

Oltre l'ablazione della FA

**Come trattare le tachicardie da rientro
sopraventricolare con crioablazione:
consigli e suggerimenti per un intervento
sicuro ed efficace**

Federico Ferraris



Survey europea impiego della crioenergia in ablazione transcatetere

Table 1 Use of cryoablation for treatment of supraventricular tachycardia and ventricular tachycardia

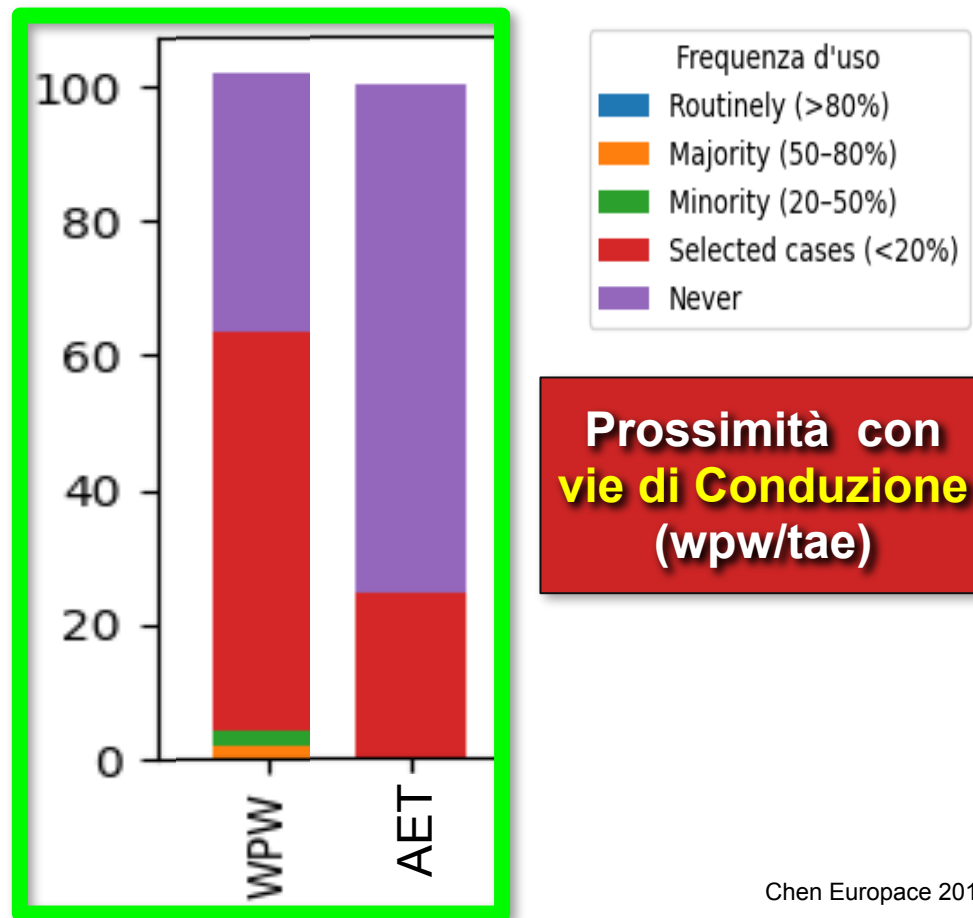
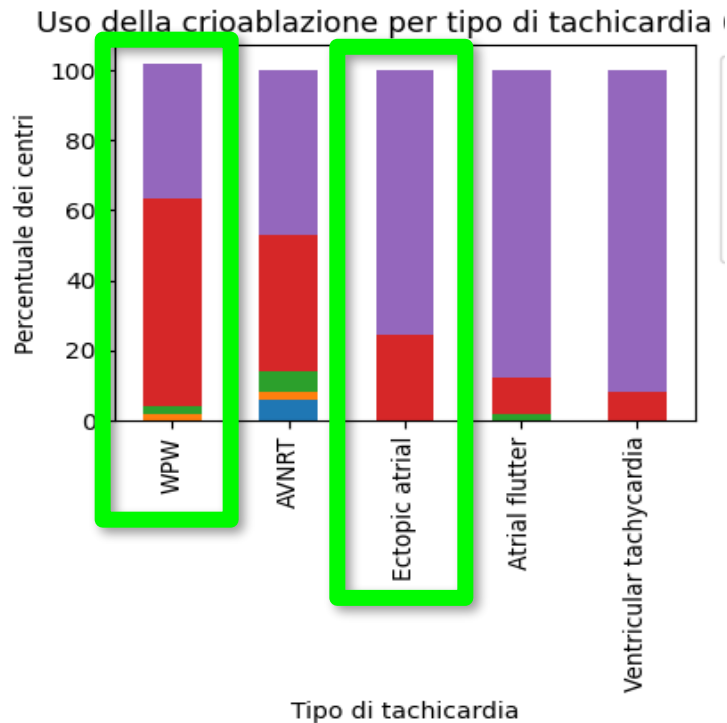
	WPW (atrioventricular reentrant tachycardia)	Atrioventricular nodal reentrant tachycardia	Ectopic atrial tachycardia	Atrial flutter	Ventricular tachycardia
Routinely (>80%)	0 (0)	3 (6.1)	0 (0)	0 (0)	0 (0)
In majority of cases (50–80%)	1 (2.0)	1 (2.0)	0 (0)	0 (0)	0 (0)
In minority of cases (20–50%)	1 (2.0)	3 (6.1)	0 (0)	1 (2.0)	0 (0)
In selected cases (<20%)	29 (59.2)	19 (38.8)	12 (24.5)	5 (10.2)	4 (8.2)
Never	19 (38.8)	23 (46.9)	37 (75.5)	43 (87.8)	45 (91.8)

Number (percentage) of centres is presented.

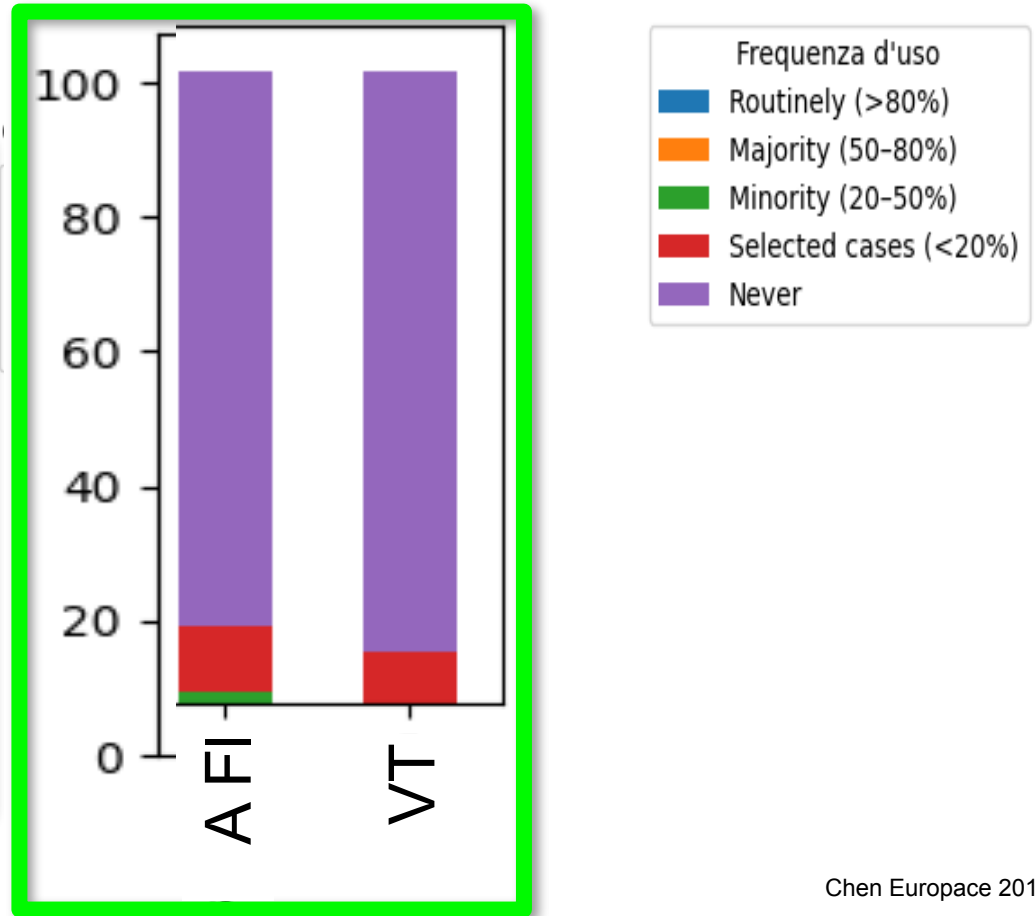
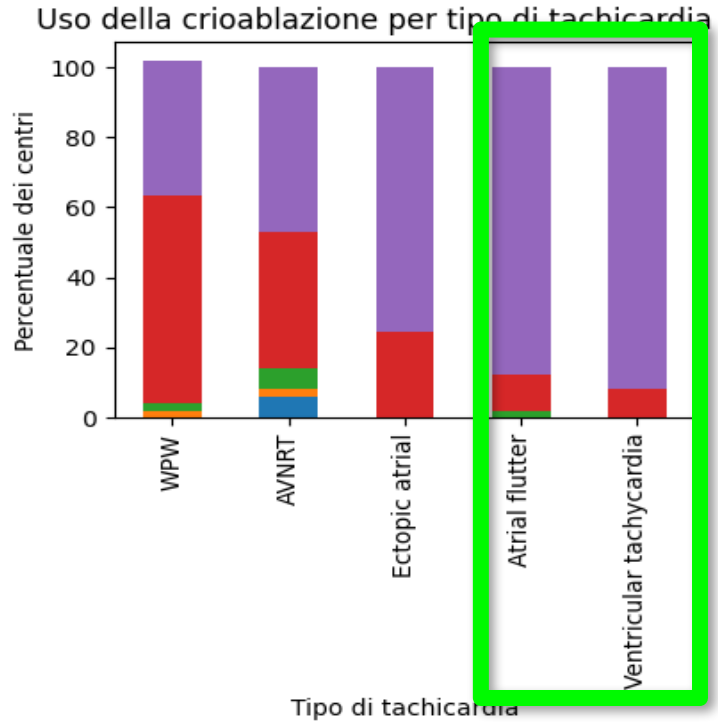
WPW, Wolff–Parkinson–White syndrome.

