

Spontaneous Coronary Artery Dissection Manifested during Ergonovine Test and Treated with Intravascular Ultrasound Guided Stenting: A Case Report

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ABSTRACT

Spontaneous coronary artery dissection (SCAD) is an uncommon cause of acute myocardial ischemia, which frequently presents as sudden death. The pathophysiology and treatment of SCAD have not been fully determined. Herein, a case of SCAD, manifesting as variant angina, which rapidly progressed during an ergonovine test, in which 3 drug-eluting stents were deployed using intravascular an ultrasound guidance, with an excellent immediate result, is reported. (Korean Circulation J 2005;35:264-268)

KEY WORDS : Spontaneous coronary artery dissection ; Ergonovine stress ; Intravascular ultrasonography ; Drug-eluting stent.

Introduction

Spontaneous coronary artery dissection (SCAD), first reported by Pretty in 1931,¹⁾ is a rare, but increasingly reported, cause of acute coronary syndromes and sudden death.²⁾ Its diagnosis has been underestimated due to the high mortality rate and because the optimal treatment has not been fully determined. Herein, a case of SCAD in a healthy woman, in whom 3 drug-eluting stents were deployed using intravascular ultrasound (IVUS) guidance, with an excellent immediate result, is reported. This is the first report of spontaneous coronary artery dissection manifesting as variant angina, which rapidly progressed during an ergonovine test.

Case

A 29-year-old woman, without any known risk factors for coronary artery disease, presented at our hospital with an acute onset of chest pain. She was on no medication, including oral

contraceptives. Her physical examination was normal. The initial electrocardiogram (ECG) showed transient ST segment elevation for 1 mm in leads II, III and aVF, with ST segment depression of 2 mm and T wave inversion in leads V4-V6, I and aVL. After relief of the chest pain with oral aspirin, intravenous heparin infusion and sublingual nitroglycerin, the ECG changes were completely resolved. A transthoracic echocardiography demonstrated a normal left ventricular systolic function, with an ejection fraction of 69% and no regional wall motion abnormalities. Initially, her CK, CK-MB and troponin-T were normal.

A coronary angiography and provocative ergonovine testing were performed to confirm the diagnosis of variant angina. Her coronary angiogram demonstrated a normal left coronary artery. However, the right coronary angiogram showed about 50% diffuse stenosis at the mid right coronary artery (RCA) (Fig. 1A). After an intravenous injection of the 4th dose of ergonovine (200 μ g), the patient experienced newly developed severe chest pain, and the ECG showed ST segment elevation of 2 mm in leads II, III and aVF. On an immediate coronary angiogram, the left coronary artery was normal, but a tiny contrast media entrapment was observed at the mid RCA, without spasm (Fig. 1B). Despite an intracoronary bolus injection of 300 μ g nitroglycerin, the patient continued to experience chest pain, and a subsequent right coronary angio-

Received : January 11, 2005

Revision Received : February 15, 2005

Accepted : February 18, 2005

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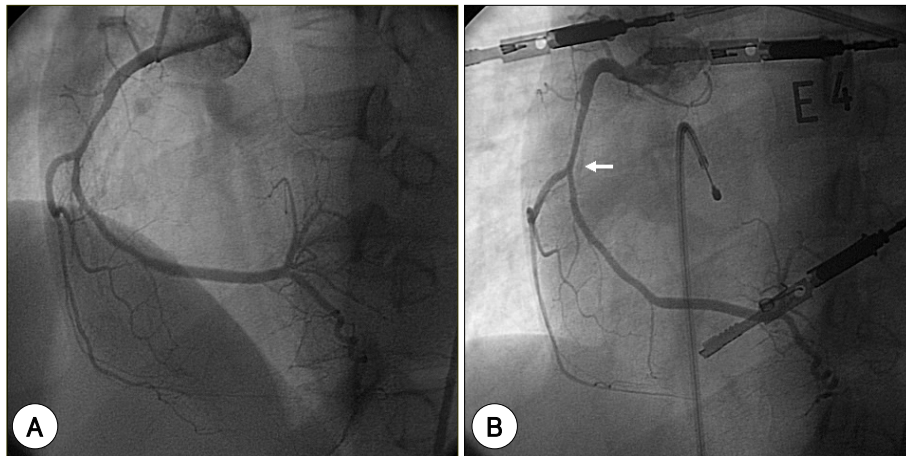


Fig. 1. A: on the left anterior oblique (LAO) view of the right coronary artery (RCA), diffuse and smooth intraluminal narrowing was observed at the mid RCA. B: the right coronary angiography, after an intravenous injection of 200 µg ergonovine, showed a contrast media entrapment (arrow) at the mid RCA, without spasm.

