I Jornada de C.B. Biomédicas VC

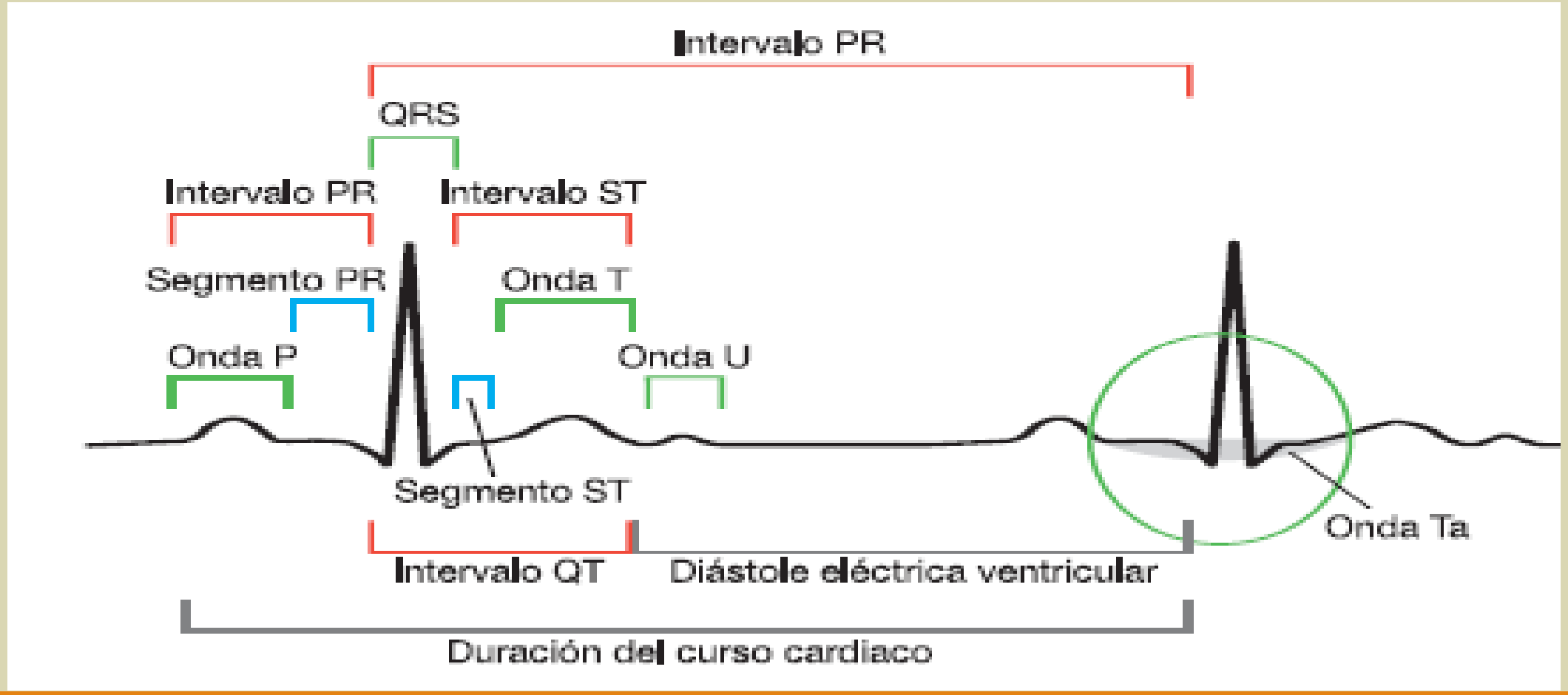
Controversialidad en el sustento fisiológico de las dispersiones del Electrocardiograma.

AUTOR: MS.C. DR. FERNANDO RODRÍGUEZ GONZÁLEZ.

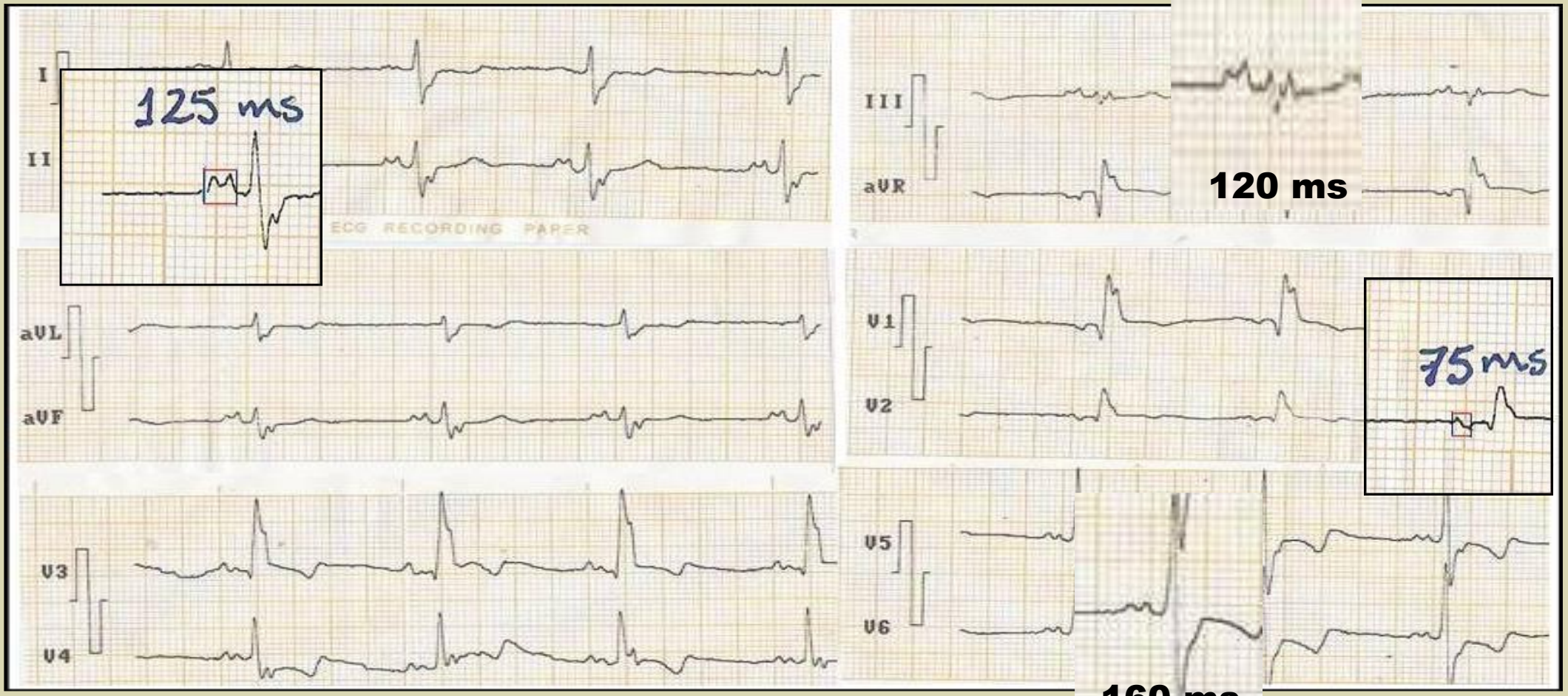
DPTO. DE ELECTROFISIOLOGÍA Y ESTIMULACIÓN CARDIACA.

CARDIOCENTRO ERNESTO GUEVARA. VC.

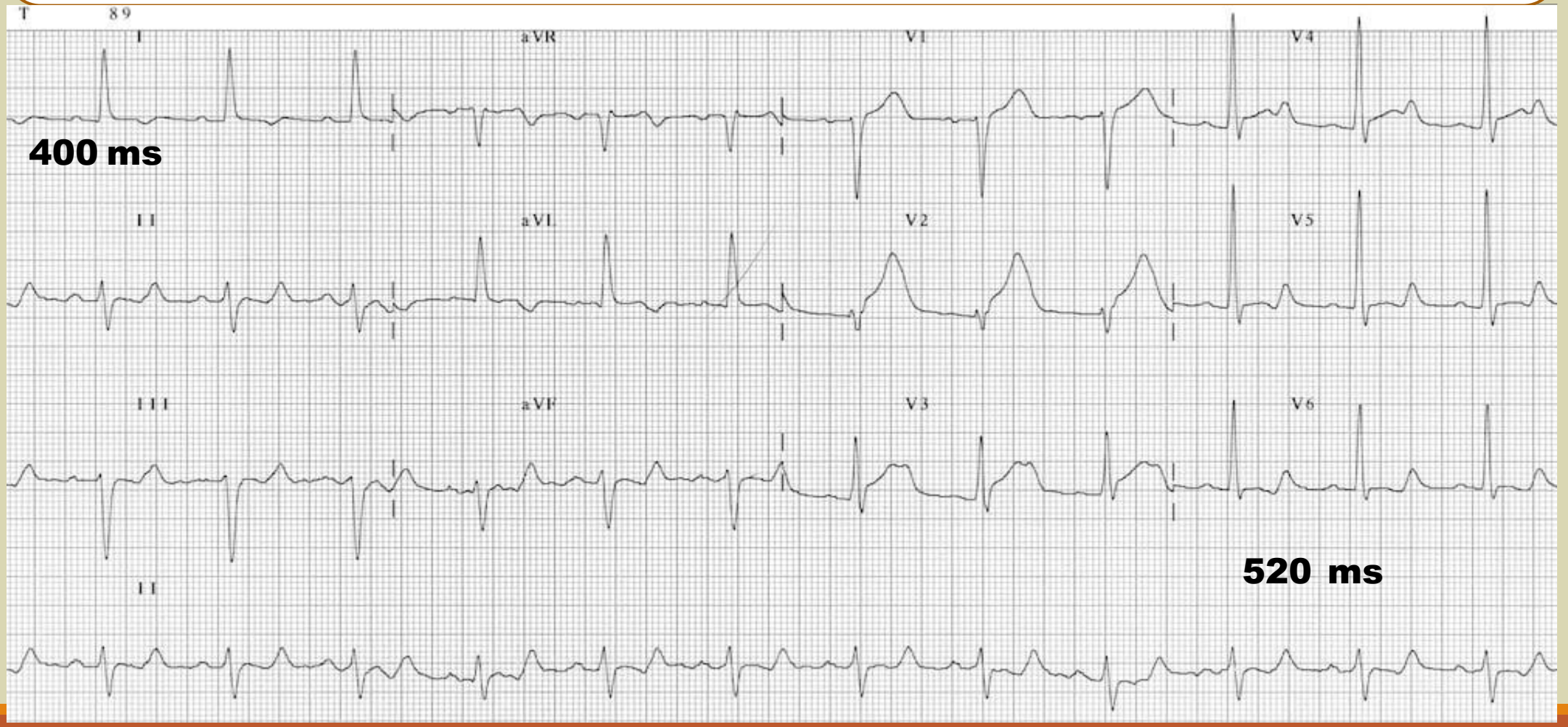
El Electrocardiograma:



