ATRIAL FLUTTER ABLATION: NEW SOLUTIONS AND SUPPORTING EVIDENCE

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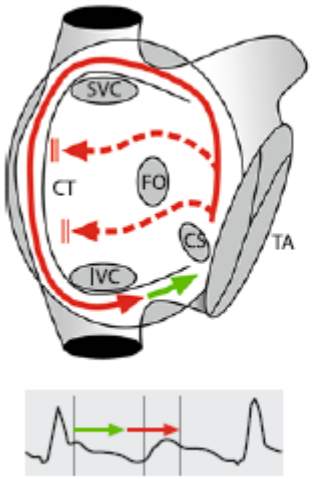
CLASSIFICATION OF ATRIAL FLUTTER

Table 6.1. Classification of atrial flutter

Right atrial CTI-dependent flutter	**Common-type atrial flutter:** **– Counterclockwise flutter** **– Clockwise flutter** **– Lower loop reentrant flutter**
▮ Right atrial non-CTI-dependent flutter	– Scar-related flutter – Upper loop flutter
▮ Left atrial flutter	– Perimitral flutter – Scar- and pulmonary vein related flutter – Left septal flutter and others

CTI Cavotricuspid-isthmus; flutter variants described in this article are displayed in bold letters, other flutter forms are described in Chapter 7

CTI DEPENDENT COUNTERCLOCK AND CLOCKWISE ATRIAL FLUTTER



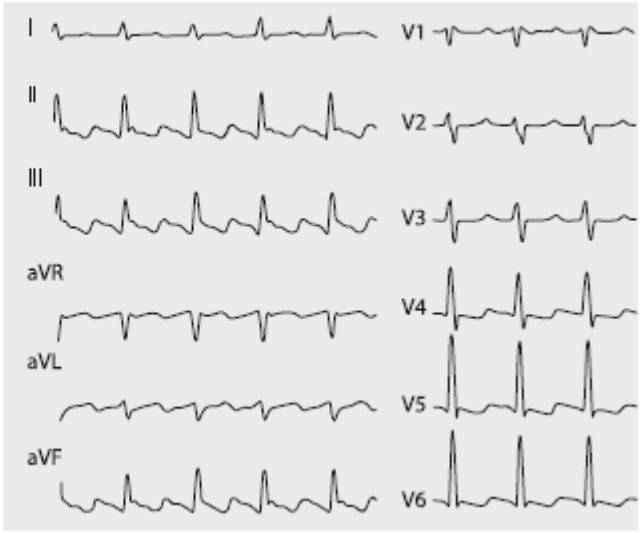


Fig. 6.2. ECG showing common-type counterclockwise atrial flutter with the typical sawtooth pattern in the inferior leads.

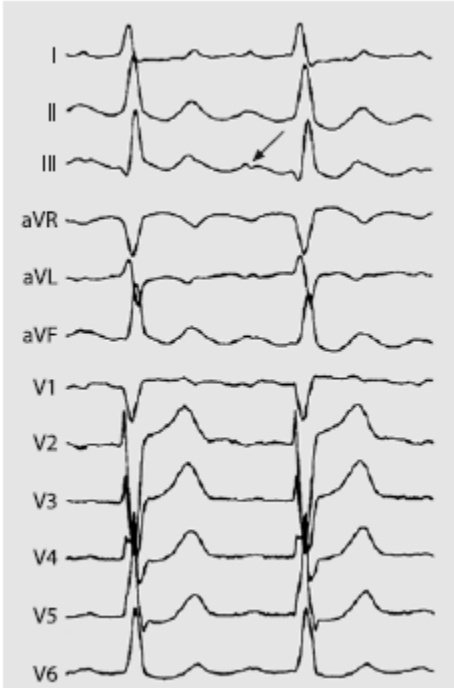
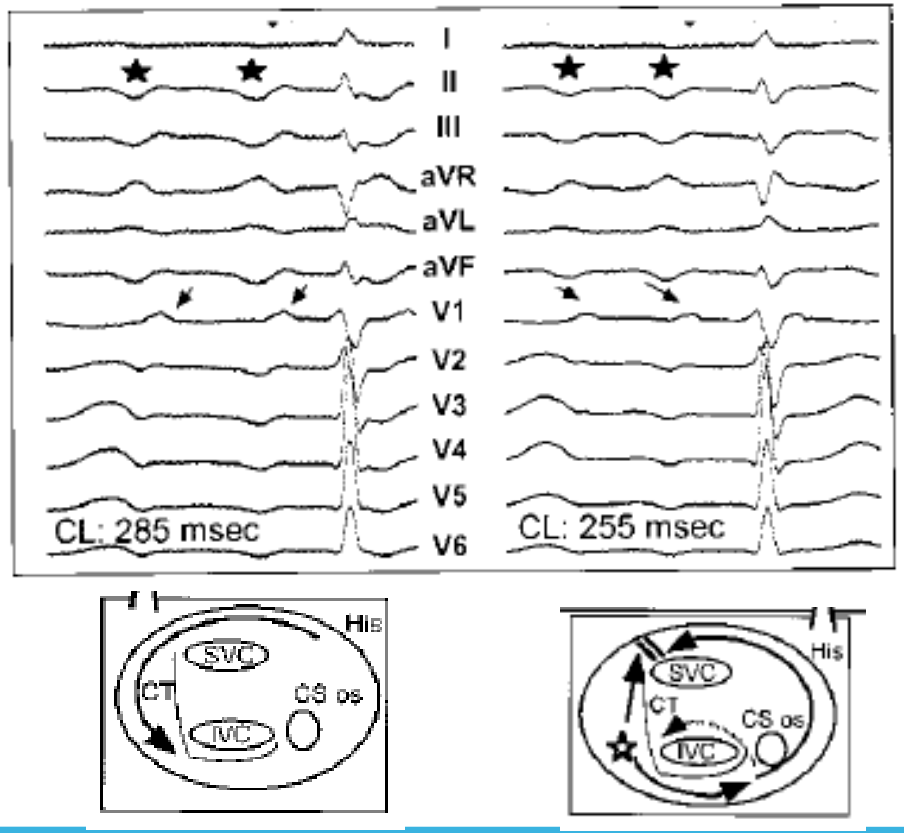