**49 centri,
18 paesi europei**

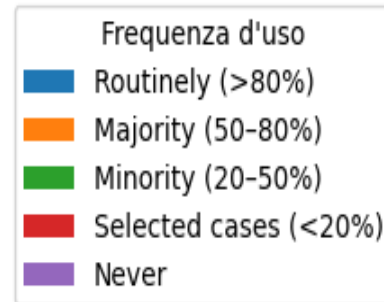
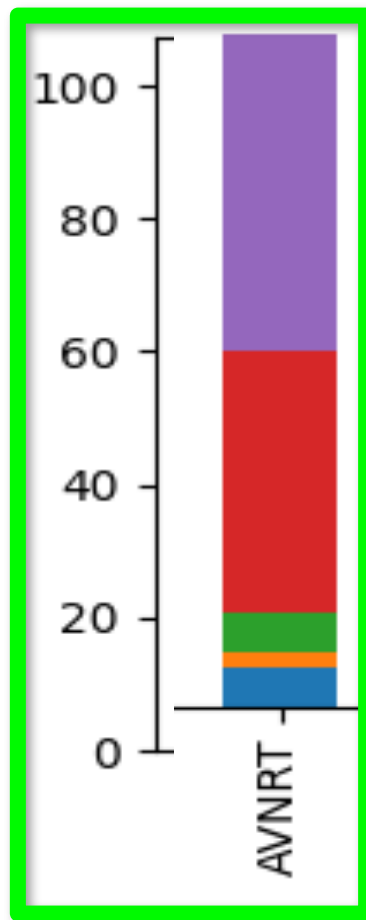
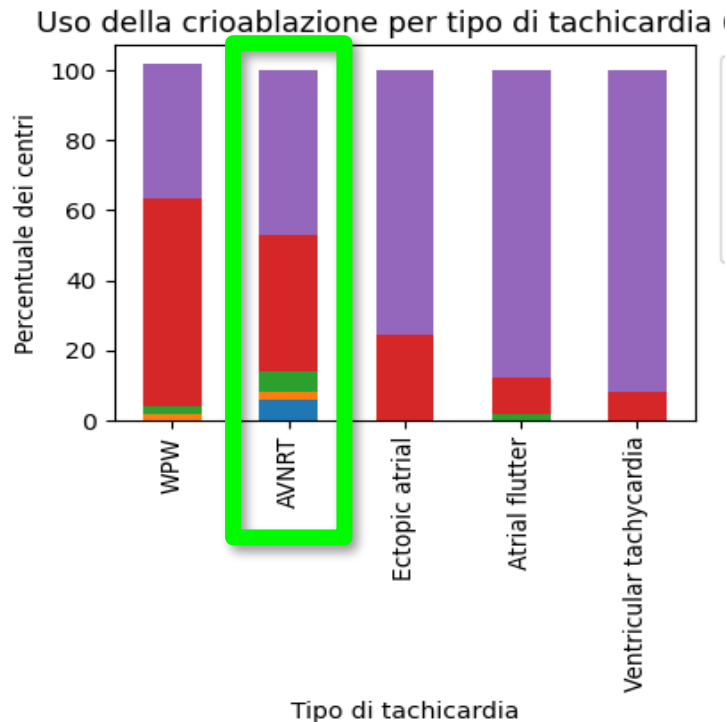
WPW e TAE



Flutter e TV



AVNRT



**Prossimità con
vie di Conduzione**

Pazienti pediatrici

In tutti i casi

Crioconsole e catetere

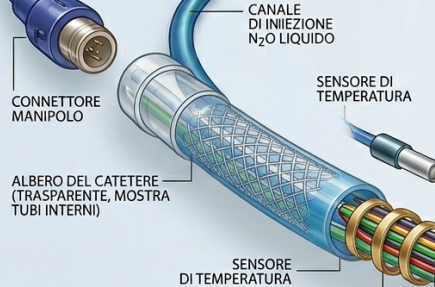
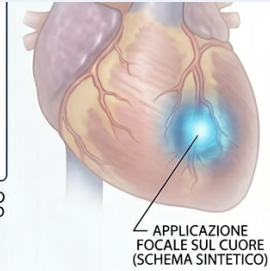
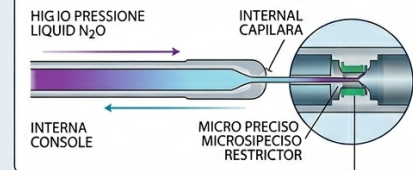


VISTA TRASVERSALE DEL CATETERE

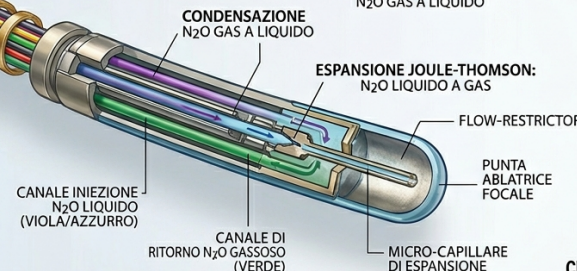
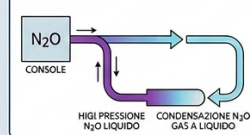


SEZIONE TRASVERSALE E MECCANISMO DI UN CATETERE PER CRIOABLAZIONE

MECANISMO DI ESPANSIONE DELL'OSSIDO DI AZOTO

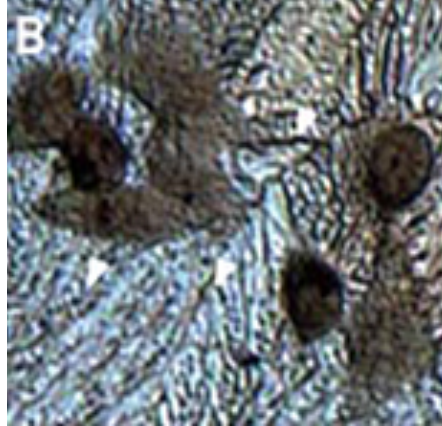
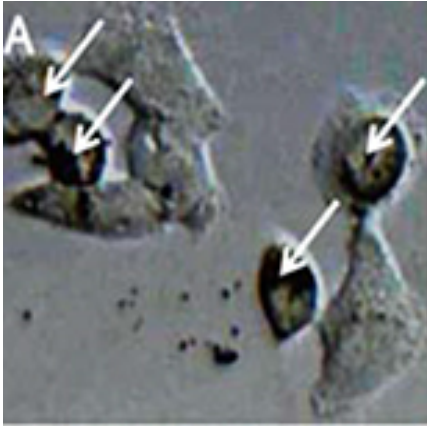


CICLO DI RAFFREDDAMENTO



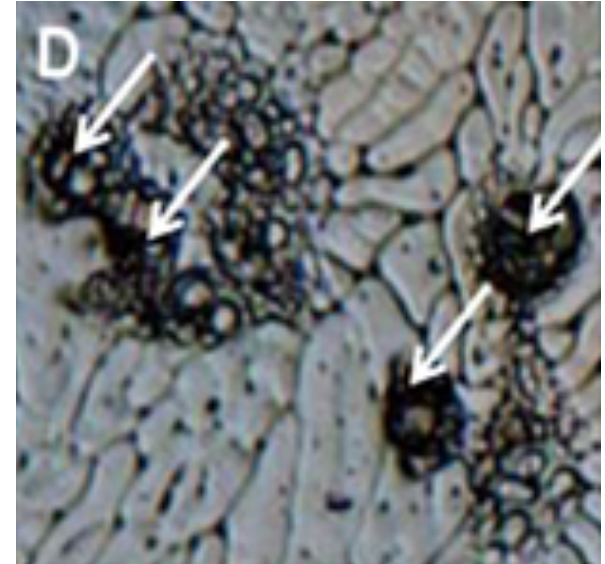
SCHEMA GENERALE DI UN CATETERE PER CRIOABLAZIONE FOCALE

Biochimica della crioablazione: **raffreddamento**

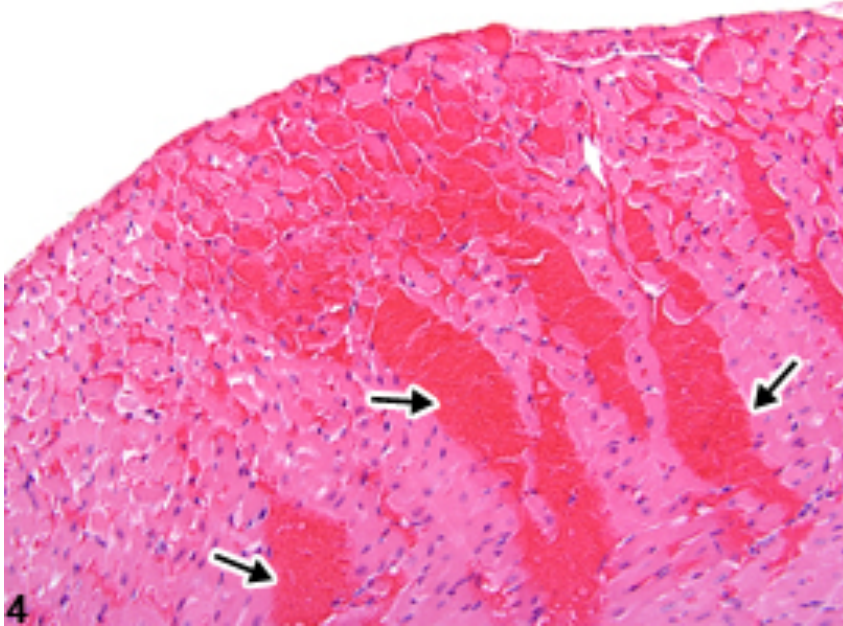


Matrice extracellulare →
gradiente osmotico

Cristalli →
danno meccanico



Biochimica della crioablazione: **riscaldamento**



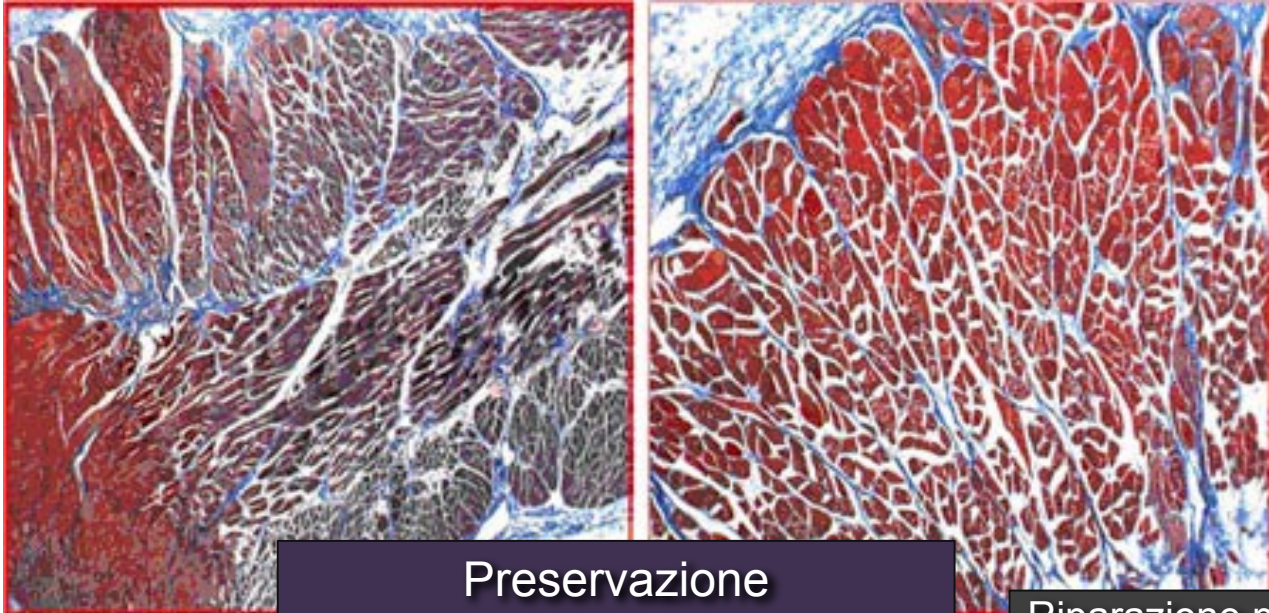
Microtrombi con
danno ischemico

Estensione della
lesione, anche per
apoptosi

Lesione crioablazione rispetto a RF

Tessuti più resistenti alla crioablazione:

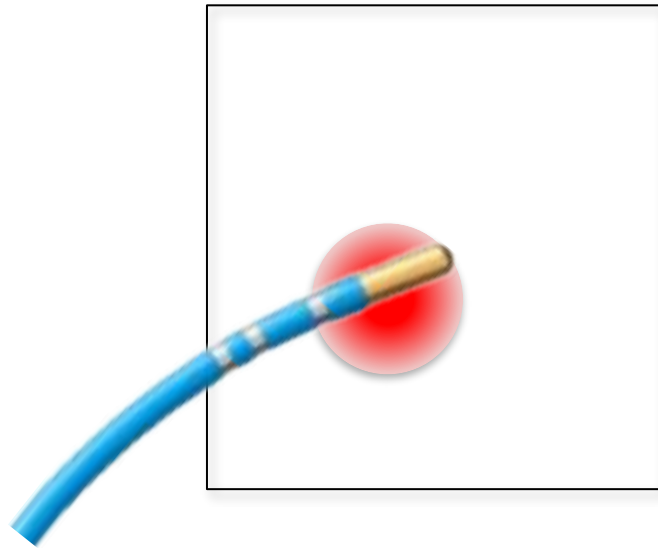
Macrofagi e Collagene



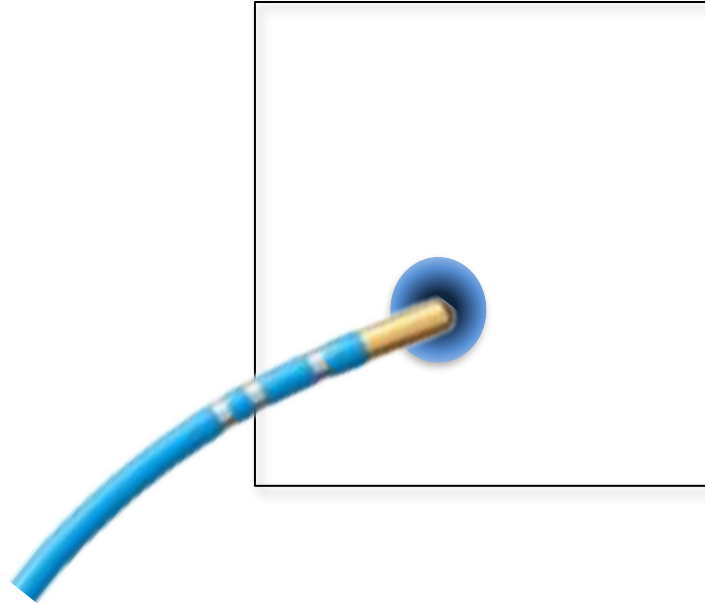
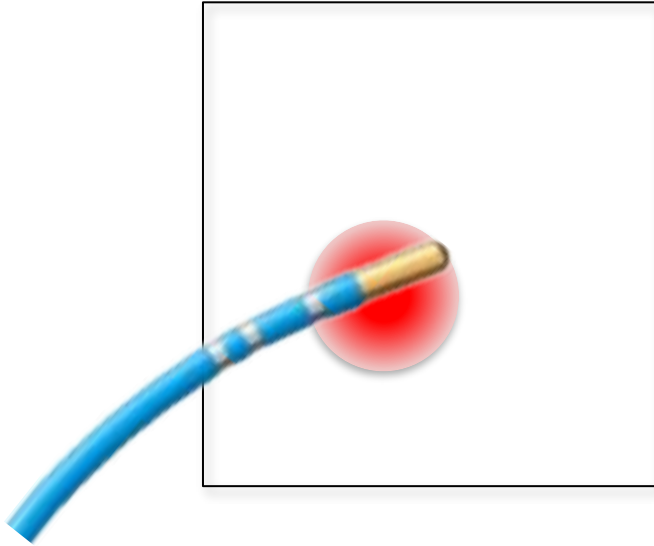
Preservazione
integrità ultrastrutturale

Riparazione più
facile

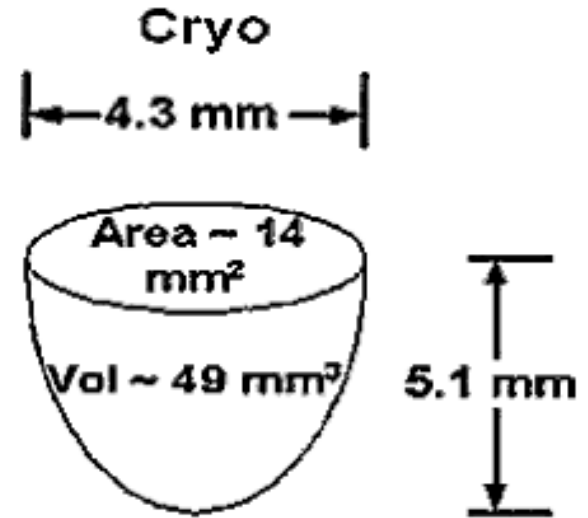
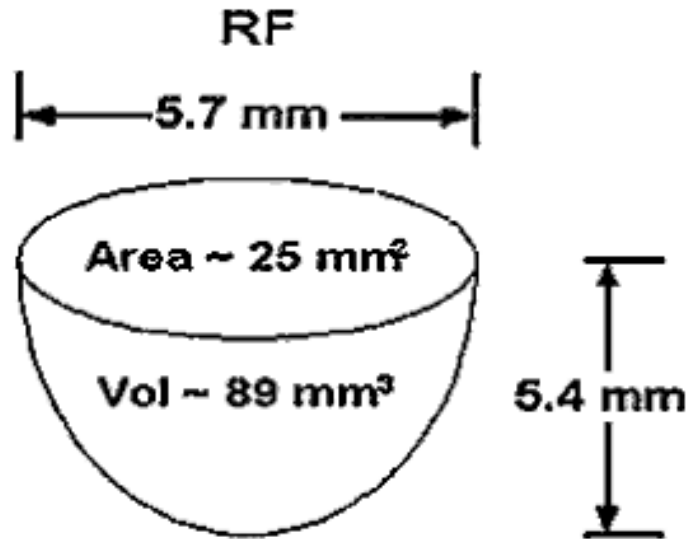
Crioaderenza



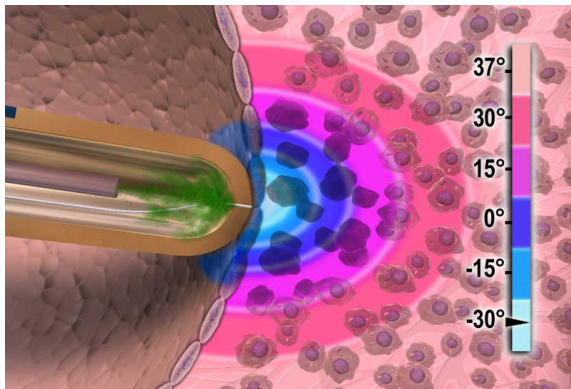
Crioaderenza



Lesione crioablazione rispetto a RF

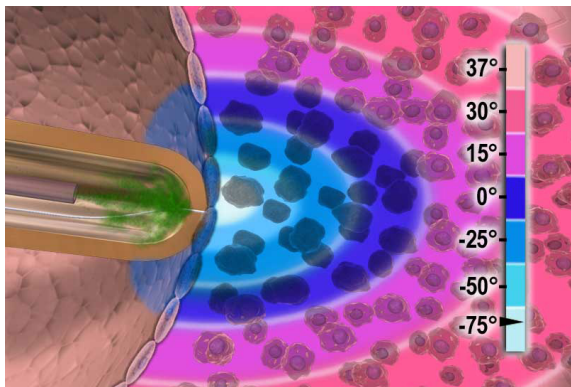


Scomparsa doppia curva in criomappaggio



Mappaggio

- 30° per 60 secondi
danno reversibile



Ablazione

- 80° per 4 minuti
danno irreversibile

Efficacia e complicanze Crioablazione AVNRT

Table I.

Clinical Results of Cryoablation for AVNRT—Comparison among Studies

Author	Year	Patients (n)	Age (years)	Follow-Up (months)	Tip Size (mm)	Acute Success (%)	Recurrence Rate(%)	Inadvertent Transient AV Block (%)
Friedman et al. ¹⁰	2004	101	39 ± 13	6	4	93	6	7
Kimman et al. ^{11*}	2004	30	52	11.7 ± 7	4	94	10	7
Zrenner et al. ^{12*}	2004	100	51 ± 18	6.2	4	97	8	17
Jensen-Urstad et al. ¹³	2006	75	53 ± 16	9.2	6	99	7	8
Collins et al. ^{14*}	2006	57	14 ± 4	40 ± 83	4	95	8	11
Papez et al. ¹⁵	2006	52	13.4	8 ± 7	4 and 6	96	11.5	9.4
Gupta et al. ^{16*}	2006	71	52 ± 16	2.2	4 and 6	85	19.7	—
Khairy et al. ¹⁷	2007	185	49 ± 14	24	4 and 6	92	9	4.3
De Sisti et al. ¹⁸	2008	150	39 ± 14	18 ± 10	6	95	17	22.7
Avari et al. ^{19*}	2008	38	14	10.8	4 and 6	97	2	24
Chanani et al. ²⁰	2008	154	13.7	12	4 and 6	95	14	6
Rivard et al. ²¹	2008	289	45 ± 16	5	4 and 6	90.7	15	5.2
Sandilands et al. ²²	2008	160	44 ± 15	18	4 and 6	93	11.9	8
Chan et al. ^{23*}	2009	80	50 ± 12	11.3	6	97.5	9	—
Bastani et al. ²⁴	2009	312	53	22 ± 10	6	99	5.8	4
LaPage et al. ²⁵	2010	61	15 ± 2	36 ± 12	4, 6, and 8	96	6.5	17
Drago et al. ²⁶	2010	76	11 ± 2	29.5	4	97.4	6.8	5
Opel et al. ^{28*}	2010	123	53 ± 14	1–19	6	93	17	—
Deisenhofer et al. ^{29*}	2010	251	53	6	6	96.8	9.4	—
Silver et al. ³⁰	2010	77	15 ± 2	12 ± 3	8	91	2.8	6.5
Gist et al. ²⁷	2011	62	30	12	4 and 6	98	15	42
Schwagten et al. ^{31*}	2011	150	51 ± 30	52 ± 30	4	97	(11) [†]	4