Dispersiones del Electrocardiograma:



Dispersiones del Electrocardiograma:



Definición de Dispersión de la onda P:

La diferencia entre la medición de la onda P mínima y P máxima en el electrocardiograma en las 12 derivaciones del ECG.

Dilaveris PE, Gialafos EJ, Sideris SK, Theopistou AM, Andrikopoulos GK, Kyriakidis M, et al. Simple electrocardiographic markers for the prediction of paroxysmal idiopathic atrial fibrillation. Am Heart J. 1998;135(5 Pt 1):733-8.

Dispersión de la onda P
Sustento Teórico:

- TEORÍA LOCAL.
  - Heterogeneidad de la conducción

VS

- TEORÍA GLOBAL, DE PROYECCIÓN o VECTORIAL

Teoría Local de la dispersión de la onda P

- **La propagación no homogénea del impulso eléctrico atrial, se manifiesta mediante ondas P de diversas duraciones.**

- **Las mayores discrepancias de duración interderivación tendrían mayor Pdis y una probabilidad incrementada de desarrollar fibrilación atrial**

Teoría Vectorial de la dispersión de la onda P

- **Proyección del vector según la relación espacial que este tenga con una derivación.**

- **Debido a este efecto existen porciones de la onda P que no pueden verse en algunas derivaciones**

Journal of Electrocardiology 66 (2021) 152–160

Contents lists available at ScienceDirect

Journal of Electrocardiology

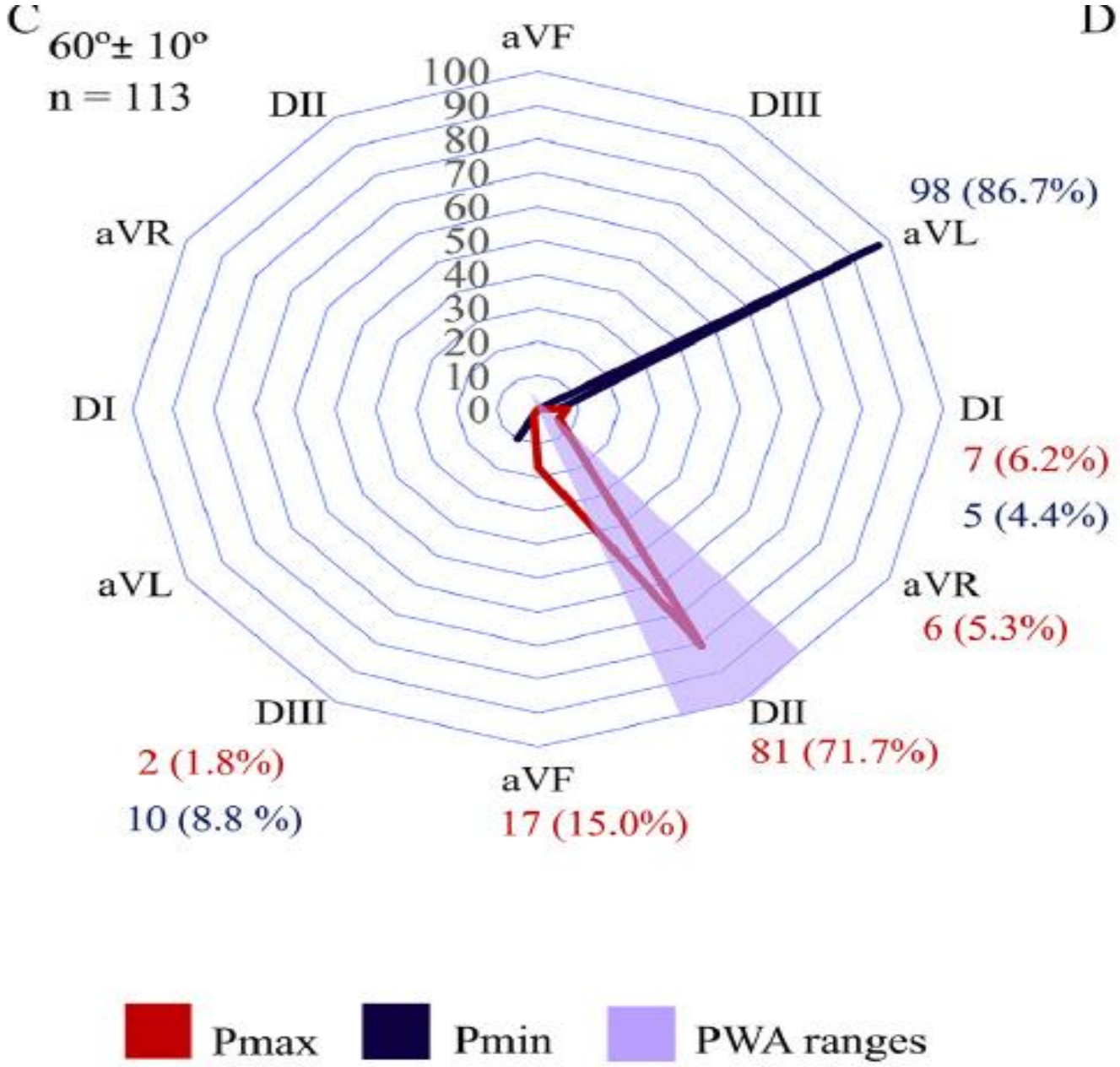
journal homepage: www.jecgonline.com

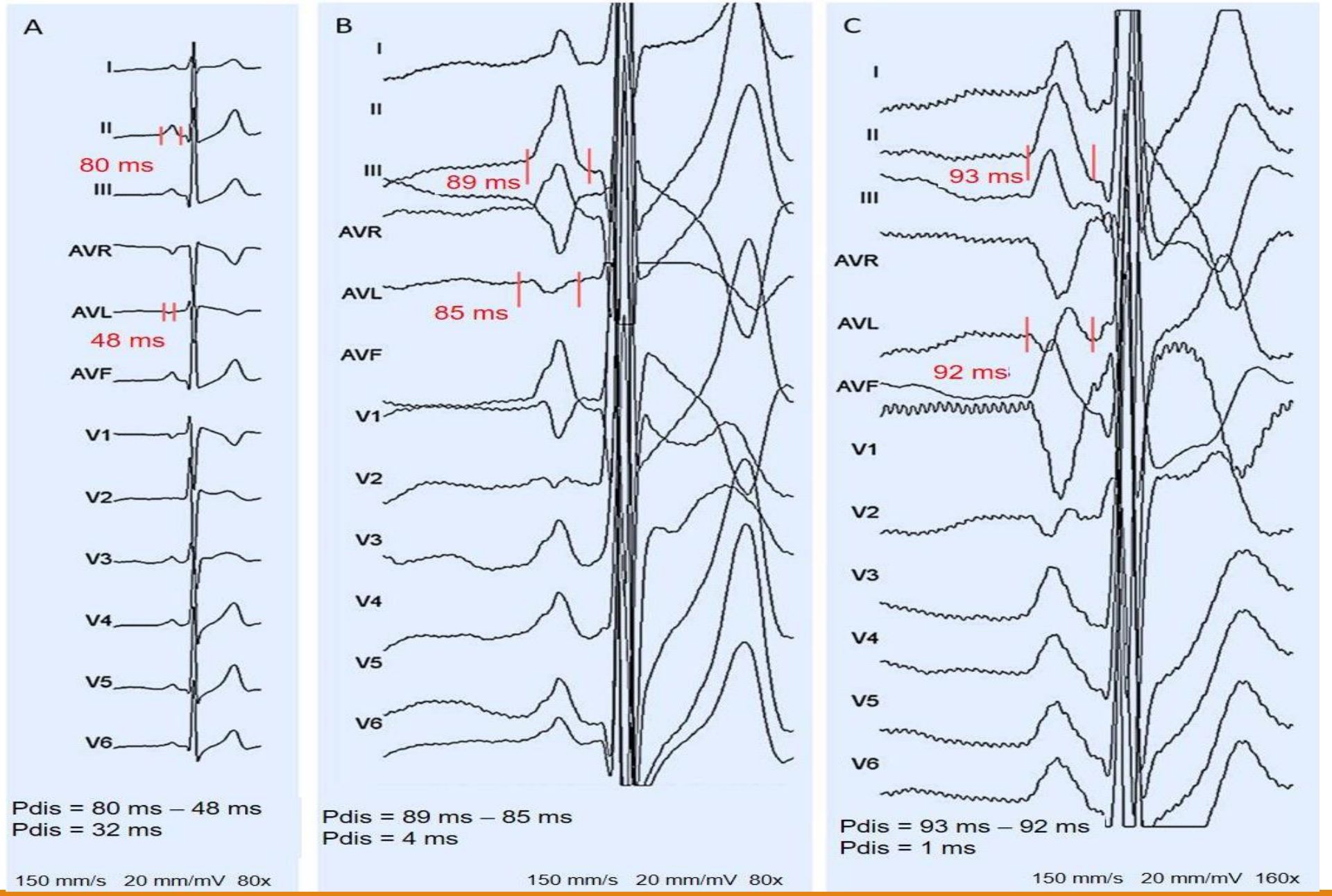
Vectorial theory surpasses the local theory in explaining the origin of P-wave dispersion

