Complex PCI 2019

Case Presentation III

Role of Optical Coherence Tomography in Primary Percutaneous Coronary Intervention

29th November 2019

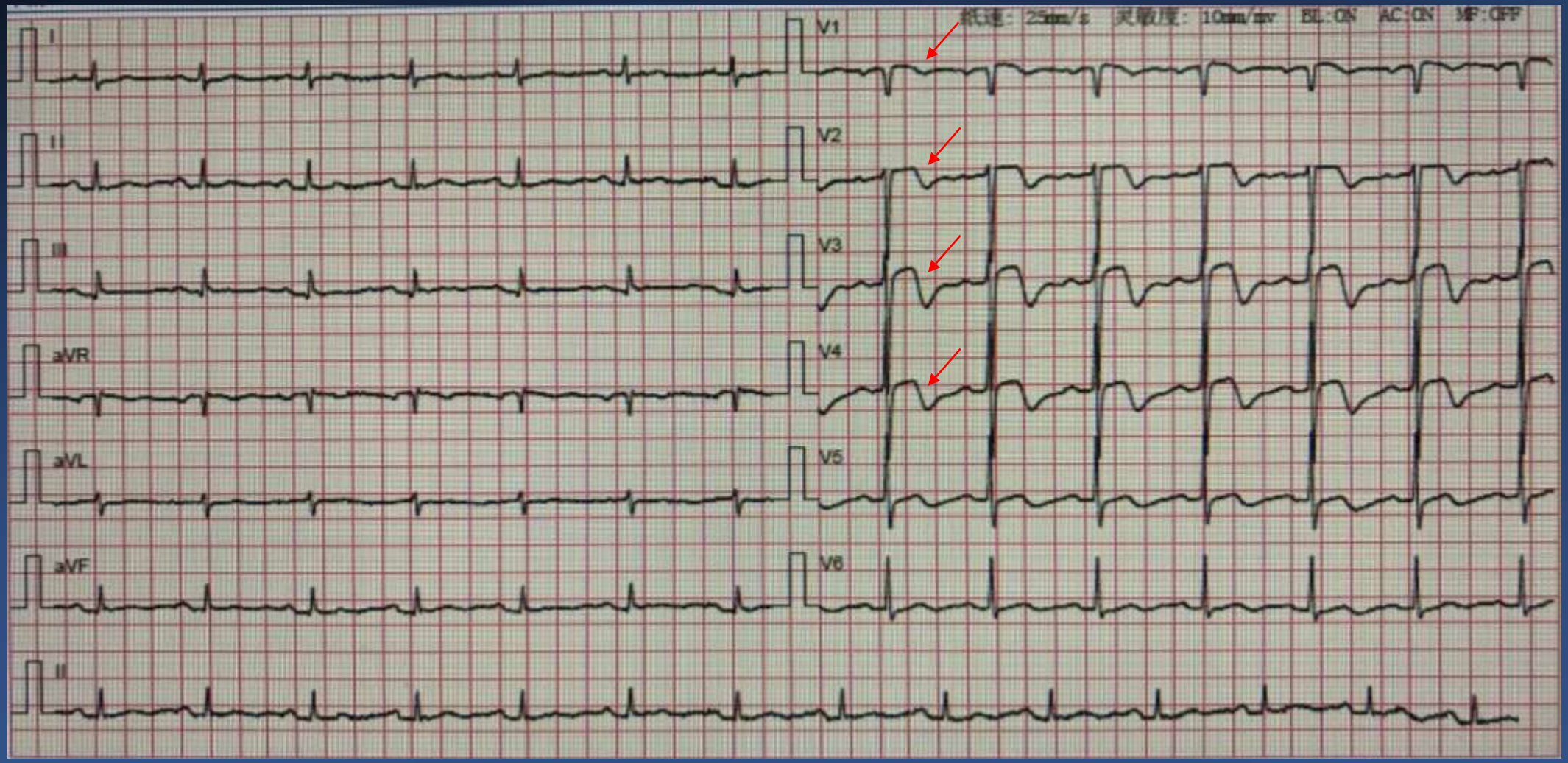
Dr. Jacky, Kit Chan

Consultant Cardiologist

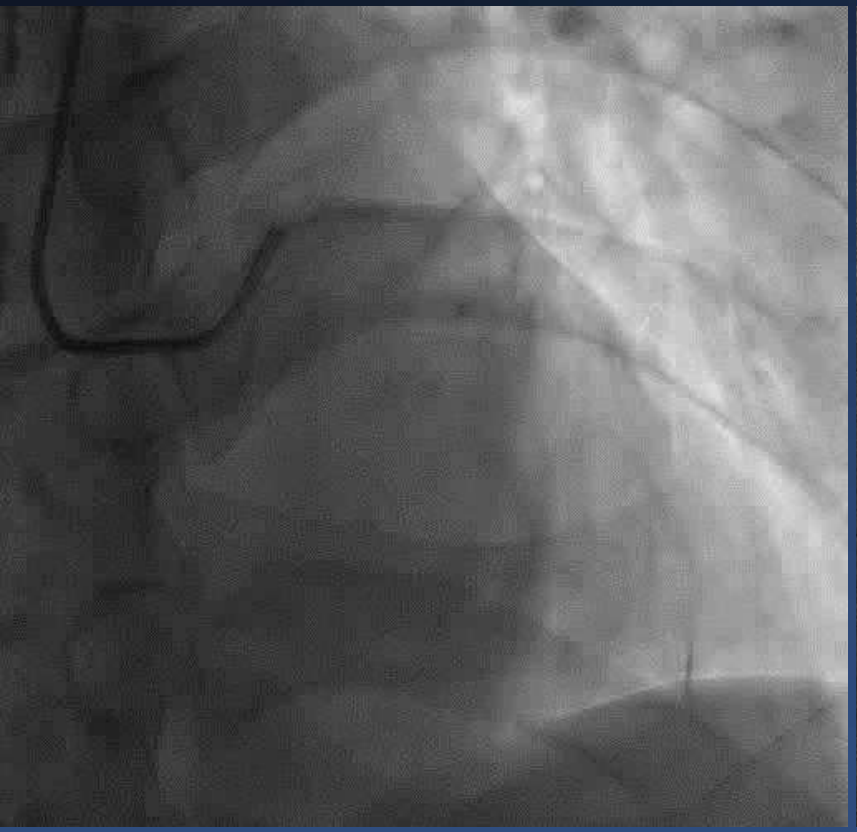
The University of Hong Kong Shenzhen Hospital

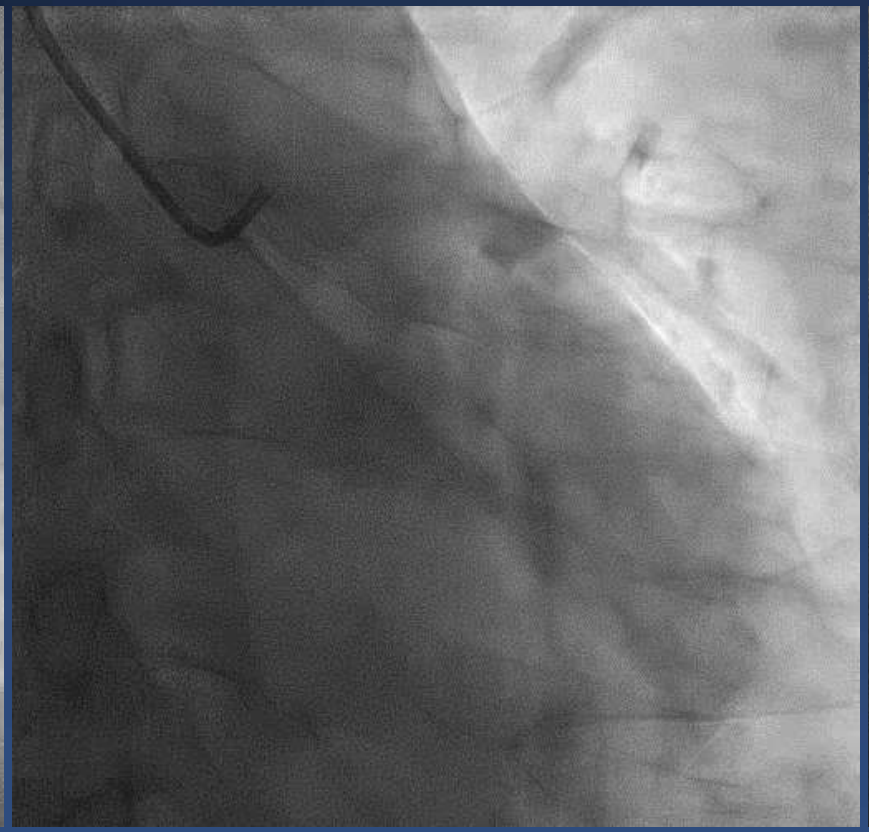
Case History

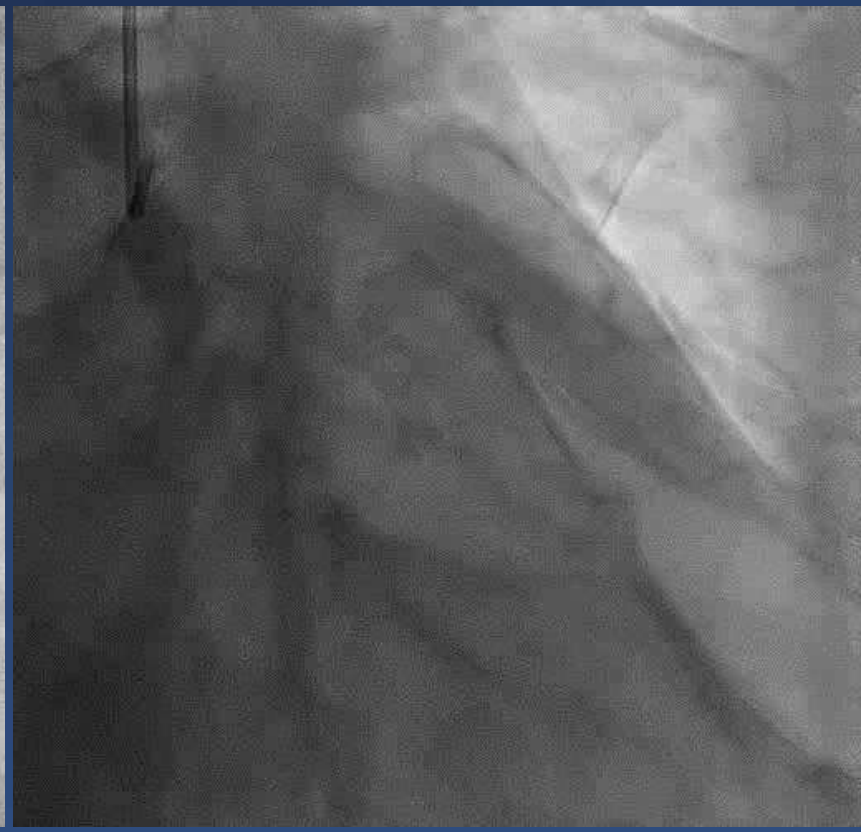
- M/65. Heavy smoker. Good past health. No other CAD risk factors.
- Admitted for chest pain for 2 days. ECG: STE / TWI V1-4.
- Echo: Normal. Troponin T 0.623ng/ml (NR: 0-0.014ng/ml). LDL 2.00mmol/L. FG: 5.57mmol/L.



