

Macro? or Micro? That is the question!

Fan Yongzhen . MD

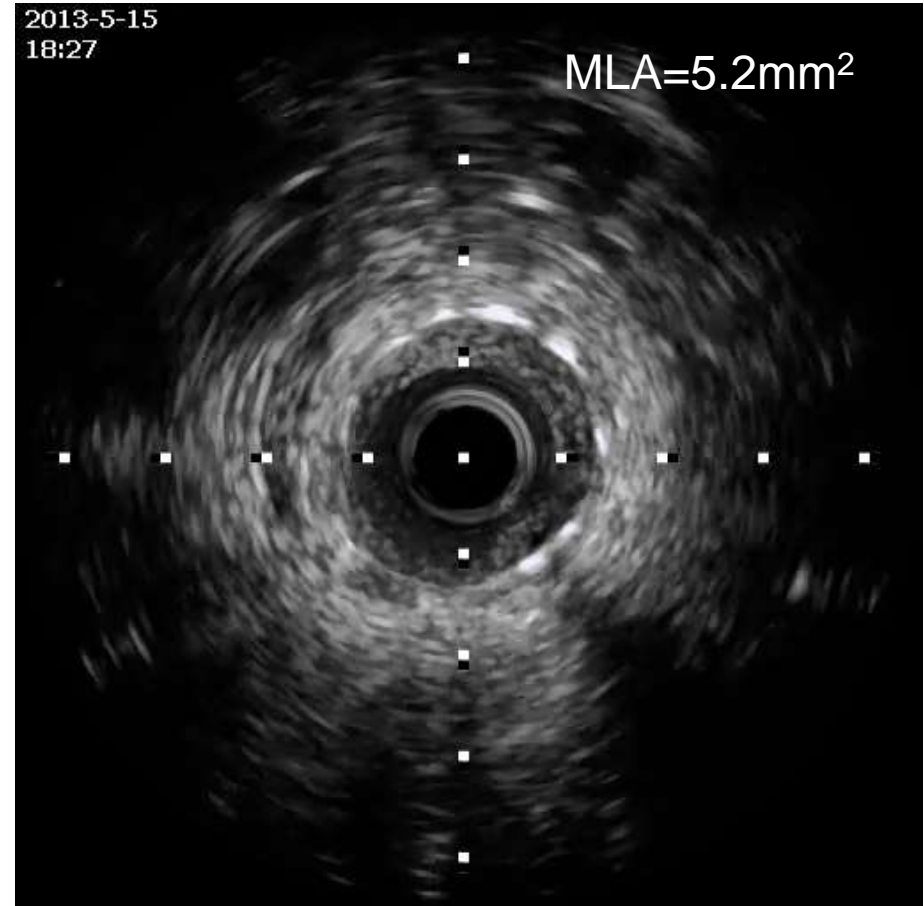
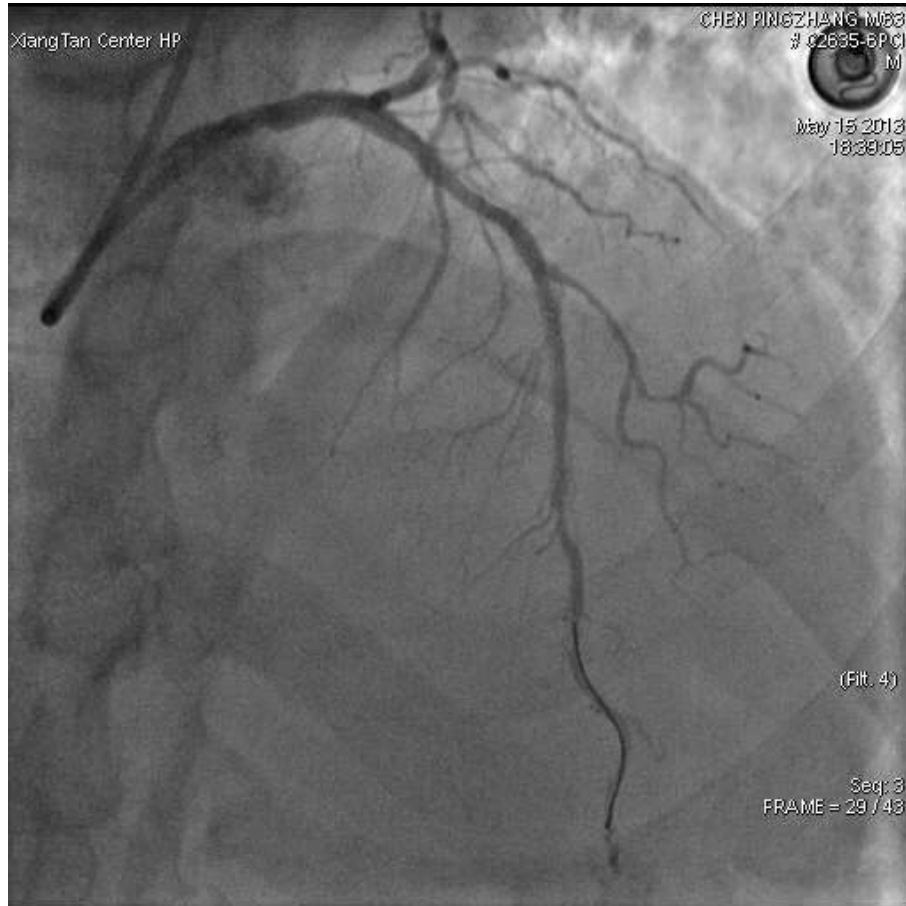
Xiangtan central hospital, China



