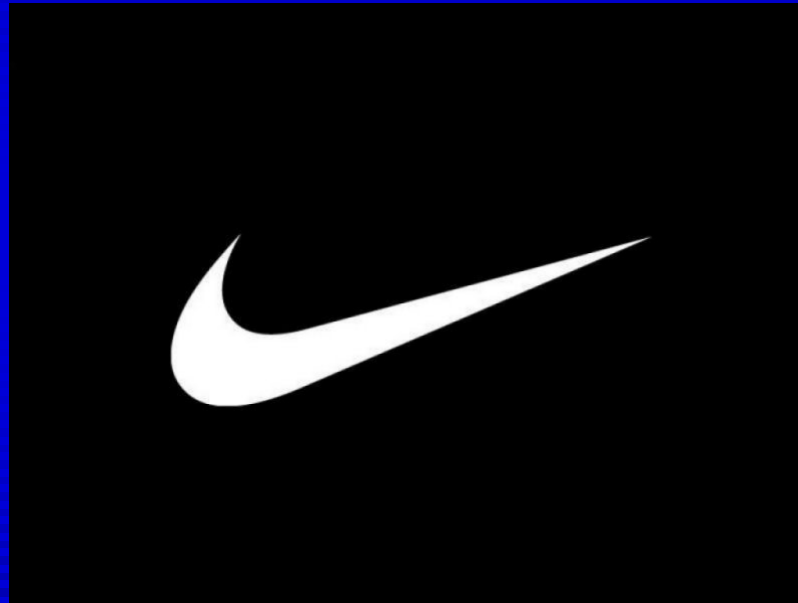# Total Revascularization in Primary Angioplasty

Dongguk University College of Medicine
Gyeongju Hospital, Gyeongju, Korea*

Deuk-Young Nah,, MD, PhD

Recanalization of the culprit lesion is the main goal of primary angioplasty for acute ST-segment elevation myocardial infarction (STEMI).

# AHA/ACC Guideline recommend
Just Culprit vessel

Class III
: PCI should not be performed in a noninfarct artery at the time of primary PCI in patients without hemodynamic compromise. (*Level of Evidence: C*)

What is the Class III?

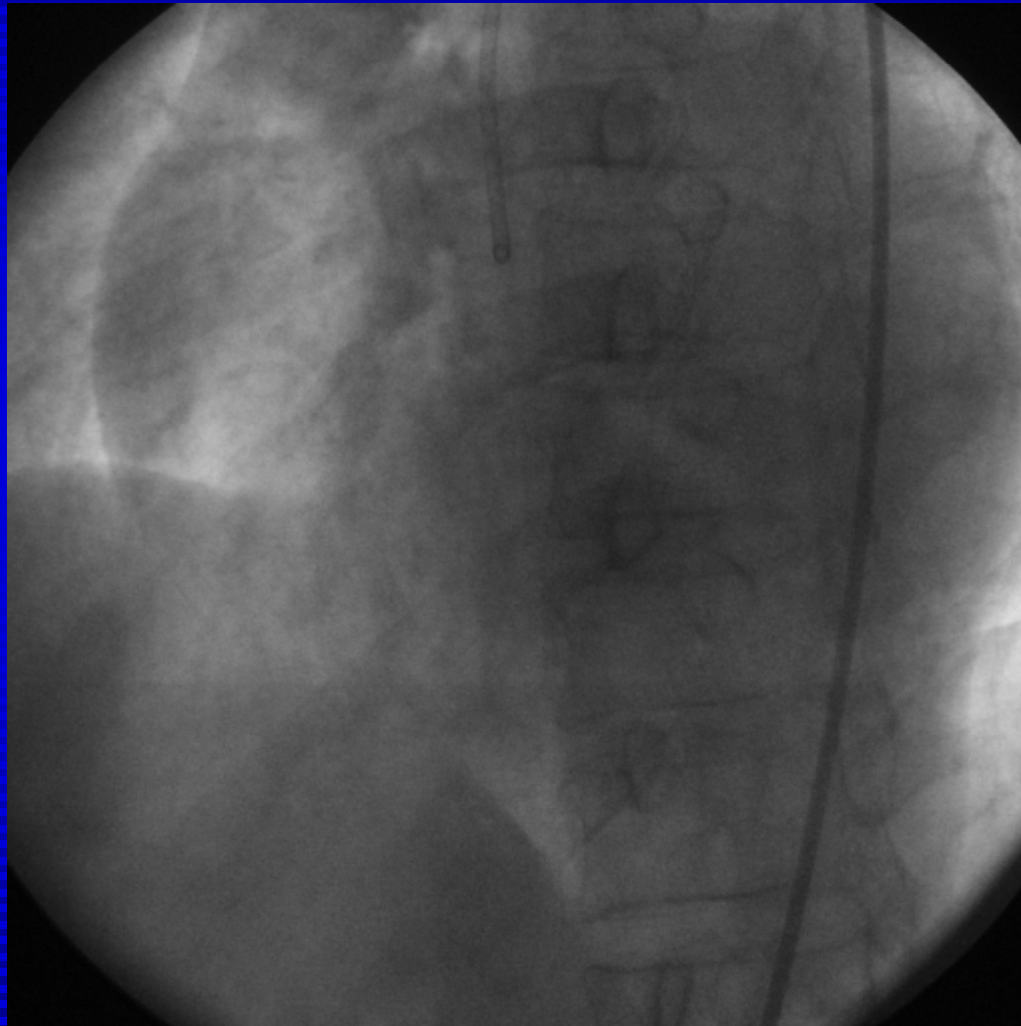**Recommendation that procedure or treatment is not useful/effective and may be harmful**

Are there any interventional cardiologist who have never experience of multi-vessel angioplasty for STEMI patients without hemodynamic compromise?

