

CASE REPORT

Sealing coronary perforation by hand-made covered stent: A case report

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ABSTRACT

Coronary artery perforation, a rare but deadly complication of percutaneous coronary intervention (PCI), can be managed by several modalities, including balloon inflation, heparin-reversing agent, thrombin injection, microcoils, fat embolization, covered-stent implantation, or surgery. We share our experience in emergency innovative management of coronary perforation during routine PCI. We faced an Ellis class III perforation of the right coronary artery during PCI. The balloon inflation technique failed to occlude the perforation, and no other facility was available to solve the problem immediately. The patient developed mild pericardial effusion but was hemodynamically stable. We made a covered stent by wrapping it with polyurethane (Tegaderm® skin dressing material) and deployed it. The perforation was sealed. The patient was discharged in stable condition and doing well at a 12-month follow-up examination. Hand-made covered stent may be a good bailout option to seal coronary perforation where premounted covered stents are not readily available.

Keywords: percutaneous coronary intervention, coronary artery perforation, covered stent

INTRODUCTION

Coronary artery perforation (CAP) is a deadly complication of percutaneous coronary intervention (PCI), though the chances are very low (0.1% to 0.5%)¹. Various modalities exist to treat CAP, such as balloon inflation, thrombin injection, microcoils, covered-stent implantation, and surgery. Each method has some benefits and drawbacks. Balloon inflation seals the perforation and maintains distal vessel flow. This method occasionally fails to close the perforation completely. Covered stents are significantly more effective in sealing CAP than balloon inflation, but it is not widely available. Moreover, a covered stent may increase the risk of stent thrombosis or in-stent restenosis. Tegaderm® is made of a thin polyurethane membrane layer used for aseptic skin dressing. Tegaderm-wrapped stents can be considered a new innovative life-saving emergency tool to treat deadly coronary perforation and can be hand-made in the catheterization laboratory (cath-lab)².

CASE DESCRIPTION

A 50-year-old hypertensive, diabetic, and dyslipidaemic man was admitted with complaints of moderately severe effort angina for several months with stable hemodynamics and without any remarkable clinical abnormalities. The complete blood count and serum creatinine level were within normal limits. A 12-lead electrocardiogram and echocardiography revealed normal findings with good bi-ventricular systolic function. A coronary angiogram done through the right radial route in Dr. Sirajul Islam Medical College Hospital, Dhaka, revealed 80–90% stenosis of proximal to mid-left anterior descending artery (LAD) and 90–95% long stenosis to mid-right coronary artery (RCA) (FIGURE 1a).

CASE MANAGEMENT

Angioplasty to the LAD and RCA with a drug-eluting stent was planned. LAD was wired with Fielder FC®, predilated with a 2×15 mm compliant balloon, and a 3×24 mm drug-eluting stent was deployed. Post-

LEARNING POINTS

1. Coronary artery perforation during a percutaneous coronary intervention is a potentially deadly complication that warrants knowledge and skills to manage it.
2. A hand-made Tegaderm® wrapped stent may be a good bailout option to manage coronary perforation where pre-mounted covered stents are not readily available.

procedure thrombolysis-in-myocardial-infarction grade -3 (TIMI-3) flow was achieved in LAD. RCA was wired with floppy wire and sequentially predilated by 1.5×12, 2×12 mm compliant balloon. A drug-eluting stent of 2.5×30 mm size was tried to deploy but failed. Then, a 2.5×12 mm non-compliant balloon was used for appropriate pre-dilatation. Then, an Ellis type-III perforation was observed in mid-RCA (**FIGURE 1b**). A

Meanwhile, an inflated balloon was kept at the perforation site to prevent progressive leakage. We cut polyurethane skin dressing material at size 2 mm less length of the stent, wrapped two-fold over the stent (**FIGURE 2a**), and changed the guide catheter to 7 Fr sized XB® to deploy the stent. The hand-made covered stent was deployed at 14 ATMs. No further extravasation (**FIGURE 2b**) was observed. Finally, the patient was discharged per the hospital's standard practice. The patient was found stable at a one-year follow-up. He was reportedly doing his professional activities without any major limitations.

