

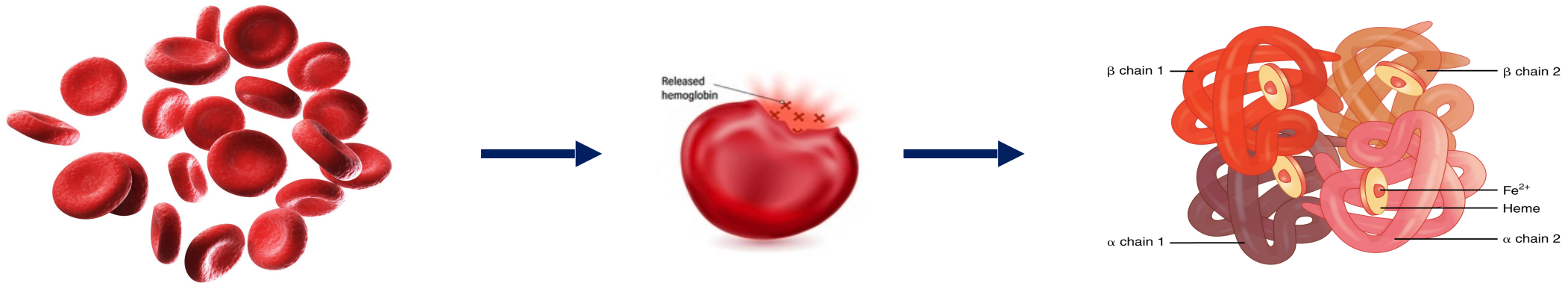
SICUREZZA E OTTIMIZZAZIONE DELLE PROCEDURE D'ABLAZIONE DELLA FA

Emolisi durante le procedure di PFA: è un problema reale?

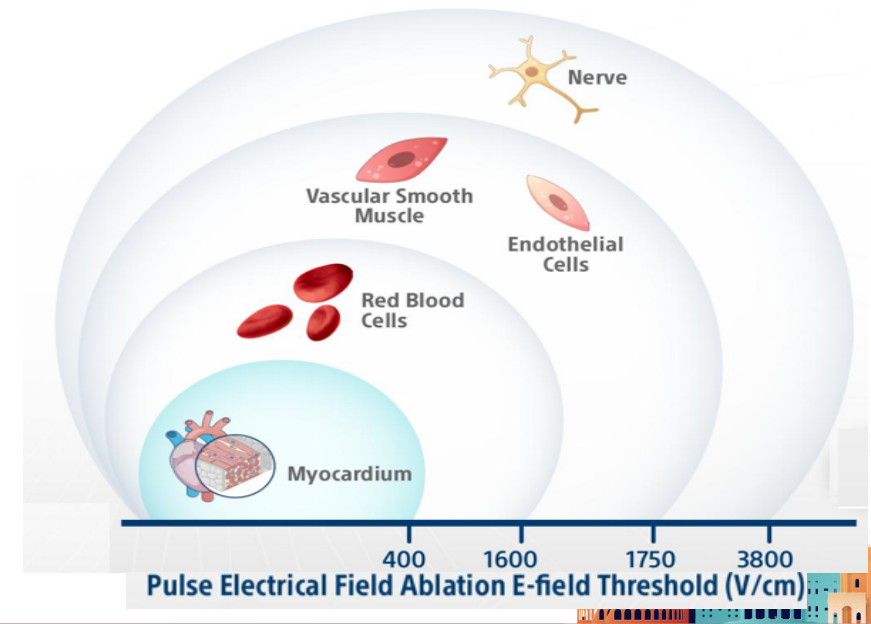
Strategie per minimizzare l'esposizione

Solimene Francesco - Schillaci Vincenzo



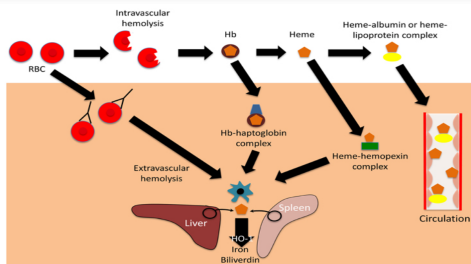


Hemolysis is the rupture or breakdown of red blood cells (RBCs) with subsequent release of hemoglobin. Hemoglobin is the red pigment in blood that transports oxygen and carbon dioxide. It is made up of four polypeptide chains, each having a heme group with iron attached to it.

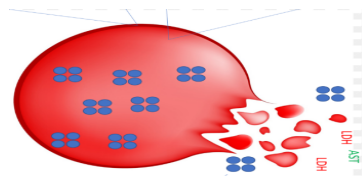


MARKER INDIRETTI

APTOGLOBINA

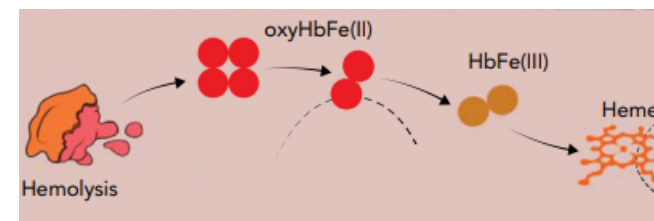


LDH, BILIRUBINA



MARKER DIRETTI

EMOGLOBINA LIBERA



FRAMMENTI ERITROCITI

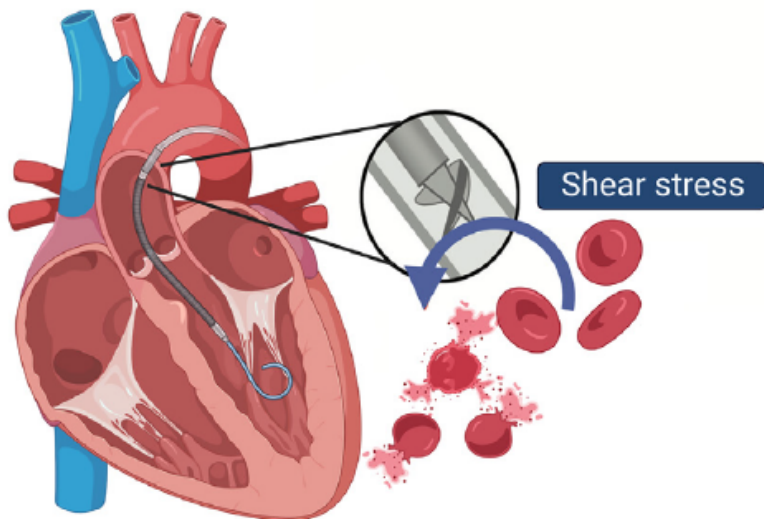


NON ESISTE UNA CLASSIFICAZIONE UNIVERSALMENTE STANDARDIZZATA DEI GRADI DI EMOLISI

Management of Bleeding and Hemolysis During Percutaneous Microaxial Flow Pump Support

A Practical Approach

Charlotte J. Van Edom, MD,^a Mario Gramegna, MD,^b Luca Baldetti, MD,^b Alessandro Beneduce, MD,^c

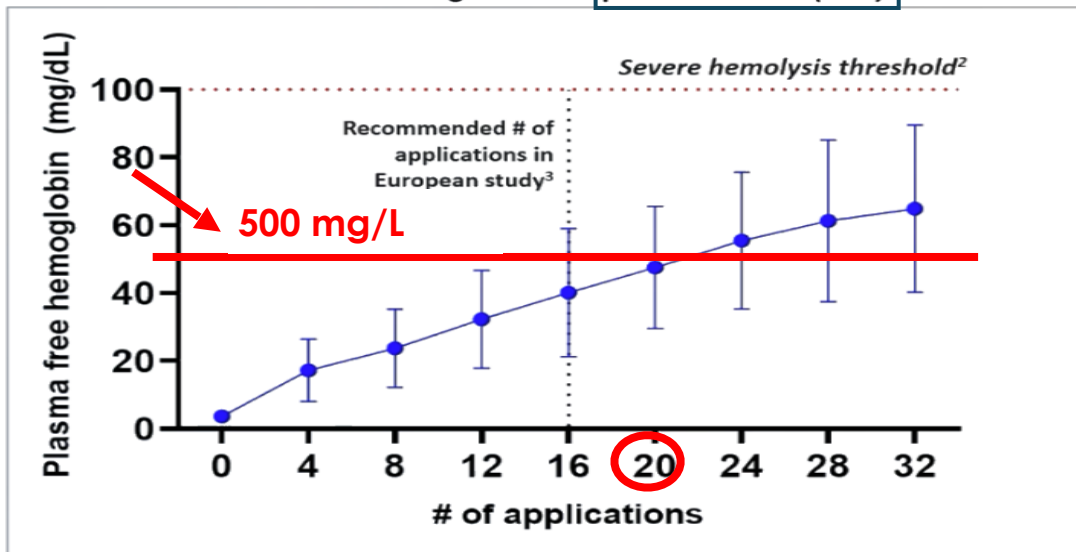


clear. Although the Extracorporeal Life Support Organization considers a pfHb concentration >50 mg/dL as a cutoff for serious hemolysis, recent pVAD registries have used a cutoff of >40 mg/dL.^{27,28} A recent consensus document providing definitions for adverse events in patients on pVAD defines hemolysis as a pfHb concentration >20 mg/dL.²⁹ Others use a decrease in hemoglobin, blood transfusion requirement plus a decrease in haptoglobin, or an increase in LDH.⁷ A retrospective registry showed that an in-

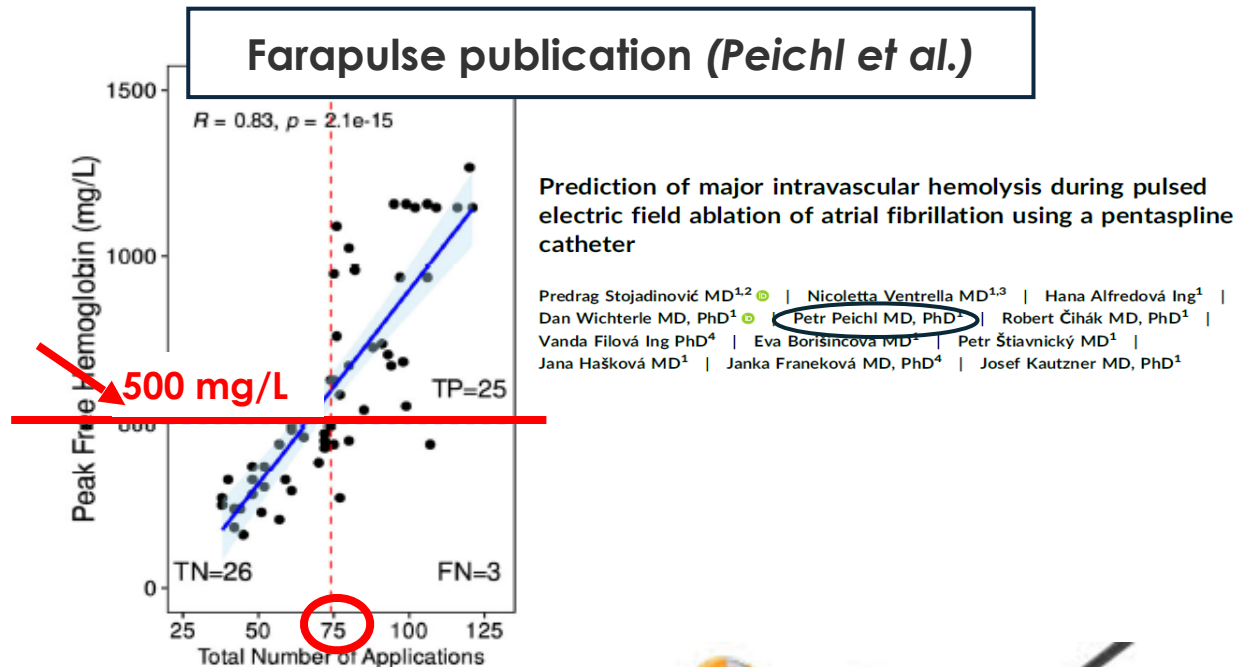


Sphere 360 at EHRA (Peichl et al.)

Plasma free hemoglobin in a porcine model (n=4)¹



Farapulse publication (Peichl et al.)



CLASSIFICAZIONE KIDGO

AKI STADIO I

Aumento della creatinina sierica:

- $\geq 0,3$ mg/dL ($\geq 26,5$ μ mol/L) rispetto al valore basale entro 48 ore;
- oppure
- Aumento della creatinina sierica **pari a 1,5-1,9 volte** il valore basale entro 7 giorni.

Volume urinario:

- $< 0,5$ mL/kg/h per 6-12 ore.

AKI STADIO II

Aumento della creatinina sierica:

- $\geq 2-2.9$ volte valore basale
- oppure

Volume urinario:

- $< 0,5$ mL/kg/h per ≥ 12 ore.

AKI STADIO III

Aumento della creatinina sierica:

- ≥ 3 volte valore basale oppure
- Aumento della creatinina sierica a $\geq 4,0$ mg/dL ($\geq 353,6$ μ mol/L);
- oppure

Inizio Terapia Sostitutiva renale

Volume urinario:

- Anuria per ≥ 12 ore
- $< 0,3$ mL/kg/h per ≥ 24 ore.



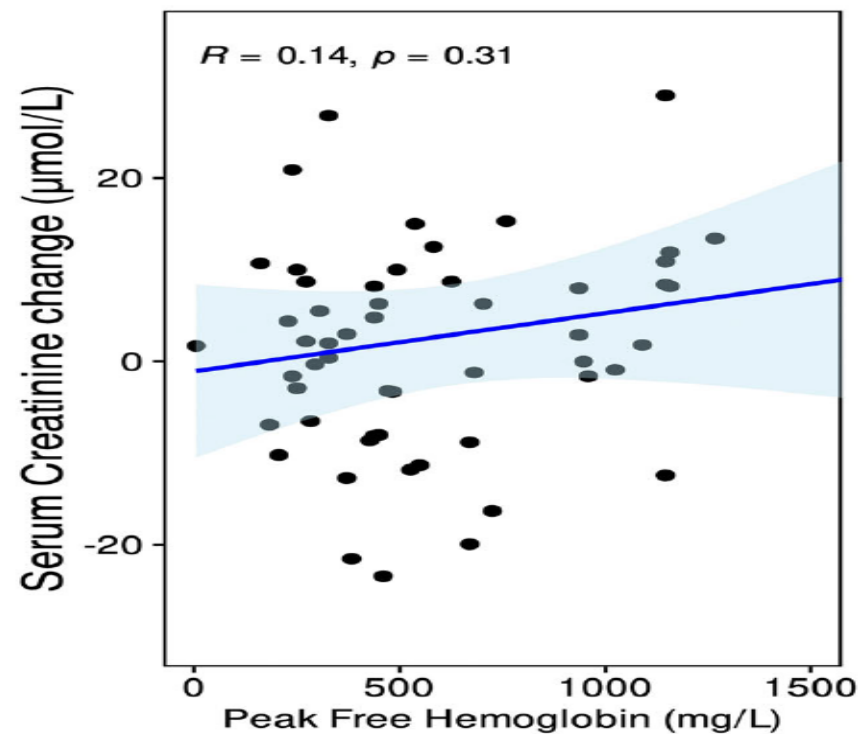
LA RELAZIONE TRA Fhb E CREATININA NON E' SIGNIFICATIVA

Prediction of major intravascular hemolysis during pulsed electric field ablation of atrial fibrillation using a pentaspline catheter

Predrag Stojadinović MD^{1,2} | Nicoletta Ventrella MD^{1,3} | Hana Alfredová Ing¹ | Dan Wichterle MD, PhD¹ | Petr Pechl MD, PhD¹ | Robert Čihák MD, PhD¹ | Vanda Filová Ing PhD⁴ | Eva Borišincová MD¹ | Petr Štiavnický MD¹ | Jana Hašková MD¹ | Janka Franecková MD, PhD⁴ | Josef Kautzner MD, PhD¹

