

Ablation endocavitaire chez l'enfant



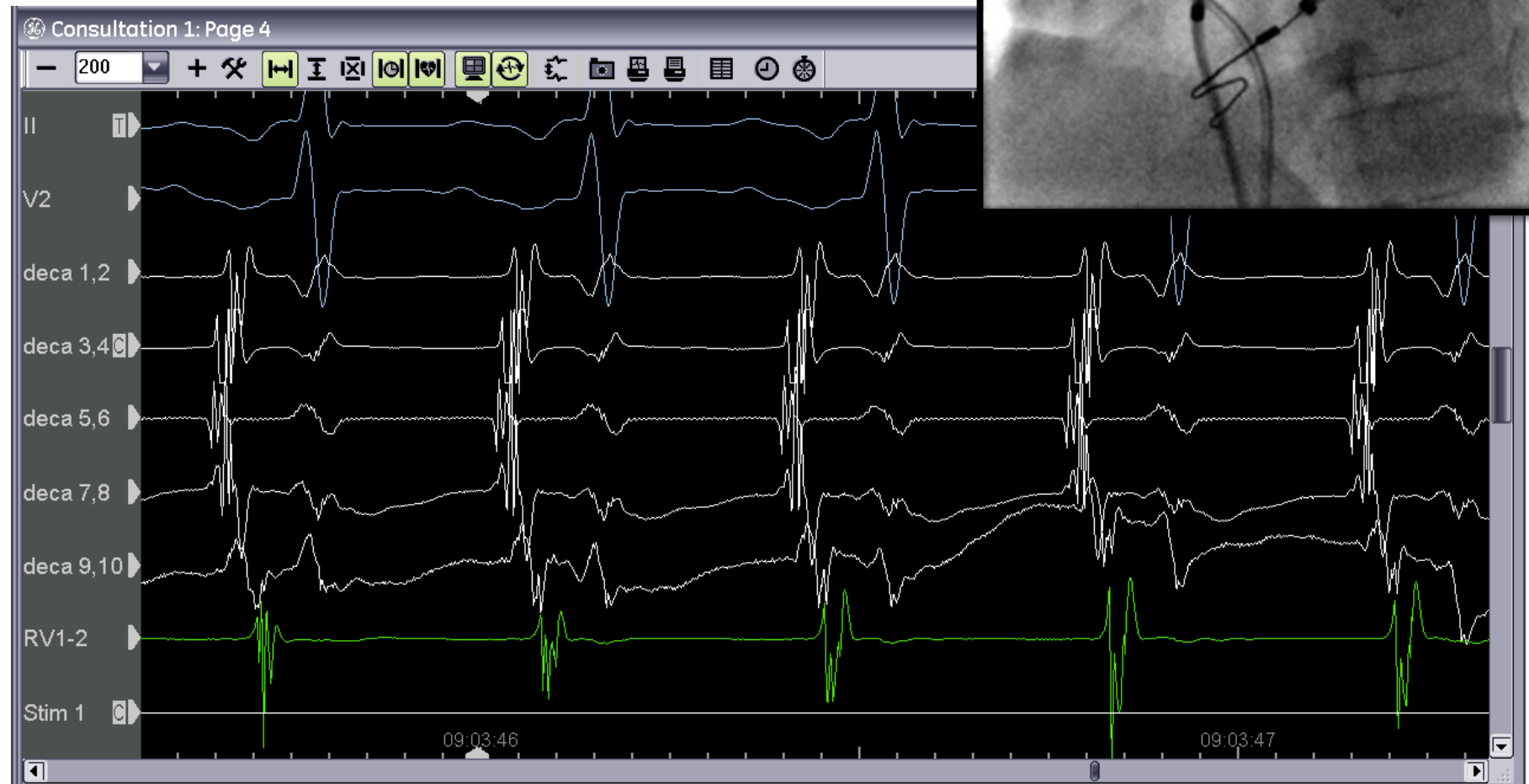
Charlotte 9 ans-27Kg - PJRT

- Diagnostic anténatal

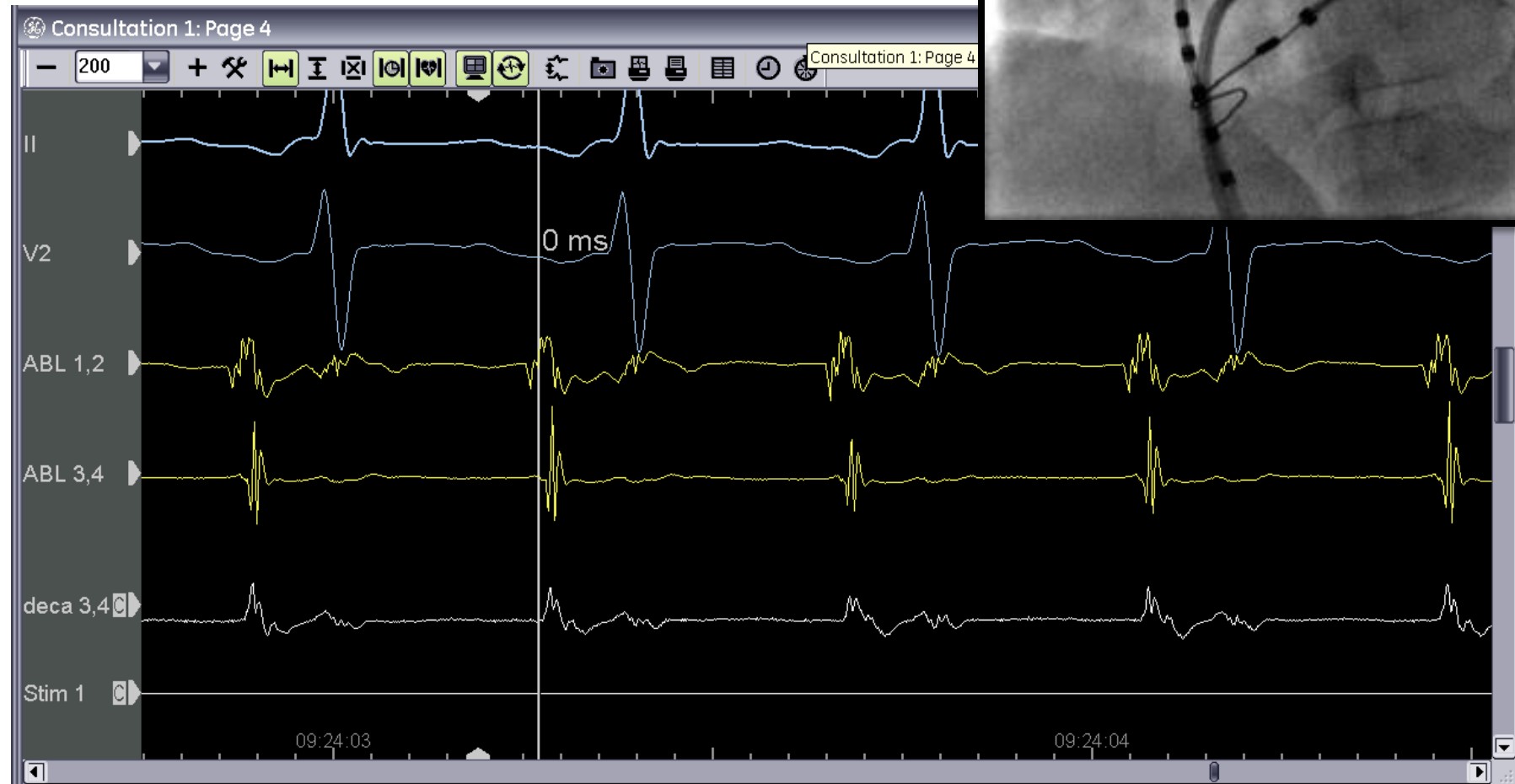
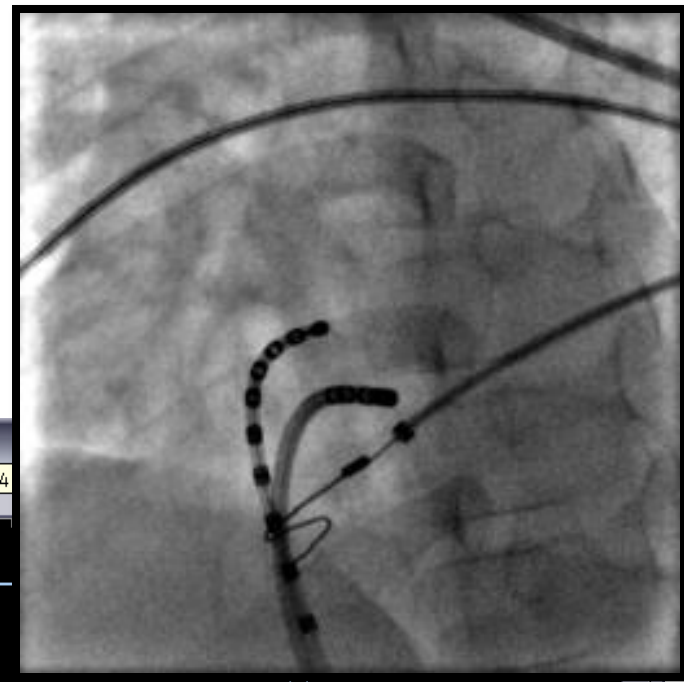


