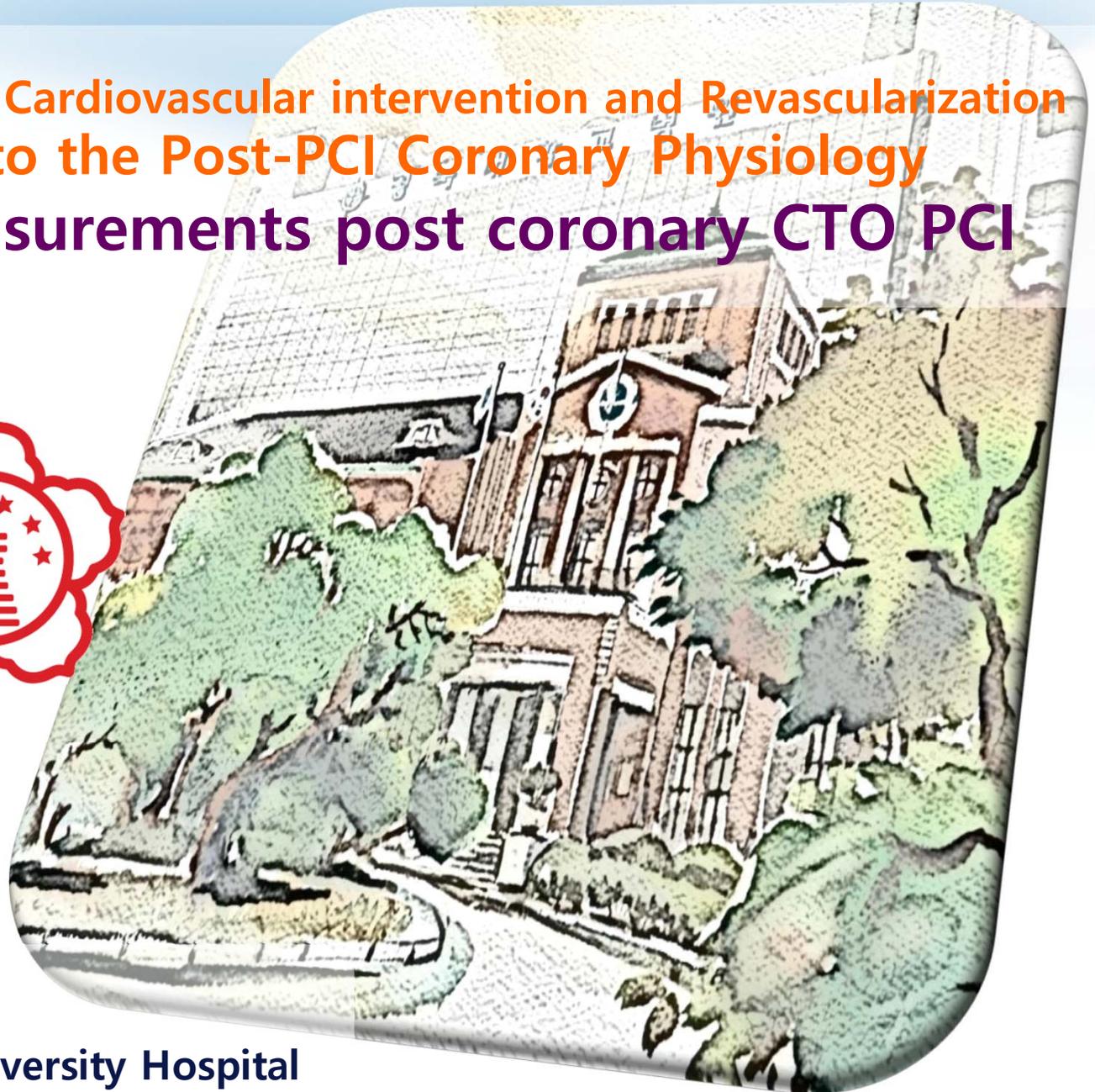


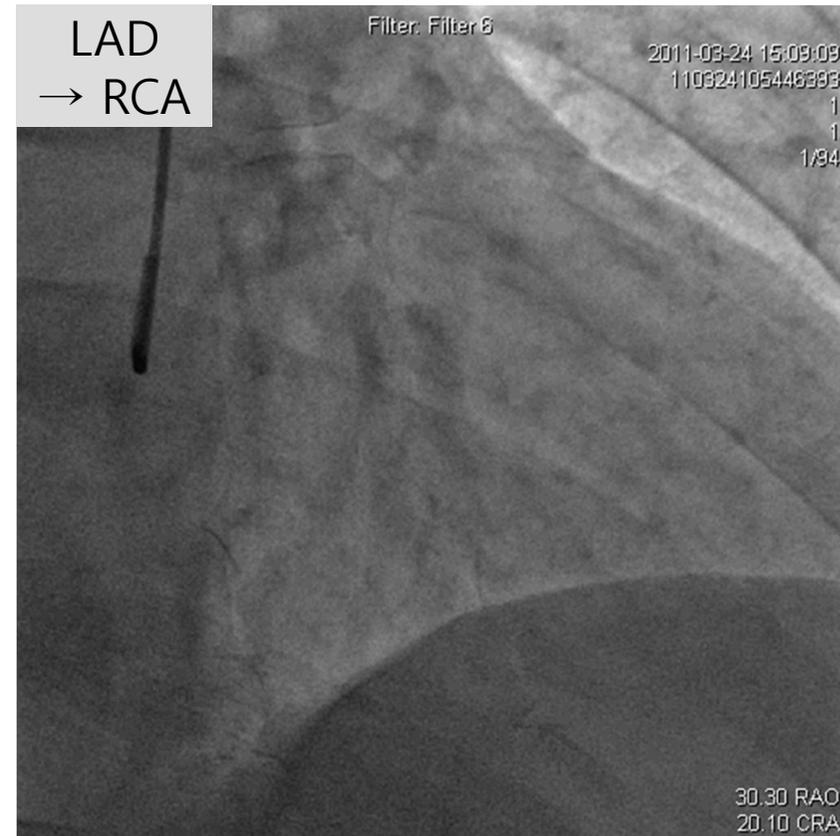
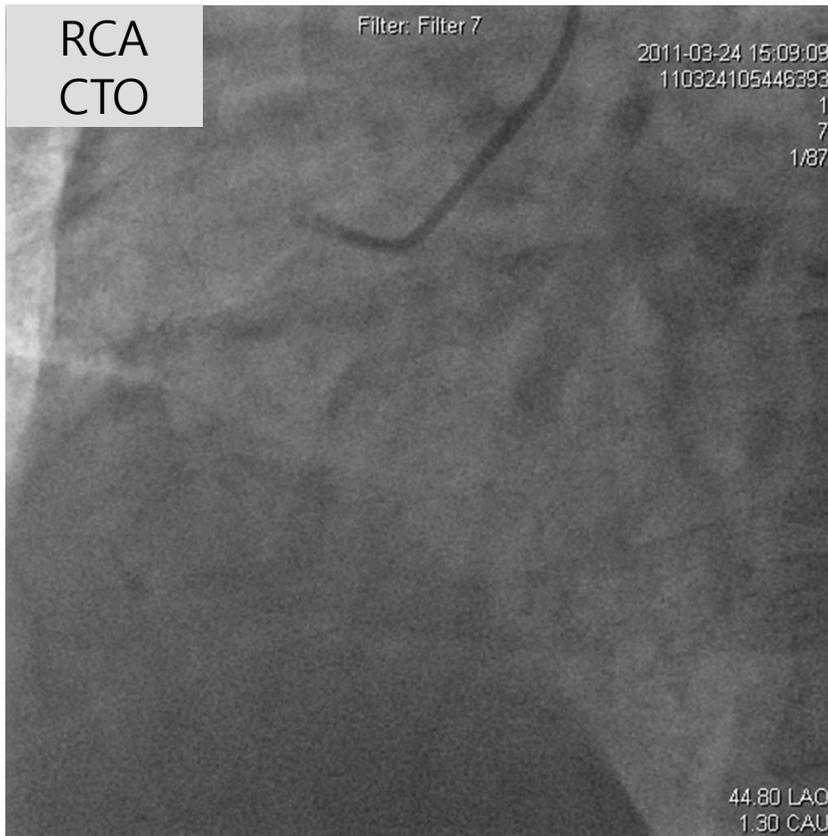
2019 Joint Meeting of Cardiovascular intervention and Revascularization
Deep Dive into the Post-PCI Coronary Physiology
Serial FFR measurements post coronary CTO PCI



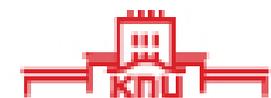
Jang Hoon Lee, MD
Kyungpook National University Hospital



