FFR-guided Complete vs. Culprit Only Revascularization in AMI Patients

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Multivessel Disease in AMI

- **30-40% in the setting of STEMI**

Muller DW, et al Multivessel coronary artery disease: a key predictor of short-term prognosis after reperfusion therapy for acute myocardial infarction. Thrombolysis and Angioplasty in Myocardial Infarction (TAMI) Study Group. Am Heart J 1991;121:1042-9

Toma M,, et al. Non-culprit coronary artery percutaneous coronary intervention during acute ST-segment elevation myocardial infarction: insights from the APEX-AMI trial. European Heart Journal 2010;31:1701-7

- **44-60% in the setting of NSTEMI**

Effects of tissue plasminogen activator and a comparison of early invasive and conservative strategies in unstable angina and non-Q-wave myocardial infarction. Results of the TIMI IIIB Trial. Thrombolysis in Myocardial Ischemia. Circulation 1994;89:1545–1556.

Invasive compared with non-invasive treatment in unstable coronary-artery disease: FRISC II prospective randomised multicentre study. FRagmin and Fast Revascularisation during InStability in Coronary artery disease Investigators. Lancet 1999;354:708–715.

- **AMI with multi-vessel disease was associated with poorer outcomes**

Park DW et al. Extent, location, and clinical significance of non-infarct-related coronary artery disease among patients with ST-elevation myocardial infarction. JAMA. 2014 Nov 19;312(19):2019-27.

Context

PART 1

Reliability of fractional flow reserve (FFR) to evaluate the functional significance of non-culprit stenosis in patients with acute myocardial infarction (AMI) and multi-vessel disease.

PART 2

Comparison of clinical outcomes between FFR-guided complete revascularization versus culprit only percutaneous coronary intervention (PCI) in patients with AMI and multi-vessel disease.

PART 3

Optimal treatment strategy for patients with AMI and multi-vessel disease (focused on treatment criteria for non-culprit stenosis)

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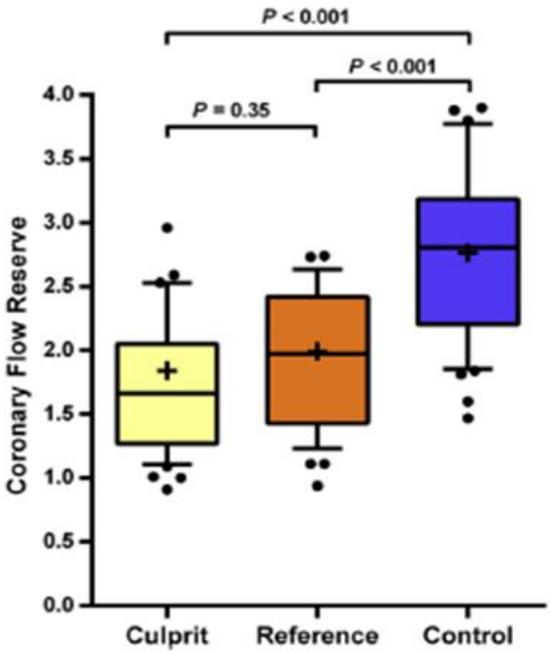
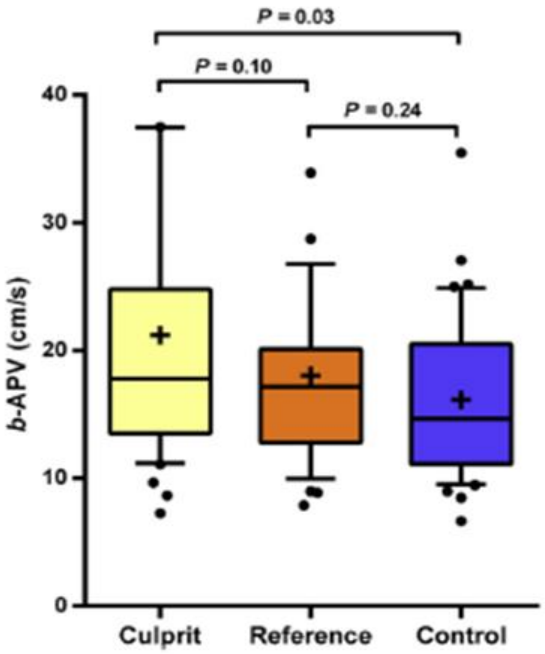
Debates for Reliability of FFR in AMI patient
- Potential Concerns of Blunted Hyperemic Response -

40 STEMI patients,
PS matched with 40 Stable Angina without obstructive lesion

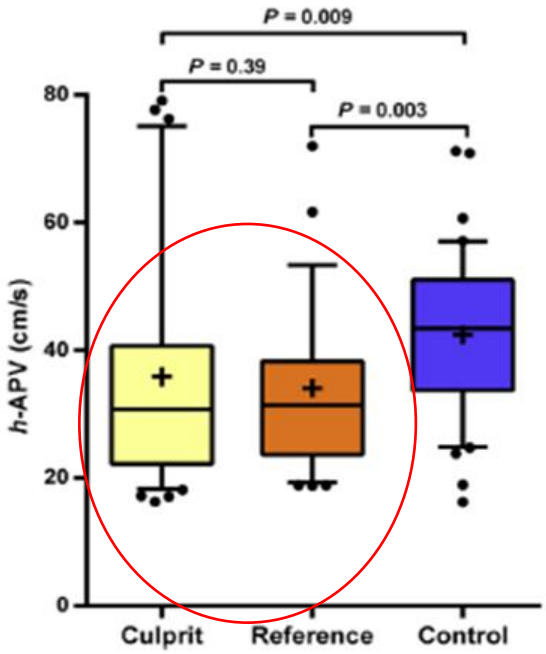
A. CFR (Doppler)