8 Novembre ²⁰⁰² ⇒ ARRÊT Cordarone
23 Novembre ⇒ Reprise des crises
Début Traitement Solalex 25 Novembre 2002
13 janvier ARRÊT Solalex Hospitalisée
Début fleccaine : unefracor
Reprise
Cordarone
le 21 janvier 2003
100 mg/jour 7 par 7.
10 mg/j. 5j sur 7 j.
10 mg/j 7j sur 7 j.
⇒ 70 mg - 5j / 2F
90 mg. 5j / 2F
10 130 mg en 2 fois.
le 19 avril P.
60 ml 2 F/j digoxine
75 mg 2 F/j Seclral.
racP.
20 mg de corgard
jour 75 mg Digoxine
mg. corgard.
+ 2 fois 1 ml de Digoxine
opline 80 mg matin
20 midi
80 Soir.
+ 1,20 ml digoxine
2F/1J
le 13 avril 2002. Début isophrine LP.
120 matin et Soir + 1,20 digoxine 2F/1J

10p SC – 4p RA



RF irriguée SC, 10p RA



RS à 14'' RF



Pharmacological and non-pharmacological therapy for arrhythmias in the pediatric population: EHRA and AEPC-Arrhythmia Working Group joint consensus statement

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Urs Bauersfeld^{8†}, Ramon Brugada⁹, Fabrizio Drago¹⁰, Natasja de Groot¹¹,
Juha-Matti Happonen¹², Joachim Hebe¹³, Siew Yen Ho¹⁴, Eloi Marijon¹⁵,
Thomas Paul¹⁶, Jean-Pierre Pfammatter¹⁷, and Eric Rosenthal¹⁸ *Europace* (2013) **15**, 1337–1382

PACES/HRS expert consensus statement on the use of catheter ablation in children and patients with congenital heart disease



Developed in partnership with the Pediatric and Congenital Electrophysiology Society (PACES) and the Heart Rhythm Society (HRS). Endorsed by the governing bodies of PACES, HRS, the American Academy of Pediatrics (AAP), the American Heart Association (AHA), and the Association for European Pediatric and Congenital Cardiology (AEPC)

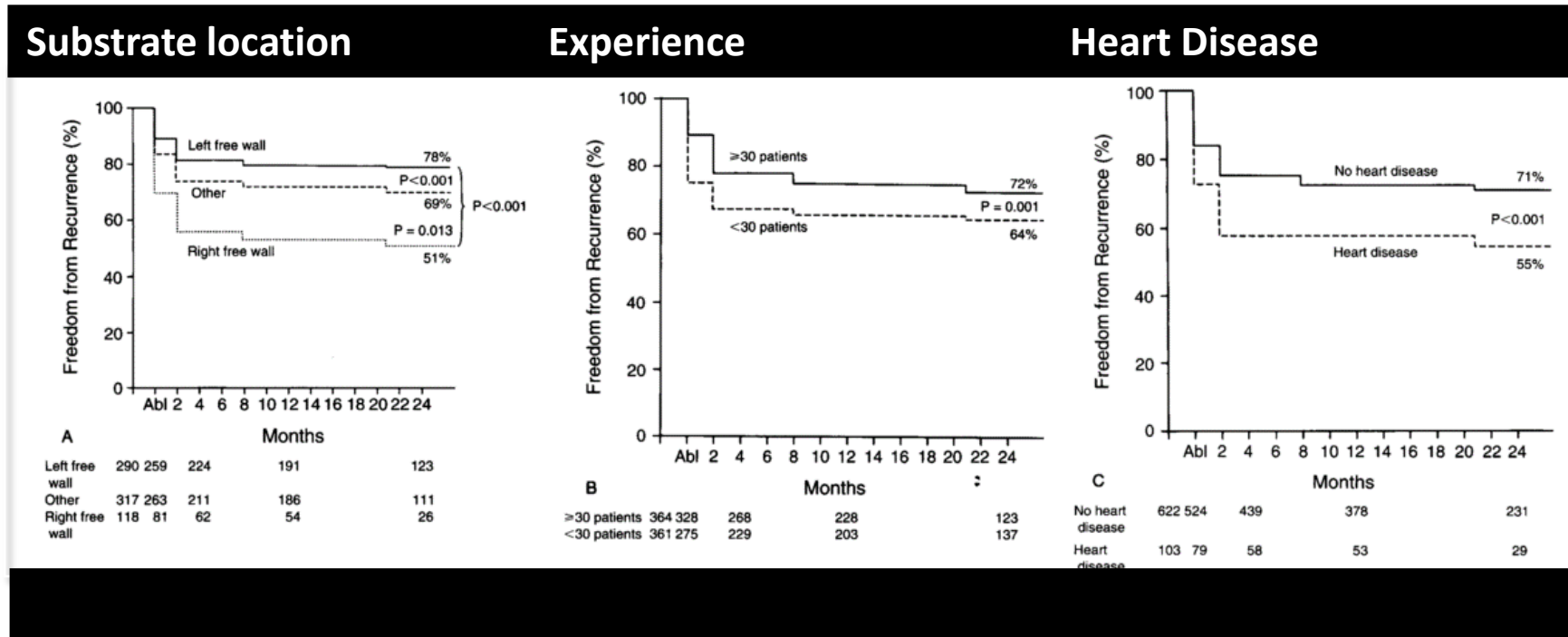
TASK FORCE CO-CHAIRS

Niveau de Preuve : C

J. Philip Saul, MD, FHRS, FACC, FAHA, FAAP,¹ Ronald J. Kanter, MD, FHRS, FACC,²

	Kugler NEJM 1994	Kugler JCE 2002		Van Hare JCE 2004	Kubus EP 2014	M3C & ICPS Registry
	1991-1992	1991-1995	1995-1999	1999-2003	2003-2010	2010-2016
Age cut off	< 21 y	< 21 y		< 21 y	< 18	< 18
Centers	24 (US)	24 (US)		24 (US)	3 (Czech Rep)	1
Patients	652			481	633	487
Prodecures	725	4193	3407	540	708	550
Energy = RF	100%	100%	100%	100%	100%	93%
Age (mean)	12,4	12,4	12,2	11,4	14,9	8,7
	11% < 5 y	6,7% < 5 y	6% < 5 y	27% < 9 y	NA	5,9% < 5 y
Weight < 15 kg	NA	NA	NA	NA	NA	2,8%
Normal Hearts	84%	NA	NA	97%	94%	88%
Acc.Pathways	82%	75%	66%	72%	61%	72%
AVN Reentry	10%	20%	29%	26%	28%	13%
Other SVTs & VTs	7%	5%	6%	0%	10%	15%
Initial Success Rate	83%	90%	95% *	96%	89%	90%
Fluoroscopy	45,9-79,6	50,9	40,1 *	38,3	14,1	8,5
Follow up	21 mo	NA	NA	NA	12 mo	12 mo
Recurrences	32%	NA	NA	NA	23%	30%
Complications	4,80%	4,20%	3,00% *	4,00%	1,40%	0,90%
Death procedural	0,15%	0,07%	0,03%	0%	0%	0,18%

Ablation outcome: independent predictive factors



	Kugler NEJM 1994		Kugler JCE 2002		Van Hare JCE 2004	Kubus EP 2014	M3C & ICPS Registry
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Complications

	Cohort
Total participants	481
Complications of electrophysiologic study	
Hematoma at catheter entry	9 (1.9%)
Hematoma other	0 (0%)
Deep vein thrombosis	0 (0%)
Emboli, pulmonary	0 (0%)
Emboli, central nervous system	0 (0%)
Emboli, other	0 (0%)
Perforation	0 (0%)
Brachial plexus injury	0 (0%)
Death	0 (0%)
Other	11 (2.3%)
None of above	461 (96%)
Any of above	20 (4.2%)
Complications of ablation	
Chest pain	1 (0.2%)
Skin burn	1 (0.2%)
Bradycardia	0 (0%)
AV block	6 (1.2%)
Right bundle branch block	1 (0.2%)
Left bundle branch block	0 (0%)
Atrial proarrhythmia	0 (0%)
Ventricular proarrhythmia	0 (0%)
Intracardiac thrombosis	1 (0.2%)
Other thrombosis	1 (0.2%)
Valvular regurgitation	5 (1.0%)
Other complications	5 (1.0%)
None of above	462 (96%)
Any of the above	19 (4.0%)

	Cohort
Total substrates	540
Diagnosis	
Manifest accessory pathway	2/234 (0.9%)
Concealed accessory pathway	1/145 (0.7%)
Paroxysmal junctional reciprocating tachycardia	0/14 (0%)
AV nodal reentrant tachycardia	3/142 (2.1%)
Atrial fibrillation	0/0 (0%)
Atrial flutter	0/1 (0%)
Ectopic atrial tachycardia	0/2 (0%)
Junctional ectopic tachycardia	0/0 (0%)
Ventricular tachycardia	0/0 (0%)
Other	0/2 (0%)
Missing	0/0 (0%)
Total	6/540 (1.1%)
Pathway location	
Right anterior	0/12 (0%)
Right lateral	0/34 (0%)
Right posterior	0/19 (0%)
Right posteroseptal	2/55 (3.6%)
Right intermediate septal	0/13 (0%)
Anteroseptal	0/12 (0%)
Left intermediate septal	0/1 (0%)
Left posterior paraseptal	1/21 (4.8%)
Left posterior	0/48 (0%)
Left lateral	0/166 (0%)
Left anterolateral	0/12 (0%)
Missing	0/0 (0%)
Total	3/393 (0.8%)

