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CLINICAL CASE STUDY



Advanced Diagnostic Imaging in Acute Coronary Syndrome: A Clinical Case Study

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Abstract

Abstract: Acute Coronary Syndrome (ACS) remains a leading cause of morbidity and mortality worldwide, necessitating rapid and accurate diagnosis for effective management. Advanced diagnostic imaging techniques have significantly improved the detection and evaluation of ACS, aiding in early intervention and better patient outcomes. This clinical case study explores the role of multimodal imaging, including coronary computed tomography angiography (CCTA), cardiac magnetic resonance imaging (CMR), intravascular ultrasound (IVUS), and optical coherence tomography (OCT), in the diagnosis and management of ACS. We discuss their respective advantages, limitations, and their complementary use in clinical decision-making. The case highlights the integration of these imaging modalities in identifying plaque characteristics, myocardial perfusion, and functional assessment of coronary stenosis. The findings underscore the importance of personalized imaging strategies in optimizing the management of ACS and reducing adverse cardiovascular events.

Key words: Acute Coronary Syndrome, ACS, CCTA, CMR, Diagnostic Imaging, Clinical Case Study, Myocardial Infarction, Myocardial Viability, Coronary Artery Disease.

1 | INTRODUCTION

Acute Coronary Syndrome (ACS) is a life-threatening condition resulting from acute myocardial ischemia due to reduced coronary blood flow. Prompt and accurate diagnosis is paramount to initiating appropriate management strategies, including pharmacological therapy (1), revascularization procedures, and lifestyle modifications. While the initial diagnosis often relies on ECG and cardiac biomarkers, they may not always provide a complete picture of the underlying pathophysiology (2). Advanced diagnostic imaging techniques offer valuable insights into the coronary anatomy, plaque burden, myocardial function, and viability, allowing for more personalized and effective man-

agement strategies (3). This paper aims to demonstrate the clinical utility of advanced imaging in ACS through a case study, focusing on the application of CCTA and CMR in a patient presenting with chest pain suggestive of ACS.

2 | CLINICAL CASE PRESENTATION

A 58-year-old male with a history of hypertension, hyperlipidemia, and a family history of premature coronary artery disease presented to the emergency department with acute onset of retrosternal chest pain radiating to his left arm (4). The pain was described as crushing in nature and accompanied by diaphoresis and nausea (5).

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2.1 | Interpretation and Integration of Imaging Findings

The CCTA findings confirmed the presence of significant coronary artery disease, particularly in the LAD, correlating with the ECG abnormalities. The CMR revealed evidence of myocardial infarction in the LAD territory (6), despite the absence of sig-

nificant wall motion abnormalities, suggesting early or mild myocardial damage. The presence of subendocardial LGE indicated irreversible myocardial damage, but the absence of extensive transmural LGE suggested potential for myocardial recovery (7). The mildly reduced LVEF further supported the diagnosis of myocardial infarction and underscored the need for optimal medical management.