B. Resting Flow Velocity



C. Hyperemic Flow Velocity



They claimed blunted hyperemic response in STEMI setting
Unreliability of non-culprit vessel FFR

De Waard et al. JACC: Cardiovascular Intervention, 2016

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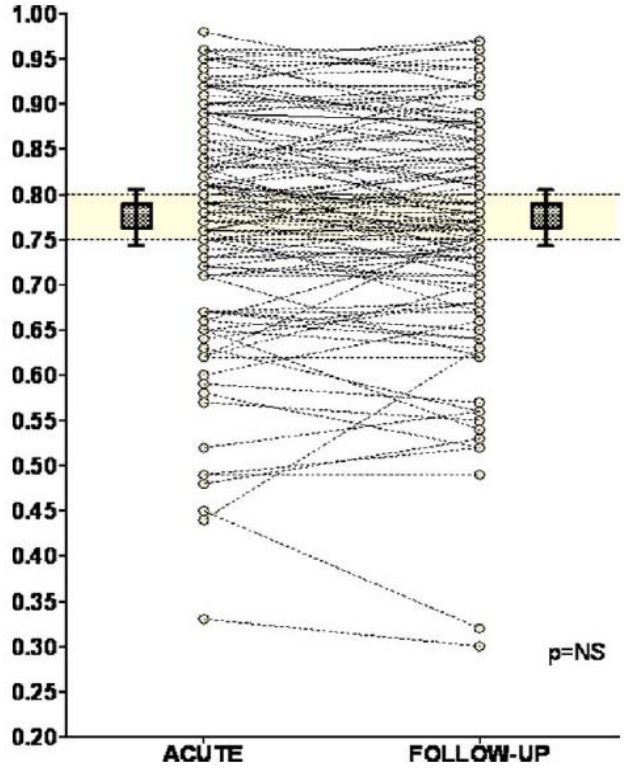
Debates for Reliability of FFR in AMI patient
- Reliability of Acute phase Non-culprit vessel FFR -

Non-culprit vessel of AMI Patient



	Acute Phase (n=101)	1 Month Follow-Up (n=101)	P Value
LVEF (%)	59 ± 15	61 ± 14	NS
LVEDP (mmHg)	18 ± 7	17 ± 7	NS
FFR nonculprit	0.77 ± 0.13	0.77 ± 0.13	NS
IMR nonculprit (IU)	20 ± 3	24 ± 6	NS
DS nonculprit (%)	56 ± 14	55 ± 14	NS
TIMI flow nonculprit	2.93 ± 0.30	2.97 ± 0.20	NS
cTFC nonculprit	15 ± 6	15 ± 6	NS

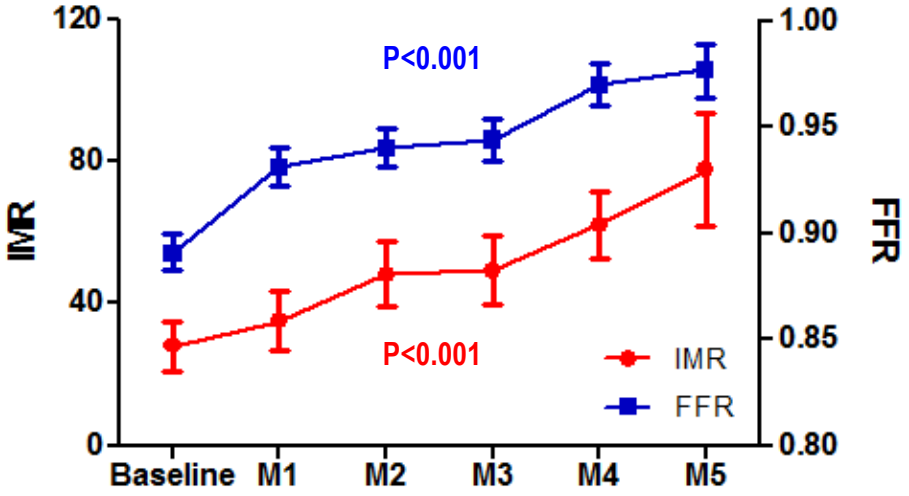
In patients with acute MI (including STEMI and NSTEMI), non-culprit FFR did not show significant change.

Ntalianis, et al. JACC: Cardiovascular Intervention, 2010

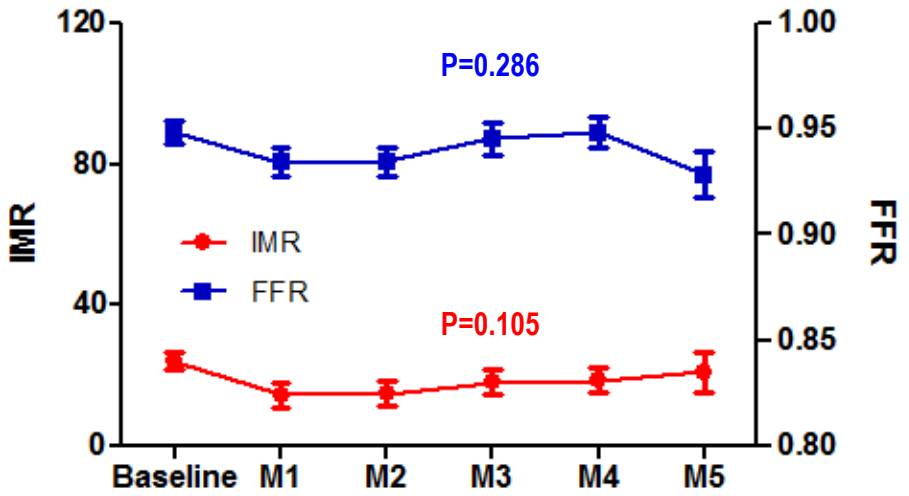
Reliability of Acute phase Non-culprit vessel FFR
- Validation using Animal Experiments -