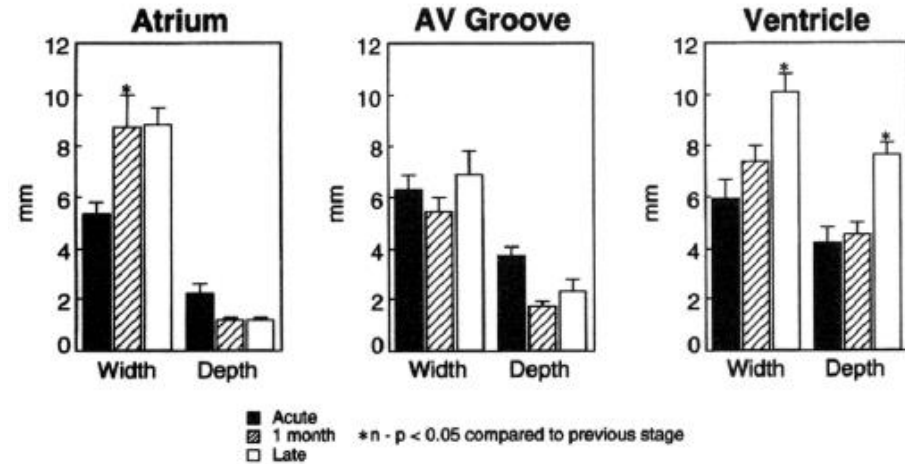
- Perforation myocardique
- BAV complet (1 à 2%)
- Lésion coronaire
- Complications thrombo-embolique
- Risque lié aux Rx
- Décès

Pathway/Mechanism	Complications/Attempts		
	Late Era		
	All Ages	< 5 Years	5–21 Years
Left free wall	32/1,074 (3%)	5/58 (9%)	27/1,016 (3%)
Right free wall	8/410 (2%)	3/32 (9%)	5/378 (1%)
Anterior septal	15/322 (5%)	3/29 (10%)	12/293 (4%)
Posterior septal	9/431 (2%)	3/49 (6%)	6/382 (2%)
AV nodal reentry	29/977 (3%)	2/11 (18%)	27/966 (3%)
Atrial ectopic tachycardia	7/194 (4%)	2/26 (8%)	5/168 (3%)
Total	100/3,407 (3%)	18/205 (9%)	82/3,202 (3%)

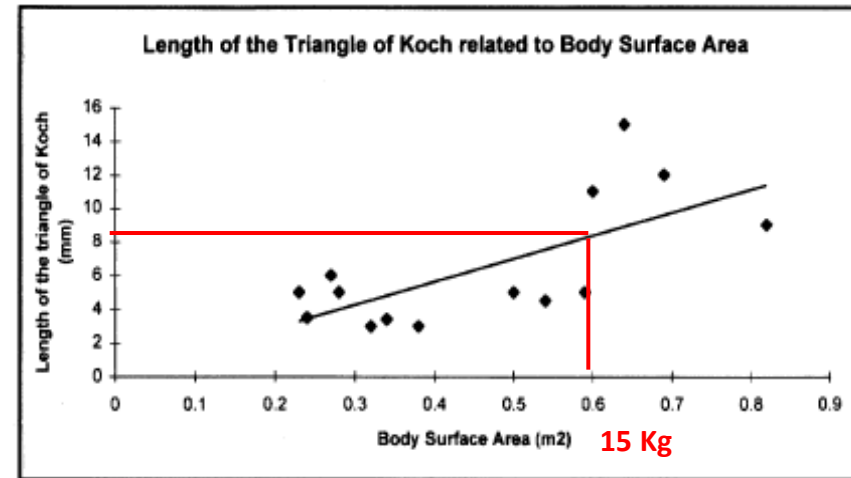
Historiquement plus de complications avant 5 ans (15 Kg)

Age < 5 ans et/ou Poids < 15 kg

- Extension de la lésion
- Risque lié aux Rx
 - Effets dose-dépendants
 - Effets aléatoires ???
- Taille du triangle de Koch
 - Poids < 15 Kg-SC < 0.6 m²
=> **TK ≤ 5 à 7 mm**



Saul et al, Circ. 1994



Goldberg et al, Am J Cardiology. 1999

:(

:)

< 15 kgs
Heart Defect / Heart Failure
Atypical / Multiple substrate
Perinodal or Epicardial target
(PJRT, Posterosept. WPW)

Teenagers
Normal heart
Typical SVT
Left sided accessory pathway

20-25% recurrences (but easier to manage)
serious adverse events # 1-2%

Programmed Ablation
1st RF success > 95%
serious adverse events # 0%

D'après les guidelines

PACES/HRS expert consensus statement on the use of catheter ablation in children and patients with congenital heart disease



Class I Ablation is recommended for the following:

1. Documented SVT, recurrent[#] or persistent[^], when medical therapy is either not effective or associated with intolerable adverse effects (LOE: C).
2. WPW pattern following resuscitated cardiac arrest (LOE: B).
3. WPW pattern with syncope when there are predictors of high risk for cardiac arrest[§] (LOE: B).
4. Persistent[^] or recurrent[#] idiopathic JET, or congenital JET associated with ventricular dysfunction, when medical therapy is either not effective or associated with intolerable adverse effects⁺ (LOE: C).
5. Ventricular ectopy or tachycardia with ventricular dysfunction, when medical therapy is either not effective or associated with intolerable adverse effects (LOE: C).
6. Recurrent[#] or persistent[^] SVT related to accessory AV connections or twin AV nodes in patients with CHD when medical therapy is either not effective or associated with intolerable adverse effects (LOE: B).
7. Ablation is effective for recurrent symptomatic atrial tachycardia occurring outside the early postoperative phase (less than three to six months) in patients with CHD, when medical therapy is either not effective or associated with intolerable adverse effects (LOE: B).
8. Pediatric cardiovascular surgical support should be available in-house during ablation procedures for smaller patients* (LOE: E).

Class IIa Ablation can be useful for the following:

1. WPW pattern with ventricular dysfunction presumed due to dyssynchrony when medical therapy is either not effective or associated with intolerable adverse effects⁺ (LOE: B).
2. Recurrent sustained monomorphic VT causing symptoms or hypotension despite antiarrhythmic drug therapy in patients with CHD (LOE: B).
3. Recurrent asymptomatic atrial tachycardia occurring outside the early postoperative phase (more than three to six months) in patients with CHD who are at increased risk of thromboembolic events or worsening heart failure, when medical therapy is either not effective or associated with intolerable adverse effects (LOE: C).
4. Substrates that have a reasonable likelihood of contributing to tachyarrhythmias in the postoperative period in the absence of other indications, when impending congenital heart surgery will result in restriction of vascular or chamber access following surgery (LOE: C).
5. Frequent ventricular ectopy thought to be contributing to deteriorating ventricular function in patients with CHD, when medical therapy is either not effective or associated with intolerable adverse effects (LOE: C).

Class IIb

1. Recurrent clinical symptoms clearly consistent with paroxysmal SVT, and one of the following at electrophysiology study: evidence for involvement of an AV accessory pathway; inducible SVT (LOE: C). Medical therapy should be considered prior to ablation (LOE: C). Cryotherapy should be considered for slow pathway modification (LOE: B).
2. When ablation is indicated, cryoablation can be useful to avoid the higher risk of complications with RF ablation (LOE: C).
3. Recurrent acute hemodynamic compromise (hypotension or syncope) from SVT (LOE: C).
4. Persistent[^] or symptomatic recurrent[#] idiopathic JET, or congenital JET, when medical therapy is either not effective or associated with intolerable adverse effects⁺ (LOE: C).
5. Polymorphic ventricular arrhythmia when there is a suspected triggering focus, arrhythmia, or substrate that can be targeted (LOE: C).
6. Creation of complete AV block with permanent pacing in patients with atrial tachyarrhythmias refractory to all medications and substrate-targeted catheter ablation who are not candidates for surgical therapy (LOE: B).

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Table 4 Indications for catheter ablation and oral prophylactic antiarrhythmic drugs for recurrent SVT or VT

Clinical situation	Recommendation	Class	Level	Reference
WPW syndrome and episode of aborted SCD	Catheter ablation	I	C	
WPW syndrome and syncope combined with preexcited RR interval during AF <250 ms or antegrade APERP during PES <250 ms	Catheter ablation	I	C	
Incessant or recurrent SVT associated with ventricular dysfunction	Catheter ablation	I	C	
Recurrent monomorphic VT with haemodynamic compromise and amenable to catheter ablation	Catheter ablation	I	C	
WPW syndrome and recurrent and/or symptomatic SVT and age >5 years	Catheter ablation	I	C	
	Flecainide, propafenone	I		
	Sotalol	I		
	Amiodarone	IIb		
WPW syndrome and recurrent and/or symptomatic SVT and age <5 years	Flecainide, propafenone	I	C	
	Sotalol	IIa		
	Catheter ablation	IIb		
	Amiodarone	IIb		
WPW syndrome and palpitations with inducible sustained SVT during EP test, age >5 years	Catheter ablation	I	C	
	Flecainide, propafenone	I		
	Sotalol	I		
	Amiodarone	IIb		

WPW, Wolff–Parkinson–White; SVT, supraventricular tachycardia; LV, left ventricular; SCD, sudden cardiac death; AF, atrial fibrillation; APERP, accessory pathway effective refractory period; PES, programmed electrical stimulation; EP, electrophysiological; AA, antiarrhythmic; level, level of Evidence; Class, recommendation classification.