Raimundo Carmona Puerta [a,*], Elizabeth Lorenzo Martínez [b], Magdalina Rabassa López-Calleja [c], Gustavo Padrón Peña [a], Juan Miguel Cruz Elizundia [a], Fernando Rodríguez González [a], Elibet Chávez González [a]

[a] *Department of Electrophysiology and Arrhythmology. Cardiovascular Hospital "Ernesto Guevara", Santa Clara City, Villa Clara Province, Cuba*
[b] *Department of Physiology, Medical University of Villa Clara, Santa Clara City, Villa Clara Province, Cuba*
[c] *Cardiology, Cardiovascular Hospital "Ernesto Guevara", Santa Clara City, Villa Clara Province, Cuba*

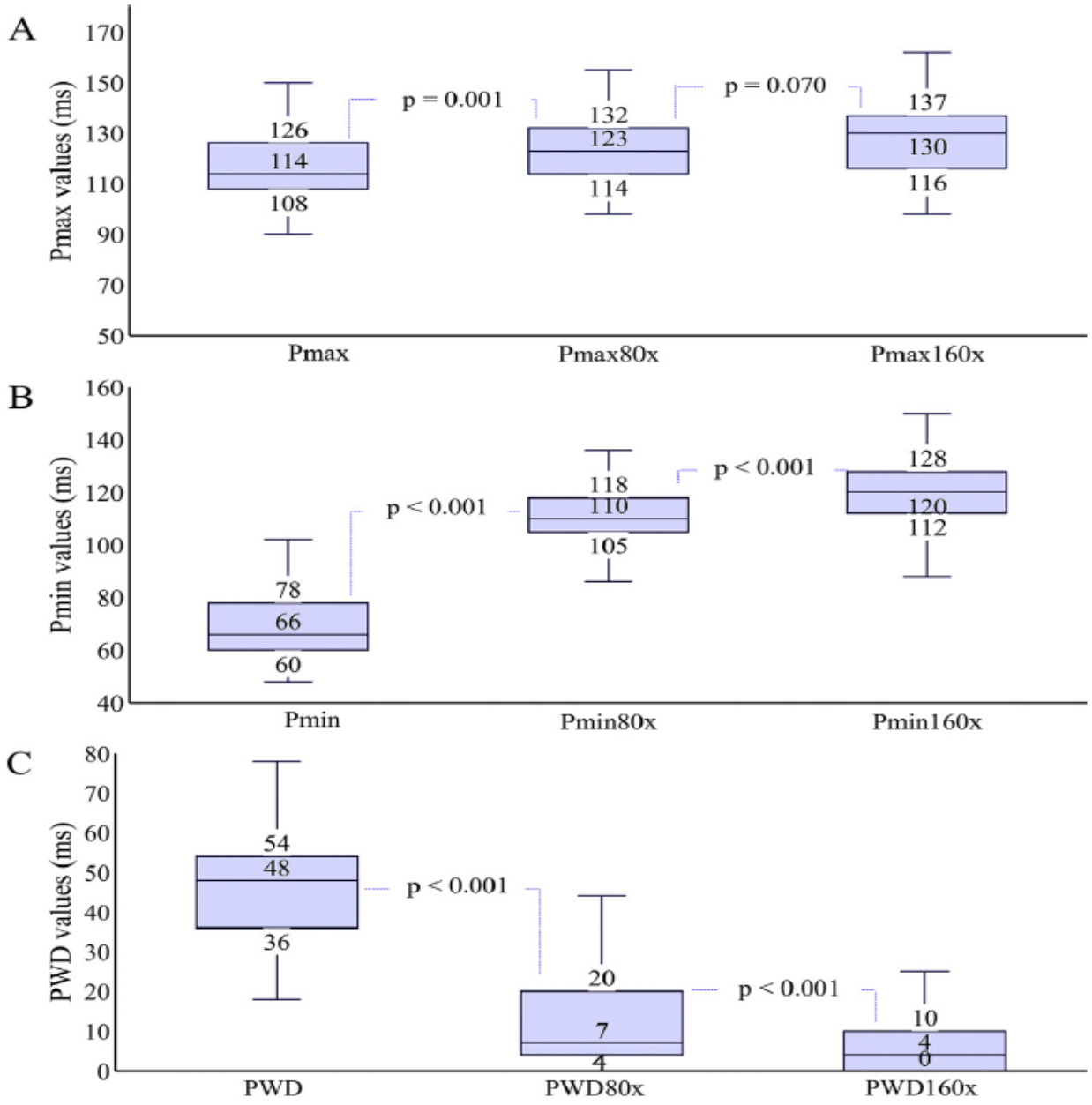
Gráfico de Radiales





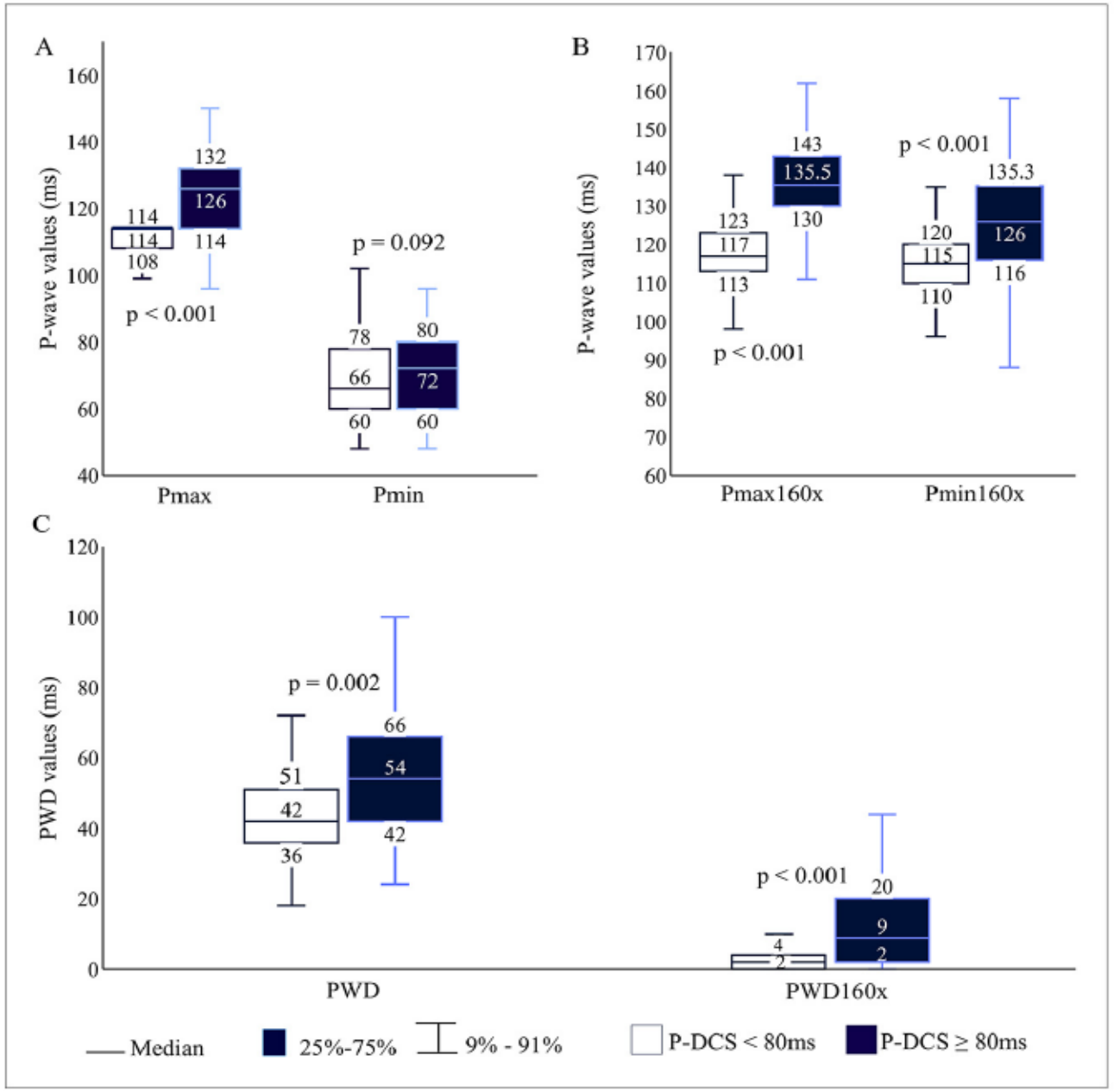
Magnificación de la onda P a 80x y 160x en un caso típico.