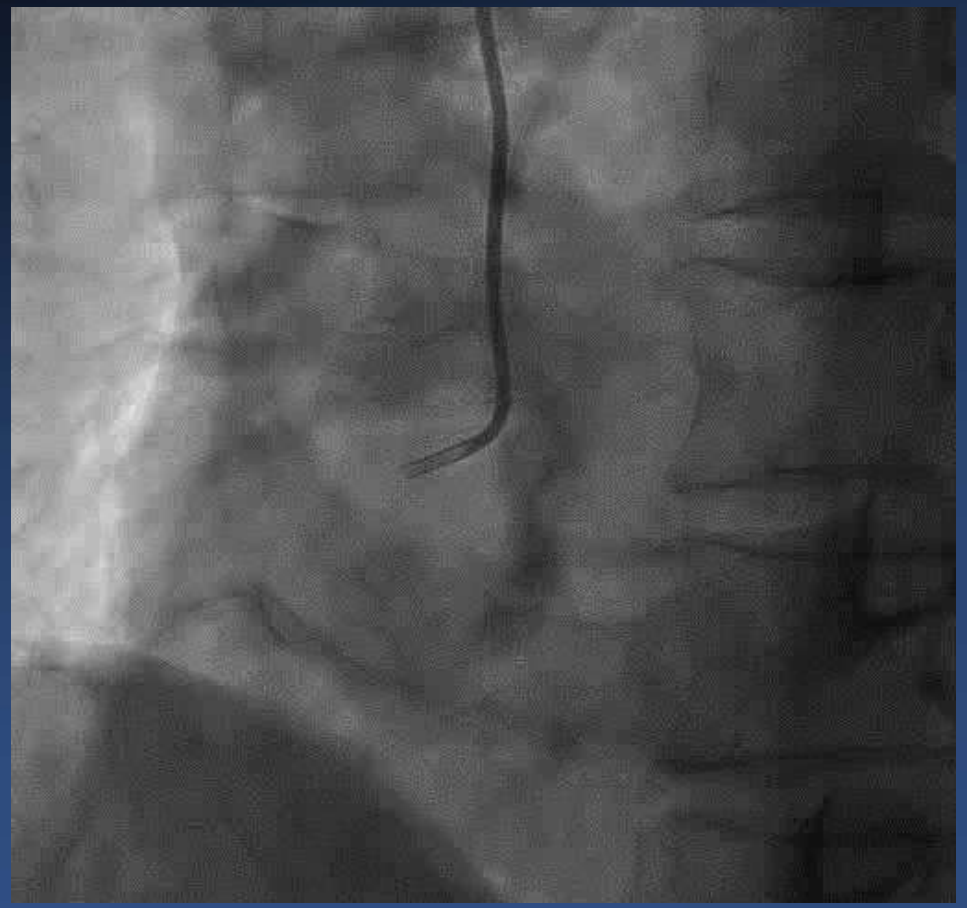
Coronary Angiogram

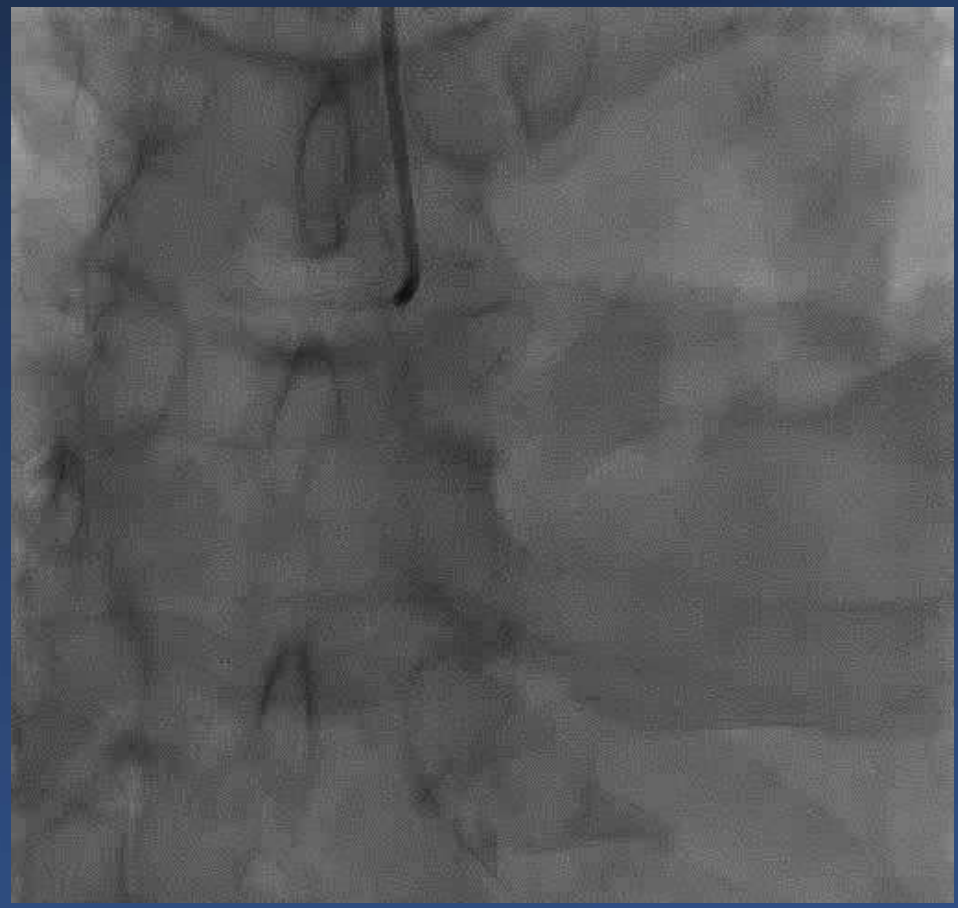






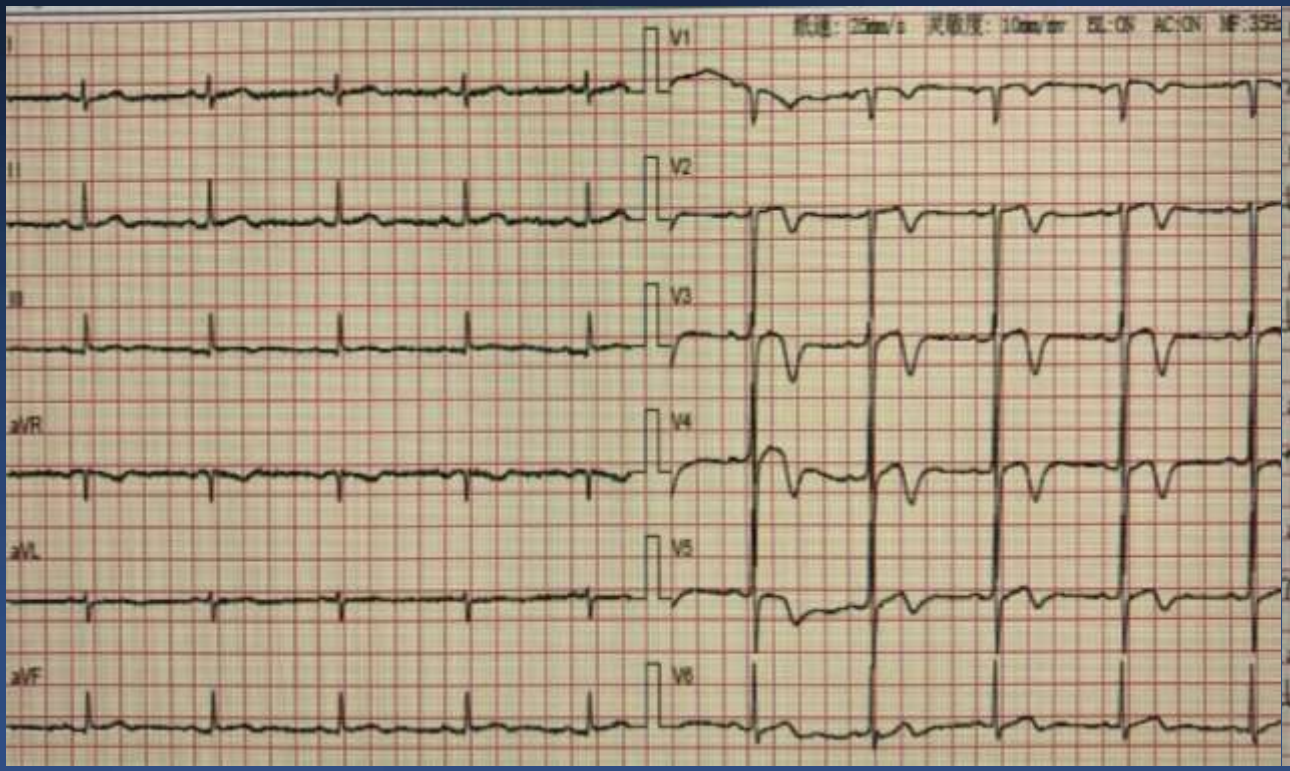
Coronary Angiogram



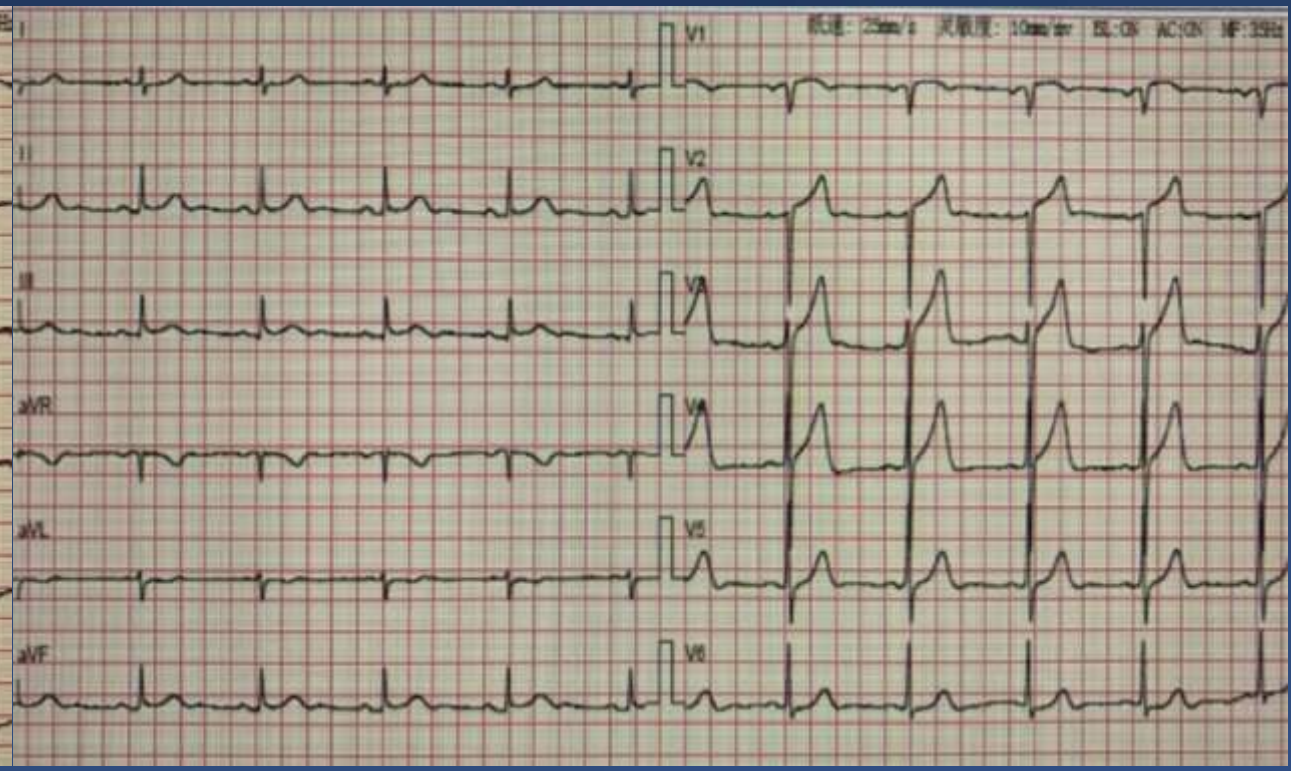


MINOCA ? Coronary Spasm ?