^aPatients should be free of significant LV dysfunction, sinus bradycardia, or pre-excitation.

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Table 4 Indications for catheter ablation and oral prophylactic antiarrhythmic drugs for recurrent SVT or VT

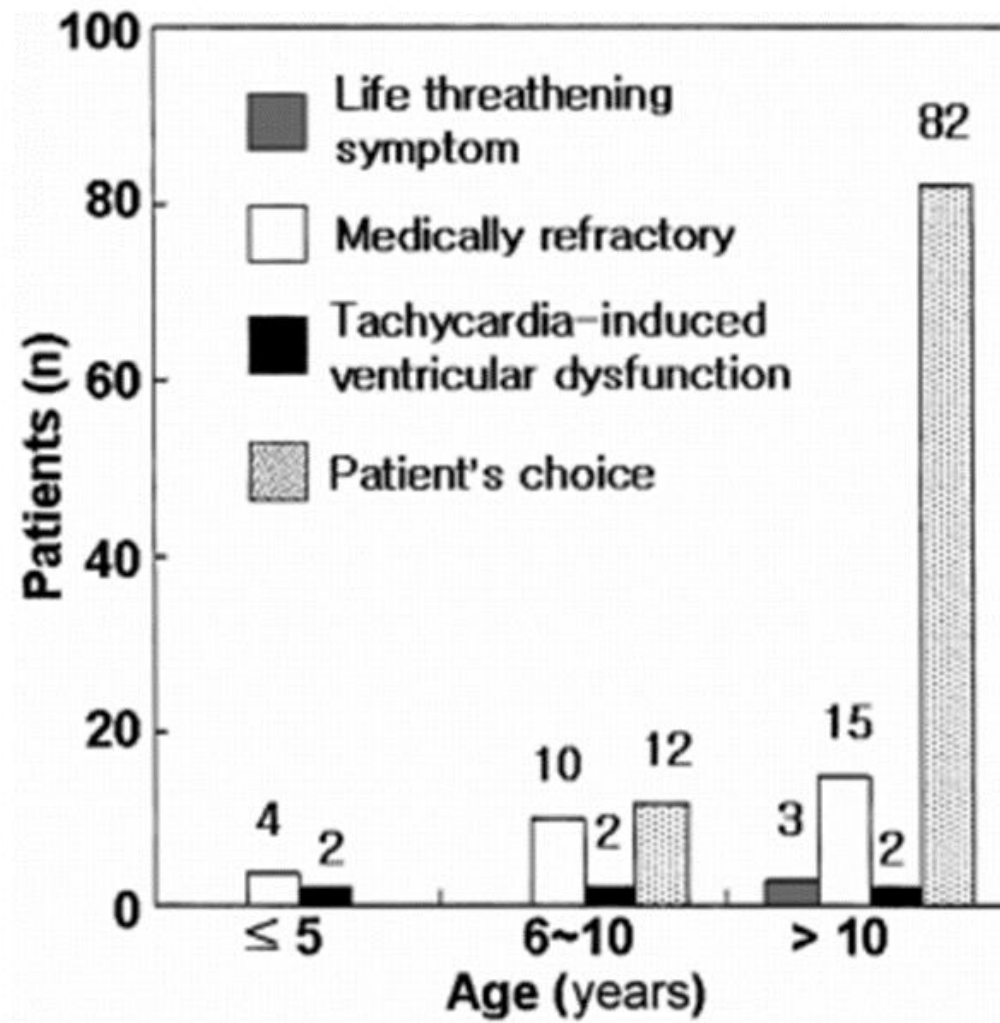
Clinical situation	Recommendation	Class	Level	Reference
SVT, age >5 years, chronic AA therapy has been effective in control of the arrhythmia	Catheter ablation	Ila	C	
SVT, age <5 years (including infants), when AA medications, including Classes I and III are not effective or associated with intolerable side effects	Catheter ablation	Ila	C	
Asymptomatic preexcitation, age >5 years, no recognized tachycardia, risks and benefits of procedure and arrhythmia clearly explained	Catheter ablation Any AA drug	IIb III	C	
Asymptomatic preexcitation, age <5 years	Catheter ablation Any AA drug	III III	C	
SVT controlled with conventional AA medications, age <5 years	Catheter ablation	III	C	
Idiopathic monomorphic ventricular tachycardia	Propranolol Sotalol Flecainide, propafenona Verapamil Procainamida Amiodarone	IIb Ila	C C	167,170

WPW, Wolff–Parkinson–White; SVT, supraventricular tachycardia; LV, left ventricular; SCD, sudden cardiac death; AF, atrial fibrillation; APERP, accessory pathway effective refractory period; PES, programmed electrical stimulation; EP, electrophysiological; AA, antiarrhythmic; level, level of Evidence; Class, recommendation classification.
^aPatients should be free of significant LV dysfunction, sinus bradycardia, or pre-excitation.

En résumé

	Grands Enfants	Petits Enfants
TDR mettant en jeu le pronostic vital (MSR/WPW)	I	I
TDR non contrôlé par les AAA responsable d'une dégradation de la FEVG	I	I
Effet secondaire intolérable des traitements antiarythmiques	I	I*/IIa
WPW symptomatique	I	IIb
Souhait d'arrêt des traitements	I*	III
Lipothymie au démarrage de la TSV	I*	III
TSV contrôlée par les traitements	IIa	III
WPW asymptomatique	IIb	III
WPW asympto mais à risque	IIa*	III
WPW asympto/pratique sportive	IIa*	III