Mediciones de la Onda P y su dispersión a 10X, 80X y 160X



Comparación de la Onda P con respecto a los tiempos de conducción Atrial (<80 ms y >=80 ms) a 10X y 160X

Análisis de regresión lineal múltiple
(F = 11,31; p < 0,001)
(R2 = 0,120).



Conclusiones para la Dispersión de la Onda P

- LA TEORÍA VECTORIAL explica casi en su totalidad el fenómeno.

- Ante la existencia de conducción interatrial enlentecida: La heterogeneidad en la conducción atrial puede ser un mecanismo adicional, pero su contribución es débil.(TEORIA LOCAL)

Definición de Dispersión del Complejo QRS:

La diferencia entre la medición del complejo QRS mínimo y QRS máximo en el electrocardiograma en las 12 derivaciones del ECG.

Gatzoulis MA, Till JA, Redington ANJC. Depolarization-repolarization inhomogeneity after repair of tetralogy of Fallot: the substrate for malignant ventricular tachycardia? Circulation. 1997;95(2):401–4. https://doi.org/10.1161/.

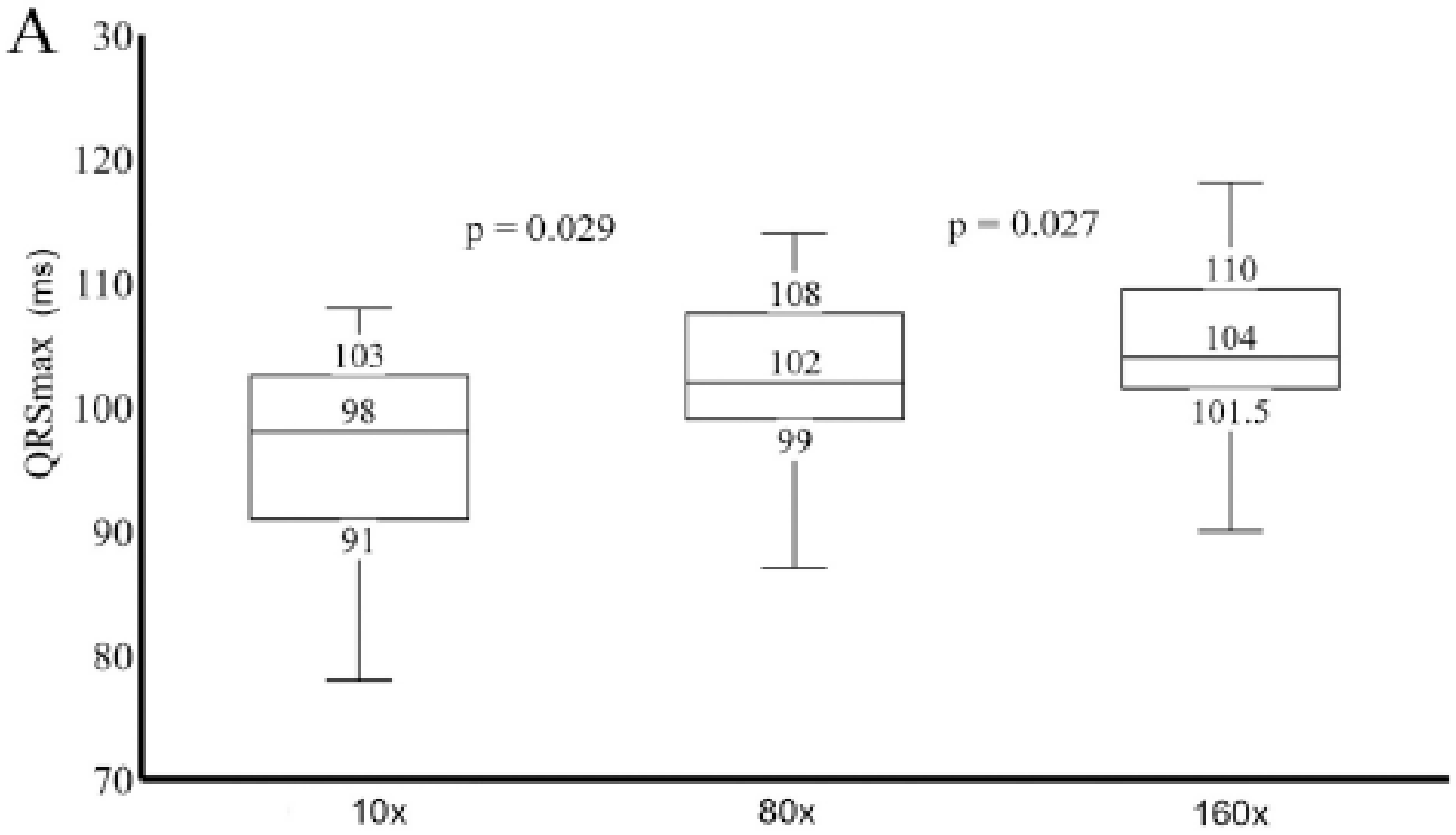
Dispersión del Complejo QRS
Sustento Teórico:

- TEORÍA LOCAL.
  - Heterogeneidad en la despolarización ventricular.

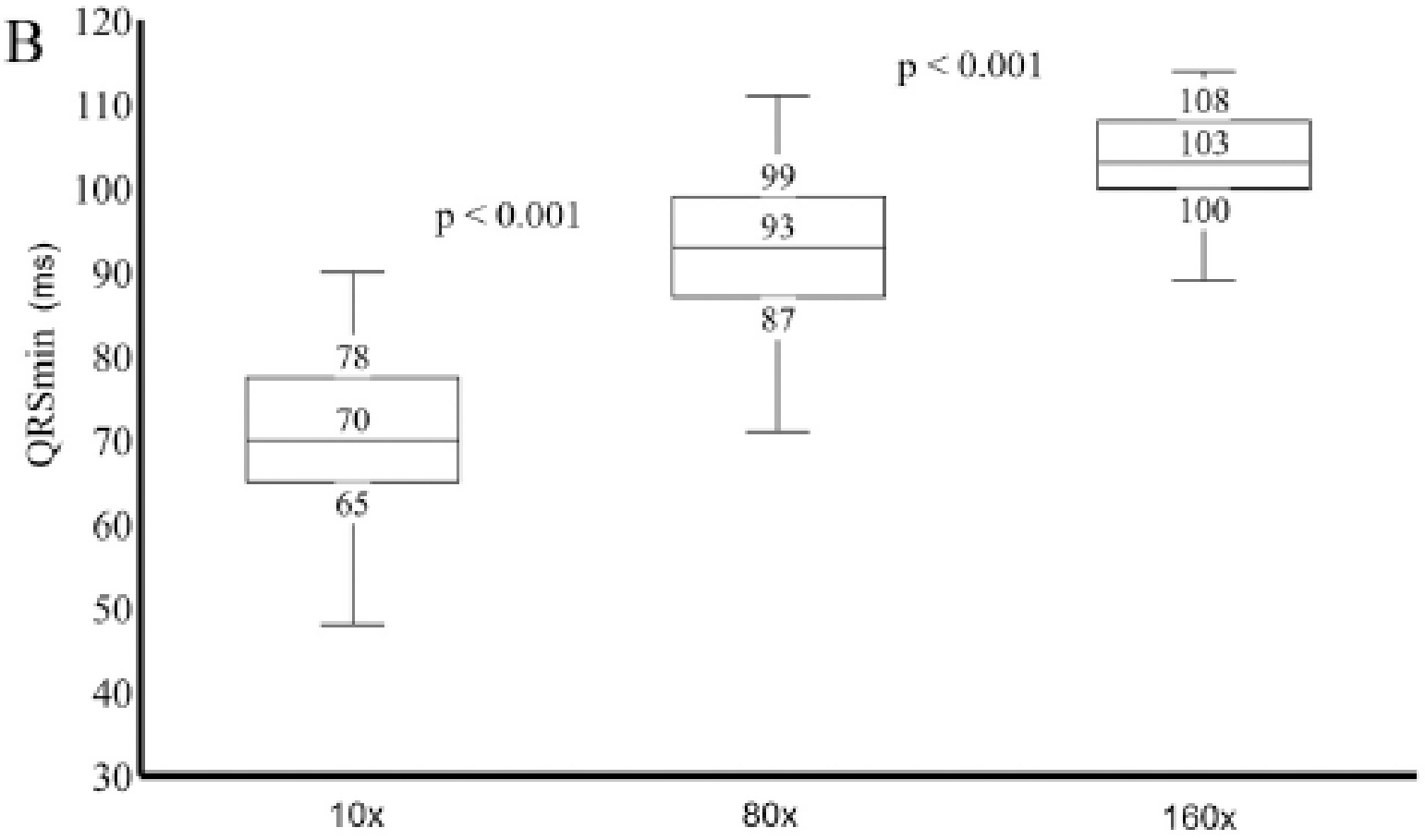
VS

- TEORÍA GLOBAL, DE PROYECCIÓN o VECTORIAL.

