Crush vs. Culotte: When to Choose and How to Do?

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Disclosure Statement of Financial Interest

Within the past 12 months, I or my spouse/partner have had a financial interest/arrangement or affiliation with the organization(s) listed below.

Affiliation/Financial Relationship	Company
• Grant/Research Support	• Abbott Vascular
• Consulting Fees/Honoraria	• Boston Scientific
• Consulting Fees/Honoraria	• Cordis J&J
• Consulting Fees/Honoraria	• Abbott Vascular
• Major Stock Shareholder/Equity	
• Royalty Income	
• Ownership/Founder	
• Intellectual Property Rights	
• Other Financial Benefit	

When are two stents needed?

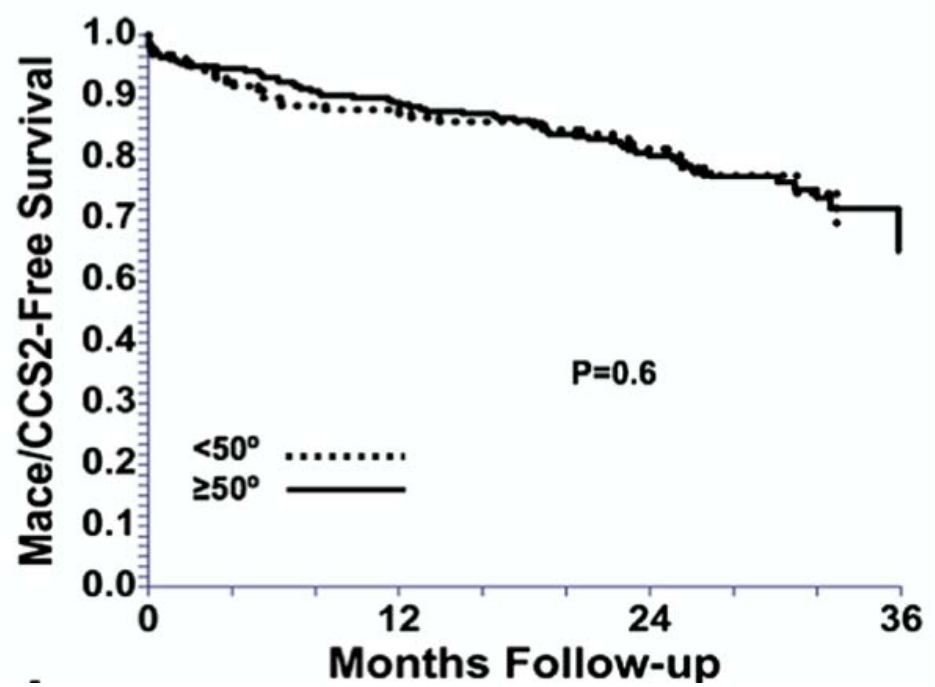
- **Bifurcation anatomy [1-3]:**
  - **Large side branch >2.5 mm [1] or >3 mm [2] in diameter and large territory of distribution**
    - **Culotte not recommended: when there is a large mismatch between the proximal MB and SB diameters due to the risk of incomplete SB stent apposition to the proximal MB**
  - **Ostial disease extending >5 mm [3] or 10-20 mm or more [1] beyond the ostium**
  - **Side branch whose access is particularly challenging should be secured by stenting once accessed [3]**
  - **Have unfavourable angle for re-crossing after MB stent implantation [1]**
    - **Bifurcations with angulation > 60 degree between the daughter vessels should be approached with single stent strategies where possible [3]**
    - **Culotte can be used in almost all true bifurcation lesions irrespective of the bifurcation angle, crush should be avoided in wide angle bifurcations [1]**
- **Operators experience**

[1] Latib A et al. *EuroIntervention.* 2010;6 Suppl J: J81-J87
[2] Sharma SK et al. *Cardiol Clin* 2010;28:55–70
[3] Hildick-Smith D et al. Consensus from the 5th EBCmeeting. *EuroIntervention* 2010;6:34-38

