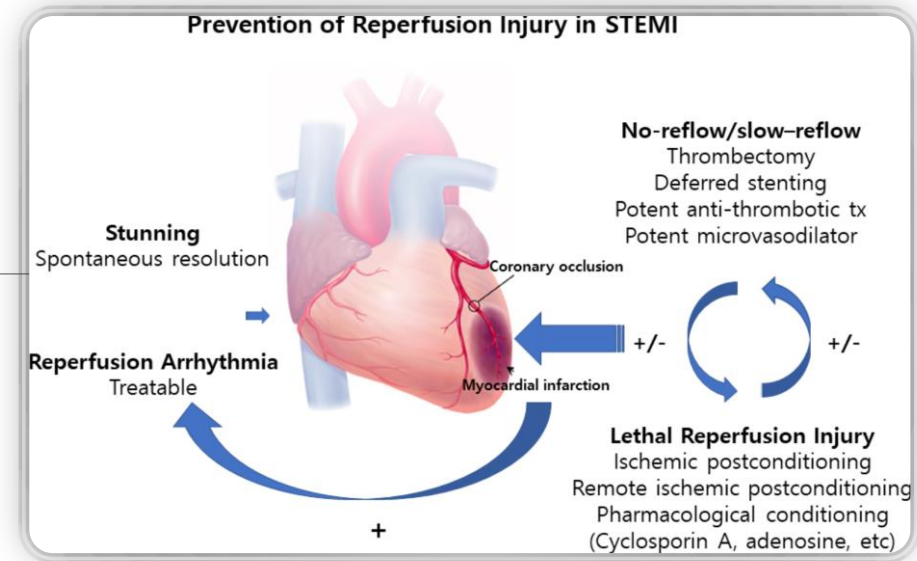


Reperfusion Injury Prevention, A Volume-Controlled Reperfusion Method in Acute Coronary Artery Occlusion

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Research status of reperfusion injury protection :



- Ischemic post-conditioning procedures in animal experiments and clinical proof of concept trial can reduce ischemia-reperfusion injury
- Post-conditioning and gradual adaptation have not shown consistent protection of cardiac function in large clinical randomized trials, such as POST, DANAMI-3 IPOST.
- Reperfusion injury acts on all ischemic areas under the occlusion section, including myocardial cells and coronary endothelial cells in the injured area.
- Endothelial cells are more tolerant to ischemia, but more sensitive to reperfusion injury.
- Non myocardial cells and microvascular injury may be the key link in the protection of reperfusion injury.

1

Lesion:

PPCI procedure has been perfected day by day, difficult to observe iPost protective effect without considering the lesion site. We prefer proximal part of dominant blood vessel

2

Start-up time:

Thrombus aspiration widely used since 2008, might delayed the start of iPost procedure, attenuate protect effect on reperfusion injury

3

Operation method:

During balloon inflate/deflate circle, uncontrolled blood perfusion which may cause reperfusion injury signal stimulation.

4

Blocking site:

The balloon dilated site is usually not on lesion, may be proximal to the target lesion.
and the forward blood flow cannot be completely blocked during the procedure.

5

Criminal vessels:

iPost assume that the target lesion is a localized/segmental lesion, cannot understand the patency of the distal vessel.

Problems with classic post-conditioning operations



Our ideas

Clinical experience:

iPost procedure might have inherent defects which affect protective effect of reperfusion injury.



Literature Review:

The end point of the clinical study focused too much on myocardial infarction size, ignored the effects on infarct-related blood vessels, endothelial function, and microvascular embolism.



Proposed assumption:

Reperfusion injury of coronary endothelial system is key issue during the PPCI



New method:

Designed “Volume-Controlled Revascularization method” based on optimized iPost and gradual reperfusion



“Volume Controlled Revascularization ”in STEMI PPCI (VCR)

Combination concept of “optimized iPost” & Gradual reperfusion

“Ping-Pong” technique, Balloon & aspiration catheter via each guiding catheter, respectively

Contemporaneous forward blood flow balloon inflation blocking at the occlusion site and distal reperfusion via aspiration catheter.

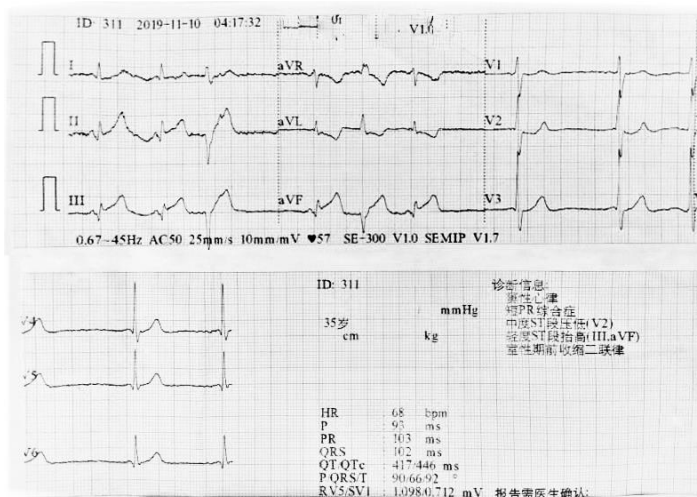
Stent or DCB as usual when hemodynamic data and blood flow are stable

Case presentation, case 1

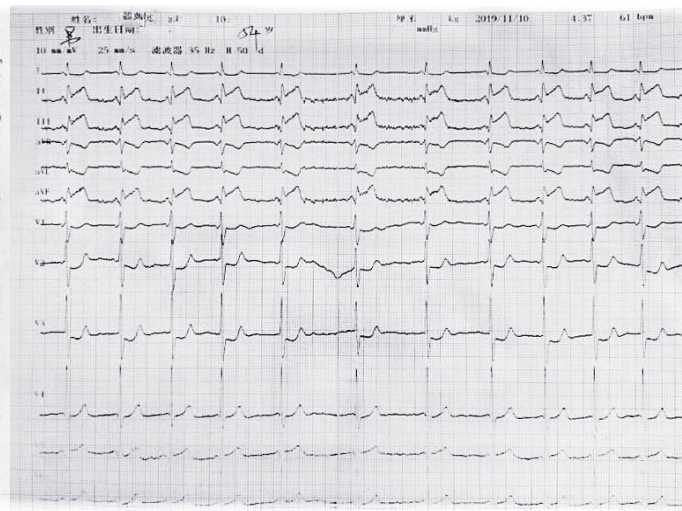
- 54 y/o male, chest pain 6 hours
- intravenous thrombolysis 4 hours ago (Recombinant human pro-urokinase , rhPro-UK, 20mg iv st, 30mg iv drop at 1mg/min)
- No history of hypertension, diabetes or smoking
- On arrival his heart rate was 80 bpm, blood pressure was 130/80 mmHg. No heart murmurs or rales in auscultation.
- TnI 0.08ng/ml (0-0.5ng/ml)