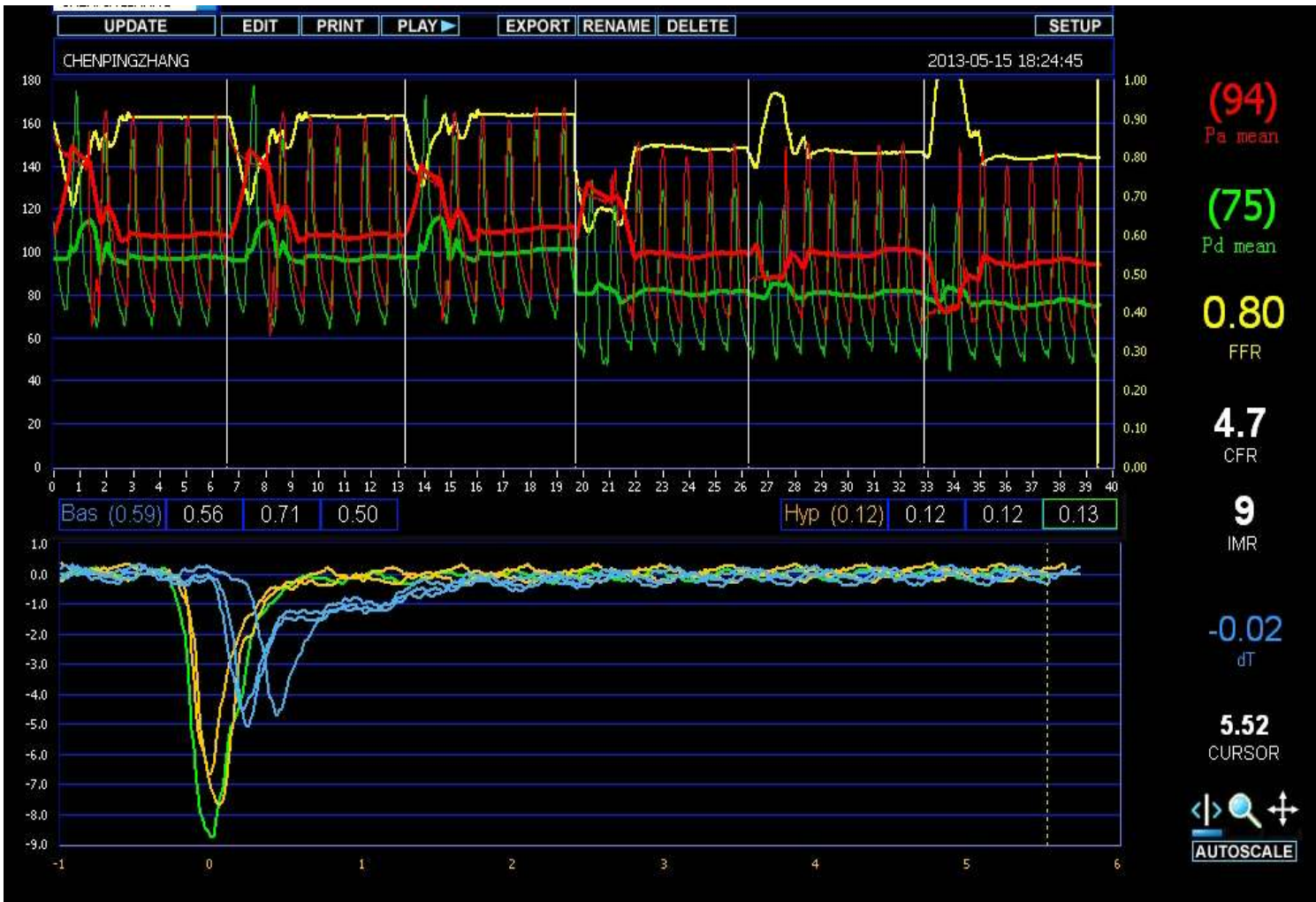
Brief History

- **Male, 60-year-old**
- **Chief complaint: Angina for 4 years, reoccur for 7 days, 2 stents were implanted in LAD 4 years ago.**
- **Risk factors: Hypertension for 10 years, Diabetes for 5years**
