Primary Coronary Intervention in ST Elevation Myocardial Infarction with Left Main Occlusion or Stenosis

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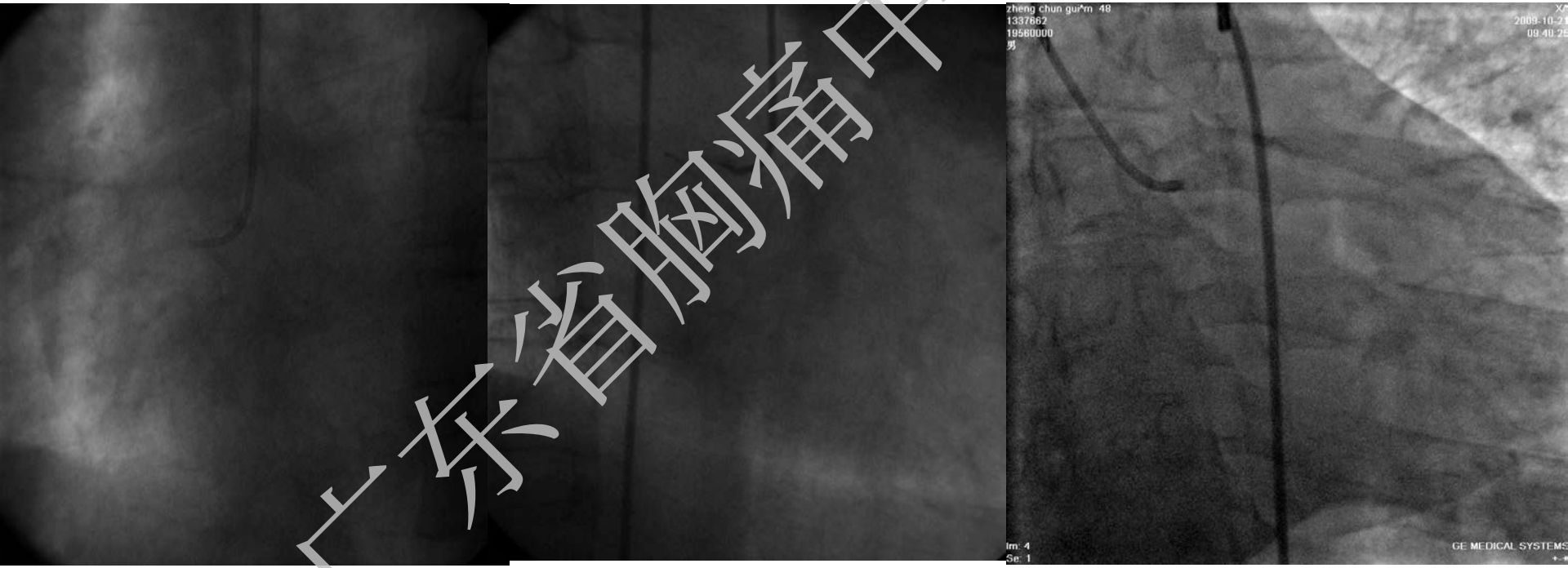
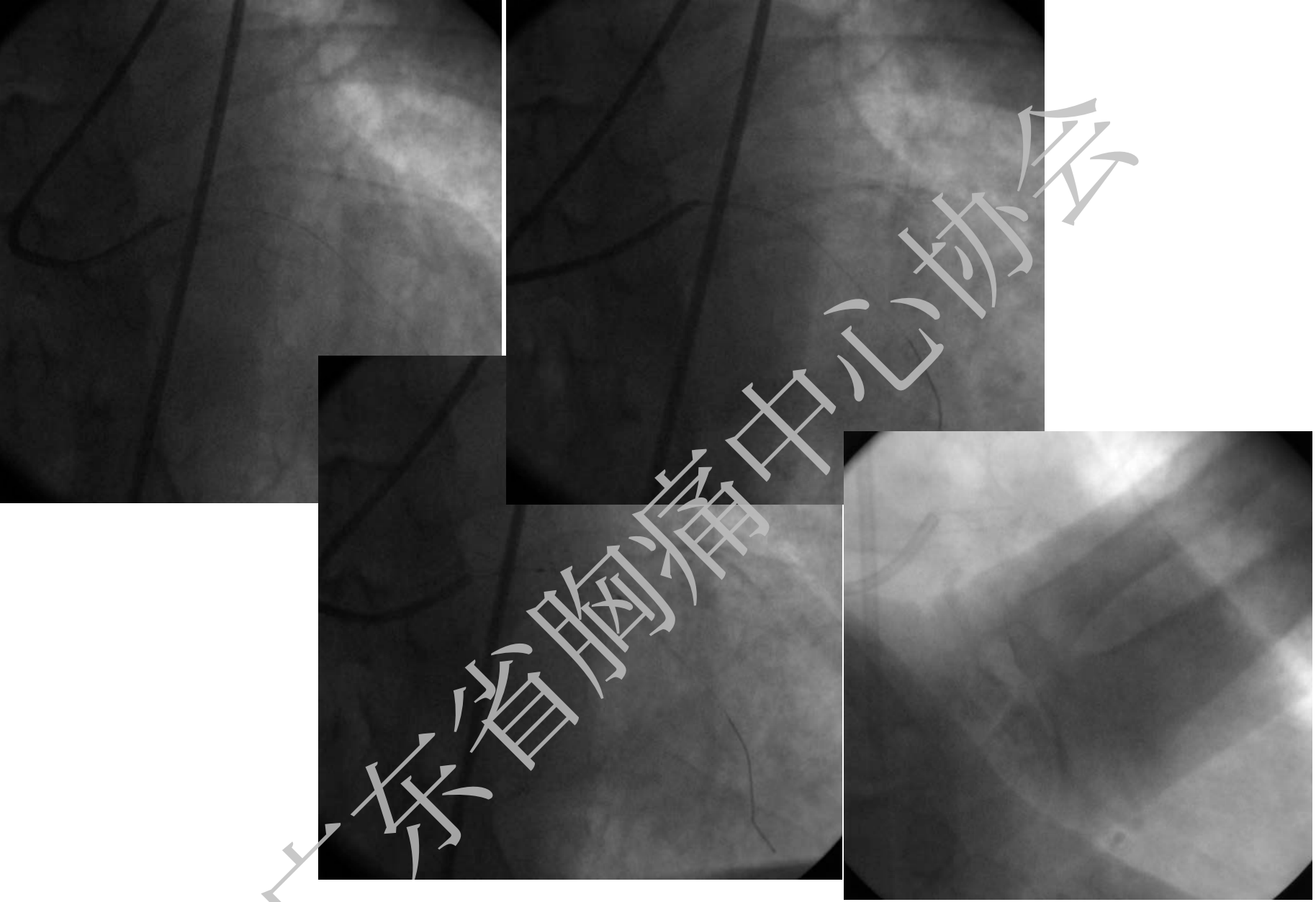
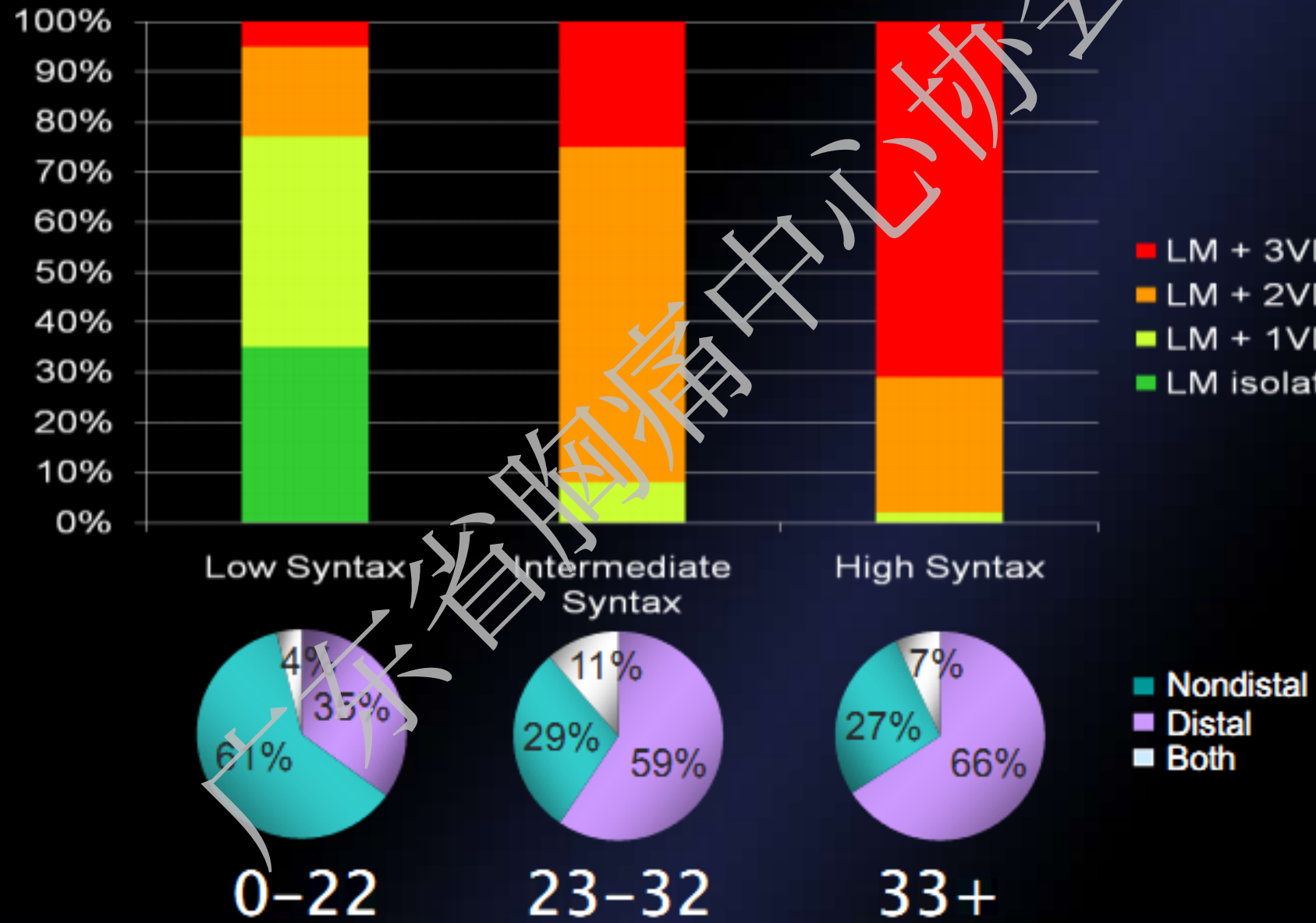
STEMI with LM Occlusion





Cardiovascular Collapse after Reperfusion

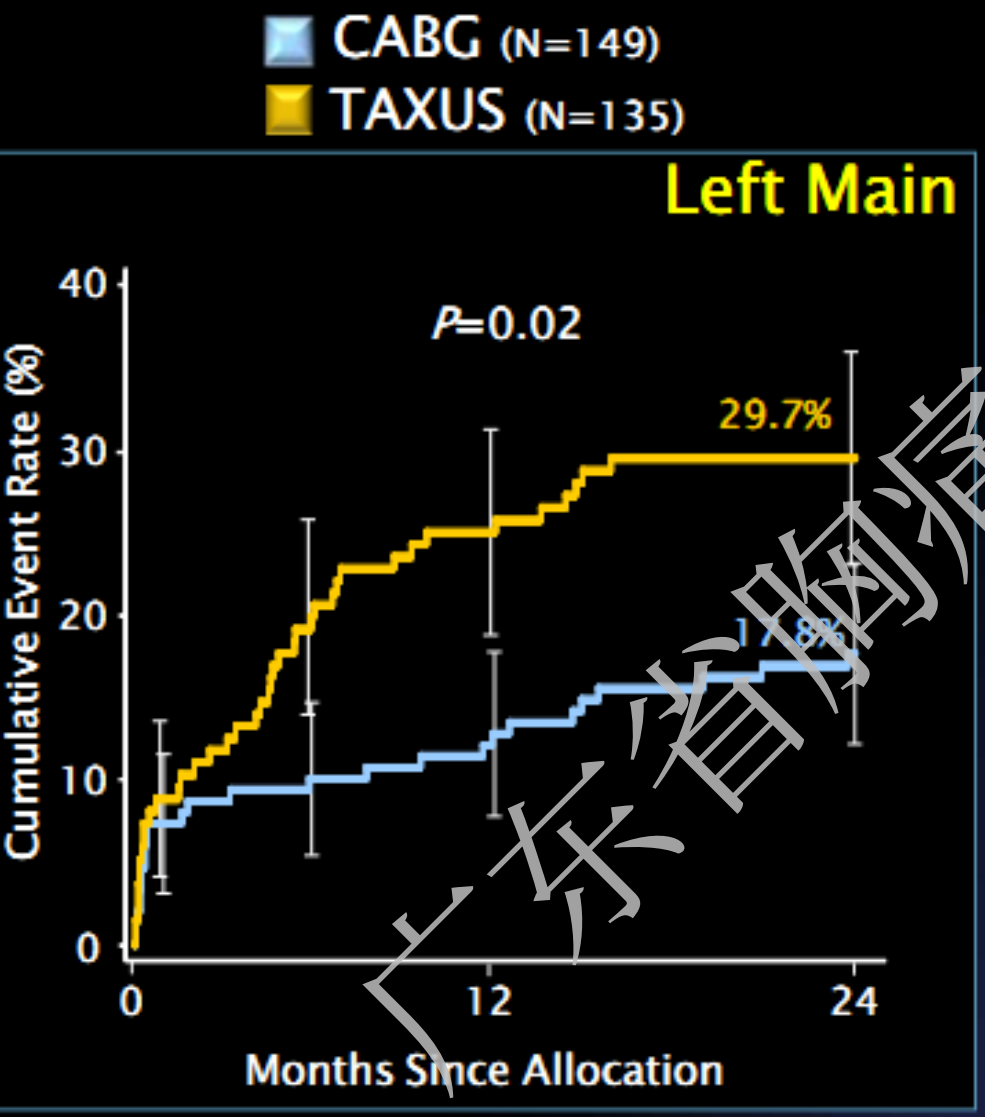
Vessel Distribution in LM Population According to Syntax Score Terciles



MACCE to 2 Years by SYNTAX Score Tercile

Left Main SYNTAX Score ≥33

SYNTAX

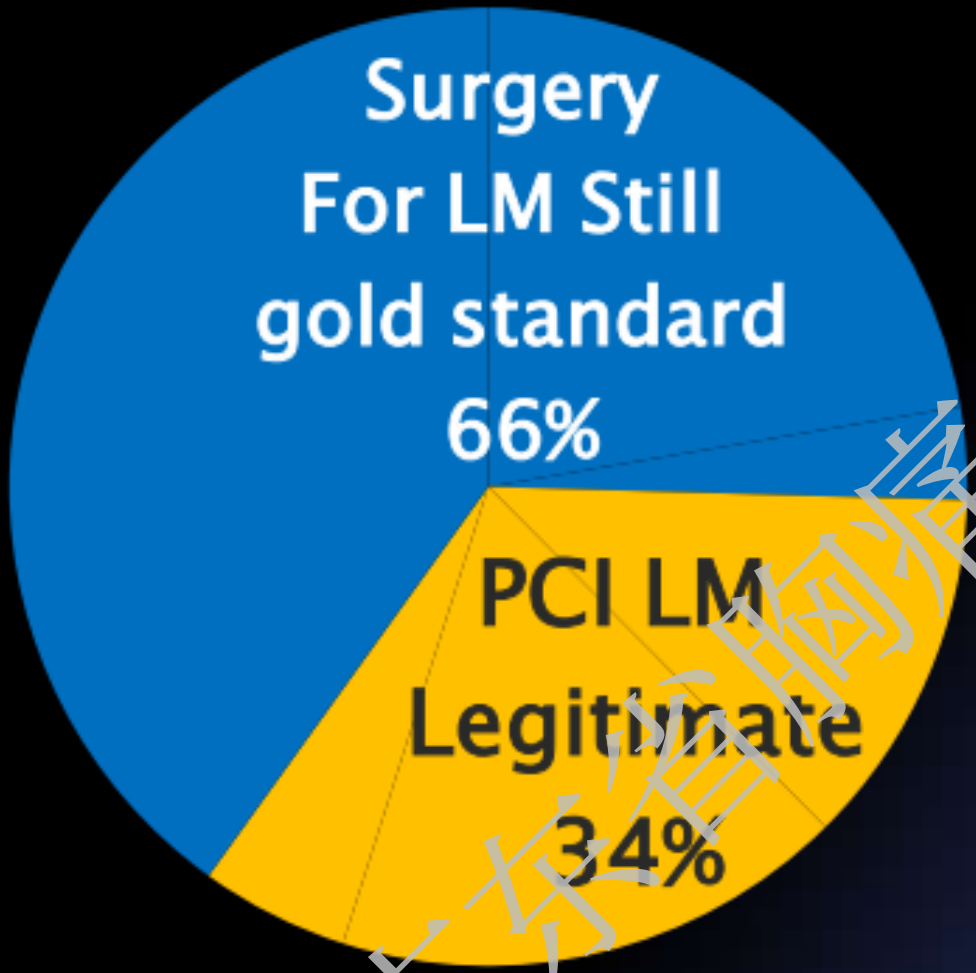


	CABG	PCI
Death	4.1%	< 10.4%
CVA	4.2%	> 0.8%
MI	6.1%	< 8.4%
Death, CVA or MI	11.5%	< 15.6%
Revasc.	9.2%	< 21.8%

Cumulative KM Event Rate ± 1.5 SE; log-rank *P* value

Site-reported data; ITT population

SYNTAX Trial Patient Distribution



Results of the SYNTAX trial suggest that 34 % of all patients with Left Main Stem are best treated with PCI , an excellent alternative to surgery… up to two year

Current Guideline Recommendations for UPLM Revascularization

		Elective PCI	ACS/AMI
ACC/AHA[1]	IIa	Class III angina and >50% LM stenosis who are *not eligible* for CABG	?
	IIb	*Alternative to CABG* may be considered in pts with anatomic conditions that are associated with a low risk of PCI procedural complications and clinical conditions that predict an increased risk of adverse surgical outcomes	
ESC[2]	IIa	Left main (isolated or 1-vessel disease ostium/shaft)	?
	IIb	Left main (isolated or 1-vessel disease distal bifurcation)	
	IIb	Left main plus 2- or 3-vessel disease, SYNTAX score <32	
	III	Left main plus 2- or 3-vessel disease, SYNTAX score >33	

1 ACC/AHA 2009 Focused Updates for STEMI and PCI. Circulation 2009;120:2271–2306

2 Wijns W, Kolh P., et al. Eur Heart J published online as doi:10.1093/eurheartj/ehq277

STATE-OF-THE-ART PAPER

Unprotected Left Main Coronary Disease and ST-Segment Elevation Myocardial Infarction

A Contemporary Review and Argument for Percutaneous Coronary Intervention

- Approximately 1% of patients undergoing primary PCI
- Revascularization is primary means of survival
- Clinically catastrophic event with in-hospital mortality that often exceeds 30% despite percutaneous or surgical revascularization
- Among hospital survivors, late term freedom from adverse events is favorable
- Hemodynamic assessment may be erroneous
- No specific treatment recommendations or guidelines
- Evidence basis is minimal compared with other PCI indications
- Bias precludes any definitive trial

Lee, Kandzari. JACC Intv 2010;3:791-795.

ULM Percutaneous Revascularization in STEMI/NSTEMI

	N	Cardiogenic Shock	In-Hospital Mortality	Follow Up Duration	Out-of Hospital Mortality
Lee et al. 2004[1]	18	78%	44%	39±22 months	0
Tan et al. 2008[2]	16	69%	46%	420 days	0
Lee et al. 2009[3]	62 (STEMI/ NSTEMI)	24%	8%	586±431 days	5%
Prasad et al. 2009[4]	28	62%	36%	26±12 months	3%
Marso et al. 1999[5]	40	92%	55%	12 months	8%
Montalescot et al. 2009[6]	514 (STEMI/ NSTEMI)	8%	11%	6 months	5%

1 Lee. Int J Cardiol 2004;97:73-76
2 Tan. Int J Cardiol 2008;126:224-228
3 Lee. CCI 2009;73:15-21
4 Prasad. CCI 2009;73:301-307
5 Marso et al. Am J Cardiol 1999;83:1513-1517
6 Montalescot Eur Heart J 2009;30:2308-2317

Challenges to Interpretation of Comparative ULM Revascularization Trials in STEMI/NSTEMI

1. Non-randomized design
2. Small sample size
3. Variable duration of follow-up
4. Selection and treatment bias
5. Absence of intent to treat

Comparative ULM Revascularization Strategies in STEMI/NSTEMI

1,799 ULM Disease and ACS, 2000-2007			
	PCI* (N=514)	CABG (N=612)	No Revasc (N=673)
Shock/Killip IV	7.9	2.7	5.4
Isolated LM	8.0	5.2	5.6
Revasc ≤24 hrs	48.0	5.1	—
Revasc ≤48 hrs	69.0	25.0#	—
IABP	20.0	24.0	4.4
GRACE Risk Score	151	134	143

Represented as percent.

*70% BMS in PCI cohort. #Median time to CABG 4.5 days

Montalescot Eur Heart J 2009;30:2308-2317

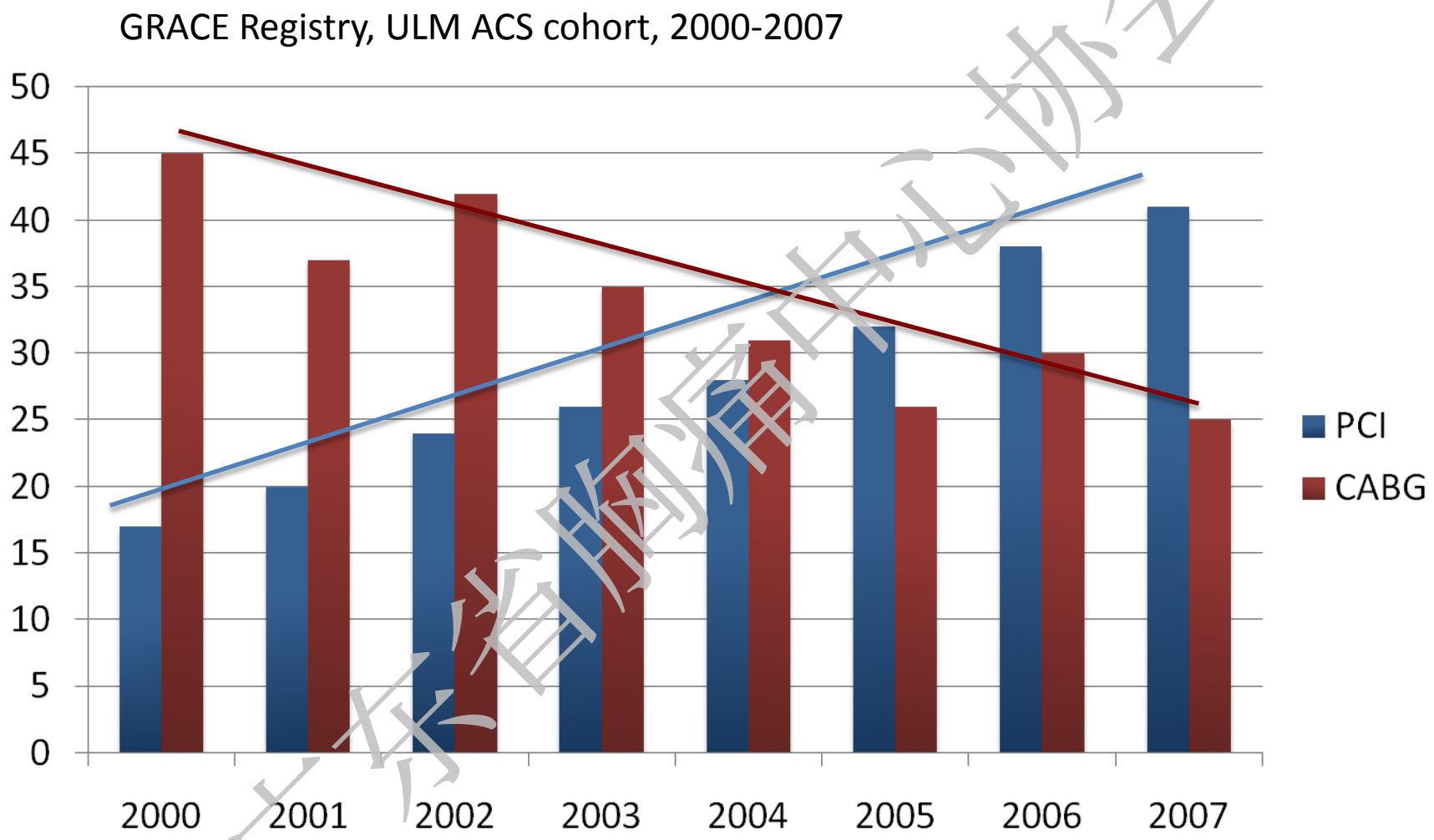
Comparative ULM Revascularization Strategies in STEMI/NSTEMI

	PCI (N=514)	CABG (N=612)	No Revasc* (N=673)	*P* Value
In-Hospital Outcomes				
Death	11.0	5.4	7.6	0.001
Death: Cardiac arrest/shock cohort	40.0	30.0	29.0	0.71
Death: STEMI cohort	13.0	5.0	12.0	0.01
Stroke	0.4	2.1	0.6	0.02
Out of Hospital to 6-Month Outcomes				
Death	5.4	1.6	10.0	0.005
Death: STEMI cohort	7.9	3.1	12.0	0.19

Represented as percent. *43% no revasc cohort underwent CABG post discharge.

Montalescot Eur Heart J 2009;30:2308-2317

Comparative ULM Revascularization Strategies in STEMI/NSTEMI



Montalescot Eur Heart J 2009;30:2308-2317

Advancing ULM As A Standard in AMI

	PCI	CABG
✓	Timely reperfusion	Delay, especially off-peak times
✓	IRA- vs IRA and non-IRA PCI	Completeness of revascularization
	Drug-eluting stents	Saphenous vein grafts
✓	Cardiopulmonary and ventricular support	Cardiopulmonary and ventricular support
✓		Stroke
		Solution to mechanical complications of AMI

Advancing ULM As A Standard in AMI

Who Should Be Considered for ULM PCI in ACS?

1. ULM occlusion with <TIMI 3 flow
2. Cardiogenic shock and/or lethal arrhythmias
3. Coexisting conditions that pose excessive CABG risk
4. If TIMI 3 flow *and* hemodynamic stability, consider:
   - Hemodynamic support
   - ULM anatomy (ostial/shaft vs bifurcation)
   - Technique, *eg*, guide catheter size, aspiration, 1 stent, IVUS
   - Extent of non-LM disease
   - Left ventricular function
   - Stroke risk
   - Suitability for DES (restenosis <u>not</u> primary concern in AMI)
   - Availability and willingness of surgical team

ULM Revascularization in Myocardial Infarction
Summary

- For ULM pts with ACS, clinical outcomes are improved with any early revascularization compared with medical therapy alone
- Treatment bias favoring PCI over CABG in highest risk patients precludes comparison between 2 modalities
- Despite differences in patient groups and decisions for treatment, ULM PCI in AMI is associated with similar early survival compared with CABG and acceptable late-term freedom from events
- Opportunities include: timing and method of hemodynamic support, late term safety of PCI, collaboration between surgical and interventional teams for revascularization and/or ventricular support

Reperfusion strategy

- **Iwasaki :**
  - **As patients with LM occlusion is complicated by high occurrence of cardiogenic shock, thrombolysis is inadequate.**
  - **When PTCA can not achieve sufficient revascularization, emergency CABG should be performed.**
- **Marso: Compared with POBA, primary stenting was associated with improved clinical outcomes.**

Jpn Circ J ,1993,57:891-897
Am J Cardiol, 1999, 83(11):1513-1517

Predictors of survivals

- Lee: The survival group had a higher frequency of good pre-intervention TIMI flow (grade ≧ 2, 70% vs. 13%, p = 0.03) than the mortality group.
- Iwasaki : Well-developed right coronary artery and good collaterals were noted in survivors.