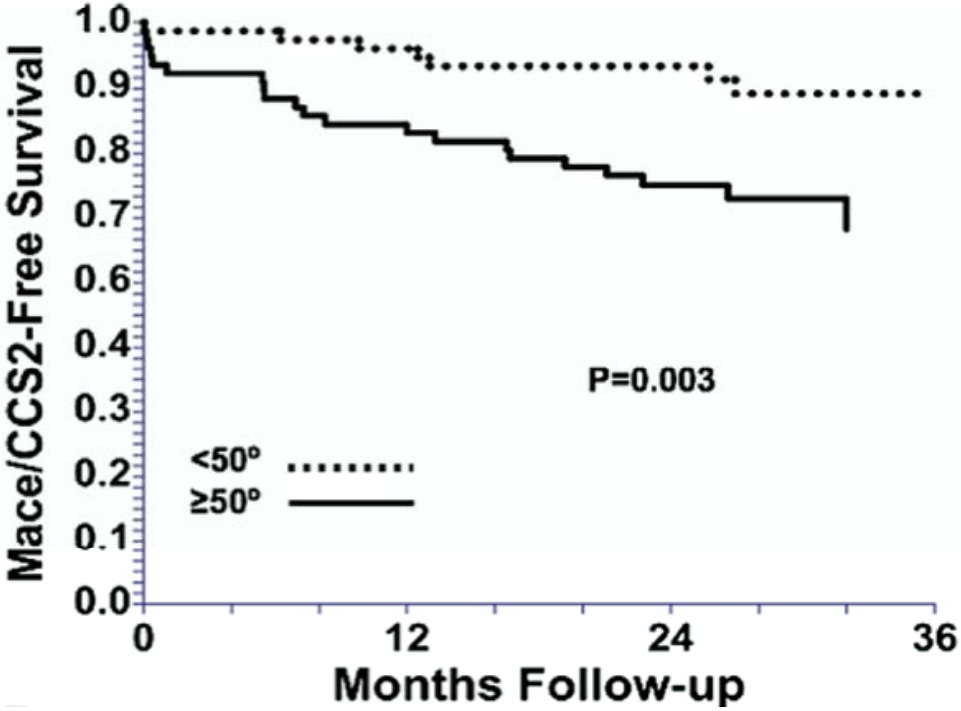
The role of bifurcation angle

Kaplan-Meier curves for MACEs or CCS class ≥2 angina-free survival

MV stenting only



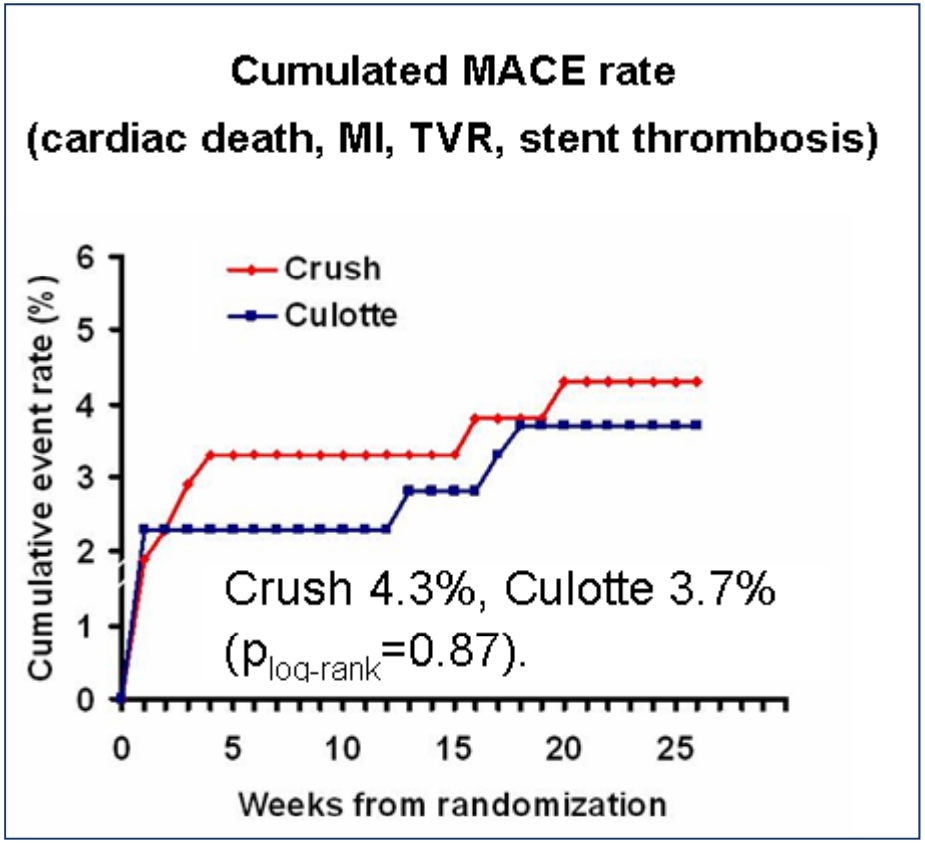
Crush/Culotte stenting



Collins N et al. *Am J Cardiol* 2008;102:404–410

Which technique is best?
Nordic Stent Technique Study *(Nordic II)*

Primary endpoint and individual endpoints

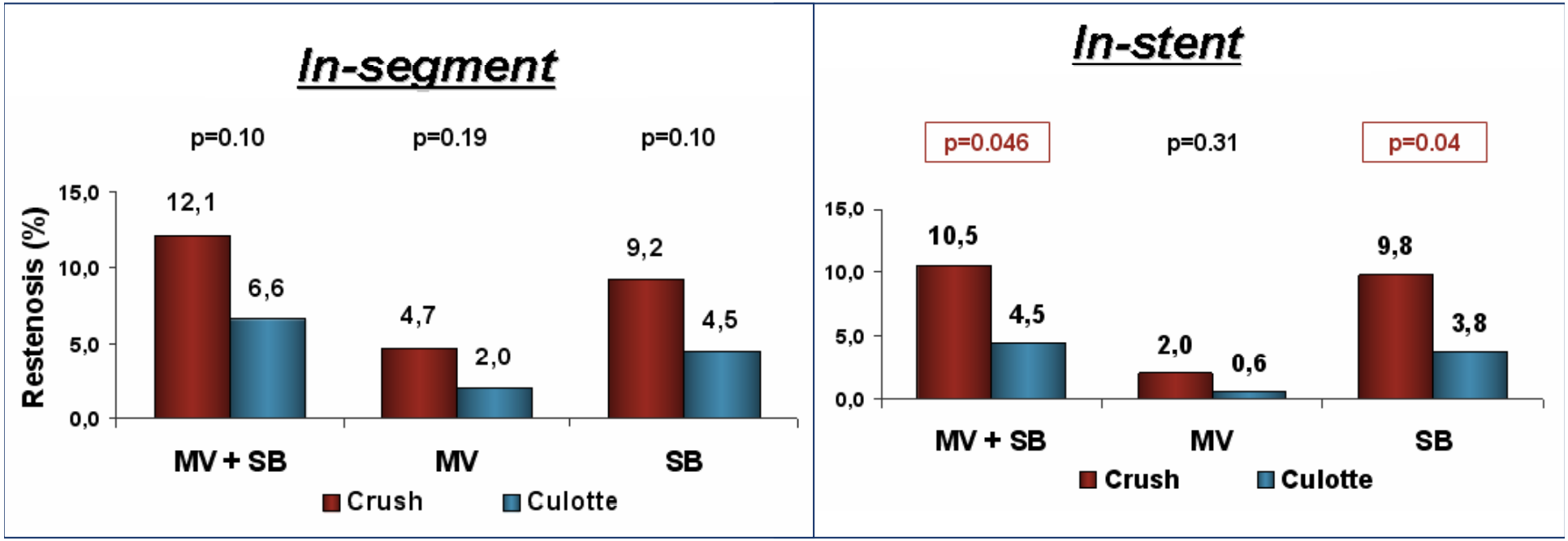


	Crush n=209	Culotte n=215	P
Total death	2 (1.0%)	1 (0.5%)	0.62
Cardiac death	2 (1.0%)	1 (0.5%)	0.62
MI	4 (1.9%)	3 (1.4%)	0.72
ST	3 (1.4%)	4 (1.9%)	0.73
TLR	5 (2.4%)	6 (2.8%)	0.77
TVR	5 (2.4%)	6 (2.8%)	0.77

Erglis et al. *Circ Cardiovasc Interv*. 2009;2:27-34

Which technique is best?
Nordic Stent Technique Study *(Nordic II)*

Restenosis rate at 8 months angio follow-up



Erglis et al. *Circ Cardiovasc Interv*. 2009;2:27-34

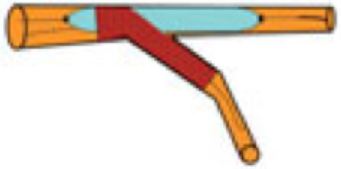
How to Do It?

