Arritmias em neonatos e lactentes

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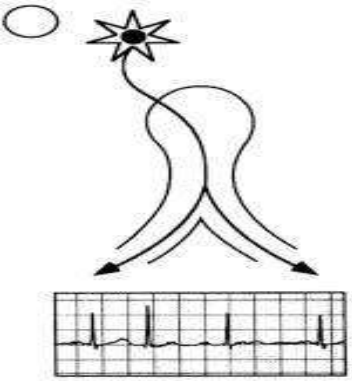
Médico assistente da seção de Eletrofisiologia Clínica e Arritmias Cardíacas do Instituto Dante Pazzanese de Cardiologia

Médico assistente do setor de Tele – ECG do IDPC

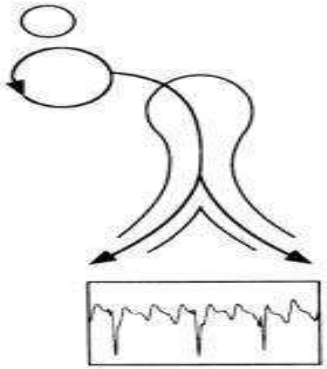
Médico da UTI cardíaca infantil e neonatal do Hcor

Faculty do PALS – AHA - CETES Hospital do Coração

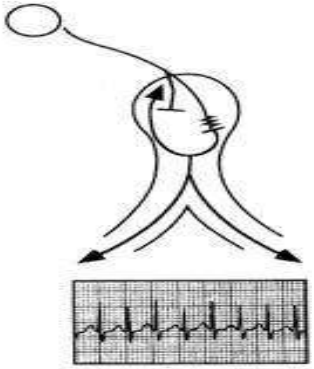
G. *EAT*



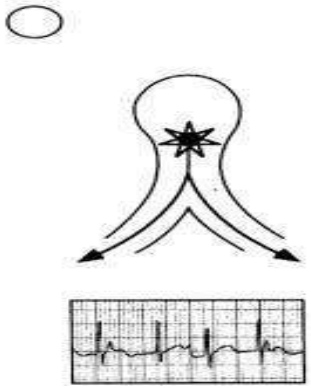
H. *IART*



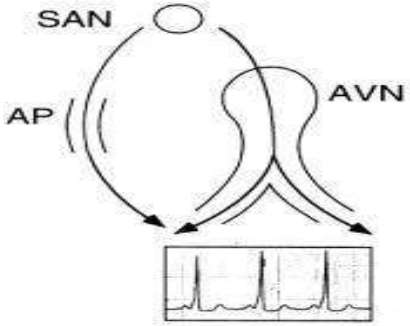
I. *AVNRT*



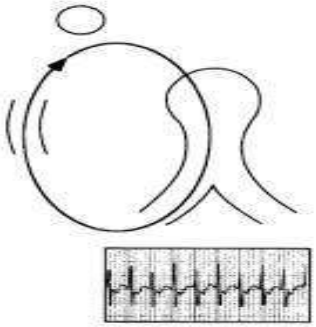
J. *JET*



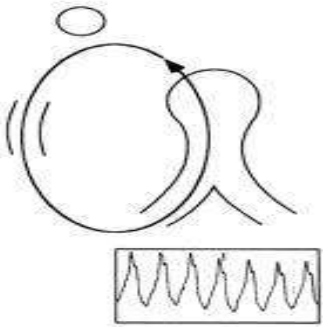
A. *WPW - Sinus Rhythm*



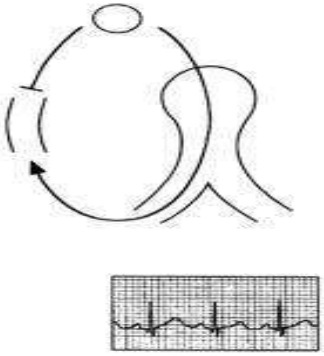
B. *ORT*



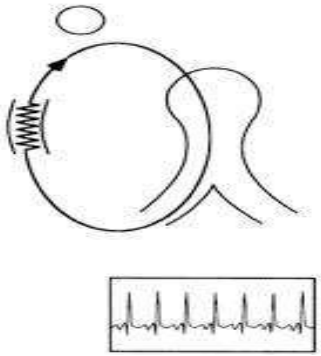
C. *ART*



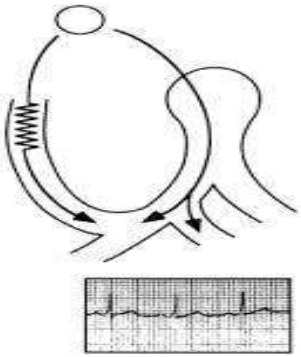
D. *Concealed AP*

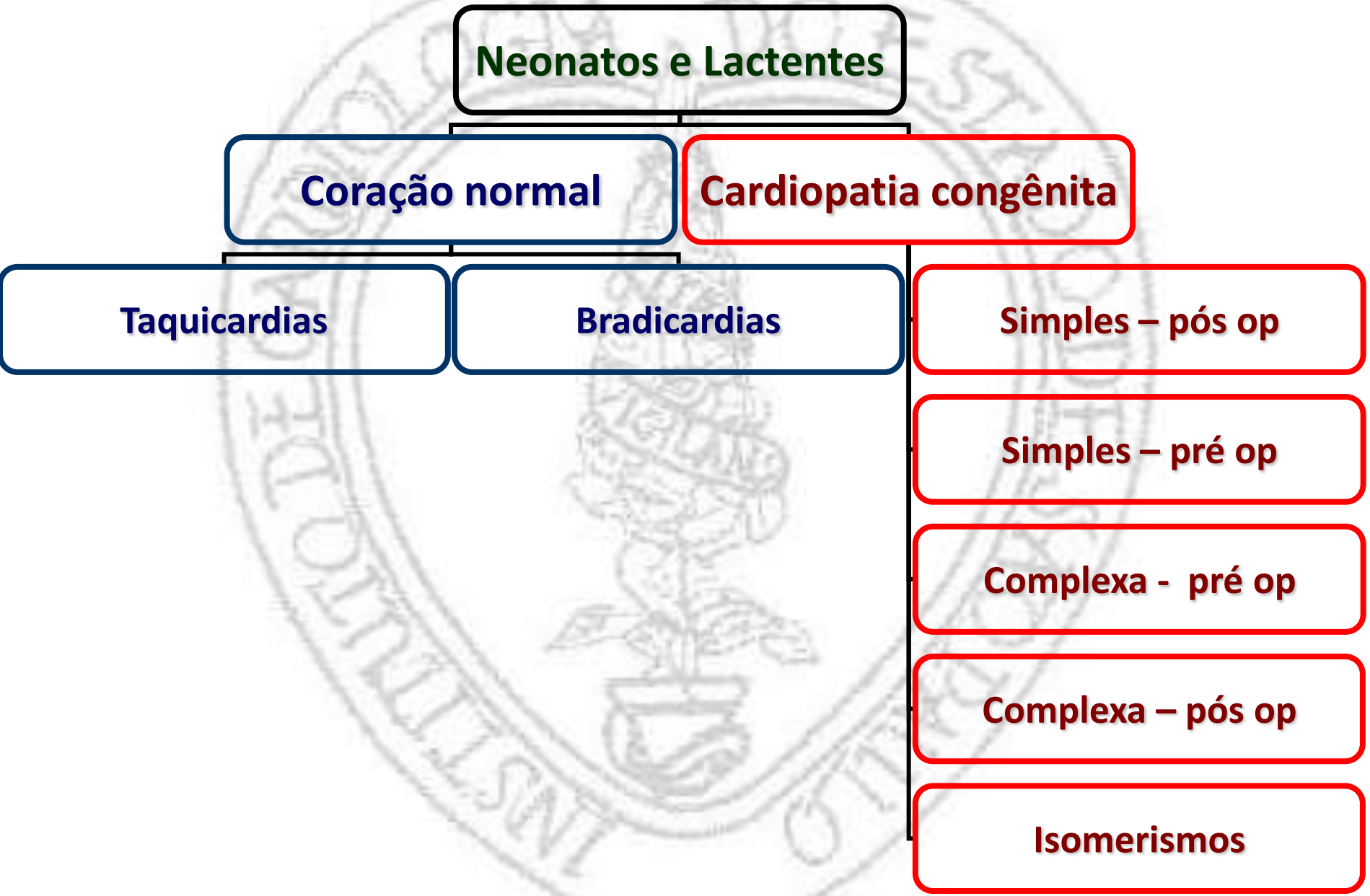


E. *PJRT*



F. *Mahaim*

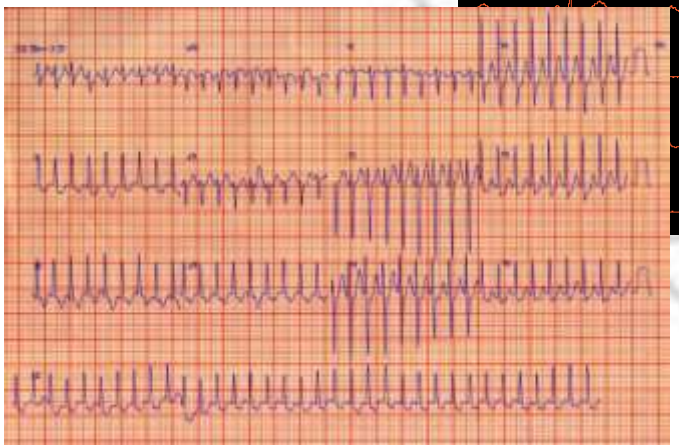



Neonatos e Lactentes
Coração normal
Cardiopatia congênita
Taquicardias
Bradicardias
Simples – pós op
Simples – pré op
Complexa - pré op
Complexa – pós op
Isomerismos

Arritmias

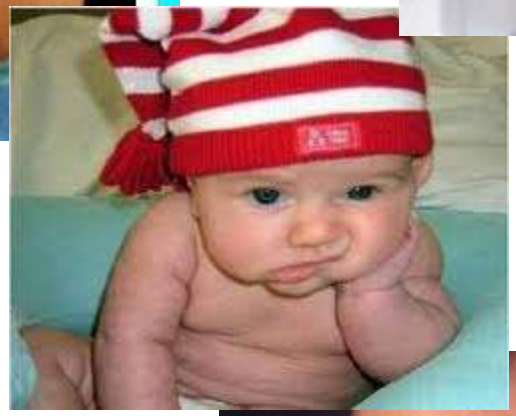
Taquicardias

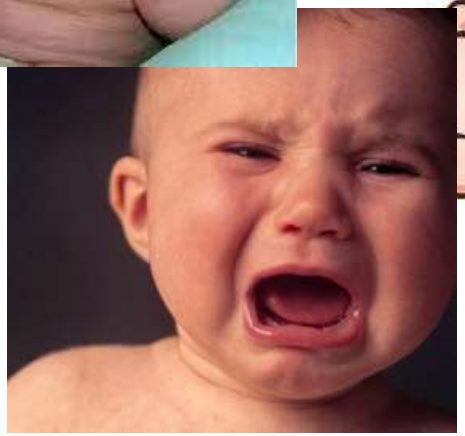
- TSV
- Ventriculares

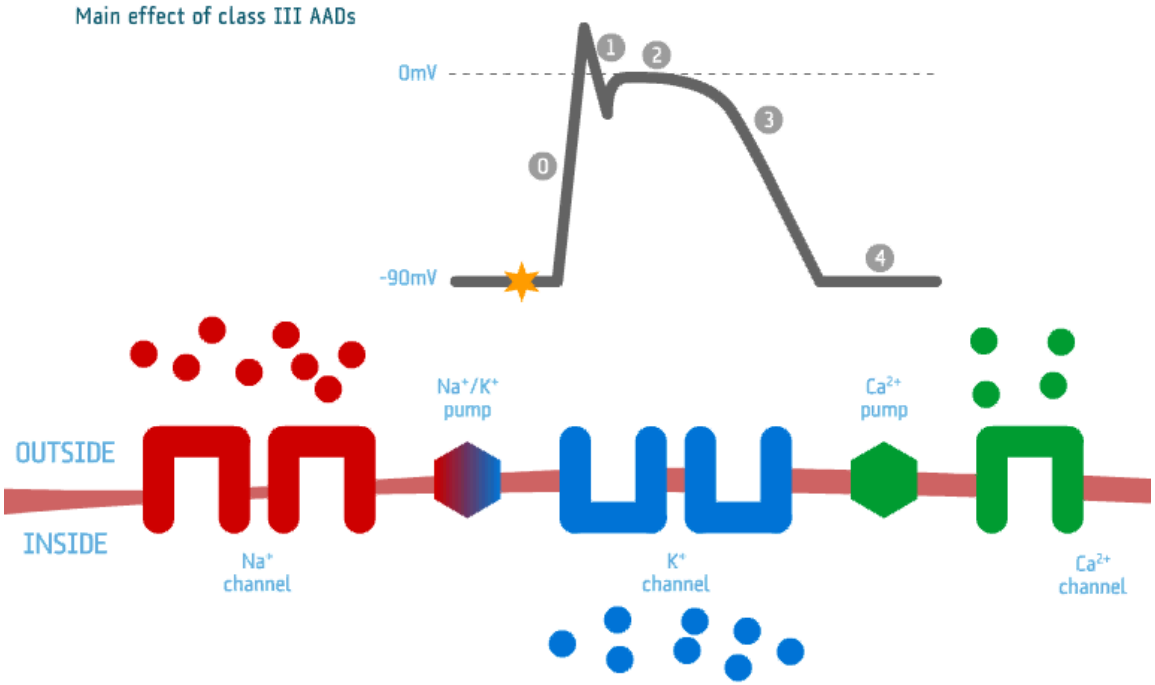


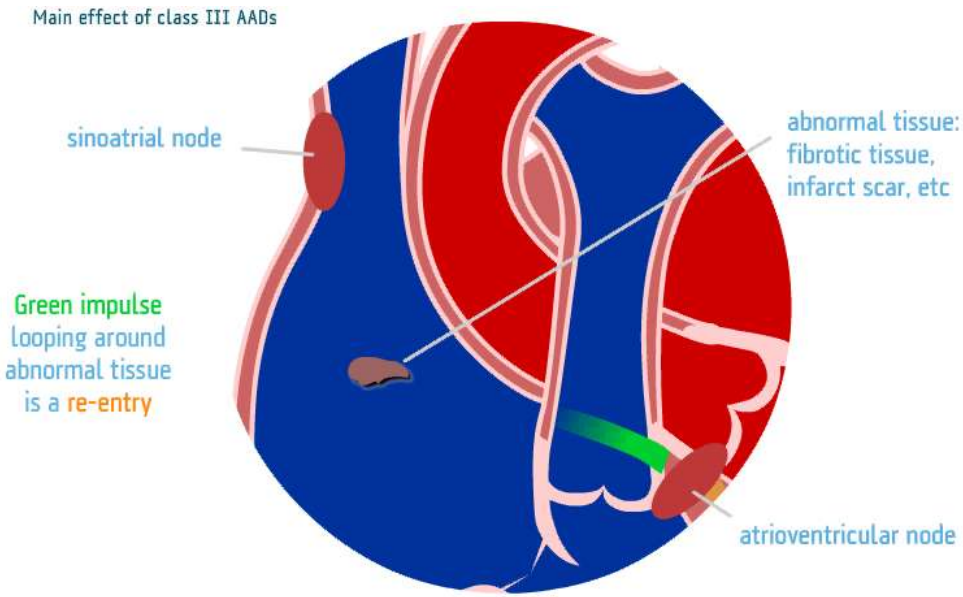
Bradicardias

- Automatismo
- Bloqueios sinoatriais
- Bloqueios AV






Main effect of class III AADs
0mV
-90mV
0
1
2
3
4
OUTSIDE
INSIDE
Na⁺/K⁺ pump
Ca²⁺ pump
Na⁺ channel
K⁺ channel
Ca²⁺ channel


Main effect of class III AADs
sinoatrial node
abnormal tissue: fibrotic tissue, infarct scar, etc
Green impulse looping around abnormal tissue is a re-entry
atrioventricular node

Classe III

TAQUICARDIA
Com Pulsos e Perfusão Inadequada

- Avalie e dê suporte ABC, conforme a necessidade
- Ofereça **oxigênio**
- Fixe o monitor/desfibrilador

Sintomas Persistem

Avalie a duração do QRS

QRS estreito (≤ 0,08 seg.) → **Avalie o ritmo com o monitor ou com um ECG de 12 derivações**

QRS largo (> 0,08 seg.) → **Possível Taquicardia Ventricular**

Provável Taquicardia Sinusal
- História compatível, consistente com causa conhecida
- Ondas P presentes/normais
- RR variável; PR constante
- Lactentes: freqüência cardíaca geralmente < 220/min
- Crianças: freqüência cardíaca geralmente < 180/min

Procure e trate as causas

Durante a Avaliação
- Garanta e verifique a via aérea avançada e o acesso vascular, quando possível
- Considere avaliação de um especialista
- Prepare-se para realizar a cardioversão

Trate os possíveis fatores contribuintes:
- Hipovolemia
- Hipóxia
- Hidrogênio (acidose)
- Hipo/hiperpotassemia
- Hipoglicemia
- Hipotermia
- Toxinas
- Tamponamento cardíaco
- Tensão no tórax (pneumotórax)
- Trombose (coronária ou pulmonar)
- Trauma (hipovolemia, aumento da PIC)

Provável Taquicardia Supraventricular
- História compatível (vaga, inespecífica)
- Ondas P ausentes/anormais
- FC não variável
- História de alteração abrupta na freqüência cardíaca
- Lactentes: freqüência geralmente ≥ 220/min
- Crianças: freqüência geralmente ≥ 180/min

Considere a realização de manobras vagais (Sem atrasos)

- **Caso o acesso IV esteja prontamente disponível: Administre adenosina** 0,1 mg/kg (dose inicial máxima 6 mg) em bolo rápido
  A primeira dose pode ser duplicada e administrada uma vez (segunda dose máxima 12 mg)

  ou
- **Cardioversão sincronizada:** 0.5 a 1 J/kg; caso não seja eficaz, aumente para 2 J/kg. Sedar, se possível, mas não adie a cardioversão

- **Cardioversão Sincronizada:** 0,5 a 1 J/kg; caso não seja eficaz, aumente para 2 J/kg Faça sedação, se possível, mas não adie a cardioversão
- Pode tentar administrar **adenosina**, se a tentativa não adiar a cardioversão elétrica

Recomendada consulta com especialista
- **Amiodarona** 5 mg/kg IV em 20 a 60 minutos

  ou
- **Procainamida** 15 mg/kg IV em 30 a 60 minutos

Não administre rotineiramente amiodarona e procainamida juntas

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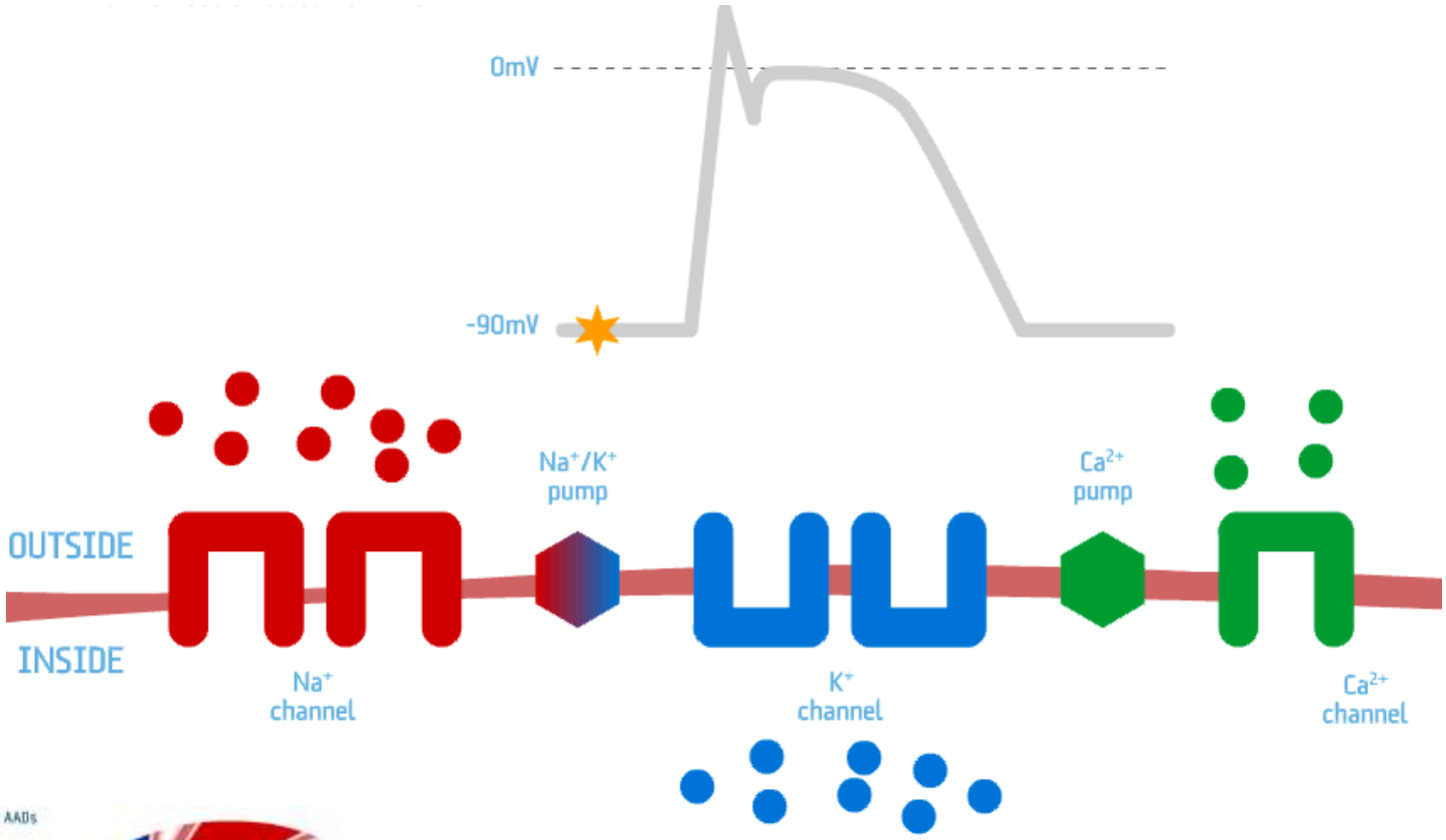
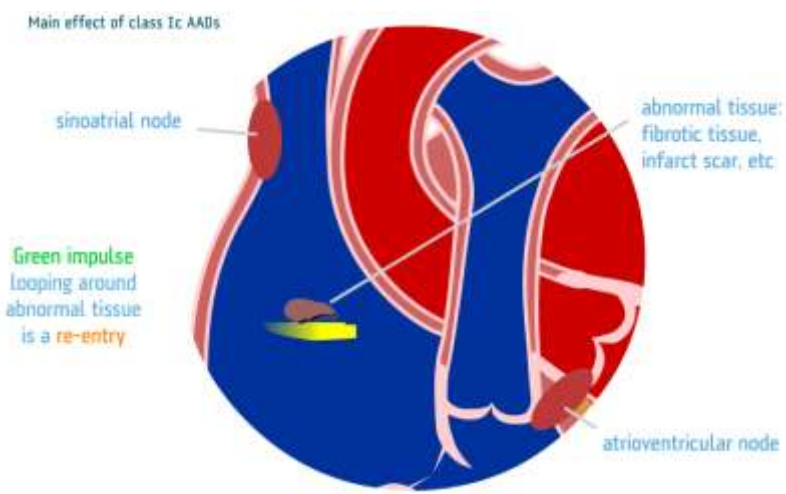
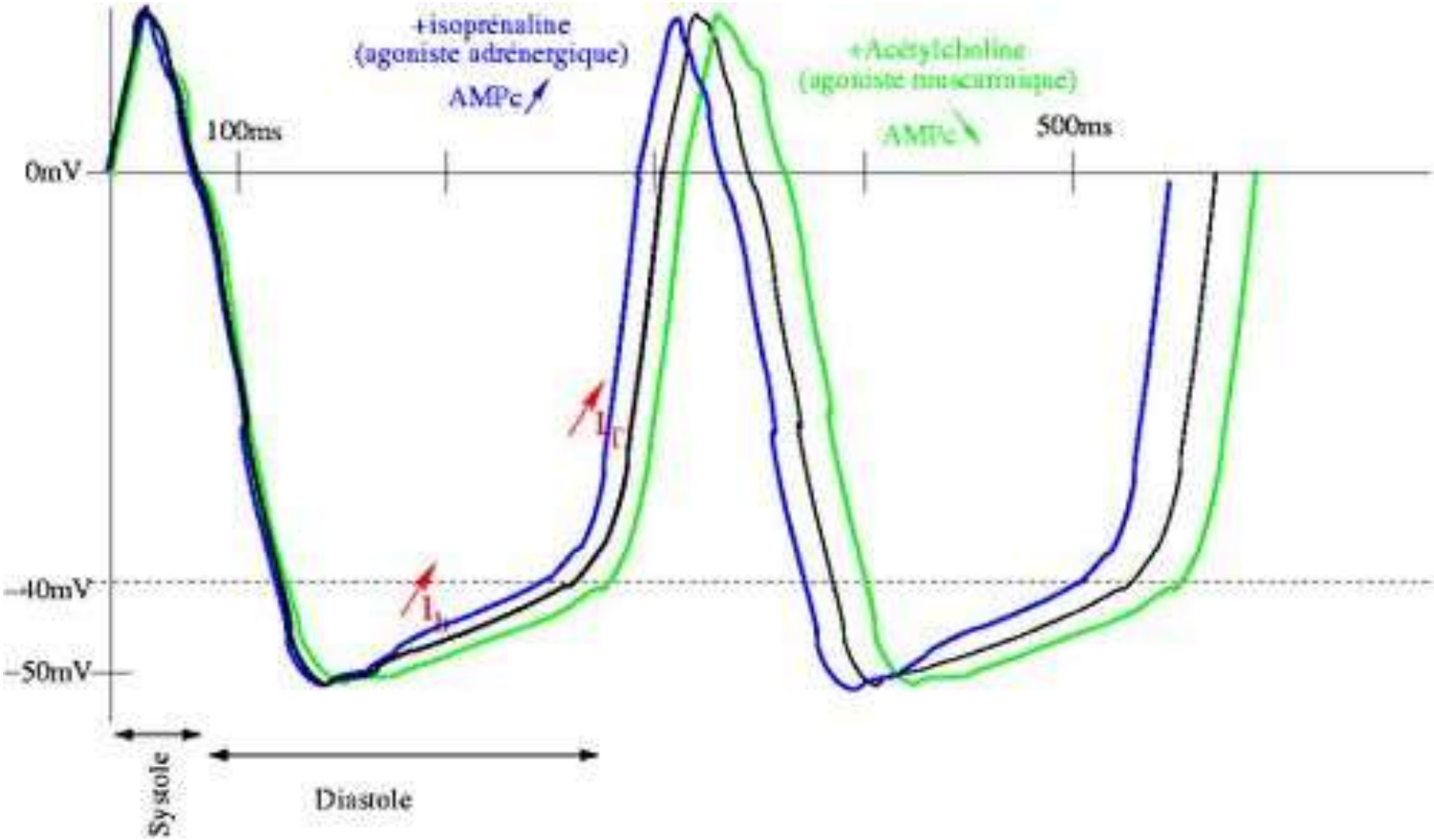
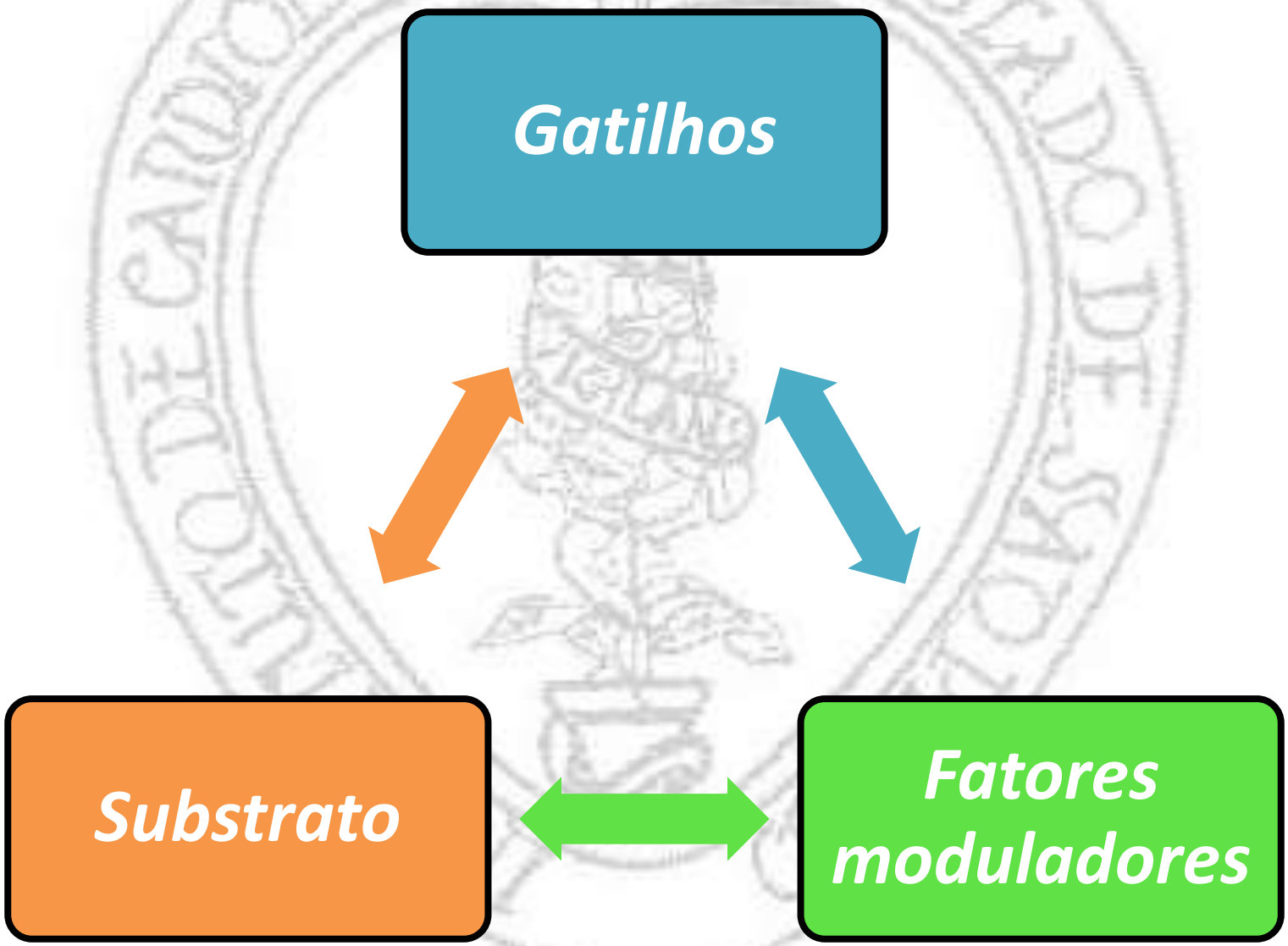

0mV
-90mV
OUTSIDE
INSIDE
Na⁺/K⁺ pump
Ca²⁺ pump
Na⁺ channel
K⁺ channel
Ca²⁺ channel


Main effect of class Ic AADs
sinoatrial node
abnormal tissue: fibrotic tissue, infarct scar, etc
Green impulse looping around abnormal tissue is a re-entry
atrioventricular node

Classe IC

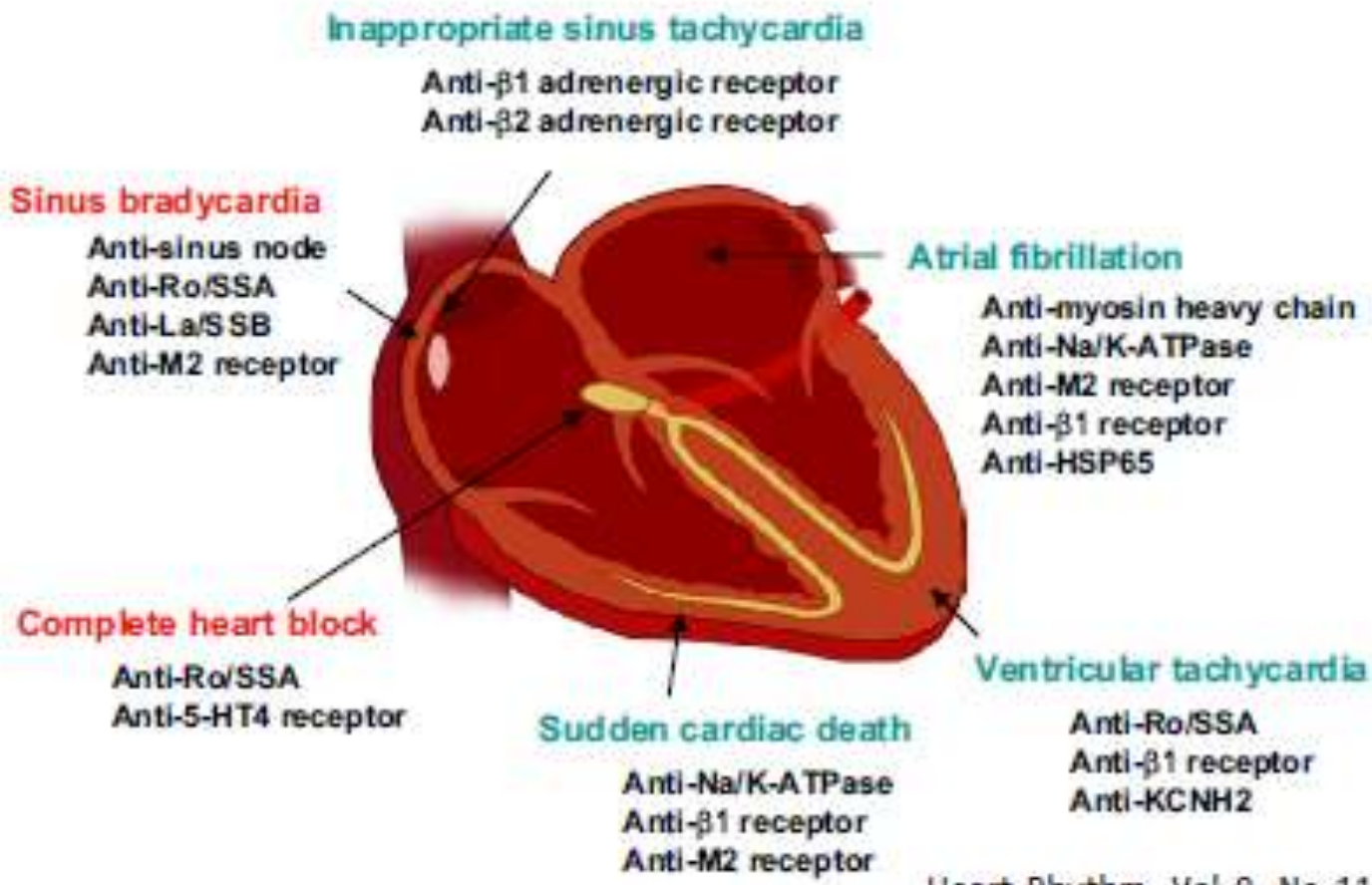

+isoprénaline
(agoniste adrénergique)
AMPc
+Acétylcholine
(agoniste muscarinique)
AMPc
100ms
500ms
0mV
-40mV
-50mV
I_f
I_{Ca}
Systole
Diastole


Gatilhos
Substrato
Fatores moduladores

CONTEMPORARY REVIEW

Autoantibodies and Cardiac Arrhythmias

Hon-Chi Lee, MD, PhD, FHRS,* Kristin T.L. Huang, BA,† Xiao-Li Wang, MD, PhD,* Win-Kuang Shen, MD, FHRS‡



Heart Rhythm, Vol 8, No 11, November 2011

Table 1 Autoantibodies and bradyarrhythmias

Arrhythmias	Autoantibodies	Associated diseases	Mechanisms
Sinus bradycardia	Anti-sinus node	Sick sinus syndrome	
	Anti-Ro/SSA, Anti-La/SSB	Neonatal lupus syndrome	Cross-reaction with α1D and α1C subunits of T- and L-type Ca^{2+} channels $\downarrow I_{Ca,L}$, $\downarrow I_{Ca,T}$
	Anti–M2 receptor	Dilated cardiomyopathy and Chagas disease	Agonist-like activity on M2 receptor $\downarrow$ cAMP, $\uparrow I_{KACh}$, $\downarrow I_{Ca,L}$
Conduction abnormalities	Anti–β1- and anti–β2-adrenergic receptor	Idiopathic conduction disturbances (atrioventricular block and intraventricular conduction block) Dilated cardiomyopathy	Agonist-like activity on β2-adrenergic receptor in conduction tissue $\uparrow G_i$, $\uparrow$ GIRK, $\downarrow I_{Ca,L}$
	Anti–M2 receptor	Chagas disease	Agonist-like activity on M2 receptor $\downarrow$ cAMP, $\uparrow I_{KACh}$, $\downarrow I_{Ca,L}$
	Anti-Ro/SSA	Systemic lupus erythematosus	$\downarrow I_{Ca,L}$, $\downarrow I_{Ca,T}$
Congenital complete heart block	Anti-Ro/SSA	Neonatal lupus syndrome	Cross-reaction with the α1C subunit of L-type Ca^{2+} channels $\rightarrow$ L-type Ca^{2+} channel internalization $\rightarrow$ $[Ca^{2+}]_i$ dysregulation $\rightarrow$ cell death $\rightarrow$ inflammation $\rightarrow$ fibrosis $\downarrow I_{Ca,L}$

cAMP = cyclic adenosine monophosphate; G_i = inhibitory G protein; GIRK = G-protein activated inward rectifier K^+ channel; $I_{Ca,L}$ = L-type calcium currents; $I_{Ca,T}$ = T-type calcium currents; I_{KACh} = acetylcholine-activated potassium currents; M2 receptor = muscarinic cholinergic type 2 receptor.

Table 2 Autoantibodies and tachyarrhythmias

Arrhythmias	Autoantibodies	Associated diseases	Mechanisms
A. Supraventricular tachyarrhythmias			
Sinus tachycardia	Anti-β1- and anti-β2 adrenergic receptors	Inappropriate sinus tachycardia	Agonist-like activity on β-adrenergic receptors, ↑ cAMP, ↑ chronotropic effect
Atrial fibrillation	Anti-myosin heavy chain	Myocarditis, dilated cardiomyopathy, and idiopathic atrial fibrillation	Inflammation
	Anti-Na/K-ATPase	Dilated cardiomyopathy	↑ $[Ca^{2+}]_i$
	Anti-M2 receptor	Dilated cardiomyopathy, Graves' hyperthyroidism	↑ I_{KACh}, ↓ APD, ↓ AERP, ↑ conduction velocity in atrial myocardium
	Anti-β1 receptors	Graves' hyperthyroidism	↑ Hyperpolarization, ↓ APD, ↑ triggered activity
	Anti-HSP65	Postoperative coronary artery bypass graft	Inflammation
B. Ventricular tachyarrhythmias			
Ventricular tachycardia	Anti-Ro/SSA	Connective tissue diseases	Cross-reaction with hERG K^+ channel, ↓ I_{Kr}, ↑ QTc
	Anti-β1-adrenergic receptor	Chagas disease, idiopathic dilated cardiomyopathy, ischemic cardiomyopathy, viral hepatitis myocarditis	Agonist-like activity on β-adrenergic receptor, ↑ cAMP, ↑ chronotopic effects, ↑ APD, ↑ QT, ↑ $I_{Ca,L}$, ↓ I_{to}, ↓ I_{Ks}, ↑ EADs, ↑ extracellular signal-regulated kinase 1/2
Sudden cardiac death			
	Anti-Na/K-ATPase	Dilated cardiomyopathy	↑ $[Ca^{2+}]_i$
	Anti-β1-adrenergic receptor	Dilated cardiomyopathy	↑ APD, ↑ QT, and triggered activity
	Anti-M2 receptor	Chagas disease	↑ QT

AERP = atrial effective refractory period; APD = activation potential duration; $[Ca^{2+}]_i$ = intracellular Ca^{2+}; cAMP = cyclic adenosine monophosphate; EAD = early afterdepolarizations; HSP 65 = heat shock protein 65; $I_{Ca,L}$ = L-type calcium currents; I_{KACh} = acetylcholine-activated potassium currents; I_{Kr} = rapid delayed rectifier potassium currents; I_{KS} = slow delayed rectifier potassium currents; I_{to} = transient outward potassium currents; M2 receptor = muscarinic cholinergic type 2 receptor; Na/K-ATPase = sodium-potassium pump.

