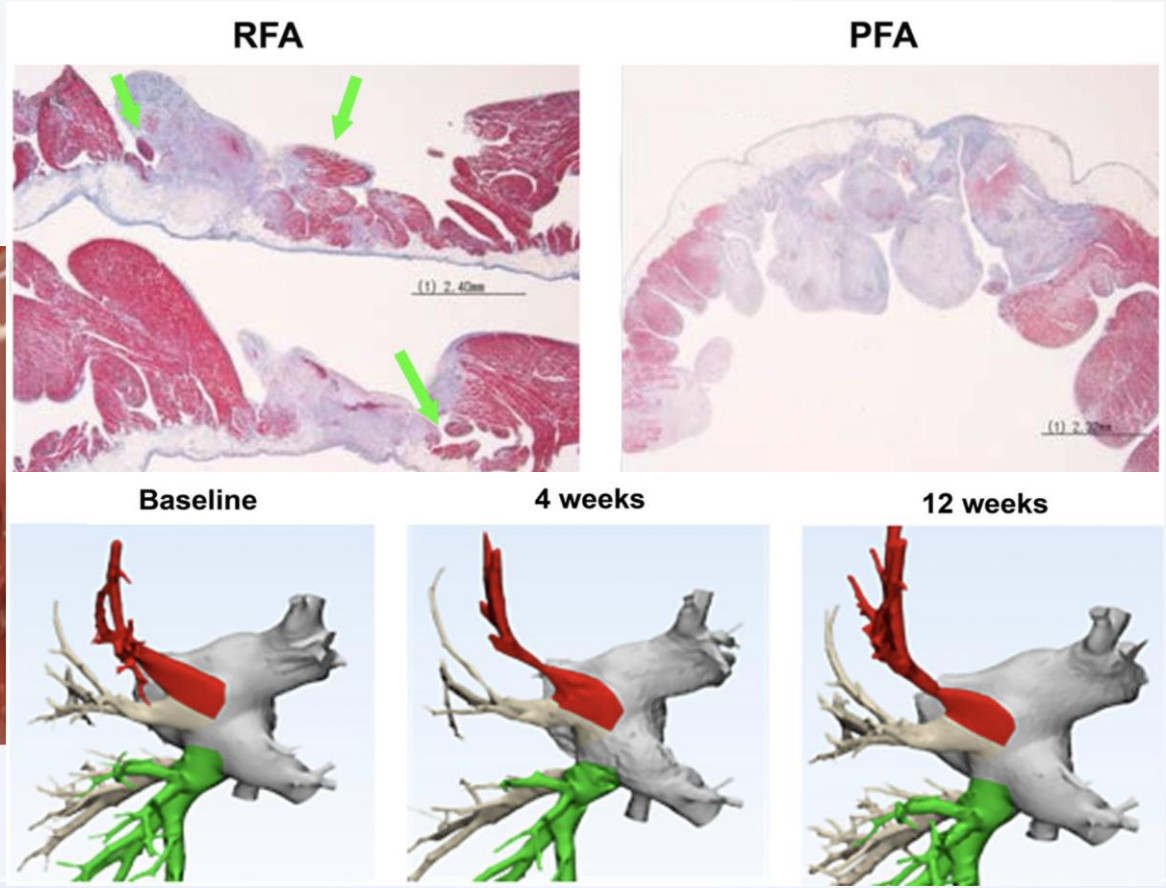
Chang DC Reese TS. Biophys J 1990;58:1-12,

Vysoká senzitivita kardiomyocytů – PFA je ničí selektivním způsobem bez poškození okolí



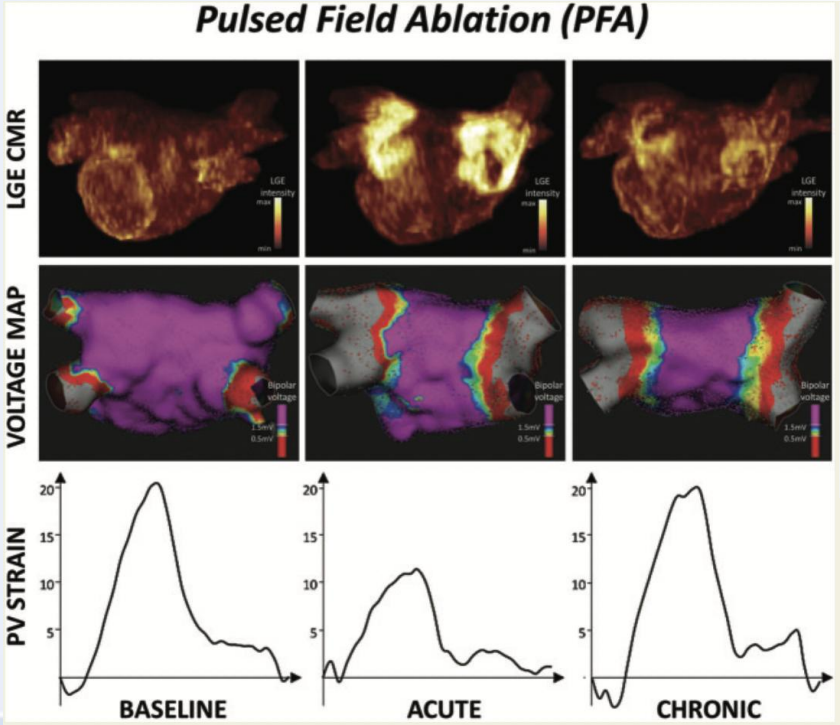
Reddy VY, et al. J Am Coll Cardiol 2019;74:315–26.

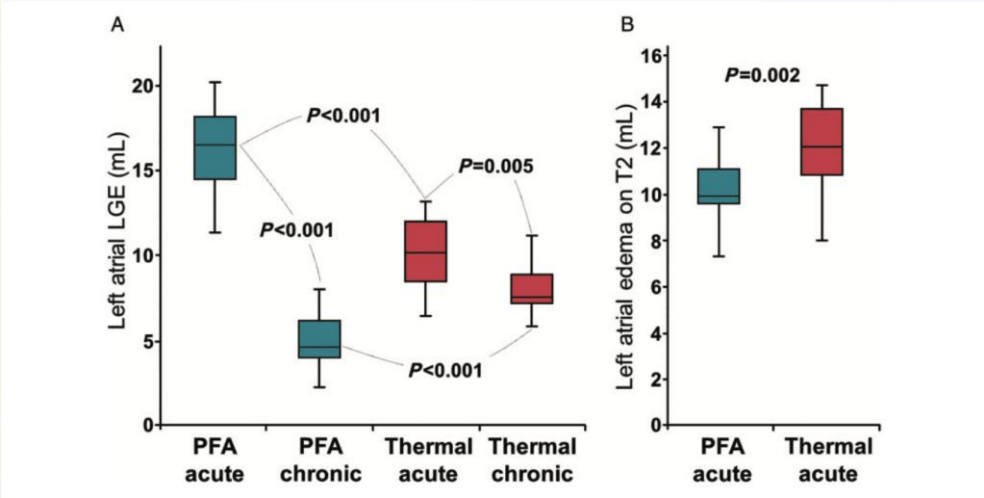
Tkáňový efekt PFA vs RFA



Bradley CJ, Haines DE. JCE 2020

PFA zabraňuje vzniku chronické fibrózy a restriktivních změn





Množství LGE po PFA vs RFA

41 PAF pts, 18 PFA, 16 RFA, 7 cryo

Nakatani Y, et al. Europace (2021) 23, 1767–1776

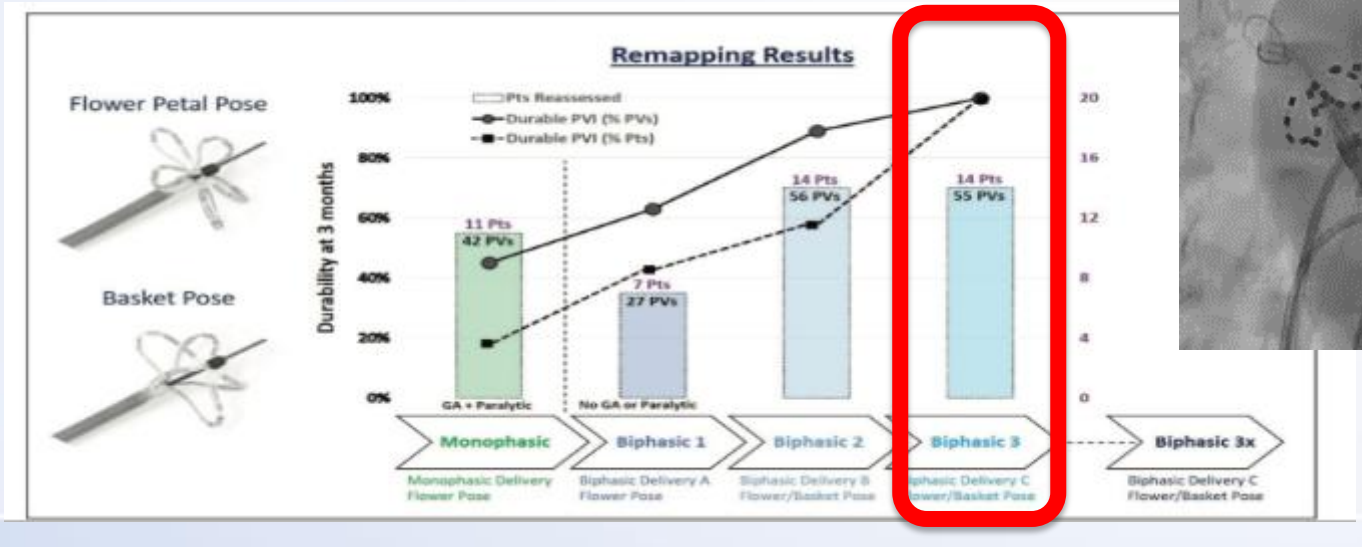
PFA „single-shot“ katetr

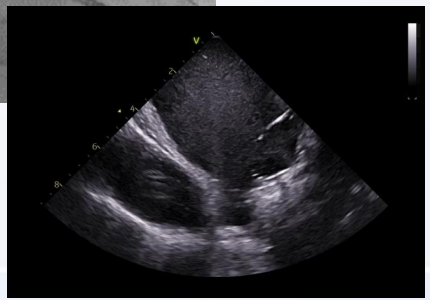
- 81 PAF, monofazická (n=15) → bifazická konfigurace (n=66)
- Čas výkonu 92±27min (vč. 20min na remapování)
- Posledních 14pts 100% trvalá izolace po 3 měsících
- Žádné léze na MRI 13pts, bez stenoz PŽ, bez poranění jícnu (endoskop+MRI)
- 6 a 12 měs absence FS u 90% a 87% případů

