# VENTRICULAR FASCICULAR TACHYCARDIA IN CYCLIST ATHLETE


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# CASO CLÍNICO
# CASE REPORT

- Homem jovem (32 anos), caucasiano, longilíneo, católico, casado, atleta (ciclista que percorria 400 km por semana) com queixas de palpitações há dois anos, que ocorriam predominantemente logo após a realização de atividades físicas intensas, acompanhadas de dor torácica não característica
- Young man (32 years), Caucasian, ectomorph biotype, catholic religion, married, athlete (cyclist that covered 400 km per week) with complaints of palpitations for two years. They occurred predominantly when he carried through intense physical activities, associated with not characteristic chest pain
- Nunca apresentou sintomas de baixo débito ou síncope
- He never presented symptoms of low debit (near-syncope) or syncope
- Antecedentes familiares de morte súbita precoce ou doença genética negativos
- Negative familiar antecedents of precocious sudden death or genetic illness in relatives
- Exame físico negativo NDN
- Normal physical examination
- Registrado evento taquiarrítmico
- Tachyarrhtmia event was recorder
- O ECG em ritmo sinusal realizado imediatamente após o evento
- The ECG in sinus rhythm was recorded immediately after event
- O ecocardiograma e cinecoronariografia foram normais
- Normal echocardiogram and Coronariography
- Realizado estudo eletrofisilógico
- Intracardiac electrophysiology study (EPS) was performed

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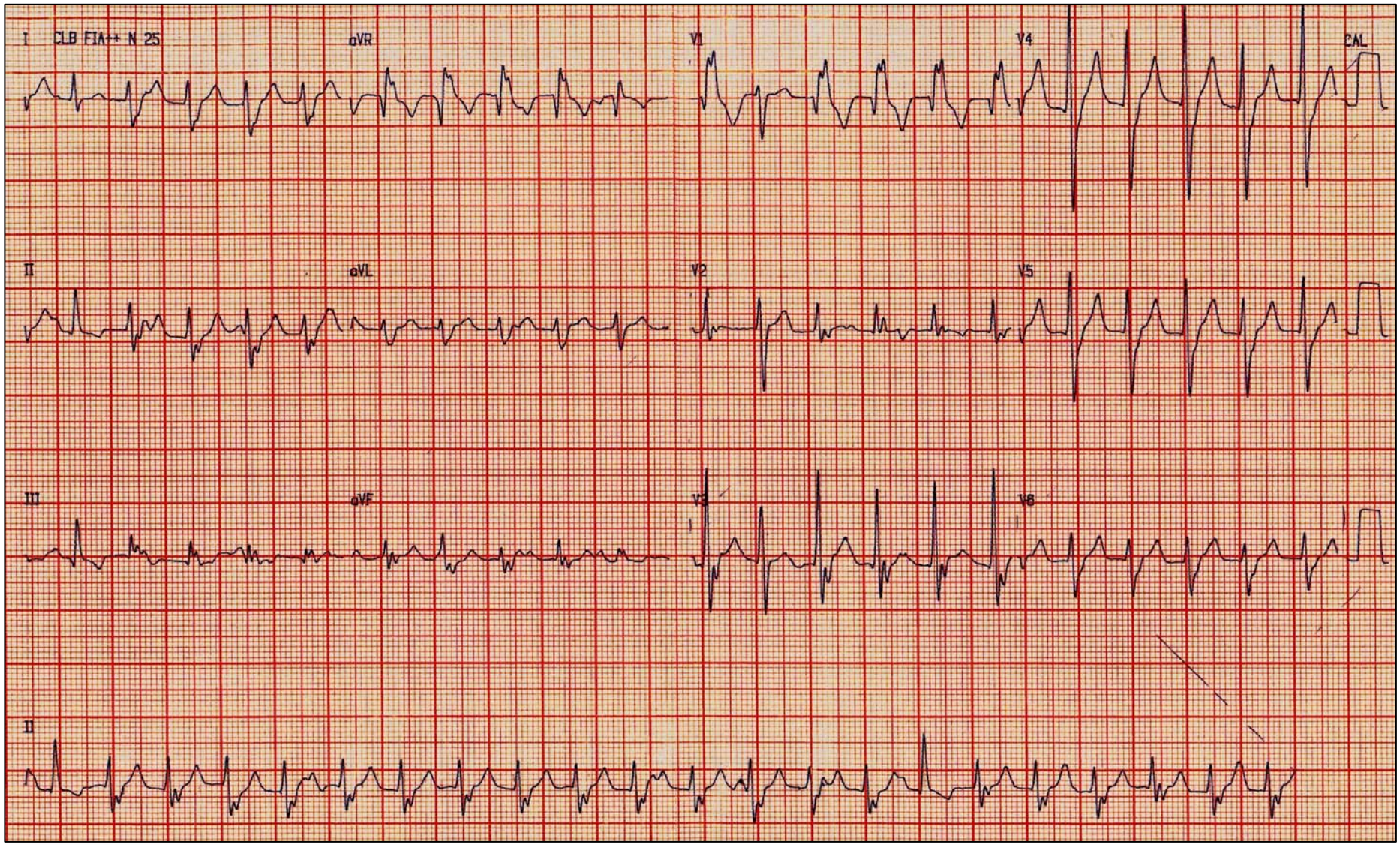
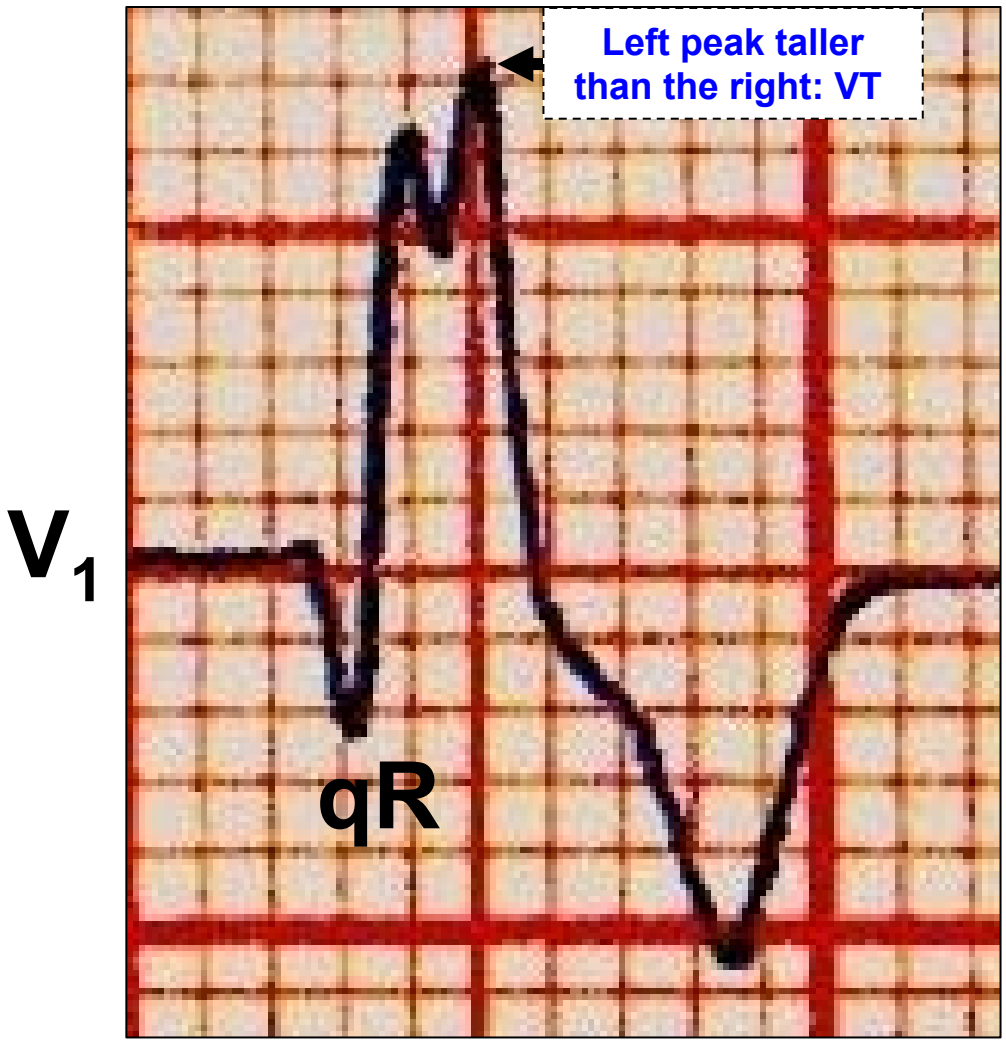
# ECG DURANTE EVENTO TAQUIARRÍTMICO
# ECG DURING TACHYARRHTMIA EVENT



