# Optimizing Follow-up Strategies Post-Complex PCI:
Answers from the POST-PCI Trial

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8TH
COMPLEX PCI 2023
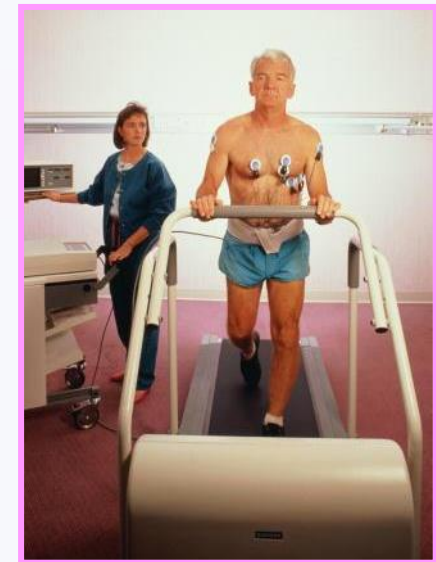MAKE IT SIMPLE! TECHNICAL FORUM A TO Z

CVRF

Disclosure

- Institutional grant/research funding to CardioVascular Research Foundation (CVRF, Korea) and/or Asan Medical Center from Abbott, Boston Scientific, Medtronics, Daiichi-Sankyo, Edwards Lifescience, HK InnoN, Daewoong Pharm, and ChongKunDang Pharm.
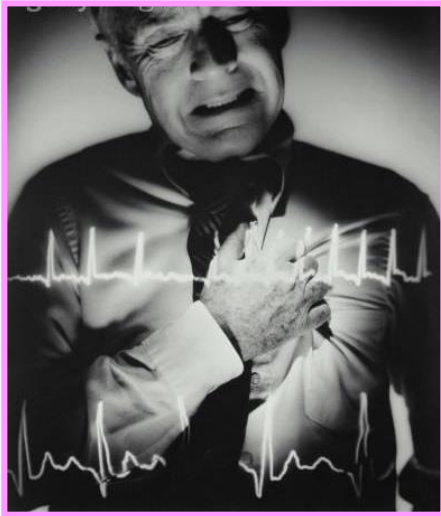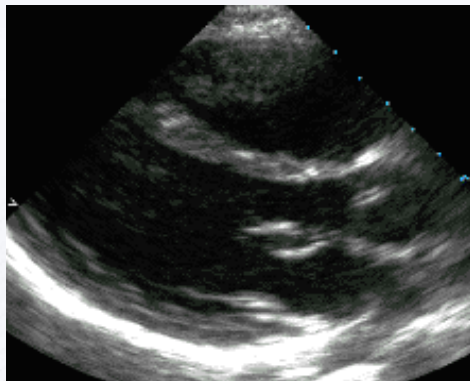
Clinical
Symptom

EKG

Treadmil Test
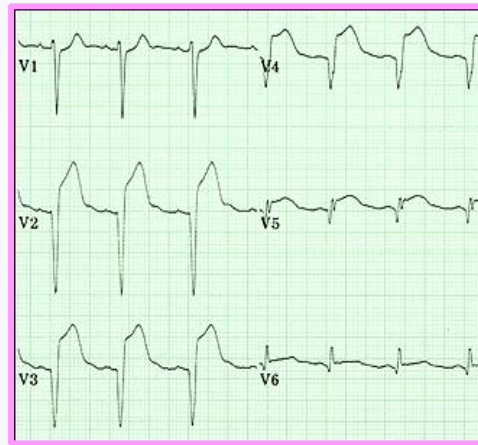
Stress Echo

Nuclear Imaging Test

**Non-Invasive
Post-PCI FU
Surveillance
in the Routine Practice**
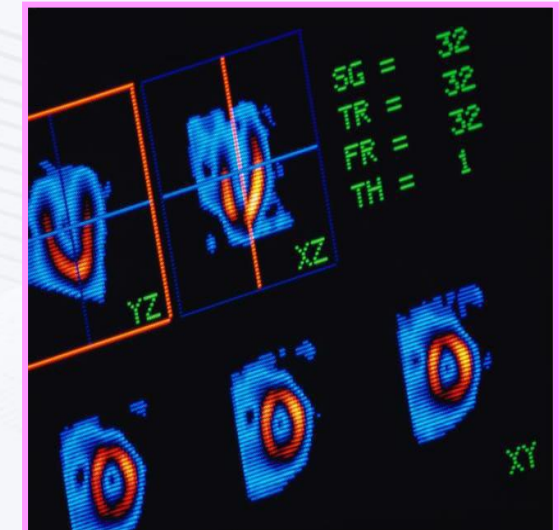
Follow-up Strategies after PCI
2018 ESC Guideline for Myocardial Revascularization
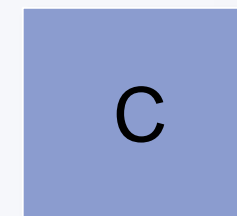
	COR	LOE
➤ Surveillance by non-invasive imaging-based stress testing <u>may be considered</u> in high-risk patient subsets 6 months after revascularization	IIb	C
➤ Routine non-invasive imaging-based stress testing <u>may be considered</u> 1 year after PCI	IIb	C
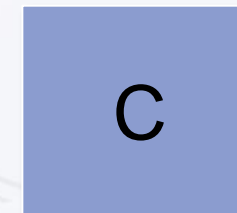
Non-Invasive
Post-PCI FU Surveillance
in the Routine Practice,
The United Status
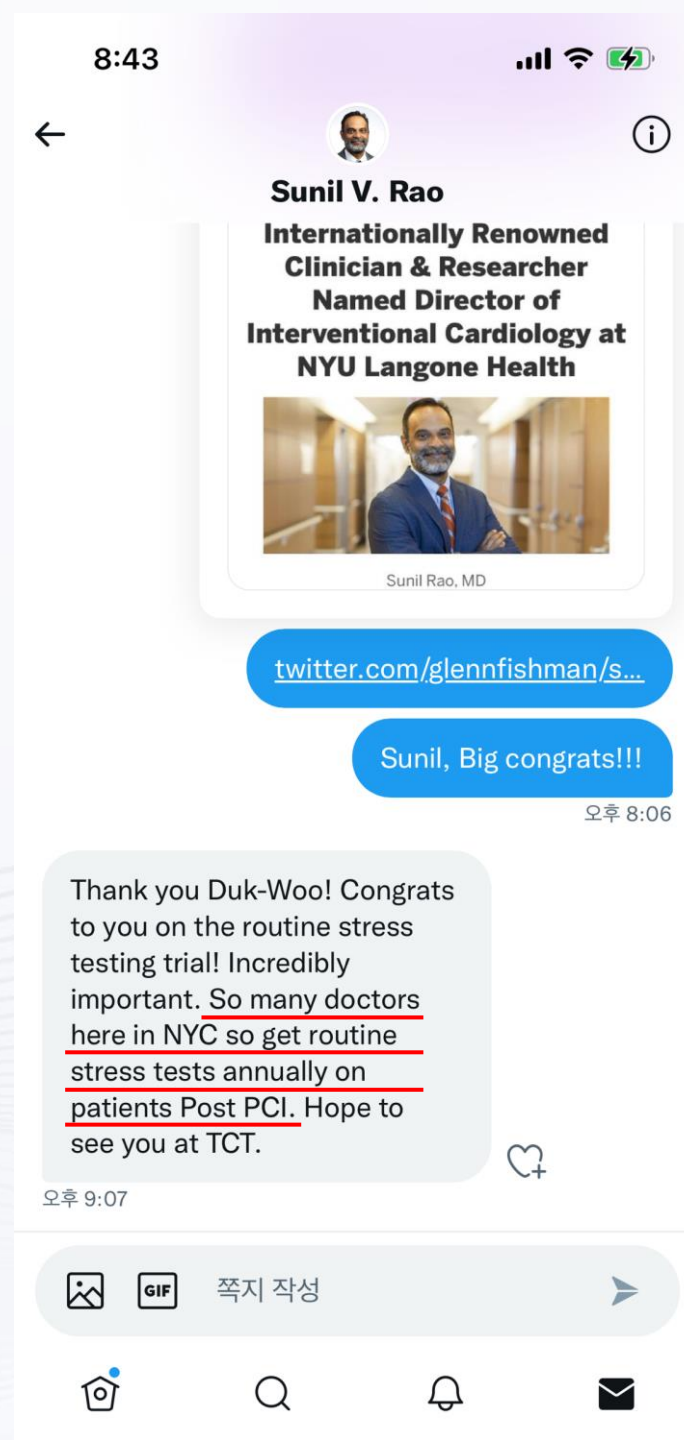
ORIGINAL ARTICLE

