Technical Variations of Two-Stent Bifurcation Treatment

Indications and Examples

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Conflict of Interest

• No conflict to report in relation to this presentation
Discussion Plan

• In clinical practice, Patients undergoing elective double stenting have more complex lesions than patients undergoing provisional stenting.
• When a decision is made to employ an elective double stenting technique several questions need to be answered:
  – Which technique to use?
    • Crush, Culotte, T, V, SKS
    • Is there an evidence-base for decision making?
    • How to choose among the various technique?
  – How to perform the procedure?
Elective Double Stenting Techniques

- T Stenting
- Crush Technique
- Culotte Technique
- V stenting
- Simultaneous Kissing Stenting (SKS)
Variants of Elective Double Stenting Techniques
Style or Substance?

• The value of a variant technique should be judged based on its additive impact on:
  
  – Ease of performance
  
  – Bifurcation stent geometry (coverage, deformation)
  
  – Clinical outcome
How to choose a specific EDS technique?

• Bifurcation anatomy
  – Bifurcation angle
  – Extent of disease in the MB proximal to the carina
  – Severity of the ostial SB stenosis (does it require aggressive predilatation)

• Operator experience
Which Technique?
Classical T stenting
Classical T stenting

• **Indications**
  – Bifurcation lesions with an angle between MB and SB of ~ 90 degrees.

• **Advantages**
  – The technique is easy, fast and not technically demanding.

• **Drawbacks**
  – When trying to position the SB stent exactly at the ostium without minimal protrusion into the MB the stent often misses the ostium (gap).
  – This technique has been largely replaced by the Modified T stenting technique.
Classic T-Stenting Problems

Hope

Elective

Provisional

Reality

Gap
## Variants of T-Stenting

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Elective Modified T-Stenting
Elective
Modified T-Stenting
Lesion Preparation
Elective Modified T-Stenting
Sequential Stent Deployment
Elective Modified T-Stenting
Sequential High Pressure Inflation + Final Kissing
Provisional
“TAP” Technique

Burzotta F et al. CCI 70:75–82 (2007)
Provisional
“TAP” Technique
Provisional “TAP” Technique
MV stenting...and SB dilatation

LAD stent positioning
Provisional “TAP” Technique
SB dissection post dilatation
Provisional “TAP” Technique
SB Stent Positioning...What’s Wrong?

Cranial RAO

Cranial LAO
Provisional “TAP” Technique

The Price of Omitting an Important Step

Could not deliver a 3.0 mm LAD balloon

Could not deliver a 1.5 mm LAD balloon

Delivered a 1.5 mm LAD balloon using a “boddy” wire
Provisional “TAP” Technique
Provisional “TAP” Technique

• Always keep the MV balloon in place as the SB stent is deployed.

• Not an optimal technique when the SB-DMV angle is <50-60 degrees (difficult to avoid too much protrusion).
1: Wire both branches and predilate if needed

2: Advance the 2 stents. MB stent positioned proximally. The SB stent will protrude only minimally into MB.
3: Deploy the SB stent

4: Check for optimal result in the SB and then remove balloon and wire from SB. Deploy the MB stent.
5: Rewire the SB and perform high pressure dilatation

6: Perform final kissing balloon inflation
The Crush Technique

Baseline

Final Result
The (Mini) Crush Technique

• **Advantages**
  – Guarantees the complete coverage of the SB ostium while ensuring the patency of both branches throughout the procedure. Compared to the culotte technique, there is need to rewire only the SB and not both branches.

• **Disadvantages**
  – Excessive metal (3 layers) in the MB proximal to the origin of the SB which can complicate rewiring and balloon re crossing.
The (Mini) Crush Technique
The (Mini) Crush Technique
Pre dilate MB

Pre dilate SB

After DES placement in distal lesions (SB & MB)
The (Mini) Crush Technique

Sequential Stent Deployment

Distal Lcx stent deployment

Ramus stent deployment
The (Mini) Crush Technique
The CRUSH Technique
Failure Modes and How to Address Them

• Inability to rewire the side branch
  – Use hydrophilic wires (careful manipulation). If they fail consider stiffer tapered tip wires (Miracle wire series).