Mediciones del QRS Máx a 10X, 80X y 160X



Mediciones del QRS Min a 10X, 80X y 160X



Mediciones de la dis. QRS a 10X, 80X y 160X

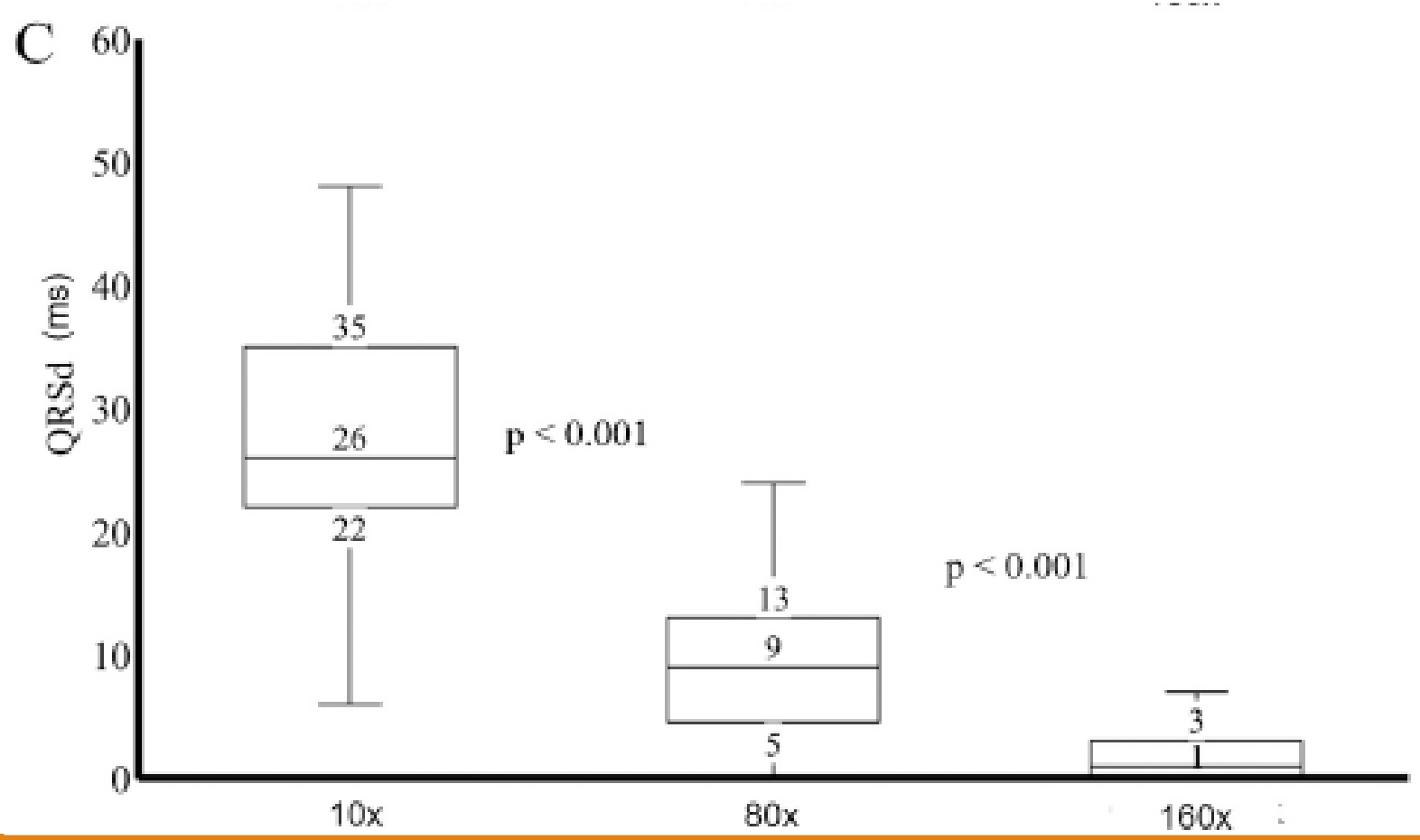
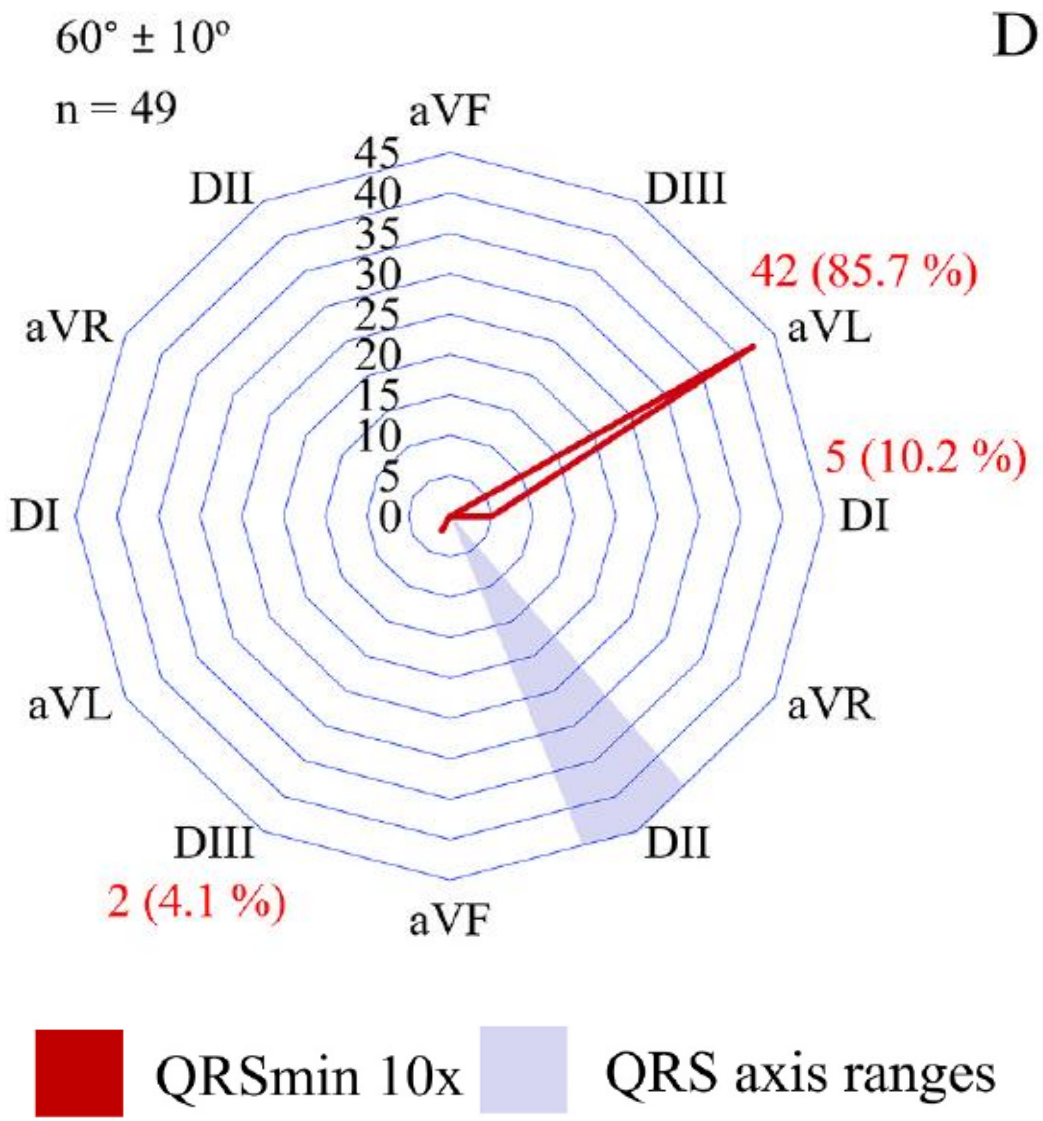
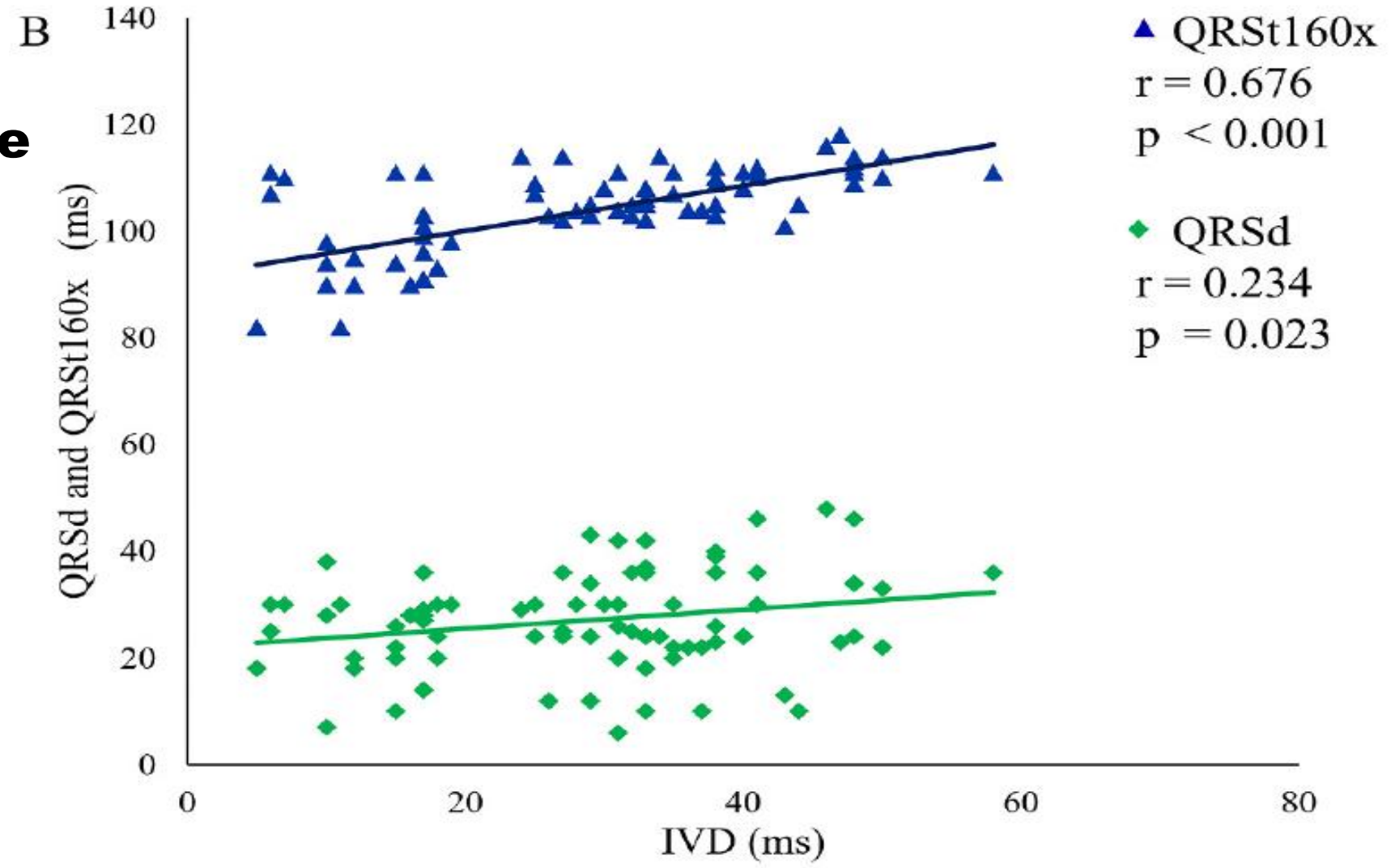


