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A Coronary Rupture in the Left Anterior Descending Artery at Second Diagonal Artery Bifurcation Level in an Intervention with a Tryton Side Branch Stent

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HAKAN TAŞ ET AL.: A Coronary Rupture in the Left Anterior Descending Artery at Second Diagonal Artery Bifurcation Level in an Intervention with a Tryton Side Branch Stent. Percutaneous coronary intervention (PCI) for bifurcation lesions (BLs) is considered high risk due to increased procedural adverse events when compared to non-bifurcation lesion. Dedicated bifurcation stents, specifically designed to allow minimally traumatic implantation in the main vessel and/or side branch while providing adequate scaffolding of the side branch ostium may offer an advantage over utilization of conventional stents. Coronary perforation as a complication of PCI is a rare but potentially lethal complication that is associated with a high rate of morbidity. Coronary artery perforation during PCI has been reported repeatedly. To our best knowledge perforation in a BL, PCI with the Tryton Side-Branch Stent has not been reported. This case highlights that the Tryton to be an easy-to-use device in BLs, also operator should be careful, not too aggressive, their potential risks should be born in mind and a graft stent must be available in catheterization laboratory for emergencies. (J HK Coll Cardiol 2013;21:51-56)

Bifurcation lesion, Coronary rupture, Dedicated stent, Graft stent

Introduction

Bifurcation lesions (BLs) accounts for 15 to 20% of percutaneous coronary interventions (PCI). PCI for BLs is considered high risk due to increased procedural adverse events when compared to non-bifurcation lesions. Dedicated bifurcation stents, specifically designed to allow minimally traumatic implantation in the main vessel and/or side branch while providing adequate scaffolding of the side branch ostium may offer an advantage over utilization of conventional stents. Previous Tryton registry studies have been reported good clinical outcomes, but these studies are limited by the small sample size and the relative short follow-up period (6 months). In straight lesions, these stents have been shown to provide good early and long term results. Acute coronary artery perforation is a rare but
challenging complication of PCI with hazardous potential for the patient. It has been reported to occur in 0.1 to 3.0% of patients undergoing PCI procedures.\(^5\) Coronary artery perforation during PCI has been reported repeatedly. To our best knowledge perforation in a BL with the Tryton Side-Branch Stent (Tryton Medical, Inc., Newton, MA, USA) after kissing balloon has not been reported.

**Case**

A 73-year-old male was admitted to our hospital with recurrent angina with a period of four weeks. He was an ex-smoker, hypertensive and dyslipidemic patient under treatment with aspirin, clopidogrel, β-blocker, angiotensin-converting-enzyme inhibitor and statin. Two months ago a bare metal stent had implanted to right coronary artery (RCA) because of inferior myocardial infarction. On physical examination blood pressure was 140/80 mmHg and pulse rate was 66 beats per minute. He also had normal laboratory tests besides elevated lipoprotein levels (predominantly high low-density lipoprotein). Patient underwent control coronary angiography via right femoral artery which yielded critical BL at the second diagonal level of the left anterior descending artery (LAD) and 20% restenosis in the stent of RCA (Figure 1A). We decided to implant a Tryton stent to the BL. Patient informed consent was taken. The LAD and second diagonal branch were wired with Asahi Prowater (0.014 inch) and Asahi Sion blue (0.014 inch), respectively (Figure 1B). A Tryton side branch stent 3.0 x 2.5 mm was deployed in the second diagonal artery at 10 atm pressure and another drug-eluting stent (DES) (Abbott Xience V 2.75 x 23 mm; Abbott Vascular Company, CA, USA) was deployed main branch to the LAD at 10 atm pressure (Figures 1C-D). Kissing dilatation was performed at 12 atm pressure with 2.5 x 25 mm Quqlimed Pyxis-C balloon to the LAD and 2.5 x 15 mm Blue Medical Protege balloon to the second diagonal branch (Figure 2A). This led to the LAD perforation at the main branch zone of the Tryton stent with contrast medium leaking into the pericardial cavity (Figure 2B). Type C coronary rupture was visualized. Pericardiocentesis was not performed because there was no evidence of cardiac tamponade. The patient was still asymptomatic and hemodynamically stable. A 2.75 x 23 mm Direct Stent-Graft (InSitu Technologies, Minnesota, USA) was implanted at the bifurcation level of LAD at 12 atm pressure (Figure 2C). After dye injection there was no contrast medium leaking into the pericardium (Figure 2D). After 15 minutes the patient complained from severe angina. An acute thrombosis was seen in the graft stent (Figure 3A). Tirofiban infusion with high dose bolus regimen was started for 24 hours and than control angiography was performed. The stents were patent (Figure 3B). At first day echocardiographic controls were made at every one hour. The patient was hospitalized for six days and discharged with medication.