Lee:Int J Cardiol, 2004, 97(1):73-76
Jpn Circ J , 1993,57(9):891-897

Experience
in Beijing Chaoyang Hospital

北京朝阳医院
Beijing Chaoyang Hospital

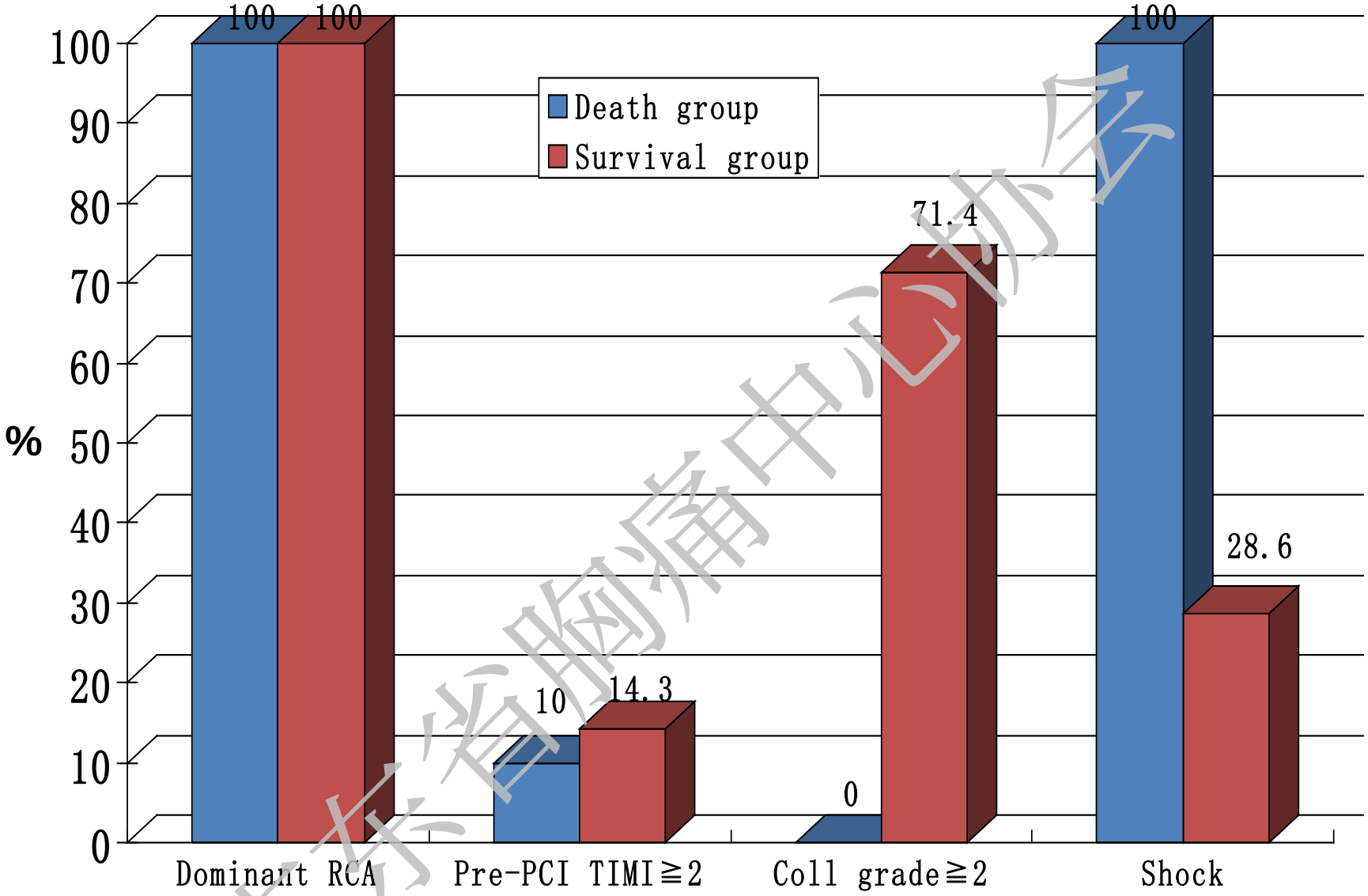
- From Jan. 1995 to Feb. 2007, there were 2021 AMI patients received primary PCIs, among whom there were 17 patients (0.84%) with AMI related with LM obstruction.
- 16 patients were male
- Age: 57.2±14.2 years（43 to 85 years）
- Occurrence of cardiogenic shock at admission: 70.6% (12/17)
- IABPs were performed in all patients

- **Stent implantation after balloon dilation was performed in 12 cases. Stent covered LM-LAD, and no intervention was performed in LCX.**
- **POBA was performed in 5 cases, and emergency CABGs were performed immediately after PCI in 2 cases of the POBA group.**

- **10 patients died in hospital and the mortality was 58.8%.**
- **follow-up in the survival cases:**
  - **The first patient received repreat angiography 18 years later, and angiogram showed there was no restenosis in stent.**
  - **Another patient died suddenly 4 years later .**
  - **The last patient was readmitted 1 month later with severe heart failure.**

The study population was divided into survival group and mortality group, and univariate analyses showed:

- **The incidence of dominant RCA (100% in survival group vs. 100% in mortality group), pre-intervention TIMI flow grade≧ 2(14.3% vs. 10.0%,** respectively, **p = 1) was similar between the survival group and mortality group.**
- **The survival group had a higher frequency of good collaterals grade≧ 2 (71.4% vs. 0%,** respectively, **p = 0.003) and lower frequency of cardiogenic shock at admission (28.6% vs. 100%,** respectively, **p = 0.003) than the mortality group.**



Clinical characteristics between death group and survival group

- **Furthermore, the study population was divided into two groups according to the collateral circulation before emergency PCI: the group without collateral flow（Rentrop grade 0-1）and the group with collateral flow （Rentrop grade 2-3）.**
- **Univariate analyses showed the group without collateral flow had higher in-hospital mortality (83.3% in the group without collateral flow vs. 0% in the group with collateral flow p = 0.003,), and a trend of higher occurrence of cardiogenic shock (83.3% vs. 40%, respectively, p = 0.117)**

Reperfusion injury?

- In the early cases with neither pre-intervention TIMI flow nor collateral flow, “cardiac collapse ” often occurred soon after TIMI flow grade 3 recovered by balloon dilation or stent implantation.
- The exact mechanism was unclear, and severe reperfusion injury might play a very important role.
- Partial re-canalization or “post conditioning” strategy might decreased reperfusion injury in such patients.

1995年-2010年

- 1995年1月至2010年6月由我们中心AMI行急诊PCI的3746患者中收集梗死相关血管（IRA）为LM者共28例
- 根据住院期间是否死亡分为死亡组和存活组，对比两组的临床及冠状动脉造影资料，对存活患者进行随访，了解是否发生严重心脏不良事件。

结果

- 共15例合并心源性休克（53.6%），共有25例患者接受PCI治疗植入支架，有2例在接受PTCA后10天内接受早期CABG治疗，还有1例于PCI操作过程中死亡。
- 院内死亡共10例（死亡率35.7%）
- 心源性休克的15例患者院内死亡共8例（死亡率53.3%）
- 存活者平均住院22.1±2.6天，均进行3月以上随访，其中6例随访超过2年，在2年以内随访期间内均无死亡、再发心肌梗死、因心绞痛再入院、心功能恶化等

表1　存活者与死亡者临床与介入诊治比较

变量	存活者 n=18（%）	死亡者 n=10（%）	P值
年龄	59.0±11.3	65.9±13.3	0.16
性别（男）	15（83.3）	9（90）	0.55
NSTEMI	5(27.8)	0	0.13
合并休克	7（38.9）	8（80）	0.04
高血压	10（55.5）	7（70）	0.84
糖尿病	2（11.1）	0	0.77
高脂血症	7（38.9）	0	0.50

吸烟	12（66.7）	7（70）	1.0
发病至再通时间（h，24例）	5.2±2.8	3.3±2.5	0.12
左室EF值	0.53±0.17	0.37±0.13	0.16
术前TIMI血流≤1级	11（61.1）	9(90)	0.11
无侧枝循环	6（33.3）	10（100）	0.001
术后TIMI血流=3级	17（94.4）	7（70）	0.08
合并RCA病变	6（33.3）	4（40）	0.72
介入操作累及LCX	6（33.3）	4（40）	0.72
IABP应用	11（64.7）	10（100）	0.05
替罗非班应用	9（50）	3（30）	0.43
较新介入治疗时代（近5年）	12（66.7）	5（50）	0.38

表2　Cox回归筛选院内死亡的相关因素

方程中的变量	*B*值	*RR*值	*P*值
年龄（每增加10岁）	3.041	20.930	0.044
存在心源性休克	3.526	33.985	0.037
较新急诊介入时代(近5年）	-11.328	<0.001	0.033
术后TIMI血流达到3级	9.39	＞100	0.08

表 3　与心源性休克的相关因素

方程中的变量	*B*值	*OR*值	*P*值
年龄	-0.77	0.47	0.18
性别	-2.07	0.13	0.35
发病至再灌注时间	-0.01	0.99	0.81
合并RCA病变	-0.56	0.57	0.62
术前TIMI 血流≤1级	1.82	6.16	0.29
无侧枝循环	2.69	14.69	0.05

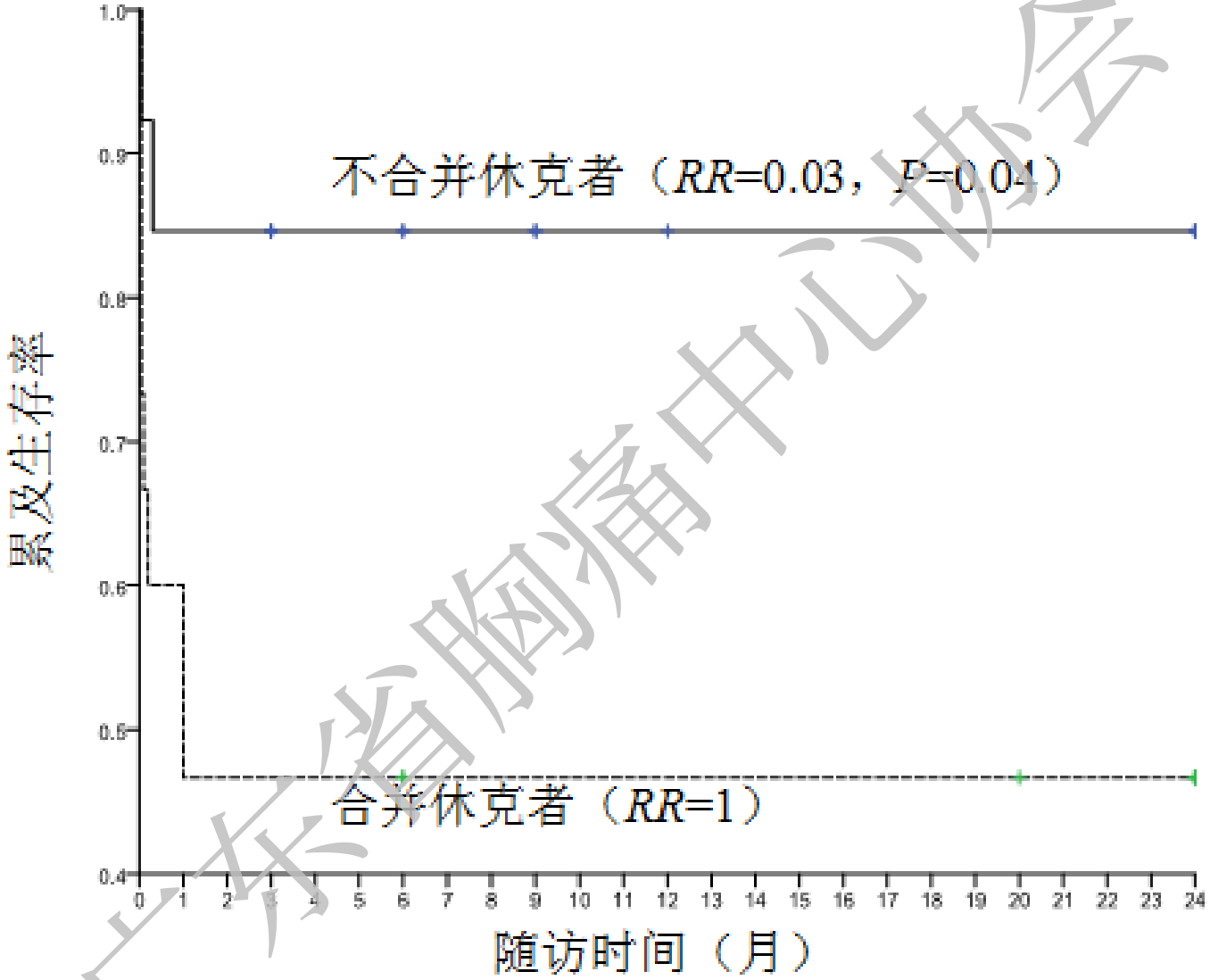
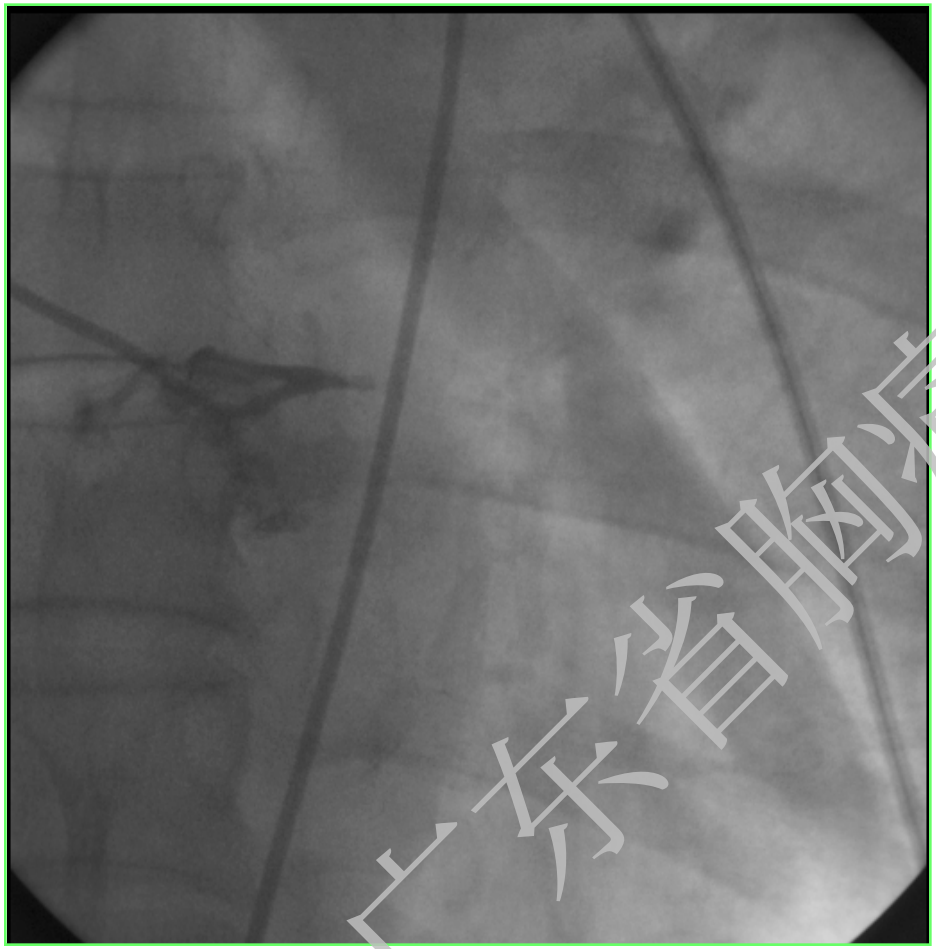
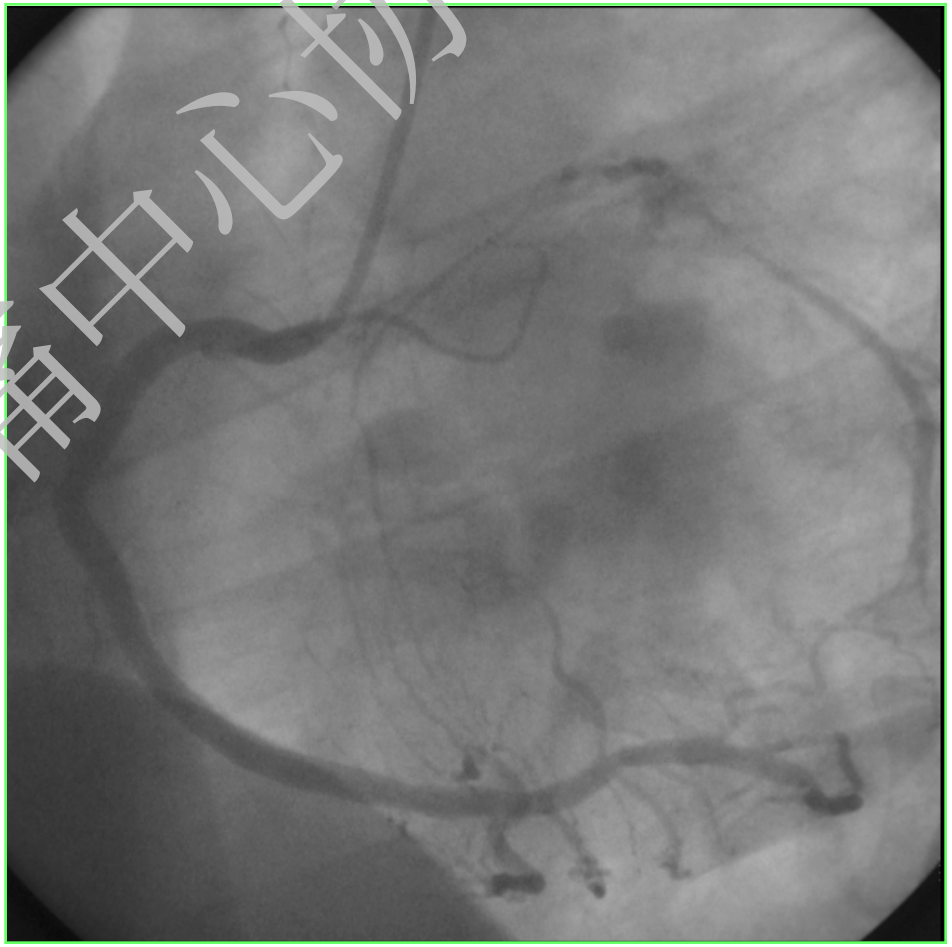


图 1　有无休克两组患者的生存曲线

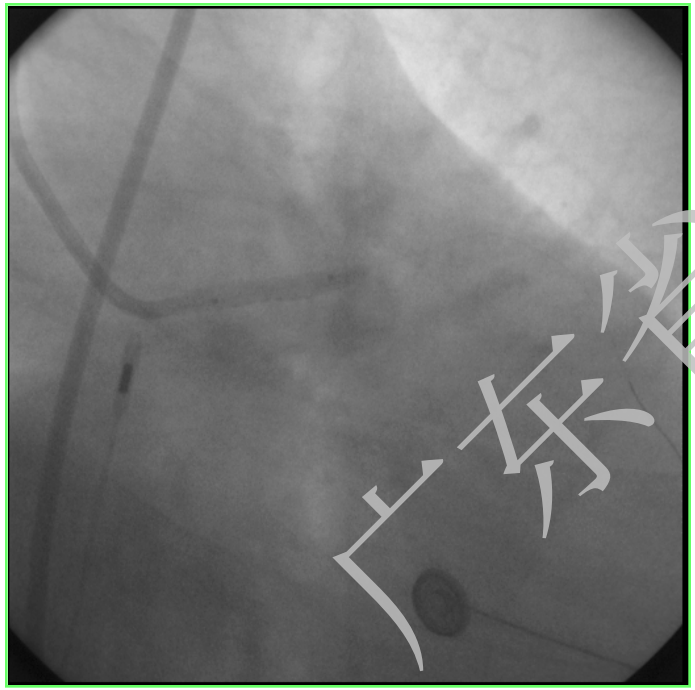
Case 1: 53-years-old male smoker presented with acute persistent chest pain of 2 hours

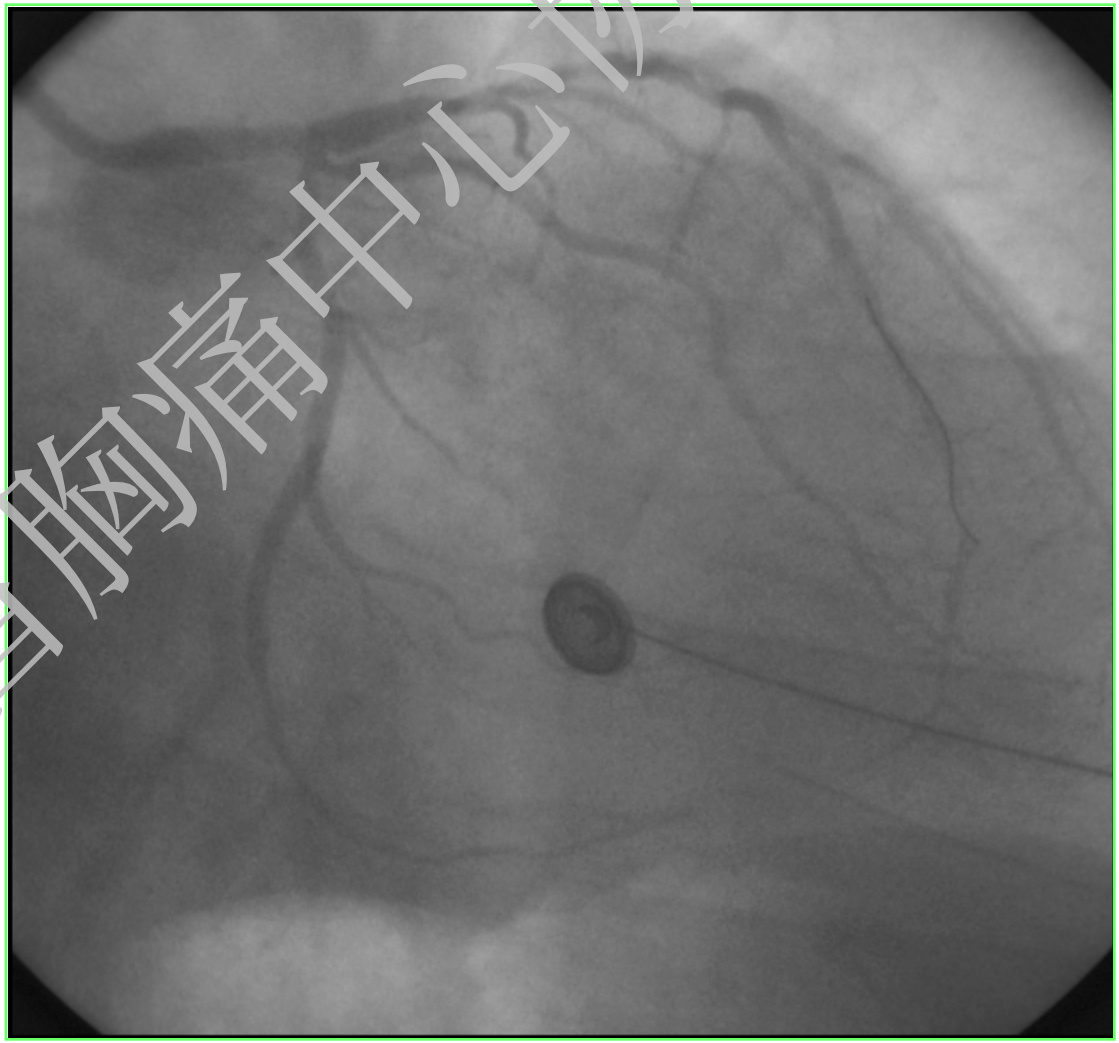




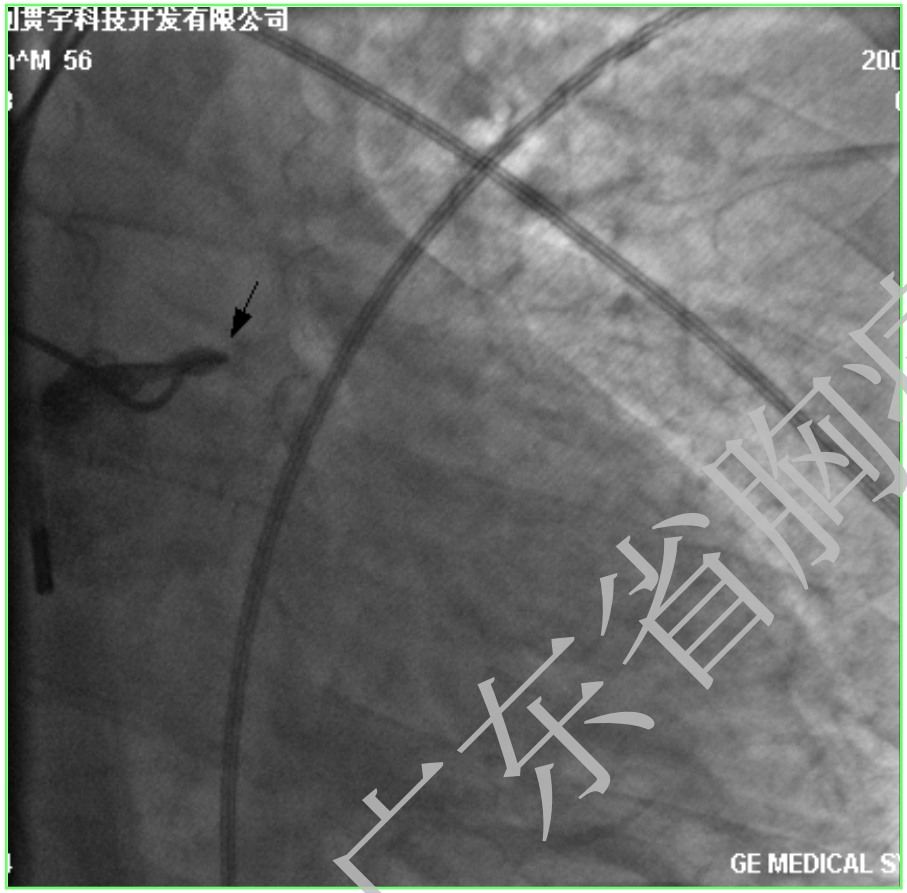
good collaterals with grade 3 was noted

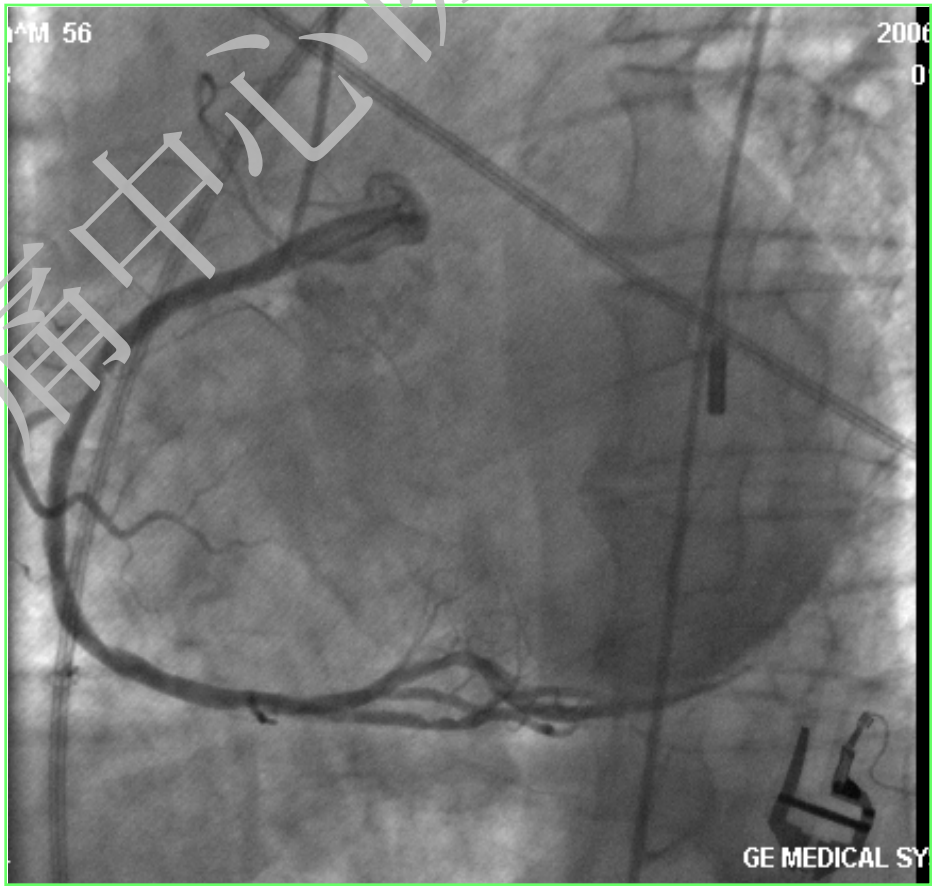
- **3.0×15mm RSTENT was implanted**
- **He kept asymptomatic during 13 months' follow-up**