# ELEMENTOS DE ARRITMIA VENTRICULAR
# VENTRICULAR TACHYCARDIA FEATURES

2do pico do QRS >1ro = TV

**Padrão de BCRD com bifasismo em V1**
**qR: RBBB with biphasic pattern in V1 lead = VT**





**PADRÃO MONOFÁSICO OU BIFÁSICO EM V1**
**MONOPHASIC OR DIPHASIC COMPLEX (R, qR or RS) IN LEAD V1=VT[1]**

**O sinal da "orelha de coelho"** **The "rabbit ear clue" sign[2]**


1) Wellens HJJ et al. Am J Med 1978;64:27
2) Gozensky C, et al. Heart Lung. 1974;3:634-636.

# DURAÇÃO DO QRS/QRS DURATION

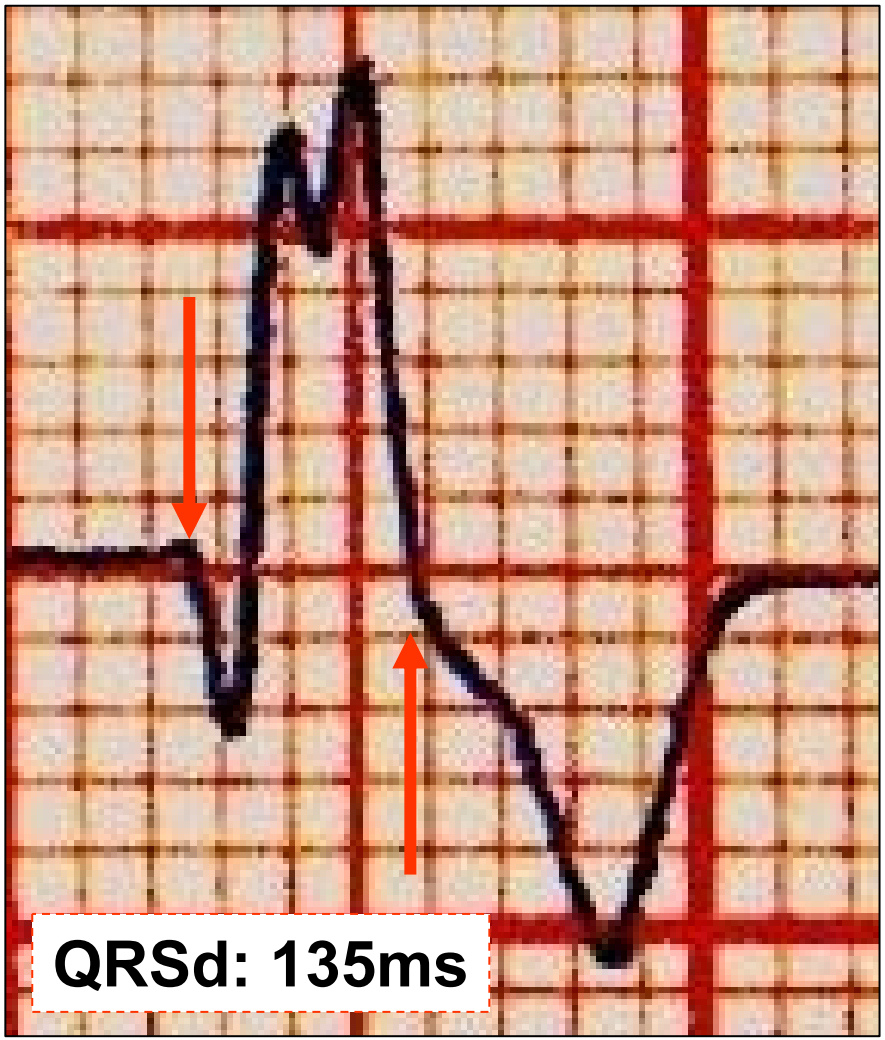
**ABERRÂNCIA OU ECTOPÍA?**
**ABERRANCY VERSUS ECTOPY**