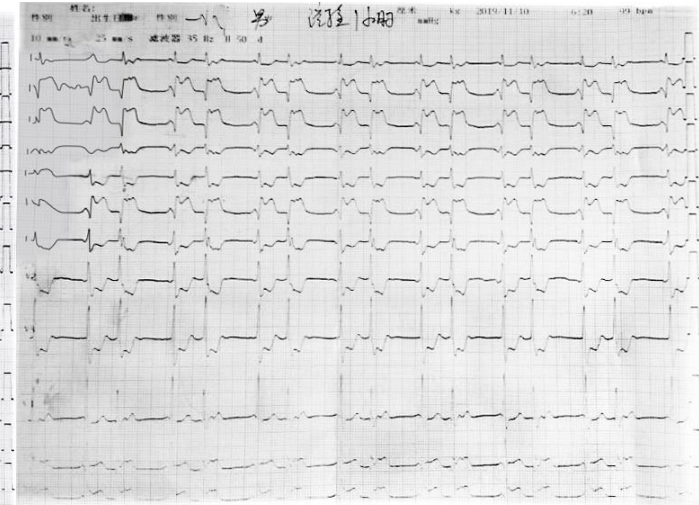
ECG Serie



On Ambulance



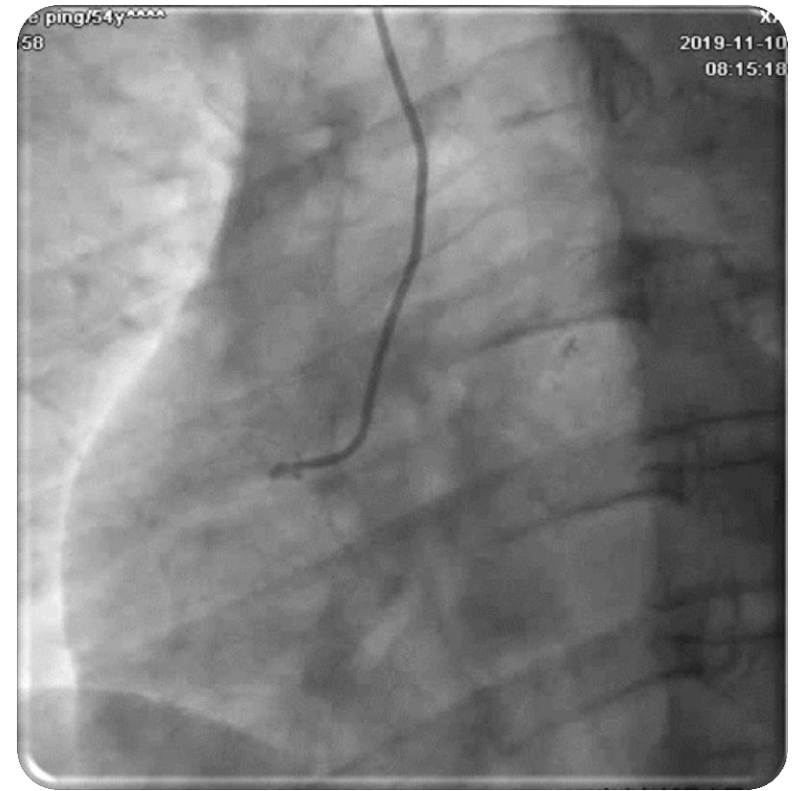
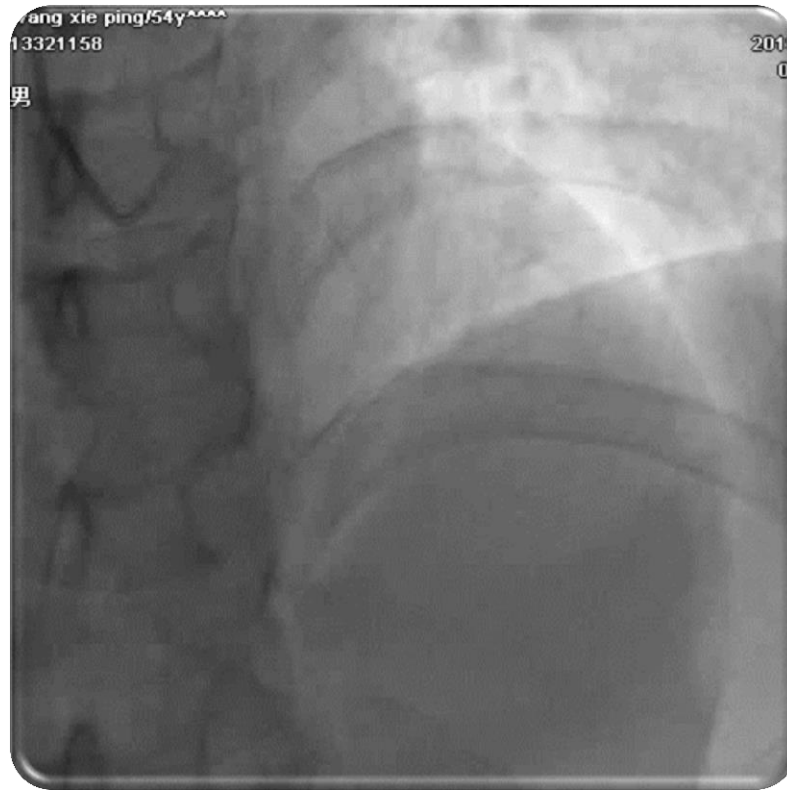
Pre-thrombolysis



1 hour after thrombolysis

ID: 311
 35岁
 mmHg
 kg
 诊断信息:
 窦性心律
 短PR综合征
 中度ST段抬高(V2)
 轻度ST段抬高(III,aVF)
 急性期前收缩二联律

HR: 68 bpm
 P: 95 ms
 PR: 103 ms
 QRS: 102 ms
 QT/QTc: 417/446 ms
 P/QRST: 90/66/92
 RV5/SV1: 1.028/0.712 mV. 报告需医生确认

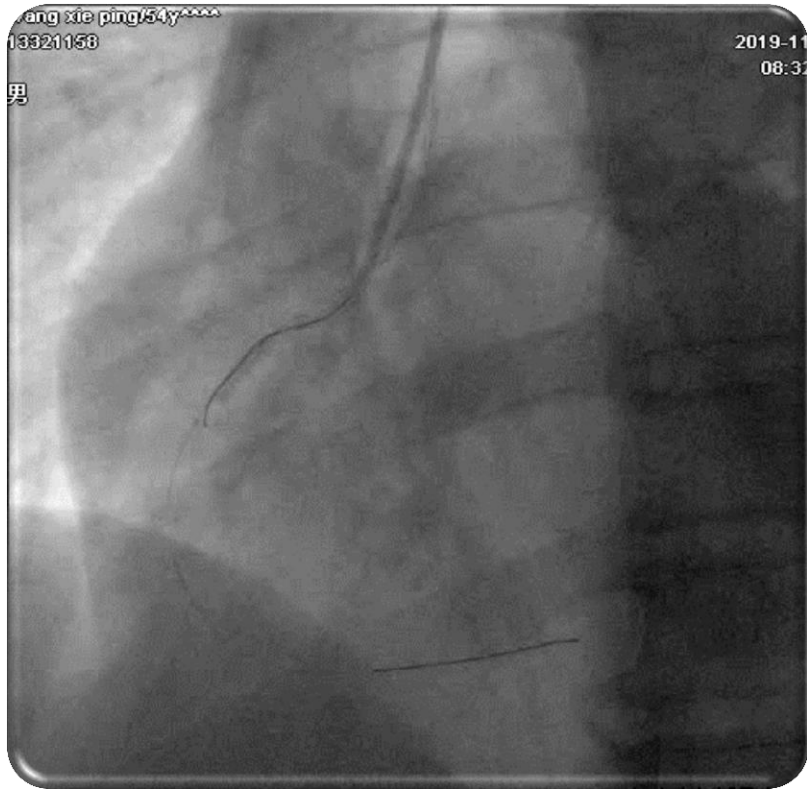


Angiography indicated total occlusion in proximal RCA,
TIMI 0

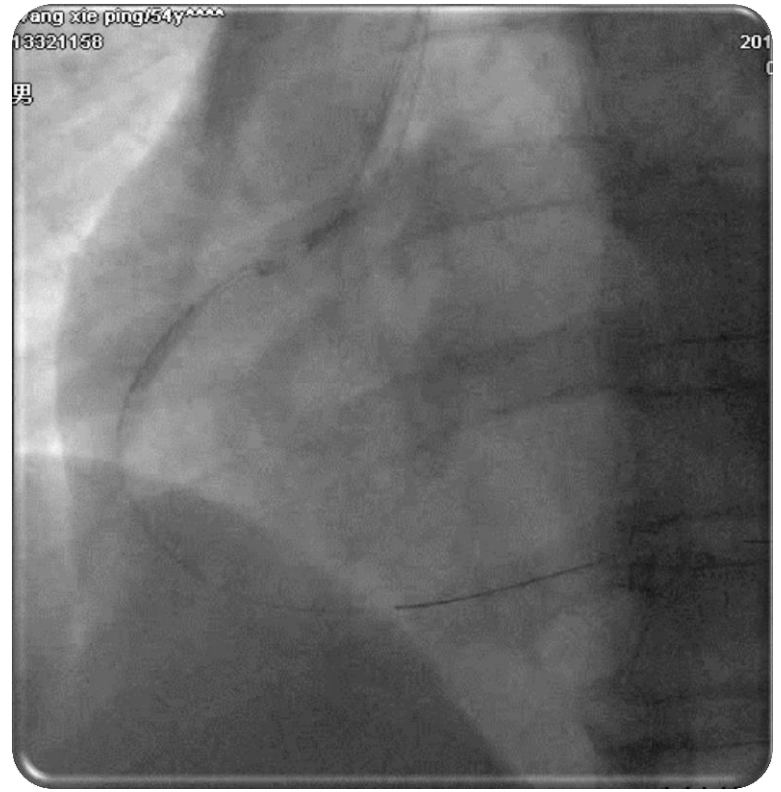


- RA route, 6FJR 4, 3.0-15mm NC balloon standby
 - Heart rate drop to 40-50bpm, blood pressure drop to 70/50mmHg while BMW wire manipulation
 - NC balloon inflated at proximal RCA, heart rate and blood pressure gradually back to stable
-