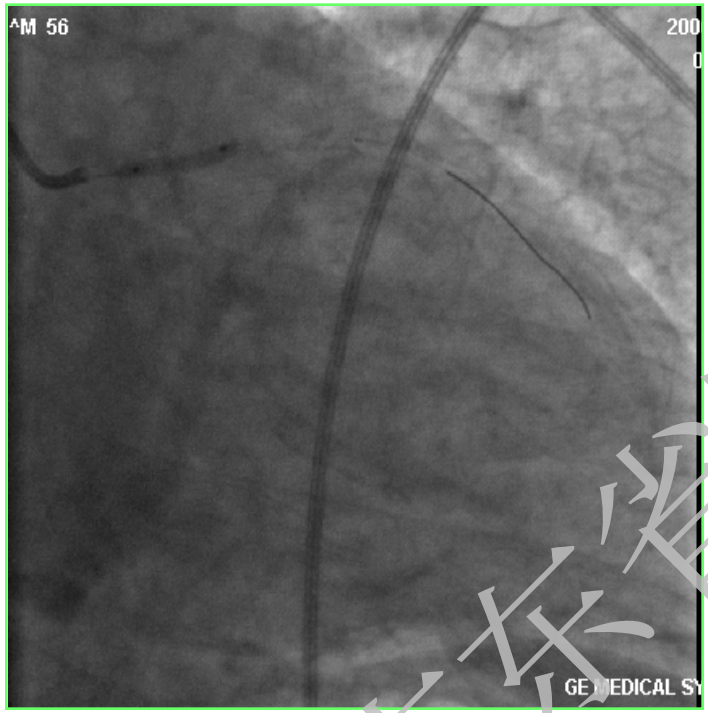


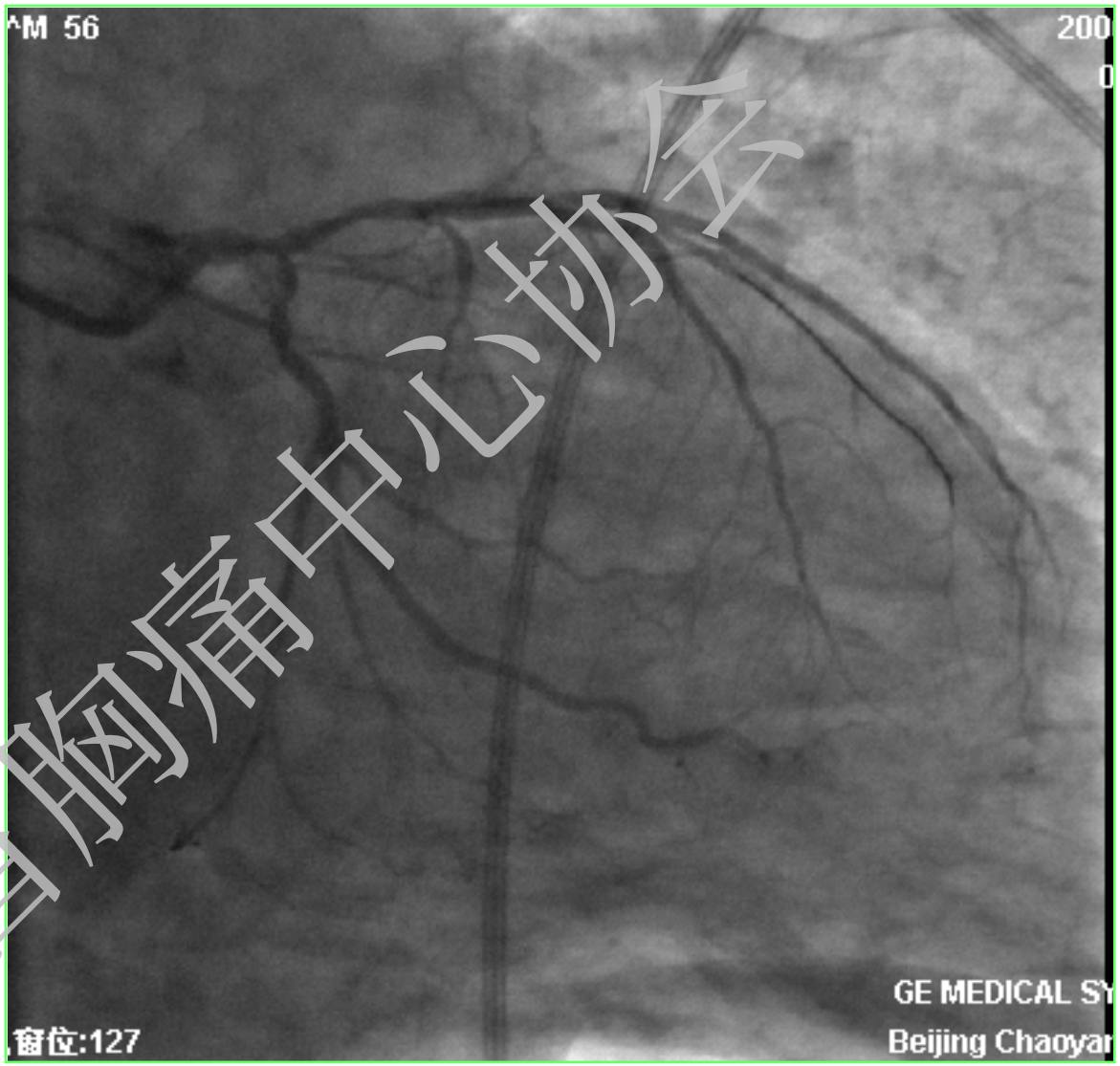
Case 2: 56-years-old male smoker presented with acute persistent chest pain of 1 hours





No collaterals was present





POBA with 2.5×15mm was performed

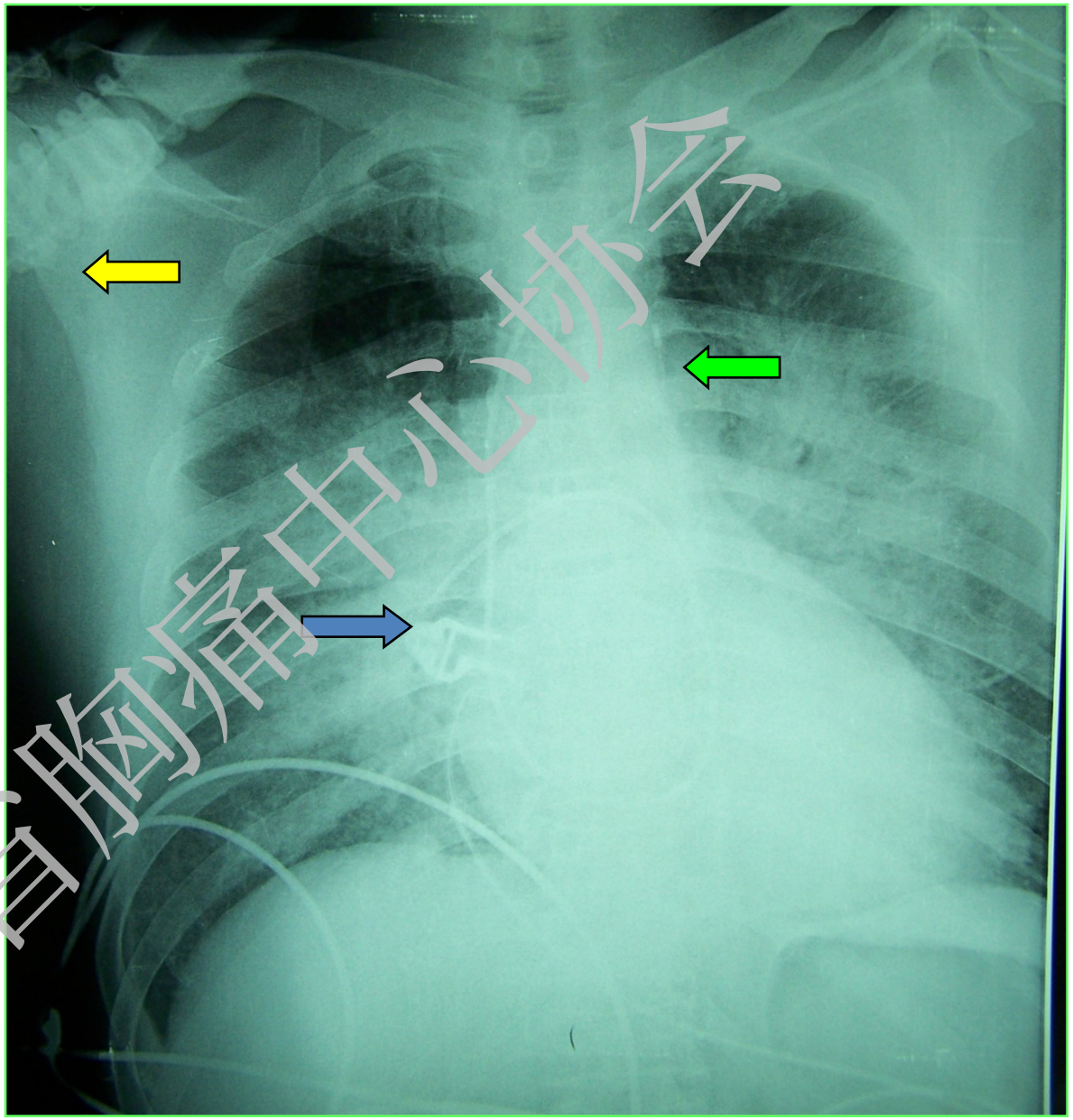
Tube of no-invasive mechanical ventilation

IABP

Swn-Ganz catheter.

PCWP: 30mmHg

CI:1.3 L/min*m^2



Died 40 hours later

Chest film: severe pulmonary edema

王乐丰，徐立，杨新春等，左主干急性闭塞或狭窄所致急性心肌梗死的急诊介入治疗

.中华心血管病杂志，2006，34（1）:5-7.

病史资料:

患者：石x，男，68岁。主诉“突发胸痛2小时”入我院急诊。

既往史：高血压10余年，吸烟史30余年，否认糖尿病和高脂血症。

入院检查：

- HR：76次/分，BP：105/70mmHg。
- 房颤心律，双肺呼吸音粗，未及明显湿罗音，双下肢无水肿。
- ECG：I、aVL，V1-6 ST段抬高0.1-1.2 mv

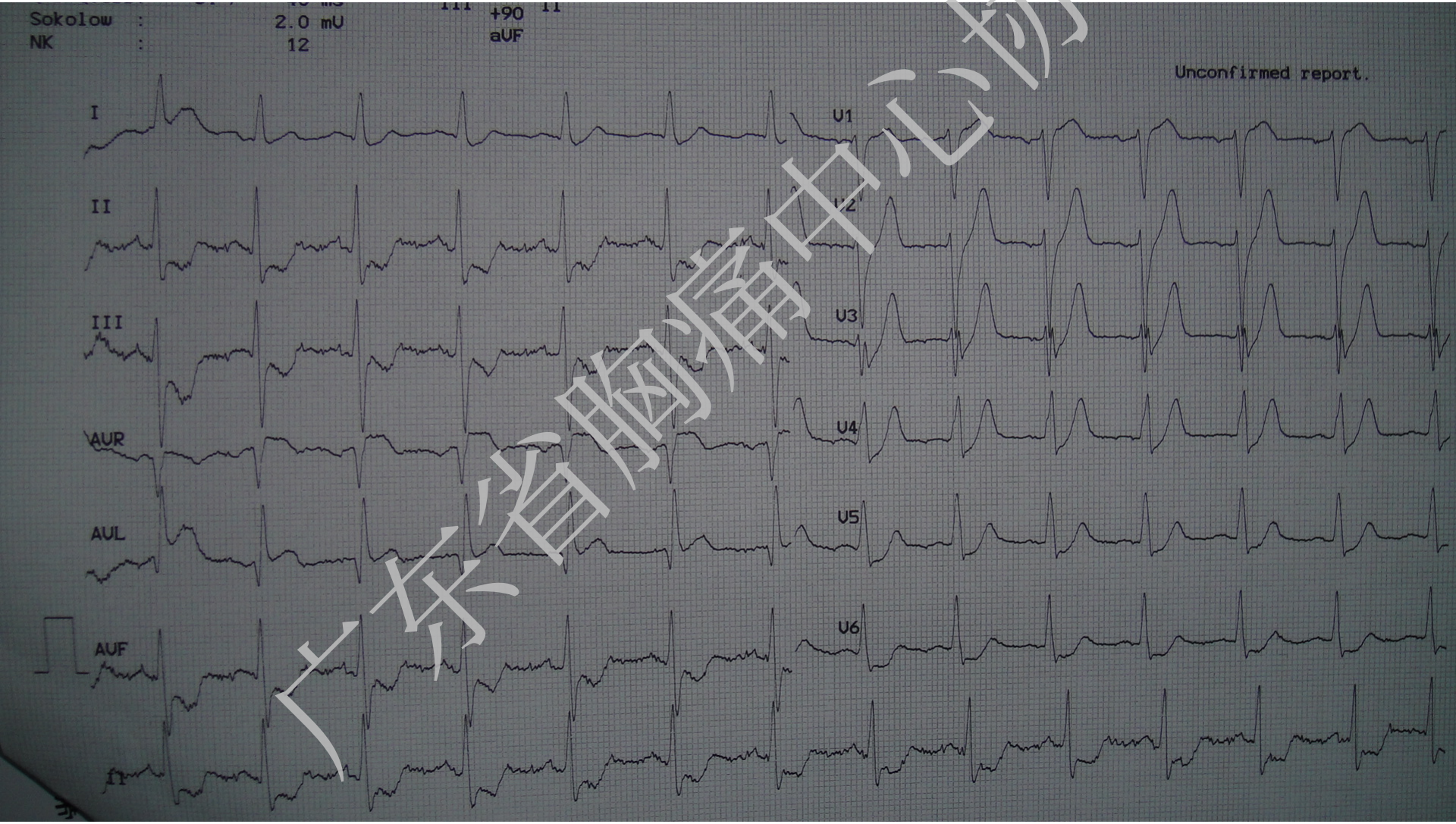
  II、III、AVF ST段压低0.2-0.8 mv

  AVR导联ST段抬高0.1 mv。

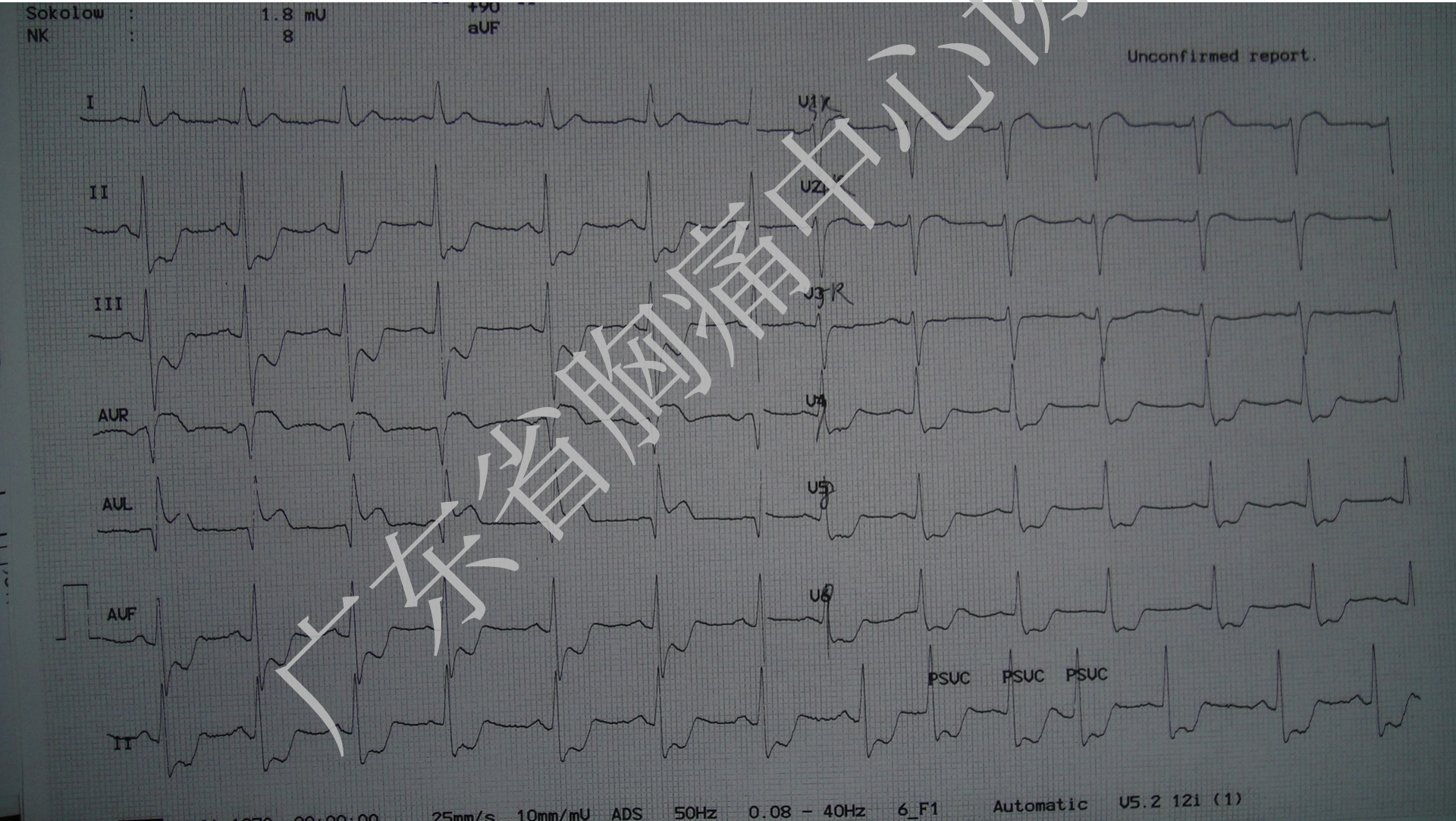
诊断：

- 结合病史、心电图，急性广泛前壁心肌梗死诊断明确，行急诊冠脉造影提示左主干完全闭塞。
- 家属不同意CABG术，交待病情后遂行PCI术，干预LM、LAD、LCX。
- 术前IABP辅助循环。

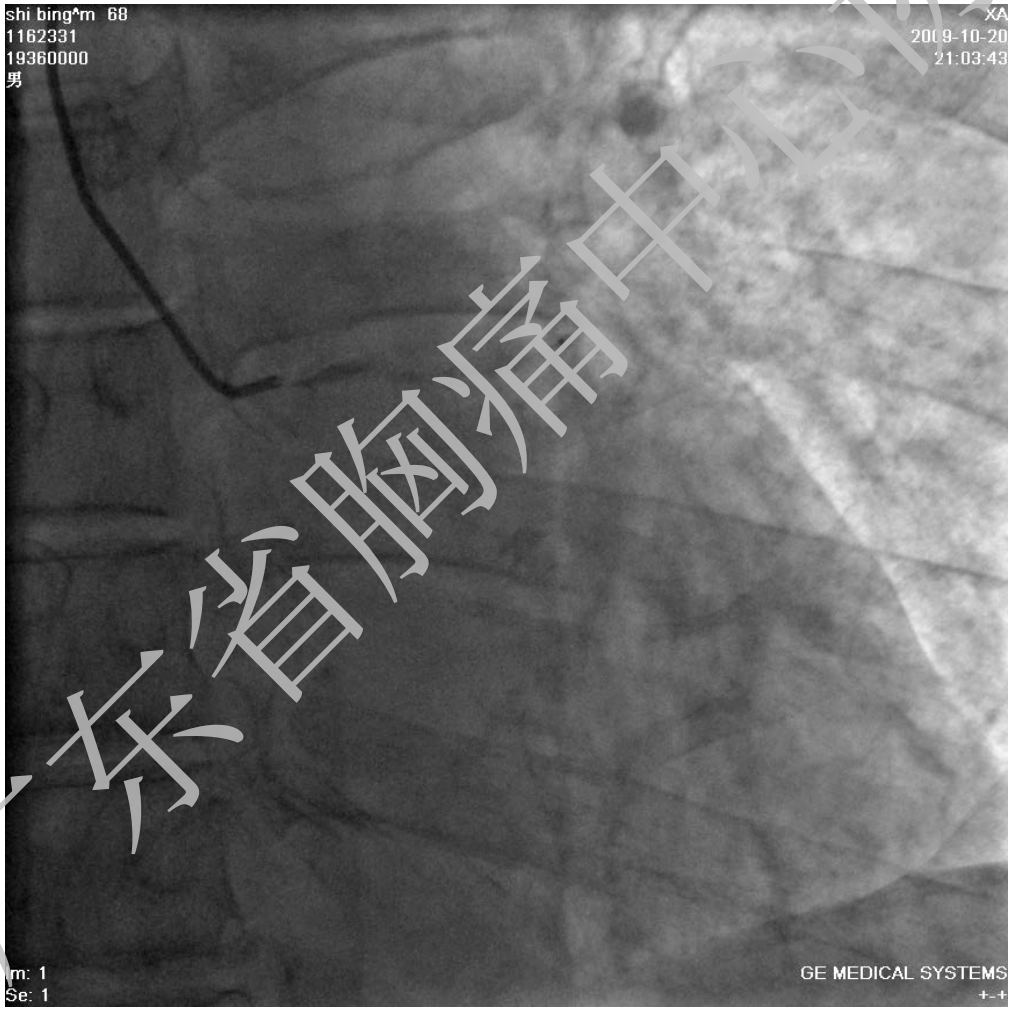
ECG



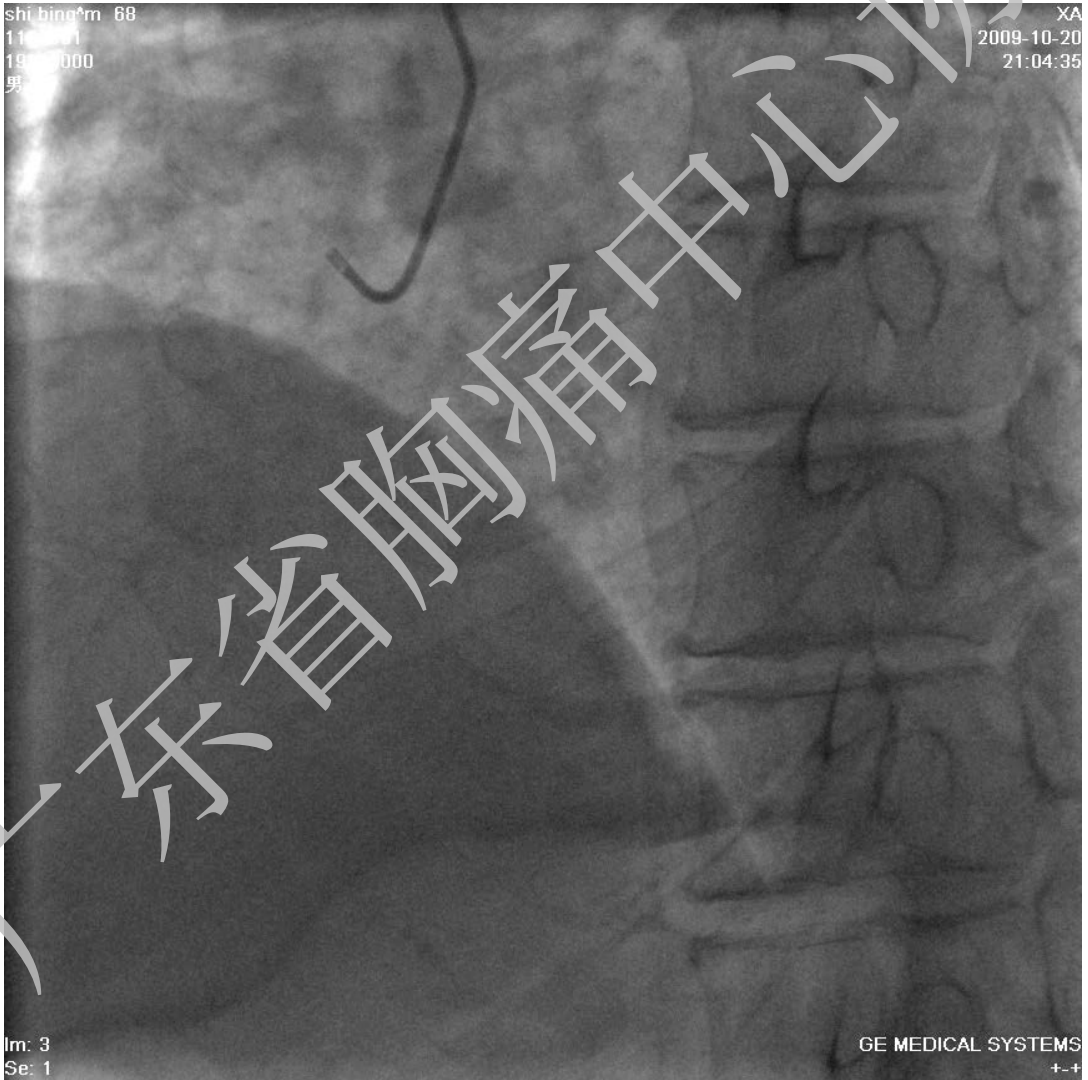
ECG



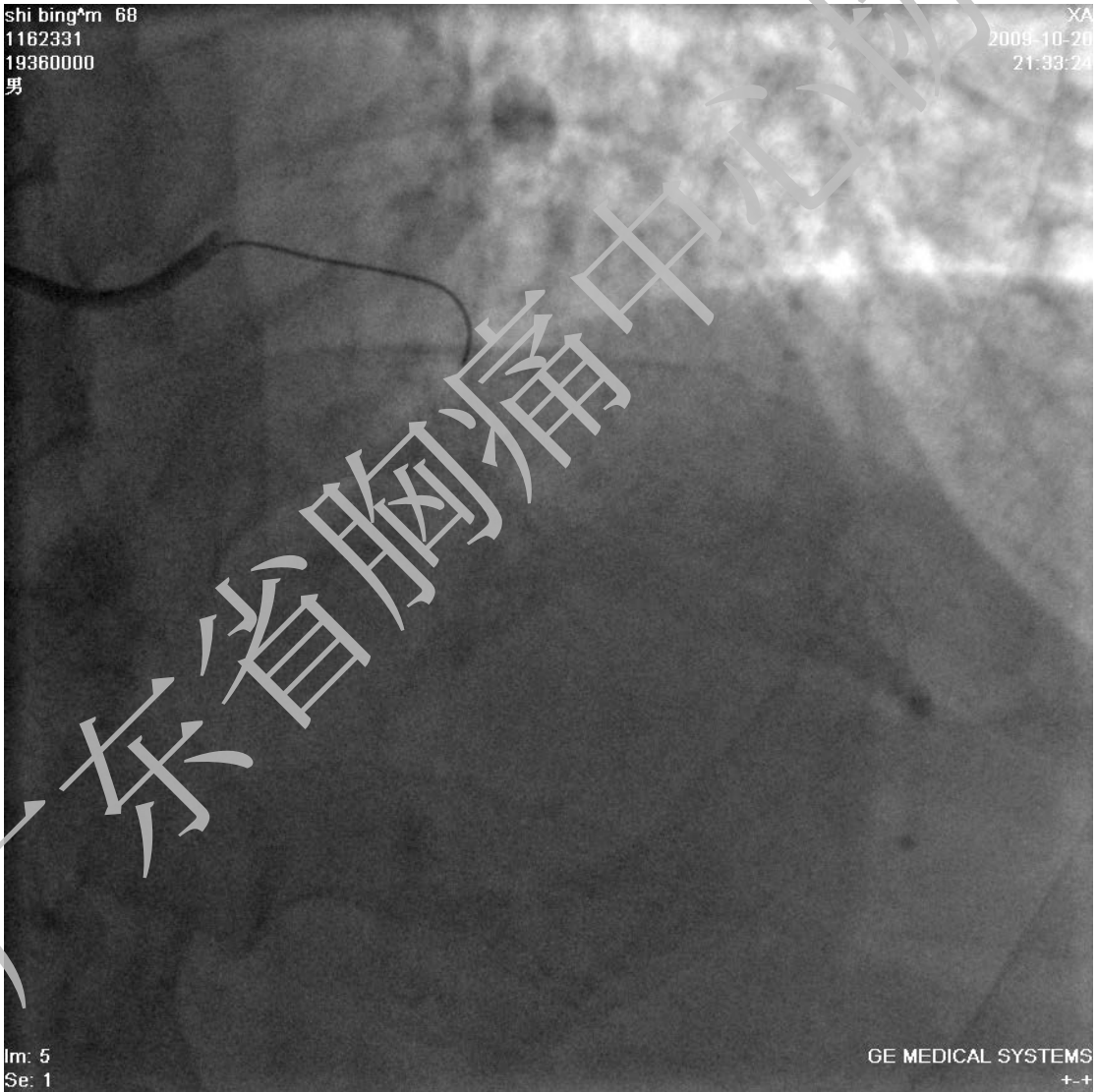
LCA:



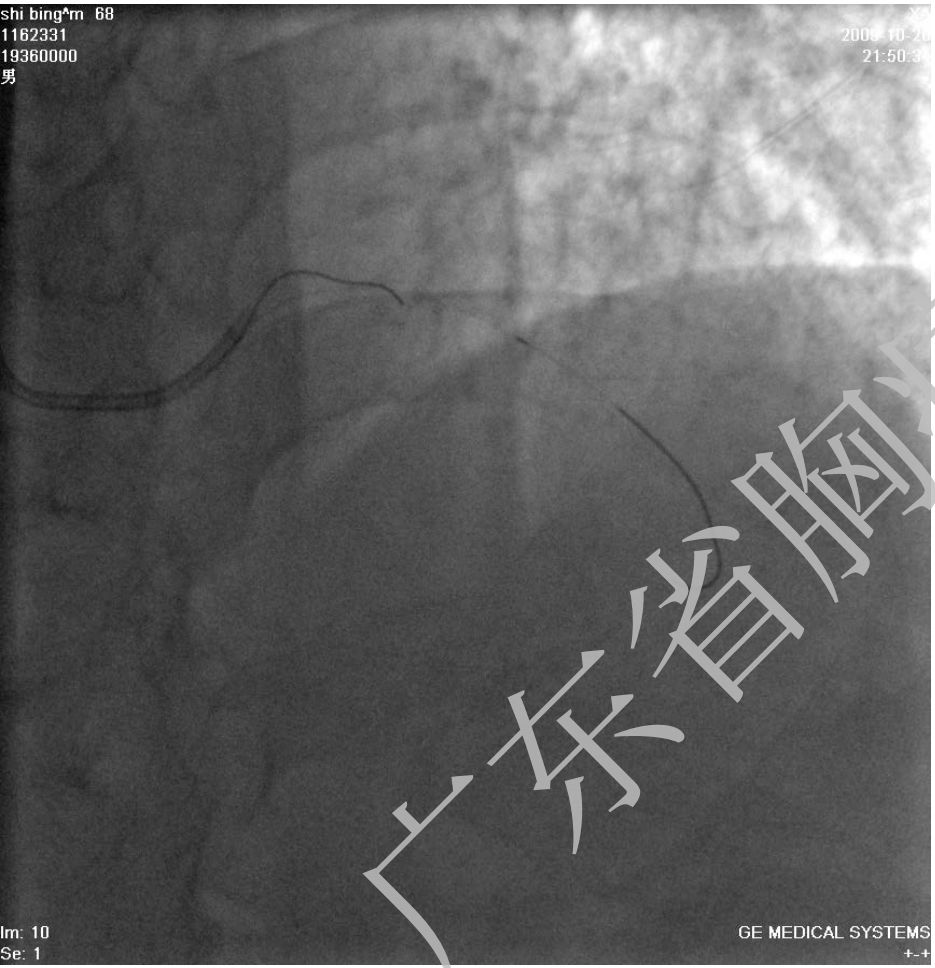
RCA：

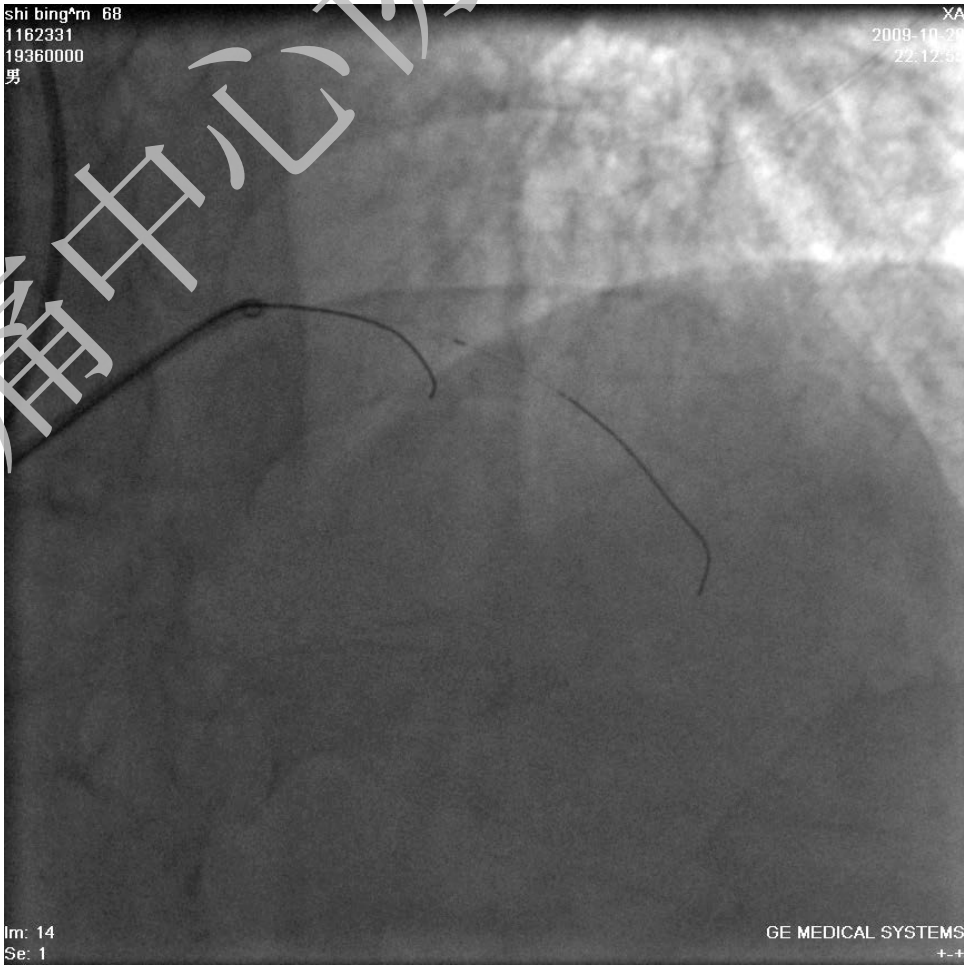


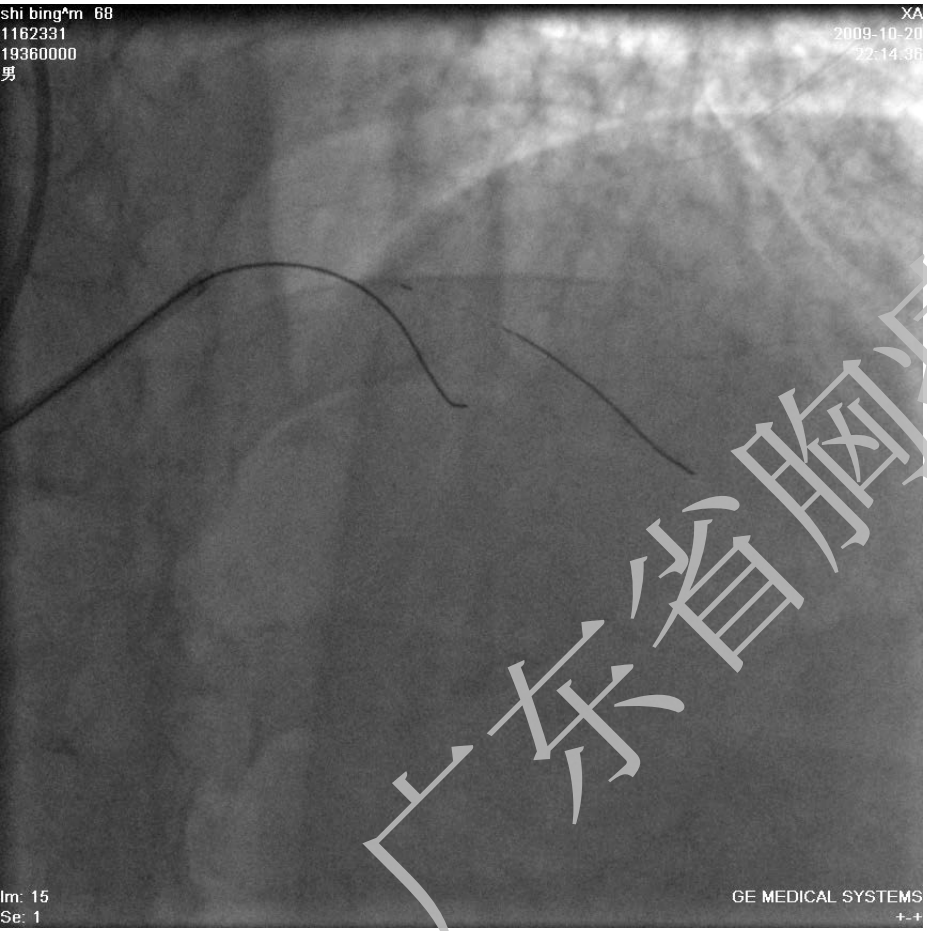
BMW通过病变，LCA前向血流恢复，LAD TIMI2级，LCX TIMI3级。



先后尝试BMW 、 PILOT50 、 PILOT 200 、 Miracle 12 通过LADo病变困难



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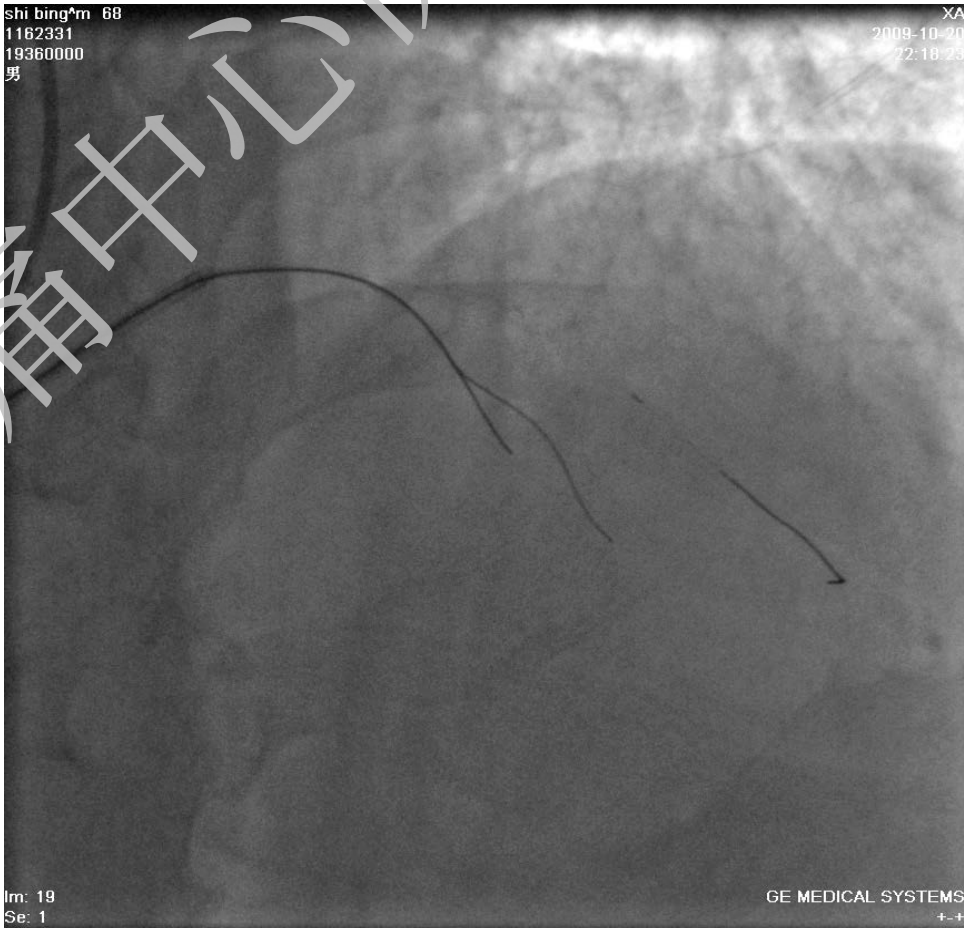
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GE MEDICAL SYSTEMS
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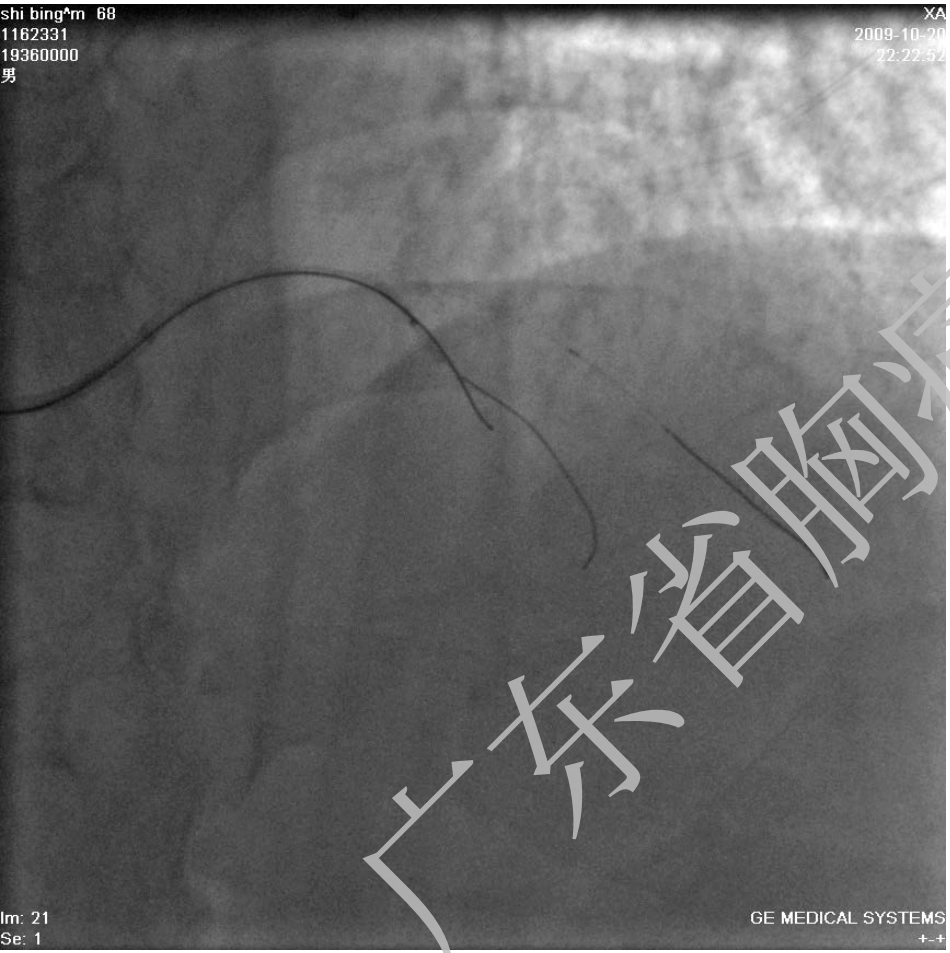
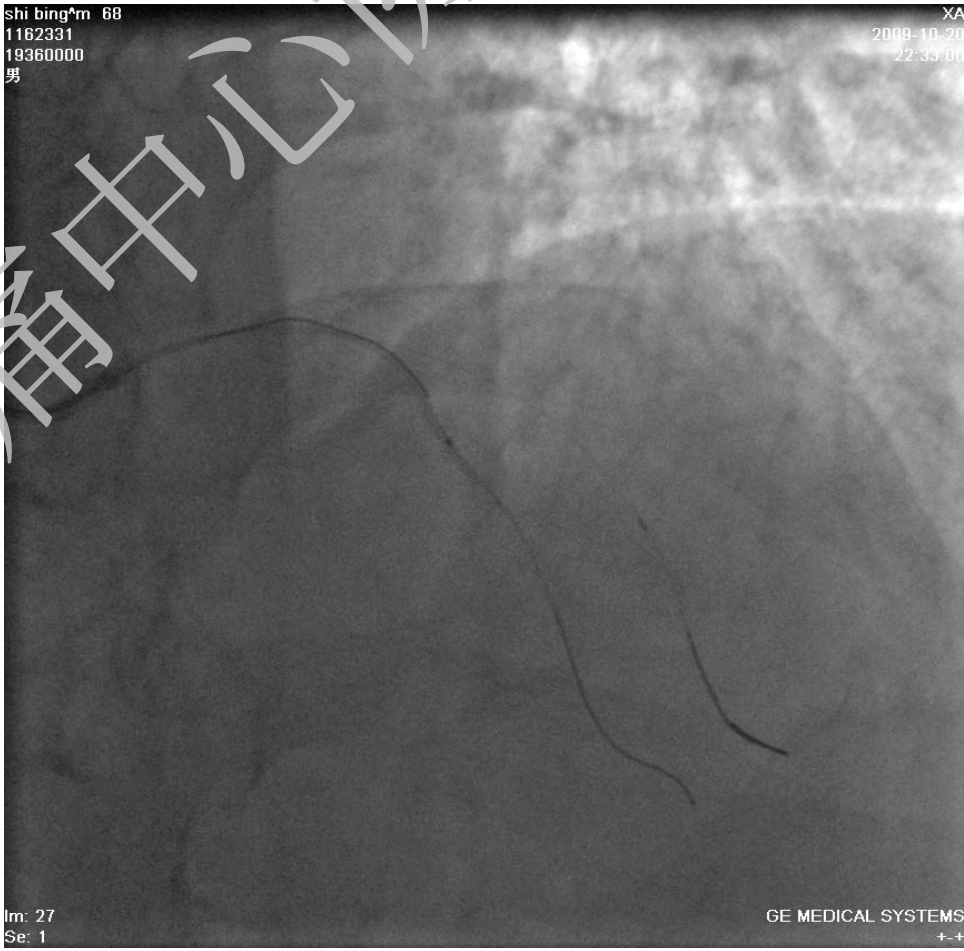
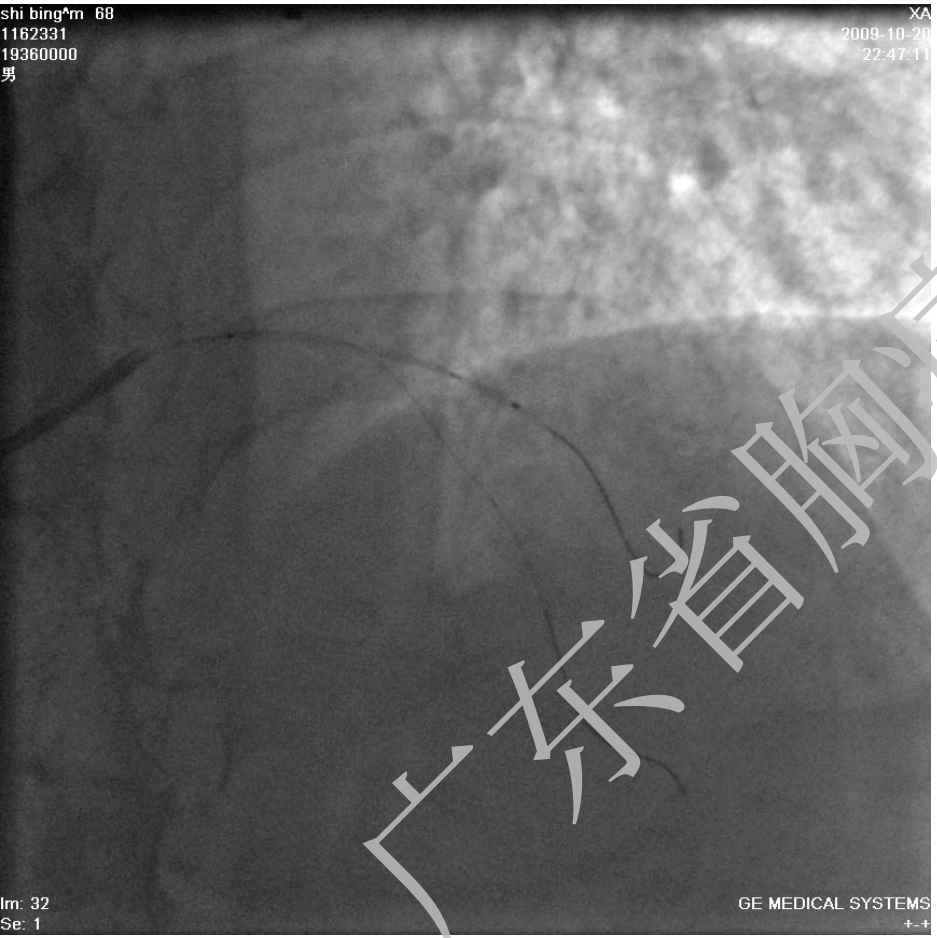
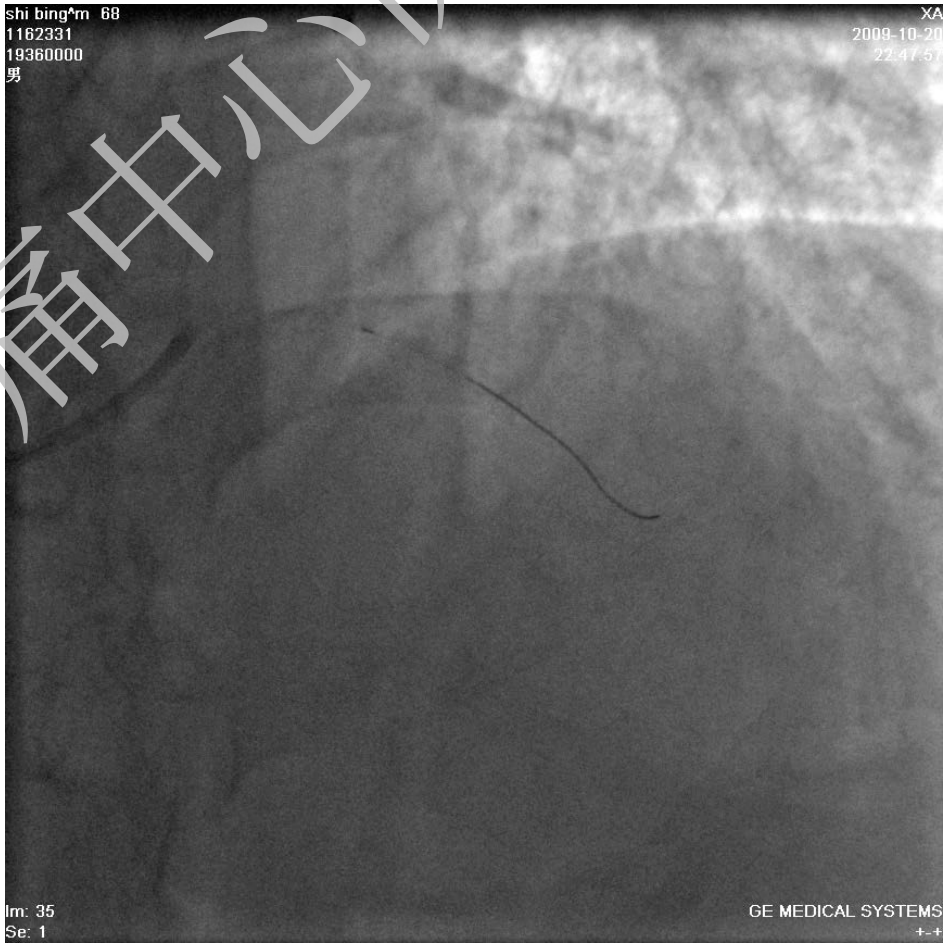
考虑导丝不能进入LAD真腔。予球囊扩张后LAD仍未显影。放弃干预LAD。





送乐普3.0X36mm支架至LM-中间支病变处，以16atmX5sec扩释。





结果：

- 术后病人病情稳定，一周后拔除IABP。
- 10天后转入普通病房。
- 后好转出院，门诊随访。

病史资料:

患者 男 48岁　主因“突发胸痛2小时”急诊入院。入院诊断：急性心肌梗死，予行急诊PCI术。既往1年前于外院在左主干置入支架一枚。

入院检查：

- HR：70次/分，BP：110/70mmHg。
- 心律齐，双肺呼吸音粗，未及明显湿罗音，双下肢无水肿。
- ECG：I、aVL，V1-6，II、III、AVF ST段