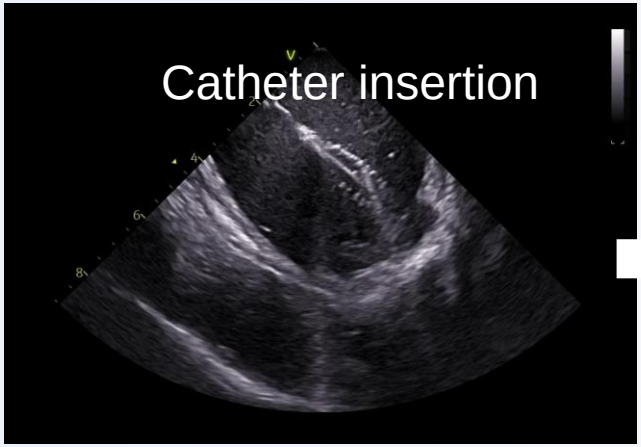
Pulsed Field Ablation for Pulmonary Vein Isolation in Atrial Fibrillation

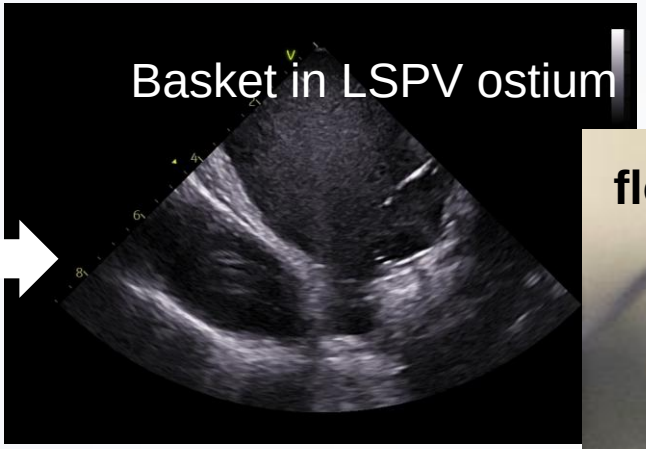
Vivek Y. Reddy, MD,[a,b] Petr Neuzil, MD, PhD,[a] Jacob S. Koruth, MD,[b] Jan Petru, MD,[a] Moritoshi Funasako, MD,[a] Hubert Cochet, MD,[c] Lucie Sediva, MD,[a] Milan Chovanec, MD,[a] Srinivas R. Dukkipati, MD,[b] Pierre Jais, MD[c]

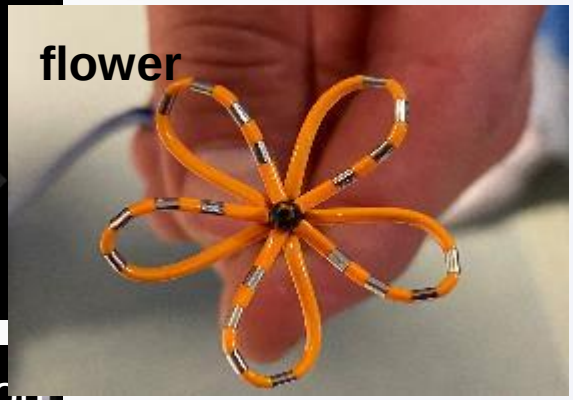
JACC VOL. 74, NO. 3, 2019 JULY 23, 2019:315–26

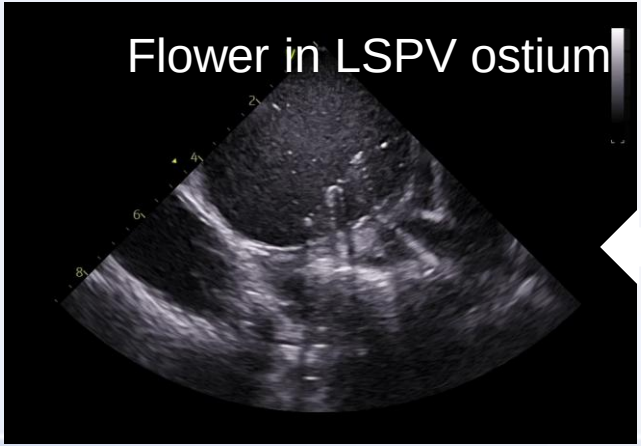


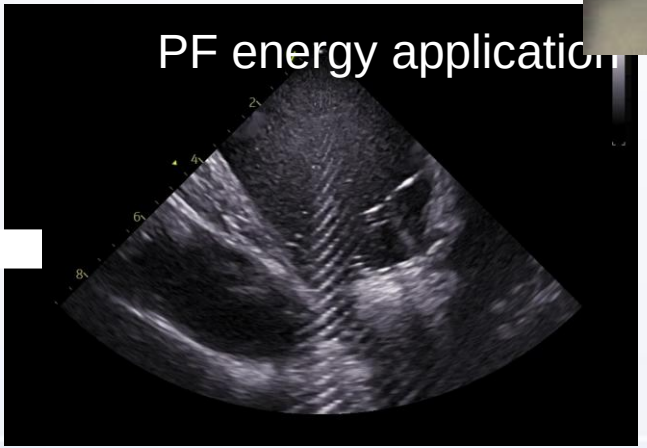



Catheter insertion


Basket in LSPV ostium

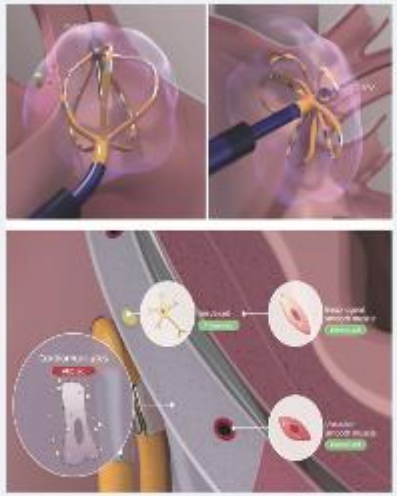

flower


Flower in LSPV ostium


PF energy application

Jednoroční výsledky single-shot PFA

PFA Catheter & Mechanism of Ablation



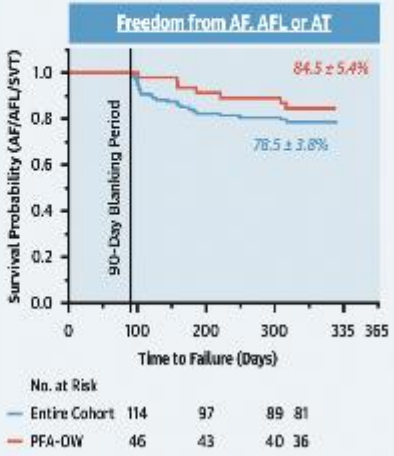
Safety

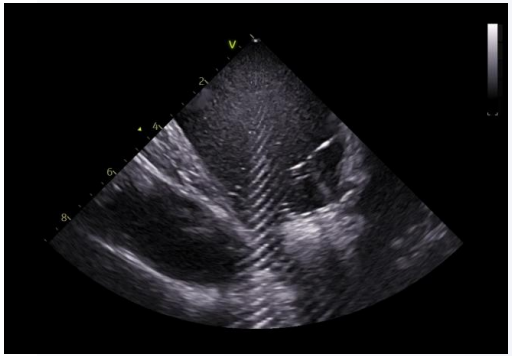
• *Esophageal Damage*	*0%*
◦ *Esophageal Dysmotility*	*0%*
◦ *Atrioesophageal Fistula*	*0%*
• *Pulmonary Vein Stenosis*	*0%*
• *Phrenic Nerve Injury*	*0%*
• *Stroke*	*0%*
◦ *Transient Ischemic Attack*	*0.9%*
• *Pericardial Effusion*	*0.8%*
• *Vascular injury*	*1.7%*
• *Death*	*0%*

Efficacy

Durability of PV Isolation (Invasive Remapping)

PFA Waveform	Per PV Basis		Per Pt Basis	
	No.%	Durable	No.%	Durable
All	429	84.8%	110	64.5%
PFA-OW	173	96.0%	44	84.1%





3 multicentre studies
IMPULSE (Iowa)
PEFCAT (Farapulse)
PEFCAT II (Farapulse)

Reddy, V.Y. et al. J Am Coll Cardiol EP. 2021;7(5):614–27.