CTO with good collaterals

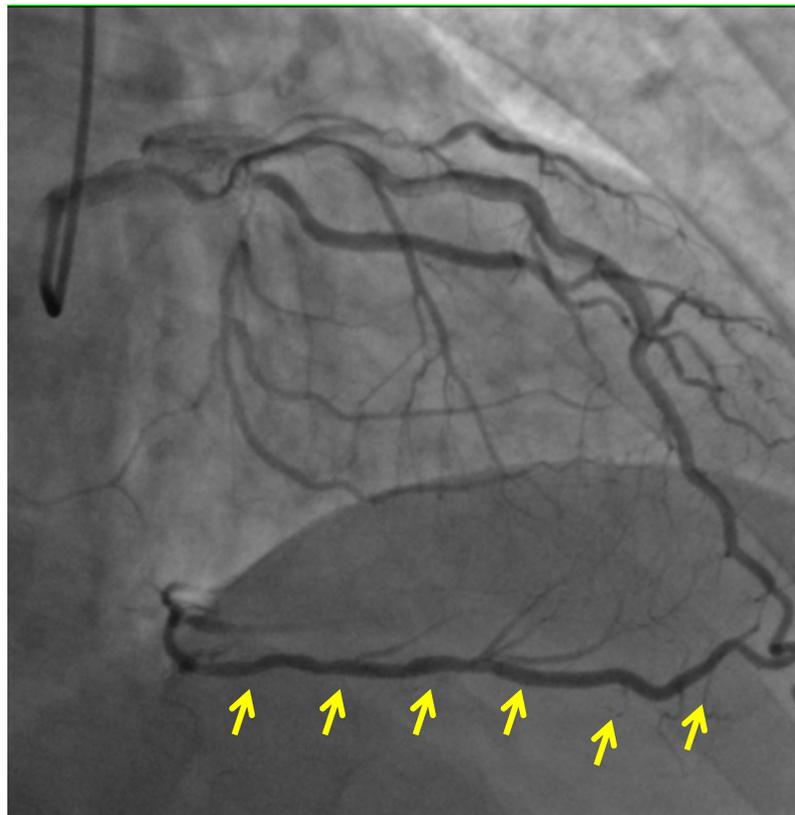


Do you believe that this well-developed collateral support is enough to save patient's life?





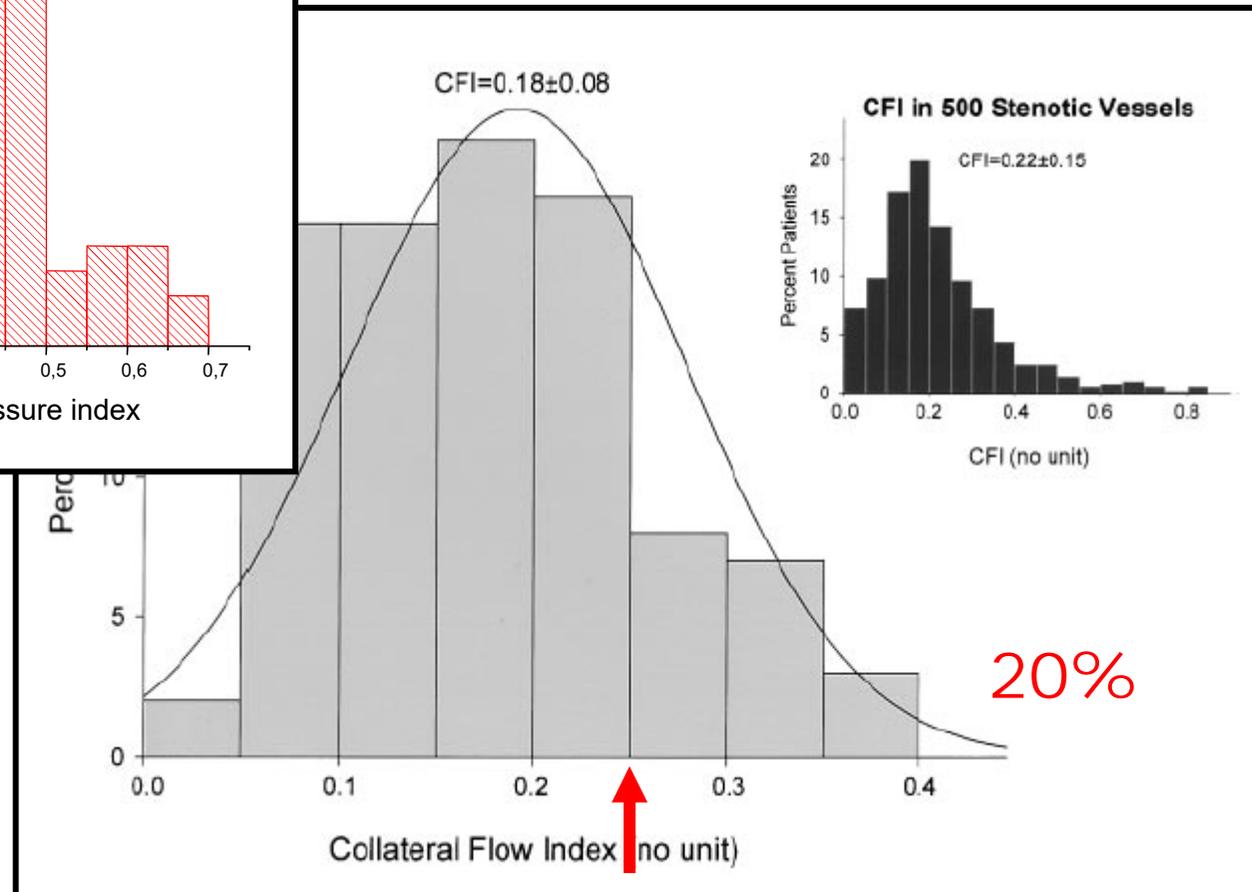
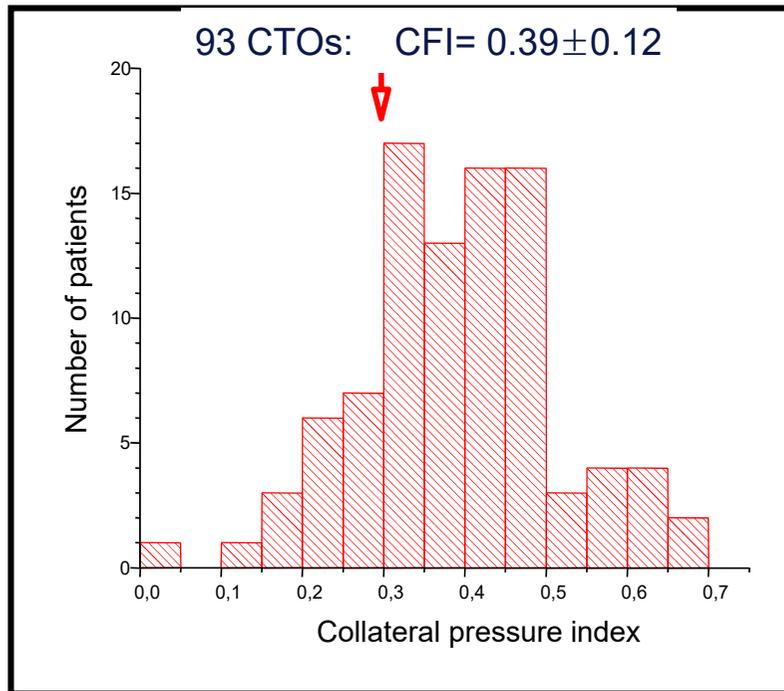
Clinical implications of collateral circulation in chronic total occlusion



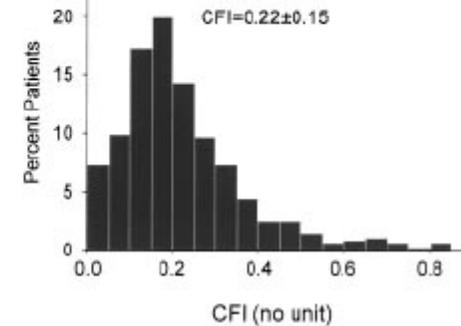
- Alternative conduits of the blood supply to myocardial areas jeopardized by ischemia
- Regression of the collaterals after CTO PCI would render the myocardium susceptible to an infarction in the event of a subsequent coronary occlusion.



Preformed collaterals in man?



CFI in 500 Stenotic Vessels





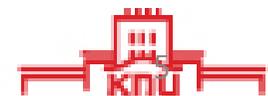
Integration of coronary physiology in CTO PCI

Major Point #1

...

**Collaterals are preformed and vary
individually**

...