• Inability to pass a balloon into the side branch
  – Use a 1.5 mm balloon
  – If it fails rewire the SB with a second wire at a different entry site
  – If it fails use a fixed wire balloon system (ACE, etc..)
Variants of Classic Crush

Problems with Classic Crush

- Excess metal in PMV
- Difficult to rewire SB
- Difficult to pass a balloon through the SB
- 8 Fr. Guide
- SB stent deformation

Mini Crush

Step Crush

Step DK Crush

Bailout Crush
The Step Crush Technique
The Step Crush Technique
The Step Crush Technique
The Step Crush Technique
Step DK Crush Technique
Sleeve Technique

“Bailout” Crush Technique

After SKS Technique

Baseline

Pre dilatation

Courtesy of Antonio Colombo, MD.
“Bailout” Crush Technique

*After SKS Technique*

Simultaneous stent insertion and deployment
“Bailout” Crush Technique
After SKS Technique

After SKS stent deployment with crush of diagonal stent.

Taxus 3.0 x 16 mm
1: Wire both branches and predilate if needed

2: Leave the wire in the more straight branch (MB) and deploy a stent in the more angulated branch (SB)
3: Rewire the unstented branch and dilate the stent struts to unjail the branch (MB).

4: Place a second stent into the unstented branch (MB) and expand the stent leaving some proximal overlap.
5: Re-cross the 2nd stent’s (MB) struts into the 1st stent (SB) with a wire and perform kissing balloon inflation.
Culotte stenting

• **Indication**
  – True bifurcation lesions particularly when the MB and the SB have the same diameter.

• **Advantages**
  – The angle between MB and SB does not constitute a problem using this technique.
  – Achieves the most homogeneous distribution of the struts at the bifurcation.

• **Disadvantages**
  – Excess metal (double layer) at the proximal MB and at the level of the carina. Therefore,.
  – SB stent malapposition to the proximal MB stent can be an issue when there is large discrepancy between the proximal MB and SB diameters.
  – This technique requires rewiring of both branches through the stent struts which can be technically demanding and time consuming.
  – Open-cell stents are preferable to closed-cell stents because it permits a larger intra strut opening toward both branches.
Culotte Stenting

Baseline

Pre dilatation

Stent SB

Stent MB
Culotte Stenting
Culotte Stenting ??
SKS stenting

1: Wire both branches and predilate if needed

2: Position two parallel stents covering both branches and extending into the MB
V: minimal protrusion into MB
SKS: double barrel into the MB
3: Deploy one stent

4: Deploy the second stent
SKS stenting

5: Perform final kissing inflation
SKS

• **Indication**
  – Medina 0,1,1 bifurcations in which the proximal MB is relatively free from disease with an angle between both branches < 90 degree.

• **Advantages**
  – Access to both branches is always preserved during the procedure with no need for rewiring any of the branches. It's relatively easy and fast.

• **Disadvantages**
  – Creation of a metallic neo carina (particularly the SKS) in the proximal MB with stent mal-apposition. Theoretically, this technique raises several concerns:
    • The risk of proximal dissection which would require converting the procedure to a crush technique.
    • If re-intervention is necessary at follow-up rewiring the stented vessels may be complicated by wire passage behind stent struts.
    • If restenosis occur in the neo carina or at the proximal stent edge it would require converting to the crush technique for treatment.
SKS Technique
Insights from the Bench

Courtesy of Yoshinobu Murasato, MD.
SKS Technique

Baseline

Courtesy of Antonio Colombo, MD.
SKS Technique

Simultaneous stent insertion and deployment

Taxus 2.75 x 20 mm

Taxus 2.50 x 20 mm
Need for a proximal stent after distal V stenting: conversion to CRUSH stenting

After SKS

Taxus 3.0 x 16 mm

Stent deployment with crush of diagonal stent

Final result
1: Wire both branches and predilate if needed

2: Position two parallel stents covering both branches and extending into the MB
   - V: minimal protrusion into MB
   - SKS: double barrel into the MB

V stenting
3: Deploy one stent

4: Deploy the second stent

Some operators deploy the two stents simultaneously.
Perform high pressure single stent postdilatation and medium pressure kissing inflation with short and non-compliant balloons
V Stenting

Courtesy of Yoshinobu Murasato, MD.
V Stenting
Ostial LAD and LCX Disease

Baseline
Sequential Deployment

FKI
V Stenting
Summary

• Largely, evidence is lacking as to the superiority of one EDS technique versus others.

• The decision as to what technique to use should be driven by bifurcation morphology and operator experience.

• Although conclusive evidence is lacking, FKI should be attempted in all patients.

• IVUS can help optimize the results and should be used more liberally.
Summary

• Variants of the traditional double stenting techniques have impacted ease of performance and bifurcation stent geometry. Its impact on clinical outcome is yet to be proven.

• At the end, final results optimization rather than technique variant is the most likely factor to impact clinical outcome.