Routine Functional Testing or Standard Care in High-Risk Patients after PCI

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Sung-Cheol Yun, Ph.D., Yong-Hoon Yoon, M.D., Seung-Ho Hur, M.D.,
Cheol Hyun Lee, M.D., Won-Jang Kim, M.D., Se Hun Kang, M.D.,
Chul Soo Park, M.D., Bong-Ki Lee, M.D., Jung-Won Suh, M.D.,
Jung Han Yoon, M.D., Jae Woong Choi, M.D., Kee-Sik Kim, M.D.,
Si Wan Choi, M.D., Su Nam Lee, M.D., and Seung-Jung Park, M.D., for the
POST-PCI Investigators*

Inclusion and Exclusion Criteria

INCLUSION

1. Patients >19 years of age who underwent successful PCI with contemporary drug-eluting stents, bioresorbable scaffolds, or drug-coated balloons.

2. Have at least one of the following **high-risk anatomical or clinical characteristics** associated with an increased risk of ischemic or thrombotic events during follow-up [1-3] :
   - **Anatomical characteristics:** left main lesion, bifurcation lesion, ostial lesion, chronic total occlusion lesion, multivessel disease (≥ 2 vessels stented), restenotic lesion, diffuse long lesion (lesion length ≥30 mm or stent length ≥32 mm), or bypass graft disease.
   - **Clinical characteristics:** medically-treated diabetes, chronic renal failure (serum creatinine level ≥ 2.0mg/dL or long-term hemodialysis), and enzyme-positive ACS.

EXCLUSION

1. Cardiogenic shock at the index admission.
2. Patients treated only with bare-metal stents or balloon angioplasty only.
3. Pregnant and/or lactating women.
4. Concurrent medical condition with a life expectancy < 1 year.
5. Patients who were actively participating in another drug or device investigational study and had not completed the primary endpoint follow-up period.
6. Patients who were unable to provide written informed consent or participate in long-term follow-up.

Endpoints

Primary endpoint

- Composite of major cardiovascular events (death from any cause, MI, or hospitalization for unstable angina) at 2 years after randomization

Secondary endpoints

- Individual components of the primary composite outcome
- Composite of death or MI
- Hospitalization for any reason (for either cardiac causes or noncardiac causes)
- Invasive coronary angiography
- Repeat revascularization procedures (target-lesion or nontarget-lesion revascularization)

MI, myocardial infarction; PCI, percutaneous coronary intervention

Patient Flow and Follow-Up

Enrolled (2153)

Randomized (1706)

Routine Functional Testing (849)

12 Died at <12 mo
 4 Withdrew consent at <12 mo
11 Were lost to follow-up at <12 mo
40 Had clinically driven angiography or
    revascularization at <12 mo

723 (92.5%) of eligible patients underwent functional testing at 12 mo according to assigned strategy

832 (98.0%) Completed 24-mo follow-up
4 (0.5%) Withdrew
13 (1.5%) Were lost to follow-up

Standard Care (857)

18 Died at <12 mo
 3 Withdrew consent at <12 mo
12 Were lost to follow-up at <12 mo
55 Had clinically driven angiography or
    revascularization at <12 mo

69 (9.0%) of eligible patients underwent functional testing at 12 mo because of clinical indication

839 (97.9%) Completed 24-mo follow-up
 3 (0.4%) Withdrew
15 (1.8%) Were lost to follow-up

Key Baseline Characteristics

	Functional Testing (N = 849)	Standard Care (N = 857)
Age [yrs], mean (SD)	64.6 (10.3)	64.8 (10.3)
Male sex	666 (78.4)	690 (80.5)
Body-mass index	24.8 (3.0)	25.0 (3.2)
Criteria for high risk after PCI, n (%)		
High-risk anatomical characteristics		
Left main disease	181 (21.3)	178 (20.8)
Bifurcation disease	373 (43.9)	369 (43.1)
Ostial lesion	128 (15.1)	127 (14.8)
Chronic total occlusion	152 (17.9)	190 (22.2)
Multivessel disease (≥2 vessels stented)	376 (44.3)	389 (45.4)
Restenotic lesion	91 (10.7)	103 (12.0)
Diffuse long lesion	585 (68.9)	611 (71.3)
Bypass graft disease	4 (0.5)	7 (0.8)
High-risk clinical characteristics		
Diabetes mellitus	321 (37.8)	339 (39.6)
Chronic renal failure	42 (4.9)	45 (5.3)
Enzyme-positive ACS	161 (19.0)	170 (19.8)
Clinical indication for index PCI, n (%)		
Stable angina or silent ischemia	598 (70.4)	582 (67.9)
Unstable angina	90 (10.6)	105 (12.3)
Non-STEMI	105 (12.4)	98 (11.4)
STEMI	56 (6.6)	72 (8.4)
Left ventricular ejection fraction [%], mean (SD)	58.8 (9.1)	58.3 (10.1)

Primary Outcome: Death, MI, Hospitalization for UA

Hazard ratio = 0.90 (95% CI, 0.61–1.35)
P-value= 0.62

Standard-Care

6.0%

Routine Functional-Testing

5.5%

Patients (%)