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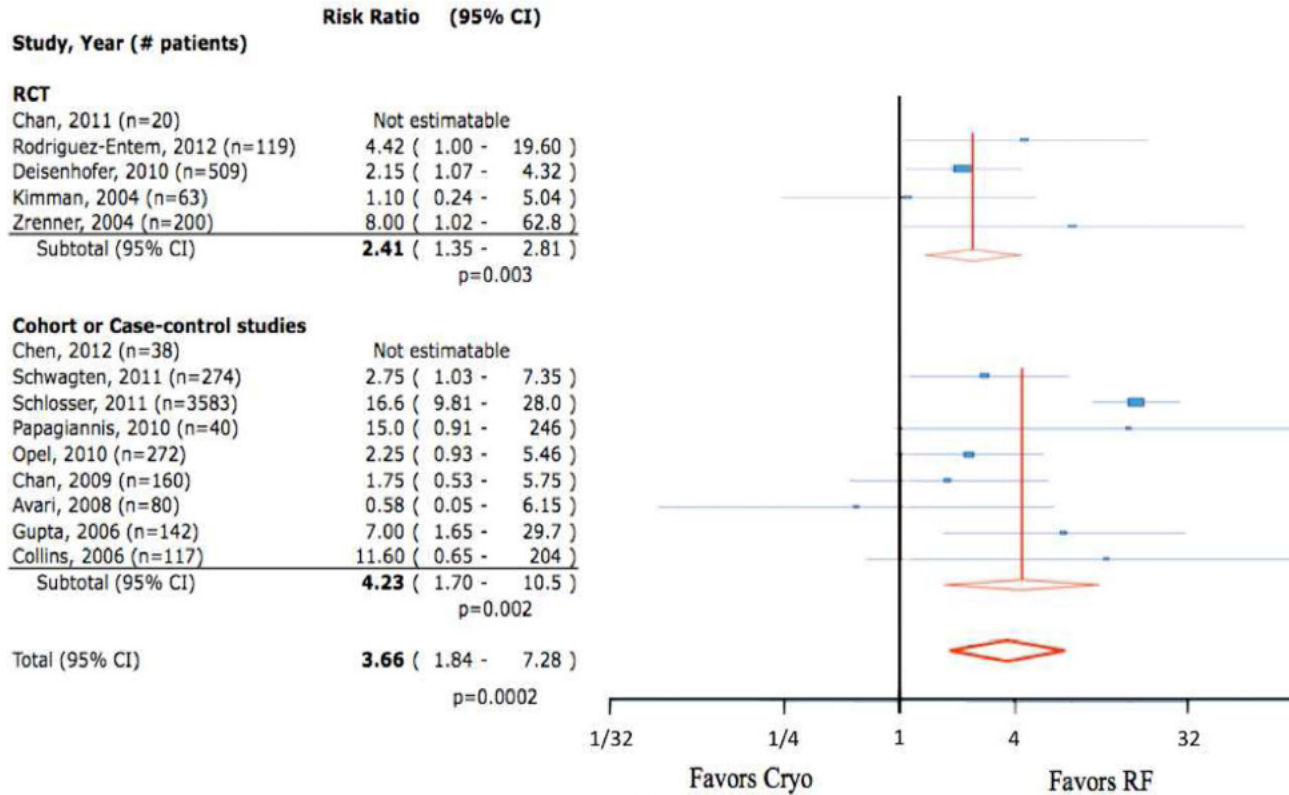
2654 pazienti

Successo in acuto: 95 %

BAV totali persistenti: nessuno

Recidive 11%

RF e Crioablazione in AVNRT



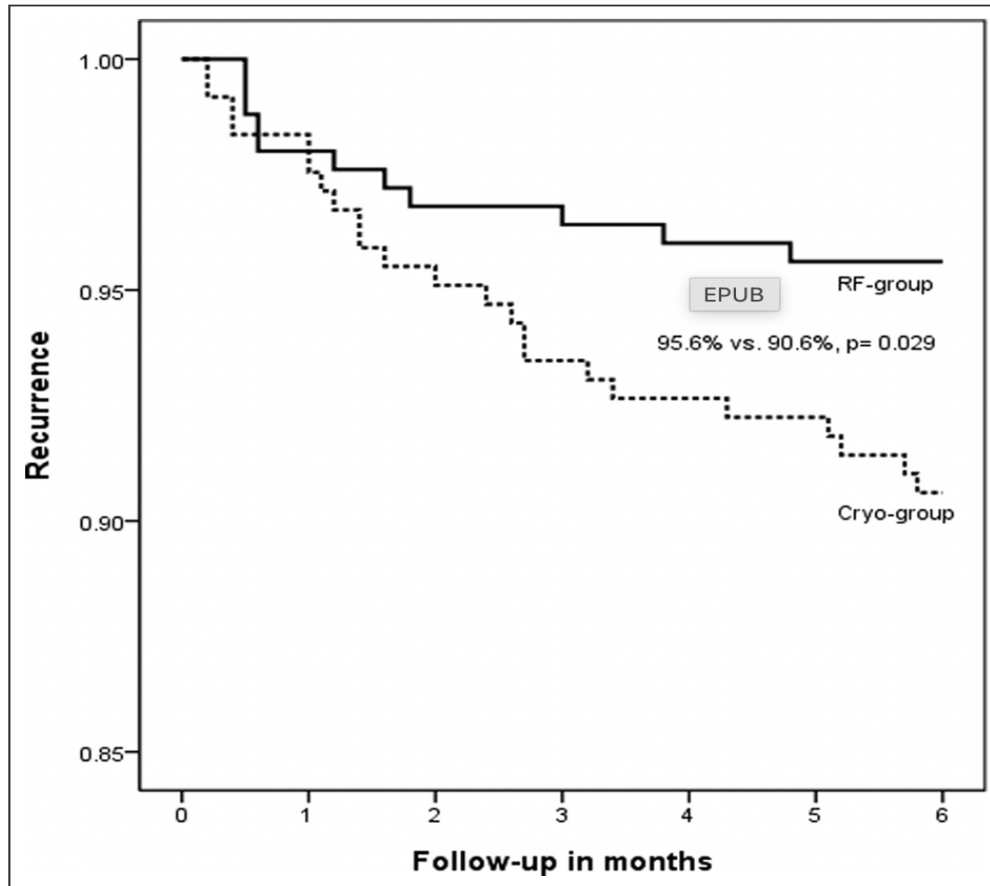
5617 pz

Recidive
RF 3.8%
crio 9.7%

Blocco AV:
RF 0,75%, Cryo 0
(p 0.01)

Figure 2. Long-term success with cryoablation versus radiofrequency ablation for AVNRT.

Studio randomizzato AVNRT RF vs Cryo



509 pazienti

**Endpoint non
inducibilità o
eco singolo**

**Efficacia a 6
mesi: recidive
9.4% vs 4.4%**

**Blocco AV:
RF 1, Cryo 0**

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Recidive 11%

(11)[†]

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Recidive

2-19%

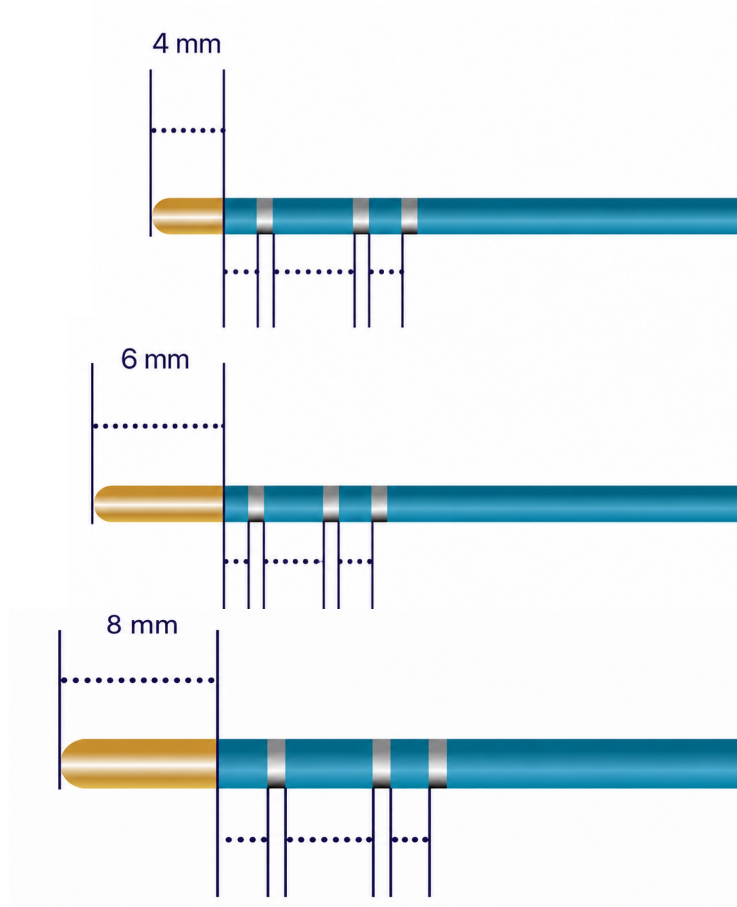
Accorgimenti per migliorare successo acuto e a lungo termine

Strumenti

Dimensione punta del catetere



Dimensione punta del catetere

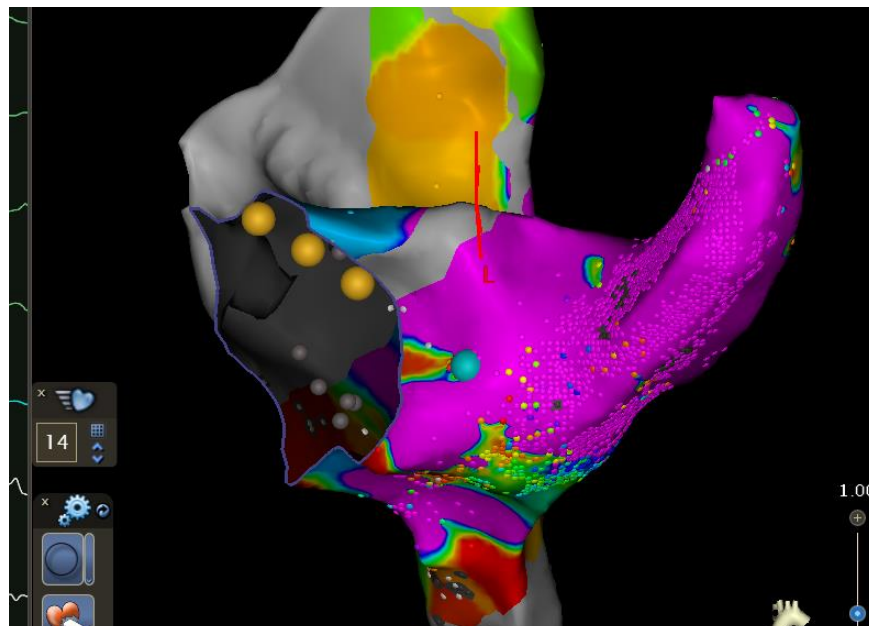


Pediatrico

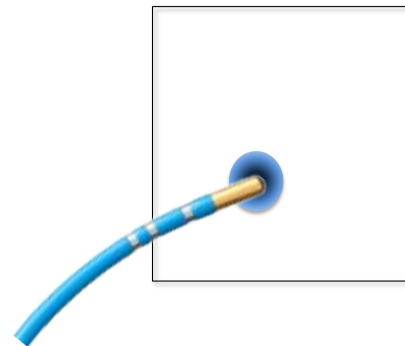
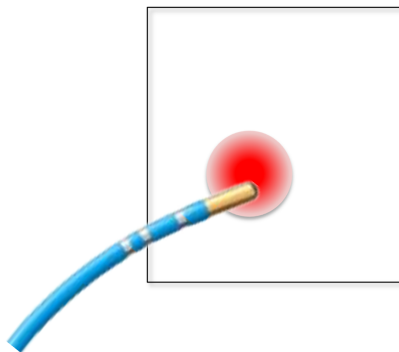
WPW parahissiano