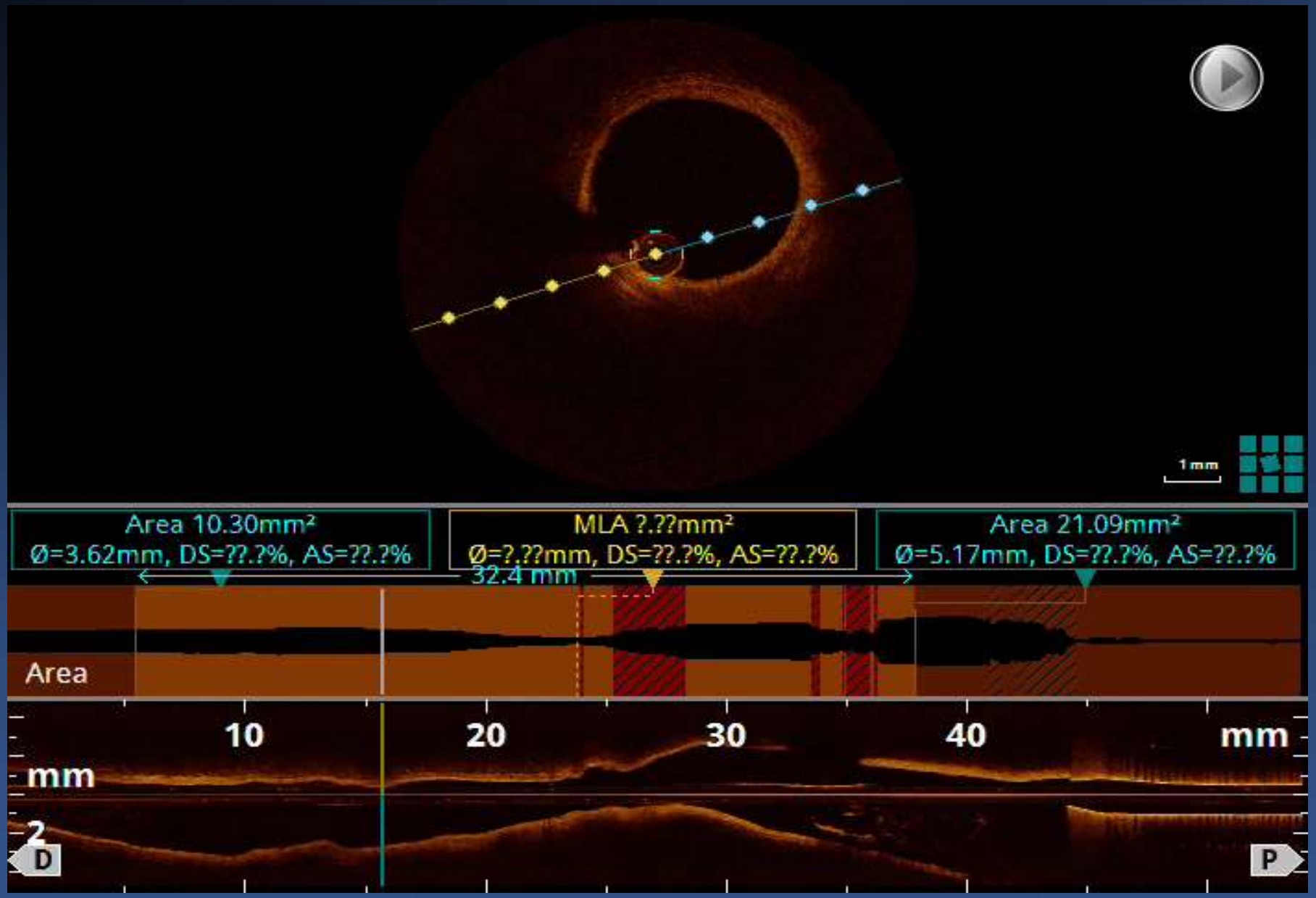
No chest pain



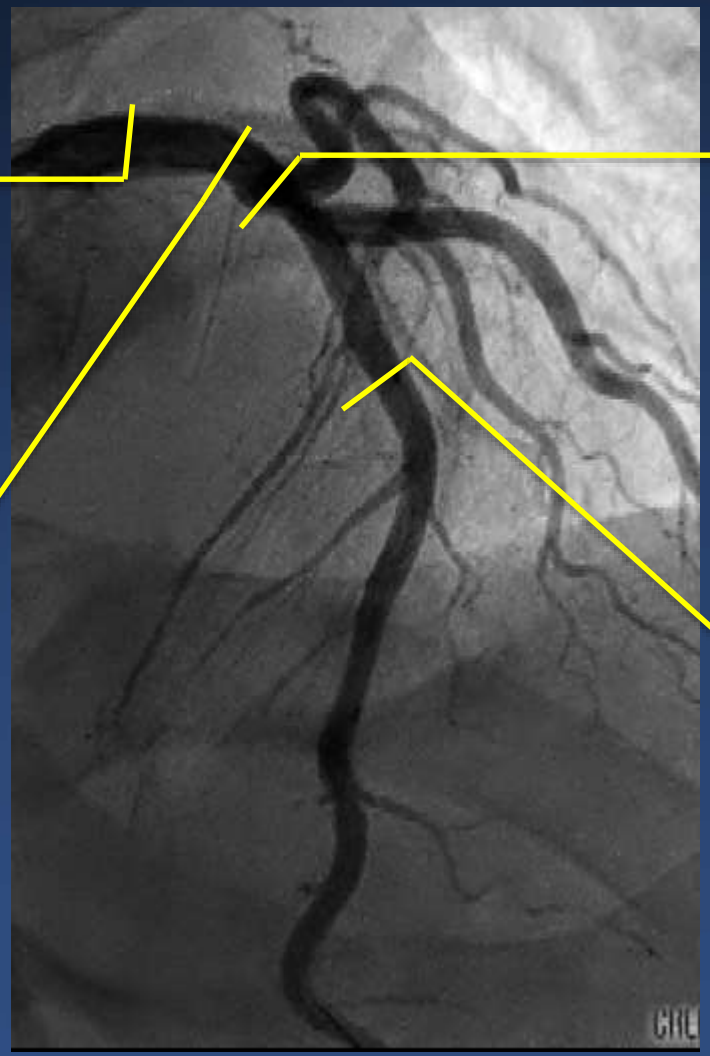
Recurrent chest pain

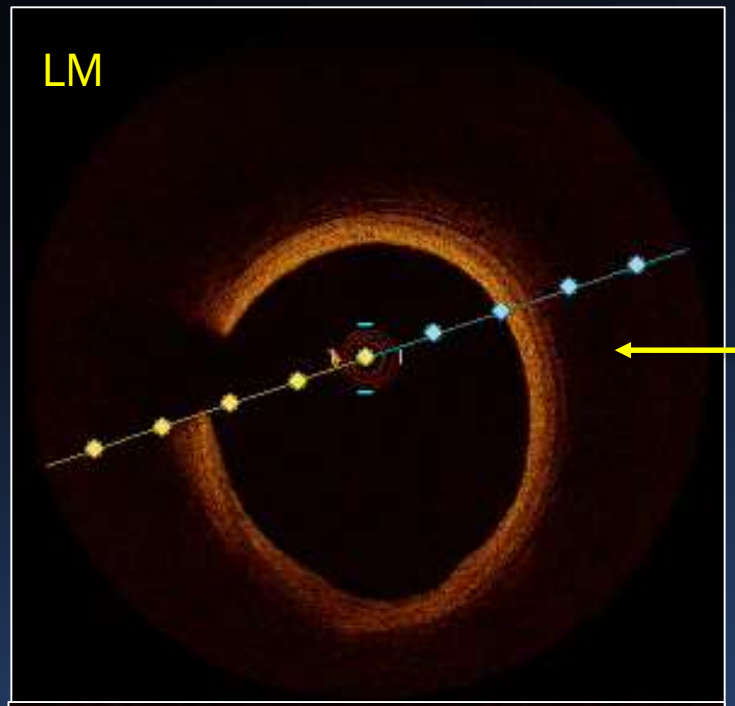


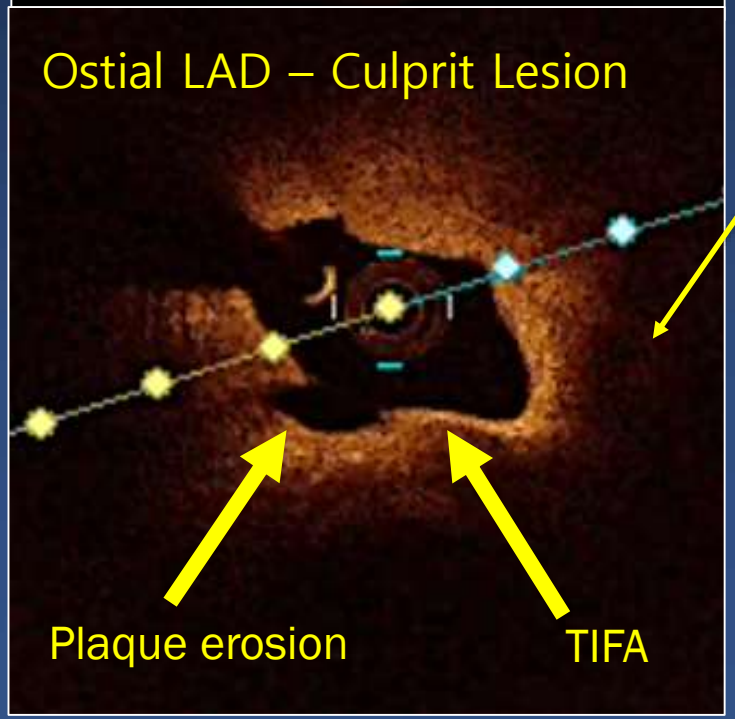
OCT – LAD to LM

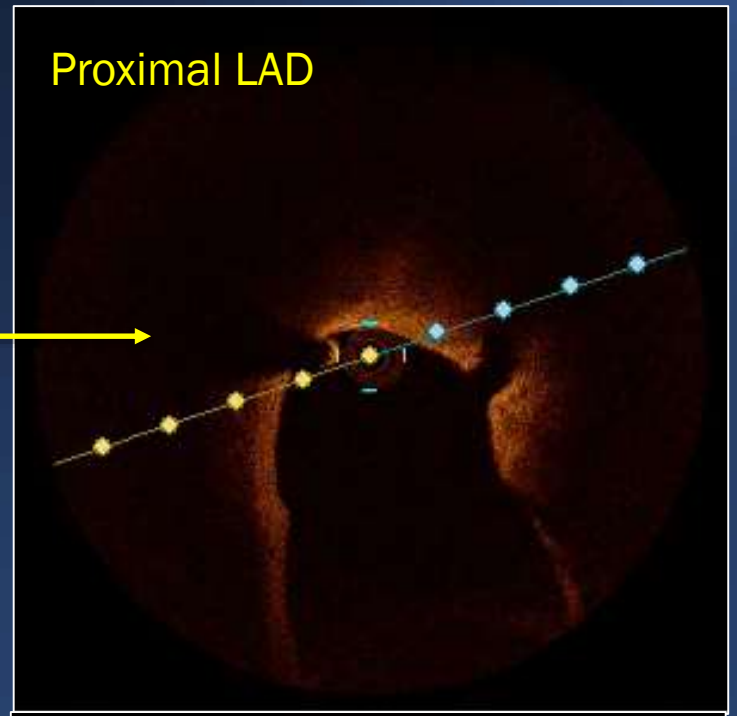

1 mm
Area 10.30mm²
Ø=3.62mm, DS=??.?%, AS=??.?%
MLA ?.??mm²
Ø=?.??mm, DS=??.?%, AS=??.?%
Area 21.09mm²
Ø=5.17mm, DS=??.?%, AS=??.?%
32.4 mm
Area
10
20
30
40
mm
mm
2
D
P

