



Revascularization for Ischaemic Cardiomyopathy: Con

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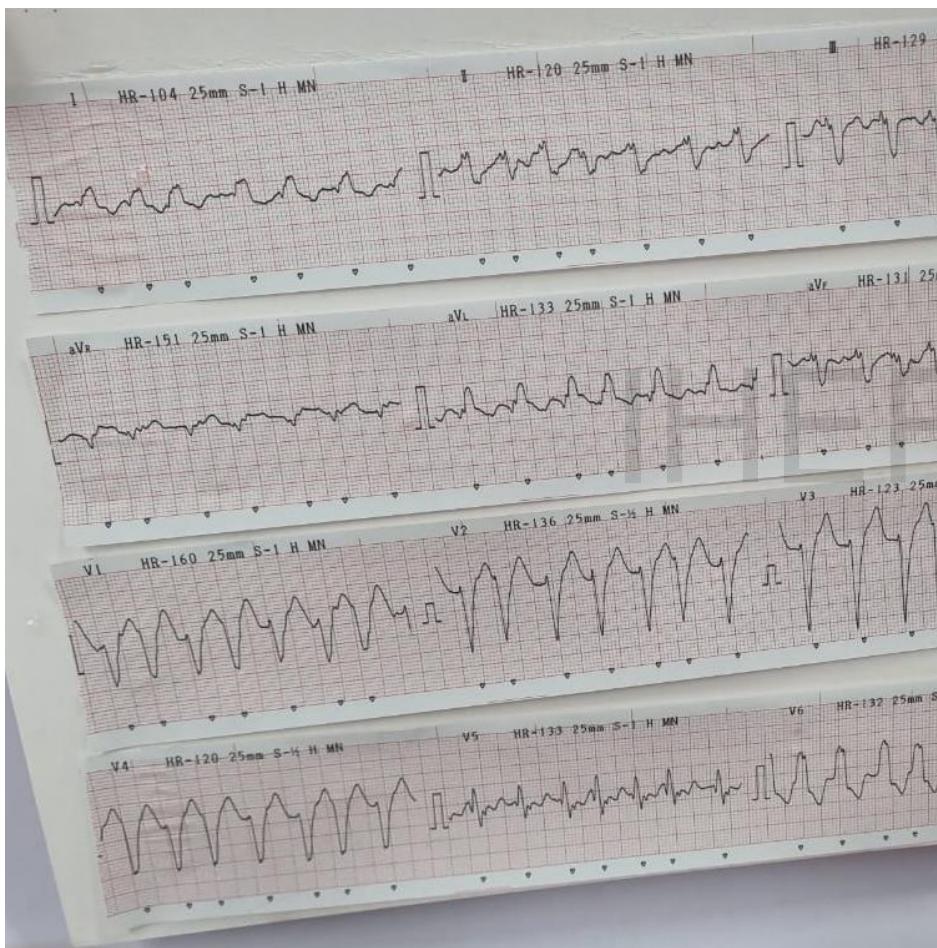
KSM KARDIOLOGI
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Introduction

- CAD is the most **common cause** of HF
- Considered as possible cause in all patients with new-onset HF
- Lack of data revascularization (PCI/ CABG) for ischaemic cardiomyopathy

Case illustration

- 51 yo male, with severe chest pain after morning breafing at the office 2 hr before admission. History of diabetes and PCI 3 years ago (2 DES LAD)
- BP 90-110/50-70, HR 120-140 x/m
- Medication : metformin 2x500 mg, apilet 1x1, candesartan 1x8 mg (Compliance ??)
- Initial lab : Ur 33 ; CR 1.2 ; Hb 12 ; Ht 37 RBG 320



Emergency PCI + IABP



SHOCK TRIAL (NEJM 1999)

TABLE 2. CHARACTERISTICS OF THE STUDY PATIENTS ACCORDING TO TREATMENT GROUP.*

CHARACTERISTIC	REVASCULARIZATION (N=152)	MEDICAL THERAPY (N=150)
Age (yr)	65.5±10.0	66.2±10.
Female sex (%)	36.8	27.3
White race, non-Hispanic (%)	72.4	78.7
Prior MI (%)	29.6	35.3
Hypertension (%)	49.0	43.5
Diabetes mellitus (%)	34.2	27.9
Congestive heart failure (%)	4.0	8.2
Renal insufficiency (%)	4.6	6.9
Prior coronary-artery bypass grafting (%)	2.0	10.0
Prior angioplasty (%)	6.7	7.4
Cigarette smoking (%)	52.6	56.8
Eligible for thrombolytic therapy (%)†	94.1	94.6
Transfer admission (%)	55.3	55.3
Anterior index MI (%)	63.6	57.4
Highest total creatine kinase (IU/liter)	3068 (1322–6350)	3464 (1543–
Median time from MI to shock (hr)	5.0 (2.2–12.0)	6.2 (2.4–15...)
Median time from MI to randomization (hr)	11.0 (5.9–19.4)	12.0 (6.3–21.8)
<6 hr from MI to randomization (%)	25.0	23.7
Lowest systolic blood pressure (mm Hg)‡	66.4±14.3	69.8±11.3
Systolic blood pressure (mm Hg)§	89.0±22.8	86.5±17.4
Diastolic blood pressure (mm Hg)§	53.9±16.8	55.1±13.6
Heart rate (beats/min)§	103.3±22.0	100.1±22.7
Pulmonary-capillary wedge pressure (mm Hg)§¶	24.2±7.1	24.3±7.7
Cardiac index (liters/min/m ²)§¶	1.8±0.7	1.7±0.5
Left ventricular ejection fraction (%)**	29.1±10.6	32.5±13.9
Number of diseased vessels (%)††		
≤1	14.0	11.5
2	21.7	24.0
3	64.3	64.6
Left main coronary artery disease (%)‡‡	23.4	17.5

TABLE 4. MORTALITY AMONG STUDY PATIENTS.*

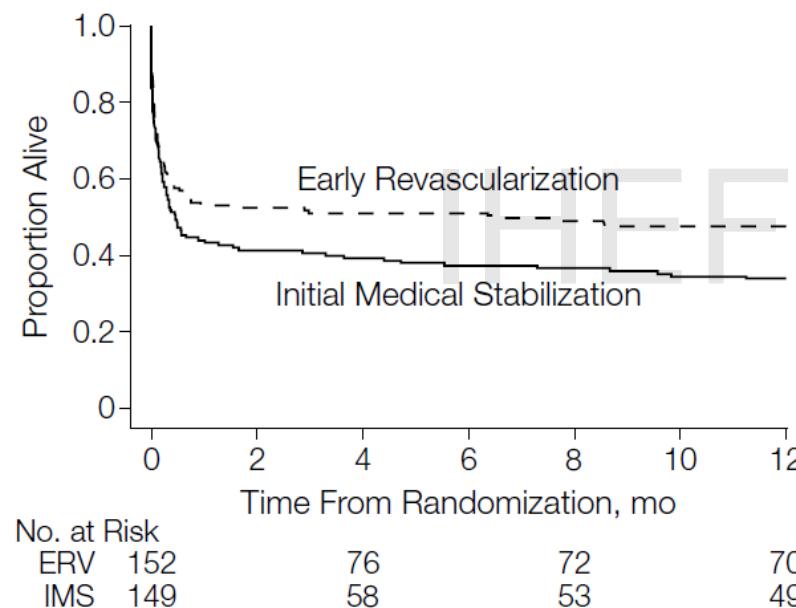
OUTCOME AND SUBGROUP	REVASCULARIZATION	MEDICAL THERAPY	DIFFERENCE BETWEEN GROUPS (95% CI)	RELATIVE RISK (95% CI)	P VALUE
	percent (number in subgroup)	percent			
30-day mortality					
Total	46.7 (152)	56.0 (150)	-9.3 (-20.5 to 1.9)	0.83 (0.67 to 1.04)	0.11
Age <75 yr	41.4 (128)	56.8 (118)	-15.4 (-27.8 to -3.0)	0.73 (0.56 to 0.95)	0.01†
Age ≥75 yr	75.0 (24)	53.1 (32)	+21.9 (-2.6 to 46.4)	1.41 (0.95 to 2.11)	
6-mo mortality‡					
Total	50.3 (151)	63.1 (149)	-12.8 (-23.2 to -0.9)	0.80 (0.65 to 0.98)	0.027
Age <75 yr	44.9 (127)	65.0 (117)	-20.1 (-31.6 to -7.1)	0.70 (0.56 to 0.89)	
Age ≥75 yr	79.2 (24)	56.3 (32)	+22.9 (0.7 to 46.6)	1.41 (0.97 to 2.03)	0.003†