Culotte

1. Wire both branches and predilate if needed.

2. Leave the wire in the straighter 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.

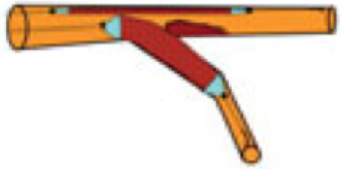
5. Re-cross the 2nd stent's (MB) struts into the 1st stent (SB) with a wire and perform kissing balloon inflation.

Mini-Crush

1. Wire both branches and predilate if needed.

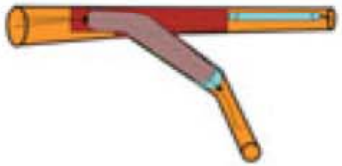
2. Advance the 2 stents. MB stent positioned proximally. SB stent will protrude only minimally into MB.

3. Deploy the SB stent.

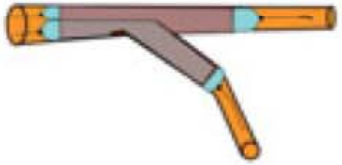


4 . Check for optimal result in the SB and then remove balloon and wire from SB. Deploy the MB stent crushing the MB stent.

5. Rewire the SB and perform high pressure dilatation.

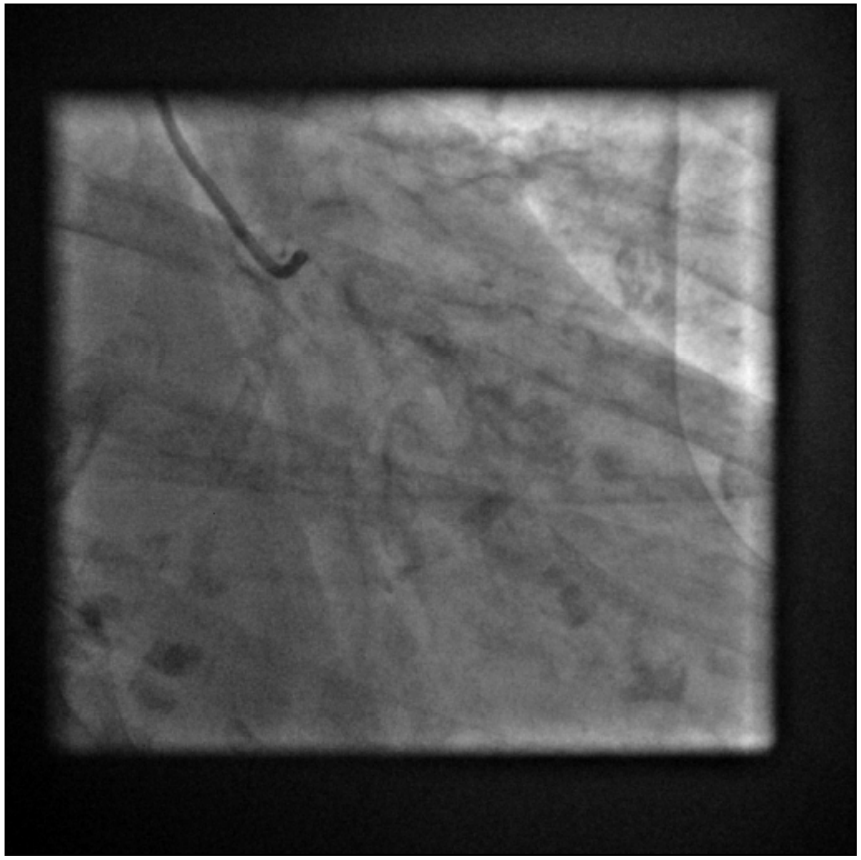


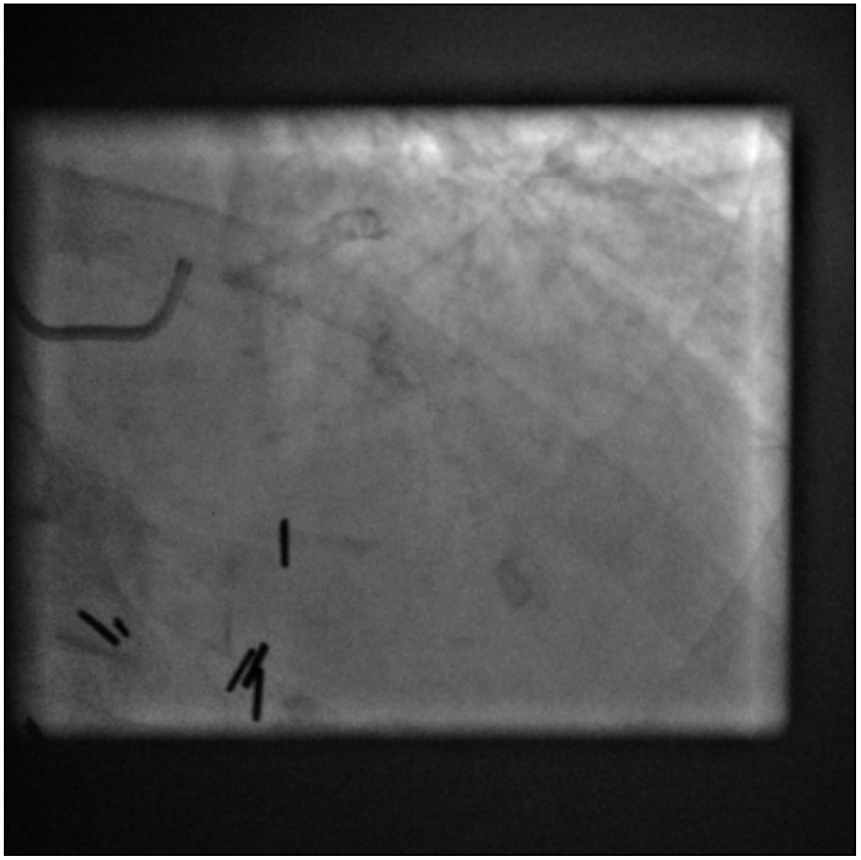
6. Perform final kissing balloon inflation.



Latib A et al. *EuroIntervention.* 2010;6 Suppl J: J81-J87

Culotte: How to Do It?

