THE ECG CHANGES THAT OCCUR DURING CORONARY SPASM

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Coronary spasm: I

- Is a temporary, abrupt, and focal contraction of the muscles of the wall of a coronary artery, that originates angina pain.

- This type of angina, classically occurs at rest and more frequently at the same time daily, specially at night.

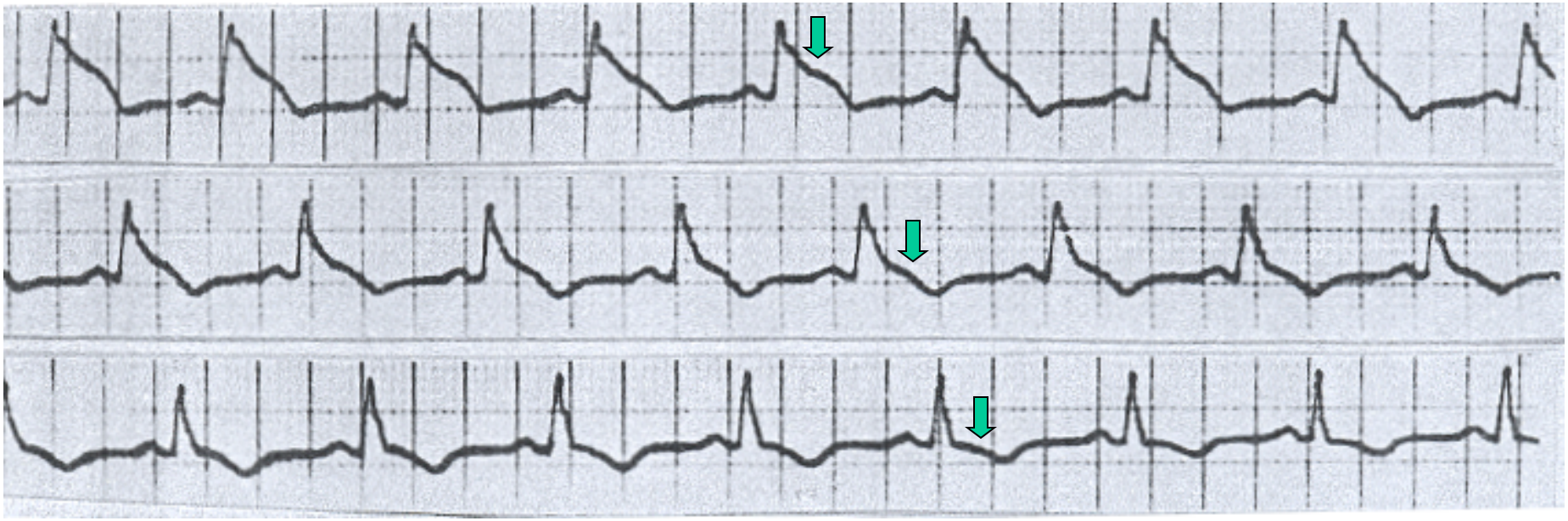
- May be present in any of the three epicardial arteries and the duration ranges may be from seconds to few minutes (2-10 minutes)

Coronary spasm:II

- Occurs more frequently in patients with evident coronary atherosclerosis.

- Several pharmacological agents (antimigraine tablets, chemotherapy drugs, amoxicilin and illicit drugs) have been identified as potential trigger, especially in young people.
- The anginal crisis last usually no more than a few minutes. However, as in the next example, the ST resolution may occur in a few seconds