TABLE 3 Primary and Secondary Endpoints (N = 25)

Primary feasibility endpoint (n = 25)	
Acute PV isolation	96/96 (100)
Secondary feasibility endpoints (n = 25)	
Chronic PV isolation (n = 22)	82/85 (96)
Chronic LAPW isolation (n = 22)	
Full cohort (n = 22)	21/22 (95)*
Treated using pentaspline catheter only (n = 21)	21/21 (100)*
Acute CTI block (n = 13)	13/13 (100)
Chronic CTI block (n = 12)	9/12 (75)
Primary safety endpoints	
Early onset (within 30 days of index procedure)	
Death	0/25 (0)
Myocardial infarction	0/25 (0)
Diaphragmatic paralysis	0/25 (0)
Stroke or TIA	0/25 (0)
Peripheral or organ thromboembolism	0/25 (0)
Cardiac tamponade/perforation	1/25 (4)†
Vascular access complications	0/25 (0)
Hospitalization (initial or prolonged)	0/25 (0)
Heart block	0/25 (0)
Pericarditis	0/25 (0)
Late onset (any time during follow-up)	
PV stenosis (>70% from baseline)	0/25 (0)
Atrioesophageal fistula	0/25 (0)

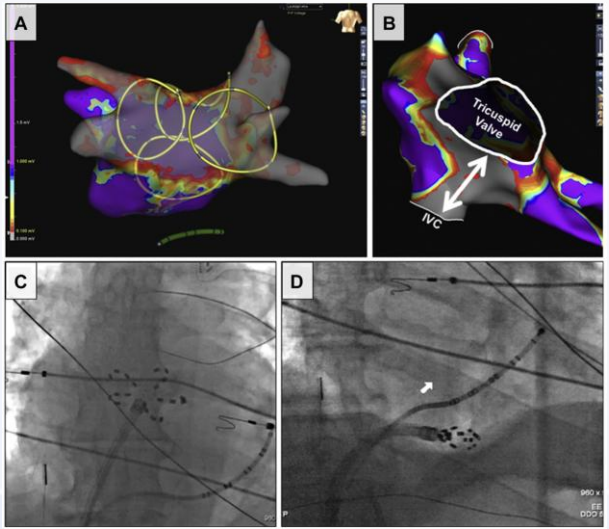
Values are n/N (%). *The lone reconnected LAPW was in the first patient receiving linear PFA using the initial Focal-1 dose. In patients undergoing posterior wall ablation with the pentaspline PFA catheter, all LAPWs remained durably ablated. †Pericardial effusion without tamponade occurred during remapping using radiofrequency only; clinical events committee adjudication pending.

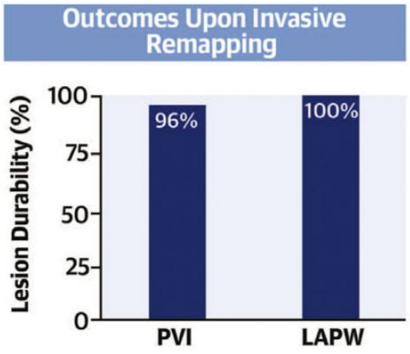
Abbreviations as in Tables 1 and 2.

JOURNAL OF THE AMERICAN COLLEGE OF CARDIOLOGY VOL. 76, NO. 9, 2020

Pulsed Field Ablation in Patients With Persistent Atrial Fibrillation

Vivek Y. Reddy, MD,[a,b] Ante Anic, MD,[c] Jacob Koruth, MD,[b] Jan Petru, MD,[a] Moritoshi Funasako, MD,[a] Kentaro Minami, MD,[a] Toni Breskovic, MD, PHD,[c] Ivan Sikiric, MD,[c] Srinivas R. Dukkipati, MD,[b] Iwanari Kawamura, MD,[b] Petr Neuzil, MD, PHD[a]





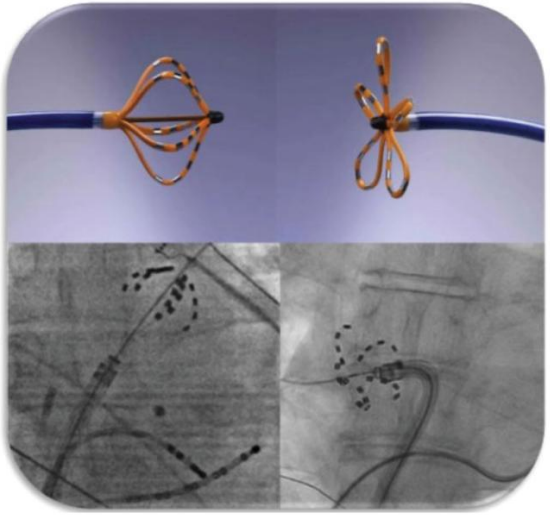
INSTITUT KLINICKÉ A EXPERIMENTÁLNÍ MEDICÍNY
KLINIKA KARDIOLOGIE
IKEM

Real-life data (MANIFEST PF Survey)

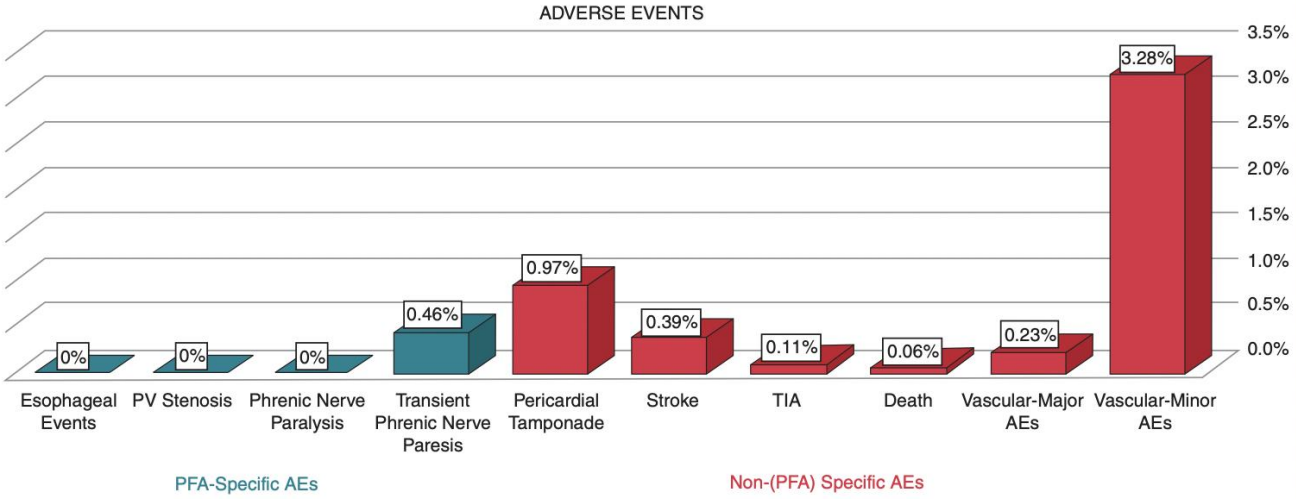
MANIFEST-PF Survey

Real-World Outcomes of PFA for AF

- 24 centers in Europe
- 90 Operators
- 1,758 Patients
- 99.9% Acute PVI Success Rate



Clinical Site Characteristics	N (24)
Practice type	
Academic (%)	70.8
Semi-academic (%)	8.3
Private (%)	20.8
No. of operators, mean (min–max)	3.8 (2–11)
Years in practice, mean (min–max)	13.2 (5.3–22.5)
Annual no. of AF ablations, mean (min–max)	704 (300–2200)
No. of PFA cases in past year, mean (min–max)	73.3 (7–291)
Date of first PFA case, month/year (earliest–latest)	7/2021 (3/2021–12/2021)



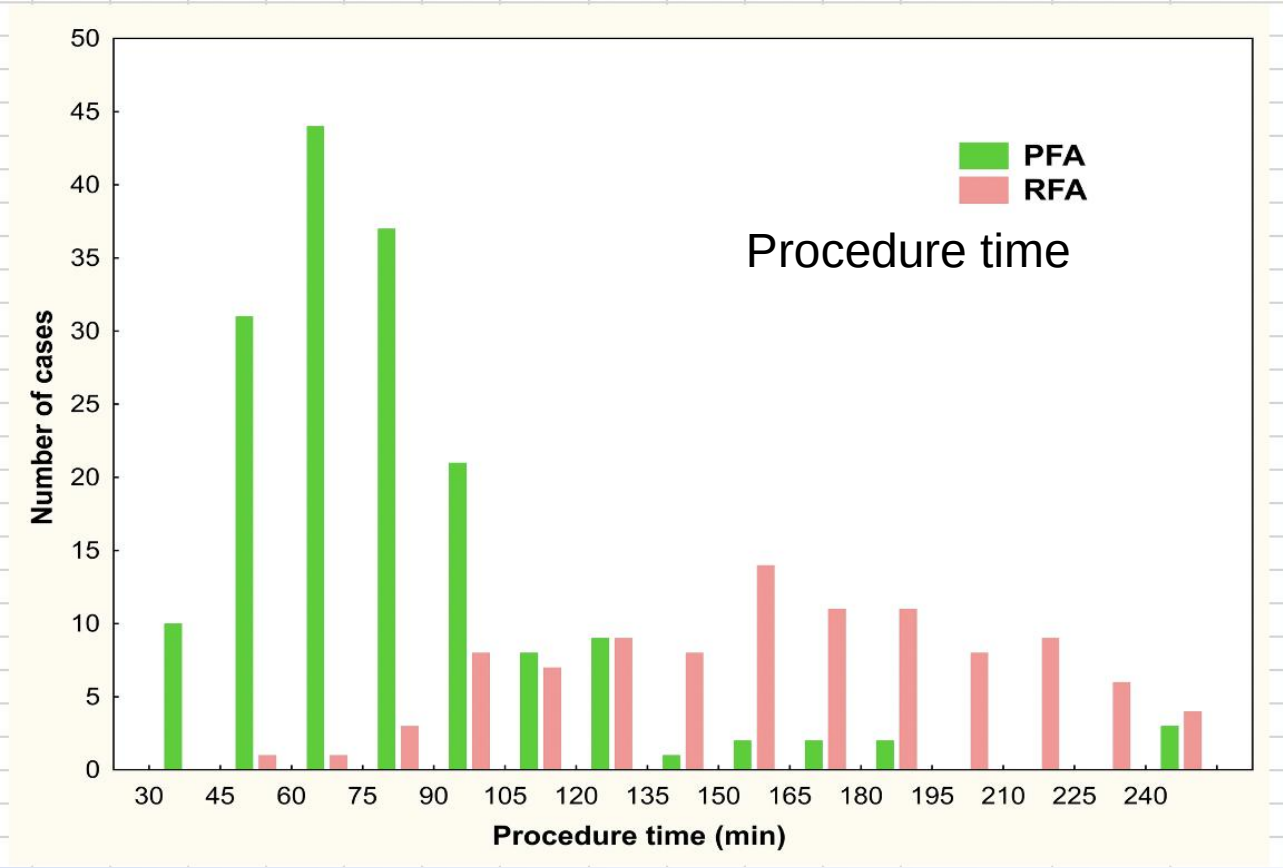
Ekanem E, et al.
Europace. 2022 Jun 1:euac050.