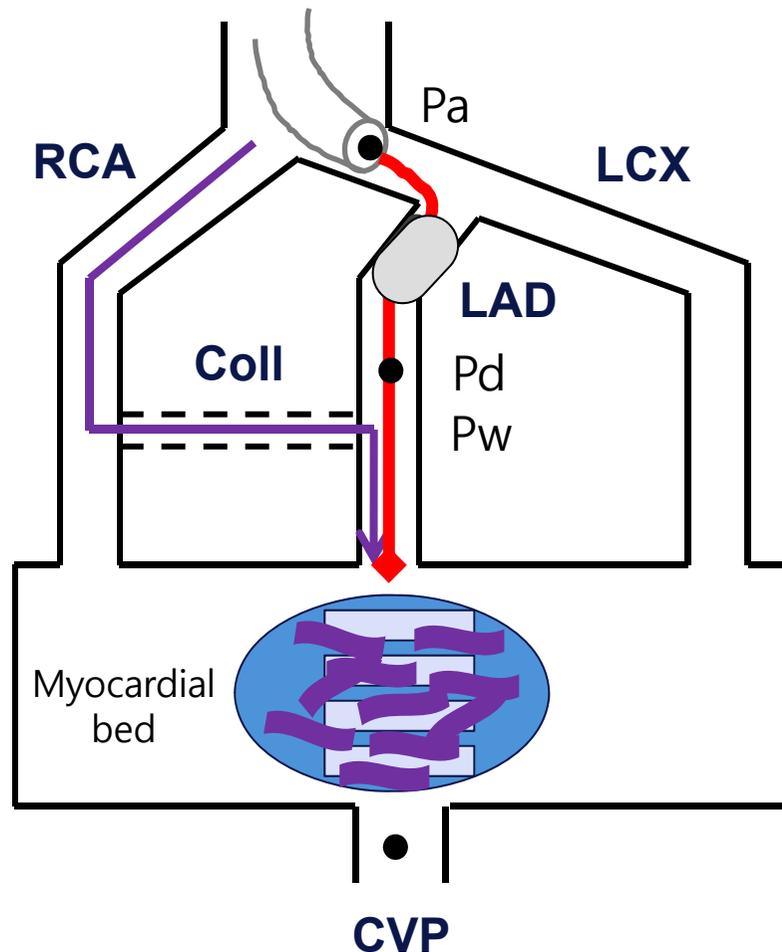


Clinical Concerns

- Collateral amount in CTO



Measurements of collateral flow



- Myocardial fractional flow reserve

$$FFR_{myo} = (Pd - Pv)/(Pa - Pv)$$

- Coronary fractional flow reserve

$$FFR_{cor} = (Pd - Pw)/(Pa - Pw)$$

- Collateral pressure index

$$CPI = (Pw - CVP)/(Pa - CVP)$$



Integration of coronary physiology in CTO PCI

Major Point #2

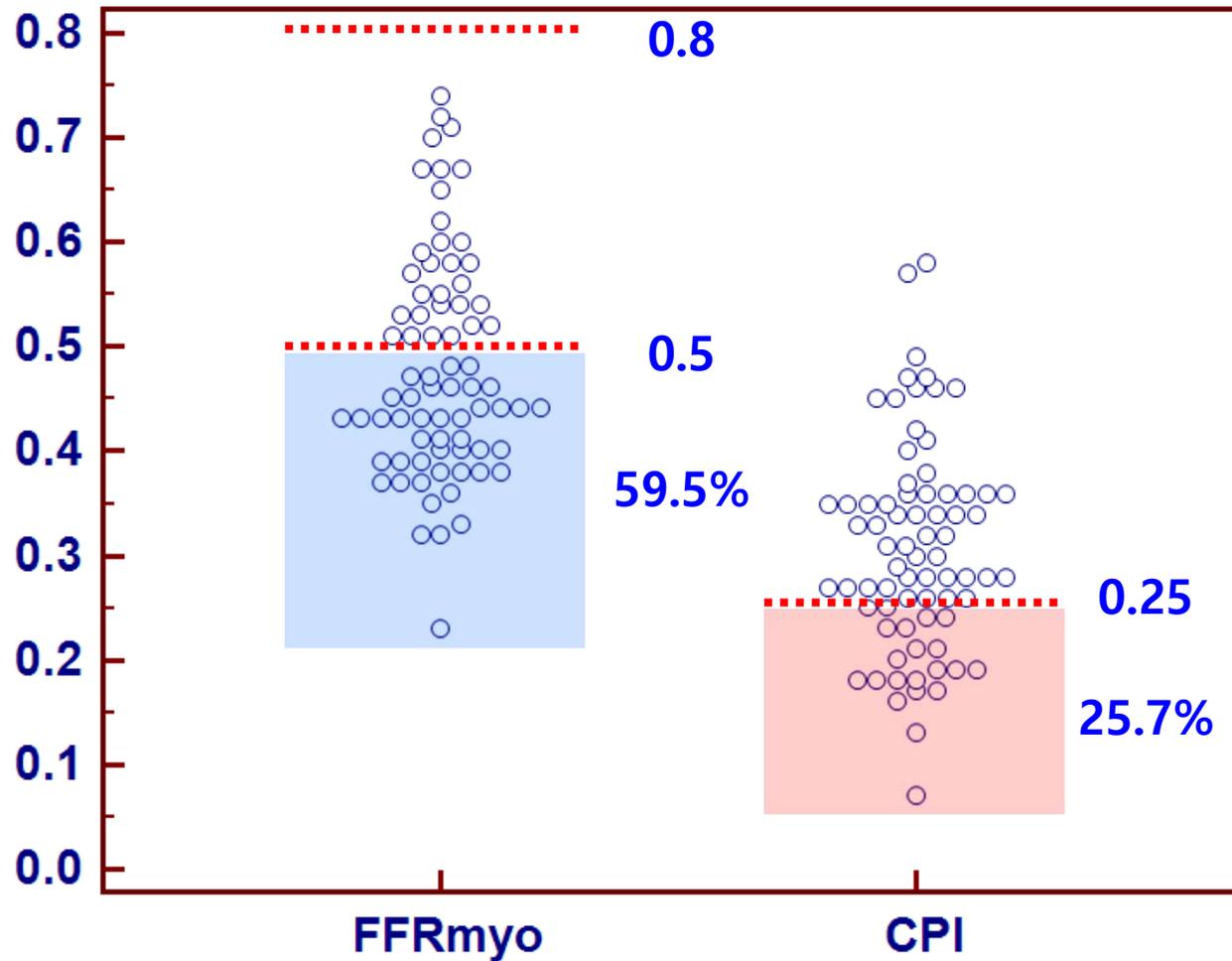
...

**Pressure intracoronary collateral
measurements are regarded as the
reference method for assessment of
coronary collateral flow**

...



FFRmyo & CPI in CTO





Integration of coronary physiology in CTO PCI

Major Point #3

...

Patients with CTO have substantial ischemic burden despite a well-developed collateral circulation

....



Clinical Concerns

- Collateral amount in CTO
- The time course of change in CTO

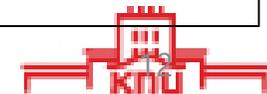
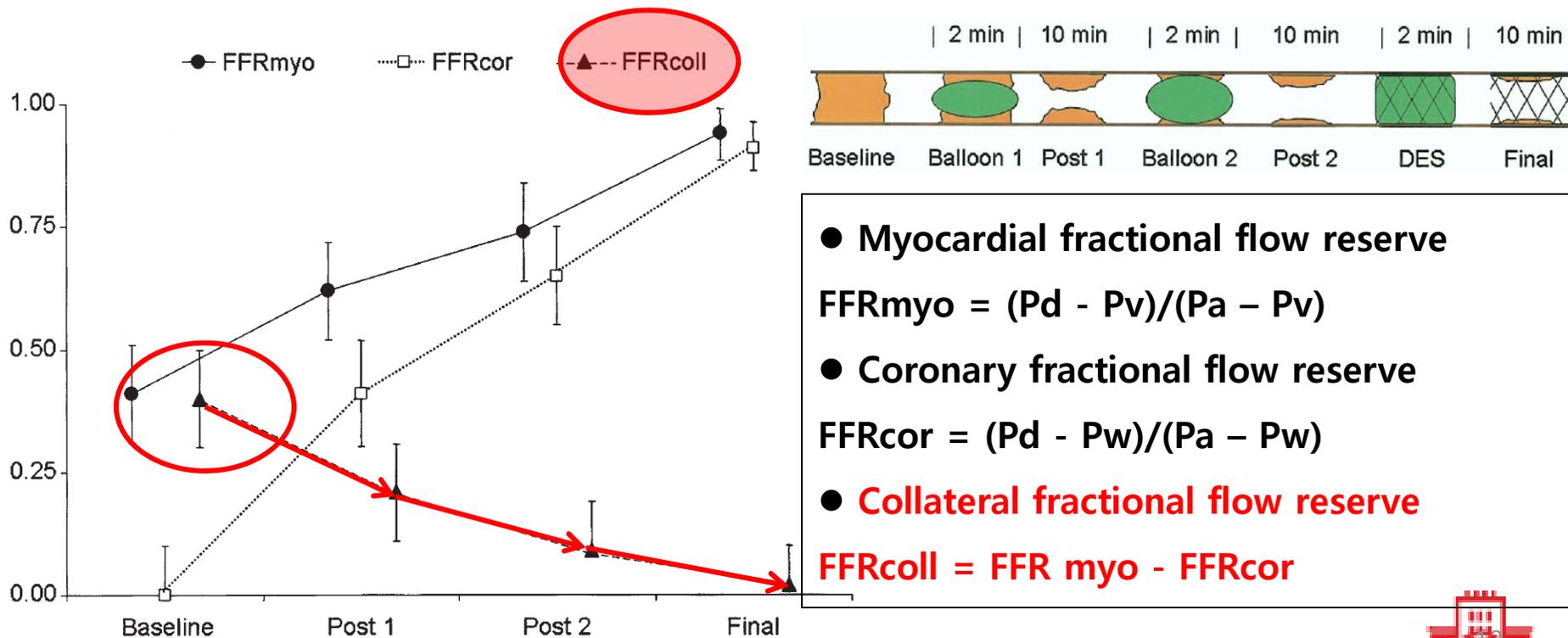


What happens to collaterals after CTO PCI?