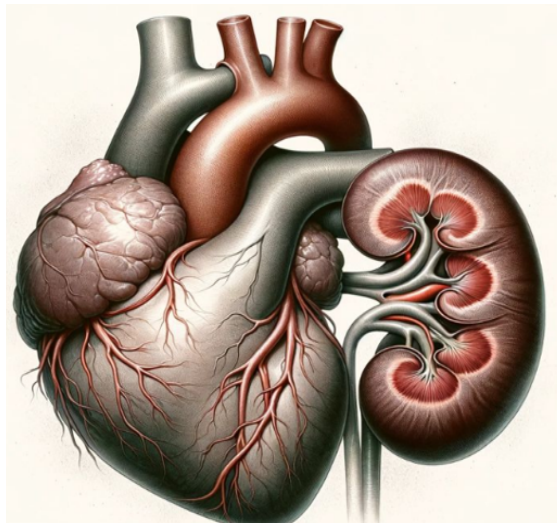
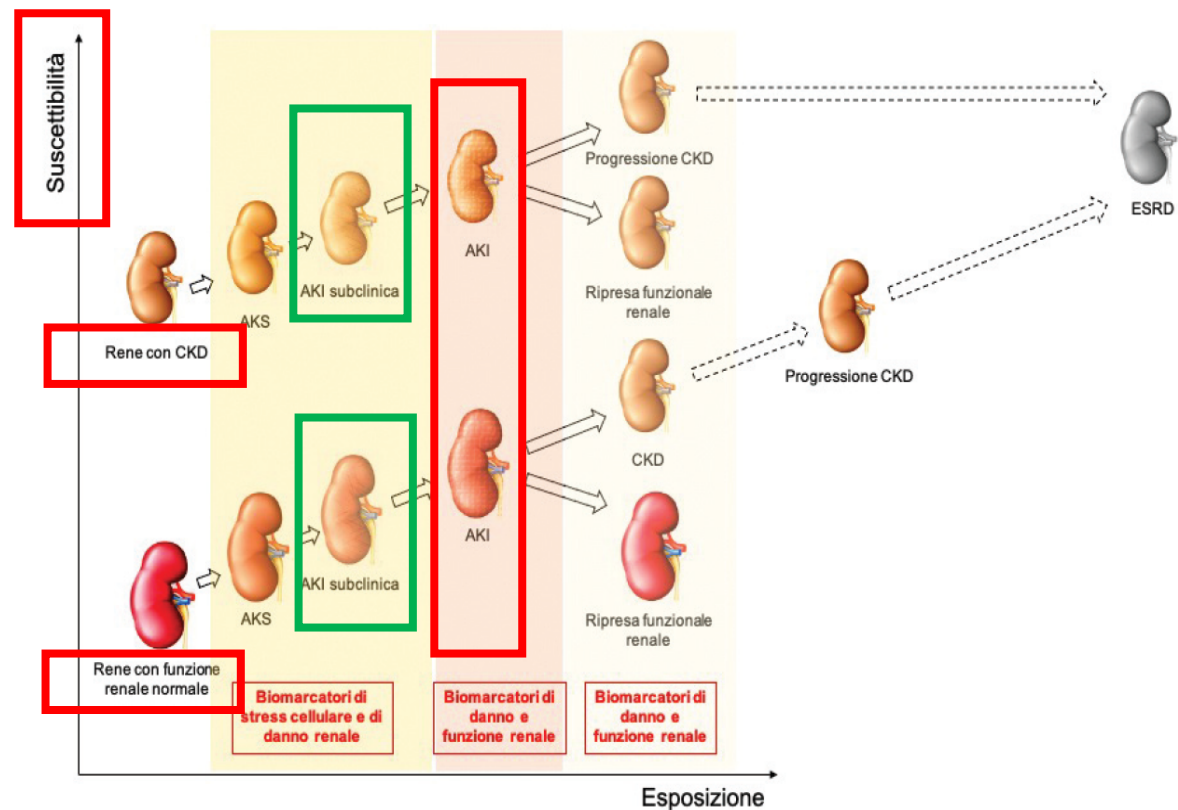
TABLE 3 Laboratory data (N = 60).

	Before procedure	After procedure	p Value ^a
Sodium (mmol/L)	141 (139, 142)	139 (137, 140)	< .001
Potassium (mmol/L)	4.3 (4.2, 4.5)	4 (3.9, 4.2)	< .001
Chloride (mmol/L)	107 (105, 108)	107 (106, 108)	> .9
Urea (mmol/L)	6.3 (5.4, 7.4)	7.2 (6.3, 9.2)	.002
Creatinine (μmol/L)	91 (80, 102)	95 (84, 108)	.4
Hemoglobin (g/L)	146 (137, 159)	136 (122, 145)	< .001
Free hemoglobin (mg/L)	40 (18, 65)	493 (327, 848) ^b	< .001
Lactate dehydrogenase (μkat/L)	3.1 (2.6, 3.6)	6.8 (5, 7.9)	< .001
Direct bilirubin (μmol/L)	12 (9, 17)	28 (16, 44)	< .001



NON ESISTE UNA RELAZIONE DETERMINISTICA TRA EMOLISI E DANNO RENALE ACUTO

FATTORI DI RISCHIO PER DISFUNZIONE RENALE NEL CONTESTO DELLA PFA



**FATTORI
DI RISCHIO**

**MALATTIA RENALE
PREGRESSA**

NEFROPATIA

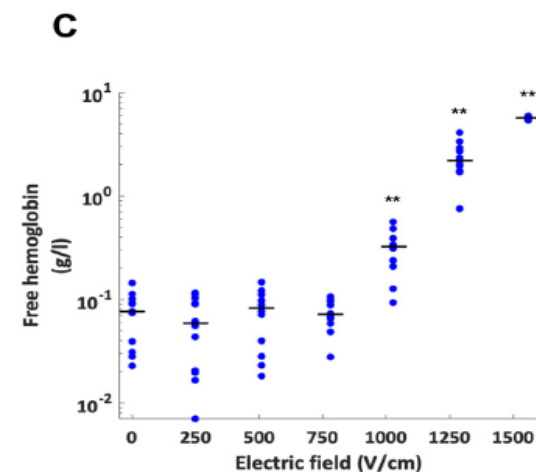
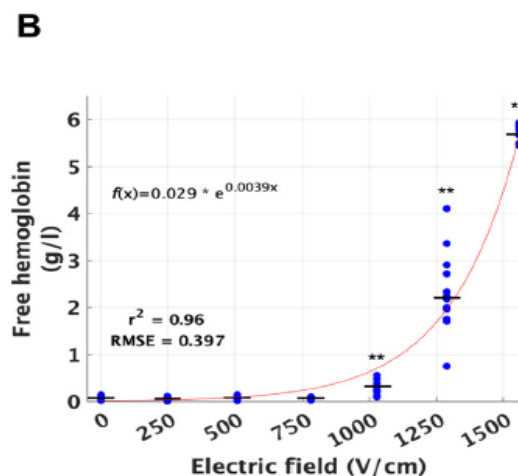
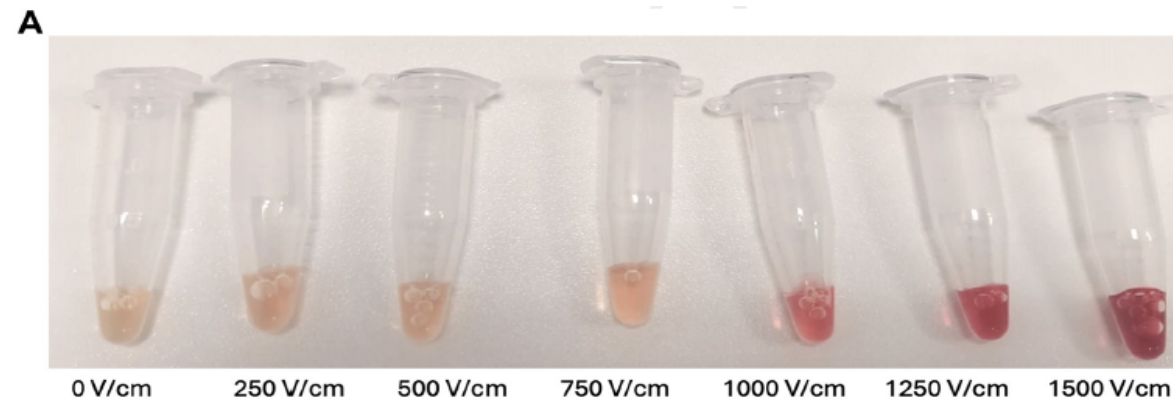
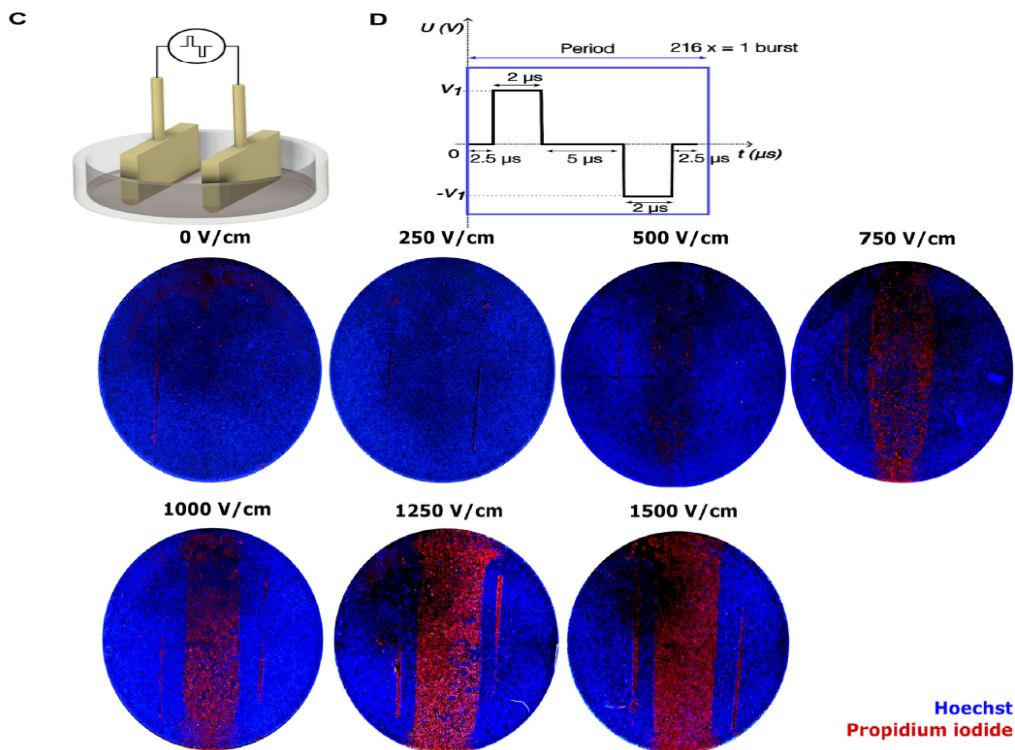
IPERPLASIA PROSTATICA

EMOLISI PREGRESSA

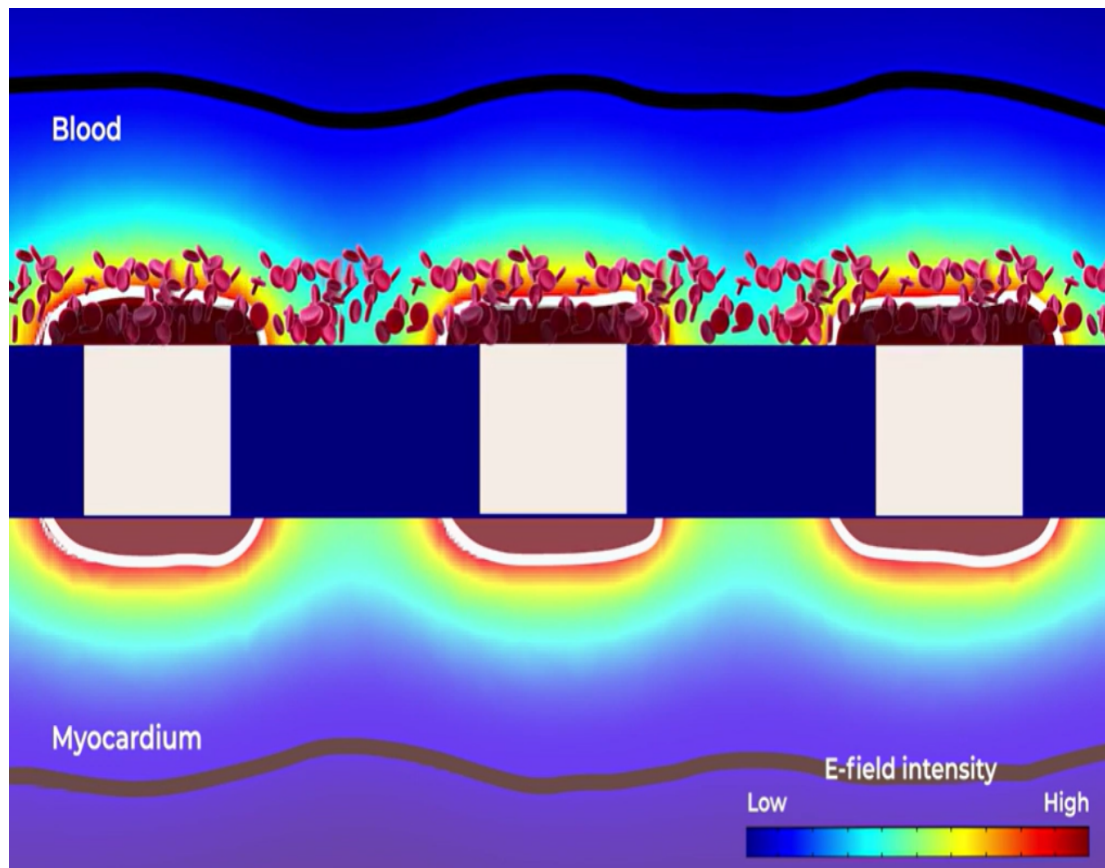
L'EMOLISI SI OSSERVA A PARTIRE DA CAMPI DI INTENSITA' PARI A 1000V/cm

Significant hemolysis is present during irreversible electroporation of cardiomyocytes in vitro ^e

Ivana Fiserova, MSc, PhD,¹ Ondrej Fiser, PhD,² Marek Novak, PhD,² Jan Tmka, PhD,¹ Antonia Gibalova, PhD,¹ David Kvapil,¹ Barbora Bacova, MD, PhD,³ Marek Hozman, MD,⁴ Dalibor Herman, MD, PhD,⁴ Klara Benesova, MSc,⁵ Pavel Osmancik, MD, PhD⁴



L'EMOLISI E' UN EFFETTO DI CLASSE DELLA PFA



Significant hemolysis is present during irreversible electroporation of cardiomyocytes in vitro ^e

Ivana Fiserova, MSc, PhD,¹ Ondrej Fiser, PhD,² Marek Novak, PhD,² Jan Tmka, PhD,¹ Antonia Gibalova, PhD,¹ David Kvapil,¹ Barbora Bacova, MD, PhD,³ Marek Hozman, MD,⁴ Dalibor Herman, MD, PhD,⁴ Klara Benesova, MSc,⁵ Pavel Osmancik, MD, PhD⁴

