Coronary Artery Perforation Following Implantation of a Drug-Eluting Stent Rescued by Deployment of a Covered Stent in Symptomatic Myocardial Bridging

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ABSTRACT

We successfully rescued a patient whose coronary artery perforated following implantation of a drug-eluting stent (DES), by deploying a stent-graft in symptomatic myocardial bridging. Our case demonstrated that coronary perforation could be handled without difficulty when perforated myocardial bridging is confined to the interventricular groove. (Korean Circ J 2010;40:148-151)

KEY WORDS: Myocardial bridging; Drug eluting stents; Angioplasty, Transluminal, percutaneous coronary.

Introduction

Myocardial bridging is defined as an epicardial coronary artery that goes intramurally through the myocardium beneath the muscle bridge. While generally benign, myocardial bridges can cause ischemia, ventricular tachyarrhythmias, atrioventricular block, and sudden cardiac death.1,2 For symptomatic patients, various therapeutic approaches have been attempted, but the optimal treatment of myocardial bridging still remains controversial.3-10 Coronary stenting has been another therapeutic option with medical and surgical treatment, but the high risk of perforation and high rate of in-stent restenosis have limited its use.5-10 Recently, we experienced a patient with a perforated coronary artery after implantation of a drug-eluting stent (DES) that was successfully rescued by deployment of covered stent in symptomatic myocardial bridging.

Case

A 46 year-old woman who had no coronary risk factors, presented with exertional chest pain for several weeks. The chest pain was typical for angina pectoris and depressed ST segments were noted at the exercise test. Echocardiography revealed normal left ventricular (LV) systolic function (ejection fraction (EF)=72%) without any regional wall motion abnormality. We performed coronary angiography which showed significant stenosis (up to 80%) aggravated by severe myocardial bridging at the mid-portion of the left anterior descending (LAD) artery (Fig. 1A) without significant stenotic lesions at other coronary arteries. The pain was not relieved by optimal medical treatment for 2 weeks. So we decided to do a percutaneous coronary intervention (PCI) at the LAD lesion. Through a 7 Fr Judkins guiding catheter, the lesion was easily crossed with a 0.014 Choice floppy guidewire. Predilatation was performed with a maverick balloon catheter (2.5 × 15 mm, Boston Scientific, Natick, MA, USA) at 10 atmospheres for 20 seconds. We deployed a Taxus stent (3.5 × 16 mm, Boston Scientific, Natick, MA, USA) according to the size of the predilated balloon catheter. The stent was inflated up to a nominal pressure 8 atmospheres. But the middle segment of the lesion was not compliant, so the stent was not fully expanded with nominal pressure. We gradually inflated the stent using 16 atmospheres (Fig. 1B). In the mean time, the coronary artery was perforat-
ed and some extravasation of contrast media was observed in the pericardium (Fig. 1C). But, the patient’s vital signs were stable (blood pressure 115/70 mmHg) with only a mild increase in heart rate. Contrast media extravasation still persisted on follow-up angiography. However, because the perforated site was entrapped intramurally through the myocardium in the interventricular groove, there was no evidence of accumulated blood at the dependent position of the pericardium on fluoroscopy or echocardiography. So we decided to observe the patient with close monitoring of symptoms and vital signs. After 10 minutes, angiography revealed continued contrast media extravasation from the perforated site. But echocardiography showed no evidence of pericar-

Fig. 1. A: angiography revealed 80% stenosis aggravated by severe muscular bridging at the mid LAD. B: at a nominal pressure of, the stent was not fully expanded in the middle segment of the lesion. So, we inflated the stent with a high pressure, up to 16 atm. C: on follow-up angiography, the coronary artery was perforated and extravasation of contrast into the pericardium was noted at the site of the lesion. D: an IVUS study showed the perforation site and a perivascular hematoma along the lesion. E: after implantation of a covered stent, leaking flow from the coronary lesion was no longer noted. F: follow-up echocardiography showed a minimal amount of pericardial effusion (arrow) without hemodynamic instability. LAD: left anterior descending, IVUS: intravascular ultrasound.

Fig. 2. A and B: four months after the stent procedure, CT angiography showed no evidence of residual hematoma or pseudoaneurysm (arrow). C: follow-up coronary angiography performed at 8 months after the procedure showed good distal flow with minimal stenosis at the proximal edge of the stent (arrow).
Важным результатом является кардиальный тампонада, обычный осложнение после PCI, но обычно не вызывает имплантации. В то время как перфорация коронарной артерии является необычным осложнением, оно требует высоких инфляционных давлений для оптимальной имплантации стента. Интервенционная IVUS может быть полезной в выборе оптимального стента для имплантации. В нашем случае мы выбрали DES, который также показал хорошую дистальную кровоток и минимальное рекостенозирование на уровне proximal edge of the stent (Fig. 2C). Пациент оставался безболезненным без признаков эксцесса.