Rapid Decline of Collateral Circulation
Increases Susceptibility to Myocardial Ischemia

The Trade-Off of Successful Percutaneous
Recanalization of Chronic Total Occlusions

Marco Zimarino, MD, PhD, Arturo Ausiello, MD, Gaetano Contegiacomo, MD, Irene Riccardi, MD,
Giulia Renda, MD, PhD, Cesare Di Iorio, MD, Raffaele De Caterina, MD, PhD
Chieti, Italy



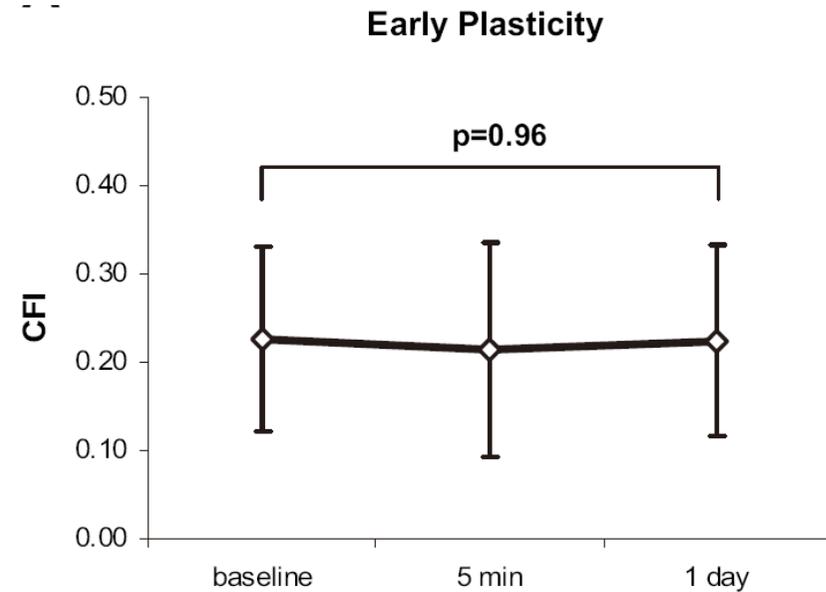
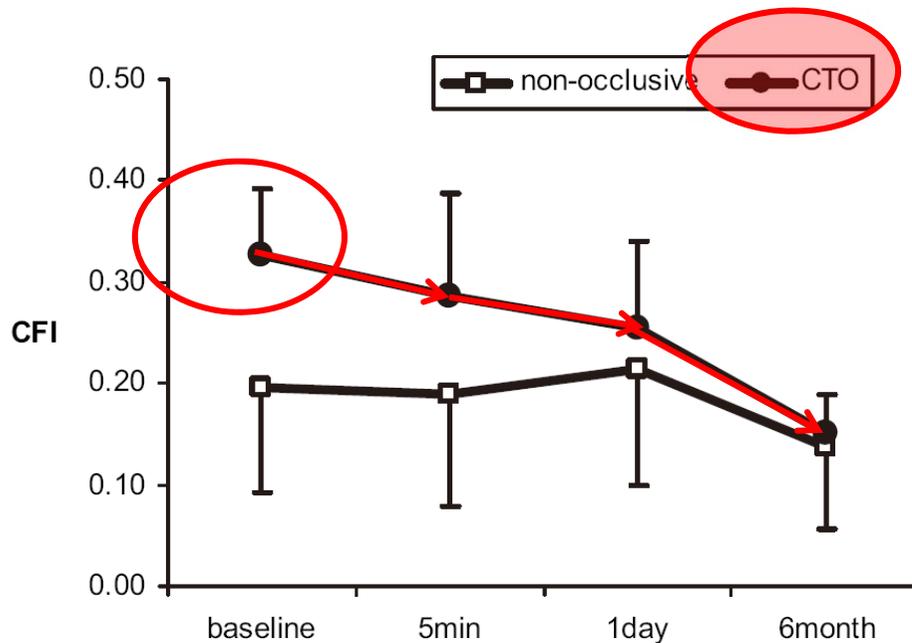


What happens to collaterals after CTO PCI?

Interventional Cardiology

Coronary Collaterals Remain Recrutable After Percutaneous Intervention

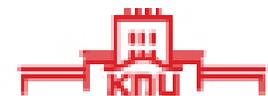
Divaka Perera, MA, MB, BChir, MD, MRCP; Gajen S. Kanaganayagam, PhD;
Mrinal Saha, MA, MBBS, MRCP; Rizwan Rashid, BSc;
Michael S. Marber, MBBS, PhD, FRCP; Simon R. Redwood, MBBS, MD, FRCP





Coronary Collaterals Function and Clinical Outcome in Patients with Chronic Total Occlusion

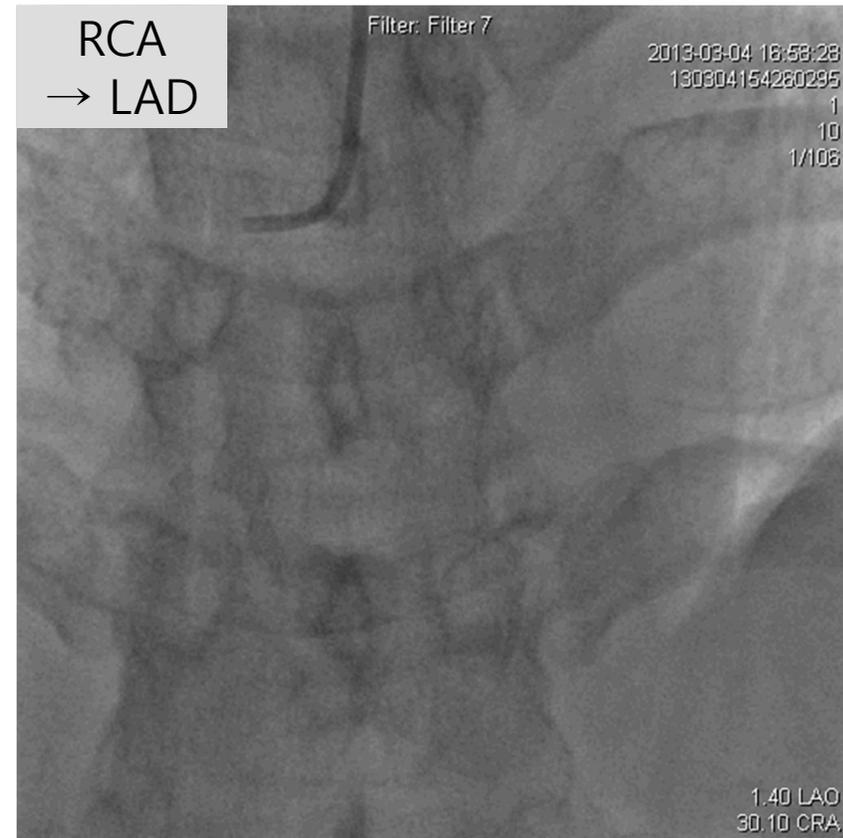
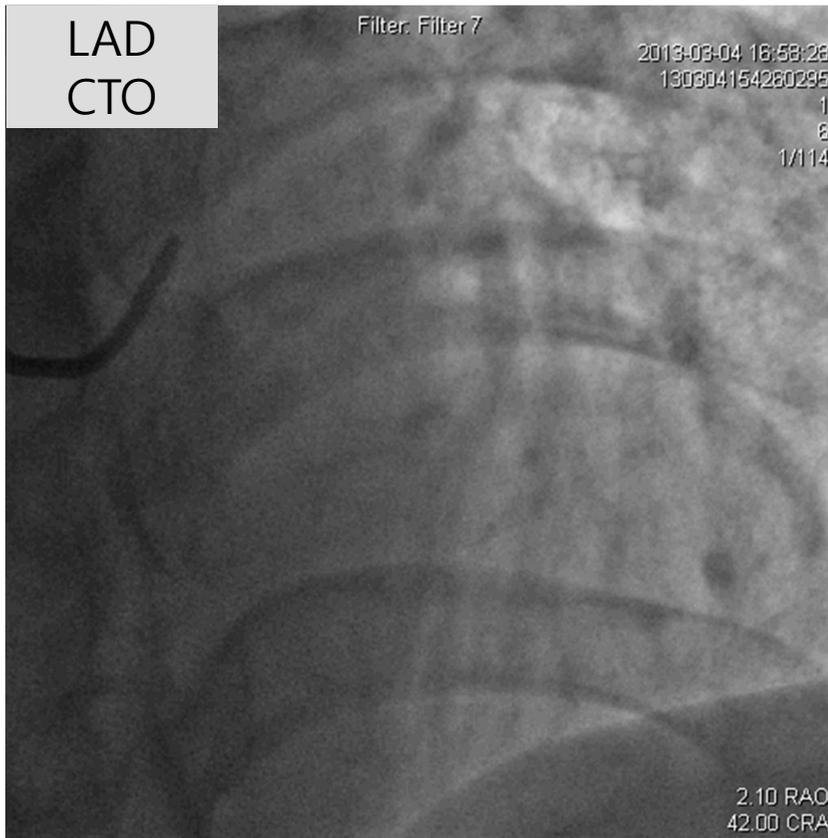
- The time-behavior of the changes in the collateral function and its clinical significance before and after PCI has not been fully investigated yet.
- We performed invasive physiologic studies in CTO patients (n=74).
- Major adverse cardiac events were defined as death, non-fatal myocardial infarction, rehospitalization for angina, and repeat revascularizations.
- Mean follow-up duration = 930 ± 446 days