AVNRT

Flutter comune/FA

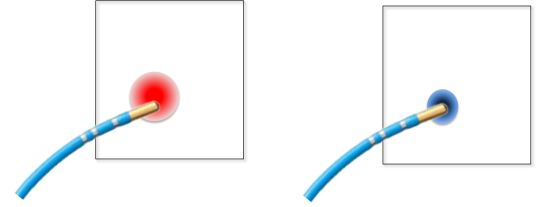
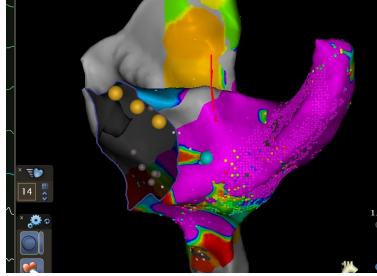


Ostio CS dilatato



Crioadesione

Introduttore lungo



Transsettale

Deflettibile

Accorgimenti per migliorare successo acuto e a lungo termine

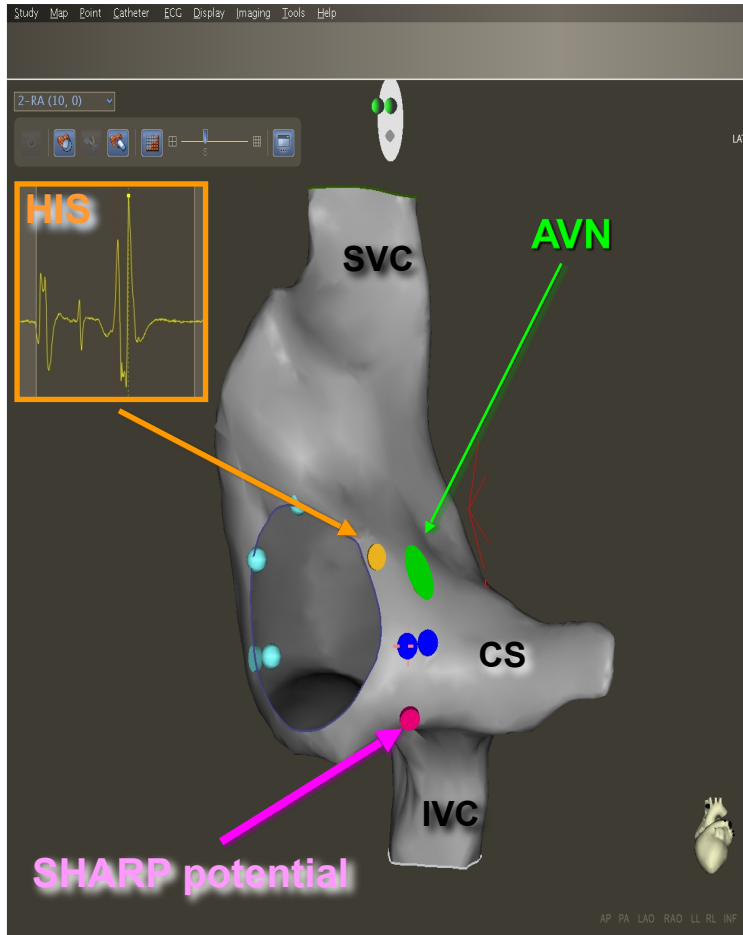
Strumenti

Punta **6 mm** AVNRT
4 mm WPW

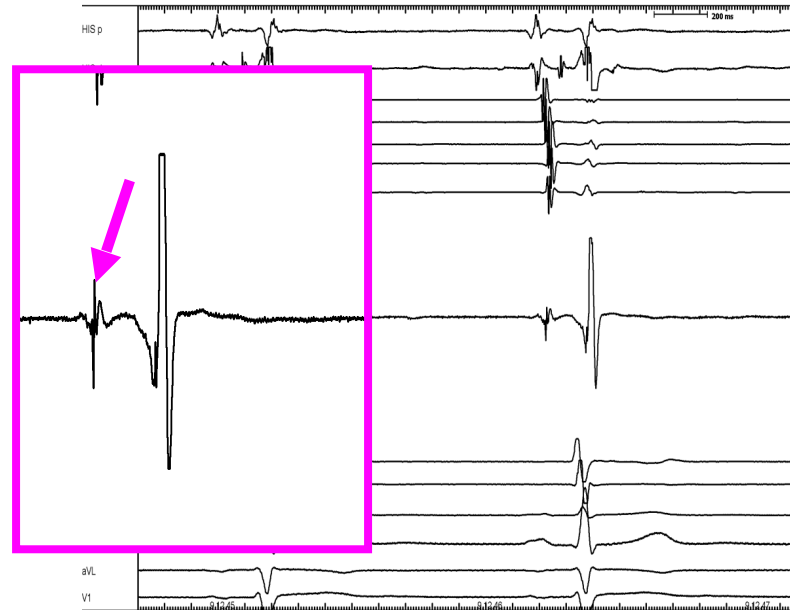
Introduttore lungo

Sito

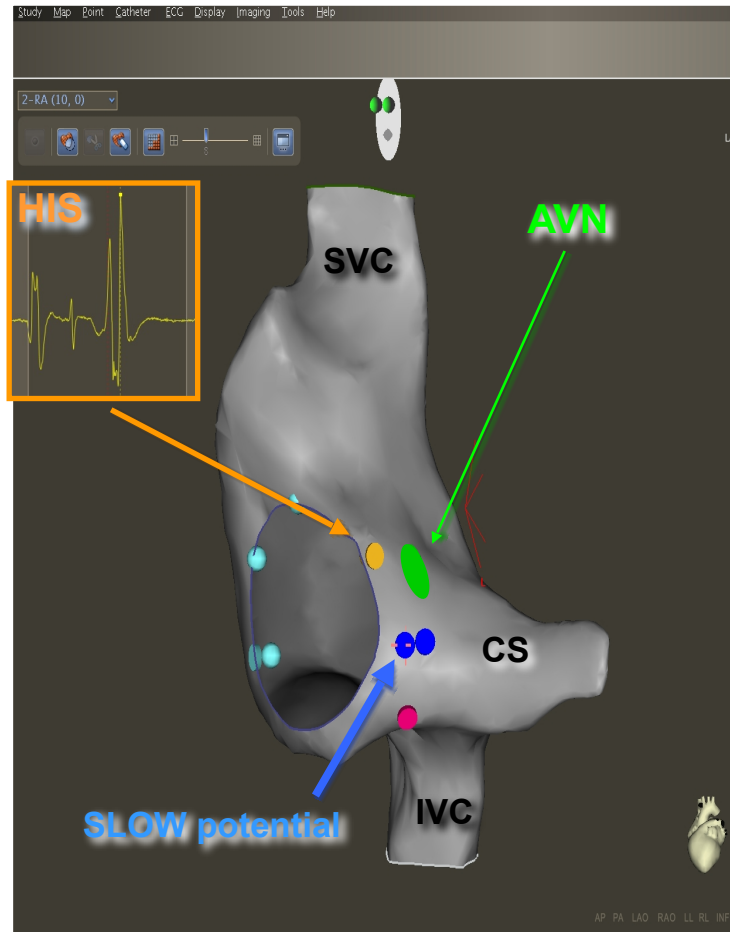
Sede ablazione: radiofrequenza



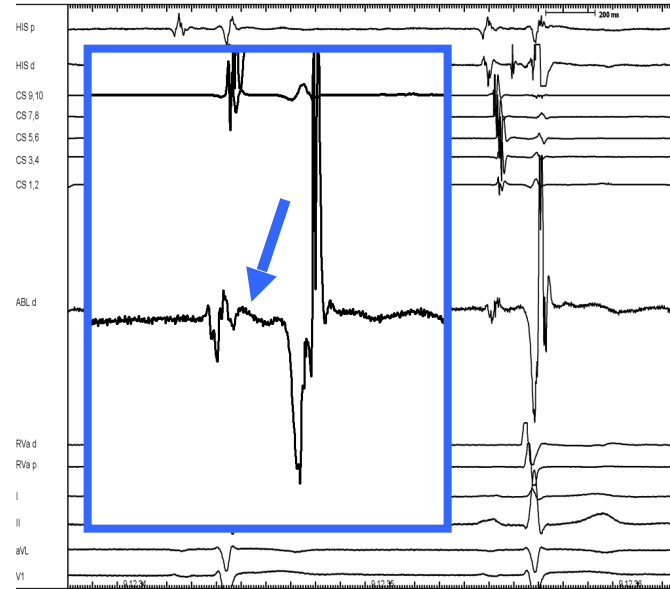
Potenziale rapido



