Bifurcation Approaches Made Simple

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Background

- Bifurcation lesions are commonly encountered in clinical practice (up to 30% of PCIs)
- In the DES era, clinical outcomes of bifurcation PCI are very good
- Various 2-stent techniques have been devised to effectively treat bifurcations lesions
- The savvy interventional cardiologist needs to be familiar with all techniques since there are certain advantages and disadvantages to each
Bifurcation PCI Techniques
Why Do Bifurcation Lesions Pose Such a Challenge?

- When treating the main vessel, shift of plaque or thrombus can lead to sidebranch occlusion, particularly if:
  - The ostium of the sidebranch itself is diseased
  - The sidebranch is of small diameter
  - Thrombus from ACS is present

- Clinical consequences of loss of the sidebranch are dependent on vessel size and amount of myocardium
Bifurcation Intervention: The Problem of Plaque Shift ("Snow Plow")
Commonly Used Bifurcation Techniques

- Provisional Stent Technique
- Crush Techniques
- Simultaneous Stent Techniques
- T Stent Techniques
- Culotte Technique
Provisional Stent Technique:

The ‘simplest’ way to treat a bifurcation lesion

Wire both vessels (if needed)
Pre-dilate as needed

Stent main branch
Rewire and balloon side branch (+/- kissing balloon inflation)
Side branch closure after PCI

A: Prebranch <5%
B: Postbranch <5%
C: Parent vessel only 5-10%

D: Bifurcation 15-20%
   Cause: Plaque shift, Spasm, Dissection

E: Ostial <5%
F: Prebranch and ostial 10-15%
Provisional Stent Technique:

Plan B

- If a second stent is needed after provisional stenting is performed (ie: dissection or compromise of the sidebranch) the following techniques can be used:

  - Culotte Technique
  - Reverse Crush Technique
  - TAP Technique
Provisional Stent Technique

**Advantages:**
- Simple
- Less Metal
- Easier to treat restenosis
- Less thrombosis?

**Disadvantages:**
- Residual stenosis at side branch
- If side branch stent needed may be harder to insert through main branch stent
Commonly Used Bifurcation Techniques

- Provisional Stent Technique
- Crush Techniques
- Simultaneous Stent Techniques
- T Stent Techniques
- Culotte Technique
The Classic Crush Technique

- Wire both vessels
- Pre-dilate as needed
- Position stents
- Deploy side branch stent, remove balloon/wire
- Deploy main branch stent- ‘crushes’ side branch stent
- Rewire side branch and perform kissing balloon inflation
The Crush Technique

Main br stent

Crushed side-br stent
2 layers of stent separate side branch from the main branch.... can be difficult to re-wire!
The Evolution of the ‘Crush’ Technique: Post-Crush Kissing Balloon Inflation

Before Kissing Balloon Inflation

After Kissing Balloon Inflation
Kissing Balloons: Before and After
Crush Technique: Variations

- Classic Crush
- Mini Crush
- Double Kissing Crush (DK Crush)
- Reverse Crush
- Step Crush
Classic Crush Technique

Mini Crush Technique
DK Crush Technique

- Position sidebranch stent as if performing a Mini Crush, in conjunction with a balloon in the mainbranch.
- Deploy sidebranch stent, withdraw sidebranch stent balloon slightly, then reinflate to high pressures to “flare” the proximal sidebranch stent.
- Remove sidebranch balloon and wire.
- Crush sidebranch stent with mainbranch balloon.
- Rewire sidebranch and perform a kissing balloon inflation.
DK Crush Technique

- Remove sidebranch wire and balloon
- Position stent in the mainbranch and deploy it
- Rewire sidebranch and perform final kissing balloon inflation
Reverse Crush Technique

Performed as a bailout strategy if provisional stenting of the main branch is suboptimal
Crush Stent Techniques

**Advantages:**
- Assures ostium coverage
- Prevents loss of side branch
- Can be used if side branch and main branch are different sizes

**Disadvantages:**
- Complex
- Time consuming
- Difficult to rewire
- Sometimes can't perform final kiss
- Difficult to treat restenosis
Commonly Used Bifurcation Techniques

- Provisional Stent Technique
- Crush Techniques
- Simultaneous Stent Techniques
- T Stent Techniques
- Culotte Technique
The Simultaneous Kissing Stent (SKS) Technique

Wire both vessels
Pre-dilate as needed
Position stents
Deploy stents simultaneously
Perform kissing balloon post-dilatation
Simultaneous Kissing Stent Technique (SKS)

Advantages:
● Simple
● Maintain wire access to both branches at all times
● Minimal ischemic time

Disadvantages:
● Can be difficult to rewire later
● Longer carinas can cause trouble later
● Requires larger vessels of similar size
● More restenosis
Simultaneous V Stenting Technique

- Identical to the SKS technique, but without the creation of a new carina
Simultaneous V Stenting Technique

**Advantages**
- Simple
- Maintain wire access to both branches at all times
- Minimal ischemic time

**Disadvantages**
- Only works if proximal main branch does not have disease
- Plaque shift more proximally can be difficult to treat:
  
  *Add a stent proximally and potentially leave a gap vs. convert to SKS*
Commonly Used Bifurcation Techniques

- Provisional Stent Technique
- Crush Techniques
- Simultaneous Stent Techniques
- T Stent Techniques
- Culotte Technique

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Traditional T Stent Technique

**PROBLEM:**

Almost NEVER is there a perfect 90 degree angle between mainbranch and sidebranch!

Use of the traditional T stent technique is associated with high risk of missing the sidebranch ostium.
The TAP Technique

T stent And Protrusion

- Wire both vessels
- Pre-dilate as needed
- Position and deploy main branch stent
- Rewire side branch and balloon dilate
- Position side branch stent so proximal edge protrudes slightly into main branch, ‘backstop’ balloon in main branch
- Deploy side branch stent first, then inflate main branch balloon to kiss
TAP Technique

**Advantages:**
- Relatively simple
- Assures ostium coverage
- Less metal at side branch ostium compared to crush
- Works when vessels are different sizes

**Disadvantages:**
- Excessive stent protrusion can cause main branch access problems later
Commonly Used Bifurcation Techniques

- Provisional Stent Technique
- Crush Techniques
- Simultaneous Stent Techniques
- T Stent Techniques
- Culotte Technique
The Culotte Technique

Wire both vessels
Pre-dilate as needed
Position and deploy stent in most angulated branch
Remove first wire, wire second branch and balloon dilate
Position second branch stent so proximal portion equal with previous stent edge and deploy
Rewire initially stented branch and perform kissing post-dilatation
Culotte Technique

**Advantages:**
- Complete coverage
- Good radial strength

**Disadvantages:**
- Complex
- Somewhat time consuming
- Vessels must be similar in size
Conclusions

• Multiple techniques have been developed to effectively treat bifurcation lesions
• Each has unique advantages and disadvantages
• Being proficient with multiple techniques will assure that you are able to perform PCI regardless of varying patient anatomy with excellent technical success
Thank You