M/52

effort-related chest pain for 6 months

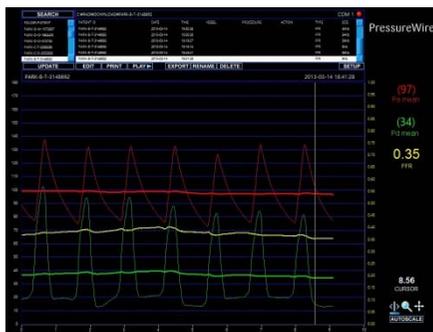
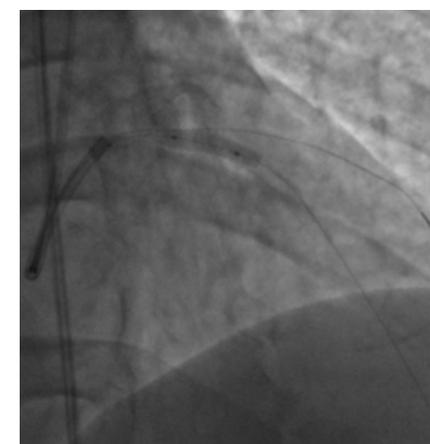
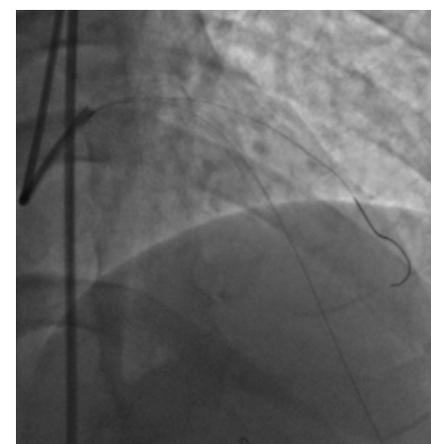
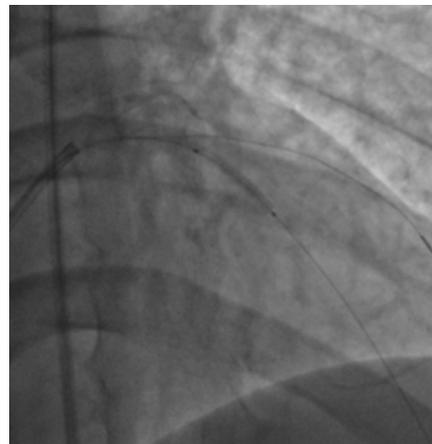
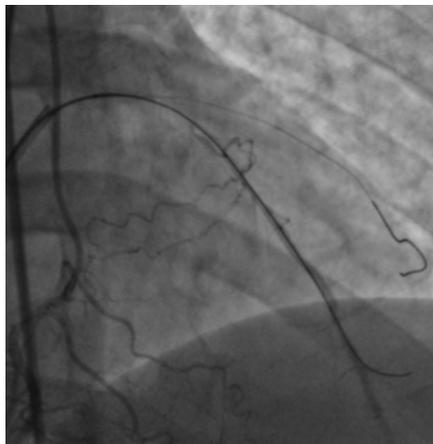
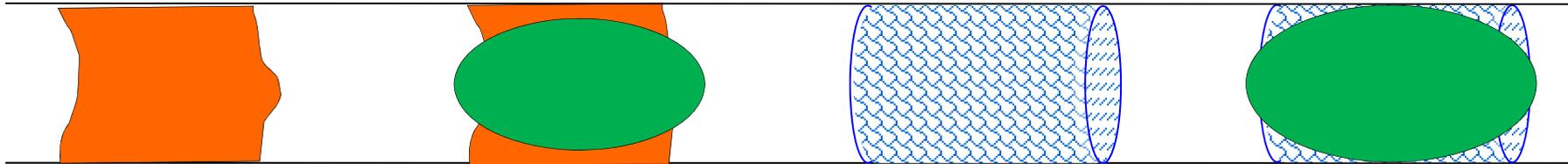




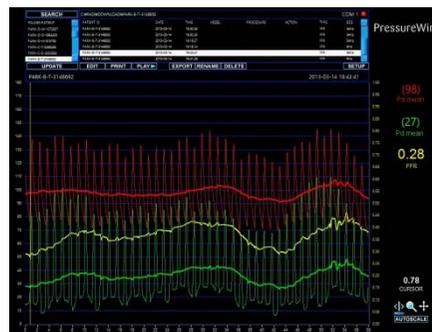
KNUH Protocol

Baseline

Post PCI



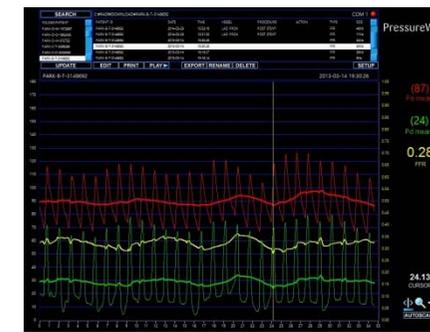
Pre-PCI FFRmyo
0.35



Pre-PCI CPI
0.19



Post-PCI FFRmyo
0.89

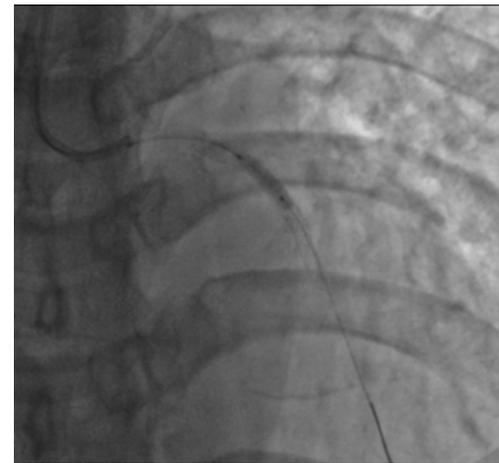
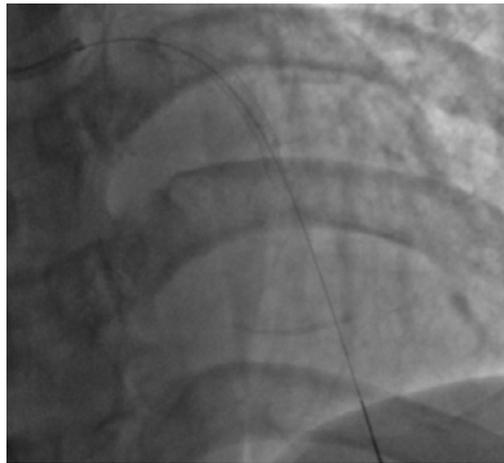
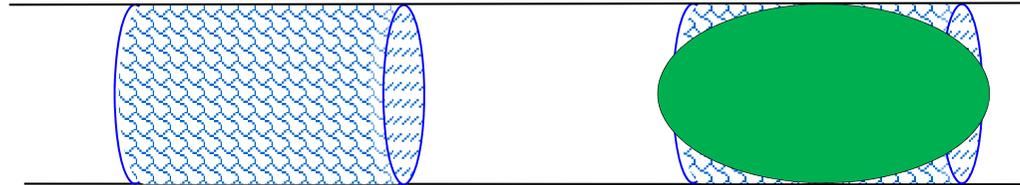


