

# Stent Choice in Very Large Left Main Lesions in 3 Patients

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*Interventionalists encounter widely different coronary anatomies during left main coronary artery stenting. Optimal percutaneous coronary intervention in left main disease necessitates stents that achieve adequate apposition and adapt to frequently disparate diameters in the same lesion, without the need for overexpansion. Until recently, stent designs have hampered the treatment of very large lesions in left main arteries. Postdilation of the stents beyond their recommended diameters can cause restenosis, thrombosis, or arterial dissection.*

*We report successful angiographic outcomes after our deployment of different stents in 3 patients, present our rationale for choosing each stent, and discuss considerations that influence the percutaneous treatment of severe left main disease. (Tex Heart Inst J 2017;44(5):353-6)*

For many years, left main (LM) disease was typically treated by cardiac surgeons, because of unfavorable results from percutaneous coronary intervention (PCI) and bare-metal stents.<sup>1</sup> Use of the first generation of drug-eluting stents (DESs) produced the same mortality rates as did surgery, with higher rates of subsequent revascularization but fewer cerebrovascular accidents.<sup>2</sup> Lower mortality rates have since been reported with the use of second-generation DESs.<sup>3</sup> As a result, the 2014 European Guidelines of Myocardial Revascularization<sup>4</sup> endorsed a class I recommendation for DES deployment in stable coronary disease when the SYNTAX score is  $\leq 22$ , the class IIa score is 23 to 32 (both with level of evidence B), and there is “suitable coronary anatomy for [the] procedures and low predicted surgical mortality.”

Ectatic LM coronary arteries (LMCAs) and those in which the lesion diameter varies pose interventional challenges. We describe the cases of 3 patients in whom our use of different stents led to satisfactory results in treating severe LM lesions.

**Key words:** Angioplasty, balloon, coronary/methods; coronary disease/therapy; coronary vessels/anatomy & histology; drug-eluting stents; percutaneous coronary intervention/trends; prosthesis design; treatment outcome

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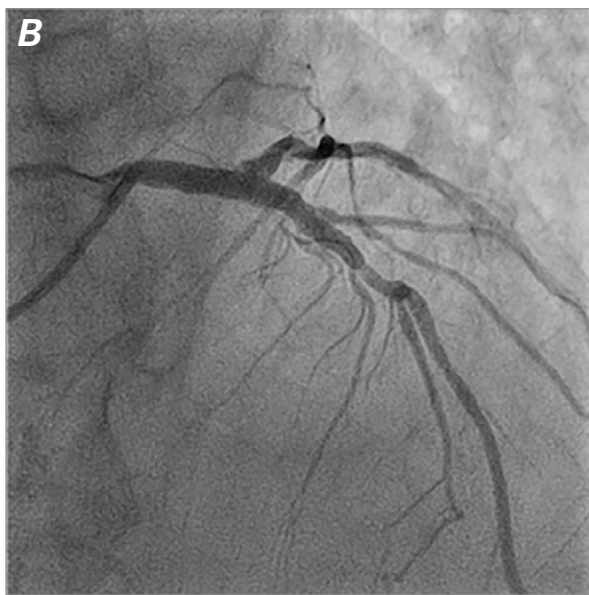
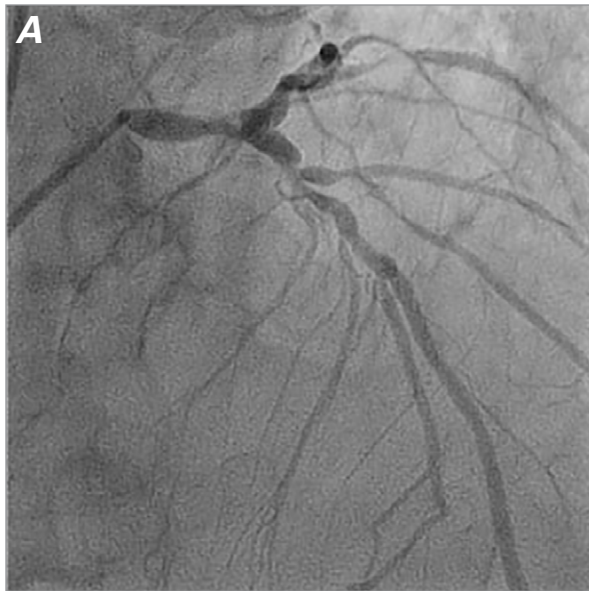
## Case Summaries