FFR and IMR Changes in Non-Culprit Vessel
- Porcine Microvascular Damage Model -

LAD (Microsphere)



LCX (No Microsphere)



Local microvascular damage in culprit vessel was not extended to non-culprit vessel territory, and non-culprit vessel FFR and IMR were not changed at all.

Lee JM, Kim HK, Choi KH… Koo BK et al. JACC: Cardiovascular Intervention, 2018

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Reliability of Acute phase Non-culprit vessel FFR
- Validation using Clinical Data -

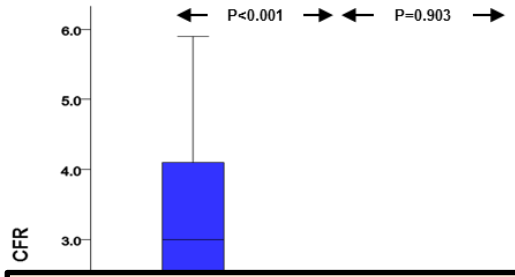
In STEMI non-culprit vessel
CFR is depressed
as with culprit vessel

IMR is elevated
only in culprit vessel

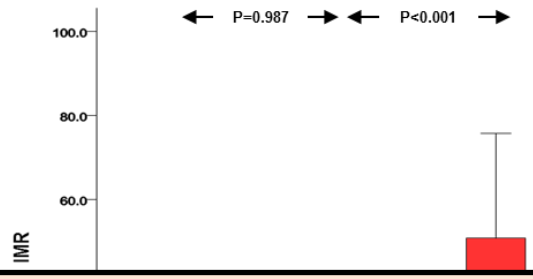
In STEMI non-culprit vessel
Resting coronary flow is increased

In STEMI non-culprit vessel
Hyperemic coronary flow is not changed

A. Coronary Flow Reserve

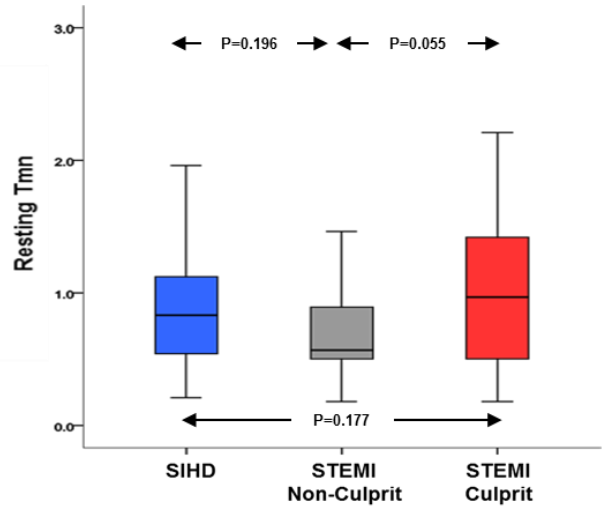


B. Index of Microcirculatory Resistance

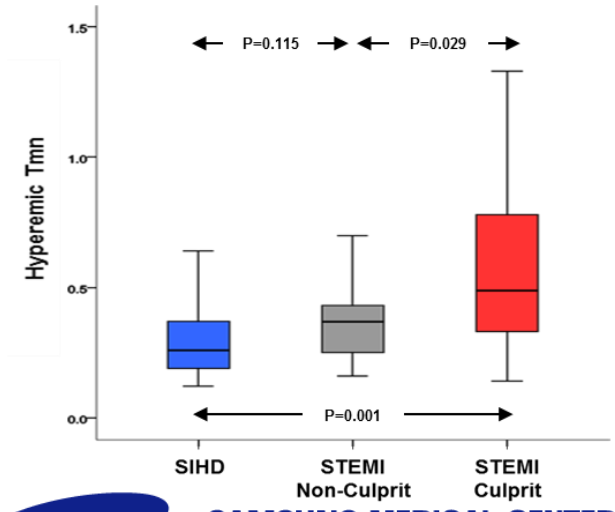


Depressed CFR in non-culprit vessels of STEMI patients is mainly due to "increased resting coronary flow" not mainly due to "depressed hyperemic coronary flow" or "increased microvascular resistance"

