Korean J Thorac Cardiovasc Surg 2012;45:45-48 □ Case Report □
ISSN: 2233-601X (Print) ISSN: 2093-6516 (Online) http://dx.doi.org/10.5090/kjtcs.2012.45.1.45

Postinfarct Ventricular Septal Defect after Coronary Covered Stent Implantation

Soon Ho Chon, M.D.[1], Young Hak Kim, M.D.[2], Hyuck Kim, M.D.[2], Won Sang Chung, M.D.[2], Jeong Ho Kang, M.D.[2], Kyung-Wook Shin, M.D.[2]

We report a case of a postinfarction ventricular septal defect caused by an acute recurrent occlusion after the implantation of a covered stent, which was performed as a rescue procedure for the ruptured left anterior descending artery during a percutaneous coronary intervention. Although the emergent implantation of a covered stent for the ruptured coronary arteries such as the left main coronary artery or the origins of the left anterior descending artery can be performed during a percutaneous coronary intervention, and a coronary bypass surgery should be considered in order to decrease the risk of complete occlusion, thus providing a superior long term patency.

Key words: 1. Postinfarction cardiac complications
2. Heart septal defects, ventricular
3. Coronary artery disease

CASE REPORT

A 62-year-old woman visited the department of cardiology due to aggravated chest pain with dyspnea, which started a week before her visit. The patient had a history of hypertension; she was diagnosed 20 years earlier. On her visit, her initial mental status was normal, blood pressure was 130/80 mmHg, pulse was 102 beats/min, body temperature was 36°C, and respiratory rate was 20 breaths/min. The initial laboratory results showed a creatinine level of 6.5 mg/dL, a high troponin-I level at 2.34 ng/mL, $PaCO_2$ 29 mmHg, PaO_2 98 mmHg, base excess -10.1 mmol/L, and oxygen saturation at 96%; the arterial blood gas analysis showed metabolic acidosis with pH 7.31. An echocardiogram showed hypokinesia of the inferior wall with a 57% ejection fraction. Suspecting coronary artery disease, we performed a coronary angiogram, which presented a stenosis greater than 70% in the proximal left anterior descending artery and a stenosis greater than 70% in the right coronary artery. During the intervention for the left anterior descending artery, a rupture suddenly occurred (Fig. 1). The bleeding was controlled after inserting a 3×19 mm Jostent polytetrafluoroethylene (PTFE)-covered stent (Abbott Vascular, Abbott Park, IL, USA) (Fig. 2). The acute renal failure was treated with continuous renal replacement therapy.

A week after the initial treatments, the patient complained of severe chest pain with dyspnea. A simple chest X-ray revealed cardiomegaly and pulmonary edema. An echocardiogram presented a low ventricular ejection fraction of about 29% with hypokinesia of the apex and interventricular

Department of Thoracic and Cardiovascular Surgery, [1]Hanyang University Guri Hospital, Hanyang University College of Medicine, [2]Hanyang University Seoul Hospital, Hanyang University College of Medicine
Received: August 4, 2011, Revised: September 5, 2011, Accepted: October 15, 2011
Corresponding author: Young Hak Kim, Department of Thoracic and Cardiovascular Surgery, Hanyang University Seoul Hospital, Hanyang University College of Medicine, 17 Haengdang-dong, Seongdong-gu, Seoul 133-791, Korea
(Tel) 82-2-2290-8469 (Fax) 82-2-2290-8470 (E-mail) yhkim@hanyang.ac.kr

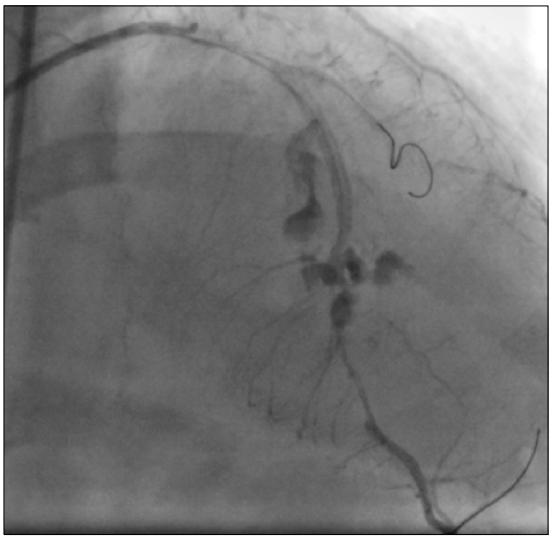

Fig. 1. The ruptured left anterior descending artery during the percutaneous coronary intervention.

Fig. 2. The Jostent polytetrafluoroethylene-covered stent implantation state at the ruptured left anterior descending artery.

septum. The troponin-I was elevated to 40 ng/mL; acute myocardial infarction was suspected. In the coronary angiogram, a segment of the left anterior descending artery, where the Jostent PTFE-covered stent was placed, was occluded. Therefore, a percutaneous balloon angioplasty was performed to re-establish the blood flow and a coronary stent was inserted in the stenotic segment of the right coronary artery.