Fig. 6.6. Characteristic ECG appearance of CTI-dependent clockwise atrial flutter. The flutter wave is notched (arrows)

LOWER LOOP REENTRY ATRIAL FLUTTER

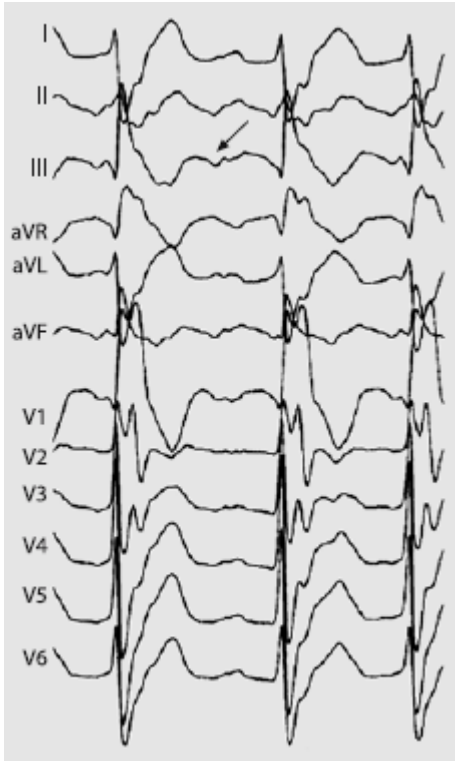
CCW

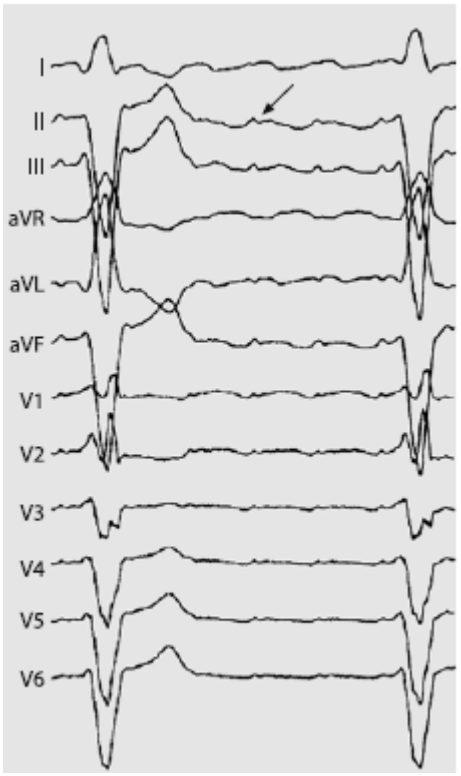


LLR

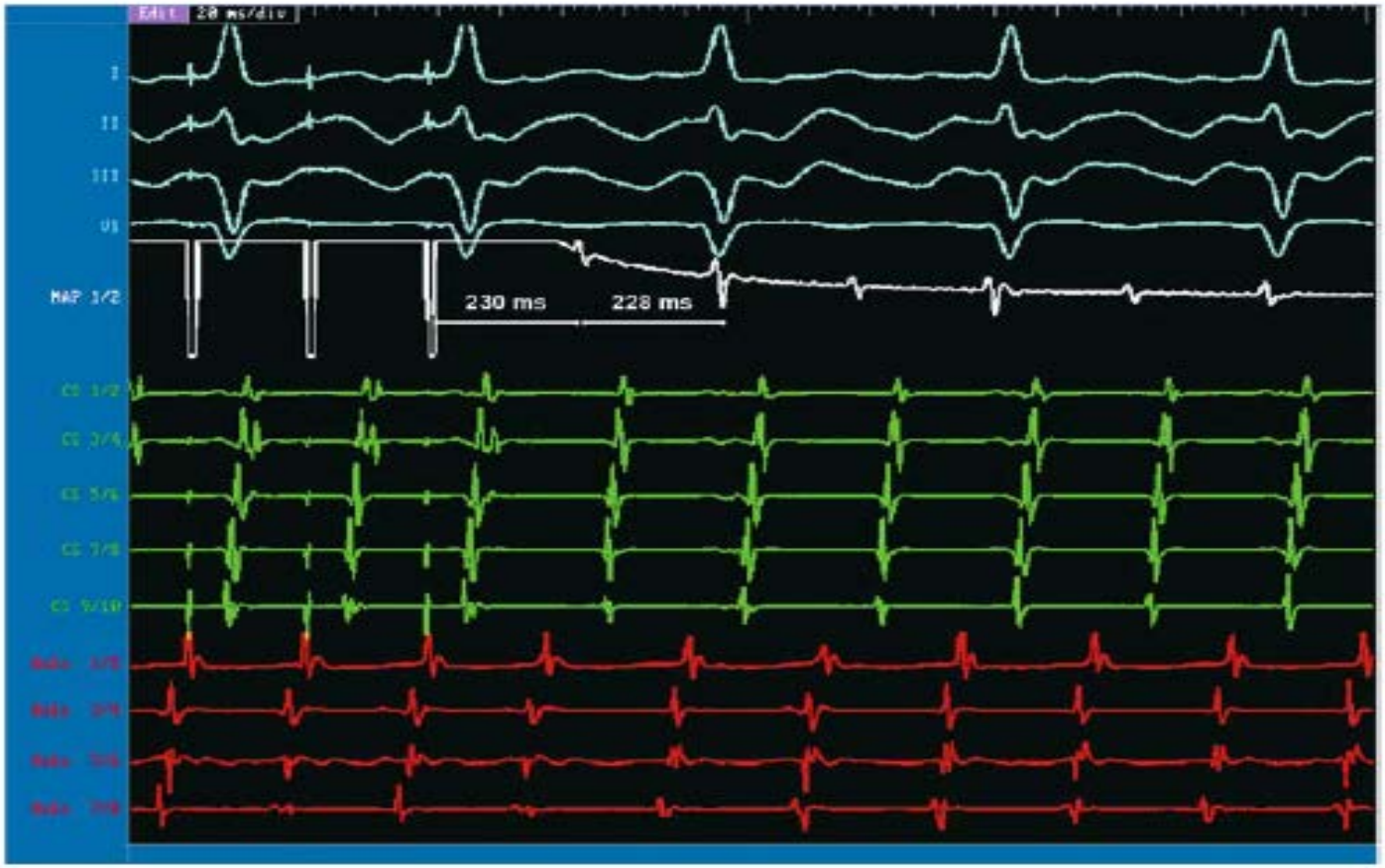
Jie Cheng et al., Circulation 1999,99; 1700-1705