C. Resting Mean Transit Time



D. Hyperemic Mean Transit Time



Choi KH, Lee JM… Koo BK et al. JACC: Cardiovascular Intervention, 2018

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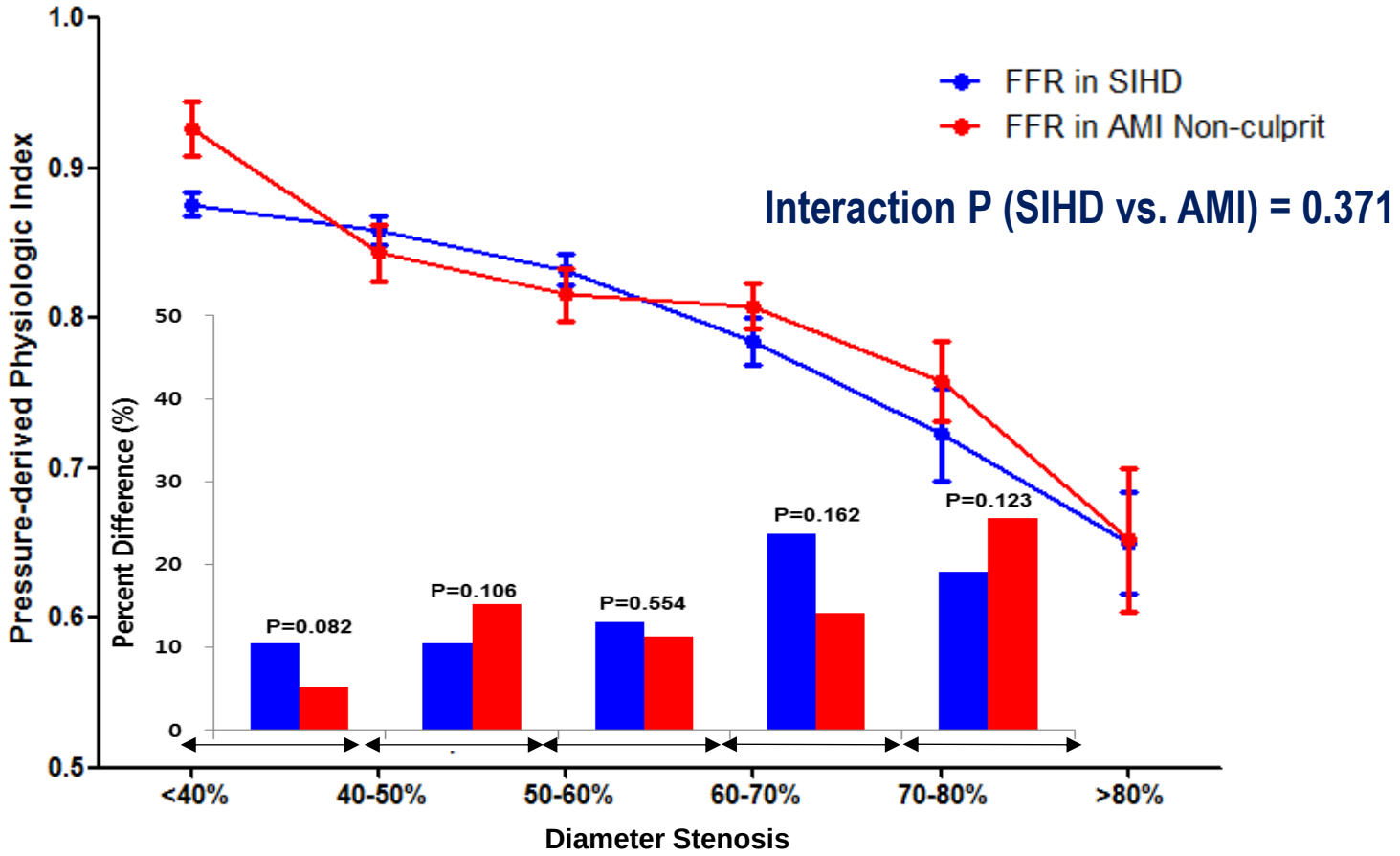
Our Previous Research
- Validation using Clinical Data -



Even in the acute stage of MI,
non-culprit FFR reliably reflect lesion severity.

Choi KH, Lee JM… Koo BK et al. JACC: Cardiovascular Intervention, 2018

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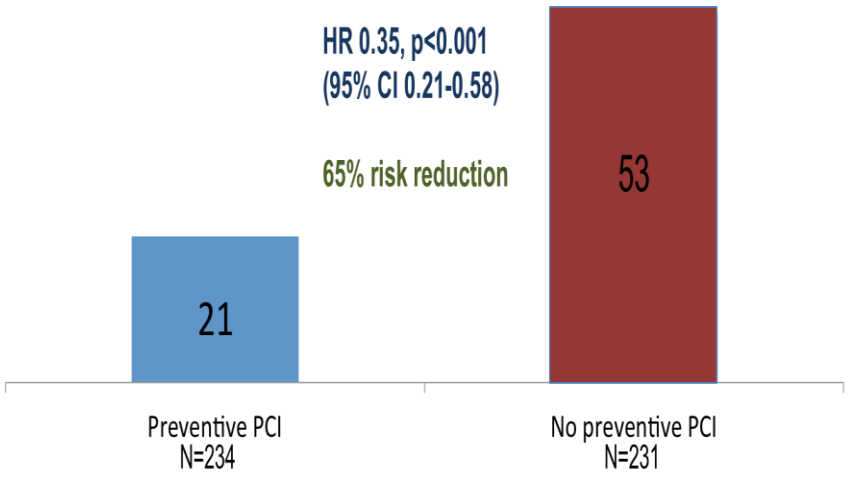
Non-culprit Lesion PCI after Primary PCI in STEMI