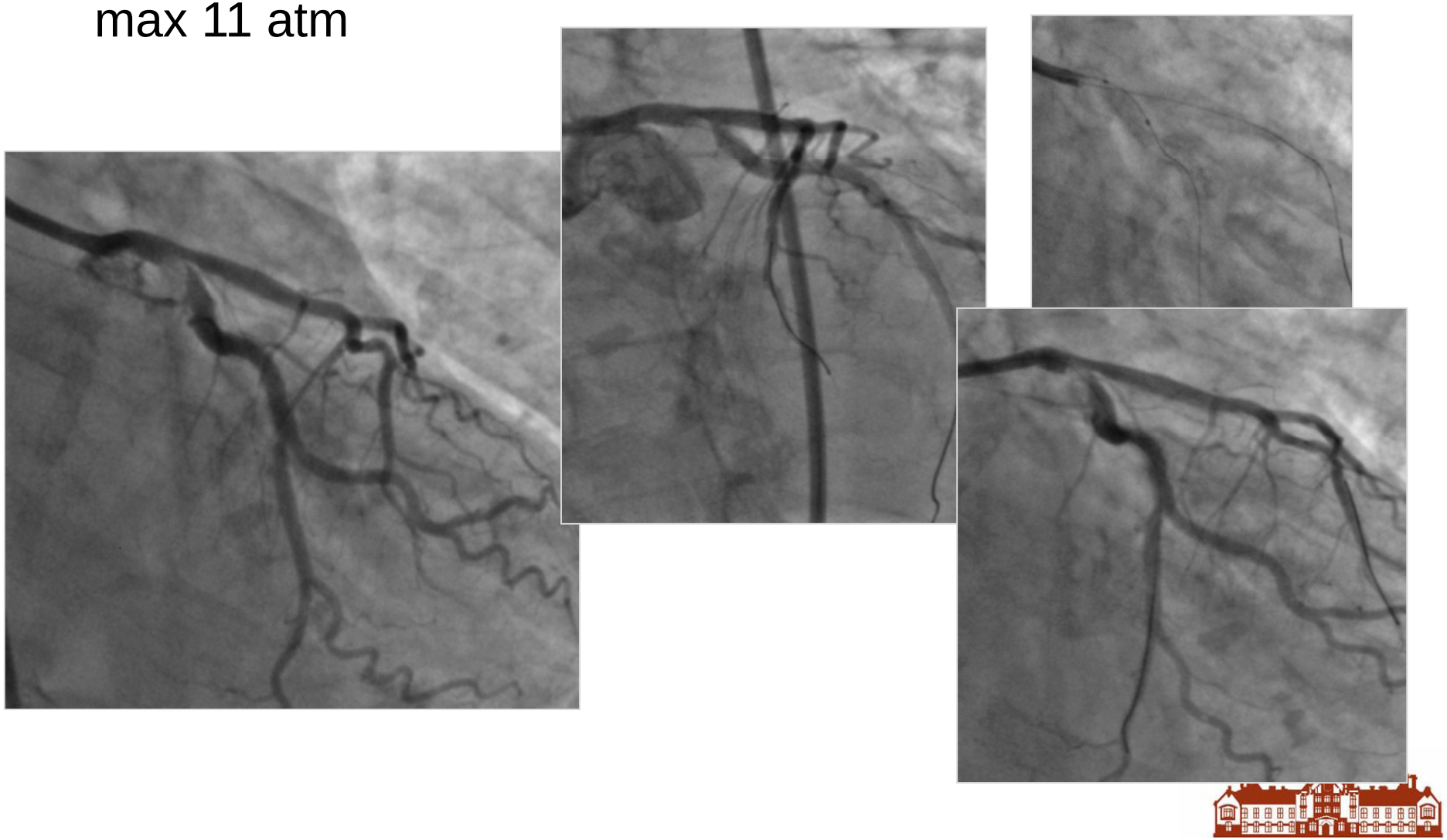




- 83 years old, female
- Cardiovascular risk factors: hypertension, dyslipidemia, CHF II
- Admitted to the hospital due to progressive chest pain, myocardial damage biomarkers (CK-MB, Troponin I) – normal levels
- Echo : normal EF – 57%, prolapss of mitral valve 3mm with regurgitation grade II

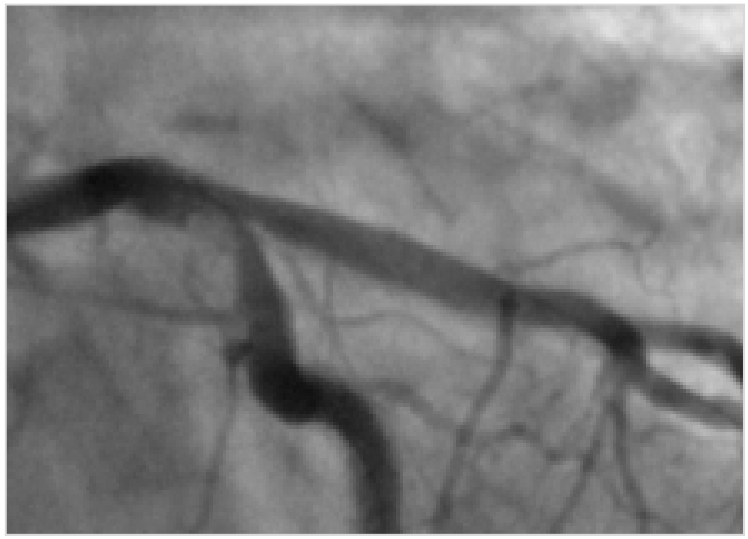
PCI: Predilatation

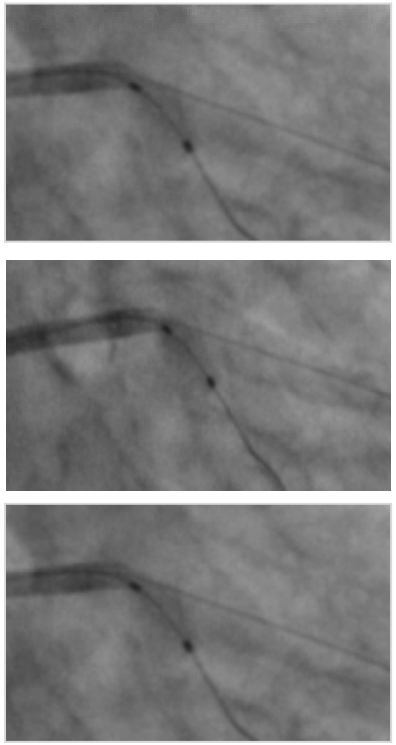
After successful wiring of both branches with floppy wires pre-dilatation with 2,5 – 12 mm balloon was done max 11 atm



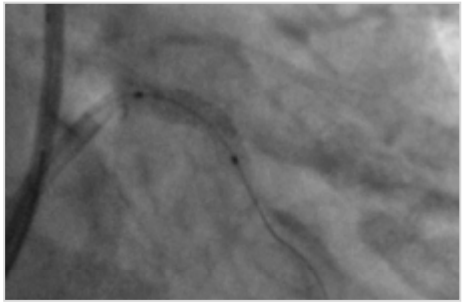
PCI: Plaque modification and LCX stenting

After pre-dilatation, plaque modification with cutting balloon (3.25-6 mm) was done. Three inflations with increased pressure max 11 atm.