DISCUSSION

The CAP during PCI may result in grave clinical outcomes, such as pericardial tamponade, myocardial infarction, need for emergency coronary artery bypass

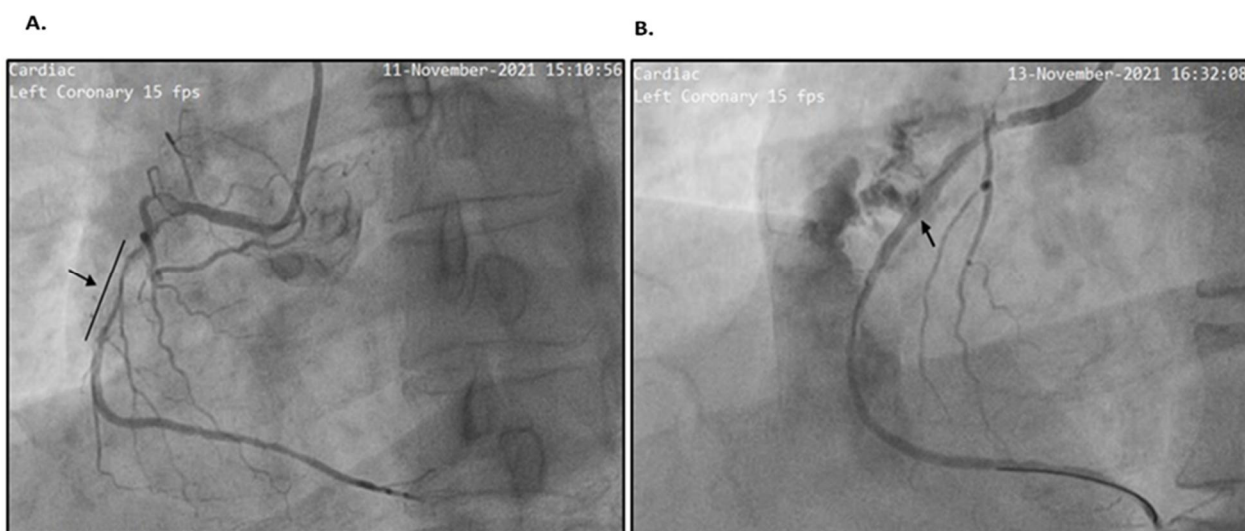


FIGURE 1 Lesion in the right coronary artery: (a) 90-95% long stenosis in proximal to mid-segment. (b) Perforation in right coronary artery (pointed).

balloon was kept inflated at the perforation site, but the leakage was not sealed. The patient's hemodynamics remained stable, though minimal pericardial effusion was observed. Our next treatment options were either emergency coronary artery bypass surgery or a covered stent deployment. Unfortunately, neither the cardiac surgery team nor the covered stent was available instantly. We made a covered stent by Tegaderm® (polyurethane) available in the cath lab for aseptic dressing.

surgery, or death.^{3,4} Several factors predispose to CAP, such as excess vessel tortuosity, narrow vessel diameter, presence of calcification, chronic total occlusion, use of an oversized balloon, and high-pressure balloon dilatation.⁵ Classical nonsurgical management for type III perforation often fails, requiring coronary stent or surgical intervention.^{4,5} The use of a covered stent can defer emergency surgery in such a life-threatening situation. Covered stent has a long history in interventional cardiology for the management of