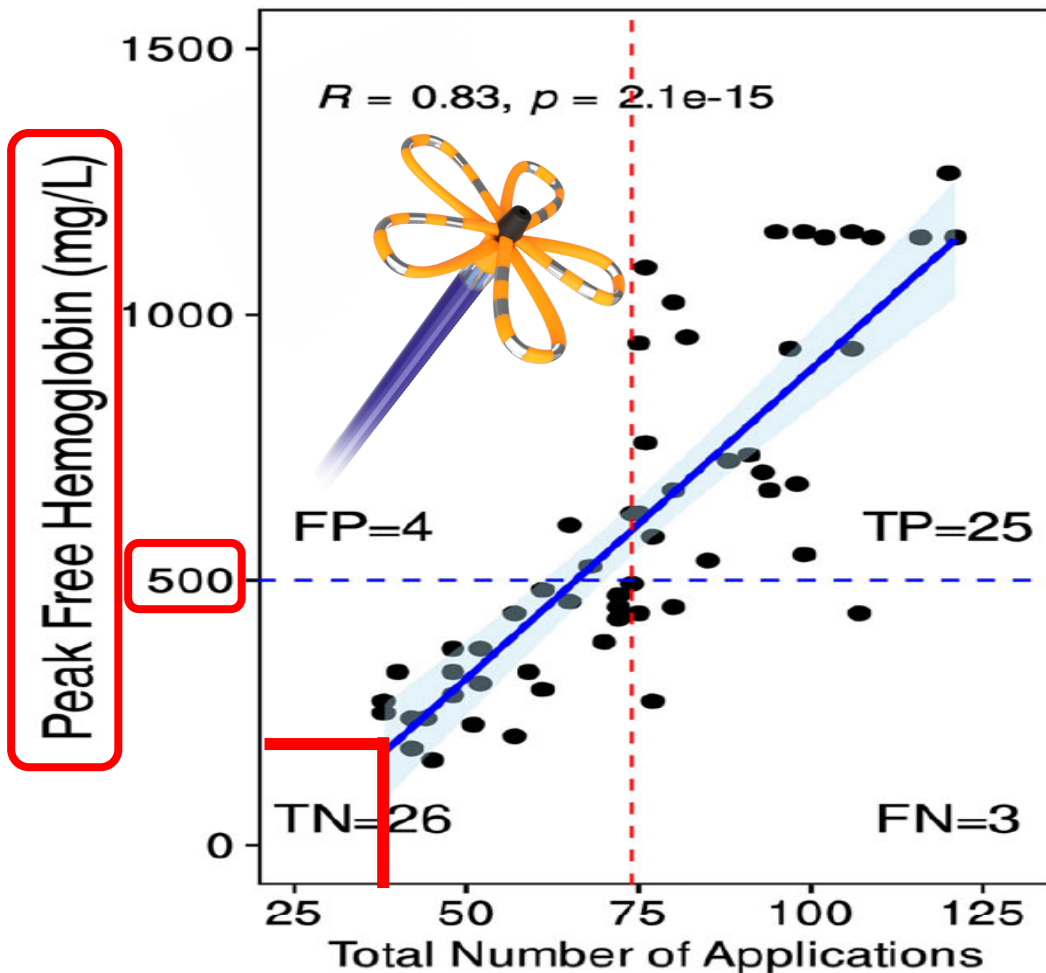
Table 1 Median values with interquartile range of cell-free hemoglobin and RBCμ and mean value ± SD of cardiomyocyte cell death from all measured parameters for each group

Pulse voltage amplitudes (V)	Simulated electric field (V/cm)	Cell-free hemoglobin (g/L)	RBCμ (abs/μL)	Cell death (%)
0	0	0.08 ± 0.06	68 ± 79	4.4 ± 1.4
75	~250	0.06 ± 0.08	331 ± 215	4.7 ± 2.1
160	~500	0.08 ± 0.07	539 ± 462	10.2 ± 2.9
241	~750	0.07 ± 0.03	1513 ± 1569	26.5 ± 5.9
320	~1000	0.32 ± 0.16	7586 ± 14,838	44.3 ± 6.2
400	~1250	2.2 ± 0.96	52,896 ± 35,992	55.5 ± 6.9
490	~1500	5.7 ± 0.39	155,358 ± 187,556	74.5 ± 17.8

I CAMPI CHE INDUCONO LA DISTRUZIONE DEI CARDIOMIOCITI CREANO EMOLISI

Prediction of major intravascular hemolysis during pulsed electric field ablation of atrial fibrillation using a pentaspline catheter

Predrag Stojadinović MD^{1,2} | Nicoletta Ventrella MD^{1,3} | Hana Alfredová Ing¹ |

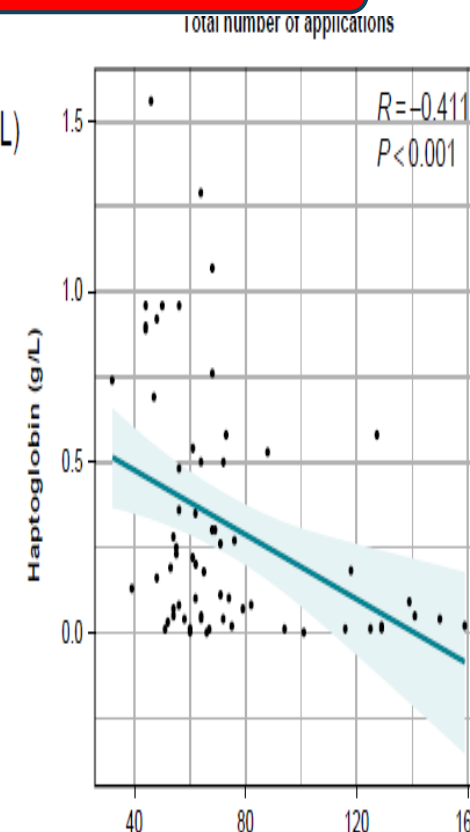
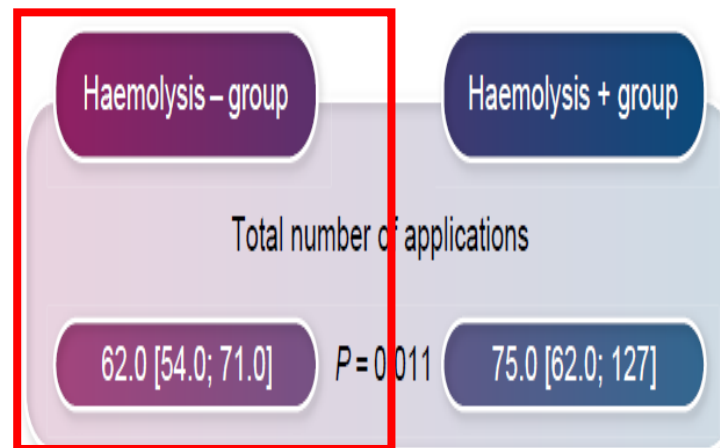


Severe acute kidney injury related to haemolysis after pulsed field ablation for atrial fibrillation

Sandrine Venier ^{1*}, Nathan Vaxelaire ¹, Peggy Jacon¹, Adrien Carabelli ¹, Antoine Desbiolles ¹, Frederic Garban ², and Pascal Defaye ¹

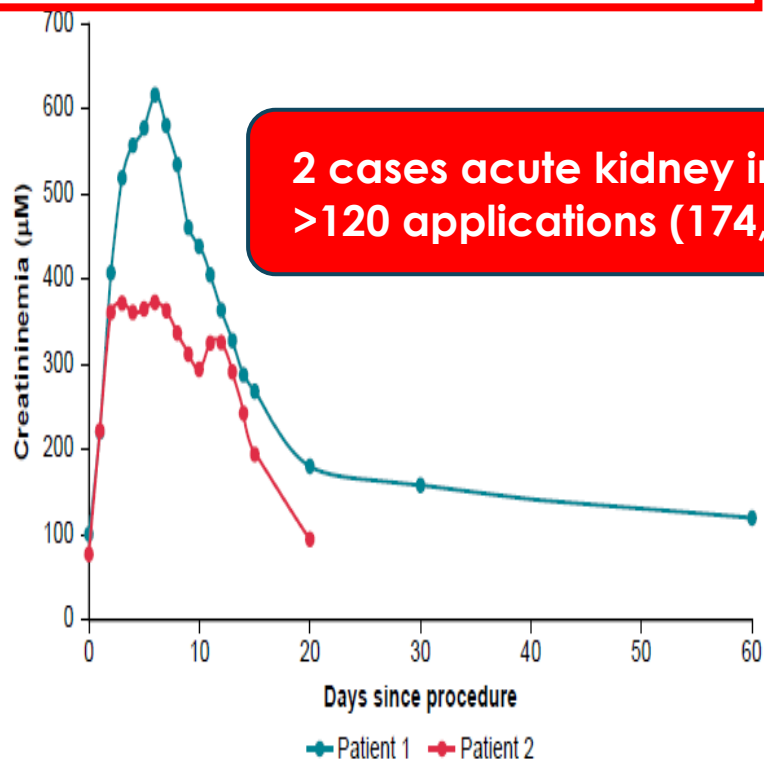
>70 applications predict Haemolysis

- 2 Cohort of 68 consecutive patients following the AKI cases.
haemolysis after PFA procedure = 28% (Haemolysis + group <0.04 g/L)
no AKI in this cohort

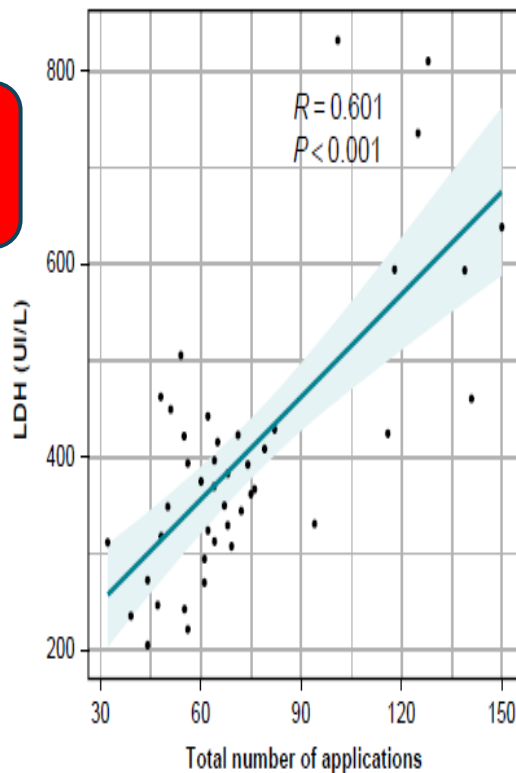


CUT OFF ASSOCIATI AD AKI STADIO 3: > 120 APPLICAZIONI

1 Two cases of AKI secondary to severe acute haemolysis: evolution of creatinine level after procedure



Correlation between biological haemolysis parameters after the procedure and the number of applications



Severe acute kidney injury related to haemolysis after pulsed field ablation for atrial fibrillation

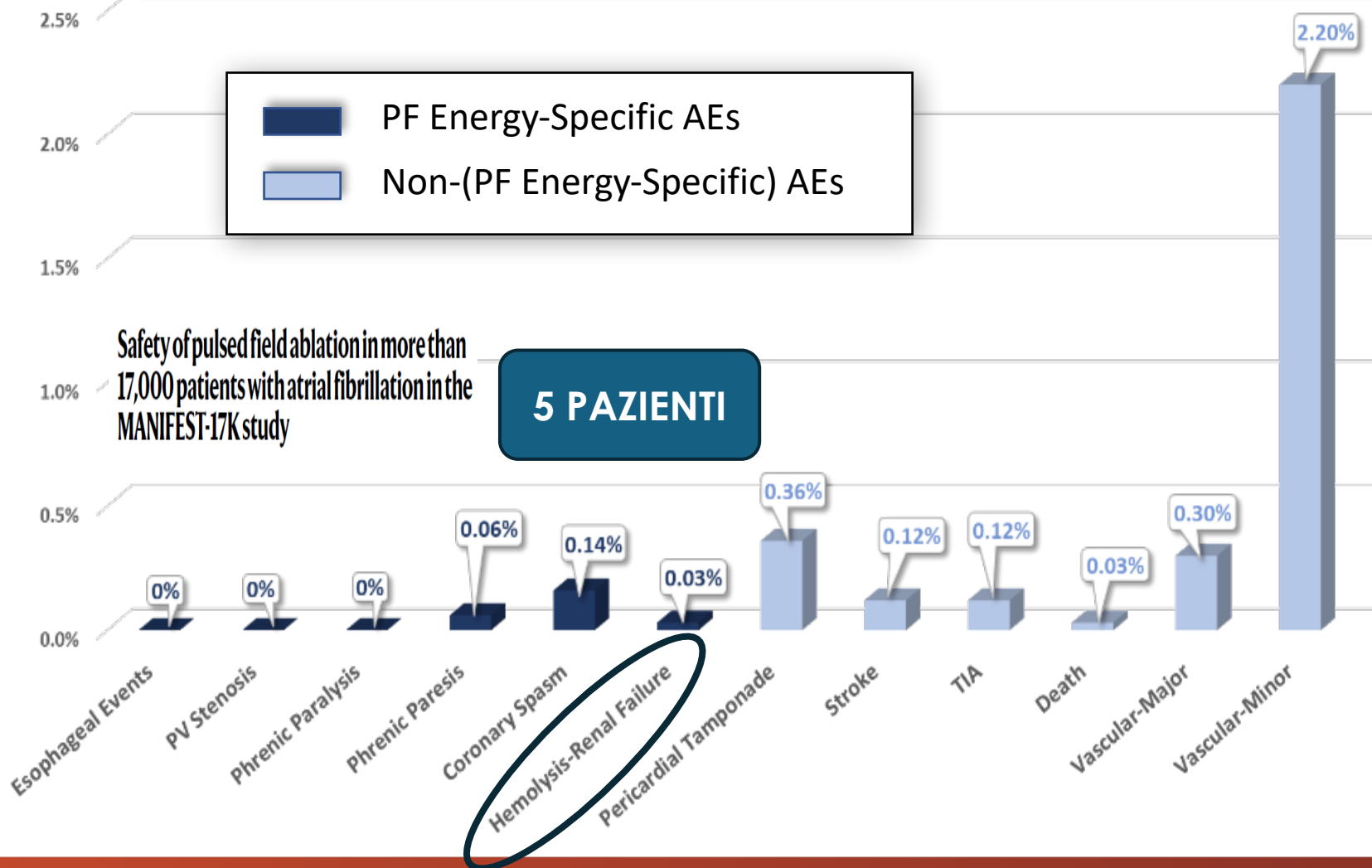
Sandrine Venier^{1*}, Nathan Vaxelaire¹, Peggy Jacon¹, Adrien Carabelli¹, Antoine Desbiolles¹, Frederic Garban², and Pascal Defaye¹

**DANNO RENALE
DI LIVELLO 3**

**1 PZ AVEVA STORIA DI
EMOLISI CRONICA**



CUT OFF ASSOCIATI DIALISI TEMPORANEA: > 140 APPLICAZIONI MEDIE





Acute kidney injury and haptoglobin depletion after pulsed field ablation: Impact of device type under routine hydration protocol

Yosuke Hayashi, MD,^{1,2} Shinsuke Miyazaki, MD,² So Asano, MD,¹ Yukio Sekiguchi, MD,¹ Junichi Nitta, MD,¹ Tetsuo Sasano, MD²

Table 2 Procedural results

Variables	All (n = 211)	Farapulse (n = 117)	PulseSelect (n = 94)	P value
Additional ablation with PFA, n (%)	61 (29%)	37 (32%)	24 (26%)	.41
LAPW isolation with PFA, n (%)	41 (19%)	33 (28%)	8 (9%)	<.001
Additional ablation with radiofrequency, n (%)	25 (12%)	9 (8%)	16 (17%)	.05
Total procedure time, min	67.1 ± 31.8	58.8 ± 23.7	77.1 ± 37.1	<.001
Total fluoroscopic time, min	20.4 ± 8.8	19.0 ± 7.8	22.2 ± 9.4	.007
Total application no.	48 (41–58)	56 (44–62)	43 (39–48)	<.001
Complication, n (%)	9 (4%)	2 (2%)	7 (7%)	.081
Postprocedural blood test				
Creatinine level, mg/dL	0.94 ± 0.35	0.95 ± 0.35	0.95 ± 0.35	.98
Aspartate aminotransferase, U/L	80.7 ± 33.7	84.7 ± 39.8	75.7 ± 23.1	.054
Lactate dehydrogenase, U/L	328 ± 86	355.8 ± 92.1	293.1 ± 61.1	<.001
Total bilirubin, mg/dL	1.6 ± 0.7	1.9 ± 0.8	1.3 ± 0.4	<.001
Haptoglobin depletion, n (%)	56 (27%)	43 (37%)	13 (14%)	<.001
AKI, n (%)	13 (6%)	8 (7%)	5 (5%)	.87