F/73, STEMI (RCA)
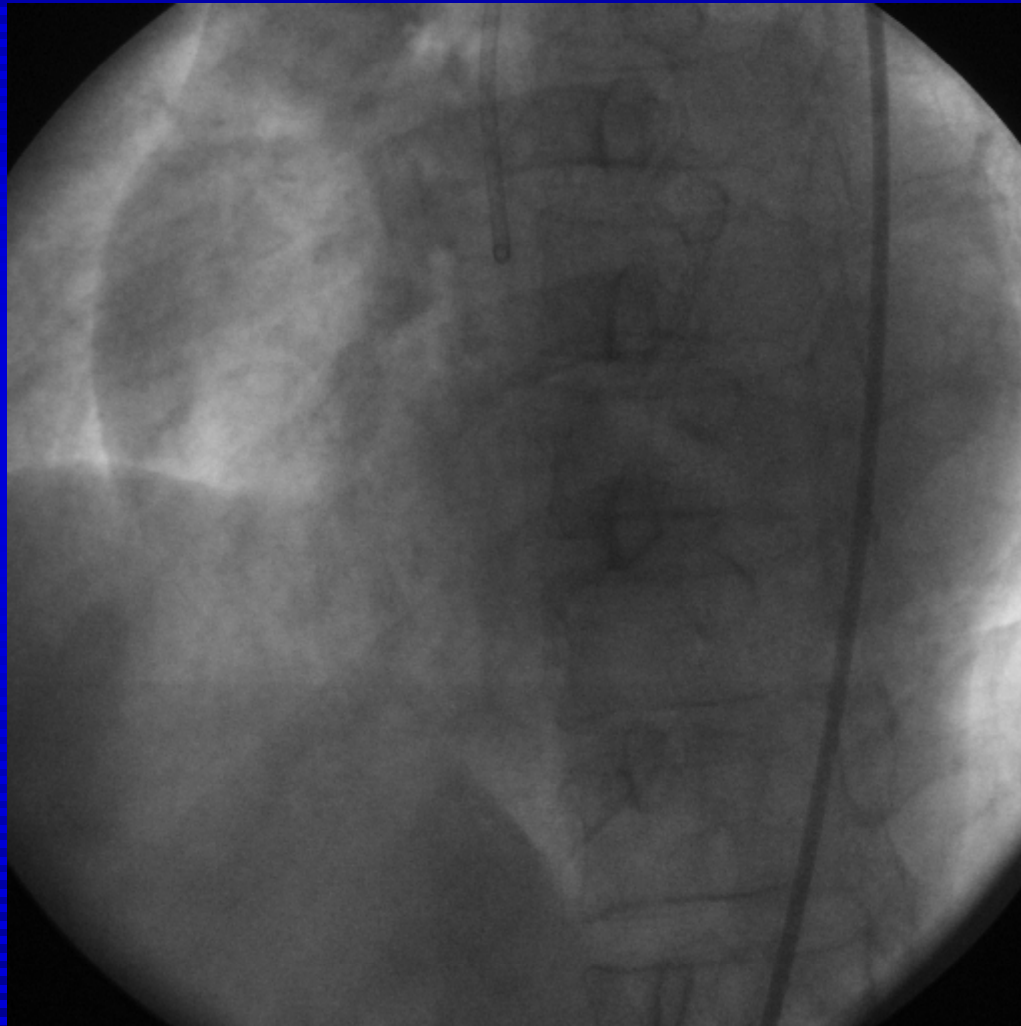
F/73, STEMI (RCA)
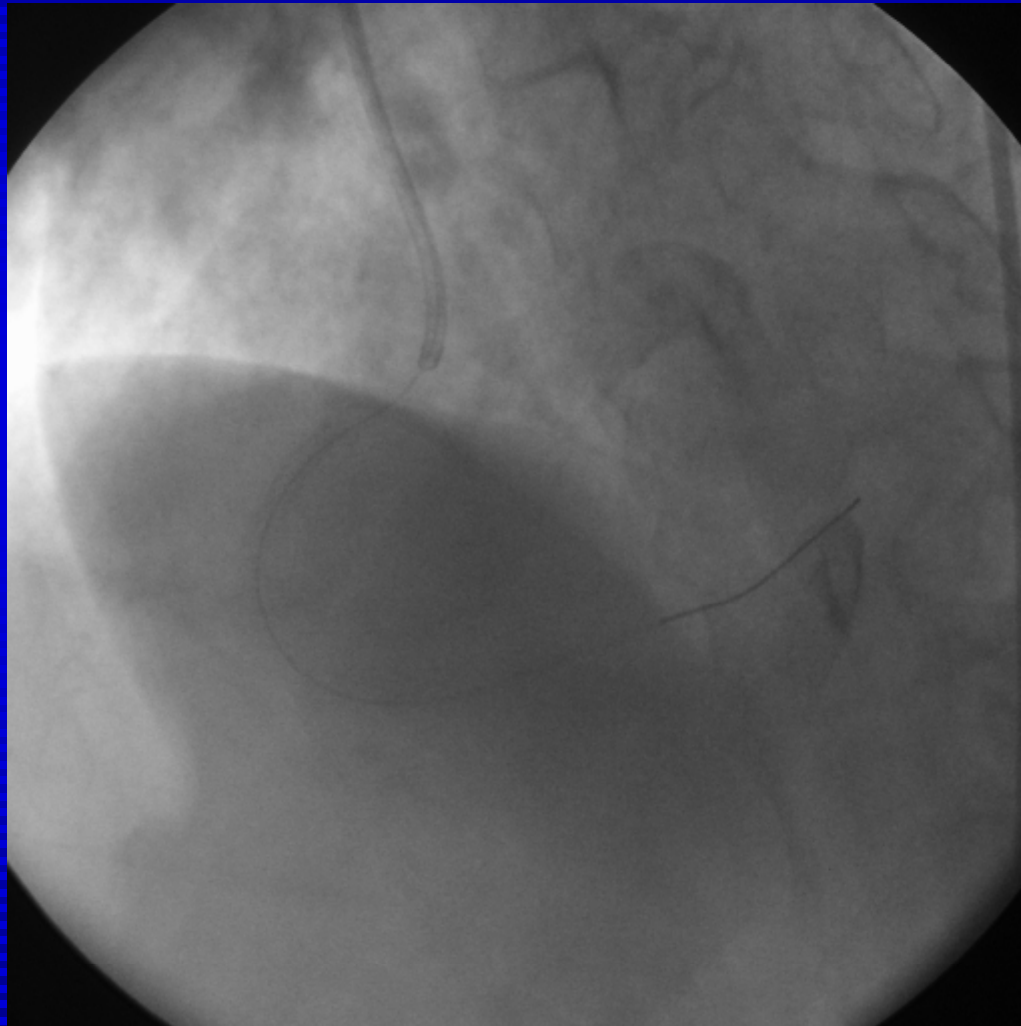
F/73, STEMI (RCA)

