# Two Road Diverged in a Cath Lab: PCI vs CABG in Complex CAD

## **Duk-Woo Park, MD**

Professor, Heart Institute, Asan Medical Center, University of Ulsan College of Medicine, Seoul, Korea





## DISCLOSURE

Institutional grant/research funding to CardioVascular Research Foundation (CVRF, Korea) and/or Asan Medical Center from Daiichi-Sankyo, Abbott, Boston Scientific, Medtronics, Edwards, Biosensor, ChongKunDang Pharm and Daewoong Pharm,



# 64 M: Stable Angina, No diabetes Left Main and 3VD





# 64 M: Stable Angina, No diabetes Left Main and 3VD





# 64 M: Stable Angina, No diabetes 3VD (concomitant RCA, syntax score 38)







## **Two Very Different Procedures for Complex CAD**



# **Procedural Climax: Take >50 minutes**

Wiring : LAD-BMW / LCX-Several Wire and Devices



1. Sion BLUE 2. Choice PT 3. BMW 4. BMW with Crusade 5. Gaia 2 (hydrophilic with uncoated distal tip) ; Lesion passed  $\rightarrow$  Then, BMW long-wire change



## **Post-Balloon CAG**







## PCI at LM Bifurcation IVUS evaluation at LCX (post-balloon)











## PCI at LM Bifurcation IVUS evaluation at LAD (post-balloon)







## LAD Os to Left Main



# PCI at LM Bifurcation Distal LCX & Mid LAD Stenting





Ultimaster T 3.0 (24)

## NC Emerge 3.5 (15)





# PCI at LM Bifurcation Proximal LCX stenting & LM-LAD Balloon Crush





## NC Emerge 3.5 (15)





## Final Kissing Balloon at Left Main







# **Final CAG**



## Concomitant RCA PCI · Final CAD, residual SS <5









## **TWO "Myocardial Revascularization" Procedures**





Doenst et al. J Am Coll Cardiol, 2019

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#### THE PRESENT AND FUTURE

JACC REVIEW TOPIC OF THE WEEK

## Improving Terminology to Describe Coronary Artery Procedures



#### JACC Review Topic of the Week

Torsten Doenst, MD, PHD,<sup>a</sup> Robert O. Bonow, MD, PHD,<sup>b</sup> Deepak L. Bhatt, MD, MPH,<sup>c</sup> Volkmar Falk, MD, PHD,<sup>d</sup> Mario Gaudino, MD, PHD<sup>e</sup>

#### ABSTRACT

Coronary artery disease (CAD) is treated with medical therapy with or without percutaneous coronary intervention (PCI) or coronary artery bypass grafting (CABG). The latter 2 options are commonly referred to as "myocardial revascularization" procedures. We reason that this term is inappropriate because it is suggestive of a single treatment effect of PCI and CABG (ie, the reestablishment of blood flow to ischemic myocardium) and obscures key mechanisms, such as the improvement in coronary flow capability in the absence of ongoing ischemia, the reperfusion in the presence of ischemia, and the prevention of myocardial infarction from CAD progression. We review the current evidence on the topic and suggest the use of a purely descriptive terminology ("invasive treatment by PCI or CABG") which has the potential to improve clinical decision making and guide future trial design. (J Am Coll Cardiol 2021;78:180–8) © 2021 by the American College of Cardiology Foundation.

### J Am Coll Cardiol 2021;78:180-8

# Different Mechanism of PCI vs. CABG

J Am Coll Cardiol 2021;78:180–8



Doenst, T. et al. J Am Coll Cardiol. 2021;78(2):180-8.

## MI prevention benefit was directly linked to survival benefit

FIGURE 2 Survival Impact Through Infarct Prevention



(A) Relationship of the difference in mortality and the difference in new nonfatal myocardial infarctions from randomized clinical trials comparing percutaneous coronary intervention (PCI) and coronary artery bypass grafting (CABG) (5). (B) Relationship of the risk ratios for all-cause mortality and nonfatal myocardial infarction (MI) from a network meta-analysis comparing PCI with various stent types and medical therapy (42).