ECG Holter Recording

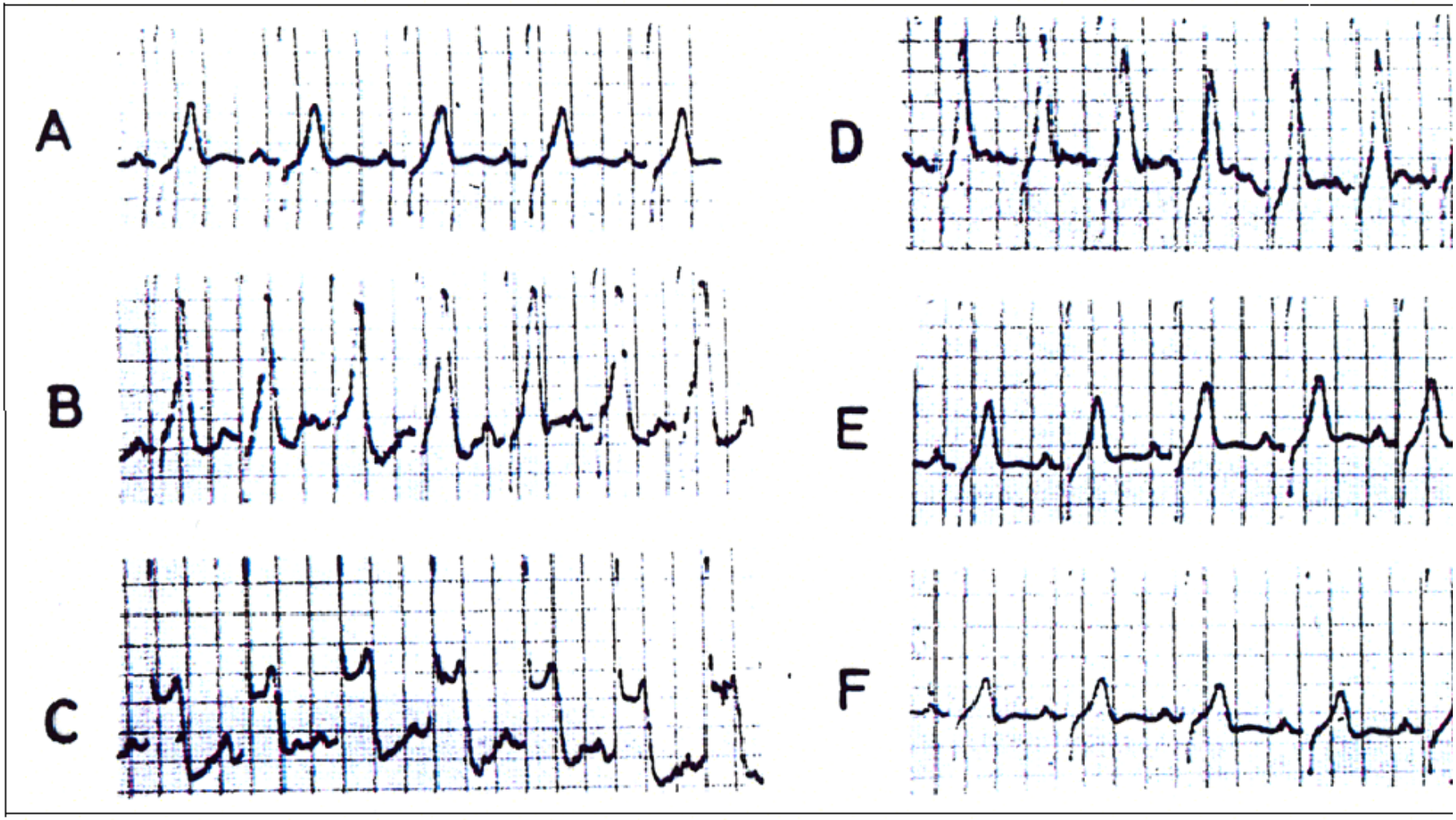


Patient with crisis of Prinzmetal angina, who presented typical pattern of subepicardial injury.
At few seconds of onset of pain, the crisis is ending and the Holter registry have recorded the ST resolution.
The arrows shows the progression of ST elevation to the resolution in few seconds.