F/73, STEMI (RCA) with LAD lesion
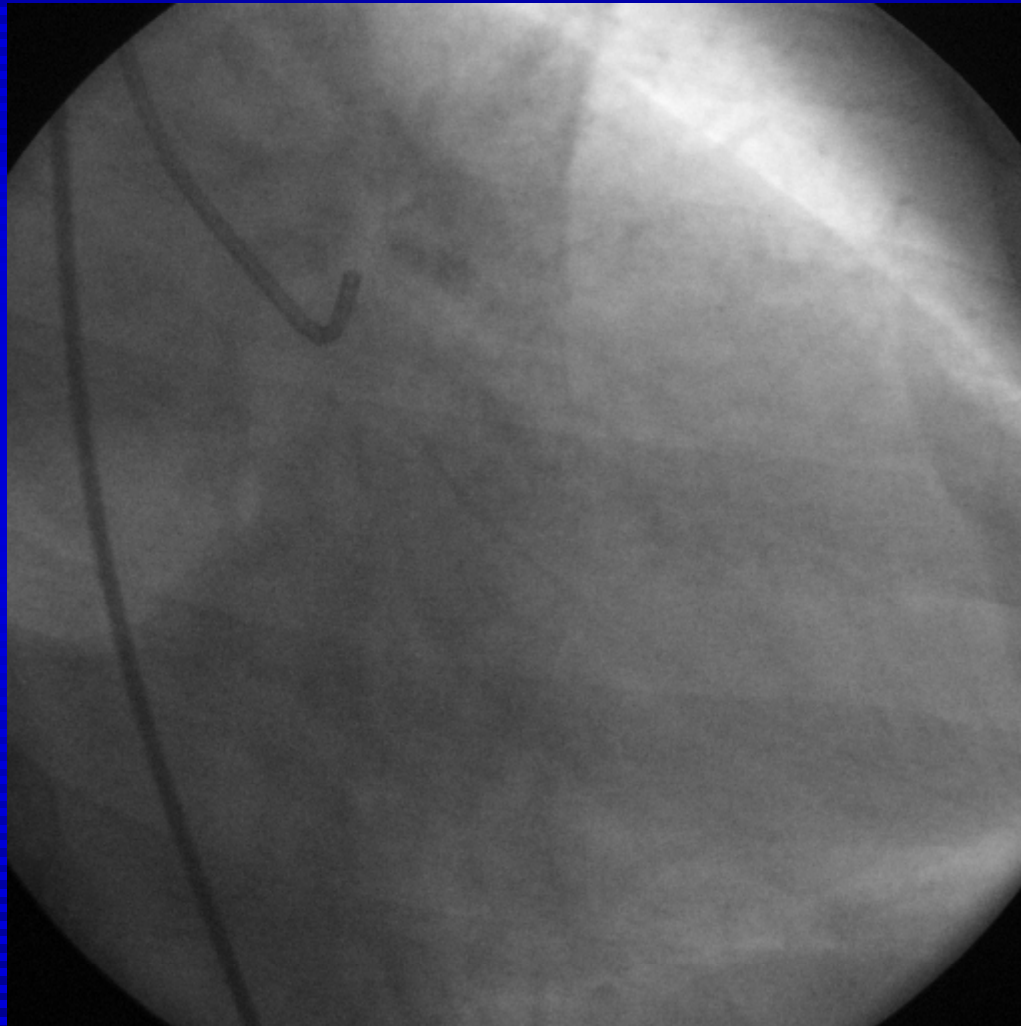
F/73, STEMI (RCA) with LAD lesion
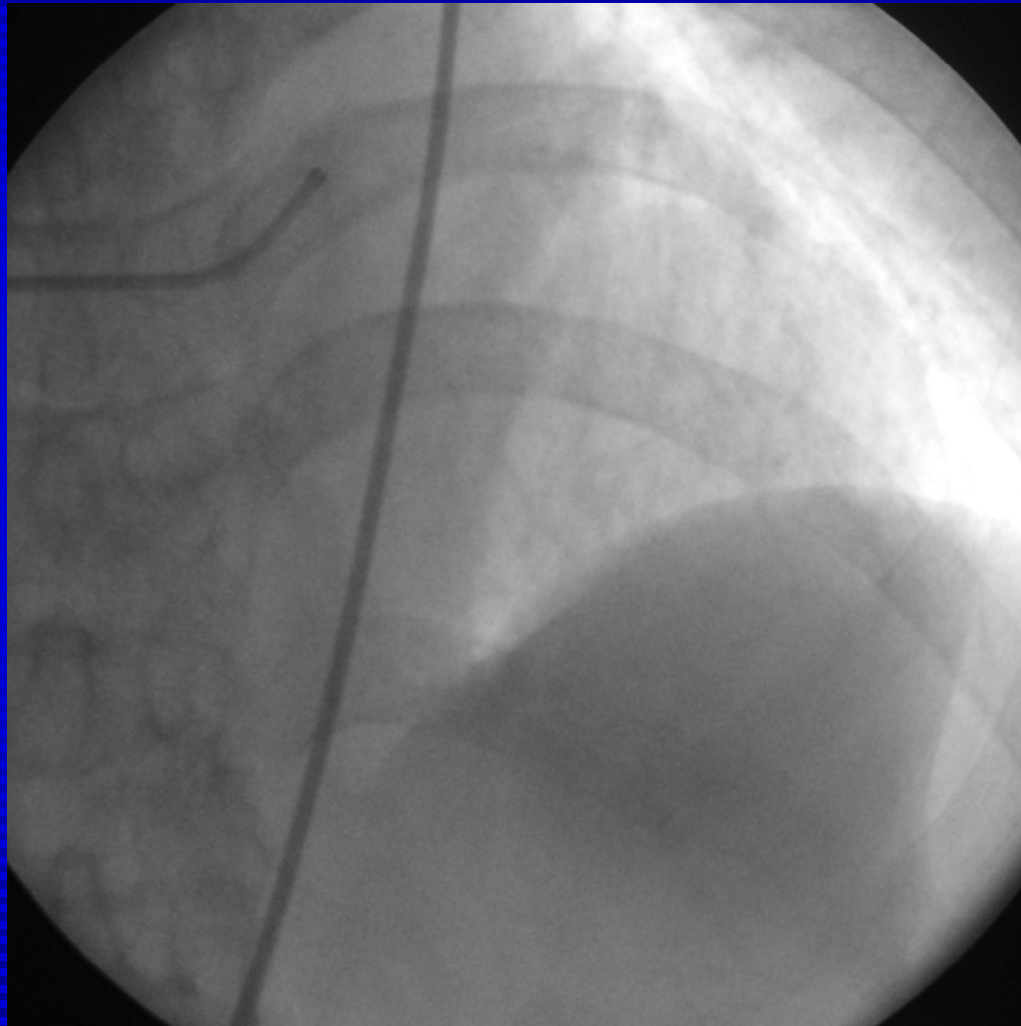
F/73, STEMI (RCA) with LAD lesion