OTHER MORFOLOGIES OF «F» WAVES





CONCEALED ENTRAINMENT

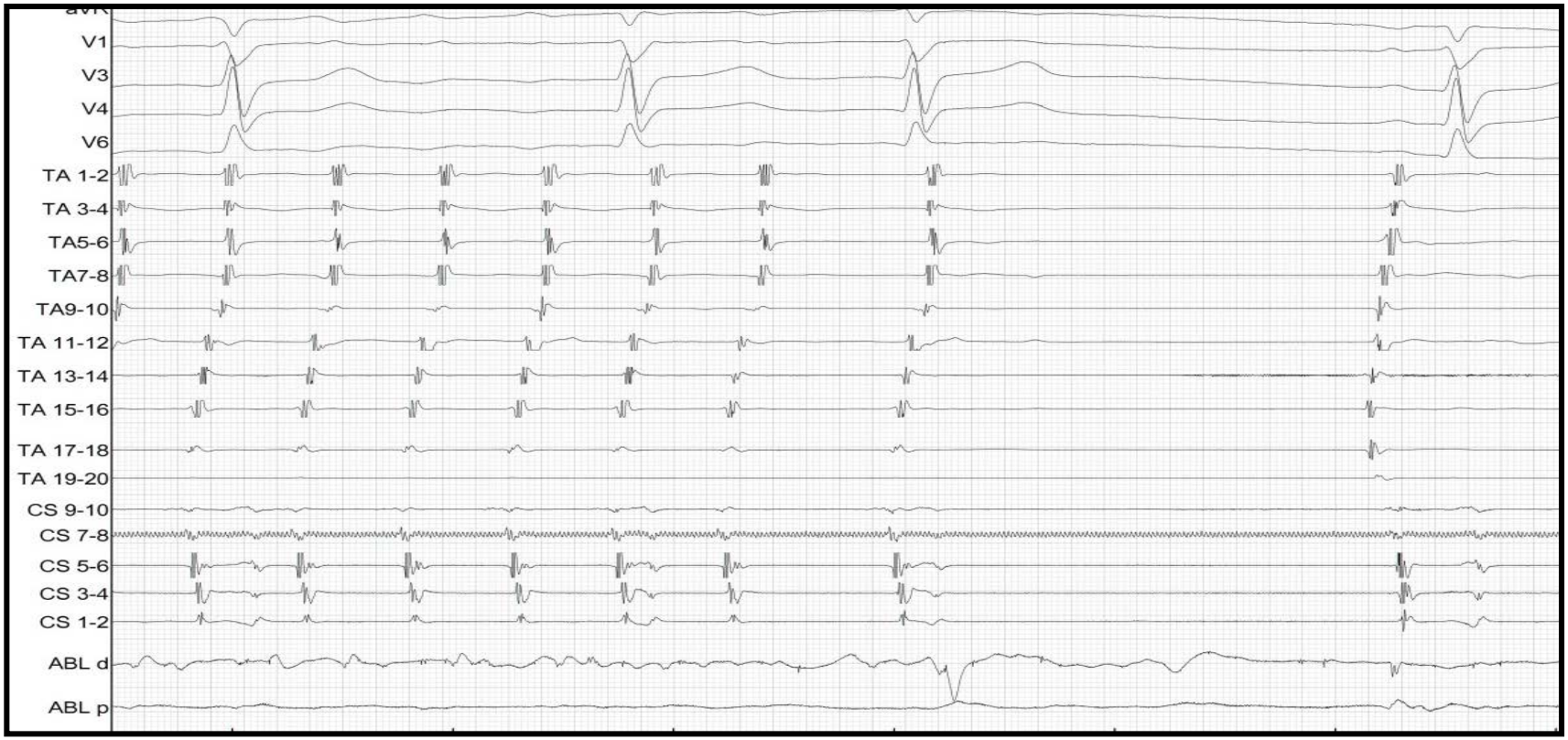


Concealed entrainment: During stimulation from inside the flutter circuitry during ongoing flutter with a rate faster than the flutter cycle length, the surface P wave should remain unchanged. After termination of stimulation, the first postpacing interval must be identical (up to 20–30 ms) to the flutter cycle length, to prove a location of the pacing site inside the circuit.

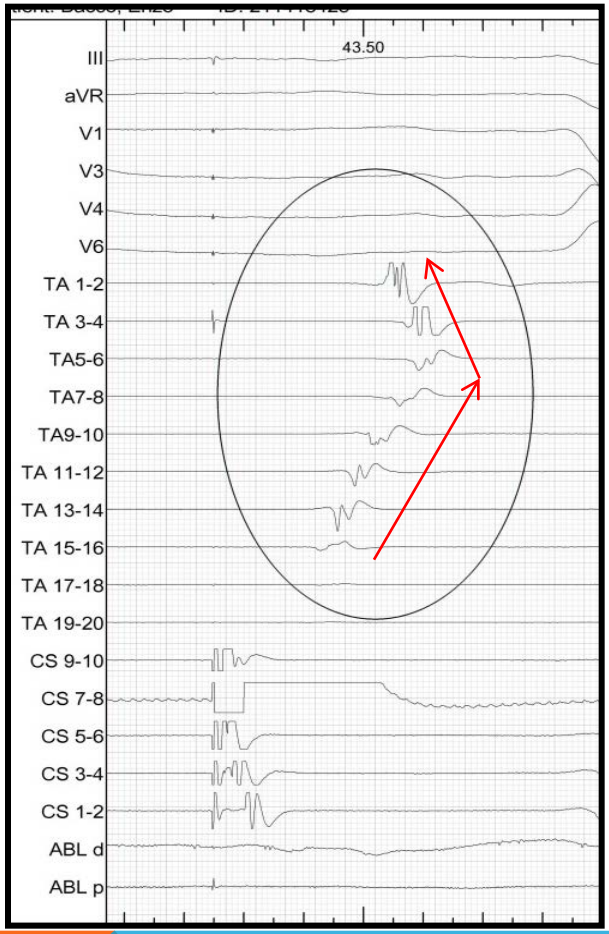
ABLATION END-POINT

- Flutter termination during ablation
- Reversion of activation along the lateral right atrium
- Recording of double (split)-potentials along the ablation line
- Differential pacing: pacing from the Halo catheter distal and proximal