Gráfico de Radiales



Correlación entre la disQRS, el QRS Total y la disincronía Interventricular



Conclusiones para la Dispersión del intervalo QRS

- Cuando el QRS es estrecho, la mejor explicación para la dispersión del QRS es la desigual proyección del vector en los diferentes ejes de las derivaciones.

- La disincronía interventricular mostró una fuerte correlación con el QRS Total, mientras fue débil frente a la dispersión del QRS.

Definición de Dispersión del Intervalo QT:

La diferencia entre la medición del intervalo QT mínimo y QT máximo en el electrocardiograma en las 12 derivaciones del ECG.

Day CP, McComb JM, Campbell RW. QT dispersion: an indication of arrhythmia risk in patients with long QT intervals. Br Heart J. 1990;63:342–4.

Dispersión del intervalo QT
Sustento Teórico:

- TEORÍA LOCAL.
  - Heterogeneidad regional de la repolarización.

VS

  - Dispersión transmural de la repolarización.

- TEORÍA GLOBAL, DE PROYECCIÓN o VECTORIAL

Evidencia: Valor diagnóstico.

La Prolongación del Intervalo QT (*Dispersión*) Primer Fenómeno electrocardiográfico.

Early Reduction of QT Dispersion after Primary Percutaneous Intervention in ST-Segment Elevation Acute Myocardial Infarction

Mechanisms and Clinical Implications

Javier Jiménez-Candil Jesús Hernández Hernández Víctor León Agüero
Ana Martín Francisco Martín José Luis Moríñigo Cándido Martín-Luengo

Department of Cardiology, University Hospital, Salamanca, Spain

Original Research

Increased QT Interval Dispersion in Diagnosis of Acute Coronary Syndrome with Atypical Symptoms and EKG

Fernando Rodríguez MD MS, Elibet Chávez MD MS, Wilfredo J. Machín MD PhD, Alain Alonso MD, Vielka González MD

MEDICC Review, July–October 2014, Vol 16, No 3–4

Evidencia: Valor Pronóstico.

Predictor Independiente de Mortalidad Cardiovascular.

- Traduce heterogeneidad regional o Transmural de la repolarización ventricular.
- Predictor de Arritmias Ventriculares Malignas.

de Bruyne MC, Hoes AW, Kors JA, Hofman A, van Bemmel JH, Grobbee DE. QTc dispersión predicts cardiac mortality in the elderly: the Rotterdam Study. Circulation 1998;97:467–472.

Jokin PM, Devereux RB , Howard BV, Fabsitz RR, ee ET, Welty TK. Assessment of QT Interval and QT dispersion for prediction of all-cause and cardiovascular mortality in American Indians: The Strong Heart Study. Circulation 2000 Jan 4;101:61–66.

El Santo Grial para la Prevención de la Muerte Súbita.

The difference between the longest and shortest QT intervals is referred to as QT dispersion. This concept was introduced in 1990 for risk identification in patients with LQTS (61). Since its introduction, QT dispersion has been one of the most popular topics in ECG research. In November 2006, a PubMed search cited 670 publications with QT dispersion in the title, and a Google search under "QT dispersion measurement" revealed 171 000 communications.

Evidencias / Controversias

1.

Controversialidad en cuanto a su utilidad:

Spargias KS, Lindsay SJ, Kawar GI, et al. QT dispersion as a predictor of long-term mortality in patients with acute myocardial infarction and clinical evidence of heart failure [see comments]. Eur Heart J 1999;20:1158–1165.

Brooksby P, Batin PD, Nolan J, et al. The relationship between QT intervals and mortality in ambulant patients with chronic heart failure. The United Kingdom heart failure evaluation and assessment of risk trial (UK-HEART) [see comments]. Eur Heart J 1999;20:1335–1341.

Yi G, Ellioitt P, McKenna WJ, et al. QT dispersion and risk factors for sudden cardiac death inpatients with hypertrophic cardiomyopathy. Am J Cardiol 1998;82:1514–1519.

Q J Med 2000; **93**:425–431

Review

QJM

QT dispersion in medicine: electrophysiological Holy Grail or fool's gold?

P. SAHU, P.O. LIM, B.S. RANA and A.D. STRUTHERS

From the Cardiovascular Research Group, Department of Clinical Pharmacology and Therapeutics, Ninewells Hospital and Medical School, University of Dundee, Dundee, UK

Evidencias / Controversias

2.

Precedente: Teoría vectorial es el sustento más robusto para los fenómenos de dispersión en el electrocardiograma.

- **Dispersión de la Onda P.**
- **Dispersión del QRS.**

Evidencias / Controversias

3.

Rautaharju *et al.*
Standardization and Interpretation of the ECG, Part IV

No inclusión en el reporte del ECG:

Until adequately validated data in specific clinical conditions are presented showing that QT dispersion on the body surface ECG is the counterpart of localized dispersion of myocardial repolarization and conveys adequately strong nondipolar signal information that cannot be extracted from the X,Y,Z components, it seems unwise to include it as a part of the routine ECG report.

Recommendation

It is recommended that QT dispersion not be included in routine ECG reports. However, because of the fundamental importance of the heterogeneity of myocardial repolarization in the genesis of malignant ventricular arrhythmias, continued research into the identification of markers of increased dispersion of myocardial repolarization on the body surface ECG is encouraged.

Evidencias / Controversias

4.

Pobreza sobre Investigaciones Aplicadas.

Natalia V. Arteyeva, Jan E. Azarov. ECG markers of local but not global increase in dispersion of ventricular repolarization (simulation study). Journal of Electrocardiology. S0022-0736(19)30745-9.

M. Malik, B. Acar, Y. Gang, Y.G. Yap, K. Hnatkova, A.J. Camm, QT dispersion does not represent electrocardiographic interlead heterogeneity of ventricular repolarization, J. Cardiovasc. Electrophysiol. 11 (2000) 835e843.