What is the Level of evidence C ?

Very limited (1-2) population risk strata evaluated

Only consensus opinion of experts, case studies, or standard-of-care.

Who is the experts
in interventional cardiology

Who is the experts
in STEMI treatment

Dr Park, Jang, Jung, Kim, Tahk & Seung are experts in interventional cardiologist.

If famous USA doctors say " total revascularization in primary angioplasty is very dangerous and harmful procedure to paitents" "don't do that"

Will you change your practice?

Definitions of Multivessel disease

- More than 70% stenosis, more than two major epicardial coronary artery.

Prevalence of Multivessel CAD in STEMI patients

- 30-50%,
- Is associated with increased morbidity & mortality

Favorable Data for Culprit Only in Primary PCI

Favorable Data for Culprit Only

Table 5. Mortality Rates (%) for Propensity Matched Multivessel Disease STEMI Patients by Revascularization Strategy During the Index Procedure

Outcome by Subgroup	Culprit Vessel Revascularization at the Time of PPCI	Multivessel Revascularization at the Time of PPCI	Percentage Difference	p Value
All patients	n = 503	n = 503		
Death, %				
In-hospital	2.0	3.4	1.4	0.14
12 months	5.5	7.1	1.6	0.23
24 months	6.6	8.6	2.0	0.17
42 months	10.8	11.8	1.0	0.23
Patients without hemodynamic instability, LVEF <20%, malignant ventricular arrhythmia	n = 458	n = 458		
Death, %				
In-hospital	0.9	2.4	1.5	0.04
12 months	4.2	5.8	1.6	0.13
24 months	4.9	7.2	2.3	0.07
42 months	6.7	10.4	3.7	0.08

Median follow-up = 22.54 months.