VT: WIDTH

SVT: ≤ 140ms

FASCICULAR VT
≤ 140ms

**$V_1$**

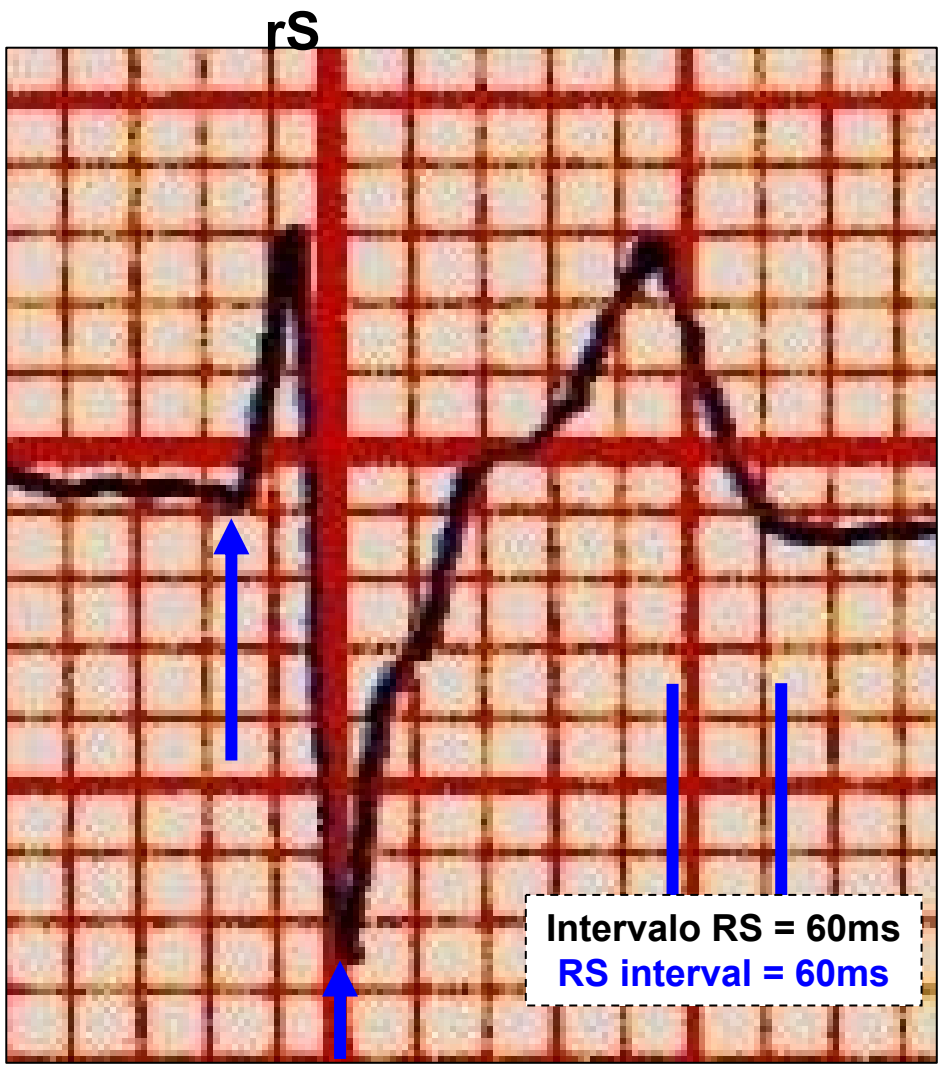



**TV COM DURAÇÃO DO QRS NÃO MUITO LARGO BORDERLINE-BROAD COMPLEX VT**

## CHAVE DIAGNÓSTICA PARA IDENTIFICAÇÃO DA TV FASCICULAR IDIOPÁTICA

## DIAGNOSTIC CLUES FROM THE SURFACE ECG TO IDENTIFY IDIOPATHIC (FASCICULAR) VT

TYPICAL VT HAS RS INTERVAL >80ms



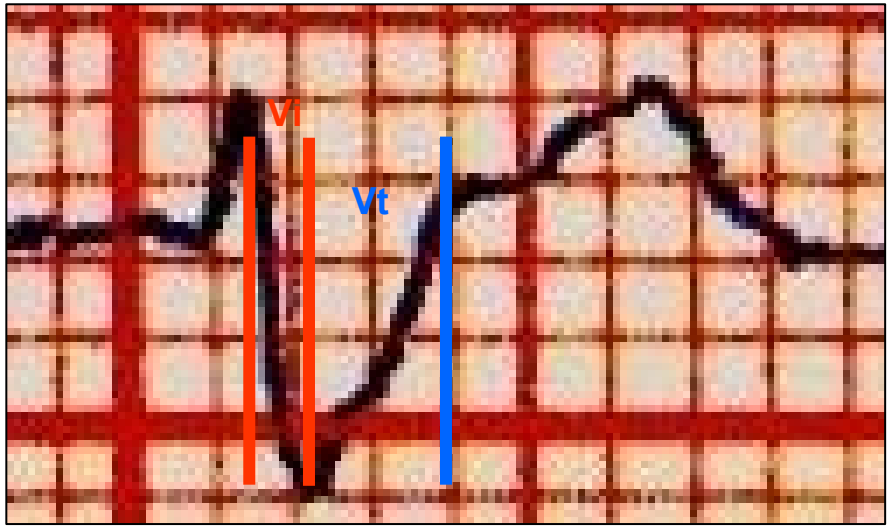

**Um padrão rS em V6 = TV**
**An rS pattern in V6 favor VT**

**Relação RS em V6 <1 = TV**
**RS ratio V6 <1 = VT**

**Intervalo RS <80ms em todas as derivações precordiais indica TV intrafascicular sensível ao Verapamil**
**RS interval < 80 ms in all precordial leads: Verapamil-sensitive Intrafascicular VT**

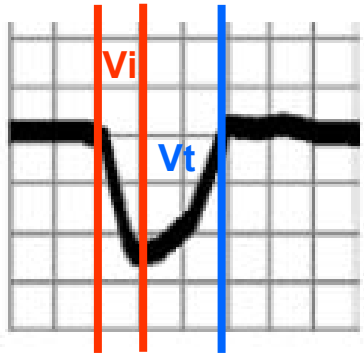
Brugada P, et al. Circulation. 1991;83:1649-1659.

**Vi/ Vt <1 = VT**




**Vt: terminal excursion of QRS complex.**

(rapid)



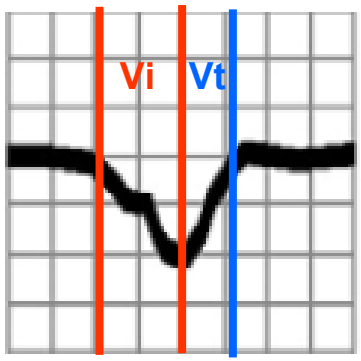

**Vi: initial excursion of QRS complex.**
**≤1 = TV**

**Vt: terminal excursion of QRS complex.**

(slow)

QS

(notched)




**Vi: initial excursion of QRS complex.**
**>1 = TVS**

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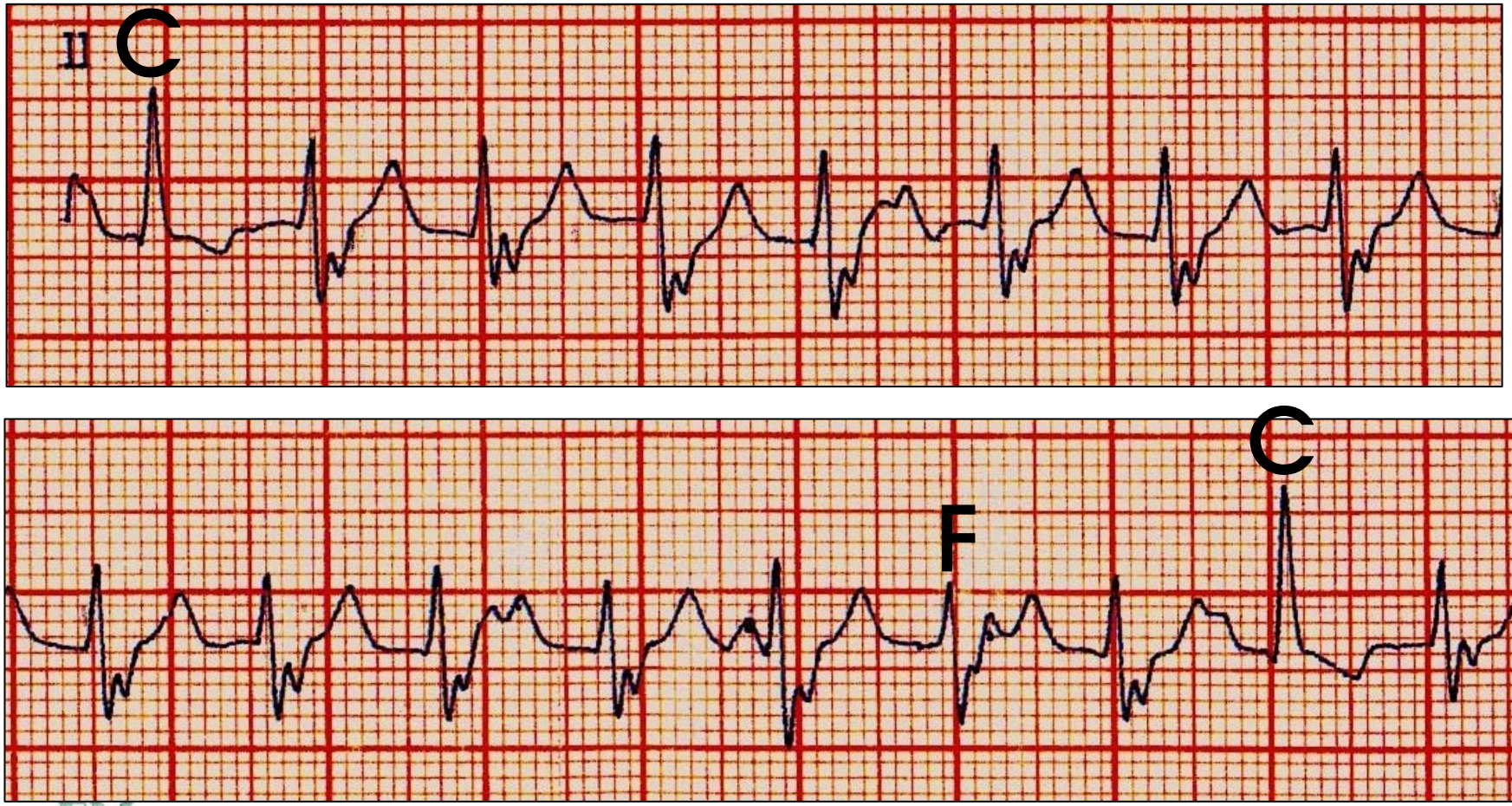
**Vereckei A, et al. Heart Rhythm. 2008; 5: 89**