#### JACC HISTORICAL BREAKTHROUGHS IN PERSPECTIVE

### Percutaneous Coronary Revascularization



#### JACC Historical Breakthroughs in Perspective

Patrick W. Serruys, MD, PHD,<sup>a,b,C,\*</sup> Masafumi Ono, MD,<sup>a,b,d,\*</sup> Scot Garg, MD, PHD,<sup>e</sup> Hironori Hara, MD,<sup>a,b,d</sup> Hideyuki Kawashima, MD,<sup>a,b,d</sup> Giulio Pompilio, MD, PHD,<sup>f,g</sup> Daniele Andreini, MD, PHD,<sup>f,h</sup> David R. Holmes, JR, MD,<sup>i</sup> Yoshinobu Onuma, MD, PHD,<sup>a,b</sup> Spencer B. King III, MD<sup>i</sup>

#### ABSTRACT

Over the last 4 decades, percutaneous coronary intervention has evolved dramatically and is now an acceptable treatment option for patients with advanced coronary artery disease. However, trialists have struggled to establish the respective roles for percutaneous coronary intervention and coronary artery bypass graft surgery, especially in patients with multivessel disease and unprotected left-main stem coronary artery disease. Several pivotal trials and meta-analyses comparing these 2 revascularization strategies have enabled the relative merits of each technique to be established with regard to the type of ischemic syndrome, the coronary anatomy, and the patient's overall comorbidity. Precision medicine with individualized prognosis is emerging as an important method of selecting treatment. However, the never-ending advancement of technology, in conjunction with the emergence of novel pharmacological agents, will in the future continue to force us to reconsider the evolving question: "Which treatment strategy is better and for which patient?" (J Am Coll Cardiol 2021;78:384-407) © 2021 by the American College of Cardiology Foundation.

### J Am Coll Cardiol 2021;78:384–407



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Serruys, P.W. et al. J Am Coll Cardiol. 2021;78(4):384-407.

#### **CENTRAL ILLUSTRATION** Landmark Developments in the History of Coronary Artery Bypass Grafting

#### THE PRESENT AND FUTURE

JACC HISTORICAL BREAKTHROUGHS IN PERSPECTIVE

### Myocardial Revascularization Surgery

JACC Historical Breakthroughs in Perspective

Michael J. Mack, MD," John J. Squiers, MD," Bruce W. Lytle, MD," J. Michael DiMaio, MD," Friedrich W. Mohr, MD

#### ABSTRACT

Coronary artery bypass grafting (CABG) was introduced in the 1960s as the first procedure for direct coronary artery revascularization and rapidly became one of the most common surgical procedures worldwide, with an overall total of more than 20 million operations performed. CABG continues to be the most common cardiac surgical procedure performed and has been one of the most carefully studied therapies. Best CABG techniques, optimal bypass conduits, and appropriate patient selection have been rigorously tested in landmark clinical trials, some of which have resolved controversy and most of which have stoked further debate and trials. The evolution of CABG cannot be properly portrayed without presenting it in the context of the parallel development of percutaneous coronary intervention. In this Historical Perspective, we a provide a broad overview of the history of coronary revascularization with a focus on the foundations, evolution, best evidence, and future directions of CABG. (J Am Coll Cardiol 2021;78:365–83) © 2021 by the American College of Cardiology Foundation.





A timeline of the important contributions to the operative procedure.

# **Still Controversies in PCI vs. CABG**

- Heterogeneity of anatomic groups
- Subsets of patients registries vs. RCTs
- Length of follow up
  - SYNTAXES 10 year follow up no difference in all cause mortality
- What is best endpoint and at what time
  - Death, cardiac death, stroke (NOBLE??), MI, Repeat intervention, Quality of Life, Return to work, days in hospital
- Is there catch up?
- Complete or incomplete revascularization concept



# The "apparent" controversy

- Published evidence consistently shows very different risk profiles and time-varying benefit for PCI and CABG.
- In real world practice the majority of patients have clinical or anatomic characteristics that clearly drive the decision between the two treatment modalities
- The key is individualization of treatment to the patient and the local expertise
- Time to get over the controversy and expect release of next version of guideline.



Piecewise analysis for the primary composite outcome of death, stroke or myocardial infarction from 0 to 30 days, 30 days to 1 year, and 1 year to 5 years – EXCEL trial