Conclusion :

- No significant difference in 30 days mortality
- Significantly lower mortality at 6 and 12 months compared to Med therapy

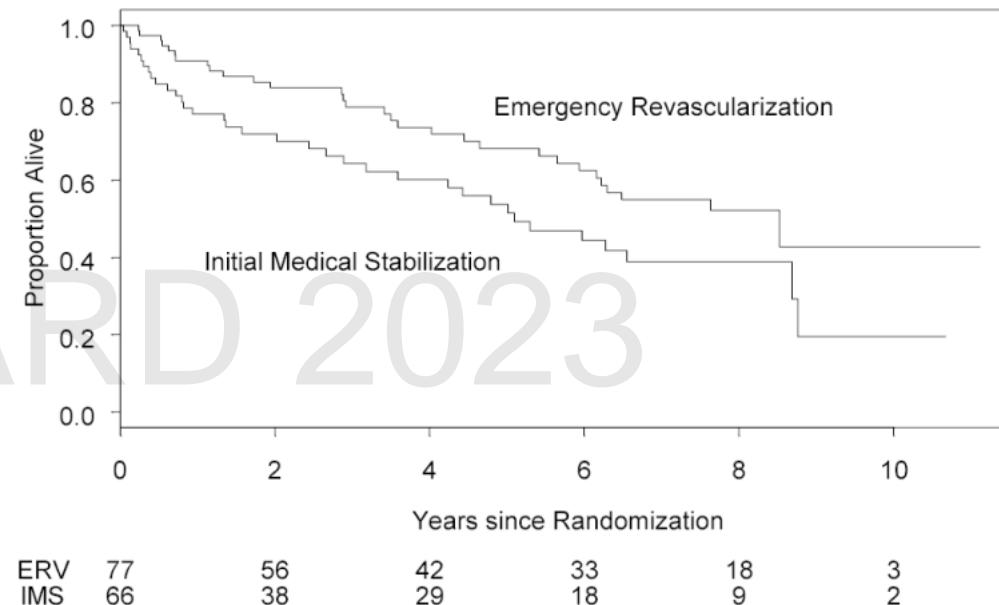
SHOCK TRIAL 1YR & LT(JAMA 2001,2006)

Figure. Kaplan-Meier Survival Curve 1-Year Postrandomization



Survival 1 yr :

- **47.6% vs 33.6%**
- **RR 0.72 ; CI 0.54-0.95**
- **13.2% absolute Δsurvival**



- **mean F/U 5.9 yr**
- **13.1% absolute Δsurvival at 3 yr**
- **13.2 % absolute Δsurvival at 6 yr**
- **Constant after 1 yr**
- **No difference w/ PCI or CABG**

CULPRIT SHOCK (NEJM 2017/2018)

- Multicenter RCT 706 pt AMI w/ shock
- Culprit lesion PCI VS immediate multivessel PCI
- End point : all cause mortality & Need RRT in 30 days

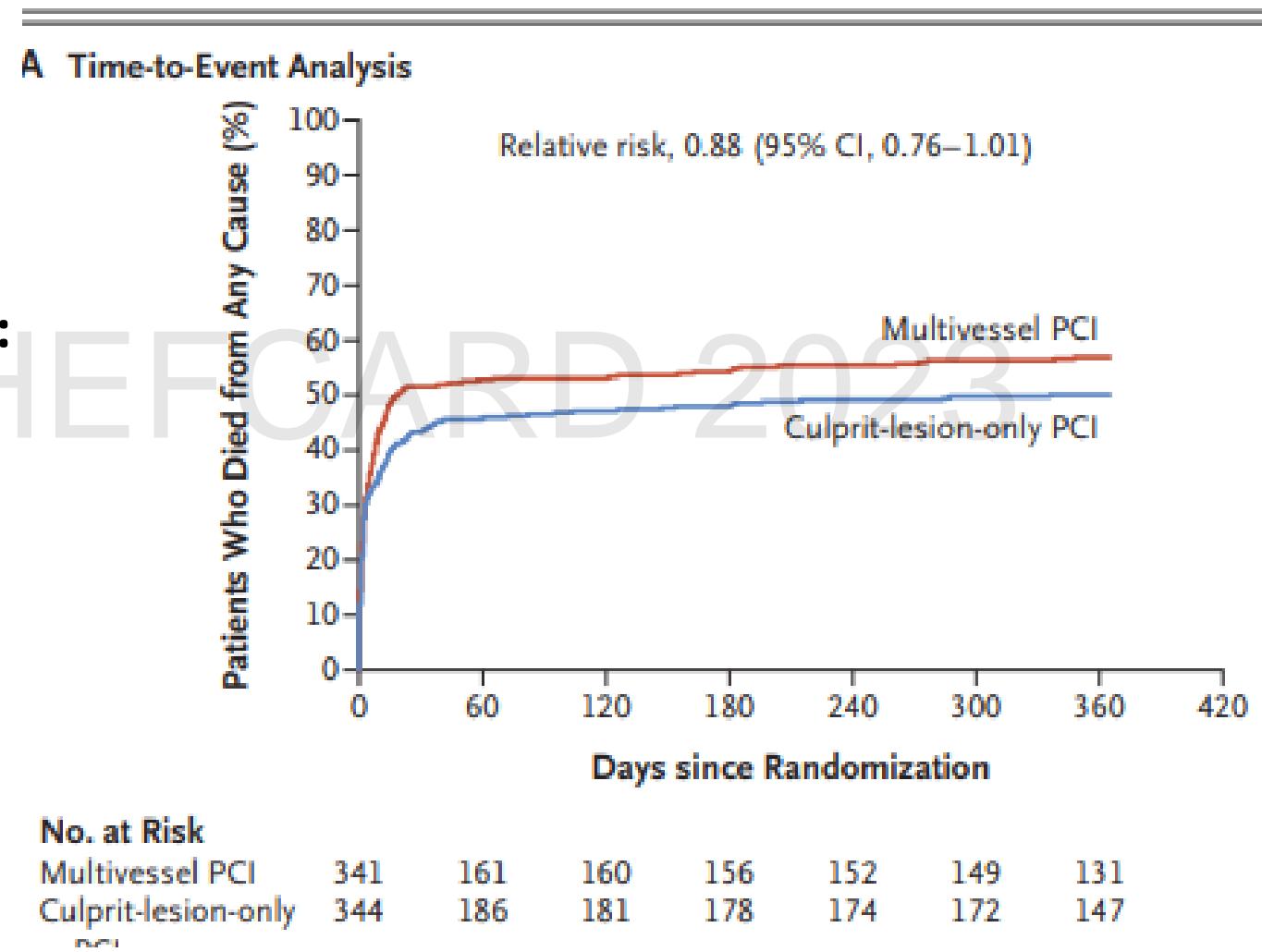
Table 1. Characteristics of the Patients at Baseline.*

Characteristic	Culprit-Lesion-Only PCI Group (N=34)	Multivessel PCI Group	Vessel related to the infarction — no./total no. (%)	
			Left anterior descending artery	Right coronary artery
Age — yr			132/343 (38.5)	156/342 (45.6)
Median	70			
Interquartile range	60–78			
Male sex — no./total no. (%)	257/343 (74.7)		76/343 (22.2)	70/342 (20.5)
Weight — kg			102/343 (29.7)	89/342 (26.0)
Median	80			
Interquartile range	70–90			
Height — cm			31/343 (9.0)	22/342 (6.4)
Median	174			
Interquartile range	168–188			
Body-mass index†			2/343 (0.6)	5/342 (1.5)
Median	26.6			
Interquartile range	24.2–29			
Cardiovascular risk factors — no./total no. (%)			77/344 (22.4)	82/342 (24.0)
Vessel related to the infarction — no./total no. (%)				
Left ventricular ejection fraction — %				
Median			33	30
			25–40	21–40
Interquartile range				

* PCI denotes percutaneous coronary intervention.

CULPRIT SHOCK (NEJM 2017/2018)

- **30 days Composite :**
RR 0.83 (P=0.001)
- **1 yr Mortality : RR**
0.88



GUIDELINES RECOMMENDATIONS

Canadian CS (2019)

RECOMMENDATION

23. In STEMI patients with CS and multivessel disease, we recommend against nonculprit lesion PCI during the initial primary PCI procedure (Strong Recommendation, Moderate-Quality Evidence).