LVEF = left ventricular ejection fraction; PPCI = primary percutaneous coronary intervention; STEMI = ST-segment elevation myocardial infarction.

Limitation of this study

- Not randomized, observational study
- Selection bias : chosen for one of the treatment options
- Not able to capture real mortality

Limitation of this study

- Unmeasured confounders that could explain why multivessel PCI is perfomed during the primary PCI.

  - **Favorable setting**
  - **Unfavoralble setting**

1. persistent pain/ST segment elevation after dilation of the culprit vessel or
 2. Another lesion causing compromised TIMI flow as well as situations   in which the culprit lesion has been easily fixed. In
3. In the patient in whom procedural success is not apparent.
4. Identification and Tx of the culprit lesion is not always easy in patients with multivessel disease in small culprit vessel or total occlusion receiving collateral circulation

Favorable Data for Total revascularization in Primary PCI

Safety of single versus multi-vessel angioplasty for patients with acute myocardial infarction and multi-vessel coronary artery disease: report from the New York State Angioplasty Registry

James A. Kong, Eric T. Chou, Robert M. Minutello, Shing Chiu Wong and Mun K. Hong

Methods Using the 2000–2001 New York State Angioplasty Registry database, we compared the in-hospital clinical outcomes of patients with multi-vessel disease (> 70% stenosis in at least two major coronary arteries), who underwent either multi-vessel angioplasty (n= 632) or infarct-related vessel angioplasty (n=1350) within 24 h of acute myocardial infarction. Patients with previous myocardial infarction, angioplasty, bypass surgery, or cardiogenic shock were excluded.

Table 1 Baseline characteristics of the study population

	Single-vessel angioplasty (n=1350)	Multi-vessel angioplasty (n=632)	P value
Age (years)	62.0±13.0	60.0±12.3	0.002
Female (%)	27.9	22.8	0.016
Hypertension (%)	61.3	61.9	NS
Diabetes (%)	20.5	16.8	0.051
Tobacco use (%)	36.7	37.2	NS
Prior stroke (%)	3.9	1.3	0.001
Chronic renal failure (%)[a]	1.0	0.6	NS
Peripheral vascular disease (%)	8.9	4.7	0.001

[a]Serum creatinine >2

Table 2 Clinical ar

			P value
Congestive heart failu			NS
Ejection fraction			0.002
GP IIb/IIIa inhibitor the			NS
Thrombolytic therapy (			NS
PCI total occlusion (%)	52.0	41.8	<0.001
Proximal LAD lesion present (%)	26.1	25.6	NS
Proximal LAD lesion present, no PCI (%)	7.0	0.9	<0.001
Stent	91.3	98.9%	<0.001

GP, glycoprotein; PCI, percutaneous coronary intervention; LAD, left anterior descending artery.

Table 3 A

Number of lesions >70%, per patient	3.2	3.5	<0.001
Lesion type per group (%)			
A	12.0	8.4	<0.001
B	60.6	67.5	<0.001
C	27.5	24.1	0.004
Lesions treated/lesions present (%)			
A	209/511 (40.9)	175/186 (94.1)	<0.001
B	1362/2584 (52.7)	1403/1488 (94.3)	<0.001
C	757/1172 (64.6)	496/531 (93.4)	<0.001
Total lesions treated/present (%)	2328/4267 (54.5)	2074/2205 (94.1)	<0.001

MVA group were slightly **younger**, *more likely to be **male***, have a lower rate of *pph vascular disease , prior stroke* and *DM*

MVA group were *more complex lesion* and more likely *to receive stents*.

Table 4 In-hospital outcomes

	Single-vessel angioplasty ($n=1350$)	Multi-vessel angioplasty ($n=632$)	P value
Major adverse cardiac events (%)	3.5	1.6	0.020
Death (%)	2.3	0.8	0.018

Table 5 Independent predictors of mortality

Variable	Odds ratio	95% Confidence interval	P value
Female sex	2.34	1.05–5.24	0.038
Multi-vessel PCI	0.27	0.08–0.90	0.033

LAD, left anterior descending artery; PCI, percutaneous coronary intervention.

Table 6 Independent predictors of major adverse cardiac events

Variable	Odds ratio	95% Confidence interval	P value
Multi-vessel PCI	0.40	0.17–0.92	0.032

LAD, left anterior descending artery; PCI, percutaneous coronary intervention.