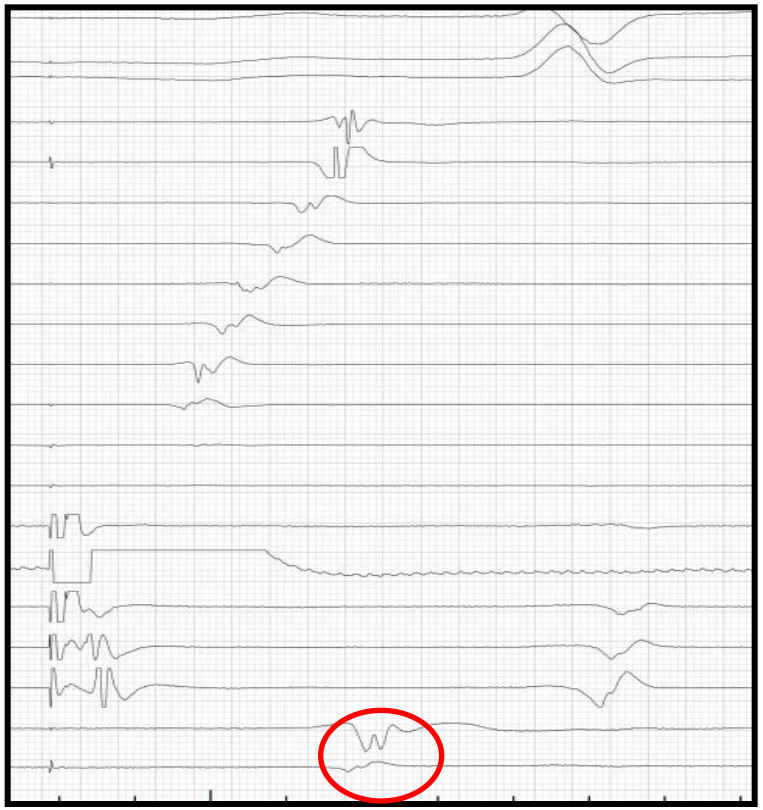
FLUTTER TERMINATION DURING ABLATION



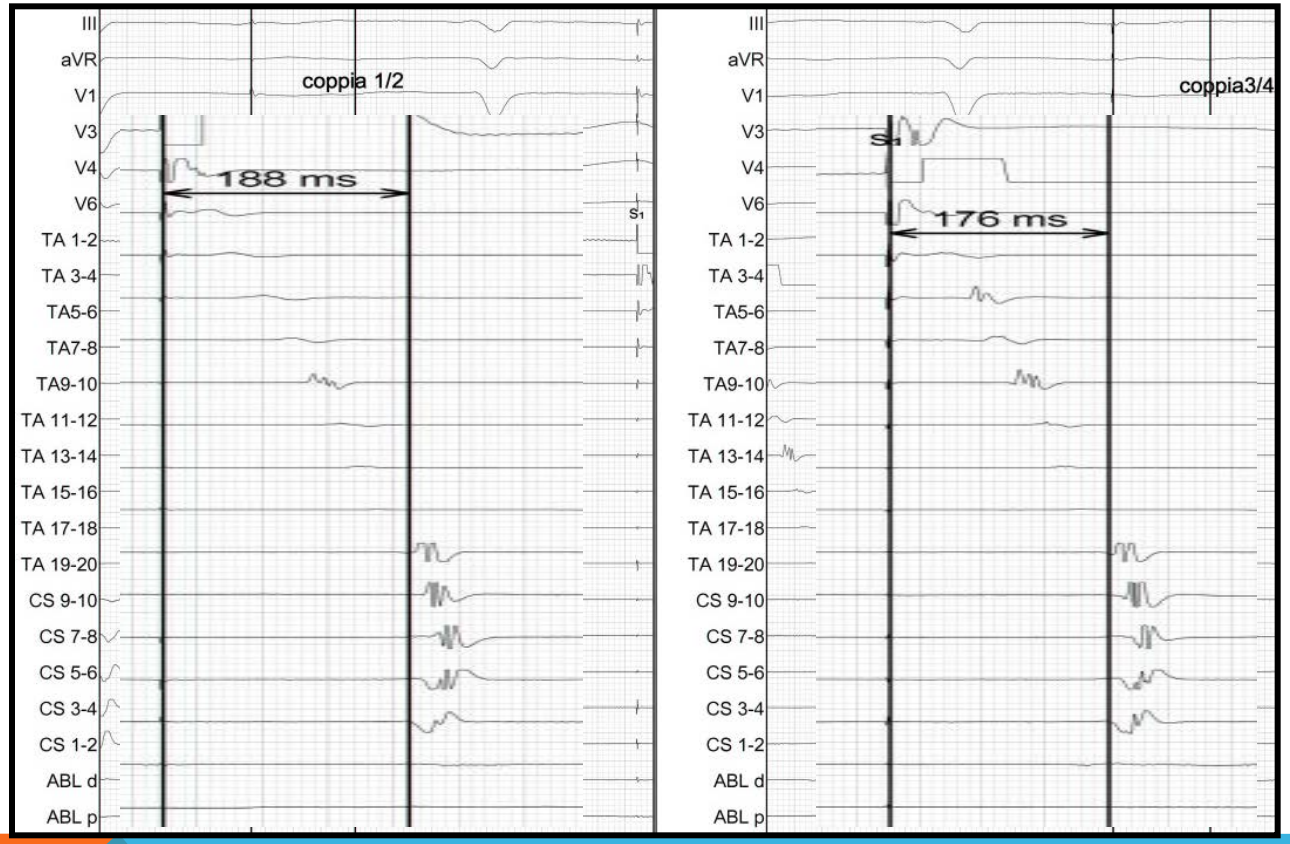
REVERSION OF ACTIVATION



RECORDING OF DOUBLE SPLIT POTENCIALS



DIFFERENCIAL PACING FROM THE HALO CATHETER DISTAL AND PROXIMAL



ATRIAL FLUTTER ABLATION TECNIQUES

Long-Term Outcomes After Catheter Ablation of Cavo-Tricuspid Isthmus Dependent Atrial Flutter

