

ANOTHER ETIOLOGY OF EPSILON WAVE: Brugada syndrome

HISTORICAL CONSIDERATIONS

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The so-called epsilon wave or **Fontaine wave** is characteristic but not pathognomonic of patients with Arrhythmogenic Right Ventricle Dysplasia/Cardiomyopathy (ARVD/C).

In approximately a 30% of the most severe cases of ARVD/C, the deflection may be observed in the J point on ST segment: **the epsilon wave**.

Epsilon wave are late potentials or low amplitude and short duration oscillations near the J point (before, just or immediately after): major criterion: if the addition of QRS complexes duration in $V1 + V2 + V3 / V4 + V5 + V6$ is \dot{g} than

The epsilon wave may be seen on a surface ECG (1) however, it is more commonly seen on SAECGs (High resolution ECG).

This wave is described as a terminal notch in the QRS complex. It is due to slowed intraventricular conduction.

Epsilon wave is a late depolarization seen only in V1-V4 leads, these waves are best seen in the ST segments of leads V1 and V2 different from J wave seen in V5, V6 and inferior leads which origin is not so clear.

- 1) Intrinsic features: they are small notches or oscillations in variable quantities (1, 2, 3 or more).
- 2) Location: at the end of QRS in the J point or onset of ST segment (there is no consensus about this).
- 3) Leads: observed in right precordial leads; however Dr. Li Zhang et al, found the epsilon wave in the leads of the frontal plane, especially in inferior leads.
- 4) Frequency in ARVD: approximately 15-30% of cases in 12-lead ECG. This percentage increases if we use the ECG with the modified protocol.
- 5) Value of criterion: considered to be a major criterion for diagnosis by the Task Force for ARVD diagnosis
- 6) High resolution ECG: observed more frequently with this method.
- 7) Pathognomonic character: in spite of the characteristics in ARVD, they are not pathognomonic, since they have been described in other diseases associated with myocardial damage: RV infarction, inferior or dorsal (3), sarcoidosis (4), sickle cell anemia (5), and now in BRUGADA SYNDROME (6)!!!!
- 8) Meaning: late posterior potentials (PP) that occur in the RV free wall in patients with ARVD or other entity.
- 9) Inversion of T wave in leads V1-V3 and/or epsilon wave found in 70% of patients with ARVD.

The reason that led Prof Fontaine to choose this name is not clear enough.

Could it be because its shape reminded him of the Greek letter epsilon as suggested by Surawicz e Knilans? (2) If this was the case, it should be stated that the epsilon-like wave is in a horizontal position:

The tracing shows in the location of the J point and the beginning of the ST segment, an indentation that reminds of the Greek letter epsilon, however, in a horizontal position.

Fontaine may have considered the sequence of Greek letters: alpha, beta, gamma, delta and epsilon? If the additional wave observed in ventricular pre-excitation is located in the Ja point (end of the P wave) and is called delta wave the following additional

wave in the Greek enumeration should be called with the following letter: epsilon.

Faced with this doubt, I decided to ask the author of this nomenclature, Dr. Fontaine himself, who replied to me thus: "Dear Dr. Perez Riera, Thanks for your documents. The naming of the ECG waves and the reason of their choice is a long story. Dr. Willis Hurst in Circulation has published a summary of these some years ago. I have strongly contributed to this paper as indicated by Dr. Hurst. Your remarks about Osborn are interesting; I will keep them in my files. Best regards."

Next, I asked him to send me the reference he mentioned, and soon Guy Fontaine did send it. "Dear Dr. Pérez Riera, Here is, as you requested to Dr. Fontaine, Dr. Hurst's reference in Circulation: Hurst JW. Naming of the Waves in the ECG, With a Brief Account to their Genesis. Circulation 1998: 98, 1837-1942.Ó

Thus, in this article, in page 1941, when Dr. Hurst mentions the epsilon wave, he says: "Fontaine discovered and named the epsilon waves. He chose the epsilon because it follows delta in the Greek alphabet and is the mathematical symbol for smallness." The term "epsilon" was nice, because it occurs in the Greek alphabet after delta; thus, delta represents the preexcitation and epsilon the post-excitation phenomenon. In addition, epsilon is also used in mathematics to express a very small phenomenon.

It was quite exciting to demonstrate that these LP located on the free wall of the RV of patients with ARVC/D could be recorded on the surface by SAECG and in some circumstances by increasing the magnification of ECG recording.

To conclude, even with the great respect I feel for Dr. Boris Surawics and Dr. Timothy Knilans, I have to comment that they made a mistake by thinking that the reason of the name was morphological and not the sequence of the Greek alphabet.

Pathological ECGs are common in young SCD victims, in spite of being taken many years before death. An ECG could help identify prospective victims of SCD, and should always be taken in cases with possible cardiac-related symptoms or a family history of SCD.

Ozeke O, Cavus UY, Atar I, Ozin B, Ilkay E. Epsilon-like electrocardiographic pattern in a patient with Brugada syndrome. *Ann Noninvasive Electrocardiol.* 2009 Jul;14(3):305-308.

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Both Brugada syndrome (BrS) and arrhythmogenic right ventricle dysplasia/cardiomyopathy (ARVD/C) can cause repolarization abnormalities in right precordial leads and predispose to sudden cardiac death (SCD) due to ventricular arrhythmias.

Although there is controversy over whether BrS is distinct from ARVD/C, it is believed that both are different clinical entities with respect to both the clinical presentation and the genetic predisposition.

The coexistence of these two relatively rare clinical entities is also reported, but, some hypothesized that it is more possible that disease of the right ventricular muscle might accentuate the Brugada electrocardiographic pattern.

In clinic practice, there may be cases where the dividing line is not so clear. We report a 33- year-old male presenting with recurrent syncope, who has a peculiar pattern of coved-type ST-segment elevation (ST-SE) with epsilon- like wave in right precordial leads.

References/Referencias

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