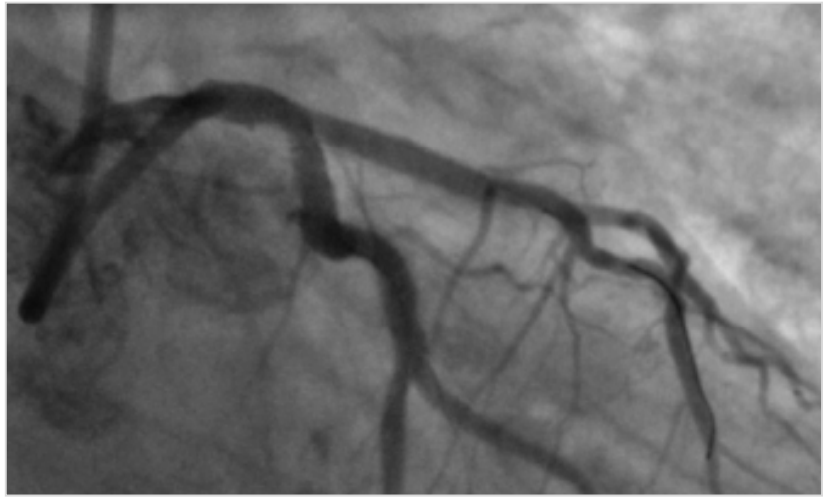




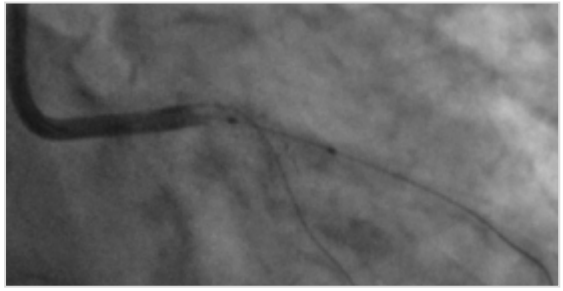
Promus Element 3.5-12 m was deployed 13 atm