A Meta-Analysis

Francisco J. Pérez, MD; Christine M. Schubert, PhD; Babar Parvez, MD; Vishesh Pathak, BA; Kenneth A. Ellenbogen, MD; Mark A. Wood, MD

RESULTS

Table 2. Acute Ablation Success Rates

	No. of Studies	No. of Patients	Success Rate, %	95% CI	Adjusted* Success Rate, %	Adjusted* 95% CI
Overall	153	9786	94.3	(93.2, 95.2)	91.1	(89.5, 92.4)
Ablation catheter						
4- to 6-mm RF	55	2449	91.4	(88.7, 93.5)	87.9	(84.2, 90.9)
8- to 10-mm/irrigated RF	54	3098	95.6	(93.2, 97.2)	92.7	(90.0, 94.8)
Cryoablation	11	489	92.6	(85.9, 96.3)	88.6	(79.1, 94.3)

Table 3. AFL Recurrence Rates

	No. of Studies	No. of Patients	AFL Recurrence Rate, %	95% CI	Adjusted* Recurrence Rate, %	Adjusted* 95% CI
Overall	155	9942	8.4	(7.4, 9.5)	10.9	(9.6, 12.3)
Ablation catheter						
4- to 6-mm RF	56	2516	10.9	(8.8, 13.4)	13.8	(11.1, 17.2)
8- to 10-mm/irrigated RF	49	3043	5.1	(3.9, 6.5)	6.7	(5.1, 8.5)
Cryoablation	10	442	10.3	(7.5, 13.8)	11.2	(7.7, 15.9)

Circulation
JOURNAL OF THE AMERICAN HEART ASSOCIATION

American Heart Association®

Is 8-mm More Effective Than 4-mm Tip Electrode Catheter for Ablation of Typical Atrial Flutter?

Chin-Feng Tsai, Ching-Tai Tai, Wen-Chung Yu, Yi-Jen Chen, Ming-Hsiung Hsieh, Chern-En Chiang, Yu-An Ding, Mau-Song Chang and Shih-Ann Chen

Circulation. 1999;100:768-771

Is 8-mm More Effective Than 4-mm Tip Electrode Catheter for Ablation of Typical Atrial Flutter?

TABLE 2. Results of Radiofrequency Linear Ablation

	Complete ICB	Incomplete ICB	RF No.	Procedure Time, min	Fluoroscopic Time, min	Recurrent AF	Af Occurrence
Group I (n=54)							11 (20%)
I A 4 mm	36 (67%)		3±1	31±12	23±15	0	
I B 4→8 mm	12	6	7±2	60±19	49±12	3	
Group II (n=50)							12 (24%)
II A 8 mm	46 (92%)*		2±1*	24±15*	14±10*	0	
II B 8→4 mm	0	4				2	

Data are expressed as mean value±SD. Both groups had a follow-up time of 10±5 months. ICB indicates low right atrial isthmus conduction block; RF No., number of applications of radiofrequency current required to achieve complete isthmus conduction block; and Af, atrial fibrillation.

*$P<0.05$, 8 mm vs 4 mm (II A vs I A).

Circulation
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Successful Irrigated-Tip Catheter Ablation of Atrial Flutter Resistant to Conventional Radiofrequency Ablation

Pierre Jaïs, Michel Haïssaguerre, Dipen C. Shah, Atsushi Takahashi, Mélèze Hocini, Thomas Lavergne, Stéphane Lafitte, Alain Le Mouroux, Bruno Fischer and Jacques Clémenty

Circulation. 1998;98:835-838

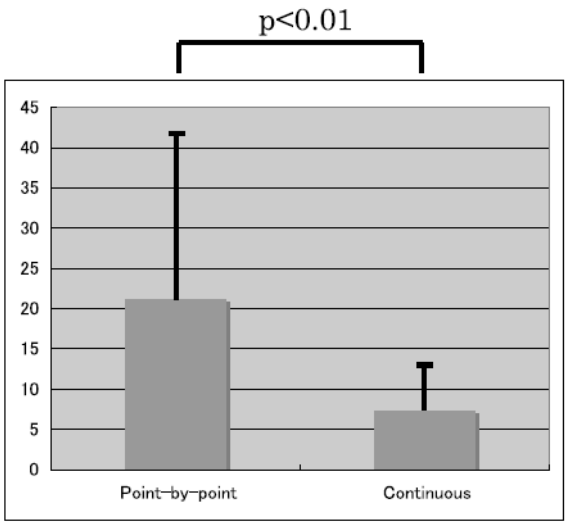
Conclusions—Irrigated-tip catheter ablation is safe and effective for achieving cavotricuspid isthmus block when conventional RF energy has failed. (*Circulation.* 1998;98:835-838.)