- **Labs:cTNT:0.15ng/ml**
- **ECG: II III aVF ST segment depression**
- **UCG: normal, LVEF 68%**
- **Diagnosis :Unstable angina**

LAD-CAG and IVUS



LAD-FFR and IMR

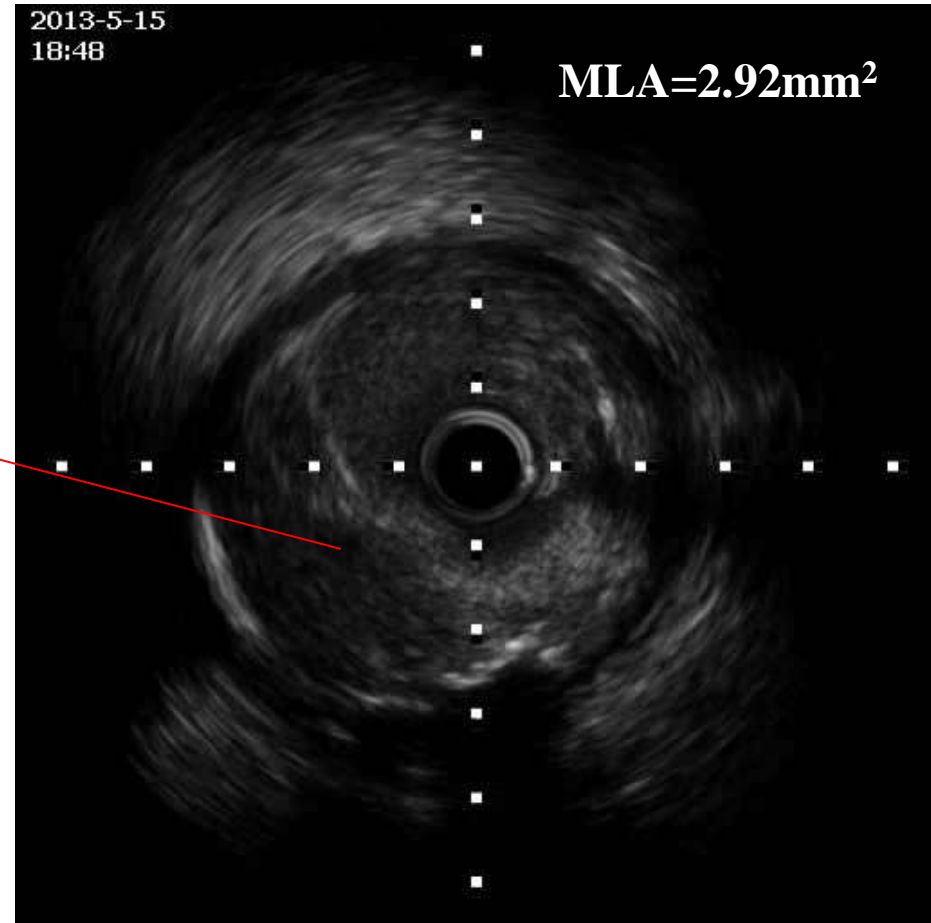
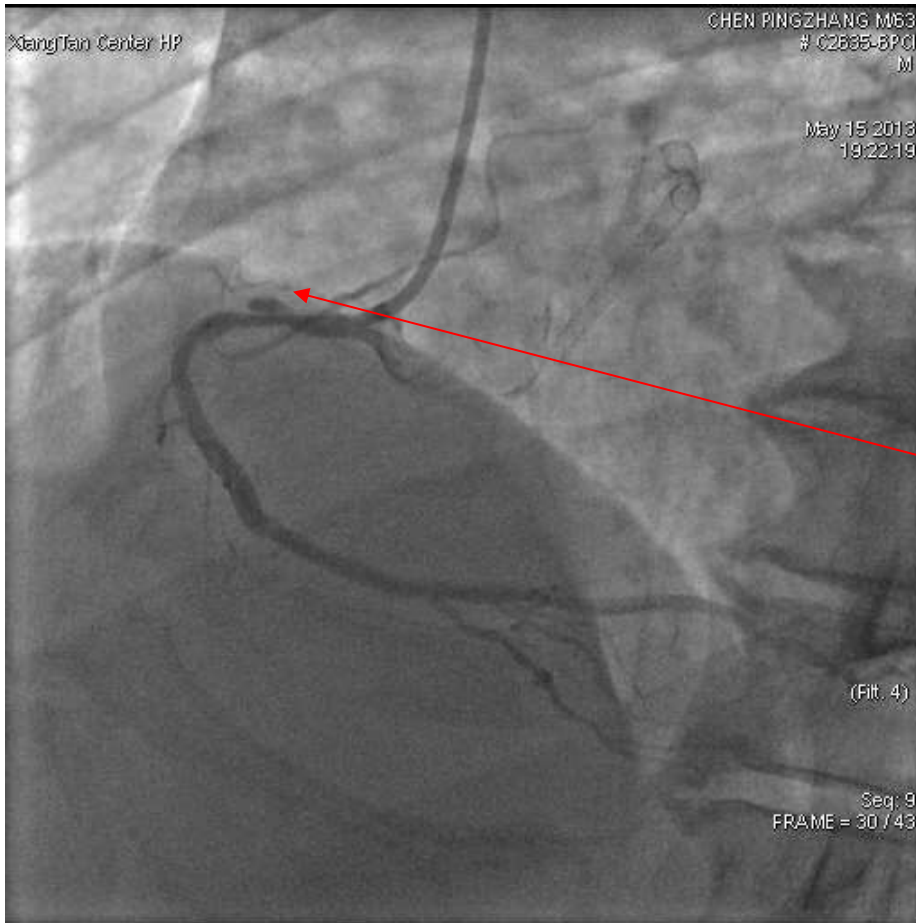