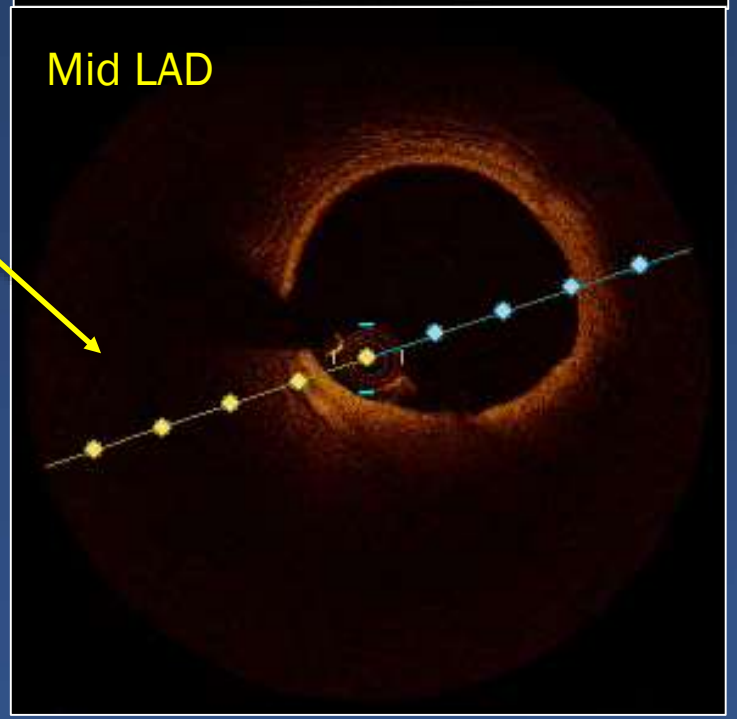
OCT – LAD to LM



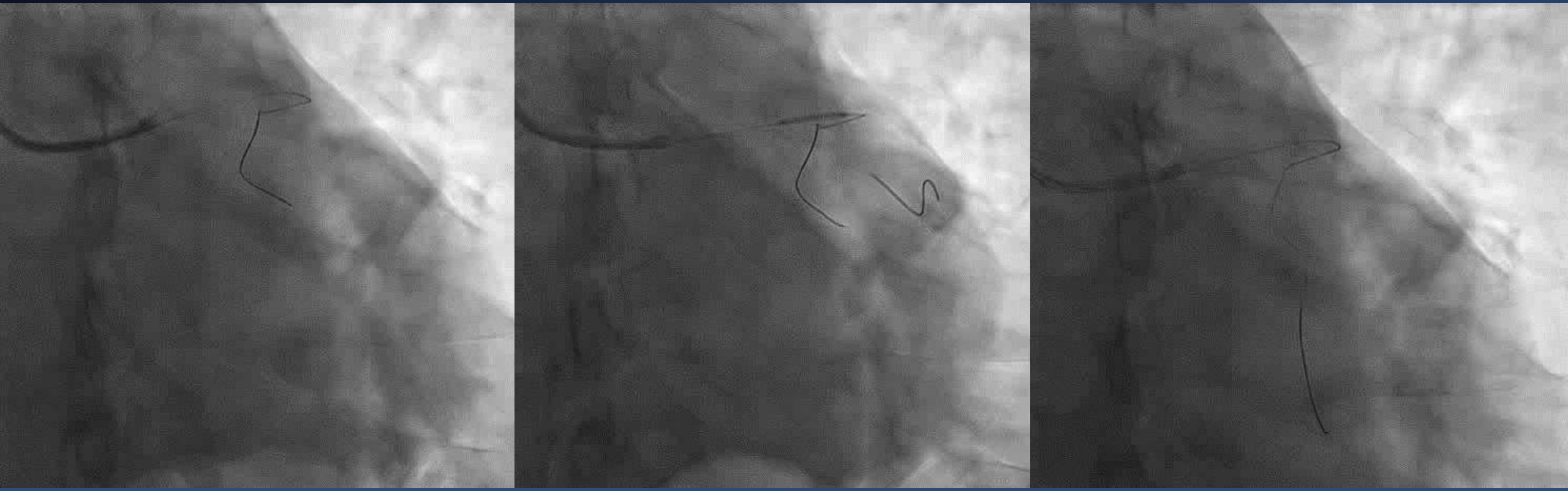

LM


Ostial LAD – Culprit Lesion
Plaque erosion
TIFA


Proximal LAD

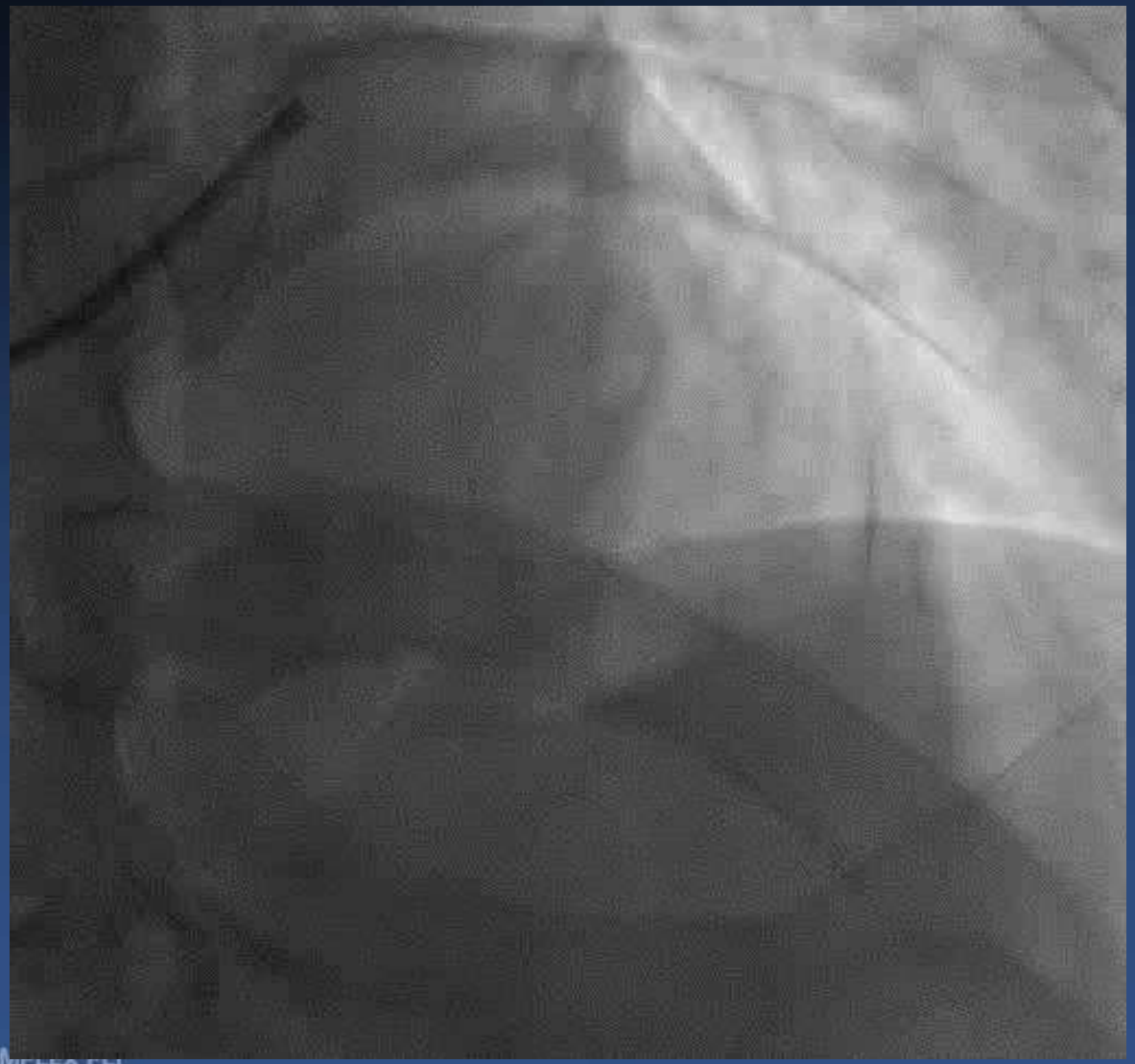

Mid LAD

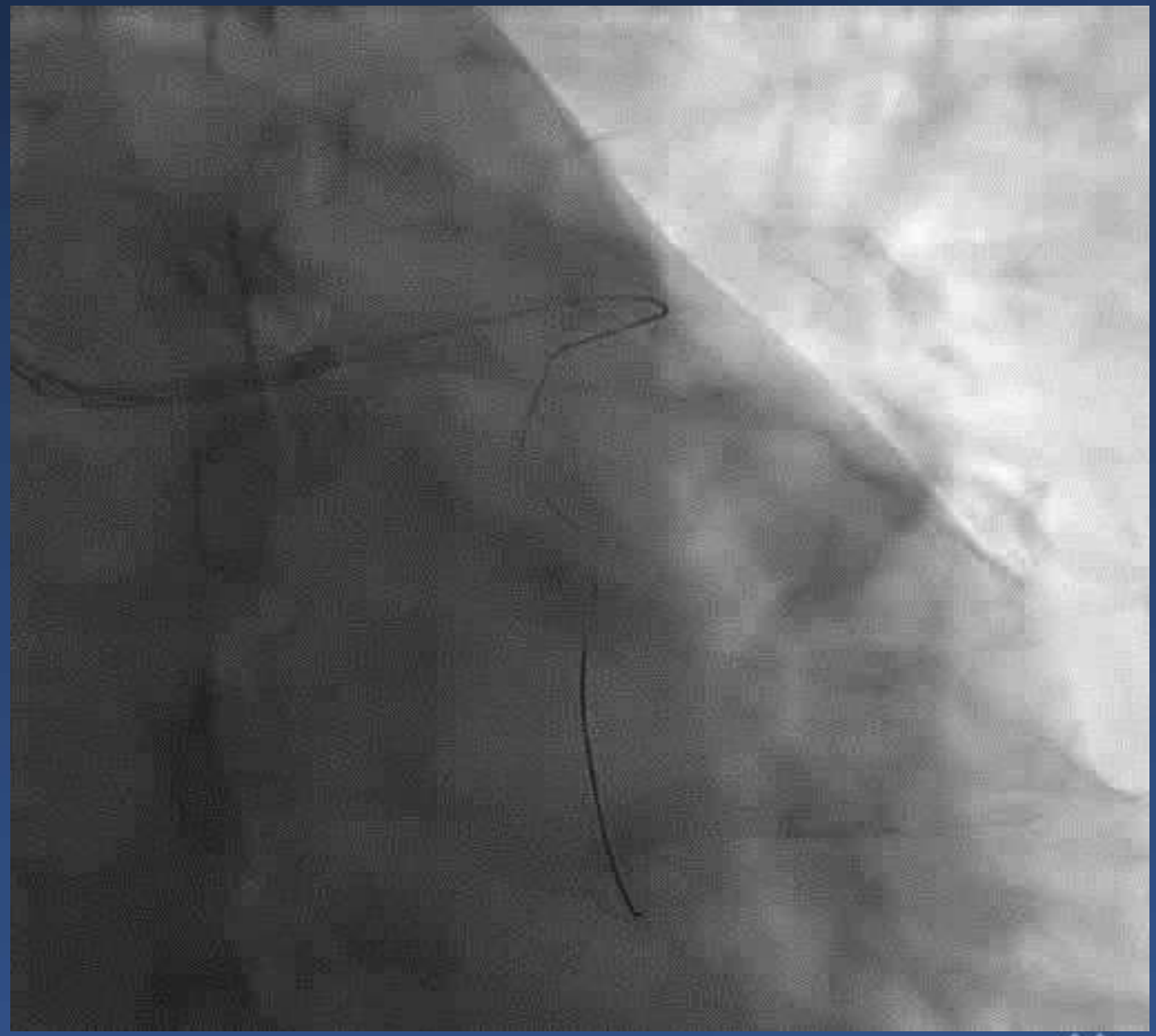
PCI to Ostial - Proximal LAD



GC: 6F EBU3.5 / GW: Runthrough & Sion / Stent: Xience Xpedition 3.5*18mm / Balloon: NCsprinter3.5*9mm

