# 5 Tips on Left Main PCI

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### To Treat or Not To Treat ?







# Significant Stenosis, *Negative FFR, 0.80*



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# Insignificant Stenosis, *Positive FFR, 0.70*





#### Plaque rupture MLA 6.2mm<sup>2</sup>







### **There Are Many Mismatches !**







#### How Many Mismatches ? Os/Shaft, Intermediate LM Disease





Park SJ et al. JACC Interv, 2014;7(8):868-874



#### What Does it Mean FFR Guided ?



FFR Cut-Off Value Matched With Positive Non-invasive Stress Test (n=45)

#### FFR <0.75

Sensitivity Specificity Positive PV Negative PV Accuracy 88% 100% 100% 88% 93%

Pijls NHJ, NEJM 1996;334:1703-8

#### FFR Guided Means Ischemia Guided !





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# What Does It Mean 50% Diameter Stenosis ?



Gould, K. L. 1974, Animal Study

FFR-Guided Means, Ischemia Guided !

Angio-Guided Means, No Ischemic threshold ! No Clinical Relevance !







### How To Implement ?







#### LM Ostial and Shaft Disease







### LM Bifurcation Disease

If Transducer Placed Beyond Bifurcation in both LAD and LCX,

Single Unit of Disease

### FFR still Works !







### FFR Guide PCI Clinical Outcome Is Good !







#### FFR Guided Clinical Outcomes of LM disease

#### Survival Rate



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Hamilos, et al. Circulation 2009;120:1505





#### FFR Guided Clinical Outcomes of LM disease

#### **MACE** Rate



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Hamilos, et al. Circulation 2009;120:1505





#### Treatment Strategy Has Been Changed after Routine Use of FFR for LM Disease

DEFER

CABG PCI



![](_page_16_Picture_3.jpeg)

Ahn JM, Park SJ et al. Am J Cardiol 2015;116:1163-1171

#### **Improved Clinical Outcomes** for LM and 3 Vessel Disease

#### Death /MI /Stroke or Repeat Revascularization At 3 Years

![](_page_17_Figure_2.jpeg)

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Ahn JM, Park SJ et al. Am J Cardiol 2015;116:1163-1171

# **Current Guideline of FFR**

![](_page_18_Figure_1.jpeg)

Task Force on Myocardial Revascularization of the European Society of Cardiology (ESC) and the European Association for CardioThoracic Surgery (EACTS); European Association for Percutaneous Cardiovascular Interventions (EAPCI), Wijns W et al. Guidelines on myocardial revascularization. Eur Heart J. 2010 Oct;31(20):2501-55. Levine GN, et al. 2011 ACCF/AHA/SCAI Guideline for PCI: Executive Summary. Circulation 2011;124:2574-2609

![](_page_18_Picture_3.jpeg)

![](_page_18_Picture_4.jpeg)

#### **5** Tips on LM PCI

 To Treat or Not To Treat - FFR Guided Decision Making Is Gold Standard.

![](_page_19_Picture_2.jpeg)

![](_page_19_Picture_3.jpeg)

### Can LM IVUS MLA Predict Functional Significance of Stenosis ?

![](_page_20_Picture_1.jpeg)

![](_page_20_Picture_2.jpeg)

![](_page_20_Picture_3.jpeg)

#### LM, Ischemic Threshold of IVUS MLA Matched with FFR <0.75 (n=55 LM Disease)

![](_page_21_Figure_1.jpeg)

![](_page_21_Picture_2.jpeg)

Jasti V et al. Circulation 2004;110:2831-6

![](_page_21_Picture_4.jpeg)

![](_page_21_Picture_5.jpeg)

#### New LM, Ischemic Threshold of IVUS MLA Matched with FFR <0.80 (n=112, Os and Shaft LM Disease)

![](_page_22_Figure_1.jpeg)

#### $Cut-off = 4.5 mm^2$

Sensitivity79%Specificity80%PPV83%NPV76%Accuracy80%

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Park SJ et al. JACC Interv, 2014;7(8):868-874

![](_page_22_Picture_6.jpeg)

#### Park's Data (n=112) 100%, Ostial/Shaft Lesions More Positive FFR Normal Distribution mean FFR 0.78 0.9 0.8 Jasti's data (n=55) 0.7 FFR Small Number, Large Vessels 58% LM Distal, 75% FFR (-), 0.6 Not Normal Distribution Mean FFR 0.86 0.5 2 8 10 12 14 16 0 4 6 MLA (mm<sup>2</sup>) 4.5 mm<sup>2</sup> 6.0 mm<sup>2</sup>

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### How do I Implement ?