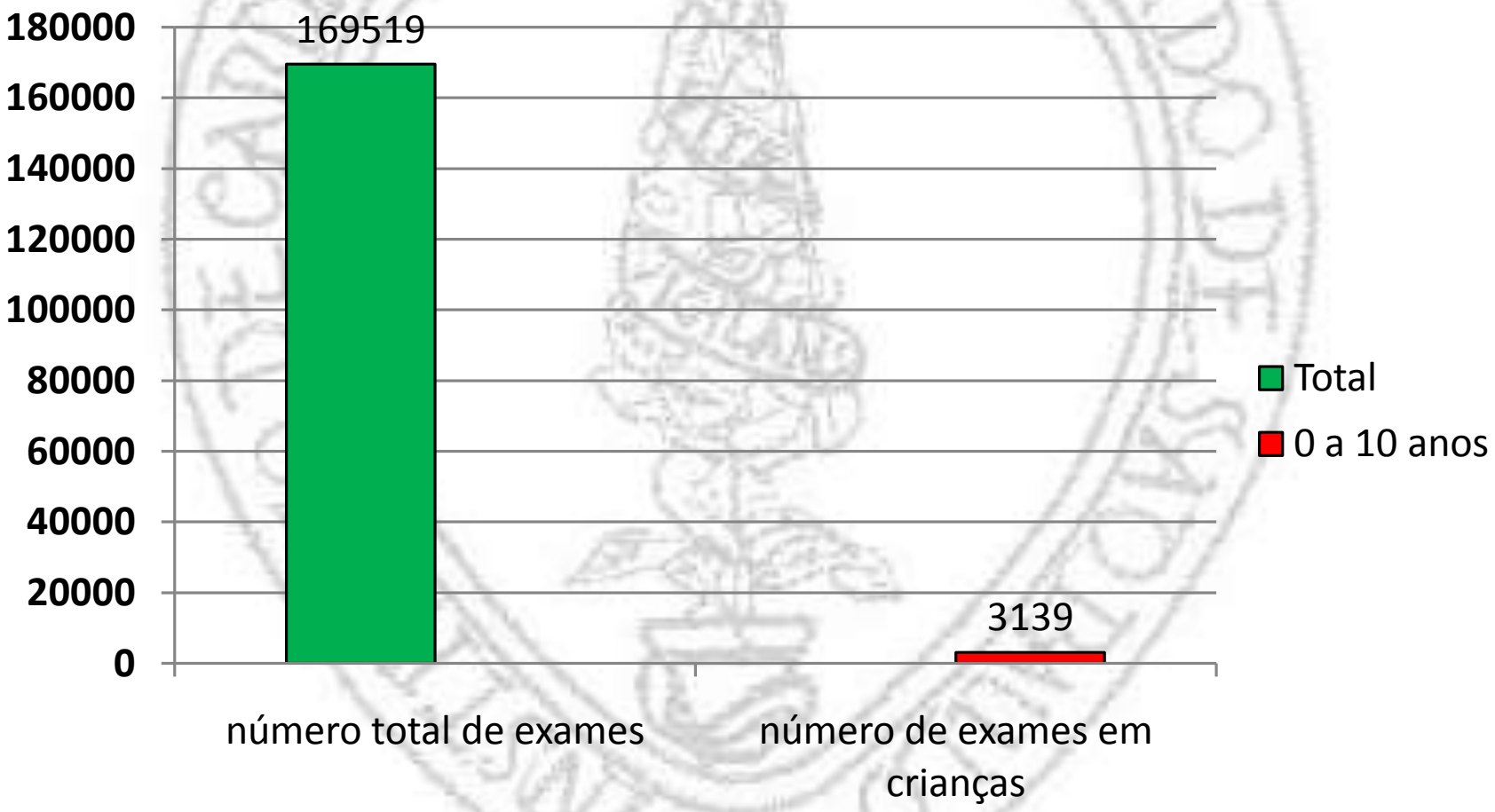
Arritmias em pediatria

- ✓ Queixa inespecífica

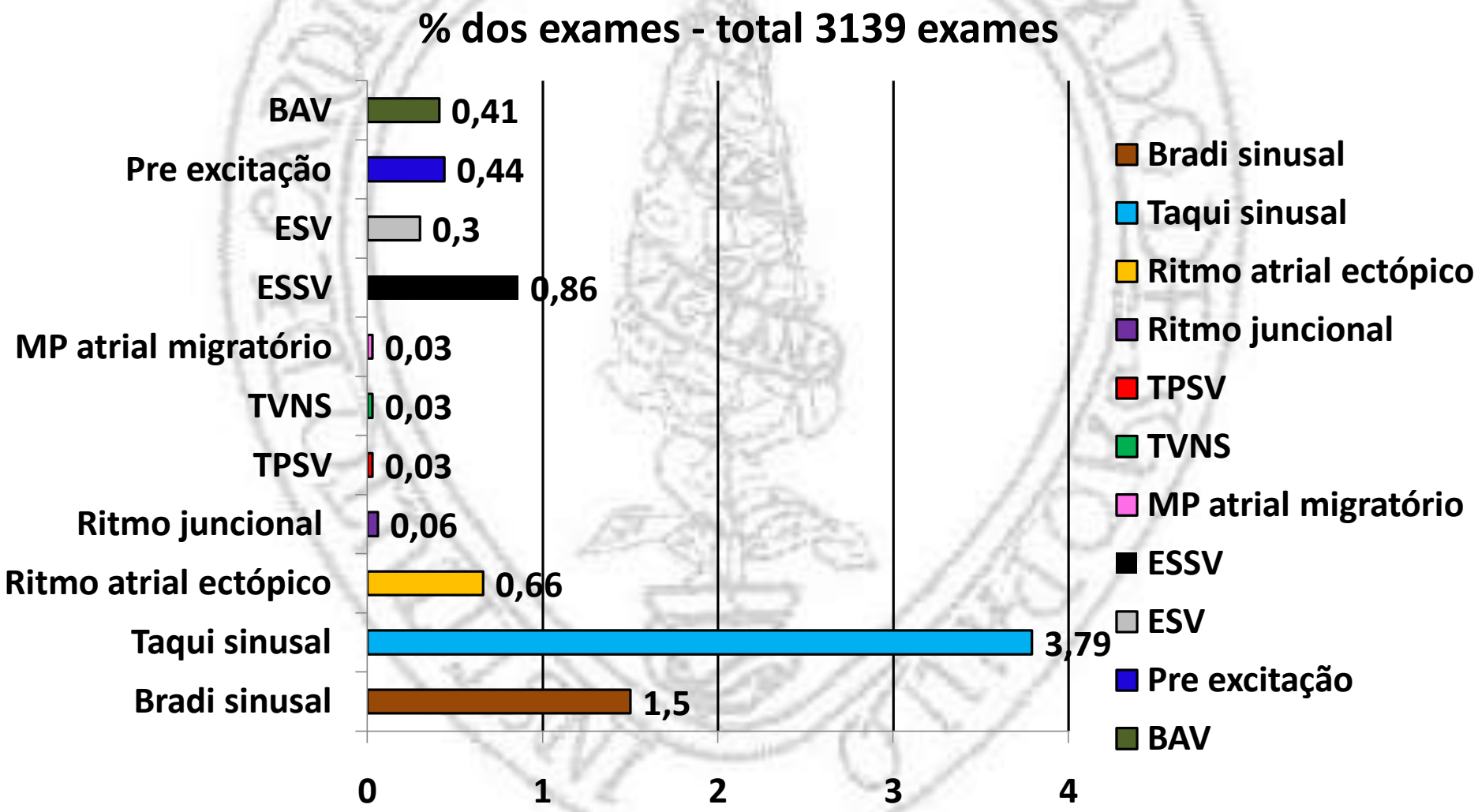
- ✓ Diagnóstico não invasivo:
  - ✓ ECG repouso
  - ✓ ECG crise
  - ✓ Holter
  - ✓ Teste ergométrico
  - ✓ Estudo eletrofisiológico

  - ✓ Terapia empírica;

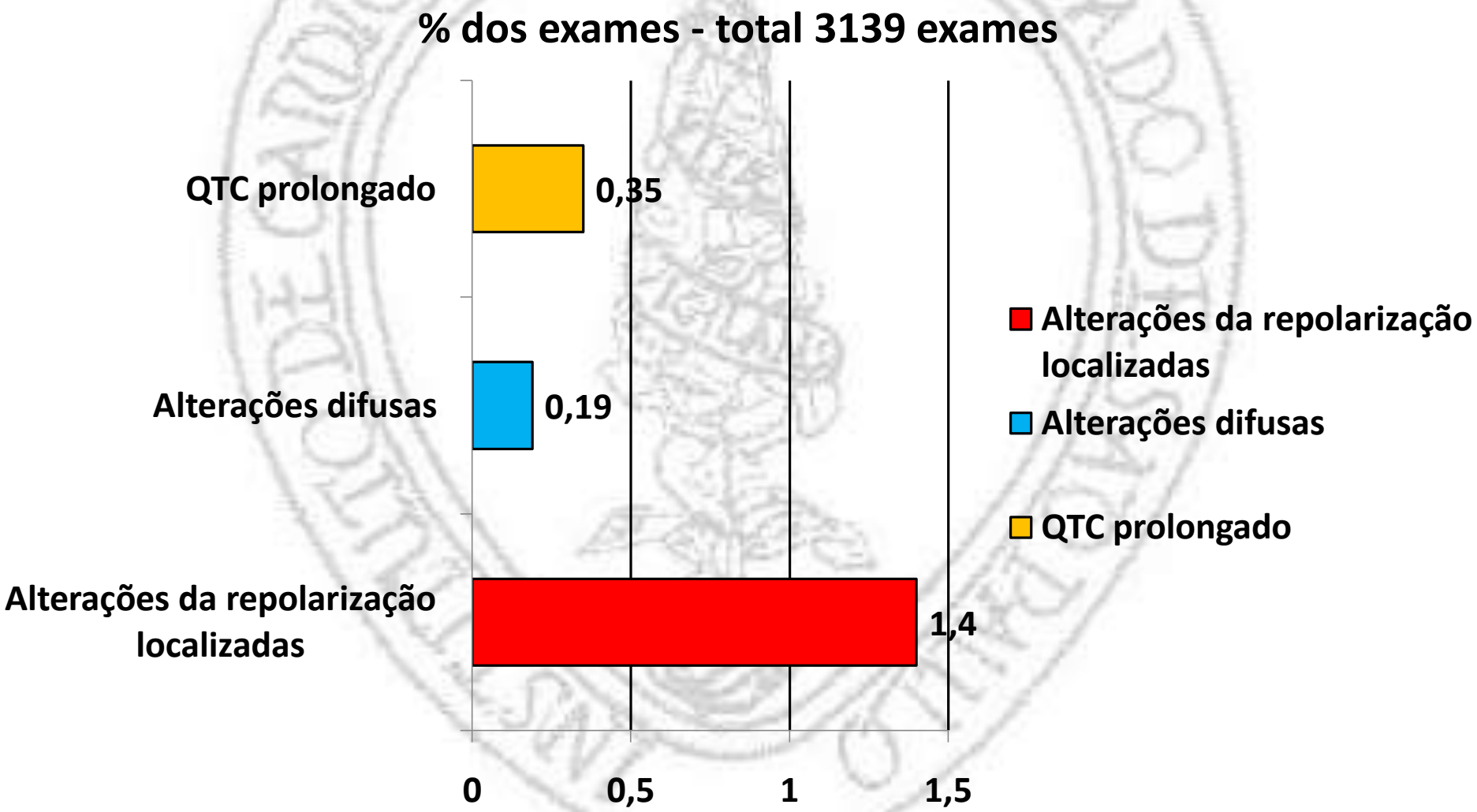
Julho 2007 – Dezembro 2010

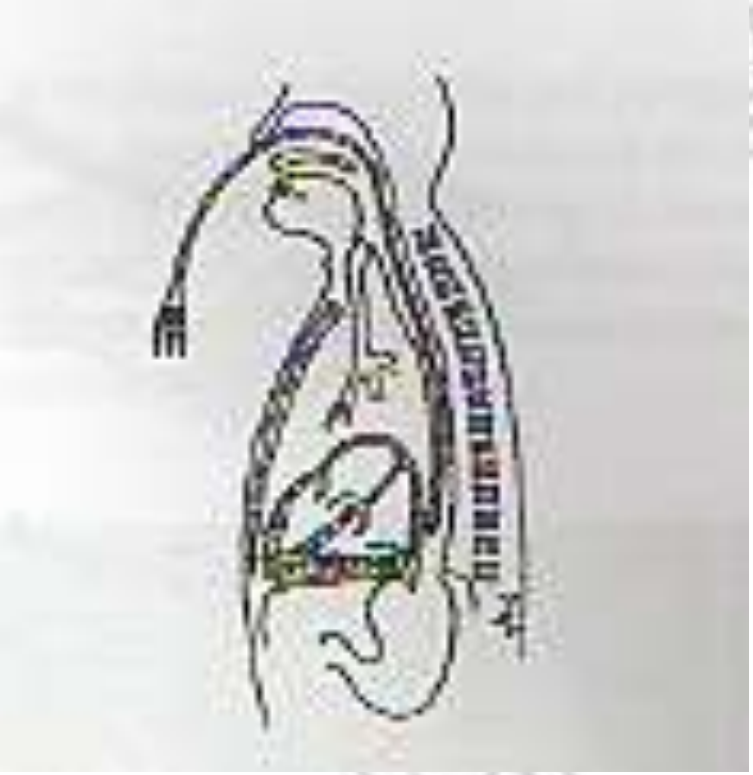


Arritmias


% dos exames - total 3139 exames
BAV
Pre excitação
ESV
ESSV
MP atrial migratório
TVNS
TPSV
Ritmo juncional
Ritmo atrial ectópico
Taqui sinusal
Bradi sinusal
0,41
0,44
0,3
0,86
0,03
0,03
0,03
0,06
0,66
3,79
1,5
0
1
2
3
4
Bradi sinusal
Taqui sinusal
Ritmo atrial ectópico
Ritmo juncional
TPSV
TVNS
MP atrial migratório
ESSV
ESV
Pre excitação
BAV

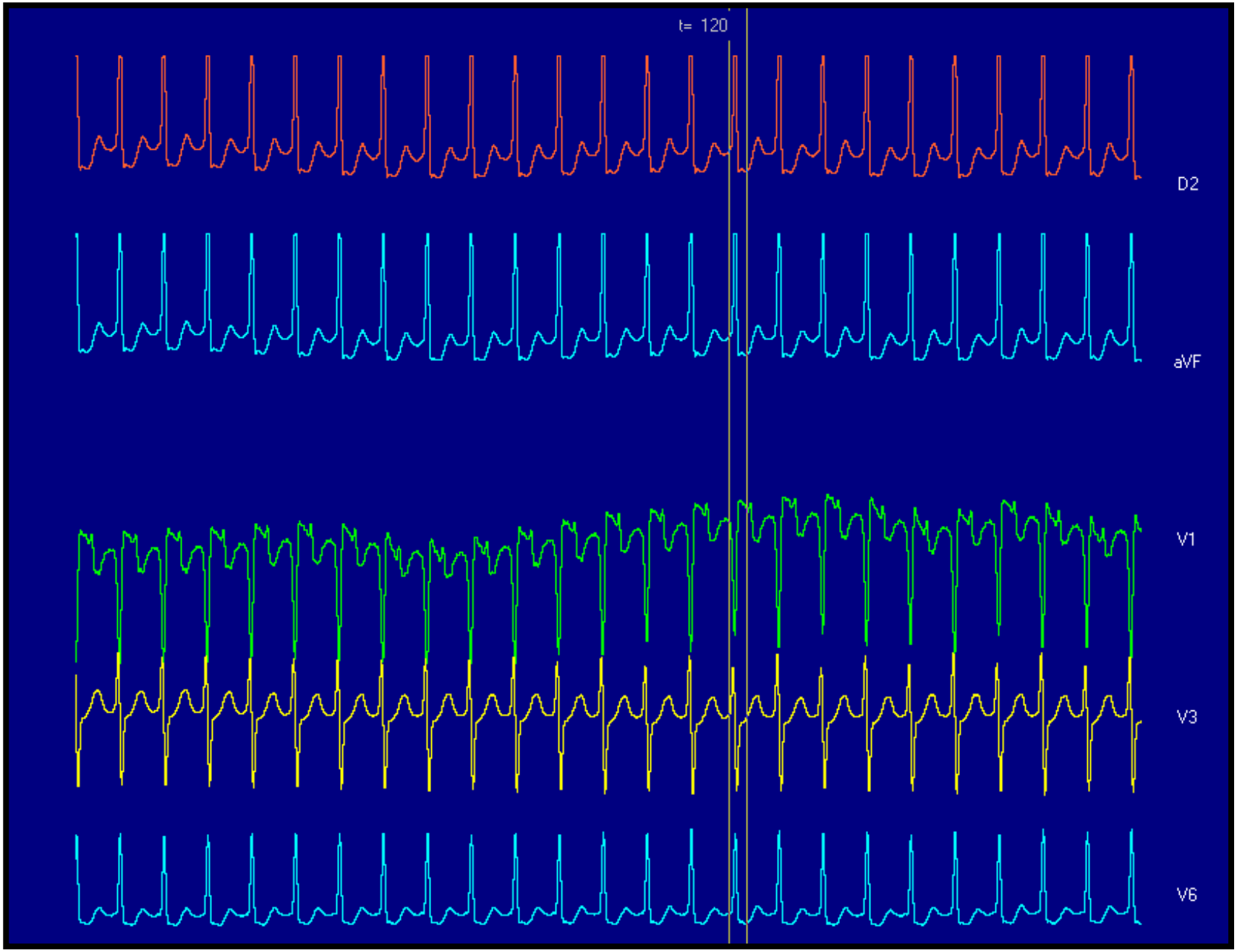
Análise da repolarização ventricular





CETE

TRAV – RP'= 120 ms



Taquicardiomiopatia em pediatria

- ✓ Disfunção ventricular associada a taquicardia
- ✓ Relação causa e efeito nem sempre bem definida
- ✓ Perda dos sintomas de palpitações e taquicardia e surgimento do quadro de ICC

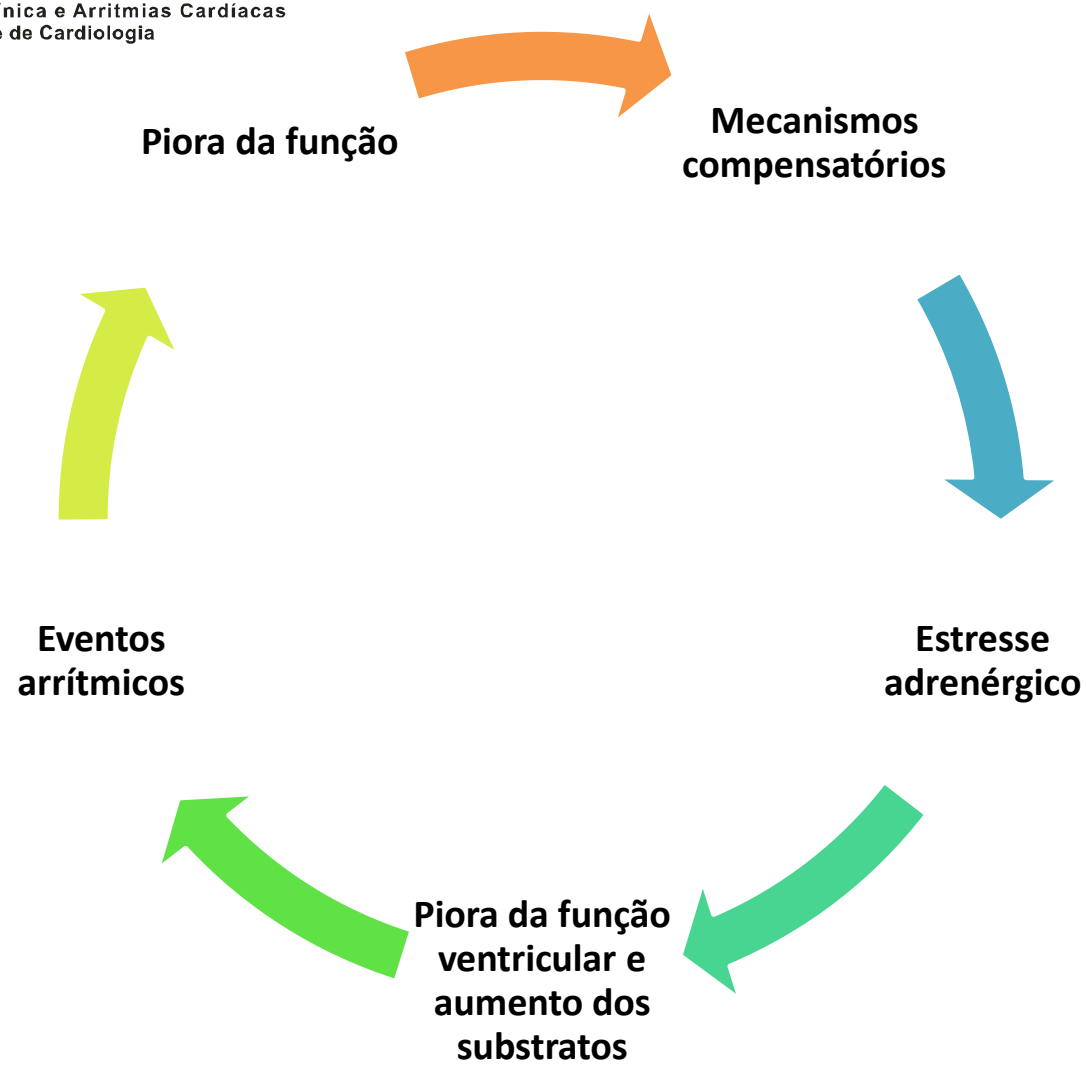
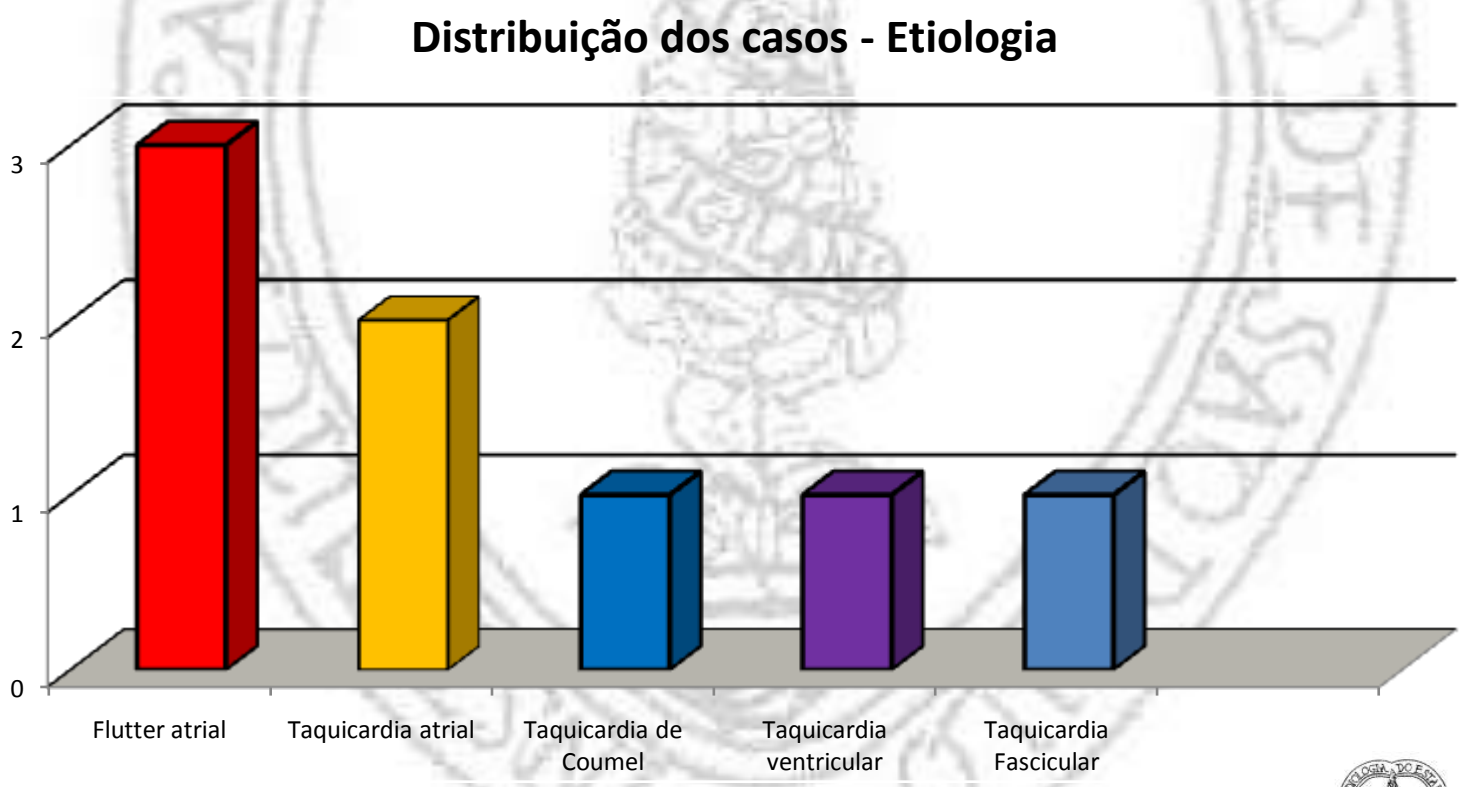

Piora da função
Mecanismos compensatórios
Estresse adrenérgico
Piora da função ventricular e aumento dos substratos
Eventos arrítmicos

Gráfico 3: Distribuição das formas de taquicardia

- Taquicardias ventriculares
- Taquicardias supraventriculares

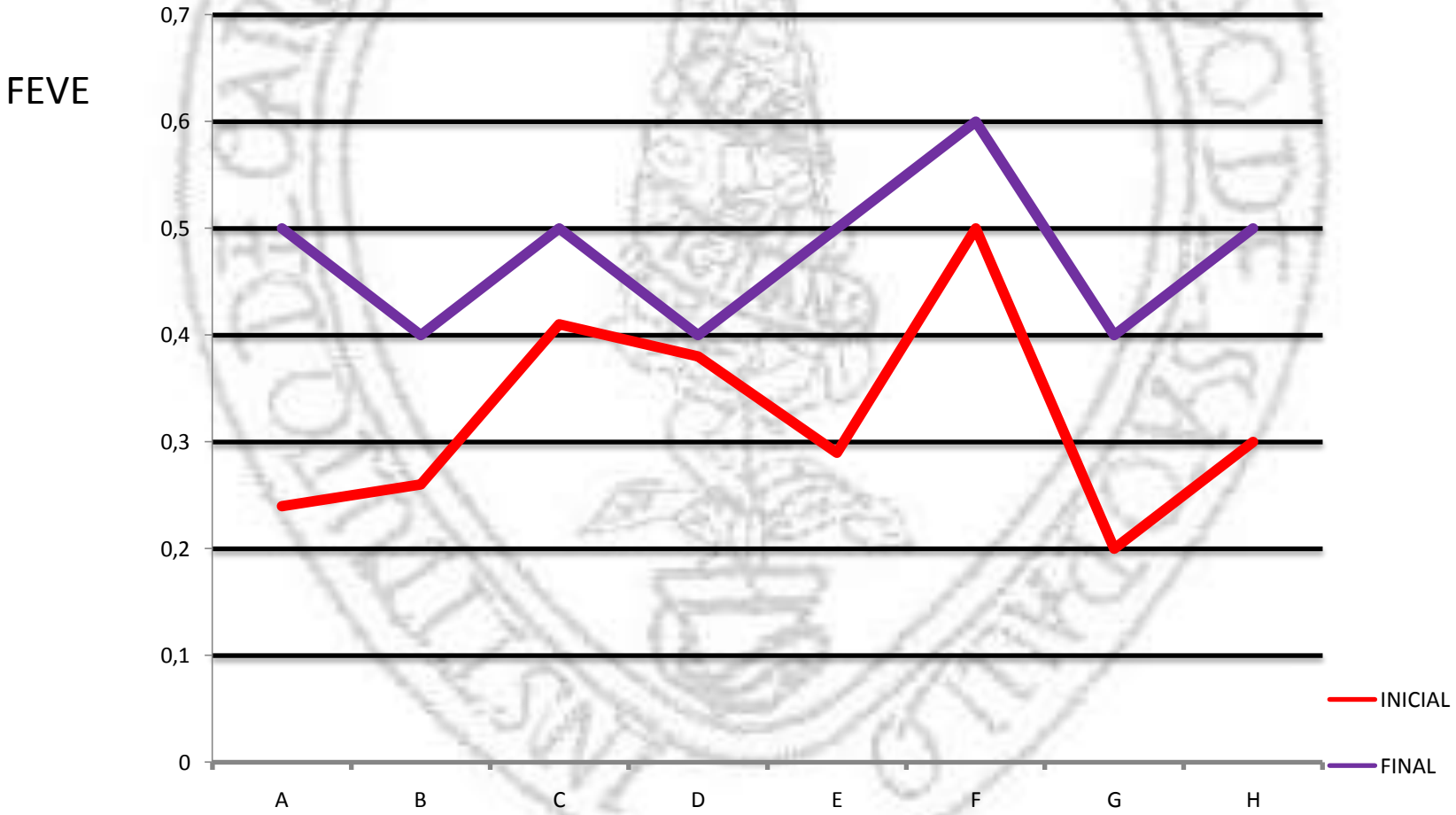
Andalaft, R et al - SOCESP 2010.

Gráfico 4: Distribuição dos casos quanto a etiologia



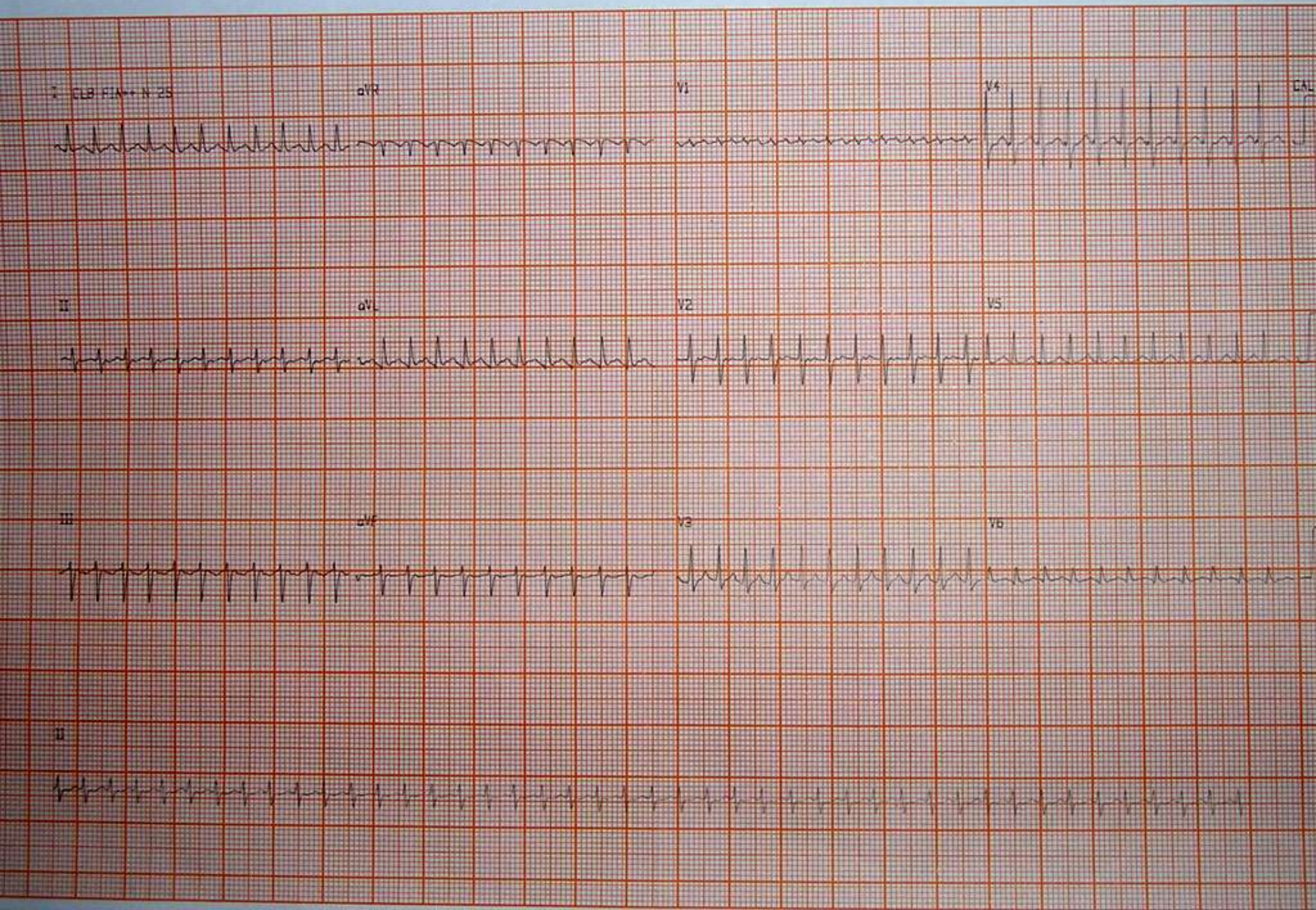
Andalaft, R et al - SOCESP 2010.

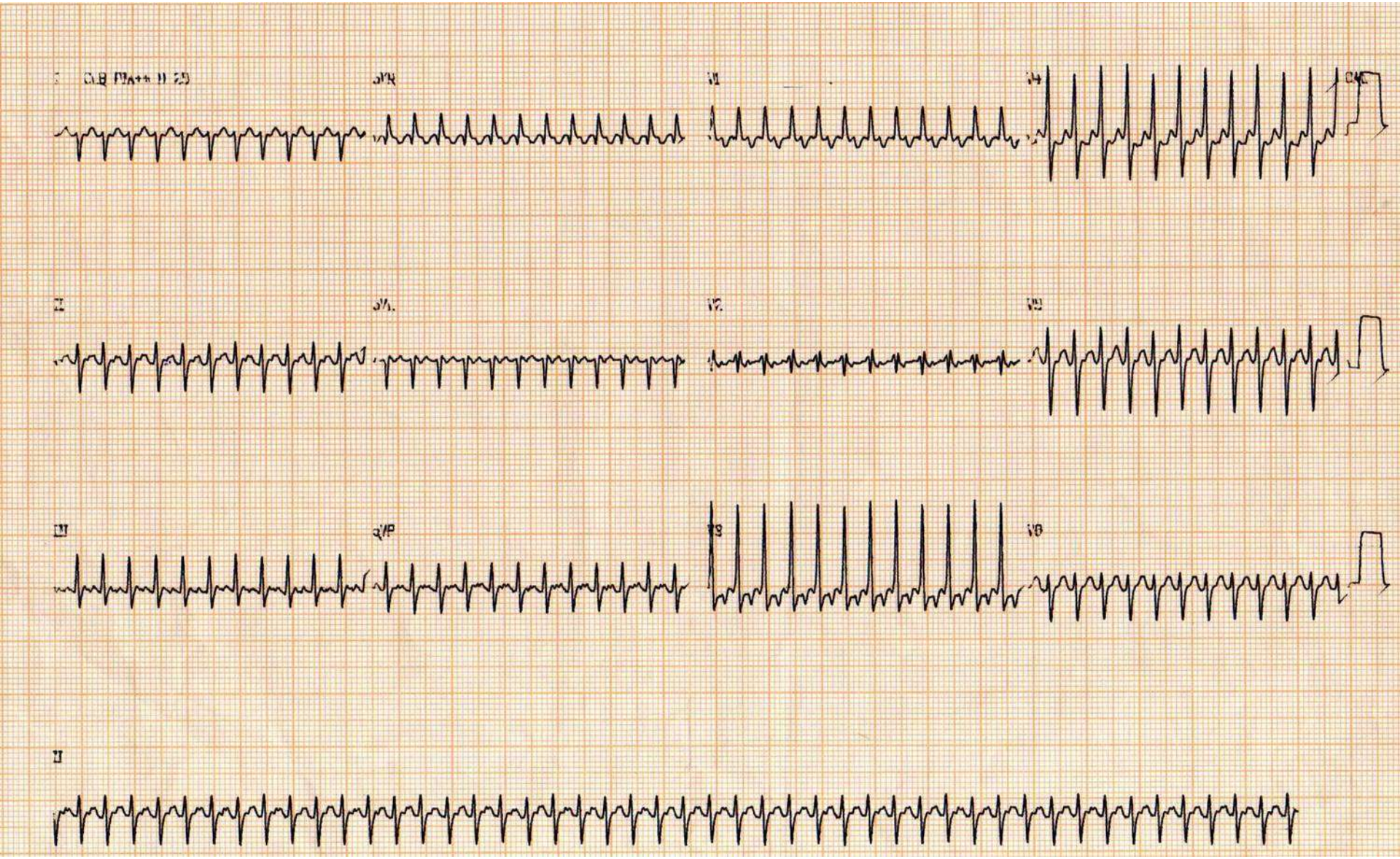
Gráfico 2: Evolução da FEVE

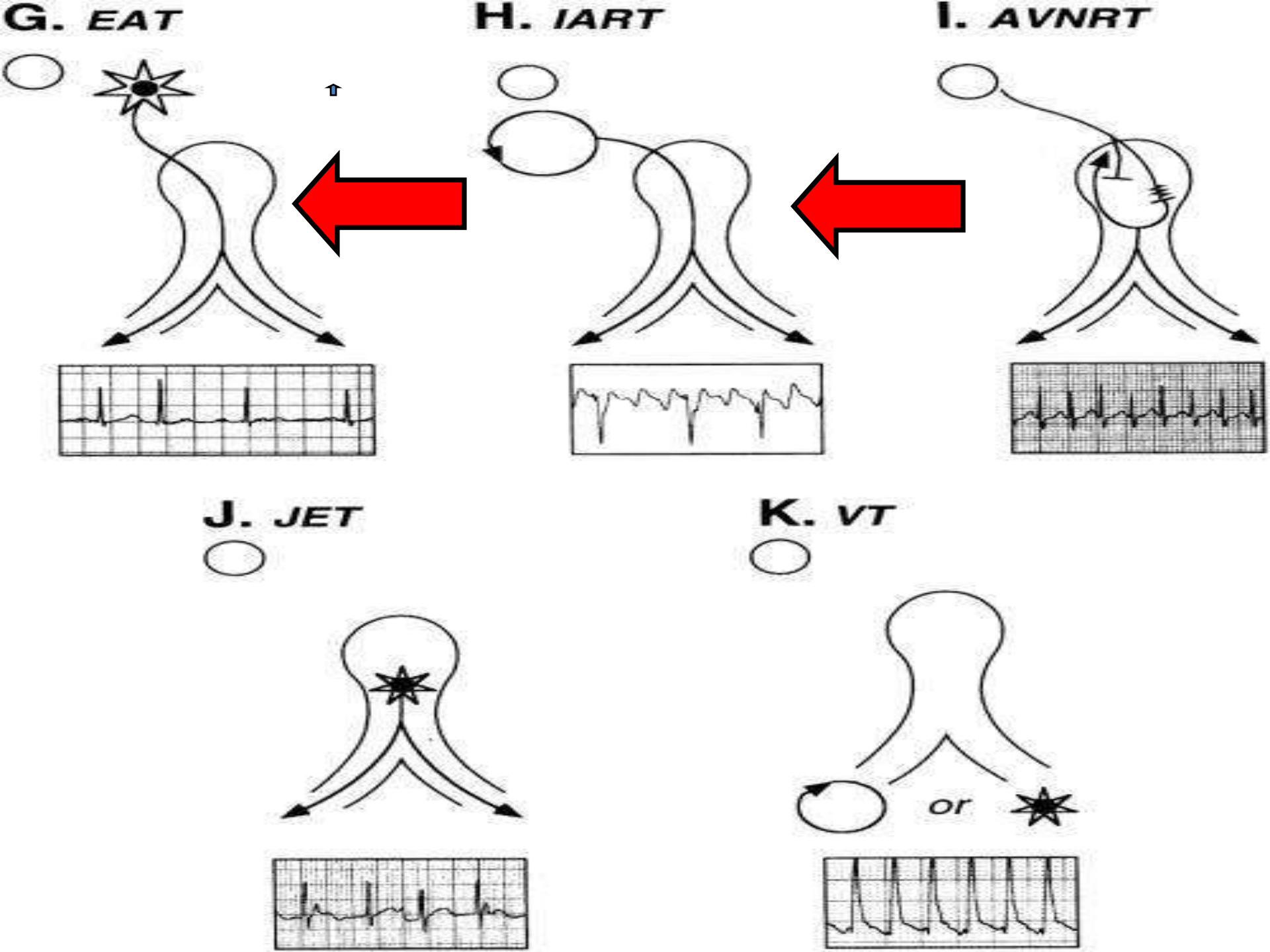


Andalaft, R et al - SOCESP 2010.