FFR=0.80

IMR=9

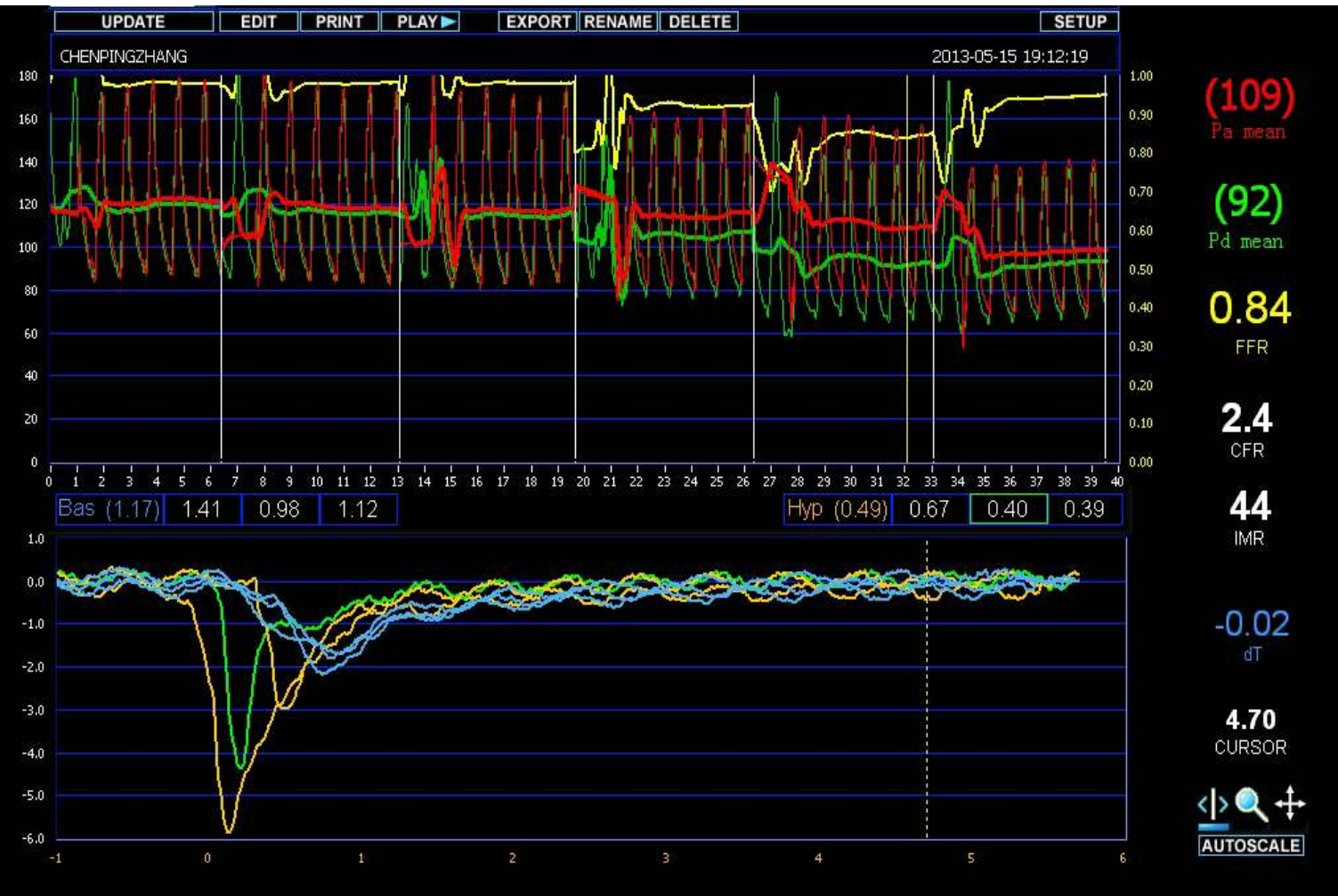
- Although FFR was not significant, it was interesting to note that FFR was 0.8 despite no significant angiographic stenosis