Coronary spasm: III

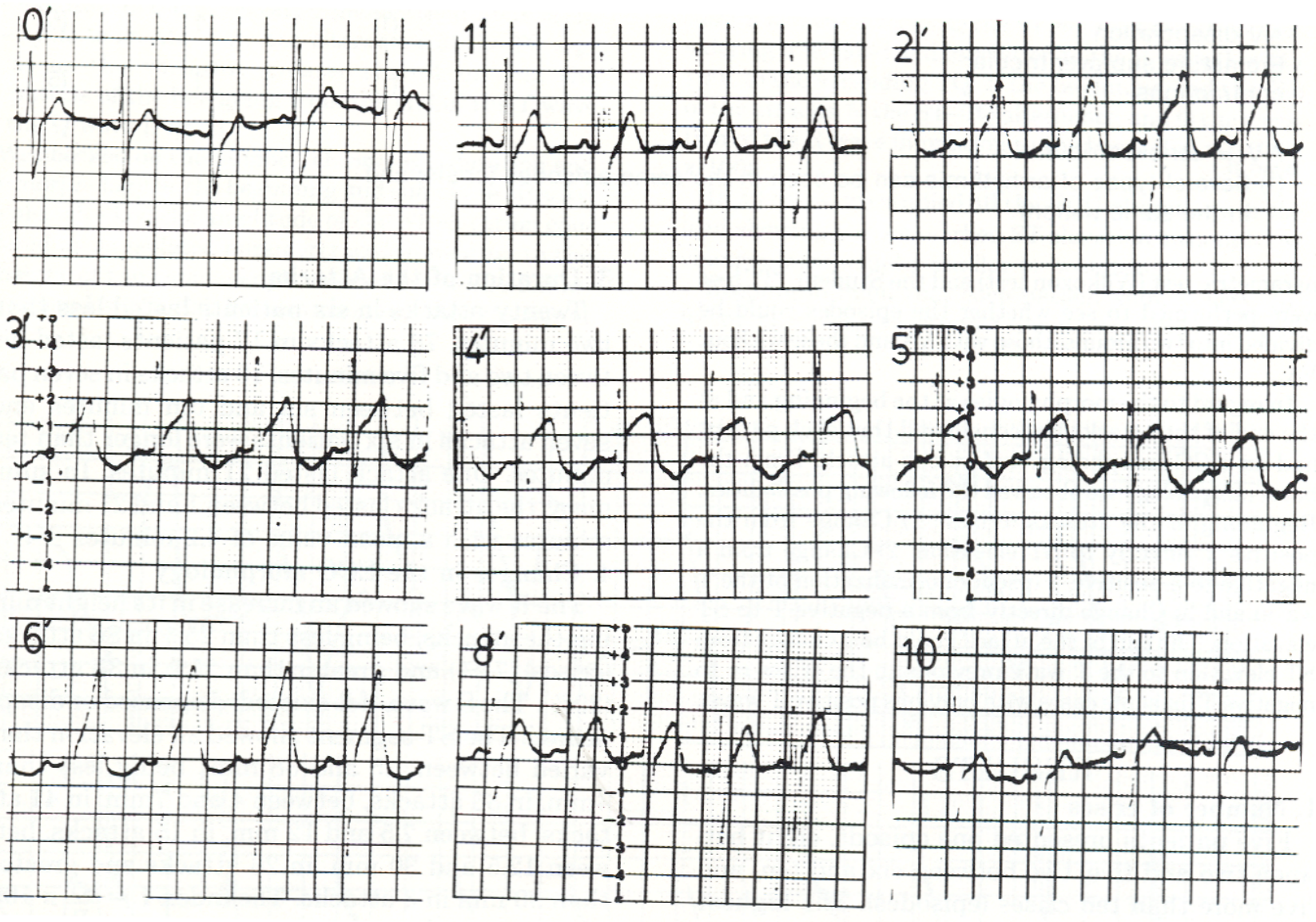
- The typical ECG change described by Prinzmetal is a very brisk development of ST-segment elevation, sometimes quite striking.

- In more than half of the cases ST segment elevation is preceded by a tall and peaked T wave, that is explained by subendocardial ischemia that is promptly followed by transmural ischemia (ST elevation) (ECG pattern of subepicardial injury).



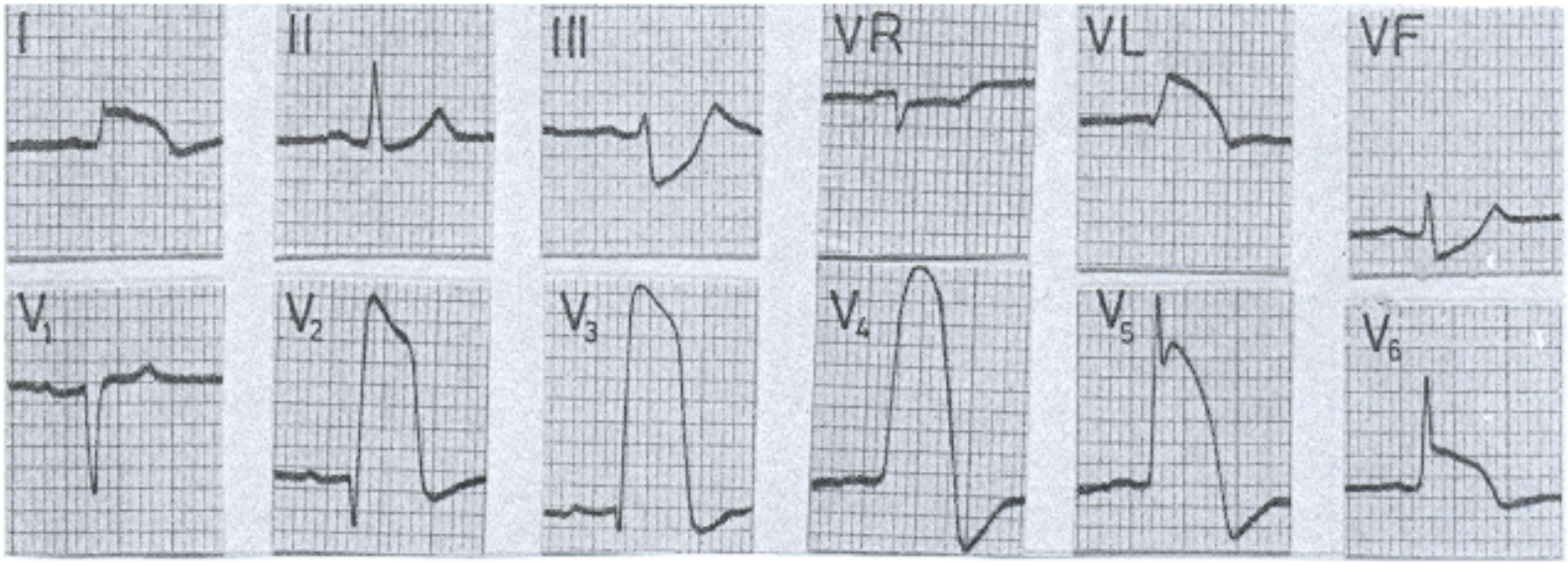
Crisis of coronary spasm recorded by Holter ECG