A EXPERIMENTÁLNÍ MEDICÍNY
KARDIOLOGIE
IKEM

Naše letošní zkušenost (1-7/2022)

	PFA (170)		RFA (100)		
Parameter	Mean	SD	Mean	SD	p<
Age (y)	65	9	64	10	0.71
Procedure time (min)	84	38	165	46	0.00001
Fluoro time (min)	10	5	6	3	0.00001
Rad. Dose (Gy.cm^2)	1.5	1.7	1.3	2.3	0.005
Persistent AF	49%		28%		0.0007
Re-do	19%		24%		0.37
Posterior wall	53%		9%		0.00001
Anterior wall	4%		19%		0.00002
Mi isthmus	9%		3%		0.06
CTI	25%		40%		0.01

PFA vs RFA



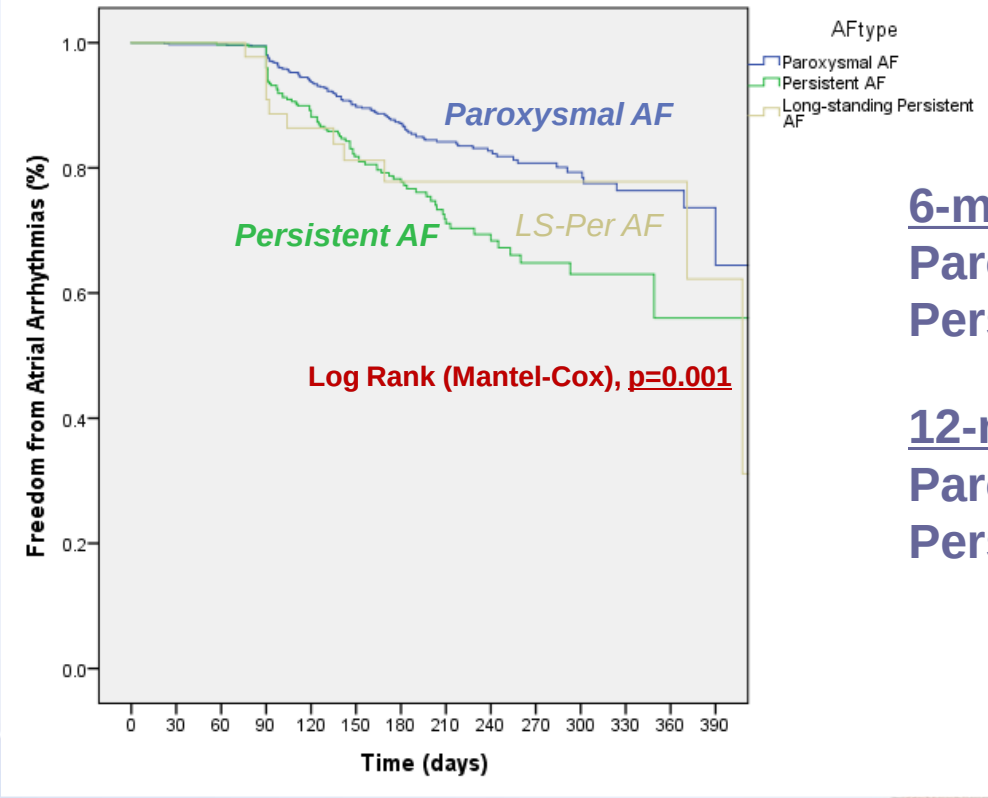
270 pts dohromady

Žádná embolická příhoda

1 hemoperikard s drenáží u případu kombinované ablace PFA a RFA

MANIFEST-PF: Efficacy

K-M Analysis of Freedom from AF/AFL: By AF Subtype



6-month Estimate

Paroxysmal AF: 86.6%

Persistent AF: 79.6%

12-month Estimate

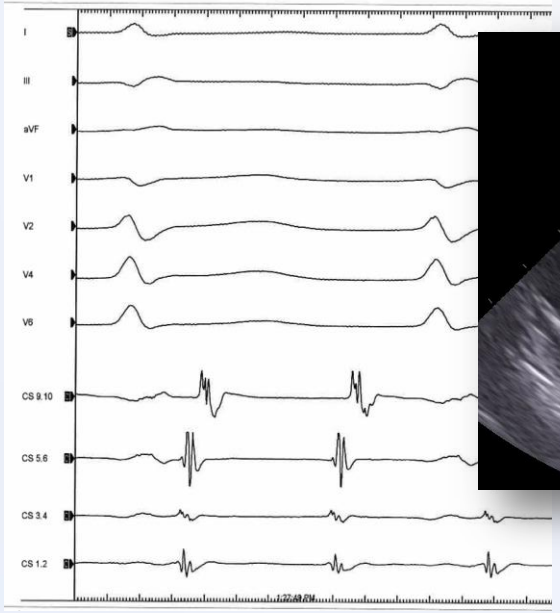
Paroxysmal AF: 73.4%

Persistent AF: 58.2%

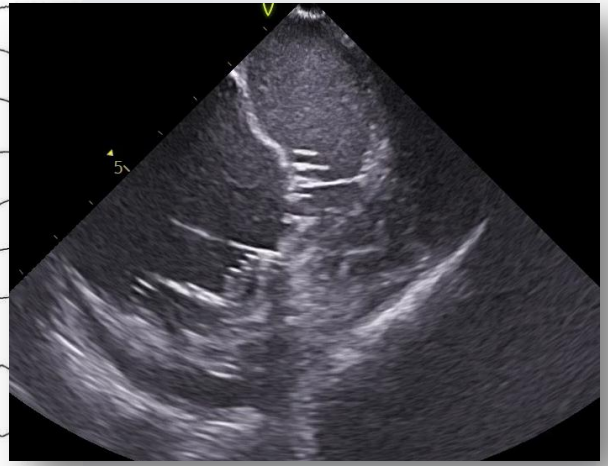
Turagam MK, et al. ESC 2022

S tímto katetrem lze provést i komplexní ablaci

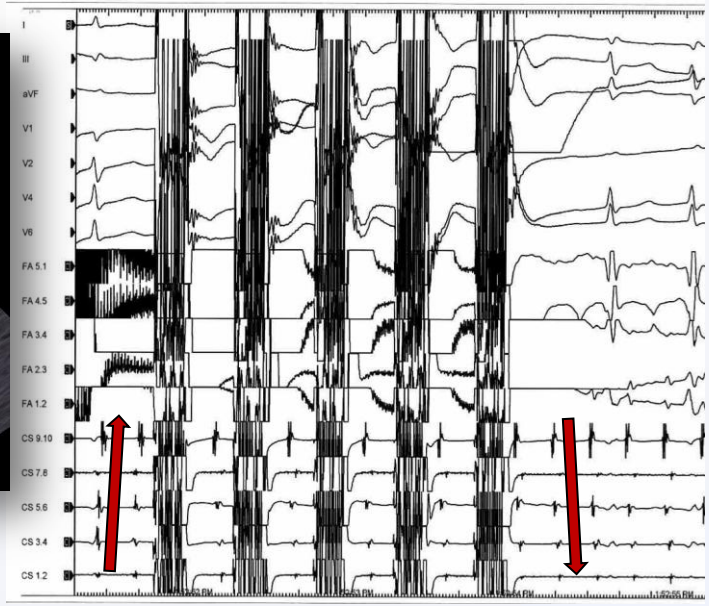
- 70letý pacient, PVI + CTI před 6 lety
- Re-do ablace s PFA



