# Coronary Bifurcation Stenting
# Myth of Ostial Stenting

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## Bifurcation Stenting

Although provisional approach in coronary bifurcation stenting has been proved to be the standard strategy of treatment, There is still lack of evidences for multiple steps of the procedure.

For so many years we have been focused on the optimization of SB, but the clinical outcome is mostly dependent on the MV stenting.

## Bifurcation Stenting

The optimal expansion of MV stent without the compromise of SB is the ultimate goal to achieve in the coronary bifurcation stenting.

Understanding the anatomy and physiology of coronary bifurcation lesion is the most important step to this goal.

## Bifurcation Stenting

The most important concepts to understand in bifurcation stenting are :

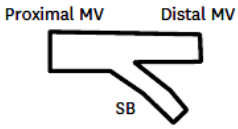
- The relationship of vessel diameter between branches
- The anatomical and functional significance of plaque shift and carina shift

They are the science behind the decision of ostial SB stenting , predictors of SB occlusion, and the rationale of POT and final kissing ballooning.

## Vessel size: Relation of the bifurcation vessels sizes

The most important concept to understand a bifurcation lesion is the relationship between the sizes of these vessels. (Proximal MV, Distal MV and SB)

Finet's law : DPV=0.678×(DMB+DSB)



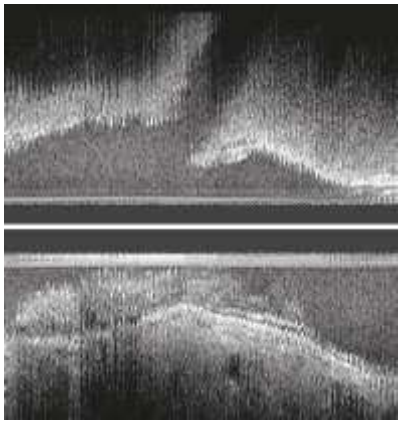

IVUS calculations is much more accurate

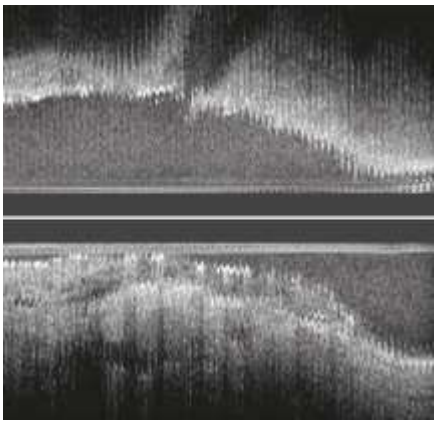
## Plaque shift and carina shift

The major mechanism of SB compromise is plaque shift from MV to SB, for the plaque burden in MV and in SB is the major risk factor of SB compromise .

Scanty amount of plaque in the carina cannot be a cause of major plaque shift, which suggests that the contribution of plaque shift may have been overestimated.

## Plaque shift and carina shift





## Plaque shift and carina shift

Instead, the carina structure itself can be shifted to SB, which can be the major cause SB compromise

The predicted percent diameter stenosis of SB ostium with full carina shifting is calculated as a cosine of bifurcation angle, which means more carina shift with narrower bifurcation angle.

## Plaque shift and carina shift

However, it was found that abnormal FFR in the SB after MV stenting was always accompanied by the plaque shift, whereas the carina shift was mostly not associated with a significant drop of FFR in SB

The reason why the carina shift is functionally not significant, is because the carina shift is mostly short and eccentric.

## Plaque shift and carina shift

Angiographically the carina shift looks exaggerated by the negative shadow of MV stent across SB ostium.

Significant stenosis in ostial SB, significant proximal MV disease, and acute coronary syndrome all are independent predictors of SB compromise, which suggests that the plaque shift is the major mechanism.

## Plaque shift and carina shift

- As a conclusion, the anatomical compromise of SB after MV stenting is not functionally so significant than it looks, because it is mostly explained by carina shift, which is not the major cause of functional compromise.
- The plaque shift superimposed on carina shift appeared to be necessary to cause a hemodynamically significant SB stenosis , and will be taken very important in the decision of ostial SB stenting .

## MV Stenting and Optimization Technique

The large the size of SB, the larger the discrepancy of proximal and distal MV size.

The first step of MV stenting is the selection of stent with optimal size to distal vessel diameter

The proximal optimization technique (POT) is post-dilating the MV stent just proximal to the carina, with a short non-compliant balloon sized for the reference diameter of proximal MV.

## MV Stenting and Optimization Technique

There have been several studies for the predictors of SB occlusion.

The significant independent predictors were SB ostial disease and lesion length, Proximal MV stenosis, ACS, and non-left main disease.

Jailed wire technique, SB predilatation, and IVUS guidance were not predictors.

## MV Stenting and Optimization Technique

IVUS studies showed that stent expansion in distal MV is significantly associated with carina shift, and the stent expansion in Proximal MV was associated with plaque shift.

Operator should consider the risk of carina and plaque shift based on this observation when they select optimal size of stent and POT balloon. The proximal and distal optimization technique can be a good solution for the optimal stent expansion avoiding SB compromise.