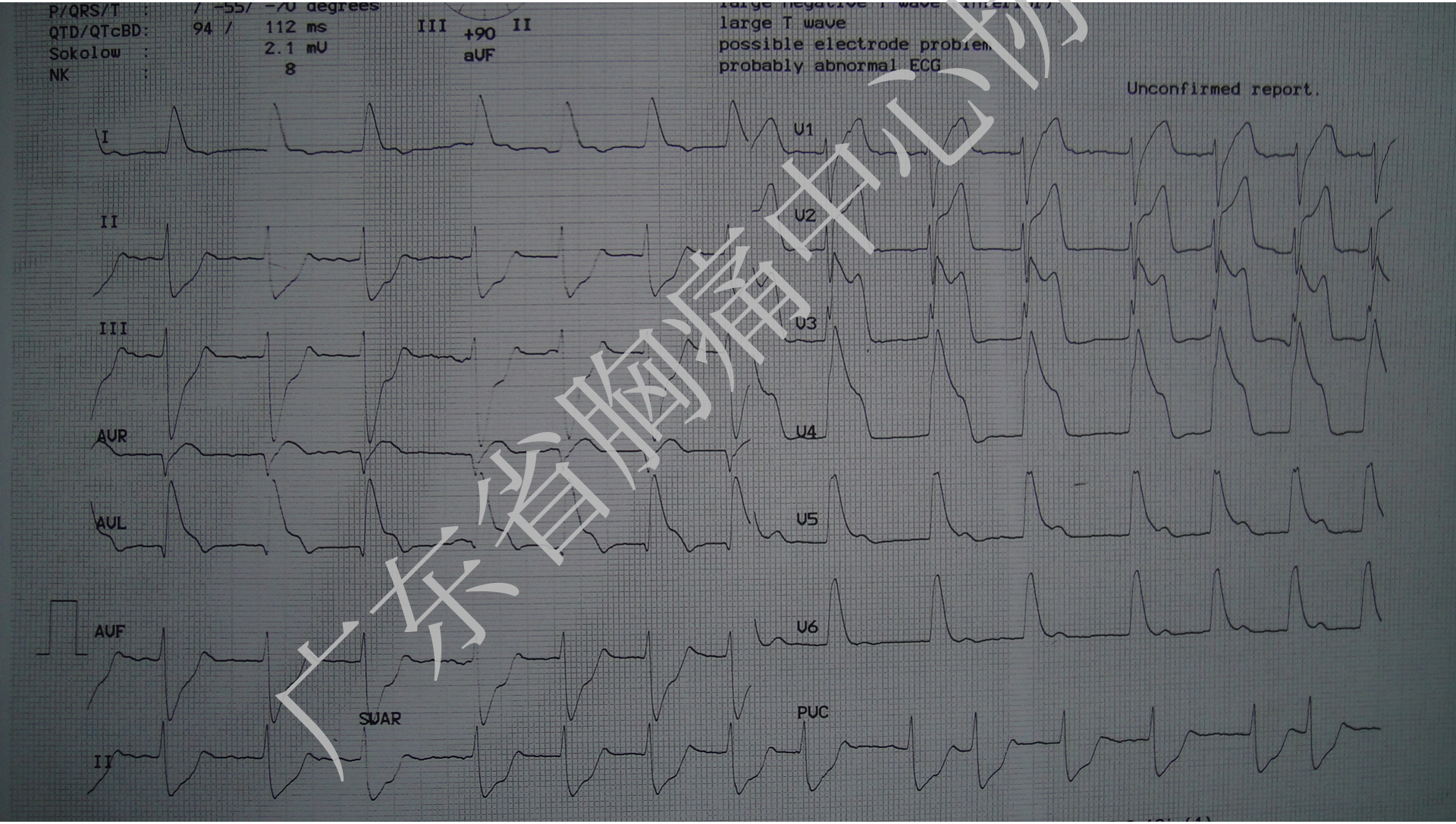
  压低0.2-0.8 mv

  AVR导联ST段抬高0.3 mv。

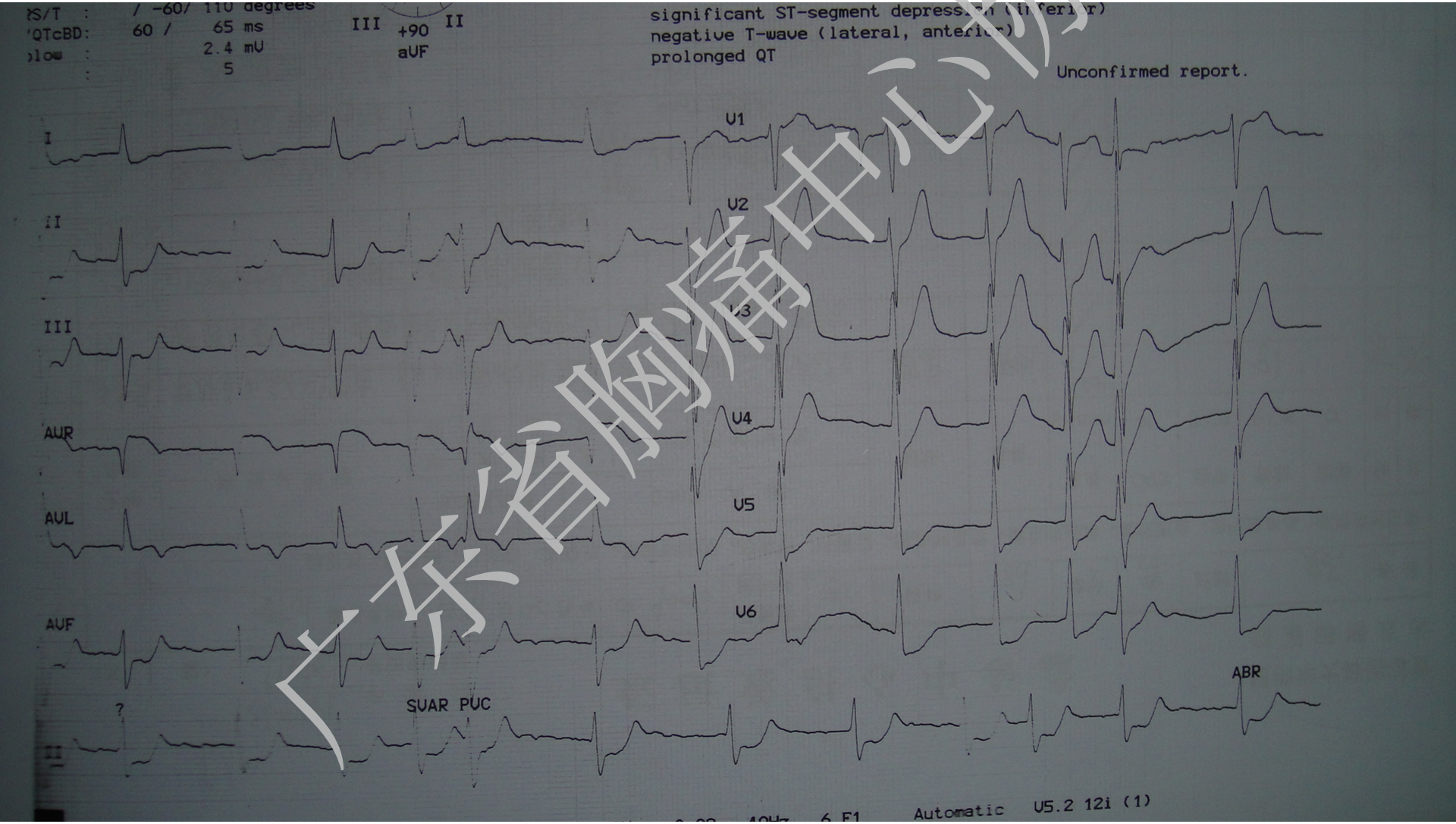
诊断：

- 结合病史、心电图，急性心肌梗死诊断明确，行急诊冠脉造影提示左主干支架内完全闭塞。
- 考虑暂无IABP辅助循环，予家属交待病情并调用IABP后行PCI治疗。

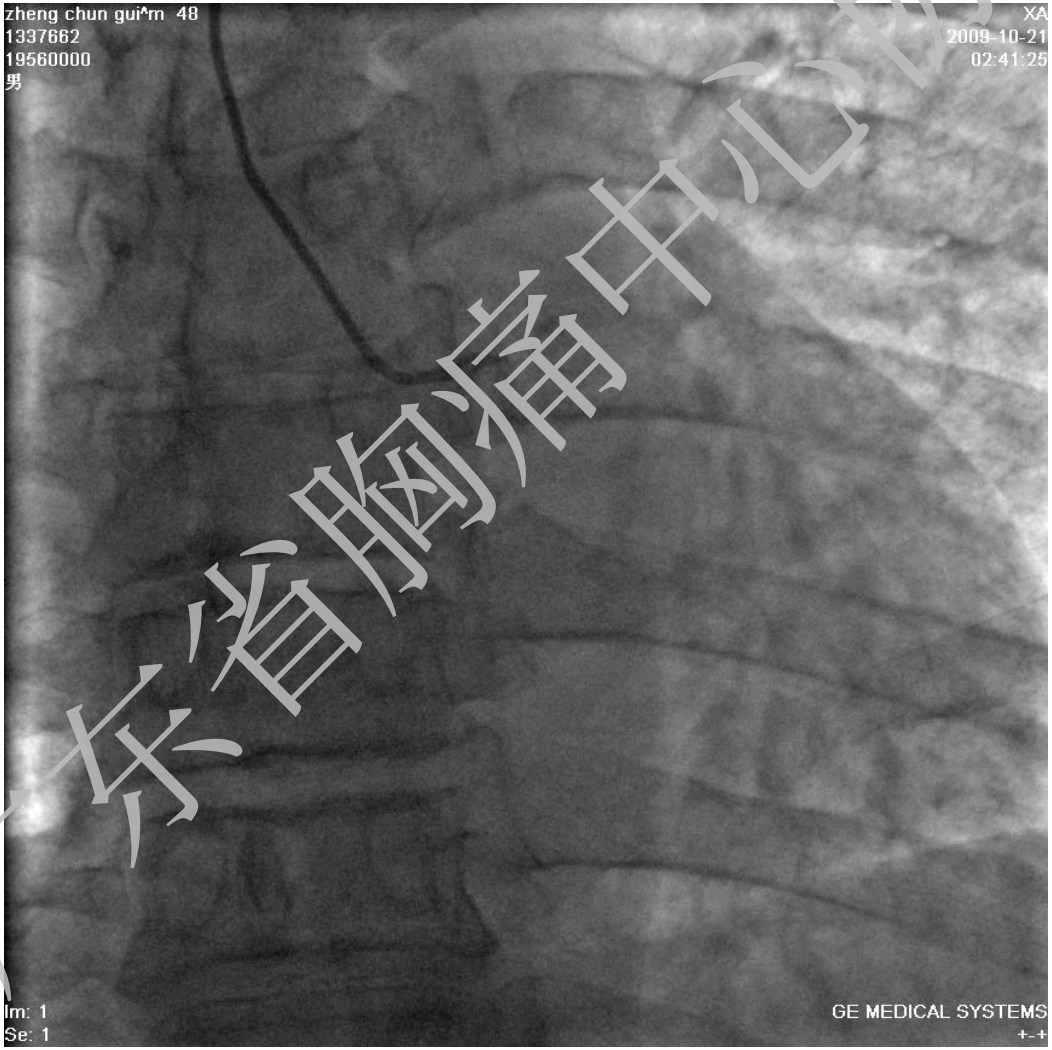
ECG



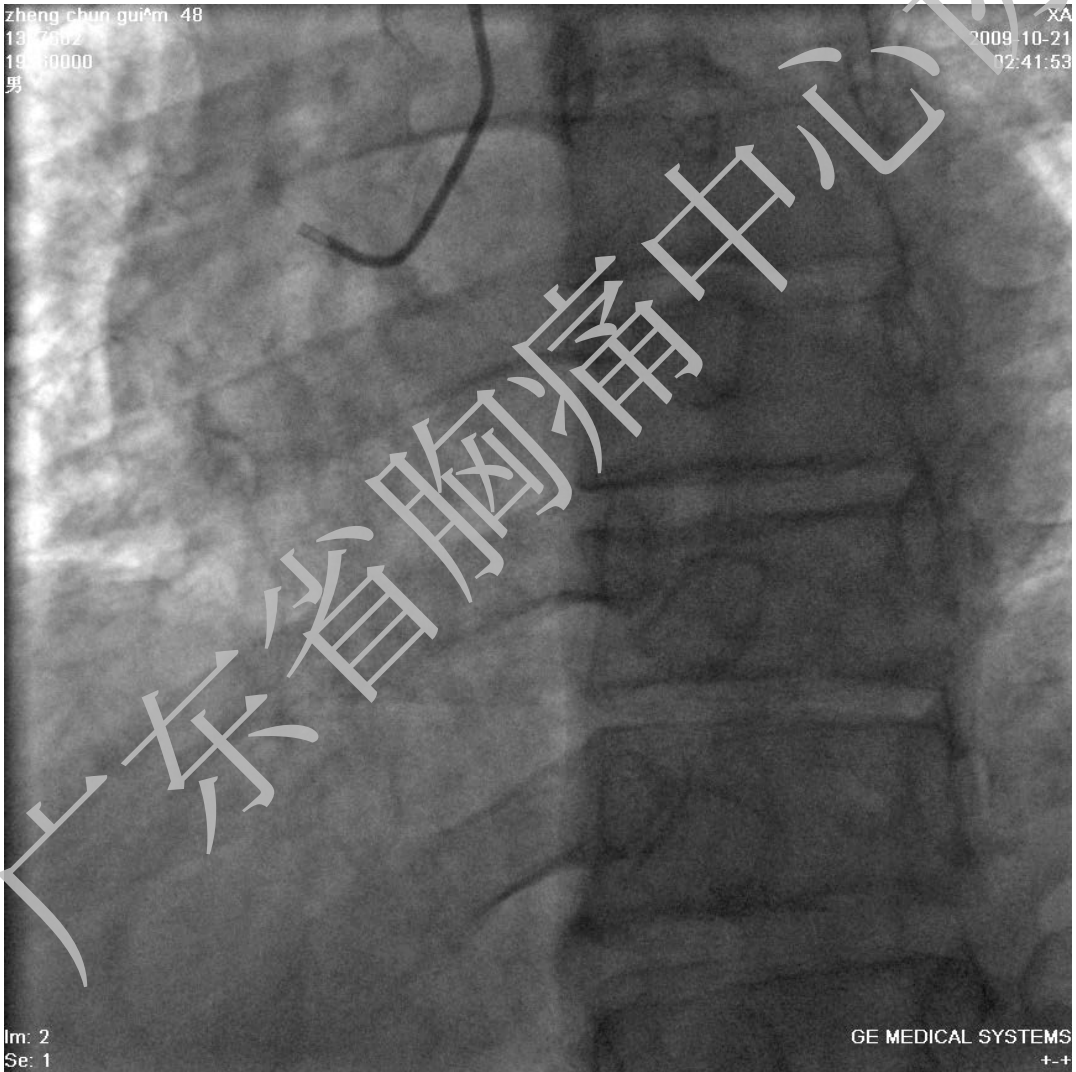
ECG



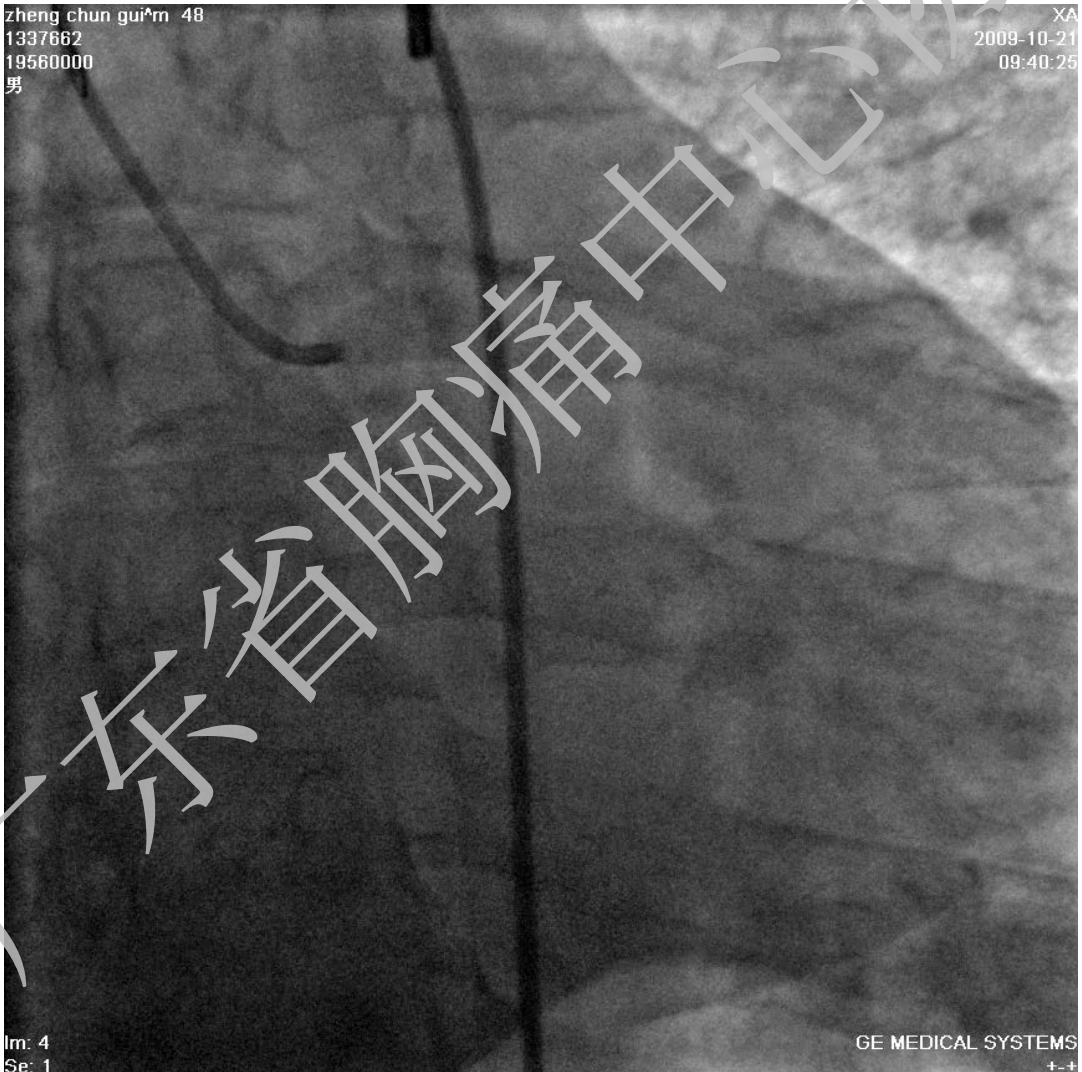
LCA: LM支架内完全闭塞。



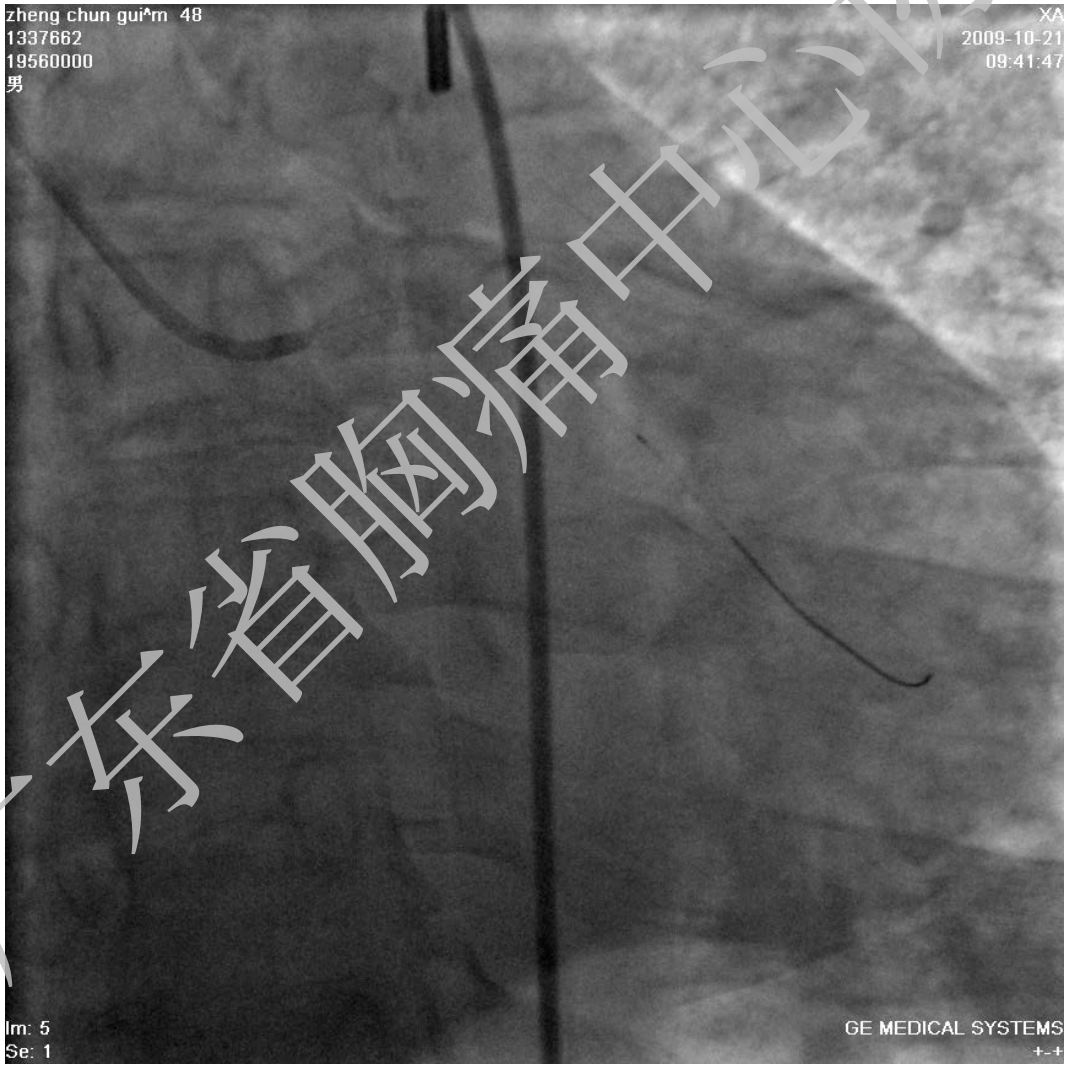
RCA：



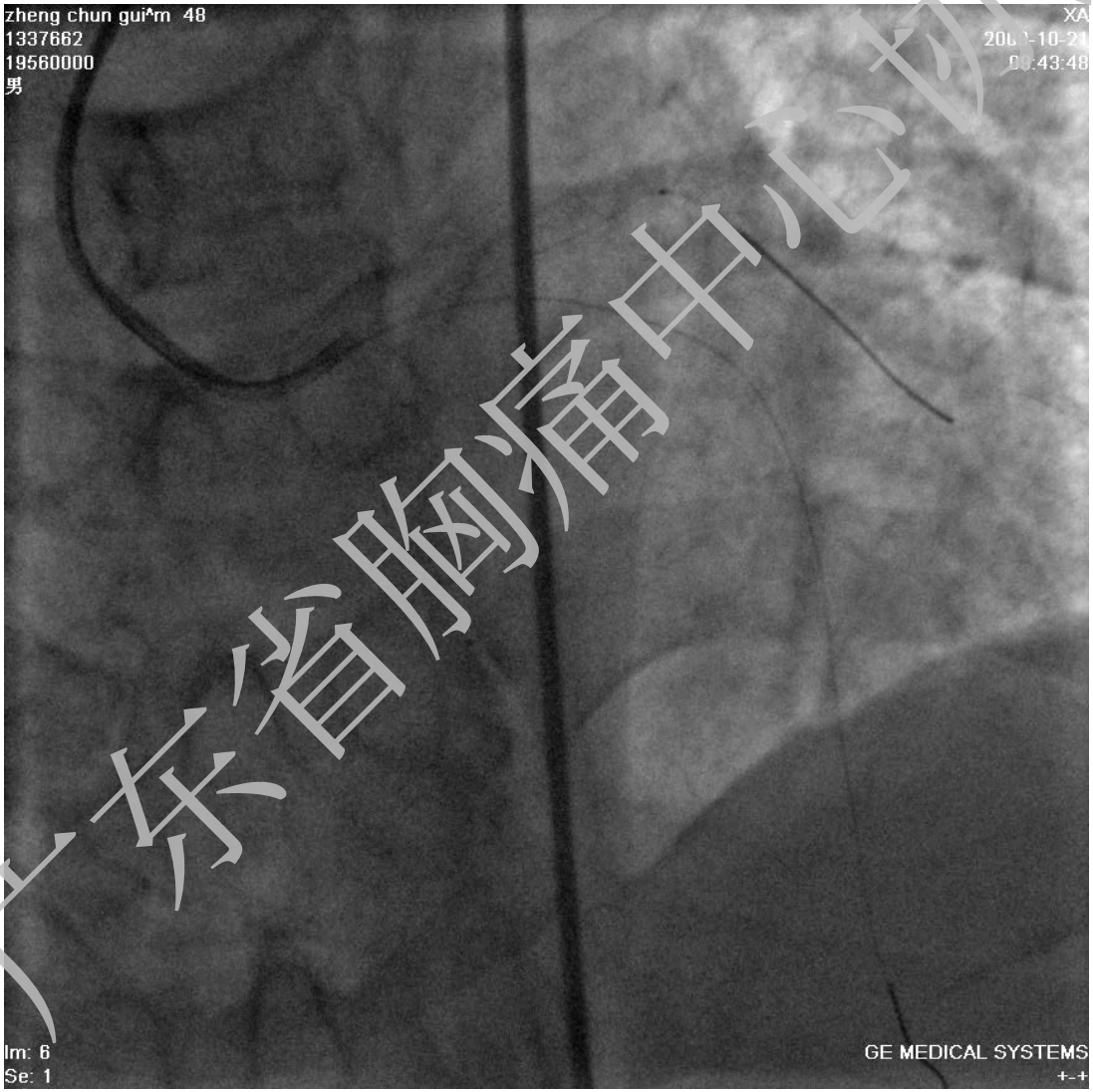
经左股动脉置入IABP辅助循环。



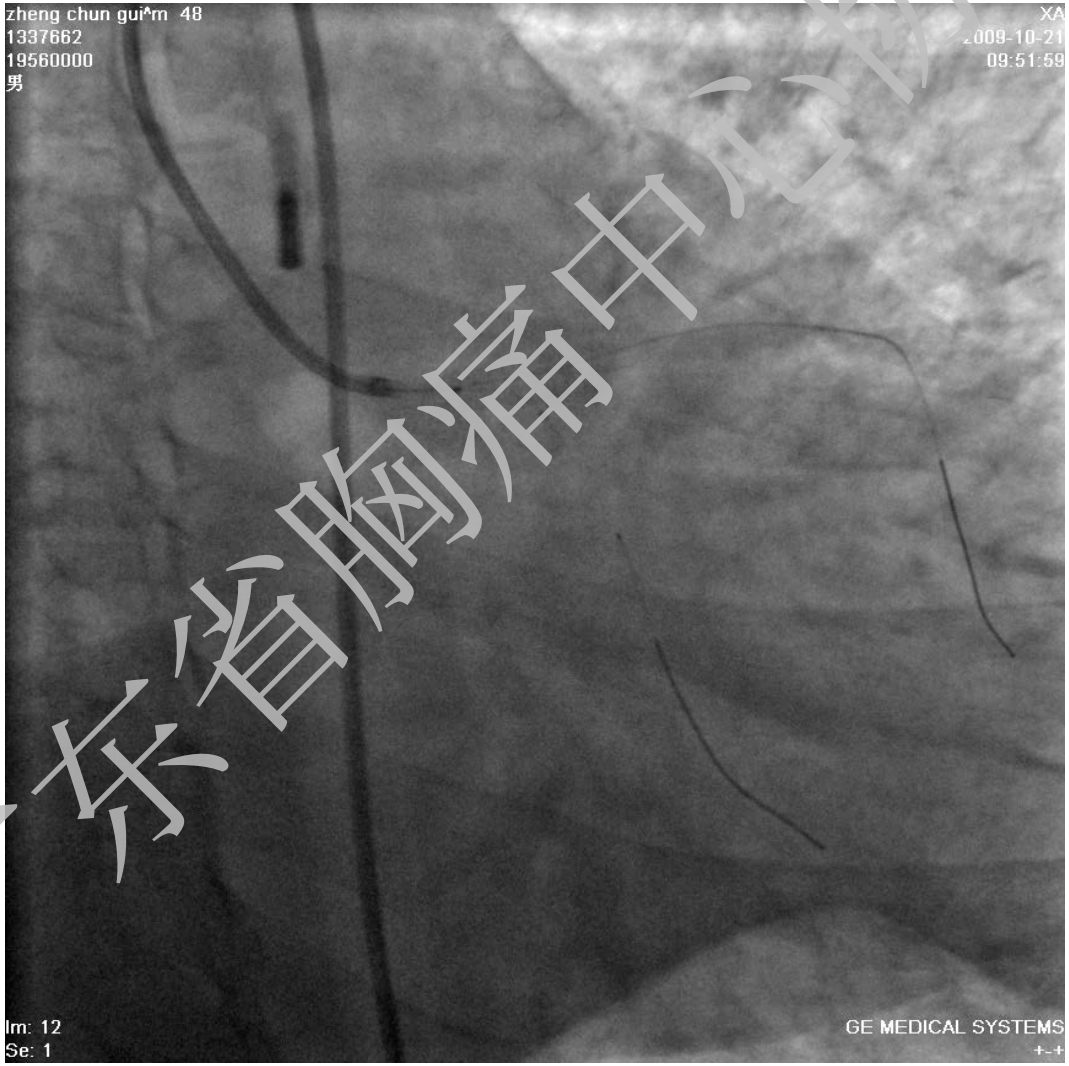
经Launcher6FJL4.0 GC送BMW GW1至LCXd。



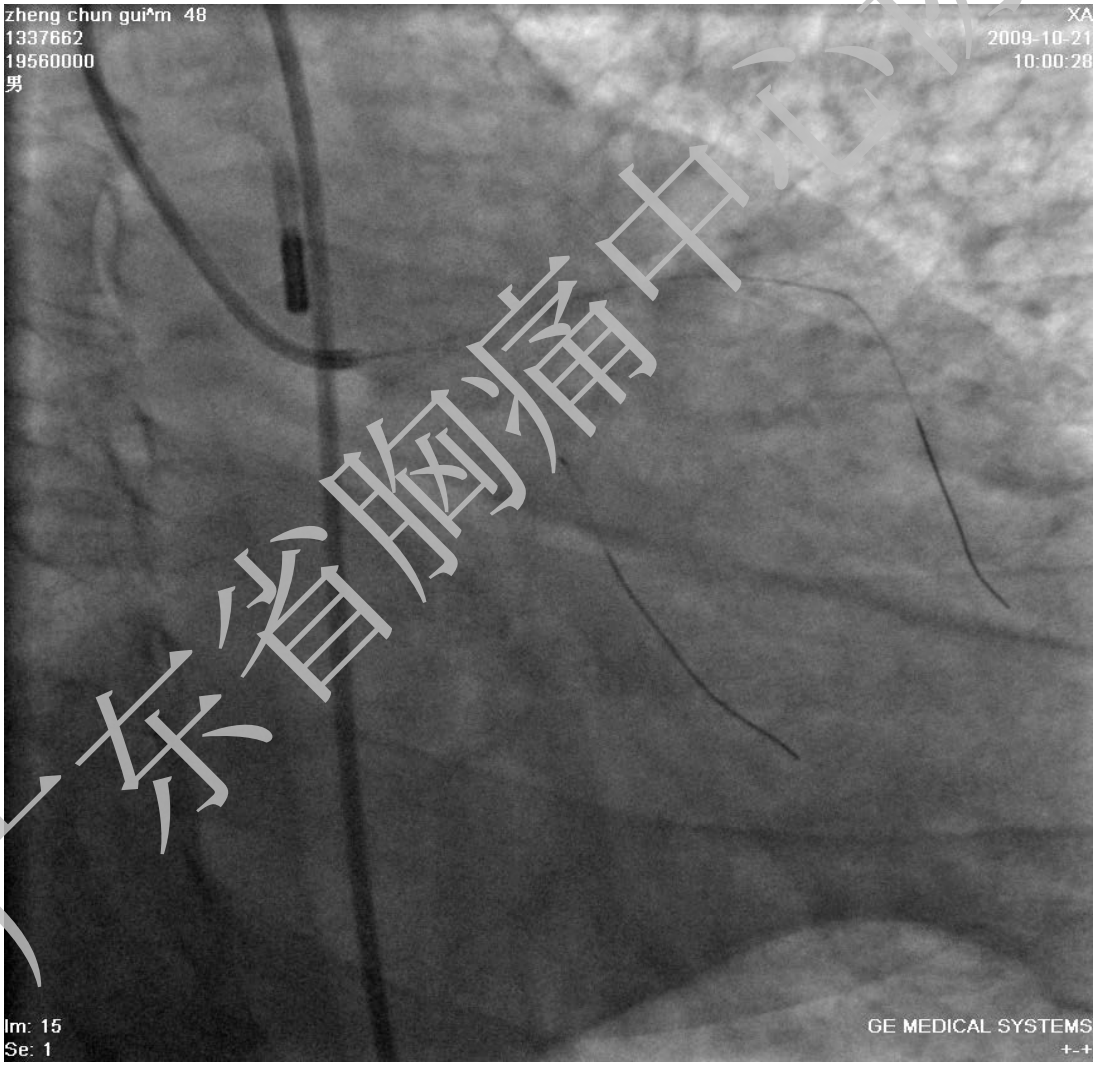
经GC送Runthrough NS GW2至LADd。



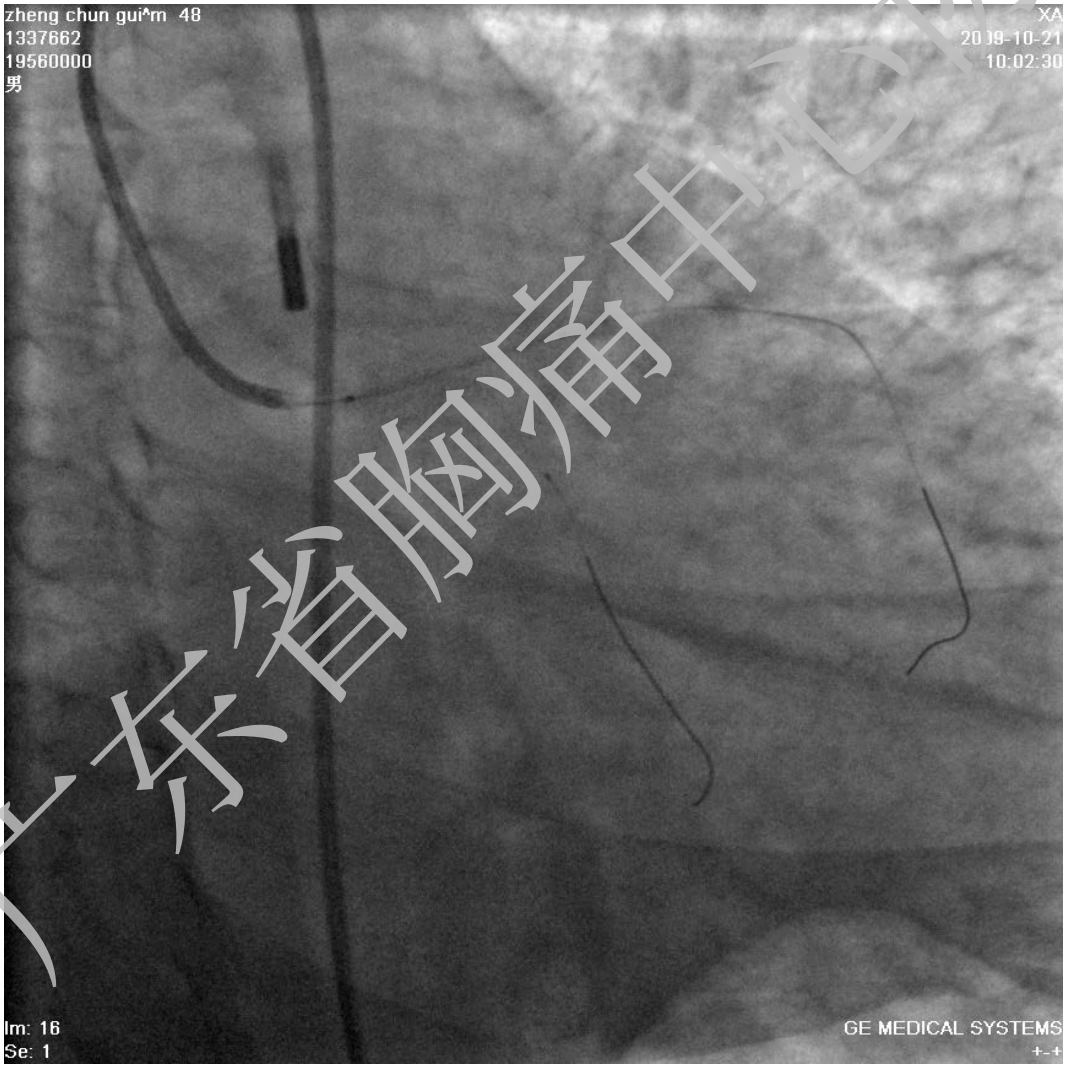
2.0*15mm球囊扩张LCXo。稳定数分钟后，予球囊扩张LADo病变。



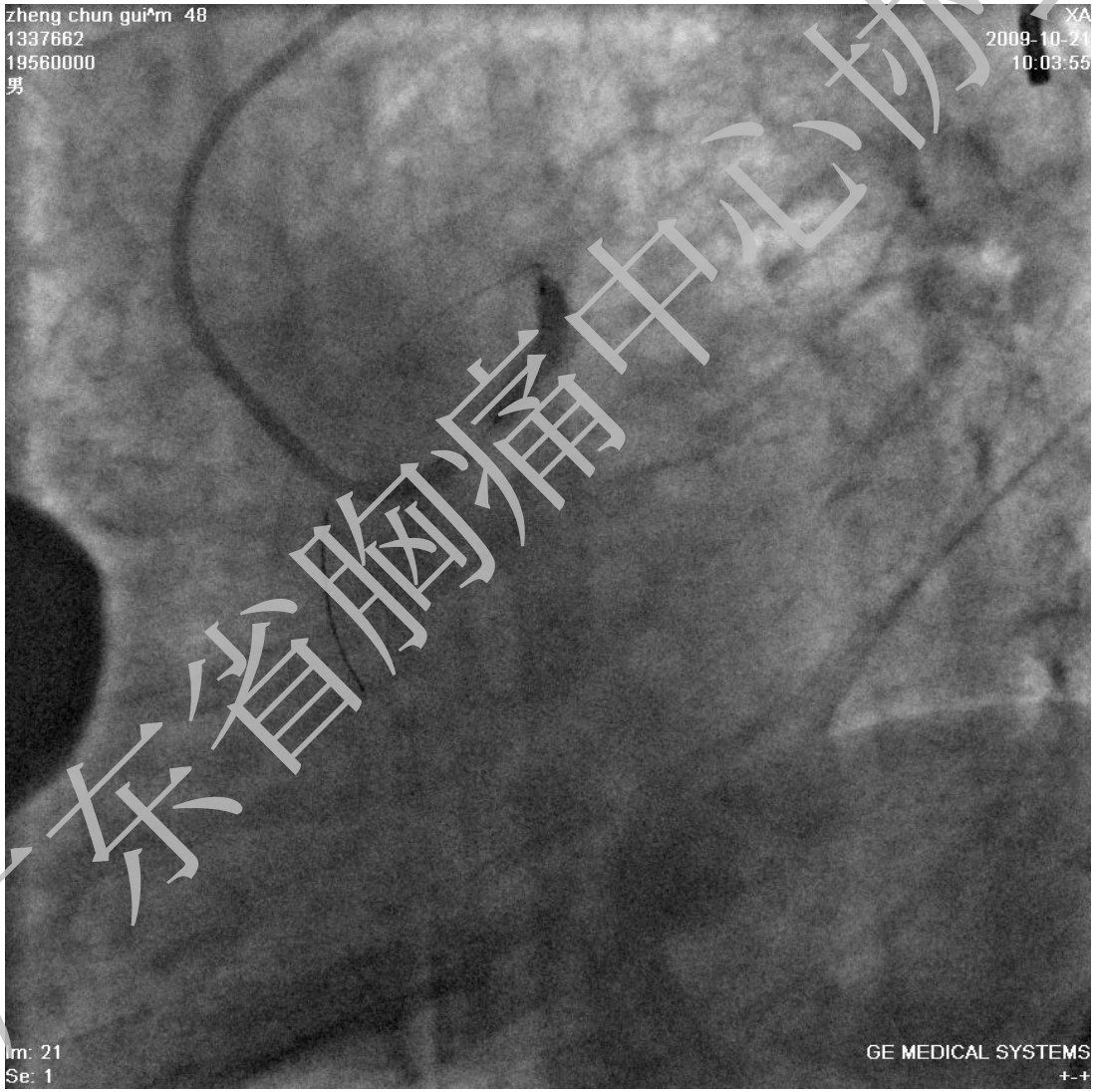
LAD、LCX扩张后造影。



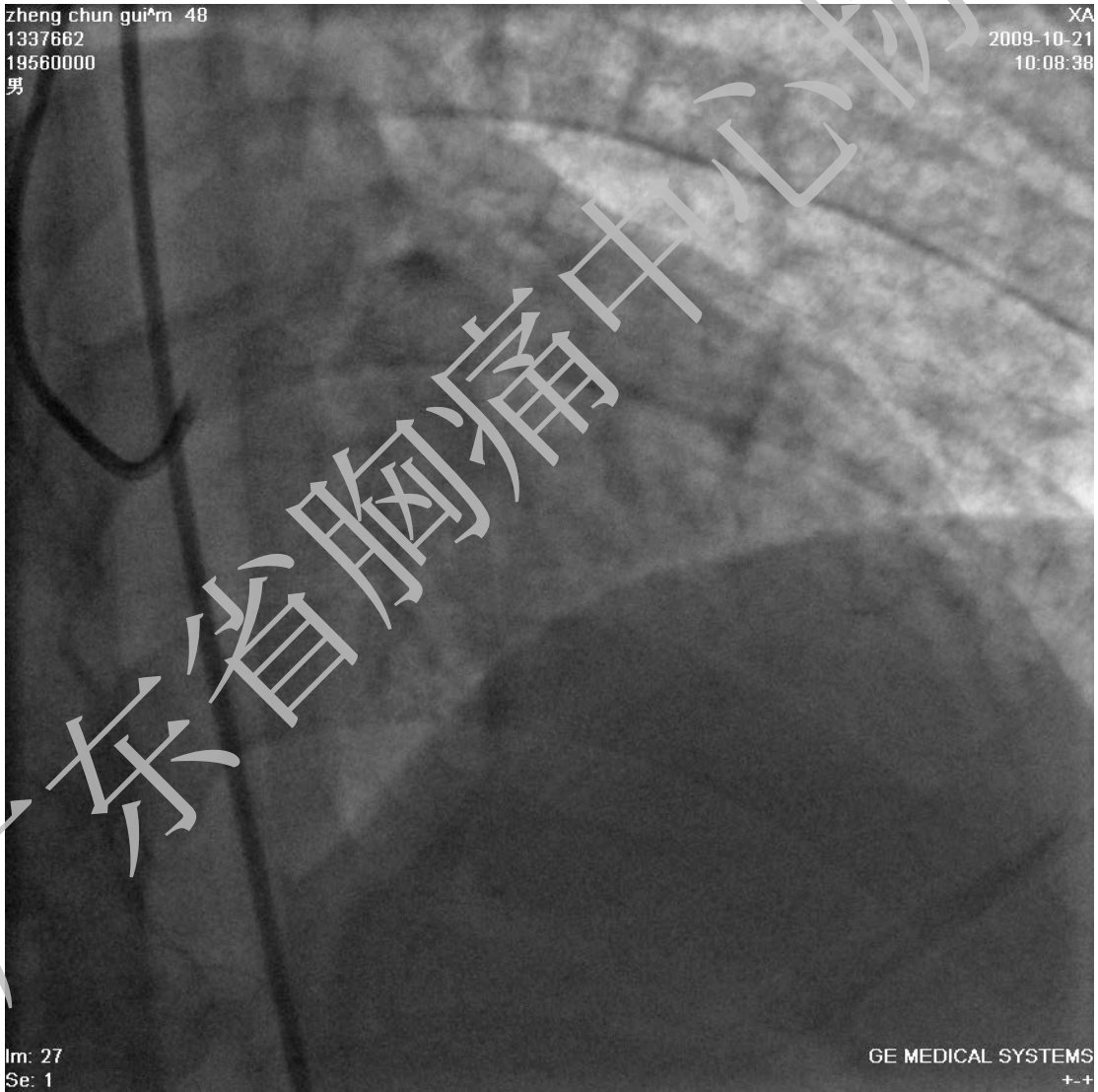
前送3.5*24mm支架至LM-LAD病变处



支架扩释



造影示支架贴壁良好，前向血流TIMI3级。

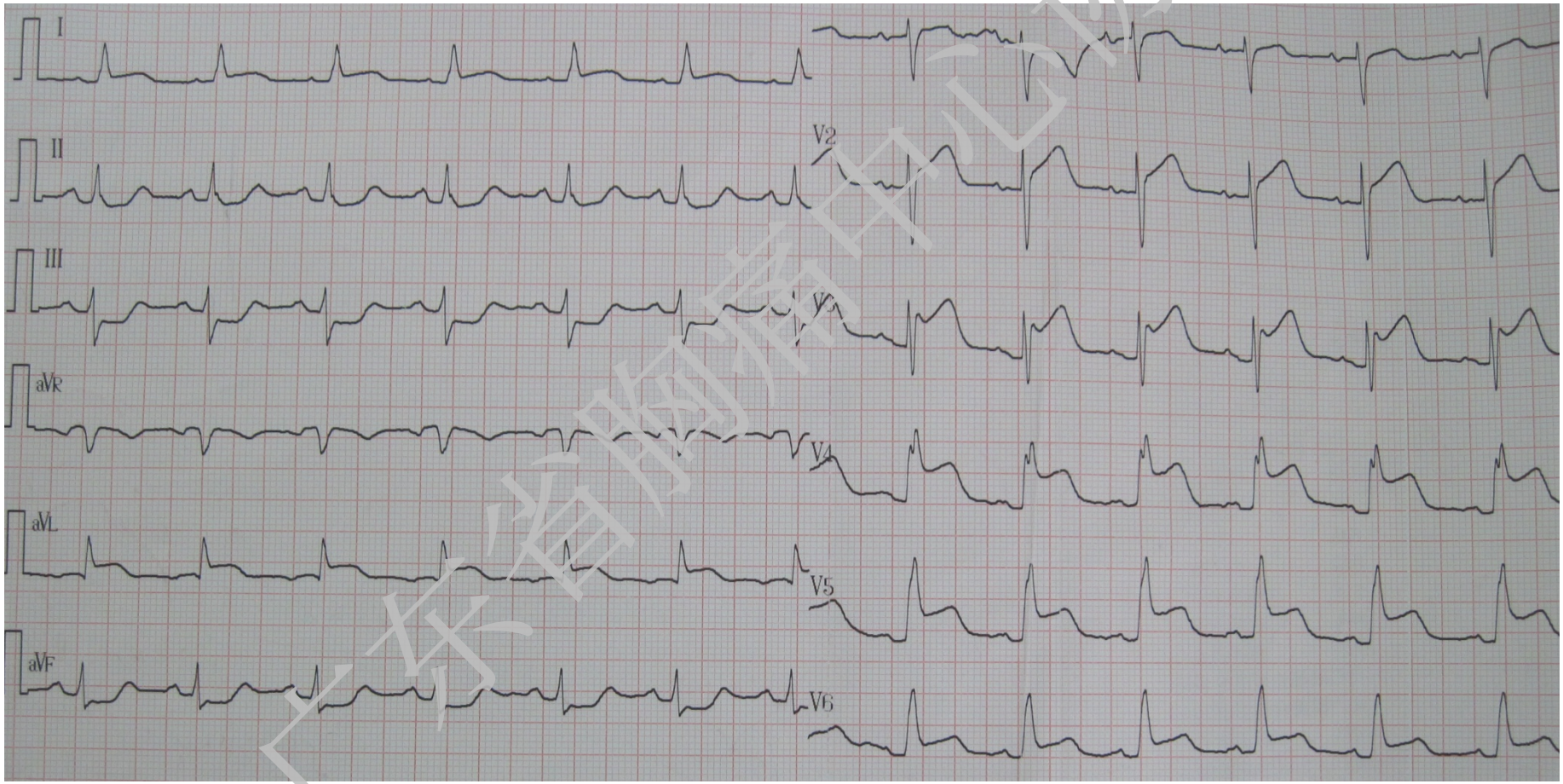


- 后患者由于经济原因自动出院。
- 出院前仍处于心源性休克状态。
- 出院后随访未死亡。

一般资料

- 王惠兰 女 71岁
- 主诉 胸痛1周 再发加重6小时
- 既往高血压10余年，糖尿病2年，高脂血症半年余。发现食道癌2年。

急诊资料



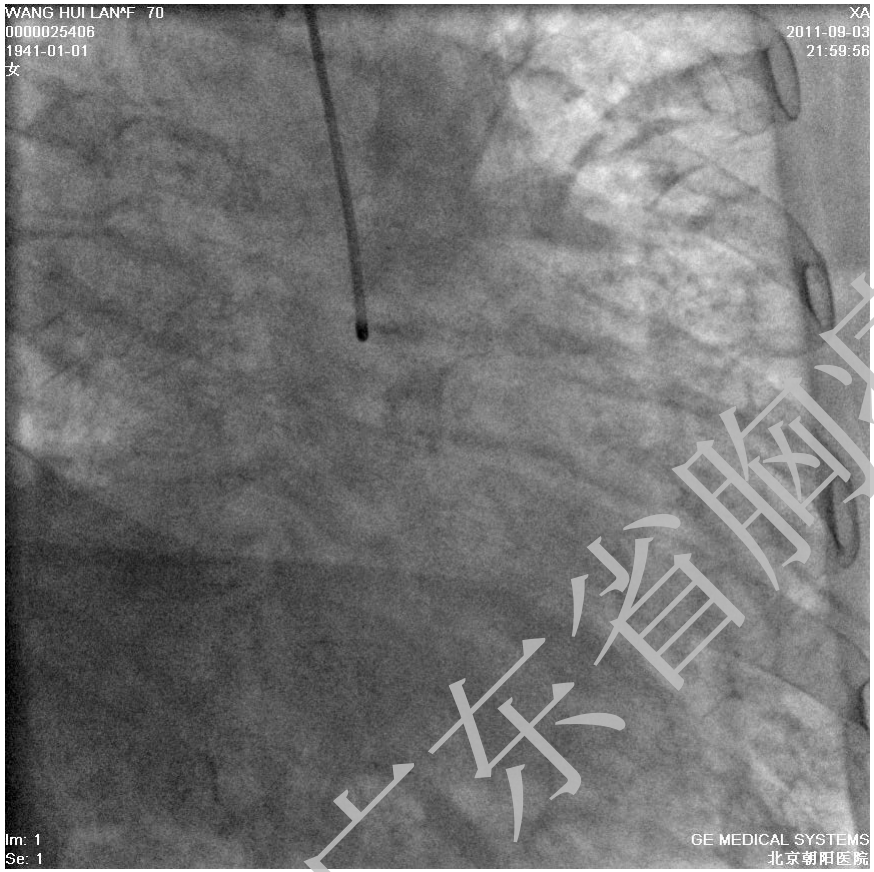
