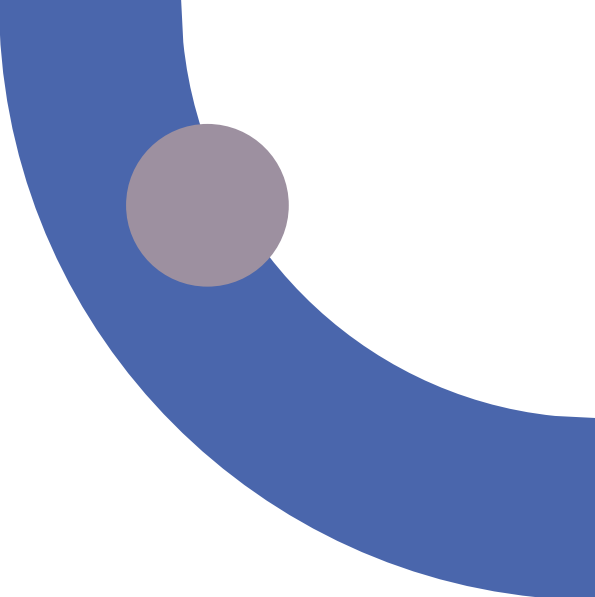


Recent Trends in Cardiovascular Medicine

Dr. Mark Christopher A, MD DM,
Freelance Cardiology Practitioner,
Pondicherry

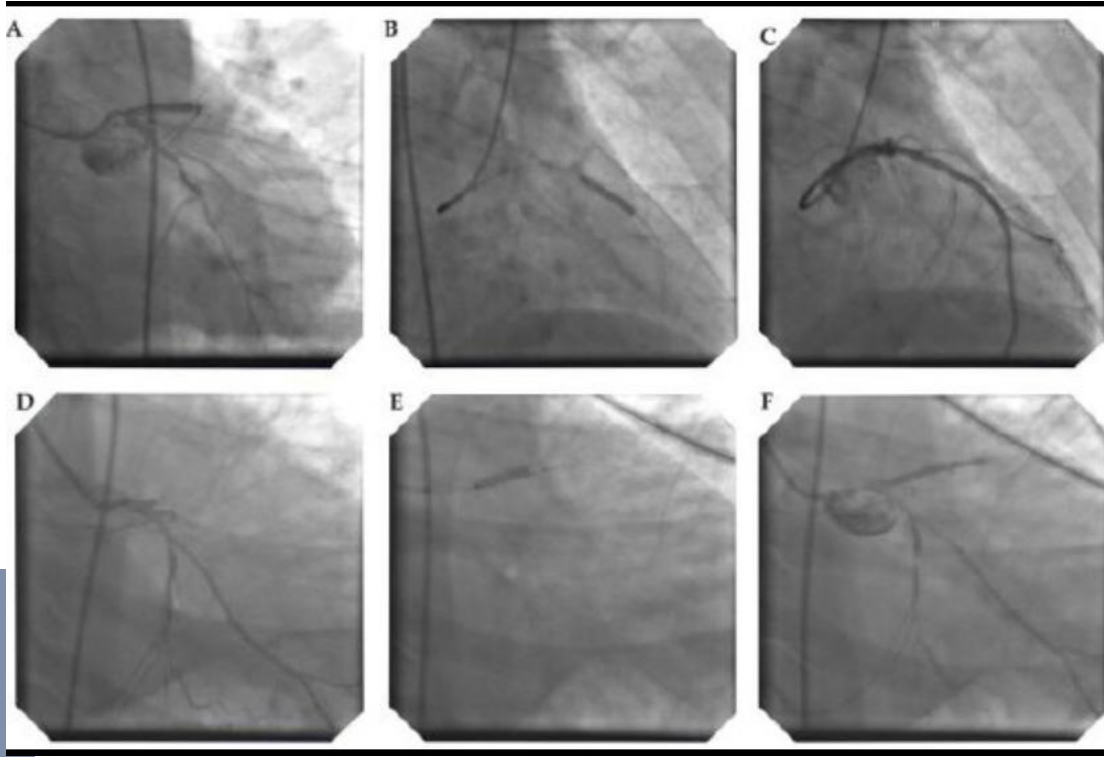


Traditional coronary imaging

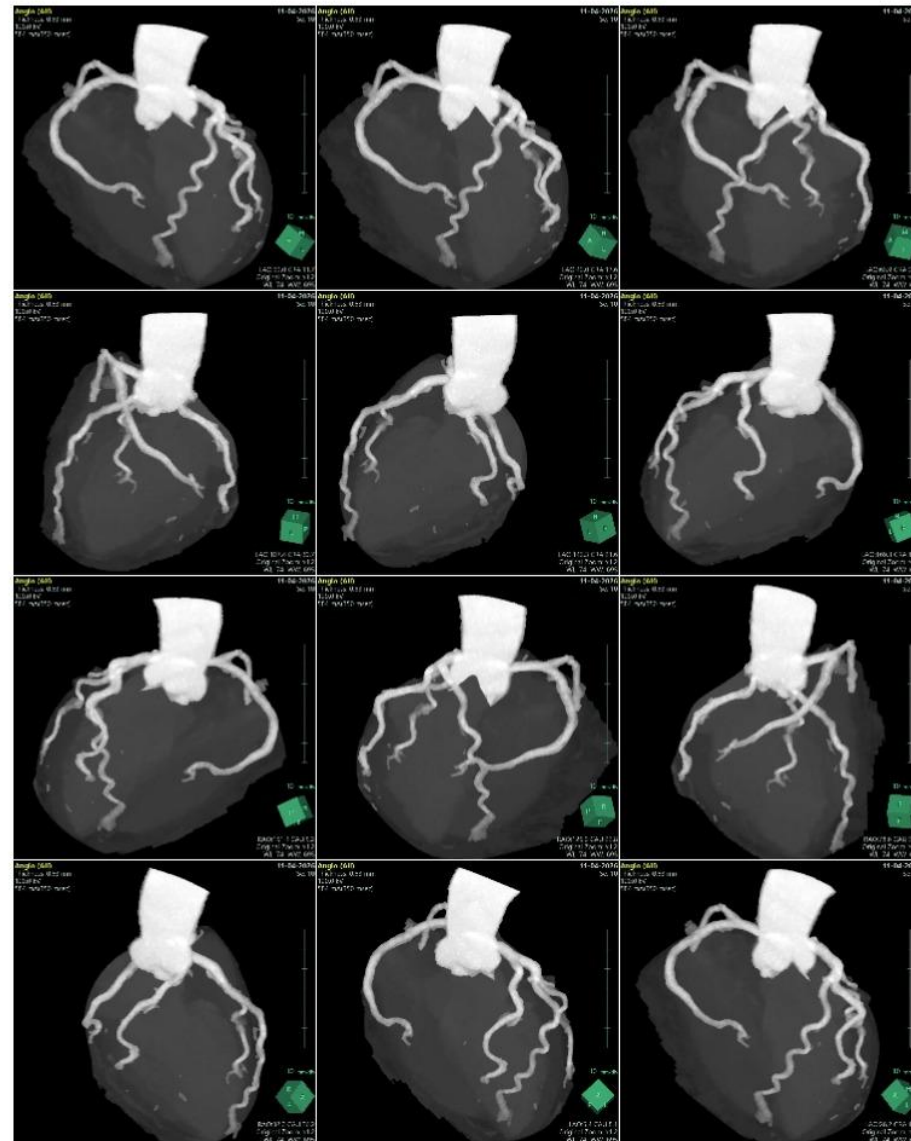
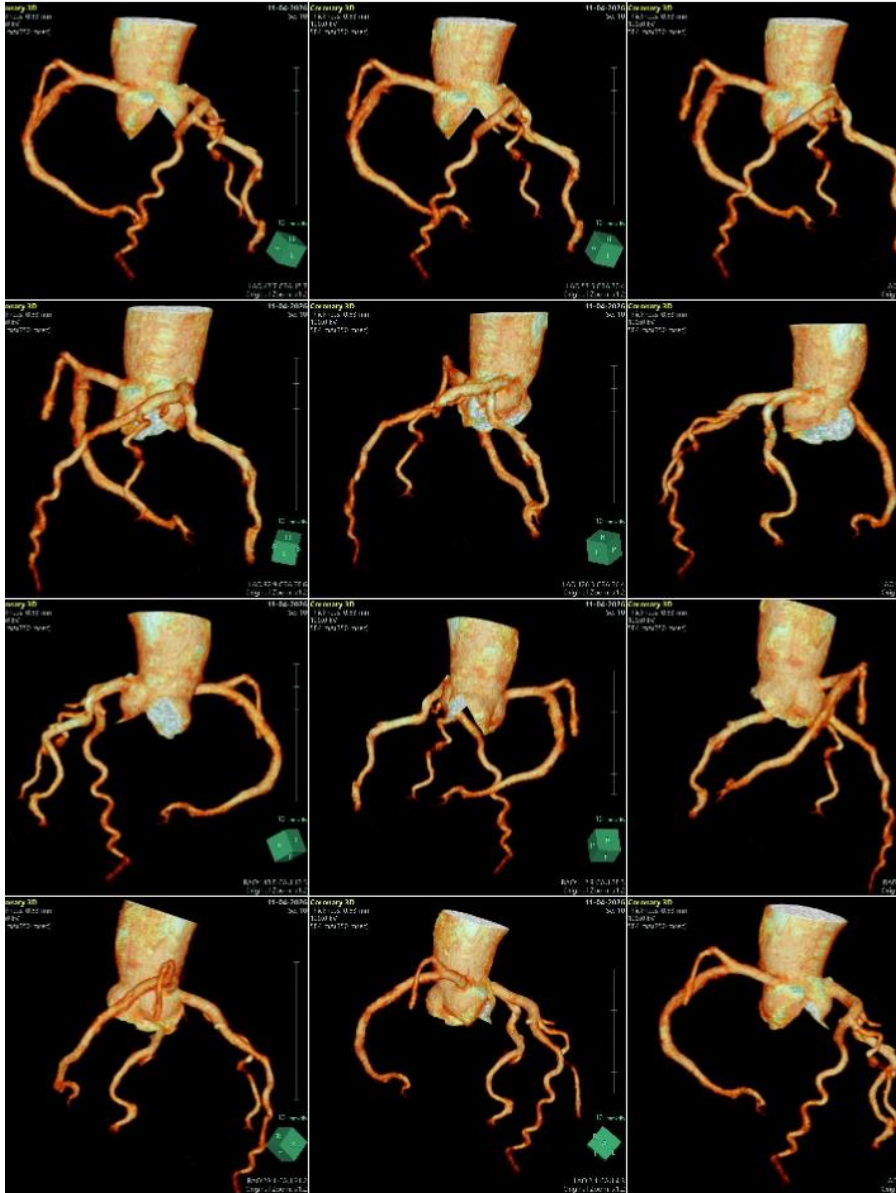
Invasive coronary angiography (ICA) remains the gold standard for visualizing coronary arteries and detecting stenoses.