RCA pre-intervention



➤ **Dissection (plaque rupture) in the proximal RCA**

RCA pre-intervention



FFR=0.84

IMR=44

➤ Does microvascular dysfunction in RCA affect the accuracy of FFR?

What did you learn? What will you do?

- **FFR=0.84, Does not the anatomical significance of proximal RCA lesion represent functional hemodynamic significance ?**
- **IMR=44, Microvascular dysfunction in RCA?**
- **Was the index of microcirculatory resistance (IMR) overestimated by the epicardial stenosis ?**
- **Or microvascular dysfunction(or injury) in RCA affect the accuracy of FFR?**

RCA pre-intervention



FFR=0.84

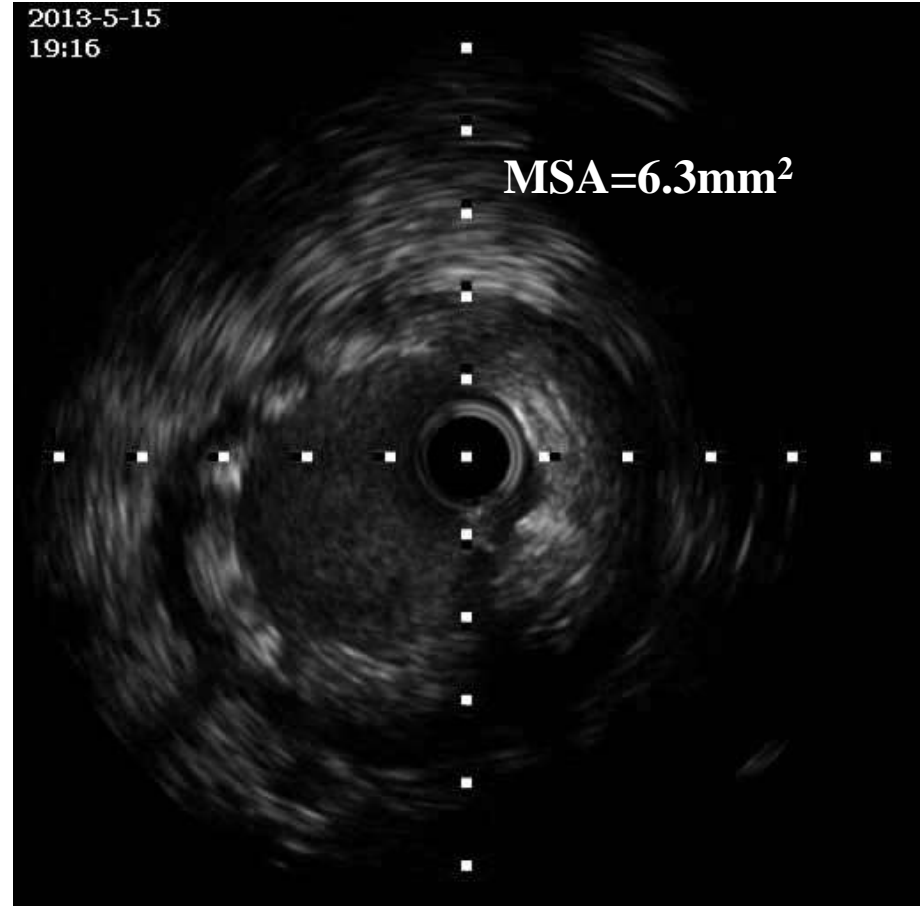
IMR=44

- When the pressure tracings of hyperemic period are carefully inspected, it can be noticed that the hyperemia is not stable. Therefore, true FFR can also be lower than 0.84.

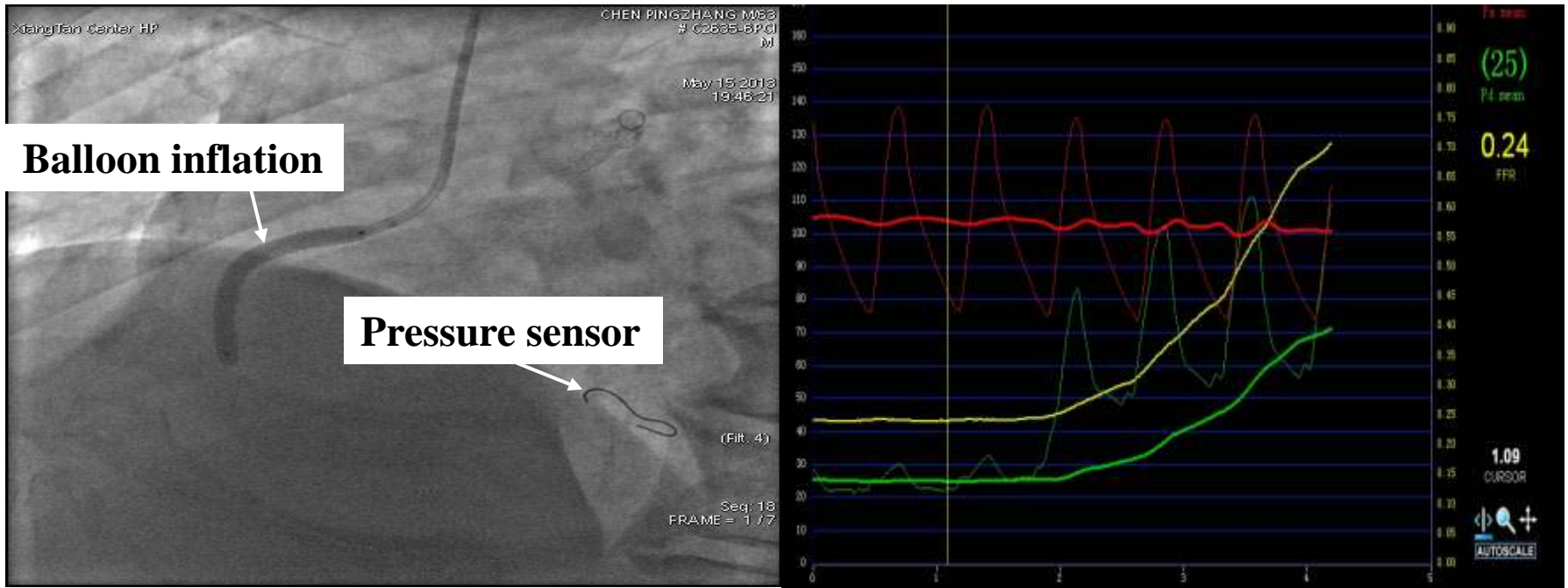
The strategy of RCA

- Because of the significant symptoms of angina and the objective evidence of ischemia, influence of microvascular dysfunction, and the possibility of submaximal hyperemia, FFR may underestimate the lesion severity.
- For the reasons above, Our team decided to do PCI for the lesion in proximal RCA.