Safety of single versus multi-vessel angioplasty for patients with acute myocardial infarction and multi-vessel coronary artery disease: report from the New York State Angioplasty Registry

James A. Kong, Eric T. Chou, Robert M. Minutello, Shing Chiu Wong and Mun K. Hong

Conclusions: **Despite the added complexity of multi-vessel angioplasty, patients in this group had** *significantly lower in-hospital mortality.* **Therefore, a strategy of multi-vessel angioplasty during acute myocardial infarction may be safe compared with infarct-related angioplasty in selected patients.**

Single vs multivessel treatment during primary angioplasty: results of the multicentre randomised HEpacoat™ for cuLPrit or multivessel stenting for Acute Myocardial Infarction (HELP AMI) Study

Di Mario Carlo[1], Sansa Mara[2], Airoldi Flavio[3], Sheiban Imad[4], Manari Antonio[5], Petronio Anna[6], Piccaluga Emanuela[7], De Servi Stefano[8], Ramondo Angelo[9], Colusso Stefania[10], Formosa Anna[11], Cernigliaro Carmelo[2], Colombo Antonio[12]
With the technical assistance of: Nicoletta Monzini[11] and Maria Antonietta Bonardi[11]

- 69 STEMI patients with multivessel disease to unbalanced randomization.
- Culprit lesion treatment (n=17)
- Complete multivessel intervention (n=52)

	Culprit (n = 17)	Complete (n = 52)	p
Two vessel disease	52.9	69.2	0.432
Three vessel disease	47.1	30.8	
Culprit lesion			
TIMI flow class PRE-PTCA 0 (%)	47.1	72.5	
TIMI flow class PRE-PTCA 1 (%)	23.5	5.9	0.141
TIMI flow class PRE-PTCA 2 (%)	11.8	7.8	
TIMI flow class PRE-PTCA 3 (%)	17.6	13.8	
LAD	57%	52%	
LCX	23%	32%	0.218
RCA	20%	16%	
PRE-PTCA reference diameter (mm)	2.92 ± 0.38	3.17 ± 0.48	0.181
PRE-PTCA MLD (mm)	0.21 ± 0.30	0.22 ± 0.41	0.354
PRE-PTCA diameter stenosis (%)	92 ± 10	93 ± 12	0.871
PRE-PTCA lesion length (mm)	11.4 ± 2.9	10.9 ± 4.6	0.289
POST-PTCA MLD (mm)	2.95 ± 0.48	2.87 ± 0.48	0.411
POST-PTCA diameter stenosis (%)	11 ± 7	12 ± 8	0.100
TIMI flow class POST-PTCA 0–1 (%)	0	2 (1/51)*	
TIMI flow class POST-PTCA 2 (%)	12 (2/17)*	10 (5/51)	0.791
TIMI flow class POST-PTCA 3 (%)	88 (15/17)	88 (45/51)	
Main angiographic characteristic non culprit lesions treated (n = 71)			
PRE-PTCA MLD (mm)	–	0.94 ± 0.41	
PRE-PTCA stenosis (mm)	–	66 ± 12	
PRE-PTCA reference diameter (mm)	–	2.79 ± 0.64	
PRE-PTCA lesion length (mm)	–	8.9 ± 7.6	
Procedural characteristics (all lesions)			
Treated lesion/patient	1.00 ± 0	2.36 ± 0.64	0.001
Stent/lesion	1.29 ± 0.61	1.12 ± 0.33	0.008
Stent/patient	1.29 ± 0.61	2.73 ± 0.78	0.001
Mean stent length (mm)	19.9 ± 8.4	16.4 ± 5.0	0.088
Max balloon pressure (atm)	13.6 ± 2.6	14.1 ± 2.5	0.561
Procedure duration (min)	53 ± 24	69 ± 38	0.032
Contrast used (ml)	242 ± 106	341 ± 163	0.025

LAD, left anterior descending artery; LCX, left circumflex artery; MLD, minimal luminal diameter; RCA, right coronary artery; TIMI, thrombolysis in acute myocardial infarction. *In 1 patient in each group culprit vessel TIMI flow could not be determined because of a too short angiographic acquisition. PTCA, percutaneous transluminal coronary angioplast.

Table 2
Angiographic and procedural characteristics.

	Culprit	Complete	p
Procedure duration (min)	53 ± 24	69 ± 38	0.032
Contrast used (ml)	242 ± 106	341 ± 163	0.025

	Culprit (n = 17)	Complete (n = 52)	p
In hospital			
Death (%)	0	1 (1.9)	0.754
Repeat MI (%)	0	0	–
Urgent PTCA (%)	0	1 (1.9)	0.675
CABG (%)	0	0	–
Any MACE (%)	0	2 (3.8)	0.164
Procedural cost (€)	12 613 ± 4490	13 328 ± 3489	0.263
1–12 month follow-up			
Death (%)	0	0	0.754
MI (%)	1 (5.9)	1 (1.9)	0.435
PTCA or CABG (%)	6 (35.3)	8 (15.4)	0.092
Any MACE (%)	6 (35.3)	8 (15.4)	0.331
Follow up cost (€)	9717 ± 5220	7054 ± 6678	0.185
12 months cumulative AE			
Death (%)	0	1 (1.9)	0.754
MI (%)	1 (5.9)	1 (1.9)	0.435
PTCA or CABG (%)	6 (35.3)	9 (17.3)	0.174
Any MACE (%)	6 (35.3)	11 (21.1)	0.331
Total Cost (€)	22 330 ± 13653	20 382 ± 11671	0.323

AE, adverse events; CABG, coronary artery bypass grafting; MACE, major adverse cardiac events; MI, myocardial infarction; PTCA, percutaneous transluminal coronary angioplasty..