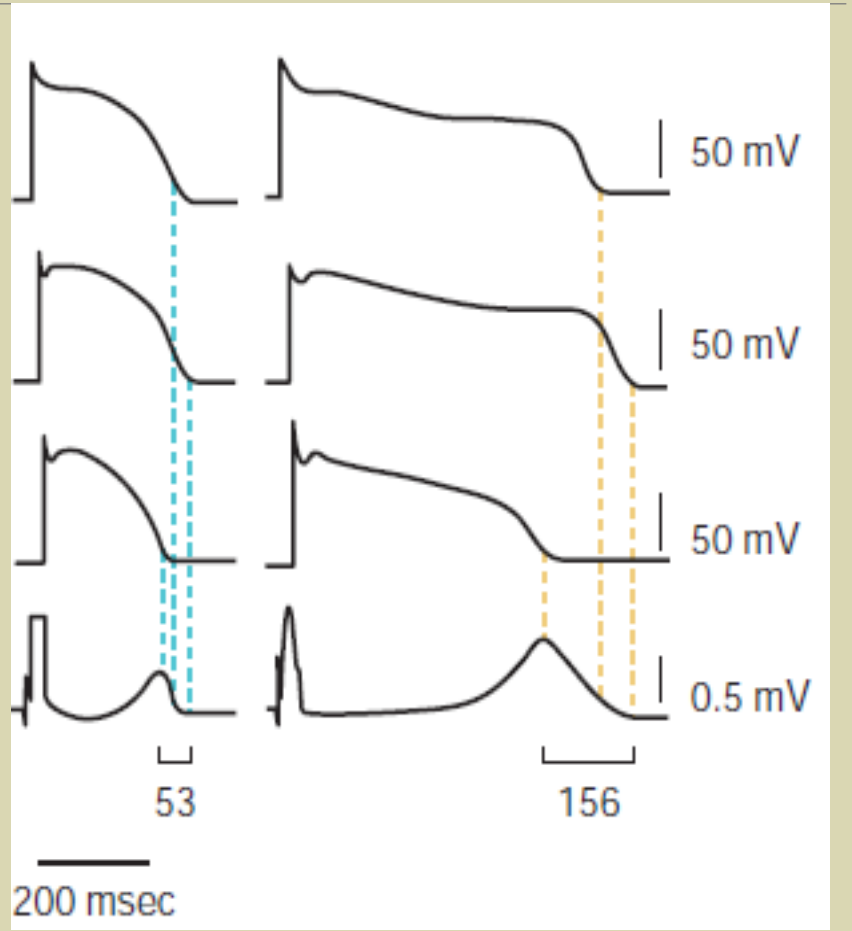
Evidencias / Controversias

5.

Posibilidad de que sea una

Covariable dependiente de la

Prolongación del Intervalo QT.



In summary, our findings suggest that regional differences in the duration of the M cell action potential form the basis for QT dispersion measured at the body surface under normal and long QT conditions. Our data indicate that the interval between the peak and the end of the T wave represents an accurate measure of regional dispersion of repolarization across the ventricular wall and as such may be a valuable index for assessment of arrhythmia risk. The presence of low-amplitude, broad, and/or bifurcated T waves, particularly under conditions of LQTS, is indicative of diminished repolarizing forces and may represent an independent variable of arrhythmic risk, forecasting the occurrence of early afterdepolarization-induced trigger beats, which can precipitate torsade de pointes. Although QT dispersion, the QT interval, the interval between the T wave peak and end, and the width and amplitude of the T wave often change in parallel, they contain different information and might not be expected to be equivalent in their ability to forecast arrhythmic risk.

sion

D, PhD,
MD

Evidencias / Controversias

Incongruencias e Inconsistencias

6.

CLINICAL ARRHYTHMOLOGY AND ELECTROPHYSIOLOGY

A COMPANION TO BRAUNWALD'S HEART DISEASE

Dispersion of Repolarization

Prolongation of the action potential duration (and QT interval) per se is not pathogenic, as evidenced by the fact that a homogeneous action potential duration prolongation (such as occurs following amiodarone therapy) fails to generate reentry. As demonstrated in experimental models of the LQTS, prolonged repolarization, transmural dispersion of repolarization, and EADs are the three electrophysiological (EP) components linked to the genesis of torsades de pointes. Transmural dispersion of repolarization arises from repolarization heterogeneity that exists between the epicardial and putative midmyocardial (M) cells that lie toward the endocardium of the LV wall. These midmyocardial cells are especially sensitive to a repolarization challenge and exhibit significant prolongation of the action potential duration compared with other transmural cell types. Several ECG indices have been proposed in recent years as noninvasive surrogates for transmural dispersion of repolarization, including the T wave peak to T wave end (Tp-e) interval, QT interval dispersion, and ratio of the amplitudes of the U and T waves.

Several ECG indices have been proposed in recent years as noninvasive surrogates for **transmural dispersion** of repolarization, including the T wave peak to T wave end (Tp-e) interval, QT interval dispersion, and ratio of the amplitudes of the U and T waves.

Evidencias / Controversias

CLINICAL ARRHYTHMOLOGY AND ELECTROPHYSIOLOGY

A COMPANION TO **BRAUNWALD'S HEART DISEASE**

QT interval dispersion. An alternate approach to determine repolarization heterogeneity is provided by the dispersion of the QT interval. The QT dispersion index is obtained by the difference between the maximal and minimal QT intervals (QTmax – QTmin) measured on a 12-lead ECG. The QT dispersion index reflects the spatial heterogeneity of myocardial refractoriness more accurately than single QT values. Visualization of the differences in QT interval in the different ECG leads can be facilitated by the display of temporally aligned simultaneous ECG leads with a slight separation on the amplitude scale.

The QT dispersion index reflects the spatial heterogeneity of myocardial refractoriness more accurately than single QT value

Evidencias / Controversias

7.

TABLE 31.5 Diagnostic Criteria for the Long QT Syndrome

			Points
Electrocardiographic Findings[a]			
A	QTc[b]	≥480 msec	3
		460–479 msec	2
		450–459 (male) msec	1
B	QTc[b] fourth minute of recovery from exercise stress test ≥480 msec		1
C	Torsade de pointes[c]		2
D	T wave alternans		1
E	Notched T wave in three leads		1
F	Low heart rate for age[d]		0.5
Clinical History			
A	Syncope[c]	With stress	2
		Without stress	1
B	Congenital deafness		0.5
Family History			
A	Family members with definite LQTS[e]		1
B	Unexplained sudden cardiac death younger than age 30 among immediate family members[e]		0.5

Evidencias / Controversias

8.

Fenómeno de los Bloqueos de Rama son uno de los mejores exponentes de dispersión temporo-espacial del PA ventricular sin traducción en la dispersión del intervalo QT.

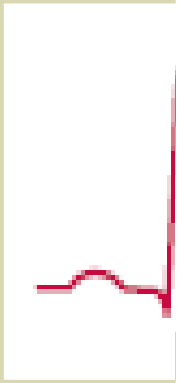
QT Dispersion, T-Wave Projection, and Heterogeneity of Repolarization in Patients With Coronary Artery Disease

Ken W. Lee, MD, MS, Paul Kligfield, MD, Gordon E. Dower, MD, and Peter M. Okin, MD

8. **La similitud entre los valores de dispersión del … tuye un elem…**

TABLE 3 Manual QT Measurements in Standard and Derived Electrocardiograms (ECGs) (n = 78 pairs)

	Standard ECGs	Derived ECGs
QT interval (ms)		
Dispersion	49 ± 23	53 ± 49
Maximum	410 ± 42	414 ± 59
Minimum	361 ± 39	361 ± 37
QTc interval (ms)		
Dispersion	51 ± 24	55 ± 48
Maximum	429 ± 38	433 ± 53
Minimum	378 ± 33	378 ± 35



Pertinencia para la realización de la Investigación.