Perimitrální flutter

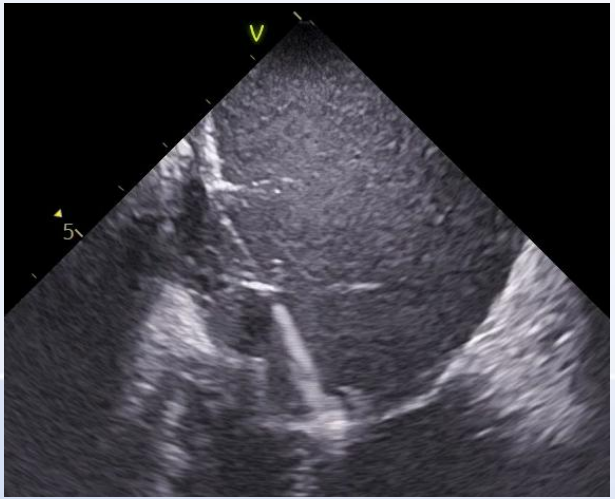


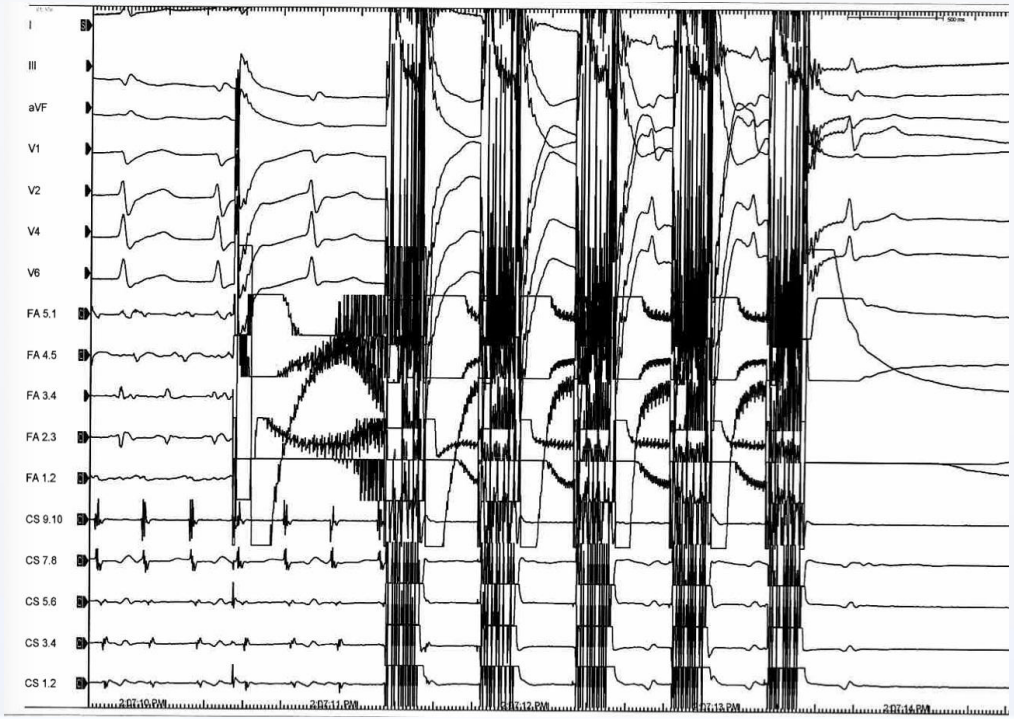
PFA na mi isthmu



Změna aktivace (na typický flutter)

Ablace na CTI laterálně





Potvrzení bloku na mi isthmu (stim ouška)

80 min čas skin-to-skin, skia 7.2 min, rad. dávka 3 Gy.cm^2

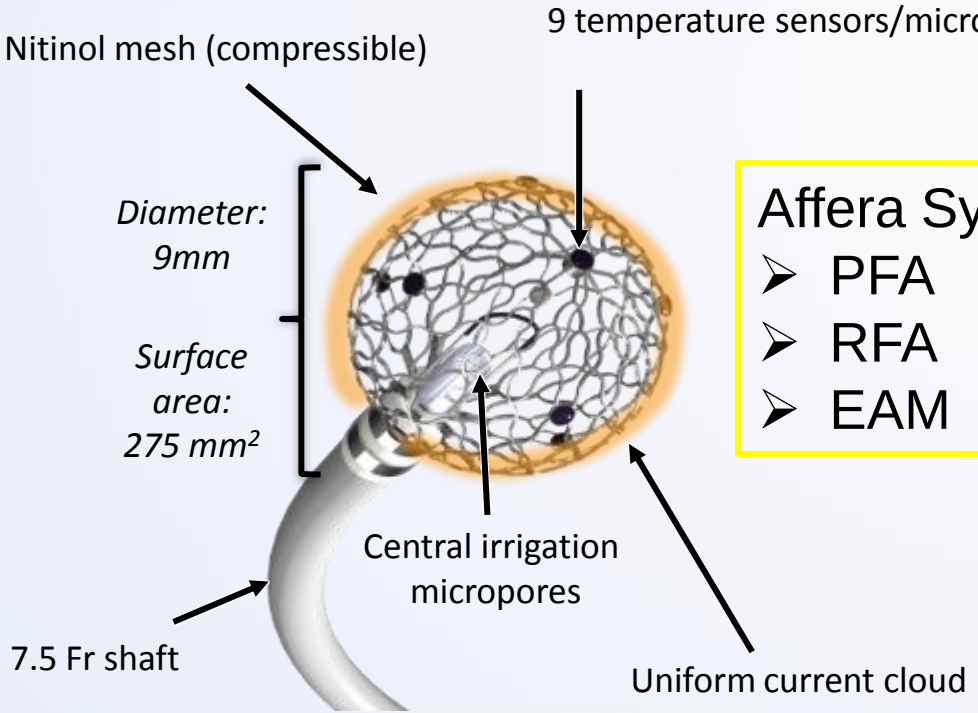
Vize …

- Trvání výkonu do 1 hodiny
- Nízké riziko komplikací – propuštění stejný den odpoledne
- Prakticky každý, kdo umí udělat bezpečně transseptální punkci a manipulovat s katetrem a vodičem může tuto ablaci udělat …

Koncept sofistikovaného mapovacího a ablačního systému pro lineární léze (k replikaci procedury Maze)

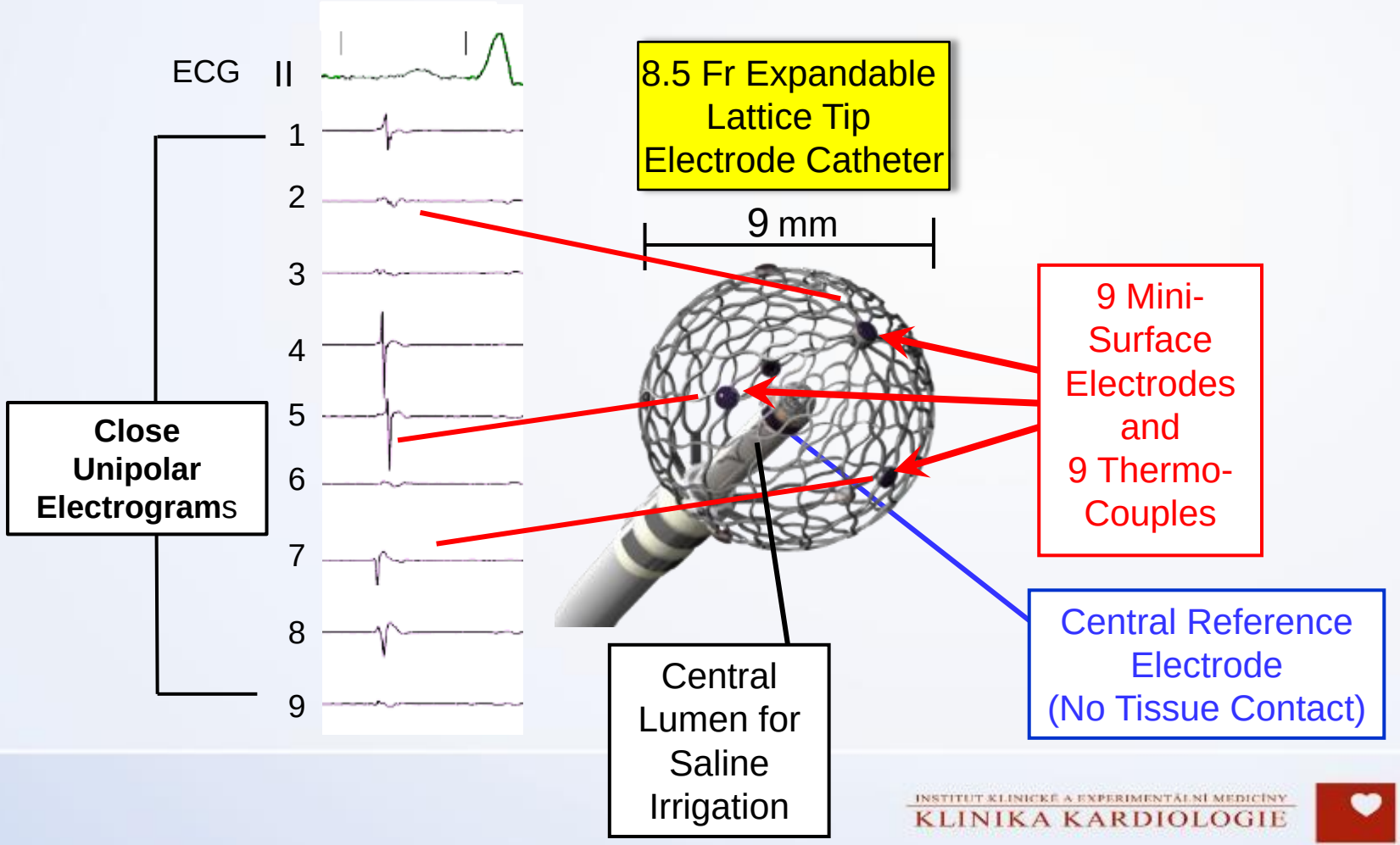
AFFERA mapping and ablation system

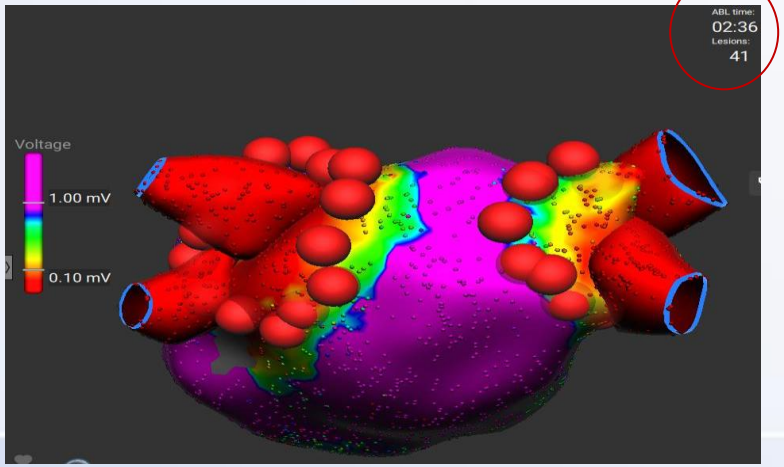
Affera, Inc., Watertown, MA, získal Medtronic



