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Dr Mario Finazzo graduated in Medicine from the University of Palermo in 1992 and completed his specialization in Diagnostic Radiology in 1997, both with honours. He worked at the University Hospital of Palermo and later as a consultant radiologist at S. Cimino Hospital and ARNAS Ospedale Civico in Palermo. Since 2010, he has served as Medical Director of Studio di Radiologia Finazzo.

His scientific work spans cardiovascular MRI, aortic imaging and coronary CT angiography, with recent research focusing on advanced image reconstruction and coronary stent assessment. He has co-authored scientific articles, ten book chapters and several EPOS and Eurorad contributions. His educational exhibit on imaging of the postoperative aorta received a Cum Laude award at ECR 2020.

He has developed extensive clinical experience in CT angiography (CTA), with a particular focus on Coronary CTA. He has attended major international radiology congresses and advanced cardiovascular imaging courses in Leiden, Rotterdam and Erlangen.

PREFACE

This is not meant to be a comprehensive or systematic textbook. In many ways, it is an imperfect book, almost a work in progress–and probably one that will never feel completely finished.

It is simply an attempt to bring together what I have learned over the years from performing CCTA in everyday clinical practice.

The book reflects my personal experience, the cases that have taught me the most, and the aspects of CCTA that I have found especially interesting: coronary atherosclerotic disease, chronic total occlusions, stents, CABG, and the technical details that can make such a difference in daily work.

For this reason, it is deliberately practical and strongly image-based.

Many of the points discussed come from real cases, practical observations, mistakes, solutions, and lessons learned along the way.

CT perfusion and photon-counting CT are included mainly as a glimpse of where cardiac CT may be heading next.

I hope these pages will be useful to those who already perform CCTA and, perhaps, encourage those who have not yet embraced it to explore what is still, for me, the CT application I find most fascinating.

Mario Finazzo

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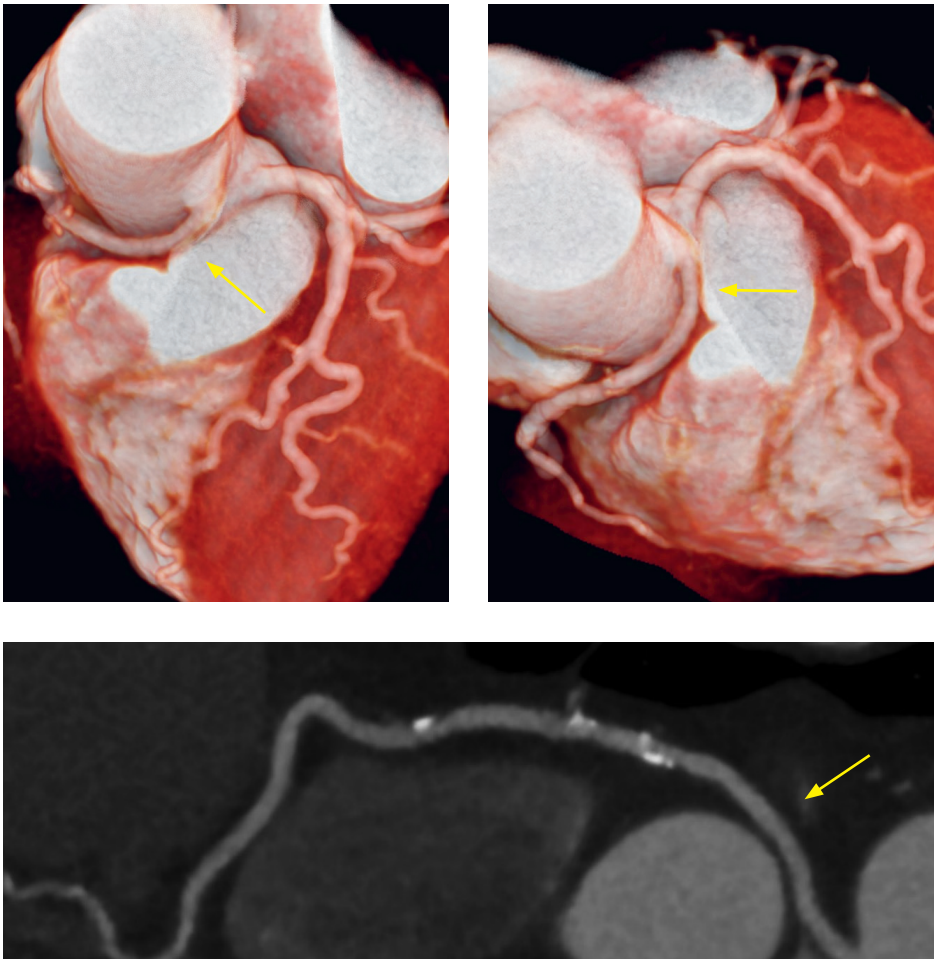