### Patient 1

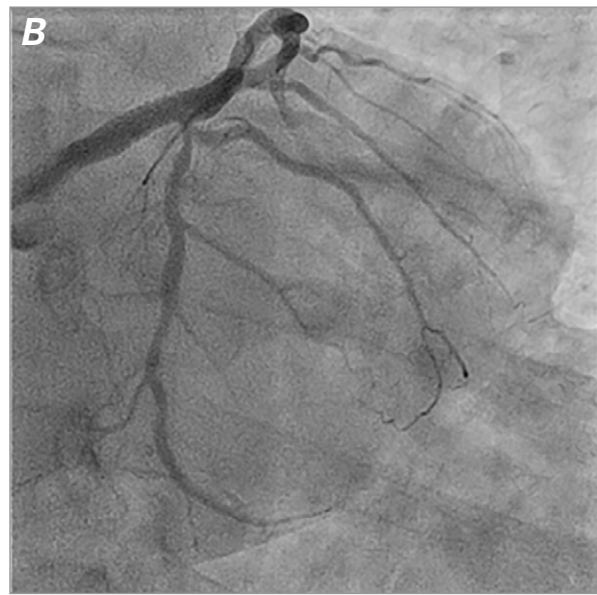
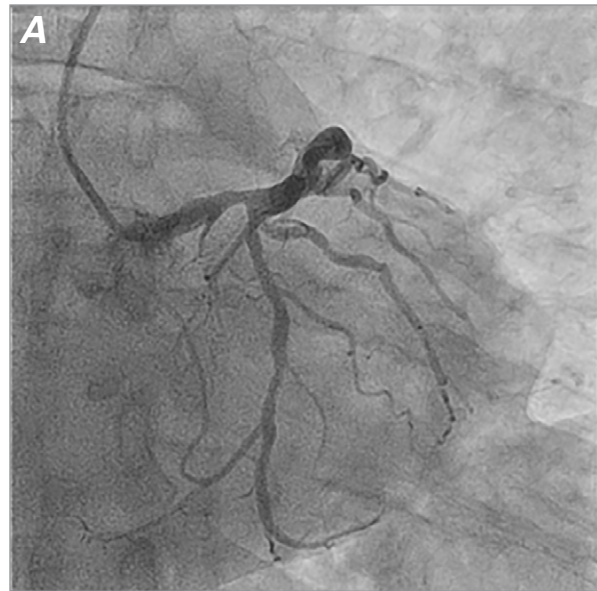
An 83-year-old man with a right-dominant coronary system was admitted with non-ST-segment-elevation myocardial infarction. Catheterization through a radial approach revealed a substantial lesion in the distal LMCA (luminal area, 4.1 mm<sup>2</sup> on intravascular ultrasound). Both reference segments—in the distal LMCA and the ostial left anterior descending coronary artery (LAD)—had aneurysmal diameters of 5.24 mm (Fig. 1A). We observed additional single lesions in the mid LAD and the obtuse marginal branch, as well as chronic occlusion of the right coronary artery (RCA) with collateral circulation. The patient had a left ventricular ejection fraction (LVEF) of 0.42 and moderate mitral regurgitation. During a single procedure, we directly deployed a 2.5 × 12-mm Ultimaster<sup>®</sup> DES (Terumo Corporation; Tokyo, Japan) in the obtuse marginal branch, a 3.5 × 12-mm SYNERGY<sup>™</sup> DES (Boston Scientific Corporation; Natick, Mass) in the mid LAD, and a 5 × 12-mm Resolute Onyx<sup>™</sup> DES (Medtronic, Inc.; Minneapolis, Minn) in the LMCA and LAD ostium, at pressures of 19 atm. The angiographic results were excellent (Fig. 1B). The patient had no subsequent restenosis or thrombosis.