(A) control. (B) initial pattern of a very tall T wave. (C) ST-segment elevation appears. (D-F) Resolution towards normal values with the ECG changes in inverse order..



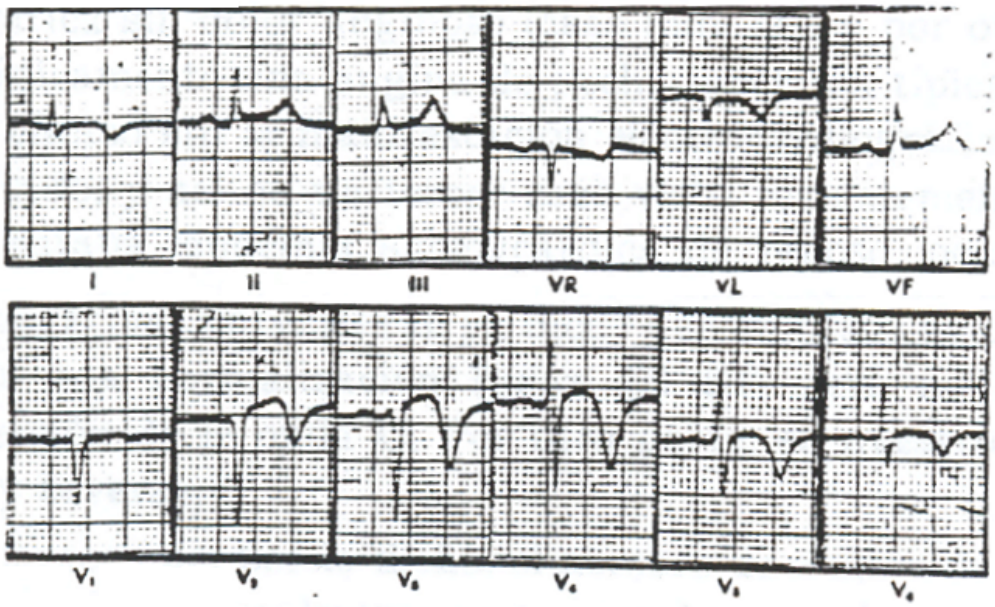
This figure shows an example of Holter ECG sequence of coronary spasm attack (Prinzmetal angina) from minute 0 (basal ECG) until resolution (minute 10).