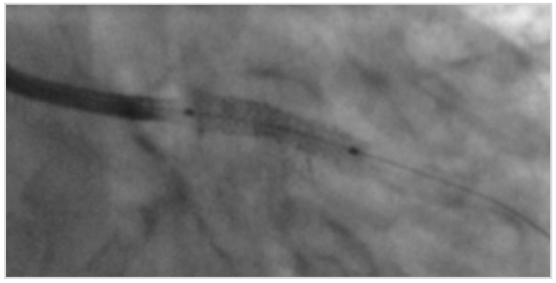
PCI: LAD stenting



LAD rewired, stent strut to LAD opened with 2.0-12 balloon 13 atm

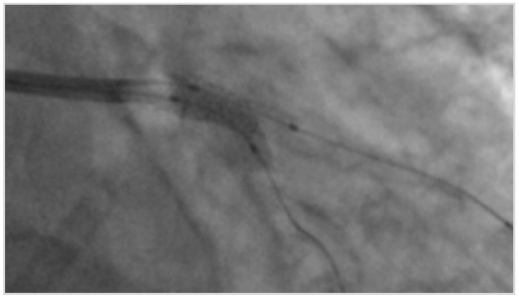


Promus Element 4.0-16 mm deployed 11 atm

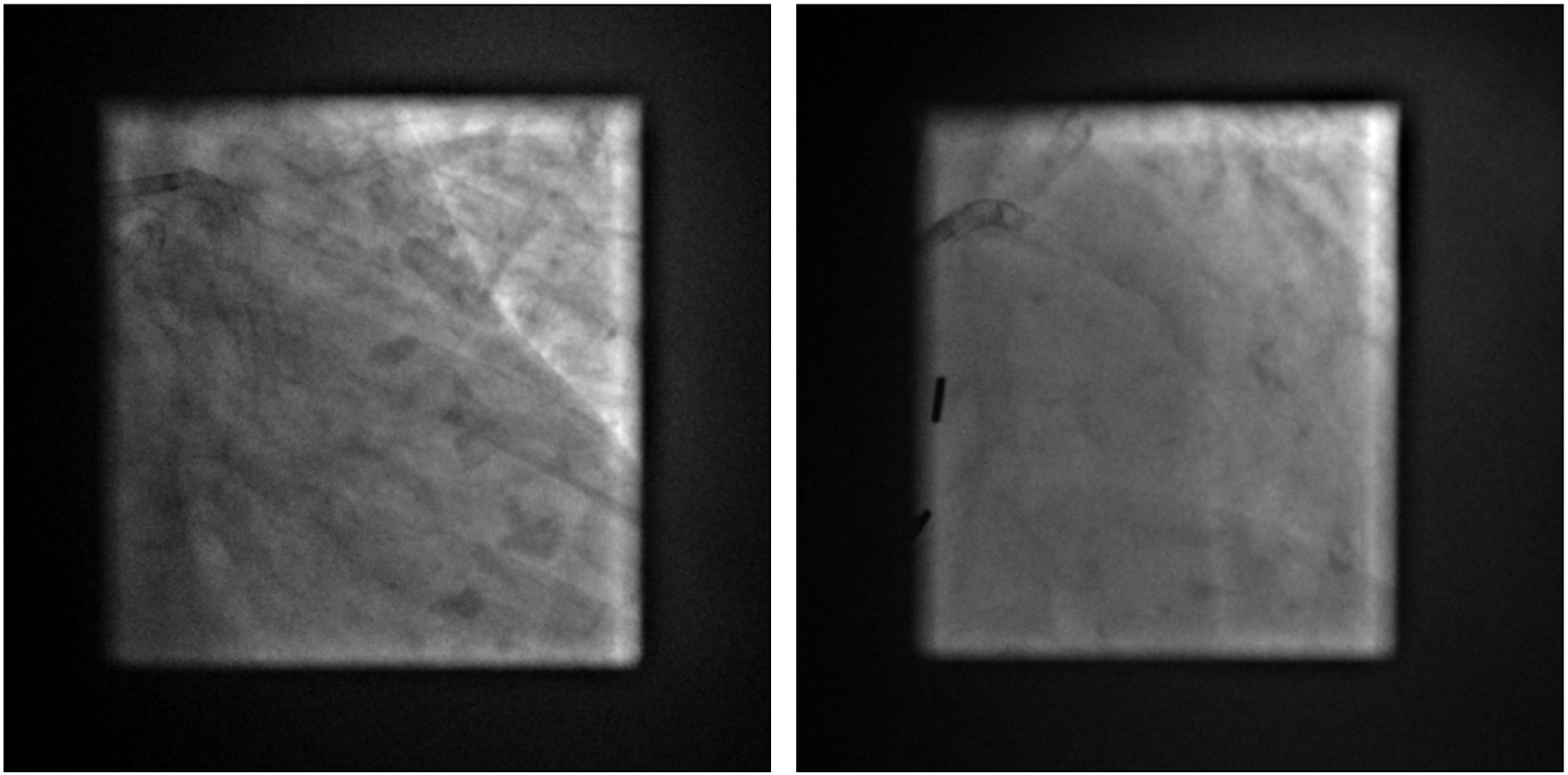


PCI: Final kissing

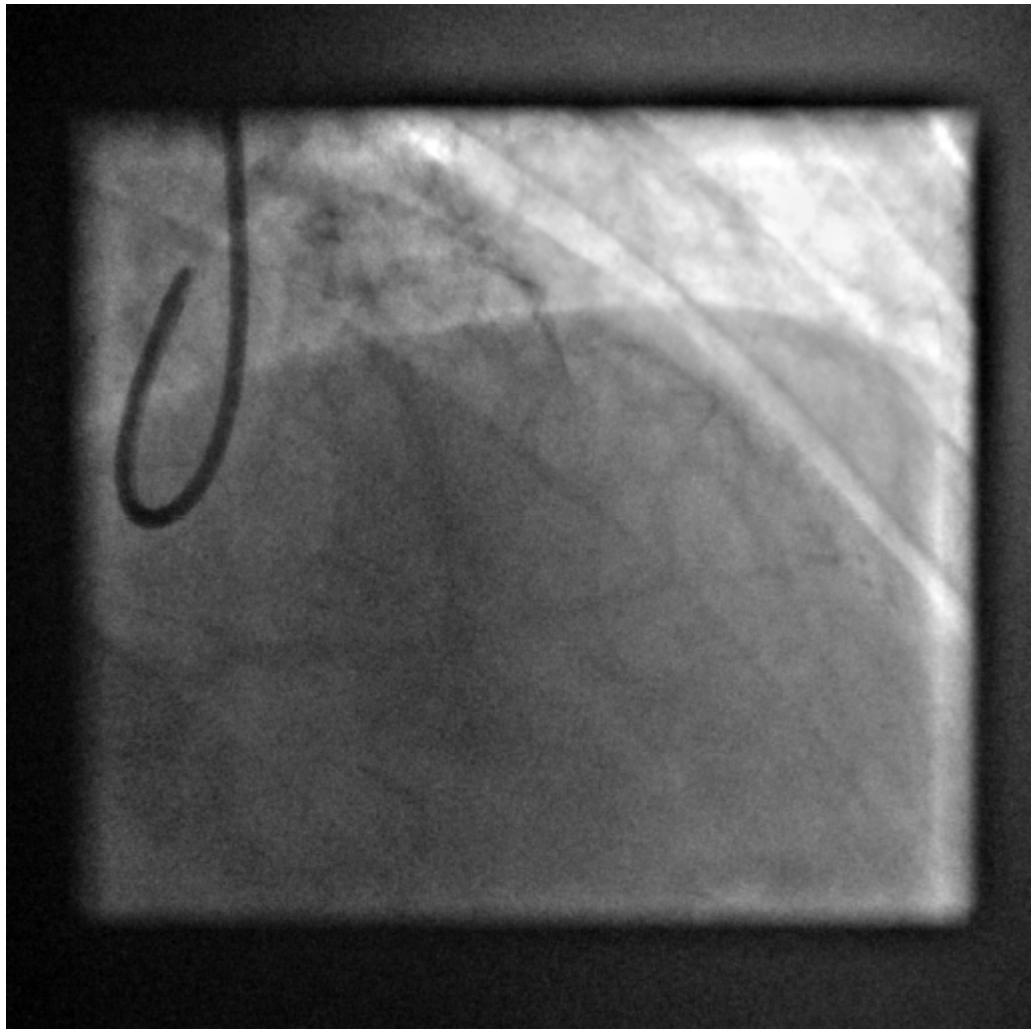
LCX was rewired and procedure was finalized with “kissing” inflation Quantum NC LAD 4.0-12 mm 9 atm, Apex 2.5-12 LCX 15 atm



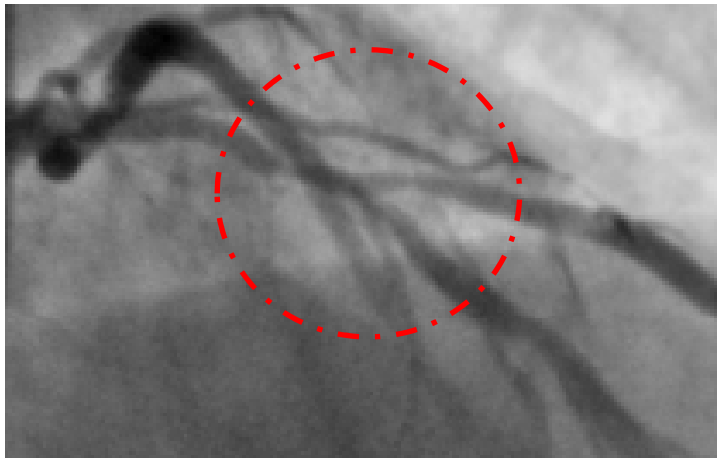
Final result



Crush: How to Do It?