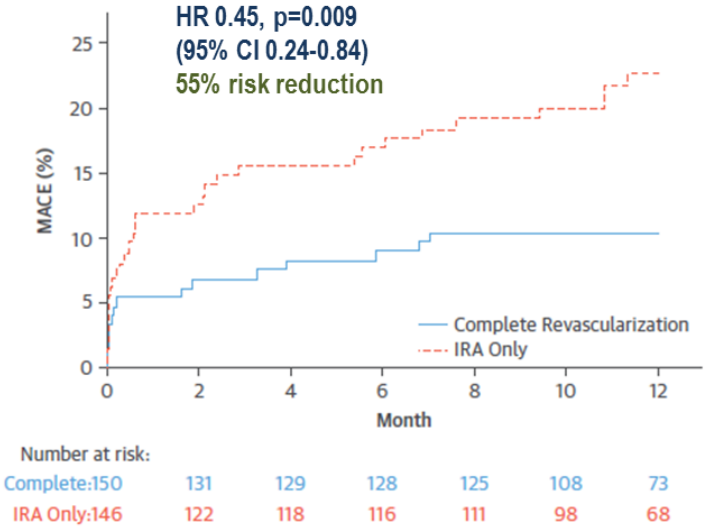
- Angio-guided Complete Revascularization vs. Culprit-Only PCI -

PRAMI – cardiac death, non-fatal MI, refractory angina



Preventive PCI for non-culprit lesion >50% DS

CvLPRIT – all death, recurrent MI, HF, ischemia-revascularization



Preventive PCI for non-culprit lesion
> 70% DS or > 50% DS in 2 views

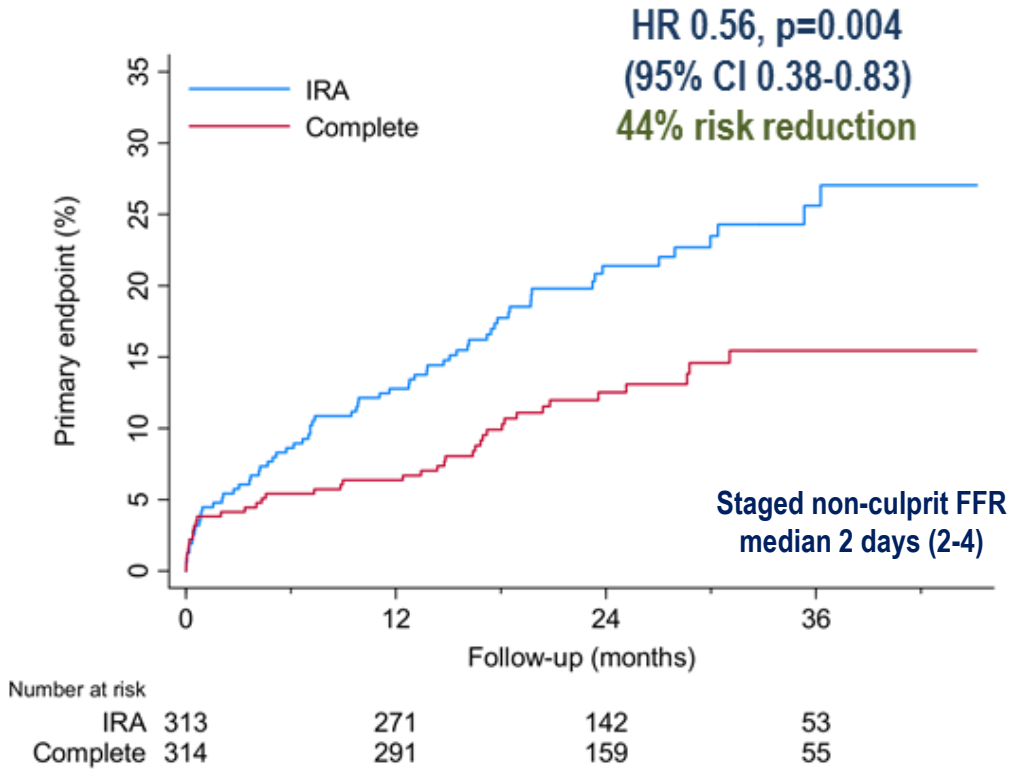
Recent RCTs presented "angiography-guided" complete revascularization showed significant benefit in patient's outcome than "culprit-only PCI"

In terms of hard endpoint (Death, MI ➔ PRAMI) or
In terms of soft endpoint (MACE but not death/MI ➔ CvPRIT)

PRAMI NEJM 2013;369:1115-23
CvLPRIT JACC 2015;65:963-72

Non-culprit Lesion PCI after Primary PCI in STEMI
- FFR-guided Staged CR vs. Culprit-Only PCI -

DANAMI-3-PREMULTI Trial



"FFR-guided" staged complete revascularization showed significant benefit in terms of composite endpoints (Any death, MI, ischemia driven revascularization)

DANAMI-3-PRIMULTI Lancet. 2015 Aug 15;386(9994):665-71.