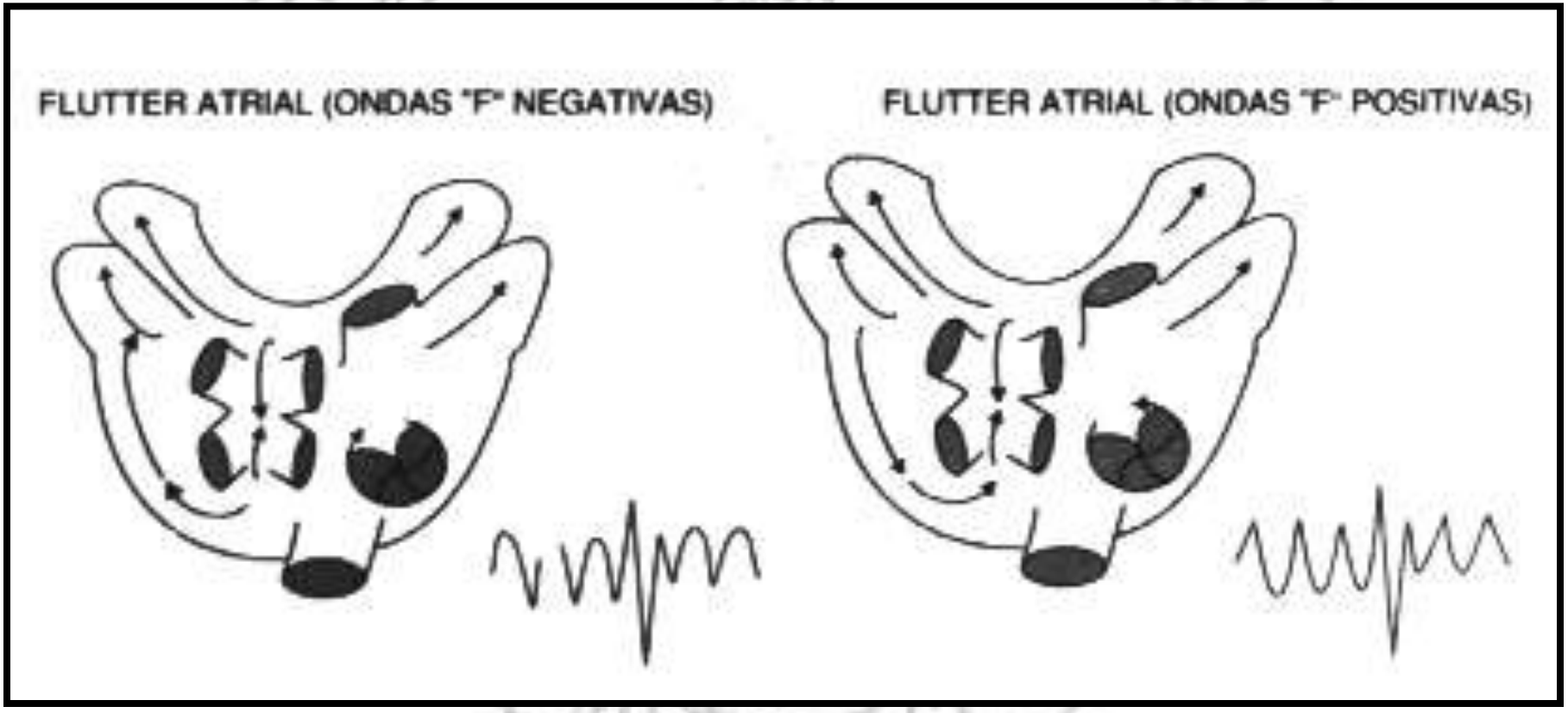
RN. mukeLW






G. EAT
H. IART
I. AVNRT
J. JET
K. VT
or

Flutter Atrial
Circuito de Reentrada - Polaridade das Ondas F



Moreira DAR, 1995

Atrial Reentry Circuits After Surgery for Congenital Heart Disease

Delacretaz et al 2000

47 circuitos em 20 pacientes

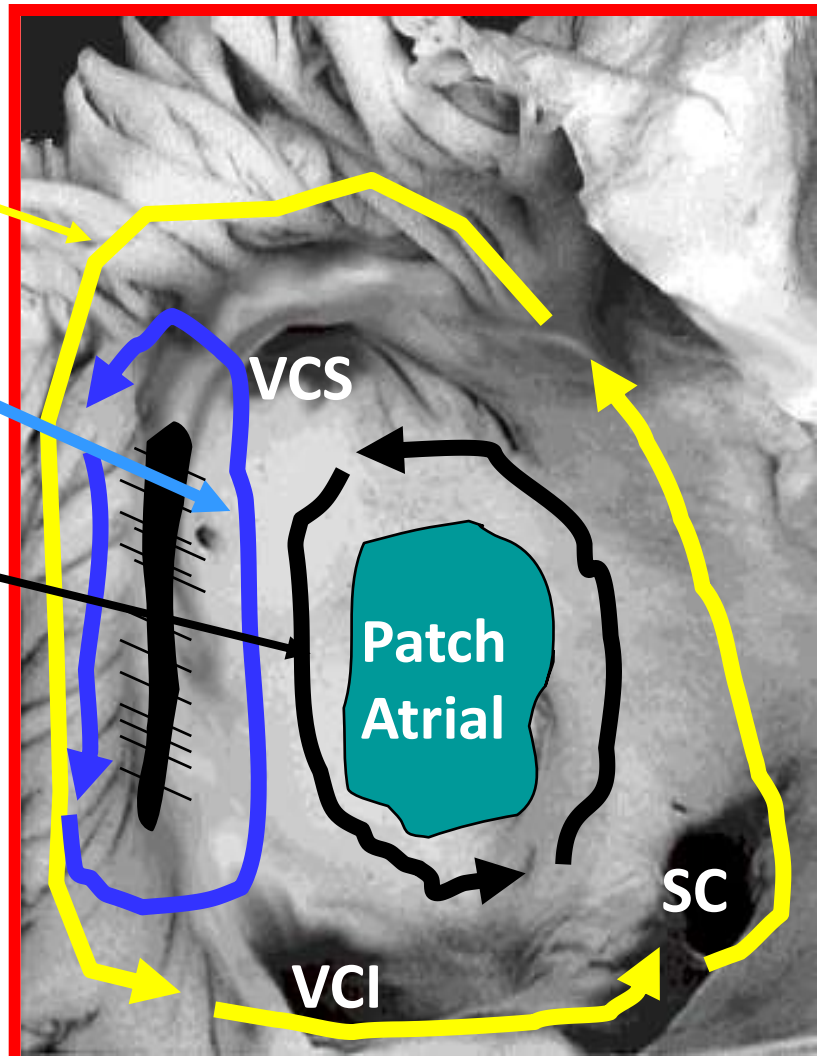
Flutter comum - 18

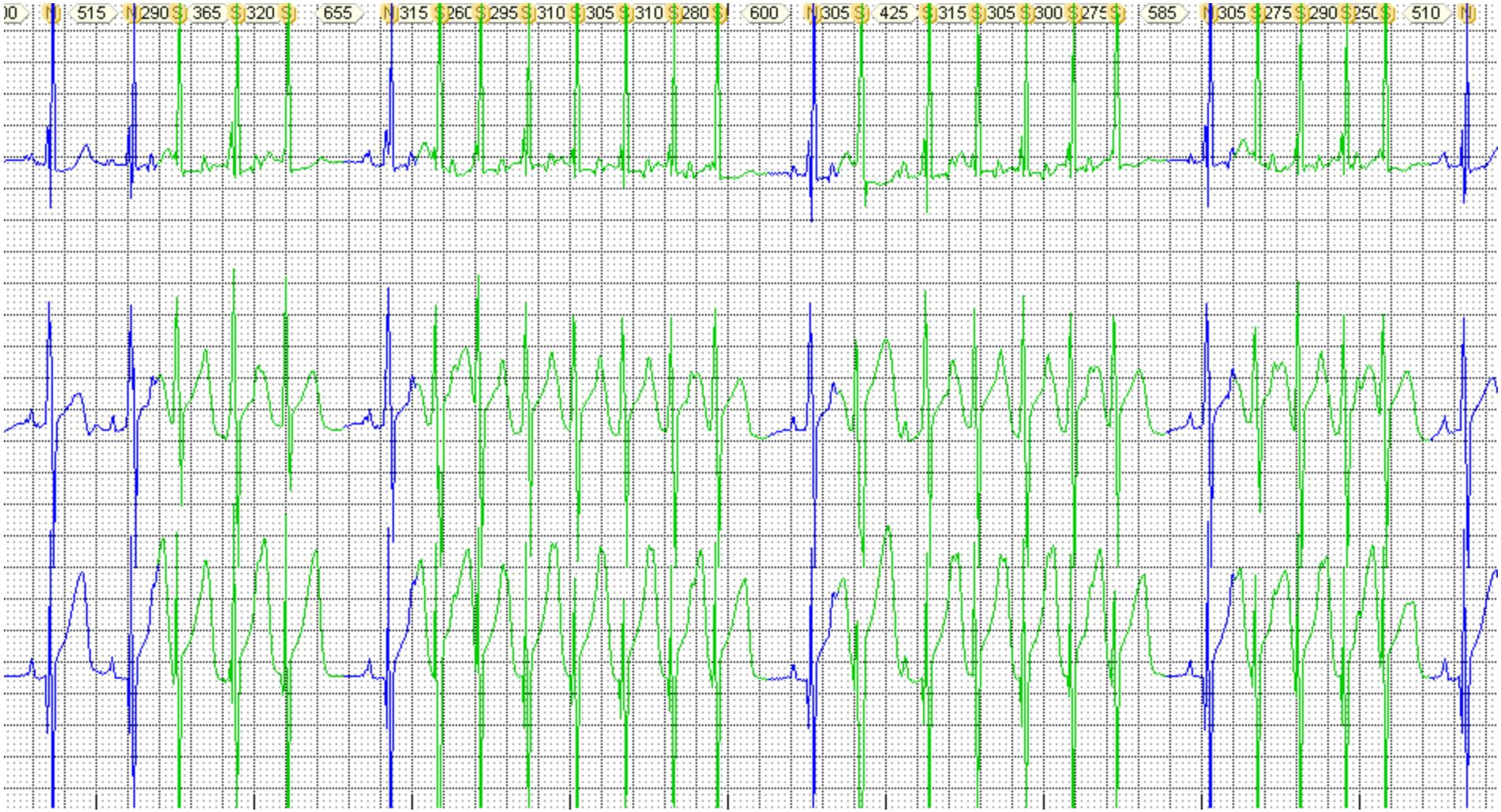
Circuito parede lateral - 19

Circuito septal - 8

Indefinido - 2

Sucesso da ablação
(livre de recorrência) - 80%
follow-up 3 - 46 meses

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290
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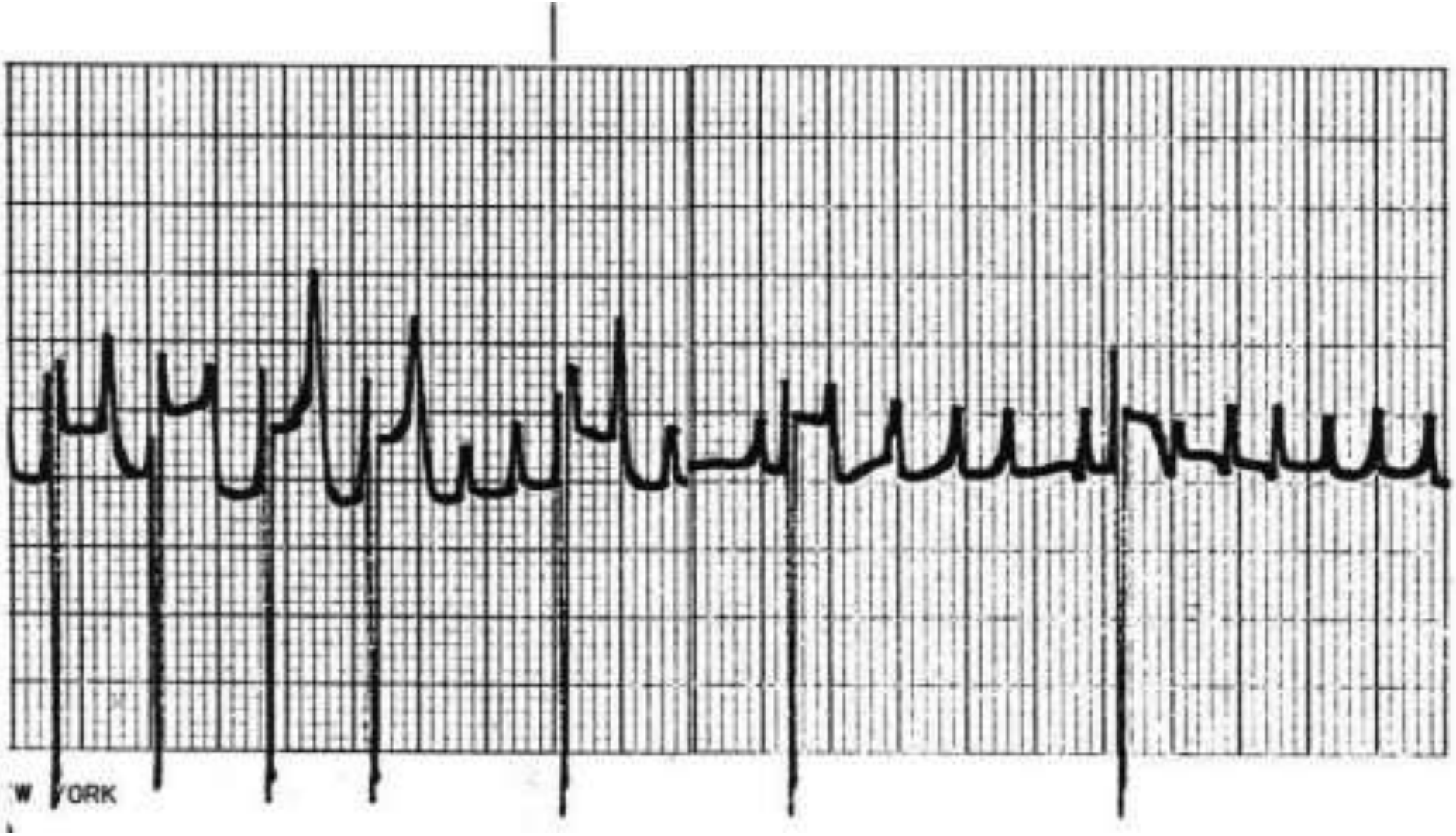
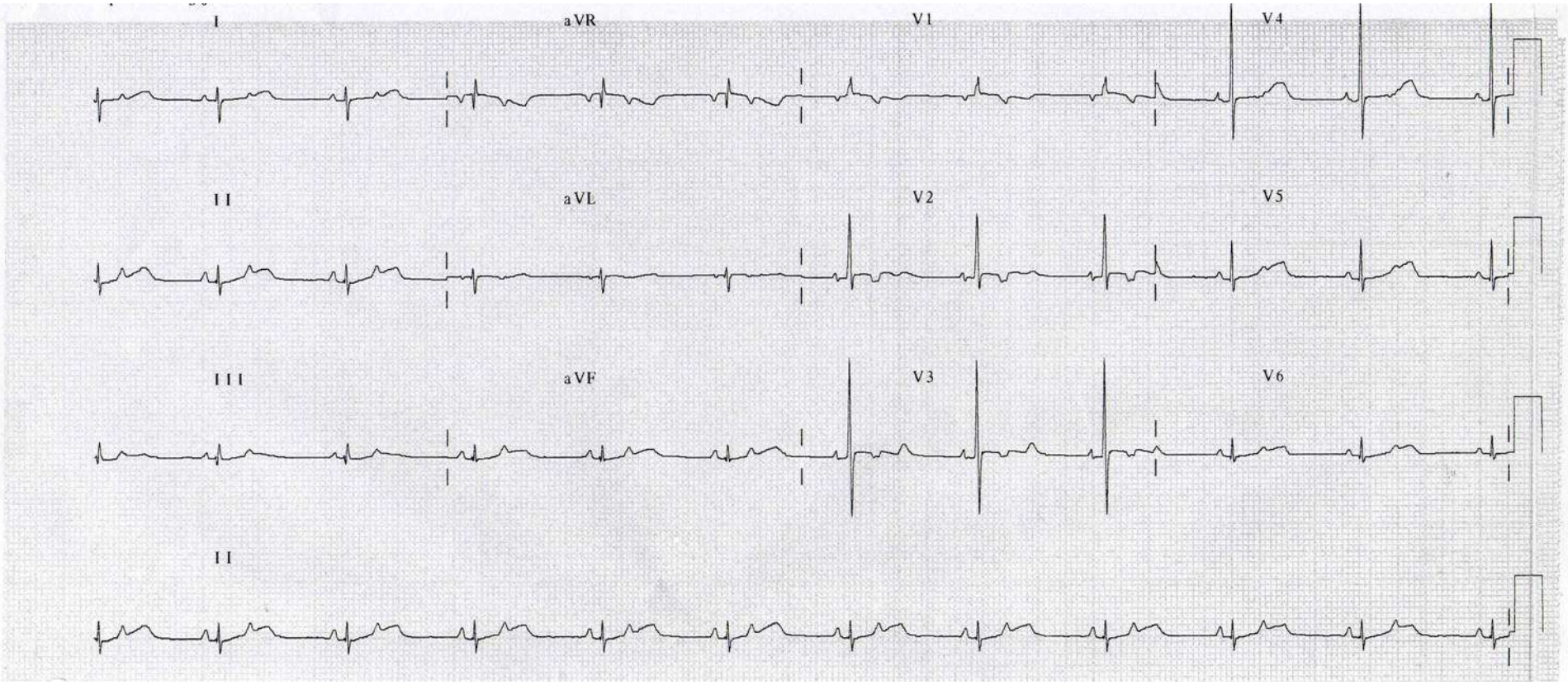
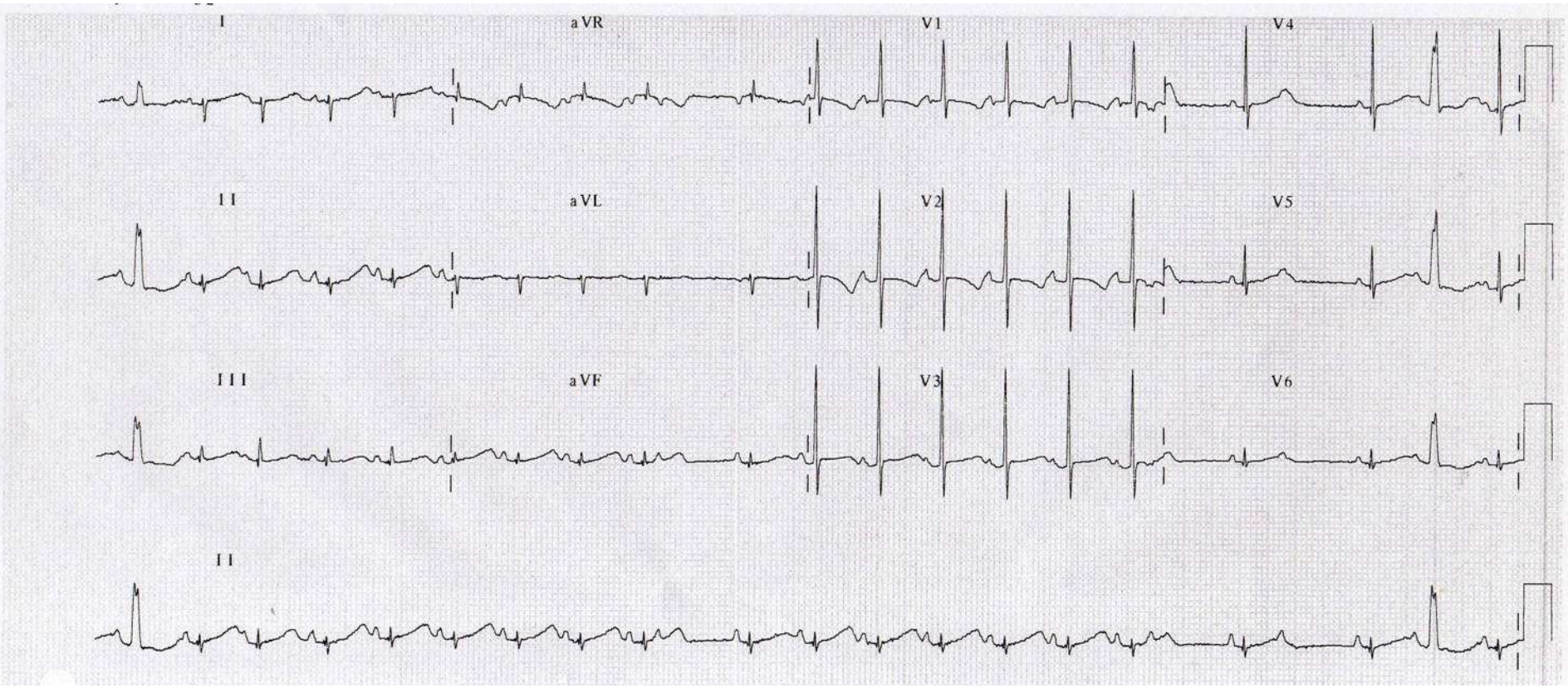

W YORK

805
820
810
795
765
C 1
C 2
C 3

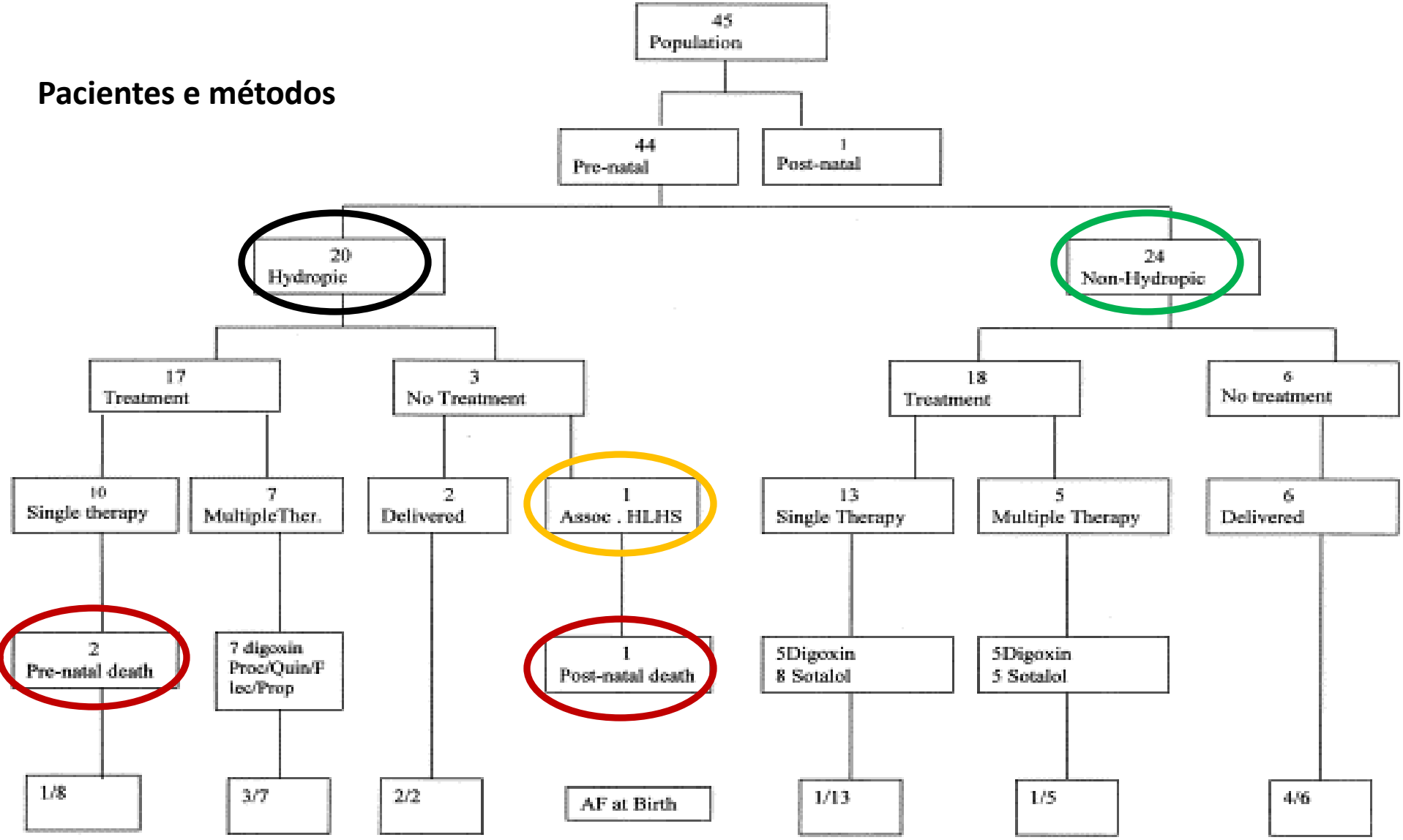

I
aVR
V1
V4
II
aVL
V2
V5
III
aVF
V3
V6
II


I
aVR
V1
V4
II
aVL
V2
V5
III
aVF
V3
V6
II

Atrial Flutter in the perinatal age group: diagnosis, management and outcome

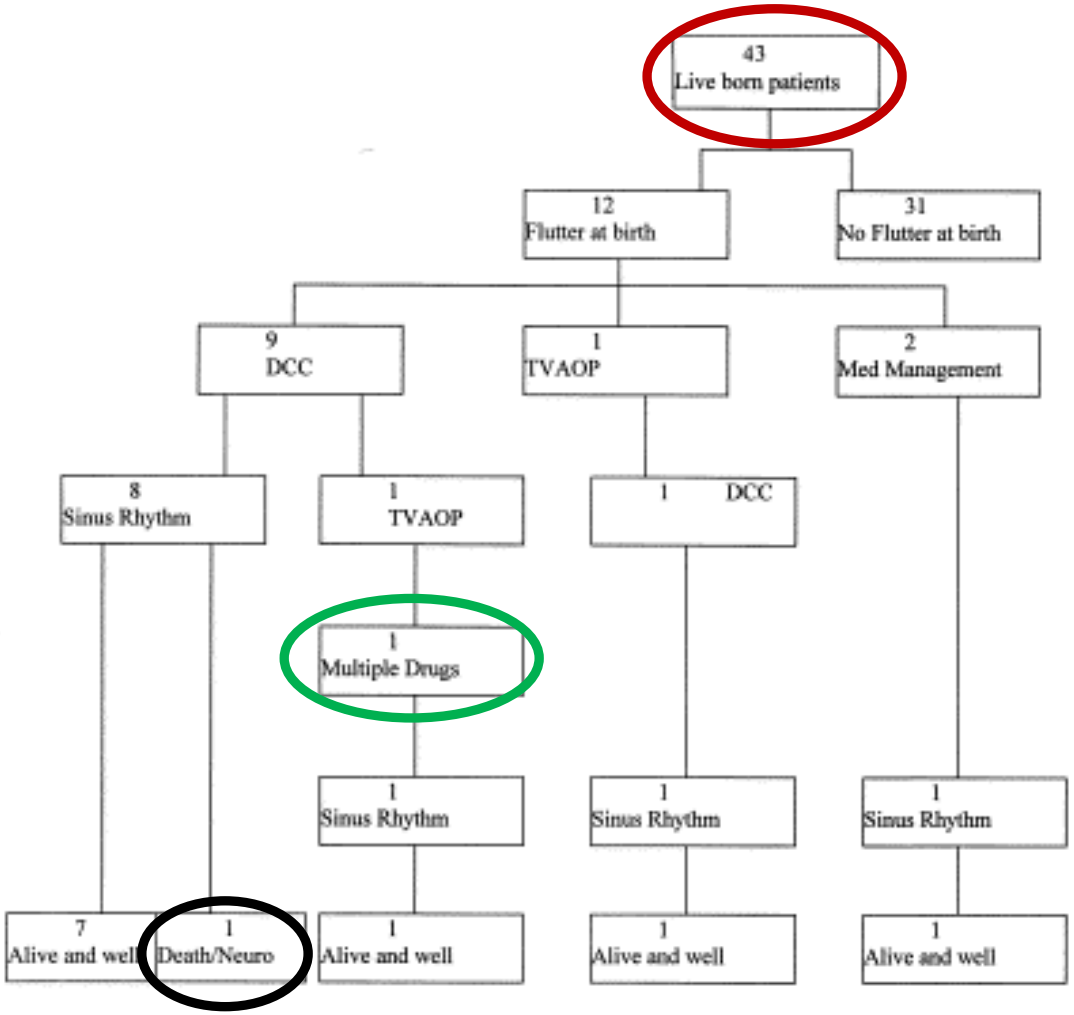
JACC 2000; 35 (3): 771-7

Pacientes e métodos



Atrial Flutter in the perinatal age group: diagnosis, management and outcome

- ✓ *Tratamento no período pós natal*
  - ✓ *Químico*
    - ✓ *Digoxina*
    - ✓ *Quinidina*
    - ✓ *Amiodarona*
  - ✓ *Eletrica*
  - ✓ *Overdrive transvenoso*
  - ✓ *Combinação química e elétrica*



JACC 2000; 35 (3): 771-7

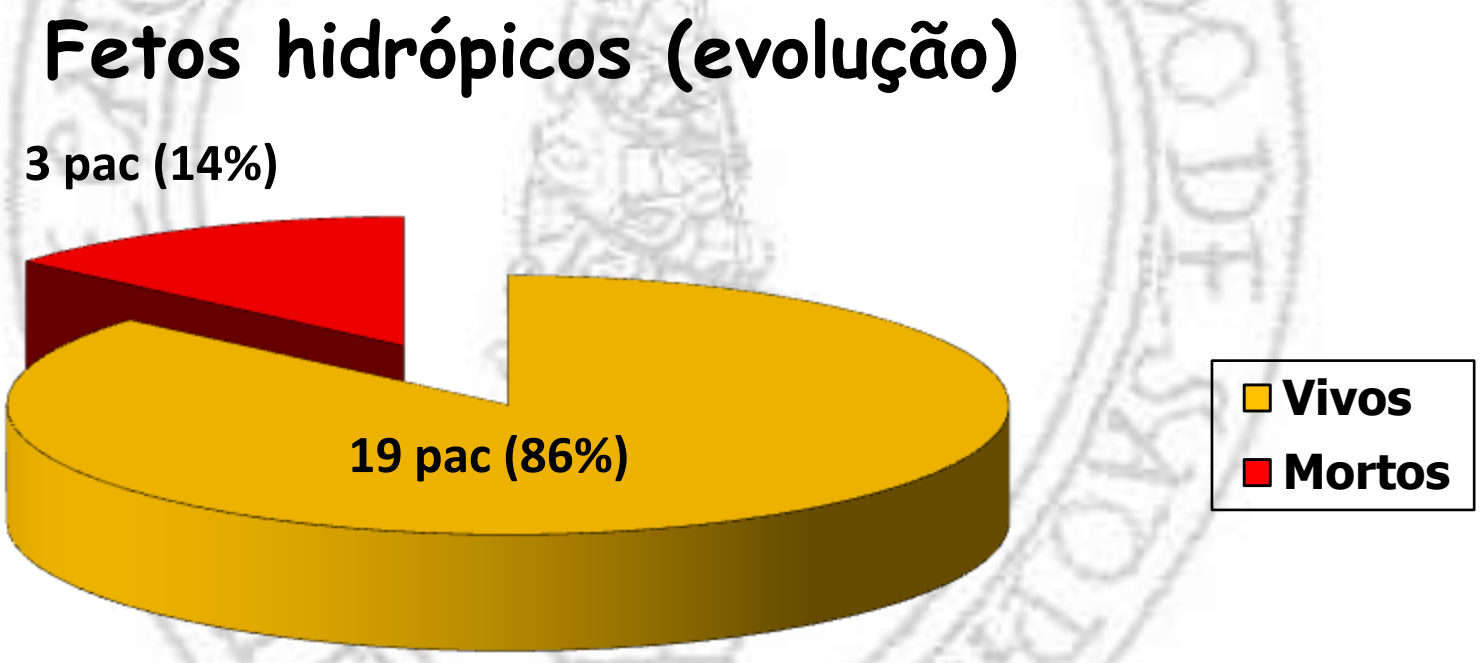
Atrial Flutter in the perinatal age group: diagnosis, management and outcome

Farmacos utilizados para reversão flutter atrial fetal

Droga	Ataque	Manutenção	Nível sérico	Fetal/mat
Digoxina	3x 1,5mg	0.25-1mg/dia	1-2 mg/ml	0,6:1
Flecainida	2x 150mg	100mg 2x/d	0,2-1mcg/ml	O,86:1
Sotalol	-	160-320mg/d	2-7mcg/ml	1,05:1
Amiodarona	1200mg/d	400-600mg/d	1-2,5mcg/ml	0,1/0,3:1
Desetilaminodarona			0,2-2,6mcg/ml	

JACC 2000; 35 (3): 771-7

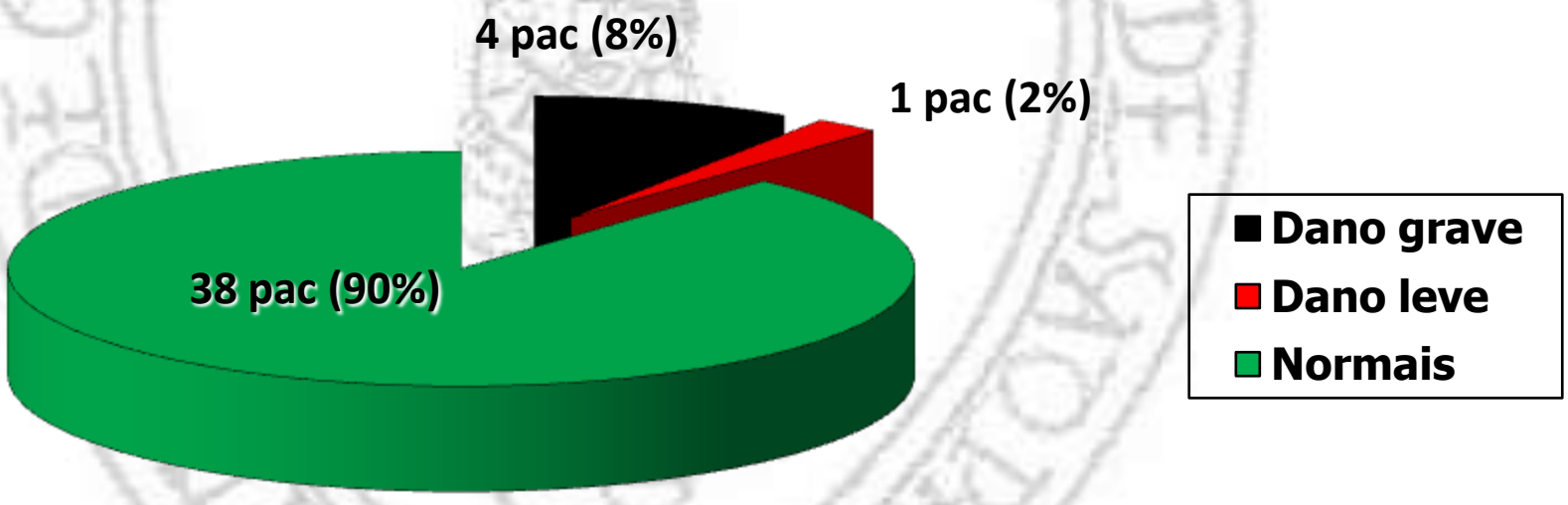
Atrial Flutter in the perinatal age group: diagnosis, management and outcome