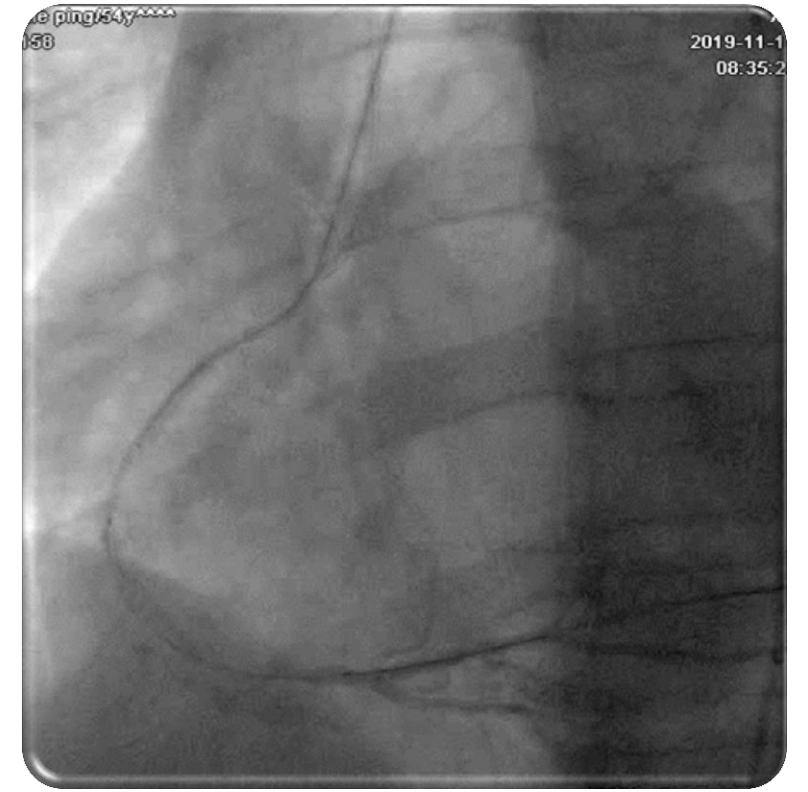
Reperfusion injury happens while workhorse wire manipulation



- RF route, 6FJR4,
- BMW2 to RCA distal

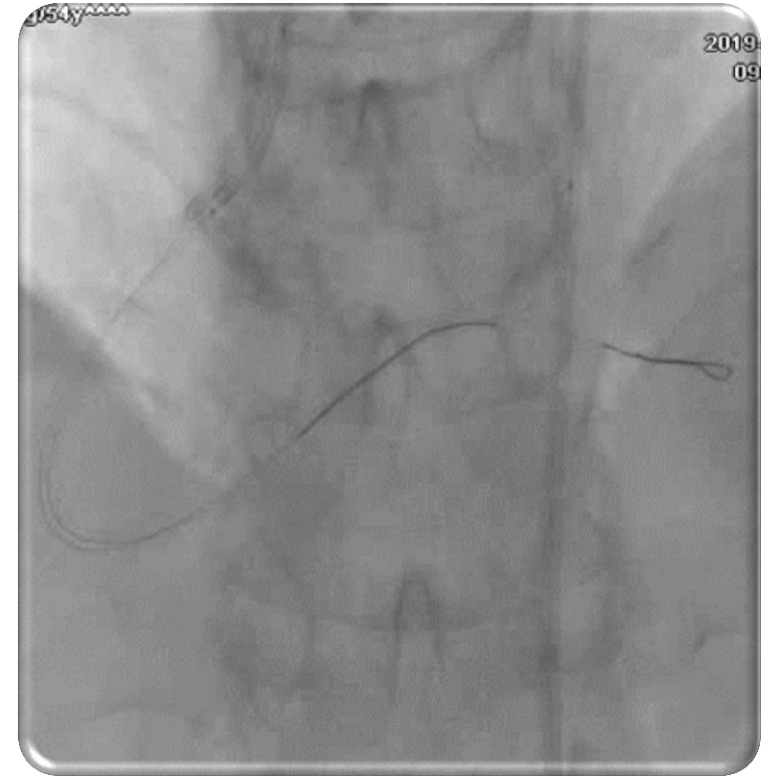
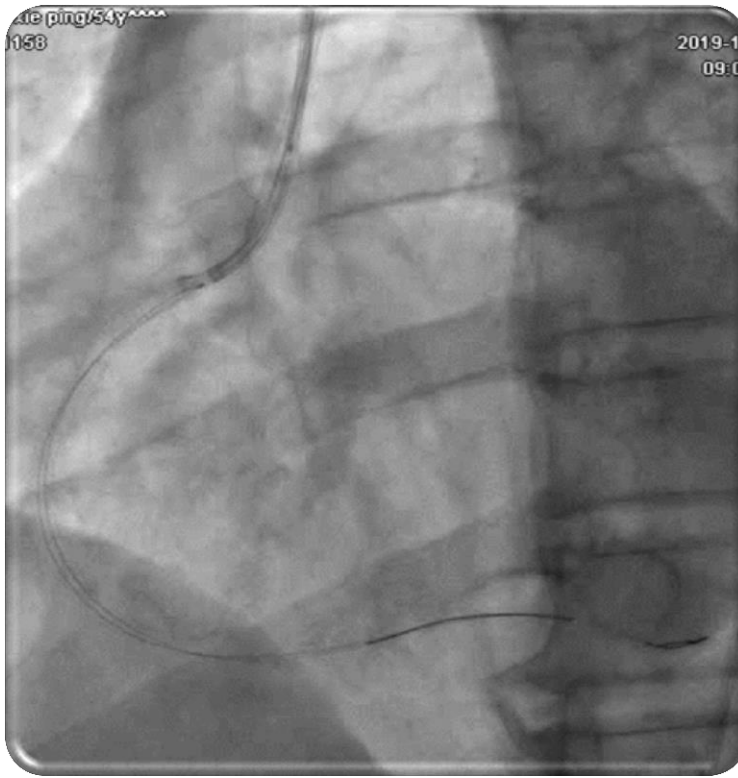
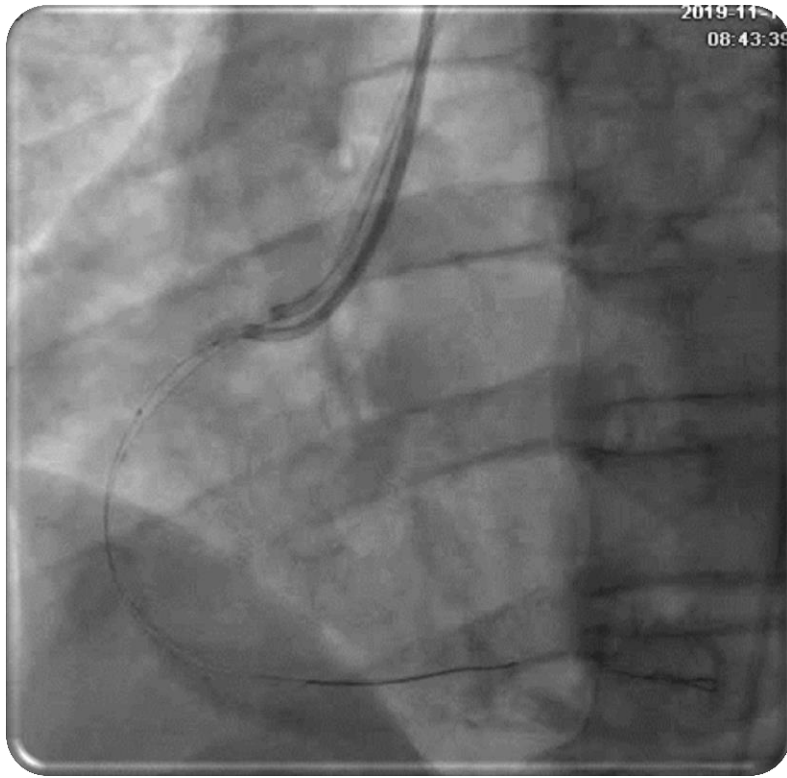


- Aspiration catheter was positioned 10-15mm advanced of NC balloon
- Keep 3.0NC balloon inflation at 8atm to block forward blood flow



- Angiography via aspiration catheter to confirm distal part patency
- Keep 3.0NC balloon at 8atm,
- Intra-aspiration catheter infusion of mixture solution (artery blood 10ml +heparin NS 10ml)
- 20ml/min for 5 mins