Affera System:

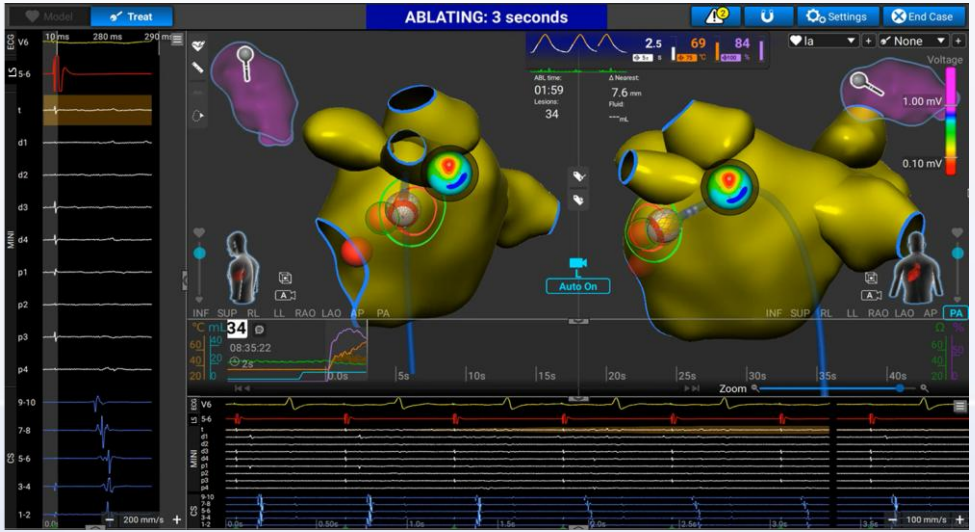
- PFA
- RFA
- EAM

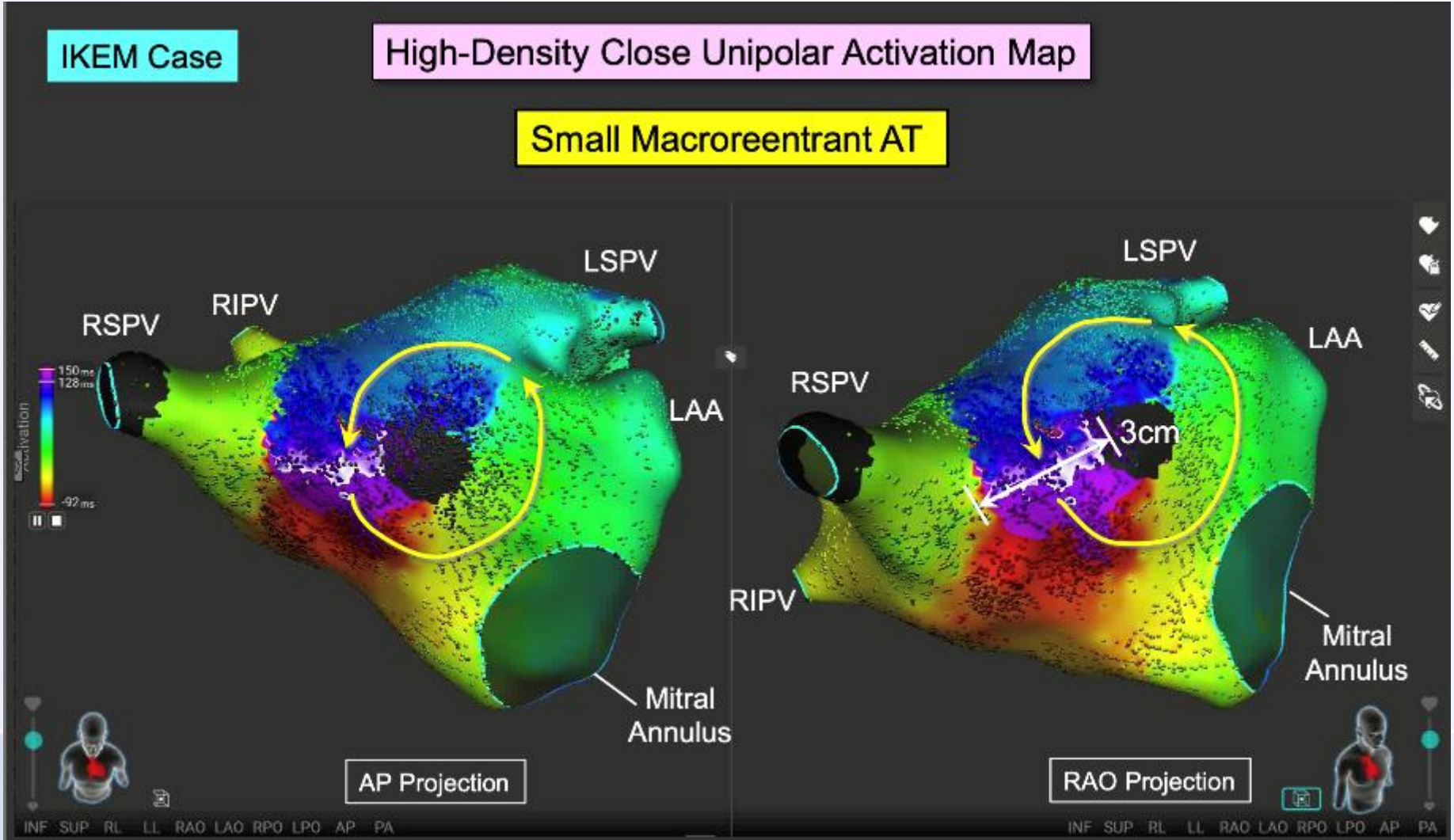

ECG II
1
2
3
4
5
6
7
8
9
Close Unipolar Electrograms
8.5 Fr Expandable Lattice Tip Electrode Catheter
9 mm
9 Mini-Surface Electrodes and 9 Thermo-Couples
Central Reference Electrode (No Tissue Contact)
Central Lumen for Saline Irrigation



První zkušenosti IKEM s RF s vysokou energií (2018)

- 8pts (67±7let) s FS/flutterem
- Průměr 38±7aplikací (3-5sec) pro IPŽ
- 4.5±1.7 aplikací (5sec) pro lineární léze
- Celková anestezie
- **Žádné**




IKEM Case
High-Density Close Unipolar Activation Map
Small Macroreentrant AT
RSPV
RIPV
LSPV
LAA
Mitral Annulus
AP Projection
RSPV
LSPV
LAA
3cm
RIPV
Mitral Annulus
RAO Projection
INF SUP RL LL RAO LAO RPO LPO AP PA
INF SUP RL LL RAO LAO RPO LPO AP PA

První zkušenosti s (HPSD RF) a mřížkovou elektrodou

JACC: CLINICAL ELECTROPHYSIOLOGY VOL. 6, NO. 5, 2020

ATRIAL FIBRILLATION

A Lattice-Tip Temperature-Controlled Radiofrequency Ablation Catheter for Wide Thermal Lesions

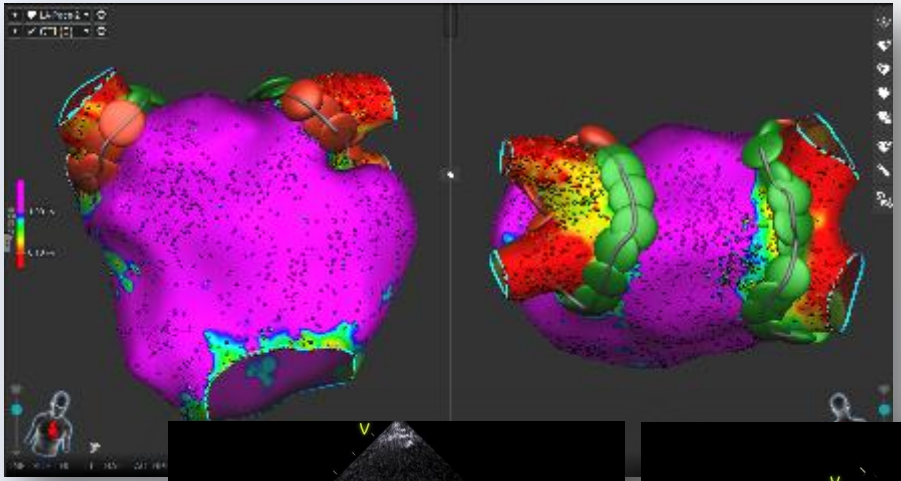
First-in-Human Experience With Atrial Fibrillation