JACC 2000; 35 (3): 771-7

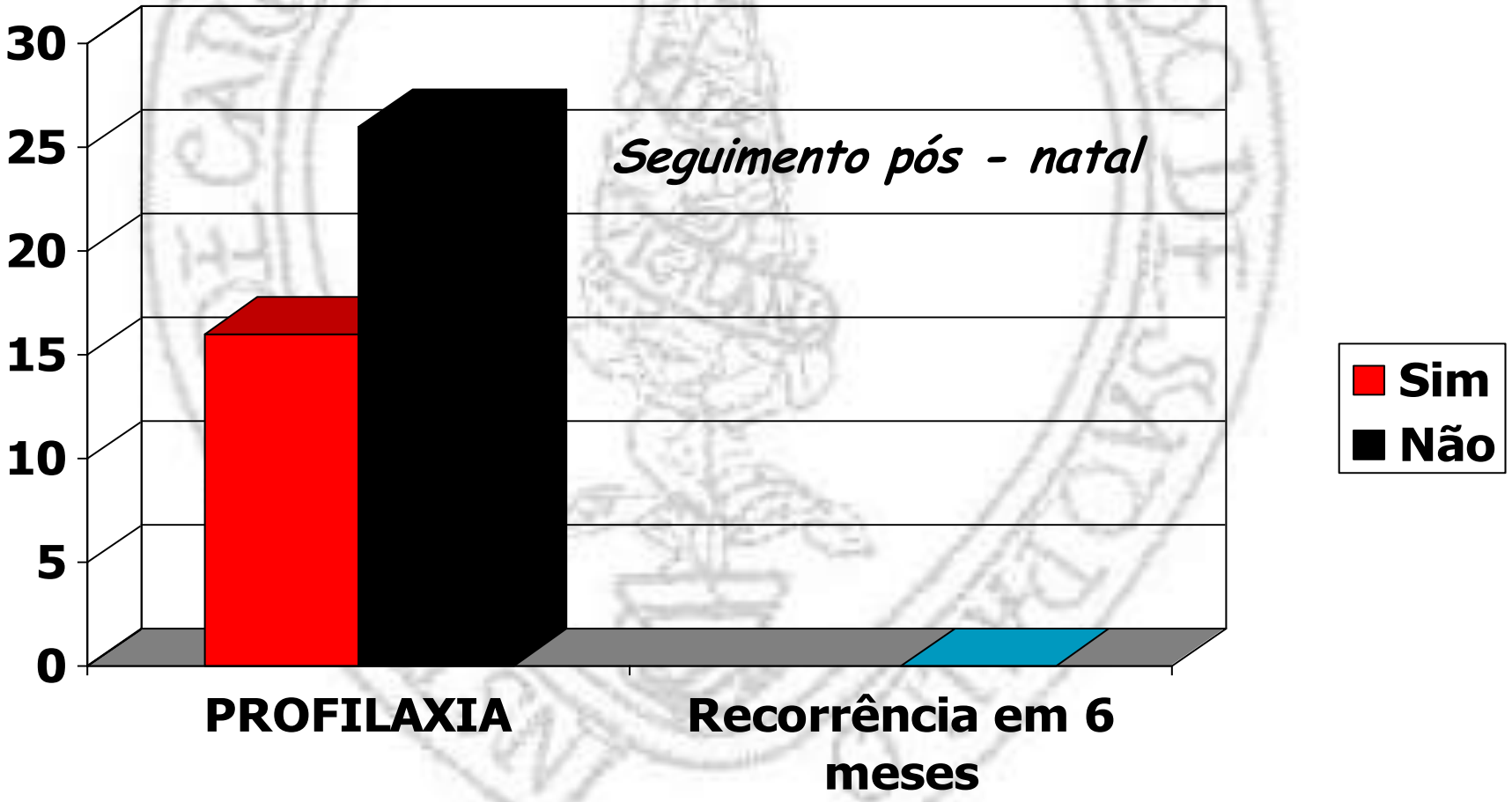
Atrial Flutter in the perinatal age group: diagnosis, management and outcome

Complicações neurológicas

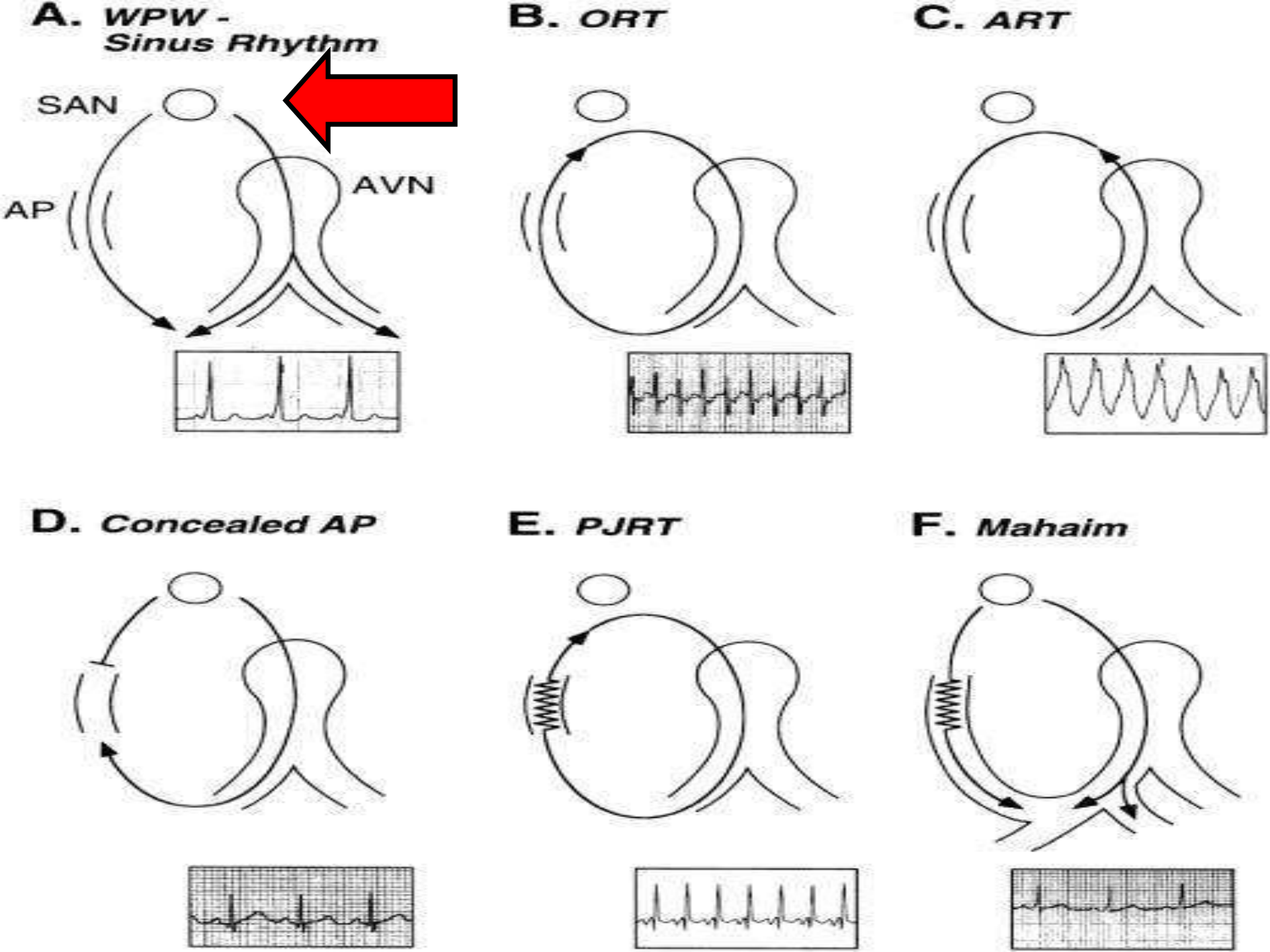


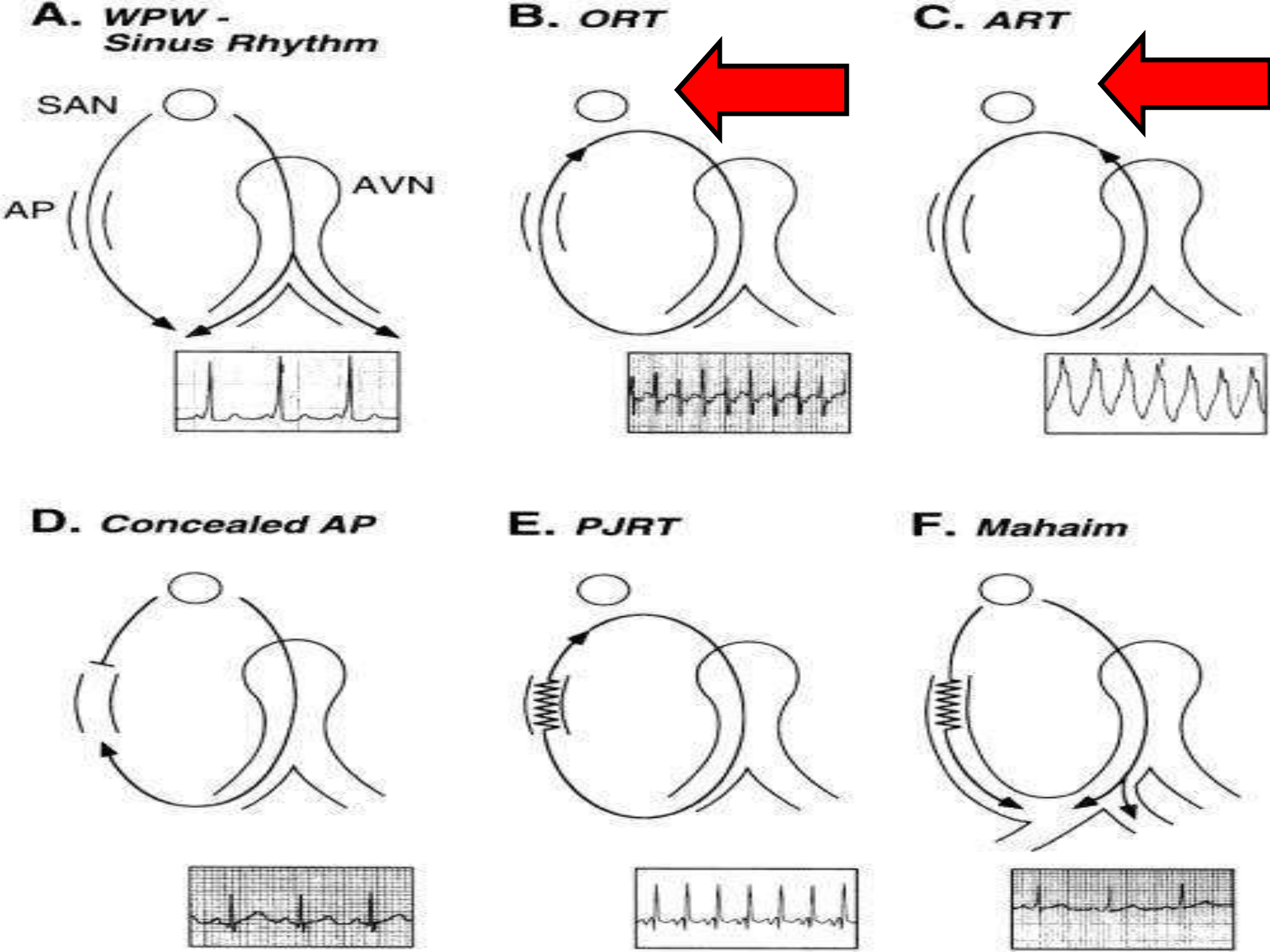
JACC 2000; 35 (3): 771-7

Atrial Flutter in the perinatal age group: diagnosis, management and outcome



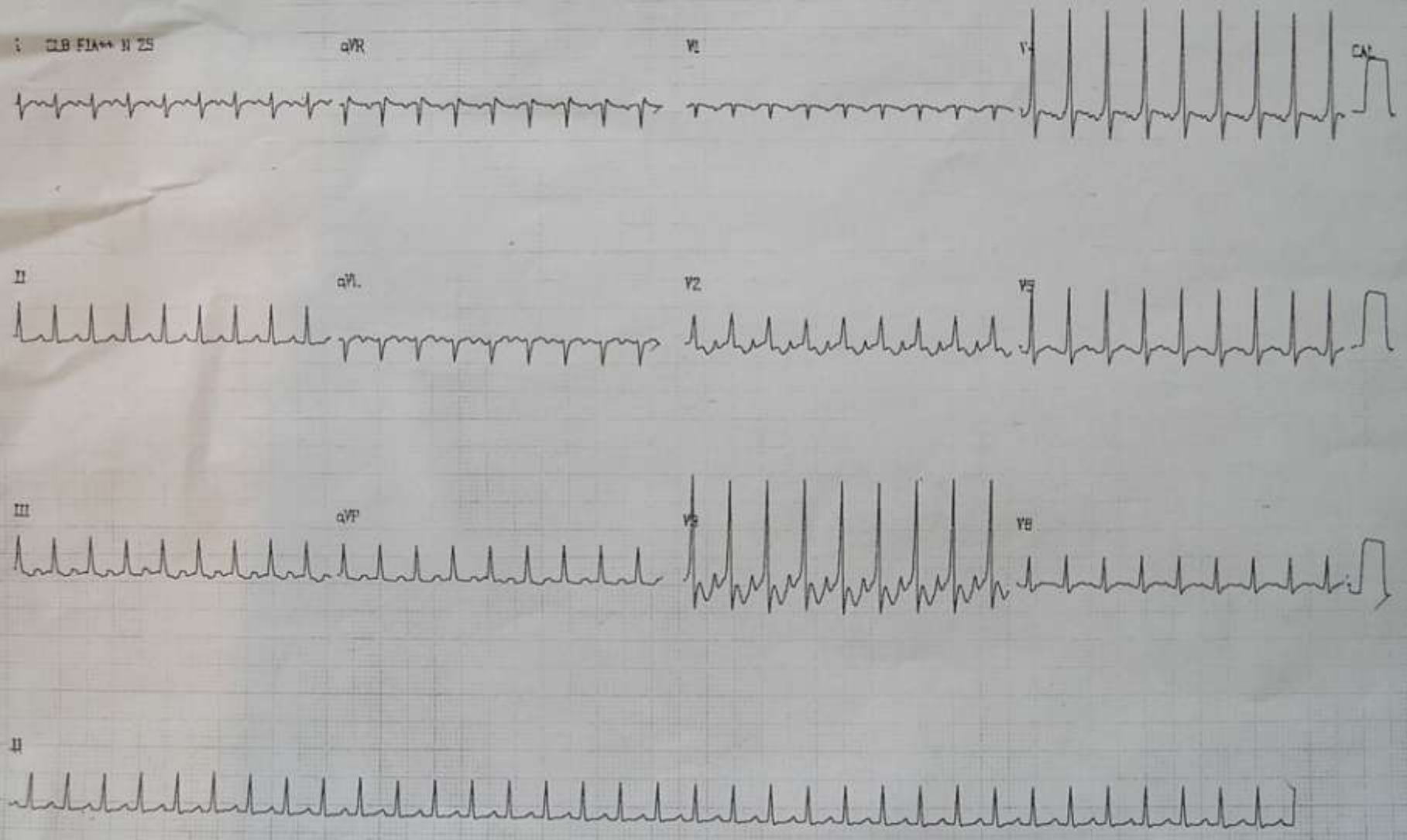
JACC 2000; 35 (3): 771-7


A. WPW - Sinus Rhythm
SAN
AP
AVN
B. ORT
C. ART
D. Concealed AP
E. PJRT
F. Mahaim


A. WPW - Sinus Rhythm
SAN
AP
AVN
B. ORT
C. ART
D. Concealed AP
E. PJRT
F. Mahaim

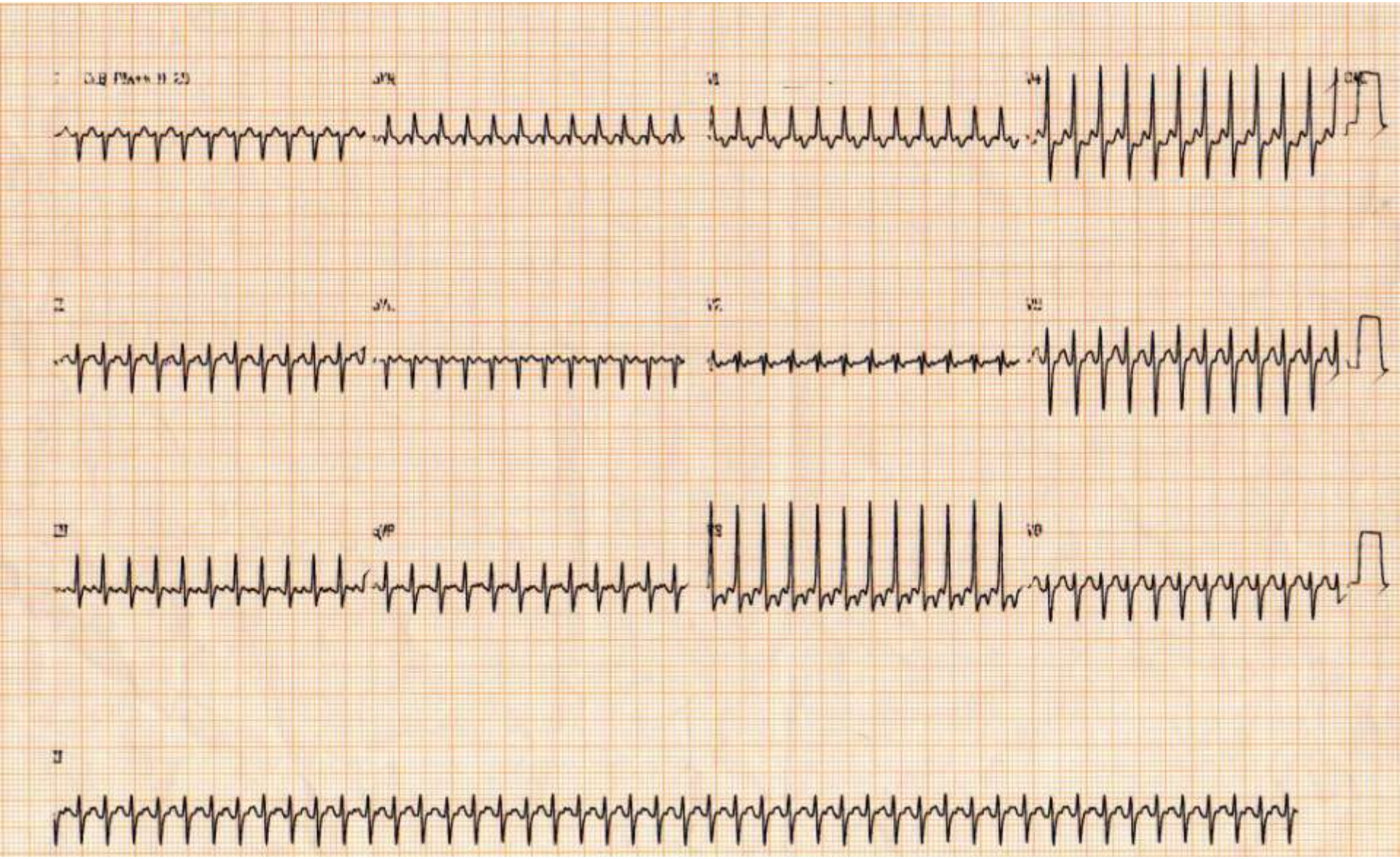
05.00h.

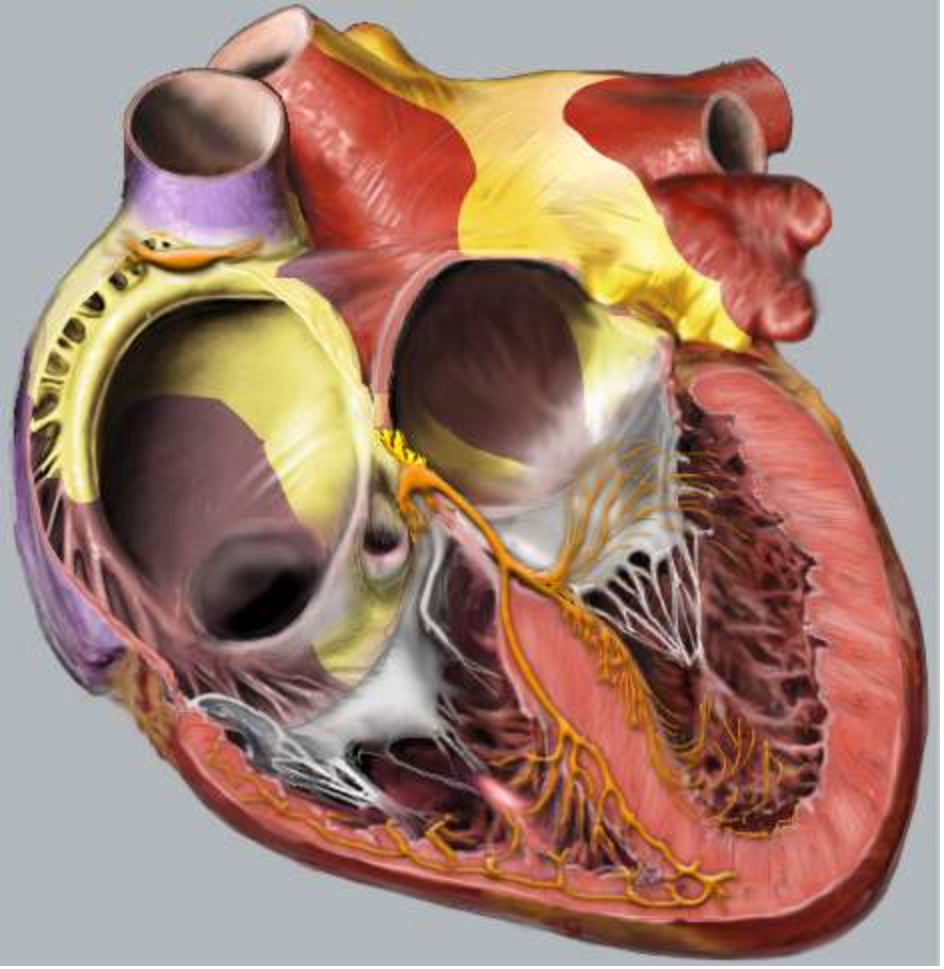
04/10/04



Características do ECG durante a TRAV

	Análise do ECG das crises de TPSV (17 pac)
Freqüência cardíaca média	276 ± 34,4
Alternância elétrica	23 %
Onda P retrógrada visível	76%
RP' (medida em ms)	95,3 ± 34,4
Infradesnivelamento ST V5 e V6	82,3%





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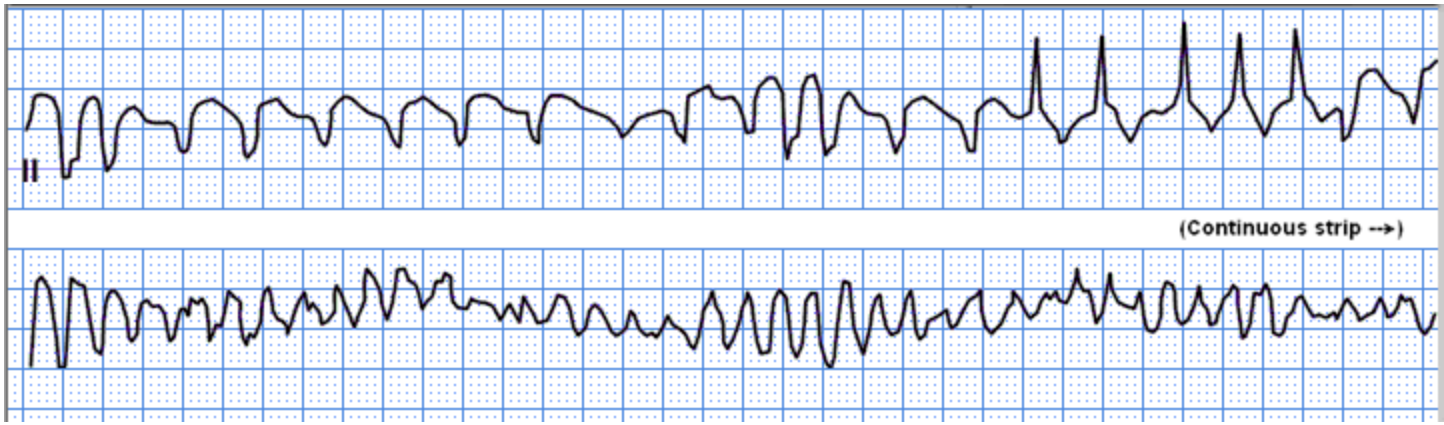
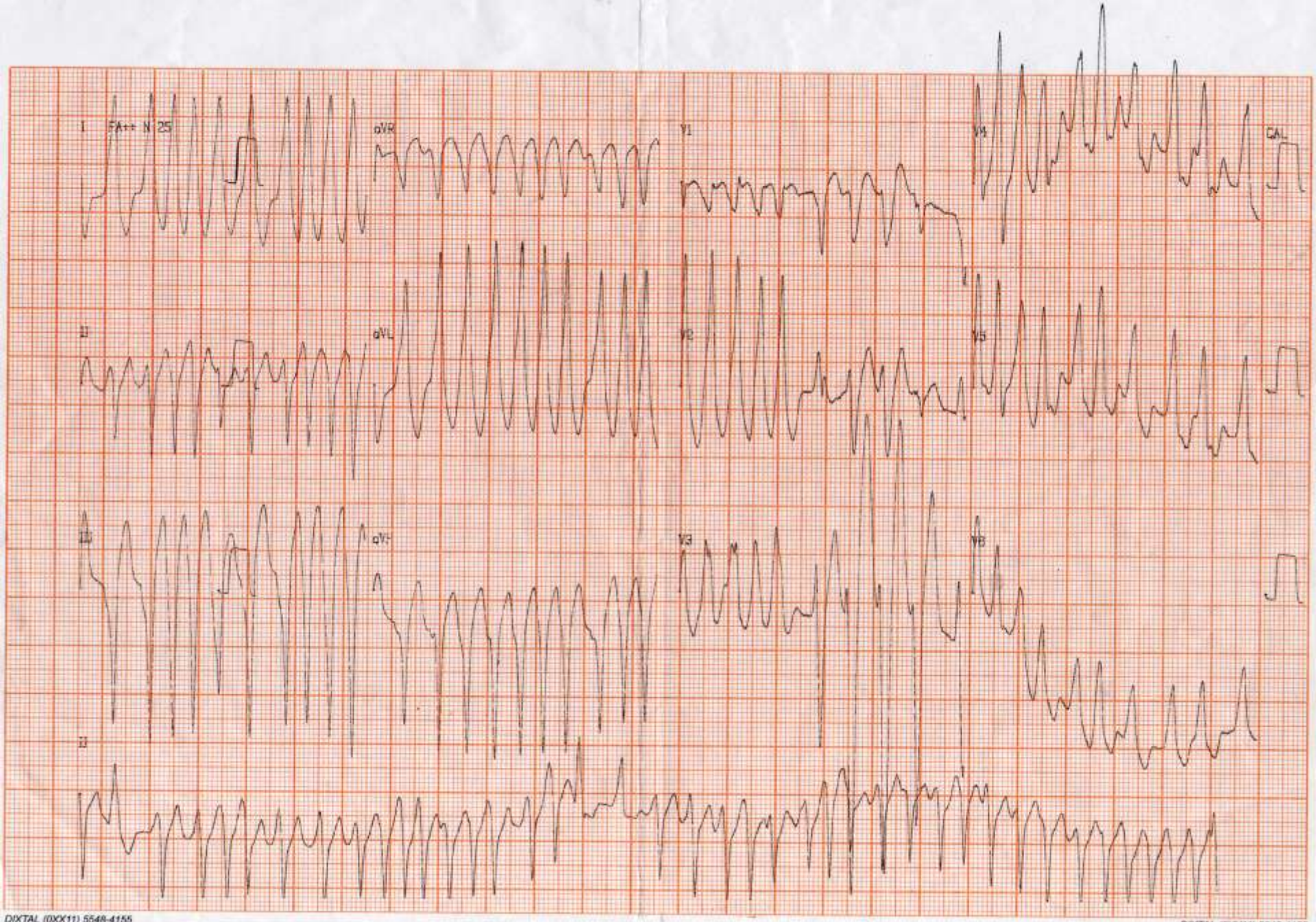
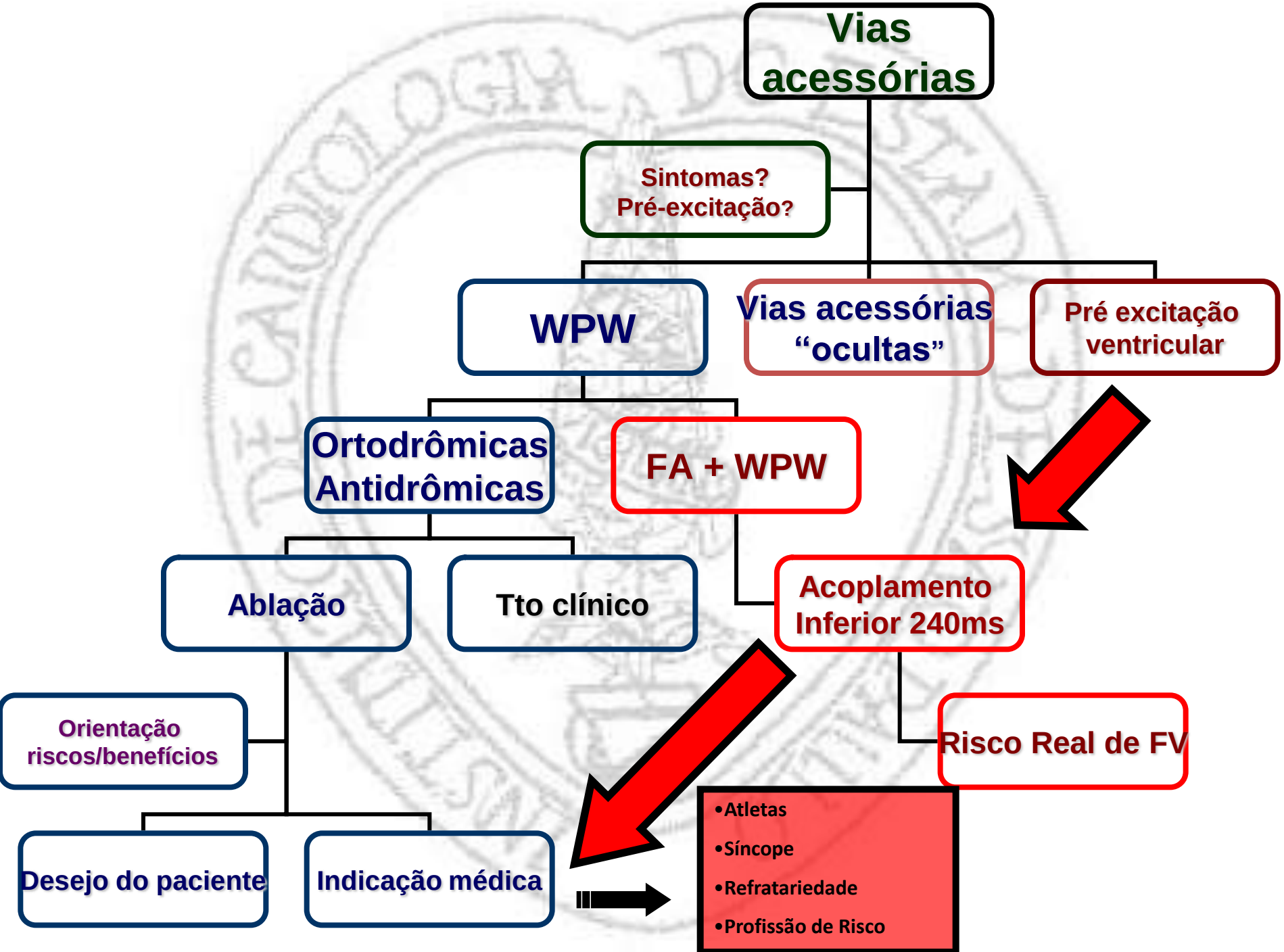
Instituto Dante Pazzanese de Cardiologia





DIXTAL (0XX11) 5548-4155
DIXTAL (0XX11) 5548-4155


Vias acessórias
Sintomas?
Pré-excitação?
WPW
Vias acessórias "ocultas"
Pré excitação ventricular
Ortodrômicas
Antidrômicas
FA + WPW
Ablação
Tto clínico
Acoplamento Inferior 240ms
Orientação riscos/benefícios
Risco Real de FV
Desejo do paciente
Indicação médica
•Atletas
•Síncope
•Refratariedade
•Profissão de Risco

Vias acessórias direitas

Póstero lateral	11%
Lateral	10%
Póstero septal	8%
Médio septal	5%
Antero septal	5%
Anterior	4%
Posterior	4%
Antero lateral	3%

Vias acessórias esquerdas

Lateral	38%
Póstero lateral	8%
Posterior	3%
Antero lateral	2%
Postero septal	1%

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(PACE 2007; 30:655–661)

Radiofrequency Catheter Ablation in Infants ≤18 Months Old

When Is It Done and How Do They Fare?

Short-Term Data From the Pediatric Ablation Registry

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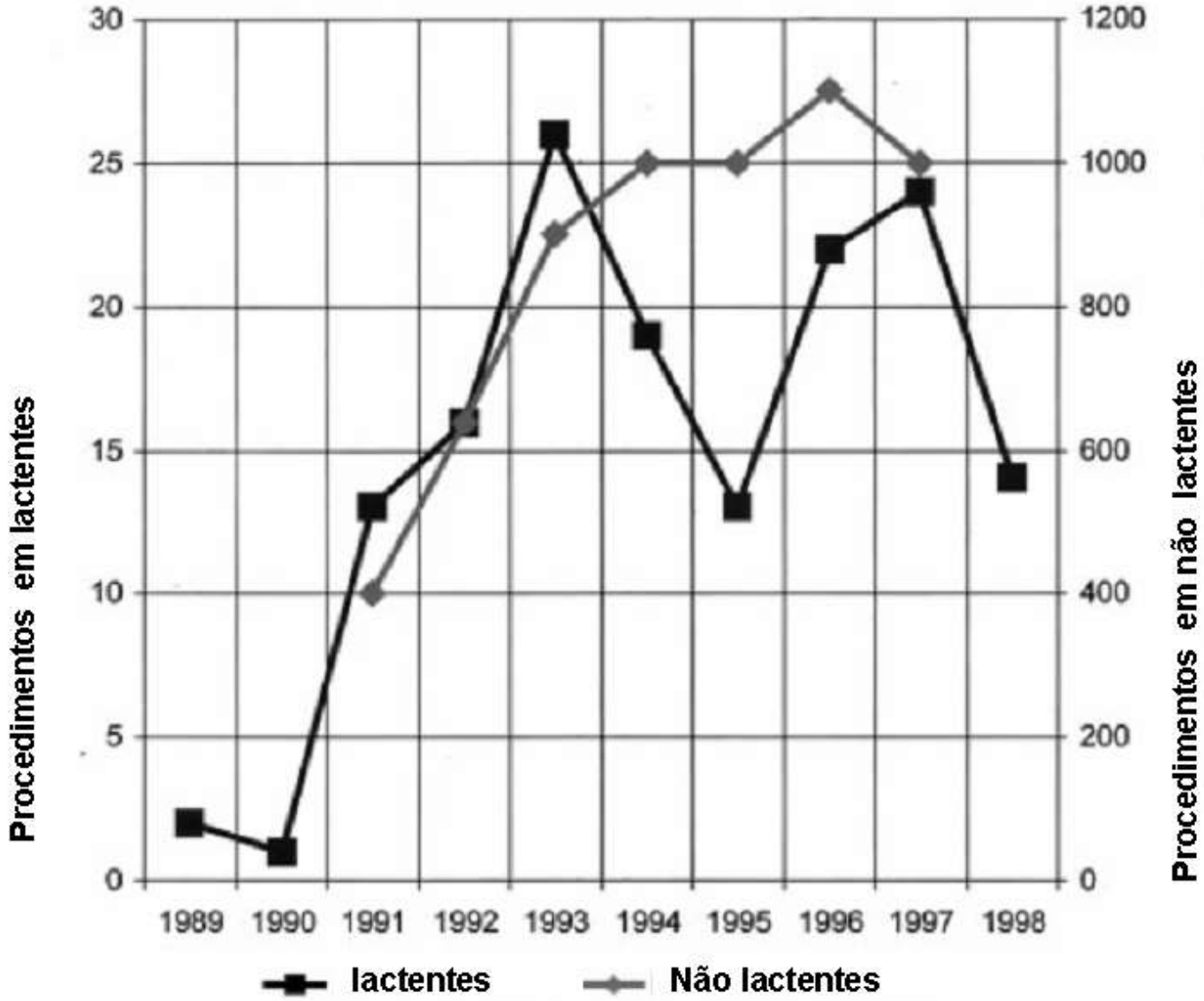

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(*Circulation*. 2001;104:2803-2808.)

Seção Médica de Eletrofisiologia Clínica e Arritmias Cardíacas
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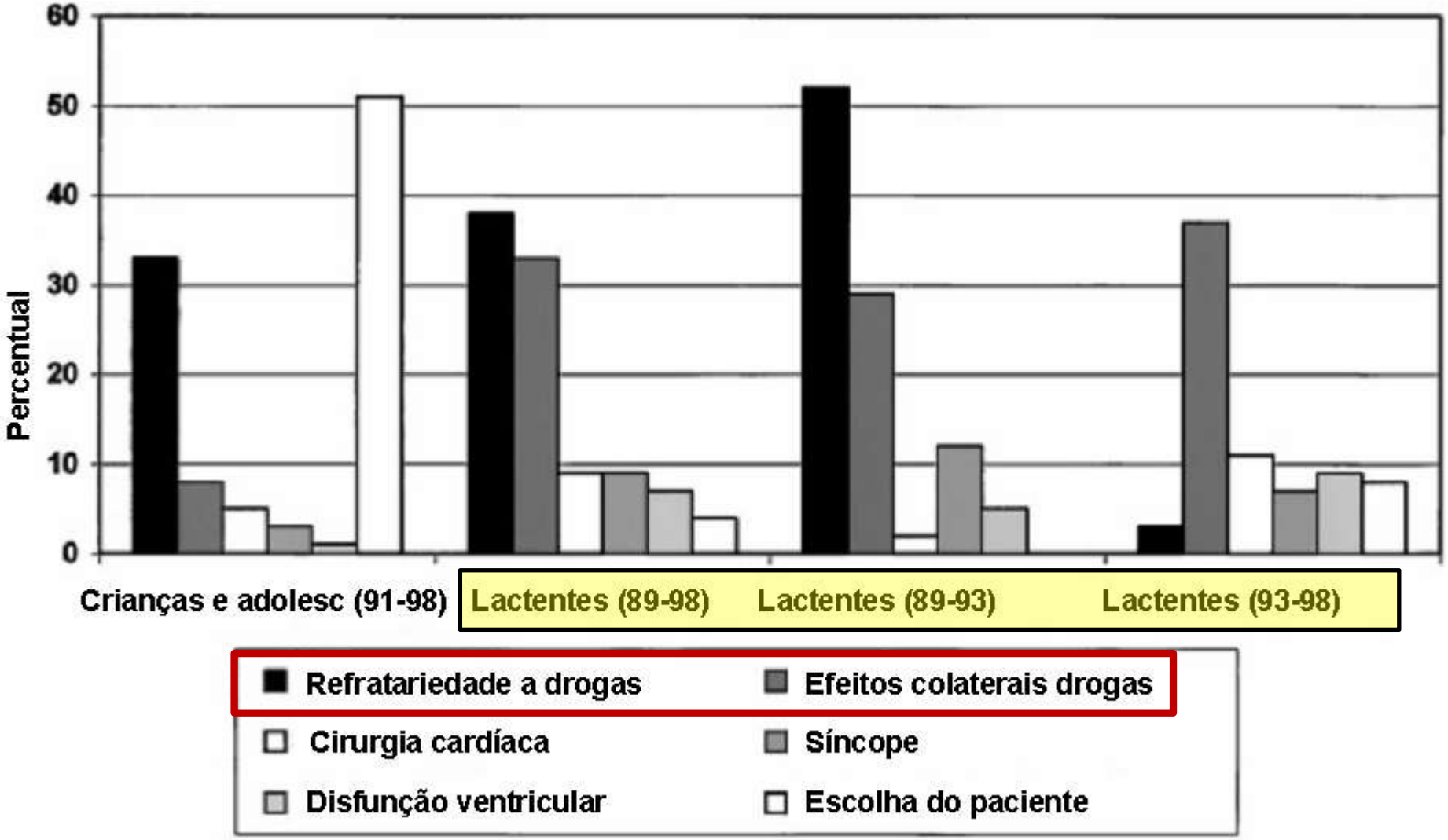

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(*Circulation*. 2001;104:2803-2808.)