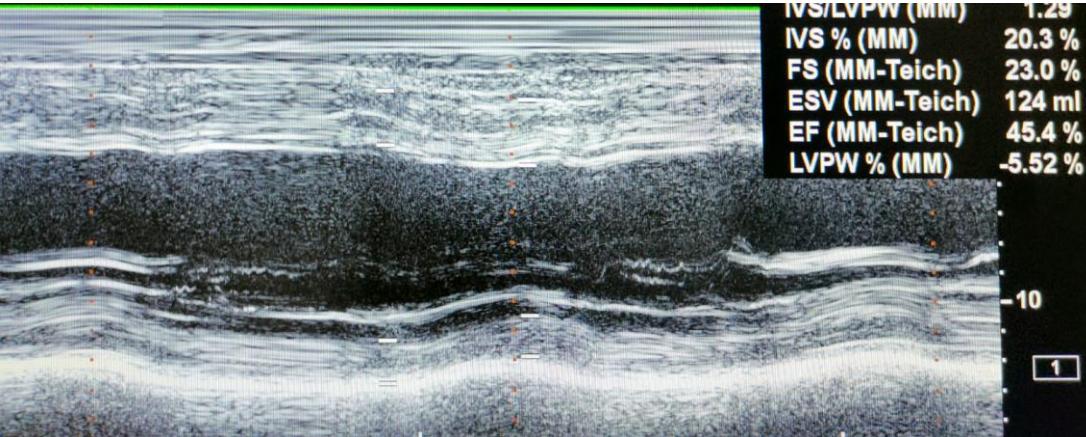
ESC (2020)

Emergency PCI of the culprit lesion is recommended for patients with CS due to NSTE-ACS, independent of the time delay from symptom onset, if the coronary anatomy is amenable to PCI.

AHA (2021)

1	B-R	<p>2. In patients with STEMI and cardiogenic shock or hemodynamic instability, PCI or CABG (when PCI is not feasible) is indicated to improve survival, irrespective of the time delay from MI onset.</p>
1	B-R	<p>2. In patients with NSTE-ACS and cardiogenic shock who are appropriate candidates for revascularization, emergency revascularization is recommended to reduce risk of death.</p>

CASE (Continue..)



Recent Th/ (3 yr FU) :

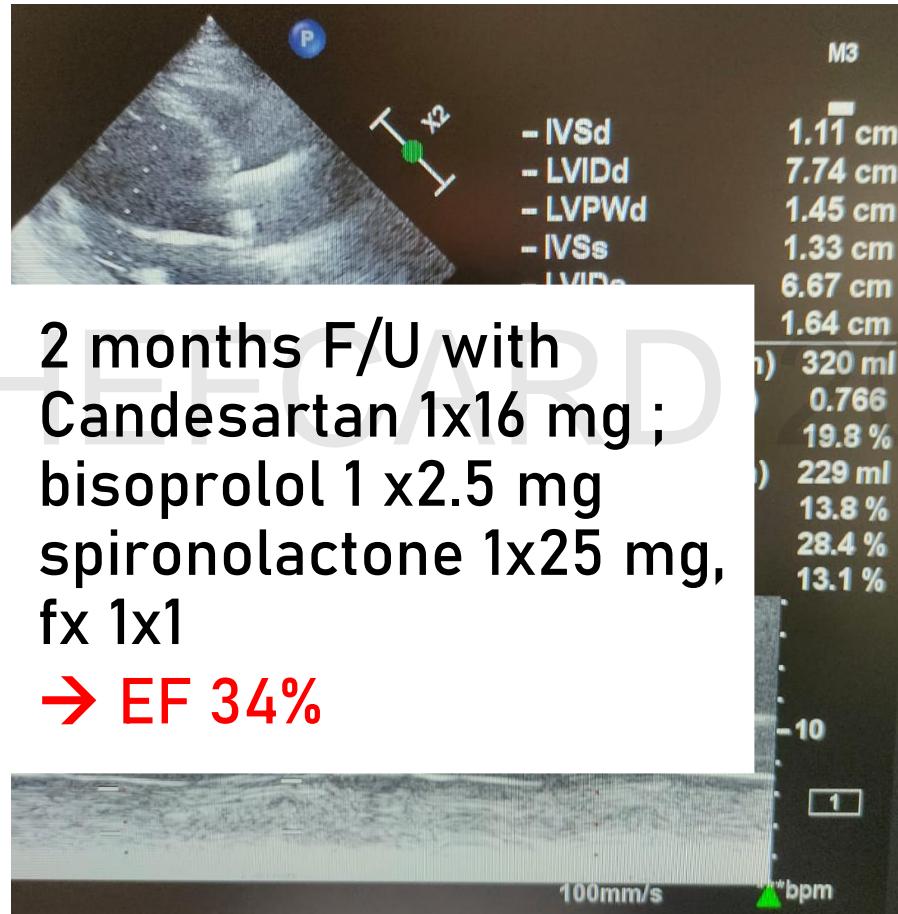
- Sac/val 2x100 mg
- bisoprolol 1x2.5 mg
- spironolactone 1x25mg
- Aspirin 1x80 mg
- empagliflozine 1x10 mg
- Atorvastatin 1x20 mg

HbA1C 5.7

Case illustration

- Patient male (76 years old), referred by urologist for cardiac evaluation before TURP op
- NYHA fc II-III, BP 130 mmhg, Cr 1.6, no DM
- ECG : SR, Q wave V1-v4

Echo & CAG



Revascularization (Stable CAD)

COURAGE (NEJM 2007)

- 2287 pts → stable CAD & objective evidence of ischemia
- PCI +OMT VS OMT
- Death & non fatal MI (med F/U 4.6yr)
- Exclusion : surgical anatomy & EF <30%

ISCHAEMIA (NEJM 2020)

- 5179 pts → stable CAD & objective evidence of ischemia
- Initial invasive+OMT (74% PCI & 26% CABG) VS OMT
- MACE(med F/U 4.6yr)
- Exclusion : LM >50% & EF <30%

Revascularization (Stable CAD)

COURAGE [NEJM 2007]:

Table 1. Baseline Clinical and Angiographic Characteristics.^a

Characteristic	PCI Group (N=1149)	Medical-Therapy Group (N=1138)	P Value
Demographic			
Age — yr	61.5±10.1	61.8±9.7	0.54
Sex — no. (%)			0.95
Male	979 (85)	968 (85)	
Female	169 (15)	169 (15)	

Table 2. Clinical Status, Risk and Lifestyle Factors, and Use of Medication.^a

Variable	PCI Group (N=1149)			Medical-Therapy Group (N=1138)				
	Baseline	1 Yr	3 Yr	5 Yr	Baseline	1 Yr	3 Yr	5 Yr
<i>Medication</i>								
No. evaluated	1147	1044	837	428	1138	1028	838	417
ACE inhibitor — no. (%)	669 (58)	668 (64)	536 (64)	284 (66)	680 (60)	633 (62)	522 (62)	260 (62)
ARB — no. (%)	48 (4)	93 (9)	104 (12)	49 (11)	54 (5)	99 (10)	108 (13)	67 (16)
Statin — no. (%)	992 (86)	972 (93)	780 (93)	398 (93)	1014 (89)	972 (95)	769 (92)	386 (93)
Other antilipid — no. (%)	89 (8)	236 (23)	324 (39)	211 (49)	94 (8)	253 (25)	321 (38)	224 (54)
Aspirin — no. (%)	1097 (96)	995 (95)	792 (95)	408 (95)	1077 (95)	977 (95)	796 (95)	391 (94)
Beta-blocker — no. (%)	975 (85)	887 (85)	705 (84)	363 (85)	1008 (89)	916 (89)	724 (86)	357 (86)
Calcium-channel blocker — no. (%) ^b	459 (40)	415 (40)	360 (43)	180 (42)	488 (43)	501 (49)	418 (50)	217 (52)
Nitrates — no. (%) ^c	714 (62)	553 (53)	396 (47)	173 (40)	825 (72)	690 (67)	511 (61)	237 (57)

Table 1. (Continued.)