FIGURE 1.5

Anomalous origin of the right coronary artery from the left sinus of Valsalva, with an initial interarterial course between the aortic root and the main pulmonary artery (yellow arrows).

VIDEO

Anomalous origin of the right coronary artery from the left sinus of Valsalva (orange arrows), with an initial interarterial course between the aortic root and the main pulmonary artery.

CHAPTER 4

CORONARY ATHEROSCLEROTIC PLAQUES

Mario Finazzo

Coronary CT angiography (CCTA) has evolved into one of the most powerful non-invasive techniques for the direct visualisation of coronary atherosclerosis. Its role extends far beyond simply answering the question of whether a stenosis is haemodynamically significant. Rather, CCTA allows a comprehensive characterisation of the overall atherosclerotic burden, plaque morphology, spatial distribution along the coronary tree, and the identification of morphological markers associated with plaque vulnerability and a higher risk of major adverse cardiovascular events.

MOVING BEYOND "STENOSIS HUNTING"

Coronary artery disease is not merely a focal narrowing of the lumen; it is a diffuse, progressive, and biologically dynamic process. Many plaques are non-obstructive and produce less than 50% luminal narrowing, yet they may still be clinically relevant because they represent the substrate for future destabilisation.

CCTA enables detection of atherosclerosis even in the absence of significant stenosis, distinguishes between calcified, mixed, and non-calcified plaques, and identifies patterns suggestive of higher-risk phenotypes (fig. 4.1). In this way, CCTA shifts the clinical paradigm from a purely "stenosis-centred" approach to a broader "plaque-centred" model, focusing on how much atherosclerosis is present, what type it is, where it is located, and how extensive it is throughout the coronary circulation.

POSITIVE REMODELLING

Positive remodelling refers to an increase in the external vessel calibre at the site of a plaque compared with an adjacent, relatively healthy reference segment. It represents a compensatory outward expansion of the vessel wall in response to plaque accumulation (figs. 4.2, 4.3, 4.4).

