CASE REPORT

Angiographic documented coronary arterial spasm in absence of critical coronary artery stenoses in a patient with variant angina episodes during exercise and dobutamine stress echocardiography

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Abstract

Dobutamine stress echocardiography is widely performed as a useful diagnostic tool in patients with known or suspected coronary artery disease. Dobutamine induced myocardial ischaemia is frequently associated with ST segment depression. ST segment elevation is uncommon and is almost always associated with prior myocardial infarction or transient total coronary occlusion. Dobutamine induced ST segment elevation in absence of significant coronary artery disease is a rare condition and is supposed to be a consequence of severe coronary artery spasm. The case of a 58 year old man with variant angina episodes at rest, during exercise test, and dobutamine stress echocardiography is reported, in whom coronary spasm without significant coronary artery stenoses was documented angiographically.

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Keywords: coronary spasm; variant angina; Prinzmetal angina; dobutamine stress echocardiography; exercise test

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A 58 year old man with a history of spontaneous pneumothorax and hyperlipidaemia was referred to a peripheral hospital with chest pain episodes at rest and on exercise. He had smoked a total of 40 pack-years but had stopped smoking one year earlier. He had never used cocaine or any other illicit drugs. On admission he was asymptomatic and the ECG showed mild T wave inversion in the precordial leads that resolved without cardiac enzyme elevation (fig 1A). Coronary angiography showed a tight stenosis of the first diagonal branch and a 40% stenosis of the mid-left anterior descending coronary artery (LAD). Left ventricular systolic function and wall motion were normal. A percutaneous transluminal coronary angioplasty (PTCA) of the first diagonal branch was performed with a satisfactory result (30–50% residual stenosis). Aspirin and atorvastatin were prescribed. That night the patient had an episode of chest pain associated with ST segment depression in the precordial leads without cardiac enzyme elevation.

The following week he complained of further chest pain episodes, lasting one to two minutes each, mainly at rest. To rule out residual ischaemia in the diagonal branch territory, a dobutamine stress echocardiography (DSE) was performed. Following a standard protocol, a dobutamine infusion at 5 μg/kg/min was increased stepwise to 20 μg/kg/min at three minute intervals. The baseline ECG showed mild T wave inversion in the precordial leads and the heart rate was 54 beats/min. At a dobutamine infusion of 5 μg/kg/min the patient developed chest pain and bradycardia (46 beats/min) and the ECG showed a 1.5 mm ST segment elevation in the inferior leads and 2 mm down sloping ST segment depression in the precordial leads (fig 2A). The DSE was continued and the chest pain and the ECG changes resolved spontaneously. At a rate of 20 μg/kg/min dobutamine, the patient developed further chest pain associated with pronounced ST segment elevation (maximum 3 mm) in the precordial leads, mild ST depression (0.5 mm) in the inferior leads (fig 2B), and

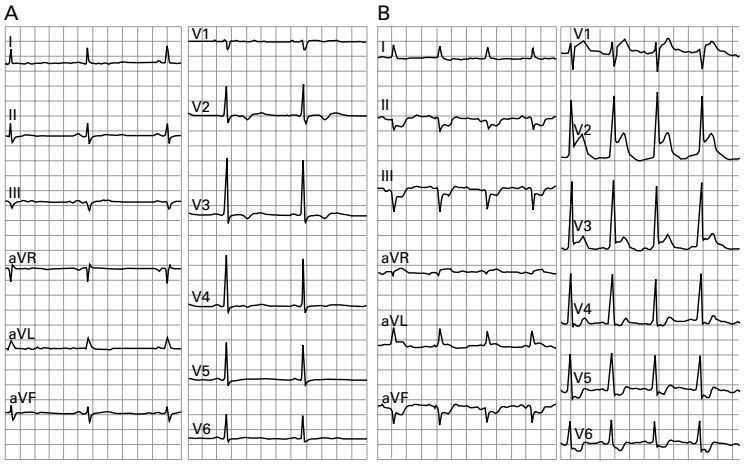

Figure 1 ECG on admission showing mild T wave inversion in the precordial leads (A). ECG tracing during exercise stress test at maximal workload demonstrating left axis deviation and pronounced ST segment elevation in the precordial leads (5 mm in V2) (B).

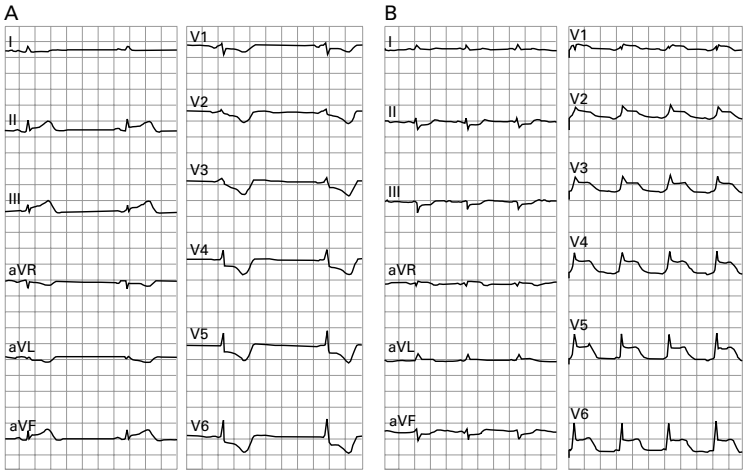

Figure 2 ECG tracing during DSE. At a rate of 5 μg/kg/min dobutamine, 1.5 mm ST segment elevation in the inferior leads and 2 mm down sloping ST segment depression in the precordial leads are observed (A). At a rate of 20 μg/kg/min dobutamine, 3 mm ST segment elevation in the precordial and 0.5 mm ST depression in the inferior leads are observed (B).