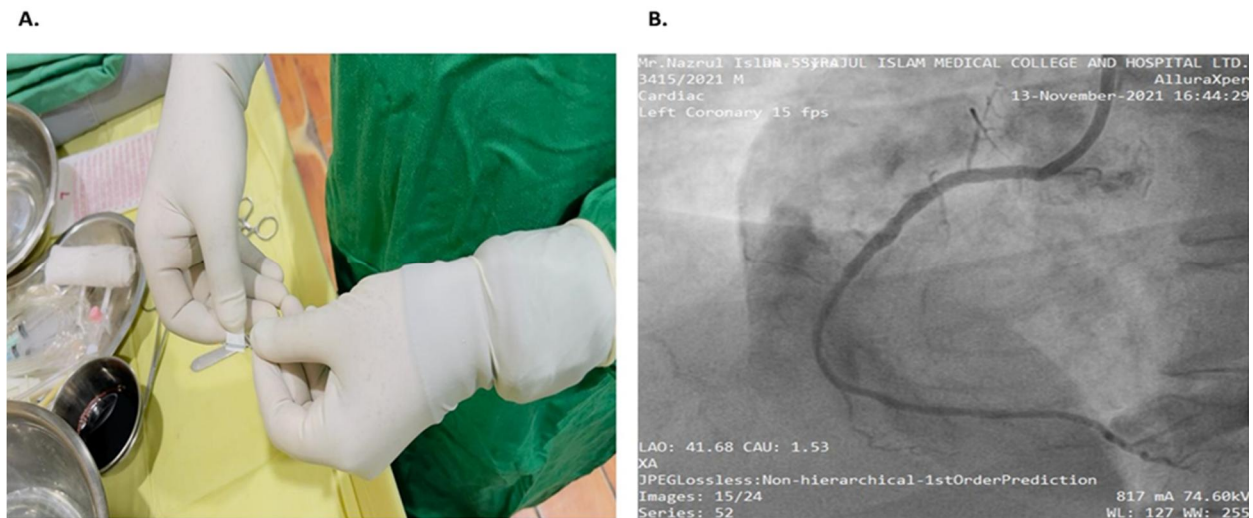


FIGURE 2 Case management (a) Wrapping of Tegaderm® cover stent; (b) After deployment of hand-made covered stent – no leaking is visible

coronary perforations and occluding coronary aneurysms.⁶ Covered stents from various materials are commercially available, such as polytetrafluoroethylene, polyurethane, and pericardium.⁷ High occurrence of in-stent restenosis (25%) and stent thrombosis (3% to 16%) long-term after polytetrafluoroethylene-made coronary stent signifies its poor outcome.⁸ Nowadays, polyurethane is used progressively in cardiac prosthetics like ventricular assist devices and prosthetic valves.⁹ Recently, coronary perforations have been treated by pericardial-covered stents.¹⁰ A self-made polyurethane coronary stent is considered an alternative to the premounted coronary stent to treat coronary perforation. Polyurethane membrane, a covering material, is widely available in cath labs and can be wrapped over appropriately sized stents within a short period and deployed with a higher-sized guide catheter (7 Fr). The procedure can be continued after proper sealing of the perforation sites using covered stent, and there is no need to reverse postprocedural standard antiplatelet and anticoagulant strategies.² The potential risks and limitations are maintenance of sterility and drug-coating of the stent. Therefore, this technique can be considered as a bail-out procedure and not for routine practice.

The present case reminds us that coronary perforation can occur during any calcified lesion intervention. CAP is a potentially deadly complication, and familiarity with the steps to manage this complication is essential.

Appropriate preparation to combat this type of emergency should be kept in the cath lab. Hand-made covered stent may be a good bailout option to manage coronary perforation where premounted covered stents are not readily available. However, further research on the long-term outcome of this procedure is warranted.

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Author Contributions

Conceived and designed the experiments: MFIK, MMH. Performed the experiments: MFIK, MMH, MSM, MAR. Manuscript writing and revising: MFIK, SA. Approval of the final version: MFIK, MAR, MSM. Guarantor accuracy and integrity of the work: MFIK, MMH.

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Conflict of Interest

The authors declare no conflict of interest.

Ethical Approval

Because the current manuscript is a case based on an emergency life-saving procedure, we did not ask for ethical approval but obtained written consent from the patient for this publication.

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