# ELEMENTOS DE ARRITMIA VENTRICULAR
# VENTRICULAR TACHYCARDIA FEATURES

**Dissociação AV: batimentos de captura e de fusão** **AV dissociation: capture and fusion beats**

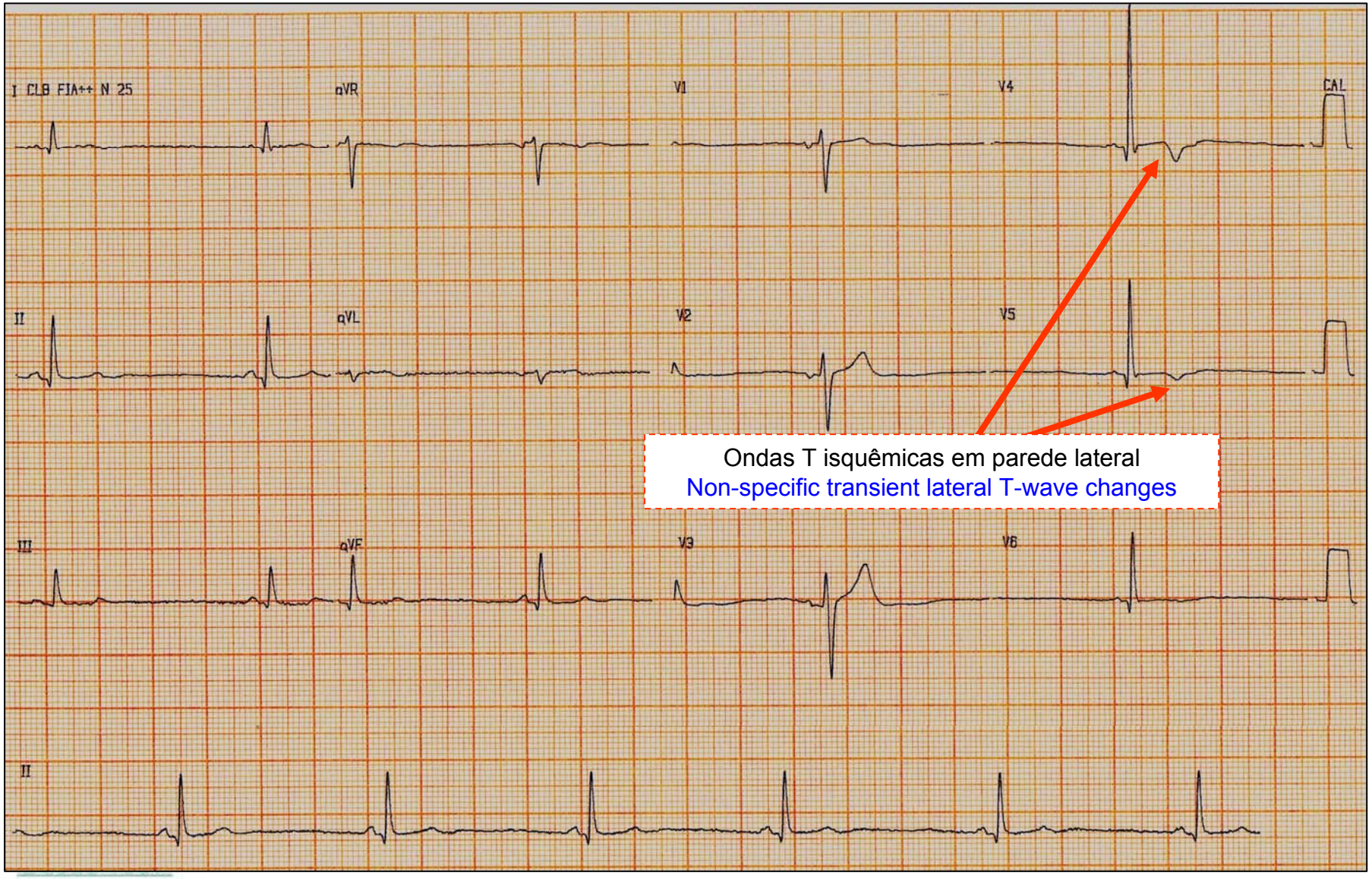



**C: Batimentos de captura**
**F: Batimentos de fusão**

**C: Capture beat**
**F: Fusion beat (intermediate pattern between "pure" sinus rhythm and extrasistolic event)**

## O ECG em ritmo sinusal realizado imediatamente após o evento

## The ECG in sinus rhythm was recorded immediately after event



# EEF/EPS

- **REGISTROS DE BASE**
  **BASAL RECORDINGS**

- Ritmo do inicio sinusal
  **Onset rhythm sinus**

- FC: 60
  **HR: 60**

- Intervalos/Intervals: AH: 95mseg (VN: 50-120mseg) **AH: 95 ms (VN: 50-120 ms);** HV: 45mseg (VN: 35-55mseg) **HV: 45ms (VN: 35-55 ms)**

- **ESTIMULAÇÃO ATRIAL PROGRAMADA**
  **PROGRAMMED ATRIAL STIMULATION**

- **Decremental: Sem indução de arritmia**
  **Decremental: No induction of arrhythmia**

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# EEF/EPS

- **ESTIMULAÇÃO VENTRICULAR PROGRAMADA/ PROGRAMMED VENTRICULAR STIMULATION**

  – Ausência de condução ventrículo-atrial. Durante a estimulação ventricular programada houve indução de taquicardia de QRS largo, padrão de BRD e eixo superior com ciclo de freqüência de 420 ms.

  **Absence of ventriculo-atrial conduction. During programmed ventricular stimulation, there was induction of tachycardia of wide QRS, RBBB pattern, and upward axis with rate cycle of 420 ms**

# EEF/EPS

- **ABLAÇÃO POR RADIOFREQUÊNCIA DA ECTOPIA VENTRICULAR**

  **RADIOFREQUENCY ABLATION OF VENTRICULAR ECTOPIA**

- Mapeamento do VE procurando a maior precocidade da ectopia em relação ao QRS. Realizada ablação com aplicações termo-controladas (60º C, 30'') de radiofreqüência em **REGIÃO MÉDIO SEPTAL DA PAREDE ANTERIOR.** Após 30' de espera, não houve recorrência da arritmia, mesmo com estimulação ventricular programada de até 3 extra estímulos e sob infusão de isuproterenol. **LV mapping looking for the earliest ectopia in relation to QRS. Ablation was conducted with thermocontrolled applications (60ºC, 30´´) of radiofrequency in the middle-septal region of the anterior wall. After waiting for 30´, there was no recurrence of arrhythmia, even after programmed ventricular stimulation with up to 3 extra-stimuli and on isuproterenol infusion**