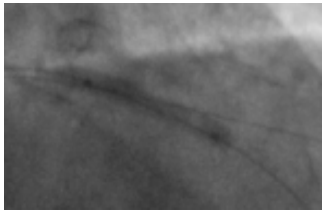


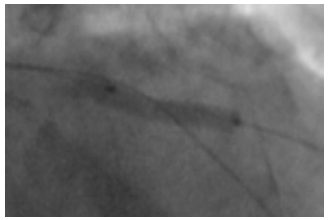
- Male 53 yo
- Clinical presentation: Stable angina III
- Factors of cardiovascular risk: dyslipidemia, smoker
- Previous PCI on Cx with BMS



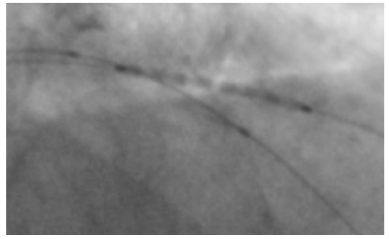
Predilatation and SB stenting

1. Lesion wired with 2 floppy wires (Choice F & Cruiser F)

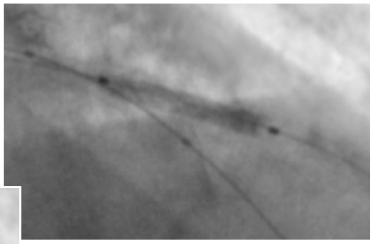


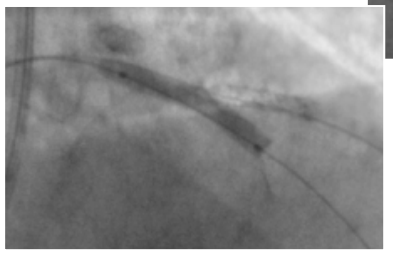


2. Pre-dilatation for MB&SB performed with Apex 2.5x15 mm

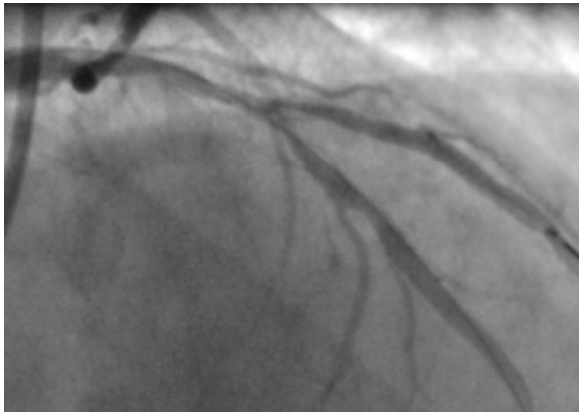


3. Cypher 2.75x18 mm in SB





4. Apex 3.0x20 mm – for mini-crush

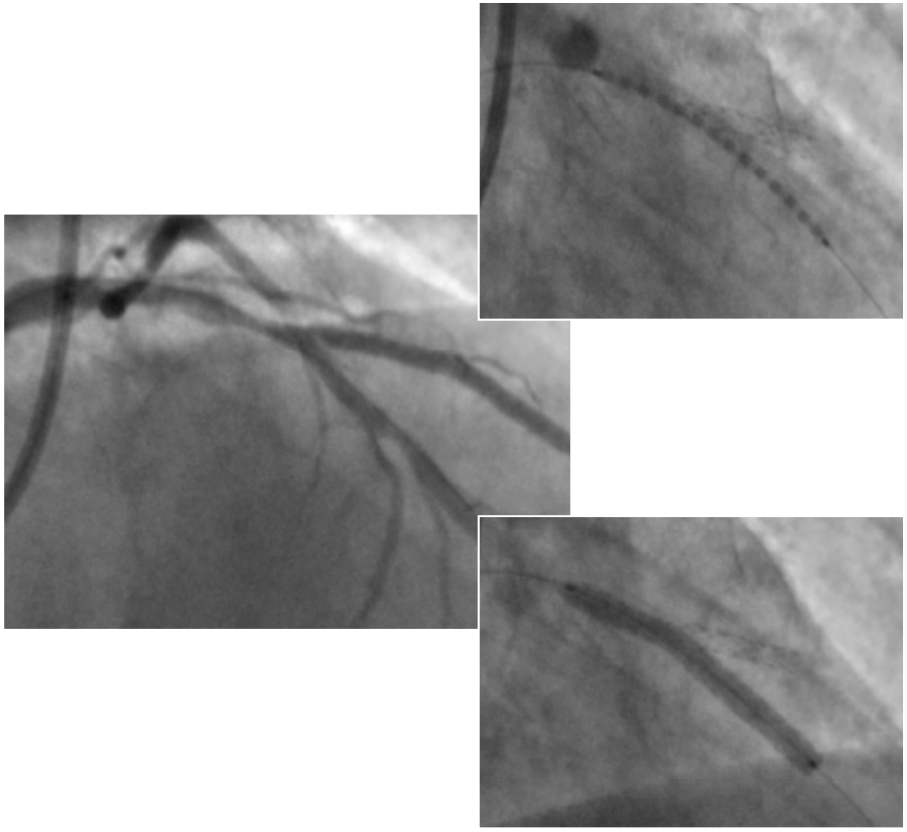


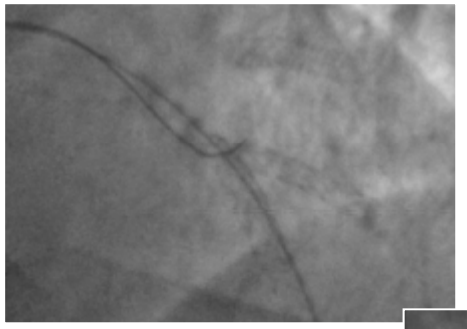
After pre-dilatation

After SB stenting

MB stenting and final kissing

5. Cypher 3.5x33 mm in MB

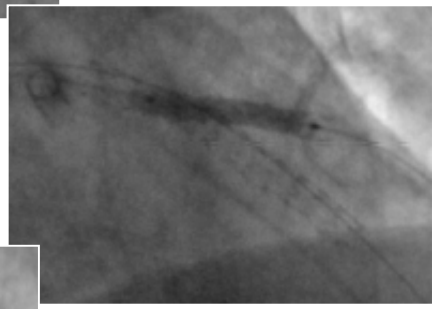


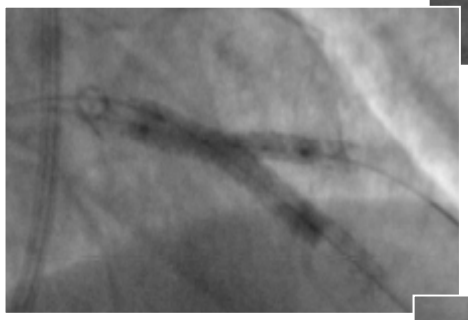


6.

