Case report

Evidence of walk-through phenomenon during echocardiographic dipyridamole stress test

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This case report deals with induced regional wall motion abnormalities that spontaneously disappeared during an echocardiographic stress test with dipyridamole. A patient underwent this test because of atypical chest discomfort and a positive result of exercise stress test. Transient septal, apical and anterior akinesia were observed after the first dose of dipyridamole, but they were short-lasting and did not return during the continuation of the test. Coronary angiography showed a critical stenosis of the left coronary artery. A mechanism similar to that responsible for the walk-through phenomenon might explain the observed findings. Thus stress echo with dipyridamole needs careful continuous monitoring, because transient wall motion abnormalities can otherwise be missed resulting in a false negative test.

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During echocardiographic stress test with dipyridamole the appearance of new regional wall motion changes is a criterion for a positive result of the test and is considered to be an end point; indeed, further continuation of the test might only worsen ischemia. This case report documents an unusual improvement of regional wall motion changes during the continuation of dipyridamole infusion.

Case report

A 50-year-old male patient was brought to our attention because of chest pain, both at rest and during exercise. The only risk factor for coronary artery disease was arterial hypertension. The pain was usually present shortly after wake up in the morning. Symptoms had been present for a few months, and were somewhat atypical because of their short duration of a few seconds or minutes. Physical examination, rest ECG, chest X-ray and blood samples were normal. A bicycle exercise test showed ST segment depression of 1 mm in V_4-V_6 leads at a workload of 125 W.

Stress echocardiography with dipyridamole and atropine was performed, according to a previously described protocol[1]. Basal examination showed left ventricular hypertrophy and normal wall motion (Fig. 1). After the first dose of dipyridamole akinesia developed in the middle septal, apical and anterior segments (Fig. 2), in the presence of light chest burning and in the absence of ECG changes. Blood pressure and heart rate were 120/80 mmHg and 70 b/min, respectively. As both symptoms and segmental wall motion changes were transient and disappeared spontaneously within less than 1 min, the test was continued and completed with the second dose plus atropine. Surprisingly, no new regional abnormalities were observed throughout the test (Fig. 3); ECG did not change either nor the patient developed chest pain. Blood pressure and heart rate at peak stress were 130/80 mmHg and 100 b/min, respectively. The tape was reviewed and transient echocardiographic abnormalities were confirmed by two other experienced blinded observers.

The patient underwent coronary angiography that showed a subocclusive stenosis in the first segment of the left anterior descending coronary artery, a 70% stenosis of the intermediate branch, and intra- and inter-coronary collaterals. Patient symptoms completely resolved following coronary angioplasty of both stenoses and stenting of the anterior descending coronary artery.

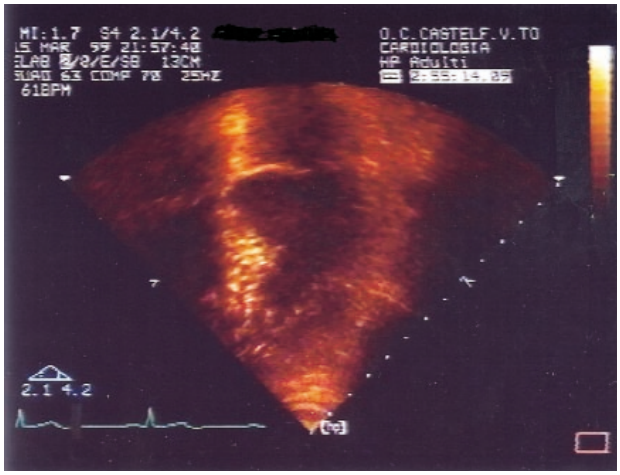

Figure 1. *End-systolic frame of an upside down 4-chamber apical view, showing the left ventricle with concentric hypertrophy and normal wall motion before the test.*