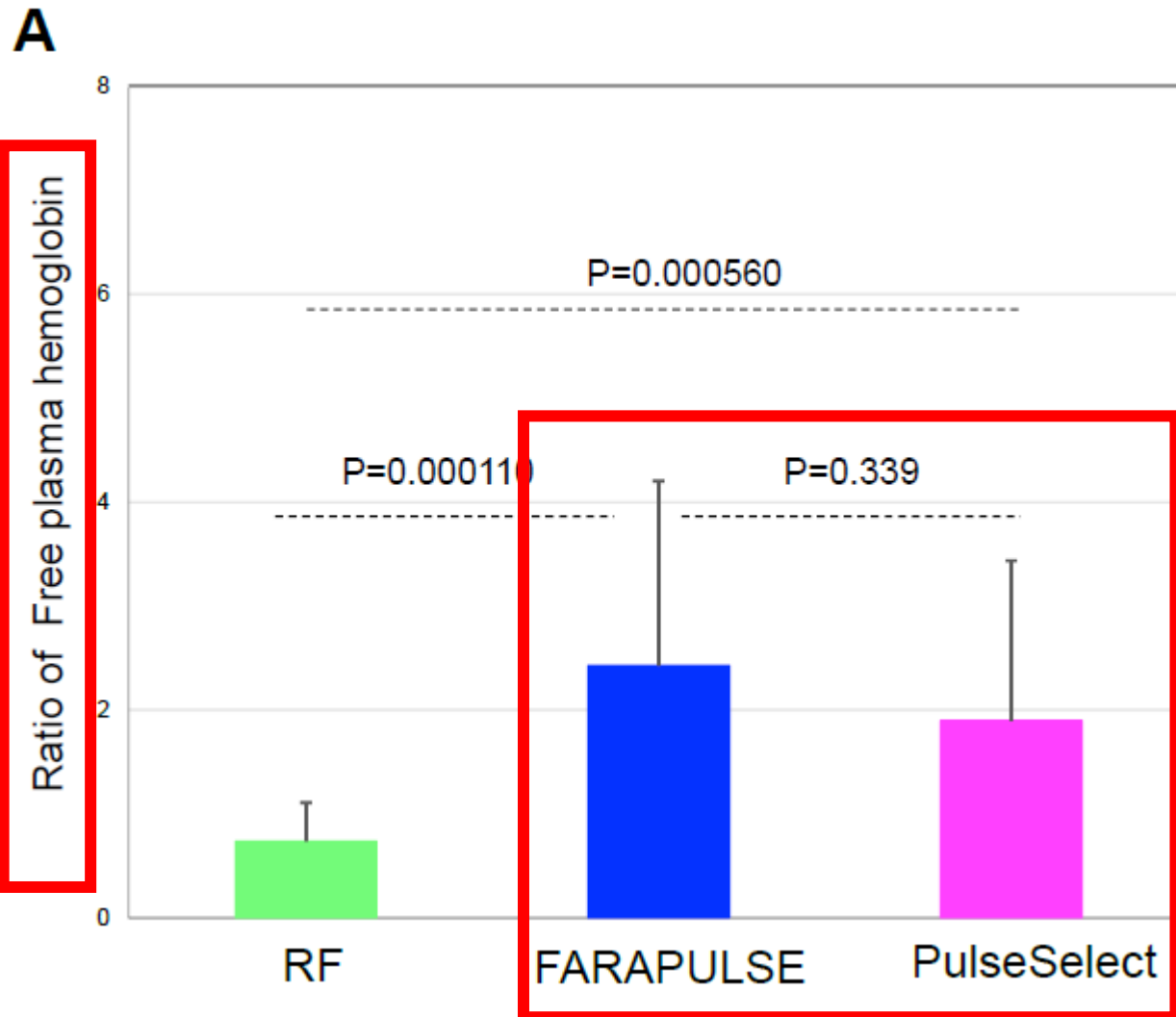
Differential subclinical hemolysis after pulsed field ablation using the FARAPULSE pentaspline catheter vs the PulseSelect circular multi-electrode array catheter

Sayana Kuraoka, MD,^{1,2} Masatsugu Nozoe, MD, PhD,¹ Hiroshi Mannoji, MD, PhD,¹
Ryo Miyake, MD,¹ Tomoki Uchikawa, MD, PhD,¹ Akihito Ishikita, MD, PhD,¹
Daisuke Nagatomo, MD,¹ Nobuhiro Suematsu, MD, PhD,¹ Toru Kubota, MD, PhD¹

120 PAZIENTI

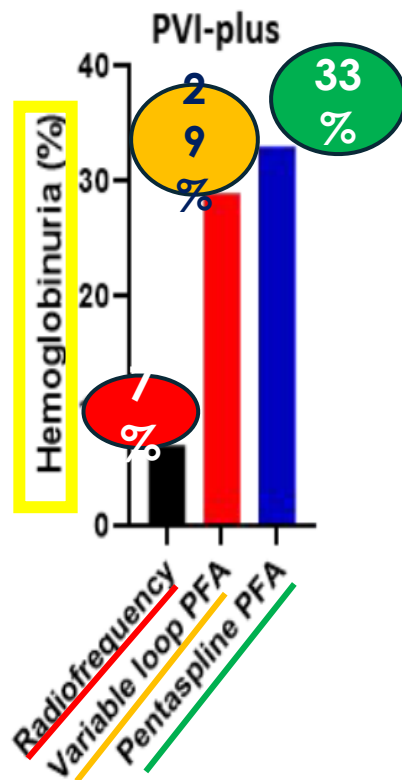
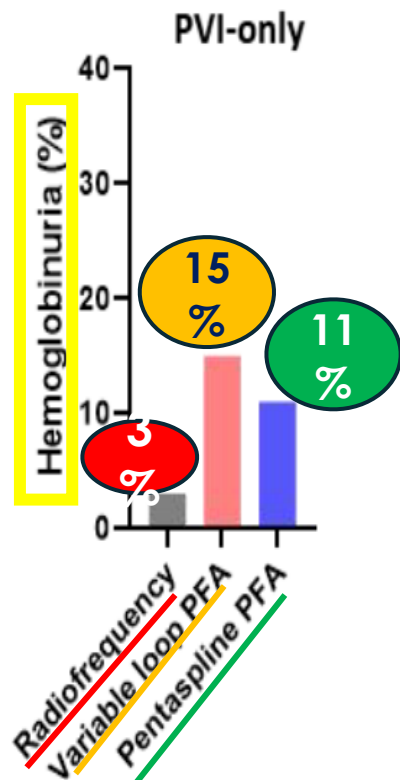
DIFFERENZA NON SIGNIFICATIVA

**APPLICAZIONI PVI:
43 FARAPULSE 47 PULSESELECT**



Intravascular haemolysis and acute kidney injury following atrial fibrillation ablation: a report using two different systems for pulsed field ablation

Maarten A.J. De Smet , Clara François , Benjamin De Becker ,
Rene Tavernier , Jean-Benoît le Polain de Waroux , Sébastien Knecht ,
and Mattias Duytschaever 



- RFA PVI-only
- Variable loop PFA PVI-only
- Pentaspline PFA PVI-only
- RFA PVI-plus
- Variable loop PFA PVI-plus
- Pentaspline PFA PVI-plus



PVI 46

PVI + 62

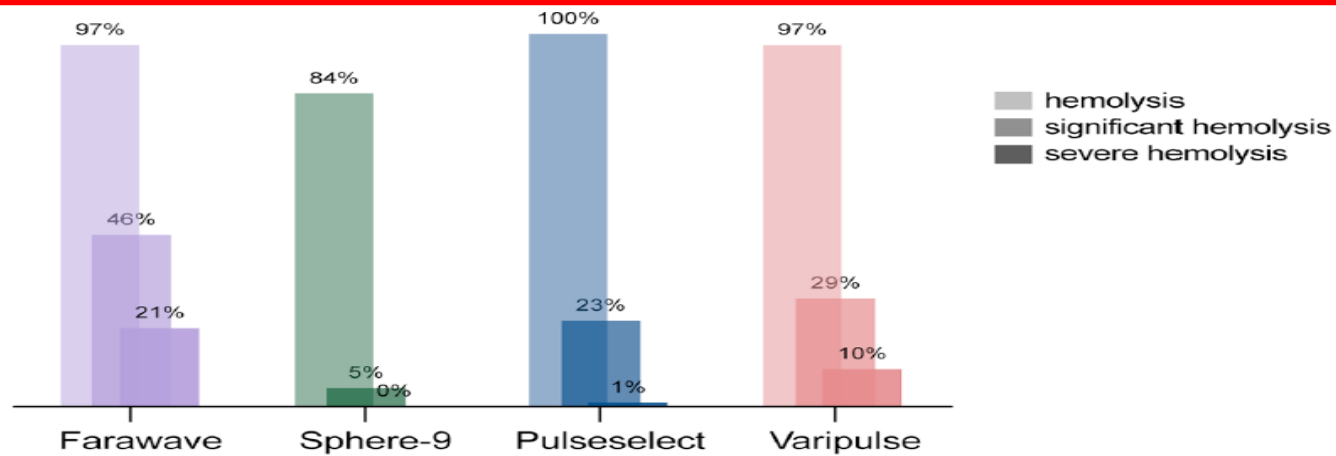
PVI 33

PVI+ 46



Pulsed Field Ablation–Related Hemolysis: Comparison Between Technologies

Carola Gianni^{ID}, MD; Amin Al-Ahmad^{ID}, MD; Mohanad Elchouemi^{ID}; Vincenzo Mirco La Fazio^{ID}, MD; Sanghamitra Mohanty^{ID}, MD; John D. Allison^{ID}, MD; Mohamed A. Bassiouny^{ID}, MD; Weeranun D. Bode^{ID}, MD; J. David Burkhardt^{ID}, MD; Paul C. Coffeen, MD; G. Joseph Gallinghouse^{ID}, MD; Rodney P. Horton^{ID}, MD; David Kessler^{ID}, MD; Javier E. Sanchez^{ID}, MD; Andrea Natale^{ID}, MD



Tecnologia	Casi di AKI (POD1)	Totale pazienti	Incidenza (%)
Farawave	15	314	4,8%
Pulseselect	4	84	4,8%
Sphere-9	4	87	4,4%



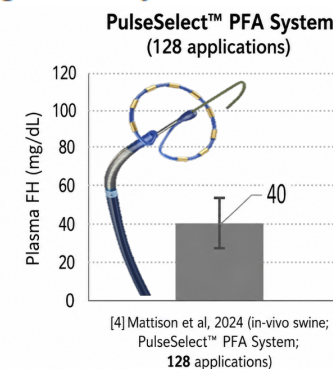
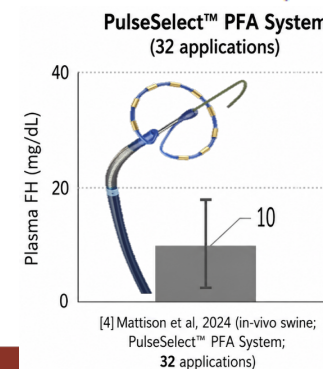
Biomarker response to balloon-in-basket pulsed field ablation: does posterior wall isolation matter?

Bilirubin increased ($p < 0.001$), while haptoglobin decreased in PVI + PWI ($p < 0.001$) but not in PVI ($p = 0.654$). Creatinine increased in PVI + PWI ($p < 0.001$) but not in PVI ($p = 0.173$). eGFR declined in PVI ($p = 0.045$) and PVI + PWI ($p < 0.001$).

Hemolysis Profile of a Novel Balloon-Filled Basket Pulsed Field Ablation Catheter

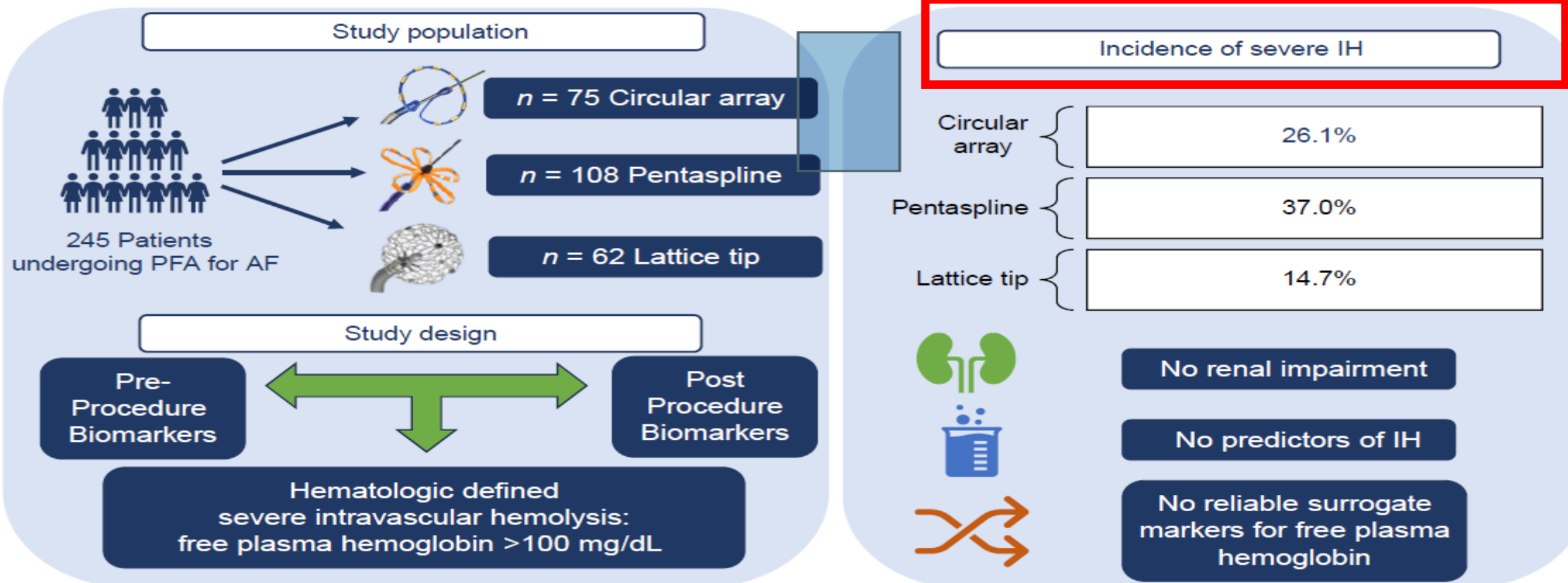
Jed Overmann, DVM, MS, DACVP; Mayara Marques, MD; Chris Lafean, BS; Catherine Pipenhagen, BS; Boyce L. Moon, MS; Jeffrey M. Fish, DVM; Atul Verma, MD

upper end of 95% CI=23.4 mg/dL), with 24.3 mg/dL being the maximum T1 plasma FH concentration seen across all animals. Plasma FH increased from a T0 mean of 6.6 ± 5.8 to 16.4 ± 5.6 mg/dL immediately after all PFA applications in the left atrium (T1). This returned