A

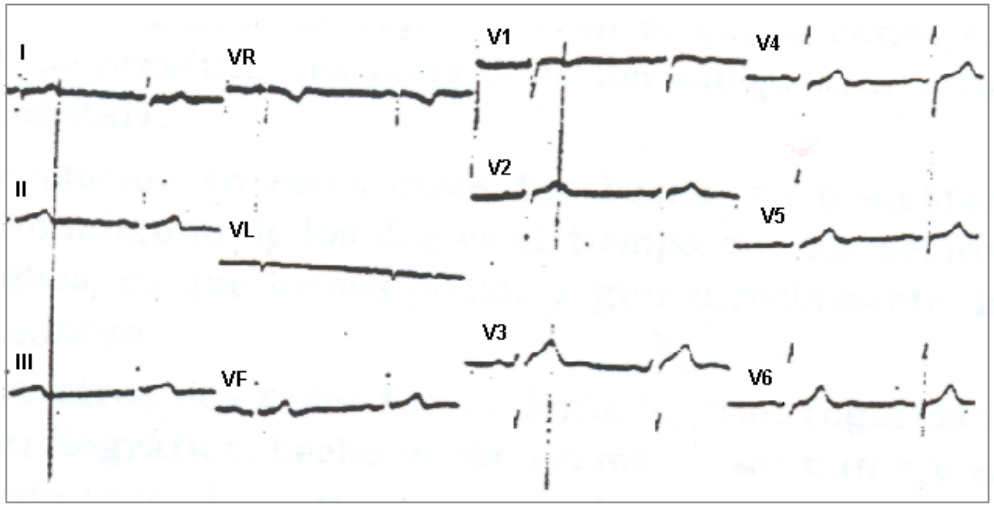


(A) Surface ECG of 65-year-old patient with typical crisis of Prinzmetal angina that presents in the peak of pain an ST-segment elevation (V1 to V6, I and VL). This case corresponds to a transitory complete proximal occlusion of LAD proximal to D1 (because ST-segment elevation from V2 to V6, I and VL with ST-segment depression in inferior leads especially III and VF. But not to S1, because then is not ST elevation in VR and V1, and ST depression in V6 .