Substratos

	Lactentes			Não Lactentes		
		Prevalência	Sucesso		Prevalência	Sucesso
Substratos	n	%	%	n	%	%
Via acessória	115	67.3	87.8	4731	66.1	90.9
TRN	7	4.1	100	1576	21.6	97
TRAV	29	17.1	89.7	332	4.9	87.3
JET	6	3.5	100	13	0.3	76.9
Flutter atrial	4	2.4	50	312	4.3	76
TV	10	5.9	70	196	2.8	65.3

Radiofrequency ablation in children and adolescents: results in 154 consecutive patients

Jens Cosedis Nielsen*, Hans Kottkamp, Christopher Piorkowski, Jin-Hong Gerds-Li, Hildegard Tanner, and Gerhard Hindricks

Herzzentrum Leipzig, University Hospital Leipzig, Leipzig, Germany

Table 1 Patients undergoing RF ablation

Diagnosis	*n*	Age (years)	Gender (M/F)	CHD *n*	Procedures		Final patient success, *n* (%)
					All *n*	Successful *n* (%)	
WPW syndrome	55	15 (12–17, 1–18)	30/25	1	62	57 (92%)	51 (93%)
Concealed AP	41	15 (13–17, 0–18)	21/20	1	44	41 (93%)	39 (95%)
AVNRT	48	16 (14–17, 5–18)	14/34	0	52	50 (96%)	47 (98%)
PJRT	1	7	0/1	0	1	1 (100%)	1 (100%)
FAT	4	12 (7–13)	1/3	0	4	4 (100%)	4 (100%)
Atrial flutter	3	13 (10–17)	2/1	3	3	3 (100%)	3 (100%)
Ventricular tachycardia	2	16 (16–16)	2/0	0	2	2 (100%)	2 (100%)
All patients	154	15 (12–17, 0–18)	70/84	5	169	159 (94%)	147 (95%)

WPW, Wolff–Parkinson–White; AP, accessory pathway; AVNRT, atrioventricular node re-entry tachycardia; PJRT, permanent junctional reciprocating tachycardia; FAT, focal atrial tachycardia; CHD, congenital heart disease. Age: medians (quartiles, ranges) are reported, for patients with FAT, atrial flutter, and ventricular tachycardia only median (ranges).

EUROPEAN SOCIETY OF CARDIOLOGY®

Europace (2006) **8**, 323–329
doi:10.1093/europace/eul021

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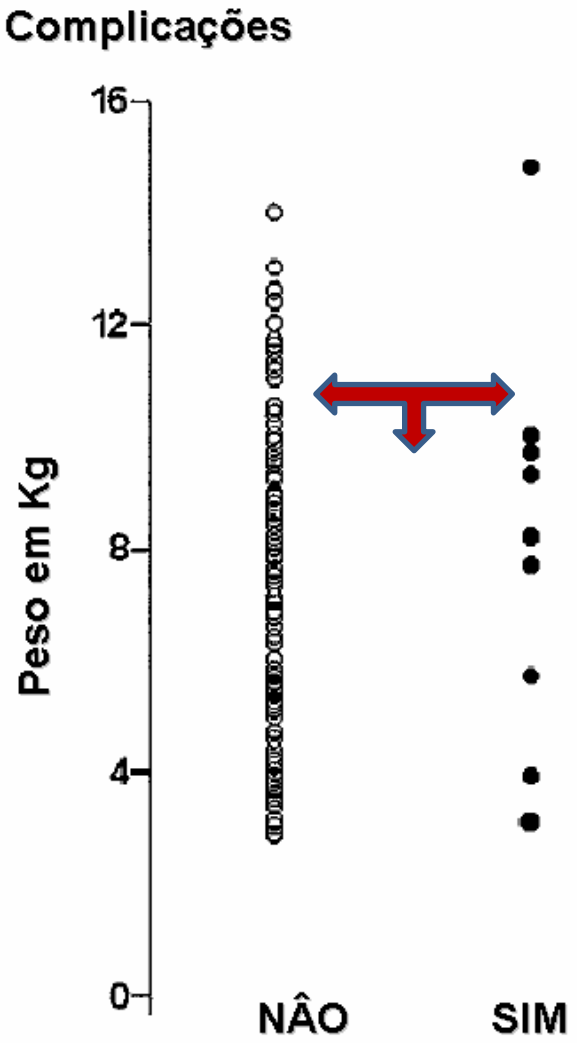


Incidência de BAVT dependente do diagnóstico

	A	B	C
N	540	537	1906
Via acessória manifesta	0,9 (1/234)	0,5 (1/204)	2,4 (15/629)
Via acessória oculta	0,7 (1/145)	0,7 (1/152)	0,5 (2/437)
Taquicardia Coumel	0 (0/14)	5 (1/20)	2,9 (1/34)
TRN	2,1 (3/142)	2,6 (4/153)	1,2 (6/505)
JET	NR	NR	11,1 (1/9)
FA	NR	NR	0 (0/4)
Flutter atrial	0 (0/1)	0 (0/3)	0 (0/87)
Taquicardia atrial	0 (0/2)	NR	0,9 (1/108)
Taquicardia ventricular	NR	0 (0/1)	1,9 (1/54)
Total de pacientes >10 anos	70 (11.4±0,17)	72 (12,2 ±0,16)	83(13,4±0,17)
Qualquer uma das acima (%)	4	2,6	3,2

(J Cardiovasc Electrophysiol, Vol. 15, pp. 759-770, July 2004)

Incidência de BAVT nas vias acessórias

	A	B	C
N	540	537	1906
Anterior direita	0 (0/12)	0 (0/12)	1,7 (1/58)
Lateral direita	0 (0/34)	0 (0/28)	3,3 (3/92)
Posterior direita	0 (0/19)	0 (0/12)	6,8 (4/59)
Póstero septal direita	3,6 (2/55)	1,6 (1/63)	3,8 (7/186)
Médio septal direita	0 (0/13)	0 (0/3)	2,7 (1/37)
Antero septal	0 (0/12)	0 (0/24)	2,3 (1/44)
Médio septal esquerda	0 (0/1)	0 (0/5)	0 (0/7)
Postero septal esquerda	4,8 (1/21)	0 (0/14)	0 (0/60)
Posterior esquerda	0 (0/48)	2,3 (1/43)	0,6 (1/157)
Lateral esquerda	0 (0/166)	0,7 (1/138)	0 (0/350)
Antero lateral esquerda	0 (0/12)	0 (0/23)	0 (0/53)
Total (%)	0,8 (3/393)	0,8 (3/376)	1,6 (18/1103)

(J Cardiovasc Electrophysiol, Vol. 15, pp. 759-770, July 2004)

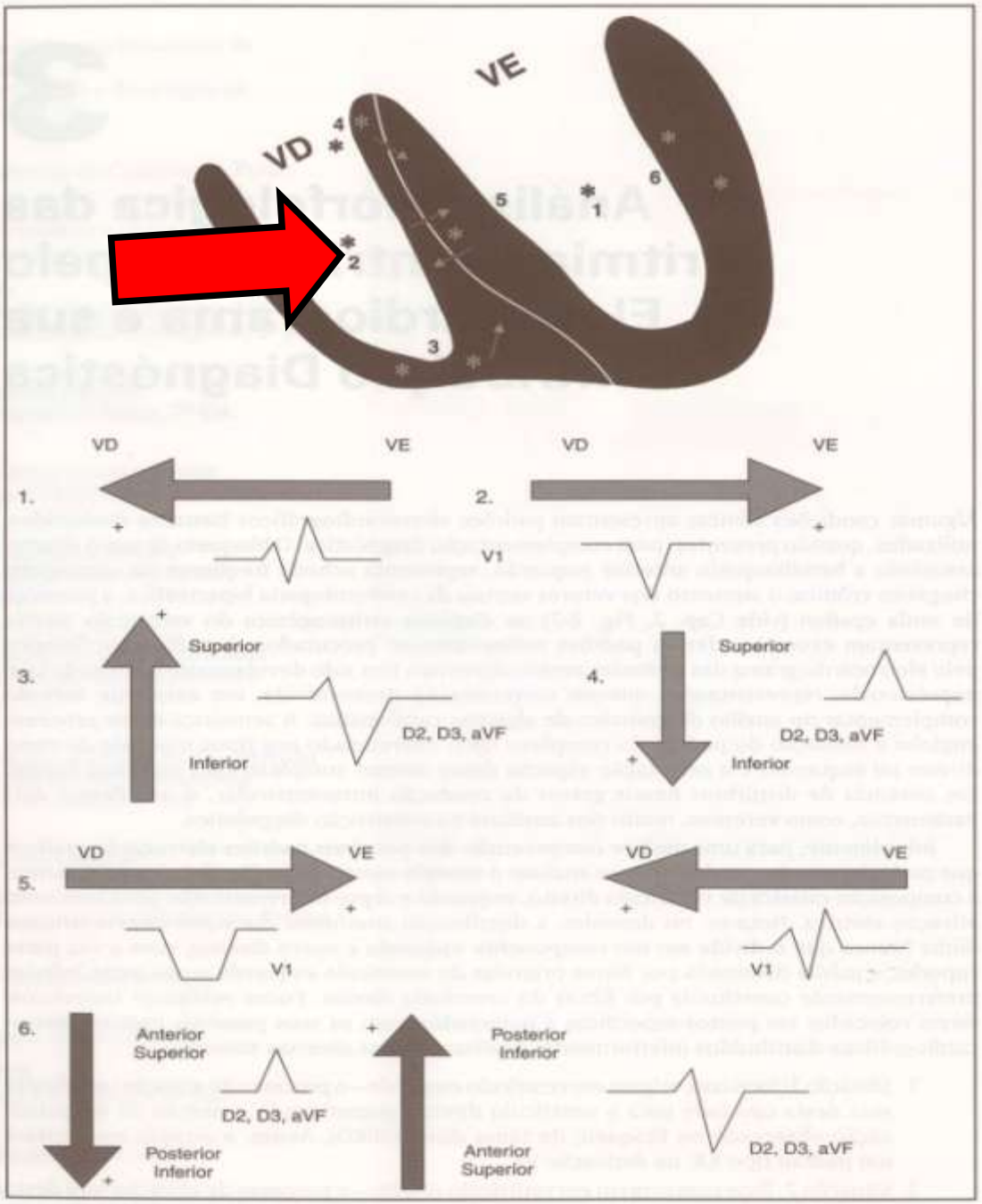


Fig. 3-1. Relações entre ectopias ventriculares e local de origem.

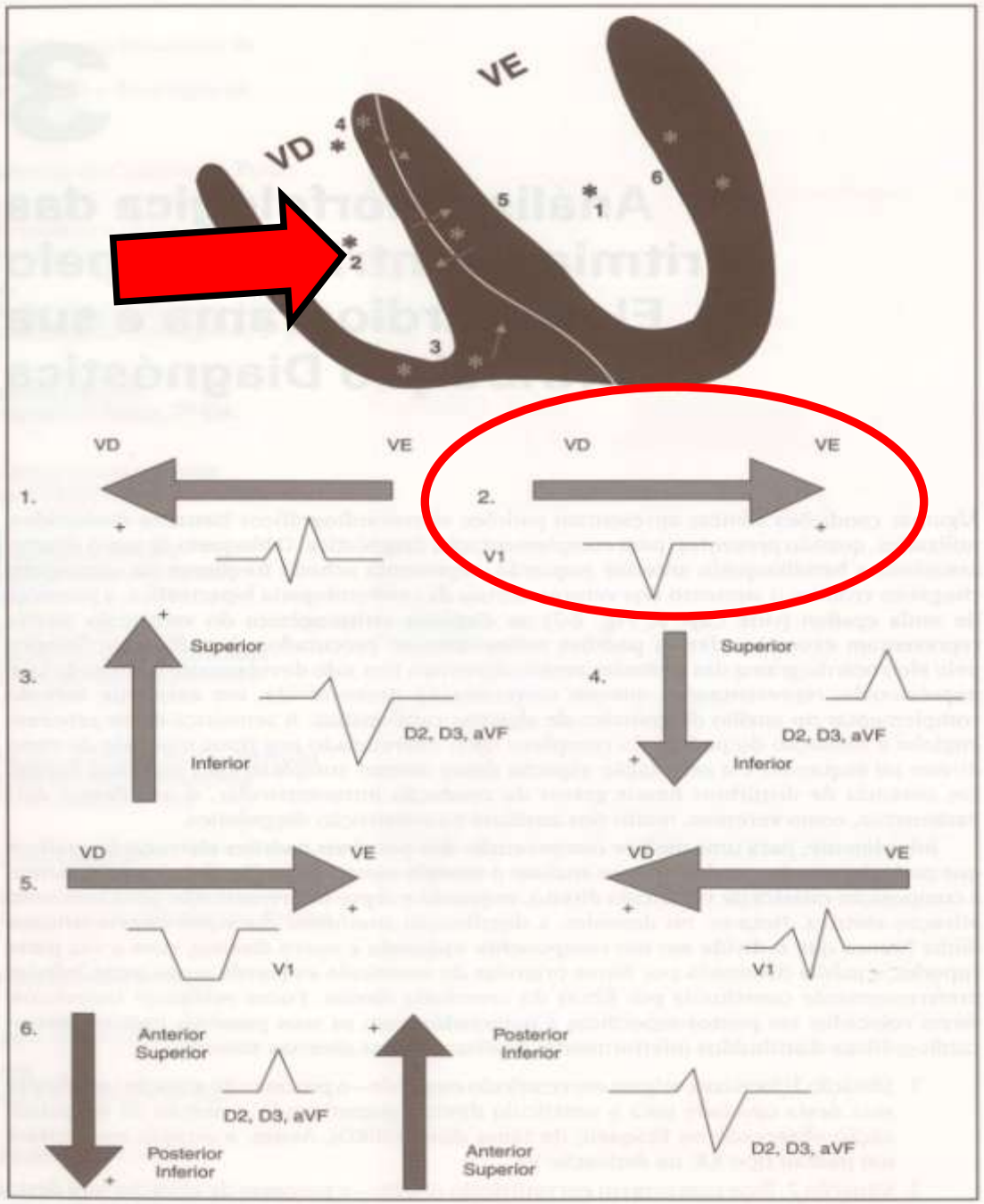
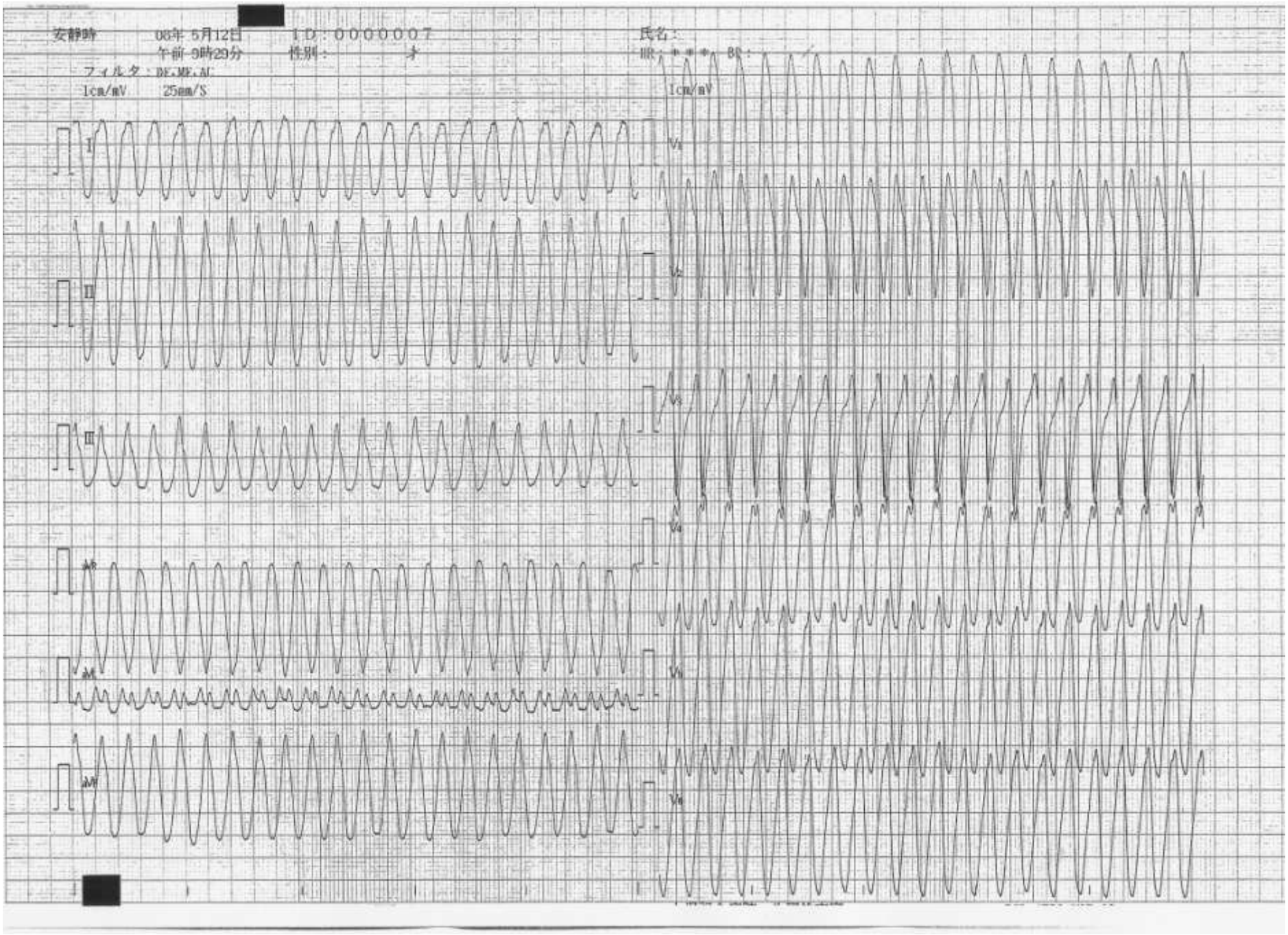


Fig. 3-1. Relações entre ectopias ventriculares e local de origem.

Ventrículo Direito


安静時
08年 5月12日
午前 9時29分
ID：0000007
性別：
才
氏名：
フィルタ：BF.MF.AC
1cm/mV
25mm/S
1cm/mV
I
II
III
aR
aL
aF
V1
V2
V3
V4
V5
V6

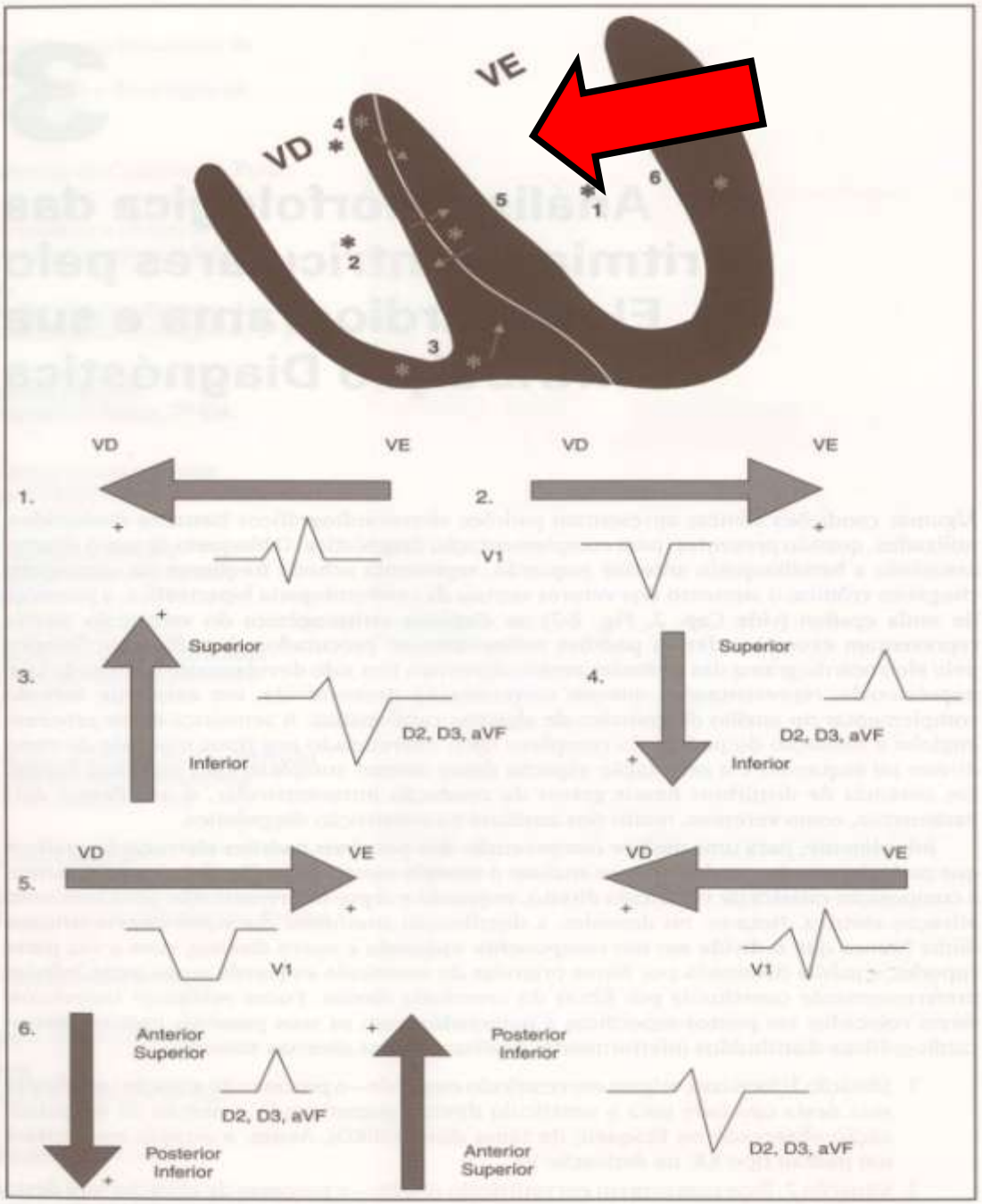


Fig. 3-1. Relações entre ectopias ventriculares e local de origem.

Ventrículo Esquerdo

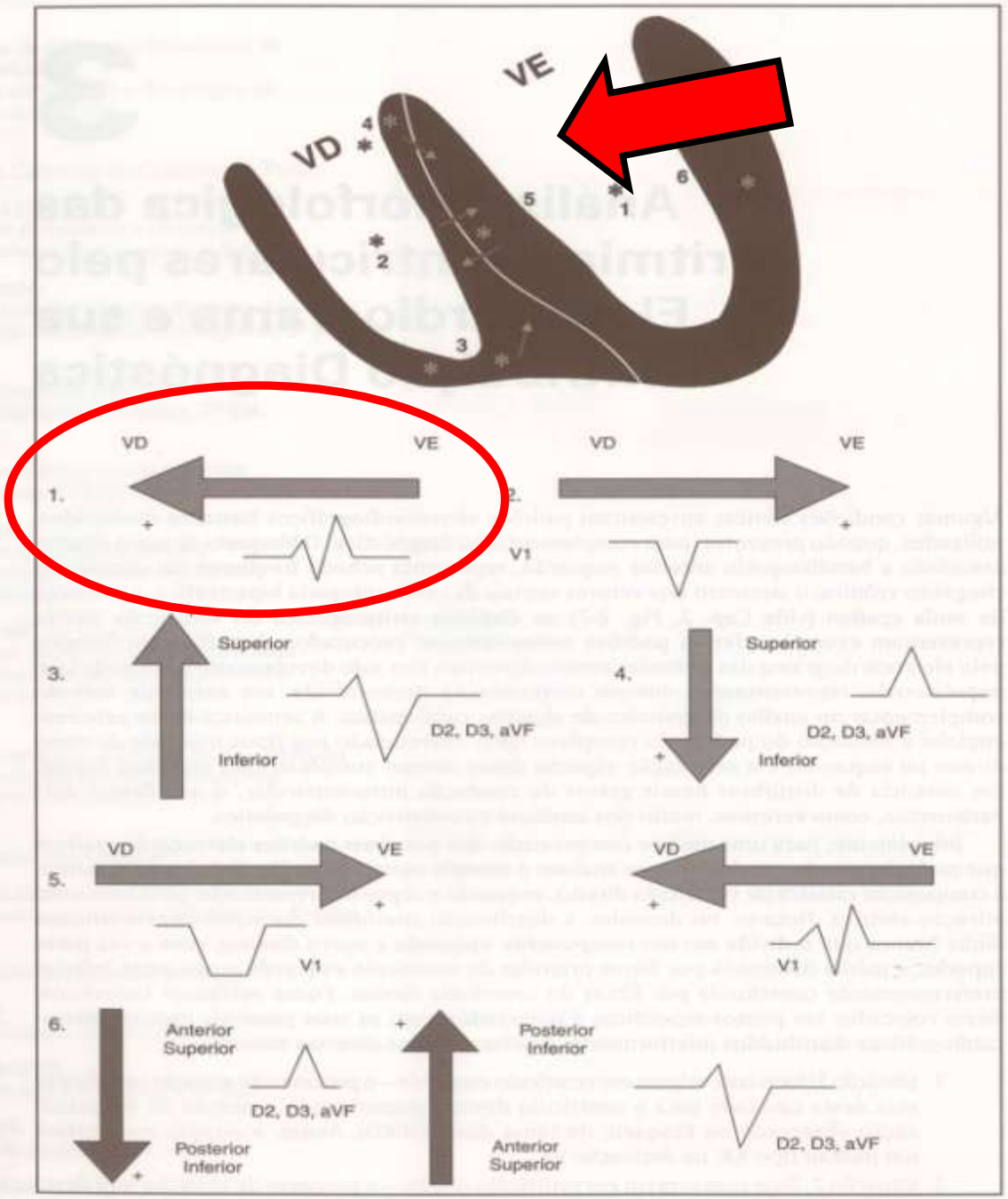


Fig. 3-1. Relações entre ectopias ventriculares e local de origem.

Ventrículo Esquerdo

Fasciculo postero-inferior

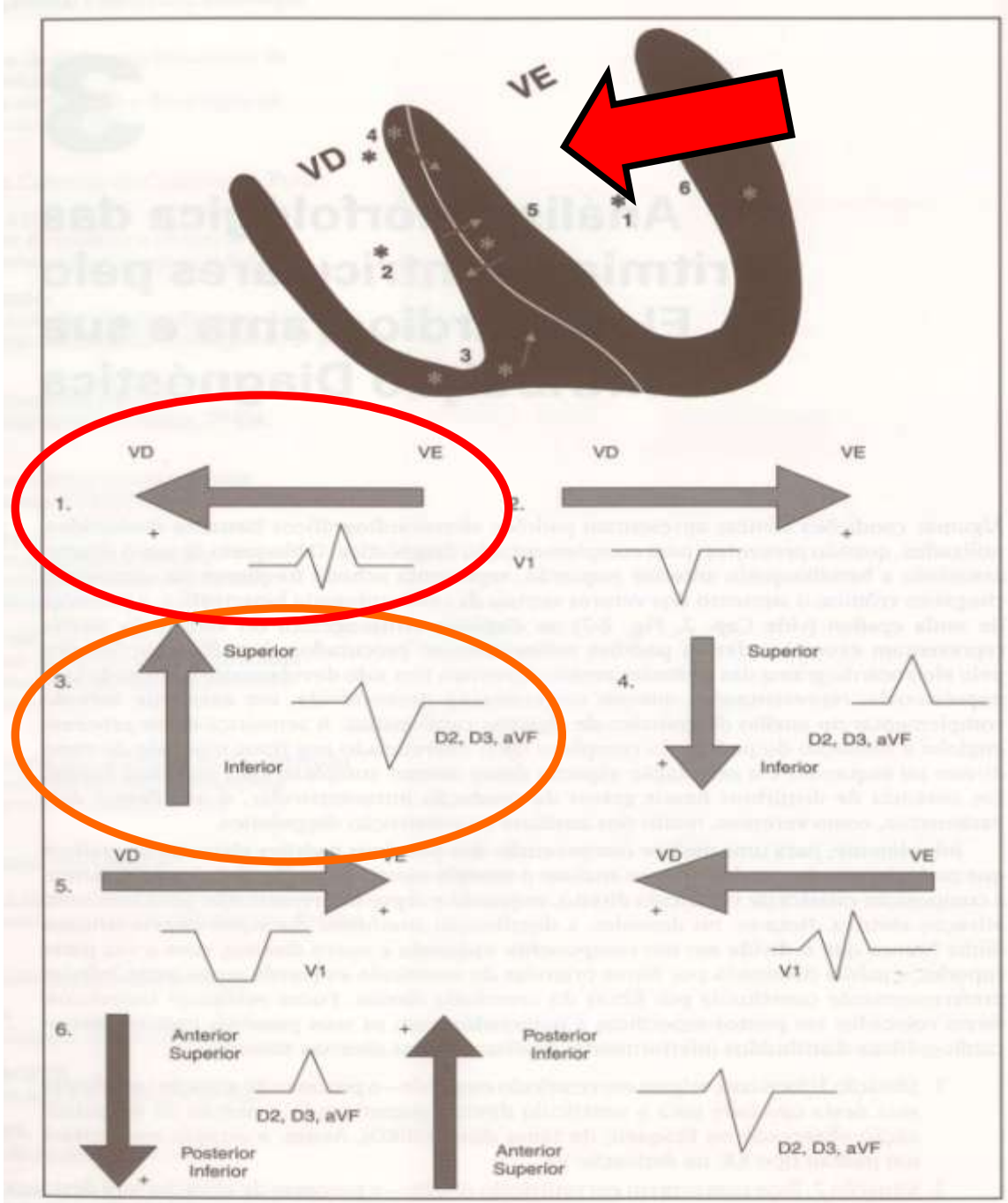
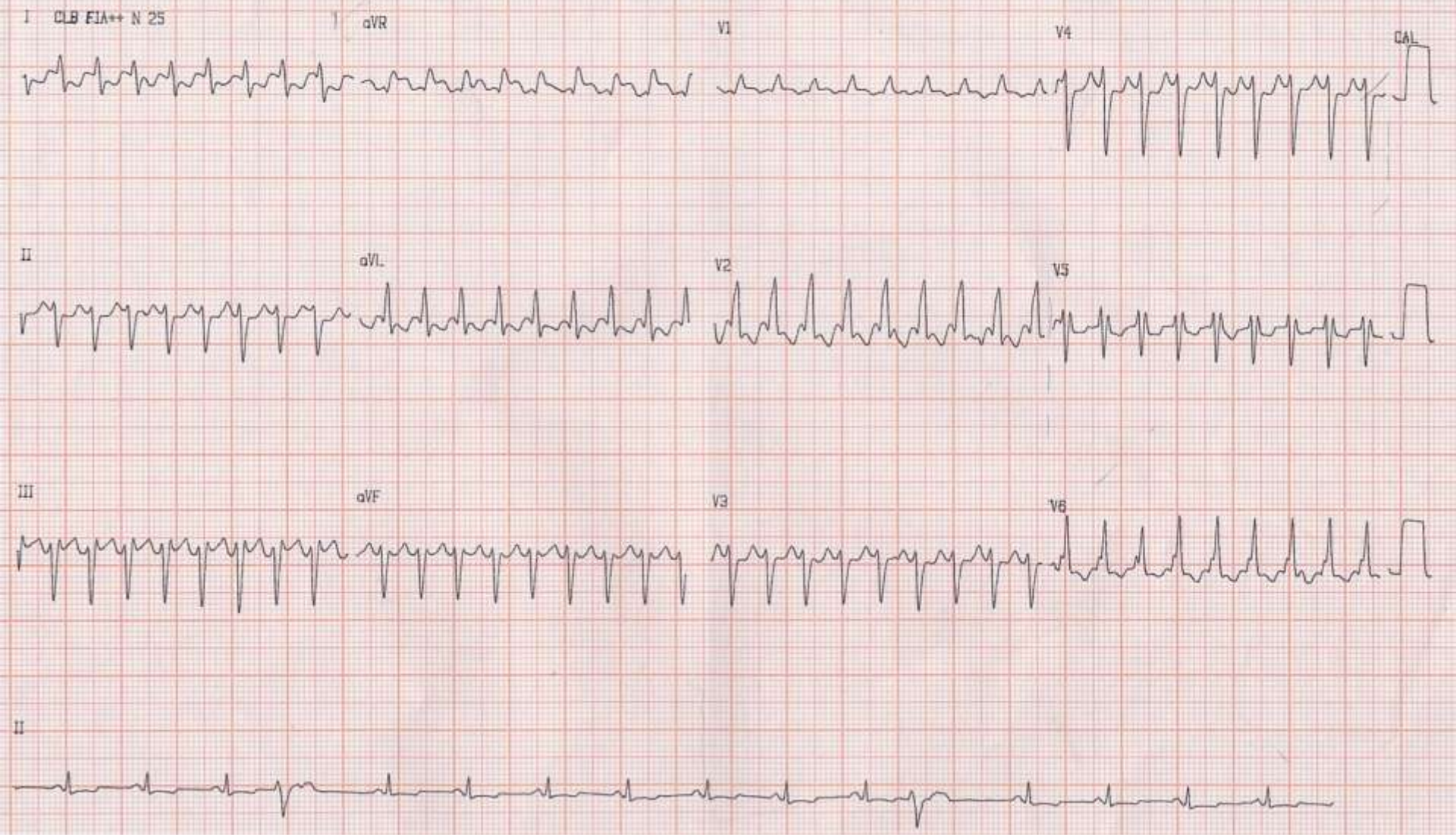


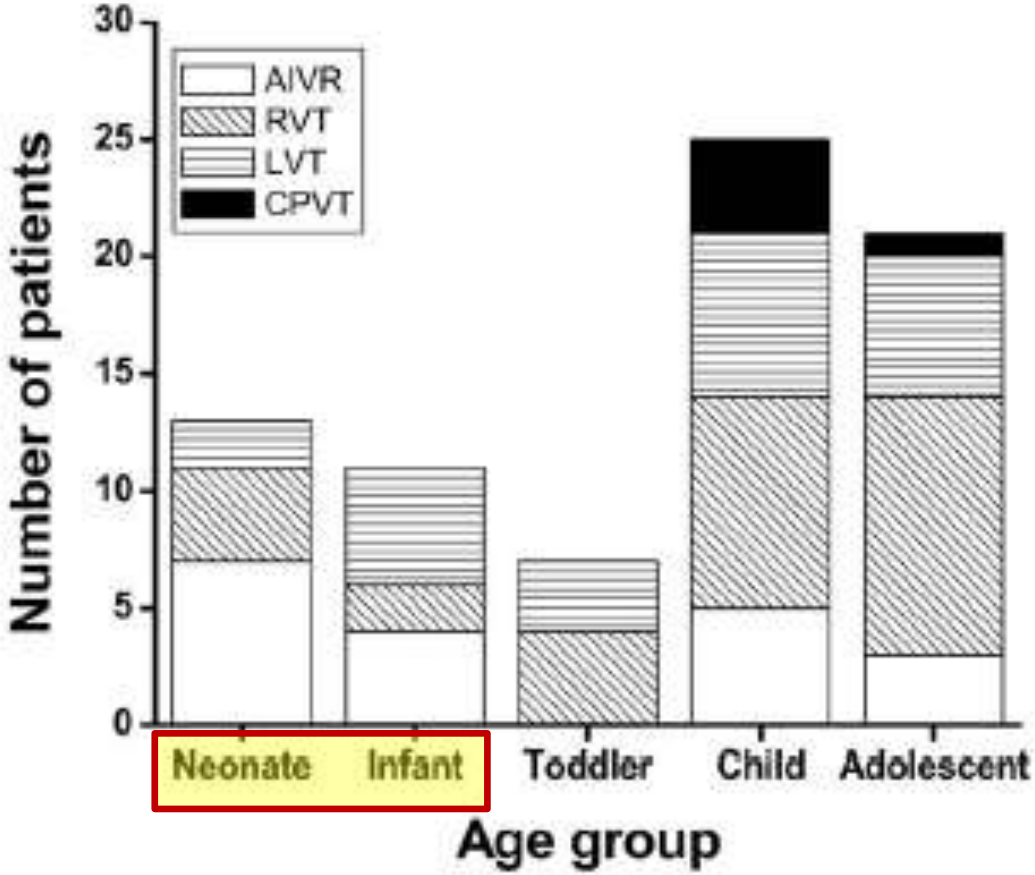
Fig. 3-1. Relações entre ectopias ventriculares e local de origem.