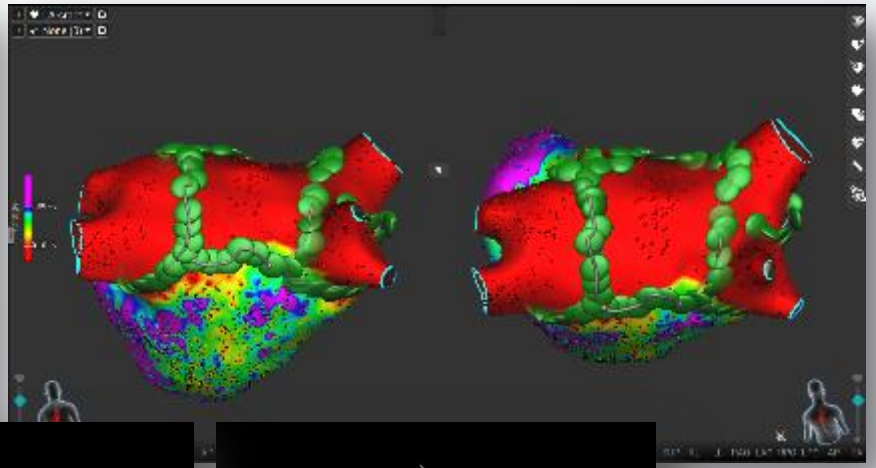
Elad Anter, MD,[a] Petr Neužil, MD, PhD,[b] Gediminas Rackauskas, MD, PhD,[c] Petr Peichl, MD, PhD,[d] Audrius Aidietis, MD, PhD,[c] Josef Kautzner, MD, PhD,[d] Hiroshi Nakagawa, MD, PhD,[e] Warren M. Jackman, MD,[f] Andrea Natale, MD,[g] Vivek Y. Reddy, MD[h,h]

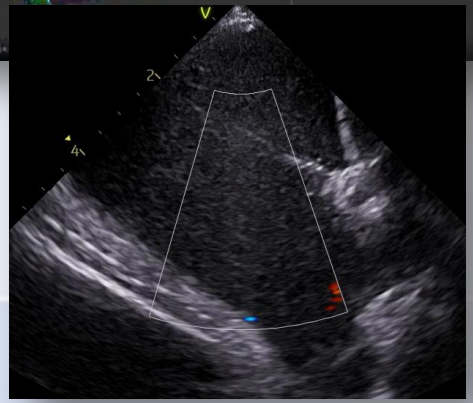
TABLE 2 Procedural Details (N = 71)

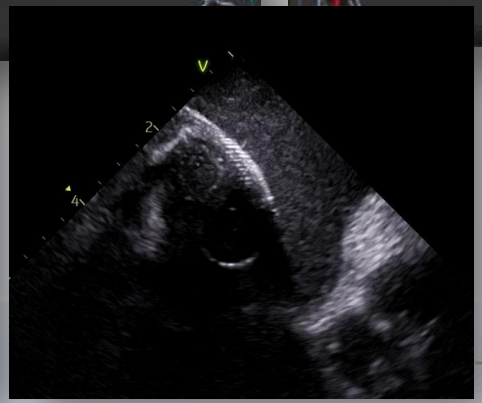
Cavotricuspid isthmus line	
Successful linear lesion	48/48 (100)
Success using lattice catheter only	48/48 (100)
Number of RF applications	5.9 ± 3.1
Total RF time, min	0.5 ± 0.24
Transpired ablation time, min*	2.3 ± 1.6
Fluoroscopy time, min†	4.8 ± 2.2
Pulmonary vein isolation	
Successful lesion set	130/130 (100)
Success using lattice catheter only	129/130 (99.2)
Number of RF applications	39.5 ± 8.9
Total RF time, min	2.7 ± 0.70
Transpired ablation time, min*	21.8 ± 12.1
Total left atrial dwell time, min‡	43.0 ± 18.4
Fluoroscopy time, min§	7.0 ± 6.7
Mitral isthmus line	
Successful linear lesion	22/22 (100)
Success using lattice catheter only	21/22 (95.5)
Number of RF applications	11.5 ± 10.7
Total RF time, min	1.0 ± 0.92
Transpired ablation time, min	5.8 ± 6.4
Roof line	
Successful linear lesion	23/24 (95.8)
Success using lattice catheter only	23/24 (95.8)
Number of RF applications	4.9 ± 1.9
Total RF time, min	0.4 ± 0.16
Transpired ablation time, min	3.0 ± 4.4

Dnes, systém dovoluje přepnutí mezi RF a PF a kombinovaný výkon





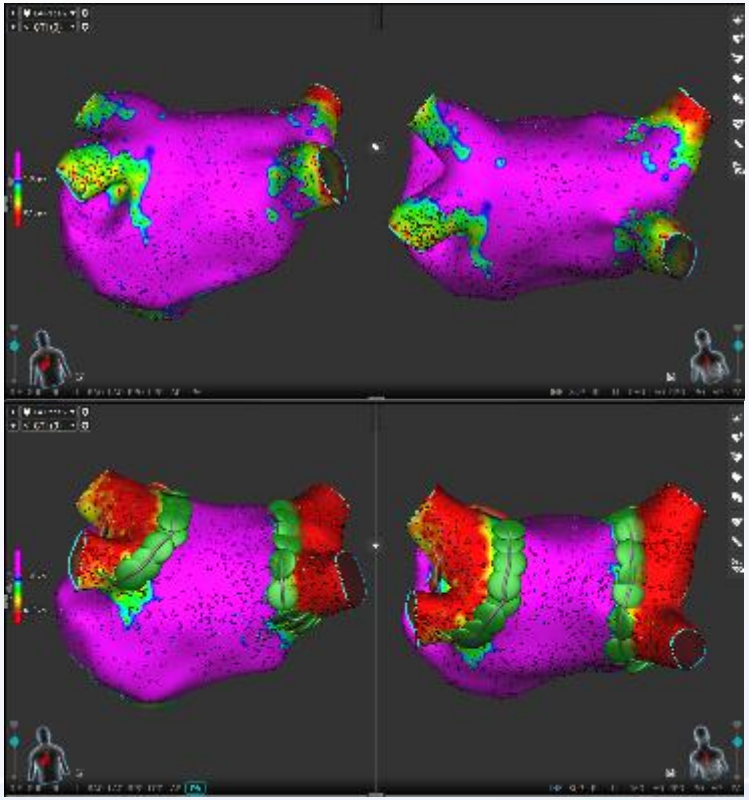




Naše zkušenosti s Affera

Sphere 9	Total	RF/PF PVI +	PF only PVI +
TOTAL	44	8	36
CTI	29	6	23
MI	14	1	13
ROOF	34	5	29
Posterior Inferior Line	18	1	17
Anterior ablation	9	0	9