Post-PCI CPI
0.18

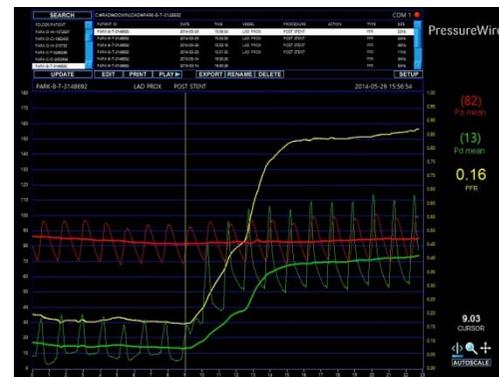




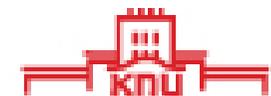
Post PCI @ 1 year



Pre-PCI FFRmyo
0.82

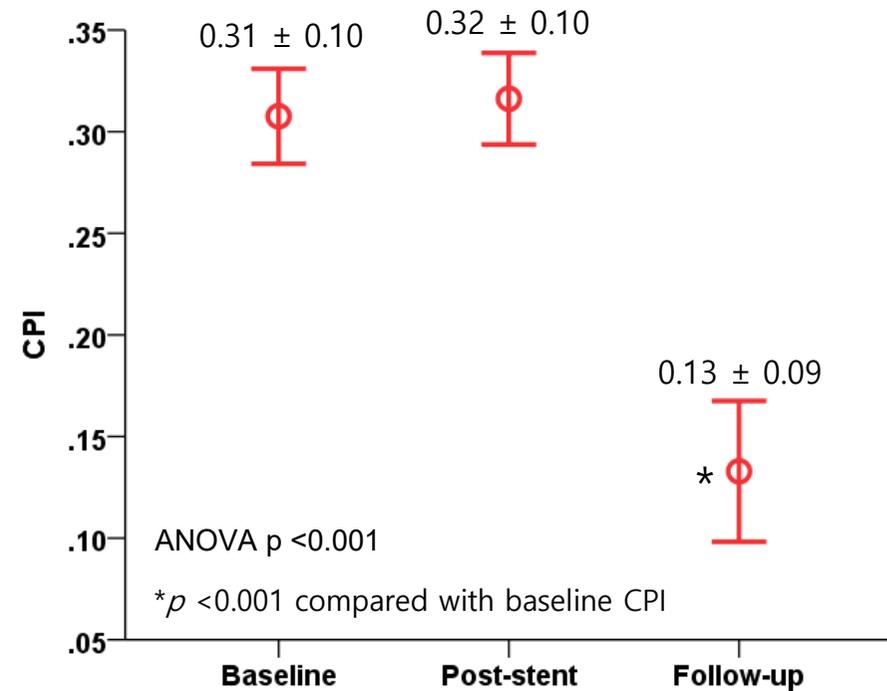
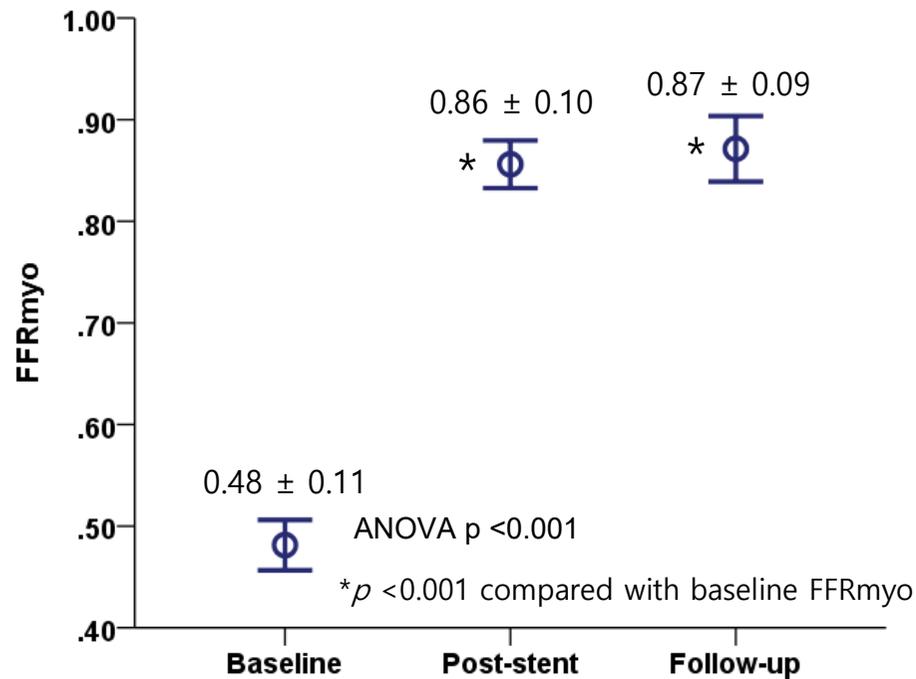


Post-PCI CPI
0.04





Time-behavior changes of FFRmyo & CPI





Integration of coronary physiology in CTO PCI

Major Point #4

...

The recruitable coronary collateral flow did not regress immediately after the PCI.

...



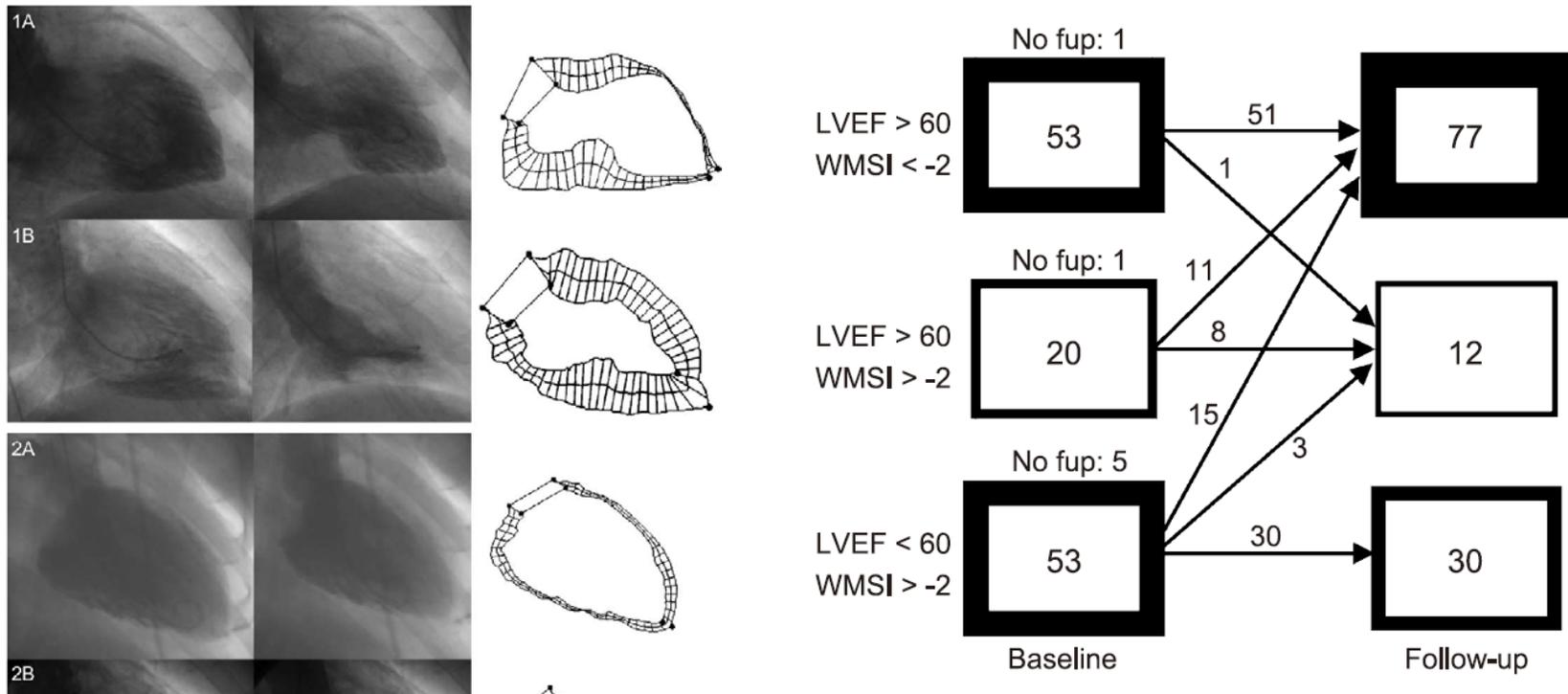
Clinical Concerns

- Collateral amount in CTO
- The time course of change in CTO
- Collateral function and prognosis
 - LV function



Collaterals and the recovery of left ventricular function after recanalization of a chronic total coronary occlusion

Gerald S. Werner, MD, Ralf Surber, MD, Friedhelm Kuethe, MD, Ulf Emig, MD, Gero Schwarz, MD, Philipp Bahrman, MD, and Hans R. Figulla, MD *Jena, Germany*