Thereafter, the symptoms of heart failure persisted and the

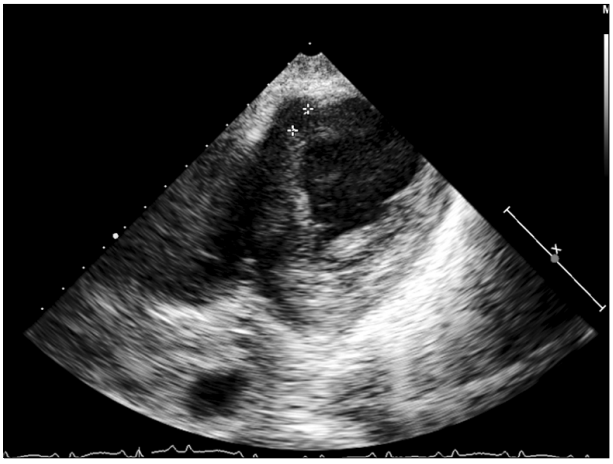

Fig. 3. The postinfarct ventricular septal defect on the transthoracic echocardiography.

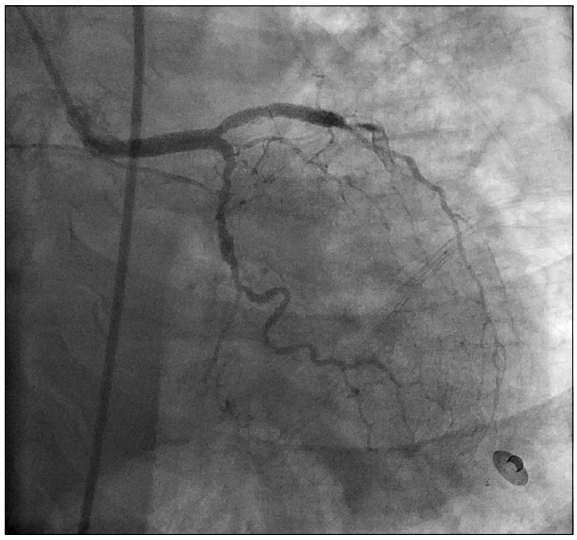

Fig. 4. The complete obstruction of the previous Jostent polytetrafluoroethylene-covered stent.

patient's hemodynamic condition rapidly deteriorated during treatment in the intensive care unit for a week. An emergent echocardiogram revealed a large ventricular septal defect at the anterior portion of interventricular septum near the apex (Fig. 3). A follow-up coronary angiogram presented a complete reobstruction of the left anterior descending artery where the Jostent PTFE-covered stent was placed (Fig. 4). The patient was transferred to our department and an emergent operation was planned.

Through a median sternotomy approach, a cannulation of

the aorta, a superior and inferior vena cava, and a cardiopulmonary bypass were performed. A vent was inserted into the left ventricle through the right superior pulmonary vein. A ventriculotomy was performed 1 to 2 cm lateral and parallel to the left anterior descending artery under the beating heart. A direct visualization through the ventriculotomy presented a ventricular septal defect located at the anterior portion of the interventricular septum near the apex.

The appropriately sized pericardium was tailored. Pledgeted 3-0 prolene, interrupted, and continuous sutures were utilized to cover the septal defect. Ventriculotomy was repaired using interrupted 3-0 Ethibond sutures with Teflon felt reinforcemen. The body temperature was elevated and the cardio-pulmonary bypass was weaned without any hemodynamic compromise. The total duration of the cardio-pulmonary bypass was 120 minutes. The intubation was maintained for one day after the operation and the postoperative course was uneventful.

DISCUSSION

A ventricular septal defect is a severe complication of acute myocardial infarction that may appear within 2 weeks after the infarction. Due to the high mortality rate, 50% of patients expire within the first week after onset and only 20% survive more than a month. A ventricular septal defect needs to be repaired, especially when emergent in patients with a hemodynamic compromise.

As experience with the quality of equipment for percutaneous coronary intervention have increased, success rates have improved and the range of applications has increased. On the other hand, various complications of percutaneous coronary intervention have been reported including coronary artery dissection and occlusion, thrombus formation, perforation, and rupture of the guide-wire with residual fragments in the coronary artery [1]. Among the lethal complications of percutaneous coronary intervention, coronary artery perforation causes hemopericardium, cardiac tamponade, and myocardial infarction. Incidence of these complications were reported to be 0.1% to 3.0% [2] with a mortality rate of about 10% [3]. Recently, percutaneous coronary intervention has been applied to more complicated lesions and to vessels with a smaller caliber. Thus, a comparatively higher rate of complications has developed. The risk factors that increase coronary artery perforation during a percutaneous coronary intervention include an oversized balloon, usage of stiff guide-wires in treating chronic occlusion, usage of cutting balloons, usage of debulking devices to remove the calcified material, usage of high-pressure inflation stents such as the sirolimus-eluting stents, and inappropriate attempts at intervention in irregularly calcified arteries [3,4].