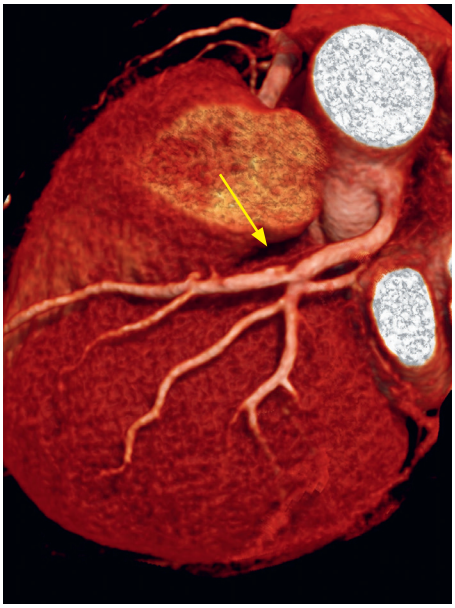
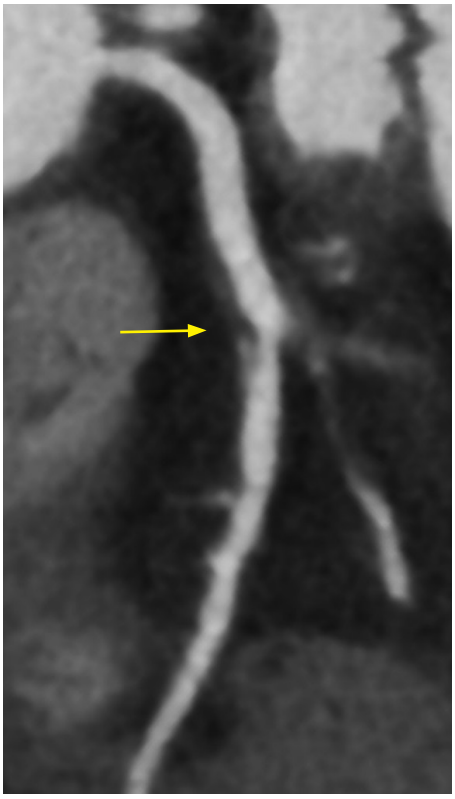
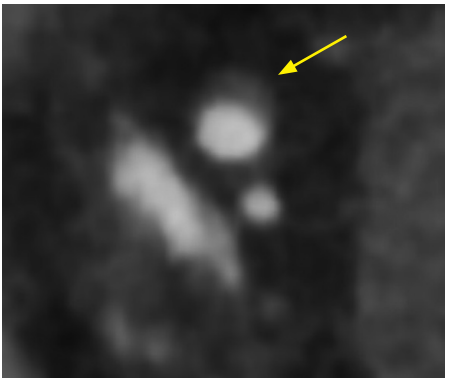
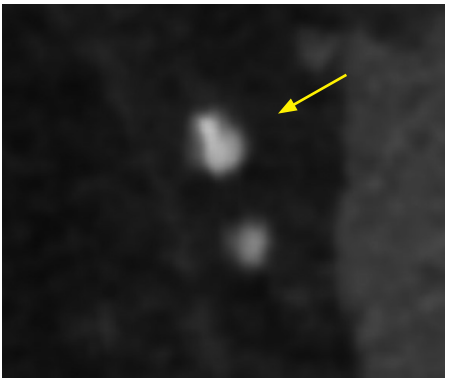


FIGURE 4.1

Eccentric predominantly lipid-rich mixed plaque in the proximal-to-mid left anterior descending artery, with mild stenosis (yellow arrows).







CHAPTER 8

TECHNICAL CONSIDERATIONS, POST-PROCESSING TECHNIQUES, AND PRACTICAL TIPS

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Francesca Finazzo

CT SCANNER ARCHITECTURES AND ECG-SYNCHRONIZED ACQUISITION IN CORONARY CT ANGIOGRAPHY

Coronary CT angiography (CCTA) requires high spatial resolution to depict small coronary vessels and high temporal resolution to limit cardiac motion. Image quality therefore depends not only on detector technology but also on scanner architecture, gantry rotation speed, detector coverage, ECG synchronization, and acquisition mode. Modern cardiac CT systems can be broadly classified as single-source or dual-source scanners, with either conventional or wide-area detector coverage.

Single-source and dual-source CT systems

Single-source CT scanners use one X-ray tube and one opposing detector array (fig. 8.1). With conventional half-scan reconstruction, data are collected over approximately half a gantry rotation, resulting in a nominal temporal resolution close to one-half of the rotation time. Thus, a scanner with a 275-ms rotation time provides a nominal temporal resolution of approximately 137.5 ms. Multi-segment reconstruction may combine data from two or more consecutive cardiac cycles, potentially reducing the effective temporal resolution to below 70 ms. However, this approach requires a stable and reproducible rhythm; beat-to-beat variability may cause misregistration because the reconstructed data originate from different cardiac cycles.