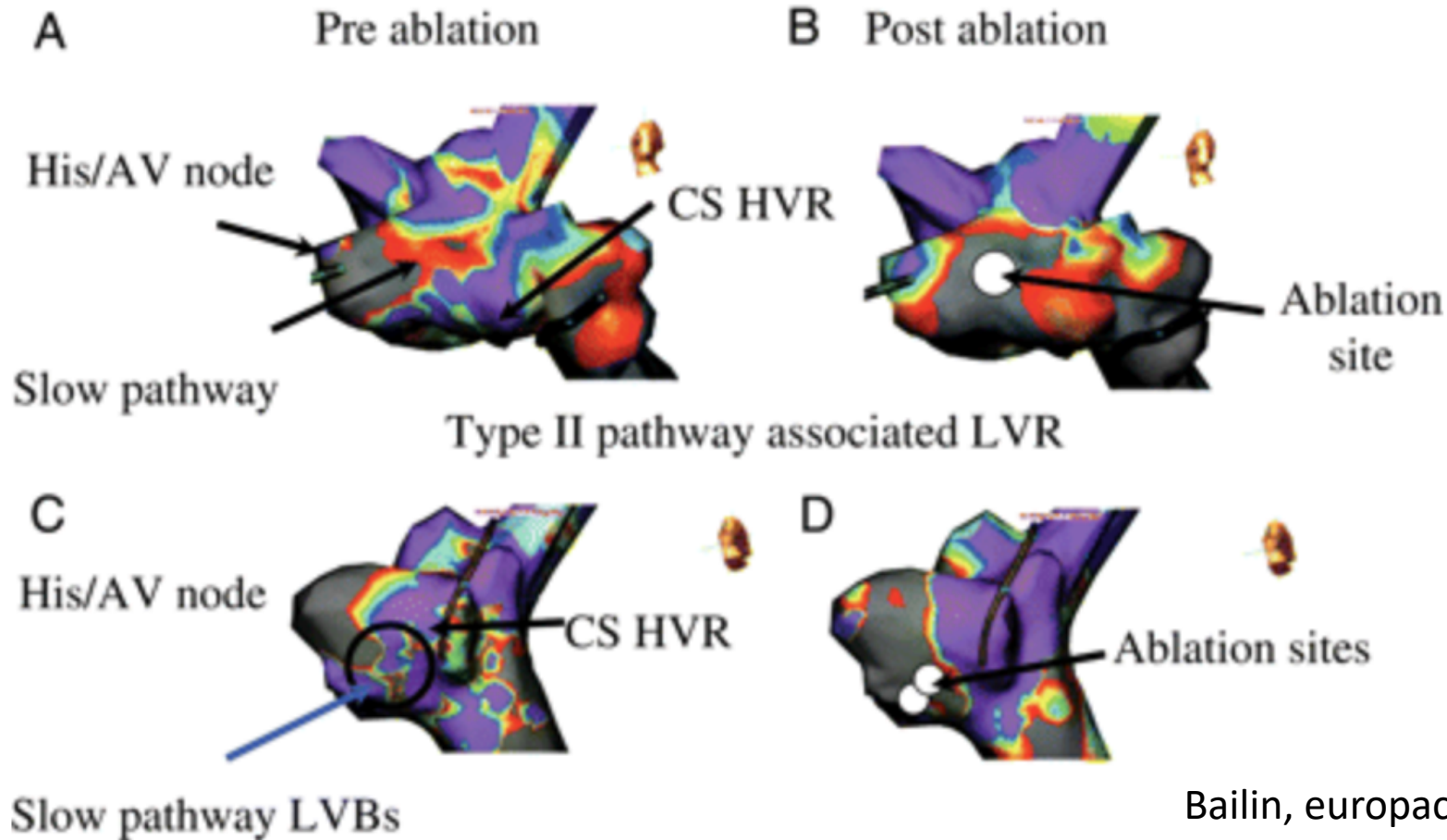
Sede ablazione: crioenergia



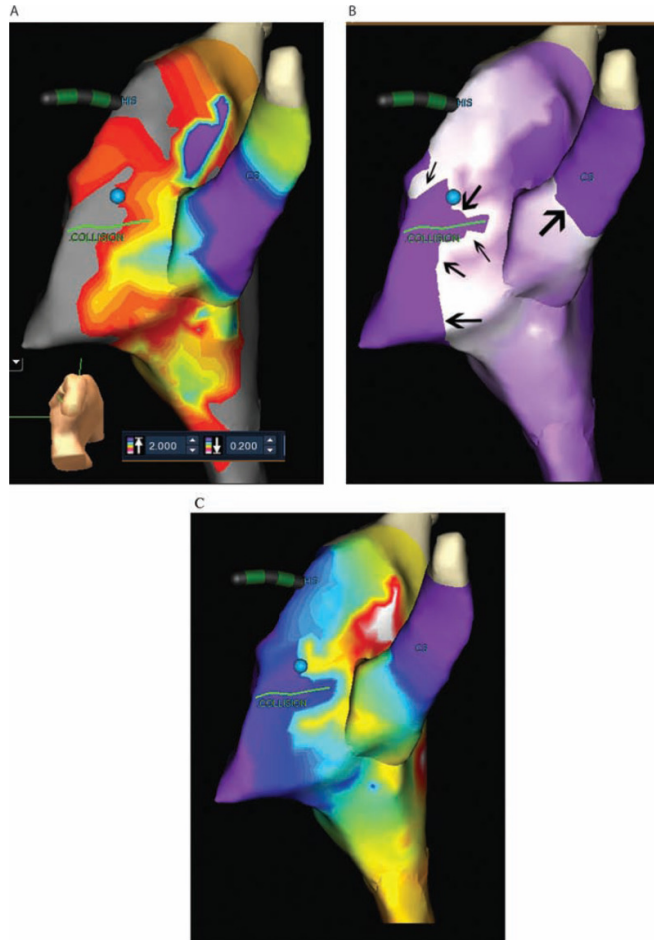
Potenziale lento



Sito di applicazione crio: low voltage bridge

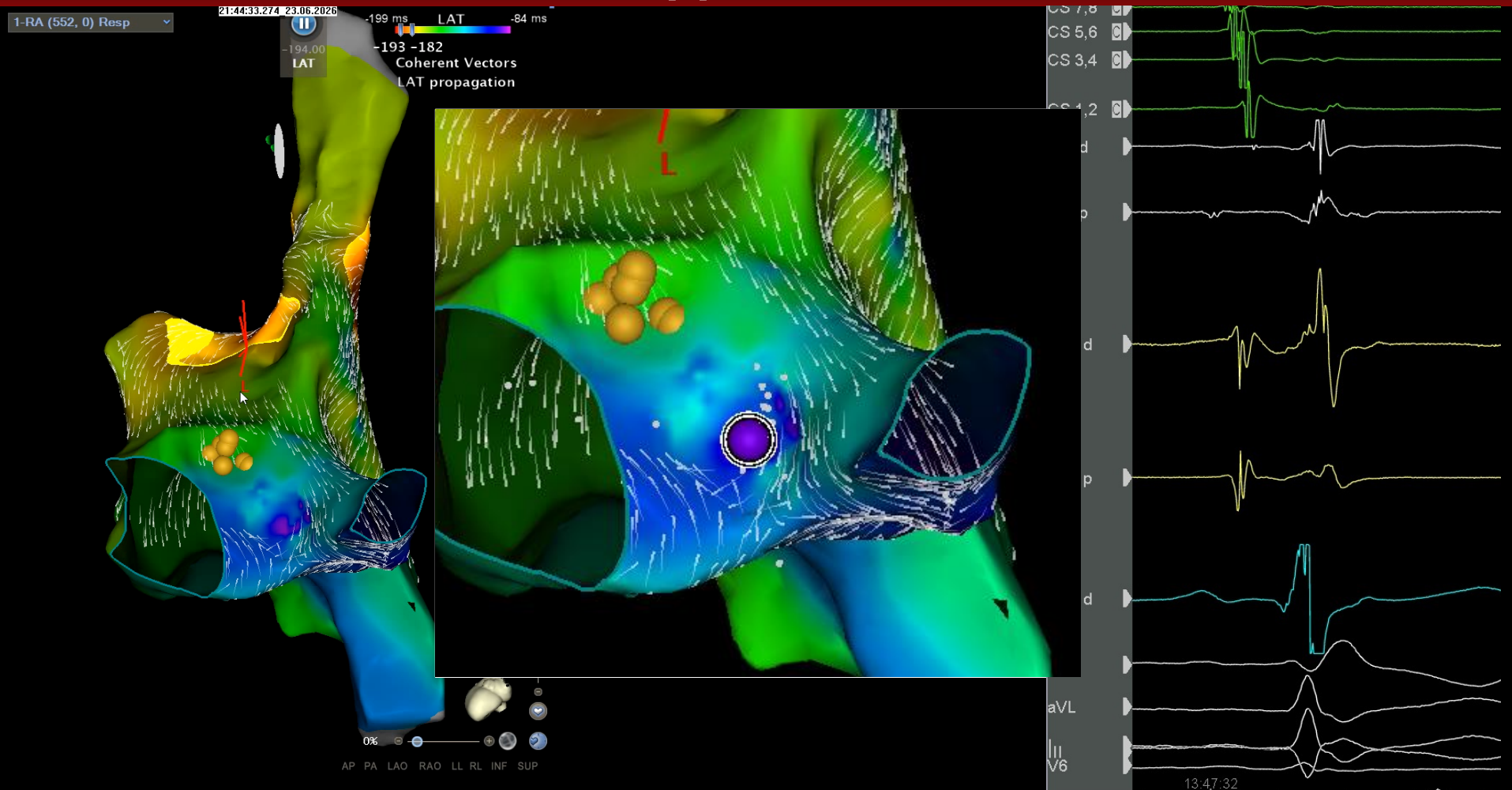


Sito di applicazione crio: confluenza attivazione



Van Aartsen, j inn card rhythm man, 2017

Sito di applicazione crio



Accorgimenti per migliorare successo acuto e a lungo termine

Strumenti

Punta **6 mm** AVNRT
4 mm WPW

Introduttore lungo

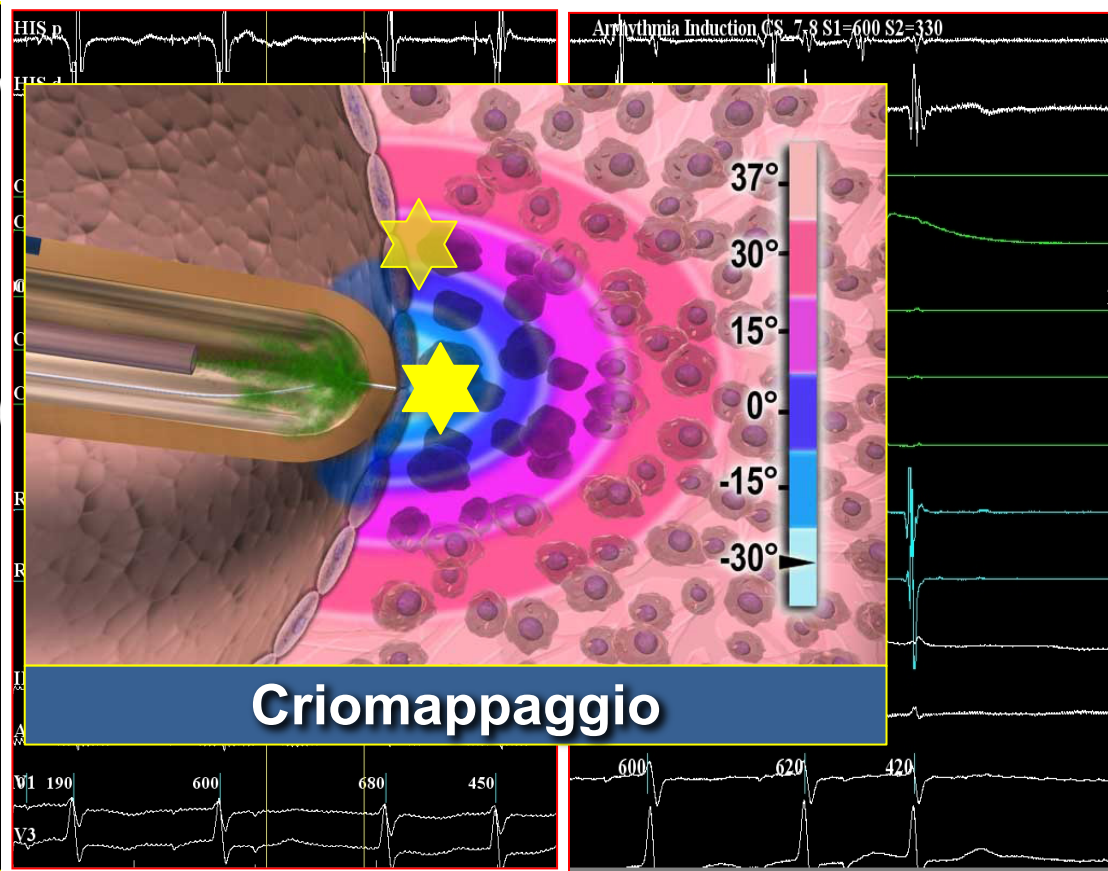
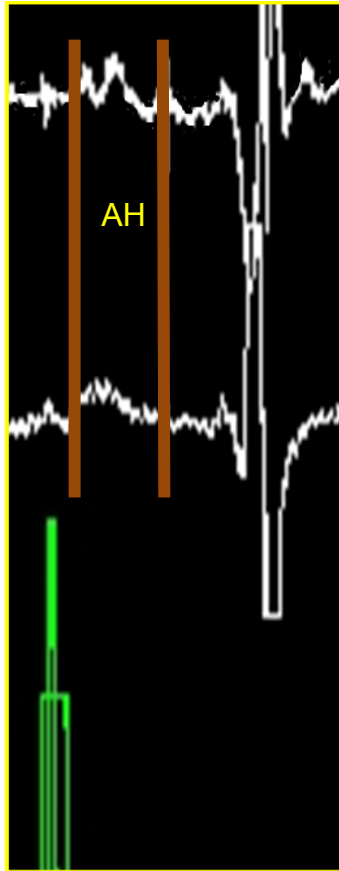
Tecnica

