

Acute Stent Thrombosis on Exercise Testing Shortly After Stent Implantation

To the Editor,

Noninvasive assessment of percutaneous revascularization outcome by exercise testing is regular practice. However, the safety of performing this procedure soon after stent implant has not been established¹ and the literature has reported isolated cases of acute stent thrombosis after exercise testing.²⁻⁸ We describe a patient who had received a stent in the mid-left anterior descending (mLAD) artery and presented stent thrombosis 10 days later, 30 min after he had undergone a submaximal exercise test with negative results.

The patient was a 64-year-old man with hypertension and diabetes admitted after several brief episodes of typical chest pain. At the time of admission, he was asymptomatic and the electrocardiogram showed ST elevation in V₁ through V₄ with QS wave in leads V₁ through V₃. Troponin-T was 0.91, creatine kinase, 143 µmol/L, and creatine kinase-MB, 22 µmol/L. The results were interpreted as an evolved anterior acute myocardial infarction (AMI); he was treated with beta blockers, acetylsalicylic acid, intravenous nitroglycerin, and low-molecular-weight heparin. Coronary angiography 3 days later showed a severe lesion in the mLAD that was treated with predilatation and implant of a 2.75/15-mm conventional pyrolytic carbon stent, which achieved angiographic success and final TIMI 3 flow (Figure 1A and B). Once the procedure was completed, a 300-mg loading dose of clopidogrel was administered, followed by 75 mg/day thereafter. Ten days later, a pre-discharge submaximal exercise test was negative. Thirty minutes after completion, the patient presented typical chest pain with ST elevation of V₁ through V₅ (Figure 2A) and therefore, intravenous abciximab therapy was started. Emergency coronary angiography showed mLAD occlusion due to in-stent