Months since Randomization
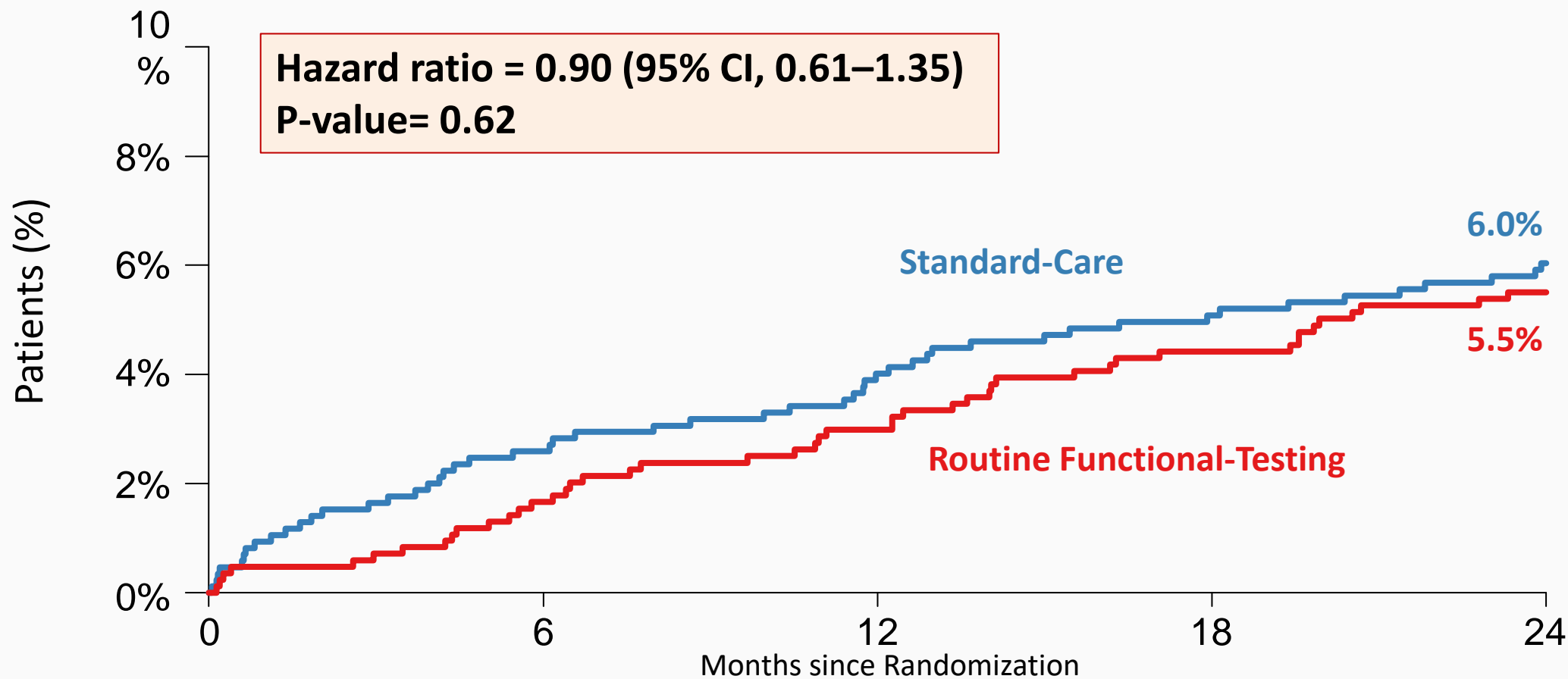
No. at Risk

Routine Functional-Testing	849	821	807	795	758
Standard-Care	857	824	808	796	762

CI, confidence interval; UA, unstable angina

Key Secondary Endpoints

Invasive Cardiac Catheterization

Log-rank P = 0.07

11.9%

Routine Functional-Testing

9.0%

Standard-Care

15

10

5

0

Patients (%)

0   6   12   18   24

Months since Randomization
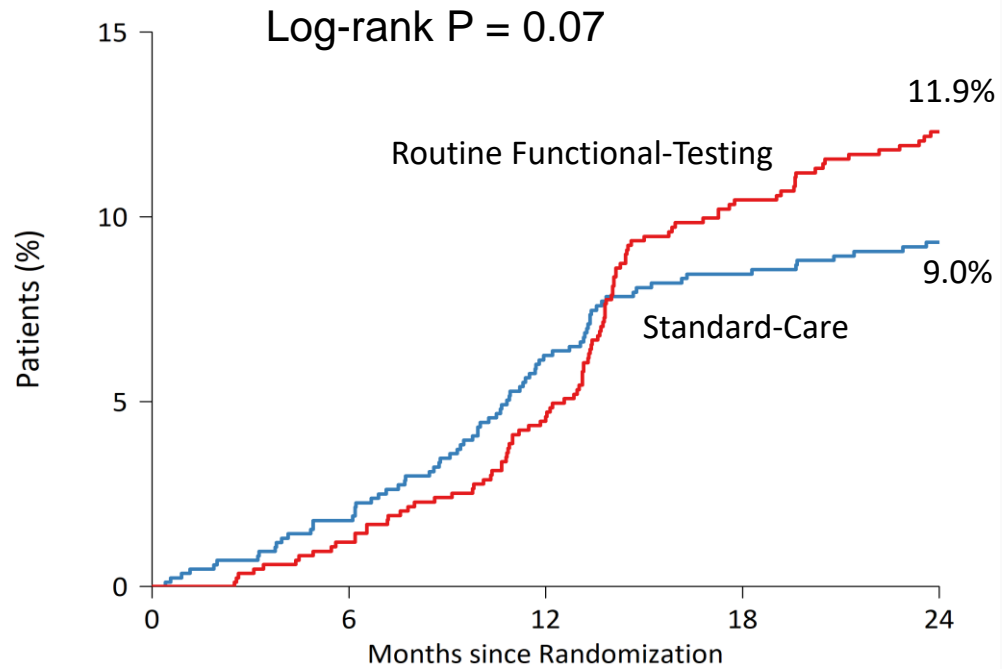
No. at Risk
Routine Functional-Testing   849   804   774   729   686
Standard-Care   857   815   771   746   716

Repeat Revascularization

Log-rank P = 0.09

7.8%

Routine Functional-Testing

5.6%

Standard-Care

15

10

5

0

Patients (%)

0   6   12   18   24

Months since Randomization
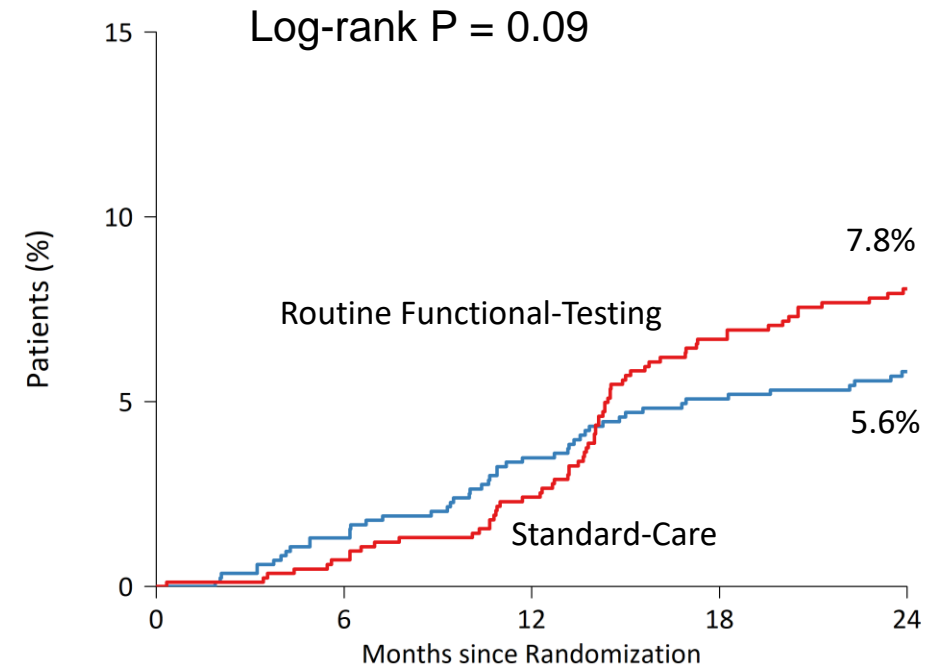
No. at Risk
Routine Functional-Testing   849   813   794   757   716
Standard-Care   857   820   795   774   741

Key Message of the POST-PCI

- In this trial involving high-risk patients who had undergone PCI,

1. Routine functional testing, as compared with standard care, did not result in a lower risk of ischemic cardiovascular events or death from any cause at 2 years.

2. Our trial do not support active surveillance with routine functional testing for follow-up strategy in high-risk patients who undergo PCI.

NEJM, Editorial

The NEW ENGLAND JOURNAL of MEDICINE

EDITORIAL

Surveillance Stress Testing "POST-PCI" — A Future Class III Recommendation?

Jacqueline E. Tamis-Holland, M.D.