### Patient 2

A 55-year-old man with a right-dominant coronary system was admitted with inferior ST-segment-elevation myocardial infarction. We performed primary PCI to the mid



**Fig. 1** Patient 1. Angiograms show **A**) an aneurysmal lesion in the distal left main coronary artery (LMCA) and ostial left anterior descending coronary artery (LAD), and **B**) good results after deployment of a Resolute Onyx stent in the LMCA and LAD ostium and deployment of a SYNERGY stent in the mid LAD.

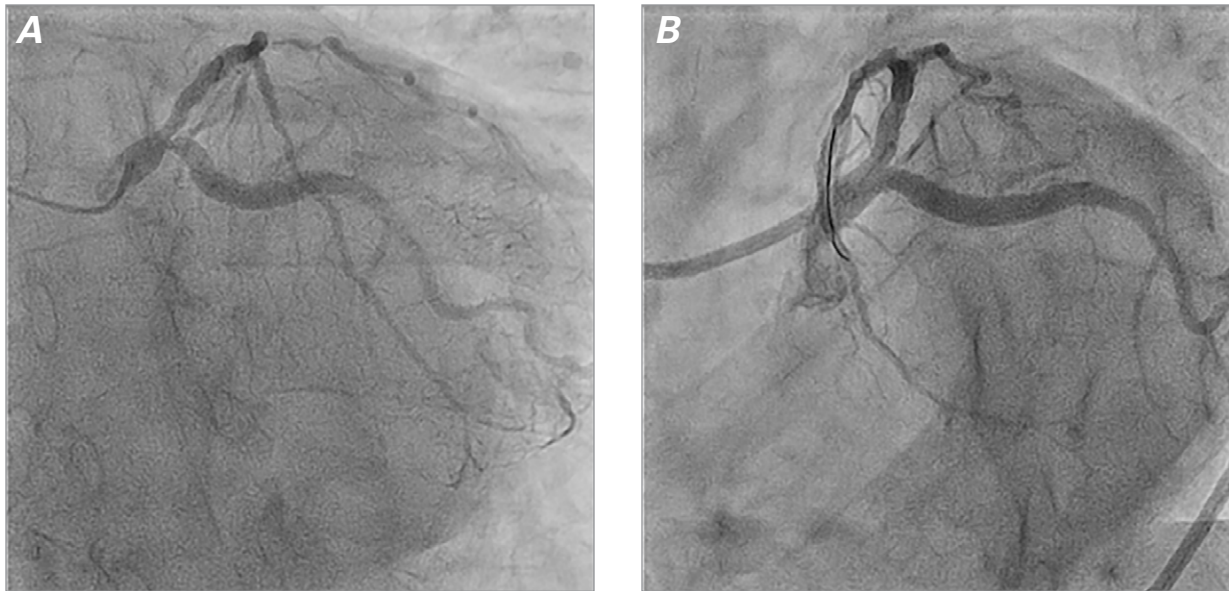


**Fig. 2** Patient 2. Angiograms show **A**) a lesion in the distal left main coronary artery and **B**) good results after deployment of a SYNERGY stent.

RCA by deploying overlapping  $3 \times 33$ -mm and  $3 \times 18$ -mm XIENCE Xpedition® DESs (Abbott Vascular; Santa Clara, Calif). During this procedure, angiograms of the LMCA showed a large lesion (luminal area,  $5.27 \text{ mm}^2$  on intravascular ultrasound) and  $5.3$ -mm aneurysmal reference diameters of the LMCA and proximal LAD (Fig. 2A). Two days later, we directly treated this lesion via a radial approach, deploying a  $4 \times 12$ -mm SYNERGY stent at a pressure of 18 atm. The final stent dimensions were  $5.4 \times 4.6 \text{ mm}$ , and the angiographic results were excellent (Fig. 2B). The patient had no subsequent restenosis or thrombosis.