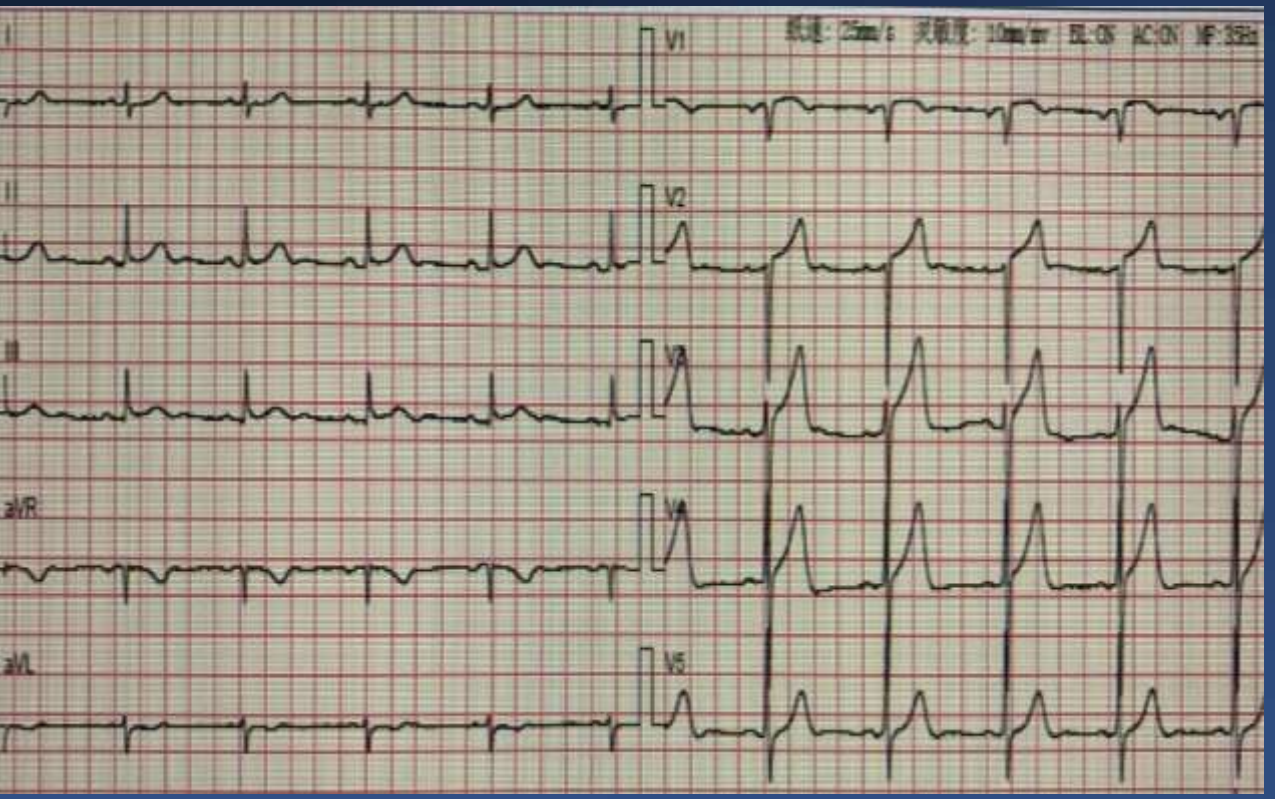
Final Angiography



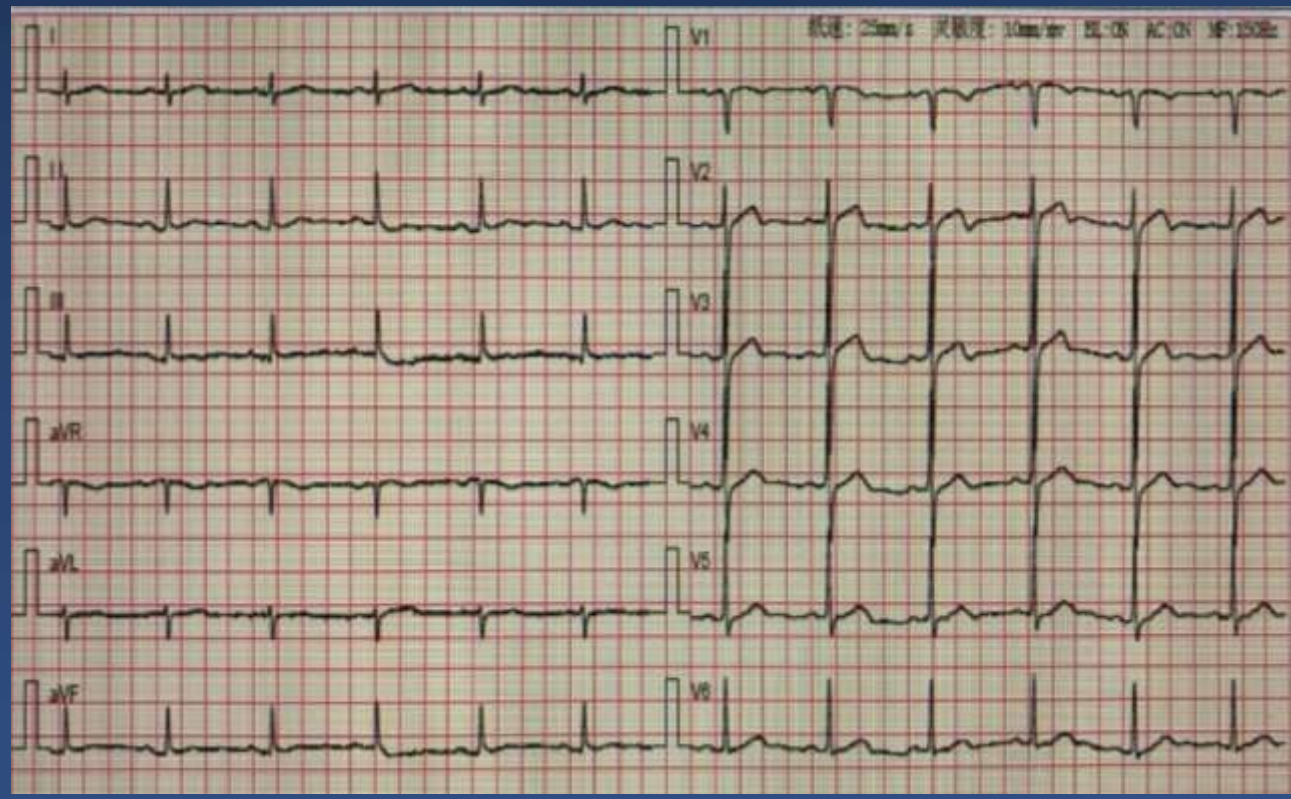


Final ECG

Pre PCI ECG during chest pain



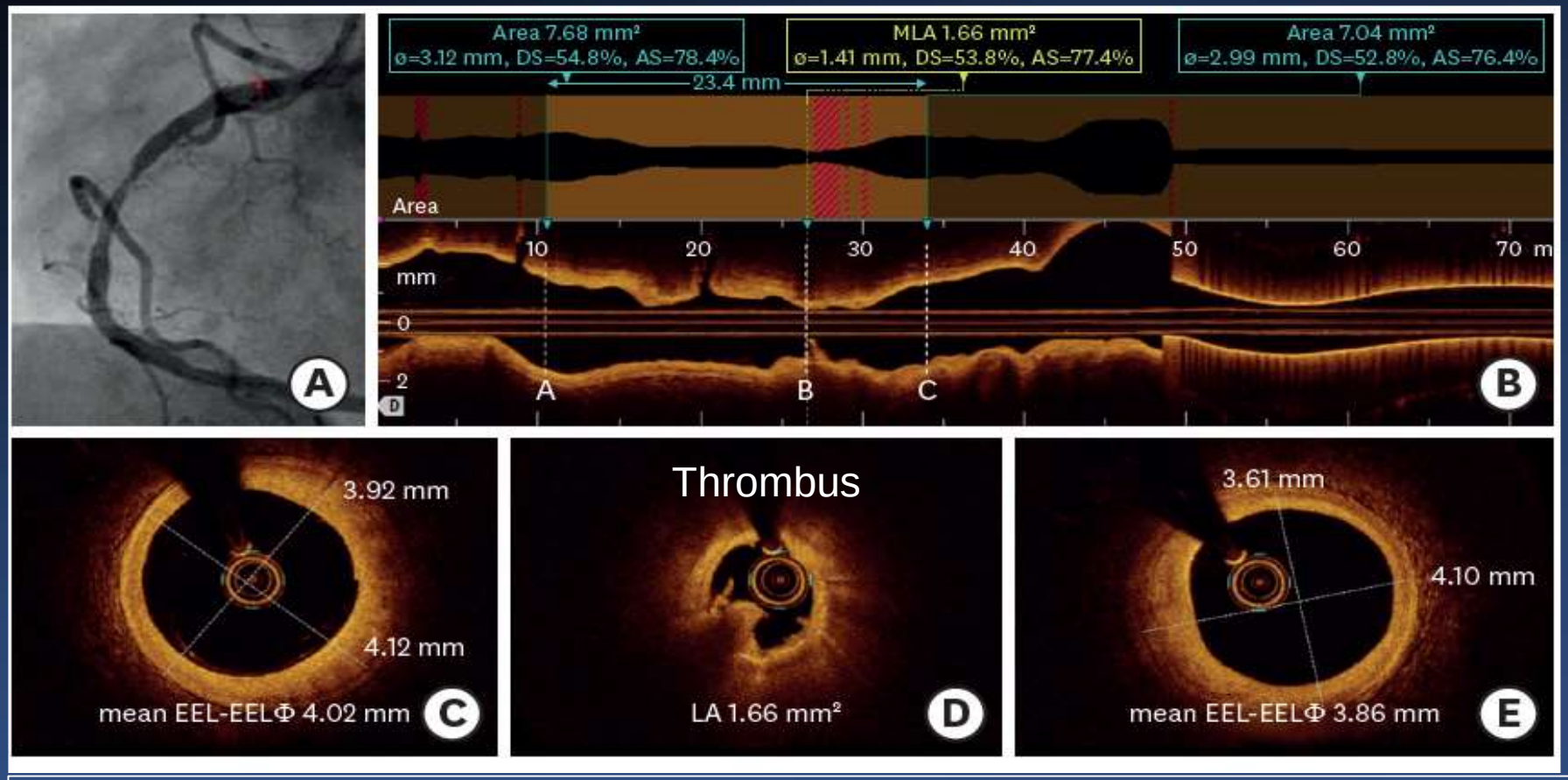
Post PCI ECG – No chest pain

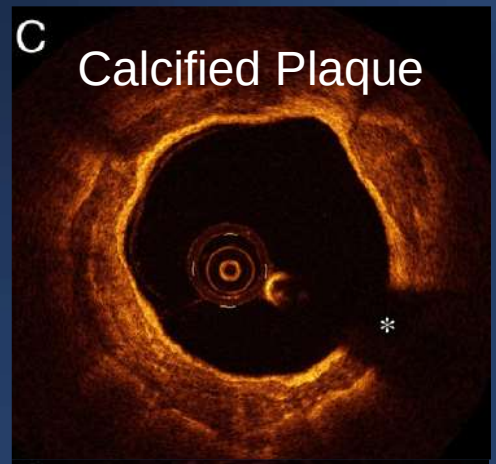


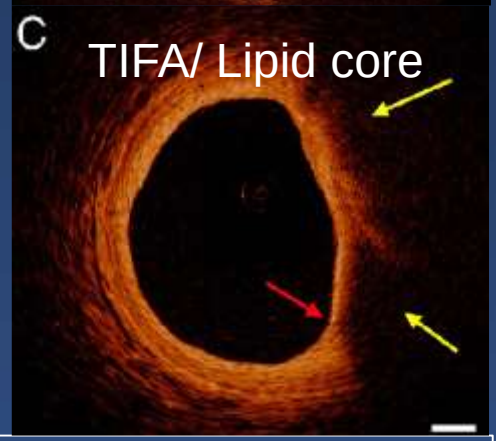
Roles of OCT in Primary PCI

Pre-PCI	During PCI	Post-PCI
Procedural planning	Stent Deployment & Optimization	Complication & Post procedural assessment
Plaque morphology (e.g. Calcium / TIFA / Thrombus load) Reference lumen diameter / stent sizing / length	Optimizing Landing zone Stent expansion	Stent apposition Stent expansion/ MSA Stent edge dissection Tissue protrusion

Pre-PCI Lesion Assessment



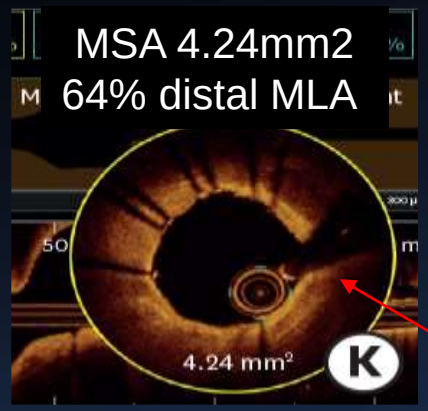


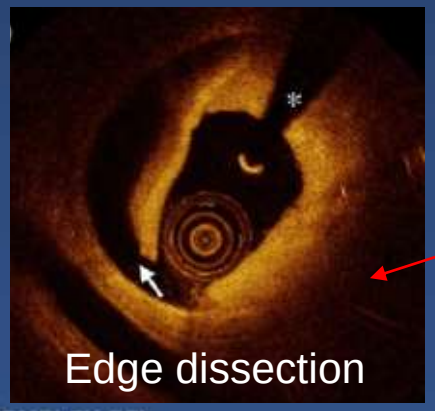


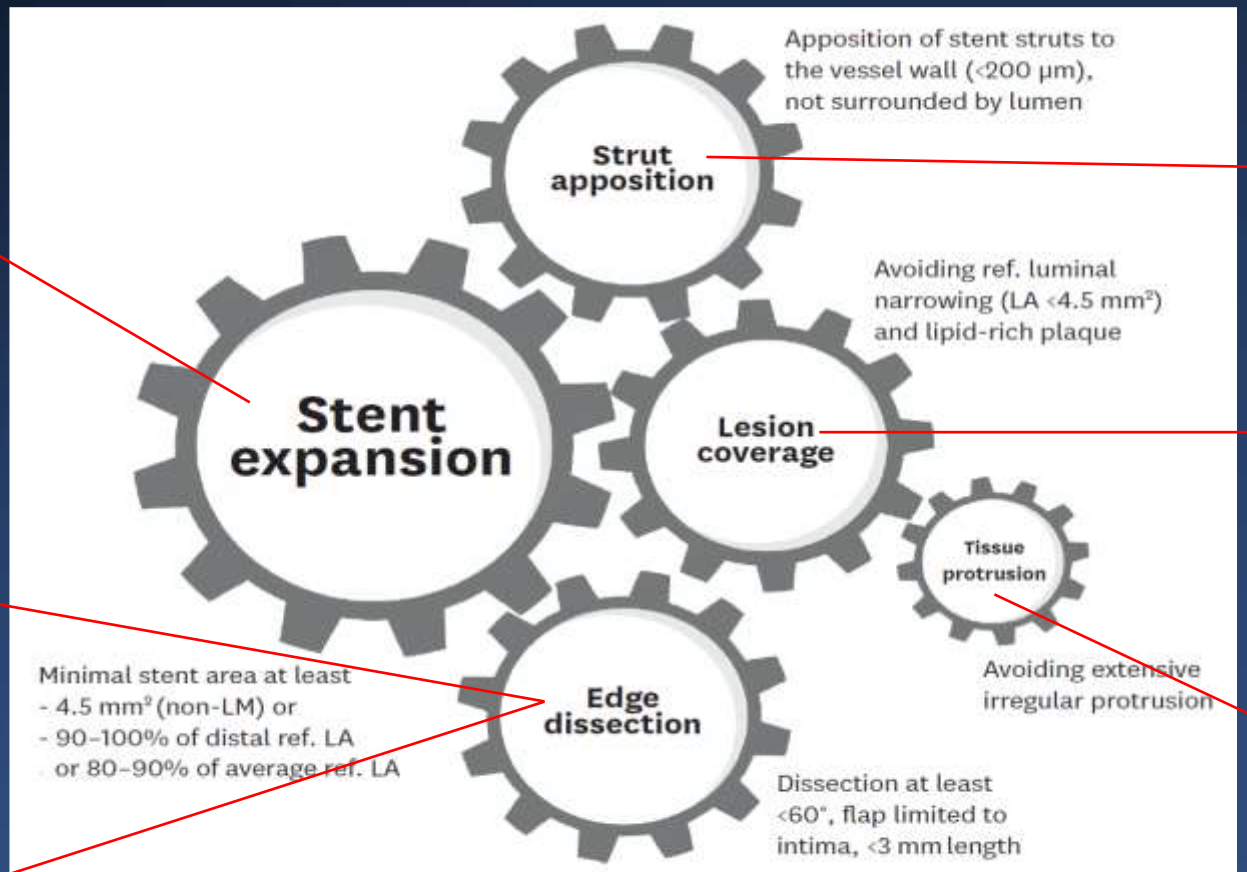
Stent sizing:
If EEL visible > 180 ° → Use the smallest of the proximal / distal reference EEL-EEL diameter and down size to the nearest 0.25mm
If EEL visible < 180 ° or not seen → Use the reference vessel luminal diameter

Ilumien III. Lancet 2016;388:2618-2628.
CLI-OPC II. JACC Cardiovasc Imaging 2015;8:1297-305.
Korean Circ J. 2019 Sep;49(9):771-793

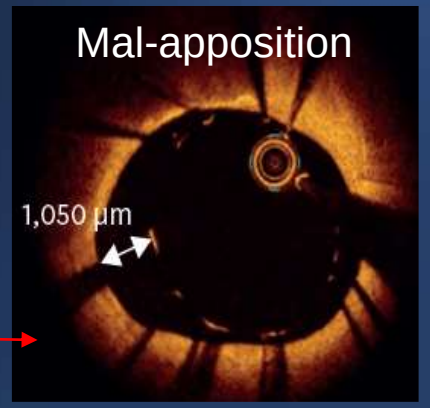
Intra-procedural and Post PCI OCT Guided Stent Deployment

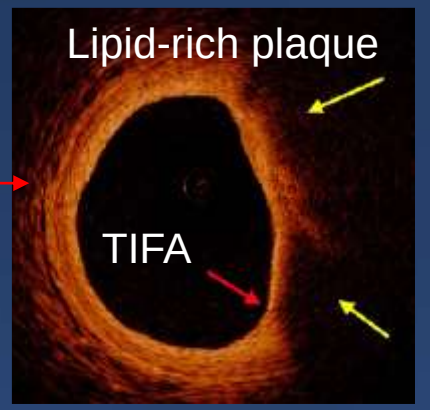


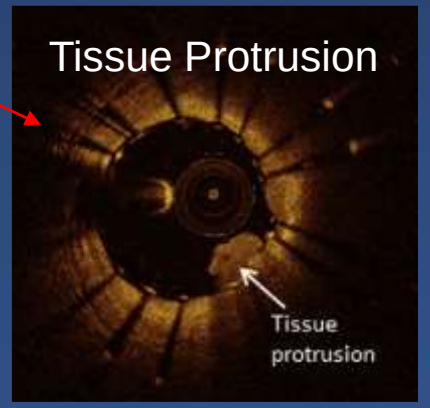




Stent expansion:
If EEL visible > 180 ° → MSA in both proximal and distal halves of the stent ≥90% relative to the closest average MLA in reference segments
If EEL visible < 180 ° or not seen → Aim MSA > 4.5mm²





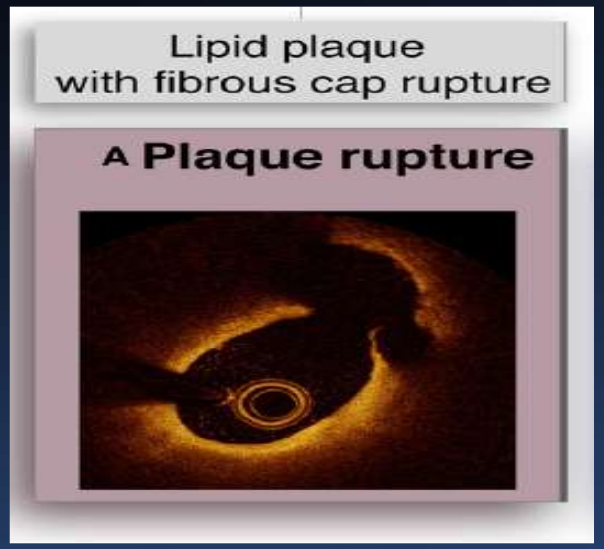


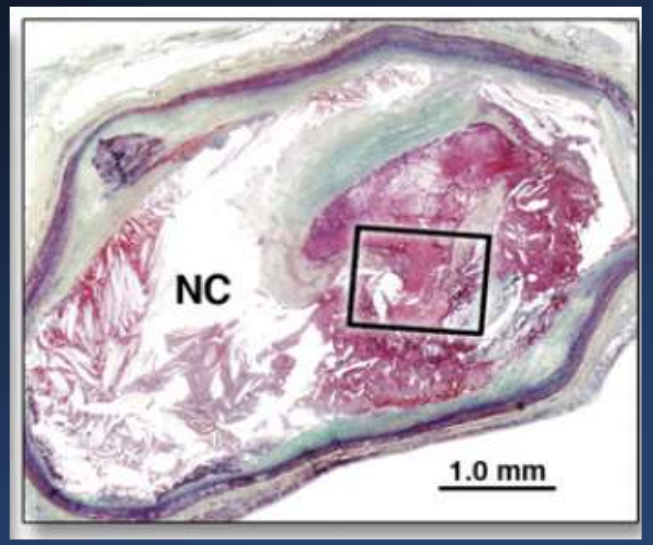
Ilumien III. Lancet 2016;388:2618-2628.
CLI-OPC II. JACC Cardiovasc Imaging 2015;8:1297-305.
Korean Circ J. 2019 Sep;49(9):771-793