A.T.L.S. 12/06/04 22:15 hs



Diagnosis-specific characteristics of ventricular tachycardia in children with structurally normal hearts

Samuel Wang, MD,*† Wei Zhu, MD,*‡ Robert M. Hamilton, MD,*§ Joel A. Kirsh, MD,*§
Elizabeth A. Stephenson, MD, FHRS,*§ Gil J. Gross, MD*§||



Heart Rhythm, Vol 7, No 12, December 2010

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Table 2 Symptoms at time of diagnosis

Symptom	AIVR	RVT	LVT	CPVT	Total
Palpitations	3	4	6	1	14
Syncope	0	5	0	2	7
Nausea/vomiting	1	3	3	0	7
Dizziness	1	4	2	0	7
Cardiac arrest	0	0	3	2	5
Cyanosis/pallor	2	1	2	0	5
Poor feeding	2	2	1	0	5
Chest pain	0	2	2	0	4
Seizure	0	1	1	0	2
Other (nonspecific)	1	0	1	0	2
Percentage symptomatic[a]	42	47	78	100	57

Diagnosis-specific characteristics of ventricular tachycardia in children with structurally normal hearts

Samuel Wang, MD,*† Wei Zhu, MD,*‡ Robert M. Hamilton, MD,*§ Joel A. Kirsh, MD,*§
Elizabeth A. Stephenson, MD, FHRS,*§ Gil J. Gross, MD*§||

Table 4 Treatment options and success

	AIVR	RVT	LVT	CPVT
Medication:	6 (32)	19 (63)	21 (91)	5 (100)
VT reduction on medication	6/6 (100)	11/19 (58)	15/21 (71)	4/5 (80)
Survivors still medicated at last follow-up	2/6 (33)	12/19 (63)	14/21 (67)	4/4 (100)
Catheter ablation:	0	2 (7)	10 (43)	0
Ablation at least partially successful		1/2 (50)	8/10 (80)	

Table 5 Response to chronic antiarrhythmic medication[a]

Medication	AIVR	RVT	LVT	CPVT
Beta-blockers	6/6 (100)	6/9 (66)	5/6 (83)	4/5 (80)
Calcium channel blockers	0	4/5 (80)	12/13 (92)	1/1 (100)
Propafenone	1/1 (100)	2/4 (50)	2/4 (50)	0
Sotalol	1/1 (100)	2/5 (40)	0/2 (0)	1/1 (100)
Amiodarone	0	3/3 (100)	3/3 (100)	1/2 (50)
Mexiletine	0	1/2 (50)	2/2 (100)	0/1 (0)
Flecainide	1/1 (100)	1/1 (100)	0	0
Digoxin	1/1 (100)	0	0/1 (0)	0
Procainamide	0	0/1 (0)	0/1 (0)	0
Quinidine	0	0	0/1 (0)	0

Table 1 Adverse reactions to amiodarone

Reaction	Incidence (%)	Diagnosis	Management
Pulmonary	2	Cough and/or dyspnea, especially with local or diffuse opacities on high-resolution CT scan and decrease in D_LCO from baseline	Usually discontinue drug; corticosteroids may be considered in more severe cases; occasionally, can continue drug if levels high and abnormalities resolve; rarely, continue amiodarone with corticosteroid if no other option
Gastrointestinal tract	30	Nausea, anorexia and constipation	Symptoms may decrease with decrease in dose
	15–30	AST or ALT level greater than 2 times normal	If hepatitis considered, exclude other causes
	<3	Hepatitis and cirrhosis	Consider discontinuation, biopsy, or both to determine whether cirrhosis is present
Thyroid	4–22	Hypothyroidism	L-Thyroxine
	2–12	Hyperthyroidism	Corticosteroids, propylthiouracil or methimazole; may need to discontinue drug; may need thyroidectomy
Skin	<10	Blue discoloration	Reassurance; decrease in dose
	25–75	Photosensitivity	Avoidance of prolonged sun exposure; sunblock; decrease in dose
Central nervous system	3–30	Ataxia, paresthesias, peripheral polyneuropathy, sleep disturbance, impaired memory and tremor	Often dose dependent, and may improve or resolve with dose adjustment
Ocular	<5	Halo vision, especially at night	Corneal deposits the norm; if optic neuropathy occurs, discontinue
	≤1	Optic neuropathy	Discontinue drug and consult an ophthalmologist
	>90	Photophobia, visual blurring, and microdeposits	
Heart	5	Bradycardia and AV block	May need permanent cardiac pacing
	<1	Proarrhythmia	May need to discontinue the drug
Genitourinary	<1	Epididymitis and erectile dysfunction	Pain may resolve spontaneously

Heart Rhythm, Vol 4, No 9, September 2007

Arritmias

Taquicardias

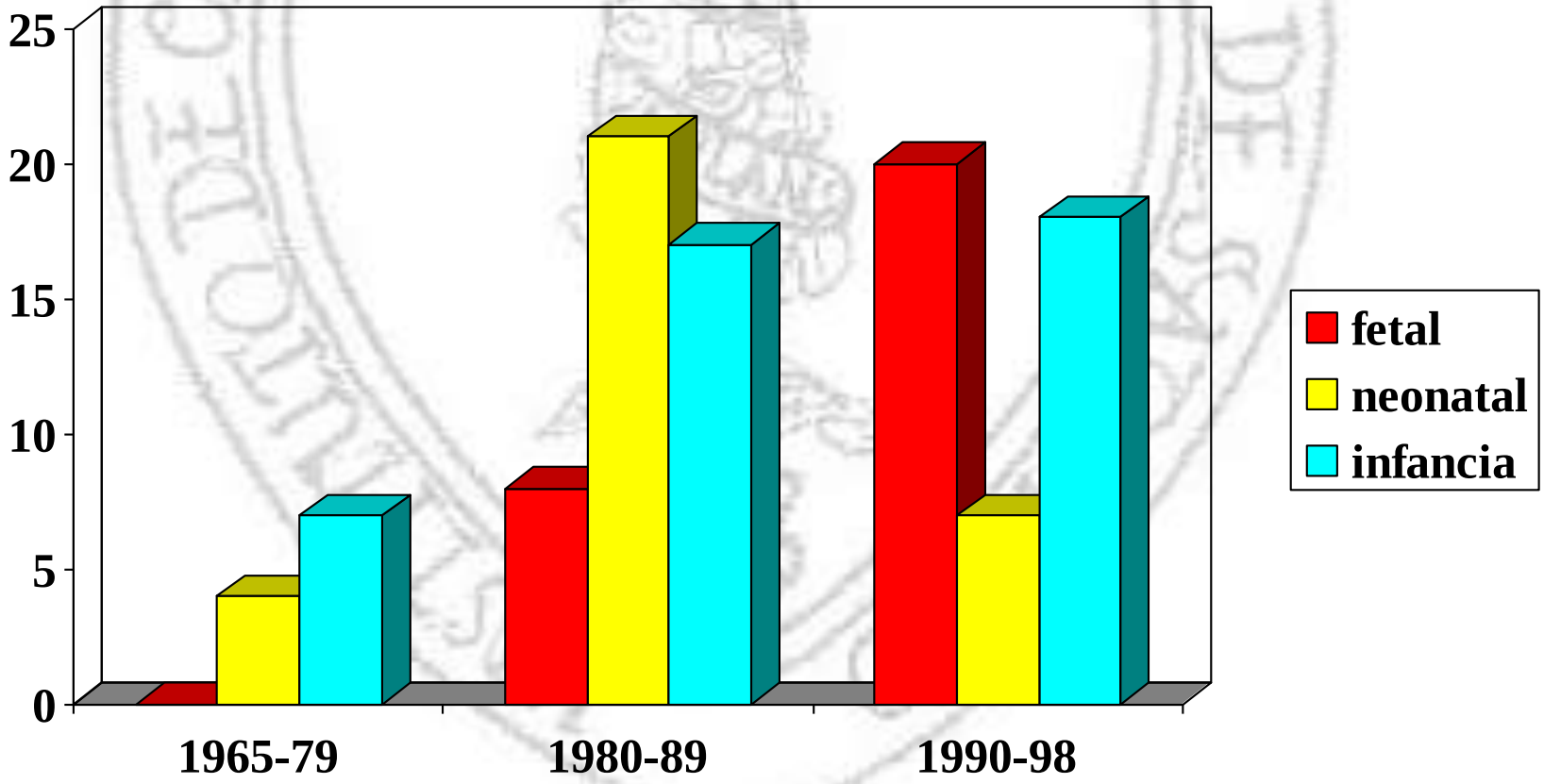
- TSV
- Ventriculares

Bradicardias

- Automatismo
- Bloqueios sinoatriais
- Bloqueios AV

Bloqueio atrioventricular congênito

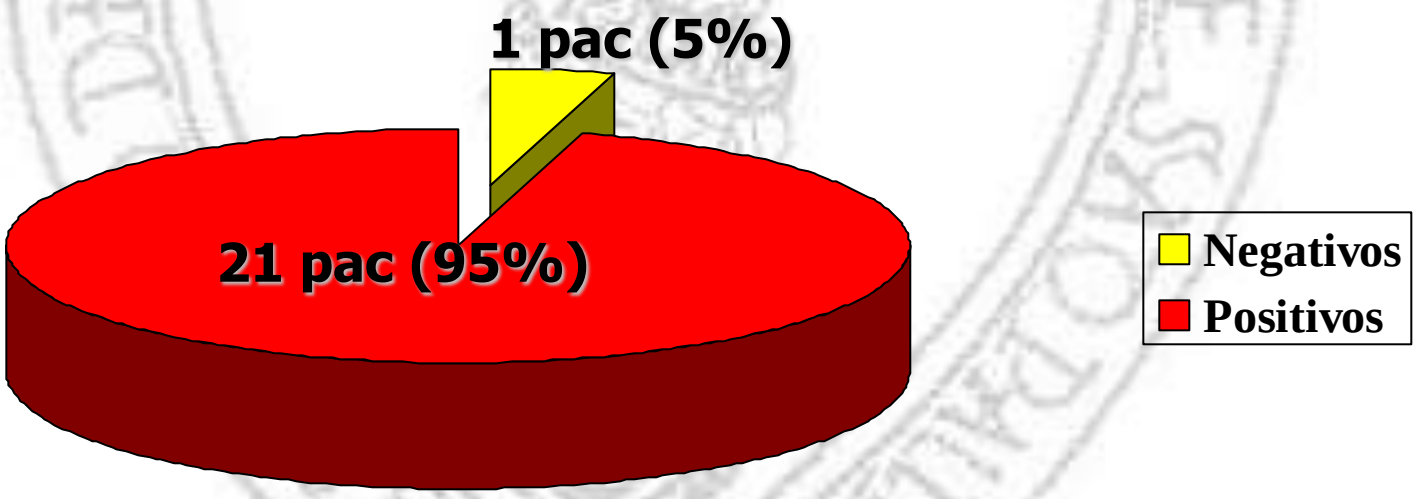
Diagnóstico na evolução das décadas



J Am Coll Cardiol 2002;39:130 –7

Bloqueio atrioventricular congênito

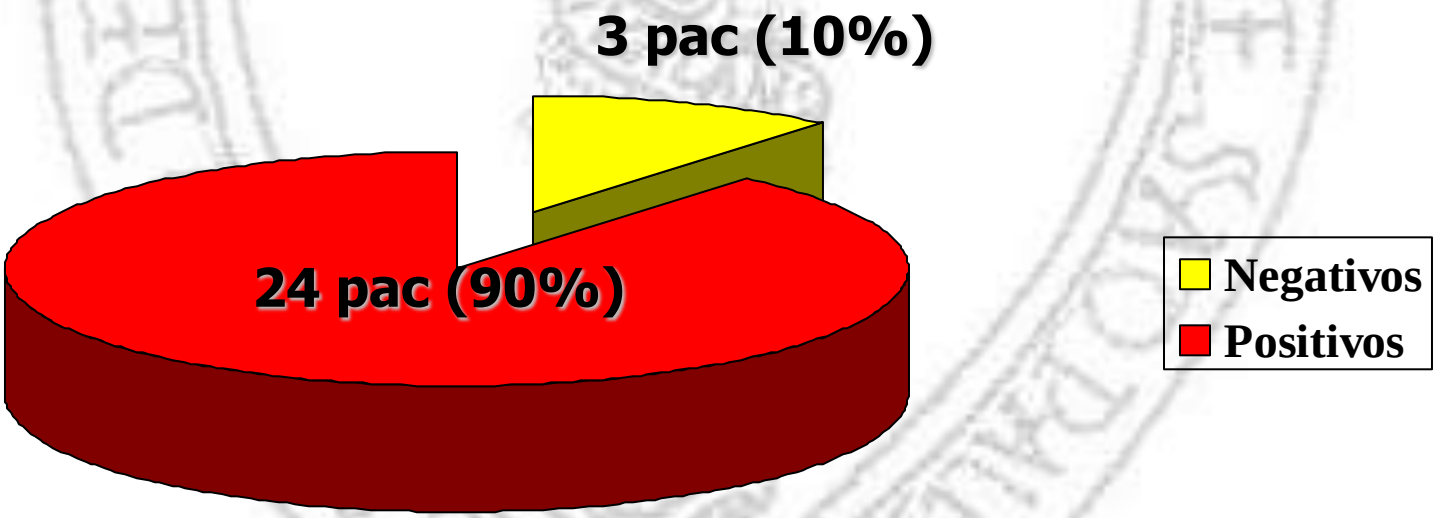
Anti Ro e Anti La maternos – Grupo com Diagnóstico fetal (n=22)



J Am Coll Cardiol 2002;39:130 –7

Bloqueio atrioventricular congênito

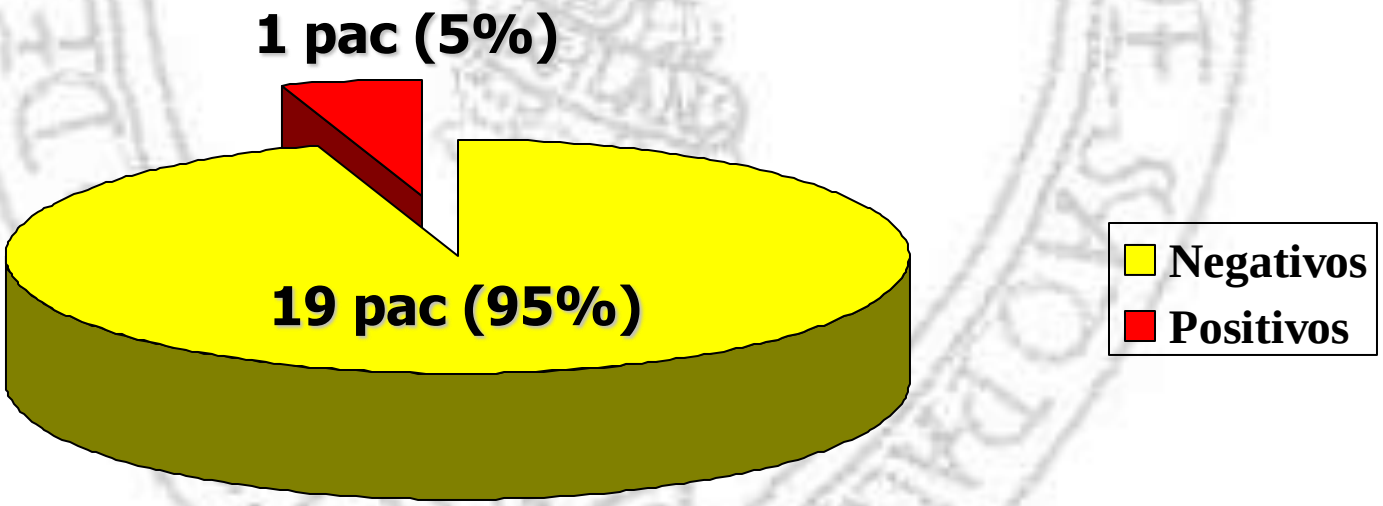
Anti Ro e Anti La maternos – Grupo com Diagnóstico Neonatal (n=27)



J Am Coll Cardiol 2002;39:130 –7

Bloqueio atrioventricular congênito

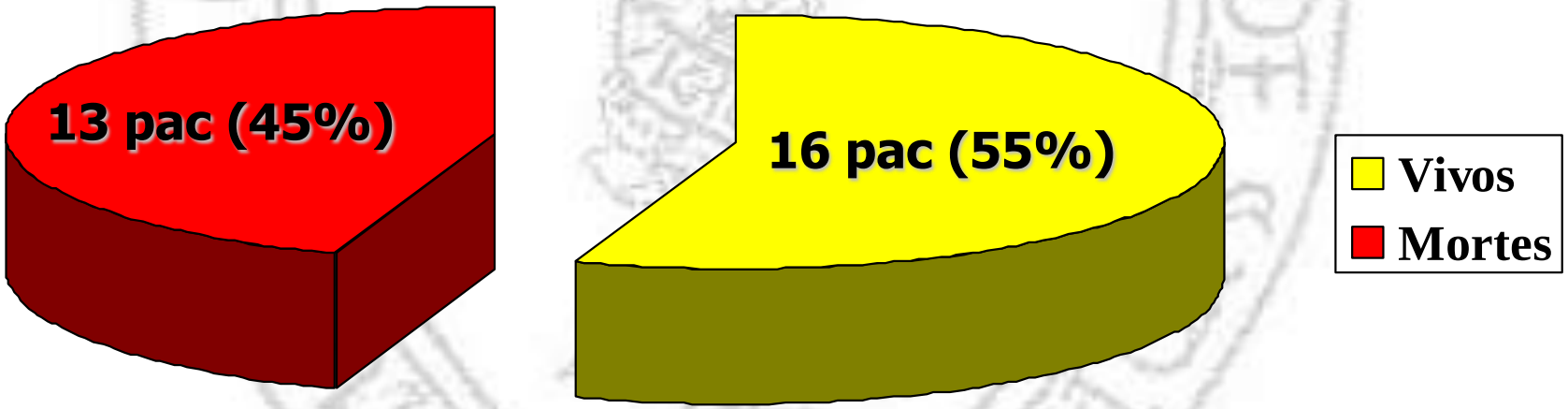
Anti Ro e Anti La maternos – Grupo com Diagnóstico na infância (n=20)



J Am Coll Cardiol 2002;39:130 –7

Bloqueio atrioventricular congênito

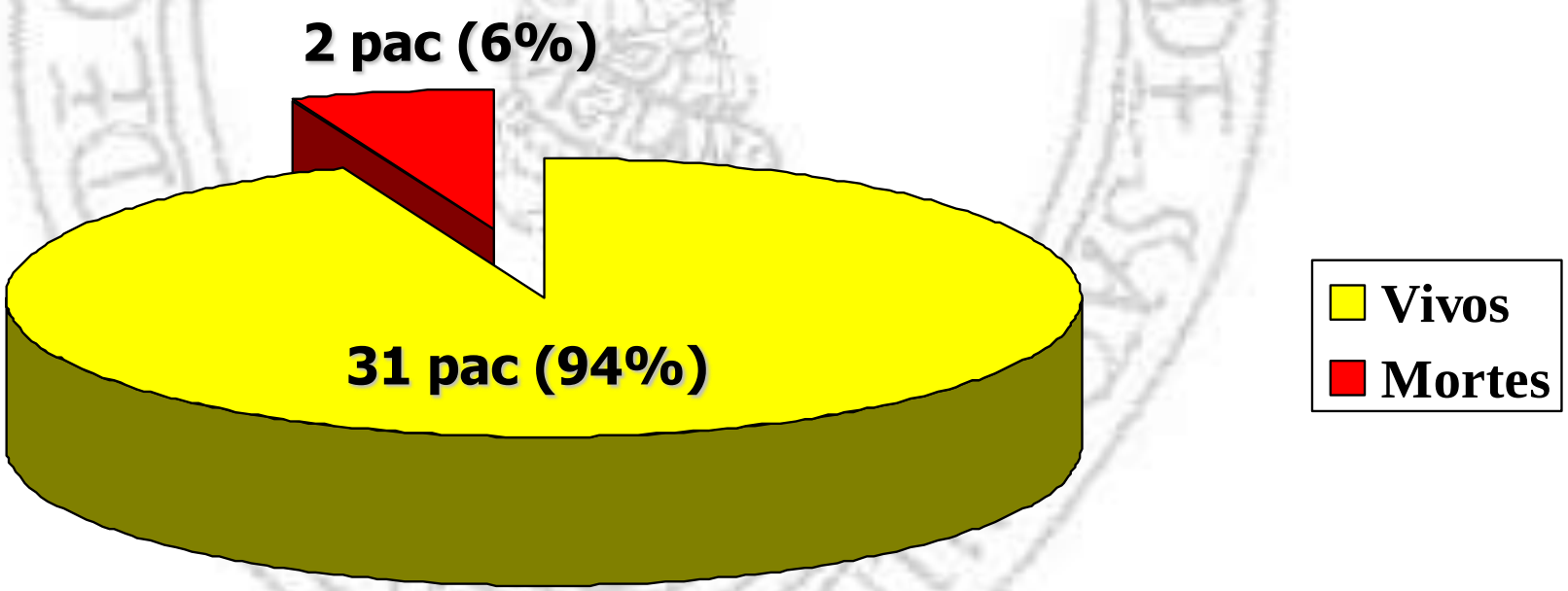
Mortalidade – Grupo com Diagnóstico fetal (n=29)



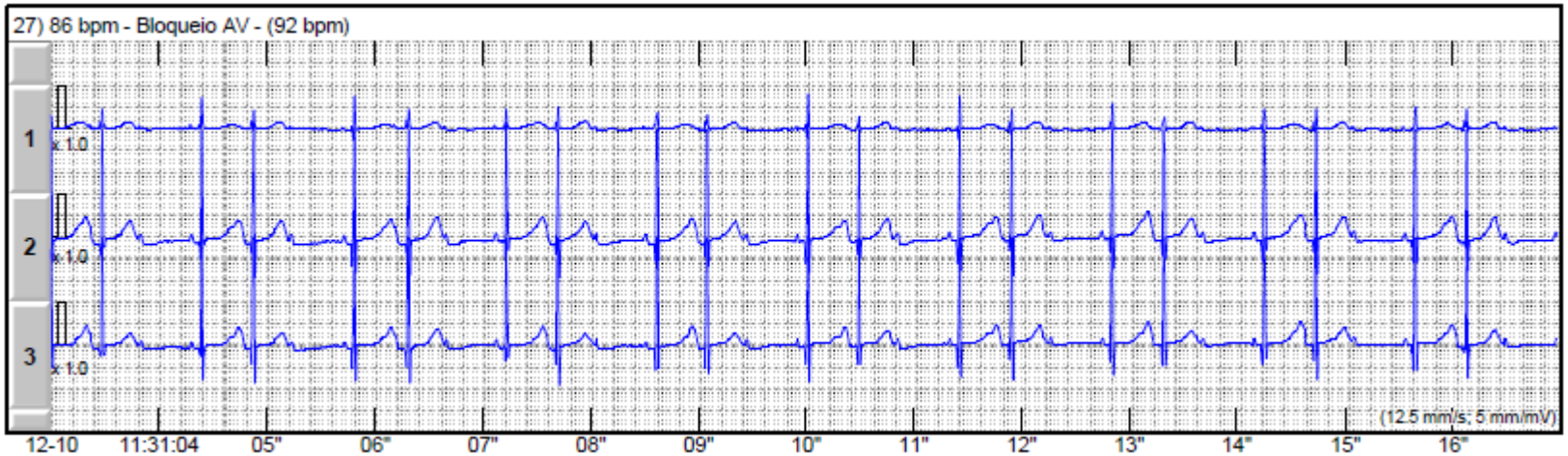
J Am Coll Cardiol 2002;39:130 –7

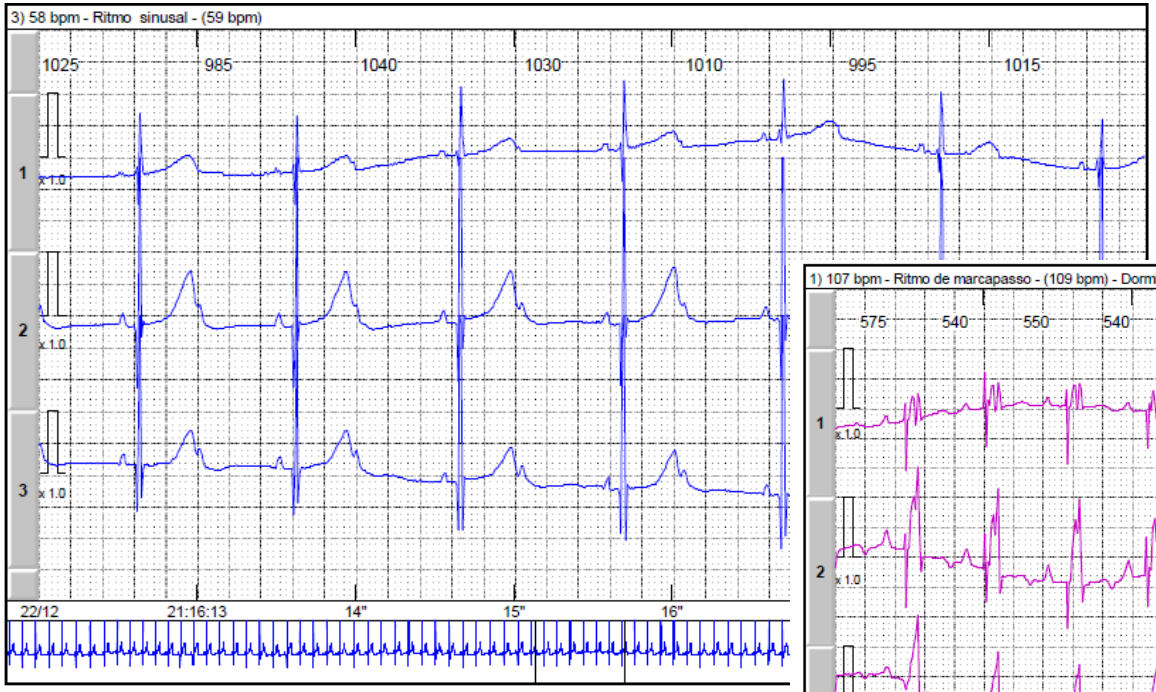
Bloqueio atrioventricular congênito

Mortalidade – Grupo com Diagnóstico neonatal (n=33)

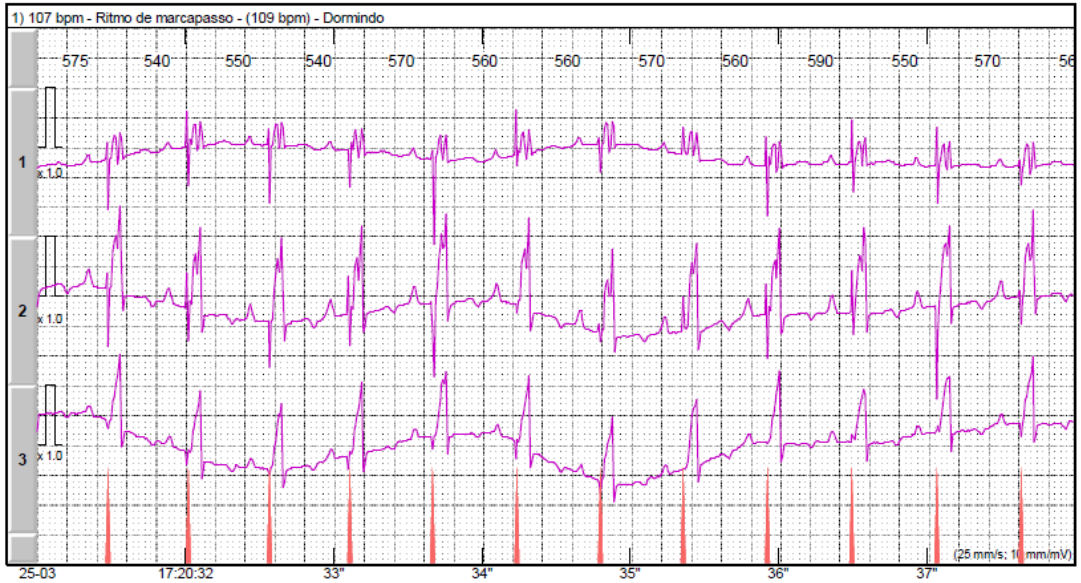


J Am Coll Cardiol 2002;39:130 –7





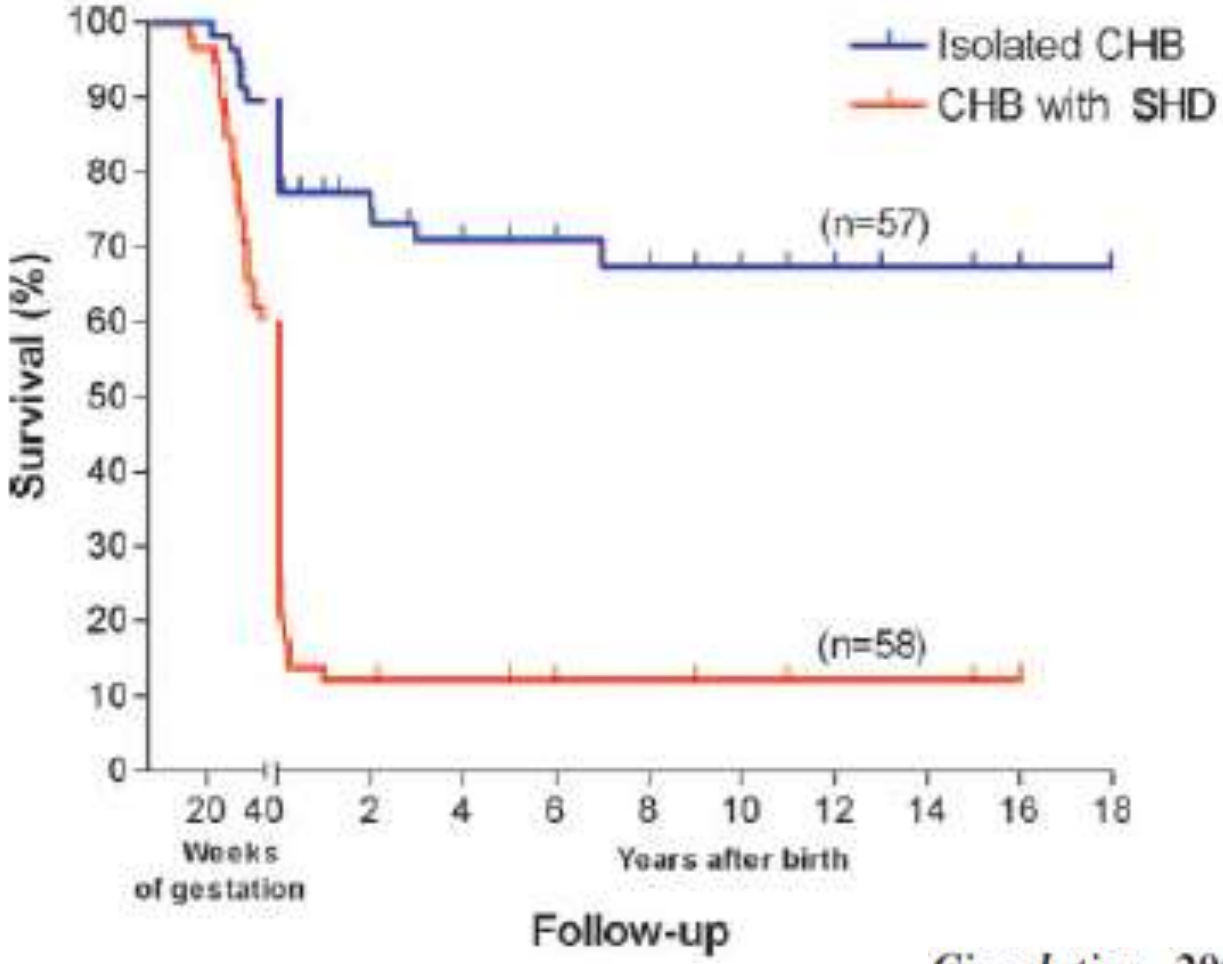
Menino 2 meses



Perinatal Outcome of Fetal Atrioventricular Block

One-Hundred-Sixteen Cases From a Single Institution

Lilian M. Lopes, MD; Gláucia Maria Penha Tavares, MD; Ana Paula Damiano, MD;
Marco Antônio Borges Lopes, MD; Vera Demarchi Aiello, MD;
Regina Schultz, MD; Marcelo Zugaib, MD, PhD



Circulation. 2008;118:1268-1275.

Table 1. Characteristics of 116 Fetuses With Congenital AV Block

	Isolated AV Block (n=57)	AV Block With SHD (n=59)	*P*
Cause	41 Anti-Ro positive	40 Left isomerism	
	16 Anti-Ro negative	8 AV discordance, 11 other SHD	
GA at diagnosis, wk	29 (18–40)	29 (10–39)	NS
Atrial rate, bpm	136.3±17.9	119.1±21.5	<0.01
Ventricular rate, bpm	58.6±13.6	56.9±11.2	NS
Hydrops, n (%)	11/57 (19)	16/59 (27)	NS
Late cardiomyopathy/EFE, n (%)	2/57 (3)	0	NA
No treatment, n (%)	46/57 (81)	0	NA
Transplacental therapy, n (%)	11/57 (19)	0	NA
Steroid only (dexamethasone), n (%)	2/57 (3.5)	0	NA
Steroid+sympathomimetic, n (%)*	4/57 (7)	0	NA
Sympathomimetic only, n (%)	5/57 (9)	0	NA
Termination of pregnancy, n (%)	0	1/59 (1.7)	NA
Fetal death, n (%)			<0.01
Yes	6/57 (10)	23/58 (40)	
No (live birth)	51/57 (90)	35/58 (60)	
Neonatal death (≤28 d), n (%)	7/51 (14)	20/35 (57)	<0.01
Neonatal survivors, n (%)	44/57 (77.1)	15/58 (26)	<0.001
Anti-RO positive	32/41 (78)	...	NA
Anti-RO negative	12/16 (75)	...	NA
Follow-up after neonatal period, n (%)	42/44 (95)	15/15 (100)	NS
Permanent pacemaker (≤28 d), n (%)	18/51 (35)	18/35 (51)	NS
Permanent pacemaker (>28 d), n (%)†	11/31 (35)	2/17 (12)	NS

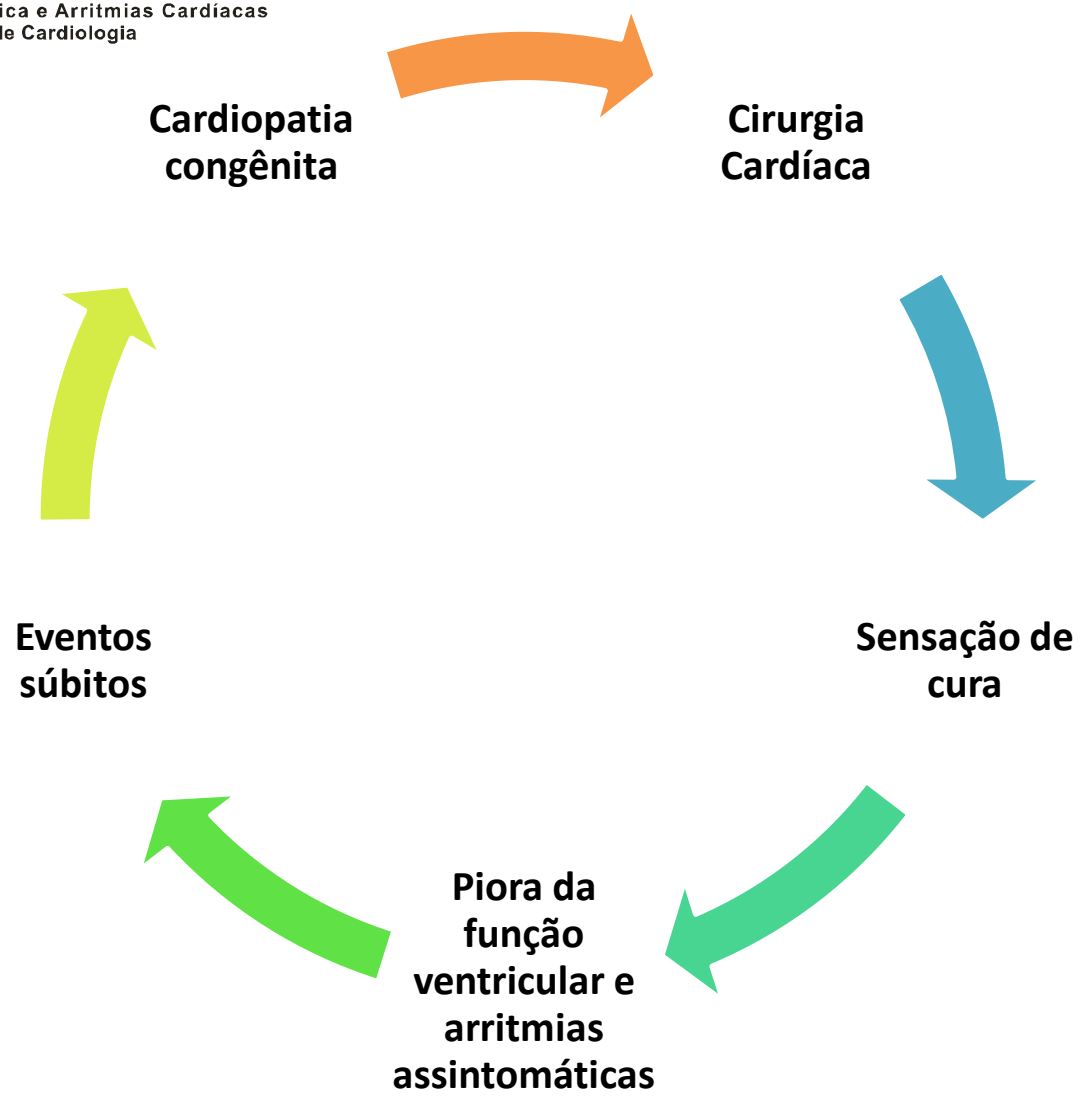
Circulation. 2008;118:1268-1275.