Final Result

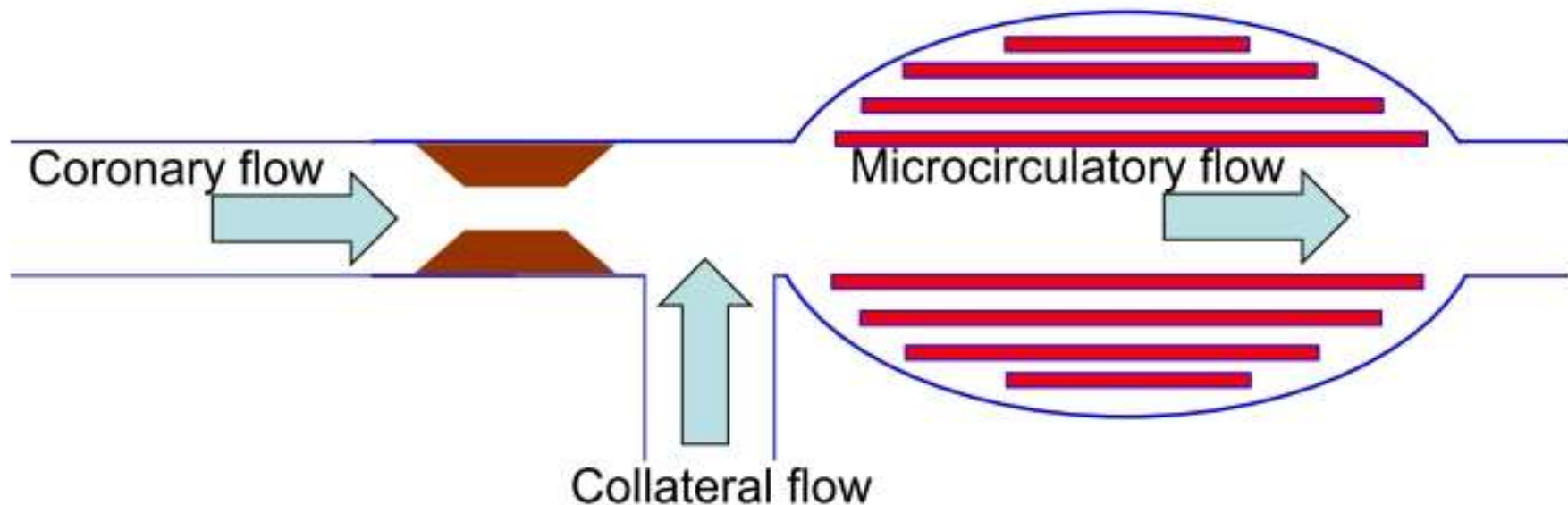


Calculation of IMR in the presence of Severe Epicardial Stenosis Requires Wedge pressure measurement



➤ **Wedge pressure can only be calculated by performing balloon inflation in the presence of significant epicardial stenosis**