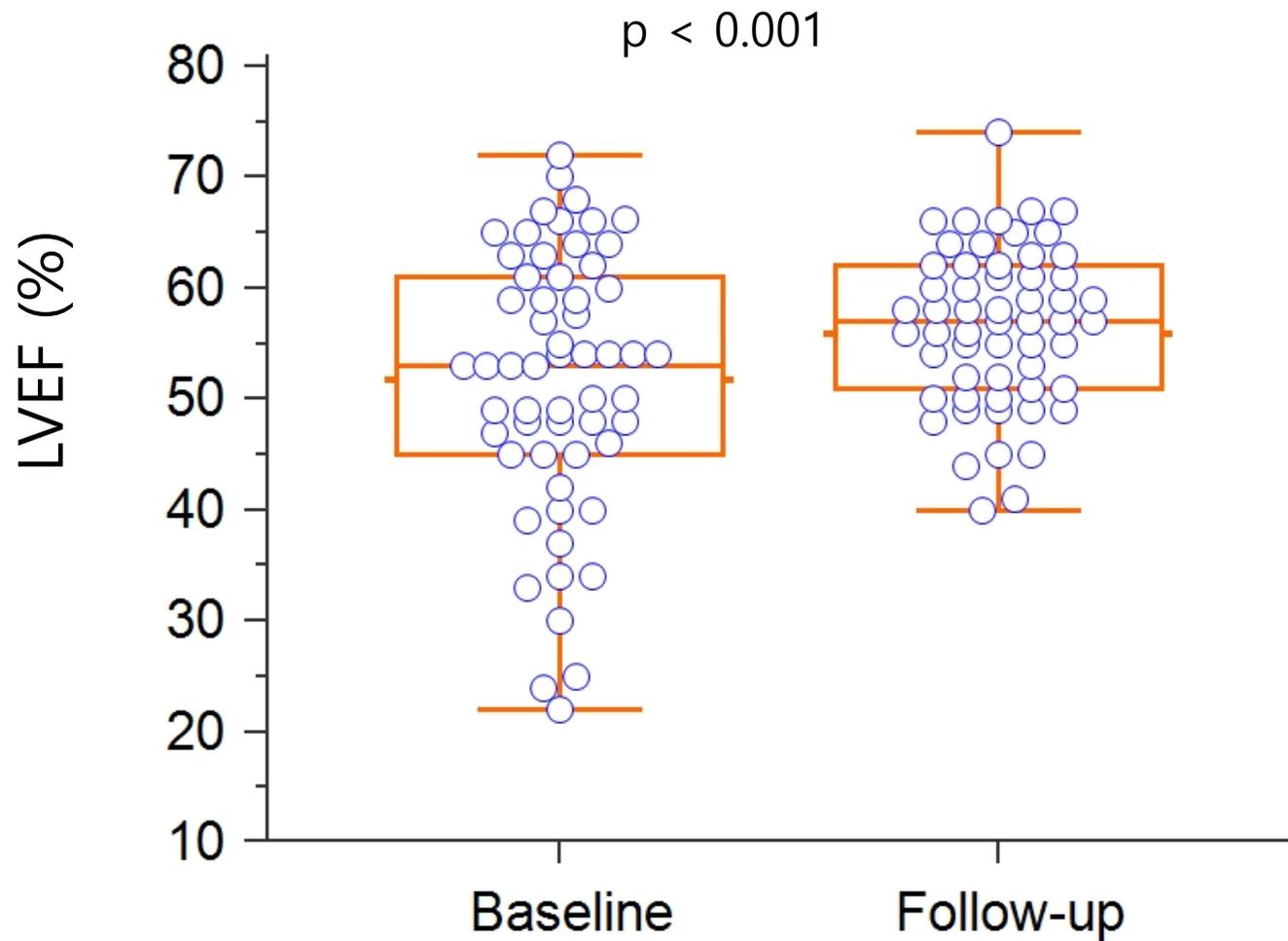


Do good collaterals predict viability and functional recovery ?



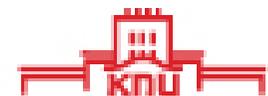
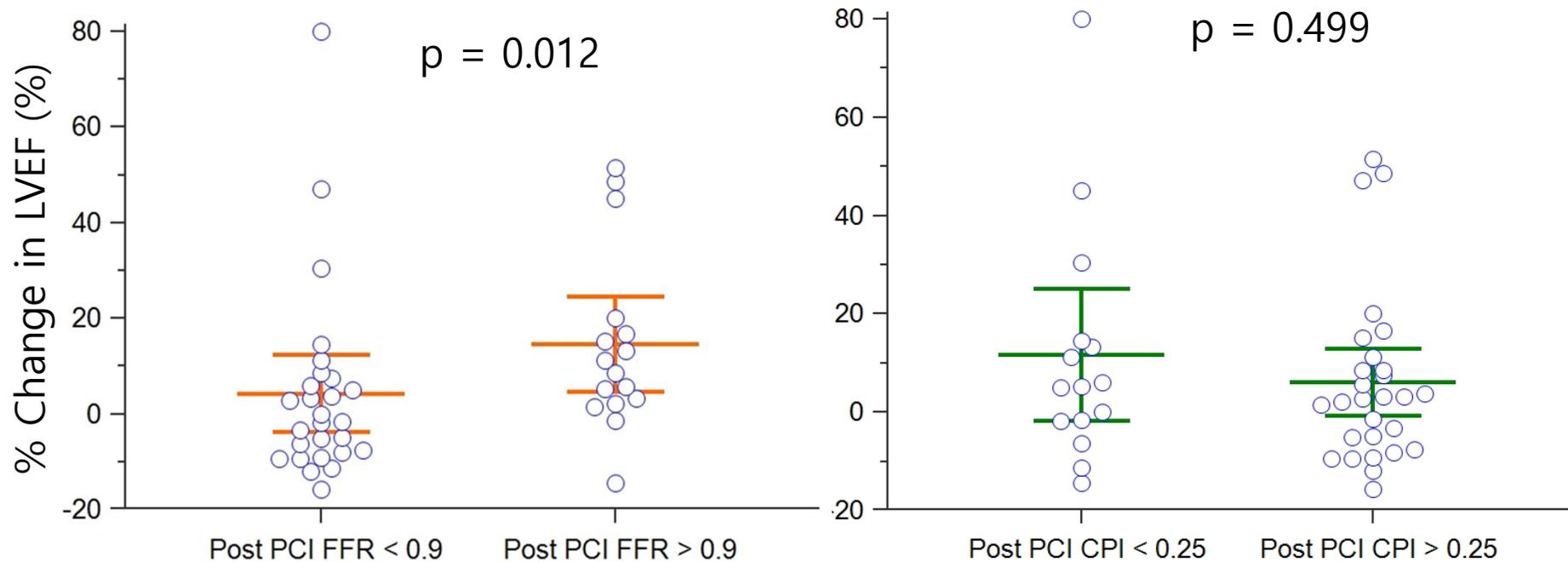


LV function after CTO PCI





Do good collateral circulations predict functional recovery?





Integration of coronary physiology in CTO PCI

Major Point #5

...

Collaterals are mandatory for a preserved LV function in CTOs, but they do not predict LV recovery

...

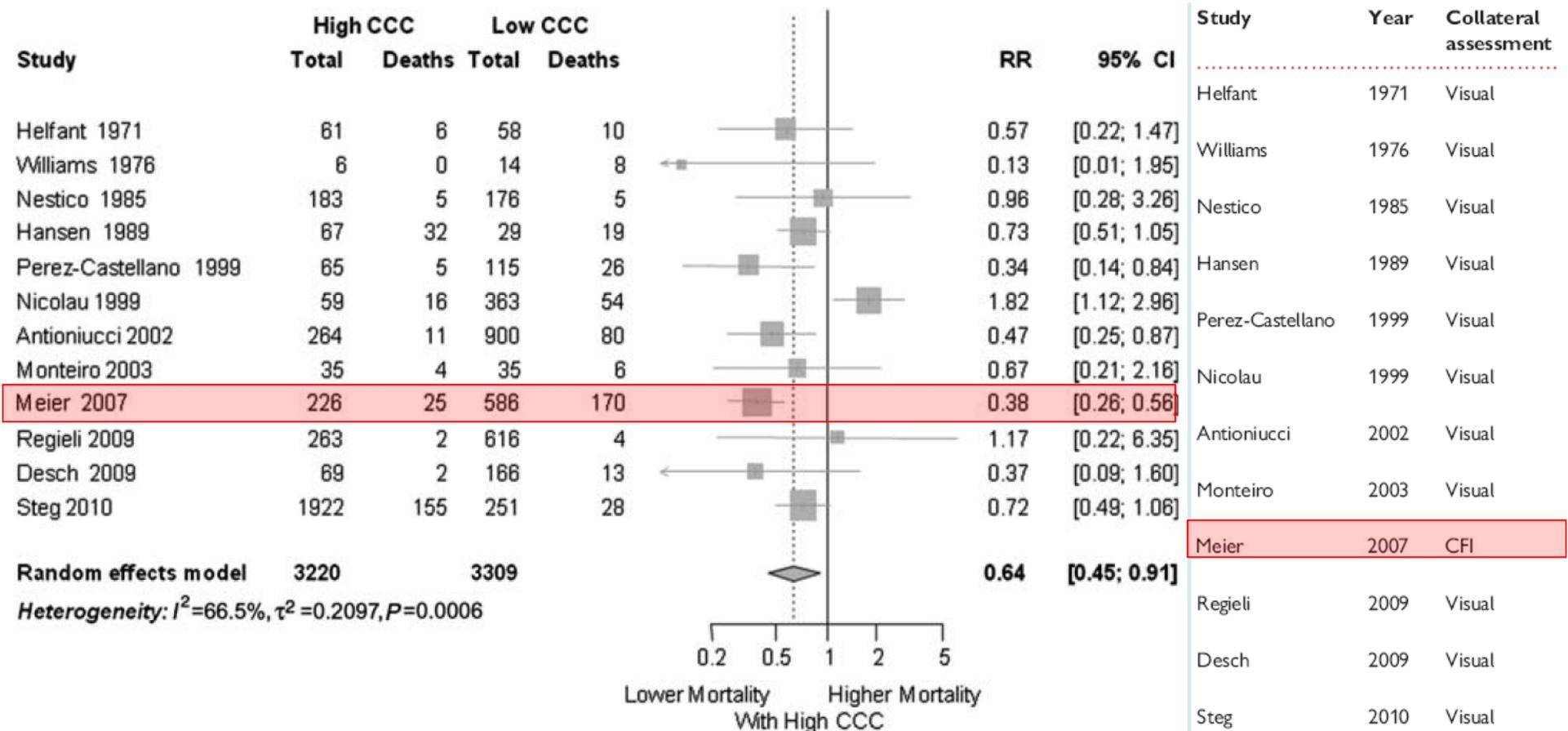


Clinical Concerns

- Collateral amount in CTO
- The time course of change in CTO
- Collateral function and prognosis
 - LV function
 - Clinical outcome



Meta-analysis (12 studies, n=6,529)