Table 3
Clinical events and cost at follow-up.

- A similar incidence of in-hospital MACE and revascularization.

Single vs multivessel treatment during primary angioplasty: results of the multicentre randomised HEpacoat™ for cuLPrit or multivessel stenting for Acute Myocardial Infarction (HELP AMI) Study

Di Mario Carlo[1], Sansa Mara[2], Airoldi Flavio[3], Sheiban Imad[4], Manari Antonio[5], Petronio Anna[6], Piccaluga Emanuela[7], De Servi Stefano[8], Ramondo Angelo[9], Colusso Stefania[10], Formosa Anna[11], Cernigliaro Carmelo[2], Colombo Antonio[12]
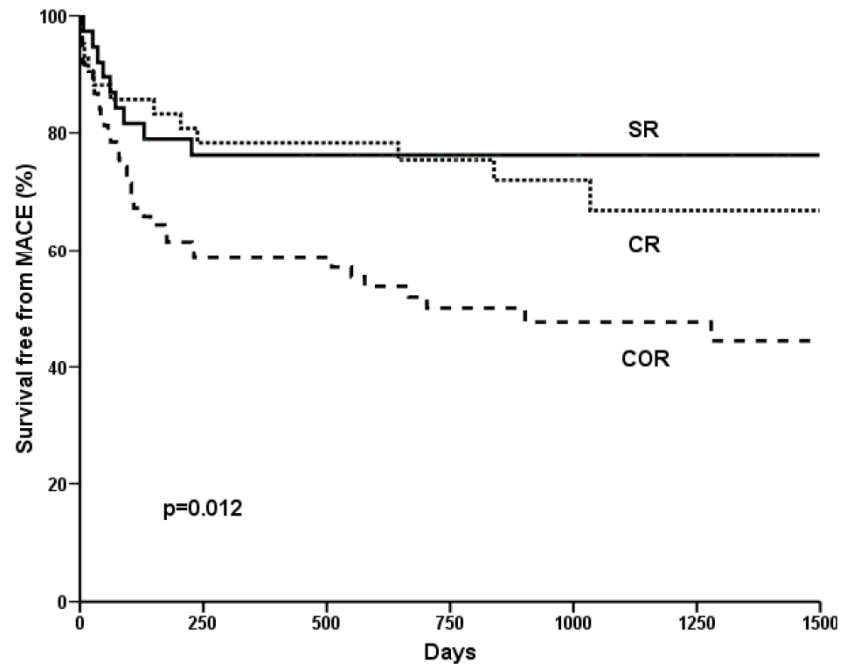With the technical assistance of: Nicoletta Monzini[11] and Maria Antonietta Bonardi[11]

- Conclusion: Multivessel treatment during primary PTCA was safe in this controlled trial.

Multivessel Coronary Disease in ST-Elevation Myocardial Infarction: Three Different Revascularization Strategies and Long-Term Outcomes
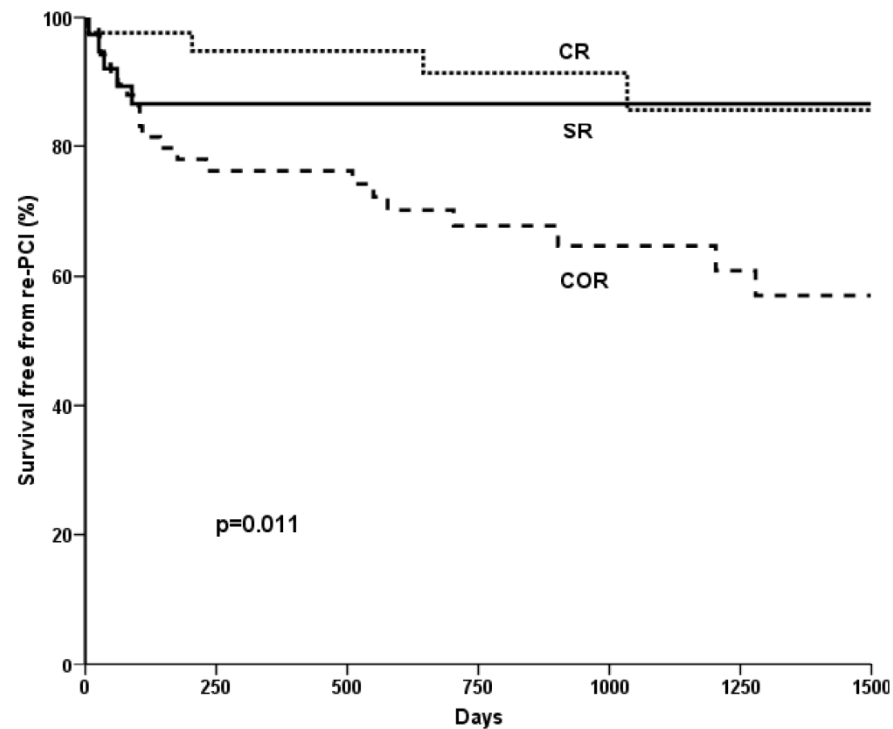
Luigi Politi, Fabio Sgura, Rosario Rossi, et al.

