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Skirt followed by trouser stenting technique: True anatomical preservation of coronary Y-shaped bifurcation lesions while using "vanishing" bioresorbable scaffolds: A report of two cases

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ABSTRACT

We report on two cases in which Y-shaped coronary bifurcations were treated with the use of Bioresorbable scaffolds. The first case was of a 50-year-old man with NSTEMI. Coronary angiography showed stenosis involving a Y-shaped bifurcation of proximal to mid LAD and diagonal. The lesion was wired using two 0.14 BMW guide wires, followed by serial pre-dilatation of LAD and Diagonal branch. The stent into proximal LAD was deployed first as a skirt (3.5 × 12 BVS). Stent was post-dilated. A second 2.5 × 28 BVS was deployed into diagonal branch, protruding backwards; along with a 2.0 × 15 SC balloon continuing into the mid LAD. Both balloons where pulled back proximally and re-inflated. The technique was repeated in reversed order for stenting the mid LAD using the third BVS (3.0 × 18 BVS). Finally two NC balloons where used to post-dilate both legs of the newly-formed trouser. The result was checked by OCT. The second case was that of a 62-year-old man with chest pain and NSTEMI. He had a history of previous PCI to LCx using bare metal stent. Coronary angiogram showed severe in-stent restenosis in mid LCX, extending into two large obtuse marginal branches. After wiring both OMs, serial pre-dilatation was done with two NC 2.5 × 20 balloons, followed by initial stenting of mid LCx inside old stent, as the proximal segment of bifurcation, using a 3.5 × 12 BVS, followed by implanting a 2.5 × 28 BVS into OM2 and 2.5 × 18 into OM1. At 6 months a clinical follow up via telephone contact revealed no recurrence of chest pain in both cases and no further intervention required.

We report on two cases in which Y-shaped coronary bifurcations were treated with the use of Bioresorbable scaffolds (Abbott Vascular, Santa Clara, CA, USA). The first case was of a 50-year-old man, smoker for twenty years with no past chronic illnesses. He presented to emergency department with persistent chest pain. ECG showed T wave inversion in leads I, aVL, V4–V6. Cardiac enzymes where elevated. He was shifted for early coronary intervention, which showed coronary single vessel disease. There was haziness involving a Y-shaped bifurcation of proximal to mid LAD with large diagonal branch (Fig. 1.). In view of patient's young age decision was taken to treat it using BVS. The lesion was wired using two 0.14 HI-TORQUE BALANCE MIDDLEWEIGHT UNIVERSAL Guide Wires (Abbott Vascular). This was followed by serial pre-dilatation of LAD and Diagonal branch at 1:1 ratio (Fig. 2a–c). The stent into proximal LAD was deployed first as a skirt (3.5 × 12 BVS; Abbott Vascular, Santa Clara, CA, USA) (Fig. 3a), then the wires were withdrawn and re-inserted through the stent lumen into mid LAD and Diagonal. This stent was post-dilated using a short NC Balloon. Next a second 2.5 × 28 BVS (Abbott Vascular, Santa Clara, CA, USA) was deployed into diagonal branch and minimally protruding backwards into the proximal LAD stent. It was deployed along with a 2.0 × 15 SC balloon placed minimally into skirt stent and continuing into the mid LAD as a modified v stenting technique (Fig. 3b). After stent deployment both balloons where pulled back proximally and re-inflated at higher pressures inside the skirt BVS. The technique was repeated in reversed order for stenting the mid LAD using the third BVS (3.0 × 18 BVS; Abbott Vascular, Santa Clara, CA, USA) and a 2.0 × 15 balloon in the diagonal side branch (Fig. 3c). Finally two NC balloons where used to post-dilate both legs of the newly-formed trouser (Fig. 3d). The result was checked by OCT (Fig. 4a–b), which showed good strut opposition to vessel walls and no strut breakage. There was no area left unstented inside the bifurcation lesion.

The second case was that of a 62-year-old man who presented with chest pain for four hours. ECG showed ST depression in infero-lateral leads. There was a history of previous PCI to LCx at another hospital 3 years ago using a bare metal stent. Coronary angiogram showed severe instent restenosis of a stent in mid LCX, extending into two large obtuse marginal branches (Fig. 5). After wiring both OMs', serial pre-dilatation was done with two NC 2.5 × 20 balloons (Fig. 6a–c), followed by initial stenting of mid LCx inside old stent, as the proximal segment of bifurcation, using a 3.5 × 12 BVS (Abbott Vascular, Santa Clara, CA, USA), followed by implanting a 2.5 × 28 BVS into OM2 and 2.5 × 18 into OM1; as was previously described for first case (Fig. 7a–c).

At 6 months a clinical follow up via telephone contact revealed no recurrence of chest pain in both cases and no further intervention required.

Stent implantation for treatment of coronary bifurcation lesions frequently impairs blood flow to side branches while changing the

Abbreviations: OCT, Optical Coherence Tomography; BVS, Bioresorbable scaffolds; SC balloon, Semi-compliant coronary balloon; NC balloon, Non-compliant coronary balloon.