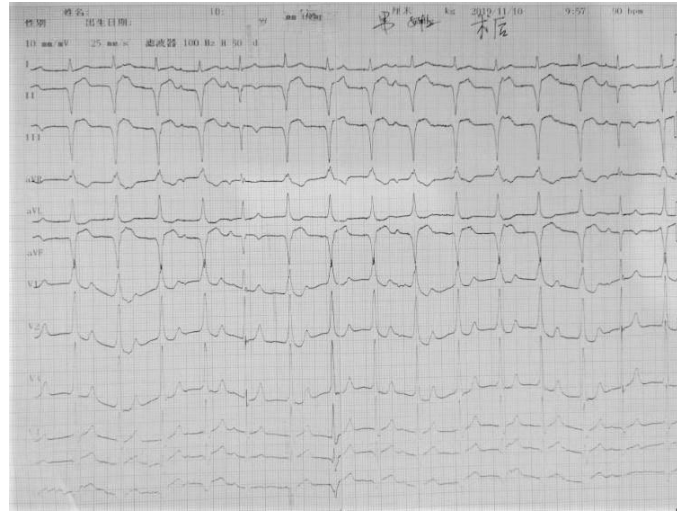




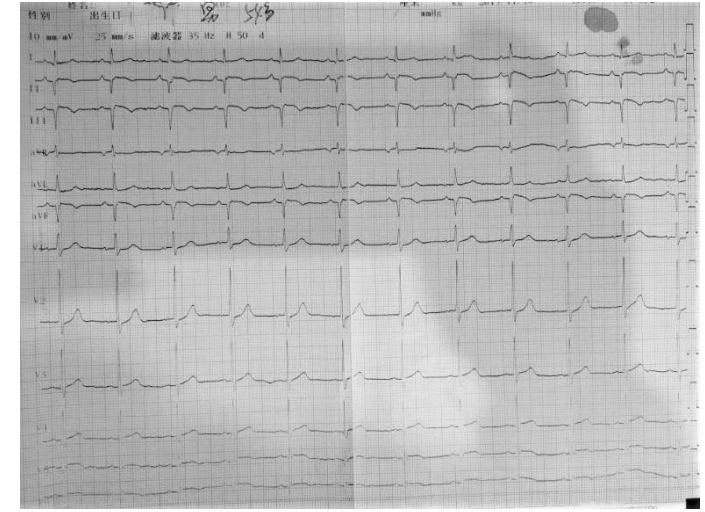
- Balloon deflated, perform angiography when hemodynamic status was stable.
- Two overlapping drug-eluting stents were deployed from mid to proximal RCA. 3.5-23mm,3.0-15mm
- 3.5-4.0NC balloon post dilation



After catheterization



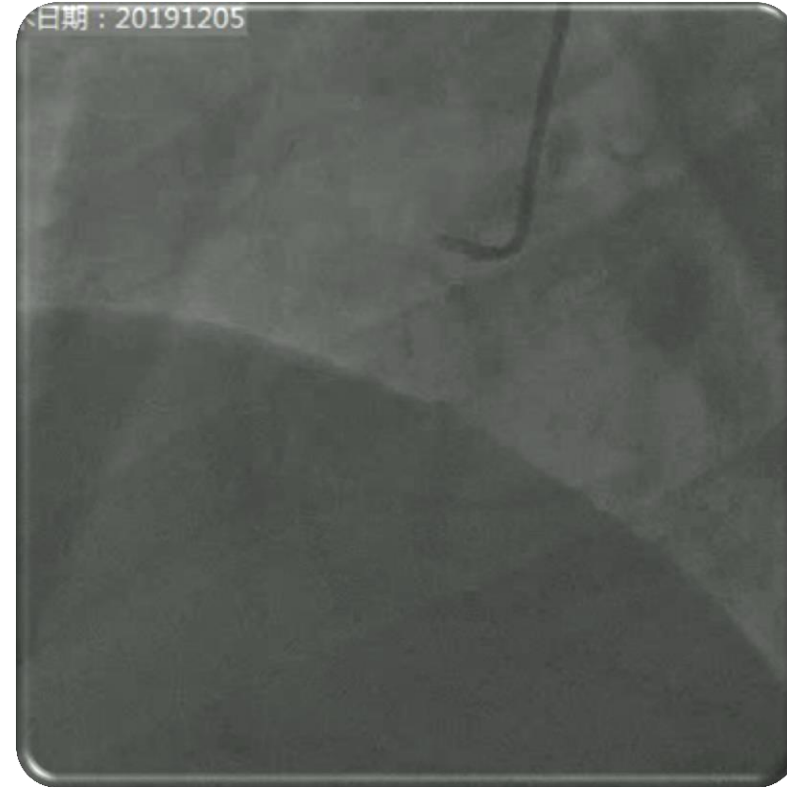
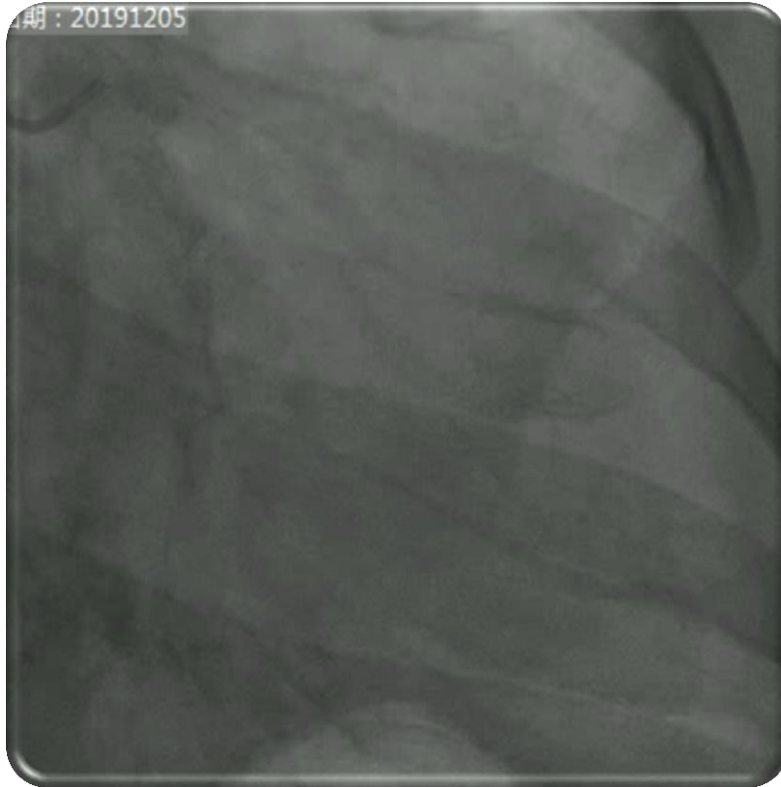
Transient arrhythmia



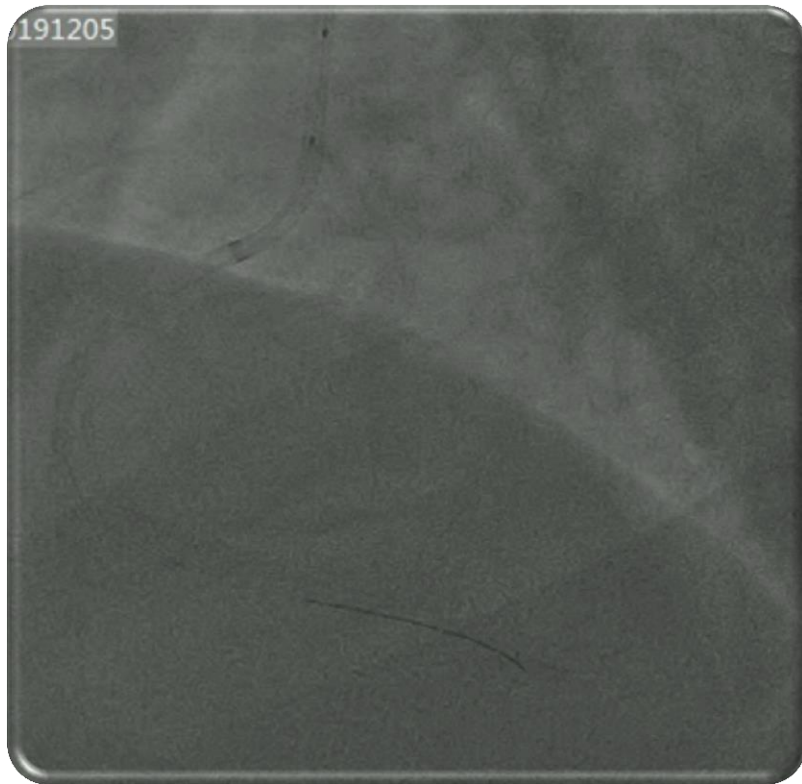
Self converting sinus rhythm

- Patient was safe transferred to ICU with blood pressure 124 /70 mmHg, heart rate 60 BPM, both lungs were free of rales.
- Elevated ST-segment resolute to base level .
- Echocardiography on day 1: Lower left ventricular posterior wall motion; LVED was 55 mm; EF58%; minor regurgitation in mitral, tricuspid and aortic valve area; a small amount of pericardial effusion. Echocardiography on day 7 maintained stable.
- BNP was 115.3 ng / ml (0-100 ng / ml) after catheterization and was 200ng/ml on discharge. Peak Troponin I level was over 50ng/ml (0-0.034) on day 1 and dropped two-fold after 24 hours.
- No arrhythmia or severe discomfort was documented.