B



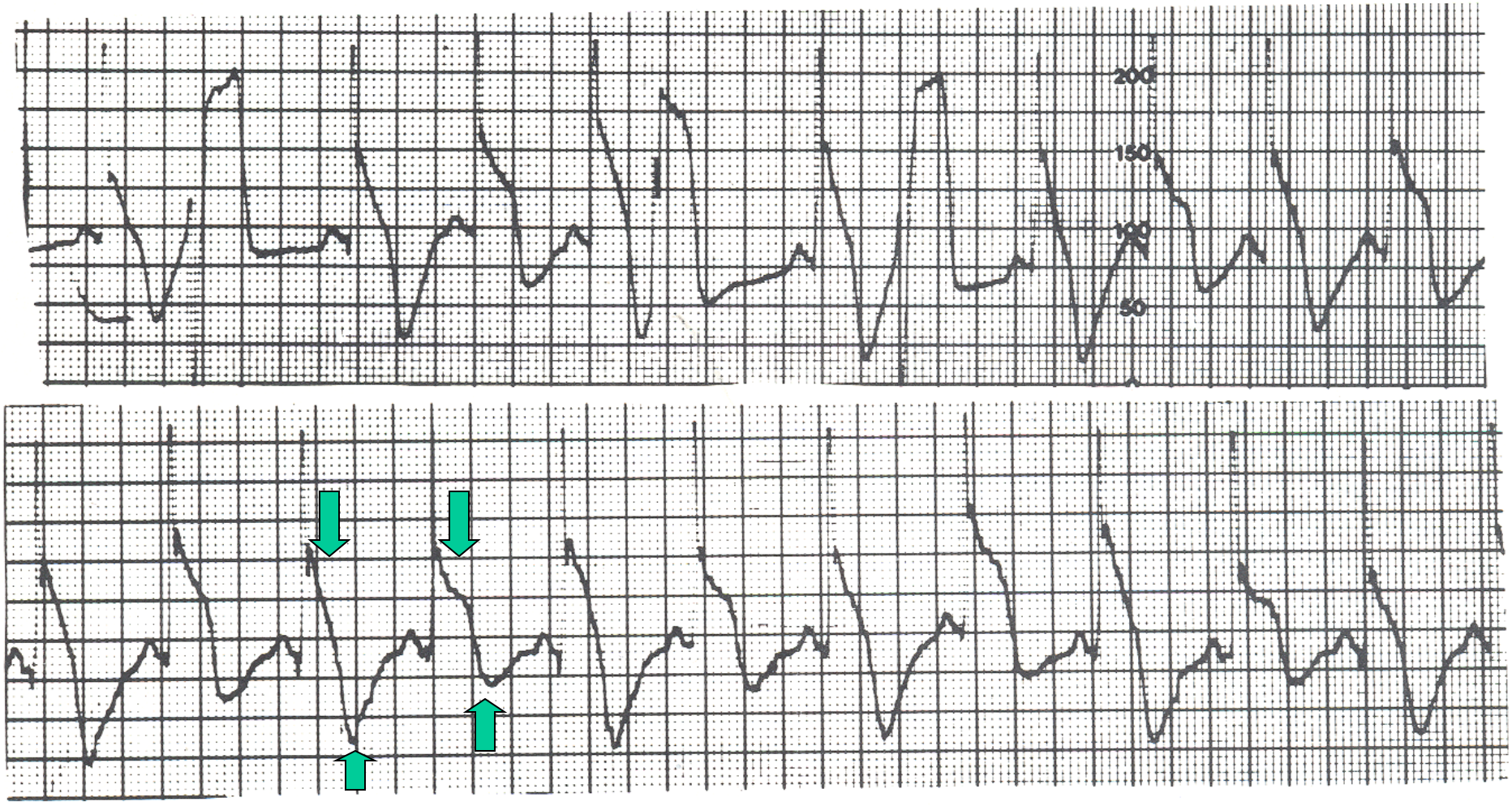
C



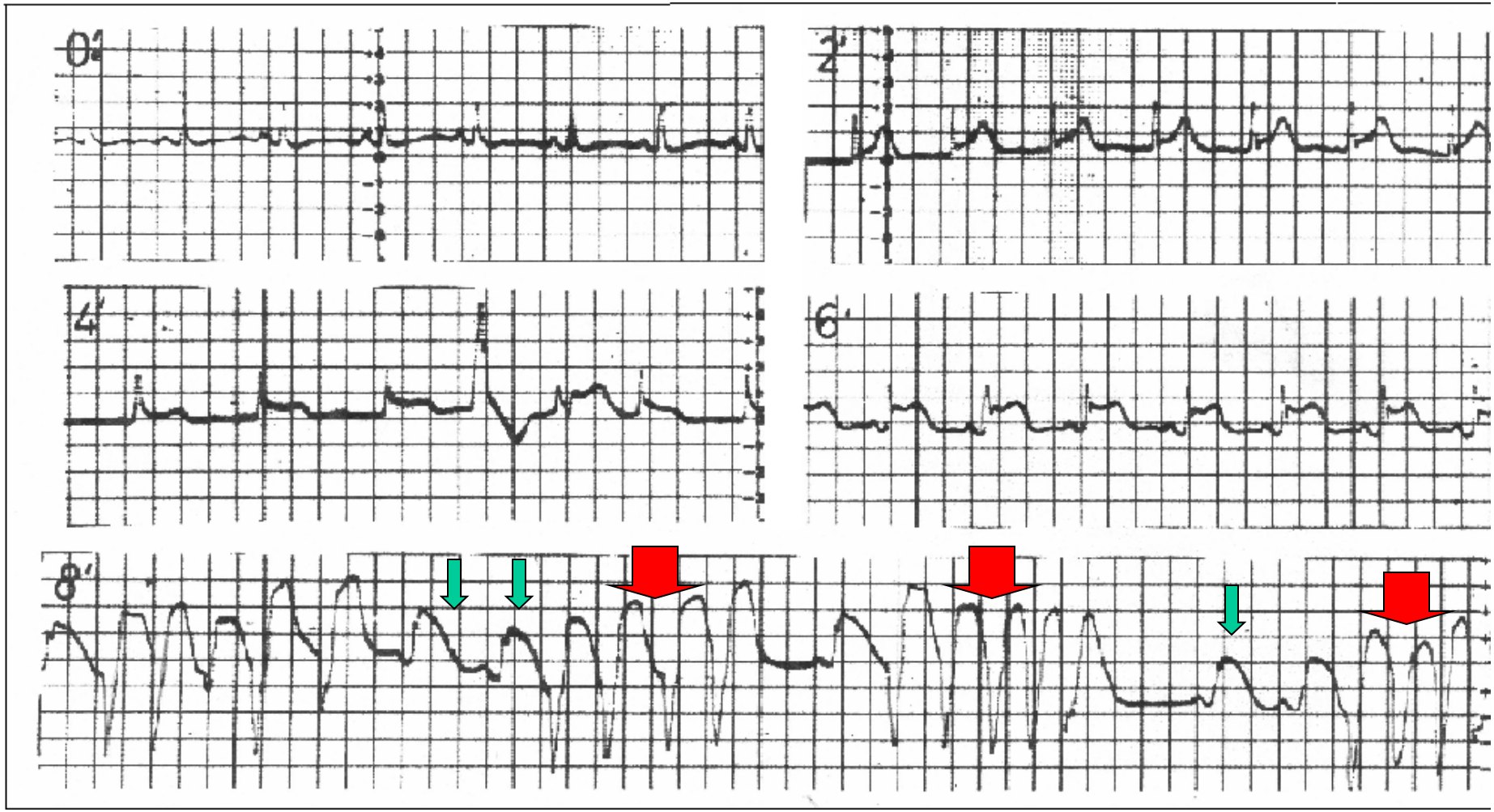
The same patient. Observe: (B) ECG some hours after the crisis of anginal pain with deep negative T wave in all precordial leads (reperfusion pattern) and (C) After 1 week the ECG was normal even with the recovery of rS morphology in V1-V2).

Coronary spasm: IV

- When coronary spasm persists longer, an ST segment/TQ-interval alternance may occur, and also ventricular arrhythmias may appear (see next example)



Holter recording of a patient with an attack of Prinzmetal angina. Observe of typical image of ST-TQ alternance (arrows) and premature ventricular contractions (PVCs).



