Culotte bifurcation stenting with paclitaxel drug-eluting stent

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Abstract The results of using the culotte bifurcation technique have not been promising with regard to bare metal stents; however, some possible advantages with regard to drug-eluting stents (DES) must be taken into account, such as the possibility to stent provisionally, to use lower French sizes, and to completely cover the coronary wall and the new carina with a single or double stent layer. The crush technique, which aims to reach a complete coverage of the coronary wall to allow antiproliferative drugs to homogeneously distribute into the coronary walls, has been introduced. The culotte technique seems to act more physiologically, allowing the creation of a new, homogeneously covered carina, without any crushed metal inside the coronary wall. We present the case of a coronary bifurcation treated with the use of the culotte technique and paclitaxel-eluting stent deployment, with good angiographic results after 10 months of follow-up. Further data are needed to evaluate the potential utility of the culotte technique in treating bifurcation coronary lesions in the area of DES.

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1. Introduction

Bifurcations are prone to atherosclerotic changes due to increased shear stress and turbulence of flow [1].

In the past, coronary bifurcations were a contraindication for percutaneous revascularization, the high risk of ischemic complications, plaque shift due to the “snow plow” effect, and side branch occlusion or dissection [2].

Despite the development of very low profile balloon, atherectomy devices, new-generation bare metal stents (BMS) and drug-eluting stents (DES), and new antiplatelet therapies, the problem of high restenosis rates in these kinds of lesions is yet to be resolved, and we still do not have definite answers regarding the need to stent the side branch at present [3].

According to different techniques, the side branch can undergo planned or intention-to-treat stenting or provisional stenting in case of suboptimal results.

Literature data rely on the experience of high-volume centers or high-volume operators [4–6] while awaiting the design of a randomized control trial that could give the interventional community some clear guidelines. Furthermore, in each bifurcation case, several anatomic and technical features such as angulation and tortuosity of the side branch, plaque burden and calcification, different devices and techniques available for predilatation and debulking, and a variety of concomitant pharmacological approaches have to be taken into account.

The case we describe offers an interesting hypothesis: when choosing a two-stent technique, open cells’ DES could be more suited to the culotte approach as opposed to closed cell design DES, where the crush technique could be favored [7–9].

2. Case report

A 48-year-old Caucasian male suffering from hyperlipidemia and complaining of unstable angina (Canadian
Cardiovascular Society Classification III) with perfusion nuclear scan consistent with ischemia in the anterolateral and posterolateral walls underwent a cardiac catheterization and selective coronary angiography by right femoral approach that showed a critical lesion of the proximal left descending artery (Type B2 according to ACC/AHA coronary lesion type classification) involving the bifurcation of a large first diagonal (D1; Type 1 according to Lefevre bifurcation classification) and a critical lesion of the mid circumflex (Type A; Fig. 1).

2.1. Procedure

Initially, both branches were wired and predilated with a 2.5×15 mm balloon; then, we removed the wire in the D1, and a 3.0×16 mm paclitaxel-eluting stent (Taxus, Boston Scientific, Natick, MA) was deployed at 15 atm on the LAD. The stent meshes were then recrossed with the wire of the stented branch and dilated by a 2.5×15 mm balloon to allow the deployment of a new 3.5×20 mm paclitaxel-eluting stent (Taxus, Boston Scientific) at 12 atm on the large D1 branch. The procedure was completed by a kissing balloon with the Maverick (Boston Scientific) 2.5×15 mm balloon at 8 atm on the LAD and a JoMed Maestro (Abbott Vascular Devices, Abbott Park, IL) 3.0×15 mm balloon at 8 atm on the diagonal (Fig. 2).

The successful stents’ apposition was then verified via IVUS examination of both the coronary branches. The mid circumflex was predilated and stented with a 2.75×20 mm Taxus stent (Boston Scientific) at 20 atm. The procedure was performed during bivalirudin (Angiomax, The Medicine Company, Parsippany, NJ) infusion. Right
common femoral artery hemostasis was obtained with Starclose (Abbott Vascular Devices). Angiographic follow-up at 10 months did not show any angiographic sign of in-stent restenosis (Fig. 3).

3. Discussion

Numerous definitions and classifications of coronary bifurcation lesions have been proposed. A bifurcation can be defined as the presence of a stenosis of 50% or more, involving both the main vessel and the ostium of the side branch.

This definition can be extended to all significant lesions of the main vessel that are in close proximity to the ostium of a side branch. Lefevre et al. defines bifurcation lesions as only those that involve a side branch with a diameter of 2.2 mm or more. Furthermore, Lefevre proposes a classification of the bifurcations according to the angle the two branches make (Y or T shape) and to the extent of atherosclerotic disease in the main and side branch (Types 1, 2, 3, 4, 4a, and 4b) [10].

Percutaneous stenting of coronary bifurcations can be divided into two main groups: stenting only the main branch and stenting the two branches (T stenting, modified T stenting, crush technique and its variants, culotte, trousers stenting, V stenting, and Y stenting).

The culotte stent technique consists of creating a new coronary carina stenting the more angulated branch first and, after balloon dilatation of the stent meshes, stenting the uncovered branch through the first stent and leaving the main vessel covered with two overlapped stent. A final kissing balloon allows creating a new carina [11].

The results for this procedure have not been promising with regard to BMS; however, some possible advantages with regard to DES must be taken into account, such as the possibility to stent provisionally, to use lower French sizes, and to completely cover the coronary wall and the new carina with a single or double stent layer.

The crush technique, which aims to reach a complete coverage of the coronary wall to allow antiproliferative drugs to homogeneously distribute into the coronary walls, has been introduced. However, this technique leaves a certain amount of crushed metal deployed against the coronary wall, possibly increasing the wall trauma and favoring subacute stent thrombosis and in-DES restenosis.

The culotte technique seems to act more physiologically, allowing the creation of a new, homogeneously covered carina, without any crushed metal inside the coronary wall.

In this case, a paclitaxel-eluting stent was chosen, although the long-term results of a double dose of a cytotoxic drug such as taxol are not yet known. Today, available data on overlapping paclitaxel-eluting stents do not confirm any unfavorable effect of doubling the dose of this drug in the short- and mid-term follow-up. Furthermore, no randomized study that could demonstrate efficacy among the various approaches in treating coronary bifurcation disease exists. The widespread use of the crush technique does not seem entirely justified on the basis of recent criticisms [12]. Recently, there is new evidence that the culotte technique may have a rebirth [13], but further randomized data are needed to evaluate the potential utility of this technique in treating bifurcation coronary lesions in the area of DES.

References