Catheters to inject contrast for real-time X-ray imaging

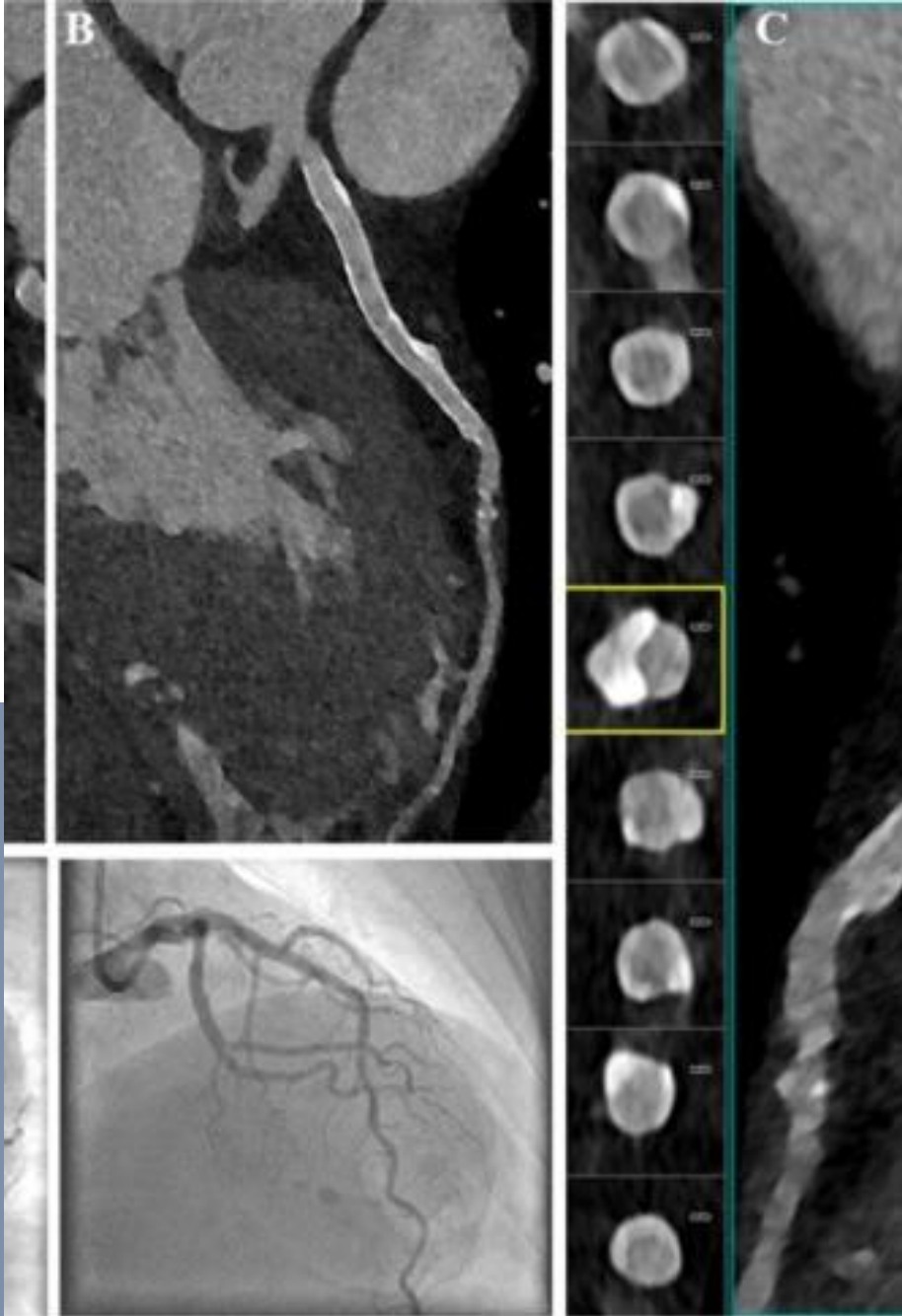
Limitations include poor assessment of plaque burden and vessel dimensions