**Discussion**

We report the successful management of a perforation of the LAD because of BL stenting with Tryton side branch stent. Coronary perforation as a complication of PCI is a rare but lethal complication that is associated with a high rate of morbidity. According to the published reports, coronary perforation occurs in 0.1-3.0% of all PCI cases and is associated with a mortality rate of approximately 10% or higher. Nevertheless, even if a provisional single-stent approach is used, PCI of a BL is still associated with poorer clinical outcomes when compared with PCI of a non-BL. Therefore, several dedicated bifurcation stents have been developed to improve clinical outcomes of BLs after PCI. One of these devices is the Tryton Side-Branch Stent (Tryton Medical, Inc., Newton, MA, USA) which is used in combination with a conventional DES in the main branch. The Tryton stent is a 5 or 6 Fr-compatible balloon expendable cobalt-chromium slotted-tube bare-metal stent. The stent consists of three zones: a distal side branch zone, a transition zone at the carina and a main branch zone. The distal side branch zone has a design similar to a regular stent, scaffolding the side branch. The central transition zone has specific
Figure 1. Angiographic images of (A) Critical lesion at the LAD and second diagonal branch bifurcation. (B) LAD and second diagonal branch were wired with Asahi Prowater and Asahi Sion blue. (C) Deployed Tryton side branch stent in to the second diagonal artery (D) Deployed drug-eluting stent in the main branch to the LAD.
Figure 2. Angiographic images of (A) After Tryton stent deployment; (B) Kissing dilatation; (C) Perforated segment of LAD and the contrast medium leaking into the pericardial cavity; (D) Graft stent emplacement at the bifurcation level of LAD and seal of the rupture and the absence of contrast medium leaking into the pericardium.
geometry of three elements which can be independently deformed to accommodate the wide range of carinal anatomy. The proximal main branch zone (‘the collar’) consists of two wedding bands and has a minimal amount of metal allowing easy delivery of a standard work-horse DES. The stent delivery system has four markers for optimal positioning of the stent.

In coronary perforation patient-related predictors of increased risk include previous interventions of the target vessel, prior myocardial infarction, female gender, and advanced patient age.6 As anatomic and procedure-related predictors of increased risk include severe vessel calcification or pronounced vessel tortuosity, low lumen diameter of the target vessel, a balloon-to-artery ratio >1.3, and the use of atheroablative interventional devices.5,6 The use of oversized balloons is a very important mechanism in the development of perforation. Achievement of a greater luminal diameter after the intervention is associated with a lower restenosis rate, but carries a higher risk for perforation. In our case patient’s advanced age, mismatch between balloon diameter and coronary artery diameter and the calcified lesion structure were the reasons of the perforation. We used 2.5 x 25 mm and 2.5 x 15 mm balloons for kissing balloon dilatation the balloon to artery ratio was approximatly 1.9 and higher than the 1.3. The proximal main branch zone of the stent was the point of the rupture. At this zone has a minimal amount of metal so protective effect of stent for rupture was minimal.

There is no consensus on the optimal treatment of patients with coronary perforation.6,7 Non-surgical prolonged balloon inflation to induce intracoronary thrombosis, implantation of (membrane-covered) stents, coil embolisation, injection of polyvinyl alcohol, and intracoronary administration of autologous blood have been reported as treatment modalities.6,8 Although the

Figure 3. Angiographic images of A: Acute thrombosis in graft stent. B: After tirofiban infusion patency of the stents.
use of graft stents is associated with good immediate success rates, long-term results are disappointing due to the high incidence of restenosis and/or late thrombotic occlusions. In our case stent-graft used for treatment of the coronary dissection but an acute thrombosis occurred 15 minutes after stenting. This might be due to excessive metal overload in the proximal portion of the left anterior descending artery. Intracoronary imaging with intravascular ultrasound or optical coherence tomography would be useful but we could not perform due to technical incompetence. Fortunately, this problem resolved with a tirofiban infusion of high bolus dose.

This case highlights that the Tryton to be an easy-to-use device in BLs, also operator should be careful, not too aggressive; potential risks of PCI to BLs should be borne in mind and a graft stent must be available in catheterization laboratory for emergencies.

Disclosure statement

The authors declare that they have no financial relationships or conflicts of interest regarding the content herein.

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