#### Ostial and Shaft LM Disease

![](_page_24_Picture_2.jpeg)

#### **Bifurcation with** Down Stream Disease

4.5~6.0 mm<sup>2</sup> **Consider FFR !** 

#### < 4.5 mm<sup>2</sup> Positive FFR

> 6.0 mm<sup>2</sup>
Negative FFR

![](_page_24_Picture_7.jpeg)

![](_page_24_Picture_8.jpeg)

#### **5** Tips on LM PCI

- To Treat or Not To Treat FFR Guided Decision Making Is Gold Standard.
- LM IVUS MLA (4.5 mm<sup>2</sup>) Can Predict Functional Significance of Stenosis !

![](_page_25_Picture_3.jpeg)

![](_page_25_Picture_4.jpeg)

### 1 Stent or 2 Stents ?

![](_page_26_Picture_1.jpeg)

![](_page_26_Picture_2.jpeg)

![](_page_26_Picture_3.jpeg)

### LM Bifurcation PCI

1 Stent	Normal or Diminutive LCX, (Medina 1.1.0., 1.0.0) Small LCX with < 2.5 mm in diameter, Focal disease in distal LCX
2 Stent	<b>Diseased LCX, (Medina 1.1.1., 1.0.1)</b> Large LCX with $\geq$ 2.5 mm in diameter Diseased left dominant coronary system Diffuse disease in distal LCX

Park SJ, Textbook of Bifurcation Stenting 2007

![](_page_27_Picture_3.jpeg)

## 1 Stent for Normal LCX

![](_page_28_Picture_1.jpeg)

![](_page_28_Picture_2.jpeg)

![](_page_28_Picture_3.jpeg)

#### 72/M, Unstable angina,

![](_page_29_Picture_1.jpeg)

![](_page_29_Picture_2.jpeg)

![](_page_29_Picture_3.jpeg)

![](_page_29_Picture_4.jpeg)

#### Not Much Plaque on LCX OS

![](_page_30_Picture_1.jpeg)

LCX Ostium Minimal-disease MLA 5.4 mm<sup>2</sup>

![](_page_30_Picture_3.jpeg)

![](_page_30_Picture_4.jpeg)

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#### 72/M, Unstable angina,

![](_page_31_Picture_1.jpeg)

![](_page_32_Picture_0.jpeg)

![](_page_32_Picture_1.jpeg)

#### DES $3.5 \times 23 \text{ mm}$

Additional high pressure Inflation with 4.0 mm non-compliant balloon

![](_page_32_Picture_4.jpeg)

![](_page_32_Picture_5.jpeg)

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#### **Angiographic Result Is Perfect !**

![](_page_33_Picture_1.jpeg)

#### No significant compromise of LCX ostium.

![](_page_33_Picture_3.jpeg)

![](_page_33_Picture_4.jpeg)

### **Post stent-IVUS**

![](_page_34_Picture_1.jpeg)

#### Good Stent Expansion Stent Area 6.2 mm<sup>2</sup>

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No Carina Shift MLA 4.7 mm<sup>2</sup>

![](_page_34_Picture_4.jpeg)

![](_page_34_Picture_5.jpeg)

#### **Any Jailing Morphology Cannot Predict** Functional Significance of Jailed LCX

#### Jailing LCX After Stent Cross-Over

![](_page_35_Picture_2.jpeg)

![](_page_35_Picture_3.jpeg)

![](_page_35_Picture_4.jpeg)

![](_page_35_Picture_5.jpeg)

#### After Stent Crossover Normal Looking LCX, Functionally Significant LCX Jailing Is Only 7%

![](_page_36_Figure_1.jpeg)

Kang SJ, Catheterization and Cardiovascular Interventions. 2014;83(4):545-52.

![](_page_36_Picture_3.jpeg)

#### Jailing LCX Defer Is Safe and Good ! Death or MI at 2 Years

![](_page_37_Figure_1.jpeg)

![](_page_37_Picture_2.jpeg)

Ahn JM et al, AJC 2017 15;119(4):528-534.

![](_page_37_Picture_4.jpeg)

#### **5** Tips on LM PCI

- To Treat or Not To Treat FFR Guided Decision Making Is Gold Standard.
- LM IVUS MLA (4.5 mm<sup>2</sup>) Can Predict Functional Significance of Stenosis !
- Stent Crossover Is Usually Enough in Case of Normal LCX. Kissing Balloon Inflation Is Not Always Good.