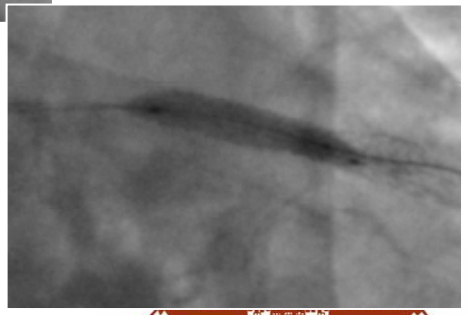
SB re-wiring

SB was opened with Apex 2.5x20 mm

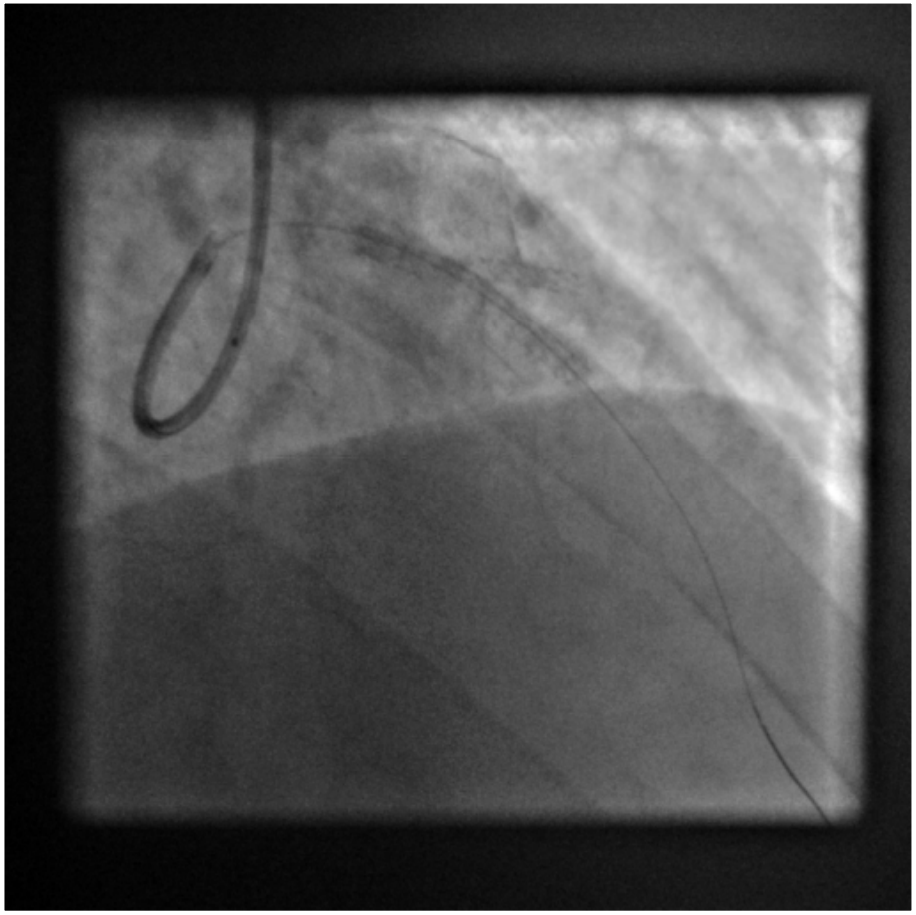


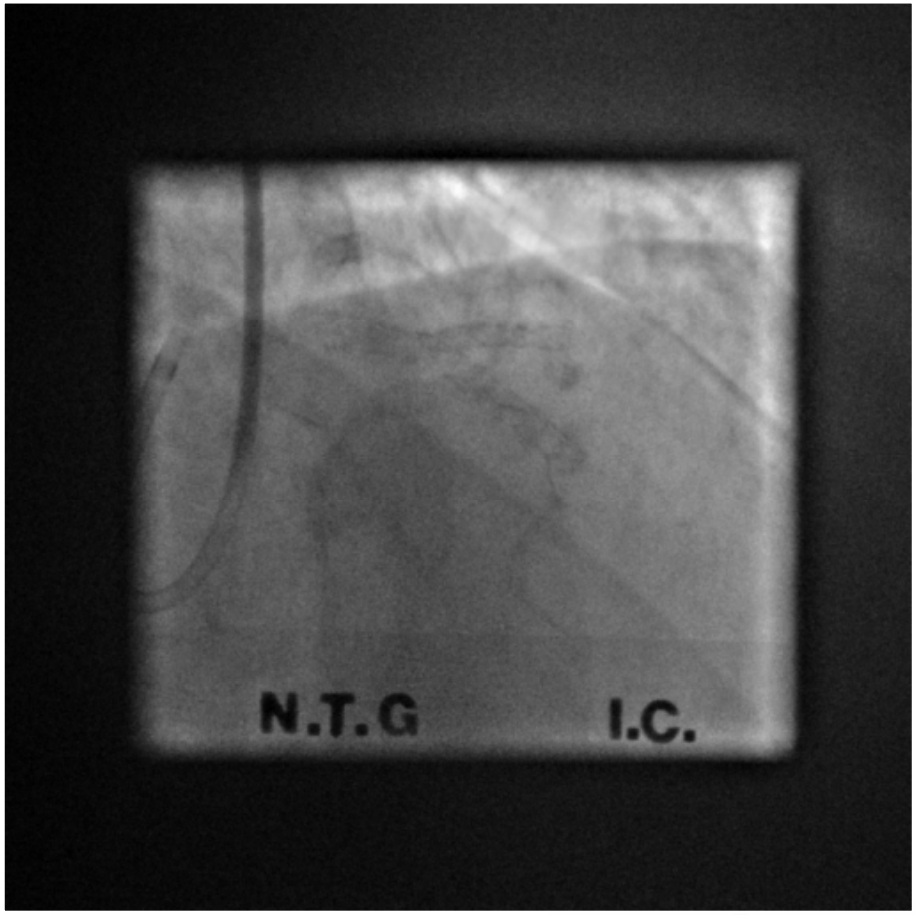


7. “Kissing” with Apex 3.0x20 mm and Apex 2.5x20 mm and NC post-dilatation for MB (3.5x15 mm)



Final result





Conclusion

- **Nordic II: If using two stent strategy – preferance should be given to Culotte stenting, associated with lower restenosis rate than Crush**
- **Culotte can be used in almost all true bifurcation lesions irrespective of the bifurcation angle, crush should be avoided in wide angle bifurcations**
- **Culotte not recommended when there is a large mismatch between the proximal MB and SB diameters due to the risk of incomplete SB stent apposition to the proximal MB**