* HRS

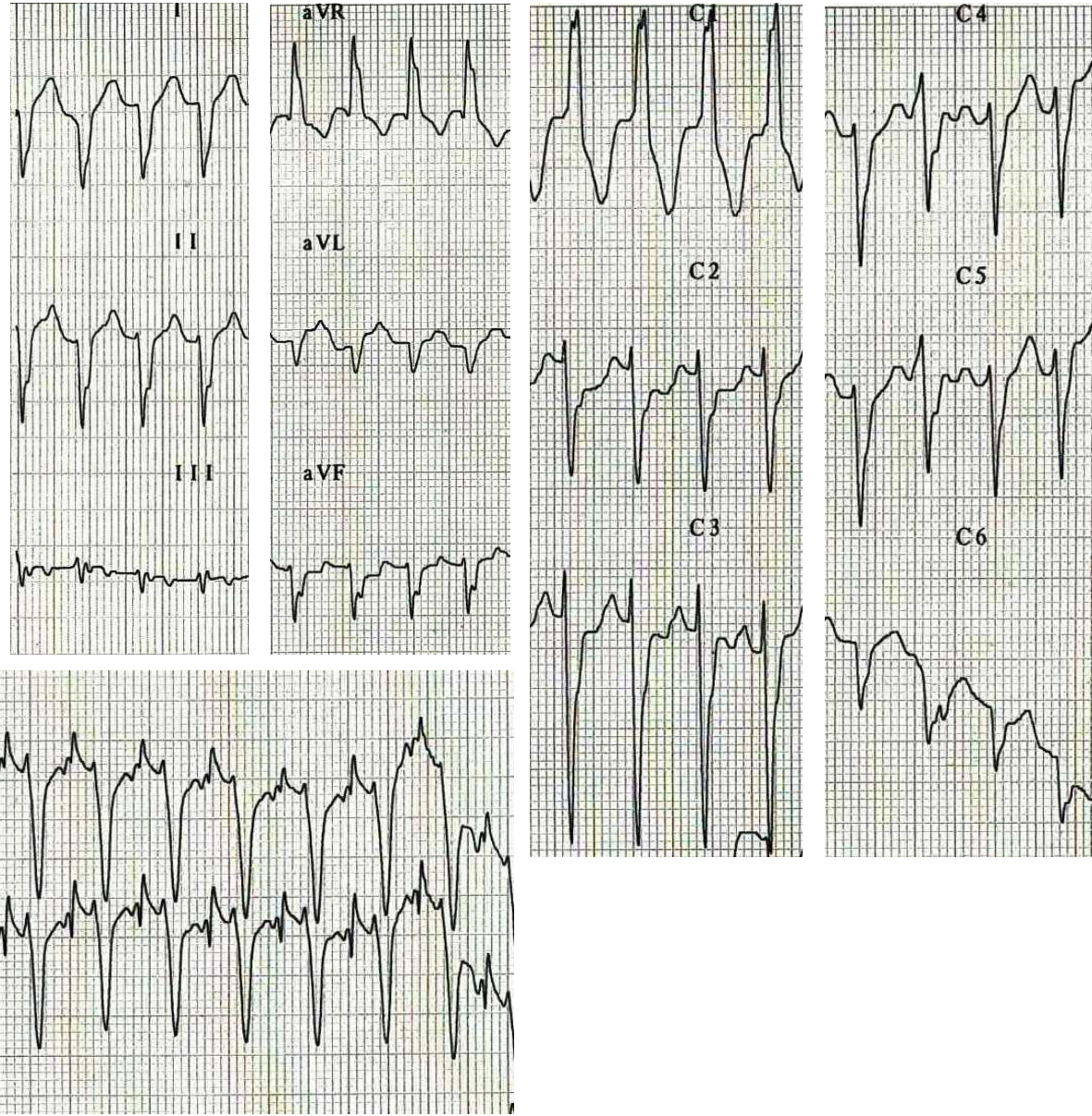


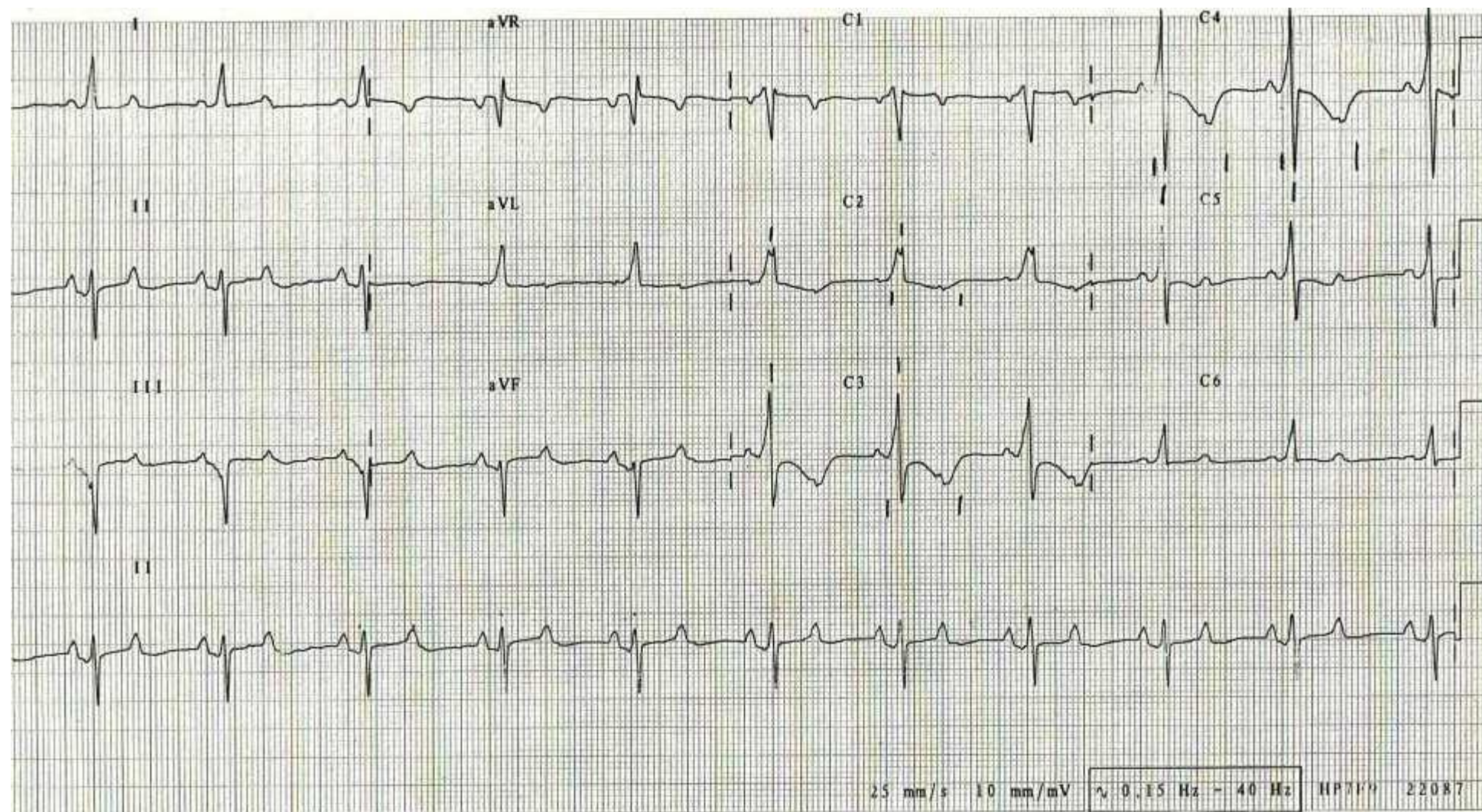
Joung et al, Circ J. 2006

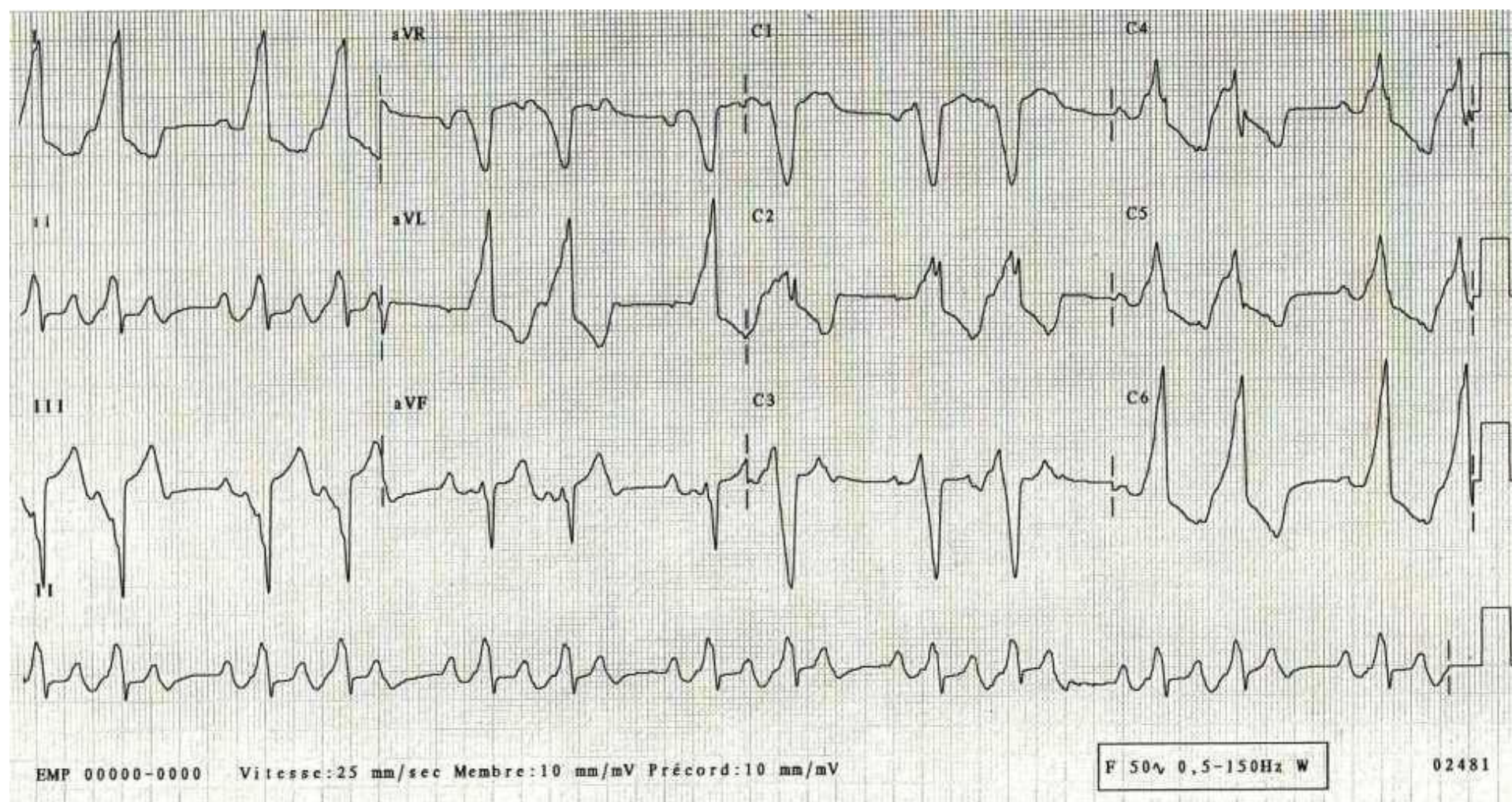
Indication d'ablation avant 15 kg

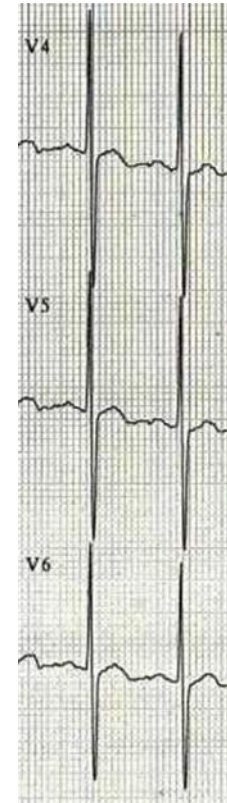
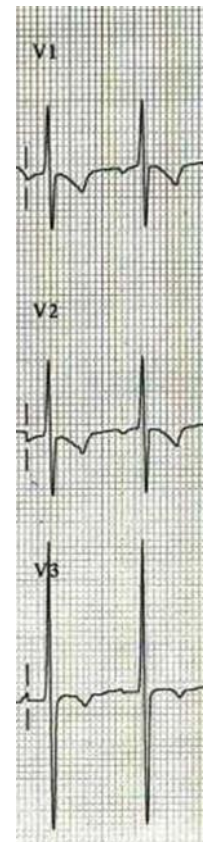
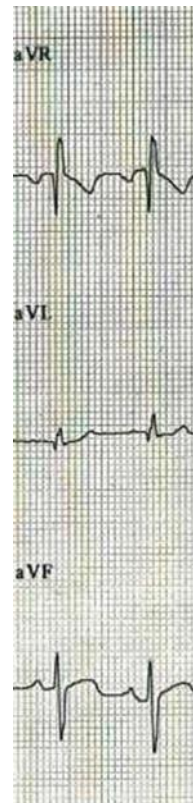
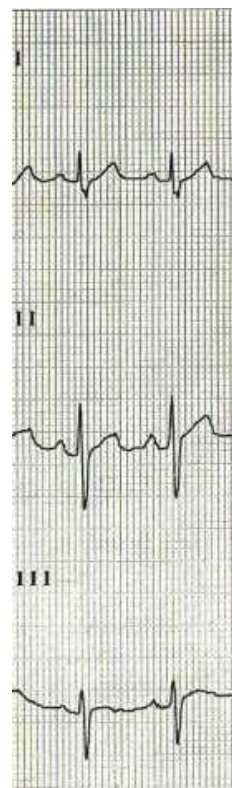
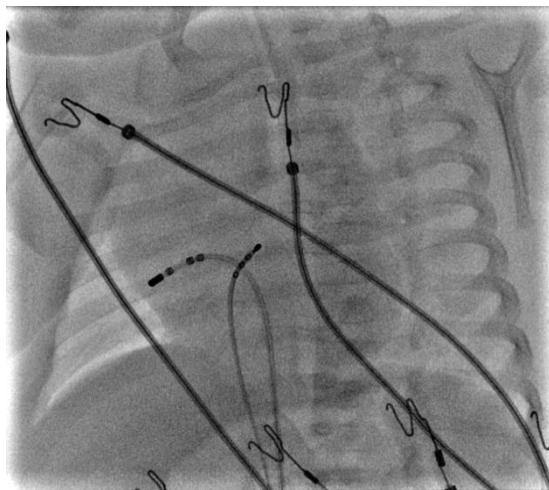
SAMI

- Diagnostic de TSV à J10 sur choc cardiogénique
- AAR: amiodarone, digoxine, bb
- Récidive itérative jusqu'à 3 mois





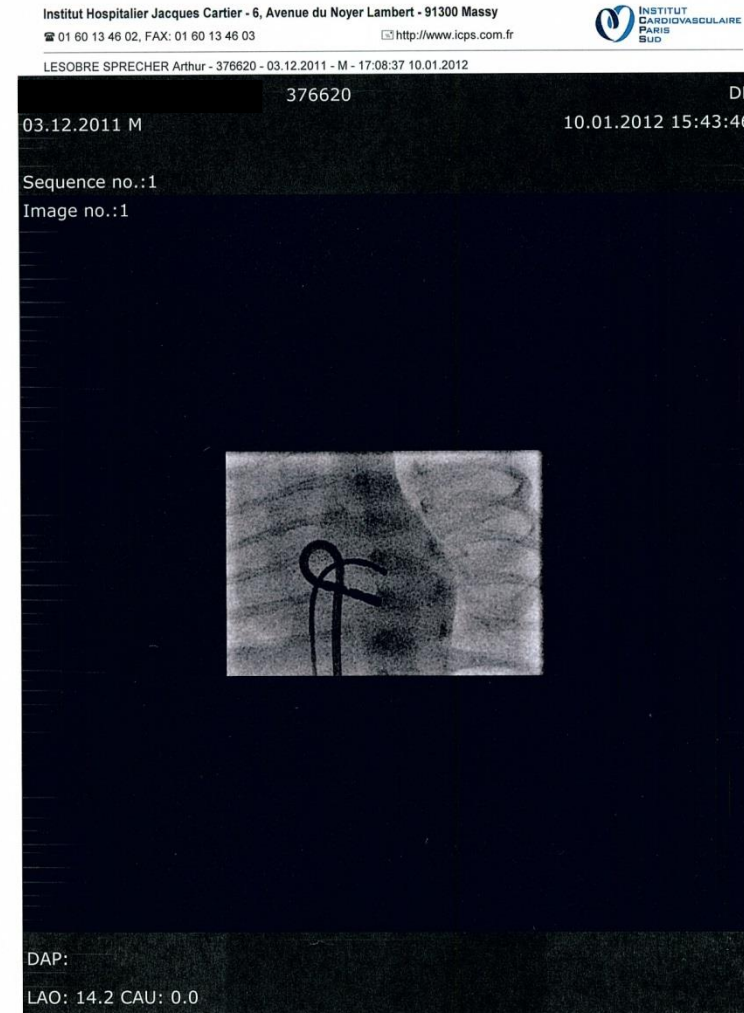




Clinical situation	Recommendation	Class	Level
Incessant or recurrent SVT associated with ventricular dysfunction	Catheter ablation	I	C
SVT, age <5 years (including infants), when AA medications, including Classes I and III are not effective or associated with intolerable side effects	Catheter ablation	Ila	C

RF < 15 kg

- Anesthésie générale
- Stimulation œsophagienne ou KT 4 Fr
- Apnée pendant le tir
- Limite en puissance: 25-50 W
- Limite en température: 60-70°C
- Durée du tir: 15 à 30 s
- Collimater les Rx, $\updownarrow$ grille
- Coronarographie selon le site d'ablation
- Anticoagulation efficace



RF vs Cryo

		RF	CRYO
Taux de succès	RR	92%	70 à 85%
	RIN	97%	80 à 97%
BAV III		1 à 3%	0%
Taux de récurrence		10%	7 à 45%

- Lésions coronaire
- Douleur
- Temps de fluoroscopie
- Thrombus local
- Stress de l'opérateur