Sequence of an attack of Prinzmetal angina with the appearance of ventricular tachycardia runs (red arrows) at the moment of maximum ST elevation (green arrow)

Occurrence of Cardiac Arrhythmias According to the Timing of the Attacks

		Beginning	Maximum ST ascent	Ending
Minor VA	18 (100%)	2 (11%)	7 (39%)	9 (50%)
Major VA	25 (100%)	5 (20%)	13 (52%)	7 (28%)
Other CA	12 (100%)	3 (25%)	7 (58%)	2 (17%)
Total	55 (100%)	10 (18%)	27 (49%)	18 (33%)

VA: Ventricular Arrhythmias
CA: Cardiac Arrhythmias

In this table we can see the occurrence of arrhythmias according to the timing of crises.
Ventricular arrhythmias (VA) outside the crises were scarce: premature ventricular contractions in five patients and supraventricular tachycardia in two patients.

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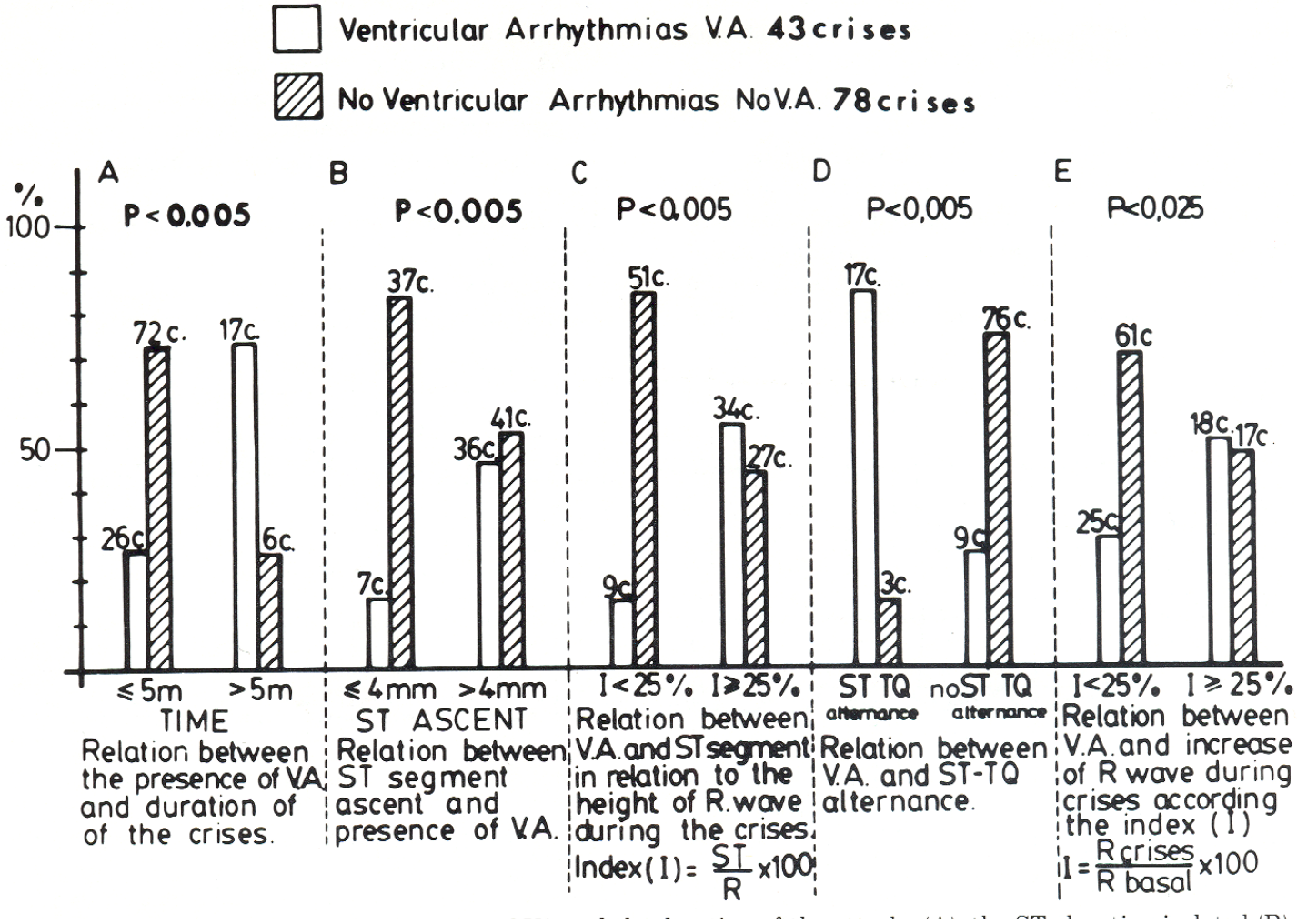

Observe in the graph relationship between the existence of ventricular arrhythmias (VA) with: the duration of the crisis (A), the ST elevation isolated (B) and the increase of R wave (C), the ST-TQ alternance (D) and the modification of the R wave in relation to the former R wave(E).