Dual-source systems use two X-ray tubes and two detector arrays positioned at an angular offset, typically close to 90° (fig. 8.2). Since each source needs to acquire only approximately one-quarter of a rotation, temporal resolution is markedly improved and may reach approximately 65-85 ms, depending on the scanner generation. This reduces dependence on very low heart rates and facilitates systolic imaging in patients with higher heart rates. Some dual-source systems also support prospectively triggered high-pitch spiral acquisition, allowing the entire heart to be scanned within a single cardiac cycle.

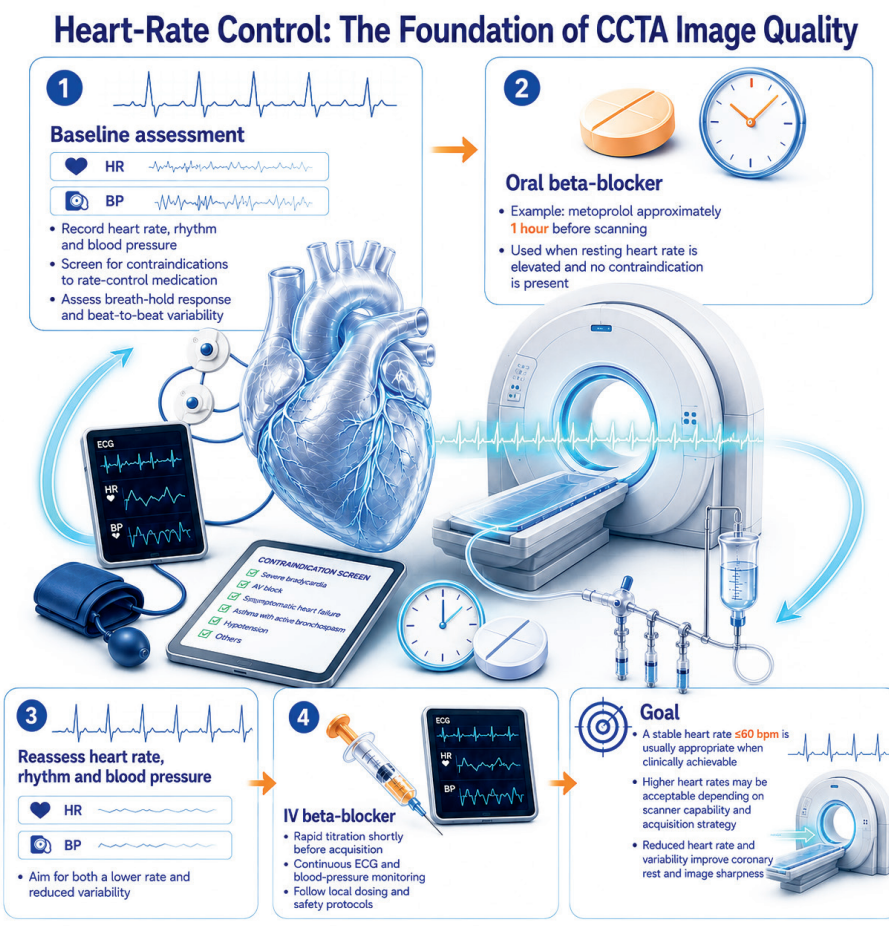


FIGURE 8.13

Beta-blockade is the cornerstone of pharmacologic preparation for CCTA. Oral or intravenous beta-blockers may be used to reduce heart rate and beat-to-beat variability, thereby improving temporal resolution and image sharpness. Careful screening for contraindications, including severe hypotension, advanced atrioventricular block, decompensated heart failure, and severe bronchospastic disease, is essential.

CHAPTER 11

STRESS CT MYOCARDIAL PERFUSION

Olga Śliwicka
Mario Finazzo

WHY PERFORM STRESS CTP?