Triedman JK, J Cardiovasc electrophysiol. 2009

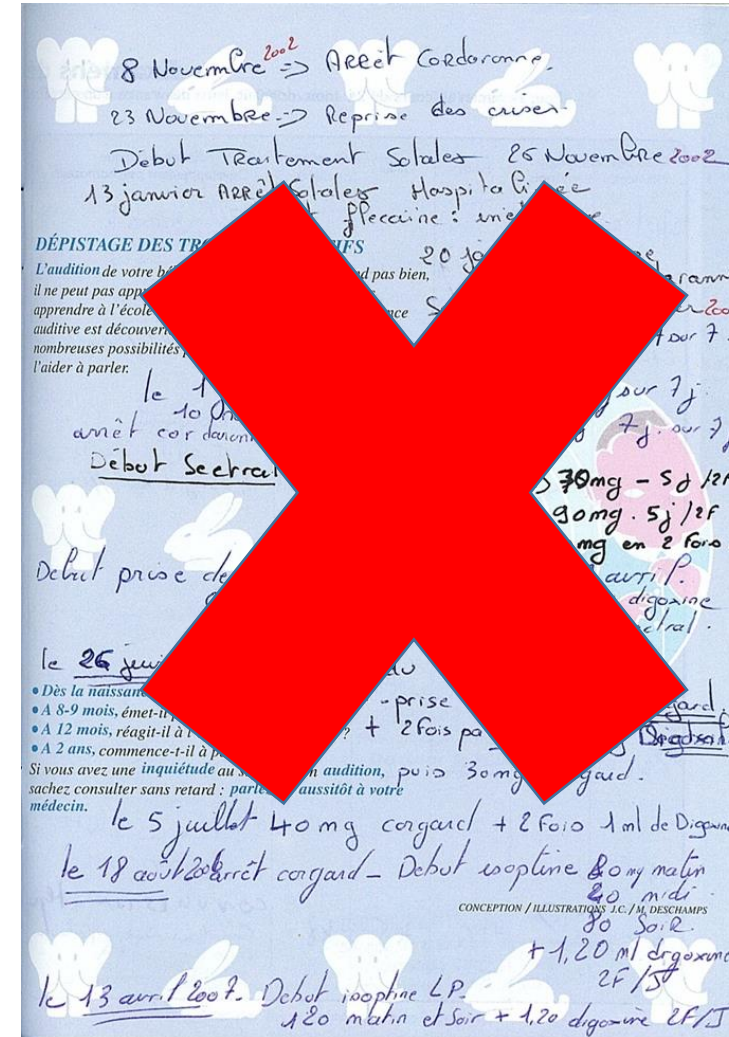
Drago et al, Pediatric Cardiol. 2006

Kriebel et al, J Cardiovasc electrophysiol. 2005

Bar-Cohen et al, H Rhythm. 2006

En bref

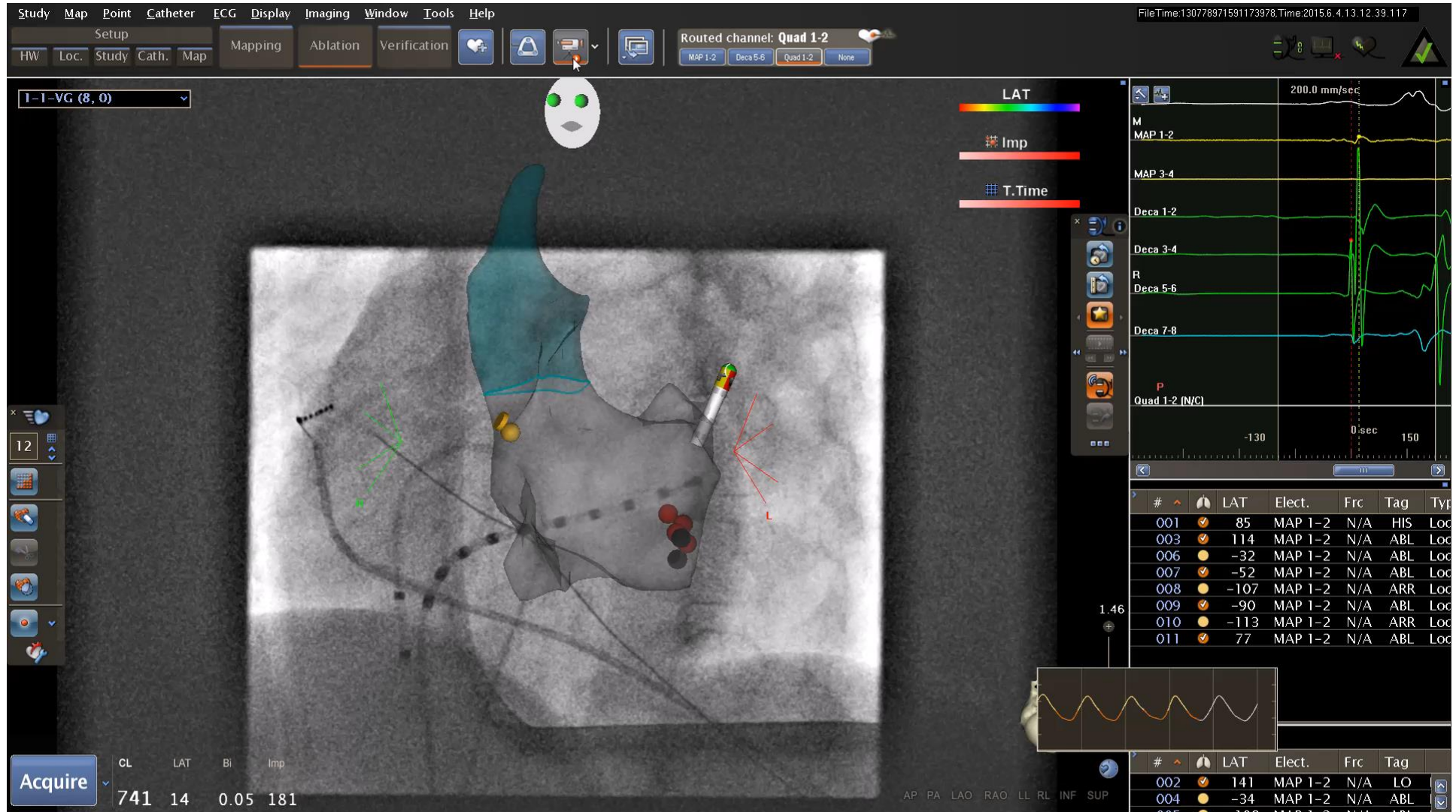
- **Dans les premières années de vie**
 - Risque de CMD rythmique
 - AAR > RF
- **Entre 5 et 10 ans**
 - Risque de CMD rythmique $\searrow \searrow$
 - Fonction du substrat, des symptômes, tolérance des AAR, volonté des parents, pratique sportive
 - AAR # RF
- **Après 10 ans**
 - Exploration de TOUT les WPW (risque de mort subite même si WPW asympo).
 - RF > AAR



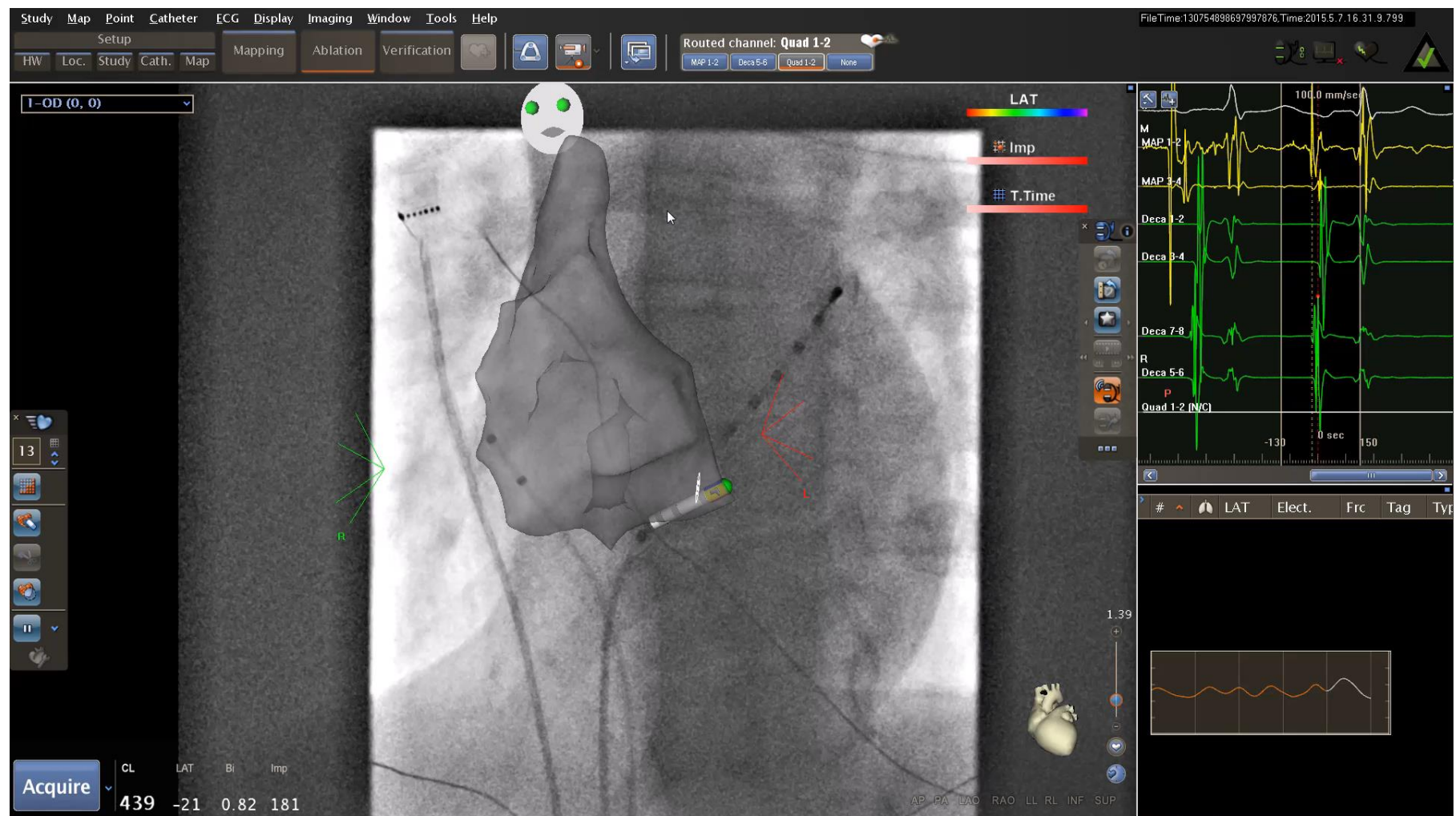
Outcomes depend on:

- Patient weight (<>15 kg) ~~vs age~~
- Underlying heart disease / heart failure
- Arrhythmic substrate / location / vascular approach
- Emergency vs programmed intervention
- Ablation energy used (RF vs Cryo)
- Physician experience (pediatric/adult EP) and EP lab standards (imaging integration, 3D navigation)