Role of OCT in delineating the mechanism of STEMI

- Plaque rupture
- Thrombus
- In-stent restenosis / Stent thrombosis
- Neoatherosclerosis
- Stent fracture
- Spontaneous coronary artery dissection
- Plaque erosion with intact fibrous cap

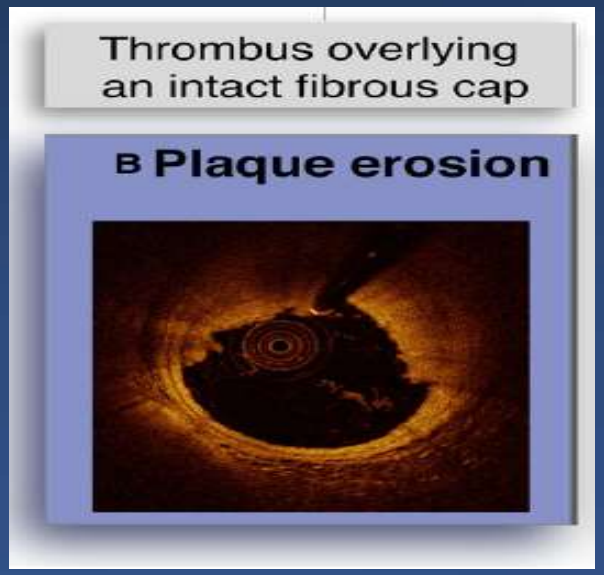
Plaque Erosion vs Plaque Rupture

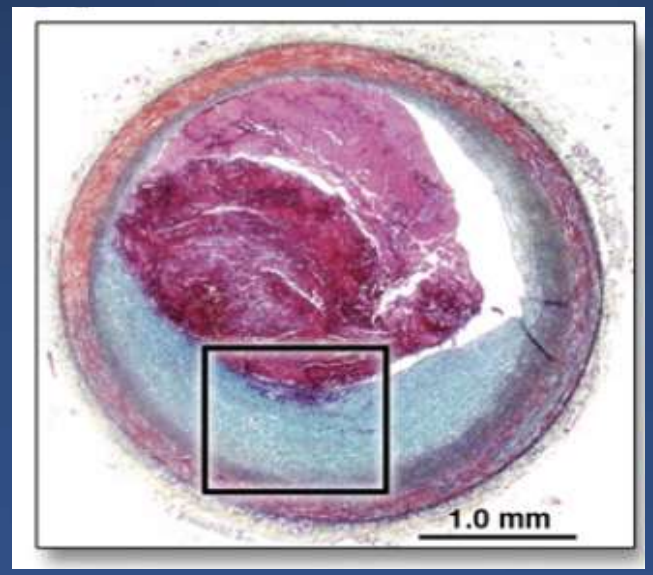




Plaque Rupture =

Fibrous cap discontinuity with a communication between the lumen and the inner core of plaque or with cavity formation within the plaque





Plaque Erosion =

- Intact & visualized plaque with overlying thrombus or
- Luminal surface irregularity at the culprit lesion without thrombus or
- Attenuation of the underlying plaque by thrombus without superficial lipid or calcification immediately proximal or distal to the site of thrombus

J Am Heart Assoc. 2019;8: e012322. DOI: 10.1161/JAHA.119.012322

J Am Coll Cardiol Img 2013;6:283–7

Plaque Erosion in STEMI

Plaque erosion with intact fibrous cap → accounts for 25% to 40% of ACS

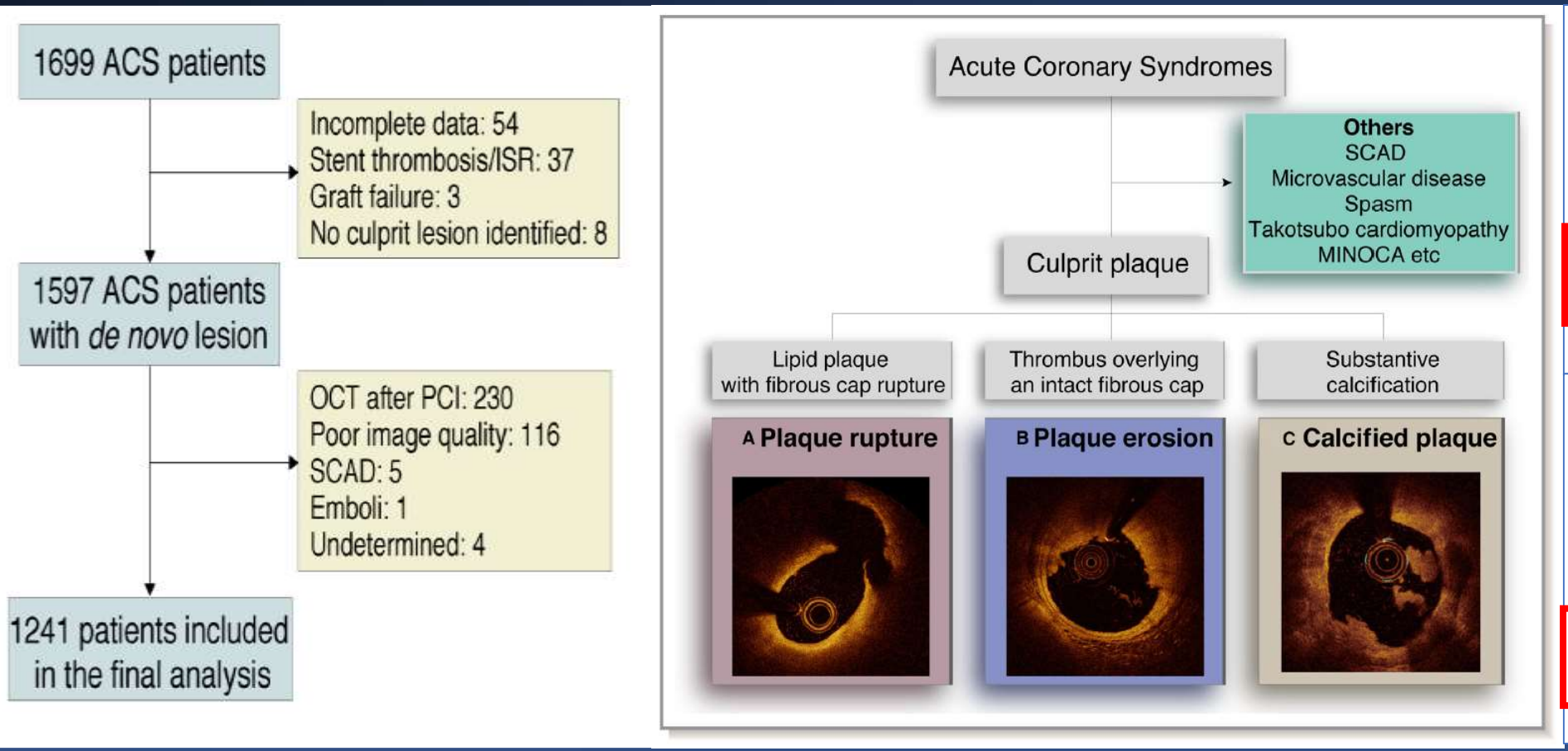
J Am Coll Cardiol. 2013;62:1748–1758.
JACC Cardiovasc Interv. 2015;8:1166–1176.
Eur Heart J. 2013;34:719–728.

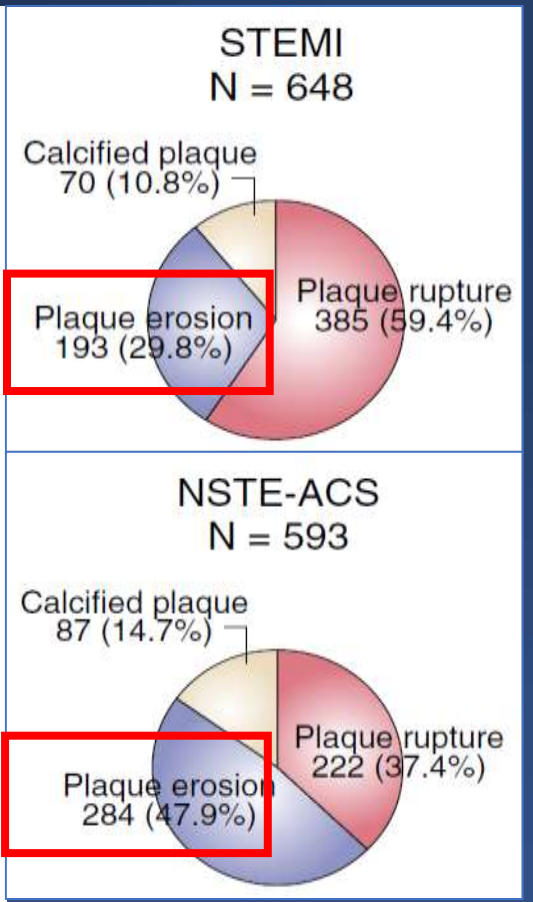
ACS patients with plaque erosion might be treated conservatively without stenting

Eur Heart J. 2017;38:792–800.
JACC Cardiovasc Imaging. 2013;6:283–287.
Arch Cardiovasc Dis. 2018;111:666–677
J Am Coll Cardiol Img 2013;6:283–7

Clinical and Laboratory Predictors for Plaque Erosion in Patients With Acute Coronary Syndromes

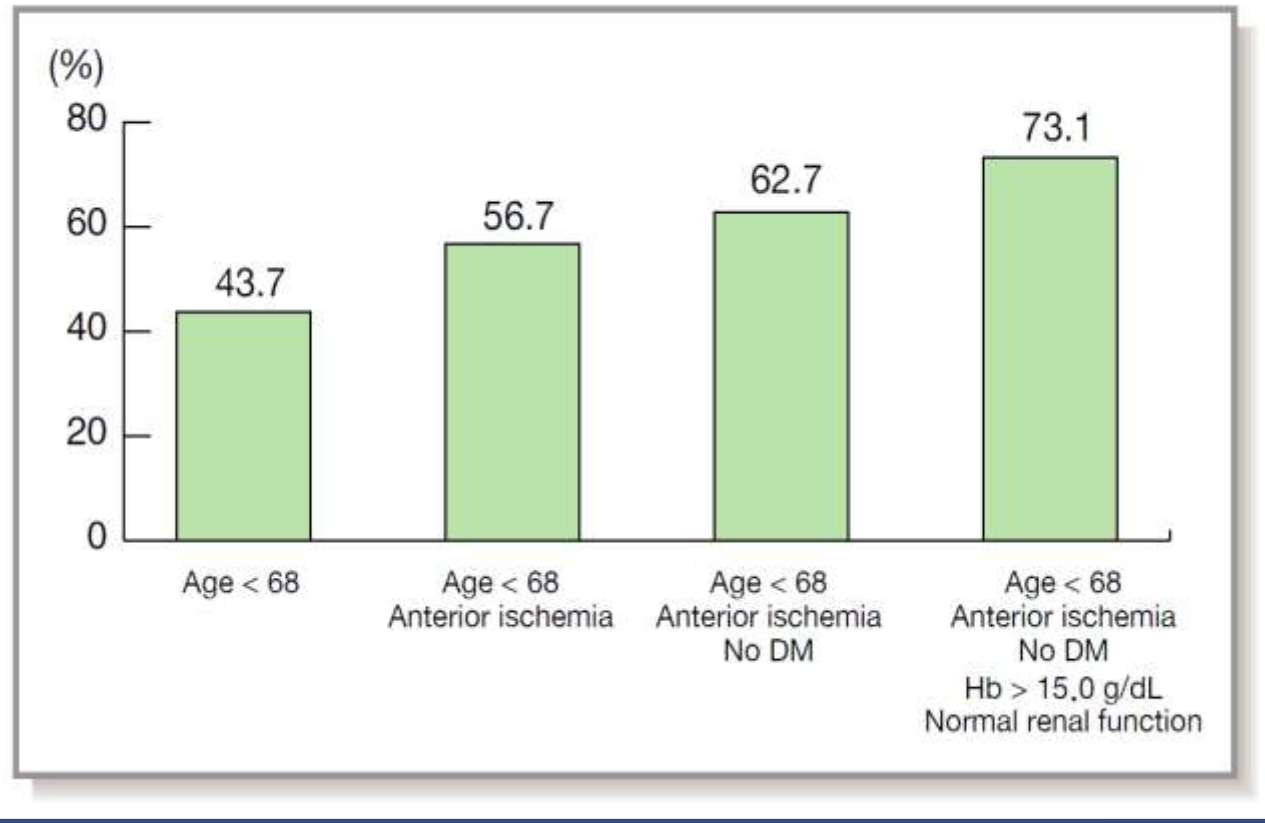
Erika Yamamoto, MD, PhD; Taishi Yonetsu, MD; Tsunekazu Kakuta, MD, PhD; Tsunenari Soeda, MD, PhD; Yoshihiko Saito, MD, PhD; Bryan P. Yan, MD; Osamu Kurihara, MD, PhD; Masamichi Takano, MD, PhD; Giampaolo Niccoli, MD, PhD; Takumi Higuma, MD, PhD; Shigeki Kimura, MD, PhD; Yoshiyasu Minami, MD, PhD; Junya Ako, MD, PhD; Tom Adriaenssens, MD, PhD; Niklas F. Boeder, MD; Holger M. Nef, MD; Francesco Fracassi, MD; Tomoyo Sugiyama, MD, PhD; Hang Lee, PhD; Filippo Crea, MD; Takeshi Kimura, MD, PhD; James G. Fujimoto, PhD; Valentin Fuster, MD, PhD; Ik-Kyung Jang, MD, PhD





J Am Heart Assoc. 2019;8: e012322. DOI: 10.1161/JAHA.119.012322

5 Independent Predictors of Plaque Erosion



- Age <68 y
- Anterior ischemia
- No DM
- Hemoglobin >15.0 g/dL
- Normal renal function

In-hospital mortality : Plaque erosion group 0.6% vs plaque rupture group 1.5% (p=0.15)
Stenting: Plaque erosion group 92.5% vs plaque rupture group 97.7% (p<0.001)

COMPLEX PCI
Make It Simple!