急诊化验

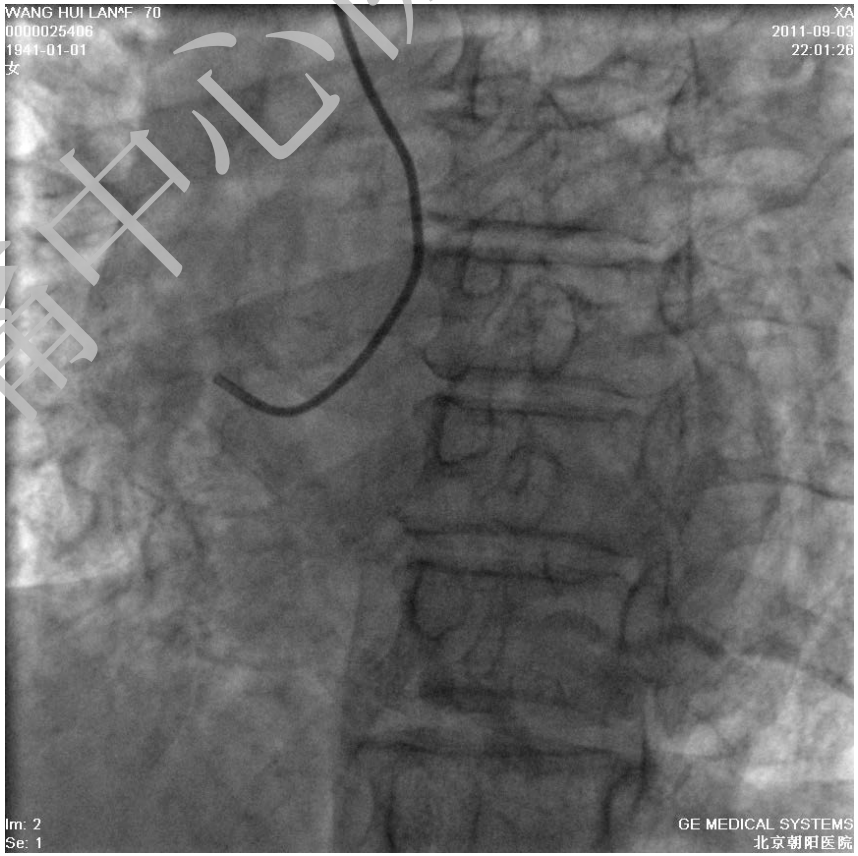
总蛋白	TP	76.8	g/L	65.0-82.0		腺苷脱氨酶	ADA	18	U/L 0-25
白蛋白	ALB	37.9	g/L	32.0-55.0		总胆红素	TBIL	7.08	umol/L 3.4-20.5
球蛋白	GLB	38.9	g/L	25.0-45.0		直接胆红素	DBIL	1.33	umol/L 0.0-6.8
白球比例	A:G	1.0		1.1-2.0	↓	间接胆红素	IBIL	5.75	umol/L 3.4-17.1
前白蛋白	PAB	0.23	g/L	0.20-0.40		总胆汁酸	TBA	1.4	umol/L 0.0-10.0
总胆固醇	CHOL	5.55	mmol/L	3.62-5.70		尿素氮	BUN	6.79	mmol/L 2.85-7.14
高密度脂蛋白胆固i	HDL-C	1.91	mmol/L	1.03-1.55	↑	* 肌酐	CREA	75.8	umol/L 35.00-106.0
低密度脂蛋白胆固i	LDL-C	3.44	mmol/L	1.81-3.36	↑	* 尿酸	URIC	335.80	umol/L 95-357
甘油三脂	TG	1.04	mmol/L	0.56-2.26		* 钙	Ca	2.31	mmol/L 2.10-2.60
脂蛋白(a)	Lp(a)	51.9	mg/dl	0.0-30.0	↑	* 磷	PHOS	1.01	mmol/L 0.81-1.49
谷草转氨酶	AST	29	U/L	10-42		* 钠	Na	138.7	mmol/L 135.0-145.0
谷丙转氨酶	ALT	19	U/L	10-40		* 钾	K	3.7	mmol/L 3.6-5.0
AST:ALT	AST:ALT	1.5				* 氯	Cl	102.9	mmol/L 101.0-110.0
肌酸激酶	CK	134	U/L	25-140		二氧化碳	CO2	23.6	mmol/L 21.0-30.0
CKMB质量	MMB	6.4	ng/ml	0.0-3.6	↑	阴离子间隙	AG	12.2	mmol/L 0-14
心肌肌钙蛋白I	CTNI	0.46	ng/ml	0.00-0.09	↑	* 血糖	GLU	10.15	mmol/L 3.30-6.10
乳酸脱氢酶	LDH	193	U/L	85-250		渗透压	OSM	284	mOSM/L 280-320