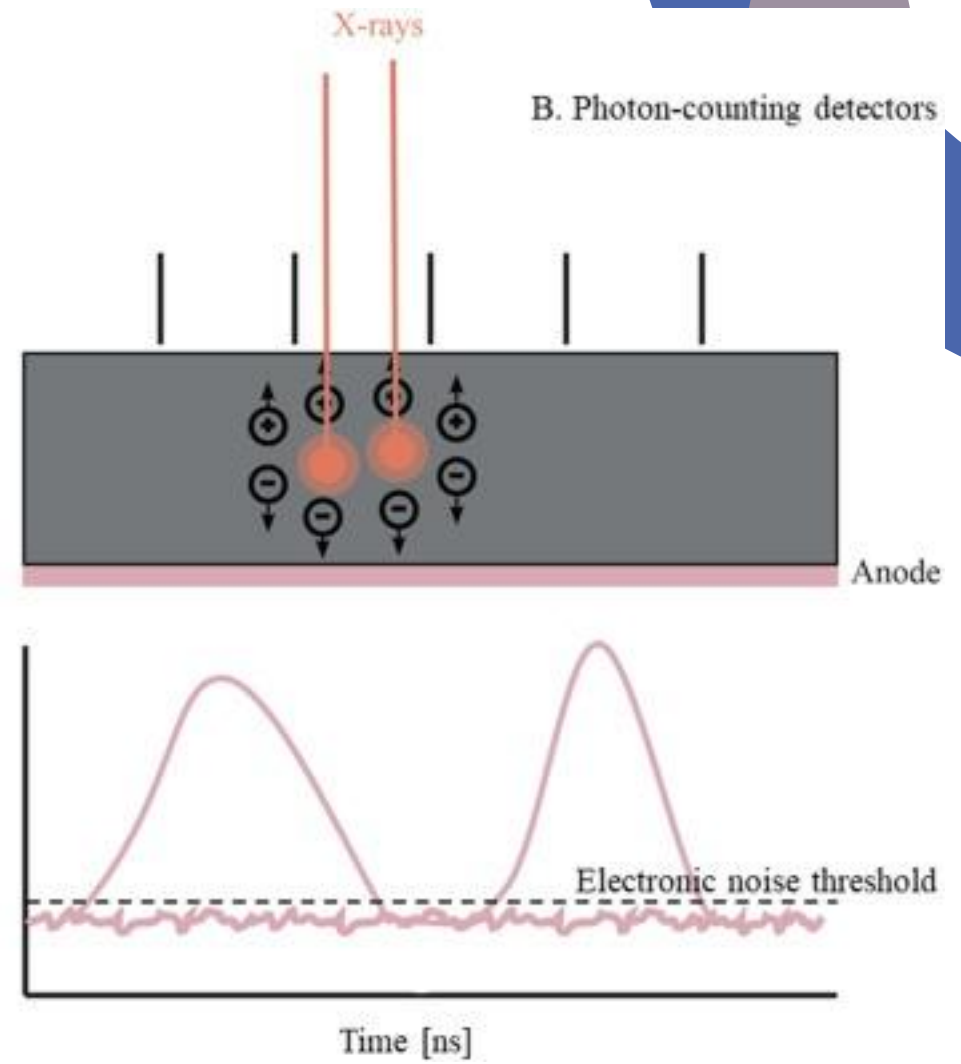
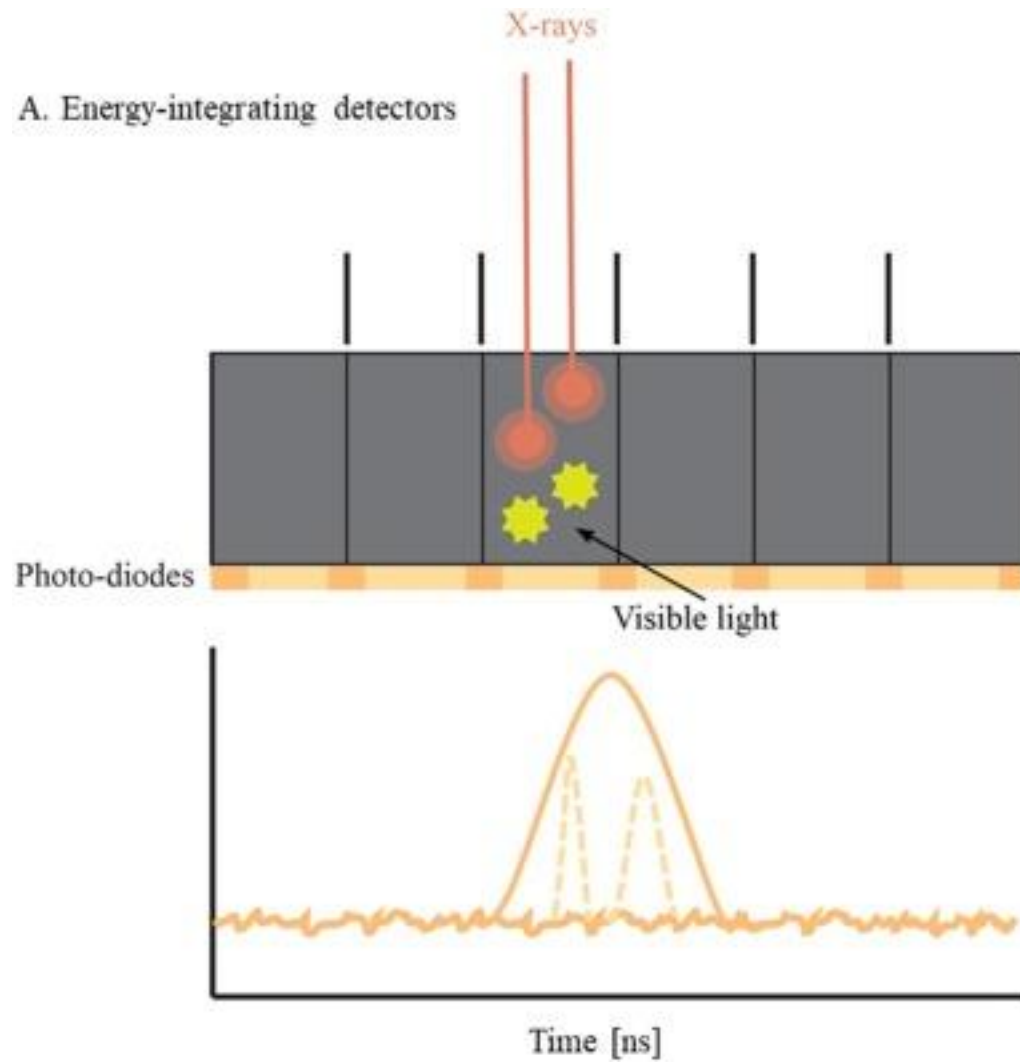
Conventional coronary
angiogram images



CT coronary images



Photon counting CT images



Advances in coronary imaging

Coronary CT angiography (CCTA) has evolved as a non-invasive alternative with high spatial resolution for plaque detection.

Photon-counting CT (PCD-CT) improves image quality, reducing overestimation of calcified stenoses by up to 29% vs. standard CT, enabling better CAD-RADS reclassification in over 50% of cases.

AI-based quantitative coronary angiography (AI-QCA) automates analysis, mimicking expert assessment for precise stent sizing

Intravascular Imaging (IVUS/OCT)

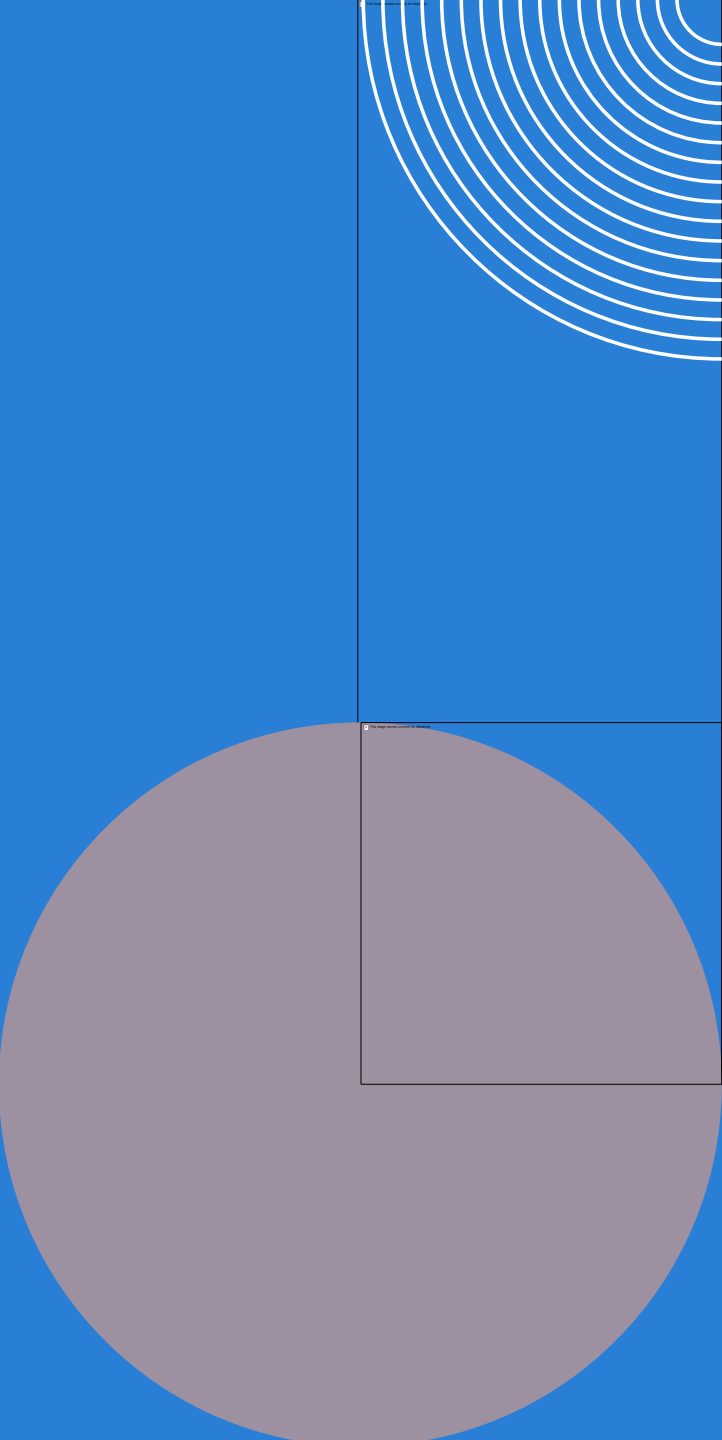
IVUS and OCT provide real-time plaque composition (lipid/calcium) and stent optimization during PCI.