Characteristic	PCI Group (N=1149)	Medical-Therapy Group (N=1138)	P Value
Angiographic			
Vessels with disease — no. (%)			0.72
1	361 (31)	343 (30)	
2	446 (39)	439 (39)	
3	341 (30)	355 (31)	
Disease in graft ^d	77 (62)	85 (69)	0.36
Proximal LAD disease	360 (31)	417 (37)	0.01
Ejection fraction	60.8±11.2	60.9±10.3	0.86

Boden et al. N Engl J Med 2007;356(15):1503-16.

ISCHEMIA [NEJM 2020]:

Table 1. Baseline Characteristics of the Patients.^a

Characteristic	Invasive Strategy (N=2588)	Conservative Strategy (N=2591)
Median age (IQR) — yr	64 (58–70)	64 (58–70)
Male sex — no. (%)	1982 (76.6)	2029 (78.3)
Diabetes — no. (%)	1071 (41.4)	1093 (42.2)
Previous myocardial infarction — no./total no. (%)	495/2580 (19.2)	496/2582 (19.2)
Previous PCI — no./total no. (%)	551/2586 (21.3)	499/2589 (19.3)
Median ejection fraction (IQR) — %	60 (55–65)	60 (55–65)

Variables	Baseline Total (N=5179)	Last Visit Total (N=5179)	Baseline		Last Visit	
			INV (N=2588)	CON (N=2591)	INV (N=2588)	CON (N=2591)
Antiplatelet or anticoagulant	100% (4978/4978)	100% (4845/4845)	100% (2499/2499)	100% (2479/2479)	100% (2409/2409)	100% (2436/2436)
Statins	94.8% (4904/5179)	95.2% (4755/4997)	94.4% (2441/2586)	95.2% (2473/2589)	95.0% (2361/2484)	95.3% (2394/2513)
High-intensity statin	40.9% (1911/4670)	66.0% (1223/4881)	40.1% (933/3282)	41.8% (978/3242)	66.3% (1602/2421)	65.8% (1619/2460)
Ezetimibe	4.1% (212/5175)	24.4% (1222/4998)	4.1% (105/2586)	4.1% (107/2589)	24.2% (602/2484)	24.7% (620/2514)
Ace inhibitor / ARB	66.0% (3416/5175)	69.4% (3469/4996)	65.2% (1685/2586)	66.9% (1731/2589)	69.2% (1718/2483)	69.7% (1751/2513)
Adherent to Medications ^e	73.9% (3672/4967)	81.5% (3991/4896)	73.7% (1823/2473)	74.1% (1849/2494)	82.7% (2012/2434)	80.4% (1979/2462)

Coronary anatomy by CCTA

Vessels ≥ 50% stenosis by CCTA^f

0	0.1% (4/2986)	0.1% (2/1490)	0.1% (2/1496)
1	23.3% (697/2986)	24.2% (360/1490)	22.5% (337/1496)
2	31.4% (938/2986)	29.1% (434/1490)	33.7% (504/1496)
3	45.1% (1347/2986)	46.6% (694/1490)	43.6% (653/1496)

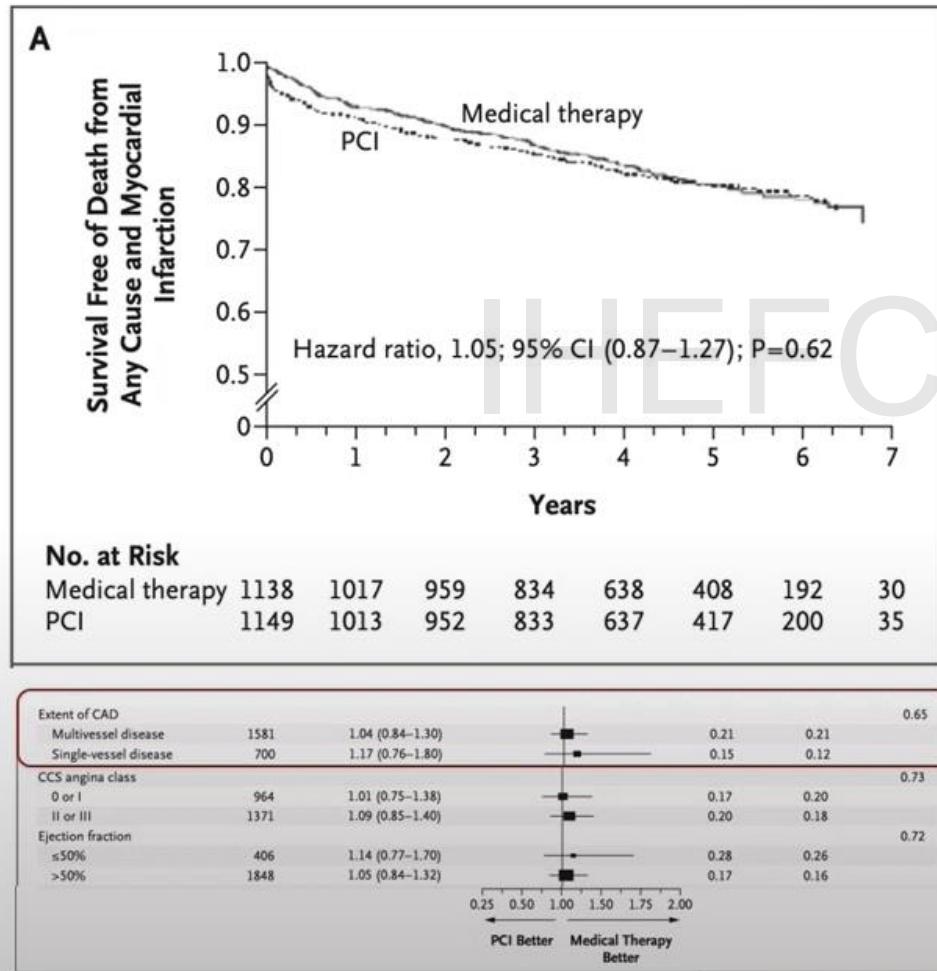
Specific native vessels with ≥ 50% stenosis by CCTA^{g,h}

Left main	1.0% (40/3845)	1.1% (21/1926)	1.0% (19/1919)
Left anterior descending	86.8% (3190/3677)	86.6% (1591/1837)	86.9% (1599/1840)
Proximal left anterior descending	46.8% (1749/3739)	46.3% (865/1870)	47.3% (884/1869)
Left circumflex	67.4% (2354/3496)	67.4% (1184/1748)	67.0% (1170/1748)
Right coronary artery	68.8% (2311/3359)	70.0% (1178/1684)	67.6% (1133/1675)

Maron et al. N Engl J Med 2020;382(15):1395-407.

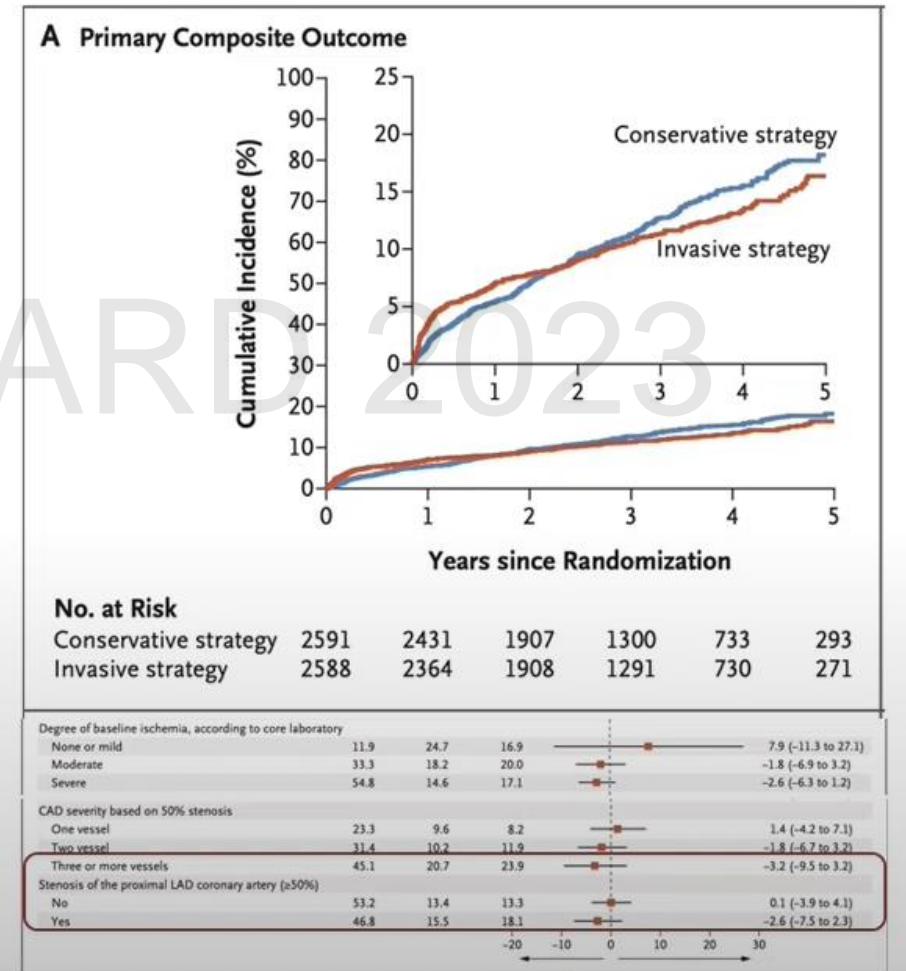
Revascularization (Stable CAD)