Randomized Comparison of the Continuous vs Point-by-Point Radiofrequency Ablation of the Cavotricuspid Isthmus for Atrial Flutter

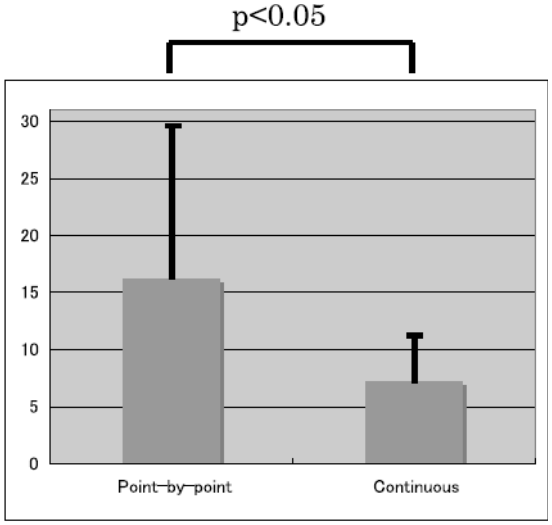
Shinsuke Miyazaki, MD; Atsushi Takahashi, MD; Taishi Kuwahara, MD; Atsushi Kobori, MD; Yasuhiro Yokoyama, MD; Toshihiro Nozato, MD; Akira Sato, MD; Kazutaka Aonuma, MD*; Kenzo Hirao, MD**; Mitsuaki Isobe, MD**

With 8 mm tip catheter

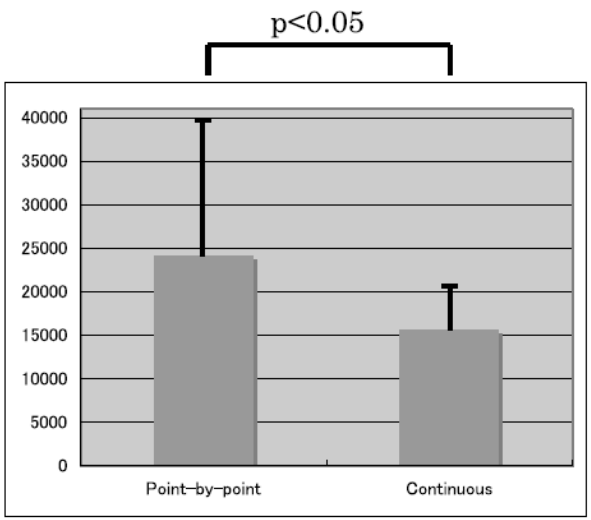
RESULTS



Procedure duration (min)



Fluoroscopic time (min)

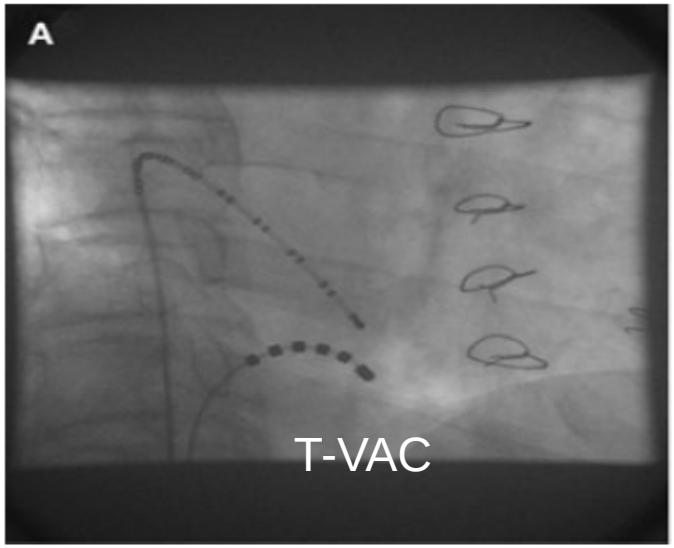


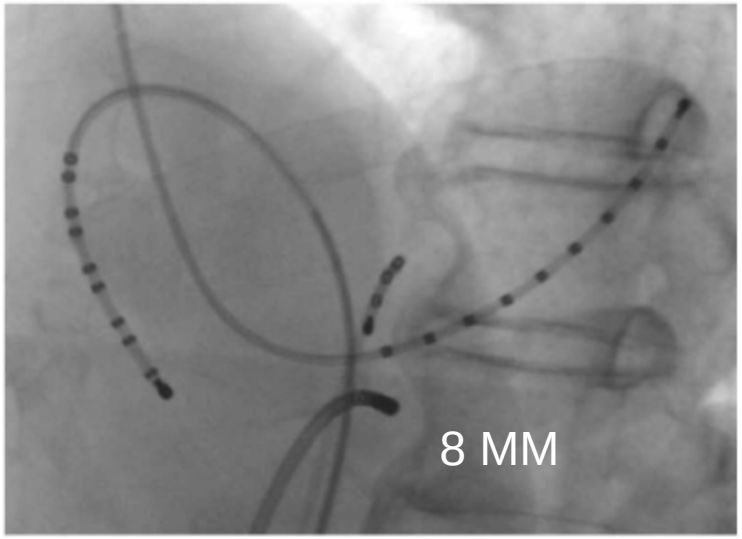
Total RF energy (J)

Conclusion In the curative treatment of common AFL, the continuous RF delivery approach could shorten the procedure and fluoroscopic time and reduce the total RF energy compared with the point-by-point RF ablation approach. (*Circ J* 2007; **71:** 1922–1926)

Randomized Comparison of Multipolar, Duty-Cycled, Bipolar-Unipolar Radiofrequency Versus Conventional Catheter Ablation for Treatment of Common Atrial Flutter

ALI ERDOGAN, M.D., NORBERT GUETTLER, M.D., OLIVER DOERR, WOLFGANG FRANZEN, M.D., NEDIM SOYDAN, M.D., MEHMET BILGIN, M.D., PASCAL VOGELSANG, MARIANA PARAHULEVA, M.D., HARALD TILLMANNS, M.D., SIEGBERT STRACKE, M.D., DURSUN GUENDUEZ, M.D., and CHRISTIANE NEUHOF, M.D.





Patient Characteristics and Results

Patient Demographics and Ablation Outcomes	8 mm	T-VAC	P-value
n (patients)	30	30	NS
Male/Female	25 / 5	22 / 8	NS
Age (years)	69 ± 3	65 ± 8.5	NS
Failed antiarrhythmic drugs (n)	1.2 ± 0.5	1.1 ± 0.6	NS
Total procedure time (min)	60.5 ± 12.7	40.2 ±15.8	0.04
RF time (min)	14.7 ± 5.2	8.5 ±3.7	0.02
Radiation dose (cGy/cm^2)	31.7 ± 12.1	14.5 ± 3.5	<0.001
RF applications (60 seconds)	8.9 ± 7.2	4.2 ± 2.4	<0.001
Bidirectional isthmus block (Yes/No)	30/30	29/30	NS
Average number of RF applications to achieve Block	18	12	<0.001
Recurrence after 4-month follow-up (n)	2	2	NS
Bidirectional block achieved with less than three RF applications	0	7	<0.01
Bidirectional block achieved with single-energy delivery	0	2	<0.01

T-VAC = tip-versatile ablation catheter; RF = radiofrequency; NS = not significant.