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# EEF/EPS

LABORATÓRIO DE ELETROFISIOLOGIA ST. JUDE MEDICAL

Version WINDOWS XP : EPTRACER V1.061


Patient : ribeiro adenilson / /

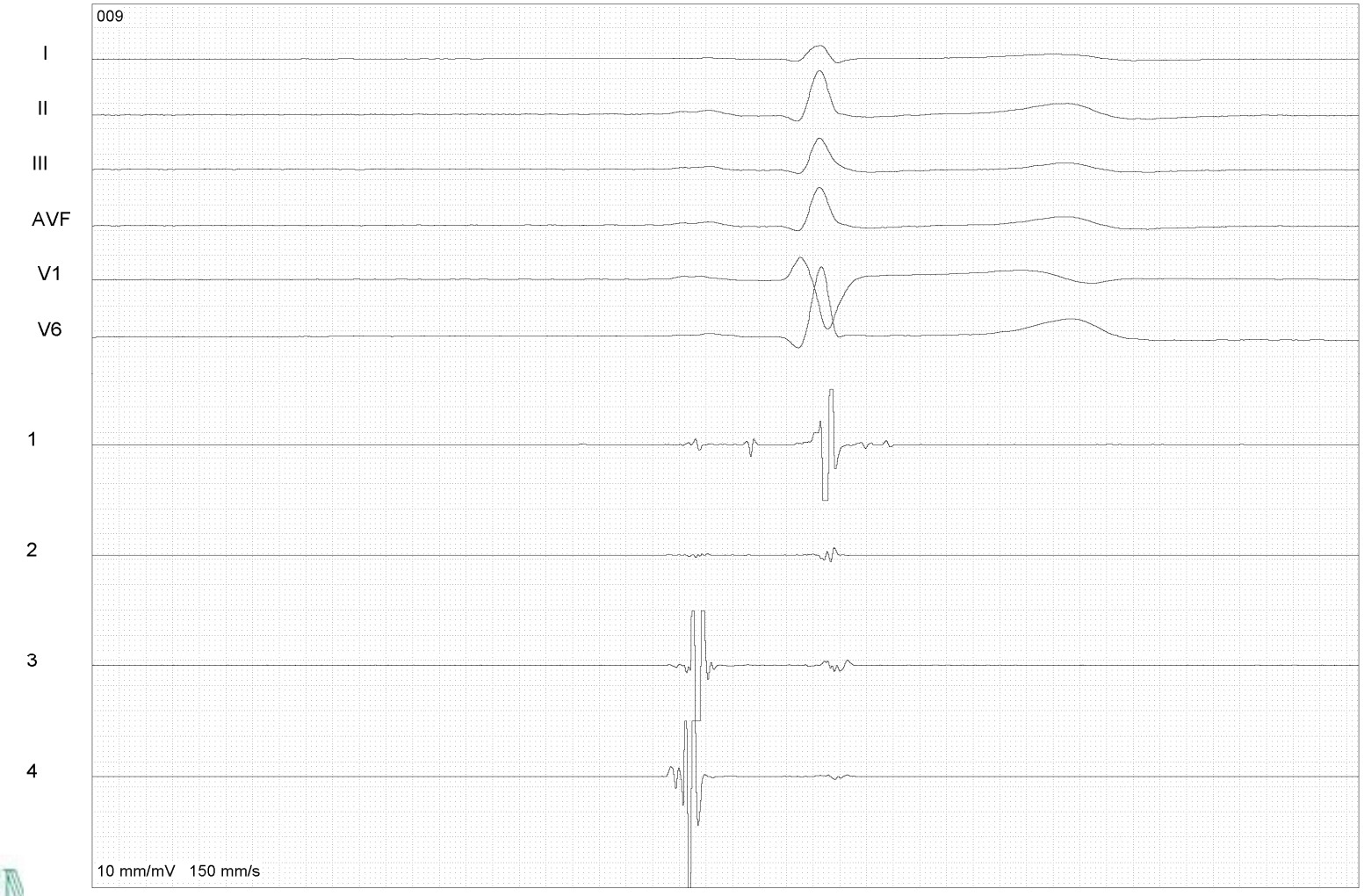
Comment :

Offline printed on : 18-09-2008 at 09:39:23.

# EEF/EPS

LABORATÓRIO DE ELETROFISIOLOGIA ST. JUDE MEDICAL

Version WINDOWS XP : EPTRACER V1.061



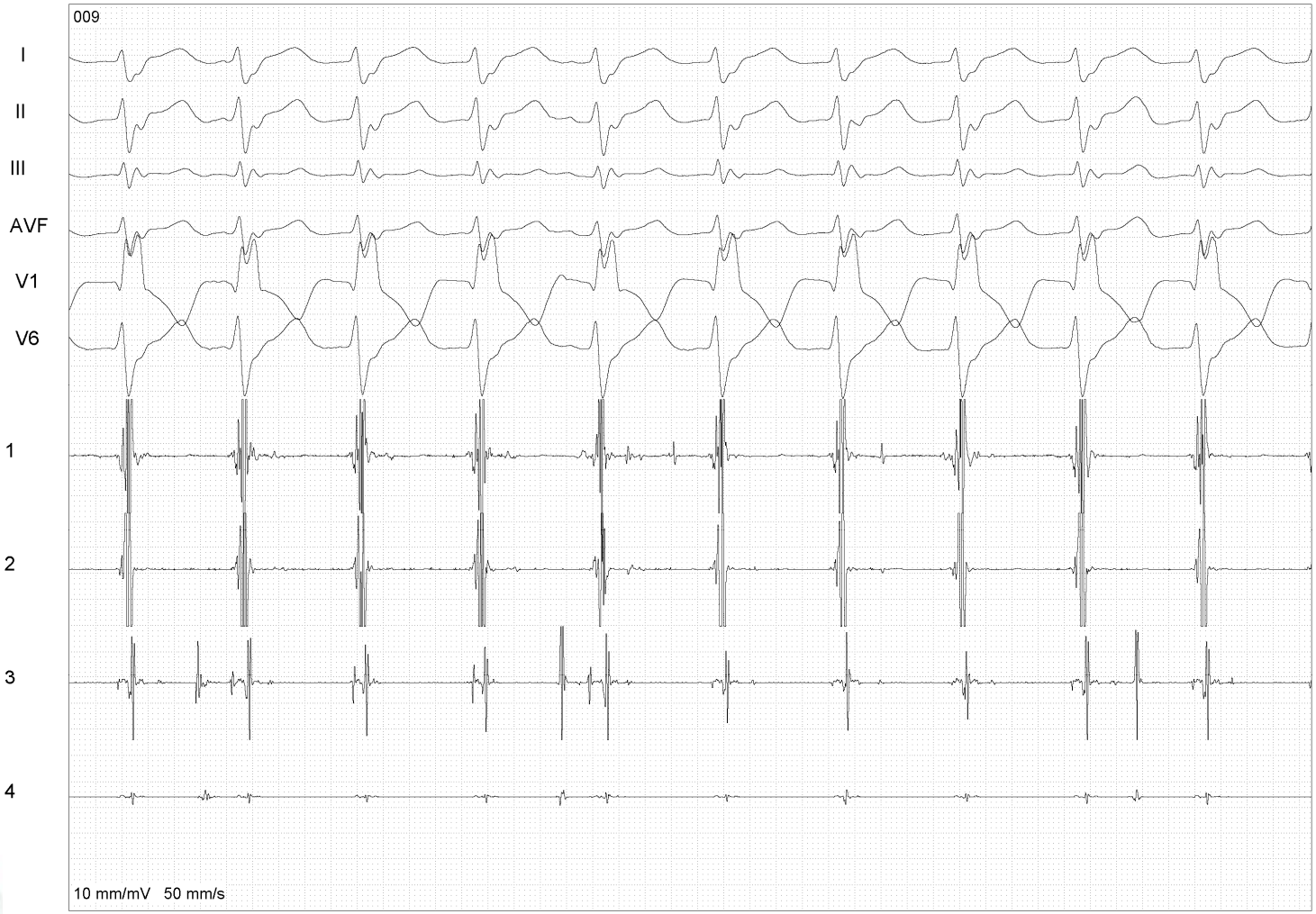

Patient : ribeiro adenilson / /
Comment :

Offline printed on : 18-09-2008 at 09:41:31.

# EEF/EPS

LABORATÓRIO DE ELETROFISIOLOGIA ST. JUDE MEDICAL

Version WINDOWS XP : EPTRACER V1.061

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Patient : ribeiro adenilson / /
Comment :

Offline printed on : 18-09-2008 at 09:53:09.