Once the perforation of the coronary artery occurs, treatments worth considering include heparin antidote protamine injection to return coagulation to normal, using low-pressure balloons to occlude the blood flow, and using a balloon designed to allow blood flow through the balloon. These measures are applicable to perforations that are small. When hemopericardium or cardiac tamponade occurs, pericardiocentesis becomes necessary. When the methods mentioned above are not available, a covered stent may be useful to reestablish the blood flow. However, if a covered stent insertion fails, there is no other option except an operation [3,4].

The most common contributor to the high mortality rate (range, 10% to 15%) in heart surgery after a percutaneous coronary intervention failure is preoperative hemodynamic instability [1,3]. Thus, percutaneous coronary intervention should be avoided in patients with risk factors for perforation [4].

In 1966, Colombo et al. [5] used covered stents for the first time. They applied a stent covered with an autologous greater saphenous vein in a patient with a perforated coronary artery after percutaneous coronary intervention. However, this method was abandoned due to the difficulty of its application [5]. Recently, a stent covered with an expandable PTFE graft with an internal and external stent surface and a diameter of 2.5 to 5 mm was developed. This stent graft, which was originally designed to treat coronary aneurysm, was applied for the first time by Ramsdale et al. [6] to treat patients with perforated coronary arteries. A higher risk of stent thrombosis follows after a covered stent is applied because it takes longer to form a complete inner wall of vascular endothelium than with conventional stents. Moreover, restenosis occurs more frequently with covered stents than conventional stents. In our case, even though clopidogrel and aspirin were ad-

ministered after inserting the covered stent, occlusion induced by stent thrombosis occurred twice within a 2 week period. Furthermore, in the application of grafts, the risk of occlusion around the bifurcation area still remains. Schuhlen et al. [7] have reported a 5.5% incidence of stent thrombosis one month after a graft insertion. Gercken et al. [2] used covered stents in 67 patients that developed postoperative stenosis of a greater saphenous vein graft, patients with complicated arterial lesions, and patients with in-stent restenosis. The rates of restenosis for each were 33.3%, 30.0%, and 38.5%, respectively, at a mean of 159 days after intervention [2].

A few studies about emergent life-saving procedures using a covered stent have proceeded to prevent perforation during a percutaneous coronary intervention, but it is still unsettled. The incidence of complications such as thrombus formation, chronic restenosis, restenosis of the branched artery, and occlusion around the bifurcation have not yet been determined. We believe that the location, diameter, length of arteries, and the amount of blood flow are the factors that affect the incidence of complications. Furthermore, the occlusion of arteries branched from a stent-implanted artery leads to acute or chronic stenosis and occlusion of the graft. This, in turn, leads to the poor development of the collateral vessels, thus increasing the risk of myocardial infarction and the associated complications.

Thus, meticulous care and observation is necessary after the implantation of covered stents in patients with perforated coronary arteries after a percutaneous coronary intervention. In conclusion, as in our case, the emergent implantation of a covered stent for ruptured coronary arteries such as the left main coronary artery or the origins of the left anterior descending artery can be performed during a percutaneous coronary intervention, and a coronary bypass surgery should be considered in order to decrease the risk of complete occlusion, thus providing superior long term patency.

REFERENCES

1. Reinecke H, Fetsch T, Roeder N, et al. *Emergency coronary artery bypass grafting after failed coronary angioplasty: what has changed in a decade?* Ann Thorac Surg 2000;70: 1997-2003.
2. Gercken U, Lansky AJ, Buellesfeld L, et al. *Results of the Jostent coronary stent graft implantation in various clinical settings: procedural and follow-up results.* Catheter Cardiovasc Interv 2002;56:353-60.
3. Fasseas P, Orford JL, Panetta CJ, et al. *Incidence, correlates, management, and clinical outcome of coronary perforation: analysis of 16,298 procedures.* Am Heart J 2004; 147:140-5.
4. Shirakabe A, Takano H, Nakamura S, et al. *Coronary perforation during percutaneous coronary intervention.* Int Heart J 2007;48:1-9.
5. Colombo A, Itoh A, Di Mario C, et al. *Successful closure of a coronary vessel rupture with a vein graft stent: case report.* Cathet Cardiovasc Diagn 1996;38:172-4.
6. Ramsdale DR, Mushahwar SS, Morris JL. *Repair of coronary artery perforation after rotastenting by implantation of the JoStent covered stent.* Cathet Cardiovasc Diagn 1998;45: 310-3.
7. Schuhlen H, Kastrati A, Dirschinger J, et al. *Intracoronary stenting and risk for major adverse cardiac events during the first month.* Circulation 1998;98:104-11.