ECG PATTERNS IN ACUTE CHEST PAIN

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THE CONCEPT OF ACUTE CORONARY SYNDROME

Acute prolonged chest pain at rest or with minimal effort is termed acute coronary syndrome (ACS). Urgent evaluation of such a patient is needed and always has to include a resting 12-lead electrocardiogram (ECG). The ECG patterns that can be encountered in the ACS consist of:

- acute ST-segment elevation myocardial infarction (STEMI)
- acute non-ST-segment elevation myocardial infarction (non-STEMI)
- T-wave inversion
- normal ECG.

Final confirmation must come from a demonstration of elevations of the cardiac markers (CPK, CK-MB and troponins).

THE CONCEPT OF THE CURRENT OF INJURY

In ischaemia of the ventricles, an additional electrical current is generated — the so-called current of injury. If the ischaemia is mainly endocardial the current of injury generated will be directed from outside the heart towards the cavity and an ECG electrode placed over this ischaemic area will be reflected as a negative current which will depress the ST segment, because the current is moving away from the electrode (Fig. 1).

If the ischaemia of the ventricle is on the epicardial side of the myocardium or transverses the thickness of the muscle, the current of injury generated will be directed from inside the heart towards the outside. An electrode placed over the ischaemic area will pick up the current moving towards the electrode and consequently register as a ST elevation. In Fig. 2 these principles are highlighted and the various ECG patterns associated with acute chest pain demonstrated.
In Fig. 3 an ECG strip is shown where, in the top panel, the ECG segments are normal while in the bottom panel, taken when the patient

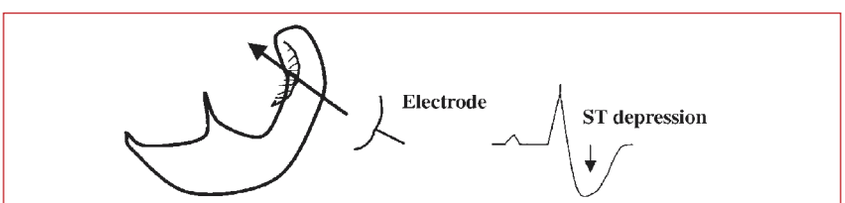

Fig. 1. Current of injury in endocardial ischaemia.

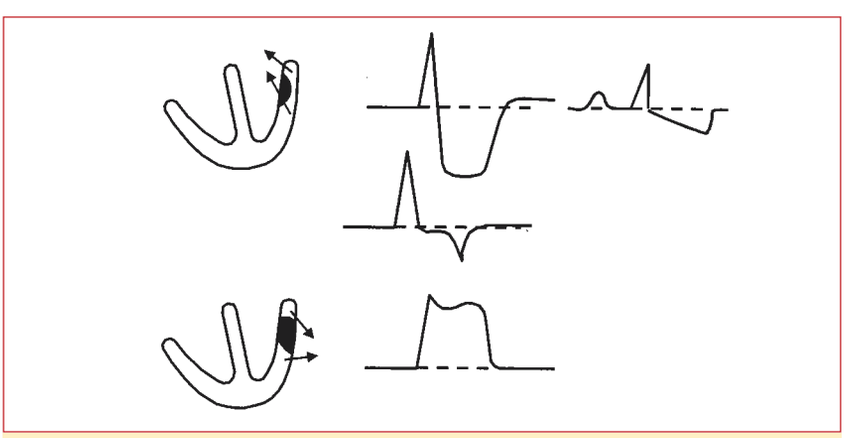

Fig. 2. ECG patterns associated with acute chest pain.

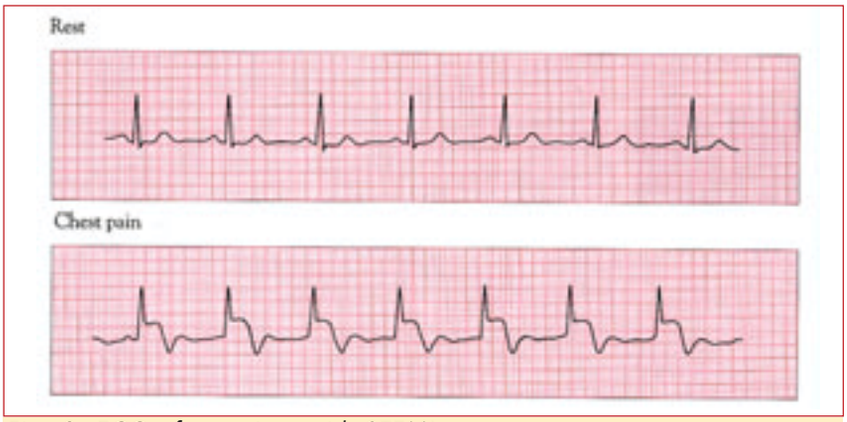

Fig. 3. ECG of a patient with STEMI.