急诊化验

*白细胞	WBC	11.92	*10^9/L	3.69-9.16
中性粒细胞%	NE%	62.5	%	50.0-70.0
淋巴细胞%	LY%	32.0	%	20.0-40.0
单核细胞%	MO%	4.2	%	3.0-10.0
嗜酸性粒细胞%	EO%	1.2	%	0.5-5.0
嗜碱性粒细胞%	BA%	0.1	%	0.0-1.0
中性粒细胞	NE#	7.45	*10^9/L	1.80-6.40
淋巴细胞	LY#	3.82	*10^9/L	1.00-3.30
单核细胞	MO#	0.50	*10^9/L	0.12-0.80
嗜酸性粒细胞	EO#	0.14	*10^9/L	0.02-0.50
嗜碱性粒细胞	BA#	0.01	*10^9/L	0.00-0.10
*红细胞	RBC	4.54	*10^12/L	3.68-5.13
*血红蛋白	HGB	143.0	g/L	113.0-151.0
*红细胞压积	HCT	40.70	%	33.50-45.00
*平均红细胞体积	MCV	89.6	fl	82.6-99.1
*平均红细胞血红蛋白含量	MCH	31.50	pg	26.90-33.30
*平均红细胞血红蛋白浓度	MCHC	351.00	g/L	322.00-362.00
红细胞分布宽度-CV	RDW-CV	13.2	%	10.0-15.0
*血小板	PLT	155	*10^9/L	101-320
血小板分布宽度	PDW	12.7	fl	9.0-18.1

造影





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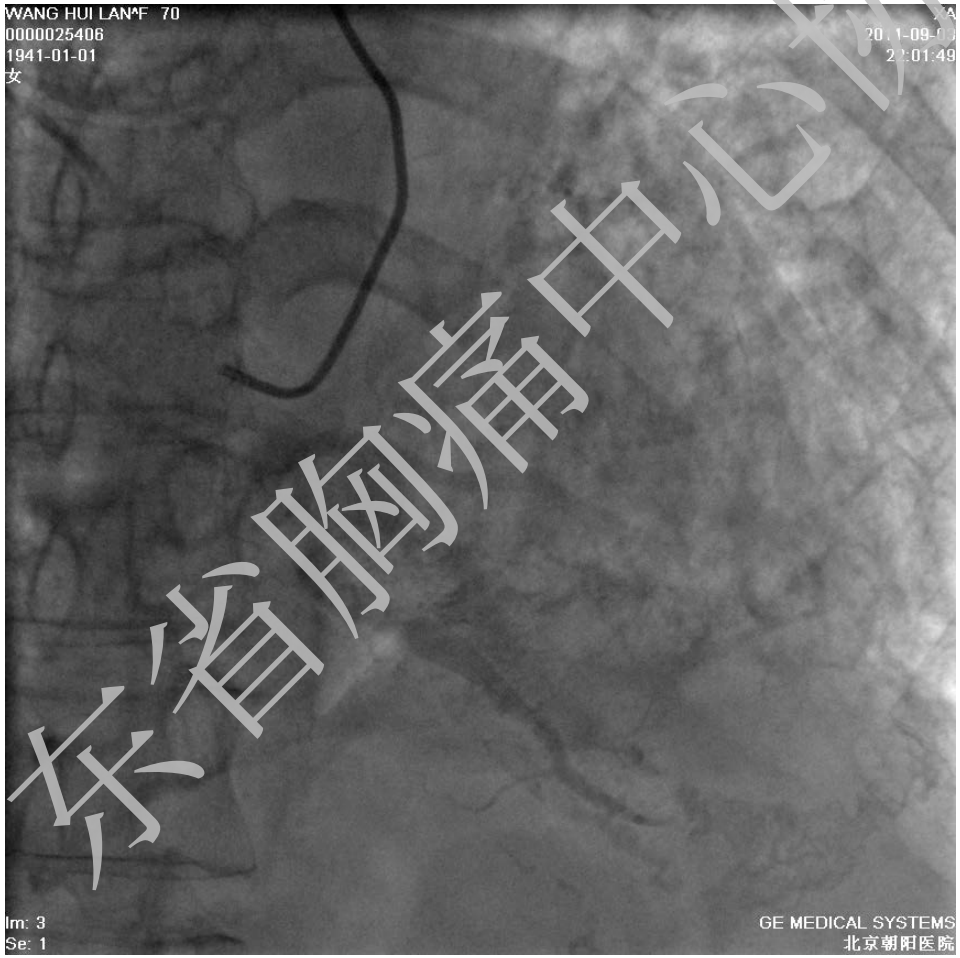
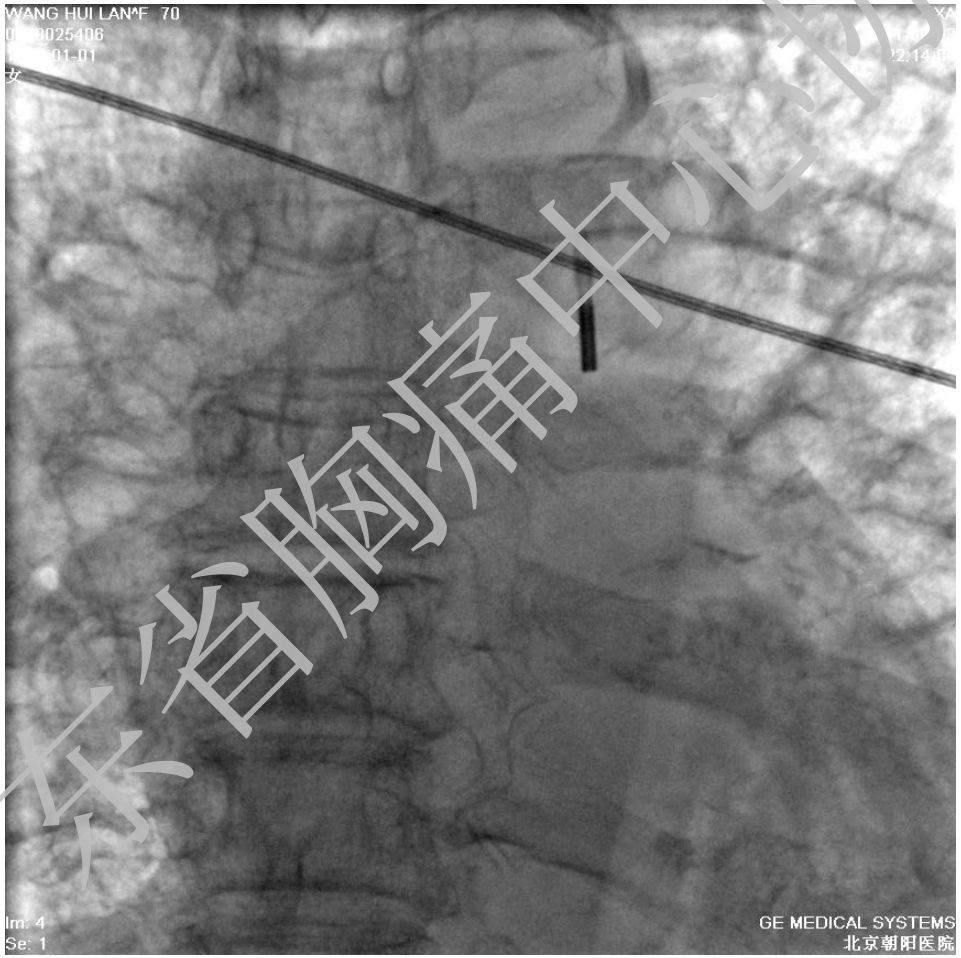


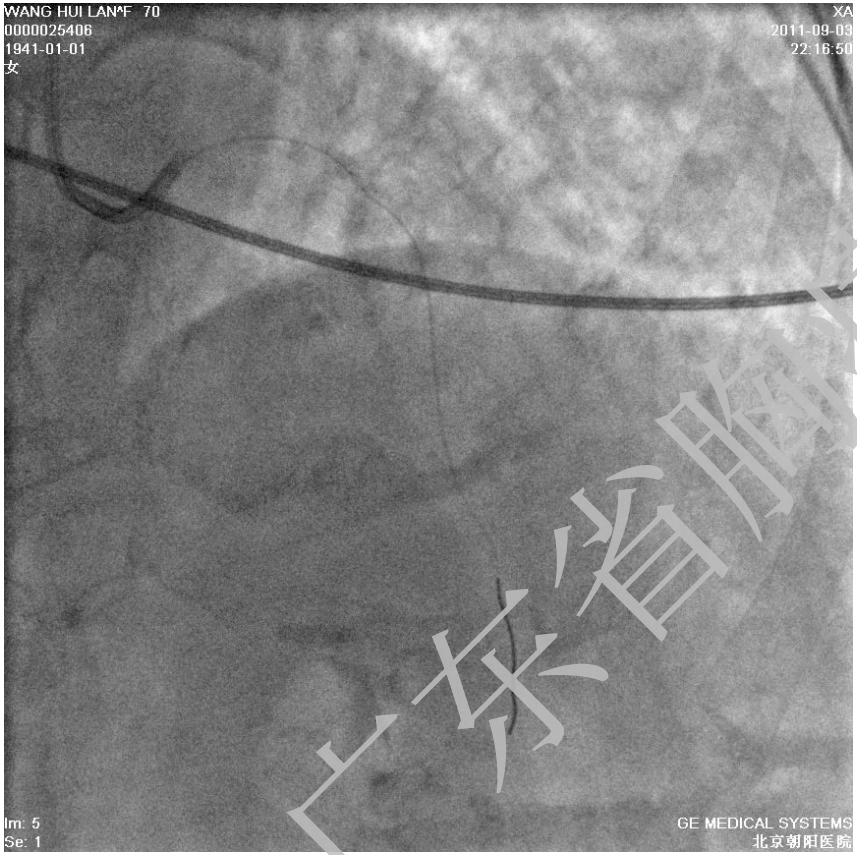
干预过程

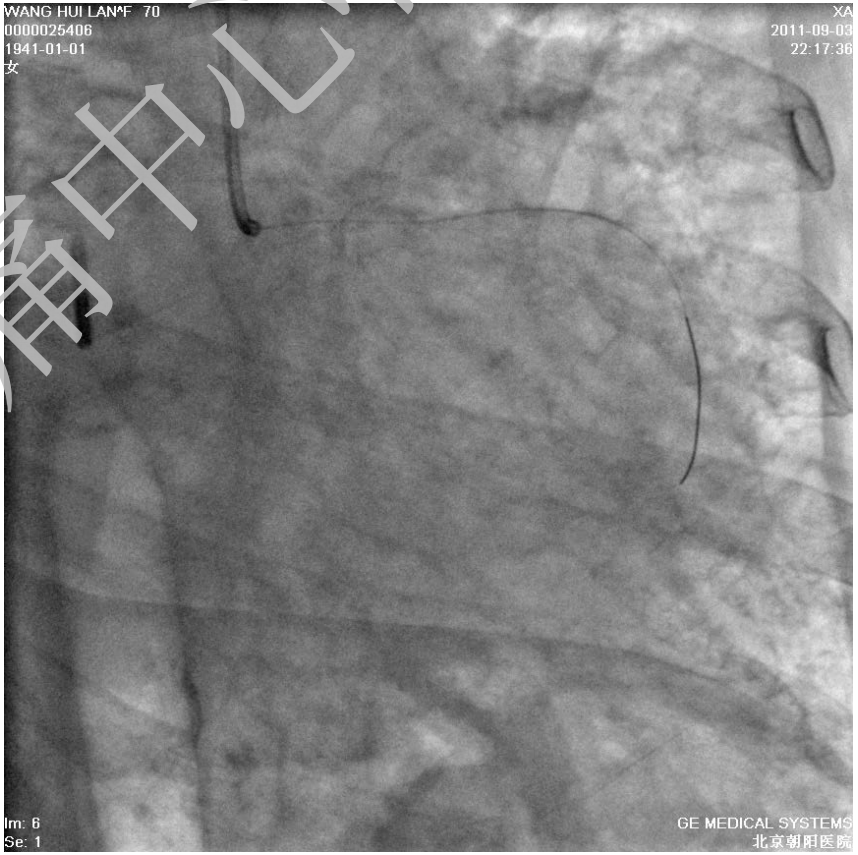
置入IABP



干预过程

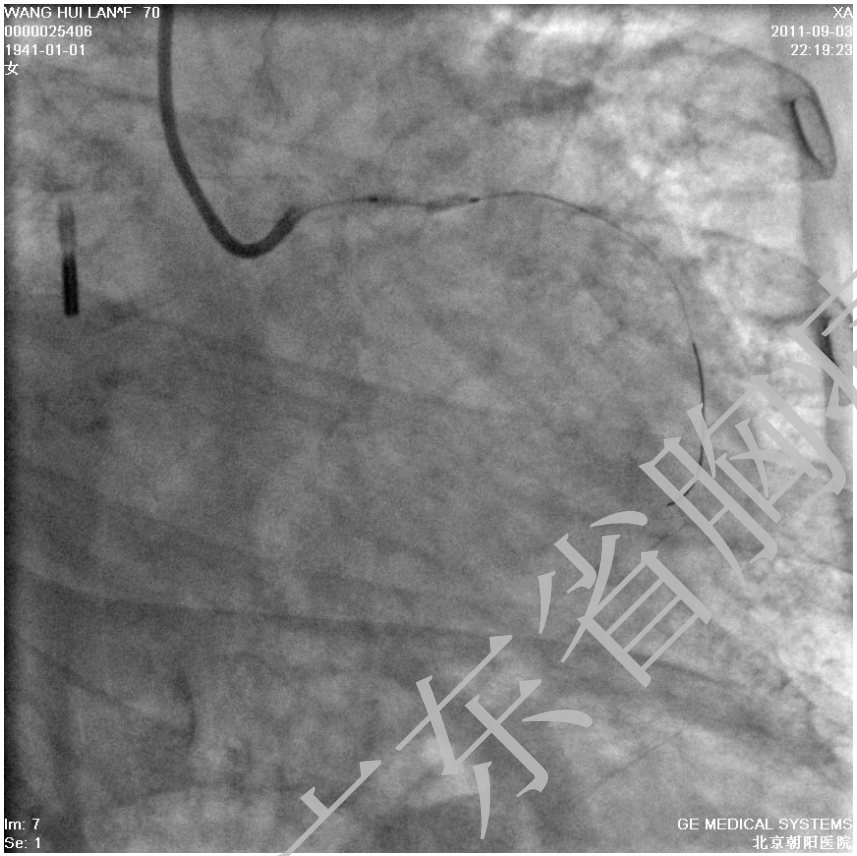
Launcher 6F JL 4.0　　Runthrough NS

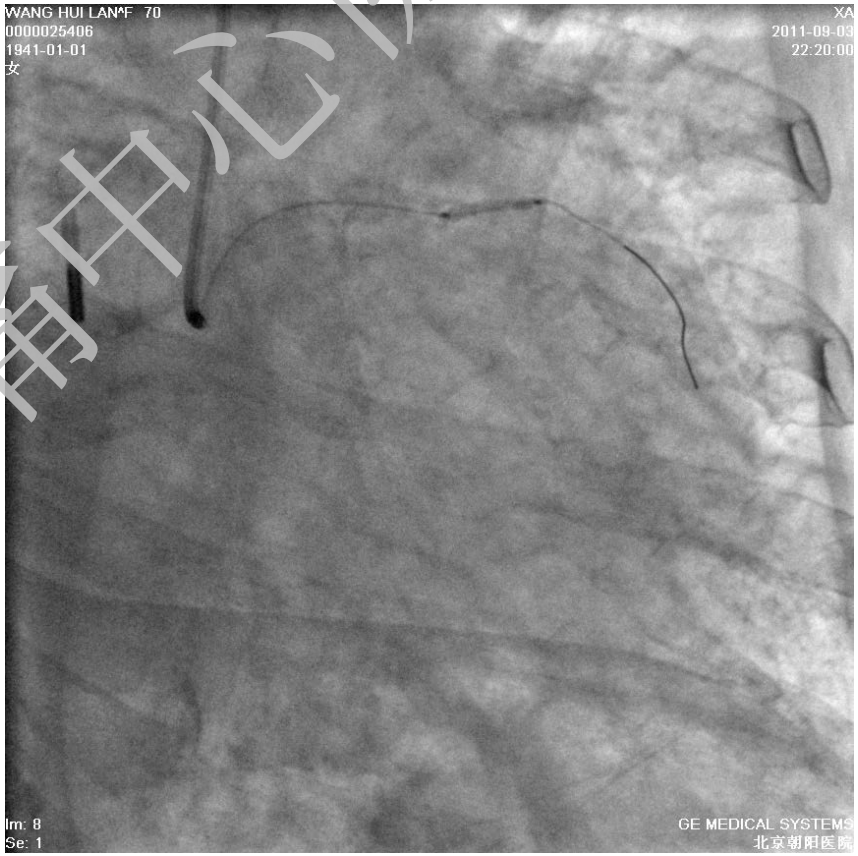




干预过程

Squent 2.0*15mm，10-12atm预扩，球囊通过LADm狭窄处困难



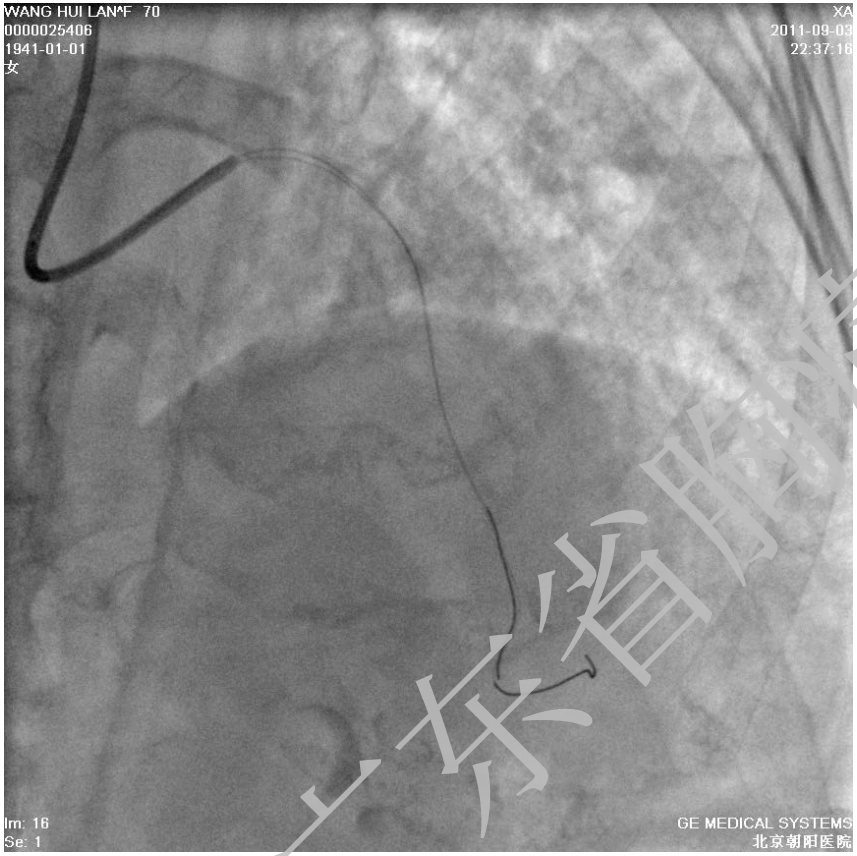


干预过程

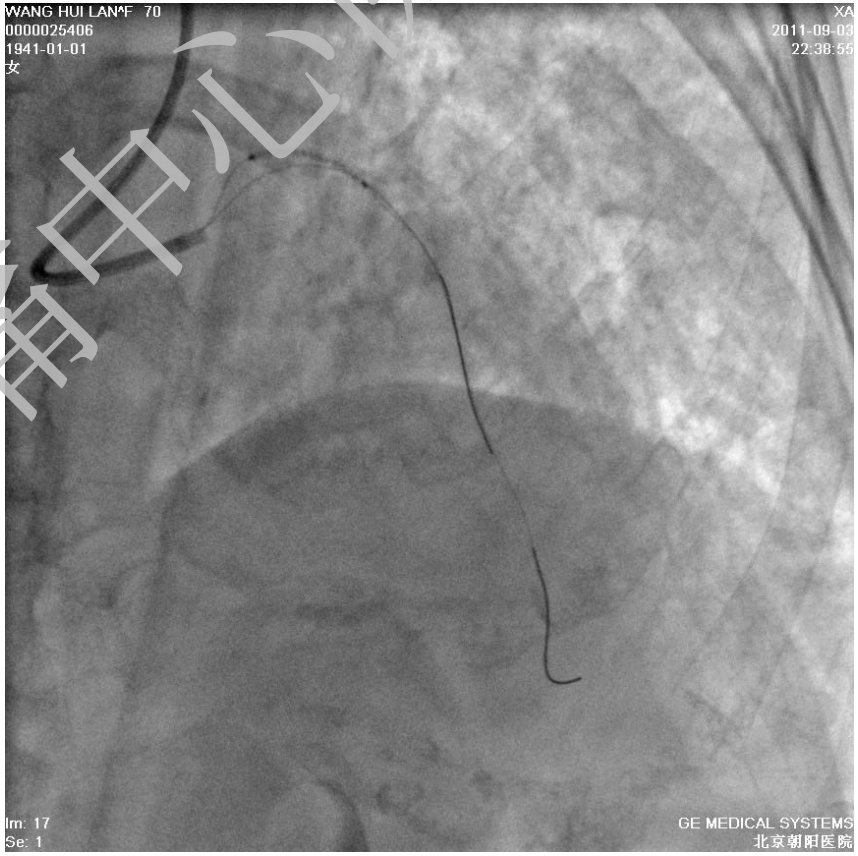
Launcher 6F EBU 3.5 ,球囊通过困难，用第二根Runthrough GW加强支撑，球囊通过，以14atm*5多次预扩