More than 100 years ago, Einthoven reported the presence of ST-segment changes on electrocardiography in a patient during exercise.[1] His discovery led to the development of the modern-day stress test. In patients with known coronary artery disease, the stress test is useful in assessing residual ischemia after an acute myocardial infarction or in cases of incomplete revascularization or when treating symptomatic patients who have had previous revascularization. It is also commonly used to guide exercise therapies before cardiac rehabilitation. Less is known regarding the role of routine surveillance stress testing in asymptomatic patients after percutaneous coronary intervention (PCI). The 2021 American College of Cardiology–American Heart Association–Society of Cardiovascular Angiography and Interventions *Guideline for Coronary Artery Revascularization* do not provide a recommendation for routine stress testing after revascularization, and the *2018 European Society of Cardiology/European Association for Cardio-Thoracic Surgery Guidelines on Myocardial Revascularization* provide a weak (class IIb) recommendation for surveillance stress testing after PCI.[2,3]

ing owing to symptoms suggestive of myocardial ischemia.[5]

In an article now published in the *Journal*, Park et al.[6] report the results of the Pragmatic Trial Comparing Symptom-Oriented versus Routine Stress Testing in High-Risk Patients Undergoing Percutaneous Coronary Intervention (POST-PCI), which explored the utility of routine surveillance stress testing after PCI. Patients with high-risk anatomical features or clinical characteristics who had undergone PCI were randomly assigned to undergo routine stress testing at 1 year after PCI or to receive standard care. At 2 years, the incidence of the primary outcome (a composite of death from any cause, myocardial infarction, or hospitalization for unstable angina) did not differ significantly between the two strategies. In a landmark analysis performed between 1 year (the period when routine testing was planned to be performed in the functional-testing group) and 2 years after PCI, the incidences of coronary angiography and revascularization were more than 2 times higher in the functional-testing group than in the standard-care group, yet

the follow-up period. These factors underscore the importance of proper procedural techniques and aggressive secondary prevention to improve outcomes after PCI.

The POST-PCI trial provides compelling new evidence for a future class III recommendation for routine surveillance testing after PCI. Until then, we must refrain from prescribing surveillance stress testing to our patients after PCI, in the absence of other clinical signs or symptoms suggestive of stent failure.

New Guideline Updates after the POST-PCI Trial

CLINICAL PRACTICE GUIDELINE

2023 AHA/ACC/ACCP/ASPC/NLA/PCNA Guideline for the Management of Patients With Chronic Coronary Disease

A Report of the American Heart Association/American College of Cardiology Joint Committee on Clinical Practice Guidelines

Developed in Collaboration With and Endorsed by the American College of Clinical Pharmacy, American Society for Preventive Cardiology, National Lipid Association, and Preventive Cardiovascular Nurses Association

Endorsed by the Society for Cardiovascular Angiography and Interventions

Circulation. 2023 Aug 29;148(9):e9-e119.

7.1. Follow-Up Plan and Testing in Stable Patients

Recommend Referenced	
COR	
2b	lth
3: No benefit	odic
3: No benefit	of LV
3: Harm	nary

death or nonfatal MI.[9] Recently, the multicenter, POST-PCI (Pragmatic Trial Comparing Symptom-Oriented versus Routine Stress Testing in High-Risk Patients Undergoing Percutaneous Coronary Intervention) RCT compared a strategy of routine functional stress testing (using exercise ECG with or without nuclear myocardial perfusion imaging or stress echocardiography) versus standard care alone 12 months after successful PCI in 1,706 high-risk patients. At 2 years of

Routine stress testing in diabetic patients after percutaneous coronary intervention: the POST-PCI trial

Hoyun Kim[1][†], Do-Yoon Kang[1][†], Jinho Lee[1], Yeonwoo Choi[1], Jung-Min Ahn[1], Seonok Kim[2], Yong-Hoon Yoon[3], Seung-Ho Hur[4], Cheol Hyun Lee[4], Won-Jang Kim[5], Se Hun Kang[5], Chul Soo Park[6], Bong-Ki Lee[7], Jung-Won Suh[8], Jae Woong Choi[9], Kee-Sik Kim[10], Su Nam Lee[11], Seung-Jung Park[1], and Duk-Woo Park ⓘ [1]*, for the POST-PCI Investigators

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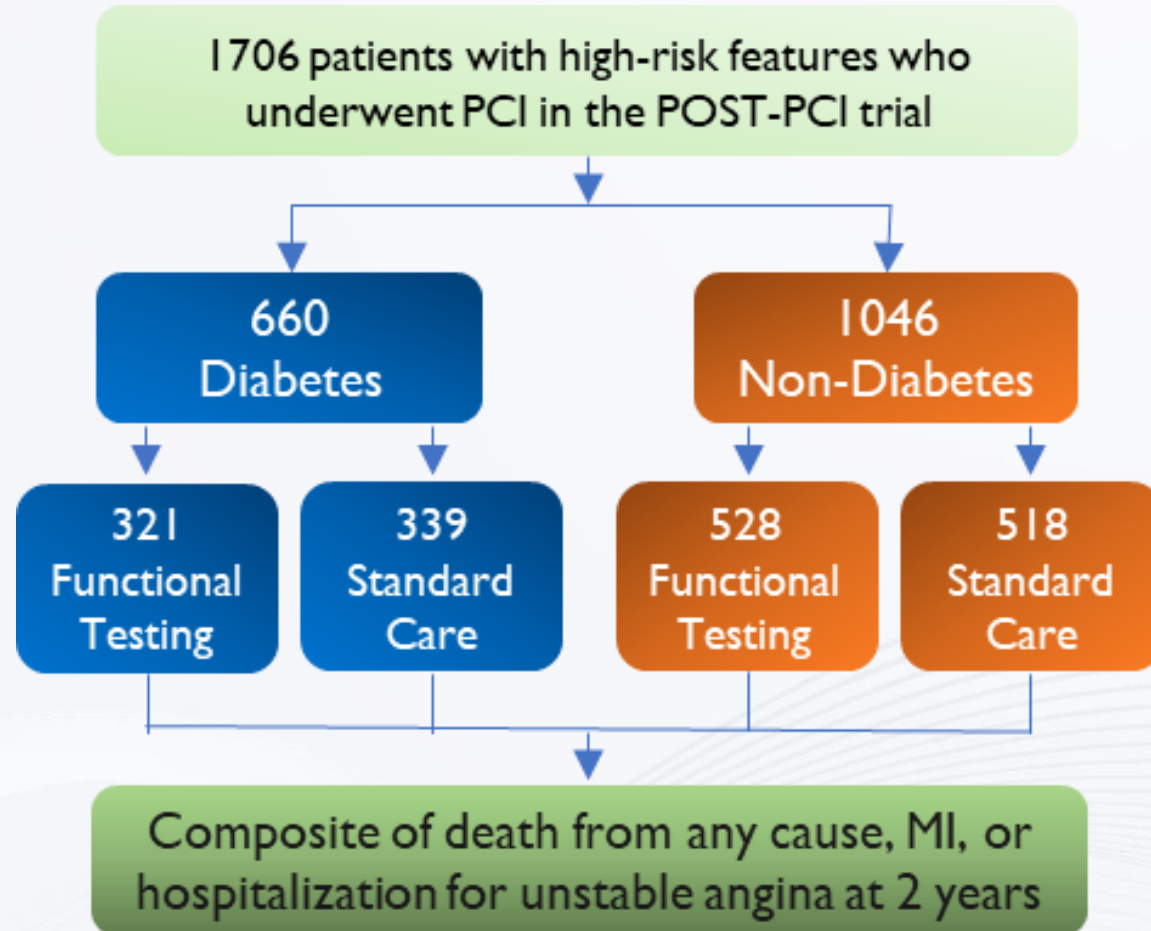
🎧 **Listen to the audio abstract of this contribution.**

Diabetes in CAD and PCI

- Diabetic patients have a more aggressive form of atherosclerosis and more extensive coronary artery disease.

  Circulation 2013;128:1675-1685
  Circulation 2015;132:923-931

- Diabetes is a major determinant of adverse clinical events after myocardial revascularization.

  The Lancet Diabetes & Endocrinology 2013;1:317-328
  Journal of the American College of Cardiology 2019;73:1629-1632

- Percutaneous coronary intervention (PCI) for diabetic patients is often being more complex and anatomically challenging.