Cuidando do pós operatório de cirurgia cardíaca

Tabela 84.3 – Correlação entre tipo de cardiopatia congênita e possíveis arritmias

Condição clínica	Substrato	Arritmias pré ou pós-operatórias	Comentários
Comunicação interatrial	Dilatação do átrio direito (pré-operatório) e atriotomia e manipulação atrial (pós-operatório)	Taquicardia atrial (pré e pós) *Flutter* atrial (pré e pós) Fibrilação atrial (pré e pós) Lesão mecânica pós-operatória do sistema elétrico do coração (pós)	Fibrilação, *flutter* atrial e taquicardia atrial geralmente surgem na evolução natural tardia
Comunicação interventricular	Lesão cirúrgica do sistema de condução ou processo inflamatório pós-CEC	Bloqueios atrioventriculares (pós) Taquicardia juncional (pós) Taquicardias ventriculares (pré e pós com disfunção miocárdica)	Episódios de taquicardia juncional no pós-operatório são bem tratados com propafenona, se não houver disfunção
Transposição corrigida de grandes artérias (L-TGA)	Distorção do sistema de condução pela inversão ventricular, lesão cirúrgica	Bloqueios atrioventriculares até BAVT	Pode ocorrer espontaneamente ou no pós-operatório de ventriculosseptoplastia, por exemplo
Isomerismo atrial	Esquerdo: ausência de nódulo sinusal; direito: dois nódulos sinusais; presença de dois nódulos atrioventriculares	Arritmias atriais (ritmos atriais ectópicos, taquicardia atrial multifocal) Taquicardia por reentrada atrioventricular por feixe acessório ou pelos dois NAV	Pode ter diversas arritmias atriais primárias ou secundárias a procedimentos cirúrgicos
Tetralogia de Fallot	Disfunção do VD ou lesão pos-operatória	Arritmias ventriculares (simples ou complexas) Maior risco quanto mais tardio o pós-operatório e maior a idade da correção cirúrgica	Risco de morte súbita e arritmias malignas quando QRS > 180 ms, insuficiência pulmonar importante e disfunção de VD
Anomalia de Ebstein	Dilatação atrial e feixes anômalos	Arritmias atriais (*flutter* e FA) WPW	Maior incidência de feixe anômalo que a população geral
Miocardiopatia hipertrófica	Feixes acessórios e reentradas na musculatura ventricular	TPSV por macrorreentrada atrioventricular	Septo maior que 30 mm, síncope, TVNS, TVS e história familiar

Seção Médica de Eletrofisiologia Clínica e Arritmias Cardíacas
Instituto Dante Pazzanese de Cardiologia



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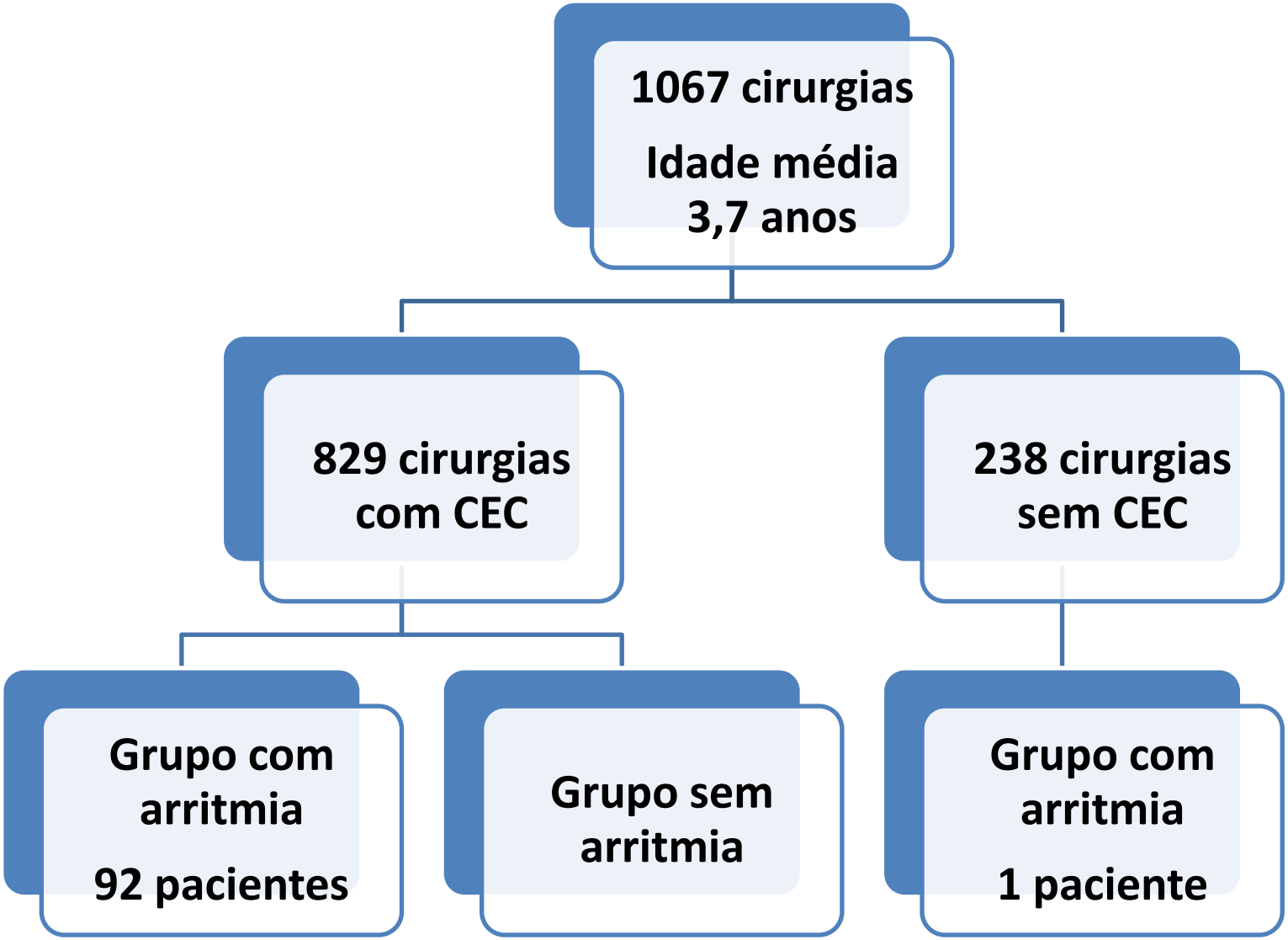
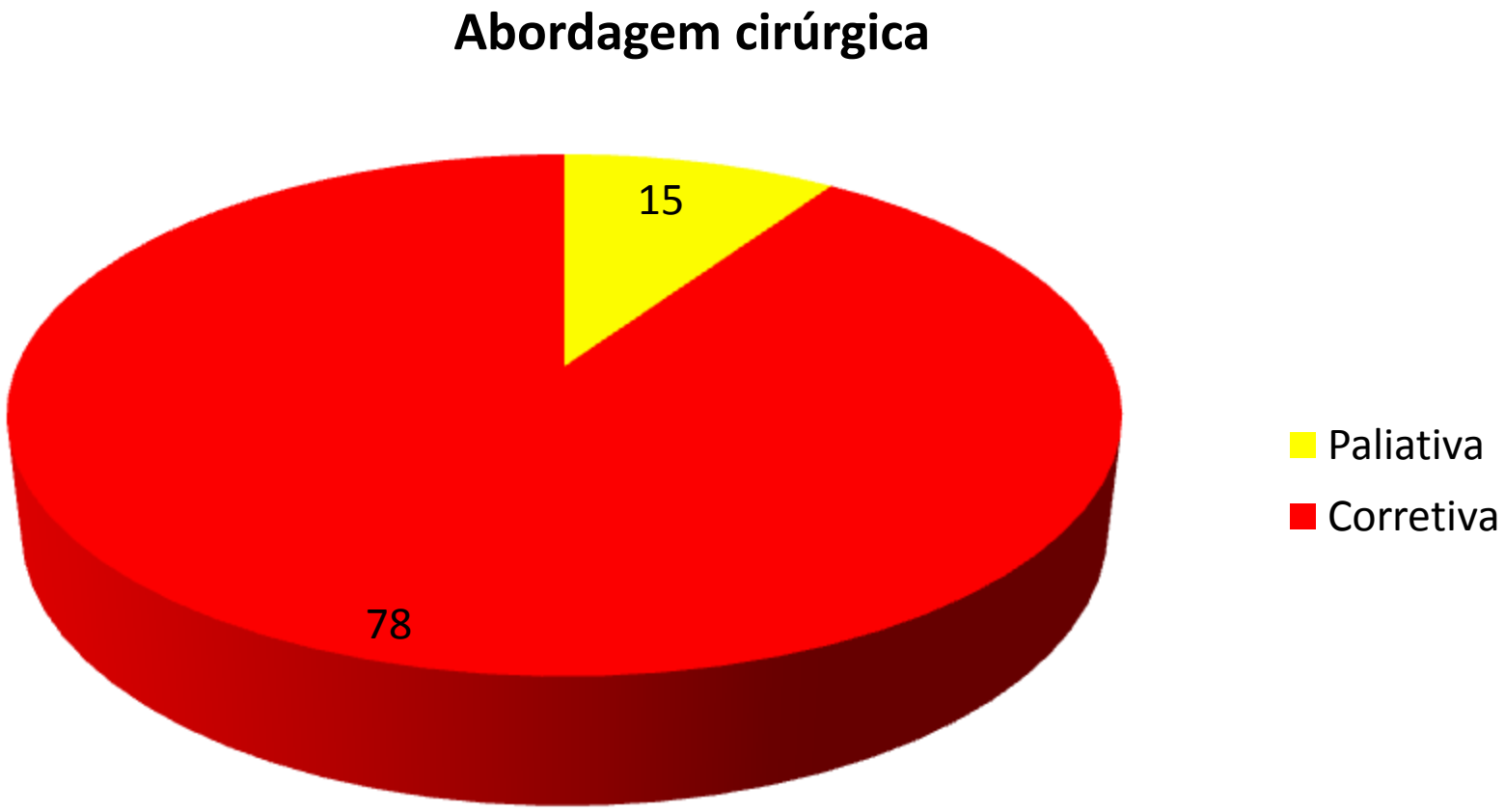
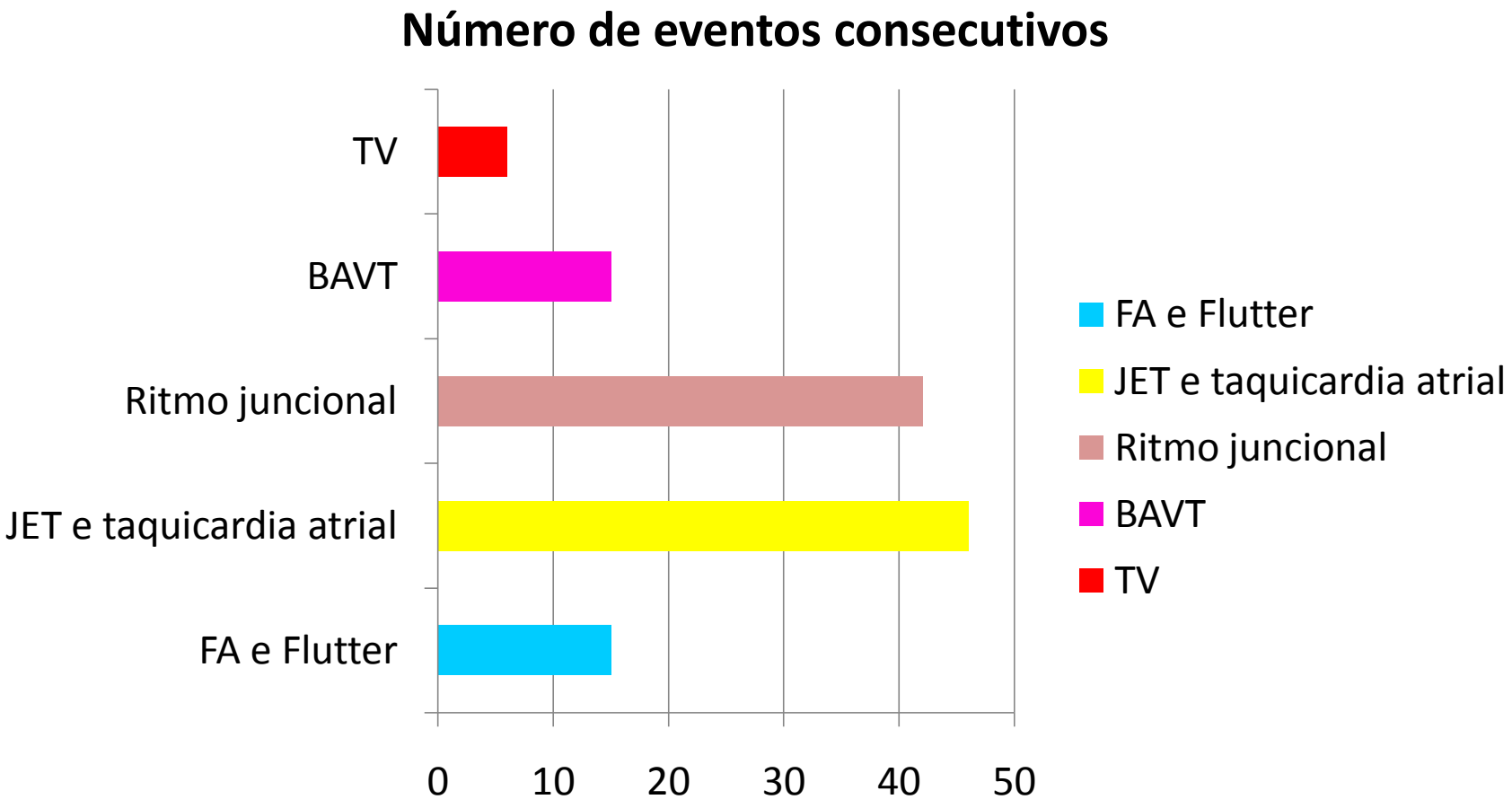
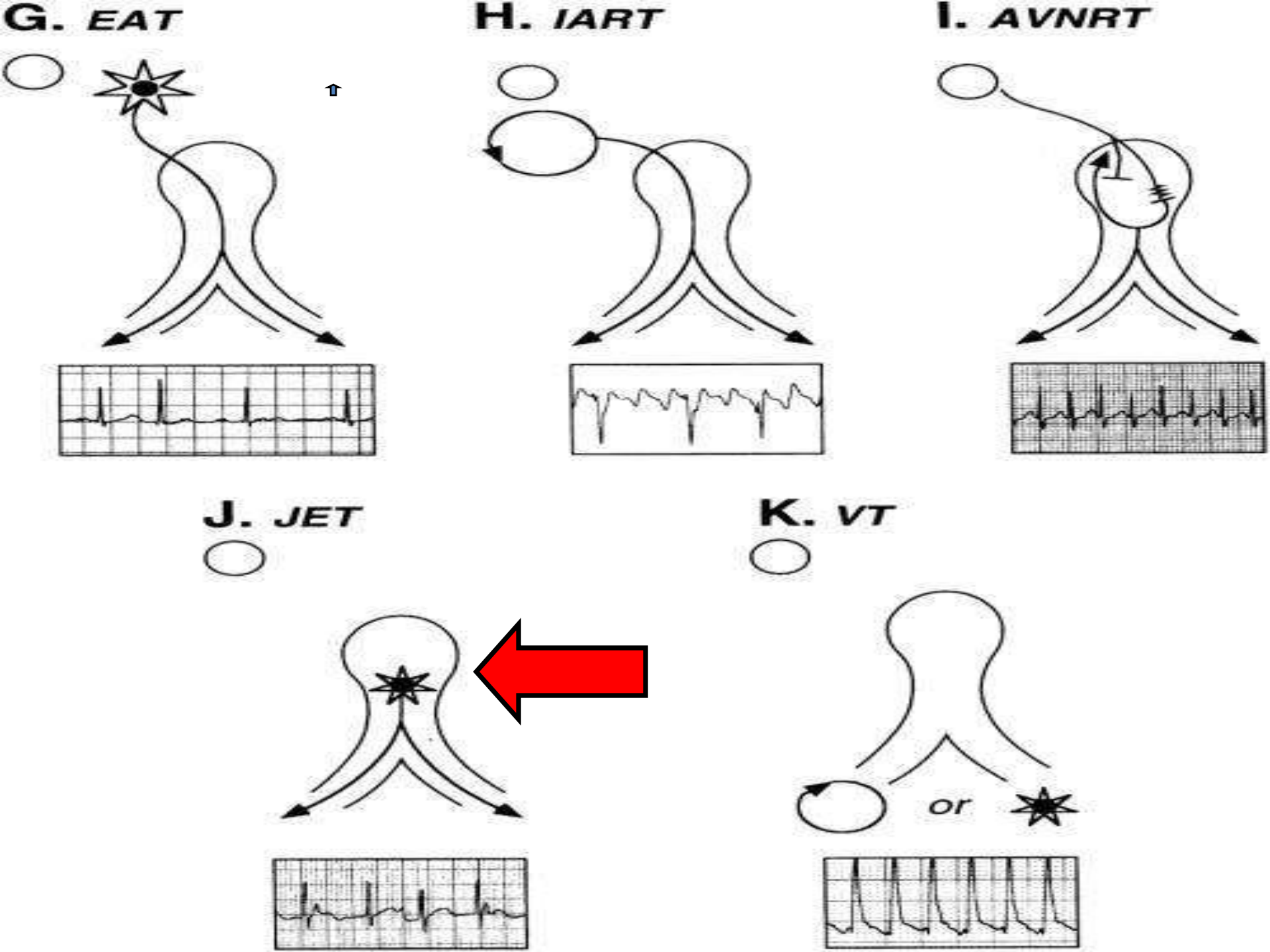


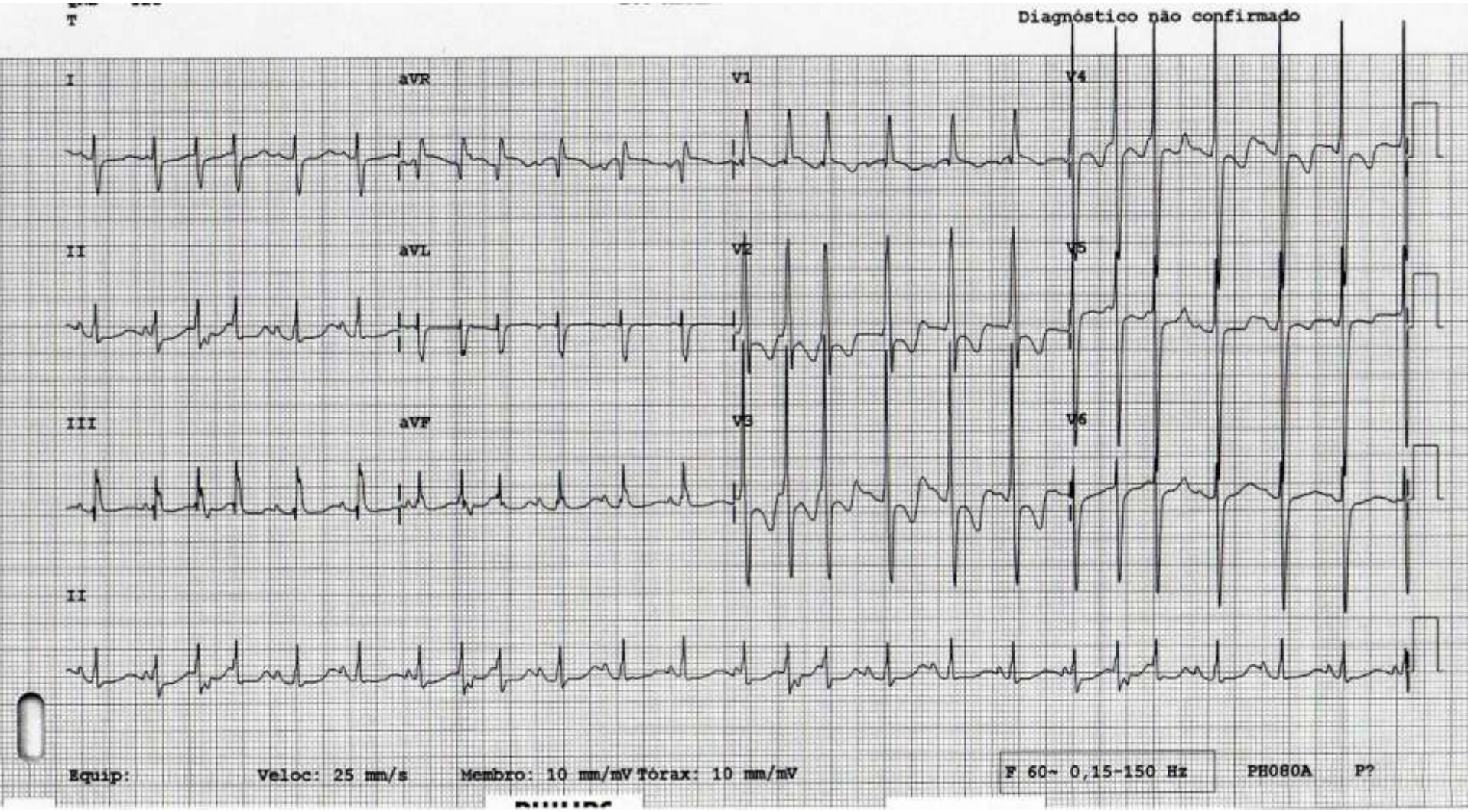
Abordagem cirúrgica nos pacientes portadores de arritmia (n=93)

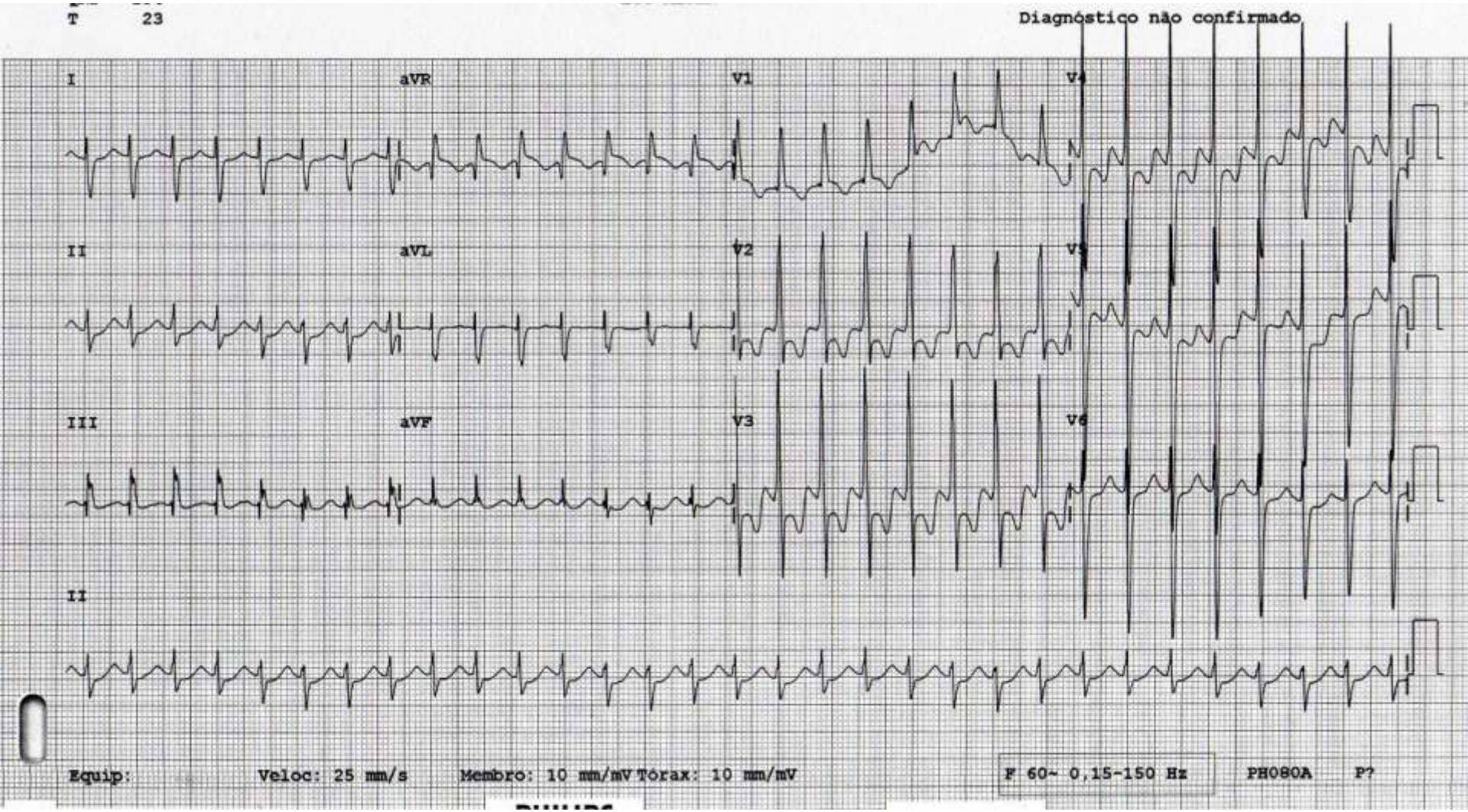


Eventos arritmicos consecutivos (124) em 93 pacientes portadores de arritmias




G. EAT
H. IART
I. AVNRT
J. JET
K. VT
or


Diagnóstico não confirmado
I
aVR
V1
V4
II
aVL
V2
V5
III
aVF
V3
V6
II
Equip:
Veloc: 25 mm/s
Membro: 10 mm/mV
Tórax: 10 mm/mV
F 60~ 0,15-150 Hz
PH080A
P?


T 23
Diagnóstico não confirmado
I
aVR
V1
V4
II
aVL
V2
V5
III
aVF
V3
V6
II
Equip:
Veloc: 25 mm/s
Membro: 10 mm/mV Tórax: 10 mm/mV
F 60~ 0,15-150 Hz
PH080A
P?

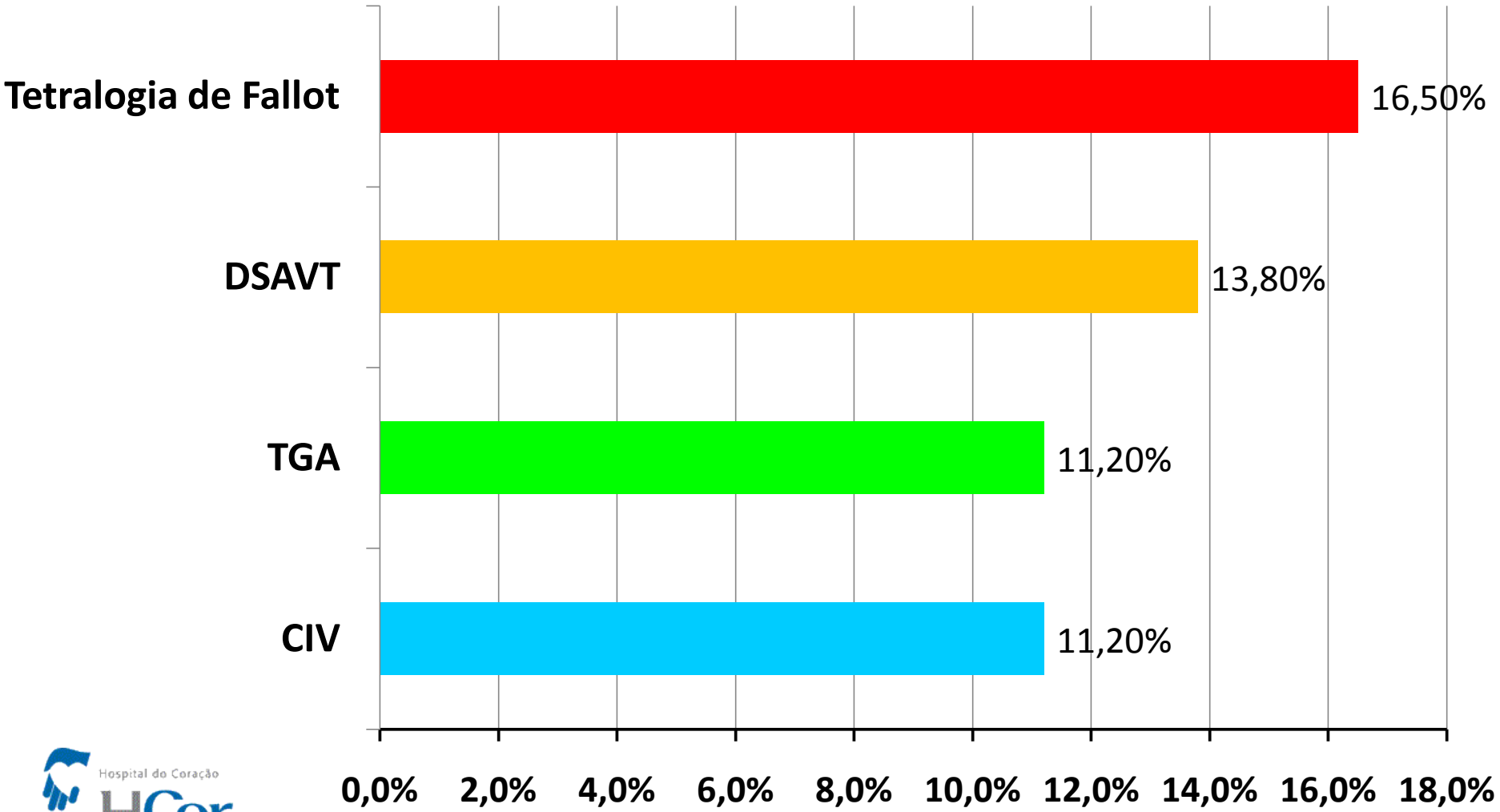
Taquicardia juncional

- Não respondem à adenosina
- Recorrem após cardioversão elétrica
- Podem melhorar conforme evolui o pós operatório

Taquicardia juncional

- Ventilação adequada e correção disturbios metabólicos
- Hipotermia (34-35 graus)
- Sedação
- Sulfato de magnésio
- Overdrive com pace atrial
- Amiodarona ou procainamida

Cardiopatias mais propensas à arritmia



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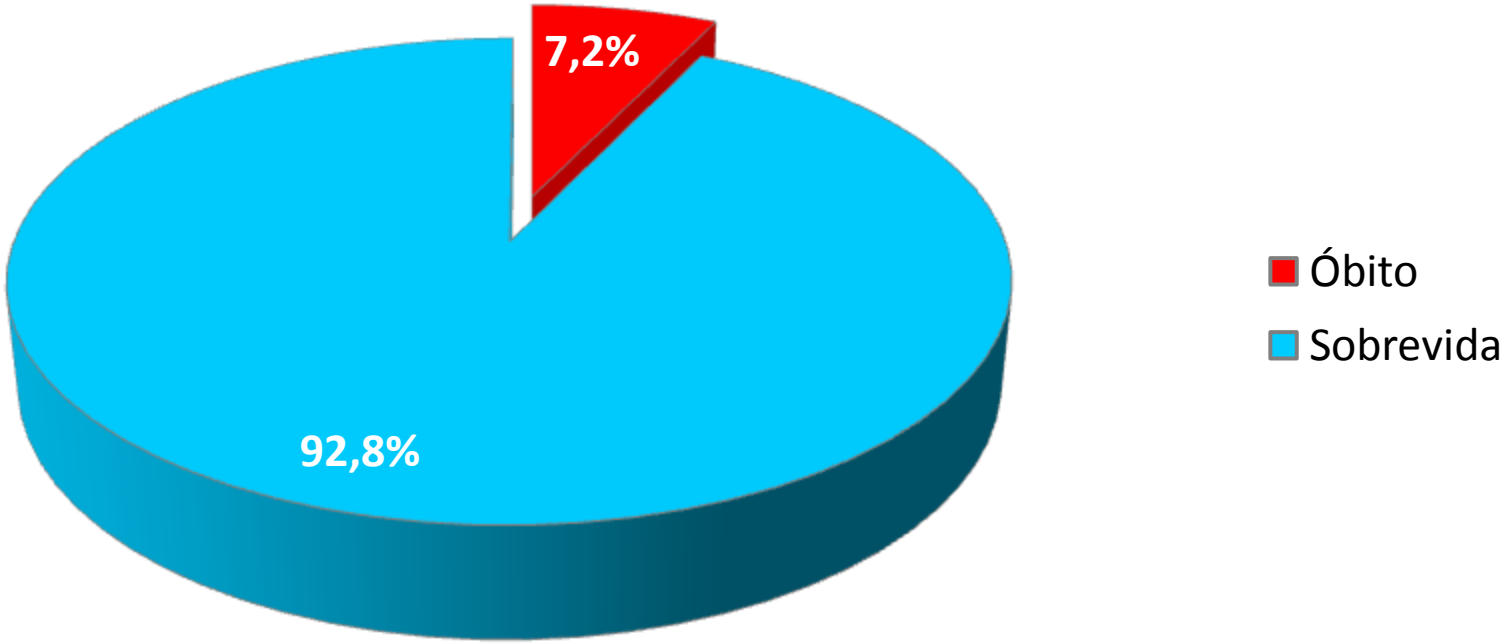
Índice de mortalidade após TSV no pós operatório

Evolução pós arritmia supraventricular



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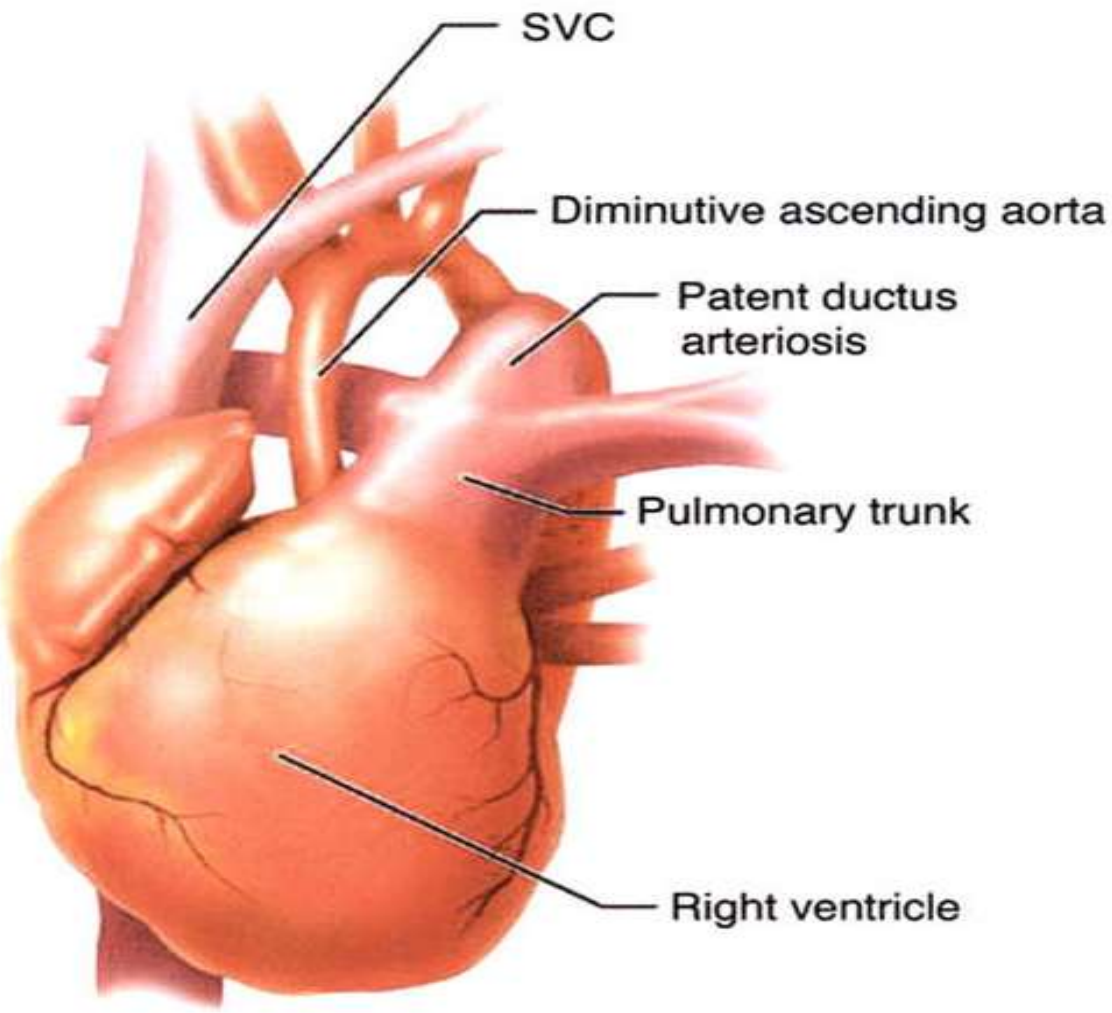
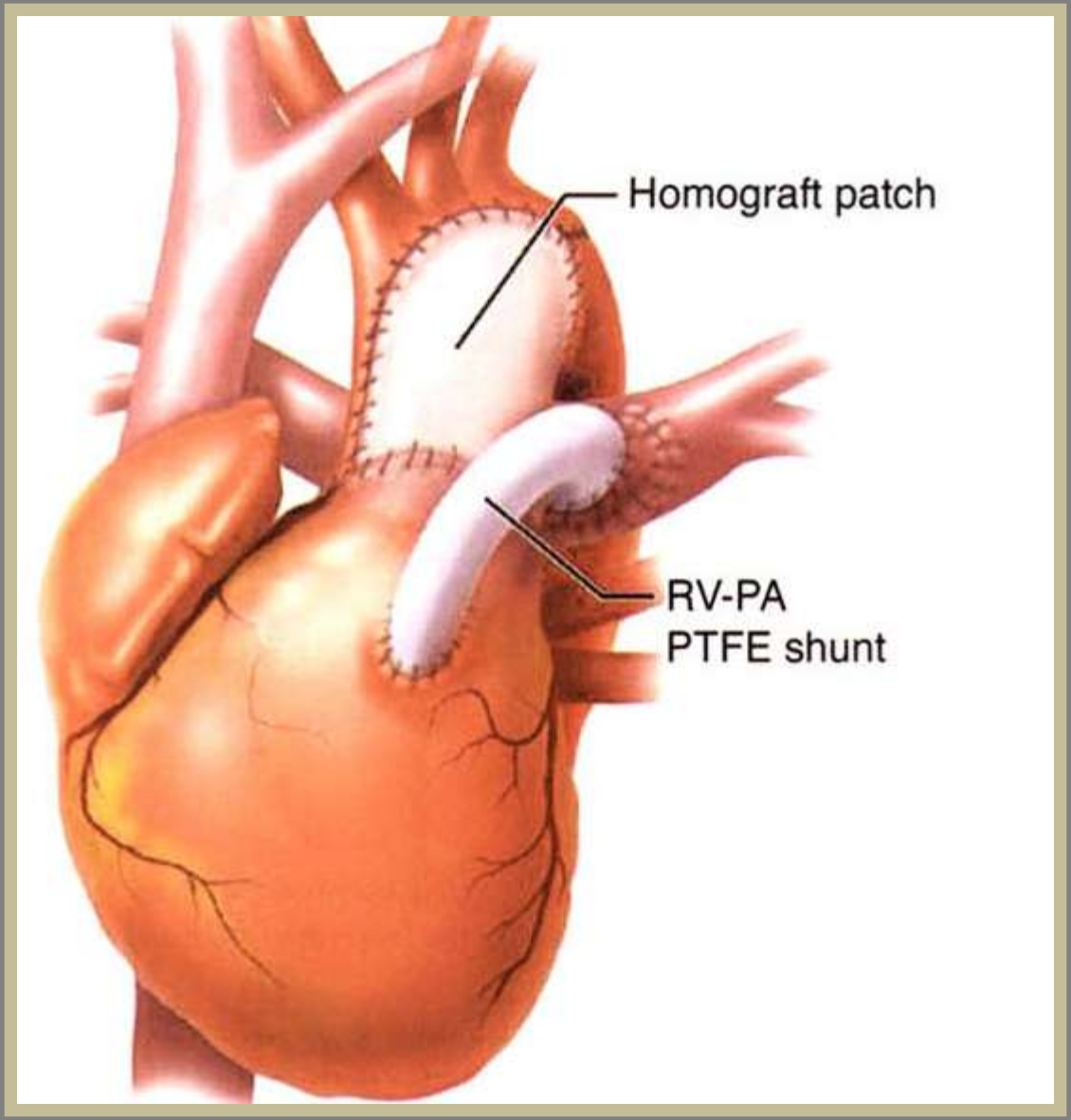
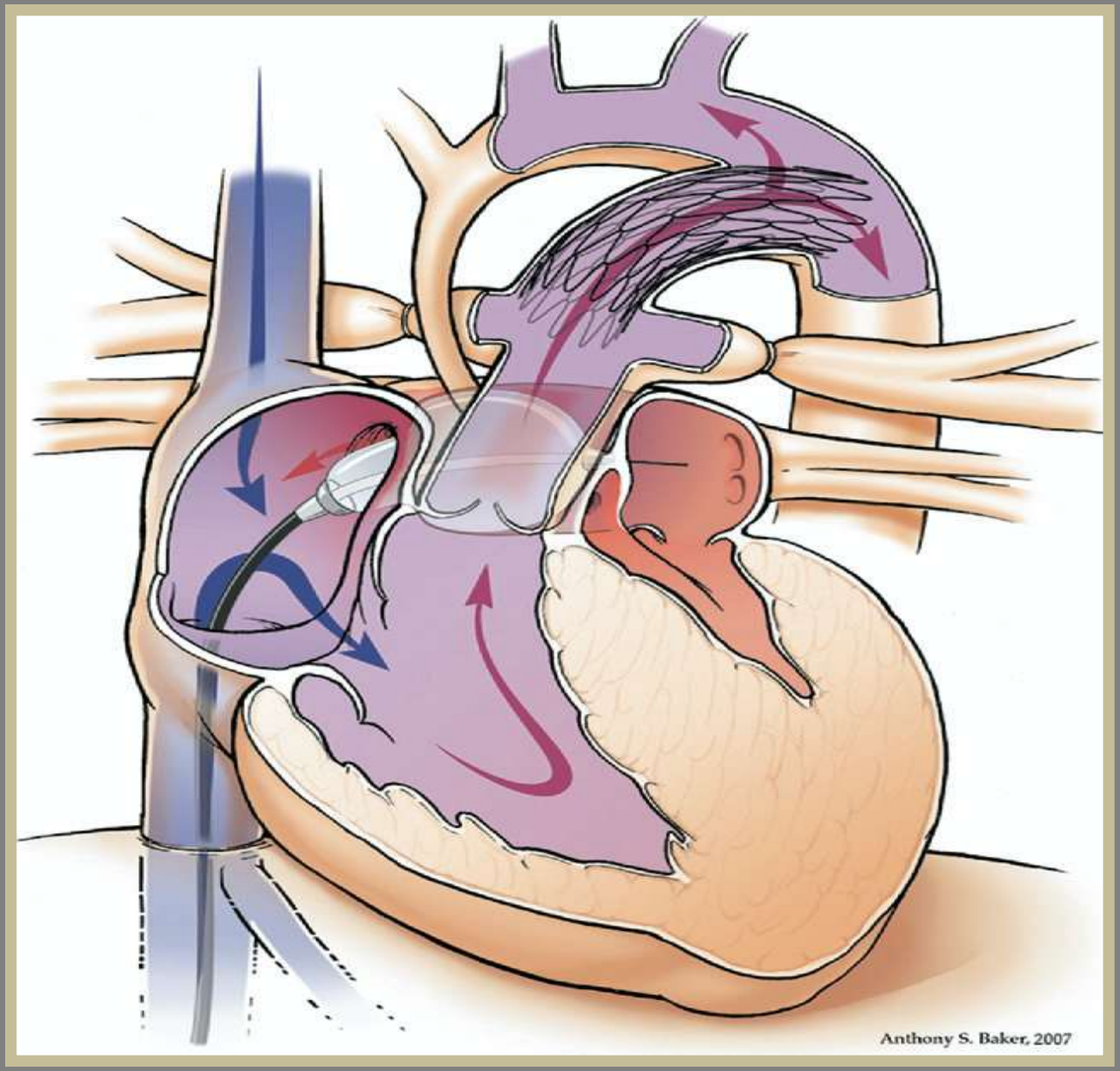

SVC
Diminutive ascending aorta
Patent ductus arteriosis
Pulmonary trunk
Right ventricle