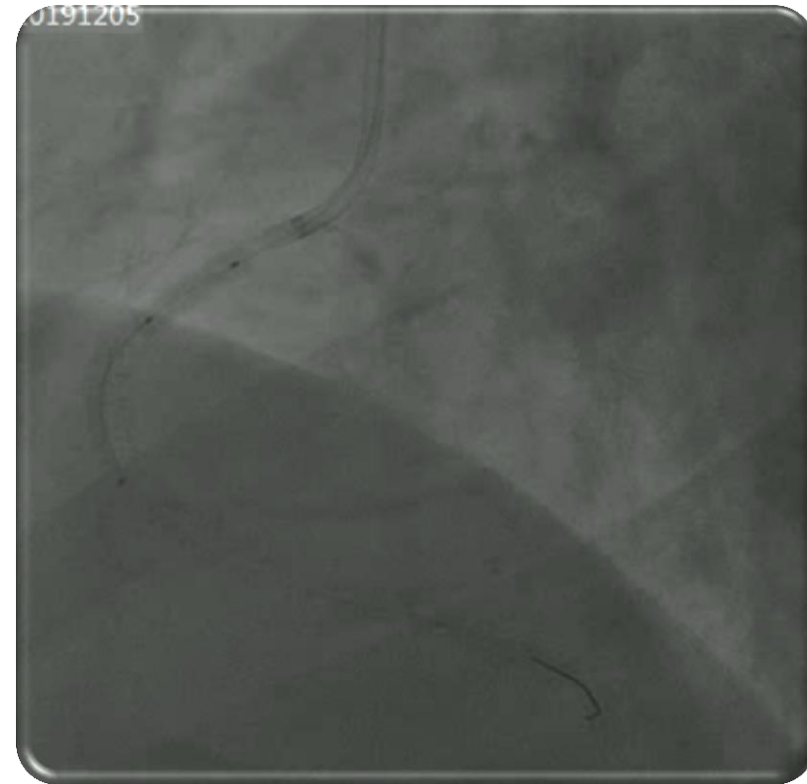
CASE 2



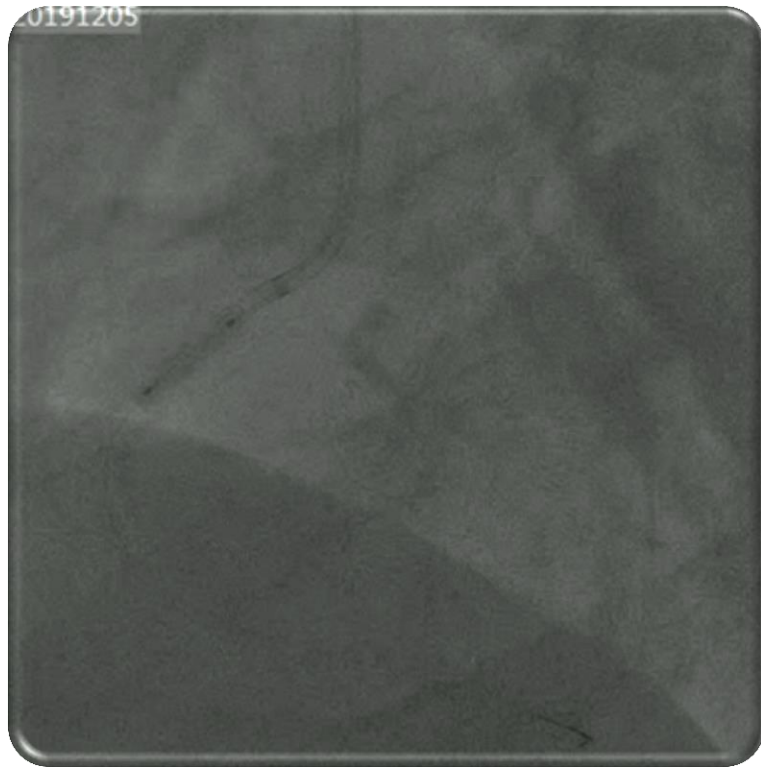
- Acute inferior STEMI,
- Total occlusion in proximal RCA, in-stent occlusion
- Active balloon occlusion and trans micro-catheter reperfusion within one 7F guiding catheter



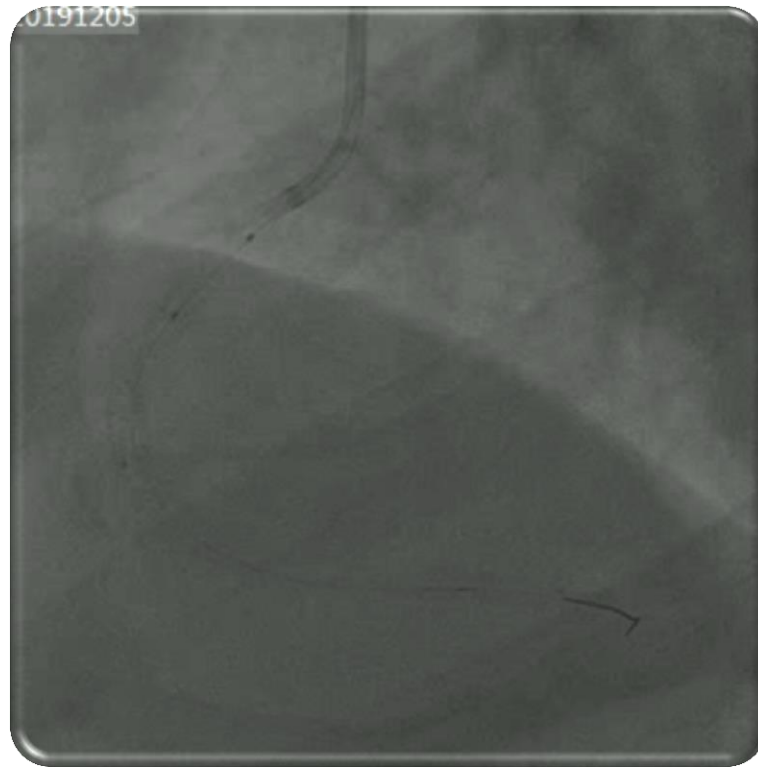
- 7FJR 4.0 GC , Workhorse wire to RCA distal,
- 3.5*16 GRIP™ 8atm block forward blood flow actively



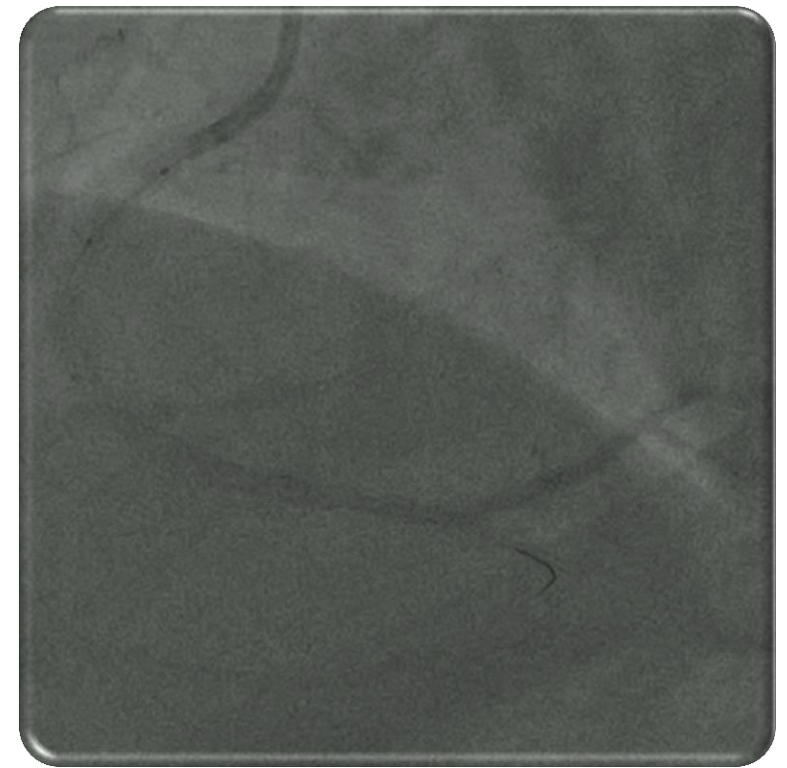
- APT 130mm microcatheter was advanced 20mm distal to GRIP™ balloon.
- Trans microcatheter angiography indicate distal part patency



- Keep 3.5NC balloon at 8atm,
- Intra-microcatheter infusion of mixture solution (artery blood 10ml +heparin NS 10ml)
- 20ml/min for 3 mins
- Difficult to maintain infusion of 20ml/min, because limited diameter of 1.9F microcatheter.