(J Cardiovasc Electrophysiol, Vol. 21, pp. 1109-1113, October 2010)

A new methodology for atrial flutter ablation by direct visualization of cavotricuspid conduction with voltage gradient mapping: a comparison to standard techniques

Steven J. Bailin[1]*, William Ben Johnson[1], Pitayadet Jumrussirikul[1], Denise Sorentino[1], and Robert West[2]

[1]Iowa Heart Center, 411 Laurel Street, Suite 1225, Des Moines, IA 50314, USA; and [2]Mercy Medical Center, Des Moines, IA 50314, USA

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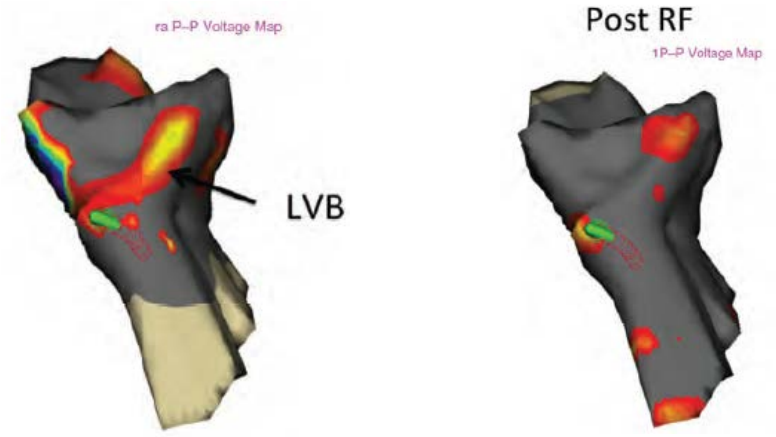


RESULTS

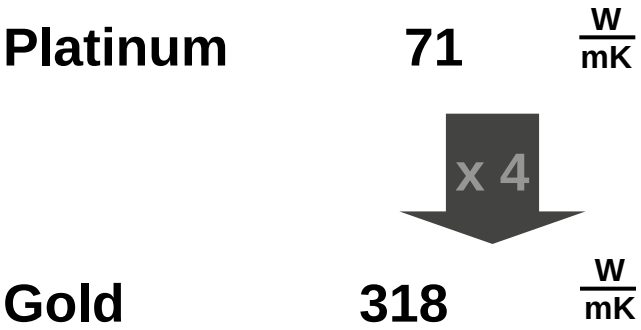
Table 2 Comparison of groups

	Group 1	Group 2	*P* value	Tukey value[a]
Lesions termination	5.8 ± 4.1	20.4 ± 15.7	0.001	0.0012
Total lesions delivered	14.2 ± 9.8	28.6 ± 12	0.001	0.009
Total RF time (seconds)	451.1 ± 202.6	1194 ± 517.8	0.0001	0.009
Total fluoroscopy time	27.1 ± 9.9	28.2 ± 13	0.56 (NS)	0.04
Total case time (minutes)	119 ± 63	127 ± 53	0.7 (NS)	(NA)

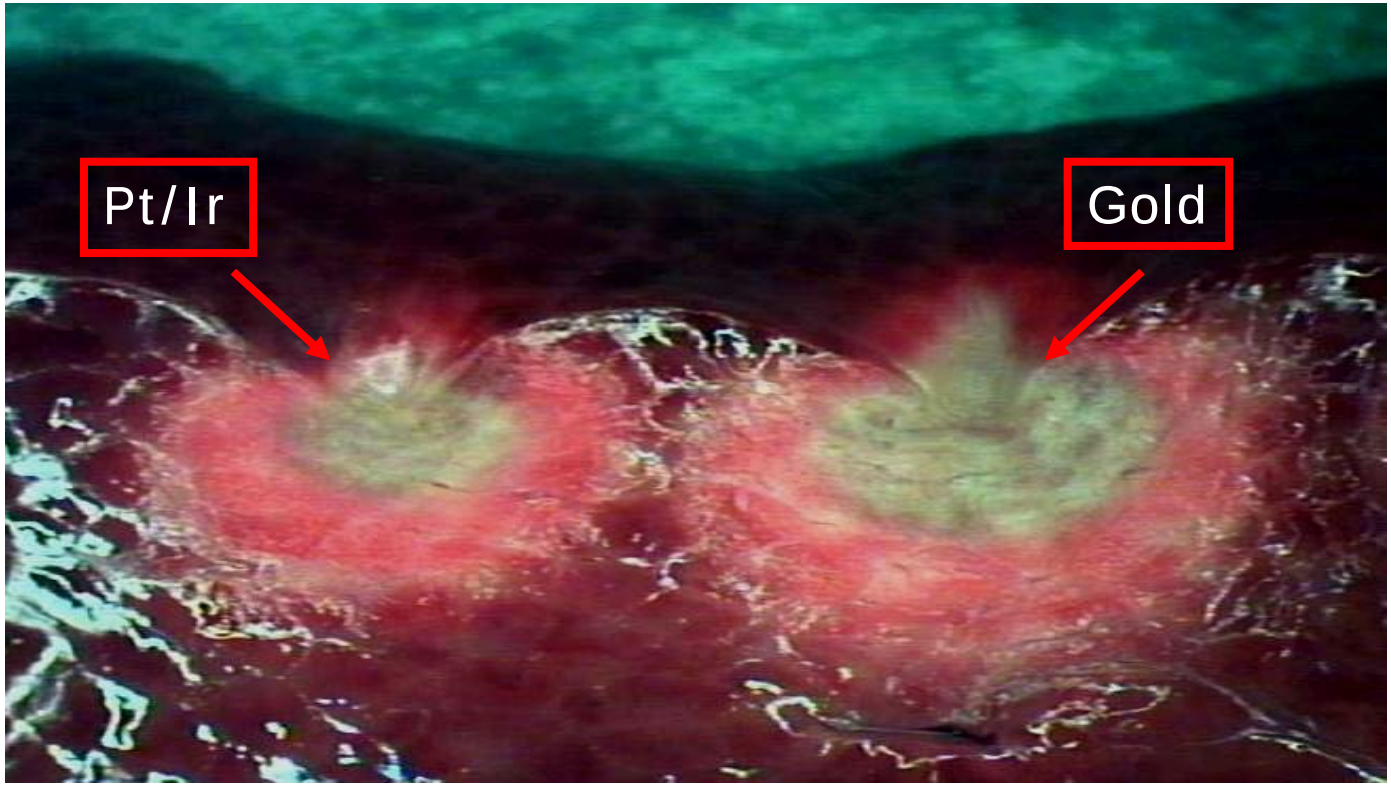
[a]Tukey value: the observations are independent and there is equal variation across observations (homoscedasticity).