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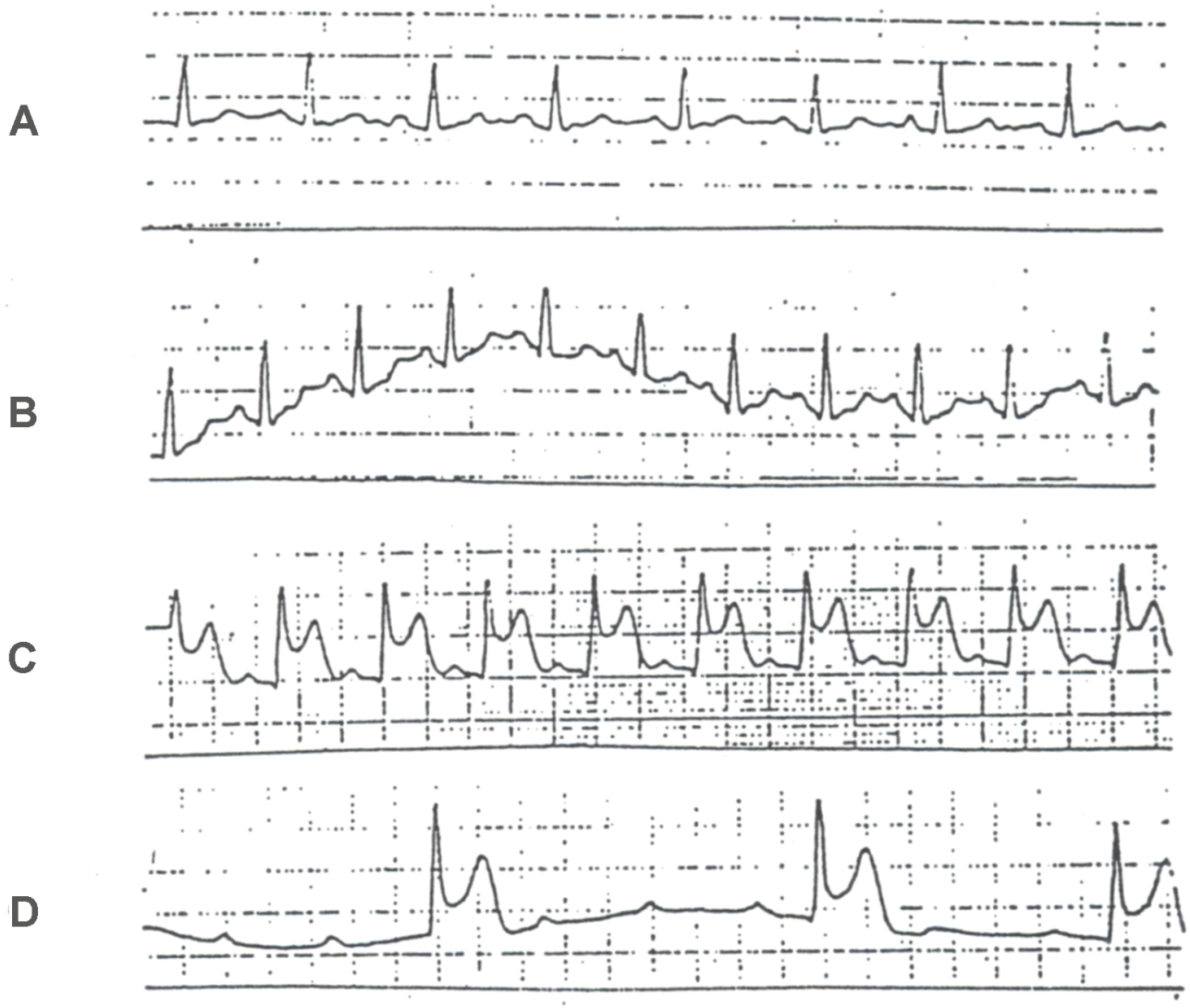
Coronary spasm: V

- Sometimes, ST segment depression may be seen, probably in patients with previous very important subendocardial ischemia

- In other occasions, pain may occur with minor or absent ECG signs. f.i Just a little more peaked T wave.

- Finally in same cases coronary spasm may occur during exercise testing. (see next slide)



Exercise test in a patient with precordial pain. Before the exercise test (A) and during it (B), ST segment is normal. At the end, there is an important ST-segment elevation by precordial pain due to coronary spasm (C), which was followed by advanced AV block (D). That disappear in few seconds.

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