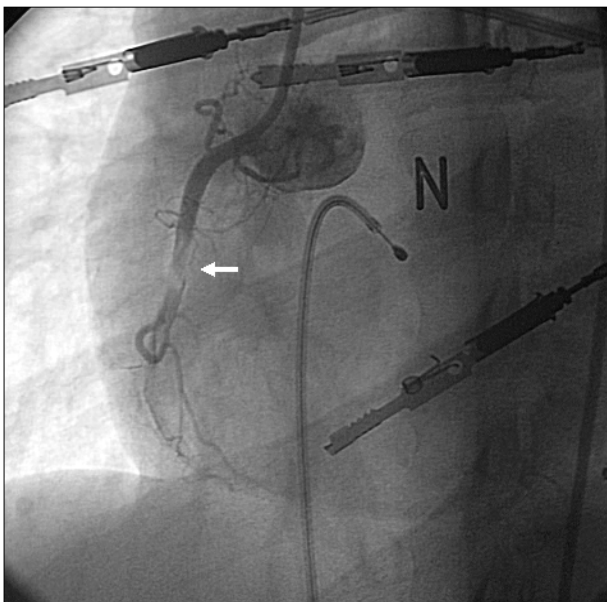


Fig. 2. LAO projection. The right coronary angiography revealed a flap-like defect, indicative of an intimal dissection (arrow), and total occlusion (TIMI 0 flow) at the mid RCA. LAO: left anterior oblique, RCA: right coronary artery.

gram revealed total occlusion (TIMI 0 flow), with a suspicious intimal flap at the mid RCA due to coronary artery dissection (Fig. 2). The lesion was crossed with a 0.014" Whisper guidewire, which was steered into the PDA with angiographic guidance. Subsequently, an IVUS (Boston Scientific Co., California, US) examination was performed to investigate the extent of the dissection and to confirm the correct placement of the guidewire within the true lumen. The IVUS showed extensive circumferential dissection, with an intimal flap, extending deep into the media layer from the proximal to the distal RCA. The true lumen has collapsed due to a false lumen. There was no evidence of atherosclerotic

change on the IVUS. However, the guidewire had been placed within the false lumen (Fig. 3). Therefore, our intention was to cross another wire into the true lumen under IVUS guidance. The IVUS was placed at the dissection entrance site, and a second guidewire was introduced into the true lumen under IVUS guidance after several attempts (Fig. 4). Two Cypher stents (3.5 × 33 mm, 3.5 × 23 mm) were deployed over the dissection, with overlap from the proximal to the mid RCA, and inflated at 16 atm. On another IVUS examination, the residual dissection remained at the distal RCA (Fig. 5). The third 3.0 × 18 Cypher stent was deployed with overlap at the distal RCA. The angiographic appearance was good, with the exception of a compromised small RV free wall branch. A final IVUS examination demonstrated complete sealing of the dissection, with good stent apposition (Fig. 6).

Discussion

SCAD is an uncommon cause of acute coronary syndromes, which is probably under diagnosed as it can manifest with sudden cardiac death.²⁾ Up to 75% of published cases are diagnosed at autopsy.³⁾ SCAD can also present with unstable angina, MI, or in rare instances, can be asymptomatic and detected incidentally on coronary angiography.⁴⁾¹⁶⁾ The incidence of SCAD is 0.1–0.3%, as based on various angiographic series.³⁾⁴⁾ Although SCAD has been reported to occur in association with pregnancy or during the early postpartum period,⁵⁾ oral contraceptives,⁶⁾ intense physical exertion,⁷⁻⁹⁾ blunt chest trauma,¹⁰⁾ connective tissue disorder, such as Marfan's or Ehlers-Danlos syndromes,¹¹⁾ and various immune or inflammatory disease, such as autoimmune thyroiditis,¹²⁾ and

