SCIENTIFIC LETTER

Percutaneous treatment of coronary bifurcation lesions: a novel "extended Y" technique with complete lesion stent coverage

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Bifurcation lesions are one of the major unsolved problems of percutaneous coronary intervention (PCI). Large metal burden in the artery, stent deformation, and stent overlap are problems associated with proposed techniques that use conventional stents.^{1–5} Several specially designed bifurcation devices have been proposed. However, none of these has been shown to be effective. We invented the "extended Y" technique, which uses conventional stent systems. In this technique, stenting of the main branch proximally and close to the origin of the side branch is followed by deployment of two kissing stents in a Y fashion in the distal branches, creating a short protrusion of a double stent barrel into the proximal stent. We studied this extended Y technique in bifurcations with disease of both the main branch and the two ostia of the distal branches.

PATIENTS AND METHODS

Thirty patients (22 men, mean (SD) age 64.6 (8.9) years) were treated. Bifurcations were left anterior descending/diagonal (50%), left anterior descending/septal (3%), circumflex/obtuse marginal (23%), or right coronary artery/posterior descending artery/posterolateral artery (23%). In four bifurcations the proximal part of the main branch was not diseased. Fifty per cent of patients had non-ST elevation acute coronary syndrome and 50% had stable angina. Side branch diameters were 2 mm or more. Paclitaxel (18 patients) or sirolimus eluting stents were used. Eight patients received a glycoprotein IIb/IIIa receptor blocker. Coronary angiograms were acquired in identical projections after intracoronary injection of 0.2 mg of glyceryl trinitrate before, immediately after, and six months after stent implantation. Quantitative coronary angiography was performed off line. Binary restenosis at follow up was defined as a diameter stenosis of 50% or more.

An 8 French guide catheter was used. The main branch and side branch were wired and predilated, preferably with kissing balloons. The side branch wire or the main branch wire (the wire located in the distal leg of the bifurcation most suitable for rewiring) was retracted, unless the operator predicted a high risk of occlusion of this branch. In such cases the wire was "jailed" during the next step: a stent was deployed proximally to the bifurcation as close as possible to the origin of the side branch. The length of this stent was chosen according to the length of the diseased segment proximally to the bifurcation. If the main branch had no or minor disease proximally to the side branch, an 8 mm stent was implanted. Postdilatation of the stent was performed whenever necessary. The branch from which the wire was retracted was then rewired through the stent lumen. After rewiring, two stents were deployed by the kissing stents method in the distal part of the main branch and in the side branch with a short common carina protruding into the proximal stent. Stent overlap between the proximal and

the kissing stents and thus the length of the "double barrel" was kept as short as possible. Kissing postdilatation was performed after retraction of the two stent balloons a few millimetres proximally. Postdilatation of the bifurcation could also be done with balloons of larger diameter. Supplementary stents could easily be implanted proximally or distally to the extended Y bifurcation.

RESULTS

All procedures resulted in less than 30% residual diameter stenosis and no dissections worse than type B. The length of the proximal stent segment ranged from 8–32 mm. The lengths of the distal part of the main branches and side branches ranged from 8–36 mm and 8–41 mm, respectively. Balloon nominal diameters ranged from 3.0–4.5 mm for main branches and from 2.0–3.0 mm for side branches. None of the patients died. Mean (SD) reference diameters for main and side branches were 3.08 (0.40) mm and 2.47 (0.31) mm, respectively. Mean (SD) postprocedural diameter stenoses in the main and side branches were 14.2 (6.2)% and 9.7 (3.4)%, respectively. At follow up in 17 patients, mean (SD) diameter stenoses in the main and side branches were 20.8 (8.0)% and 12.4 (8.3)%, respectively. The rate of binary restenosis in both types of branches was 0.

A patient treated with extended Y for in-stent (bare metal) restenosis in a circumflex/obtuse marginal bifurcation was readmitted four days later with a focal stent thrombosis in the side branch. The lesion was treated by crushing the side branch stent and finalised by kissing balloons inflation.

DISCUSSION

We present promising preliminary results of a novel technique for PCI in coronary artery bifurcation lesions: the extended Y technique. This technique seems to overcome many of the problems with known techniques for bifurcation PCI and it is especially suitable for true bifurcation lesions with involvement of a long segment of the main branch proximally to the origin of the side branch. The main feature of the new technique is the initial implantation of a stent proximally and close to the bifurcation. This protects against dissection caused by the subsequent distal kissing Y stenting (fig 1).

Bifurcation PCI with simultaneous kissing Y or V stenting is well known and has been found to be rapid, safe, and effective in the treatment of medium and large bifurcation lesions.³ However, in the presence of proximal main branch disease, a long metal carina may be needed to cover the diseased main vessel segment. Furthermore, a proximal dissection caused by kissing stents cannot be solved by subsequent stenting, as this will lead to either an unstented segment or to stent deformation. Lastly, when using the Y technique without proximal stenting, late proximal disease progress or in-stent restenosis cannot be stented with

Figure 1 Angiograms and ultrasound images of "extended Y" stenting in a complex coronary artery lesion involving a left anterior descending and diagonal artery bifurcation. (1) Right cranial view; (2) kissing predilatation with undersized balloons; (3) positioning of a stent proximal to the bifurcation; (4) deployment of the stent proximal to the bifurcation; (5) positioning of kissing stents after wire repositioning; (6) final result in the right cranial projection. Kissing stents were deployed and postdilatation was performed. Lower two sections are ultrasound images of (A) a proximal stent segment and (B) bifurcation stent carina. The final angiographic result (bottom) with markers for intravascular ultrasound positions.

overlap. Also, the blood flow and endothelialisation process are largely unknown in long metal carinas or when stents are deformed after crush, culotte, and T bifurcation stenting.^{1 2 5} All these techniques can interfere with blood flow and endothelialisation and predispose to stent thrombosis.

Even if the presented novel extended Y technique leads to less stent deformation and seems to solve most of the problems of bifurcation PCI with conventional techniques, long term follow up of larger series than the presented 30 patients is needed. Furthermore, the need for three drug eluting stents for one bifurcation lesion may be considered a limitation of the technique.

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