  Circulation: Cardiovascular Interventions 2015;8:e001944

Diabetic Subgroup Analysis of the POST-PCI trial

1706 patients with high-risk features who underwent PCI in the POST-PCI trial

- 660 Diabetes
  - 321 Functional Testing
  - 339 Standard Care
- 1046 Non-Diabetes
  - 528 Functional Testing
  - 518 Standard Care

Composite of death from any cause, MI, or hospitalization for unstable angina at 2 years

Primary outcome

- Composite of death from any cause, MI, or hospitalization for unstable angina at 2 years
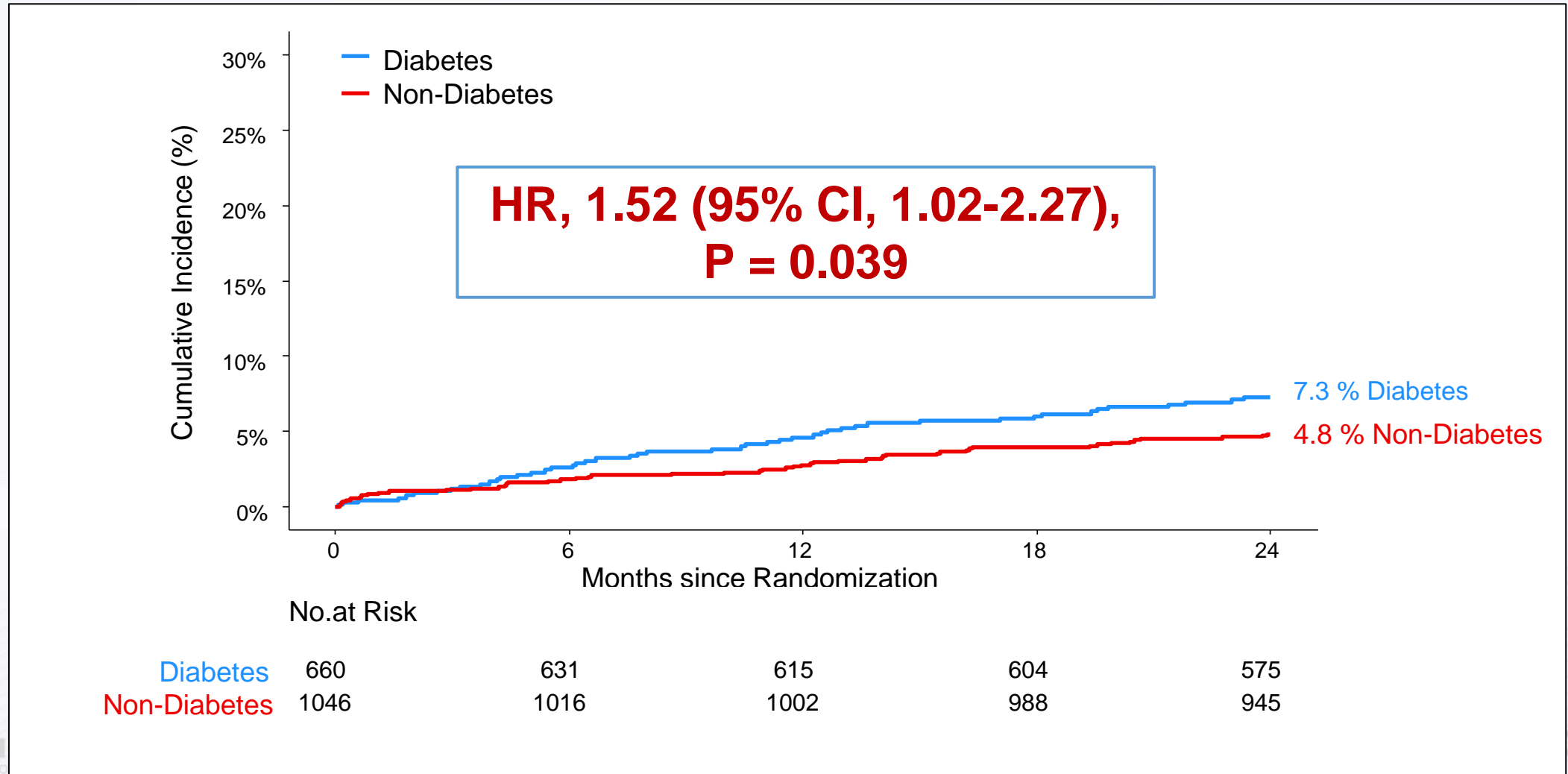
Secondary outcome

- Individual component of primary outcome

- Any hospitalization for cardiac or noncardiac causes

- Invasive coronary angiography

- Repeat revascularization

Primary Composite Outcome

*A composite of Death from any cause, MI, or hospitalization for UA at 2 years*

Diabetes vs. Non-Diabetes

HR, 1.52 (95% CI, 1.02-2.27), P = 0.039

7.3 % Diabetes
4.8 % Non-Diabetes

No.at Risk

Diabetes	660	631	615	604	575
Non-Diabetes	1046	1016	1002	988	945

Take Home Message

In the absence of clinical signs or symptoms suggestive of stent failure or disease progression, routine surveillance stress testing after PCI should not be recommended among diabetic patients.