Sito

Segnale di via lenta

Mappa elettroanatomica

Scomparsa doppia curva in criomappaggio



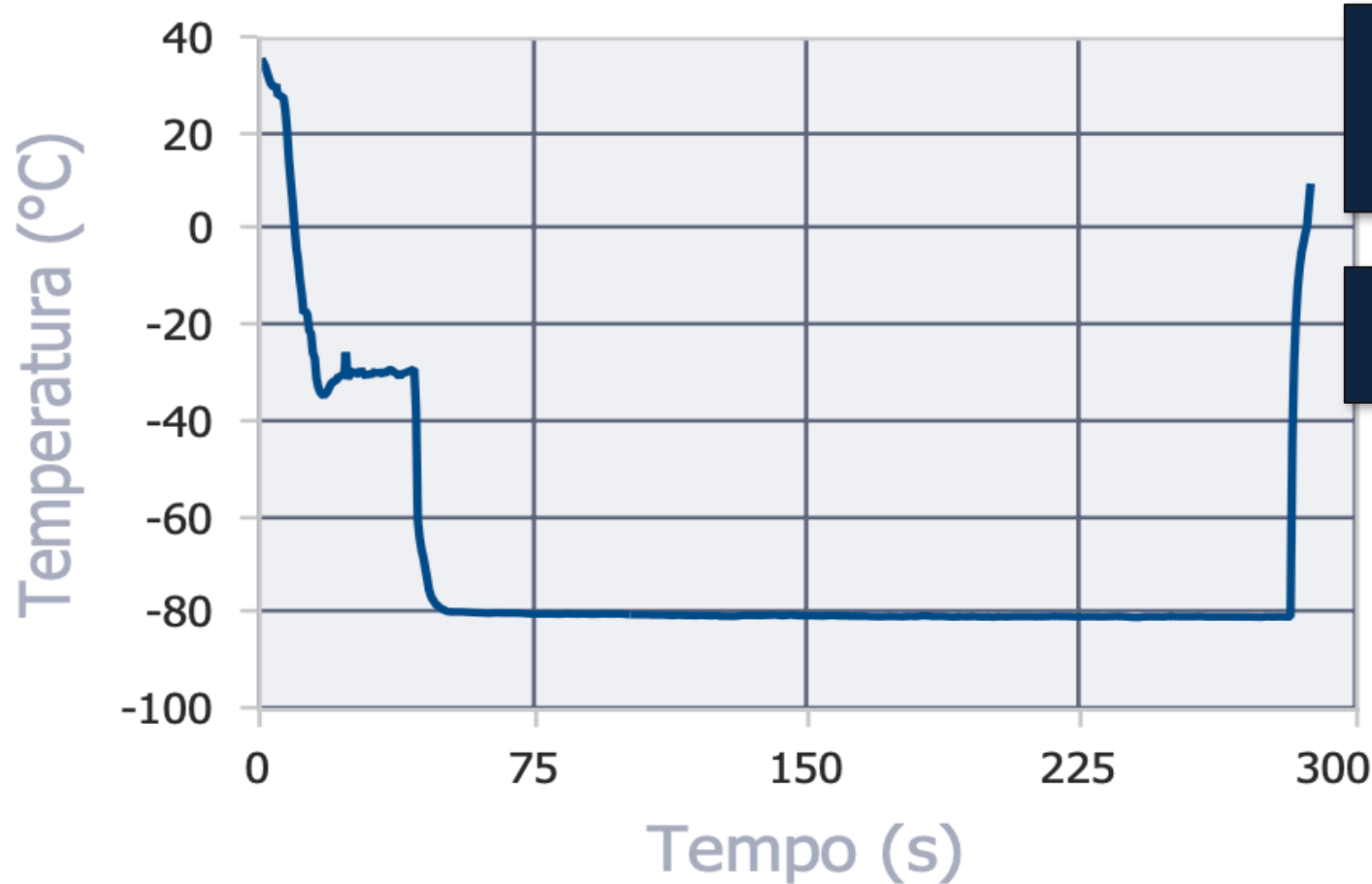
30 secondi di criomappaggio

AH stabile

Scomparsa
inducibilità

Scomparsa
jump

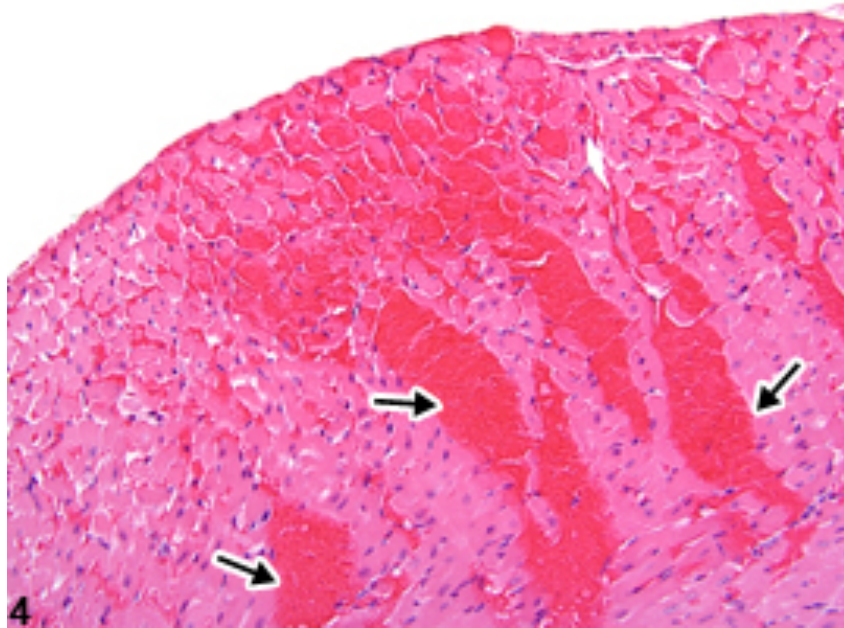
Applicazione di crioenergia



Applicazione
**almeno
240 secondi**

Monitorando
intervallo AH

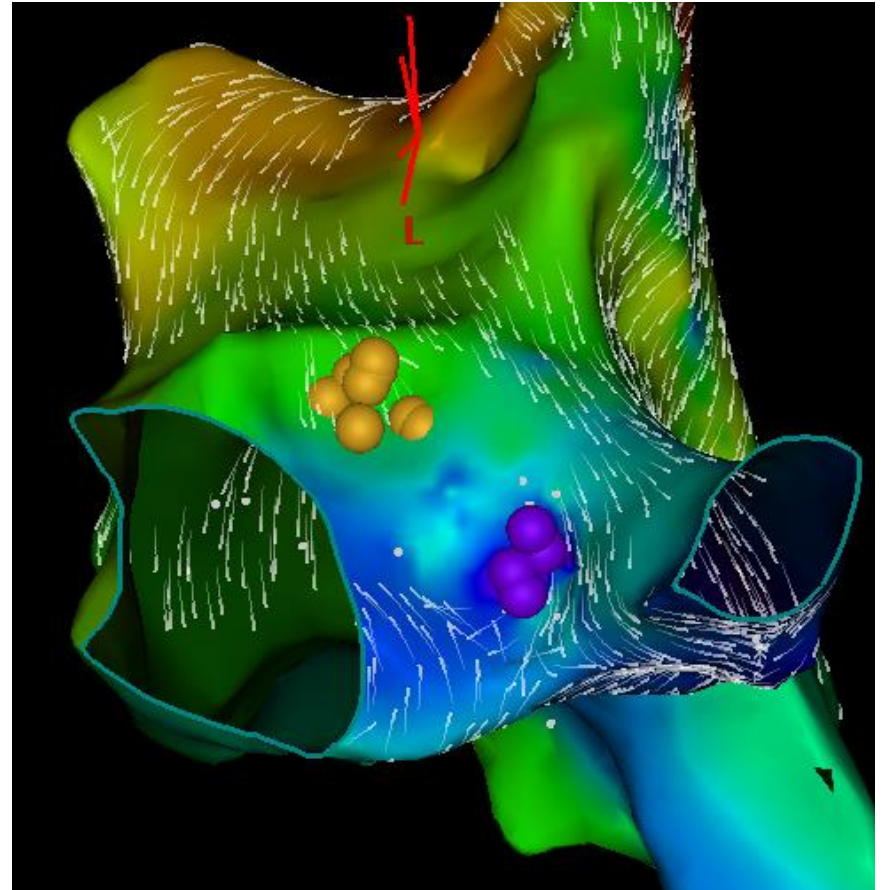
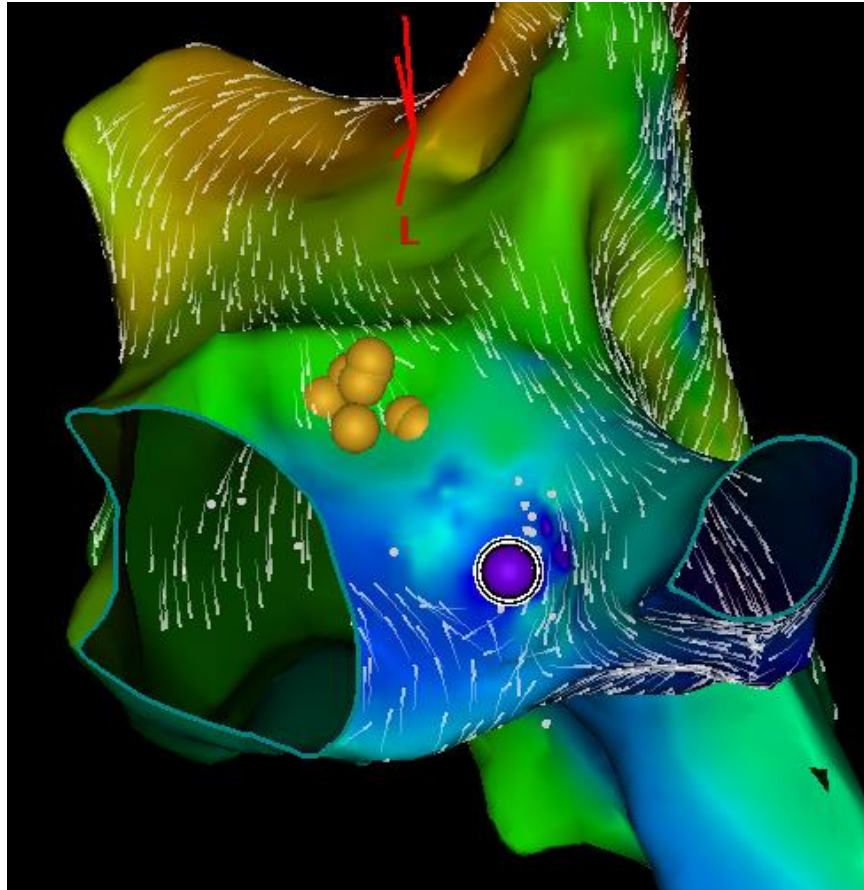
Applicazione bonus stesso sito e estensione