### Patient 3

An 85-year-old woman was admitted with non-Q-wave myocardial infarction and a normal LVEF. Angiograms obtained through the right radial artery showed a right-dominant coronary tree with mild disease in an aneurysmal LMCA, substantial disease in the distal LAD and first diagonal branch, a severe ostial lesion in an ectatic left circumflex coronary artery (LCx) (Fig. 3A), and a mildly diseased RCA. Angiograms with intravascular ultrasound showed luminal reference diameters of  $3.5 \times 3.3 \text{ mm}$  in the proximal LAD,  $5.1 \times 4.8 \text{ mm}$  in the LCx, and  $6.2 \times 5.8 \text{ mm}$  in the LMCA. We successfully deployed 2 Nobori® DESs (Terumo): one ( $2.5 \times$



**Fig. 3** Patient 3. Angiograms show **A**) a mildly diseased left main coronary artery (LMCA) and a severe lesion in the left circumflex coronary artery (LCx) ostium, and **B**) good results after deployment of a STENTYS stent in the LMCA and a Resolute Integrity stent in the LCx.

18-mm) in the distal LAD, and the other ( $2.25 \times 14$ -mm) in the first diagonal branch. The patient was scheduled for staged PCI to the ostial LCx, through femoral access.

We assumed that LM stenting would be necessary to ensure success at the LCx ostium, so we took a double-stent approach. Two days after the first intervention, we performed rotational atherectomy with 1.75- and 2.25-mm burrs. Because of the 6-mm reference diameter in the LMCA, we deployed a  $3.5\text{--}4.5 \times 17$ -mm Paclitaxel-Eluting Self-Apposing<sup>®</sup> Coronary Stent (STENTYS S.A.; Paris, France). We next used a  $3.5 \times 15$ -mm noncompliant balloon to dilate the posterior LCx ostium, and then deployed a  $4 \times 12$ -mm Resolute Integrity<sup>®</sup> DES (Medtronic) at a pressure of 16 atm. We postdilated this last stent by using a  $5 \times 12$ -mm noncompliant balloon. A final kissing-balloon inflation was performed. Angiographic results confirmed optimal stent apposition (Fig. 3B). The patient had no subsequent restenosis or thrombosis.

## Discussion

In the LM territory, variables such as lesion location, coronary dominance, and the presence of calcium can interfere with attaining optimal PCI results. If the bifurcation is involved, then the Medina classification type,<sup>5</sup> LCx angle, LMCA diameter, and diameters of both branches can also affect the results. In an ectatic or aneurysmal LMCA, only a few current stent designs can overcome disparate dimensions between the LMCA and its branches; the use of other stents might lead to

deformation or substantial shortening of the stent platform. In one study of 125 patients who had significant left epicardial arterial stenosis,<sup>6</sup> the mean maximal diameter of the distal LM stem was  $5.7 \pm 0.7$  mm (range, 4–7.4 mm), which would necessitate postdilating the DES platforms beyond the recommended diameters—even in conservative sizing—to attain good apposition.

Optimal PCI should not lead to intraprocedural complications and should ensure a minimal incidence of posterior thrombosis and restenosis. Precisely correlating the final stent diameter and the reference diameters at each point of the lesion can avoid overexpansion and subsequent coronary artery dissection. Correct stent apposition decreases the incidence of restenosis and thrombosis, so a suitable final diameter at each point of the lesion is again crucial.

We chose our patients' stents accordingly. Because Patient 1 had a type 1.0.1 lesion per the Medina classification,<sup>5</sup> with similar aneurysmal reference diameters in the LMCA and the LAD ostium, the  $5 \times 12$ -mm Resolute Onyx DES was a good option. Patient 2's Medina type 1.0.0 lesion necessitated our using the  $4 \times 12$ -mm SYNERGY stent, which can expand to 5.75 mm, achieve good apposition, and leave the LCx ostium uncovered. In Patient 3, the  $3.5\text{--}4.5 \times 17$ -mm STENTYS DES was most appropriate, given the disparate reference diameters of 3.5 mm at the LAD ostium and 6.2 mm at the LMCA.

We conclude that PCI in ectatic or aneurysmal LM disease necessitates the use of stents specifically designed to achieve adequate apposition and adapt to disparate diameters in the same lesion.

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