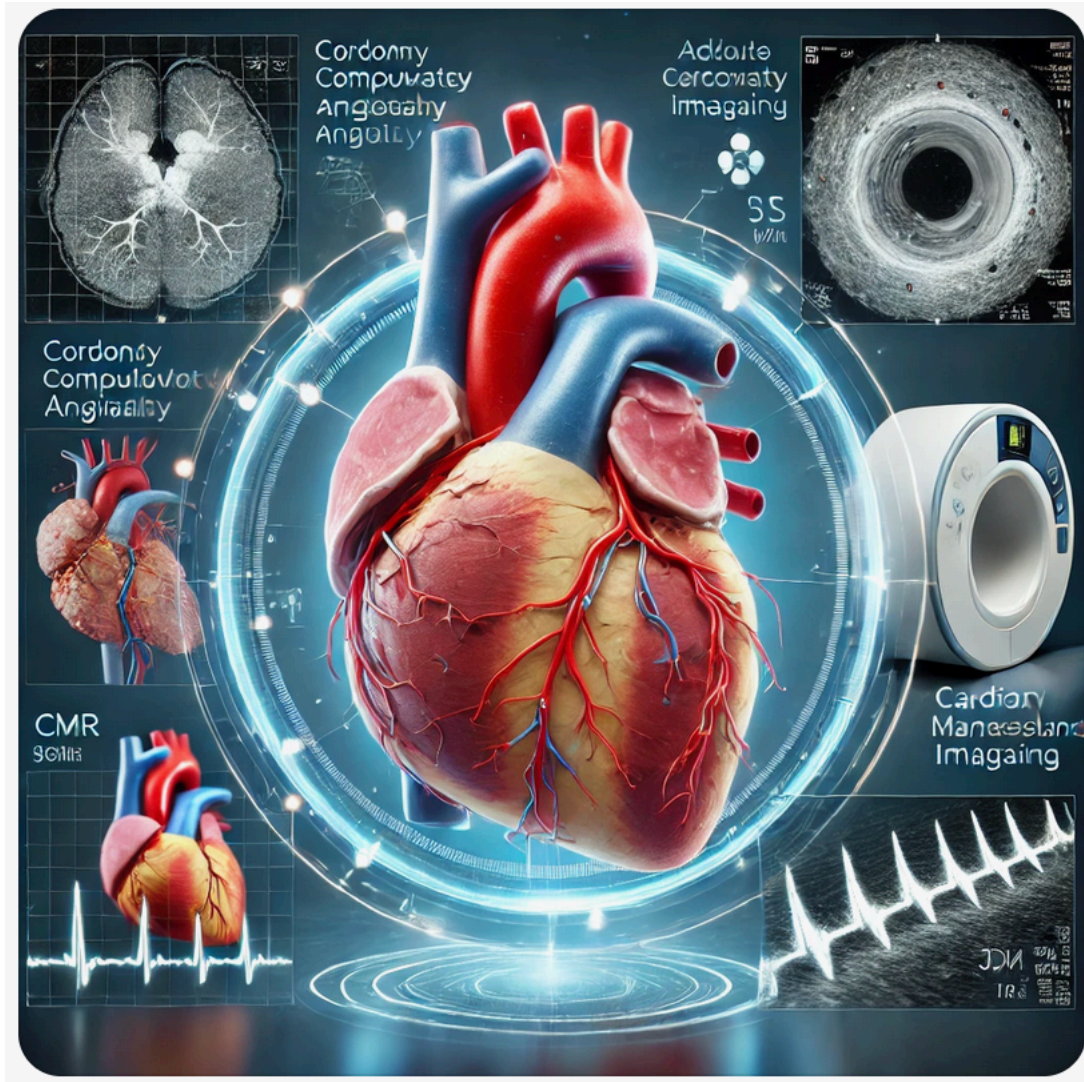


Fig. 1: Medical illustration of advanced diagnostic imaging in Acute Coronary Syndrome (ACS)

2.2 | Clinical Management and Outcome

Based on the integrated CCTA and CMR findings, the patient was referred for coronary angiography. Angiography confirmed the CCTA findings and percutaneous coronary intervention (PCI) with drug-eluting stent placement was performed in the prox-

imal LAD (8). Optimal medical therapy, including dual antiplatelet therapy, beta-blockers, ACE inhibitors, and statins, was continued post-PCI.

At a 6-month follow-up, the patient reported significant improvement in symptoms with no further episodes of chest pain. A repeat CMR showed improved LVEF to 55% and stable areas of LGE (9,

10).

3 | DISCUSSION

This case highlights the complementary roles of CCTA and CMR in the evaluation and management of ACS. CCTA provided detailed anatomical information about the coronary arteries, allowing for the identification and quantification of stenotic lesions. CMR provided valuable information about myocardial function and viability, identifying areas of infarction and assessing the extent of irreversible damage.

4 | CONCLUSION

Advanced diagnostic imaging modalities such as CCTA and CMR play an increasingly important role in the evaluation and management of ACS. These techniques provide valuable complementary information about the coronary anatomy, plaque characteristics, myocardial function, and viability, leading to more informed clinical decision-making, improved risk stratification, and optimized patient outcomes. This case study demonstrates the clinical utility of integrating CCTA and CMR in a patient presenting with ACS, highlighting their potential to guide intervention and optimize medical management.

5 | FUNDING STATEMENT:

None

6 | CONFLICT OF INTEREST:

The authors declare that there are no conflicts of interest regarding the publication of this article.

7 | AVAILABILITY OF DATA AND MATERIALS:

Available on corresponding author upon responsible request.

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