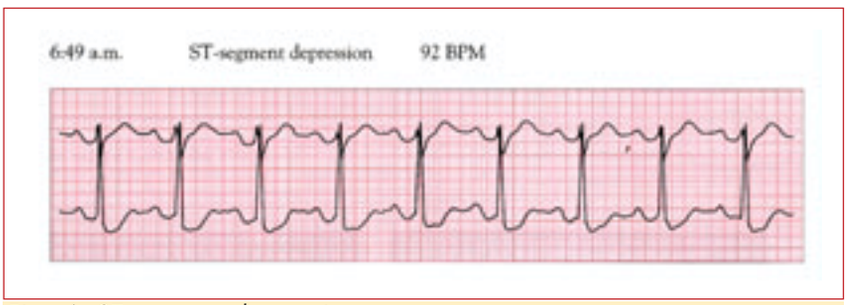

Fig. 4. ST-segment depression.

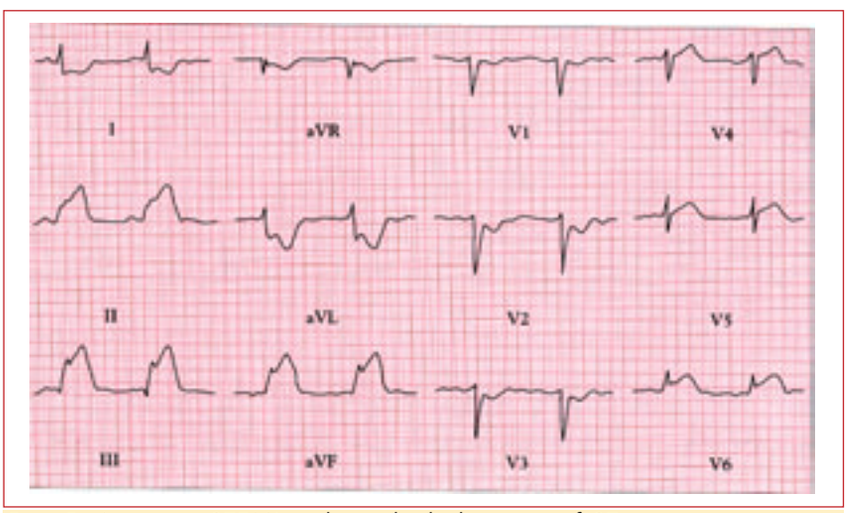

Fig. 5. An acute STEMI with marked elevation of ST segments.

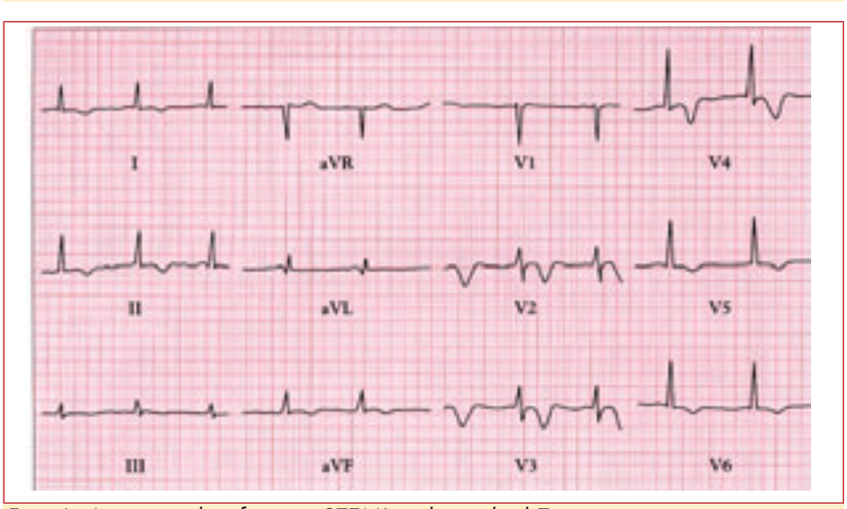

Fig. 6. An example of a non-STEMI with marked T-wave inversion.

developed chest pain, ST-segment elevation is demonstrated. In this patient a STEMI was diagnosed. In Fig. 4 ST-segment depression is demonstrated. In Fig. 5 an acute STEMI is shown with marked elevation of ST-segments in leads II, III, avF, V4 and V5. There is reciprocal ST depression in other leads. In Fig. 6 an example of a non-STEMI is shown with marked T-wave inversion.

SUMMARY

During chest pain of cardiac origin at rest (ACS) various ECG patterns may develop. The ST segments can be elevated (STEMI), depressed (non-STEMI) or T-wave inverted, or the ECG may rarely even stay normal. Final proof of diagnosis rests with elevation of cardiac markers.

THE MARVEL OF INEXPENSIVE CARDIOVASCULAR DRUGS: ASPIRIN

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HOW DOES ASPIRIN WORK?

Aspirin irreversibly inhibits cyclo-oxygenase (COX_1 and COX_2). This leads to the inhibition of thromboxane A_2, rendering platelets unable to aggregate and initiate a thrombus. A dose of 100 mg aspirin will completely abolish the thromboxane A_2 effect. The antiplatelet effect of aspirin is maximal within 60 minutes after a dose of 160 mg. The antiplatelet effect of a single dose of aspirin can be detected before any drug can be measured in the blood (due to exposure of platelets to aspirin in the portal circulation). The antiplatelet effect lasts 7 - 10 days (the lifetime of platelet).