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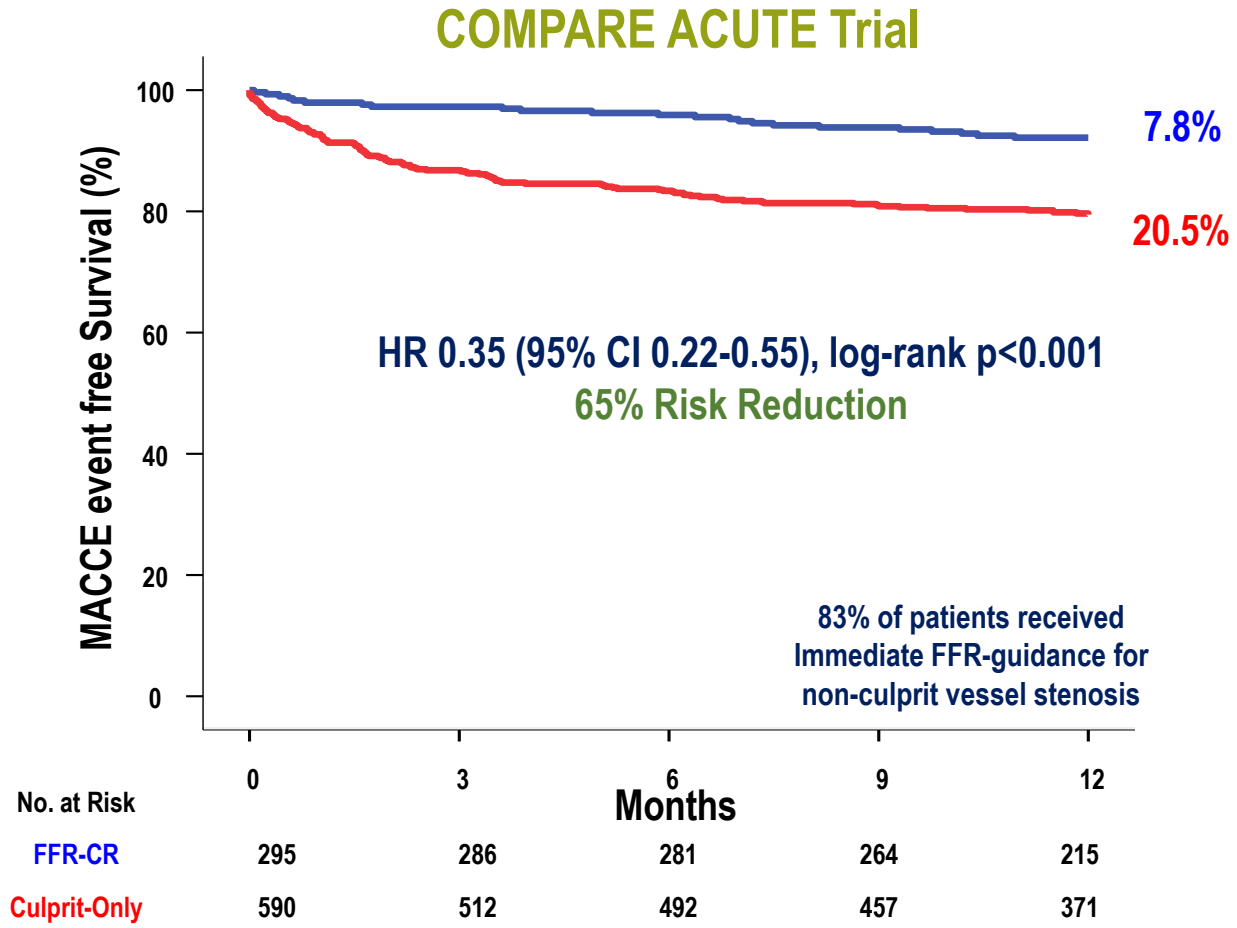
Non-culprit Lesion PCI after Primary PCI in STEMI
- FFR-guided Immediate CR vs. Culprit-Only PCI -



"FFR-guided" immediate complete revascularization showed significantly lower risk of MACCE than culprit-only PCI

COMPARE-ACUTE N Engl J Med 2017; 376:1234-1244

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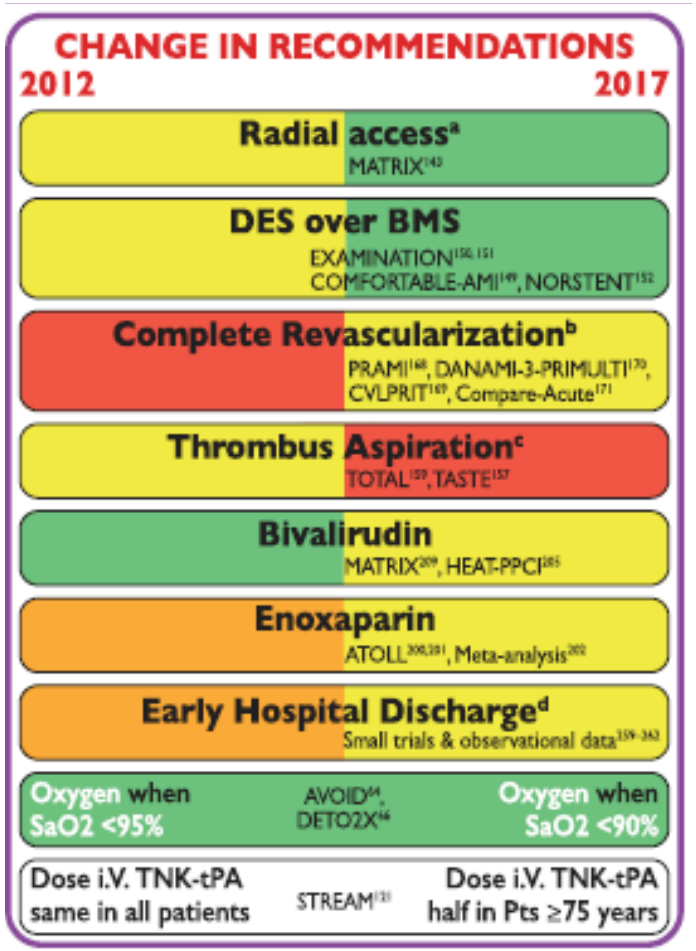
Non-culprit PCI in STEMI multivessel
Updated ESC 2017 Guideline



Non-IRA strategy		
Routine revascularization of non-IRA lesions should be considered in STEMI patients with multivessel disease before hospital discharge.[167–173]	IIa	A
Non-IRA PCI during the index procedure should be considered in patients with cardiogenic shock.	IIa	C
CABG should be considered in patients with ongoing ischaemia and large areas of jeopardized myocardium if PCI of the IRA cannot be performed.	IIa	C

For Non-culprit vessel stenosis:
The optimal timing of revascularization (immediate vs. staged) and optimal treatment criteria (%DS, FFR, or vulnerability) has not been clarified.