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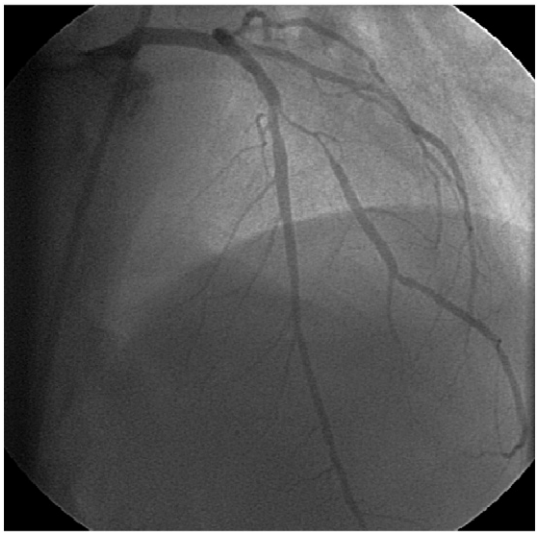

Fig. 1. AP cranial of LAD/diagonal bifurcation (medina 1.1.1).

configuration of the coronary tree [1]. There are numerous techniques devised to tackle coronary bifurcations using metallic stents [2] but the generally accepted practice is the stenting of main vessel with provisional side branch stenting. This has proved to be as effective as and safer than the more sophisticated techniques [3]. For Bioresorbable scaffolds numerous facts have caused the interventional community to discourage their use in lesions covering large side branches. Firstly, the tensile strength and elastic modulus of BVS are several times lower than metal alloys [4], which affect its radial strength and cause more pronounced acute stent recoil. Secondly, OCT studies have shown the development of Neo-intimal bridges on BVS struts across the Side-branch ostium, leading to focal lumen reduction [5]. In bench reconstructions, re-crossing and aggressive kissing balloon through BVS struts leads to breakage of longitudinal links and disconnection of circular rings resulting in "unzipping" of that section of the scaffold [6]. In the ABSORB trial [7], no lesions covering a side branch >2.5 mm could be included. In view of those facts, the use of BVS in treating true coronary bifurcations remains off-label, as a case by case scenario. Despite that multiple case reports were reported in literature, in which there is accumulating evidence of the feasibility and safety of BVS use to treat complex coronary bifurcations using conventional interventional techniques [8–12].

Different from other reports, we report on the use of an old technique, rarely in use nowadays, which preserves the anatomy of a bifurcation yet avoiding the need for re-crossing and predilating through the struts. Not every bifurcation is suitable for such a treatment strategy. The size of proximal main vessel and the two distal limbs should be suitable to accommodate the implanted BVS. The reason the initial BVS is implanted proximally first, followed by the other two BVSs' used as two legs of trouser starting from inside first stent, is to avoid leaving a gap of unstented vessel wall. Hence there is no segment of vessel wall left untreated and importantly there is no strut crushing involved. The technique is relatively time and resource-consuming and technically challenging. Hence there is a need to rationalize its use for clinically relevant situations where side branch loss leads to dismal clinical consequences. Although good acute results can be achieved, as evidenced by OCT, further follow up at 6 and 12 months needs to be obtained in more cases before we achieve definitive conclusions about the safety and effectiveness of this treatment strategy.

We present two cases of Y-shaped coronary bifurcations treated with the sole use of Bioresorbable scaffolds (Abbott Vascular, Santa Clara, CA, USA) without distorting native vessel anatomy with excellent acute results as evidenced by OCT. Further studies are required to assess its safety and efficacy.

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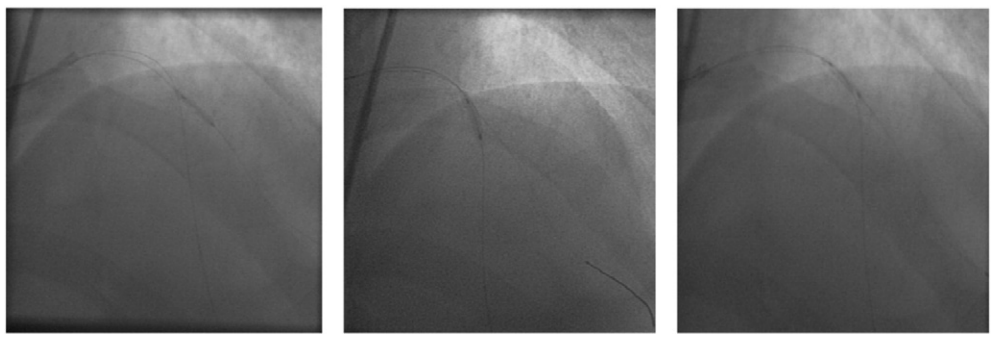

Fig. 2. Serial pre-dilatation of side branch, distal main branch then proximal LAD.

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