IMR Calculation Requires Pw Measurement in the Presence of Epicardial Stenosis

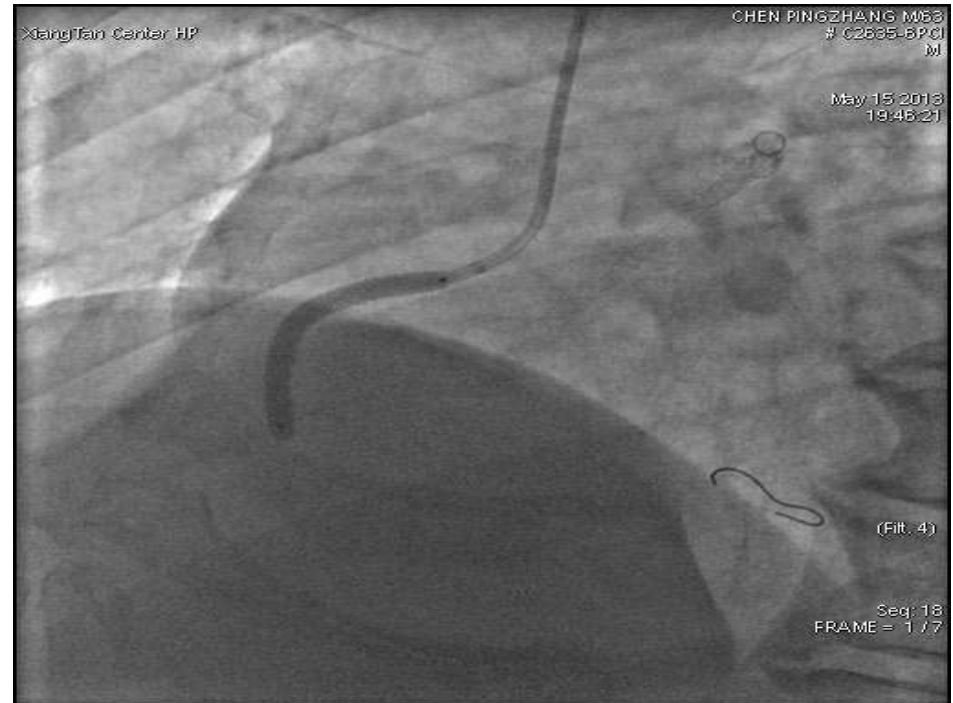
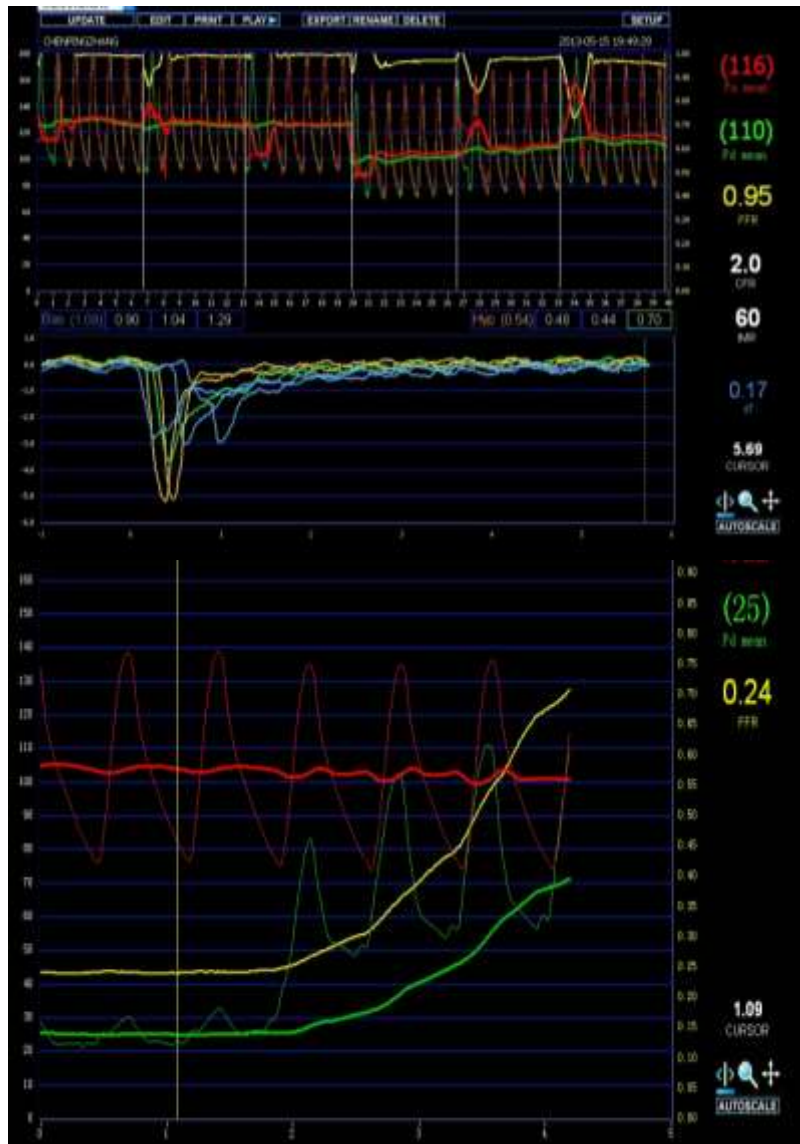


IMR corrected for collateral flow:

$$Pa \times Tmn \times \frac{Pd - Pw}{Pa - Pw}$$

Aarnoudse et al. *Circulation* 2004
Fearon et al. *Circulation* 2004

Post Intervention



Pa=116 Pd=110 Pw=25 Tmn=0.49

TMR of pre PCI=Pa × Tmn × (Pd-Pw/Pa-Pw)=43

FFR=0.95

Follow up

- Dual antiplatelet and Nicorandil
- No symptom of angina for half a year's follow-up.
- ECG:II III aVF ST segment was normal

Discussion for the case

- Epicardial stenosis severity affects and overestimates index of microcirculatory resistance (IMR) ,does not affect True Microcirculatory Resistance (TMR)
- Microvascular dysfunction and submaximal hyperemia in RCA may affect the accuracy of FFR, high FFR may not always guarantee excellent coronary flow.
- There can be pitfalls in FFR and IMR measurements, even in every modality.

Take home message

- The discordance of CAG, IVUS and FFR,IMR is not a matter of right or wrong
- It is important that we should adequately understand the basic principles, limitations and pitfalls of each modality to make an appropriate strategy for the treatment CAD
- The decision to perform revascularization should integrate anatomical information with functional information that provide objective proof of ischemia