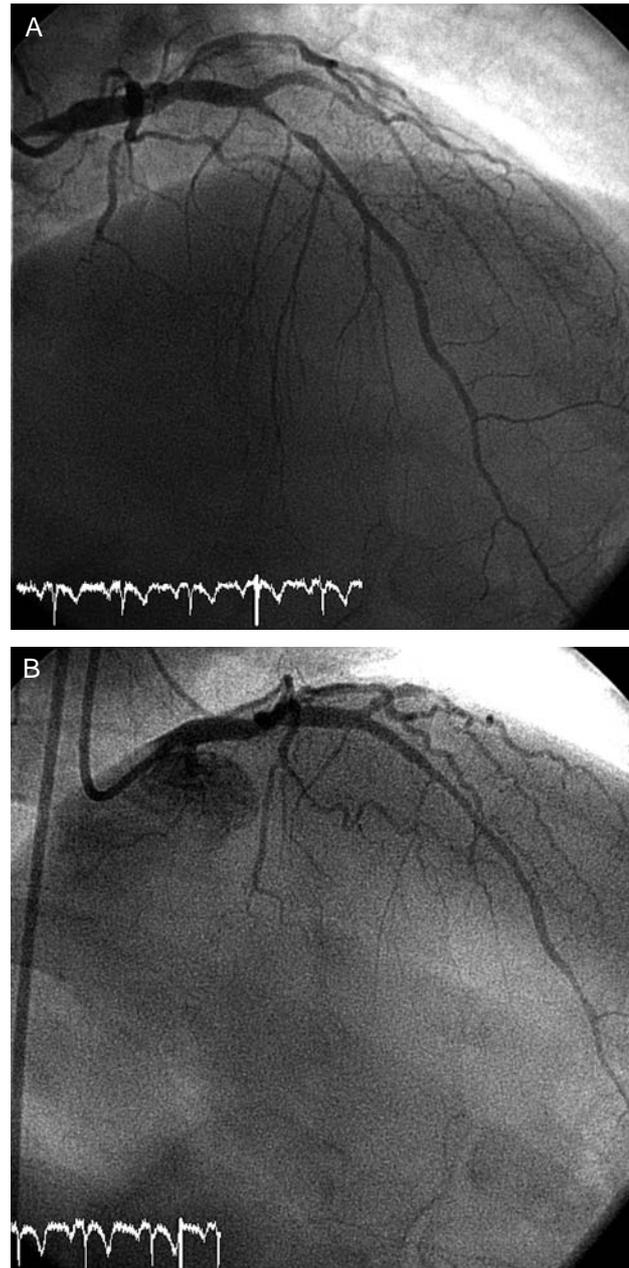


Figure 1. Severe lesion in the mid-left anterior descending artery at admission (cranial right anterior oblique view), before (A) and after (B) stent placement.

thrombosis. A thrombectomy was performed with an aspiration catheter (Export, Medtronic), and a 3/18-mm in-stent sirolimus-eluting stent was implanted, restoring TIMI 3 flow (Figure 2B and C). The maximum CK peak was 1212 µmol/L at 6 h. The patient was discharged 5 days later with no subsequent complications.

We found several cases of stent thrombosis related to exercise testing in the literature,²⁻⁸ and one case after stress echocardiography with dobutamine done 6 weeks after stent implantation.⁹ The time between stent placement and the exercise test varied from 4 days to 16 months, which questions

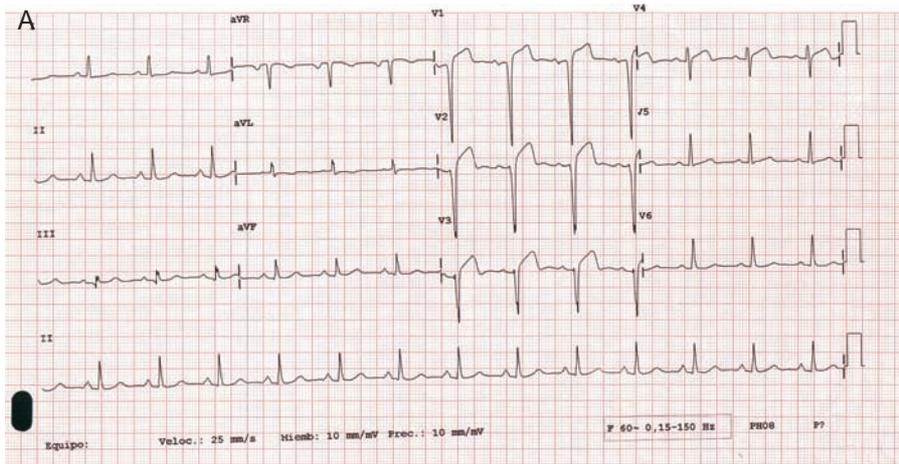
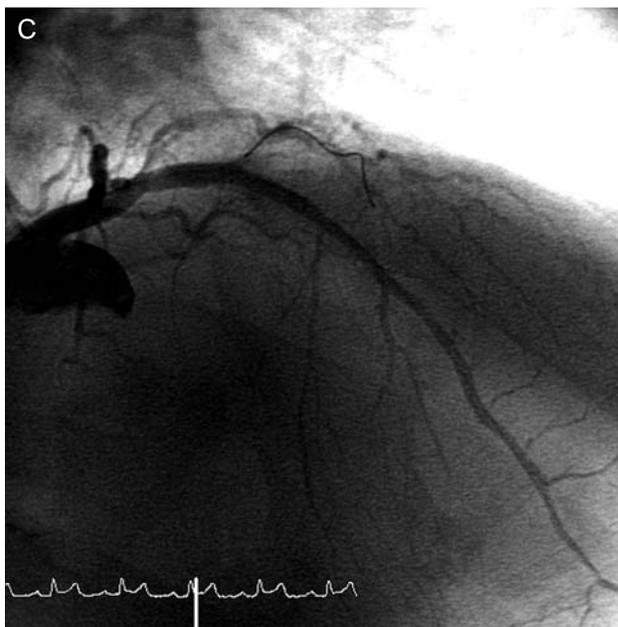
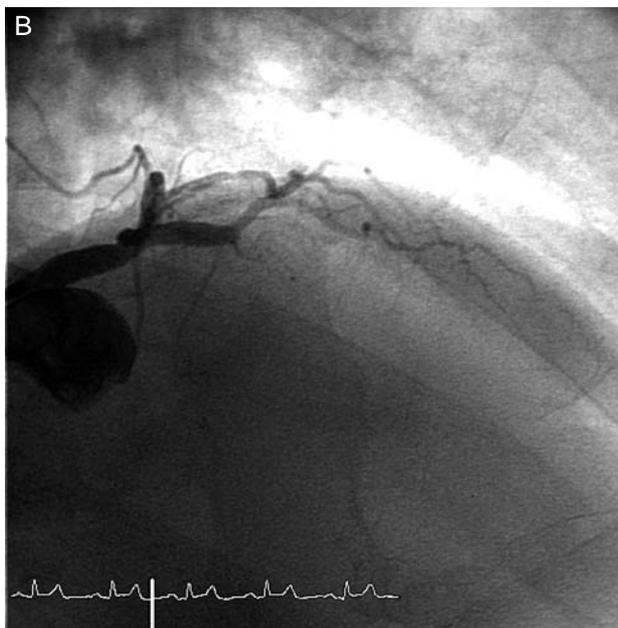