COURAGE [NEJM 2007]:



Boden et al. N Engl J Med 2007;356(15):1503-16.
407

ISCHEMIA [NEJM 2020]:



Maron et al. N Engl J Med 2020;382(15):1395-

Revascularization (ICM)

1

STICH (NEJM 2011)

2

STICHES (NEJM 2016)

3

REVIVED BCIS 2 (NEJM 2022)

STICH (NEJM 2011)

- **InClusion criteria : CAD amenable to CABG w/
LVEF < 35%**
- Medical therapy alone (17% crossover CABG)
- Medical therapy + CABG
- Primary aoutcome : **all cause mortality**
- Follow –up : Median F/U 56 mths

STICH (NEJM 2011)

- + 60 yr M>F
- 35-40% CCS 0
- 50% CCS2 & >80% NYHA II-III
- LVEF 28%

Table 1. Baseline Characteristics of the Patients.*

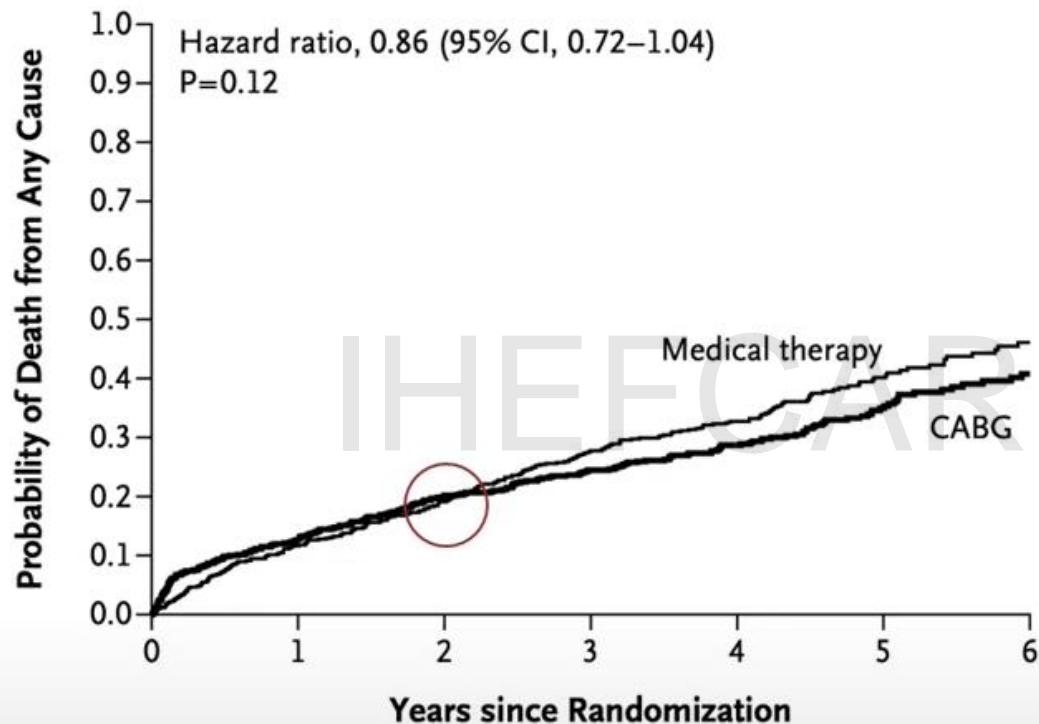
Variable	Medical Therapy (N = 602)	CABG (N = 610)
Age — yr		
Median	59	60
Interquartile range	53–67	54–68
Female sex — no. (%)	75 (12)	73 (12)
Race or ethnic group — no. (%)†		
White	402 (67)	389 (64)
Hispanic, Latino, or nonwhite	200 (33)	221 (36)
Body-mass index‡		
Median	27	27
Interquartile range	24–30	24–30
Medical history — no. (%)		
Previous myocardial infarction	472 (78)	462 (76)
Hyperlipidemia	370 (61)	360 (59)
Hypertension	370 (61)	358 (59)
Diabetes	238 (40)	240 (39)
Previous percutaneous coronary intervention	74 (12)	82 (13)
Chronic renal insufficiency	45 (7)	49 (8)
Previous stroke	41 (7)	51 (8)
Previous CABG	14 (2)	22 (4)
Current smoker	122 (20)	130 (21)
Current CCS angina class§		
0	225 (37)	217 (36)
I	91 (15)	96 (16)
II	260 (43)	265 (43)
III	23 (4)	25 (4)
IV	3 (<1)	7 (1)
Current NYHA class		
I	74 (12)	65 (11)
II	307 (51)	319 (52)
III	205 (34)	207 (34)
IV	16 (3)	19 (3)

STICH (NEJM 2011)

Coronary Anatomy		Rx # (%)		CABG # (%)			
# Vessels with > 50% stenosis		BL	1 Year	Last F/U	BL	1 Yr	Last F/U
1					57 (9)		55 (9)
2					190 (32)		176 (29)
3					355 (59)		378 (62)
LM CAD					14 (2)		18 (3)
Rx	Medical Therapy			CABG			
	BL	1 Year	Last F/U	BL	1 Yr	Last F/U	
BB	88%	92%	90%	83%	90%	90%	
ACEi/ARB	88%	91%	89%	91%	92%	89%	
MRA	46 %	53%	53%	46%	51%	54%	
ASA	85%	88%	84%	80%	88%	84%	
Statin	83%	90%	87%	79%	91%	90%	

- PARADIGM HF 2014
- DAPA-HF (2019) &
- Emperor Reduced (2021)

STICH (NEJM 2011)