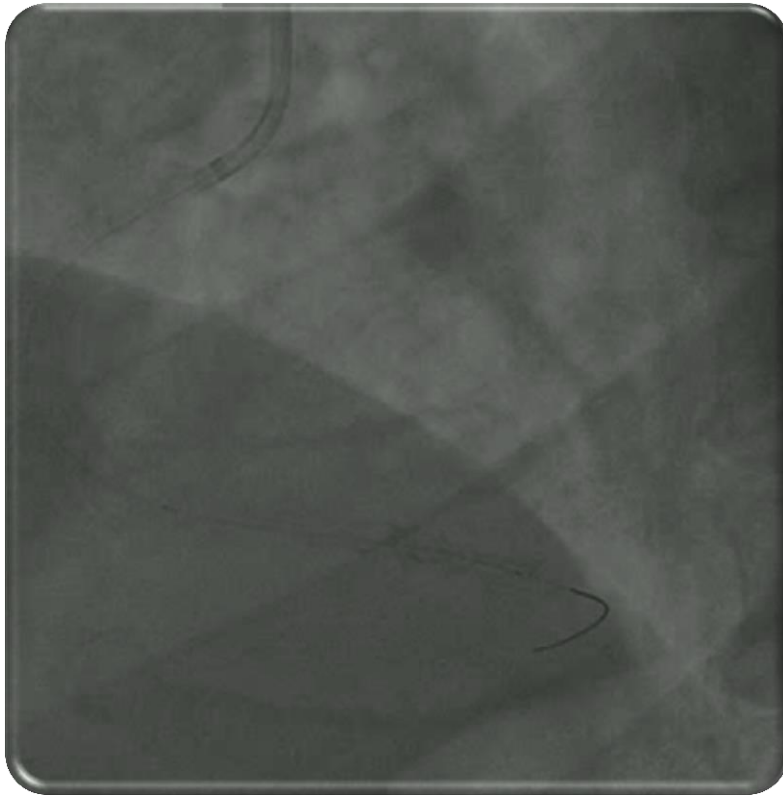


- Angiography show in-stent stenosis in Mid-RCA, blood flow TIMI III
- Note balloon inflate/deflate location was proximal to target lesion



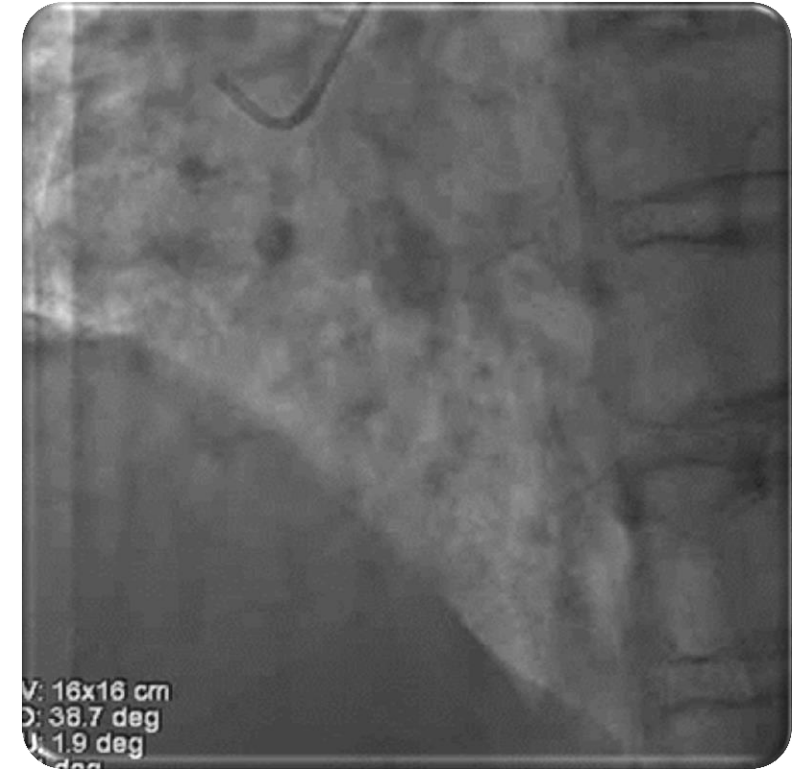
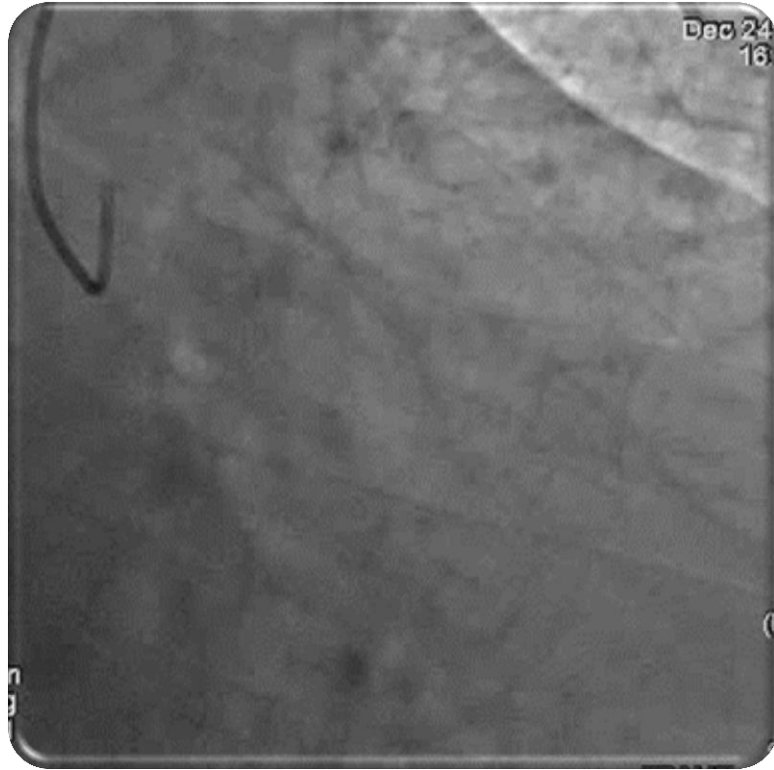
Dilation with GRIP™ 3.5*16 at 10atm for 30s