**Discussion**

Хотя коронарная имплантация представляет собой эффективный инвазивный подход для улучшения симптомов у пациентов с миокардиальной перфорацией, это связано с высоким риском коронарной перфорации. Ранее было показано, что в результате миокардиальной перфорации могут возникнуть различные последствия, такие как гематома, пункционная шейка, перфорация и смерть. У пациентов с миокардиальной перфорацией трудно управлять анатомическими и гистологическими различиями в месте перфорации, что может привести к высокой частоте рекостенозирования. Из-за высокого риска рекостенозирования, интенсивная коронарная перфорация может быть особенно трудна для управления. Однако, благодаря использованию DES, у нас было получено хорошее кровоток и минимальное рекостенозирование. Мы использовали DES с гидродинамикой и атеросклеротической перфорацией, что дало возможность управлять перфорацией и минимизировать риск рекостенозирования. Это дало нам возможность улучшить симптомы у пациентов с миокардиальной перфорацией.

**REFERENCES**

1) Tauth J, Sullebarger T. Myocardial infarction associated with myocardial bridging: case history and review of the literature. Catheter Cardiovasc Diagn 1997;40:364-7.
2) Cutler D, Wallace JM. Myocardial bridging in a young patient with sudden death. Clin Cardiol 1997;20:581-3.
3) Alegría JR, Herrmann J, Holmes DR Jr, Lerman A, Rihal CS. Myocardial bridging. Eur Heart J 2005;26:1159-68.
4) Mohlenkamp S, Hordt W, Ge J, Ehrb R. Update on myocardial bridging. Circulation 2002;106:2616-22.
5) Broderick TM, Kereiakes DJ, Whang DD, Toltzis RJ, Abbottsmith CW. Myocardial bridging may predispose to coronary perforeation during rotational atherectomy. J Invasive Cardiol 1996;8:161-3.
6) Hering D, Horstkotte D, Schwimmbeck P, Piper C, Bilger J, Schultheiss HP. Acute myocardial infarct caused by a muscle bridge of the anterior interventricular rumus: complicated course with vascular perforation after stent implantation. Z Kardiol 1997;86:630-8.
7) Berry JF, von Mering GO, Schmalfluss C, Hill JA, Kerensky RA. Systolic compression of the left anterior descending coronary artery: a case series, review of the literature, and therapeutic options including stenting. Catheter Cardiovasc Interv 2002;56:58-63.
8) Kim BJ, Gwon HC, Hong JS, et al. Clinical aspects of coronary artery perforation during percutaneous coronary intervention. Korean Circ J 2003;33:277-83.
9) Haager PK, Schwartz ER, vom Dahl J, Klues HG, Relfelfmann T, Hanra P. Long term angiographic and clinical follow up in patients with stent implantation for symptomatic myocardial bridging. Heart 2000;84:403-8.
10) Choi SH, Shim SJ, Byun KH, Choi D, Shim WH. A case of coronary stenting in the management of myocardial ischemia caused by myocardial bridging. Korean Circ J 2001;31:940-4.
11) Morales AR, Romanelli R, Tate LG, Boucek RJ, de Marchena E. Intrumeral left anterior descending coronary artery: significance of the depth of the muscular wall. Hum Pathol 1993;24:693-701.
12) Glogov S, Zarins C, Giddens DP, Ku DN. Hemodynamics and atherosclerosis: insights and perspectives gained from studies of human arteries. Arch Pathol Lab Med 1988;112:1618-31.
13) Qian J, Zhang F, Wu H, et al. Size of coronary artery in myocardial bridge compared with adjacent nonintunneled left anterior descending coronary artery. Am J Cardiol 2007:99:1653-5.
14) Ajluni SC, Glazier S, Blankenship L, O’Neill WW, Safian RD. Perforations after percutaneous coronary interventions: clinical, angiographic, and therapeutic observations. Cathet Cardiovasc Diagn 1994;32:206-12.

15) Gruberg L, Pinnow E, Flood R, et al. Incidence, management and outcome of coronary artery perforation during percutaneous coronary intervention. Am J Cardiol 2000;86:680-2.