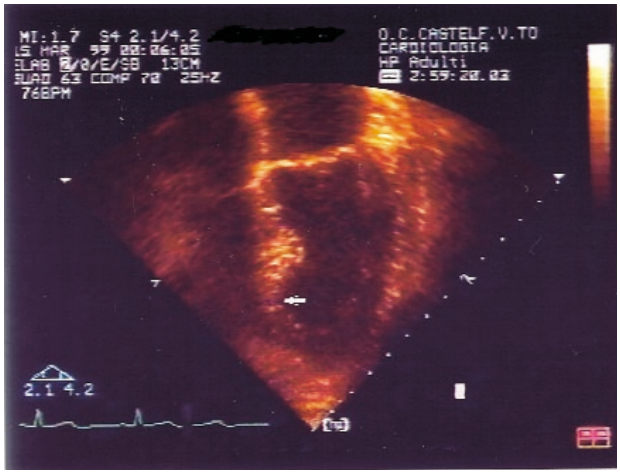

Figure 2. *After the first dose a septal-apical* (arrow) *and latero-apical akinesia developed.*

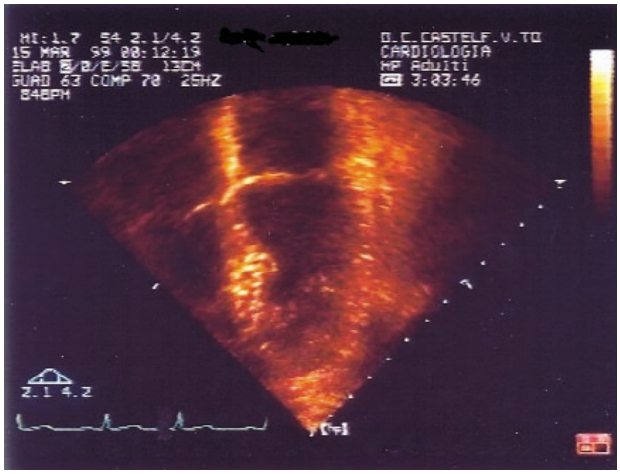

Figure 3. *After the spontaneous disappearance of the akinesia, the test was continued and completed with atropine without the induction of new dyssynergies.*

Discussion

In 1897 Osler first described walk-through angina as the chest pain that a patient can overcome by persisting in the effort. It is worth noting that the walk-through phenomenon is characterized not only by an improvement of anginal symptoms, but also by the disappearance or lessening of associated ST segment depression. The phenomenon does not seem dependent on the type of stressor and has been reported during both exercise and atrial pacing ECG test. Indeed spontaneous resolution of pacing-induced ST segment depression has been observed, despite maintenance of the same pacing rate. To the best of our knowledge, this is the first report describing this phenomenon in the setting of an echocardiographic stress test.

Stress echocardiography is extensively used for the diagnosis and prognostic stratification of coronary artery disease, because of its high sensitivity in the detection of coronary stenoses revealed by new regional wall motion abnormalities during myocardial-induced ischemia. Different mechanisms may be responsible for dipyridamole-induced ischemia: the "steal effect" caused by the potent arteriolar vasodilation induced by the drug[2]; the increase in the rate-pressure product, especially in association with atropine; spasm of epicardial coronary arteries, typically occurring after the abrupt withdrawal of the coronary vasodilation induced by the infusion of aminophylline[3].

The mechanism responsible for the walk-through phenomenon during dipyridamole infusion observed in our patient can only be speculative. It is unlikely that regional wall motion abnormalities were predominantly caused by an increase of myocardial oxygen consumption, as they subsequently disappeared in the presence of a higher rate-pressure product. A biphasic modulation of the coronary blood flow at the level of epicardial coronary stenoses and of coronary microcirculation can be postulated, with induction of ischemia at an early stage, relieved by subsequent recruitment of collateral vessels. Dipyridamole might also have induced coronary spasm due to vagal withdrawal resulting in autonomic imbalance, triggered, in turn, by generalized vasodilation at the beginning of the test[4] followed by spontaneous resolution. Another possibility is that ischemic preconditioning made the myocardium more resistant to ischemia caused by the higher dose of dipyridamole as proposed in order to explain walk-through angina[6]. In this case, dipyridamole might have induced preconditioning also by inhibiting adenosine re-uptake resulting in high local concentration of this substance and direct stimulation of A_1 receptors[7].

This case report shows that the walk-through phenomenon can occur during stress echocardiography with dipyridamole. Its presence may be responsible for a false negative result of the test, because wall motion changes can be transient and disappear despite the infusion of higher doses of dipyridamole. Our findings sug-

gest that it might be insufficient to record only the frames corresponding to the final phase of each infusion step and that it might be advisable to continuously monitor the echocardiogram throughout the test.

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