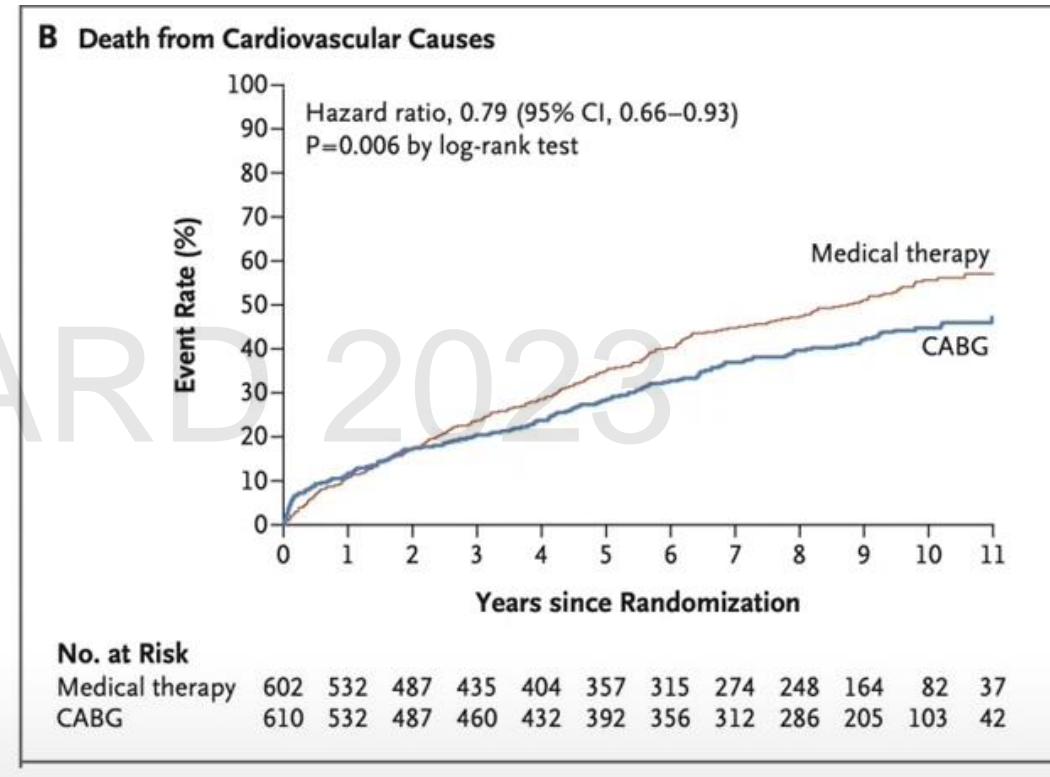
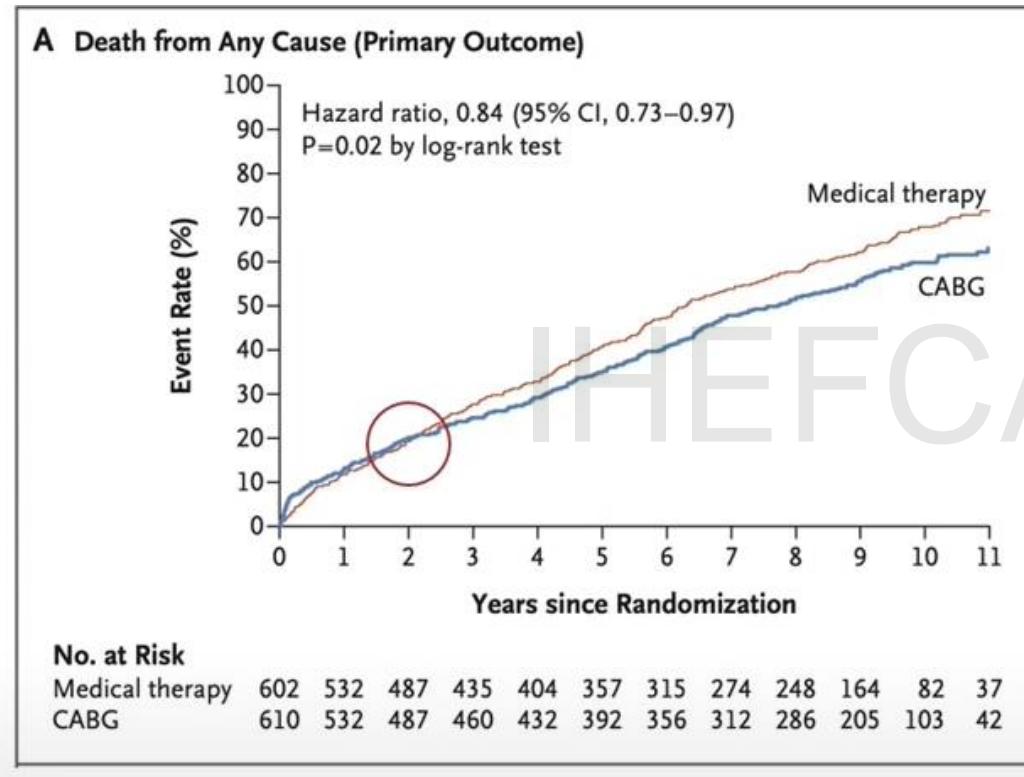


No. at Risk							
Medical therapy	602	532	487	435	312	154	80
CABG	610	532	486	459	340	174	91

Figure 1. Kaplan-Meier Curves for the Probability of Death from Any Cause.
CABG denotes coronary-artery bypass grafting.

- Median F/U 56 Mths :
- RR 0.86 (0.72-1.04), P 0.12

STICHES (NEJM 2016)



- Median Survival :
- 7.73 yrs in CABG (1.4 yr longer) Vs 6.29 yrs in medical therapy
- NNT 14

STICH/ES (NEJM 2011/2016)-Conclusions

- Overall mortality 62.5% of Pts at 10 yrs
- No mortality benefit at 5 yrs post revascularization
- Signal for mortality benefit w/ surgical revascularization at 10 yrs
- Upfront mortality risk (3x) w/ CABG until 2 yrs
- Signal for reduction of CV hospitalization
- Medical therapy has advanced since the original trial & only 50% were on MRA

REVIVED BCIS 2 (NEJM 2022)

- Multicenter open label RCT of 700 pts
- PCI + optimal medical therapy (96.3% underwent PCI → 71% complete revascularization)
- OMT alone
- Inclusion : LVEF <35% w/extensive CAD ; demonstrated viability in >4 dysfunctional myocardial segments amenable for PCI
- Primary outcome : all cause mortality & HF hospitalization (median F/U 41 mths (3.4 yr))
- Secondary outcome : LVEF & KCCQ QOL score

IHEFCARD 2023

REVIVED BCIS 2 (NEJM 2022)

Characteristic	PCI (N=347)	Optimal Medical Therapy (N=353)
NYHA functional class — no./total no. (%)§		
Age — yr	I or II	265/345 (77) 248/350 (71)
Male sex — no. (%)	III or IV	80/345 (23) 102/350 (29)
CCS angina class — no./total no. (%)¶		
Race — no. (%)†	No angina	228/346 (66) 236/351 (67)
White	I or II	111/346 (32) 107/351 (30)
Asian	III	7/346 (2) 8/351 (2)
Black	Left ventricular ejection fraction — %	
Mixed, other, or not reported	27.0±6.6	
Body-mass index‡	27.0±6.9	
Hypertension — no./total no. (%)	Coronary artery disease characteristic	
Diabetes — no. (%)	Median BCIS jeopardy score (IQR)**	10 (8–12) 10 (8–12)
Current or previous smoker — no. (%)	Left main coronary artery disease — no./total no. (%)	50/346 (14) 45/352 (13)
Previous myocardial infarction — no. (%)	Three-vessel coronary artery disease — no./total no. (%)	133/346 (38) 148/352 (42)
Previous PCI — no. (%)	Two-vessel coronary artery disease — no. (%)	178 (51) 166 (47)
Previous CABG — no. (%)		

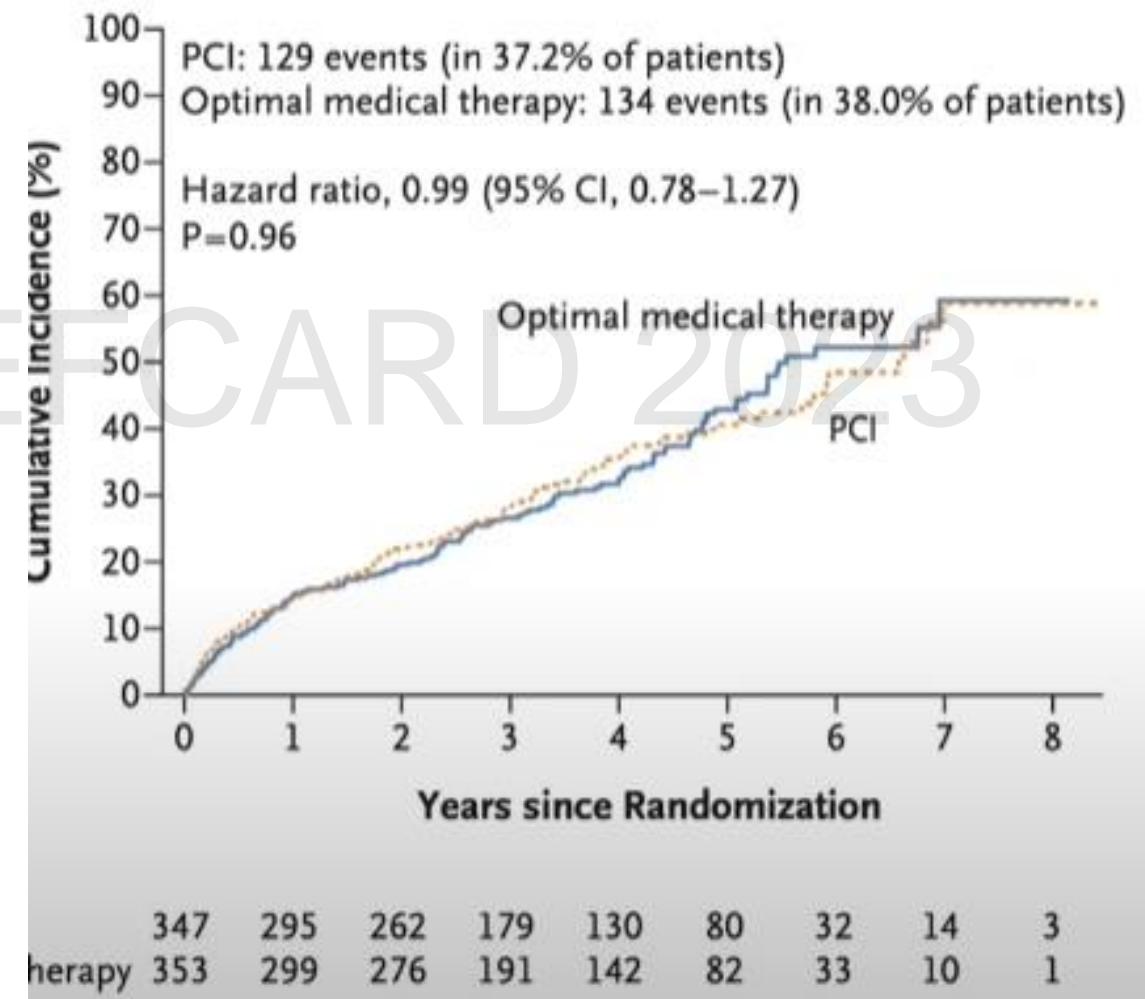
REVIVED BCIS 2 (NEJM 2022)