J Am Heart Assoc. 2019;8: e012322. DOI: 10.1161/JAHA.119.012322

CONCEPTS ON THE VERGE OF TRANSLATION

OCT-Based Diagnosis and Management of STEMI Associated With Intact Fibrous Cap

STEMI (N=31)

Plaque erosion with intact fibrous cap – No plaque rupture

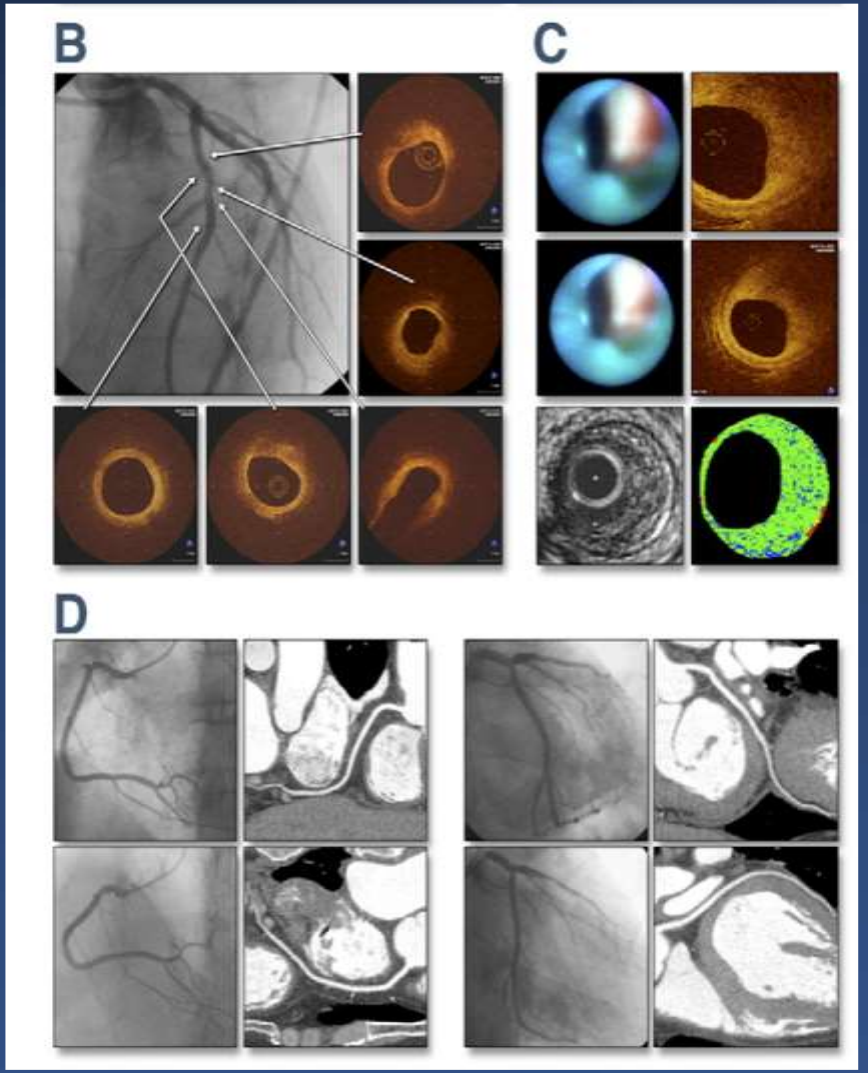
Group 1 (40%)

Group 2 (60%)

Sub-critically occlusive plaque → DAPT without PCI

PCI & Stenting

All asymptomatic at median follow-up of 753 d
Regardless of stent implantation



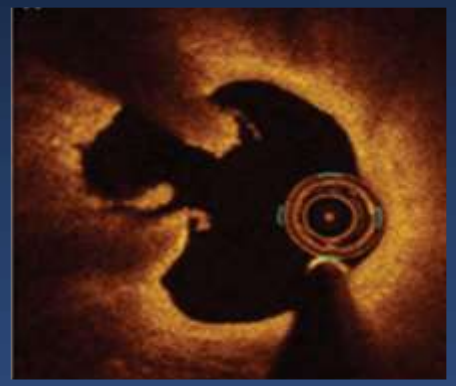
J Am Coll Cardiol Img 2013;6:283–7

Clinical Significance of the Presence or Absence of Lipid-Rich Plaque Underneath Intact Fibrous Cap Plaque in Acute Coronary Syndrome

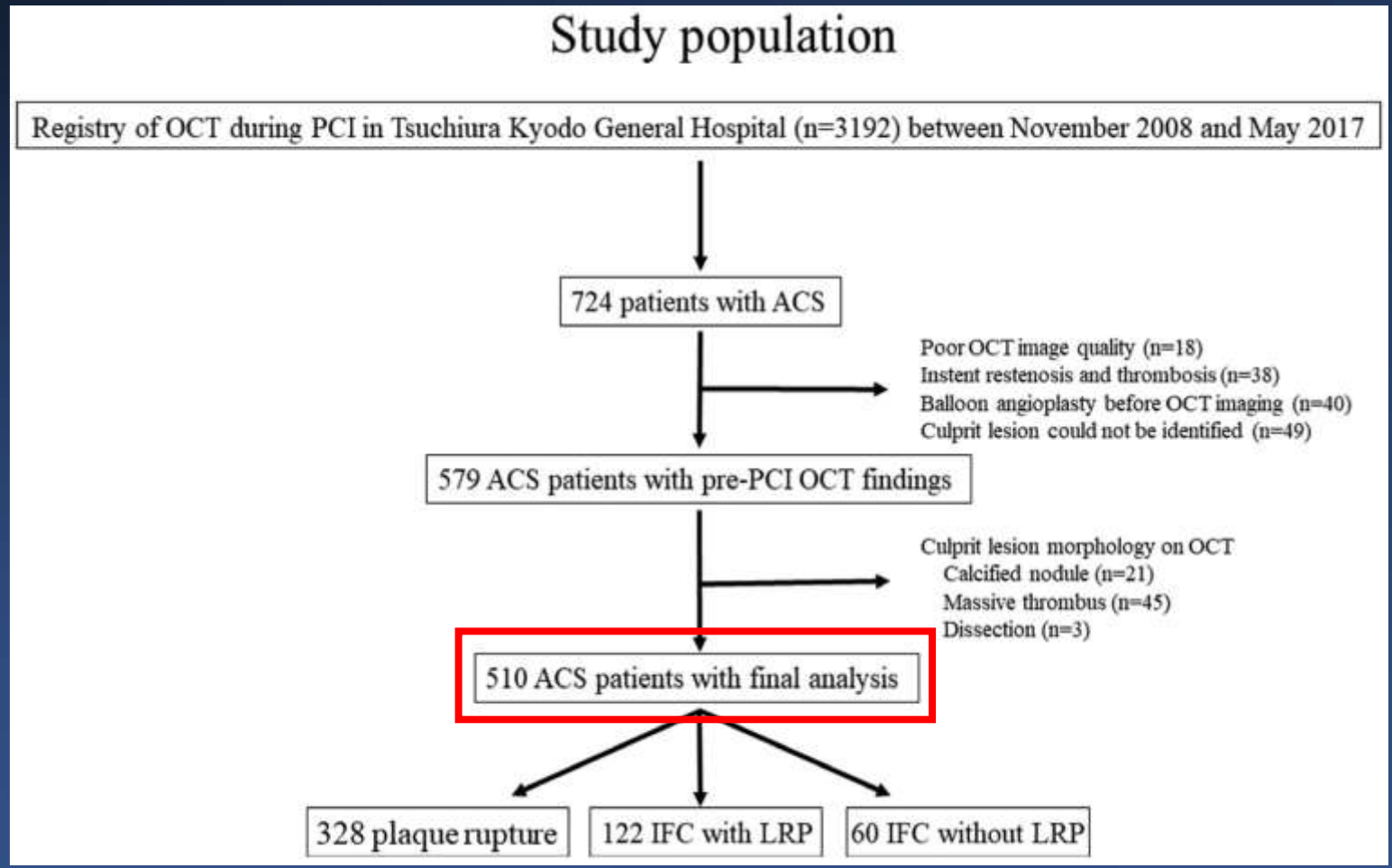
Masahiro Hoshino, MD; Taishi Yonetsu, MD; Eisuke Usui, MD; Yoshihisa Kanaji, MD; Hiroaki Ohya, MD; Yohei Sumino, MD; Masao Yamaguchi, MD; Masahiro Hada, MD; Rikuta Hamaya, MD; Yoshinori Kanno, MD; Tadashi Murai, MD, PhD; Tetsumin Lee, MD; Tsunekazu Kakuta, MD, PhD

Plaque Rupture (PR)
N = 328 (64%)

99% had LRP

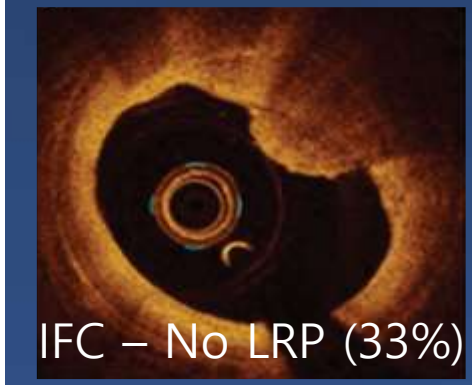


IFC = Intact fibrous cap
LRP = Lipid-rich plaque
PR = Plaque rupture



No Plaque Rupture
N = 182 (36%)

IFC – LRP (67%)



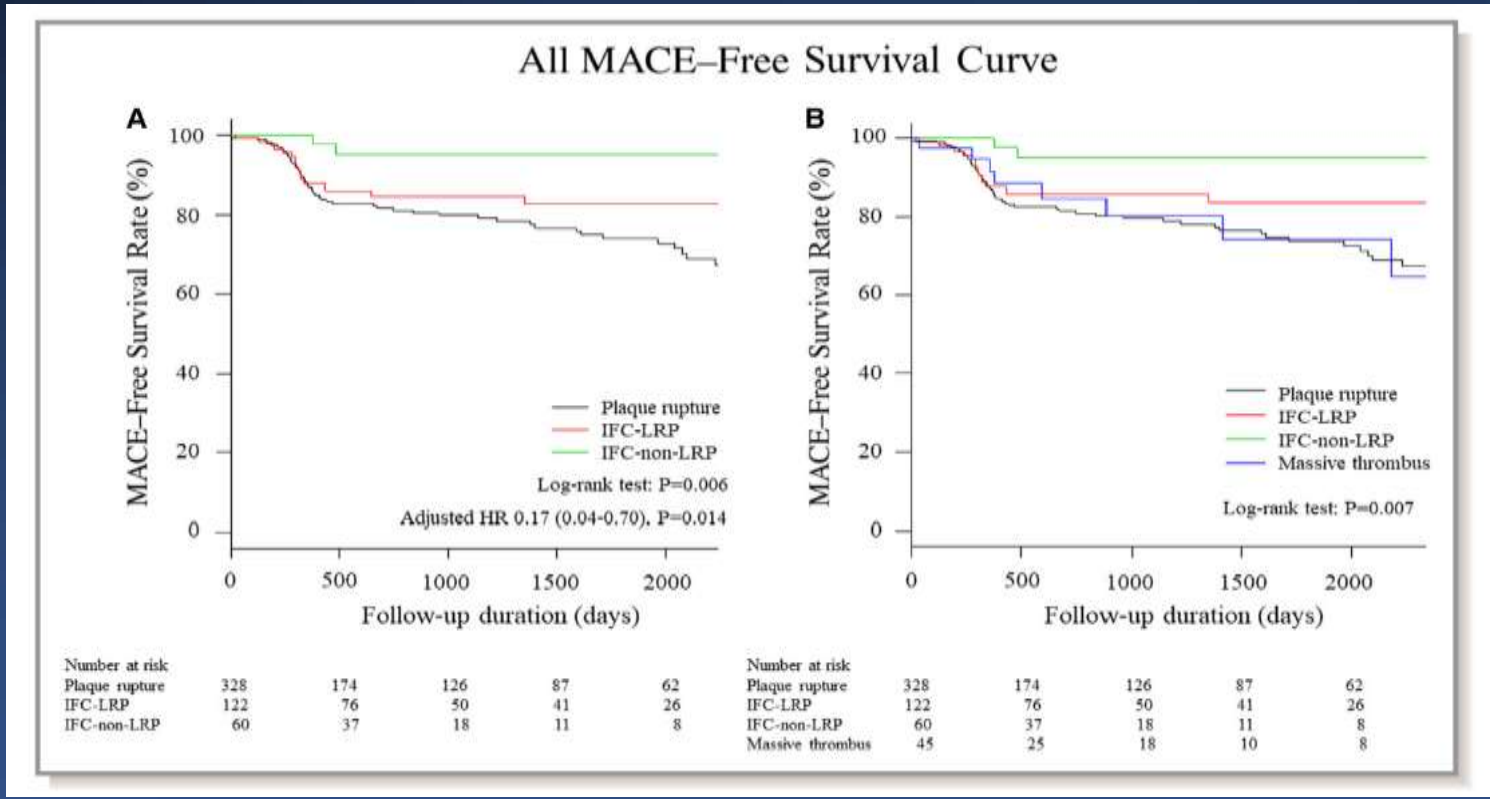
IFC – No LRP (33%)

J Am Heart Assoc. 2019;8:e011820. DOI: 10.1161/JAHA.118.011820

Clinical Significance of the Presence or Absence of Lipid-Rich Plaque Underneath Intact Fibrous Cap Plaque in Acute Coronary Syndrome

Masahiro Hoshino, MD; Taishi Yonetsu, MD; Eisuke Usui, MD; Yoshihisa Kanaji, MD; Hiroaki Ohya, MD; Yohei Sumino, MD; Masao Yamaguchi, MD; Masahiro Hada, MD; Rikuta Hamaya, MD; Yoshinori Kanno, MD; Tadashi Murai, MD, PhD; Tetsumin Lee, MD; Tsunekazu Kakuta, MD, PhD

Intact Fibrous Cap without Lipid-rich Plaque = Independent predictor of better prognosis
→ lower MACEs vs Plaque Rupture and Intact Fibrous Cap group with Lipid-rich Plaque.