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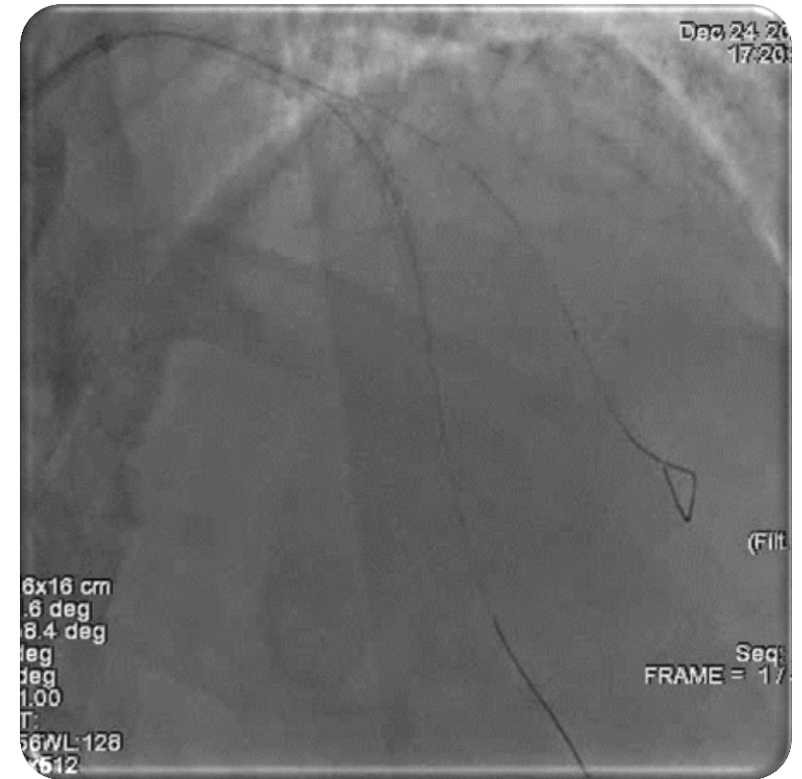
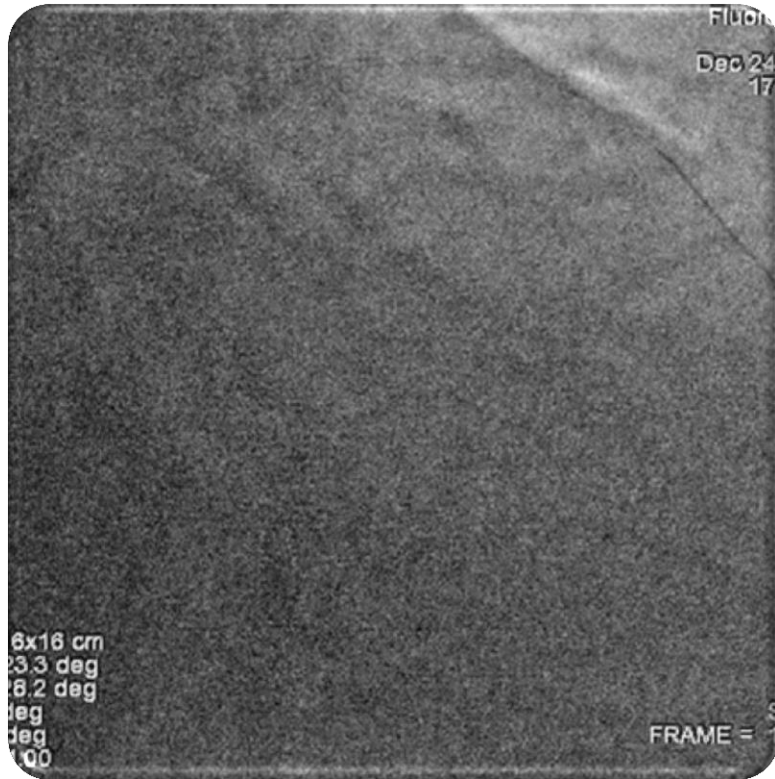
Blood flow TIMI III

- 3.5*30mm DCB @12atm, 60s. Residual stenosis<30%, TIMI III,
- stable hemodynamic data during procedure
- 1.9F microcatheter cannot provide sufficient perfusion volume (>20ml/min)
- Other microcatheter (such as 2.8F) not covered by current insurance policy

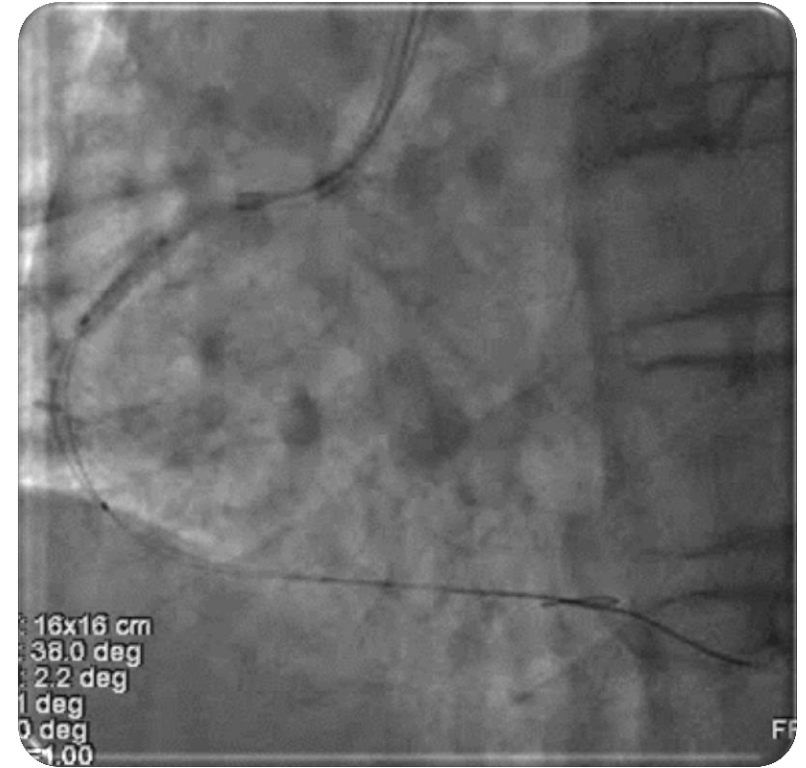
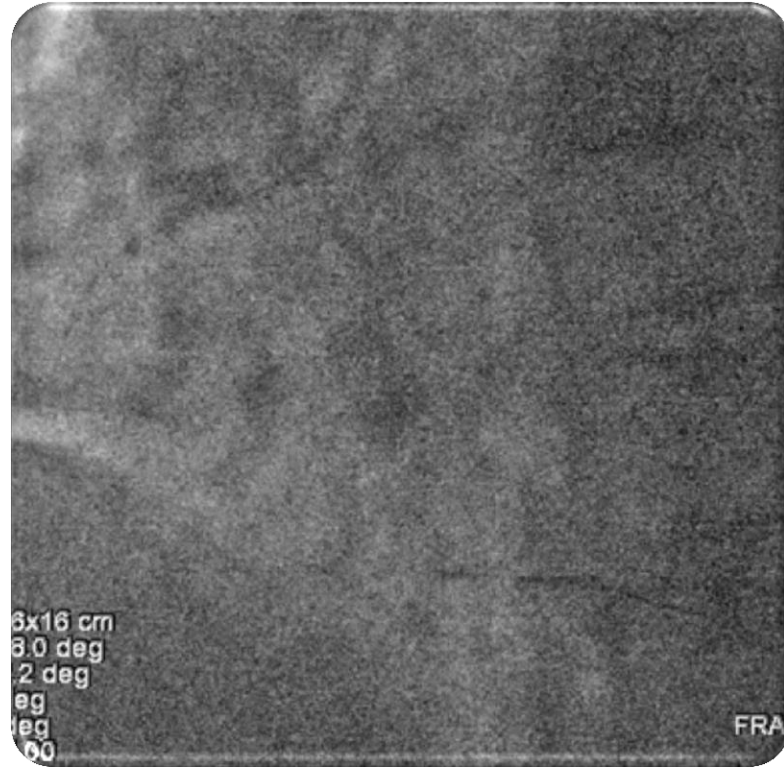
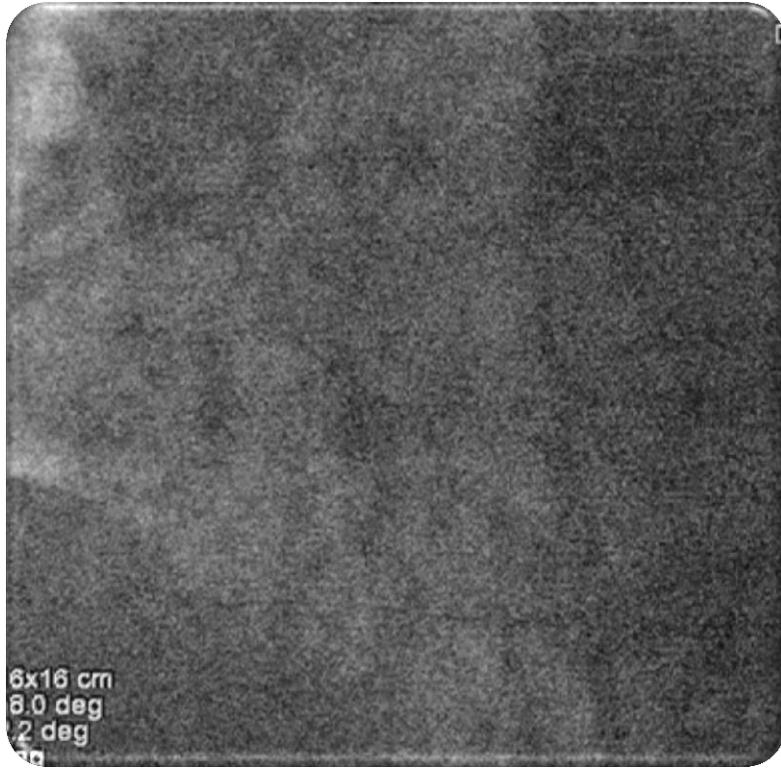


CASE 3

- 57 yls male, acute inferior & anterior STEMI 4 hours
- LAD proximal subtotal occlusion, TIMI 0-1; RCA proximal total occlusion, TIMI 0. Supine shortness of breath, blood pressure 130/80mmHg
- Dural guiding catheter technique via RA & RF route, inserted blockage balloon and aspiration catheter via separate guiding catheter respectively, active forward blood flow blockage and distal part perfusion were performed.
- 5 rounds of intra-aspiration catheter infusion, instant blood flow TIMI III, patient was in stable condition during and after procedure.