干预过程

第一次预扩后结果

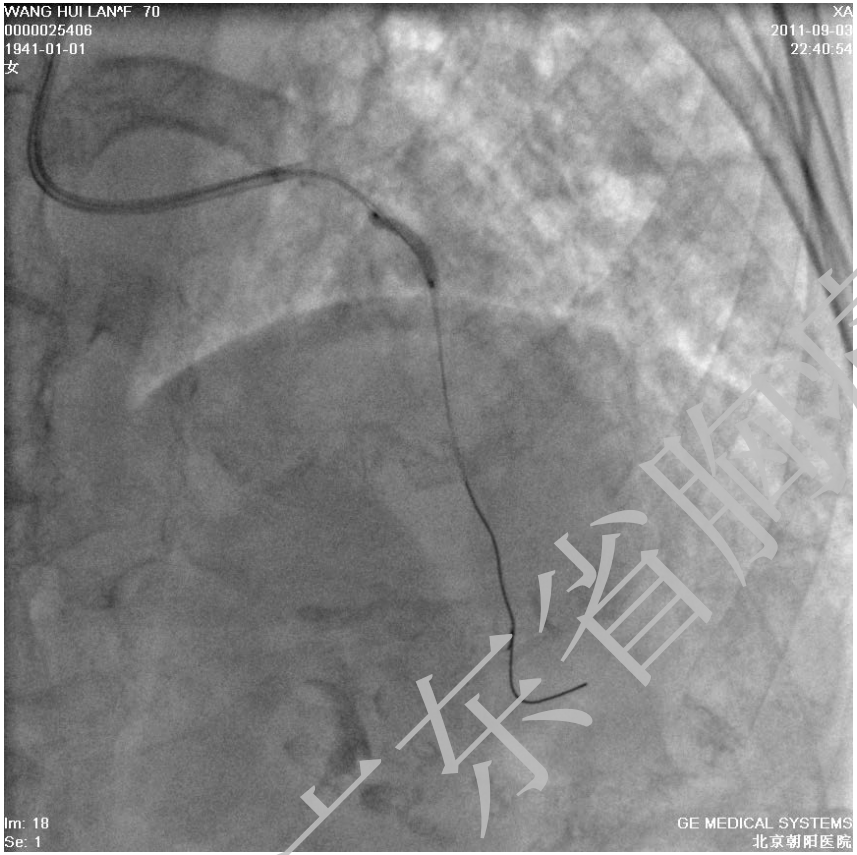


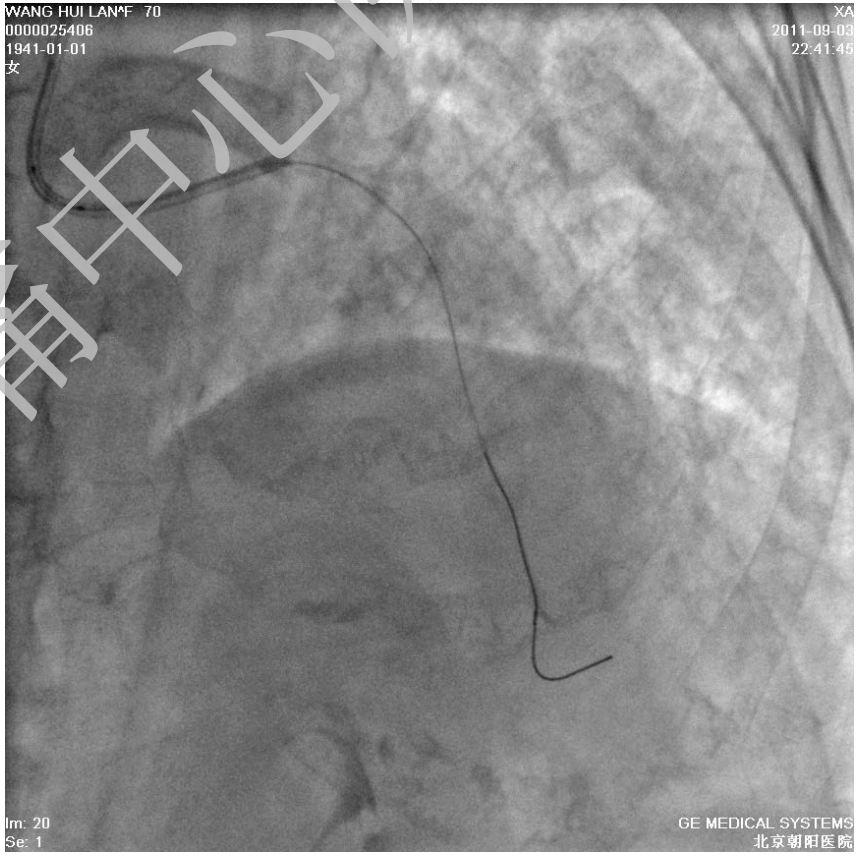
多次送Firebird2.5*18mm支架支架通过仍然困难



干预过程

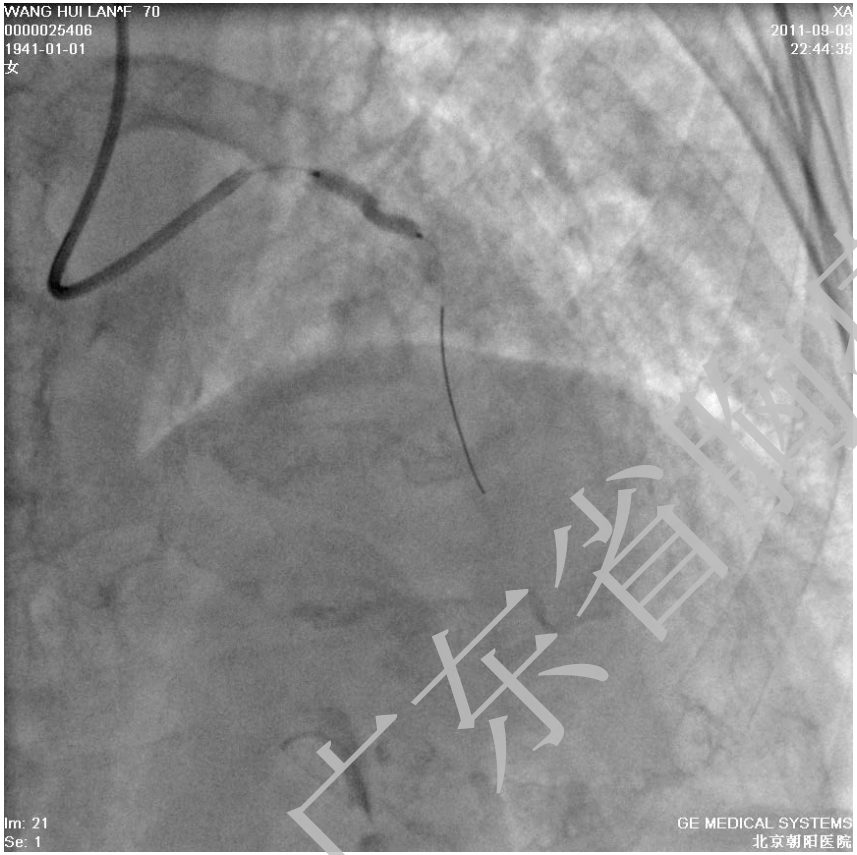
再次送Sequent 球囊至病变处，以16-18atm*5sec扩张

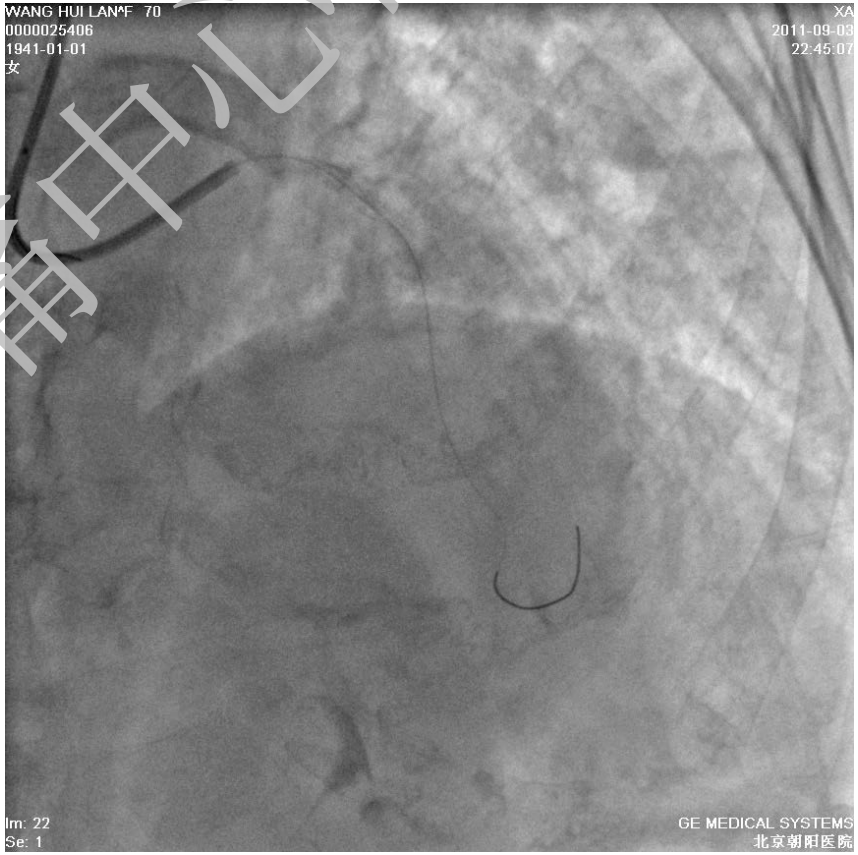




干预过程

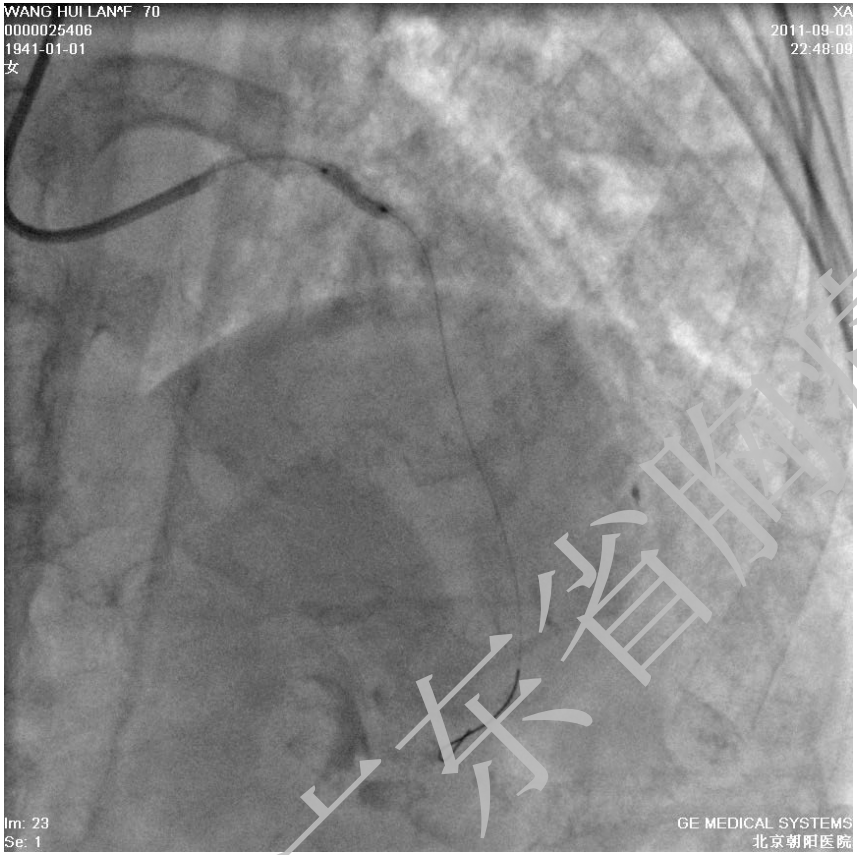
Firebird支架损坏，支架Endeavor Resolute 2.5*18mm支架成功通过病变处，14atm*5sec扩释

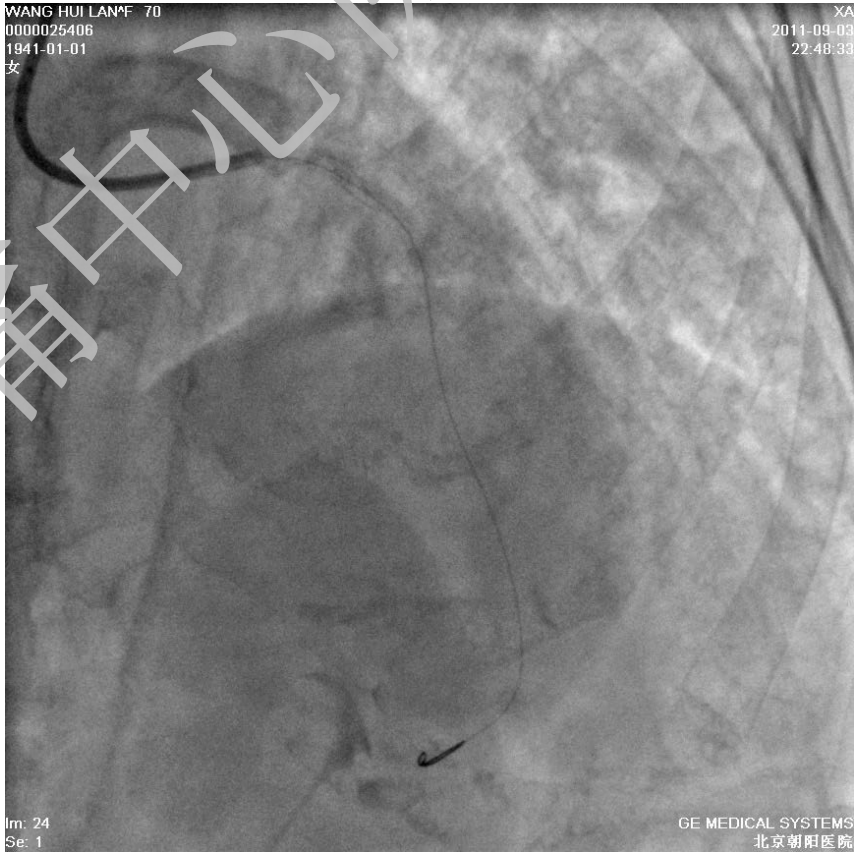




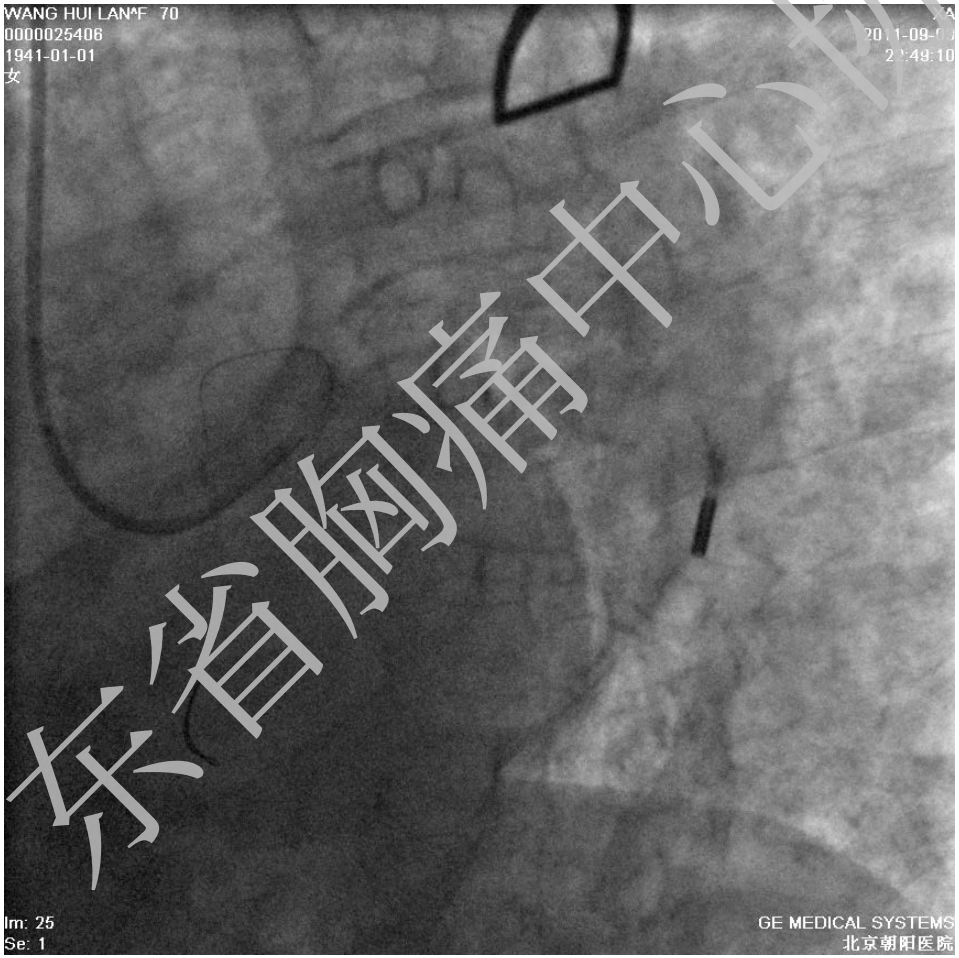
干预过程

Sprinter NC 2.5*12mm球囊2，以16atm*5sec后扩



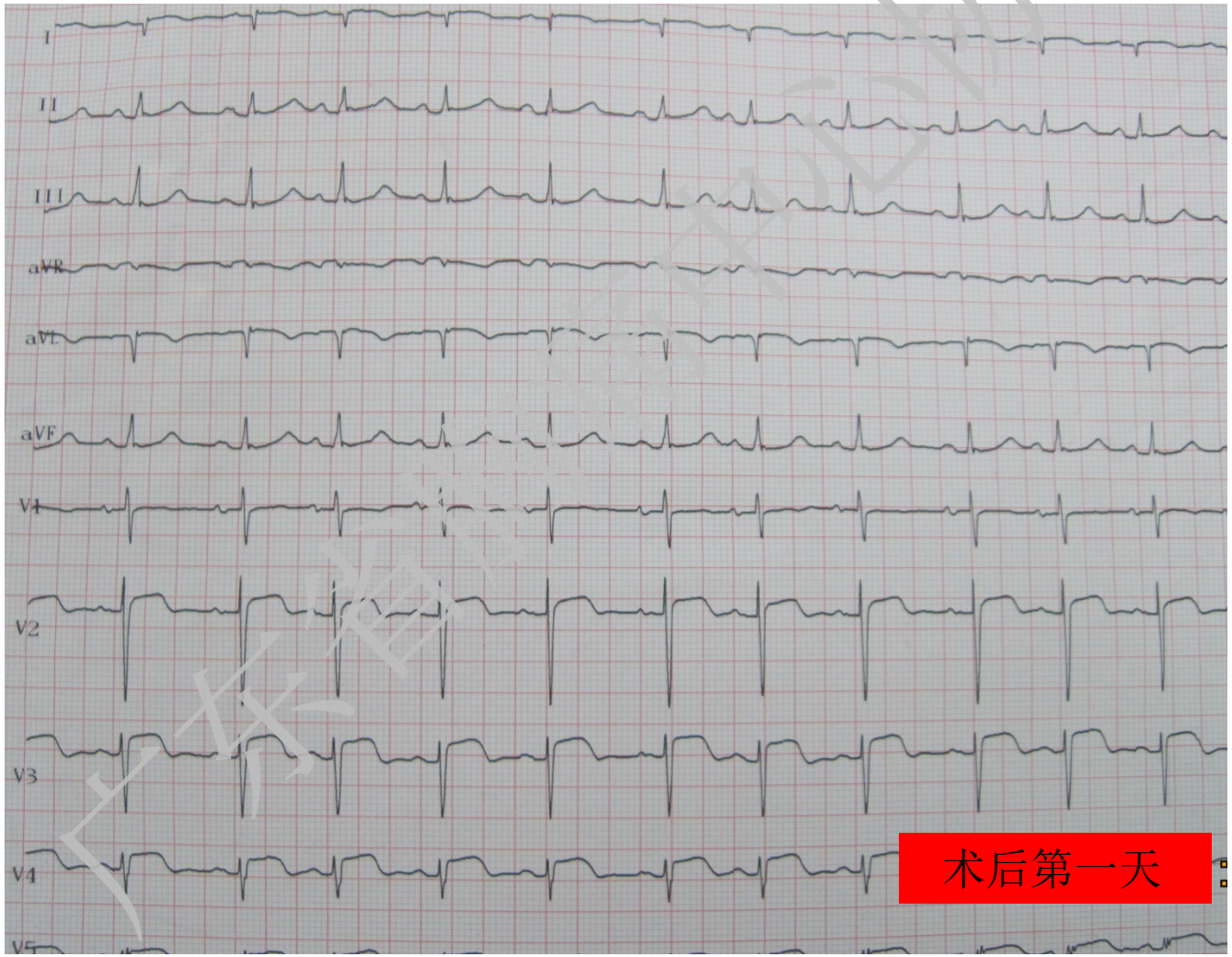


最终结果

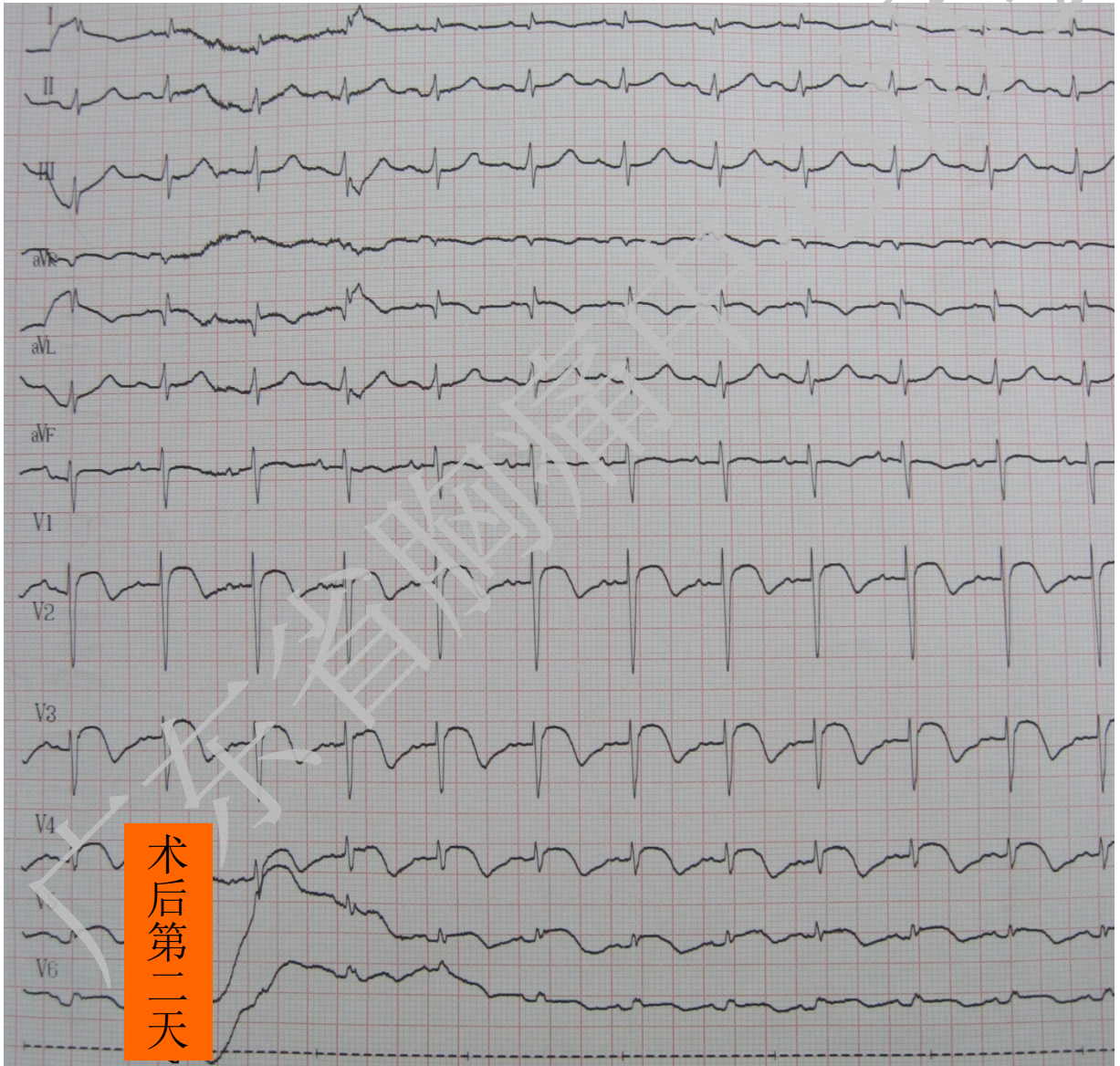


术前患者呕吐一次，术中未诉明显不适，神志精神可，在IABP支持下血压维持在110/80mmHg左右，术后入CCU继续观察，给予冠心病二级预防。

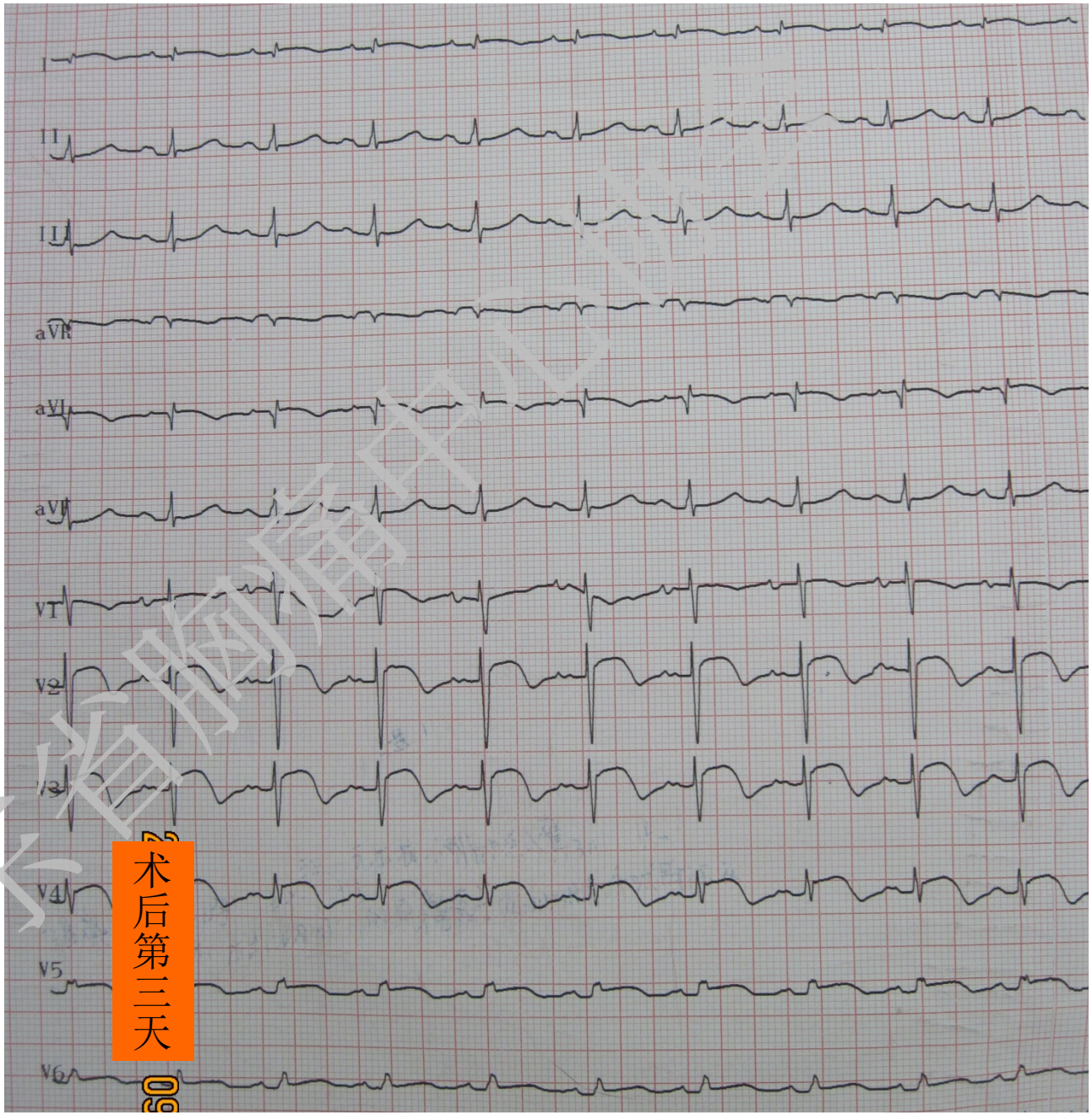
术后心电图



术后心电图



- 术后心电图



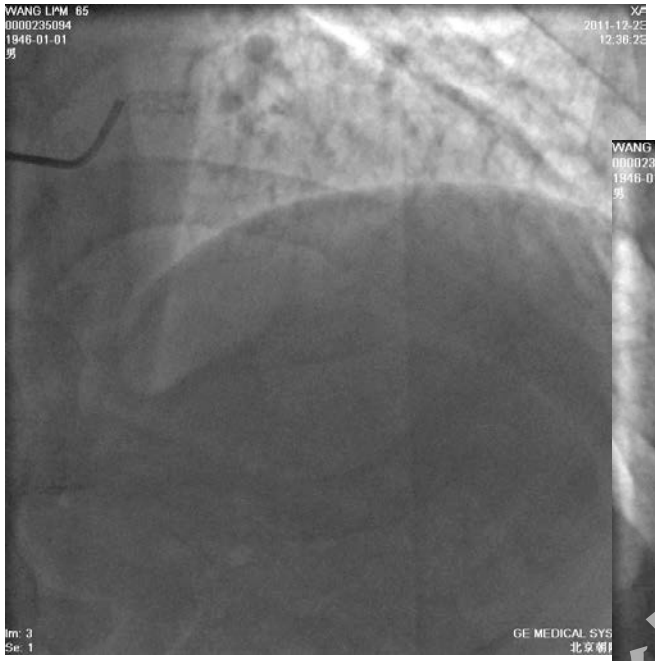
Conclusion

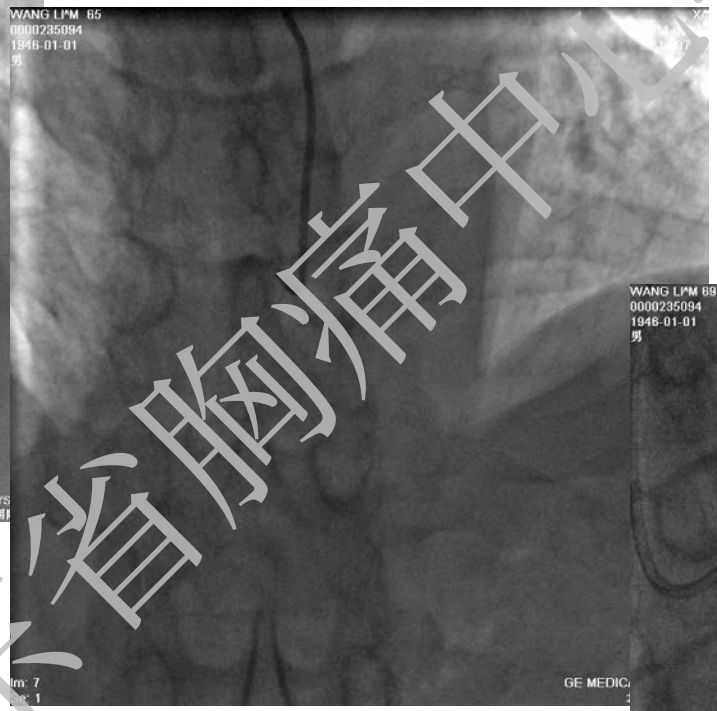
- 1.Survival rate was low for patient without collateral circulation and poor antegrade flow。
- 2.IABP is essential。GPI and Thrombectomy is very important。
- 3.Symptom to balloon time is very important. Strategically open IRA with postconditioning to reduce reperfusion injury.

总结

- GI bleeding and emergent ulcer、kindney insufficiency、pulmonary infection
- IABP 2 weeks or longer，ECMO may be better
  。

第一个左主干急诊PCI病人
18年后再次LAD择期PCI





Thank You !