McGILL UNIVERSITY MONTREAL

Rx	PCI		OMT	
	BL	2 yrs	BL	2 yrs
ACE	69%	50%	67%	44%
ARB	16%	20%	17%	18%
ARNI	16%	32%	26%	37%
BB	91%	92%	90%	94%
MRA	51%	54%	48%	57%
SAPT	49%	67%	51%	64%
Statin	85%	88%	86%	85%

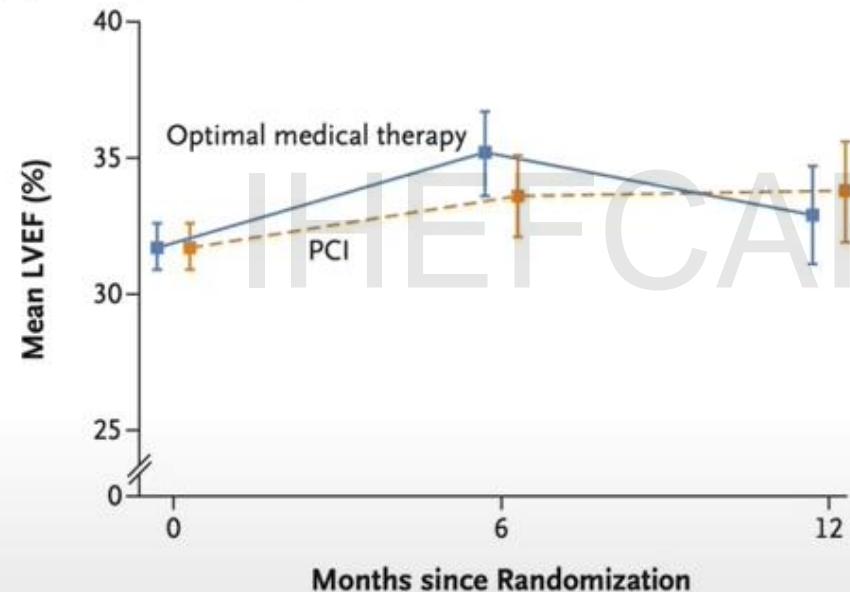
REVIVED BCIS 2 (NEJM 2022)

- F/U 41 mths:
HR 0.99 (0.78-1.27)
P=0.96



REVIVED BCIS 2 (NEJM 2022)

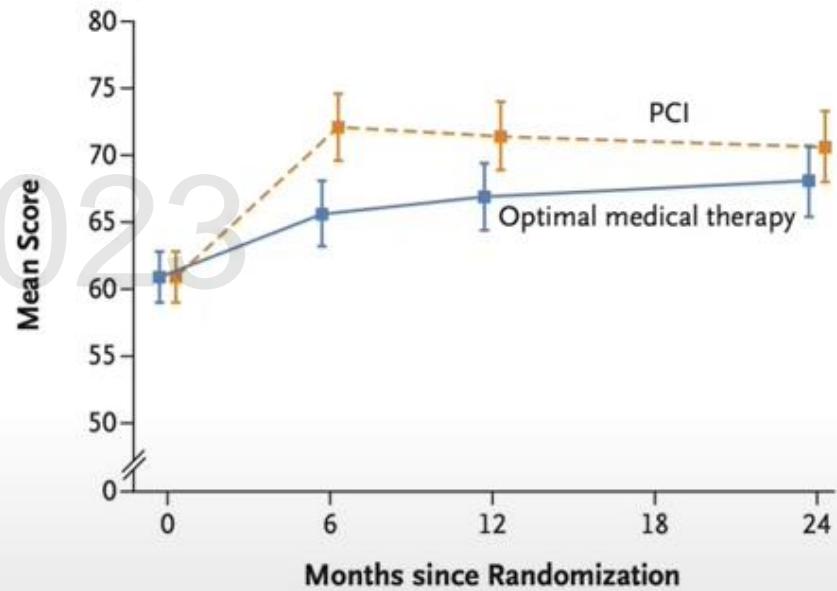
A Echocardiographic Estimates of LVEF



No. of Patients

PCI	264	276	262
Optimal medical therapy	276	264	267

B KCCQ Overall Summary Score



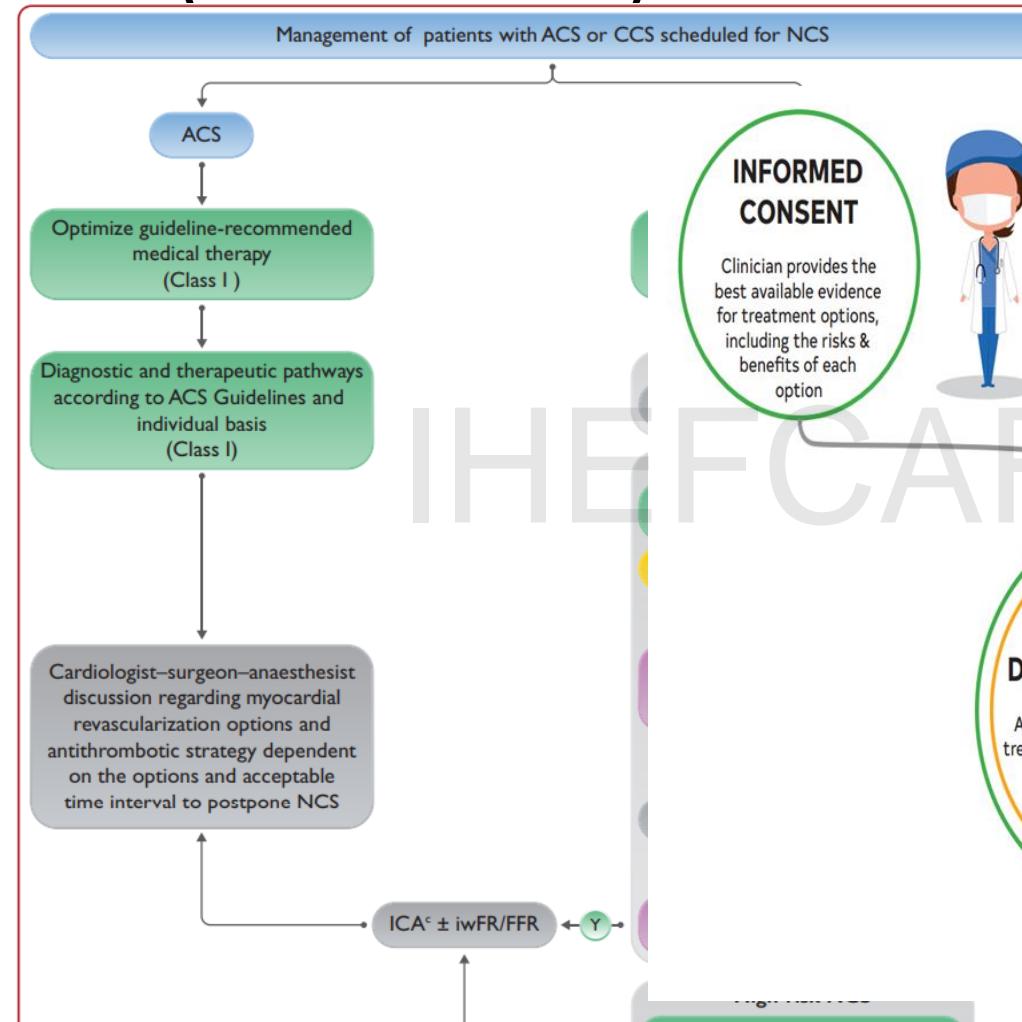
No. of Patients

PCI	319	270	268	228
Optimal medical therapy	318	285	268	228

REVIVED BCIS 2 (NEJM 2022)-Conclusions

- There is no mortality benefit of PCI Vs Medical therapy in ICM and severe LVD in 41 Mths
- There is no significant improvement in LV function w/ PCI VS OMT at 12 mths in ICM and severe LVD
- There is no significant improvement in QOL with PCI Vs medical therapy in ICM & LVD

Case (continue)



Recommendation Table 20 — Recommendations for management of heart failure in patients undergoing

	Class ^a	Level ^b
HF scheduled to evaluate and levels, unless 113,422,423	I	B
HF medical	I	A
it is volume status	I	C
D specialists management clinical	I	C

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^aClass of recommendation.
^bLevel of evidence.