## MV Stenting and Optimization Technique

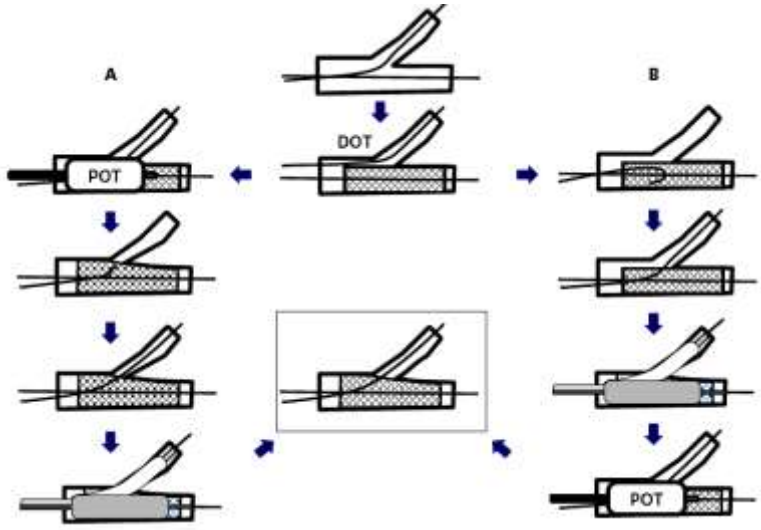
1) Start with wiring the MV and a large SB.
2) Predilate the MV. Predilate the SB with severe ostial stenosis.
3) MV stenting with a size just optimal to distal MV, avoiding stent overexpansion (distal optimization)
4) Rewiring the SB using the wire inserted in SB. Wire prolapse technique is useful to avoid wire undermining of the stent.

## MV Stenting and Optimization Technique

5) POT may help wiring SB, and is also important for the stent apposition in the proximal MV. You can do POT before SB rewiring according to the EBC consensus

6) SB ballooning with or without final kissing ballooning and SB stenting.

## MV Stenting and Optimization Technique




- **Predilatation of SB**

Predilatation lowers the risk of SB compromise after MV stenting .

So predilatation is reasonable way to prevent SB compromise in the high-risk lesion. But do it carefully not to make dissection in SB.

- **SB ballooning and final kissing ballooning**

After MV stenting, the ostium of SB is jailed by the stent struts across the MV, frequently along with SB ostial stenosis. The purpose of SB ballooning is to free the SB from jailed strut, dilating the SB ostium.

**SB ballooning and final kissing ballooning**

Consensus is that FKB is mandatory after SB ballooning. But, there have a lot of debates on the indication of SB ballooning after MV stenting.

SB ballooning deforms MV stent struts, often not fully corrected by FKB

## SB ballooning and final kissing ballooning

The indication of SB ballooning is TIMI flow < 3 may be the optimal indication in non-left main bifurcation, and residual stenosis >70% in left main bifurcation.

## POT-side-POT (re-POT)

- The major benefit of FKB is not the SB treatment, but the optimal stent expansion in MV. So FKB can be replaced by the final POT.
- POT is also beneficial to facilitate the cross of wire and balloon after MV stenting. So, first POT is to be done for this original purpose. If SB treatment is needed, SB is rewired and treated with SB ballooning. SB ballooning will result in the MV stent deformation and stent carina shift into MV, which can be corrected by second POT, instead of FKB.

## POT-side-POT (re-POT)

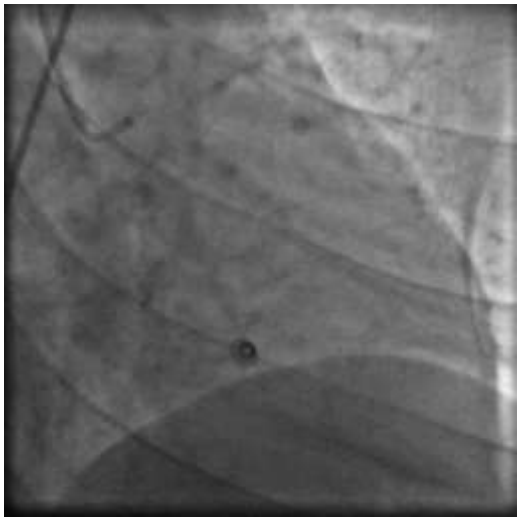
- Compared to conventional FKB, POT-side-POT is simpler and can be done through a smaller guiding catheter.
- The most challenging part of POT- side-POT is correct location of POT balloon. It should cover the proximal edge of stent carina.

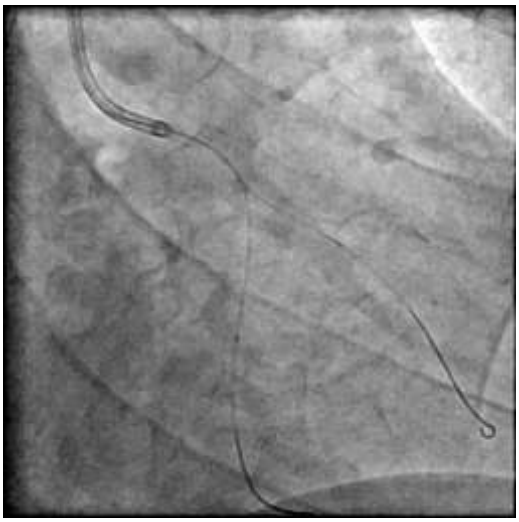
## Indication of SB stenting in the provisional approach

SMART-STRATEGY trial was designed to answer this

In conservative group, SB stenting is indicated if TIMI flow <3 in non-left main bifurcation, and diameter stenosis >50% or dissection in left main bifurcation. In aggressive group, SB stenting is indicated if diameter stenosis >50% or dissection in non-left main and diameter stenosis >30% or dissection in left main bifurcation.

Target vessel failure (TVF), the primary endpoint was similar between 2 groups (9.4% vs. 9.2%, p=0.97).





## Take home points

There is still lack of evidences for multiple steps of the bifurcation stenting procedure; wiring, predilatation, MV stenting, SB proximal optimization, SB ballooning, SB stenting, and final kissing ballooning.

The treatment of bifurcation lesions is still in some ways an art form.