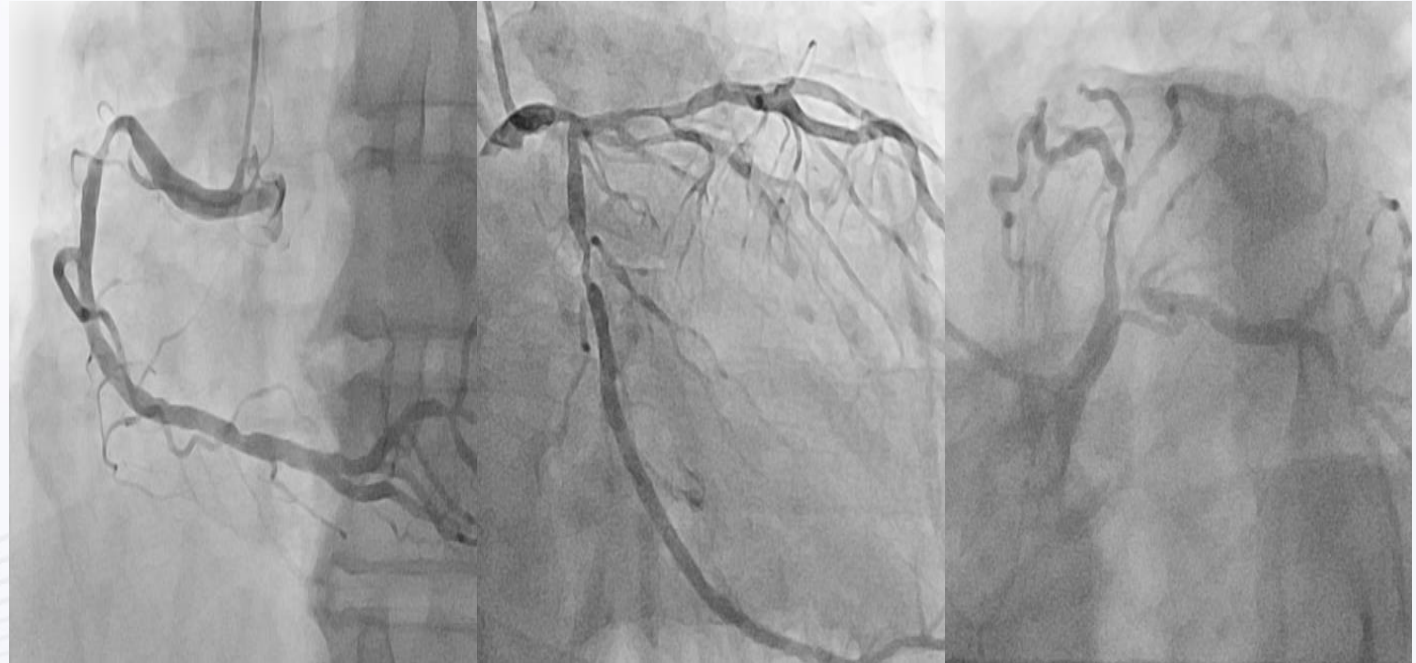A pre-specified subgroup analysis of the POST-PCI trial
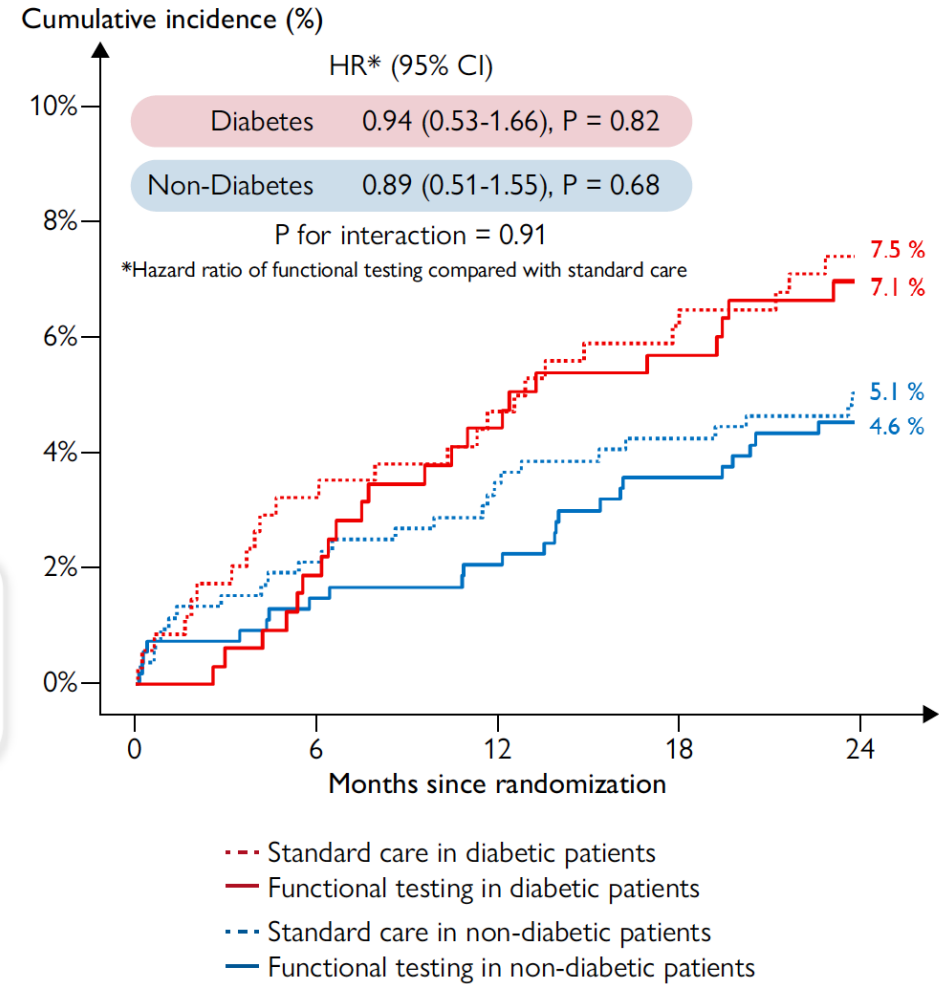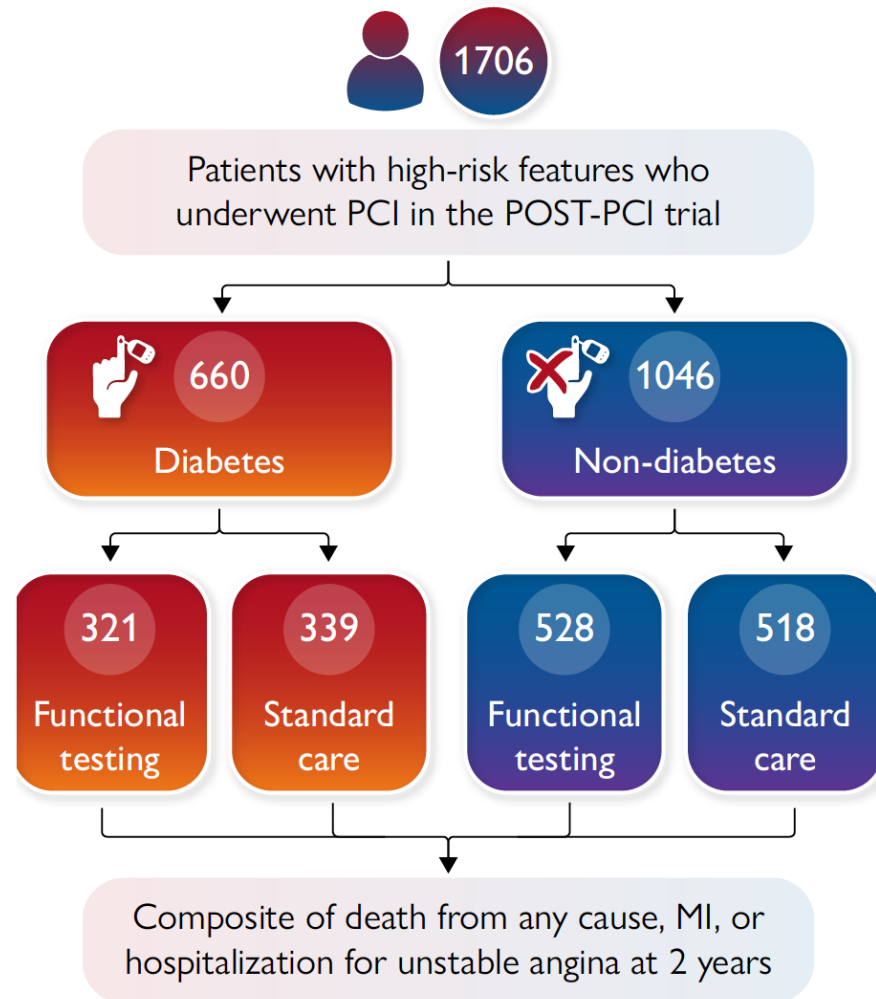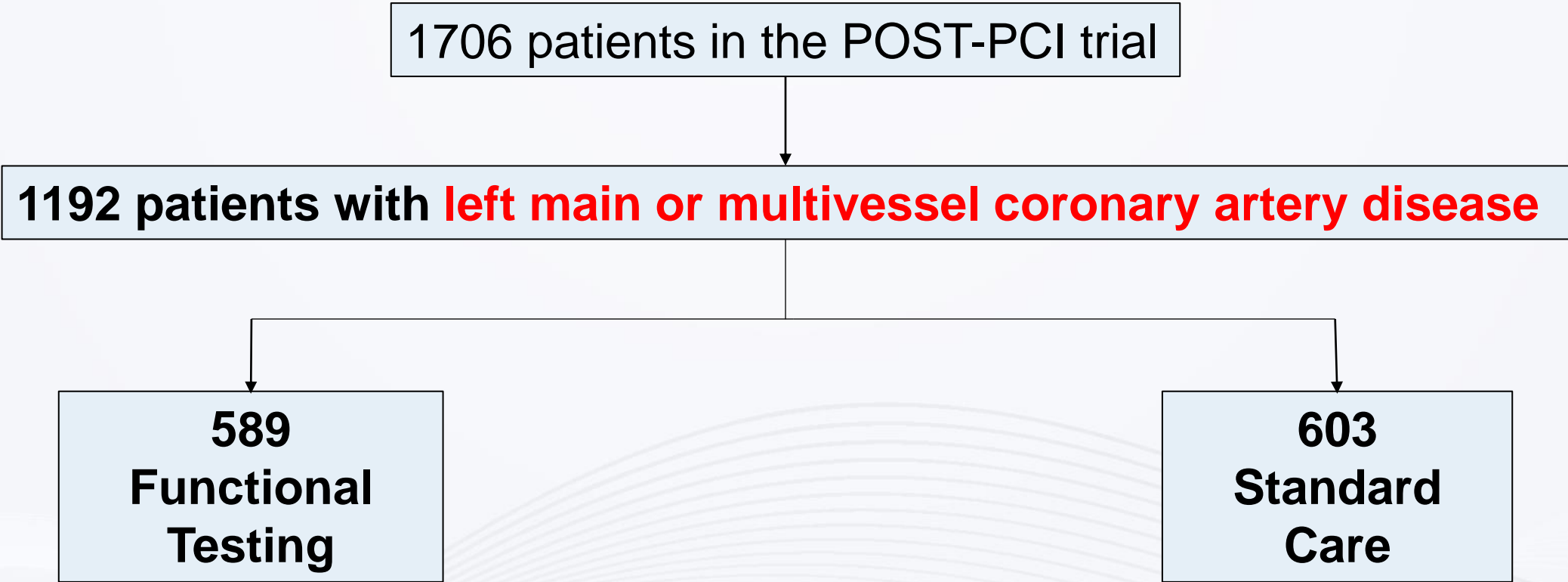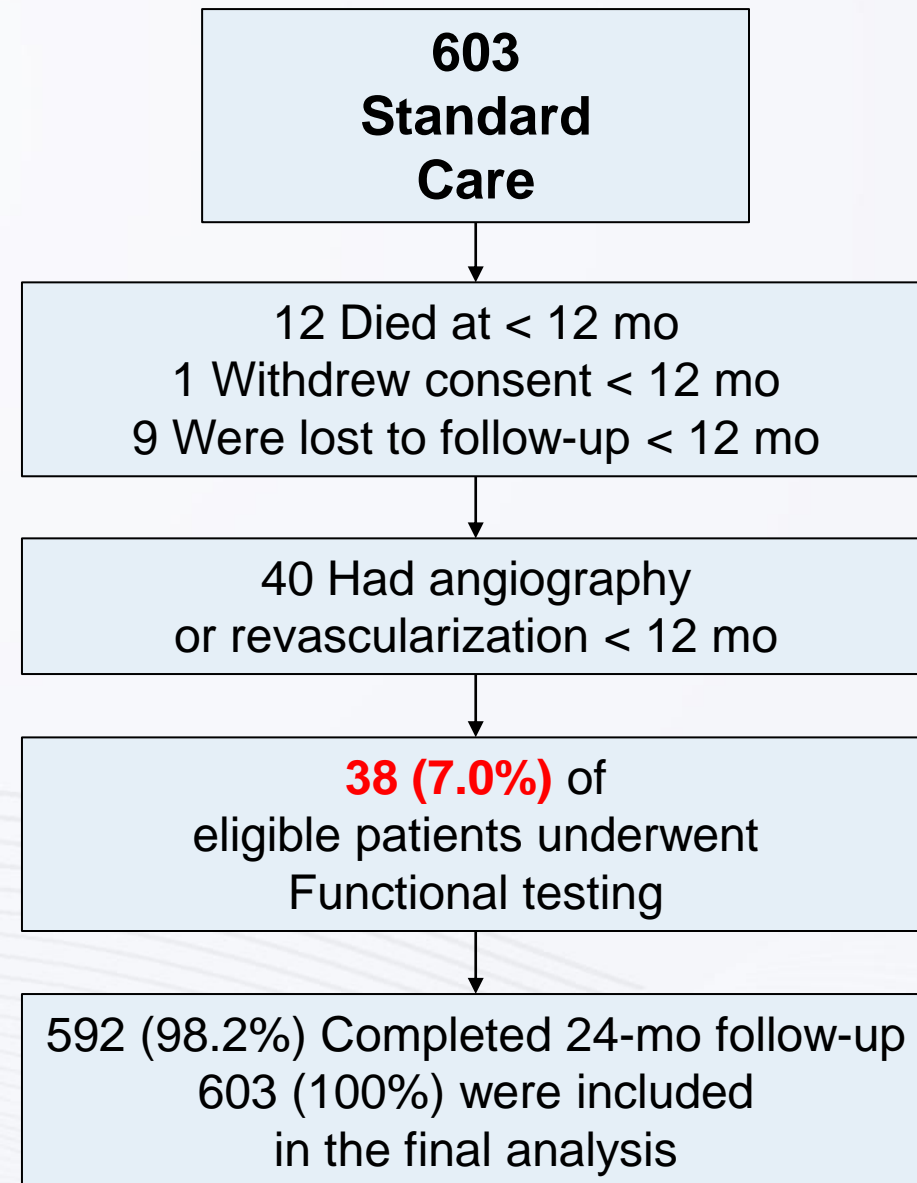
Left Main and Multivessel Disease