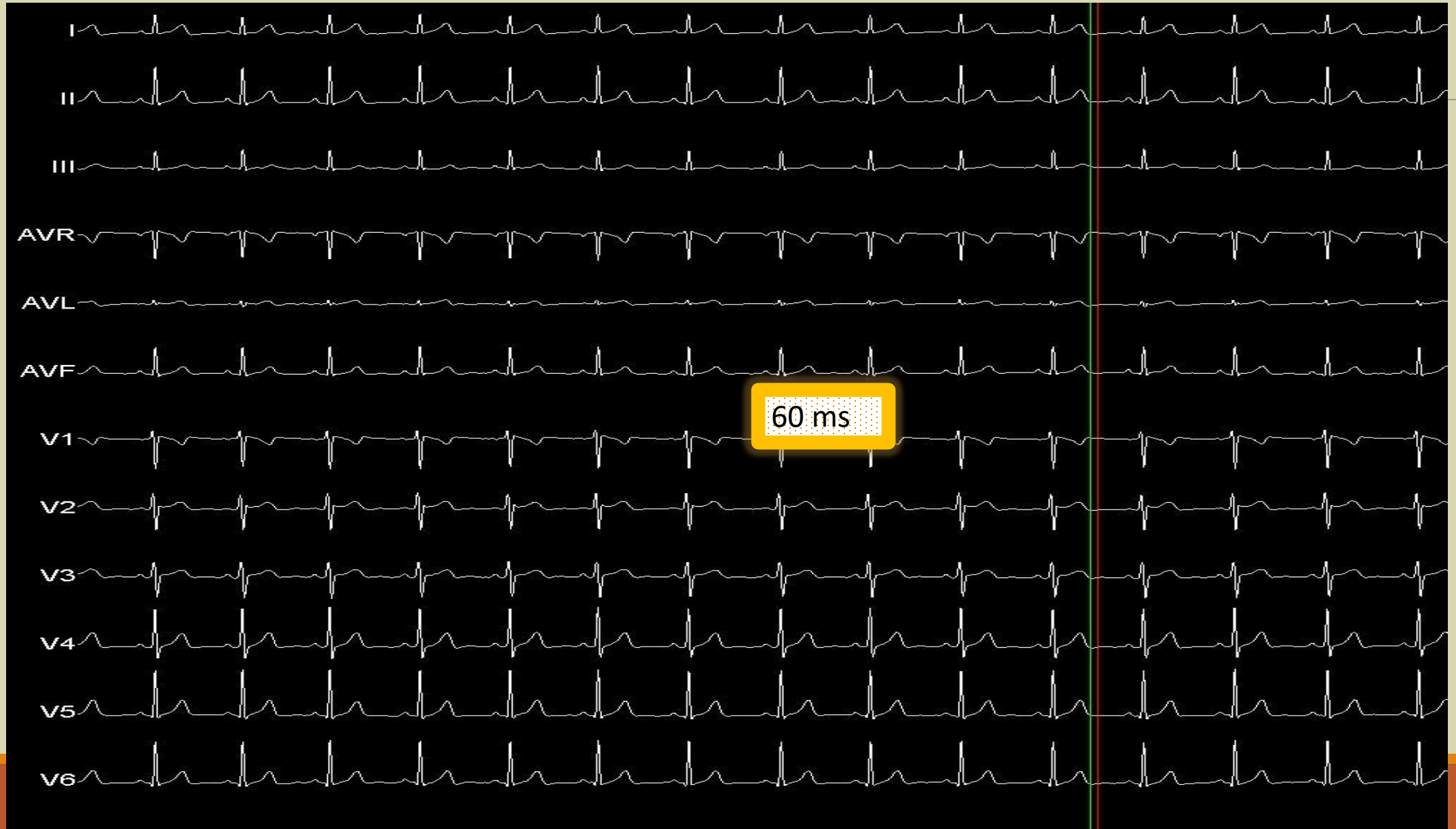
1.

Recomendación de realizar la medición del QT en las derivaciones II, V5, o V6.

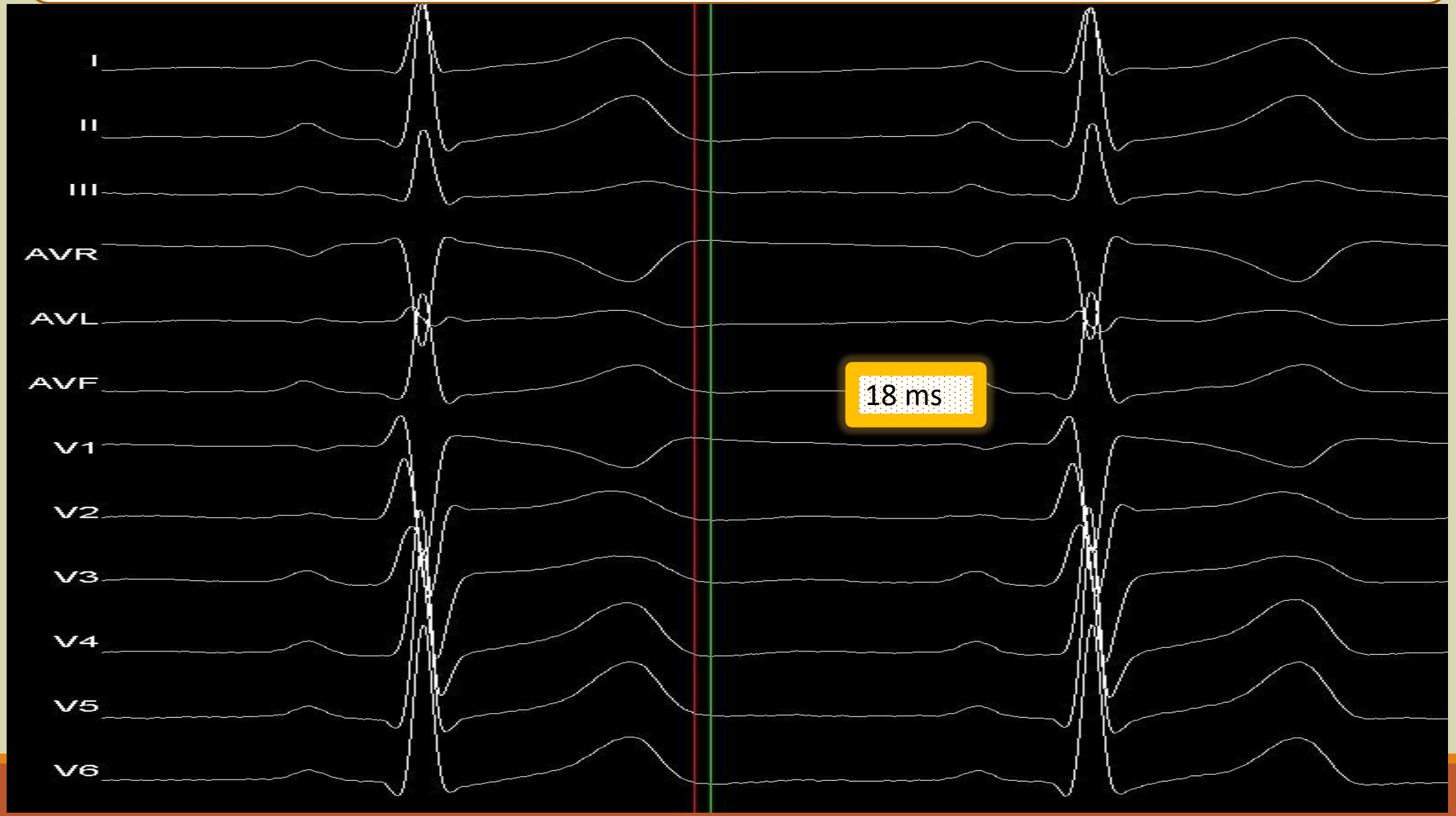
2.

Bondades de la amplificación digital del ECG

Dispersión del iQT en ECG convencional.



Atenuación de la dispersión del iQT tras la Magnificación del ECG.

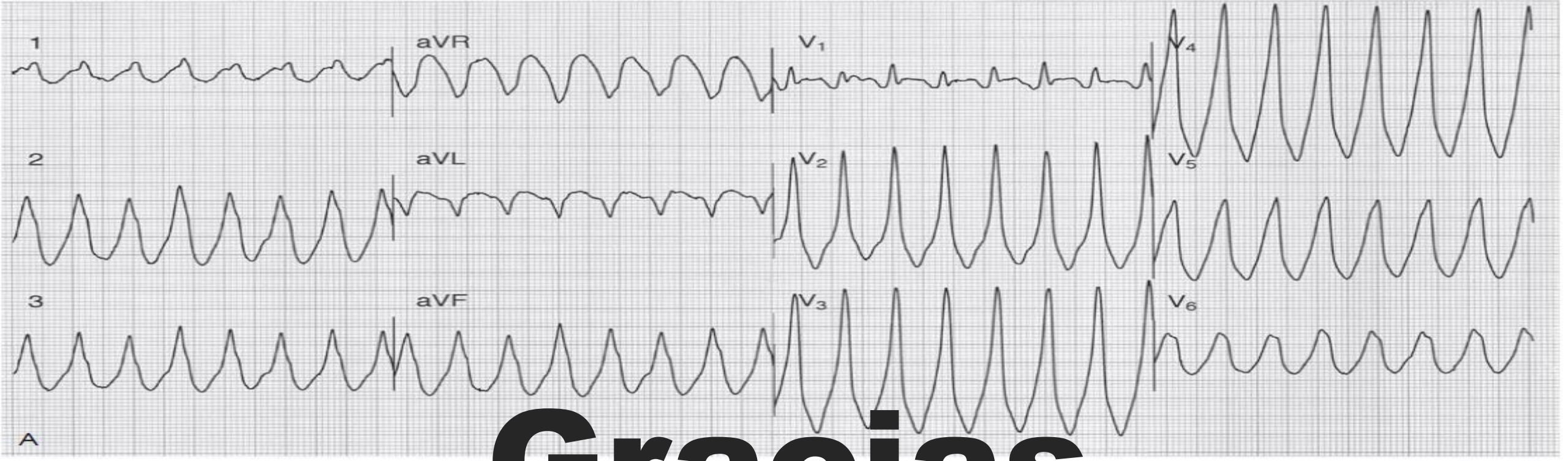


Conclusiones ?

T. Vectorial

Dispersión del Intervalo QT

T. Local



Gracias