Integration of coronary physiology in CTO PCI

Major Point #6

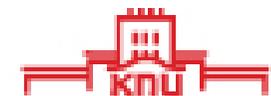
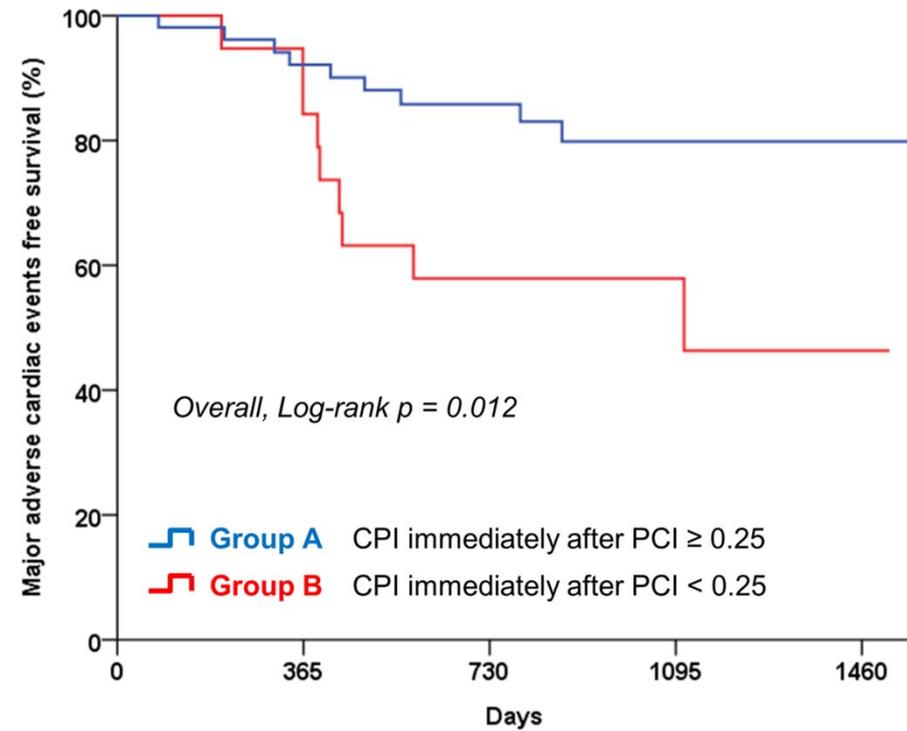
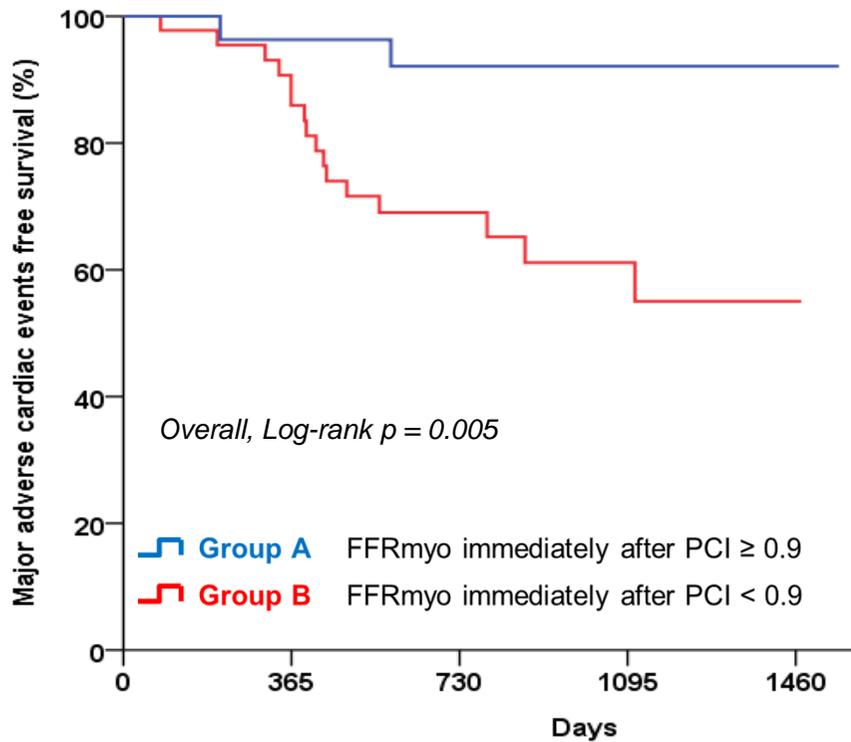
...

**Despite controversial, a well-functioning
collaterals minimize future cardiovascular
events and saves lives**

...

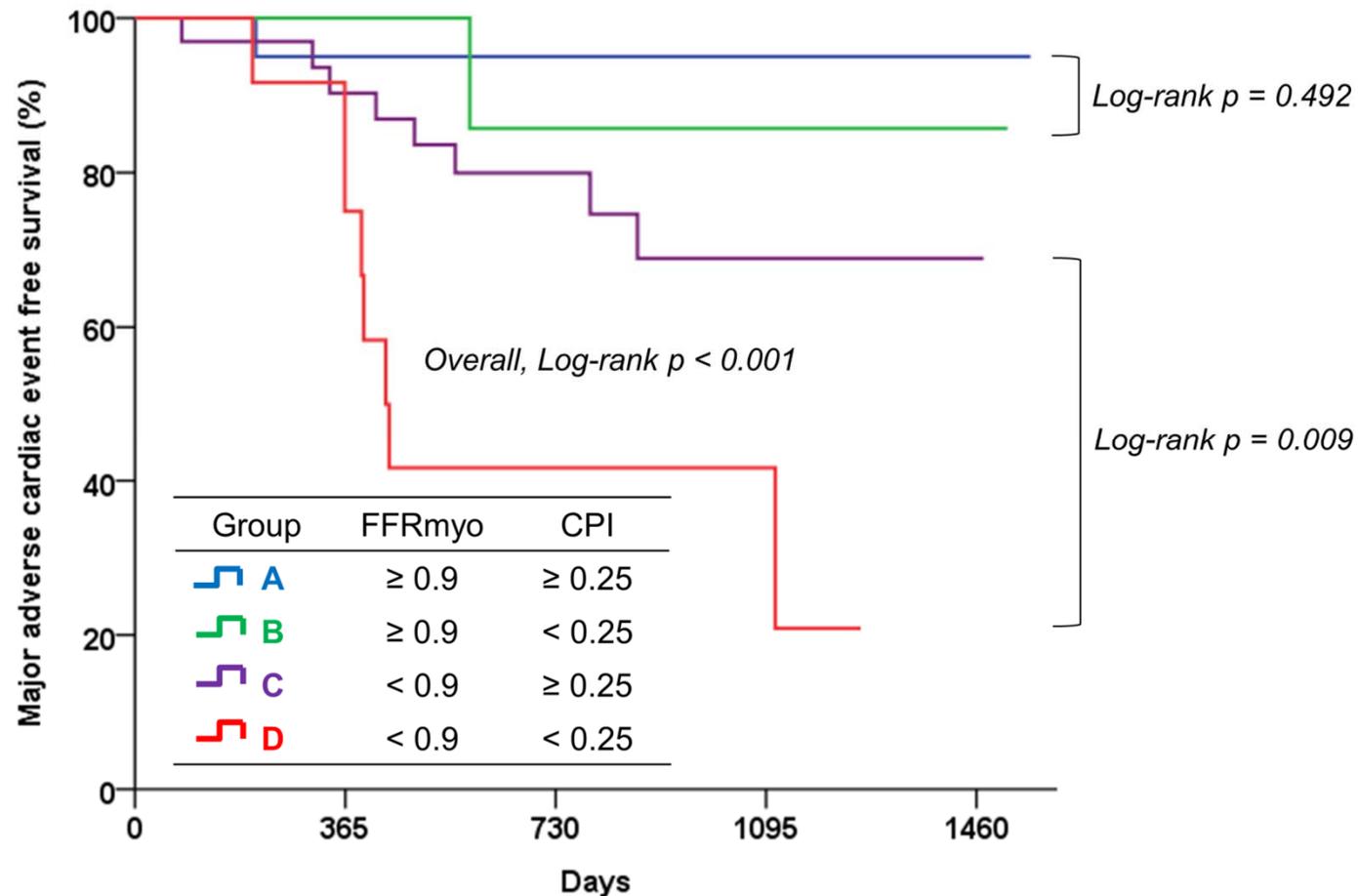


Cumulative MACE free survival rates

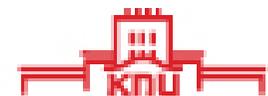




Cumulative MACE free survival rates



Major adverse cardiac events were defined as death, non-fatal myocardial infarction, rehospitalization for angina, and repeat revascularizations.





Integration of coronary physiology in CTO PCI

Major Point #7

...

**Good collateral function does not reach the
capacity of the open artery**

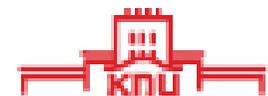
...





Take Home Message

- CTO patients have substantial ischemic burden despite a well-developed collateral circulation.
- The recruitable coronary collateral flow did not regress immediately after the PCI.
- Aggressive effort to reduce the ischemic burden should be tried to further improve the clinical outcome in CTOs.





Thank you for your attention!!



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