# EEF/EPS

LABORATÓRIO DE ELETROFISIOLOGIA ST. JUDE MEDICAL

Version WINDOWS XP : EPTRACER V1.061


Patient : ribeiro adenilson / /
Comment :

Offline printed on : 18-09-2008 at 09:53:24.

# CARACTERIZAÇÃO
# CHARACTERIZATION

- **Definição: TV mais comum de TV idiopáticas usualmente obsevada em pessoas sem cardiopatia estrutural aparente (predominantemente em homens jovens), usualmente manifestada por palpitações e com padrão ECG de BCRD e eixo do QRS dependente de qual fasciculo do ramo esquerdo está envolvido. Extremo desvio do eixo para esquerda é obserado na variedade da divisão póstero-inferior (>90% dos casos) e desvio para direita quando a envolvida é a divisão ântero-superior.**

  **Definition: VT is the commonest form of idiopathic VT usually seen in individuals (predominantly in young males) without apparent structural heart disease, usually presents as paroxysmal palpitations, with right bundle branch block pattern. The QRS axis depends on which fascicle is involved in the re-entry. Extreme left axis deviation is noted with left posterior fascicular tachycardia (>90% of cases) and right axis deviation with left anterior fascicular tachycardia.**

- **Duração do QRS não é muito aumentada ou relativamente estreita, usualmente entre 120 e 140 ms e o intervalo RS entre 40 e 80ms.**

  **Characteristically the QRS duration is a borderline-broad complex or relatively narrow QRS complex, usually between 120ms and 140ms and RS interval between 60 to 80ms occurring.**

- **Esta é una arritmia importante con manifestações do ECG e opções terapêuticas únicas.**

  **It is an important cardiac arrhythmia with specific electrocardiographic features and therapeutic options.**

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**Zipes DP, et al. Am J Cardiol. 1979; 44: 1–8.**

# TV ESQUERDA IDIOPÁTICA VERAPAMIL SENSITIVA OU REENTRANTE INTRAFASCICULAR

## IDIOPATHIC LEFT VT (ILVT) VERAPAMIL-SENSITIVE INTRAFASCICULAR RE-ENTRANT VT

- OUTRAS DENOMINAÇÕES SYNONYMOUS TV FASCICULAR SENSÍVEL AO VERAPAMIL
- VERAPAMIL-SENSITIVE FASCICULAR TACHYCARDIA

- TV IDIOPÁTICA DO VENTRÍCULO ESQUERDO IDIOPATHIC LEFT VENTRICULAR TACHYCARDIA (ILVT)

- TV DE BELHANSEN BELHASSEN VT

- TV DE COMPLEXOS QRS NÃO MUITO LARGOS BORDERLINE-BROAD COMPLEX TACHYCARDIA

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# RETROSPECTO HISTÓRICO
# HYSTORICAL BACKGRAUND

- **Maio/1972: Cohen et al. Primeira descrição: TV com complexos QRS relativamente estreitos**
  **May 1972: Cohen et al[1]. First description: VT with a relative narrow QRS complexes (≤140ms).**

- **1979: Zipes et al. Relata três pacientes com TV caracterizada por QRS entre 120-140ms, padrão de BRD e extremo desvio do eixo para a esquerda. Estes autores descreveram a tríade: 1) indução com o marcapasso atrial; 2) BRD com extremo desvio do eixo a esquerda; 3) ausência de cardiopatia estrutural.**
  **1979: Zipes et al[2]. reported three patients with VT characterized by QRS width of 120 to 140 ms, RBB pattern and extreme left-axis deviation. These authors described the characteristic triad: 1) Induction with atrial pacing; RBBB pattern with extreme left axis deviation; 3) without structural heart disease**

- **1981: Belhassen et al[3] foram os primeiros em relatar a caracteristica terminal do evento com a administração de verapamil endovenosa, sendo denominada TV de Belhassen responsivel ao verapamil.**
  **1981: Belhassen et al[3] were the first to report on the characteristic termination of this VT with intravenous verapamil, hence accounting for the terms Belhassen VT and verapamil-responsive VT to describe the condition.**


1) Cohen HC, et al.Circulation. 1972; 45:1035-1043.
2) Zipes et al. Am J Cardiol. 1979; 44:1–8.
3) Belhassen B, et al. Br Heart J. 1981;46:679–682.

# ASPECTOS EPIDEMIOLÓGICOS
# EPIDEMIOLOGICAL ASPECTS

- **Idade: Usualmente observada entre 15 e 40 anos.**
  **Age: Usually observed between 15 and 40 year.**

- **Gênero: Predominância masculina (70% dos casos)**
  **Gender: Male predominance (70% of cases).**

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# SUBTIPOS
# SUBTYPES

**Fascicular VT has been classified into three subtypes with two more common subtypes, posterior and anterior[1]:**

1) **TV do fascículo posterior: eixo elétrico com desvio a esquerda representando 92% dos casos**
   **Left posterior fascicular VT:** Left axis deviation: 92% of cases.

2) **TV fascicular anterior 7% dos casos.**
   **Left anterior fascicular VT :** 7%[2].

3) **TV do septo alto <1%.**
   **Upper septal fascicular VT. <1%[3].**


1) Ramprakash B, et al Indian Pacing Electrophysiol J. 2008;8:193-202.
2) Nogami A,et al. J Cardiovasc Electrophysiol. 1998;9:1269-1278.
3) Kudoh Y, et al. Jpn Circ J. 1988; 52: 385–389

# MECANISMOS
# MECHANISMS

- A TV verapamil sensitiva compreende em um grupo heterogêneo com multiplos mecanismos eletrofisiológicos.

  Verapamil-sensitive VT encompasses a heterogeneous group of tachycardias that may result from multiple cellular electrophysiologic mechanisms[1].