Figure 2. A: electrocardiogram 30 min after the exercise test was completed. B: emergency coronary angiography (cranial right anterior oblique view) showing thrombosis in the stent implanted in the mid-left anterior descending artery 30 min after the exercise test was completed. C: outcome after thrombectomy and placement of in-stent stent.



the safety of doing strenuous physical exercise for a long time after stent implant.

The related factors included inherent thrombogenicity of the stent, platelet activation and hyperreactivity caused by strenuous physical exercise,^{10,11} as well as a possible rupture of the arterial intima due to vessel wall stress secondary to increased blood pressure and flow during physical exercise.¹² In a prospective study, Roffi et al¹³ randomized 1000 patients to undergo symptom-limited exercise testing or not the day after stent implant. The factors associated with stent thrombosis were unstable angina, greater number of stent implants, greater length treated with stent, and suboptimal angiographic results. Although the primary endpoint (stent thrombosis in the first 14 days after the exercise test) was only observed in 5 patients from each group (1% in both groups), there were more patients with unstable angina in the group that had not undergone the test (22% vs 30%; $P < .01$), which could increase the number of thromboses in this group. In addition, the study only included half the patients who received a stent in this period. Pierce et al¹⁴ analyzed 261 patients by exercise test in the two months after stent implant for symptoms or as the predischage assessment following AMI. No acute coronary syndrome occurred after the exercise test, although the evaluation only included 261 of the 2105 patients with stent implant during the study period. Goto et al¹⁵ also failed to find a relationship between subacute stent thrombosis and exercise testing in 4360 patients who underwent stent placement after an AMI. According to the American College of Cardiology and American Heart Association guidelines,¹ the safety of early exercise testing after a percutaneous revascularization procedure is not established. However, because it can promote early return to work and daily activities, it is considered a Class IIa indication for these purposes.

In conclusion, although subacute stent thrombosis related to early exercise testing is extremely rare, particularly in patients on dual antiplatelet therapy, it has been reported and can have fatal consequences. Although late cases have been described,^{6,7} this phenomenon is probably even less common, since exercise tests are routinely done without complications 6 months after stent implant. We found only one case of stent thrombosis after a dobutamine stress echocardiography.⁹ The mechanisms involved would be the same as after the exercise test, with the additional possibility of vasospasm secondary to dobutamine.

Therefore, because in-stent thromboses are a rare but potentially serious complication, we believe that exercise testing and stress echocardiography should only be done in the first few days after stent placement if there is a clinical indication (recurrent angina or need to assess ischemia dependent on other lesions observed in the coronary angiography) and should be deferred whenever possible.

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