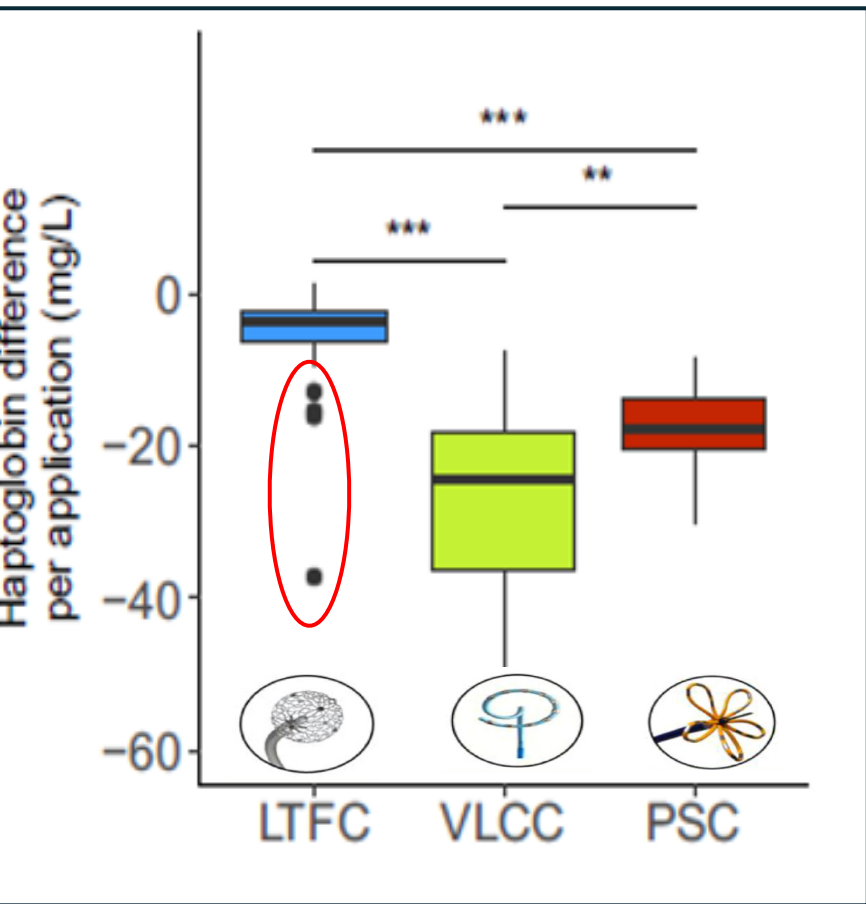
PULSESELECT vs FARAPULSE vs SPHERE 9

Incidence of laboratory defined severe intravascular hemolysis across commercially available pulsed field ablation technologies for atrial fibrillation

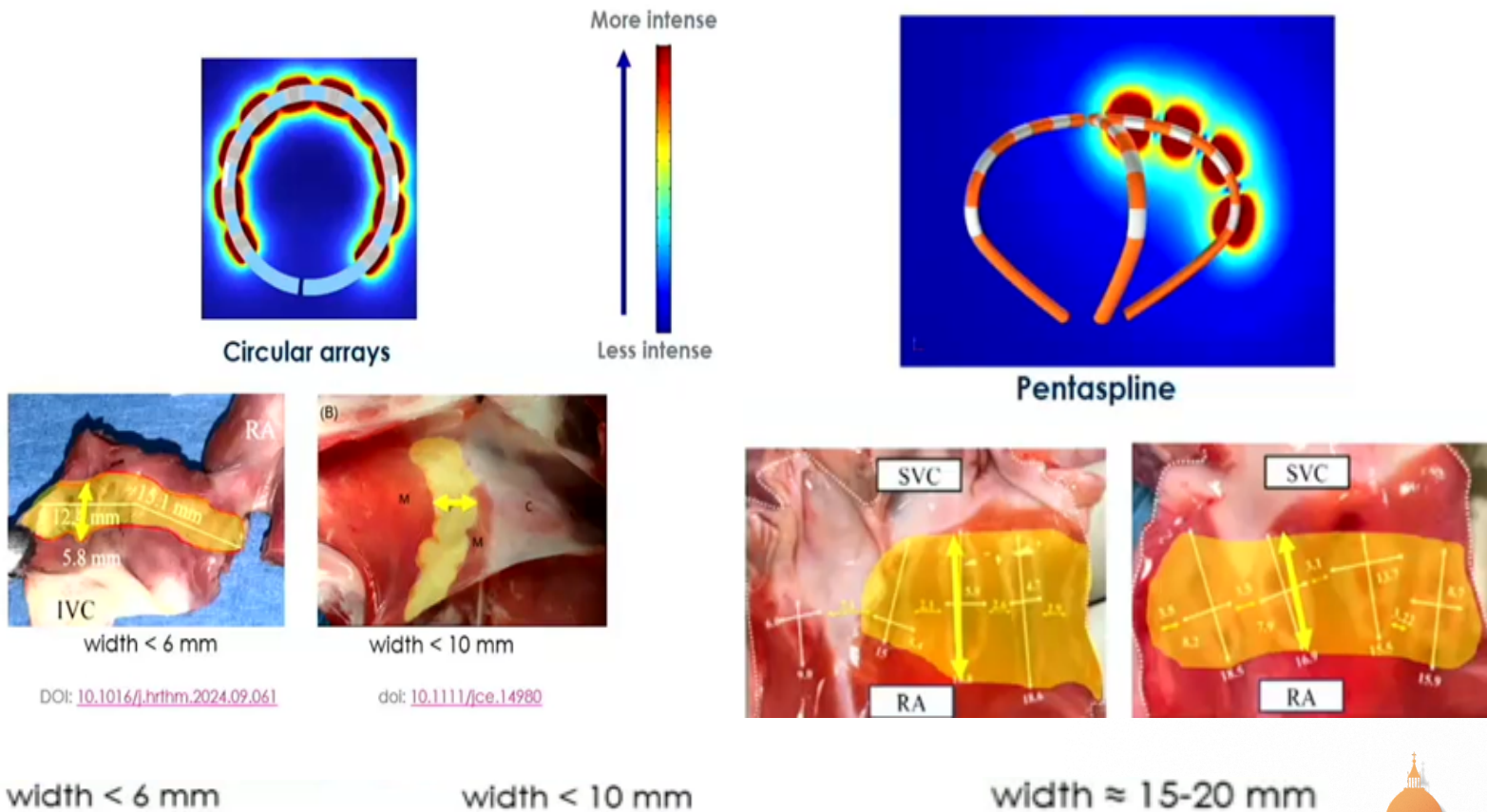


Hemolysis Induced by Pulsed-Field Ablation of Atrial Arrhythmias: A Comparative Analysis of Current Systems

Johannes Bruss¹ | Thomas Kueffer¹ | Hildegard Tanner¹ | Fabian Noti¹ | Andreas Haeberlin^{1,2} | Gregor Thalmann¹ | Nikola Asenov Kozuharov¹ | Boldizsar Kovacs¹ | Valon Spahiu¹ | Claudia Herrera Siklody¹ | Tobias Reiblich¹ | Laurent Botet¹



CONFRONTO SU EMOLISI NORMALIZZATA ALLE APPLICAZIONI



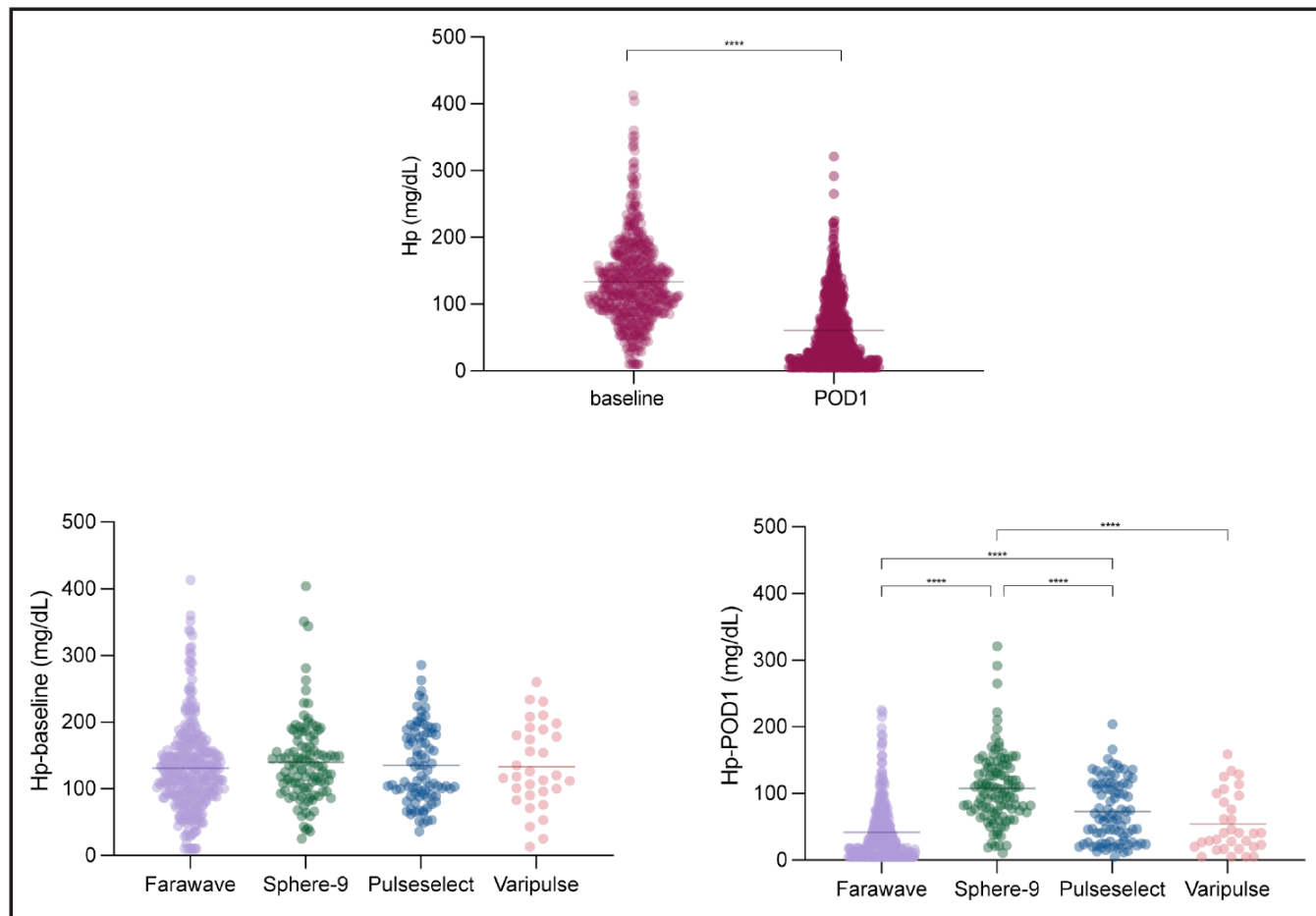
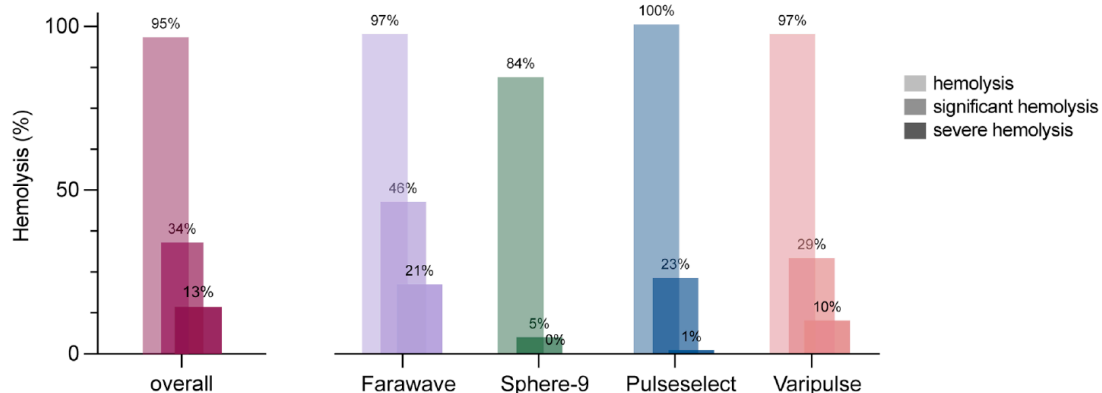
NESSUNA DIFFERENZA NEI VALORI DI CREATININA

Circulation: Arrhythmia and Electrophysiology

ORIGINAL ARTICLE

Pulsed Field Ablation–Related Hemolysis: Comparison Between Technologies

Carola Gianni¹, MD; Amin Al-Ahmad², MD; Mohanad Elchouemi³; Vincenzo Mirco La Fazio⁴, MD; Sanghamitra Mohanty⁵, MD; John D. Allison⁶, MD; Mohamed A. Bassiouny⁷, MD; Weeranun D. Bode⁸, MD; J. David Burkhardt⁹, MD; Paul C. Coffeen, MD; G. Joseph Gallinghouse¹⁰, MD; Rodney P. Horton¹¹, MD; David J. Kessler¹², MD; Javier E. Sanchez¹³, MD; Andrea Natale¹⁴, MD



CONCLUSIONS: PFA-induced hemolysis is common, with different PFA technologies exhibiting variable degrees of hemolysis, lower with the focal PFA catheter Sphere-9 when compared with single-shot PFA catheters.



Outcome & platform	Studies
Acute kidney injury (risk ratio)	
Pentaspine	5
Circular array	2
Variable-loop	1
Focal PFA	1
LDH at 24h (mean difference, U/L)	
Pentaspine	6
Circular array	2
Focal PFA	1
Balloon-in-basket	1
Haptoglobin at 24 h (mean difference, g/L)	
Pentaspine	3
Circular array	1
Balloon-in-basket	1
PFH at end of procedure (mean difference, mg/L)	
Pentaspine	4
Circular array	2
Spherical	1
Procedure time (mean difference, minutes)	
Pentaspine	5
Circular array	2
Focal PFA	1
Balloon-in-basket	1

IL RISCHIO DI DANNO RENALE E' LO STESSO PER TUTTI I CATETERI PFA

Hemolysis and renal safety of pulsed-field vs thermal ablation for atrial fibrillation: A systematic review and meta-analysis ^e

Table 2 Subgroup analysis of outcomes by pulsed-field ablation (PFA) catheter platform

Outcome & platform	Studies (k)	Effect size (95% CI)	Heterogeneity (I ²)
Acute kidney injury (risk ratio)			
Pentaspine	5	1.15 (0.25–5.19)	0%
Circular array	2	0.15 (0.01–2.25)	0%
Variable-loop	1	7.68 (0.42–138.92)	N/A
Focal PFA	1	0.35 (0.01–16.81)	N/A
LDH at 24h (mean difference, U/L)			
Pentaspine	6	80.33 (62.53–98.12)	66%
Circular array	2	36.52 (–25.91 to 98.96)	82%
Focal PFA	1	30.00 (8.85–51.15)	N/A
Balloon-in-basket	1	–7.50 (–23.52 to 8.52)	N/A
Haptoglobin at 24 h (mean difference, g/L)			
Pentaspine	3	–0.53 (–0.74 to –0.33)	72%
Circular array	1	–0.26 (–0.54 to 0.01)	N/A
Balloon-in-basket	1	0.08 (–0.12 to 0.28)	N/A

Hemolysis magnitude varied by PFA platform; AKI did not.