Anatomical stenosis severity does not always predict physiological significance. Calcification, stents, multiple sequential stenoses, diffuse disease, and intermediate narrowing may make CCTA difficult to interpret or may exaggerate the apparent severity of disease. Conversely, patients with ischemia and non-obstructive coronary arteries (Inoca) may have microvascular or diffuse disease without a focal severe stenosis. Stress CTP addresses the practical question: does a visible coronary abnormality cause inducible ischemia?

Best Use

Stress CTP should be reserved for cases in which clinically relevant uncertainty remains and its findings may influence patient management. It provides limited additional value after a clearly normal CCTA or when the clinical scenario already warrants invasive evaluation or treatment.

CORE PRINCIPLES

How Vasodilator Stress Reveals Ischemia

Stress CTP is based on the relationship between coronary resistance and myocardial flow reserve. At rest, coronary autoregulation allows the distal microcirculation to maintain myocardial blood flow across a broad range of perfusion pressures. Consequently, a moderate epicardial stenosis may not produce an evident resting perfusion abnormality, because resistance vessels downstream from the lesion can dilate and preserve flow. Rest imaging alone may therefore remain normal until the stenosis becomes advanced or resting flow can no longer be maintained.

Vasodilator stress changes this equilibrium. In normally supplied territories, adenosine-pathway stimulation markedly reduces microvascular resistance

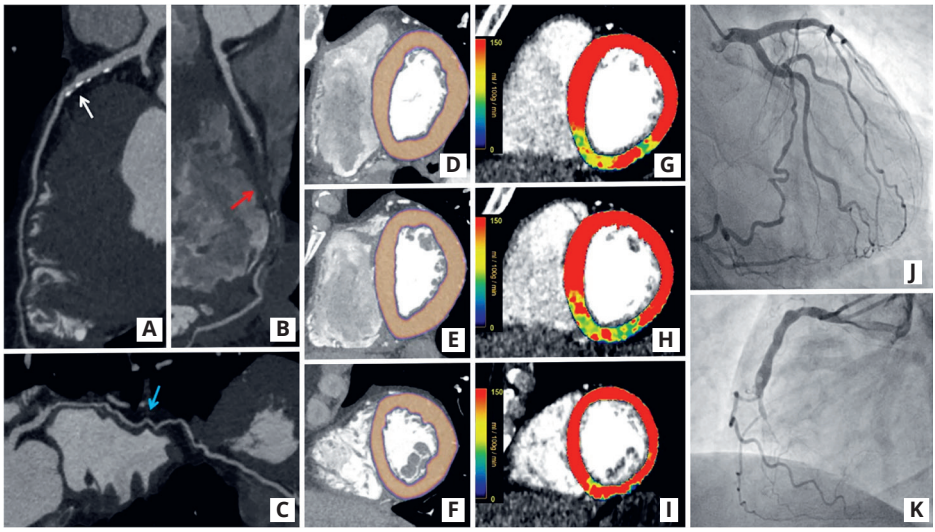


FIGURE 11.1

A, B, C: Coronary CTA demonstrated moderate mid-LAD stenosis (A, white arrow), chronic total occlusion of the mid-RCA (B, red arrow), and collateral supply to the RCA from the LCX (C, blue arrow).
D, E, F: rest myocardial perfusion assessment showed fully viable myocardium.
G, H, I: following adenosine administration, dynamic stress CTP demonstrated inducible ischemia involving the basal-to-mid inferoseptal and inferior walls and the basal inferolateral wall.
J, K: invasive assessment confirmed the absence of relevant LAD stenosis, collateral supply from the LCX, and chronic total occlusion of the mid-RCA.

CTA: computed tomography angiography; LAD: left anterior descending coronary artery; RCA: right coronary artery; LCX: left circumflex coronary artery; CTP: computed tomography perfusion.

Source: Sliwicka O, Sechopoulos I, Baggiano A, Pontone G, Nijveldt R, Habets J. Dynamic myocardial CT perfusion imaging-state of the art. Eur Radiol. 2023 Aug;33(8):5509-5525.