Largest meta-analysis shows IVUS/OCT reduces death, MI, thrombosis vs. angiography alone.

Class IA recommendation for complex lesions; CALIPSO trial confirms larger stent areas with OCT

Functional and AI Enhancements

- FFR-CT provides non-invasive functional assessment of lesion significance, integrated with CCTA for prognostic insights.
- Multidetector and photon-counting CT reduce radiation while enhancing resolution; AI aids in quantitative plaque analysis.
- These tools expand CCTA's role in CAD management, minimizing invasive procedures.



Traditional coronary angioplasty

10

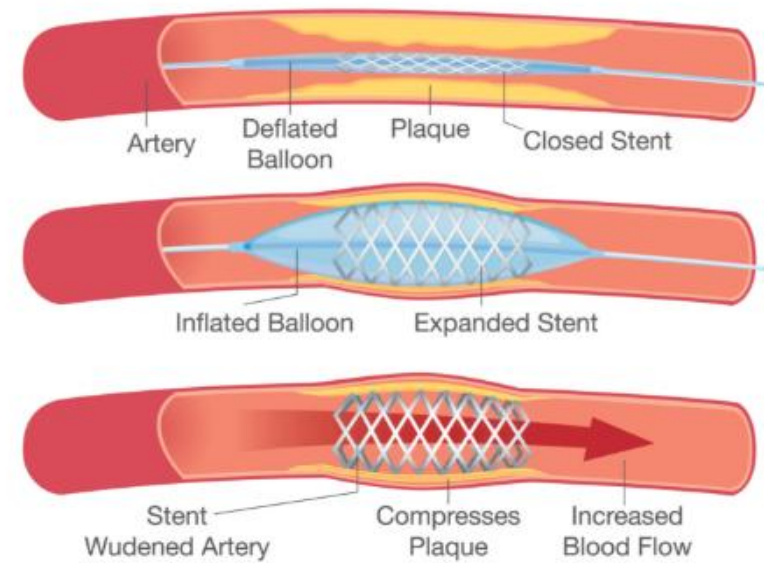
Percutaneous coronary intervention (PCI), or angioplasty, opens blocked arteries using balloons and stents.

Drug-eluting stents (DES) prevent restenosis but introduce permanent metallic scaffolds.

Guided mainly by angiography, it improves blood flow in 90% of cases with shorter recovery than CABG.

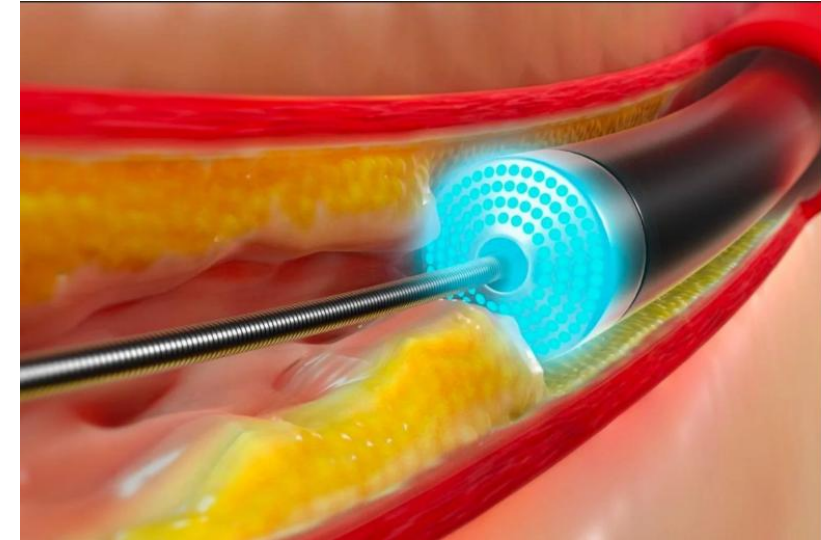
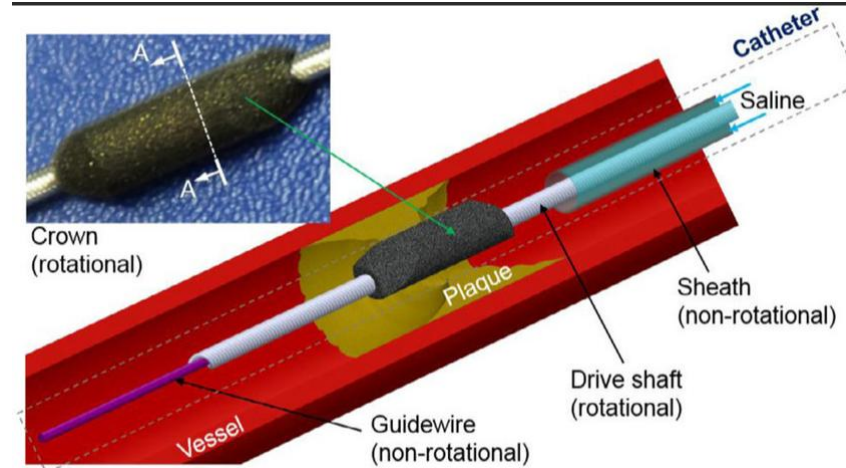
Angioplasty

Balloon Angioplasty and Stents



Rotablator, orbital atherectomy and Laser atherectomy

12



CT-derived FFR

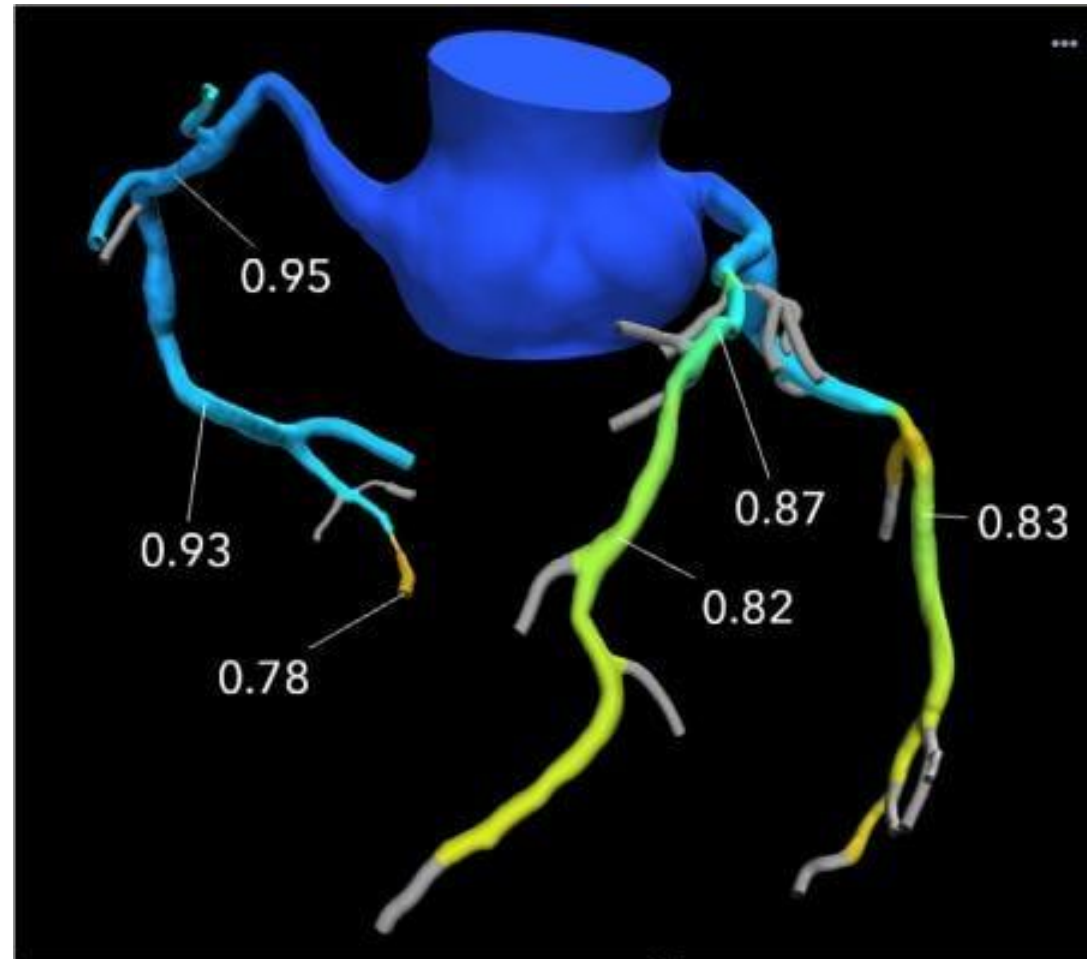
CT-FFR computes fractional flow reserve from CCTA data using AI algorithms, avoiding invasive wires.