![](_page_38_Picture_4.jpeg)

![](_page_38_Picture_5.jpeg)

## 2 Stents for True Bifurcation

![](_page_39_Picture_1.jpeg)

![](_page_39_Picture_2.jpeg)

![](_page_39_Picture_3.jpeg)

#### 70/M, Unstable angina *True Bifurcation Lesion (Medina 1,1,1)*

![](_page_40_Picture_1.jpeg)

![](_page_40_Picture_2.jpeg)

![](_page_40_Picture_3.jpeg)

#### Separate Pull Back IVUS True Bifurcation Disease (Medina 1,1,1), Significant Plaque in LCX OS

![](_page_41_Picture_1.jpeg)

#### LAD Ostium

#### LCX Ostium

![](_page_41_Picture_4.jpeg)

![](_page_41_Picture_5.jpeg)

![](_page_41_Picture_6.jpeg)

#### Why LAD and LCX Separate Pullback ?

#### Oblique imageinerth LLAXO PPullbackk

LCX

LM

![](_page_42_Picture_2.jpeg)

Looks Good !

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LAD

### **Mini-Crushing** !

![](_page_43_Picture_1.jpeg)

#### Sequential High pressure inflation in Both LCX and LAD

#### Final kissing balloon inflation with moderate pressure.

![](_page_43_Picture_4.jpeg)

![](_page_43_Picture_5.jpeg)

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### **Final Angiography**

![](_page_44_Picture_1.jpeg)

![](_page_44_Picture_2.jpeg)

![](_page_44_Picture_3.jpeg)

![](_page_44_Picture_4.jpeg)

#### Final IVUS, Effective Stent Area

#### LAD Stent CSA : 8.8 mm<sup>2</sup>

# LCX Stent CSA : 5.1 mm<sup>2</sup>

![](_page_45_Picture_3.jpeg)

![](_page_45_Picture_4.jpeg)

![](_page_45_Picture_5.jpeg)

### **2 Stent Techniques**

- Mini-crush (or step crush)
- T-stent, modified T-stent or TAP
- Culotte
- V-stent
- Y-stent (SKS-simultaneous kissing stents)

![](_page_46_Picture_6.jpeg)

![](_page_46_Picture_7.jpeg)

![](_page_46_Picture_8.jpeg)

#### Effective Stent Area (Rule of 5,6,7,8 mm<sup>2</sup>) Restenosis Rate < 5% and TLR < 2%

![](_page_47_Figure_1.jpeg)

![](_page_47_Picture_2.jpeg)

Kang et al. Circ Cardiovasc Interv 2011;4:1168-74

![](_page_47_Picture_4.jpeg)

![](_page_47_Picture_5.jpeg)

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- LM IVUS MLA (4.5 mm<sup>2</sup>) Can Predict Functional Significance of Stenosis !
- Stent Crossover Is Usually Enough in Case of Normal LCX. Kissing Balloon Inflation Is Not Always Good.
- Any 2 stents Technique Is Feasible in True LM Bifurcation Disease. Most Important Procedural Issue Is IVUS Guided Optimization (Rule of 5,6,7,8 mm<sup>2</sup>) after Sequential High Pressure and Kissing Balloon Inflation.

![](_page_48_Picture_5.jpeg)

![](_page_48_Picture_6.jpeg)

### Can Different DES Make Any Different Clinical Outcomes ?

#### Preliminary Analysis 2017 IRIS-MAIN, IRIS-DES, and PRECOMBAT (n=2,692 LM PCI)

![](_page_49_Picture_2.jpeg)

![](_page_49_Picture_3.jpeg)

![](_page_49_Picture_4.jpeg)

### **Primary End Point** Target-Vessel Failure

![](_page_50_Figure_1.jpeg)

![](_page_50_Picture_4.jpeg)

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- Any 2 stents Technique Is Feasible in True LM Bifurcation Disease. Most Important Procedural Issue Is IVUS Guided Optimization (Rule of 5,6,7,8 mm<sup>2</sup>) after Sequential High Pressure and Kissing Balloon Inflation.
   Different DES Can Not Make Any Different Clinical Outcomes. (Any DESs are Equivalent in LM PCI).

![](_page_51_Picture_5.jpeg)

![](_page_51_Picture_6.jpeg)

# Thank You !!

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