High-Voltage Nanosecond Pulse Field Ablation Using a Compliant Circular Catheter to Treat Atrial Fibrillation

Lesion Durability and One-Year Outcomes

Vivek Y. Reddy, MD,^{a,b} Jan Petru, MD,^a Johan Vijgen, MD,^c Mohit Turagam, MD,^b Jacob S. Koruth, MD,^b Moritoshi Funasako, MD,^a Pavel Hala, MD,^a Pieter Koopman, MD,^c Jan Skoda, MD,^a Giuseppe Stifano, MD,^d Mirco Vincenzo La Fazia, MD,^e David Kenigsberg, MD,^f Andrea Natale, MD,^{d,e} Petr Neuzil, MD, PhD^a



FIGURE 1 The nsPFA Catheter and System

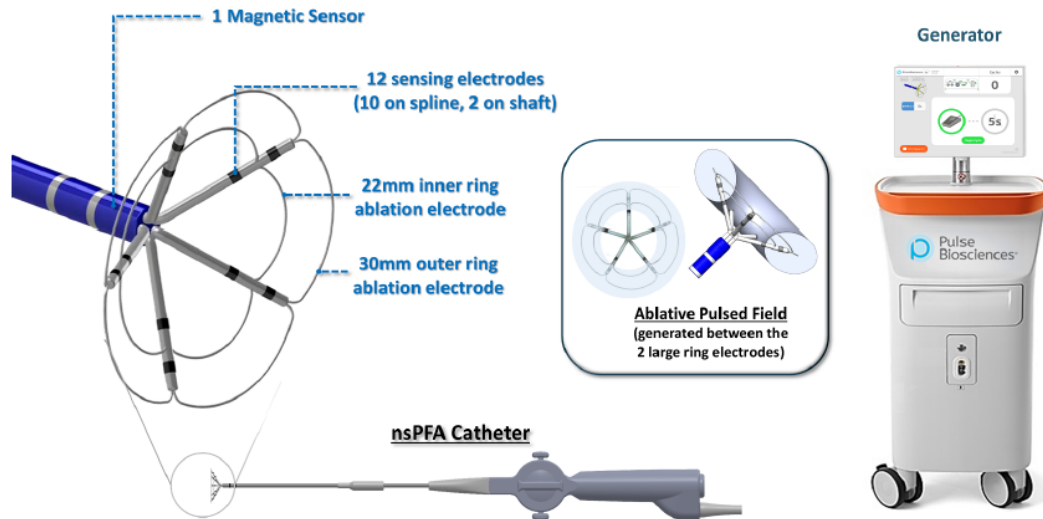


TABLE 3 Safety Outcomes

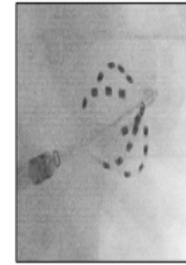
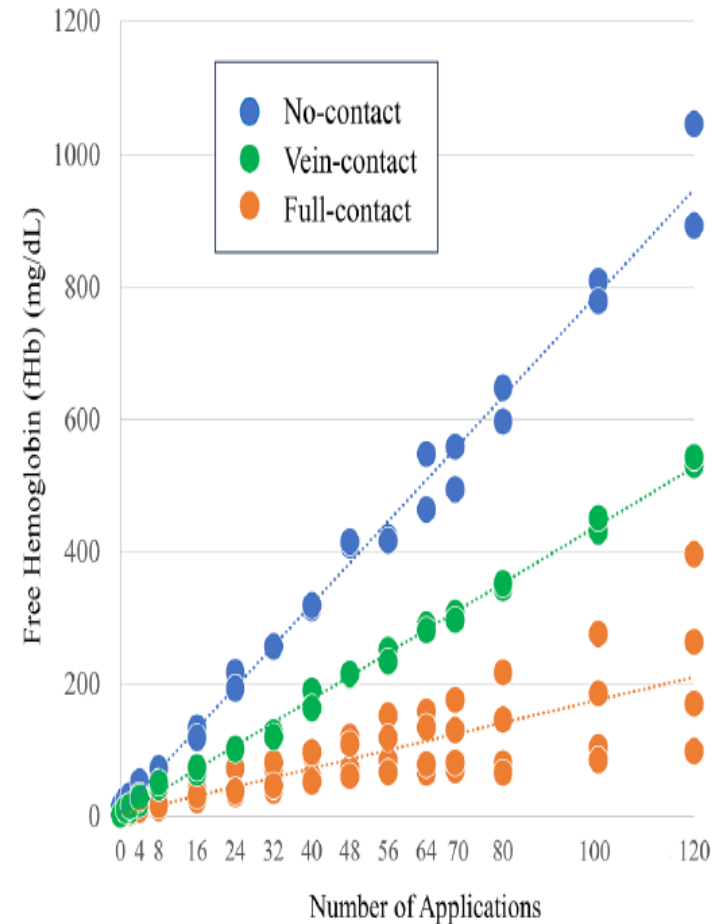
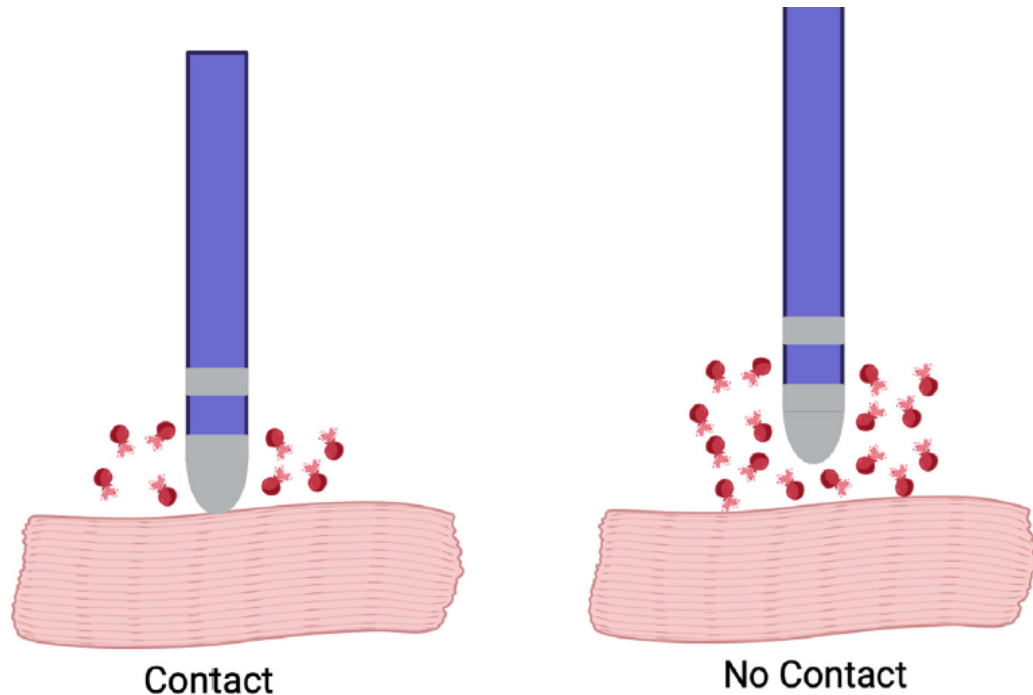
	Full Cohort (N = 177)	5-Second Cohort (n = 141)
Asymptomatic cerebral embolism	0	0
Atrioesophageal fistula	0	0
Bleeding requiring transfusion	0	0
Cardiac perforation/tamponade	1	1
Death	0	0
Esophageal injury resulting in perforation	0	0
Myocardial infarction	0	0
Pericarditis requiring intervention or hospitalization	0	0
Phrenic nerve injury/diaphragmatic paralysis	0	0
Pulmonary edema/respiratory insufficiency	0	0
Pulmonary vein stenosis ($\geq 70\%$ diameter reduction)	0	0
Stroke or transient ischemic attack	1	1
Esophageal dysmotility or gastroparesis	0	0
Vascular access complication requiring intervention	0	0
Hemolysis resulting in kidney injury	1	1



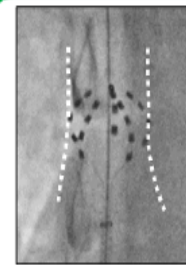
COME MITIGARE L'EMOLISI: CONTATTO, NUMERO DI APPLICAZIONI

Hemolysis After Pulsed Field Ablation: Impact of Lesion Number and Catheter-Tissue Contact

Moritz Nies¹, MD; Jacob S. Koruth², MD; Mikuláš Miček³, MD, PhD; Keita Watanabe⁴, MD, PhD; Veronika C. Tibenská⁵, PhD; Štěpán Královec; Leoš Tejkl, PhD; Petr Neuzil⁶, MD, PhD; Vivek Y. Reddy⁷, MD



No-Contact
fHb increase
7.8 mg/dL/application
Coefficient of determination
 $R^2 = 0.989$

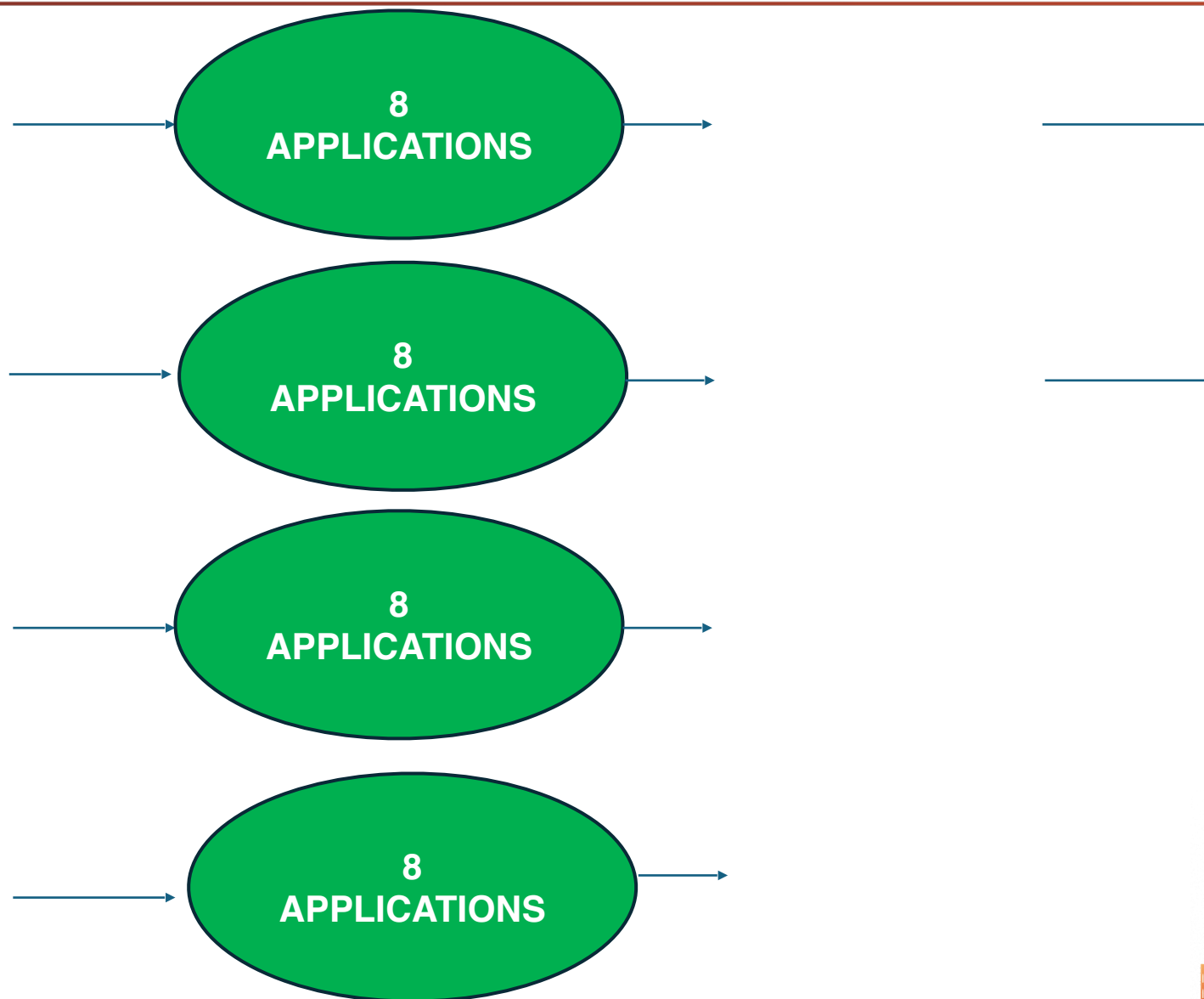


Vein-Contact
fHb increase
4.4 mg/dL/application
Coefficient of determination
 $R^2 = 0.997$



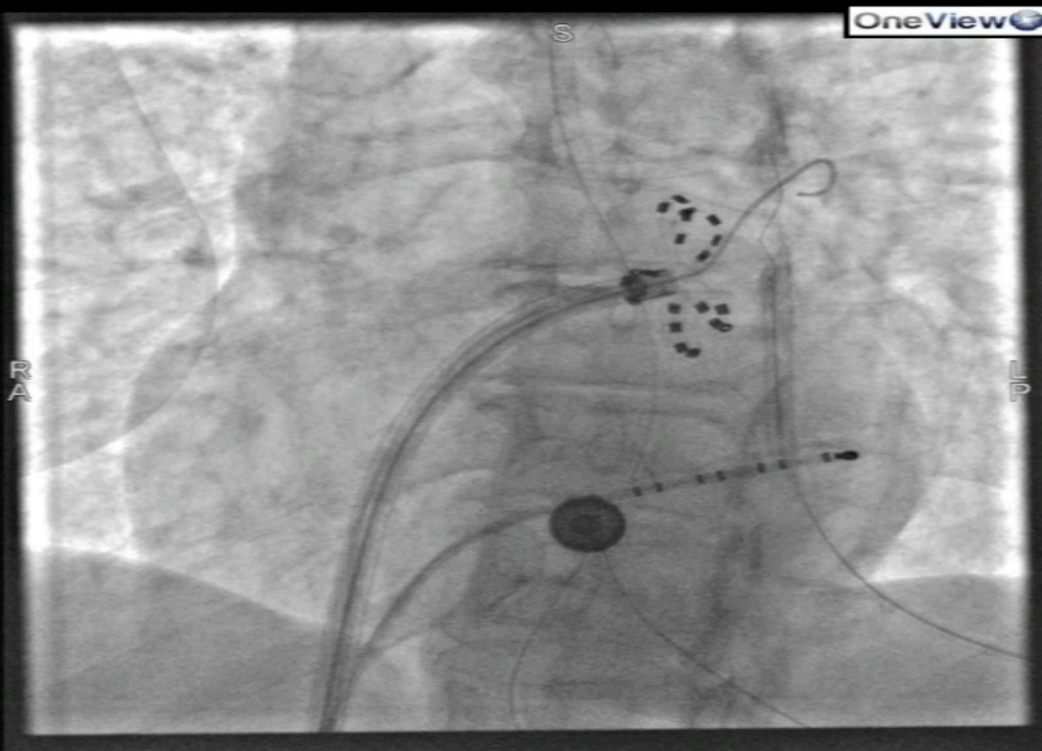
Full-Contact
fHb increase
1.7 mg/dL/application
Coefficient of determination
 $R^2 = 0.658$