It overcomes limitations of traditional FFR with high concordance, guiding revascularization non-invasively.

CONFIRM2 registry shows AI-QCT predicts MACE better than pre-test probability via plaque volume metrics

CT guided FFR

14



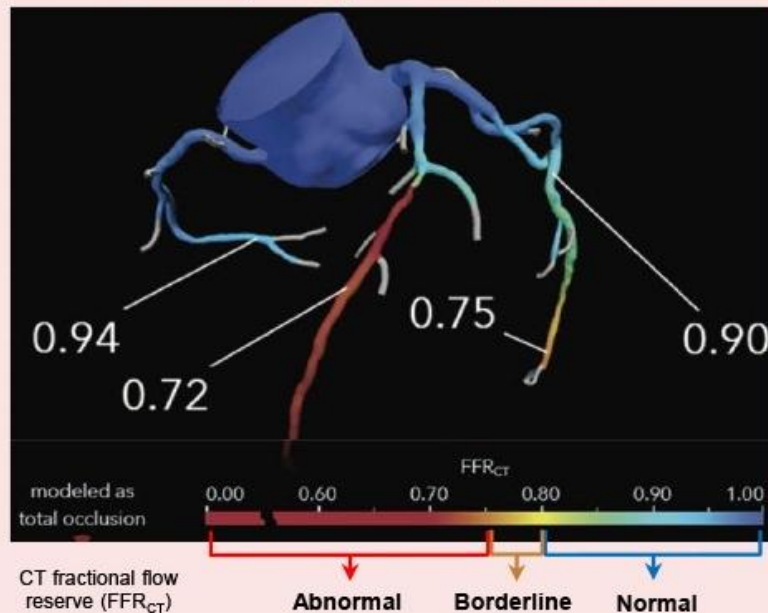
CT guided FFR

15

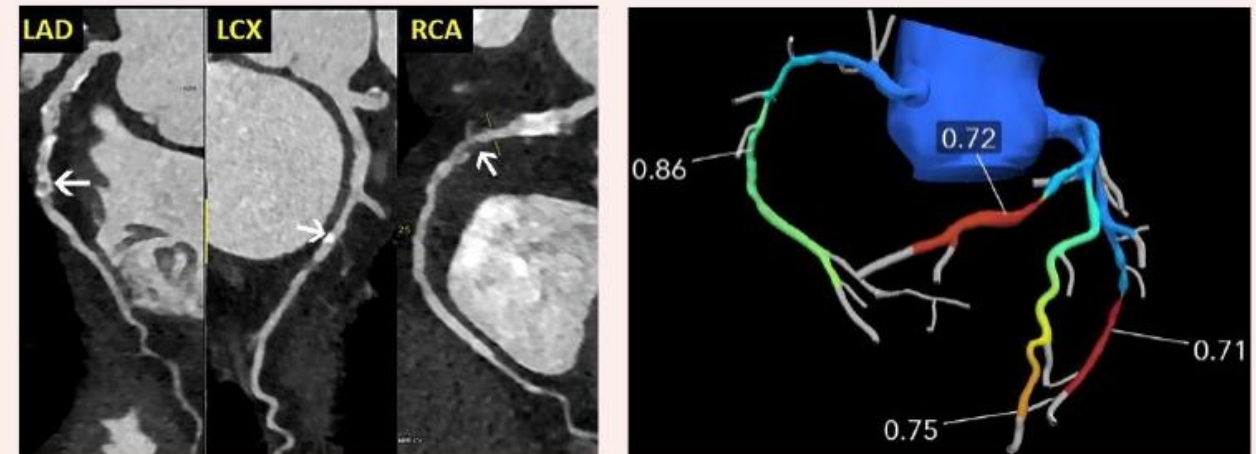
CT Fractional Flow Reserve: A Practical Guide to Application, Interpretation, and Problem Solving

Basics

Physiologic simulation technique utilizing routine CTA data to mathematically model coronary flow, pressure, resistance



Utility in preprocedural planning



CTA	Left anterior descending artery	Left circumflex artery	Right coronary artery
FFR _{CT}	Severe stenosis 0.72	Severe stenosis 0.71	Moderate stenosis 0.86

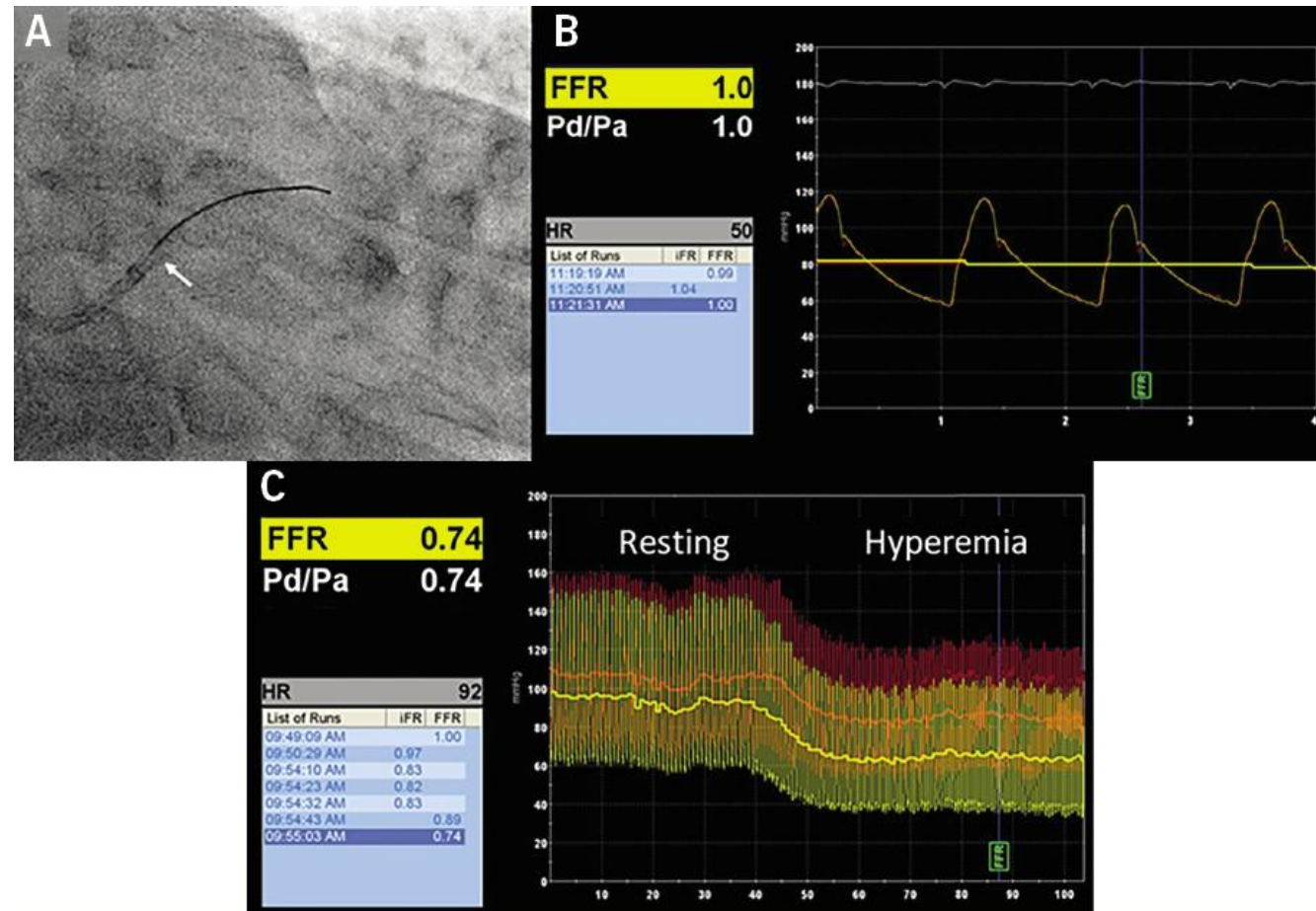
Patient underwent revascularization of the LAD and LCX

Rajiah P et al. Published online: February 4, 2022
<https://doi.org/10.1148/rg.210097>

RadioGraphics

Pressure wire FFR

16



Key: FFR = fractional flow reserve; iFR = instantaneous wave-free ratio; Pa = aortic pressure; Pd = distal pressure

CT derived FFR

1. CT-FFR computes fractional flow reserve from CCTA data using AI algorithms, avoiding invasive wires.
2. It overcomes limitations of traditional FFR with high concordance, guiding revascularization non-invasively.
3. CONFIRM2 registry shows **AI-QCT** predicts MACE better than pre-test probability via plaque volume metrics.