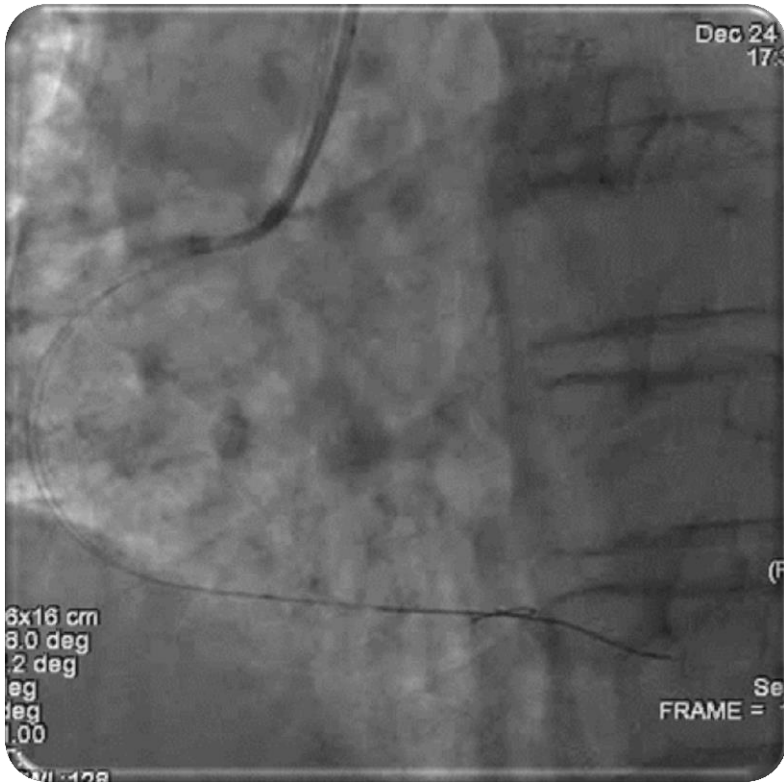
- Diffuse lesion in LAD, proximal tortuosity and calcification.
- Firebird stent 2.5*29mm, 3.0*23mm from mid to proximal LAD
- TIMI III and collateral circulation from apex and septal branch to RCA



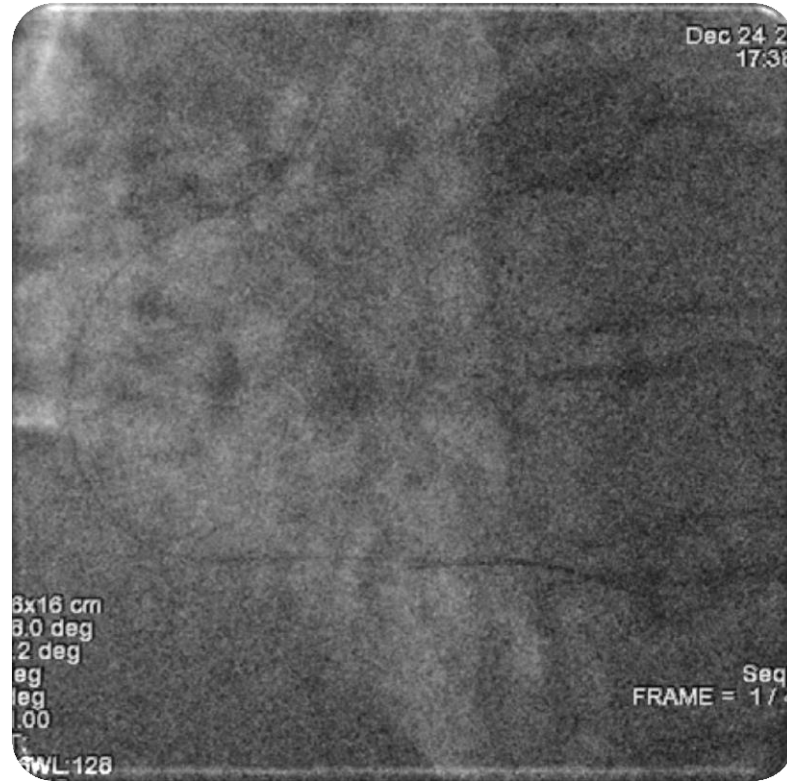
- RA route JR 4 GC
- Wire to distal RCA
- 3.5 NC balloon inflated @ 8atm block forward blood flow

- Aspiration catheter was positioned 15mm advanced of NC balloon
- Keep 3.5NC balloon inflation at 8atm to block forward blood flow

- Angiography via aspiration catheter to confirm distal part patency



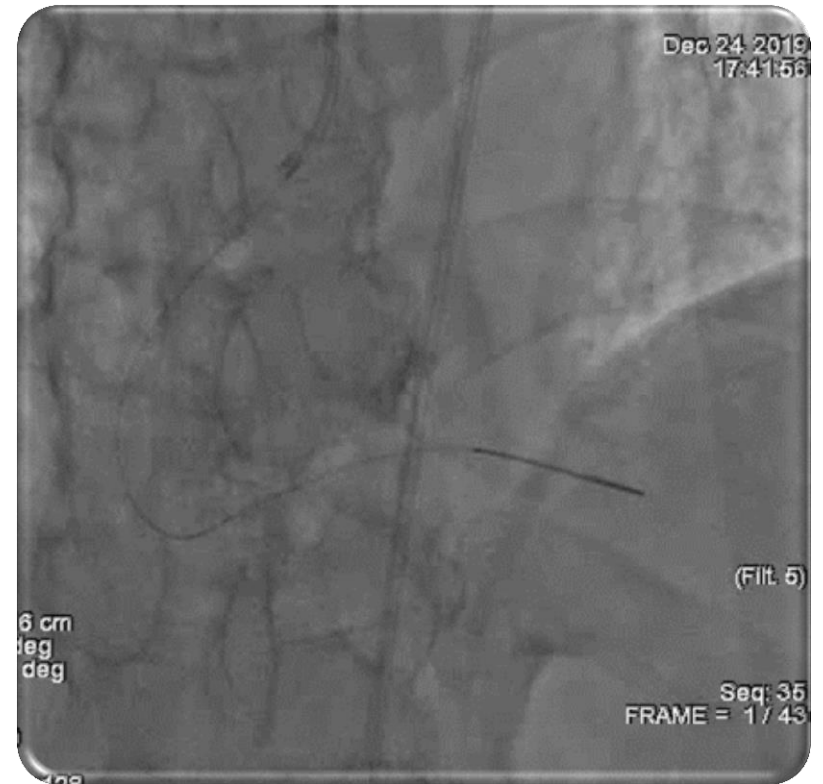
- Keep 3.5NC balloon at 8atm,
- Intra-aspiration catheter infusion of mixture solution (artery blood 10ml +heparin NS 10ml)
- 20ml/min for 5 mins



- Firebird 4.0*29mm stent deployed @ 12 atm



- TIMI III blood flow with poor local expansion at target lesion



- Post dilation with 4.0 NC @ 12-14 atm, fully expansion with TIMI III blood flow
- Heart rate & blood pressure maintain stable, Bp: 105/80mmHg

Discussion:

Classic iPost is still in continuous improvement

Protection target switched for ischemia reperfusion

The criteria of termination of protective operation

Discussion:

Classic iPost is still in continuous improvement:

Start-up time,

flow management,

cycle times and operation duration,

start-up and termination criteria

Discussion:

Protection target change for ischemia reperfusion:

From maintaining mitochondrial integrity of AAR cardiomyocytes and controlling mPTP opening, to protection against reperfusion injury of non-cardiomyocytes, such as vascular endothelial cells.

Discussion:

The standard of termination of protective operation:

Fixed number of iPost cycles?

or according to stable blood flow or hemodynamic status?

Reduce ischemia-reperfusion injury and improve the effect of perfusion therapy

To establish a reperfusion injury protection strategy with adequate restoration of coronary blood flow and reduction of microvascular obstruction(MVO) as the primary endpoint

Research goals for “VCR”

THANKS

谢谢您的关注