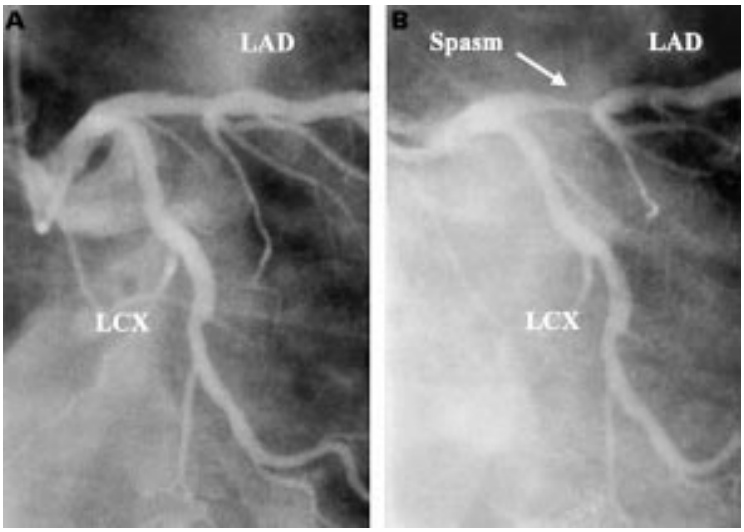

Figure 3 Angiographic images of the left coronary artery (right anterior oblique) demonstrating a non-significantly diseased proximal LAD (A) developing a spontaneous sustained spasm (B).

a non-sustained wide QRS complex tachycardia. Echocardiography showed no associated wall motion abnormalities. The procedure was stopped and nasal nitrates were sprayed. Heart rate and blood pressure reached maximums of 95 beats/min and 130/70 mm Hg, respectively. The symptoms and the ECG changes disappeared within five minutes. About two hours later, coronary angiography was repeated, showing a 50% residual stenosis of the first diagonal branch and a 40% stenosis of the mid-LAD. PTCA and stenting of the diagonal branch and PTCA of the LAD were performed with good results. At the end of the procedures, the patient developed a persistent spasm of the proximal LAD requiring systemic and intracoronary nitrates as well as systemic calcium antagonists (fig 3). The following day the patient performed a symptom limited treadmill stress test. Again, at maximal workload, he developed chest pain, left anterior fascicular block, and a 4 mm ST segment elevation in the anteroseptal leads (fig 1B) with frequent premature ventricular contractions and bigeminus. The ECG changes and the symptoms ceased a few minutes after nitrates were administered. The patient was discharged with nitrates and calcium antagonists and has remained free from symptoms.

Discussion

Exercise induced ST elevation in patients with previous myocardial infarction may simply indicate left ventricular wall asynergy. ST segment elevation without prior myocardial infarction is a rare condition and is commonly associated with critical coronary artery stenosis.[1] Temporary ST segment elevation associated with chest pain is the hallmark of variant (Prinzmetal) angina, and is a consequence of severe coronary spasm. In a way that is not yet fully understood, exercise can induce coronary spasm in patients with variant angina, as demonstrated in small groups of patients subjected to supine bicycle exercise on the cardiac catheterisation table.[2] DSE is widely performed as a useful diagnostic tool in patients with known or suspected coronary artery disease. Through its inotropic and chronotropic effects, dobutamine increases the myocardial oxygen demand and may induce ischaemia and segmental wall motion abnormality in the presence of significant coronary artery disease. Myocardial ischaemia induced by dobutamine is frequently associated with ST segment depression on the ECG. Conversely, ST segment elevation is uncommon during DSE and is virtually always associated with prior myocardial infarction or subtotally stenosed coronary arteries.[3] As a pharmacologic agent, dobutamine has not been associated with coronary spasm. However, there are rare reports describing electrocardiographic ST segment elevation during dobutamine infusion in the absence of significant coronary artery disease or previous myocardial infarction, suggesting that dobutamine induced coronary arterial spasm may occur.[4 5] In our patient, the ECG changes during DSE suggested spasm of the right coronary artery at a low dose of dobutamine (ST segment elevation in the inferior leads and ST segment depression in the precordial leads) and spasm of the LAD at higher dose (pronounced ST segment elevation in the precordial leads and mild ST depression in the inferior leads) (fig 2). The second coronary angiography showed no haemodynamically significant coronary artery stenosis. In the wrong assumption that coronary spasm most likely developed on the top of two mild stenoses of the first diagonal branch and the mid-LAD, PTCA of these two segments was performed with good results. However, at the end of the procedure, the very proximal LAD, not involved in the PTCA and not significantly diseased (fig 3A), developed a spontaneous sustained spasm (fig 3B). Hypercholesterolaemia and previous smoking may have predisposed this abnormal coronary vasomotor response.[6] Other triggering conditions such as hyperventilation or cocaine were ruled out.

Despite the low frequency of coronary spasm during DSE, echocardiographers should be aware of this potentially dangerous complication. Our patient not only developed ST segment elevation and angina, but also a non-sustained wide QRS complex tachycardia. Although the risk of serious arrhythmogenicity associated with ST segment elevation during DSE has been reported to be very low,[7] one case of ventricular fibrillation associated with chest pain and ST segment elevation during DSE in the absence of significant coronary artery disease has been described.[8] The present case report has some practical consequences. First, in certain conditions, dobutamine may trigger coronary artery spasm. Second, if both ST segment elevation and wall motion abnormality during DSE occur, nitroglycerin rather than β blockers would be the first line treatment to avoid unopposed α adrenergic stimulus in patients with variant angina.[9] Third, if coronary artery spasm is suspected, PTCA of non-significant lesions is not indicated because spasm does not necessarily occur at the site of mild lesions. In this setting a provocation test with hyperventilation or ergonovine maleate may be useful.[10]

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