- **PCI has been widely performed** for patients with **multivessel or left main coronary artery disease** in the daily clinical practice, **although CABG is recommended** as the standard strategy for these high-risk patients
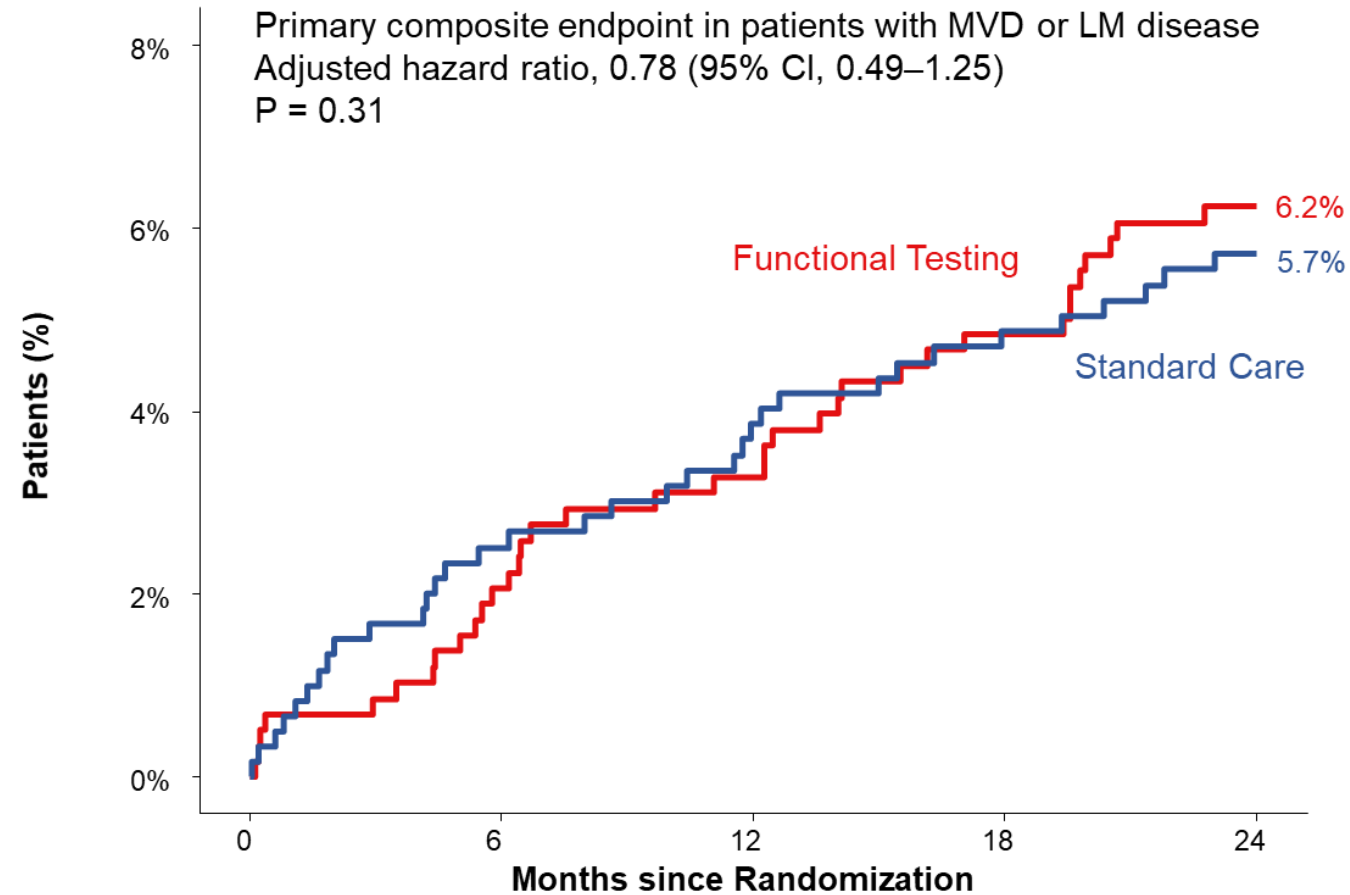
JACC In-Revision