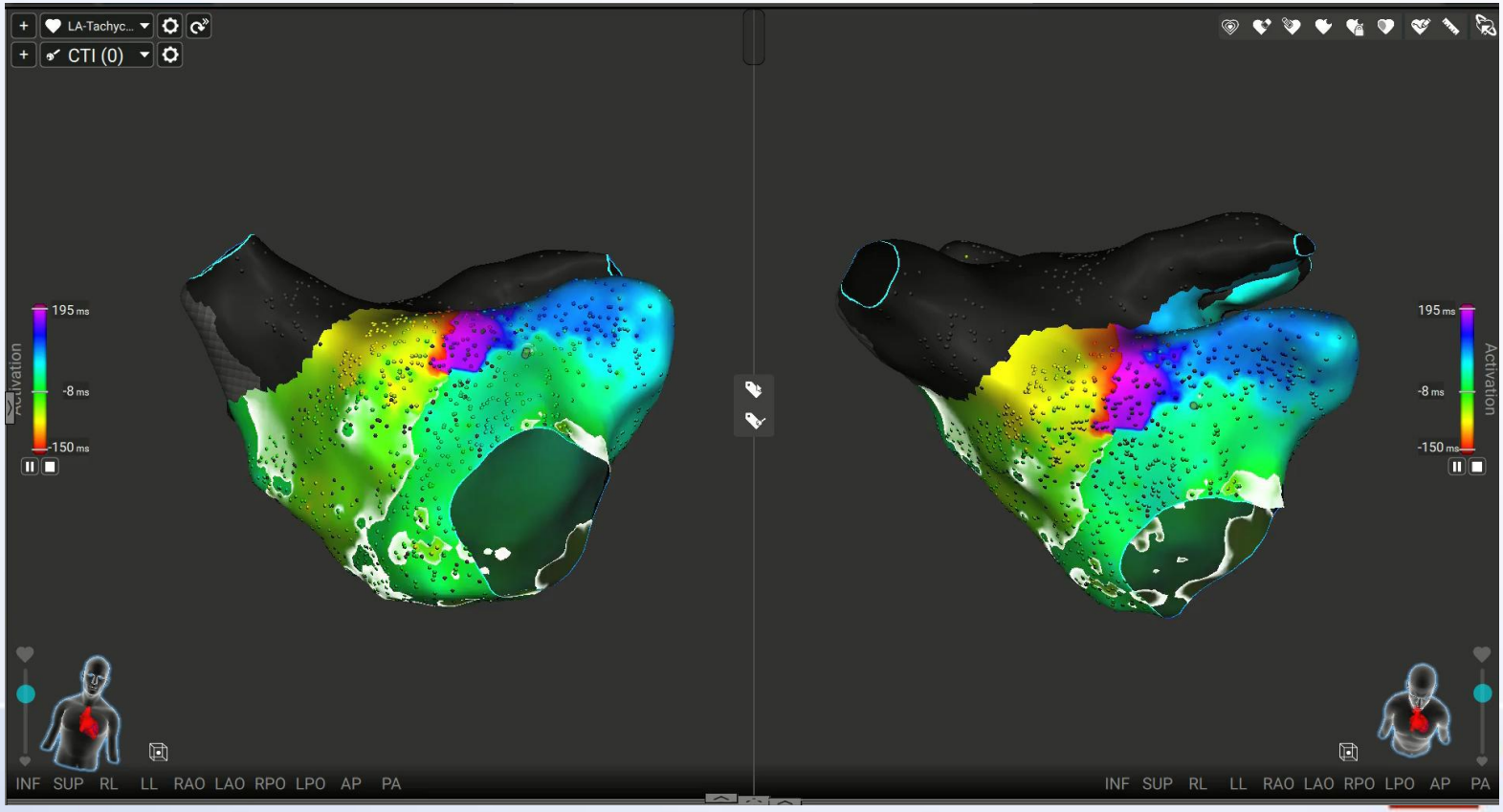
Sphere PVI	PF PVI
TOTAL	11

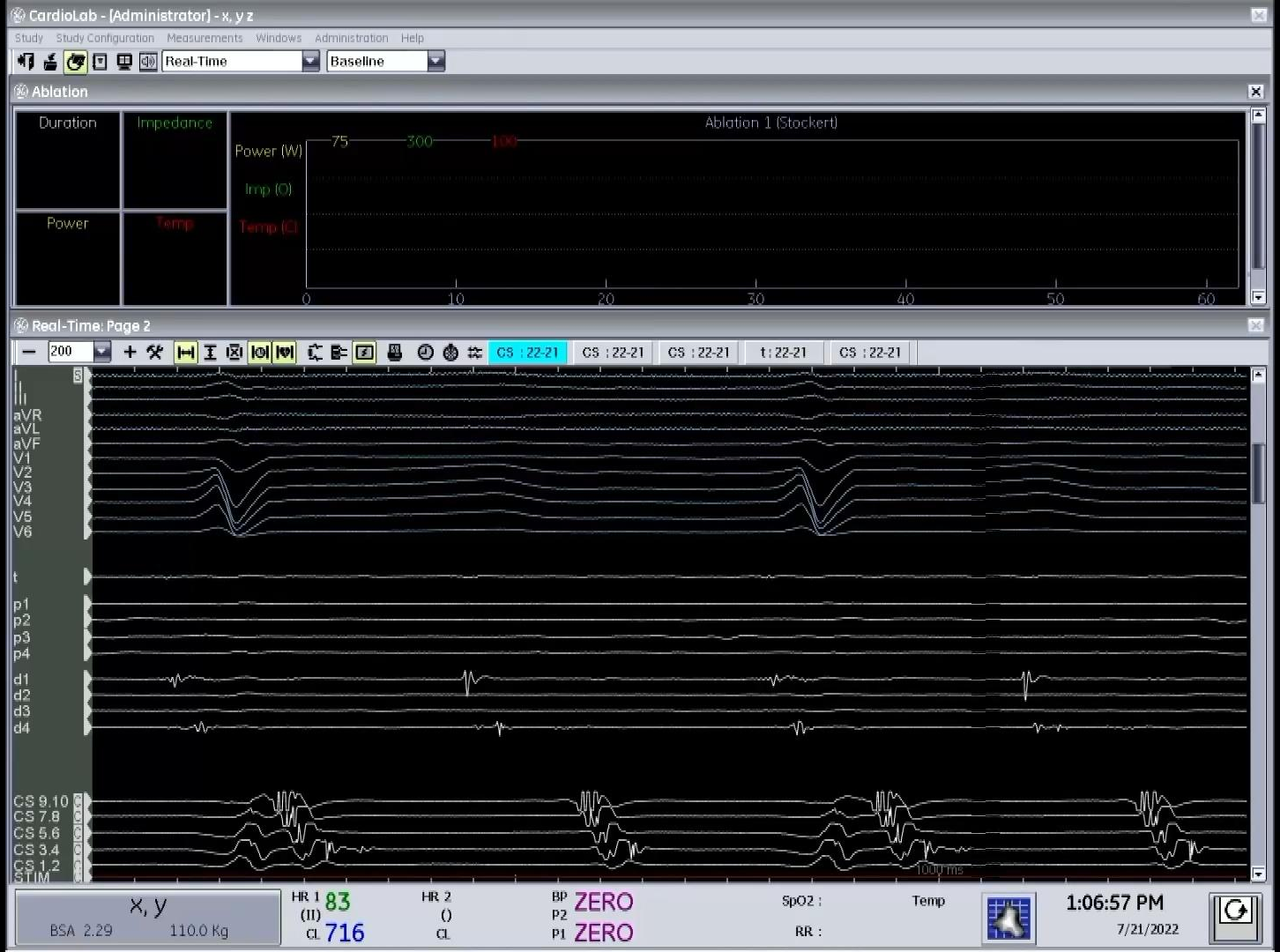


Ilustrativní případ

- 69letý muž, BMI 34, persistující FS
- Ablace v rámci randomizované studie, celeková anestezie
- Mapa LS, izolace PŽ a zadní stěny, indukce typického flutteru, přechod do LS flutteru při entrainmentu
- Aktivační mapa LS, ablace flutteru v LS a nakonex linie na CTI, neindukovatelnost
- Trvání výkonu 150 min, skia 3.3 min, rad dávka 0.38 Gy.cm^2

Fast mapping of left-sided flutter




CardioLab - [Administrator] - x, y z
Study
Study Configuration
Measurements
Windows
Administration
Help
Real-Time
Baseline
Ablation
Duration
Impedance
Power
Temp
Ablation 1 (Stockert)
Power (W)
75
300
100
Imp (O)
Temp (C)
0
10
20
30
40
50
60
Real-Time: Page 2
200
CS ; 22-21
CS ; 22-21
CS ; 22-21
t ; 22-21
CS ; 22-21
aVR
aVL
aVF
V1
V2
V3
V4
V5
V6
t
p1
p2
p3
p4
d1
d2
d3
d4
CS 9,10
CS 7,8
CS 5,6
CS 3,4
CS 1,2
STIM
100 ms
x, y
BSA 2.29
110.0 Kg
HR 1
(II)
83
CL
716
HR 2
()
CL
BP
ZERO
P2
P1
ZERO
SpO2 :
RR :
Temp
1:06:57 PM
7/21/2022

První zkušenosti u člověka (lattice-tip electrode, RF/PF or PF/PF)

	RF / PF Cohort * (n = 40)	PF / PF Cohort (n = 36)	RF Only † (n = 71)
Fluoroscopy Time, min	5.6 ± 4.1	2.7 ± 2.4	7.0 ± 6.7
Saline Infusion, mL	444 ± 189	452 ± 233	432 ± 147
Energy Application Time, min ‡			
PV Isolation	3.3 ± 1.1	3.2 ± 0.9	2.7 ± 0.7
Mitral Isthmus Line	1.3 ± 0.5	0.9 ± 0.6	1.0 ± 0.9
LA Roof Line	0.3 ± 0.2	0.4 ± 0.2	0.4 ± 0.2
CT Isthmus Line	0.5 ± 0.3	0.5 ± 0.2	0.5 ± 0.2
Transpired Ablation Time, min §			
PV Isolation	23.3 ± 9.5	22.0 ± 6.8	21.8 ± 12.1
Mitral Isthmus Line	7.8 ± 4.3	3.5 ± 1.8	5.8 ± 6.4
LA Roof Line	2.2 ± 3.1	1.4 ± 0.7	3.0 ± 4.4
CT Isthmus Line	2.2 ± 2.2	2.6 ± 2.1	2.3 ± 1.6

Reddy VY, et al. Circ A&E2020 Jun;13(6):e008718

Vize blízké budoucnosti

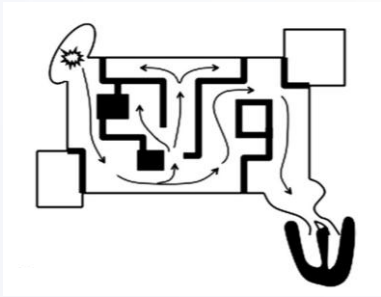
- Trvání výkonu do 1 hodiny
- Nízké riziko postprocedurálních komplikací – ambulantní výkon
- Kdokoliv, kdo provede bezpečně transeptální punkci a je schopen manipulovat vodiči a katetry bude schopen dělat iniciální izolaci plicních žil
- Pro komplexní ablaci bude možno využít sofistikovanějších mapovacích a ablačních systémů

Vize …

- Unverzální mapovací a ablační systémy jako tento dovolí ušít ablaci na míru konkrétnímu pacientovi a nakonec umožní i provedení procedury MAZE
- Katetrizační MAZE by měla maximalizovat účinnost v udržení sinusového rytmu

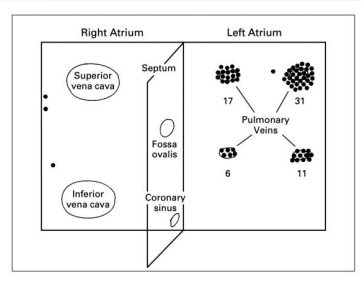
Okruh se uzavírá…

Chirurgická procedura Maze
(časná 90 léta)



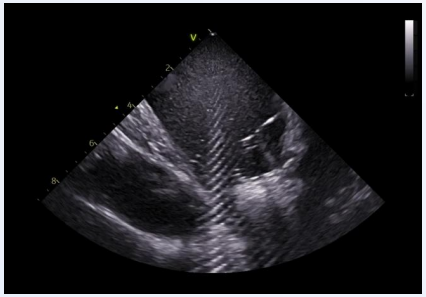
Snaha reprodukovat katetry
(polovina 90tých let)

Objev spouštěčů v PŽ
(konec 90tých let)



Nové techniky a technologie
izolace PŽ

Rozvoj strategií pro
modifikaci substrátu



Nová technologie - PFA

Rychá, bezpečná, účinná metoda
izolace PŽ

Co si odnést domů?

- Katetrizační ablace má největší potenciál k udržení SR
- ČR je v počtu ablací na milion obyvatel na jednom z předních míst na světě
- Situace se ještě dál zlepší - PFA je nová netermální technologie katetrizační ablace, která je vysoce selektivní
- Rozšíření PFA má potenciál učinit katetrizační ablaci účinnější, bezpečnější a rychlejší (a tím zlepšit časnou kontrolu rytmu u mnohem většího počtu nemocných)

PRAGUE RHYTHM

25th

PRAGUE RHYTHM

With live demonstrations
(Novel Technology Forum)

MARCH 19 - 21, 2023,
Prague, Czech Republic