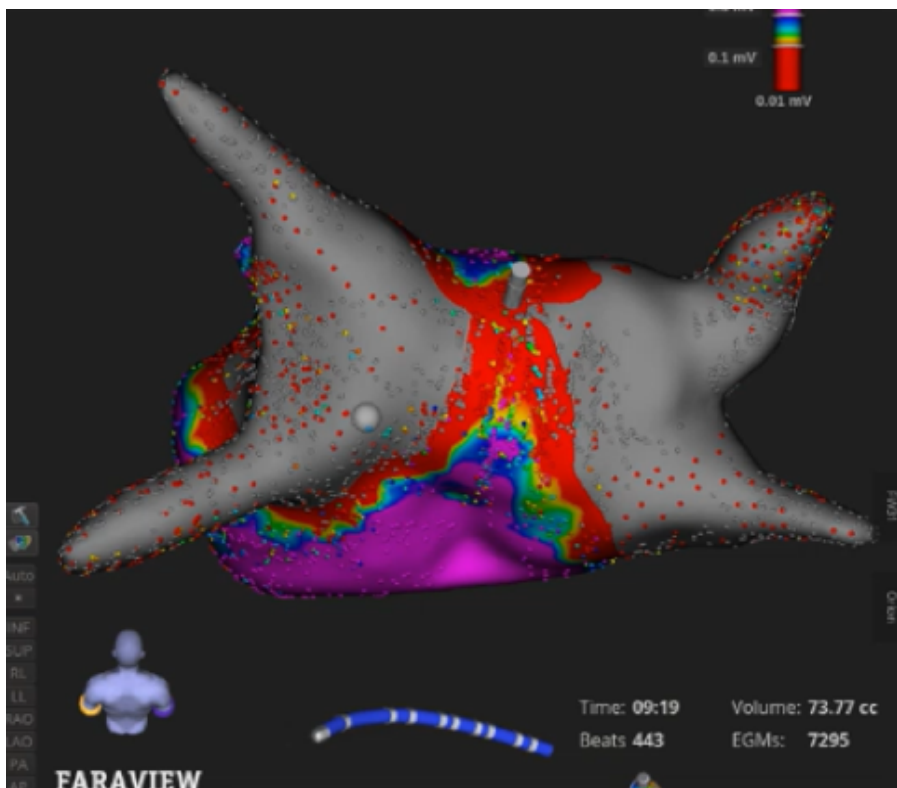
FARAPULSE WORKFLOW BEFORE FARAVIEW



PHYSICIAN BLINDED TO FARAVIEW

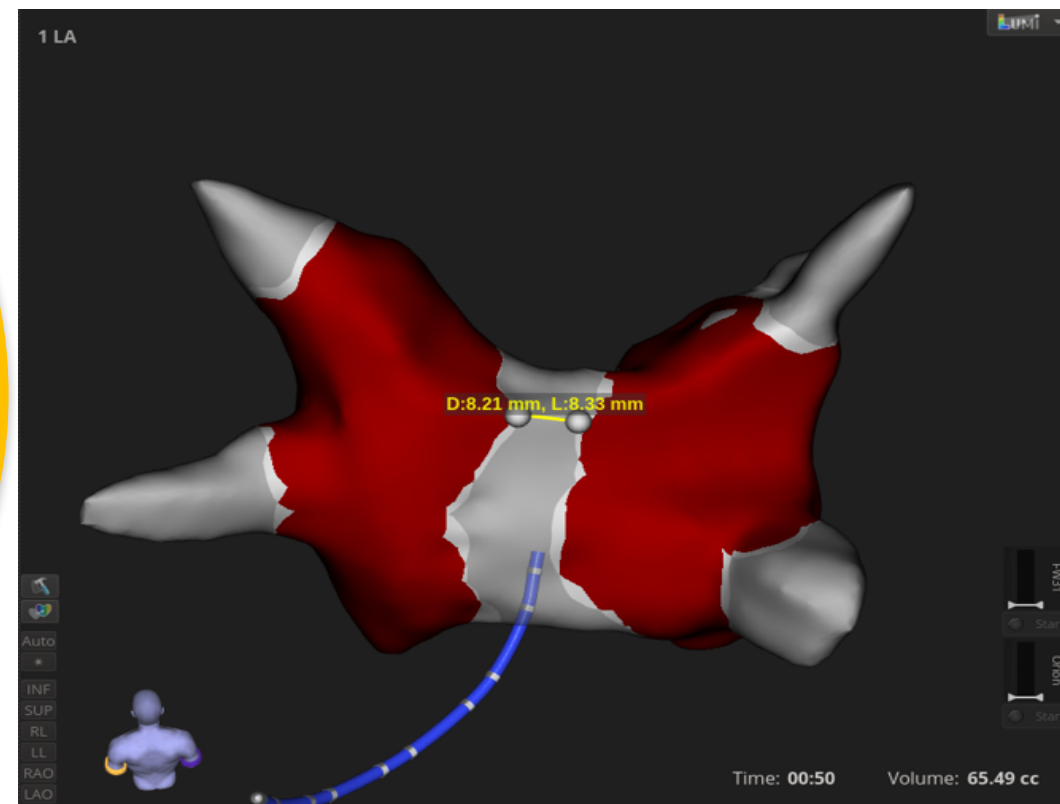
ROOF APPLICATIONS



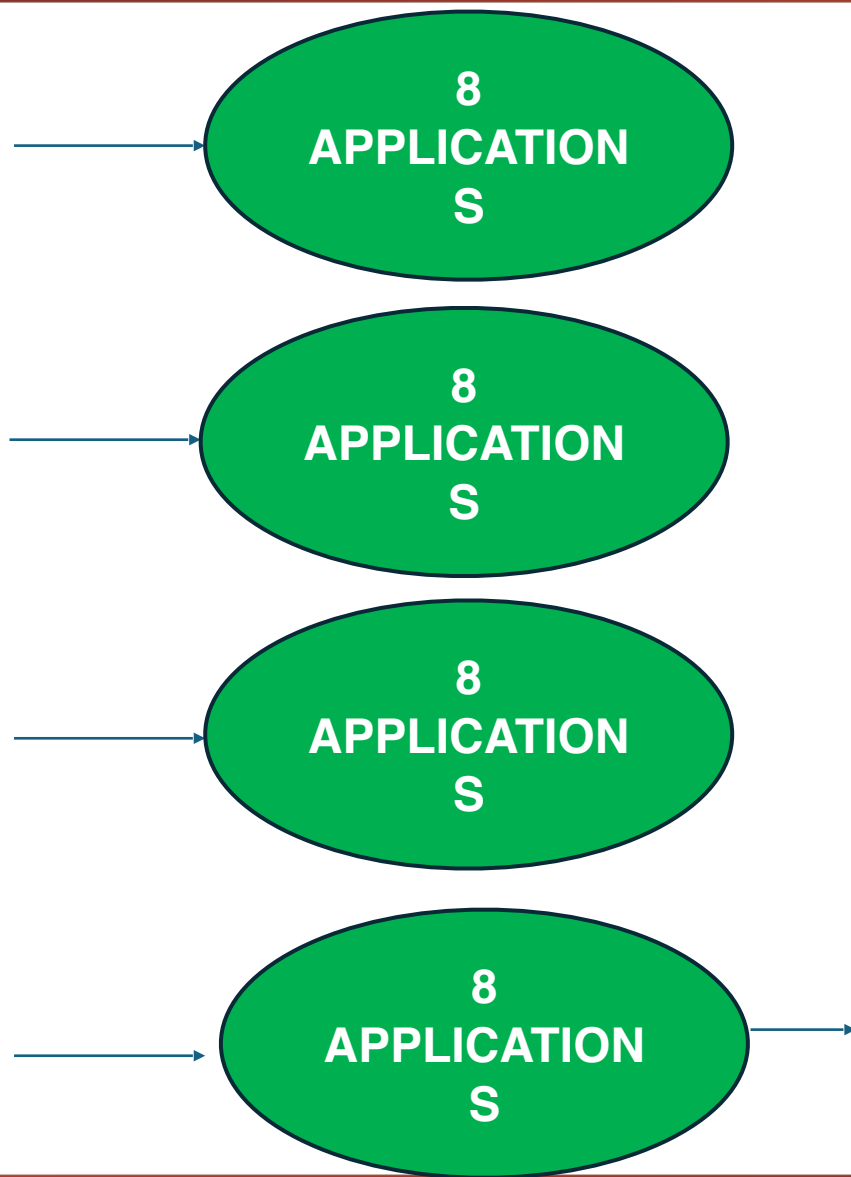


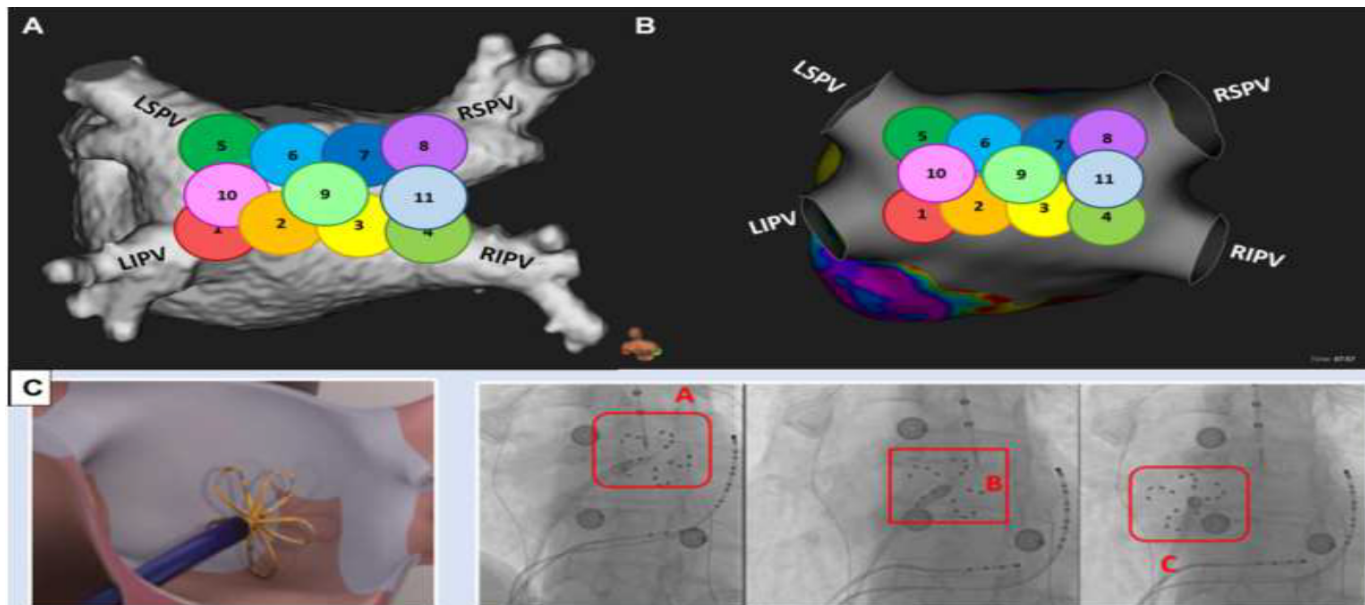
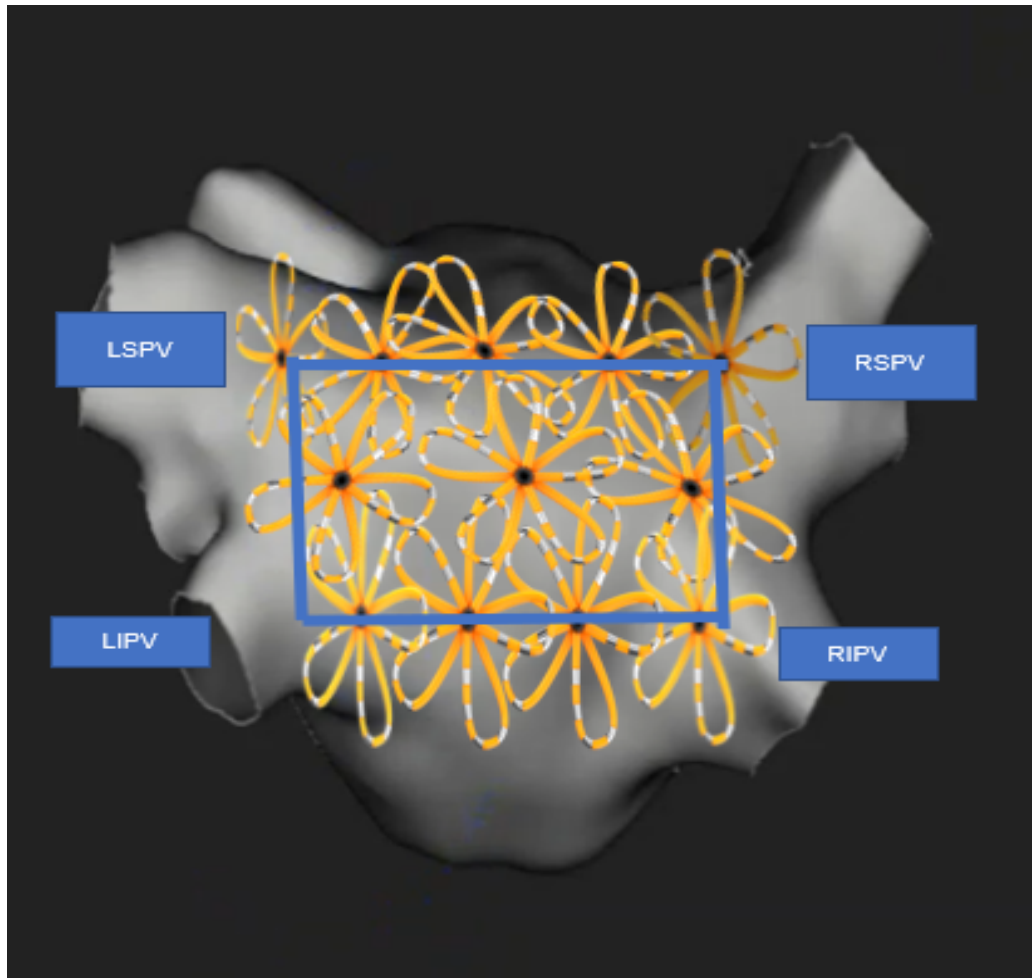
10 %
BLOCKED ROOF

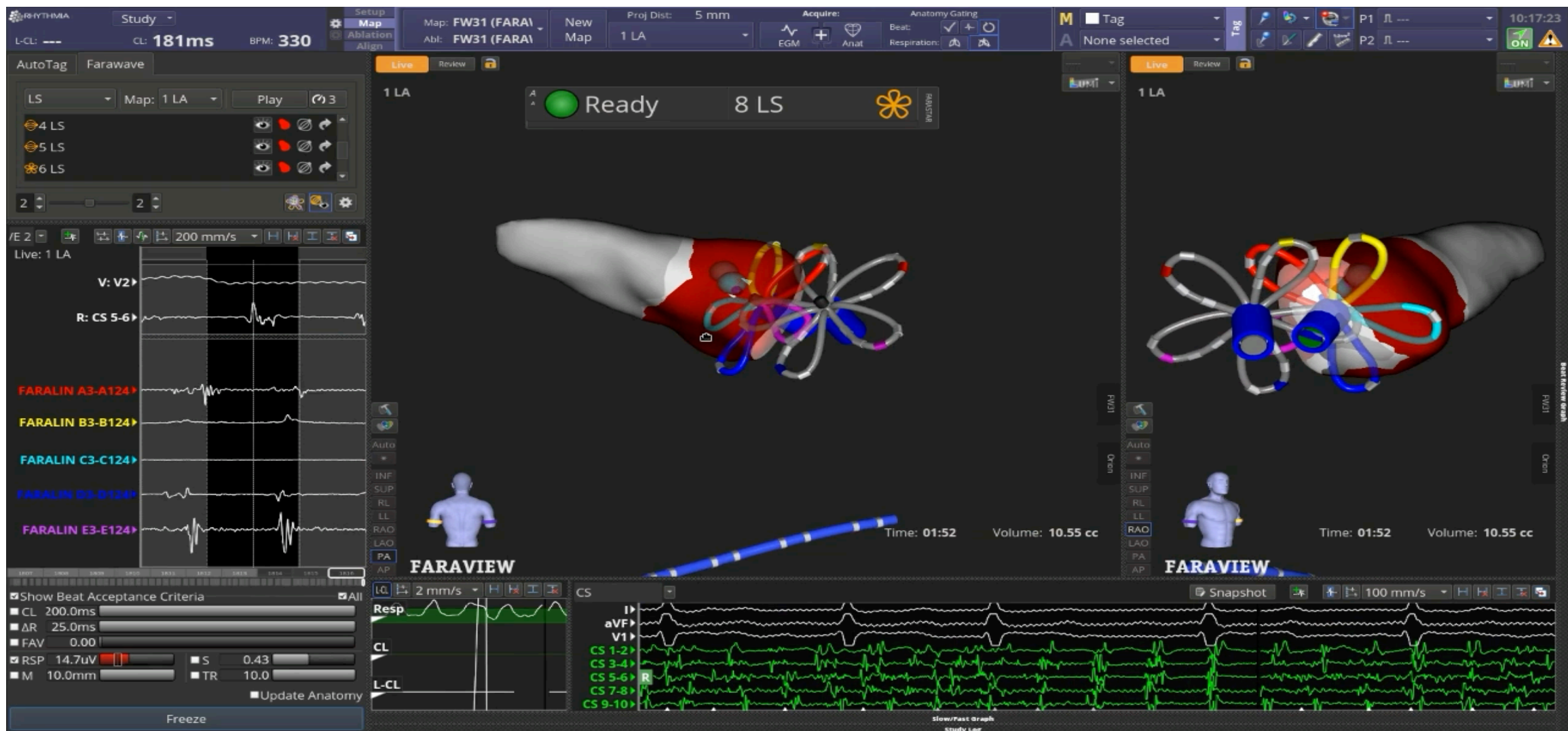
30%
NARROW CORRIDOR



FARAPULSE WORKFLOW AFTER FARAVIEW







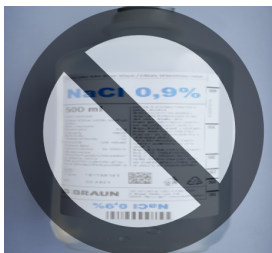
IDRATAZIONE

Acute Kidney Injury Resulting From Hemoglobinuria After Pulsed-Field Ablation in Atrial Fibrillation

Is it Preventable?