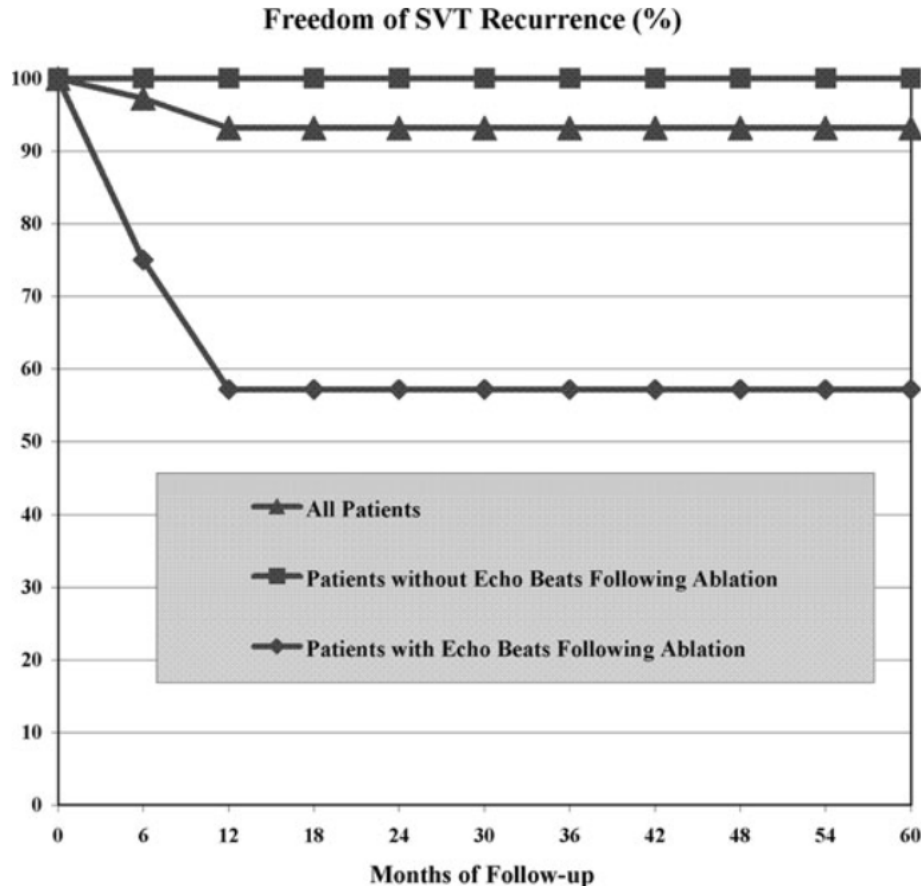
**Danno sia da
congelamento che da
riscaldamento**

**Più cicli estendono la
lesione**

Estensione della lesione



Importanza Endpoint



75 AVNRT consecutive

Followup 12 mesi

3 recidive complessive

**Nessuna recidiva se
assenza di echo**

Nessun blocco

Attesa



Accorgimenti per migliorare successo acuto e a lungo termine

Strumenti

Punta **6 mm** AVNRT
4 mm WPW

Introduttore lungo

Tecnica

Criomappaggio

Consolidamento
lesione bonus

Endpoint: scomparsa
doppia curva

Attesa

Sito

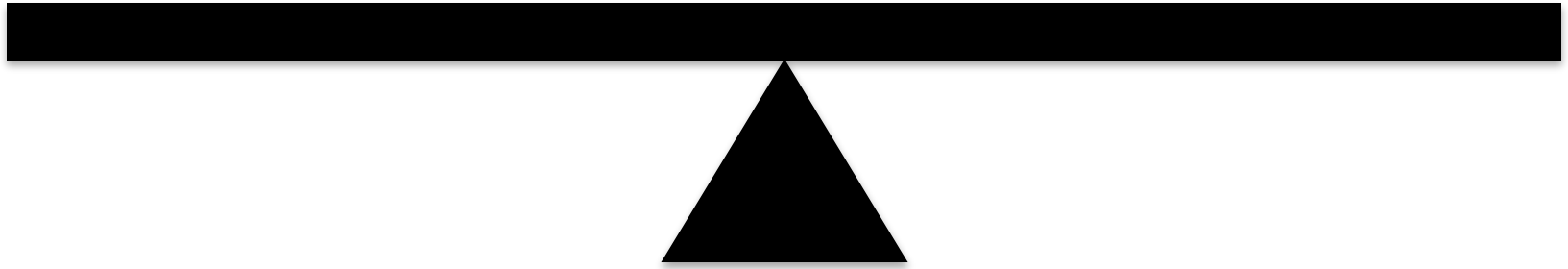
Segnale di via lenta

Mappa elettroanatomica

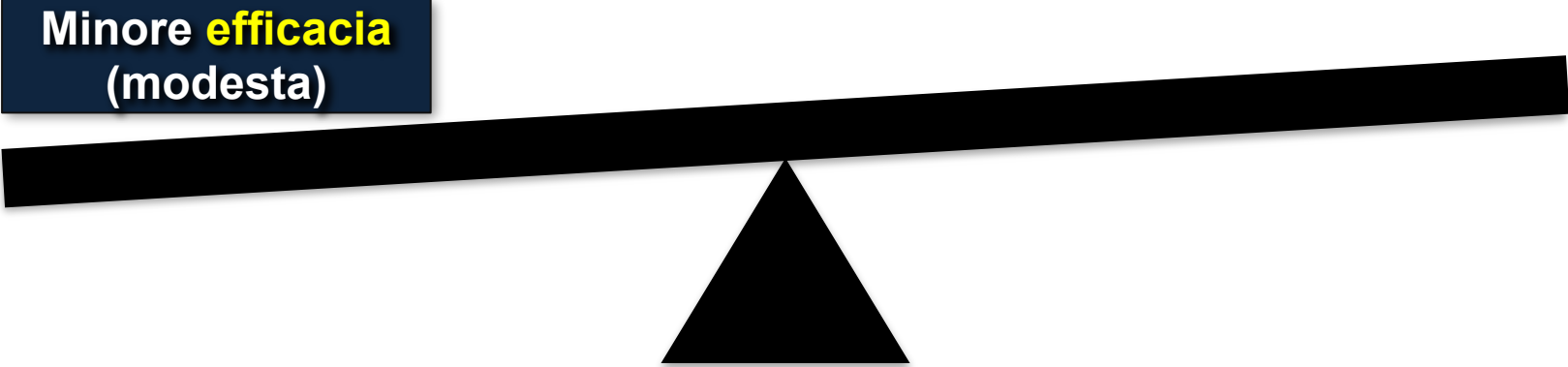
Author	Journal	Year	Patients number	Age	Mapping strategy	Acute success	Recurrence
Bearl (48)	C Heart Dis.	2015	28	15.3	LVB	96%	3.5%
Reddy (46)	HR	2017	71	14.3	LVB	98.5%	0
Drago (49)	Europace	2018	35	12.1	LVB + SP potential	100%	0
Drago (50)	Europace	2020	184	13	LVB + SP potential	99.2%	2.7%
Drago (51)	JICE	2021	21	13	LVB (HD grid)	100%	0
Drago (43)	PACE	2023	14	6.5	LVB + SP	100%	0
Van Aartsen (52)	JICRMM	2017	39	15	Wave collision	100%	2.8%
Fogarty (53)	JICRMM	2023	52	15	Wave collision	-	-
Tseng (54)	HR	2023	36	16.5	Wave collision + LVB	100%	5.6%
O'Leary (55)	JICE	2023	13	15.7	OT pivot point	100%	7.6%
Howard (56)	JCE	2022	46	14	RIPPLE MAP	100%	0
Total						99.2%	3.3%

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Crioablazione TSV da rientro: crioenergia vs RF



Crioablazione TSV da rientro: crioenergia vs RF



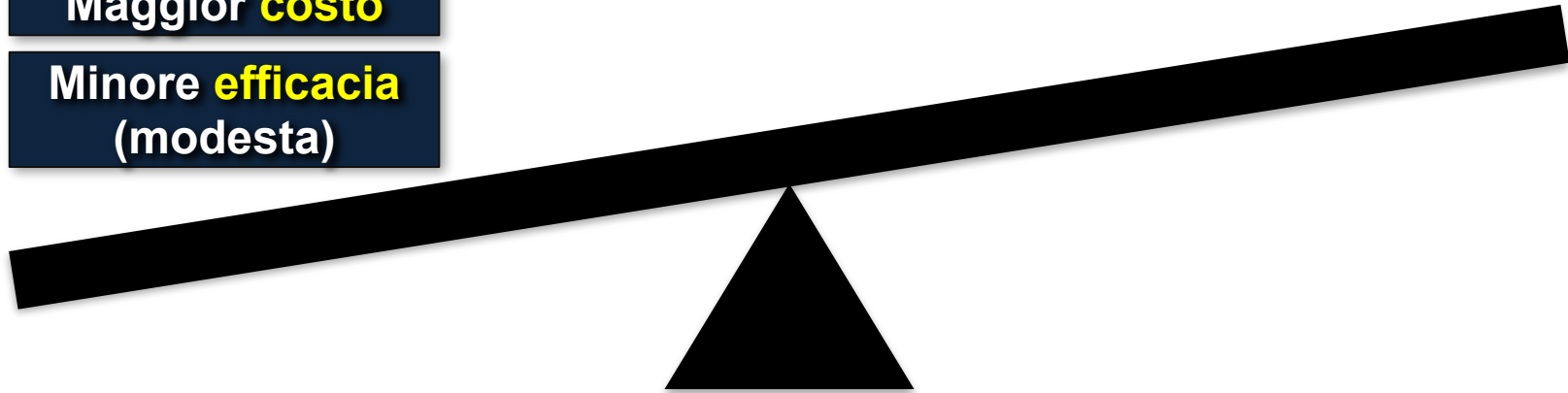
Minore **efficacia**
(modesta)

Crioablazione TSV da rientro: crioenergia vs RF

Maggiori **tempi**

Maggior **costo**

Minore **efficacia**
(modesta)



Crioablazione TSV da rientro