COMPLEX PCI 2021 MAKE IT SIMPLEY TECHNICAL FORUMA TO Z

Stone et al. NEJM, 2019

## **All-Cause Mortality, Updated Meta-Analysis**

#### FIGURE 2 All-Cause Mortality Between PCI Versus CABG in Recent Meta-Analyses

		Study-Level Meta-Analysis				Patient-Level Meta-Analysis	
Trial (Ref. #)	Population	Ga	udino, et al (2020)		Ahmad, et al. (2020)		Head, et al. (2018)
EXCEL (35,132)	LMCAD		hert	*	<b></b>		
NOBLE (36,131)	LMCAD		H H		H H		H-1
PRECOMBAT (32,128)	LMCAD			1.0			H
BEST (37)	MVD		<b>⊢</b> +	1	1		H
SoS (133)	MVD			1	1		; <b></b>
ARTS (134)	MVD	1.	HH		1		HH
ERACI II (135)	MVD		HH	i	i		, <b>⊢</b> •-i
LE MANS (23)	LMCAD	1.		1	1		
Boudriot et al (42)	LMCAD						1
MASS-II (136)	MVD			1	1		H-H-H
VA CARDS (130)	DM with MVD		H	1	1		H
CARDIA (126)	DM with MVD or complex 1VD						
FREEDOM (34,129)	DM with MVD		ire-i	1			i Han
SYNTAX (26,27,125)	3VD or LMCAD		6-1 1		HH I		<b>⊷</b>
Cisowski et al (137)	Proximal LAD			+	1	1	1
Blazek et al (138)	Proximal LAD					1	
Drenth et al (139)	Proximal LAD	10		1	1	1	
Kim et al (140)	Proximal LAD	i•		1	1	1	1
Myoprotect I (141)	High risk features			1	1		
Octostent (142)	Referred for PCI			1	1	1	1
SIMA (143)	Proximal LAD			1	1	1	1
Hong et al (144)	Proximal LAD			1	i		Ì
Gaudino, et al. Stentin Ahmad, et al. LMCAD Head, et al. MVD or	g vs. CABG LMCAD	RR: 1.17 (1.0	5-1.29) R	R: 1.03 (0.	82-1.30)	HR: 1.20	(1.06-1.37)
		0.1	1	10 0.1	1	10 0.1	1 10



PW Serruys et al. J Am Coll Cardiol 2021;78:384–407



## J Am Coll Cardiol 2021;78:384–407

CVRF

# **Soft Clinical End Point**

**CENTRAL ILLUSTRATION:** Disease-Specific Health Status After PCI Versus CABG as Measured by the SAQ



Baron, S.J. et al. J Am Coll Cardiol. 2017;70(25):3113-22.





## Contemporary STATE-OF-THE-ART PCI : What Make Complex PCI To Be Equivalent To CABG



# Contemporary state-of-the-art PCI with functional and imaging concepts: forethoughts on the FAME 3 trial



Duk-Woo Park, MD, PhD; Seung-Jung Park\*, MD, PhD

Division of Cardiology, Asan Medical Center, University of Ulsan College of Medicine, Seoul, South Korea

# EuroIntervention 2019;15:e219-e221 published online 3 -edition June 2019

EDITORIAL

COMPLEX PCI 202

#### DW Park, SJ Park, Eurointervention 2019;15:e219-e221



## Imaging and Physiology-Guided Contemporary Complex PCI

## Role of IVUS

### Pre-PCI

- Can assist the functional evaluation of LMCA disease
- Provide more reliable information on lesion characteristics than angiography
- Helpful in planning PCI strategy (especially for distal LMCA bifurcation lesion)

### Post-PCI

- Ensure stent optimization with subsequent postdilatation
- · Identify procedural complications

## Role of FFR

### Pre-PCI

 Provide accurate information on the functional status of angiographic intermediate or ambiguous LMCA lesions

#### Post-PCI

Assessment for jailed branches after left main PCI



Park SW, Park SJ, Park DW. JACC Asia submitted



## Three-Year Events in SYNTAX II PCI vs SYNTAX PCI or CABG in 3VD



J Am Coll Cardiol 2021;78:384–407





# Surgery Also Improve

FIGURE 1 Bilateral Internal Mammary Coronary Artery Bypass Grafts



FIGURE 2 Techniques Related to Coronary Artery Bypass Grafting With Reversed Saphenous Vein Grafts



J Am Coll Cardiol 2021;78:365-83

## PCI vs. CABG Heart Team Discussions: Different indications clearly drive the decision





### Park SW, Park SJ, Park DW. JACC Asia submitted



## **Obvious Choices vs. Equipoise**





## **SYNTAX SCORE 52**





# **Obvious Choices vs. Equipoise**











# PCI vs. CABG Heart Team Discussions: Two different merits

## PCI

<u>Early advantages</u>
Less invasive
Fewer peri-procedural complications (stroke, MI, Afib, bleeding, AKI, etc.)
Lower 30-day MACE
More rapid recovery with better early QoL and earlier angina relief



# CABG

Late advantages • More durable • Fewer adverse events beyond 1 year – particularly MI and repeat revascularization procedures

## PCI and CABG

No significant <u>major</u> differences in long-term survival, MACE (death, MI or stroke) or QoL





- PCI and CABG are different interventions that are performed in different patients with different aims.
- Surgery is associated with higher peri-procedural risk and discomfort and better long-term clinical outcomes.
- PCI assures outcomes comparable to surgery with much lower invasiveness.
- The two interventions are complementary, not antagonists