**1) Macro-reentrada interfascicular**
**Intrafascicular macro re-entrant tachycardia**

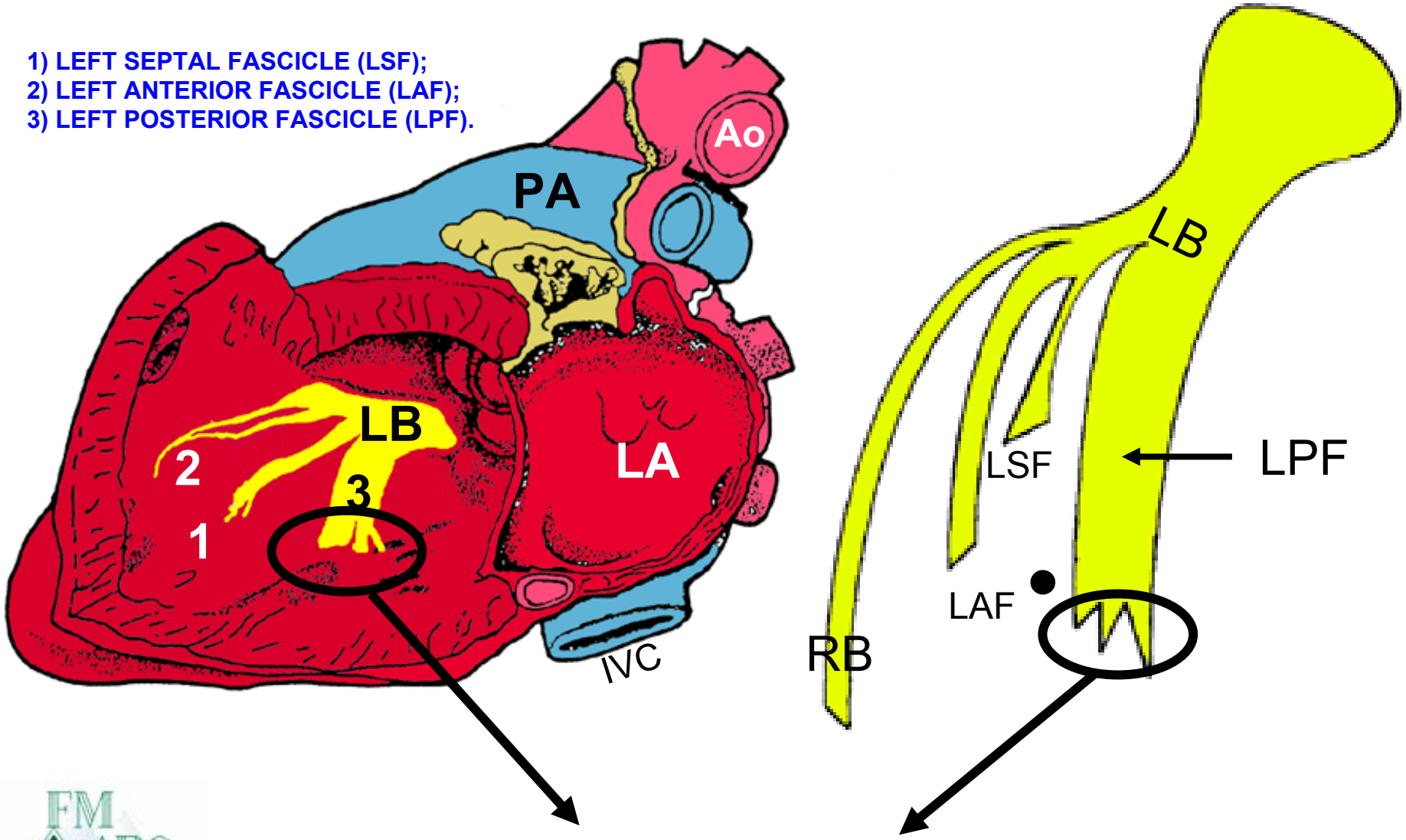
**2) Mediada por atividade deflagrada**
**cAMP-mediated triggered activity**

**3) Sensível ao Propanolol**
**Propranolol sensitive**

1) Griffith MJ, et al. Am J Cardiol. 1994;73:759-764

# MECANISMO DE MACRORRENTRADA INTERFASCICULAR
# INTERFASCICULAR MACRO REENTRY MECHANISM

1) LEFT SEPTAL FASCICLE (LSF);
2) LEFT ANTERIOR FASCICLE (LAF);
3) LEFT POSTERIOR FASCICLE (LPF).

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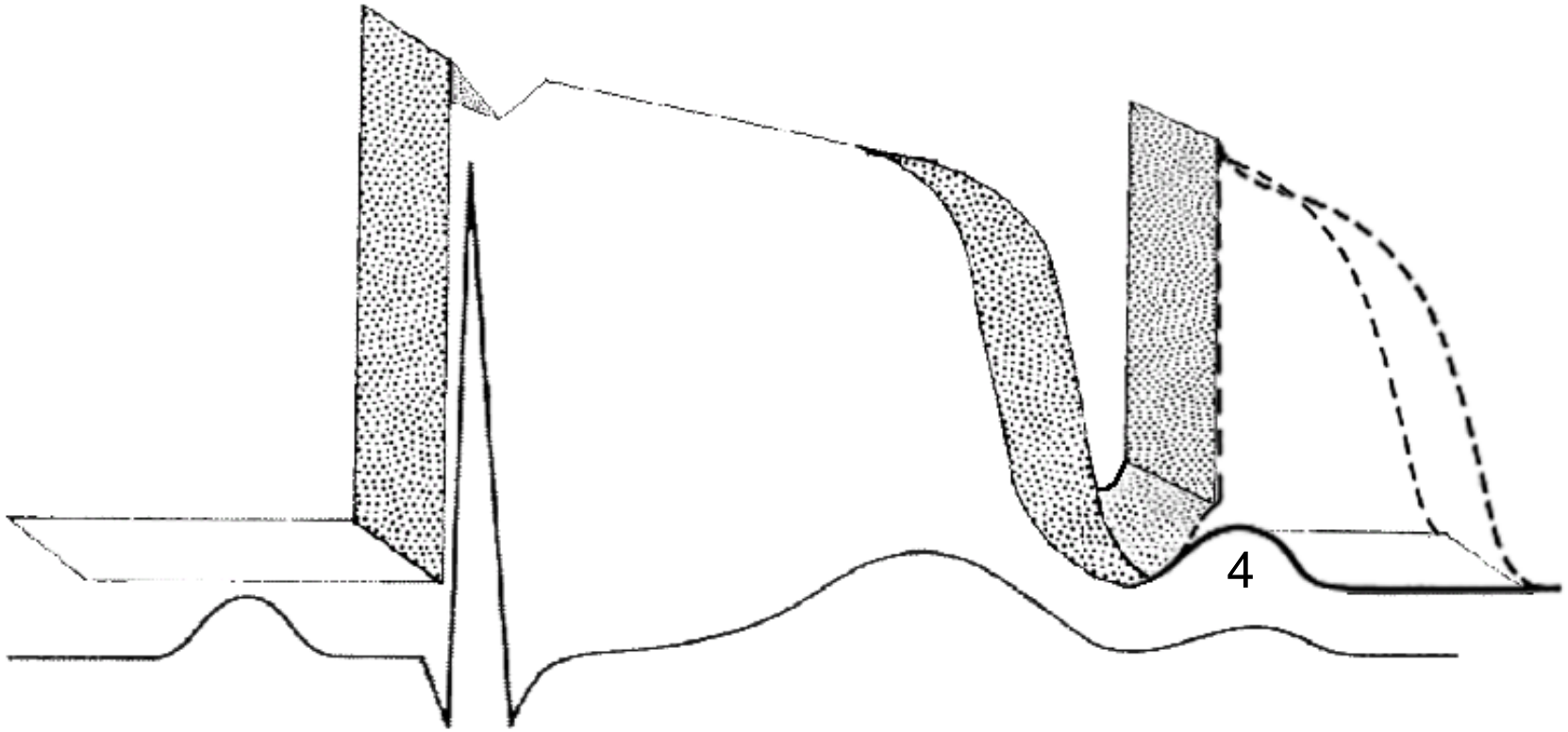
CLASSICAL ORIGEN AREA: REGION OF THE
POSTEROINFERIOR INTERVENTRICULAR SEPTUM

# BY DELAYED AFTER DEPOLARIZATION
## cAMP-mediated triggered activity




**Concept:** they are oscillations of the membrane potential that occur after having completed phase 3 of AP or in phase 4. When they reach the limit, they trigger a new AP. They are observed in high rates (tachycardia-dependent). Their mechanism is caused by the opening of the $I_{NS.}$ channel, sensitive to intracellular $Ca^{2+}$ concentration.

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# Manifestations

1) Palpitações / Palpitations
2) Tonturas / Dizzines
3) Pré-sícope / Presyncope
4) Síncope / Syncope
5) Morte cardiaca súbita reportada em apenas um caso.
   Sudden cardiac death was reported only in one case[1].

- Deflagrador de eventos / Events Trigger:
  - ✓ Em repouso/ At rest
  - ✓ Estimulação adrenérgica / Catecholamine stimulation: exercise or post exercise and isoproterenol infusion.

1) German LD, et al. Am J Cardiol. 1983; 52: 1202-1207.