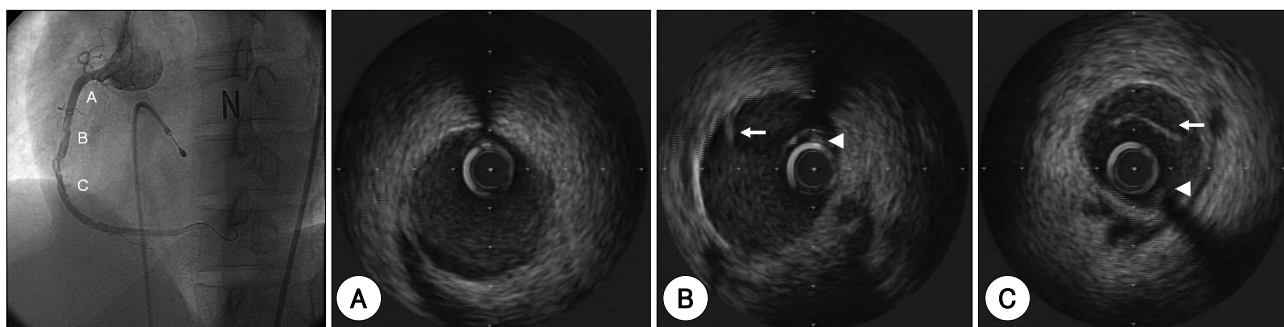


Fig. 3. Right coronary angiography after crossing the guide wire. Intravascular ultrasound showed an intimal flap and a collapsed true lumen next to the false lumen. Arrows identify the intimal flap. Arrowheads indicate the guidewire placed within the false lumen.

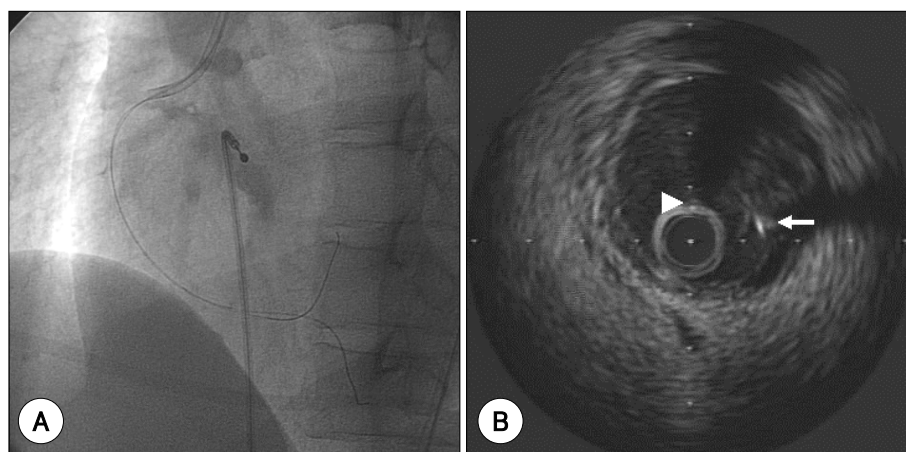


Fig. 4. A: two guidewires were placed in the right coronary artery. B: intravascular ultrasound showed that the 2nd guidewire (arrow) was placed within the true lumen and the first (arrowhead) within the false lumen.

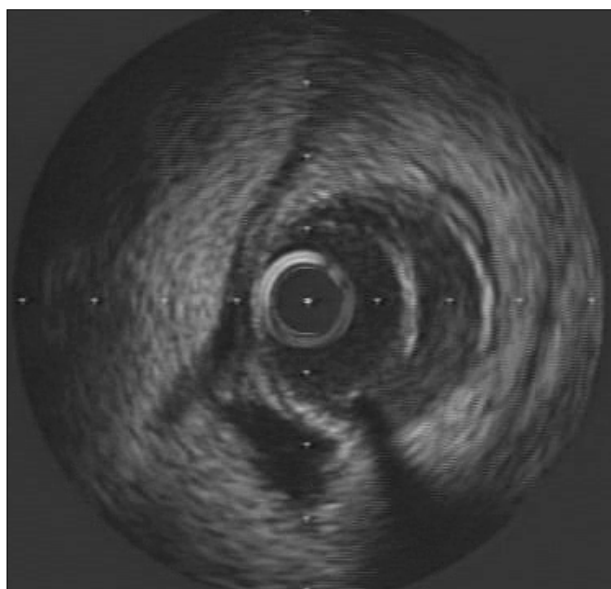


Fig. 5. IVUS at the distal RCA after the implantation of two stents, which shows the residual dissection. IVUS: intravascular ultrasound, RCA: right coronary artery.

systemic lupus erythematosus,¹³⁾ the pathophysiology of SCAD remains unclear. Our case was not associated with any of the above conditions.