214 consecutive patients STEMI with MVD were randomized to 3 different strategies:

1) culprit vessel angioplasty only (COR group)
2) staged revascularization (SR group)
3) simultaneous treatment of non-IRAs (CR group)

Pts at risk COR	84	47	40	25	17	15	8
SR	65	53	45	20	9	3	0
CR	65	53	49	28	15	6	3

Table 4. Multivariable determinants of MACE

Covariates	Adjusted HR	95%CI	p
COR group (referent)	1		
SR vs. COR group	0.377	0.194-0.732	0.004
CR vs. COR group	0.495	0.262-0.933	0.030
Age	0.991	0.967-1.019	0.497
Male gender	1.398	0.714-2.739	0.310
Diabetes mellitus	1.606	0.894-2.8861	0.113
LVEF before PCI	1.000	0.957-1.010	0.976
Killip class	1.718	1.167-2.529	0.006
Chronic renal failure	1.926	1.012-3.665	0.046
CIN	1.587	0.519-4.852	0.418

Multivessel Coronary Disease in ST-Elevation Myocardial Infarction: Three Different Revascularization Strategies and Long-Term Outcomes

Luigi Politi, Fabio Sgura, Rosario Rossi, et al.

Conclusions: Culprit vessel only angioplasty was associated with the highest rate of long-term MACE as compared to multivessel treatment.

Culprit only versus complete coronary revascularization during primary PCI

Dahud Qarawani [b], Menachem Nahir [b], Mouin Abboud [b],
Yevgeny Hazanov [b], Yonathan Hasin [a,*]

[a] The Baruch Padeh Medical Center, Poriya, Cardiovascular Institute, 15208, Tiberias, Israel
[b] Cardiovascular Department, Poria Medical Center, Israel

- **120 consecutive patients with acute STEMI and multivessel coronary stenosis,**

- **Complete revascularization (CR): 95**
- **Culprit only revascularization (COR): 25**

Table 4
Clinical course and echocardiographic findings

	CR	COR	P
Reischemia[a]	4 (4.2%)	8 (32%)	0.002
Reinfarction[a]	3 (3.1%)	4 (16%)	0.01
Recatheterization[a]	7 (7.3%)	8 (32%)	0.001
Acute heart failure[a]	9 (9.4%)	8 (32%)	0.01
Hospitalization (days)	4.45±1.27 days	9.62±2.33 days	0.001
Improvement in WM non-culprit segment	14 (14.7%)	0	0.01
Improvement in WM culprit segment	22 (23%)	5 (20%)	0.85
CK max	1422±355	1358+343	P=NS
Nadir hemoglobin	11.9±0.6	11.5±0.7	P=NS
Blood transfusion[a]	4 (4.2%)	6 (24%)	P=0.01
Transient renal failure	8 (8.4%)	1 (4%)	P=0.01
In-hospital mortality	4 (4.2%)	1 (4%)	P=NS
1 year mortality	9 (9.4%)	2 (8%)	P=0.06

[a] One event per one patient reported.

- **CR was associated with reduced incidence of major cardiac events (recurrent ischemia, reinfarction, acute heart failure and in-hospital mortality 16.7 vs 52%, *p*=0.0001)**

Culprit only versus complete coronary revascularization during primary PCI

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[a] *The Baruch Padeh Medical Center, Poriya, Cardiovascular Institute, 15208, Tiberias, Israel*
[b] *Cardiovascular Department, Poria Medical Center, Israel*

- ***Conclusion:*** **Multivessel PCI during AMI is feasible and safe. Complete revascularization resulted in an improved acute clinical course.**

A. A. Khattab
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C. Röther
B. Liska
R. Toelg
G. Kassner
V. Geist
G. Richardt

Multi-vessel stenting during primary percutaneous coronary intervention for acute myocardial infarction

A single-center experience

- **MV PCI Group: 28 patients**
- **Culprit vessel only PCI Group: 45 patients**

- **Not randomized, single-center experience,**
- **To evaluate safety and feasibility of MV PCI during primary PCI.**

Clin Res Cardiol 97:32–38 (2008)

- **Peak CK** and **CK-MB** were significantly **lower** in patients of the MV-PCI group

- **Similar rate of major adverse cardiac events (death, recurrent infarction,or TLR) at 30 days and one year in the two groups.**

- **The incidence of new revascularization was similar in the two groups.**

Conclusion

Anyway !

- ACC/AHA guideline recommend **Just Culprit vessel PCI** in STEMI patients without hemodynamic compromise

But !

Conclusion

- We have to do total revascularization in STEMI patients with hemodynamic compromise.

Conclusion

- We can do total revascularization in STEMI patients in whom successful culprit vessel stenting has been readily accomplished during a smooth procedure, leading to TIMI grade III and nearly complete ST-segment resolution

We have to solve many problems in the treatment of STEMI patients with multivessel disease.

1. which treatment modality is best ?
   Culprit only or
   Total revascularization

2. What kind of patients and lesion are indications for Total revascularization?.

We have to solve many problems in the treatment of STEMI patients with multivessel disease.

3. When can we do procedure non-infarct related artery?

during primary PCI or index in -hospital stay

or clinically driven or functional study

induced ishemia guide PCI after

discharge

We have to solve many problems in the treatment of STEMI patients with multivessel disease.

4. What kind of stent is better?

Bare metal stent or

DES or

New coming DES

Thank you for your attention