# ECG pós evento imediato

# Immediate resting ECG

- **Alterações pseudo isquemica transitórias (mudanças na onda T) em parede ínfero-lateral.**

  **Non-specific transient inferolateral T-wave changes may be present after cessation of event (our case).**

- **ECG após a ablação pode mostrar:**
  - **Novas ondas Q na parede inferior e/ou desaparecimento de onda Q em DI e aVL.**

  **The ECG morphology changes after ablation were divided into two categories:**
  - **1) With new or deepening Q wave in inferior leads and/or disappearance of Q wave in leads I and VL**
  - **2) Without change.**

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# CONCLUSÕES
# CONCLUSIONS

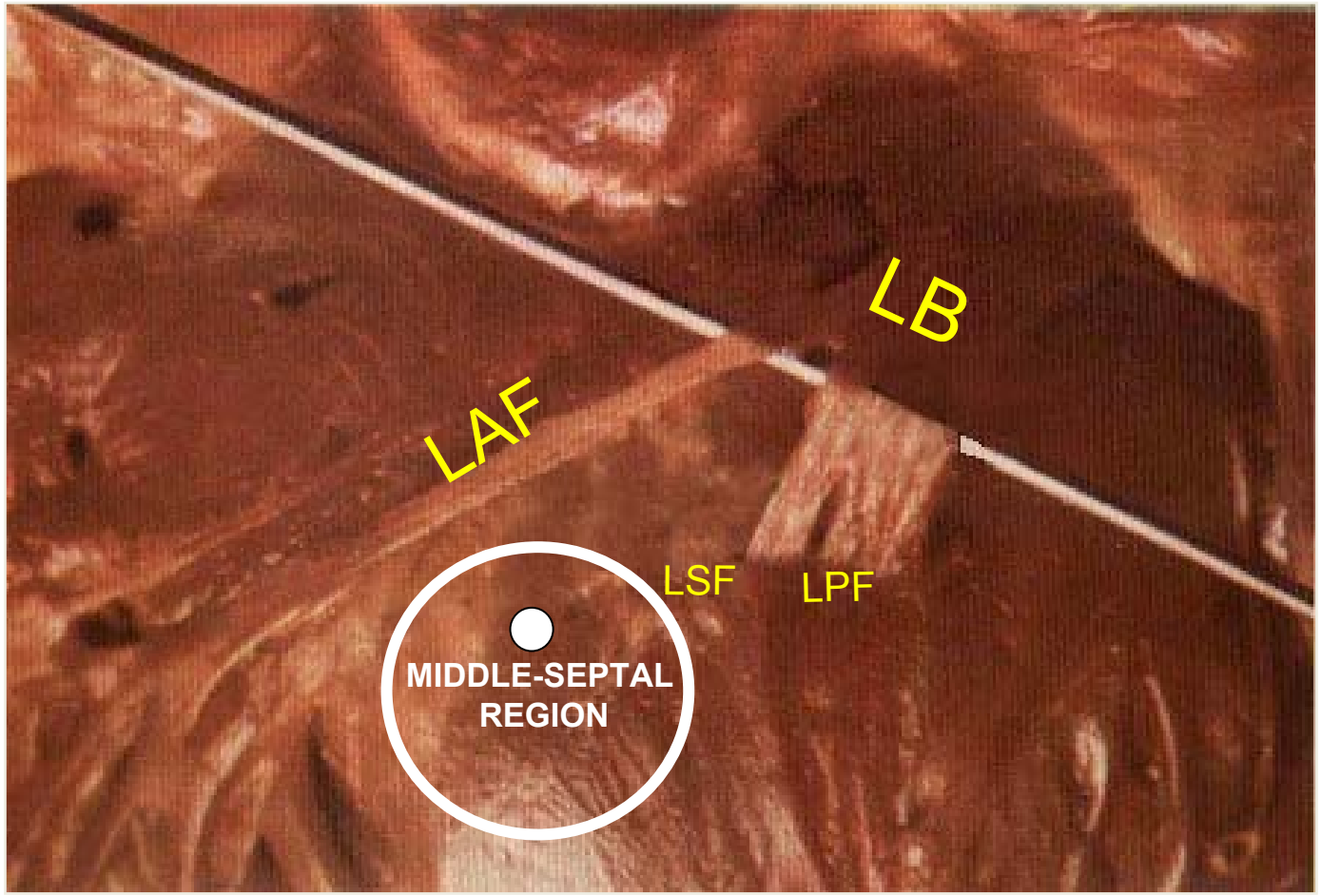
- **Taquicardia ventricular de região médio-septal da parede anterior do VE.**

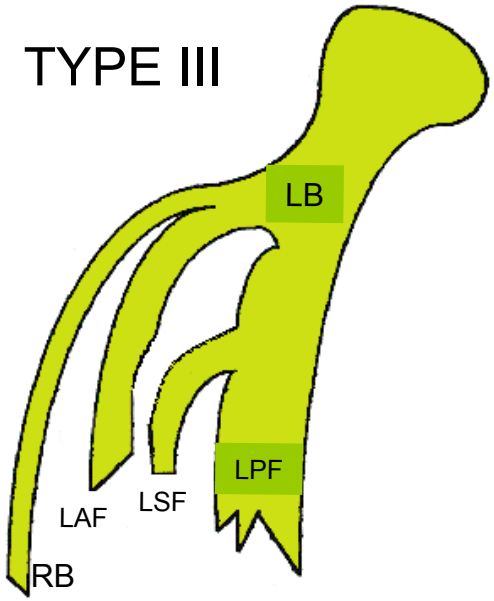
  **Ventricular tachycardia of the middle-septal region of the LV anterior wall**

- **Ablação por radiofrequência com sucesso**

  **Successful radiofrequency ablation**

# INTERPRETATION OF THE TRIFASCICULAR NATURE OF THE HUMAN LEFT HIS SYSTEM




In the figure extracted from the original book by rosenbaum (1), we believe the LSF originates in the LPF (TYPE III). Rosenbaum called this "false tendons of the LPF".

1) Rosenbaum MB, Elizari MV, Lazzari JO. Los Hemibloqueos. Editorial Paidos. Buenos Aires, 1967

# MVT WITHOUT APPARENT STRUCTURAL HEART DISEASE

## CLASSIFICATION

1) MVT sensitive to adenosine by triggered activity.

2) MVT sensitive to verapamil by intrafascicular reentry.

3) MVT sensitive to propranolol and automatic.

4) Undifferentiated MVT.

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# 1) MVT SENSITIVE TO ADENOSINE BY TRIGGERED ACTIVITY

**SENSITIVE TO ADENOSINE (TRIGGERED ACTIVITY): MORPHOLOGY:** LBBB with inferior axis, RBBB; inferior axis; RBBB, superior axis.

**INDUCTION:** programmed stimulation +- catecholamines.

**MECHANISM:** triggered activity mediated by cyclic adenosine monophosphate (cAMP).

**SENSITIVE:** adenosine, verapamil and propranolol.

**“ENTRAINMENT”:** negative.

# 2) MVT SENSITIVE TO VERAPAMIL BY INTRAFASCICULAR REENTRY

**MORPHOLOGY:** RBBB, inferior axis; RBBB, superior axis: it originates in the left posterior fascicle, or in the anterior fascicle, or RBBB and LBBB alternating.

**MECHANISM:** interfascicular macro-reentry.

**“ENTRAINMENT”:** positive;

**SENSITIVE:** verapamil and + - propranolol.

# 3) MVT SENSITIVE TO PROPRANOLOL AND AUTOMATIC

**INDUCTION:** catecholamines. Induced by incessant exercise.

**MORPHOLOGY:** RBBB or LBBB or left ventricle or polymorphic.

**MECHANISM:** increased automaticity.

**“ENTRAINMENT”:** negative.

**SENSITIVE:** transient/permanent suppression with propranolol. Transient suppression with adenosine or with no effect.

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# 4) UNDIFFERENTIATED MVT

**INDUCTION:** by exercise.

**MORPHOLOGY:** LBBB with left axis. VT of RV outflow tract.

**MECHANISM:** reentry.

**“ENTRAINMENT”:** positive.

**SENSITIVE:** adenosine, propranolol or verapamil: negative.

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**MUITO OBRIGADO !!!!!**