The prognosis of patients with SCAD is poor. Approximately 70% of cases are diagnosed at necropsy.¹⁴⁾ Several treatment modalities, such as medical therapy (with and without thrombolysis and aggressive antiplatelet treatment), percutaneous coronary intervention and coronary bypass surgery, have been reported, but with variable success rates.¹⁵⁻¹⁷⁾ Mohamed and associates reviewed 102 survivors of symptomatic SCAD, where 42 patients were treated medically, 41 with coronary artery bypass grafting and 7 with coronary angioplasty and/or stenting.¹⁸⁾ Thrombolytic therapy has been successfully used in SCAD,¹⁹⁾²⁰⁾ however, due to the potential risk for propagation of dissection and expansion of the intramural hematoma, the use of thrombolytics should be avoided.²¹⁾²²⁾ Spontaneous healing of a coronary dissection using medical therapy has been reported.²⁰⁾ Surgical bypass surgery is usually reserved for patients with dissection of the left main coronary artery or multiple vessels.¹⁷⁾¹⁸⁾ Percutaneous coronary intervention has resulted in good treatment in some patients presenting with acute coronary syndromes, with one vessel involvement other than the left main coronary artery.¹⁶⁾²³⁾ A recent paper, which analyzed an IVUS database of 15,000

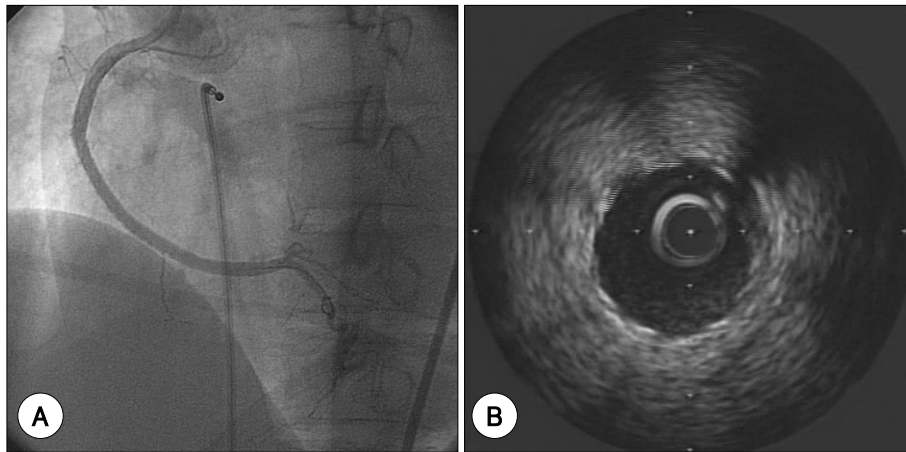


Fig. 6. A: LAO projection. Post-stent implantation angiography; three cypher stents were deployed. The angiographic result was good, with the exception of a compromised small RV free wall branch. B: IVUS showed complete sealing of the dissection, with good stent apposition. IVUS: intravascular ultrasound, RV: right ventricle.

preintervention patients, identified five cases of unsuspected dissection without the classical angiographic appearance; these patients showed only moderate coronary luminal narrowing and no evidence of intimal tears.²⁴⁾ IVUS guided percutaneous coronary stenting has become a safe and efficacious treatment as IVUS allows the dissection site and extent of dissection to be identified, with the avoidance of catastrophic false lumen stenting.²⁵⁾²⁶⁾ The use of angioplasty alone, without stenting, is associated with a potential risk of dissection propagation.¹⁶⁾ Firstly, Porto and associates reported a successful result with drug-eluting stents (DES) using IVUS guidance in a case of SCAD.²⁷⁾ We also successfully deployed three DES, directly, in a young woman with SCAD, without predilation at the mid to distal RCA, with overlap, under IVUS guidance. IVUS allowed us to detect the real extent of the dissection and ensure the correct placement of the guide-wire within the true lumen. We preferred DES because the patient was relatively young, and the dissected segment very long and extensive.

We think SCAD needs to be included as a possible differential diagnosis in patients with chest pain. This is the first report of a patient of SCAD presenting as variant angina, which rapidly progressed during an ergonovine test. IVUS-guided primary coronary stenting, with DES, is considered an efficacious treatment for patients with SCAD.