Homograft patch
RV-PA
PTFE shunt

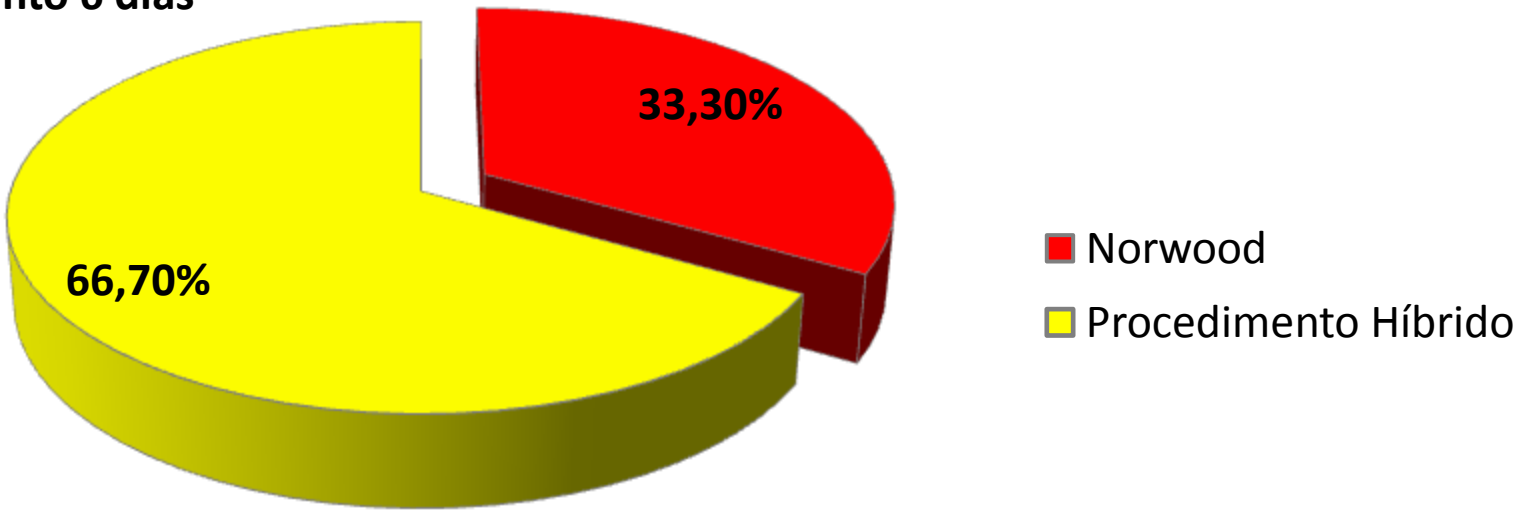

Anthony S. Baker, 2007

Estratégia de abodagem cirúrgica

21 pacientes com fisiologia de SHCE

Idade média do procedimento 6 dias

Tipo de abordagem cirúrgica



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Incidência de arritmias no pós operatório

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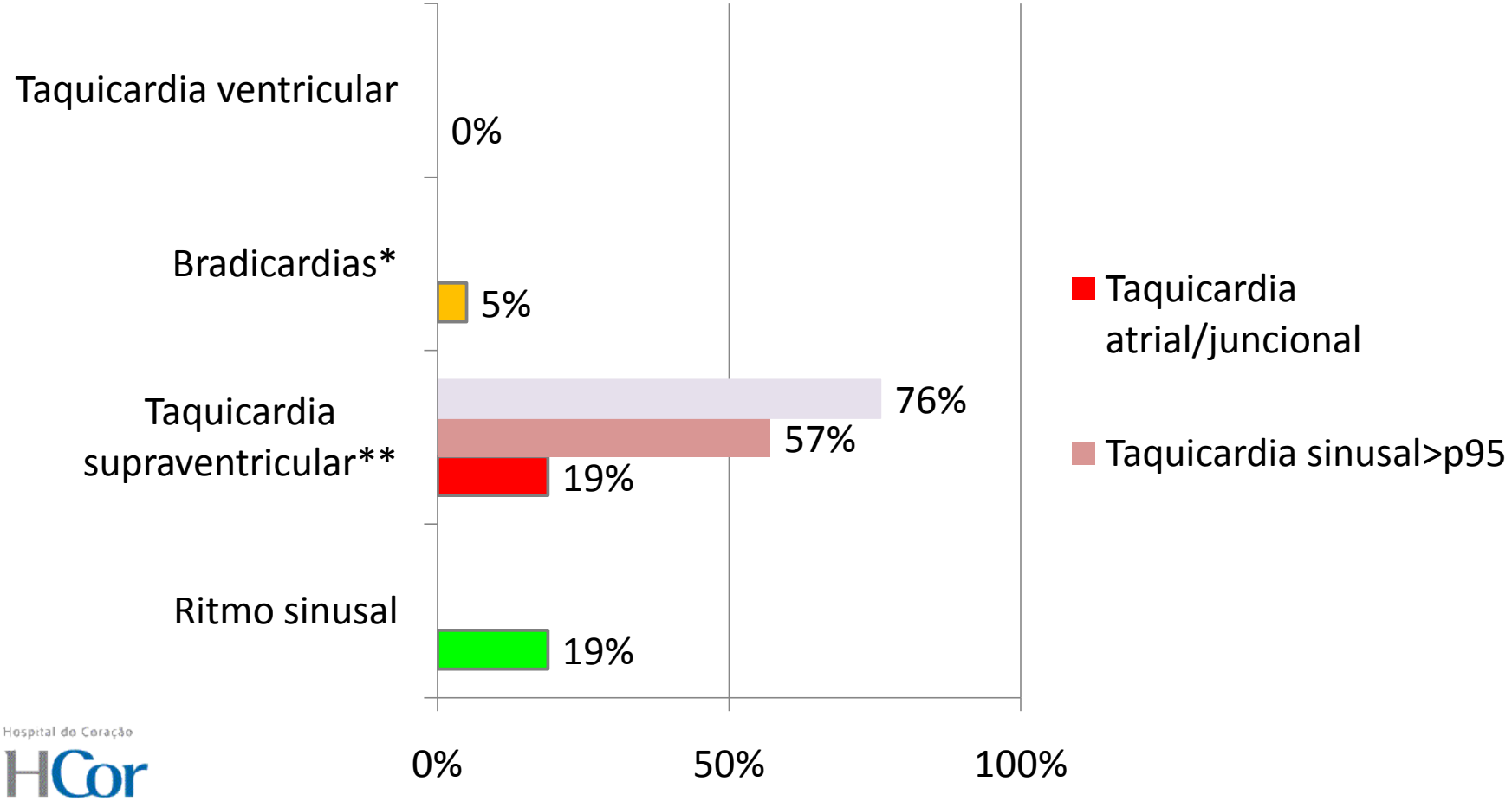
Ritmos encontrados no pós operatório



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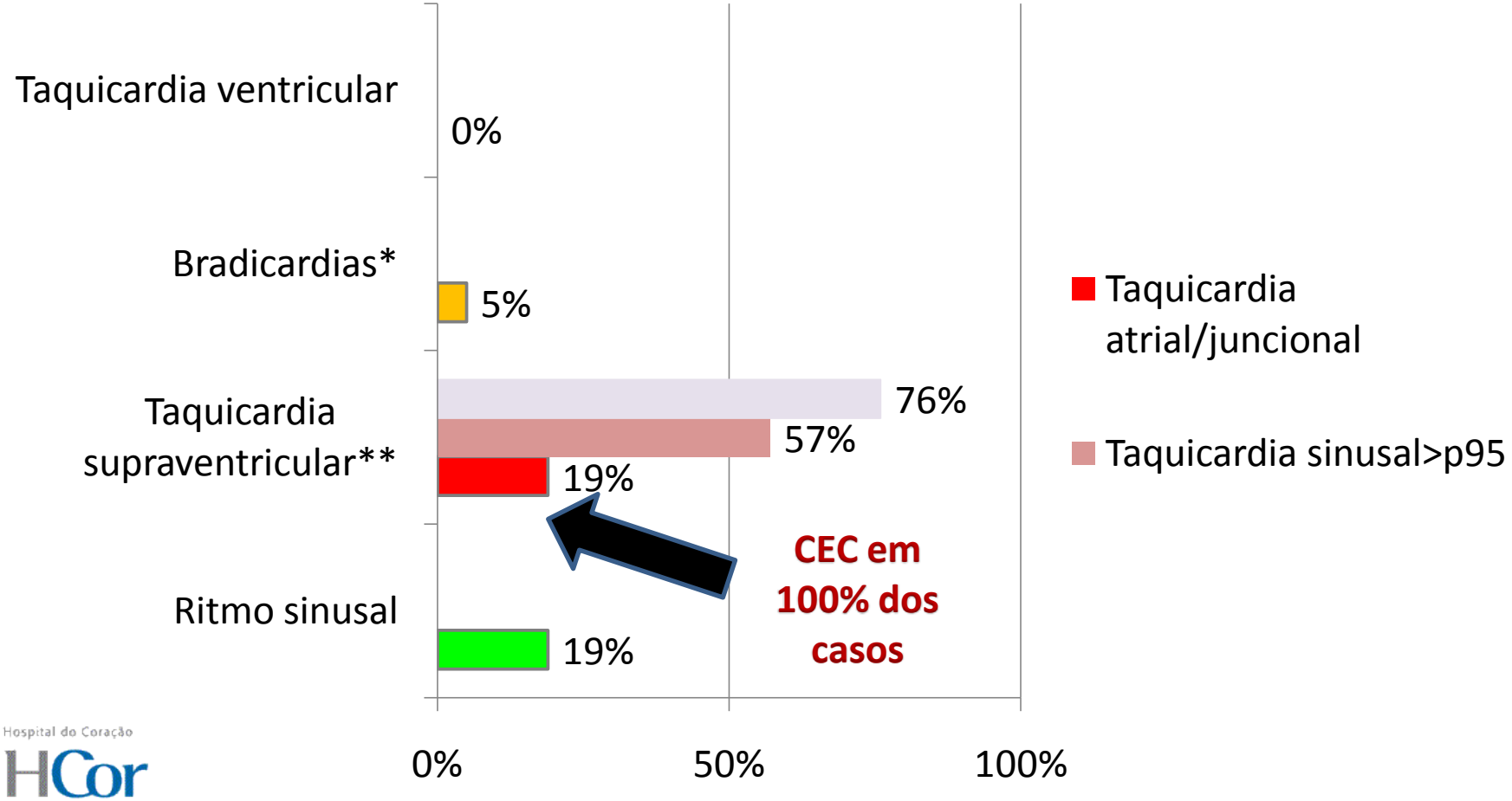
* Bradicardia – 5P com bradicardia sinusal – 1 P necessitou de MP

** Incluindo taquicardia sinusal com FC maior que p95 para idade

Ritmos encontrados no pós operatório



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* Bradicardia – 5P com bradicardia sinusal – 1 P necessitou de MP

** Incluindo taquicardia sinusal com FC maior que p95 para idade

Incidência de PCR no pós operatório

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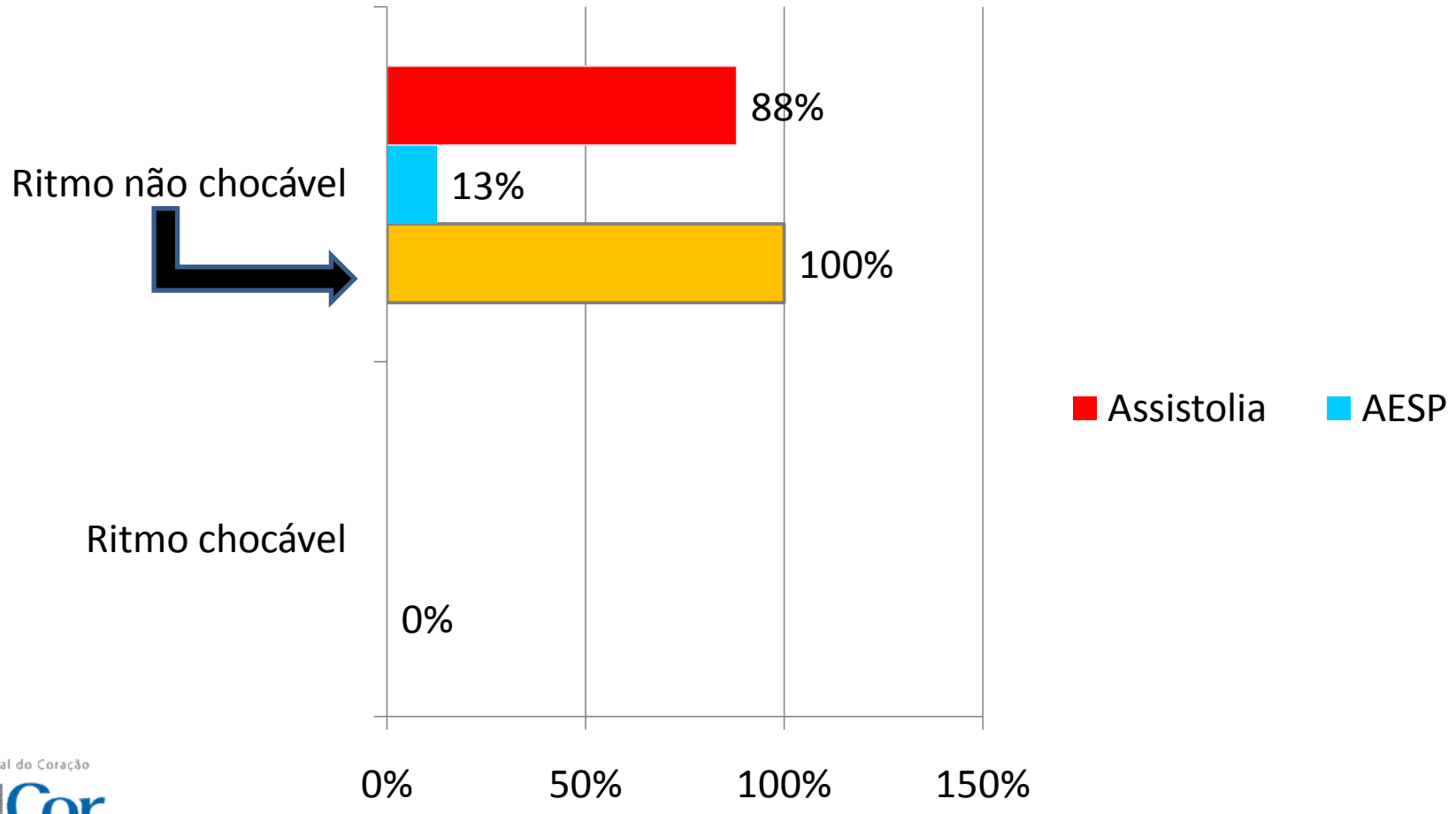
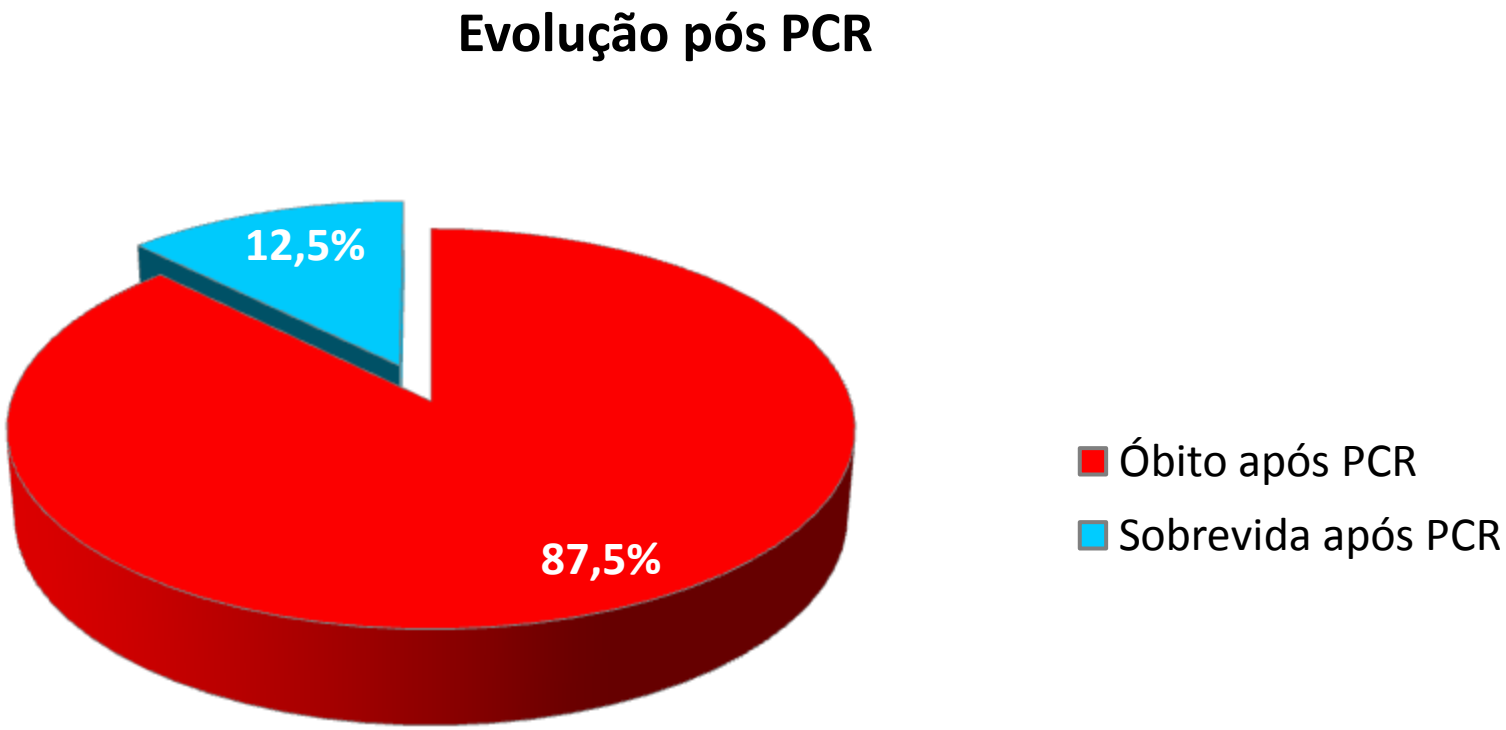
Ritmos encontrados no pós operatório



* Bradicardia – 5P com bradicardia sinusal – 1 P necessitou de MP

** Incluindo taquicardia sinusal com FC maior que p95 para idade

Índice de mortalidade após a PCR



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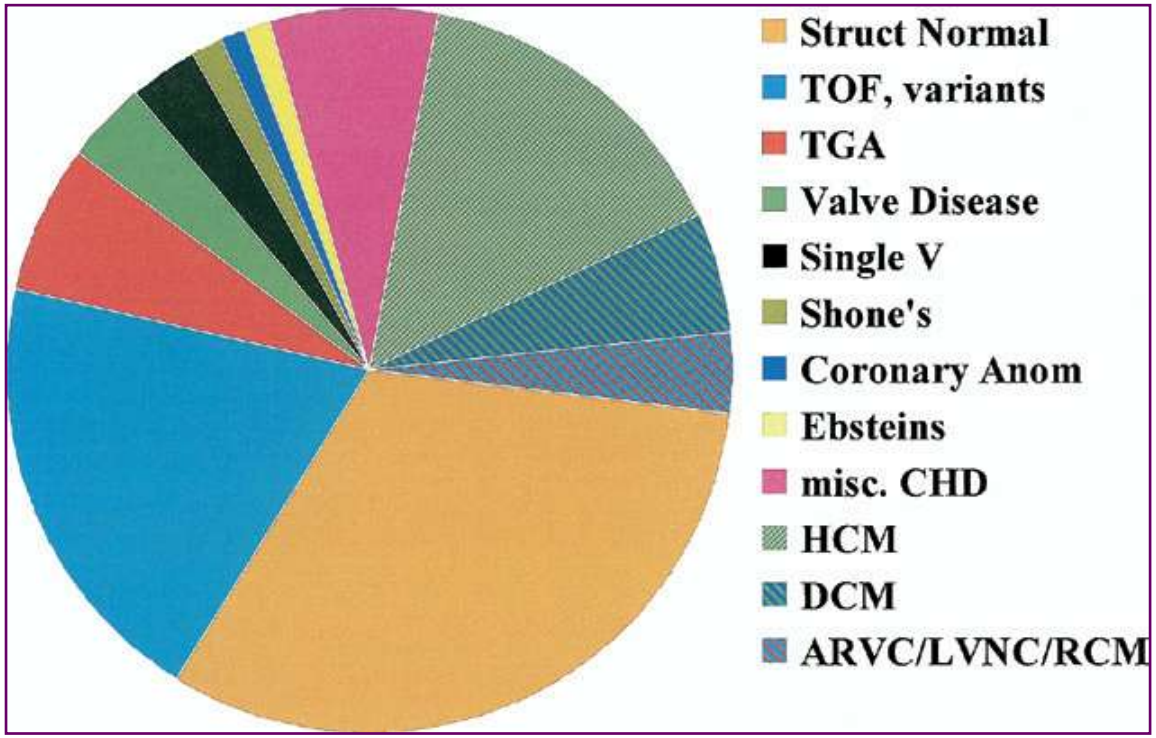
Morte súbita

Results of a Multicenter Retrospective Implantable Cardioverter-Defibrillator Registry of Pediatric and Congenital Heart Disease Patients

Charles I. Berul, MD,* George F. Van Hare, MD,†‡ Naomi J. Kertesz, MD,§ Anne M. Dubin, MD,†Frank Cecchin, MD, Kathryn K. Collins, MD,‡ Bryan C. Cannon, MD,§ Mark E. Alexander, MD,*John K. Triedman, MD,* Edward P. Walsh, MD,* Richard A. Friedman, MD§

Boston, Massachusetts; Palo Alto and San Francisco, California; and Houston, Texas



Anatomic Diagnoses of Pediatric and Congenital Implantable Cardioverter-Defibrillator Recipients

JACC 2008;51:1685–91

Results of a Multicenter Retrospective Implantable Cardioverter-Defibrillator Registry of Pediatric and Congenital Heart Disease Patients

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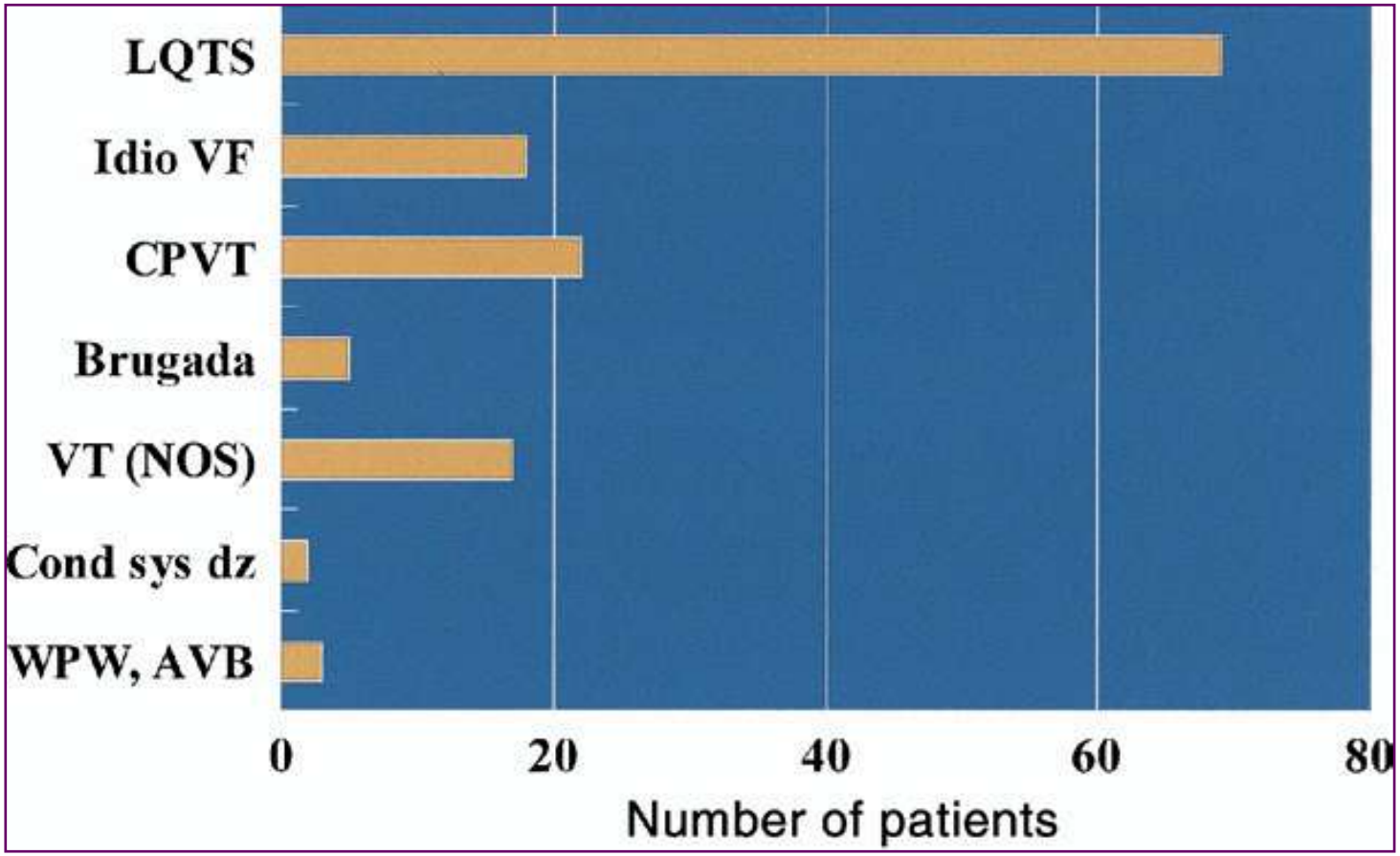
Boston, Massachusetts; Palo Alto and San Francisco, California; and Houston, Texas



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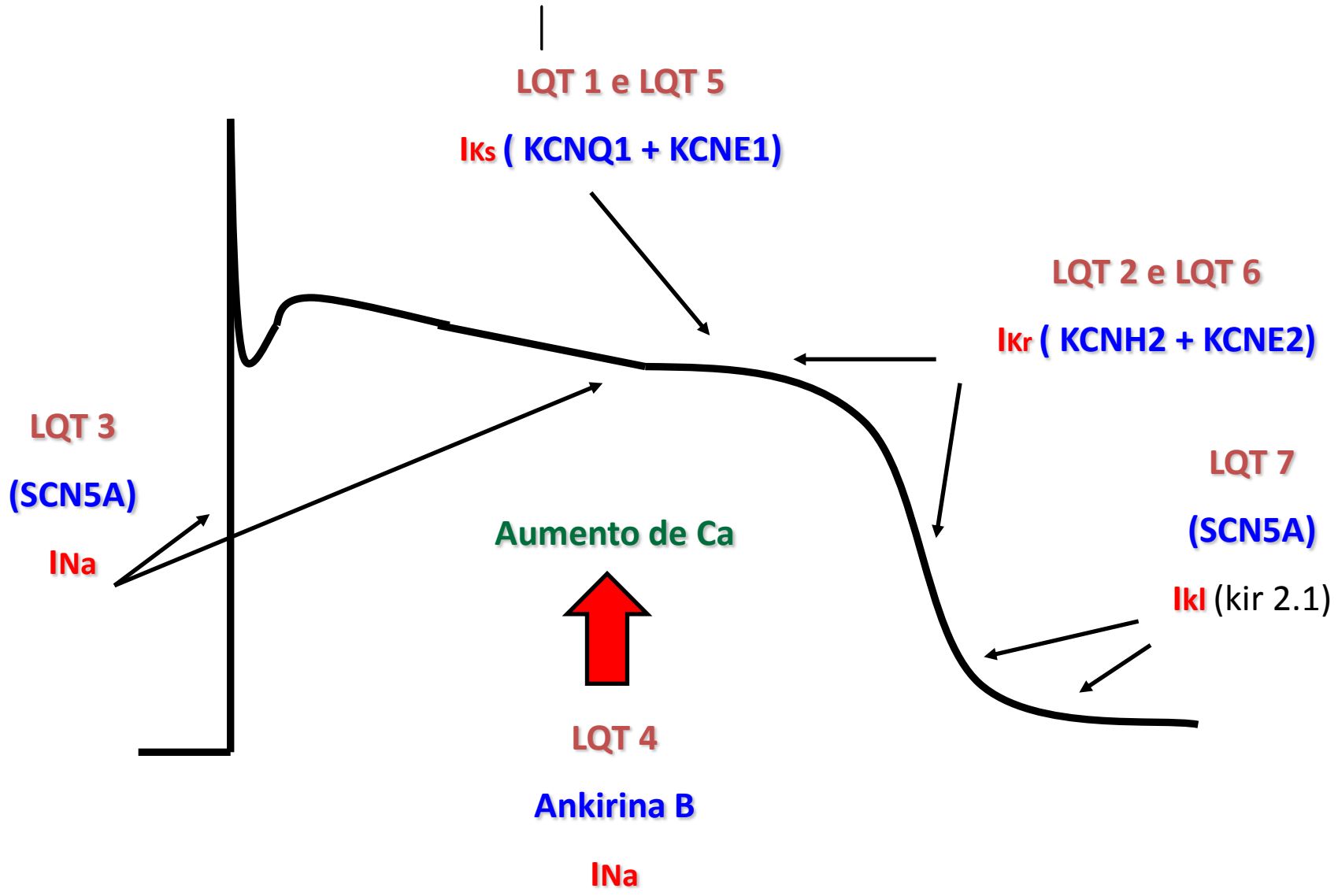
Sudden infant death syndrome: Do ion channels play a role?

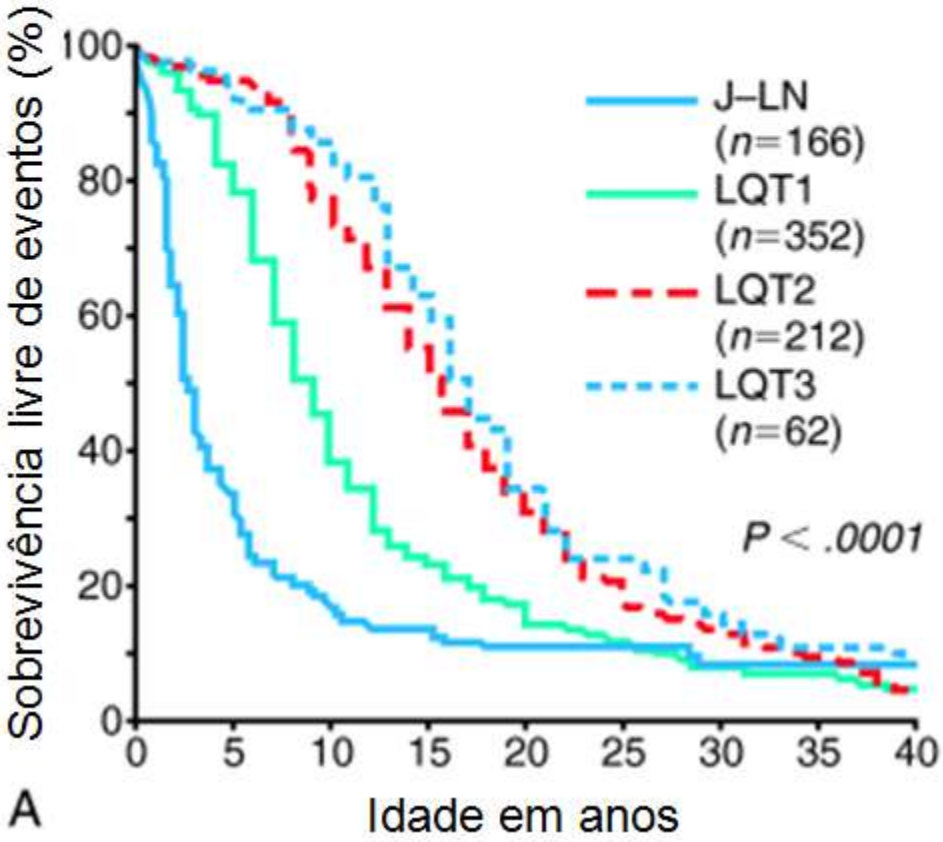
David W. Van Norstrand, BS, Michael J. Ackerman, MD, PhD

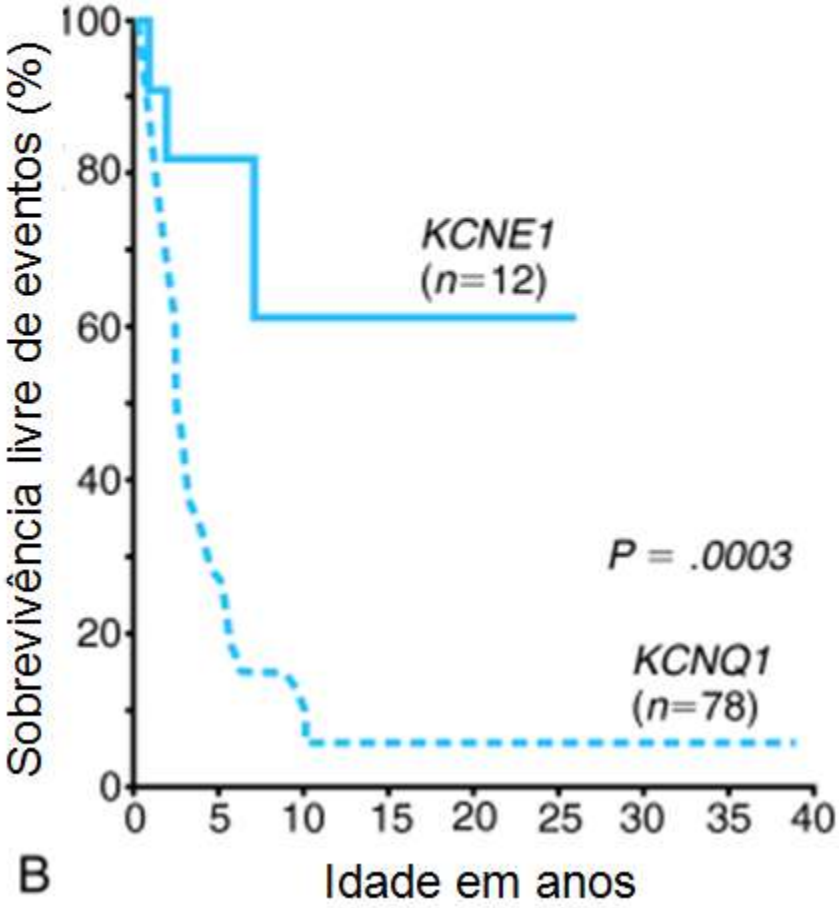
Table 2 Channelopathy genes implicated in pathogenesis of sudden infant death syndrome

Gene	Channelopathy genotype	Reference
CAV3	LQT9	50
GPD1L	BrS2	51
KCNE2	LQT6	47
KCNH2	LQT2/SQT1	47, 49
KCNQ1	LQT1/SQT2	44, 47, 49
RYR2	CPVT1	34
SCN5A	LQT3, BrS1	42, 43, 45, 47

BrS = Brugada syndrome; CPVT = catecholaminergic polymorphic ventricular tachycardia; LQT = long QT syndrome.


LQT 1 e LQT 5
IKs (KCNQ1 + KCNE1)
LQT 2 e LQT 6
IKr (KCNH2 + KCNE2)
LQT 3
(SCN5A)
INa
Aumento de Ca
LQT 7
(SCN5A)
IkI (kir 2.1)
LQT 4
Ankirina B
INa





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Cardiac rhythm devices in the pediatric population: Utilization and complications

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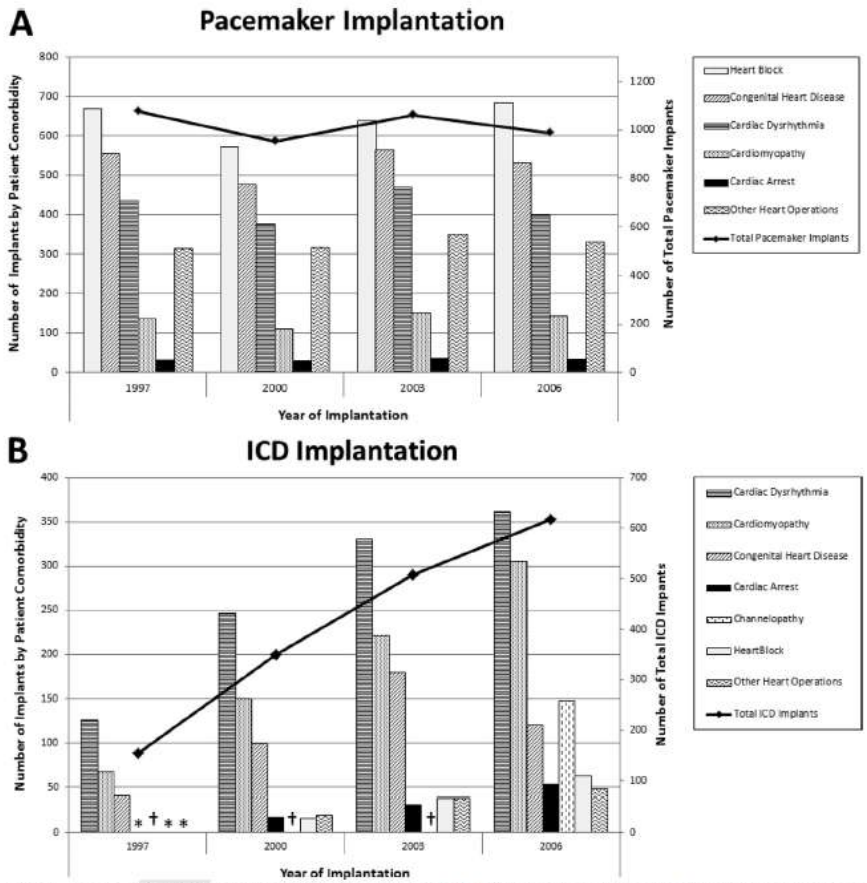

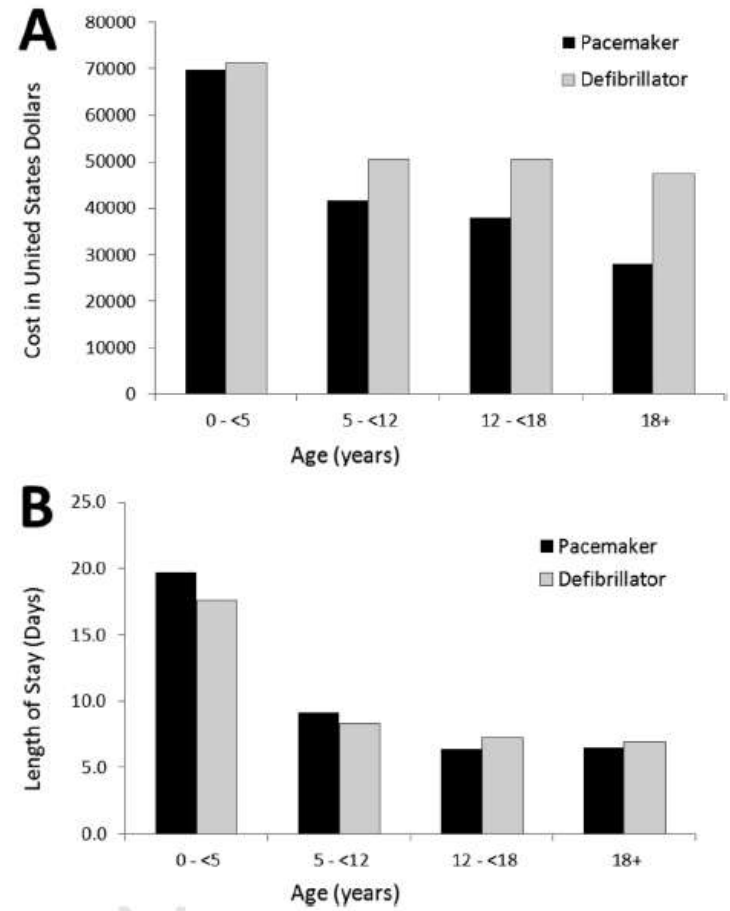

Conclusões

Tratar pacientes pediátricos envolve não só o conhecimento das arritmias cardíacas mas também o conhecimento da neonatologia e da pediatria, pois se a criança não é um adulto em miniatura o neonato e o lactente possuem necessidades especiais e certamente não são apenas crianças muito pequenas

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Obrigado !!!

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