Ibanez B et al. Eur Heart J. 2018 Jan 7;39(2):119-177.

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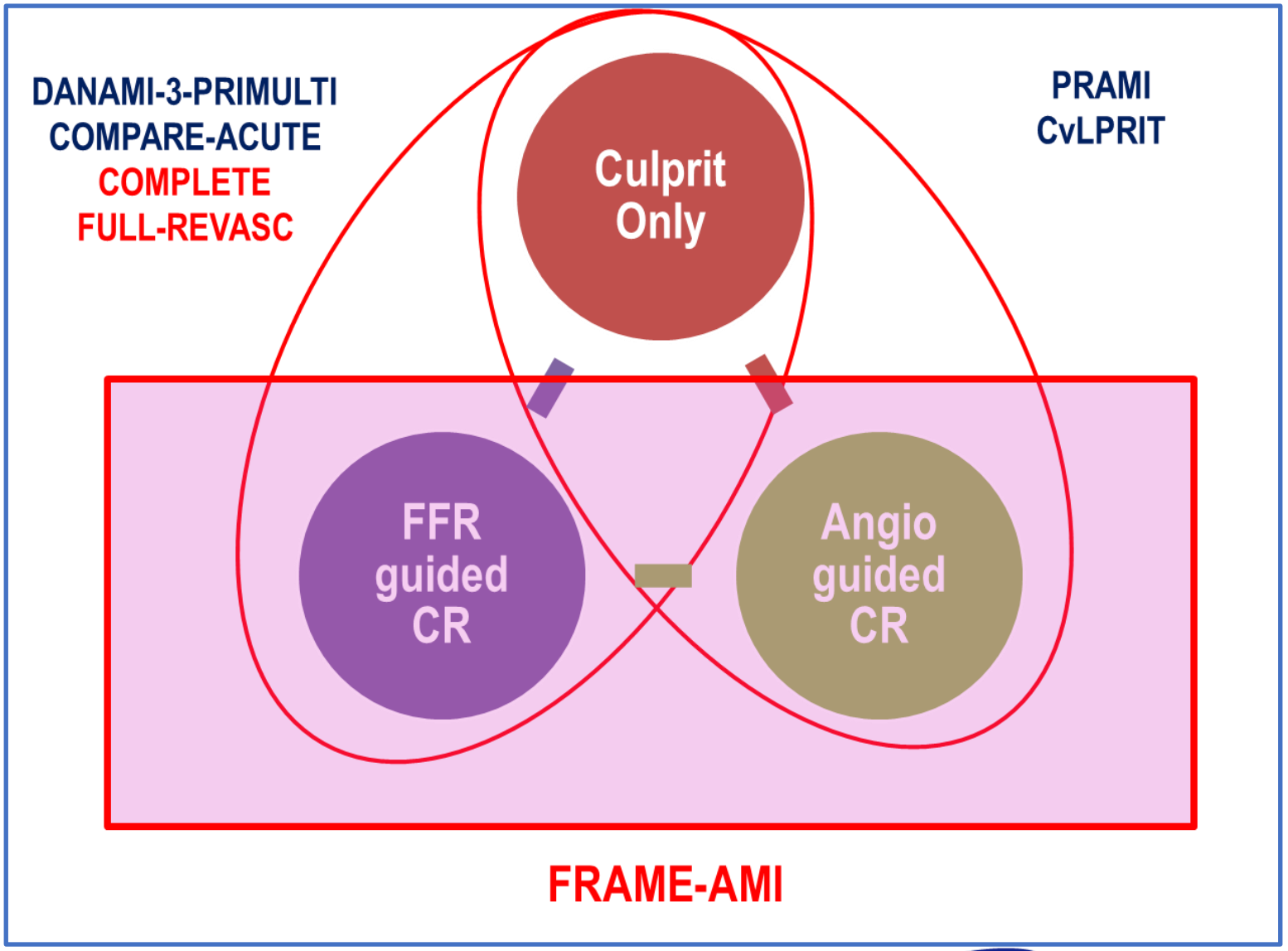
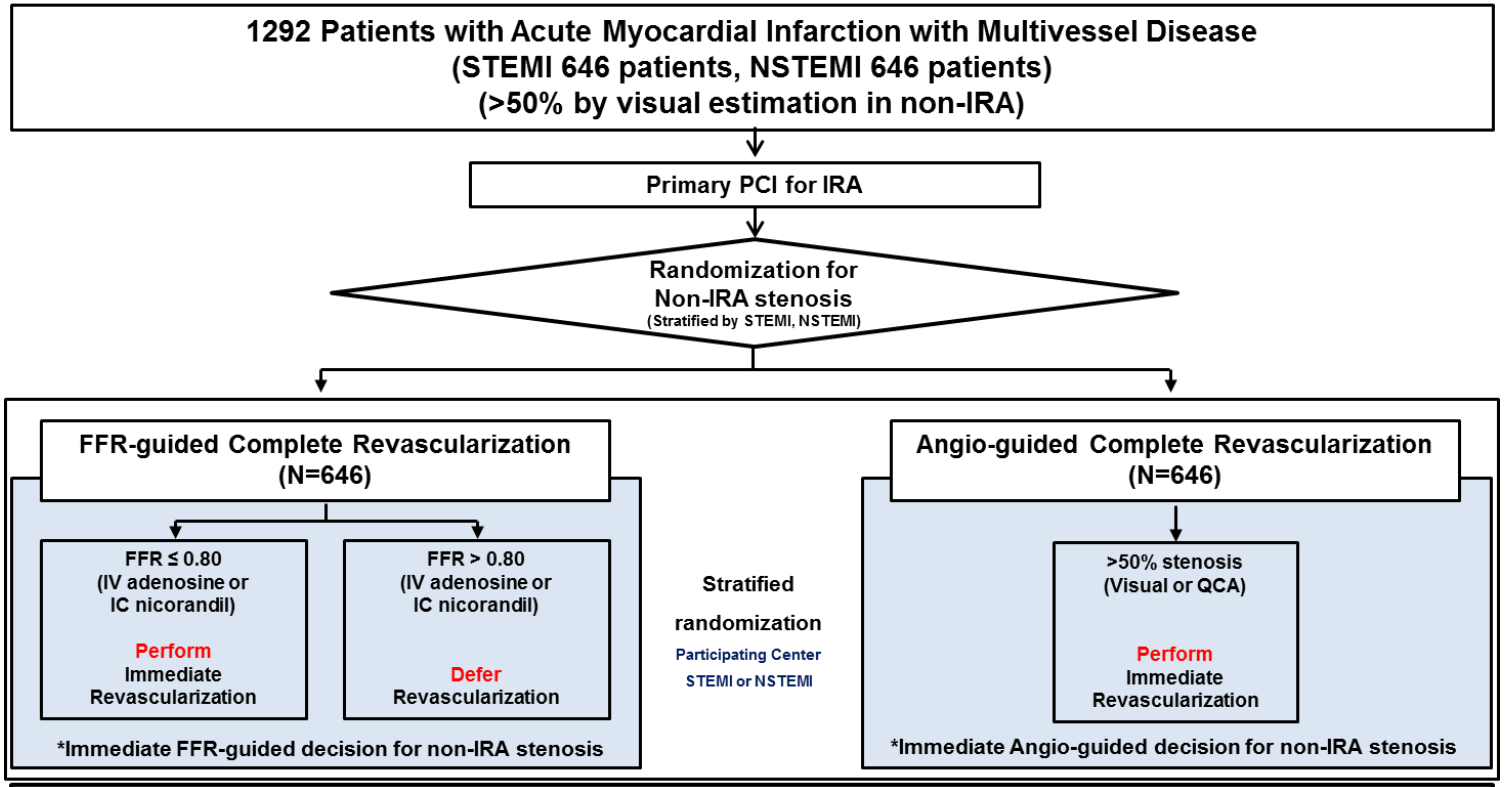
Non-culprit PCI in STEMI multivessel
Current Evidences and Future Perspectives