Imaging-Guided PCI Advances

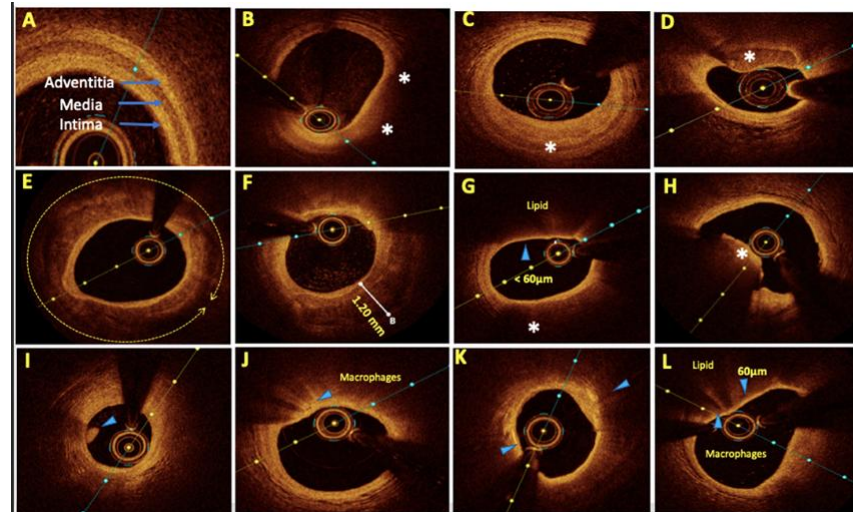
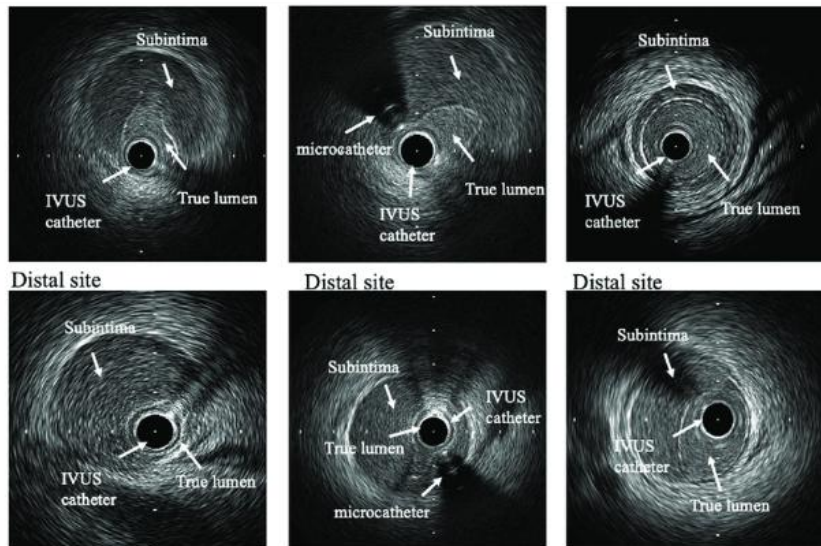
Intravascular ultrasound (IVUS) and optical coherence tomography (OCT) offer superior visualization of plaque, lumen, and stent apposition over angiography alone.

IVUS guidance earns class IA recommendation for complex lesions like bifurcations, reducing MI and revascularization risks

OCT provides higher resolution but less penetration.

2024 meta-analyses confirm IVUS's consistent benefits in PCI optimization.

IVUS and OCT



Drug-Coated Balloons and Stents

1. Drug-coated balloons (DCBs) deliver antiproliferative drugs like paclitaxel without scaffolds, ideal for in-stent restenosis, small vessels, and bifurcations.
2. Trials like REC-CAGEFREE-I (2024) show DCBs comparable to DES in safety and efficacy, preserving future options.
3. Short-duration DAPT (1-3 months) post-PCI is now recommended for high-bleeding-risk patients.

Drug coated balloons

DCBs deliver antiproliferative drugs (paclitaxel/sirolimus) without permanent stents, preserving vasomotion.

FDA approved 2024 for ISR; AGENT IDE shows 41% TLF reduction vs. plain balloons.

REC-CAGE-FREE suggests viability for small vessels, shorter DAPT in high-bleed-risk patients.

Robotic Assisted Angioplasty

1. Robotic systems enable micron-level precision for calcified/tortuous vessels, reducing radiation to operators.
2. Market growth projected through 2033 due to minimally invasive benefits in high-risk cases.
3. Improves dexterity, lowers clinician exposure, ideal for CTOs and complex angioplasties.

Robotic angioplasty



Clinical Guidelines Update

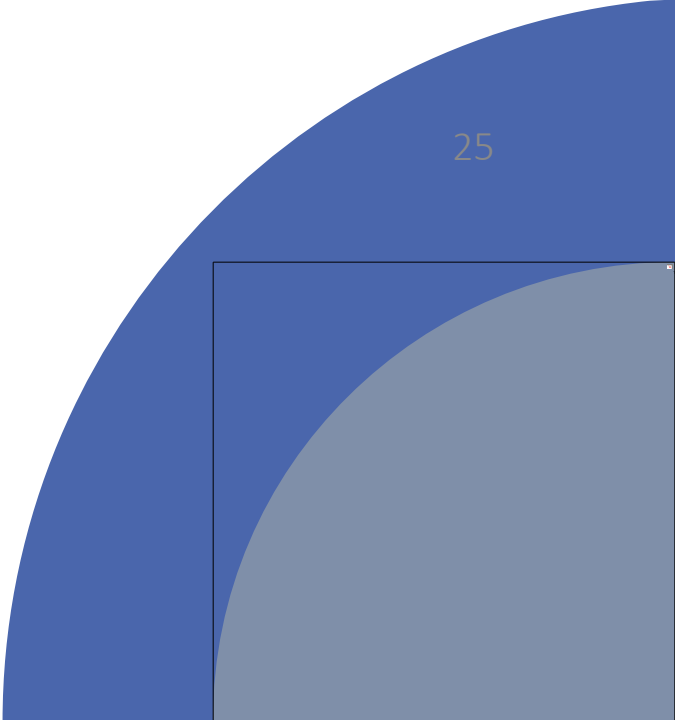
2024 CCS guidelines prefer CABG over PCI for complex cases but endorse PCI with IVUS for low SYNTAX scores.

Complete revascularization via PCI reduces death/MI in TAVI patients.

Photon-counting CT and AI-QCA shift paradigms toward precise, less invasive diagnostics.

Clinical evidence

Clinical Evidence Summary		
Advance	Key Trial/Study	Outcome Benefit
IVUS/OCT	Lancet meta-analysis (2024)	↓ Death/MI/TVR
CT-FFR	Multiple registries	Non-invasive ischemia detection
DCB	AGENT IDE (2024)	↓ TLF 41% in ISR
Robotic PCI	Market analysis	↑ Precision, ↓ radiation
CCTA/AI	CONFIRM2	↑ MACE prediction



Angiographically derived FFR for PCI



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ORIGINAL ARTICLE



Angiography-Derived Fractional Flow Reserve to Guide PCI

Authors: William F. Fearon, M.D., Allen Jeremias, M.D. , Guy Witberg, M.D., M.P.H., Rasha Al-Lamee, M.D., Ph.D., David J. Cohen, M.D. , Amir Kaki, M.D., Rahul P. Sharma, M.D., M.B., B.S., , for the ALL-RISE Investigators* [Author Info & Affiliations](#)

Published March 29, 2026 | DOI: 10.1056/NEJMoa2600949 | Copyright © 2026



Abstract

BACKGROUND

Assessing intermediate coronary lesions with an intracoronary pressure wire improves clinical outcomes in patients undergoing cardiac catheterization and percutaneous coronary intervention (PCI). However, clinical use of pressure-wire–based physiological assessment remains low. Measurement of fractional flow reserve (FFR) derived from coronary angiographic images alone correlates well with pressure-wire–based FFR measurements and may simplify procedures, but its effect on clinical outcomes is unknown.