Voies accessoires



RIN

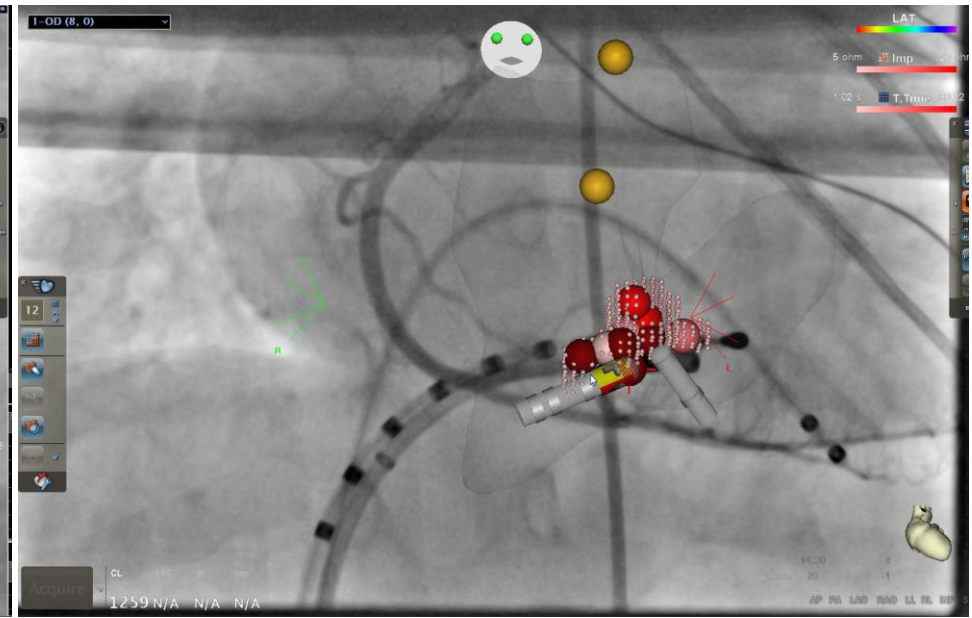
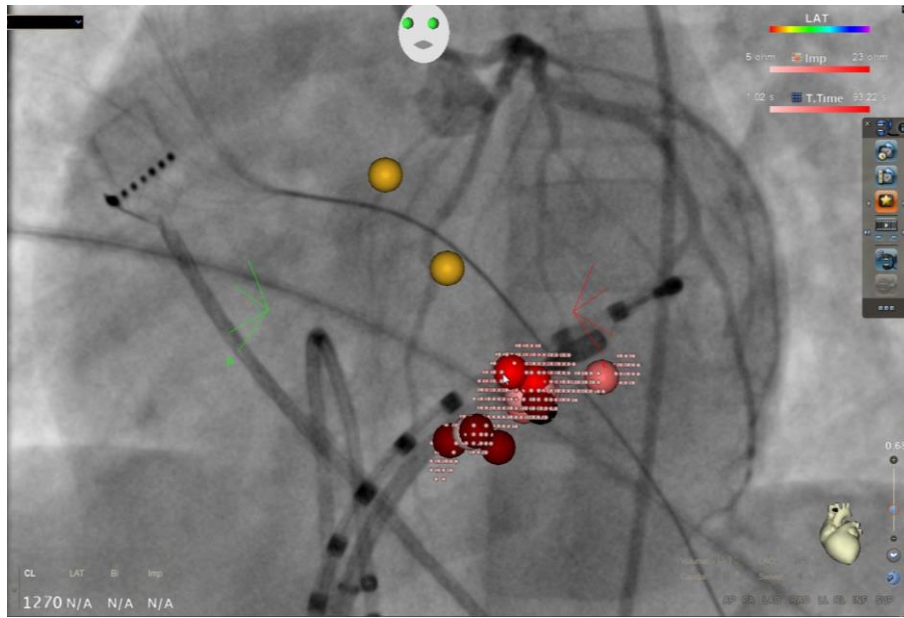


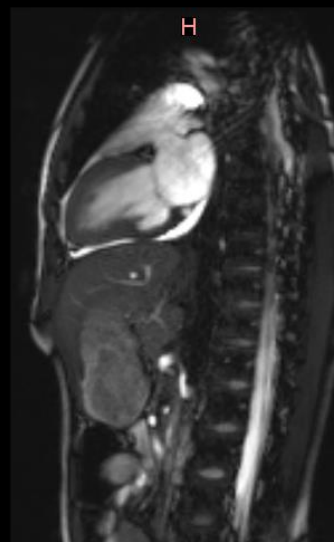
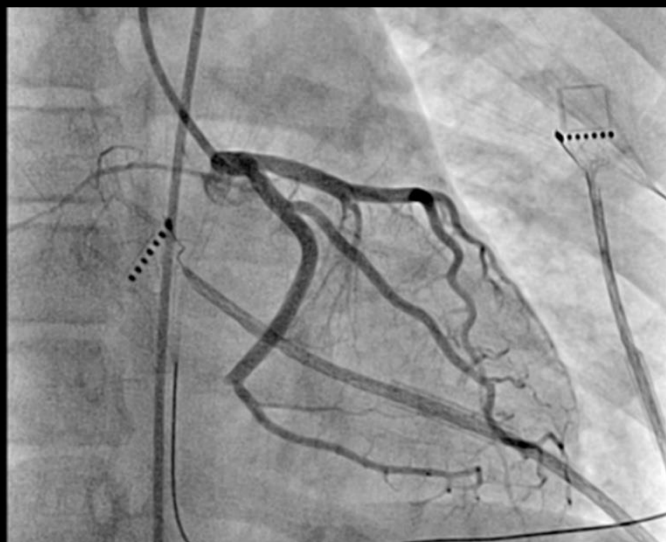
RIN



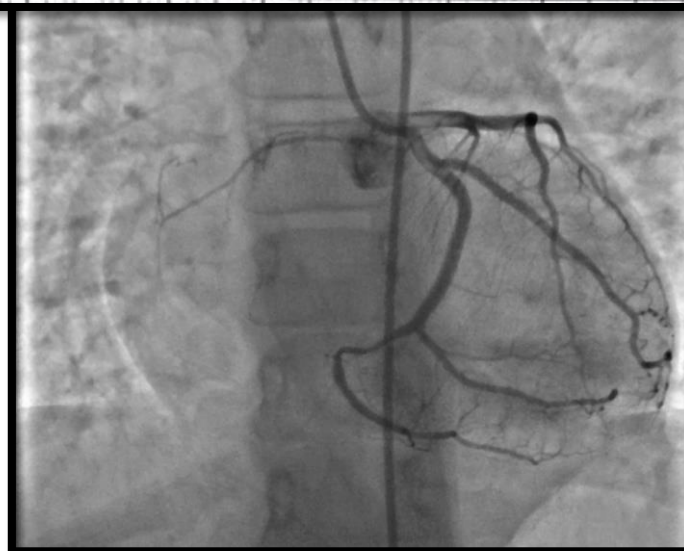
RIN



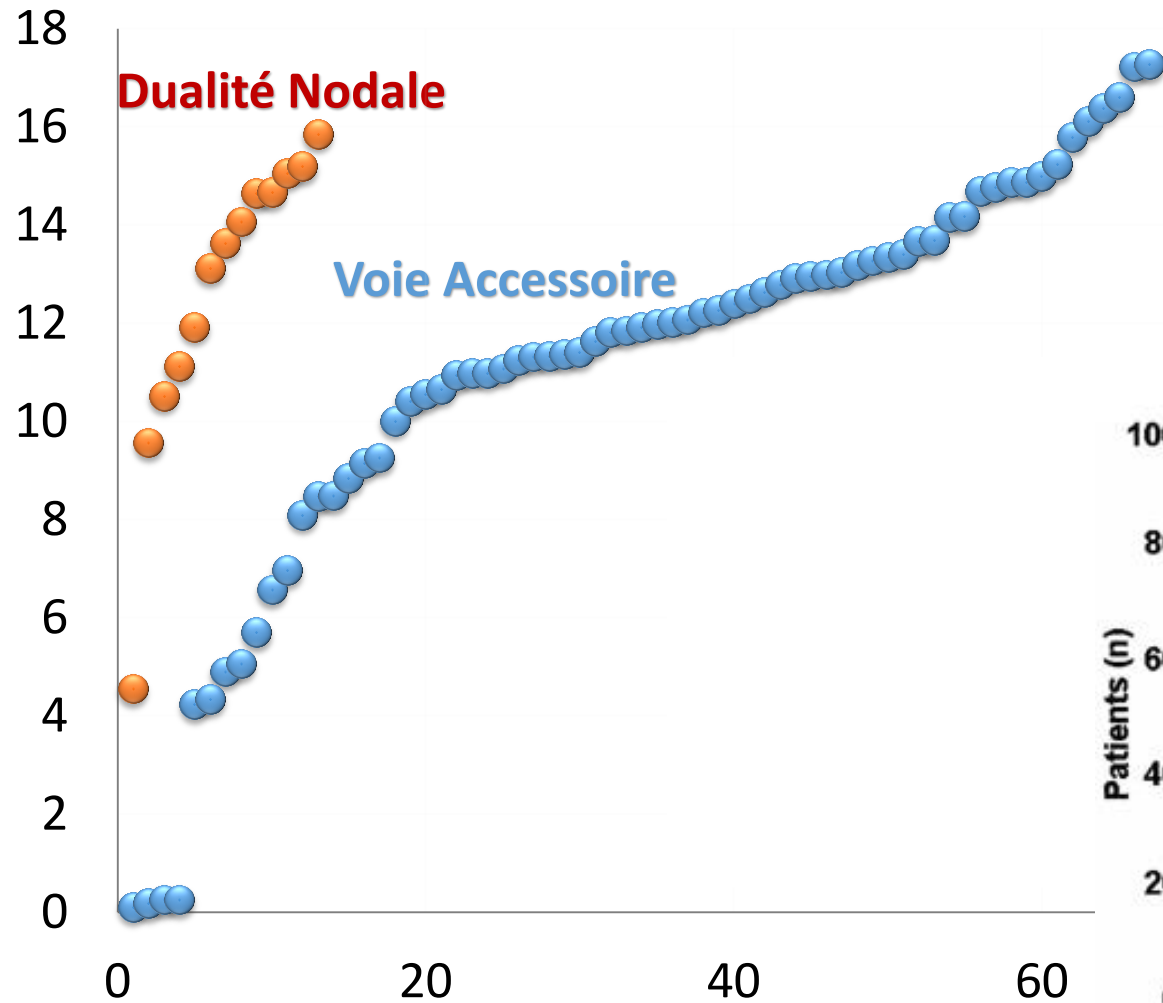




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Ablations pédiatriques ICPS



Joung et al, Circ J. 2006