Future Perspectives

- FFR-guided CR vs. Angiography-guided CR in AMI -

FRAME-AMI Trial (NCT02715518)



The non-IRA PCI should be performed during the same intervention, however, exceptions can be made for complex lesions where the operator estimates that the revascularization procedure will require significant contrast overload which may lead to deterioration of cardiac and renal function of the patient.
Such procedures can be performed in a staged procedure during the same hospitalization.

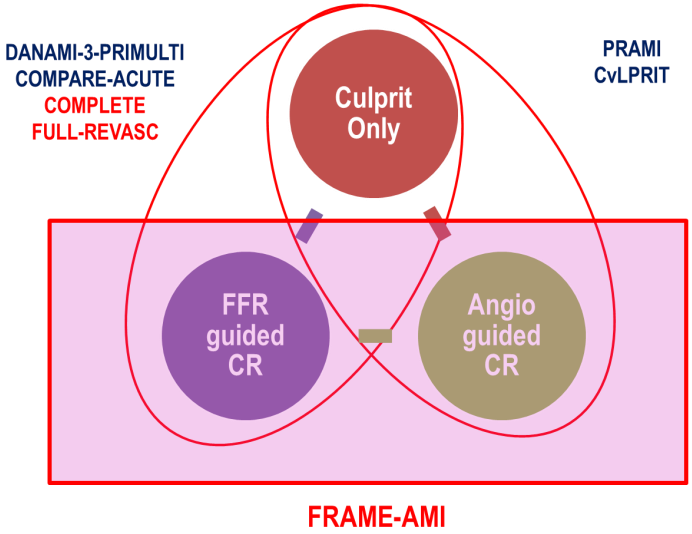
Analysis at 24 months after Index Procedure

Primary Endpoint	A composite of All death, Any Myocardial Infarction, Any Revascularization
Secondary Endpoints	All-cause mortality, any myocardial infarction with or without periprocedural MI, any revascularization, cerebrovascular accident, angina symptom score (Seattle Angina Questionnaire), ARC-defined stent thrombosis, incidence of contrast induced nephropathy

Summary

➢ In AMI Patients with Non-culprit Stenosis

- For the "Non-Culprit Lesion" of STEMI and NSTEMI (multivessel), FFR-guided strategy is reasonable and reliable, even in the acute stage of AMI.
- In STEMI with multivessel disease, FFR-guided strategy for non-culprit stenosis already proved its prognostic benefit than culprit-only PCI (DANAMI-3-PRIMULTI, COMPARE-ACUTE).
- In STEMI/NSTEMI with multivessel disease, More evidence is needed to compare FFR-guided CR vs. Angio-guided CR. FRAME-AMI Trial will clarify this issue.



Thank You For Your Attention !

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