REFERENCES

- 1) Pretty HC. Dissection aneurysm of a coronary artery in a woman aged 42. *Br Med J* 1931;1:667.
- 2) Basso C, Morgagni GL, thiene G. Spontaneous coronary artery dissection: a neglected cause of acute myocardial ischaemia and sudden death. *Heart* 1996;75:451-4.
- 3) Jorgensen MB, Aharonian V, Mansukani P, Mahrer PR. Spontaneous coronary dissection: a cluster of cases with this rare finding. *Am Heart J* 1994;127:1382-7.
- 4) Nishikawa H, Nakanishi S, Nishiyama S, Nishimura S, Seki A, Yamaguchi H. Primary coronary artery dissection observed at coronary angiography. *Am J Cardiol* 1988;61:645-8.
- 5) Roth A, Elkayam U. Acute myocardial infarction associated with pregnancy. *Ann Intern Med* 1996;125:751-62.
- 6) Azam MN, Roberts DH, Logan WF. Spontaneous coronary artery dissection associated with oral contraceptive use. *Int J Cardiol* 1995;48:195-8.
- 7) Ellis CJ, Haywood GA, Monro JL. Spontaneous coronary artery dissection in a young women resulting from an intense gymnasium "work-out". *Int J Cardiol* 1994;47:193-4.
- 8) Almahmeed WA, Haykowski M, Boone J, et al. Spontaneous coronary artery dissection in young women. *Cathet Cardiovasc Diagn* 1996;37:201-5.
- 9) Sherrid MV, Mieres J, Mogtader A, Menezes N, Steinberg G. Onset during exercise of spontaneous artery dissection and sudden death: occurrence in a trained athlete. *Chest* 1995;108:284-7.
- 10) Masuda T, Akiyama H, Kurosawa T, Ohwada T. Long-term follow-up of coronary artery dissection due to blunt chest trauma with spontaneous healing in a young woman. *Intensive Care Med* 1996;22:450-2.
- 11) Bateman AC, Gallagher PJ, Vincenti AC. Sudden death from coronary artery dissection. *J Clin Pathol* 1995;48:781-4.
- 12) McDonald GS. Spontaneous primary dissection of the coronary artery. *Ir J Med Sci* 1989;158:304-6.
- 13) Sharma AK, Farb A, Maniar P, et al. Spontaneous coronary artery dissection in a patient with systemic lupus erythematosus. *Hawaii Med J* 2003;62:248-53.
- 14) DeMaio SJ Jr, Kinsella SH, Silverman ME. Clinical course and long-term prognosis of spontaneous coronary artery dissection. *Am J Cardiol* 1989;64:471-4.
- 15) Kamineni R, Sadhu A, Alpert JS. Spontaneous coronary artery dissection: report of two cases and a 50-year review of the literature. *Cardiol Rev* 2002;10:279-84.
- 16) Vale PR, Baron DW. Coronary artery stenting for spontaneous coronary artery dissection: a case report and a review of the literature. *Cathet Cardiovasc Diagn* 1998;45:280-6.
- 17) Thistlewaite PA, Tarazy RY, Giordano FJ, Jamieson SW. Surgical management of spontaneous left main coronary artery dissection. *Ann Thorac Surg* 1998;66:258-60.
- 18) Mohamed HA, Eshawesh A, Habib N. Spontaneous coronary

- artery dissection: a case report and review of the literature. *Angiology* 2002;53:205-11.
- 19) Leclercq F, Messner-Pellenc P, Carabasse D, Lucke N, Rivalland F, Grolleau R. Successful thrombolysis treatment of a spontaneous left main coronary artery dissection without subsequent surgery. *Eur Heart J* 1996;17:320-1.
 - 20) Cheung S, Mithani V, Watson RM. Healing of spontaneous coronary dissection in the context of glycoprotein IIB/IIIa inhibitor therapy. *Cathet Cardiovasc Interv* 2000;51:95-100.
 - 21) Buys EM, Sutorp MJ, Morshuis WJ, Plokker HW. Extension of a spontaneous coronary artery dissection due to thrombolytic therapy. *Cathet Cardiovasc Diagn* 1994;33:157-60.
 - 22) Zupan I, Noc M, Trinkaus D, Papovic M. Double vessel extension of spontaneous left main coronary artery dissection in young women treated with thrombolytics. *Catheter Cardiovasc Interv* 2001;52:226-30.
 - 23) Gonzales JJ, Hill JA, Conti CR. Spontaneous coronary artery dissection treated with percutaneous transluminal angioplasty. *Am J Cardiol* 1989;63:885-6.
 - 24) Maehara A, Mints GS, Castagna MT, et al. Intravascular ultrasound assessment of spontaneous coronary artery dissection. *Am J Cardiol* 2002;89:466-8.
 - 25) Aql RA, Zoghbi GJ, Iskandrian AE. Spontaneous coronary artery dissection with pseudoaneurysm formation diagnosed by intravascular ultrasound: a case report. *Echocardiography* 2004;21:153-7.
 - 26) Aql RA, Zoghbi GJ, Iskandrian AE. Spontaneous coronary artery dissection with pseudoaneurysm formation diagnosed by intravascular ultrasound: a case report. *Echocardiography* 2004;21:153-7.
 - 27) Porto I, Banning AP. Intravascular ultrasound imaging in the diagnosis and treatment of spontaneous coronary dissection with drug-eluting stents. *J Invasive Cardiol* 2004;16:78-80.