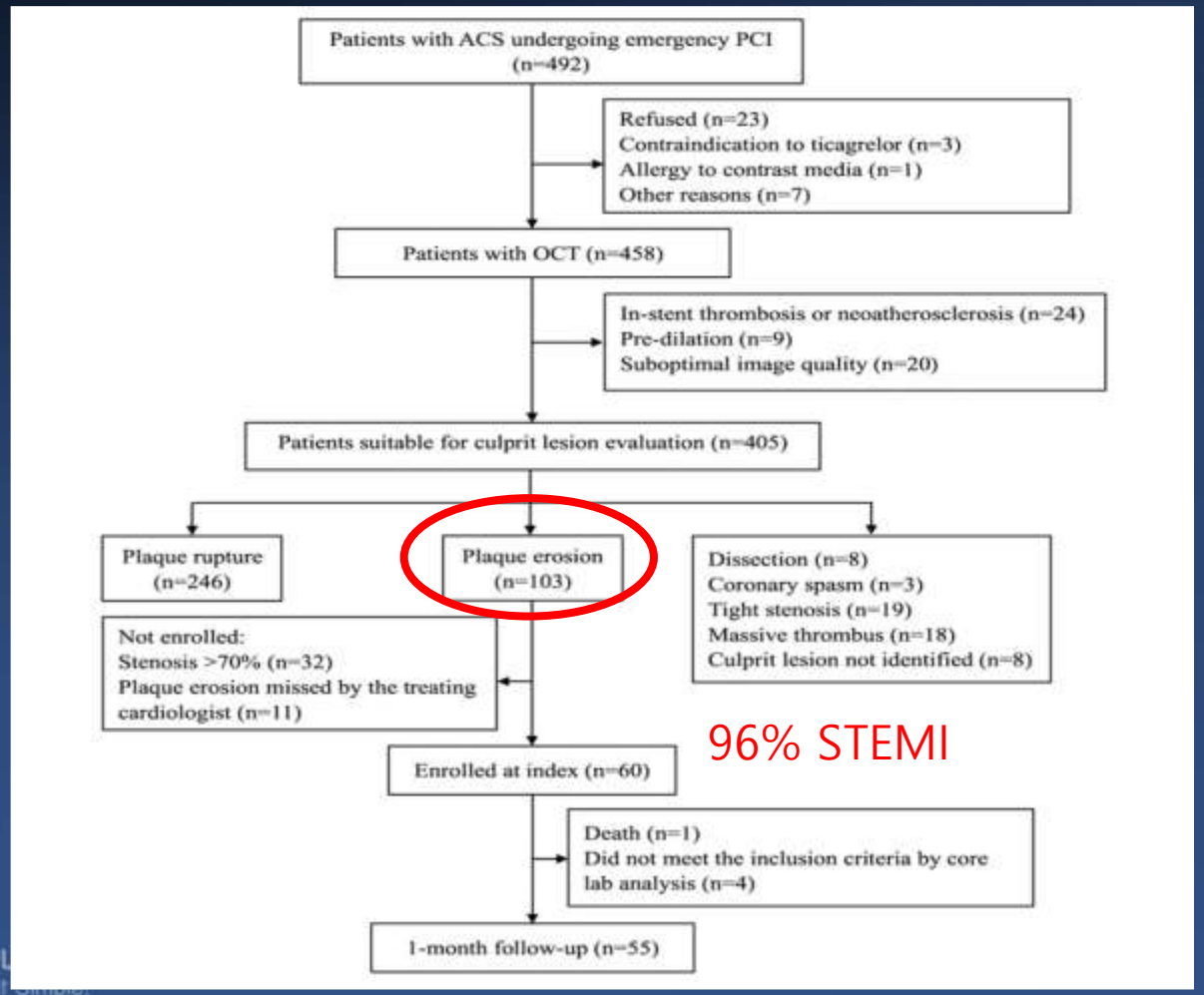


Diameter stenosis
Plaque erosion gp
77.0+/-20.2%
Vs
Plaque rupture gp
83.2+/-18.4%

MACE = Cardiac death, MI, Revascularization → Occurred in 16.7% at median follow-up duration of 621d

J Am Heart Assoc. 2019;8:e011820. DOI: 10.1161/JAHA.118.011820

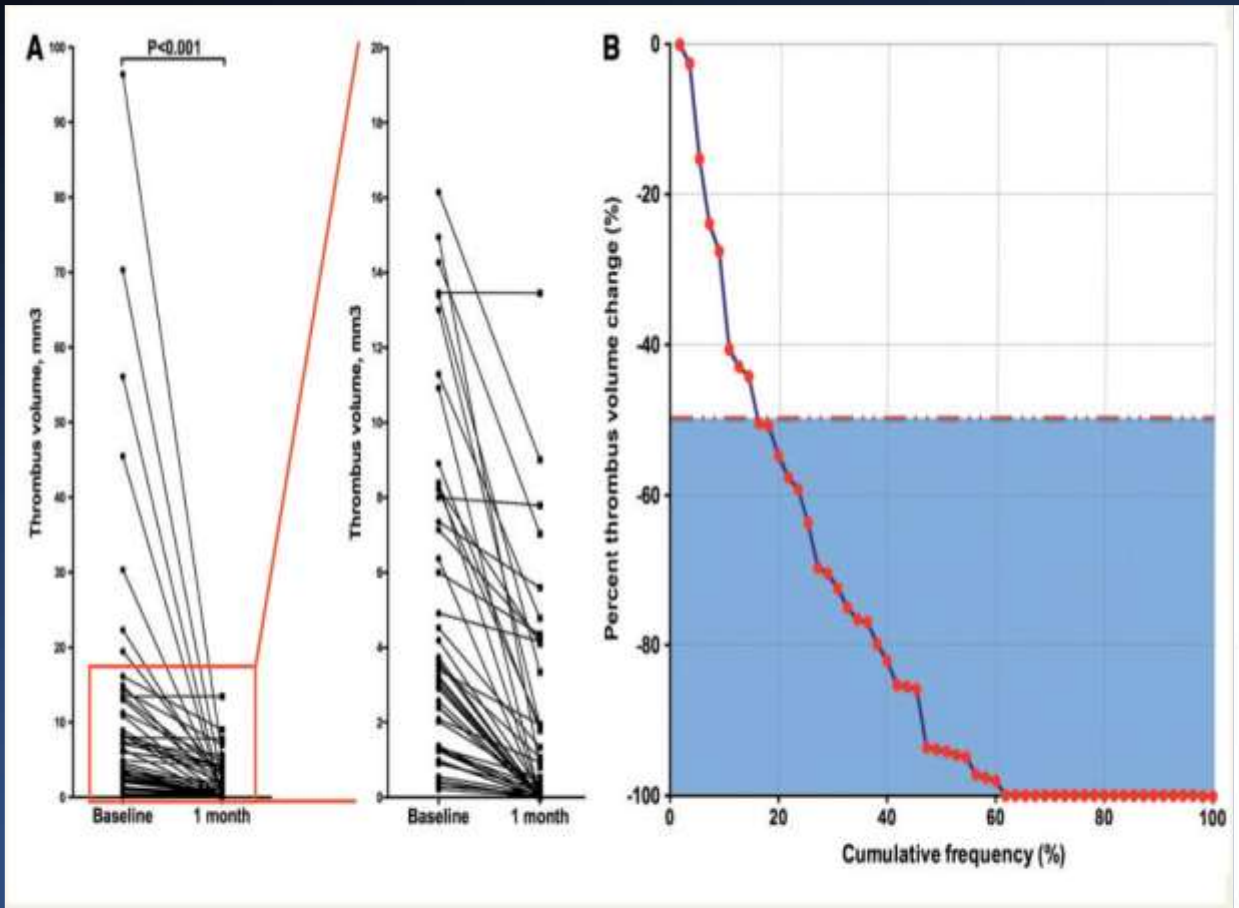
Effective anti-thrombotic therapy without stenting: intravascular optical coherence tomography-based management in plaque erosion (the EROSION study)

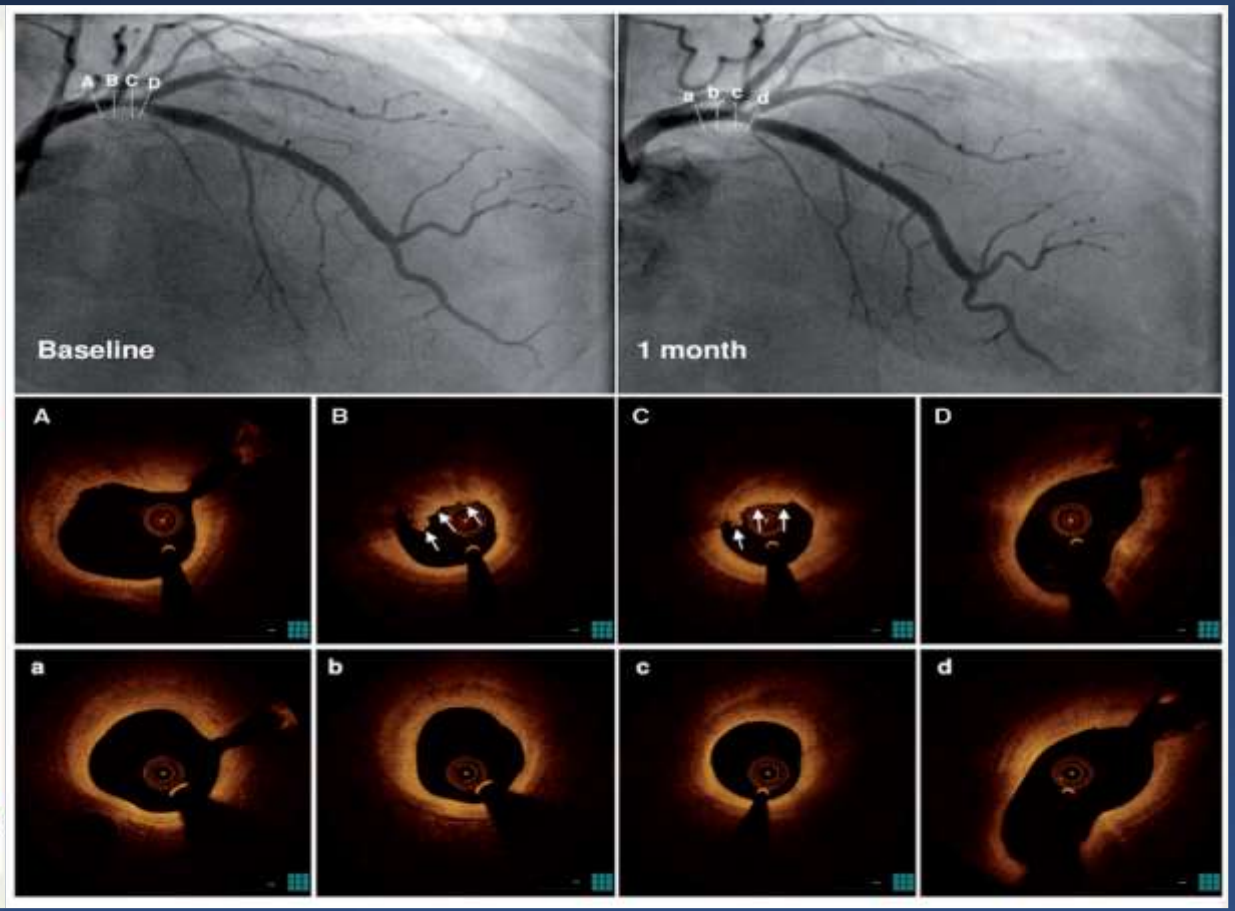


- In all ACS patients with OCT evaluated:
  ~ 25% had plaque erosion without rupture
- In patients with plaque erosion
  ~ 60% had diameter stenosis <70%
  Mean diameter stenosis 56.7+/-10.4mm
- In patients with plaque erosion & diameter stenosis <70% → anti-thrombotic / no stenting
- OCT repeated in 1 month

European Heart Journal (2017) 38, 792–800
doi:10.1093/eurheartj/ehw381

Clinical outcome, absolute and percentage thrombus volume reduction at 1 month OCT follow-up in patients with plaque erosion & <70% diameter stenosis





Outcome: 78% patients had >50% reduction of thrombus volume at 1 month. ~ 40% no visible thrombus at 1 month

No reported CV death, re-MI, ACS hospitalization, clinically-driven TVR, stroke. 1 patient died of GI bleeding

Conclusion

1. OCT has pivotal roles in STEMI & Primary PCI in delineating the disease mechanism and procedure optimization

2. Plaque erosion with intact fibrous cap (PE IFC) accounts for 25-40% of ACS

3. 40-60% of PE IFC had sub-critical coronary stenosis, which could be managed conservatively without stenting & carries favorable prognosis

Discussion

- Role of routine OCT in stable STEMI patients –
  - especially in non-occlusive lesions after thrombectomy
- Pathophysiology of plaque erosion with intact fibrous cap
- Optimal strategy in managing STEMI patients with PE IFC :
  - Conservative medical therapy vs stenting ?