CVRF

Results

1706 patients in the POST-PCI trial

1192 patients with left main or multivessel coronary artery disease

589
Functional
Testing

603
Standard
Care

589
Functional
Testing

603
Standard
Care

10 Died at < 12 mo
4 Withdrew consent < 12 mo
9 Were lost to follow-up < 12 mo

12 Died at < 12 mo
1 Withdrew consent < 12 mo
9 Were lost to follow-up < 12 mo

26 Had angiography
or revascularization < 12 mo

40 Had angiography
or revascularization < 12 mo

486 (90.0%) of
eligible patients underwent
Functional testing

38 (7.0%) of
eligible patients underwent
Functional testing

574 (97.4%) Completed 24-mo follow-up
589 (100%) were included
in the final analysis

592 (98.2%) Completed 24-mo follow-up
603 (100%) were included
in the final analysis

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Primary composite endpoint in MVD or LM Disease

Primary composite endpoint in patients with MVD or LM disease
Adjusted hazard ratio, 0.78 (95% CI, 0.49–1.25)
P = 0.31

Functional Testing — 6.2%

Standard Care — 5.7%

Patients (%) (y-axis: 0%, 2%, 4%, 6%, 8%)

Months since Randomization (x-axis: 0, 6, 12, 18, 24)

No.at Risk

Functional Testing	589	567	557	547	520
Standard Care	603	580	570	563	540

JACC In-Revision

Each Cohort of MVD or LM Disease
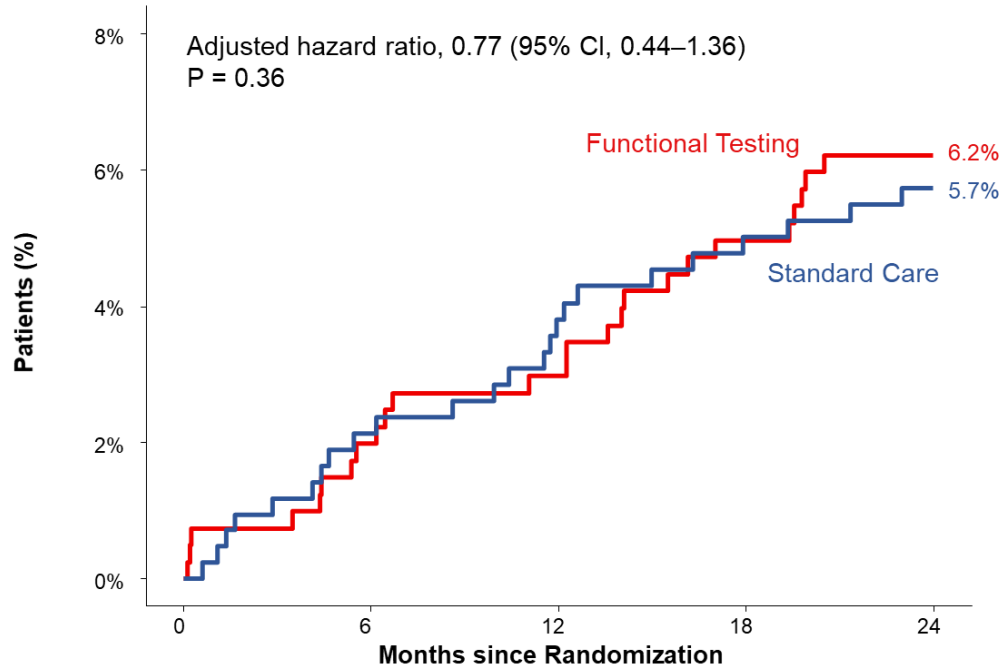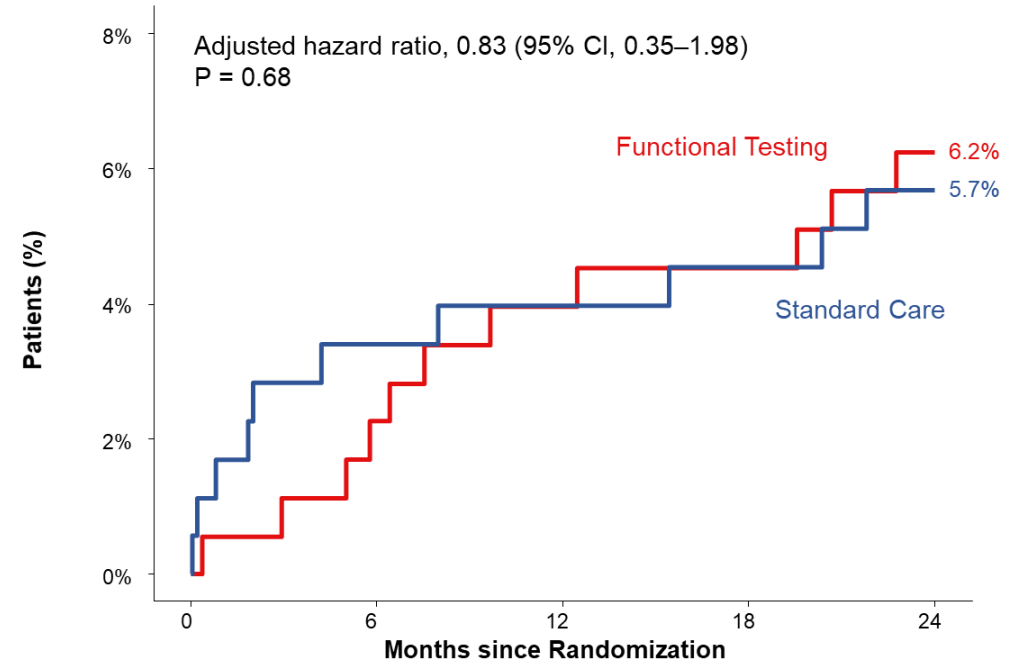
Primary composite endpoint in MVD group

Primary composite endpoint in Left Main group

JACC In-Revision

Summary,
MVD and LM Disease

- In high-risk patients with **MVD or LM disease** who underwent PCI → follow-up strategy of routine functional testing did not reduce the MACE at 2 years.

- **These findings only increased the frequency of non-essential invasive procedures without providing any benefit in hard clinical outcomes.**

7. PATIENT FOLLOW-UP: MONITORING AND MANAGING SYMPTOMS

7.1. Follow-Up Plan and Testing in Stable Patients

Recommendations for Follow-Up Plan and Testing in Stable Patients
Referenced studies that support the recommendations are summarized in the Online Data Supplement.

COR	LOE	RECOMMENDATIONS
2b	B-R	1. In stable patients with CCD and with previous ACS or coronary revascularization, referral to telehealth programs, community-based programs, or both for lifestyle interventions may be reasonable as an adjunct to usual care to improve management of cardiovascular risk factors.[1-7]
3: No benefit	B-R	2. In patients with CCD without a change in clinical or functional status on optimized GDMT, routine periodic testing with coronary CTA or stress testing with or without imaging is not recommended to guide therapeutic decision-making.[8-10]
3: No benefit	B-R	3. In patients with CCD without a change in clinical or functional status, routine periodic reassessment of LV function is not recommended to guide therapeutic decision-making.[11,12]
3: Harm	B-NR	4. In patients with CCD without a change in clinical or functional status, routine periodic invasive coronary angiography should not be performed to guide therapeutic decision-making.[13-17]