Angiographically derived FFR for PCI

Angiographic picture FFR Vs Pressure wire FFR

Result non inferior

Early Surgery or Conservative Care for Asymptomatic Aortic Stenosis at 10 Years

Early surgery mortality 2/73
Conservative 17/73



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ORIGINAL ARTICLE



Early Surgery or Conservative Care for Asymptomatic Aortic Stenosis at 10 Years

IVUS vs Angiographic Guided High-risk PCI

1010 Patients Angiographic and 1009 IVUSs



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ORIGINAL ARTICLE



Intravascular Ultrasound–Guided or Angiography–Guided Complex High-Risk PCI

Authors: Roberto Diletti, M.D., Ph.D. , Joost Daemen, M.D., Ph.D., Benjamin Faurie, M.D., Marco Barbierato, M.D., Didier Tchétché, M.D., Thomas Hovasse, M.D., Koen Teeuwen, M.D., Ph.D.,  +21, for the IVUS-CHIP

Investigators* [Author Info & Affiliations](#)

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IVUS vs Angiographic Guided High-risk PCI

Procedural time Angiographic 66.2 IVUS 88.8 min

Target vessel failure at 19 months
Angiographic 112 IVUS 142

Procedural complications
Angiographic 10.2 IVUS 11.3

Left atrial appendage closure or Medical therapy



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ORIGINAL ARTICLE



Left Atrial Appendage Closure or Medical Therapy in Atrial Fibrillation

Authors: Ulf Landmesser, M.D. , Carsten Skurk, M.D., Paulus Kirchhof, M.D., Thorsten Lewalter, M.D., Johannes Hartung, M.D. , Andi Rroku, M.D., Burkert Pieske, M.D.,  +22, for the CLOSURE-AF Trial Investigators* [Author Info](#) & Affiliations

Published March 18, 2026 | N Engl J Med 2026;394:1270-1280 | DOI: 10.1056/NEJMoa2513310 | **VOL. 394 NO. 13**

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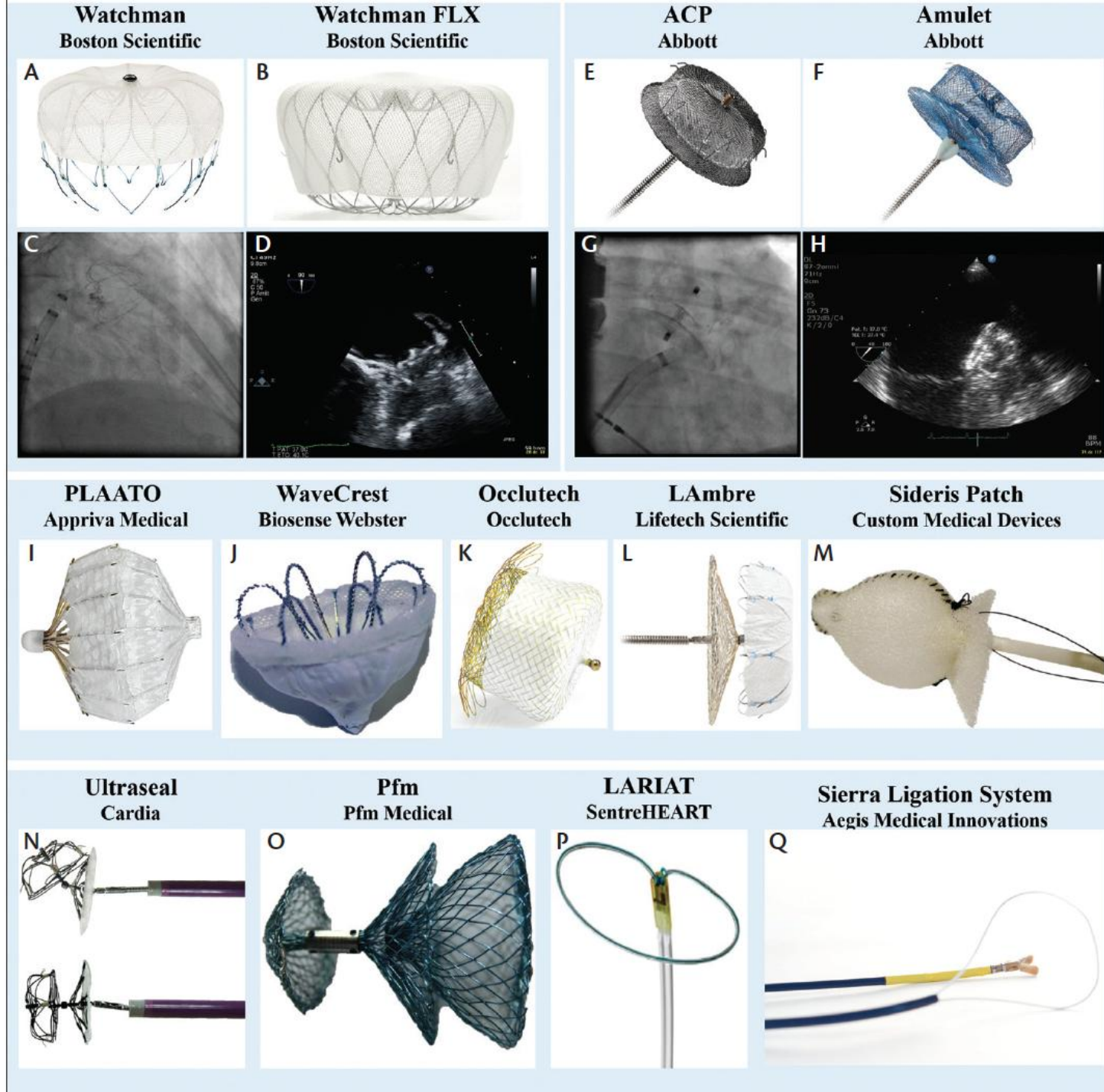
Left atrial appendage closure or Medical therapy

a first **primary end-point event** had occurred in

155 patients (incidence per 100 patient-years, 16.8) in
the device group

127 patients (incidence per 100 patient-years, 13.3) in
the medical-therapy

La appendage closure devices



Left atrial appendage closure or Medical therapy

Serious adverse events occurred in 368 patients (82.5%) in the **device group**

and 342 (77.4%) in the **medical-therapy group**



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Left Atrial Appendage Closure or Medical Therapy in Atrial Fibrillation

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Left Ventricular Unloading in High-Risk Percutaneous Coronary Intervention



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Left Ventricular Unloading in High-Risk Percutaneous Coronary Intervention

Authors: Divaka Perera, M.D. , Matthew Ryan, Ph.D. , Saad M. Ezad, Ph.D., Sohail Q. Khan, M.D., Ian Webb, Ph.D., Peter D. O'Kane, M.D., Roshan Weerackody, Ph.D.,  +23, for the CHIP-BCIS3 Investigators* [Author Info & Affiliations](#)