Sanghamitra Mohanty, MD, MS,^a Michela Casella, MD,^a Paolo Compagnucci, MD,^b Prem Geeta Torlapati, MD, MPH,^a Domenico Giovanni Della Rocca, MD, PhD,^c Vincenzo Mirco La Fazia, MD,^a Carola Gianni, MD, PhD,^a Gian-Battista Chierchia, MD, PhD,^c Bryan MacDonald, MD,^a Angel Mayedo, MD,^a Umer N. Khan, MD,^a John Allison, MD,^a Mohamed Bassiouny, MD,^a G. Joseph Gallinghouse, MD,^a John D. Burkhardt, MD,^a Rodney Horton, MD,^a Amin Al-Ahmad, MD,^a Luigi Di Biase, MD, PhD,^d Carlo de Asmundis, MD, PhD,^c Antonio Dello Russo, MD,^b Andrea Natale, MD^{a,d,e,f}

GROUP 1: 28 pts, No Hydration



GROUP 2: 75 pts, Hydration 2L



PFA usata per PVI, PWI, LAAI

Emoglobinuria post ablazione, test

Conferma Emolisi con Test Aptoglobina

Danno renale valutato con creatininemia



COME MITIGARE L'EMOLISI

IDRATAZIONE

Group 1

Group 2

Procedural data

Procedure time, min	86.77 ± 21.13	79.70 ± 24.13	0.188
PFA applications	57.38 ± 22.78	59.28 ± 22.49	0.755
Fluoroscopy time, min	23.62 ± 9.59	22.32 ± 7.34	0.483

Consecutive AF patients receiving PFA (n = 103)

No post-ablation hydration
(n = 28; initial 28 patients) S-Cr: 0.86±0.27 mg/dL
of PFA applications: 52.07±23.99

Dark-color urine (hemoglobinuria): 21 (75%)
LDH: Increased
Haptoglobin: Decreased
Hydration: 494.01±71.65 ml
S-Cr: 1.46±0.81

Planned post-ablation hydration (n = 75; subsequent 75 patients)
S-Cr: 0.88±0.27 mg/dL
of PFA applications: 59.28±22.49

No detectable hemoglobinuria
Hydration: 2,082.50±258.8 ml
S-Cr: 0.93±0.25

ASSENZA DI IDRATAZIONE NEL GRUPPO I

TABLE 2 Serum Biomarkers at Baseline and Follow-Up

Group 1 (n = 28)	Baseline	Follow-Up	Mean Change	P Value
Creatinine, mg/dL	0.86 ± 0.27	1.46 ± 0.81	0.68 ± 0.76	<0.001
Hemoglobinuria+ (n = 21)	0.86 ± 0.24	1.30 ± 0.35		<0.001
S-Cr >2.5 (n = 4/21)	0.85 ± 0.15	2.95 ± 0.21		
No hemoglobinuria (n = 7)	0.85 ± 0.25	0.91 ± 0.25		
WBC, k/mm ³	6.08 ± 1.69	10.14 ± 2.63	4.12 ± 3.05	<0.001
Hb, g/dL	15.08 ± 1.45	13.13 ± 1.74	1.88 ± 1.37	<0.001
Platelets, /mm ³	20,776.00 ± 5052.17	19,290.48 ± 5,300.93	1,525.00 ± 2,847.14	0.31
Hematocrit, %	45.15 ± 4.21	39.36 ± 5.52	5.19 ± 3.79	<0.001
Myoglobin, ng/mL	79.85 ± 73.55	202.56 ± 183.99	108.59 ± 188.86	0.06
Total bilirubin, mg/dL	0.89 ± 0.39	1.70 ± 1.16	0.65 ± 0.97	0.002

4 pazienti con danno renale di livello 3 avevano livelli di creatinina >2.5
Questi pazienti hanno ricevuto una media di 93 applicazioni



IDRATAZIONE

Group 2 (n = 75)	Baseline	Follow -Up	Mean Change	P Value
Creatinine	0.88 ± 0.25	0.93 ± 0.25	0.06 ± 0.17	0.18
WBC, k/mm ³	6.06 ± 1.60	9.01 ± 3.39	2.93 ± 3.32	<0.001
Hb, g/dL	14.24 ± 1.32	13.13 ± 1.41	1.32 ± 1.59	<0.001
Platelets, /mm ³	20,483.10 ± 4,290.85	18,685.71 ± 4,117.07	1,976.47 ± 2,445.11	0.01
Hematocrit, %	43.90 ± 3.96	40.11 ± 3.96	4.51 ± 5.02	<0.001
Myoglobin	62.58 ± 35.13	111.33 ± 91.75	52.15 ± 72.12	0.01
Total bilirubin, mg/dL	0.80 ± 0.35	0.90 ± 0.57	0.20 ± 0.14	0.62

Values are mean ± SD or n (%).

Hb = hemoglobin; S-Cr = serum creatinine; WBC = white blood cell.

La creatinina non aumenta in nessun caso neanche nei pazienti in cui venivano fatte applicazioni in numero maggiore (nessun caso con emoglobinuria)



IDRATAZIONE

Hydration to Prevent Kidney Injury After Pulsed Field Ablation

Importance of Timing and Fluids Amount

Vincenzo Mirco La Fazia, MD,^a Sanghamitra Mohanty, MD,^a Prem Geeta Torlapati, MD,^a Carola Gianni, MD, PhD,^a Domenico Giovanni Della Rocca, MD,^{a,b} Weeranun Bode, MD,^a G. Joseph Gallinghouse, MD,^a Amin Al-Ahmad, MD,^a Luigi Di Biase, MD, PhD,^{a,c} Andrea Natale, MD^{a,d,e,f}

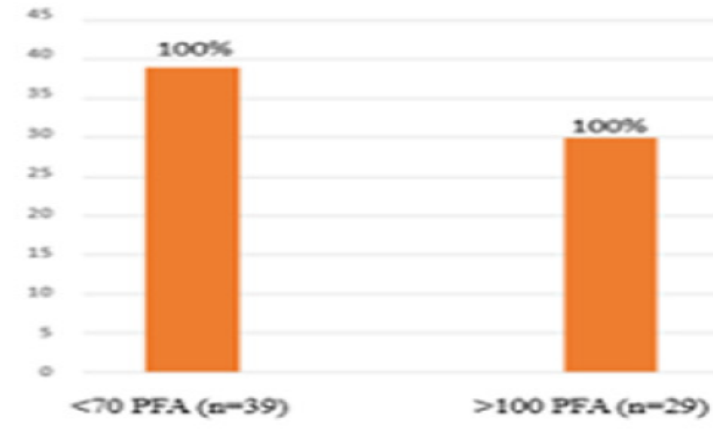
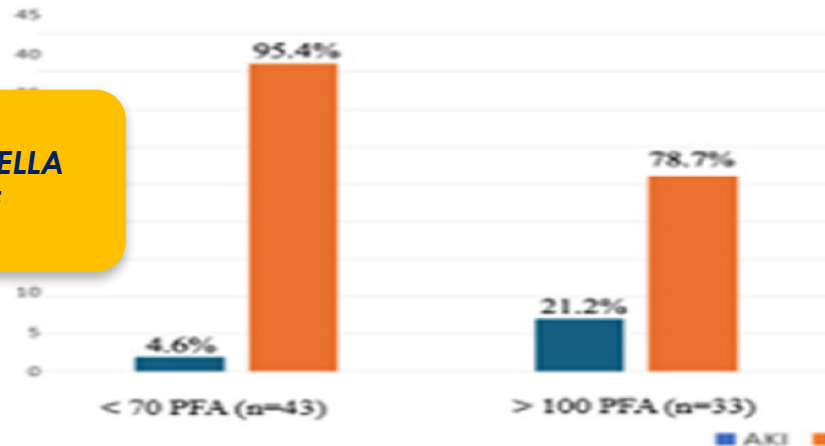
Atrial Fibrillation Patients undergoing Pulsed Field Ablation

**1 LITRO RINGER PRE ABLAZIONE
O
1 LITRO RINGER PRE
+ 1 LITRO NaCl POST (>100)**

1 Liter Pre-Ablation
or
1 Liter Pre-Ablation + 1 Liter Post-Ablation
n=102

2 Liters Pre-ablation
n=106

**2 LITRI PRE ABLAZIONE
(1 RINGER + 1 NaCl)
+ eventuali 500 mL NaCl (>100)**



**TIMING: 1-2 ORE PRIMA DELLA
PRIMA APPLICAZIONE**



IDRATAZIONE

	Group 1 (n=102)	Group 2 (n=106)	P value
Baseline			
Age, y	67.4 ± 12.2	64.6 ± 11.5	0.182
Sex, male	68 (66.7%)	72 (67.9 %)	0.608
AF type			
Paroxysmal	76 (57.1%)	24 (52.2%)	
Persistent	32 (24.1%)	10 (21.7%)	0.574
Long standing persistent	25 (18.8%)	6 (13.0%)	
Hypertension	86 (64.7%)	31 (67.4%)	0.737
Diabetes	21 (15.8%)	11 (23.9%)	0.215
CHA2DS2-VASC			
0	11 (8.3%)	6 (13.0%)	
1	14 (10.5%)	5 (10.9%)	0.626
>2	108 (81.2%)	35 (76.1%)	
LVEF (%)	52.7 ± 12.1	53.8 ± 13.6	0.624
Procedural			
PVI only	13 (12.7%)	11 (10.4%)	0.593
Procedural time (min)	76.1 ± 11.1	79.7 ± 12.8	0.073
PF application (min)	75.8 ± 23.7	77.5 ± 25.5	0.669
Fluoroscopy time (min)	24.8 ± 10.6	15.4 ± 9.2	0.724

**9 AKI GRUPPO 1: 7 CON PIU' DI 100 APPLICAZIONI
0 AKI GRUPPO 2**

**2 AKI CON 54 e 50 APPLICAZIONI: ENTRAMBI CON
MALATTIA RENALE STADIO 3**

**INDIPENDENTEMENTE DA AKI, LA CREATININA NEL GRUPPO
1 SALE SIGNIFICATIVAMENTE POST PROCEDURA**

B

	Baseline (mg/dL)	Follow-up (mg/dL)	Mean change (mg/dL)	P value
Group 1 (n=102)	0.92 ± 0.27	1.41 ± 0.12	0.49 ± 0.21	<0.001
Group 2 (n=106)	0.94 ± 0.30	1.02 ± 0.36	0.08 ± 0.25	0.084



I TRE FENOTIPI DI APTOGLOBINA: 1-1,2-1,2-2

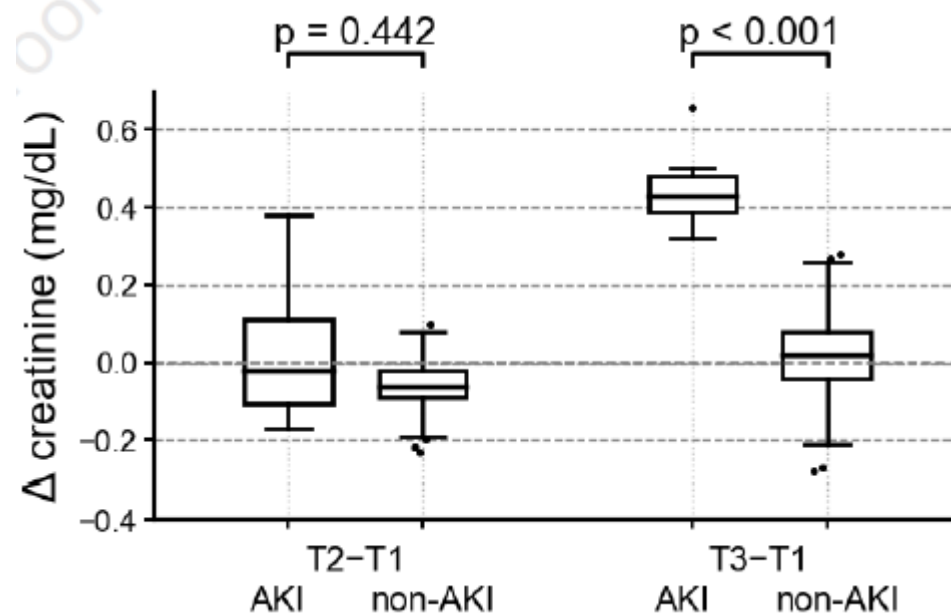
Patient vulnerability associated with acute kidney injury after pulsed field ablation: A role for baseline biomarkers and haptoglobin phenotype

Kazumasa Suga, MD, Hiroyuki Kato, MD, PhD, Kodai Yamazaki, MD, Taku Sakurai, MD, Shinji Yamazoe, MD, Kazuhito Tsuzuki, MD, PhD, Tomoyuki Ota, MD, PhD, Hisashi Murakami, MD, PhD, Kenji Kada, MD, PhD, Naoya Tsuboi, MD, PhD, Satoshi Yanagisawa, MD, PhD, Yasuya Inden, MD, PhD, Toyoaki Murohara, MD, PhD

Table 3. Clinical and laboratory characteristics of patients who developed postprocedural AKI.

Case	Age (years)	Sex	AF type	eGFR at T1 (mL/min/1.73 m ²)	Haptoglobin at T1 (mg/dL)	Haptoglobin phenotype	LDH at T1 (IU/L)	Catheter type	Total PFA applications
1	67	Male	Persistent	87.1	22	2-2	304	Circular-array	36
2	83	Male	Paroxysmal	44.4	30	2-2	200	Circular-array	34
3	79	Female	Persistent	35.1	33	2-2	245	Pentaspine	46
4	64	Male	Persistent	52.5	94	2-2	271	Pentaspine	66
5	68	Male	Persistent	43.4	39	2-2	201	Pentaspine	84
6	80	Male	Persistent	43.8	111	2-2	305	Circular-array	67
7	69	Male	Paroxysmal	20.8	55	2-2	324	Circular-array	74

AF, atrial fibrillation; AKI, acute kidney injury; eGFR, estimated glomerular filtration rate; LDH, lactate dehydrogenase; PFA, pulsed field ablation; T1, immediately before the procedure (baseline).



I TRE FENOTIPI DI APTOGLOBINA: 1-1,2-1,2-2