ALCATH FLUTTER
THE NEW GOLD TIP CATHETER FOR ATRIAL FLUTTER

Gold vs Platinum: increased conductivity



Increased lesions



Lewalter et al.; J Cardiovasc Electrophysiol, Vol. 16, 770-772, July 2005

„Gold-Tip results in shorter procedural and flouroscopic times, and fewer RF applications using the maximum voltage-guided technique of CT Isthmus ablation."

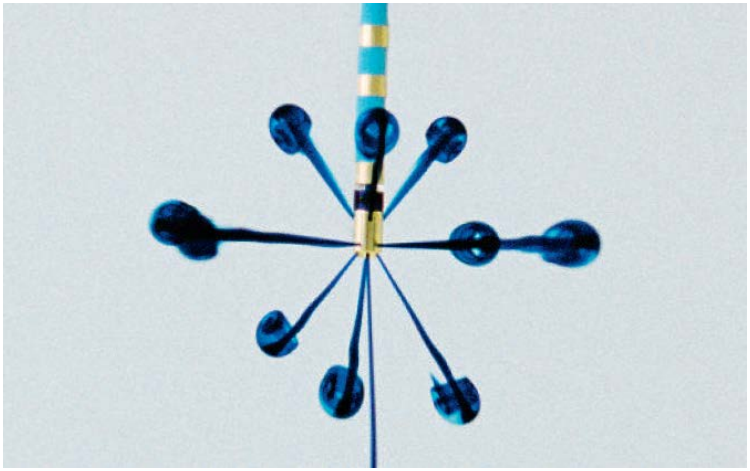
Single-center study	Gold 8mm n = 15	Standard 8mm n = 16	p
Number of RF applications	4.6 ± 1.9	6.6 ± 3.1	p<0,001
Total RF delivery time (sec)	280 ± 117	480 ± 310	p<0,001
Mean procedure time (min)	56.4 ± 12	73.1 ± 15	p<0,05
Fluoroscopic exposure (min)	4.9 ± 2.3	7.1 ± 3.8	p<0,01

Source:
Kardos et al.; Cavotricuspid Isthmus Ablation with Large-Tip Gold Alloy Versus Platinum-Iridium-Tip Electrode Catheters, PACE, Vol. 32 Supplement 1, March 2009, S. 138 – 140.

FLIGHT STUDY

Prospective, multi-site, non-randomized, non-interventional study.

8 MM GOLD TIP



4 MM IRRIGATED TIP

Primary endpoint :

Cumulative radiofrequency time (CRFT) defined as cumulative time of RF delivery during an entire ablation procedure of CTI-dependent AFL.

Secondary endpoint:

Catheter success rate

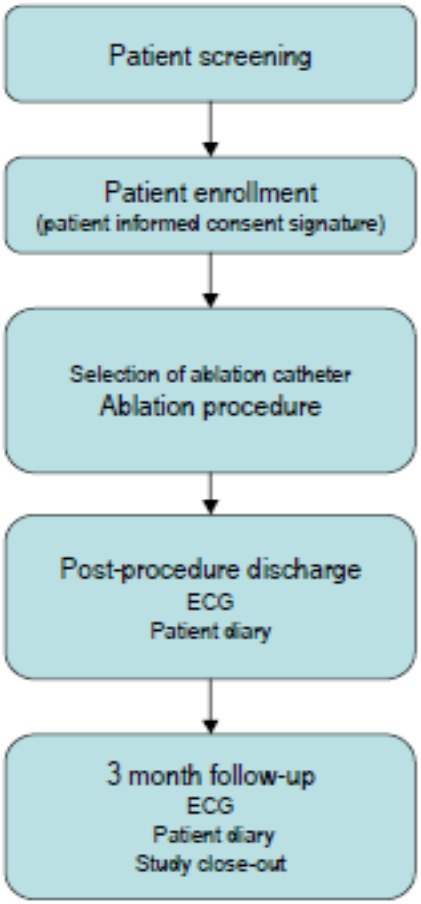
Procedural success rate

Acute clinical success rate

Three-month clinical success rate

Association of catheter, procedural, clinical success rates with of the following

FLIGHT STUDY DESIGN



FLIGHT Study - Status Report

Clinical Atrial Flutter	*All*	*8mmRCF*	*ecRCF*	*P*
Counter-clockwise	25	13	12	1.00

Procedure	*All*	*8mmRCF*	*ecRCF*	*P*
Catheter change	0	0	0	
CRFT, min				
Median (25-75pct)	5.7 (4.0-9-0)	5.0 (3.0-9.0)	7.6 (5.5-12-5)	
mean	12.3	9.1	15.3	
Total RF deliveries	7.5 (4.0-14.0)	6.0 (3.0-12.0)	8.5 (5.5-27.0)	

REPORT ATC FLUTTER MONZA									
	#	Tot	%	average	sd	q1	q2	q3	Output
Patients	64								64
Age				66,2	8,8	60,5	67	72,75	67(61-73)
Males	51	64	79,7%						79,7%
Recurrences	1	64	1,6%						1,6%
Fluoro time (s)				15,8	9,8	9	13	20	13(9-20)
RF deliveries				15,5	10,2	9,5	13	19	13(10-19)
RF delivery time (s)				863,3	566,1	488	708	1038	708(488-1038)