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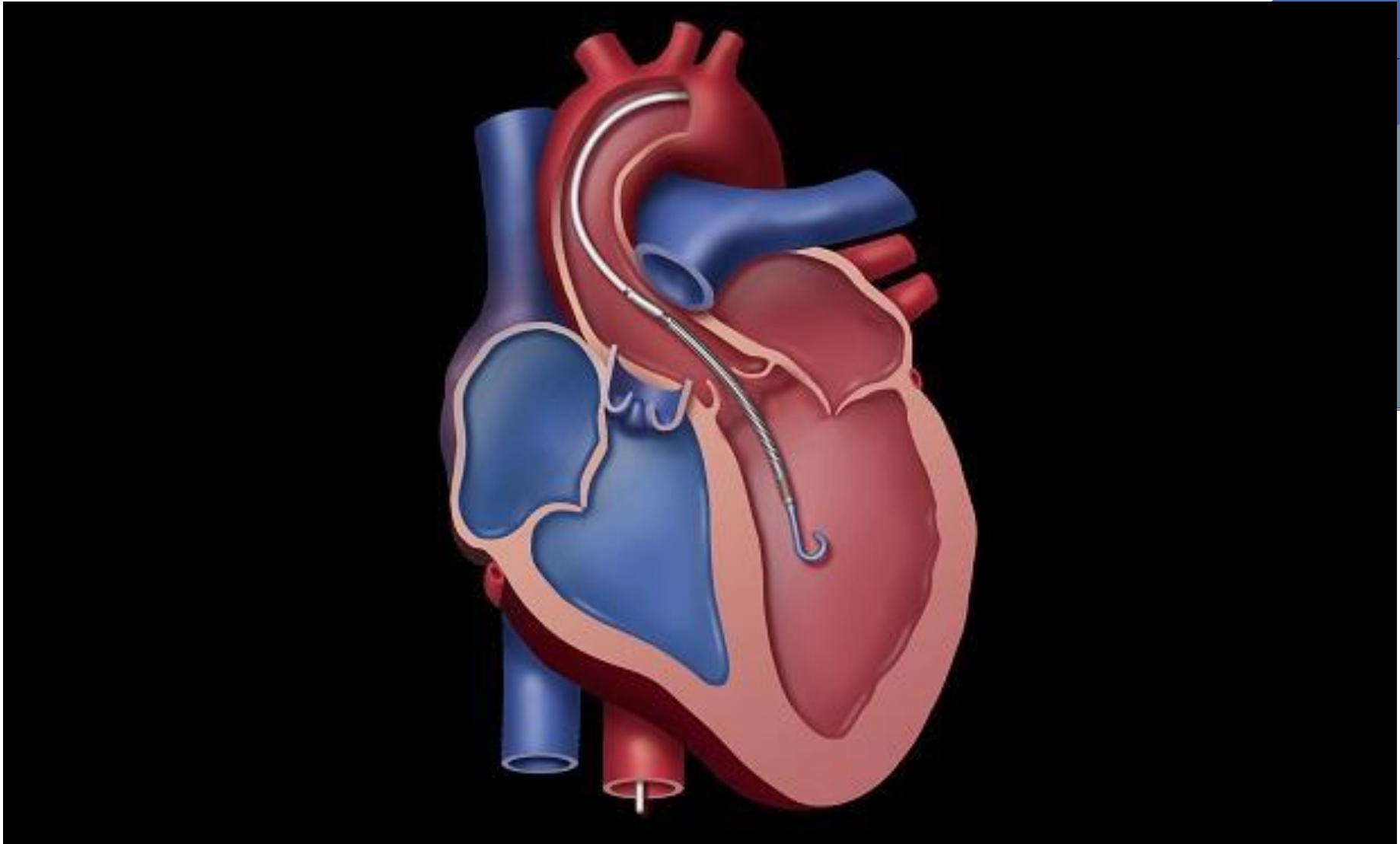


Left Ventricular Unloading in High-Risk Percutaneous Coronary Intervention

patients with severely impaired left ventricular function undergoing complex PCI

Elective left ventricular unloading with a microaxial flow pump

DID NOT reduce the risk of major adverse clinical outcomes at a minimum of 12 months.



Ultrasound-Facilitated, Catheter-Directed Fibrinolysis for Acute Pulmonary Embolism



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Ultrasound-Facilitated, Catheter-Directed Fibrinolysis for Acute Pulmonary Embolism

Authors: Kenneth Rosenfield, M.D., Frederikus A. Klok, M.D., Ph.D. , Gregory Piazza, M.D. , Andrew S.P. Sharp, M.D., Fionnuala Ní Áinle, M.D., Michael R. Jaff, D.O. , Stefano Barco, M.D., Ph.D.,  +30, for the HI-PEITHO Investigators* [Author Info & Affiliations](#)

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Ultrasound-Facilitated, Catheter-Directed Fibrinolysis for Acute Pulmonary Embolism

273 patients in each group

A primary-outcome event occurred in

11 patients (4.0%; 95% confidence interval [CI], 2.3 to 7.1) in the intervention group

28 (10.3%; 95% CI, 7.2 to 14.5) in the control group (relative risk, 0.39; 95% CI, 0.20 to 0.77; P=0.005).

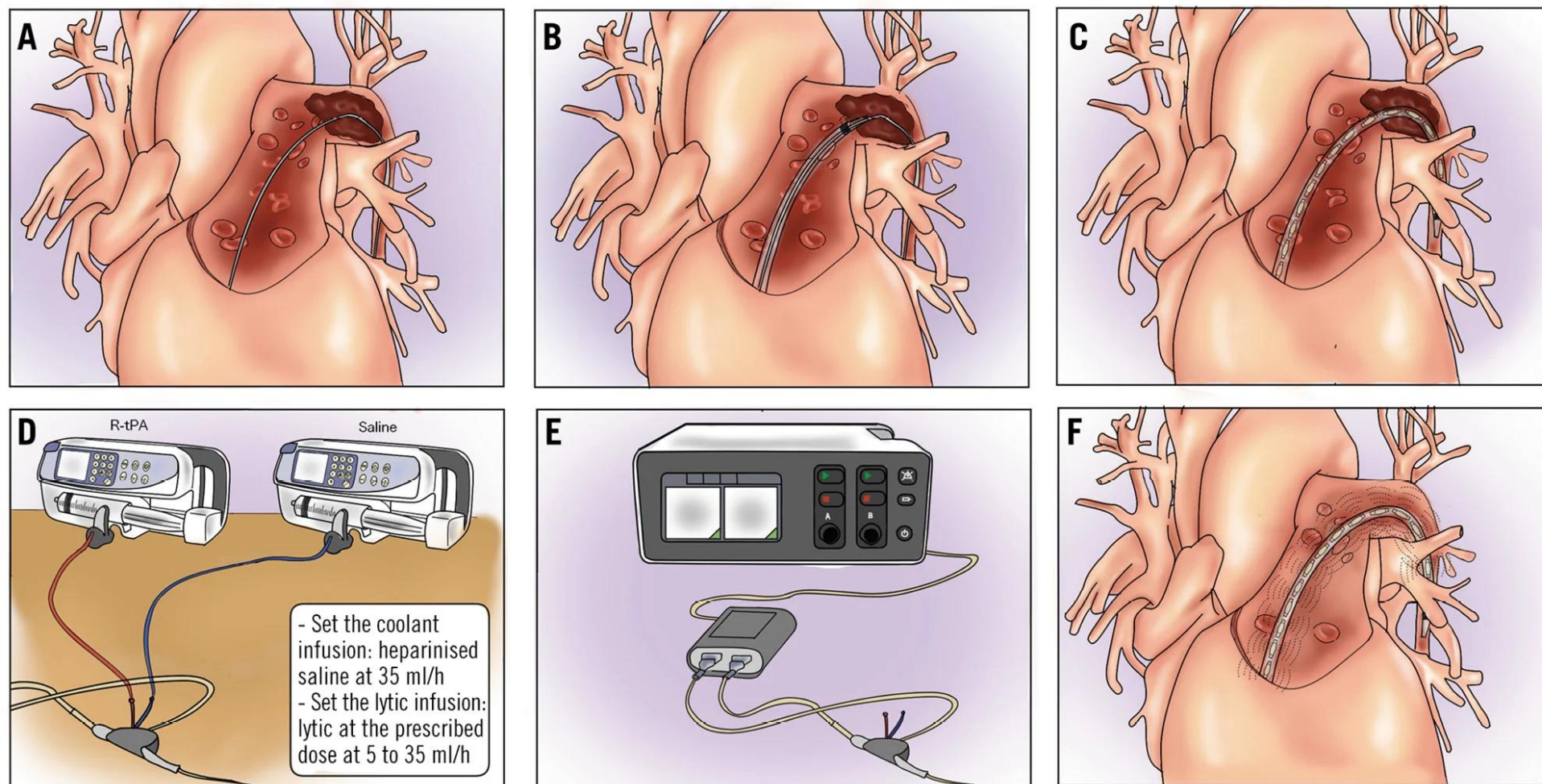
Ultrasound-Facilitated, Catheter-Directed Fibrinolysis for Acute Pulmonary Embolism

Intermediate risk pulmonary embolism

Better results with ultrasound facilitated catheter-directed fibrinolysis

Ultrasound facilitated catheter directed thrombolysis

41



Future directions

Ongoing developments include novel biomarkers, radiation-minimizing protocols, and broader AI/IVI integration.

Photon-counting CT promises routine ultrahigh-resolution CCTA; DCBs may rival DES in more scenarios.

Photon-counting CT and AI integration promise ultra-low radiation CCTA.

These advances improve outcomes, cut costs, and personalize CAD care.

Ongoing trials for DCBs in de novo lesions and robotics in routine PCI.
ESC 2024 guidelines prioritize imaging-guided PCI for complex cases

Thank you