CASE (Continue..)

- Try to use optimal GDMT : Arni 2x200 mg ; bisoprolol 1x5 mg; MRA 1x25 mg : empagliflozin 1x10 mg → EF 39%, NYHA fc I-II

3 mths

Pre/peri-post-OP

- Deep discussion w/ surgeon and anesthesiologist
- Carefully assess functional class and congestion pre-op (biomarker before and after)
- Unventfull operation and could discharge after 3 days

- Admitted again due to lack of medical compliance

Recent

Take Home message

- Ischaemic LV dysfunction + cardiogenic shock → Urgent revascularization (w/ PCI only the culprit vessel)
- Signal mortality benefit of CABG at 10 years
- Revascularization (PCI/CABG) should not be undertaken to treat and improve left ventricular dysfunction
- 4 pillar of GDMT got potential outperformed recent advancement in revascularization methods
- Revascularization need multidiscipline approach with patient oriented care

Thank you
IHEF CARD 2023

PCI *versus* CABG

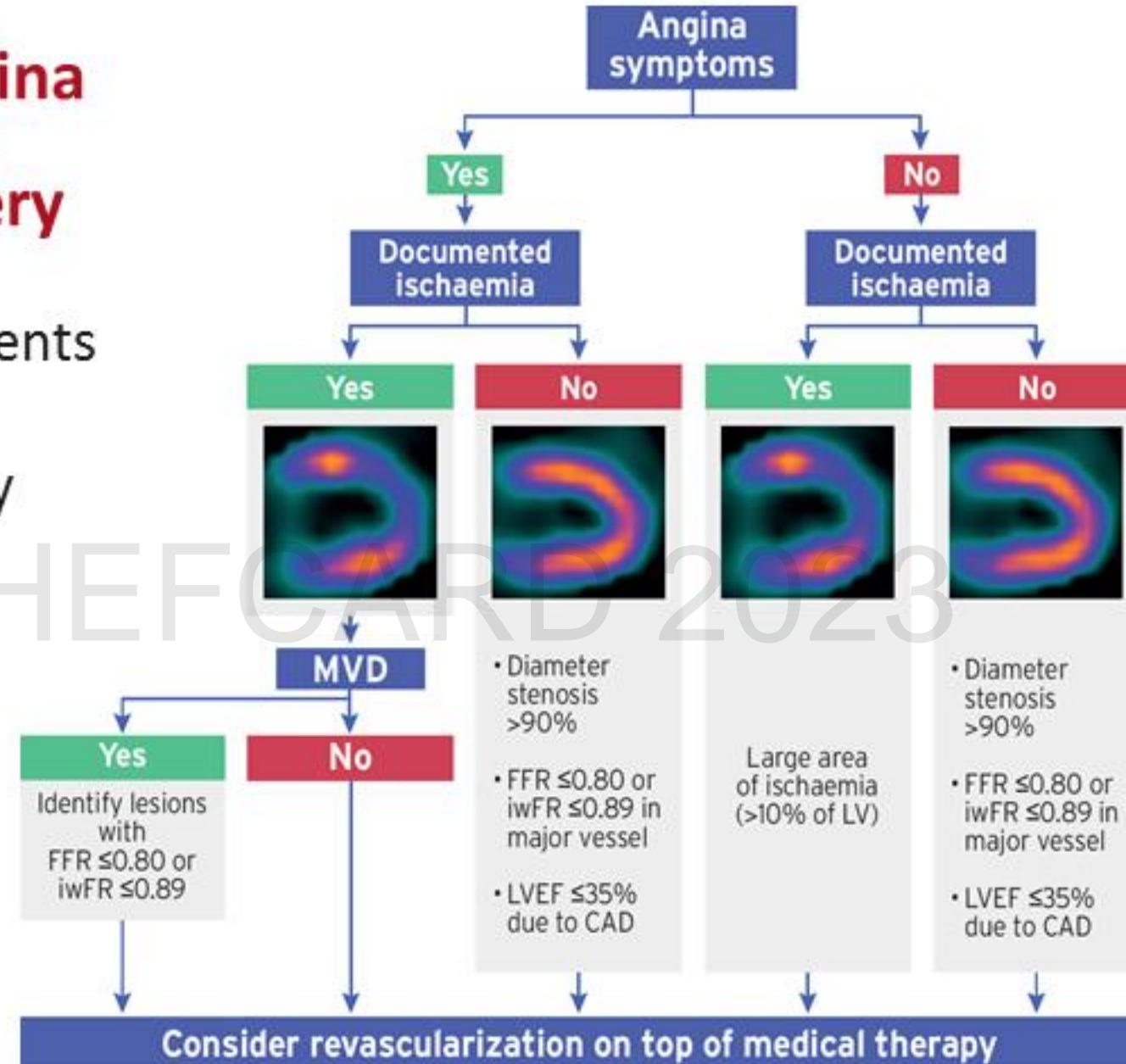
- The choice of PCI or CABG in IHF patients is uncertain due to the fact that most studies comparing PCI and CABG in patients with CAD have excluded patients who have significant ventricular dysfunction



Patients with angina and/or dyspnoea and coronary artery disease

Decision tree for patients undergoing invasive coronary angiography

CAD = coronary artery disease;
FFR = fractional flow reserve;
iwFR = instantaneous wave-free ratio;
LV = left ventricle;
LVEF = left ventricular ejection fraction;
MVD = multivessel disease.



Patients with angina and/or dyspnoea and suspected coronary artery disease

Definitions of high event risk for different tests

Exercise ECG

Cardiovascular mortality >3% per year according to Duke Treadmill Score.

SPECT or PET perfusion imaging

Area of ischaemia ≥10% of the left ventricle myocardium.

Stress echocardiography

≥3 of 16 segments with stress-induced hypokinesia or akinesia.

CMR

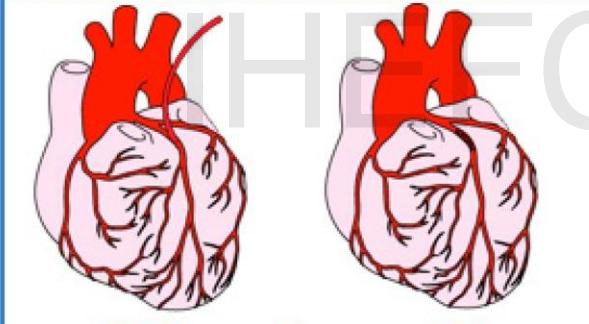
≥2 of 16 segments with stress perfusion defects or ≥3 dobutamine-induced dysfunctional segments.

Coronary CTA or ICA

Three-vessel disease with proximal stenoses, LM disease, or proximal anterior descending disease.

Invasive functional testing

FFR ≤0.8, iwFR ≤0.89.

Scenario	Evidence	Striking a balance between...
<p>→ Impaired LV function → Ischemic heart disease → Substantial viable myocardium</p>  <p>CABG X PCI</p> <p>↓</p> <p>→ Improvement of LVEF → Improvement of symptoms → Better long-term survival</p>	<p>HEART APPROACH CREDO-Kyoto STICH STICHES NNECDSG KorAHF</p>	<p>High periprocedural risk Late mortality benefit</p> 