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The Importance of Defining the Coronary Anatomy in Suspected Myopericarditis: A Case Report

Authors' Contribution:
Study Design A
Data Collection B
Statistical Analysis C
Data Interpretation D
Manuscript Preparation E
Literature Search F
Funds Collection G

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Patient: Male, 36-year-old
Final Diagnosis: NSTEMI
Symptoms: Chest discomfort
Medication: —
Clinical Procedure: Coronary angiogram via trans radial route
Specialty: Cardiology • General and Internal Medicine

Objective: Unusual clinical course

Background: It is challenging to distinguish between acute coronary syndrome (ACS) and myocardial injury due to alternative causes (eg myopericarditis, coronary vasospasm, and pulmonary embolism), as they often share similar presentations, especially in young patients. Coronary computerized tomography angiography (CCTA) is increasingly recognized as a fast and safe diagnostic tool for rapid assessment of the coronary anatomy among patients with a low to intermediate cardiovascular risk profile and/or atypical chest pain. However, its utility among patients with possible ACS is still debated.

Case Report: A 36-year-old man presented to our institution with intermittent pleuritic chest pain and malaise over the preceding 7 days. He was a smoker and his father had ACS at the age of 45 years. The patient had unspecific electrocardiographic changes and elevated troponin values. The initial transthoracic echocardiogram indicated a normal ejection fraction without any wall motion abnormalities. Presuming a very low chance of coronary artery disease due to his age and atypical symptoms, we ordered a CCTA, which identified a thrombotic lesion in the right coronary artery (RCA). An invasive coronary angiography, including an optical coherence tomography, confirmed the presence of a thrombotic lesion located at the level of the proximal RCA, which was consequently treated with 1 drug-eluting stent.

Conclusions: Physicians should always eliminate underlying coronary artery disease among patients with unclear myocardial injury, irrespective of a patient's presentation, age, and estimated cardiovascular risk. In this context, CCTA represents a safe and simple tool to rapidly assess the coronary anatomy, especially in younger patients.

Keywords: Acute Coronary Syndrome • Coronary Angiography • Coronary Artery Disease • Myocardial Infarction • Pericarditis

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Background

In recent years, the widespread use of highly sensitive cardiac troponin assays have improved the early diagnosis of acute myocardial infarction (MI). However, the use of these assays leads to the early recognition of myocardial injury secondary to alternative causes, including myopericarditis, coronary vasospasm, hypertension, severe anemia, and pulmonary embolism. This early recognition leads to some diagnostic dilemmas [1] and 14% to 33% of all patients with suspected acute coronary syndrome (ACS), ultimately have an alternative diagnosis [2].

Acute myopericarditis accounts for approximately 5% of all hospital admissions for acute chest pain [3]. Studies assessing the incidence and prevalence of MI vs myopericarditis in patients with an ACS presentation report various data on this incidence and prevalence. A study based on a retrospective registry reported that high troponin values in young patients (18 years to 29 years) can be the expression of both, acute (or chronic) coronary artery disease and myopericarditis, with a similar likelihood of being affected by 1 of these conditions [4]. Due to myocardial involvement, some patients present with electrocardiographic (ECG) changes and elevated cardiac biomarkers, resembling an acute MI presentation. Differentiating between ACS and MI becomes even more challenging, if the patients present with atypical symptoms, subtle ECG changes, or the lack of these symptoms or changes. Therefore, based on the clinical and ECG information, it becomes impossible to make a definitive diagnosis and the majority of patients still undergo an invasive coronary angiography to secure the final diagnosis.

However, there is growing evidence about the feasibility and safety of using a noninvasive coronary angiography called a coronary computerized tomography angiography (CCTA) for rapid assessment of the coronary anatomy among patients with a low to intermediate cardiovascular risk profile and atypical chest pain [5-9]. Moreover, studies have evaluated its utility among patients with possible ACS [10].

Here, we present the case report of a man who presented with an atypical manifestation of ACS along with a high likelihood of myopericarditis, where the use of CCTA ultimately guided patient diagnosis and management.

Case Report

A 36-year-old man presented to our emergency department with intermittent chest pain over the preceding 7 days. The pain was sharp, not aggravated by physical activities, and not alleviated by nitroglycerine. He had been generally unwell for a few days, and denied fever or prior infections. The patient had no medical history of any illnesses and did not take any medications or illicit drugs. His cardiovascular risk consisted of active smoking (21 pack years) and a family history positive for premature coronary artery disease. His father had ACS at the age of 45 years. His physical examination revealed normal body temperature, slightly elevated blood pressure (141/96 mmHg) and sinus tachycardia (heart rate of 106 beats/min). The ECG showed minimal PQ-segment depressions and diffuse ascending ST-segment elevations over the precordial leads, interpreted as early repolarization (**Figure 1**). Laboratory testing showed initially high-sensitive troponin-T (hs-TnT) level of 776 ng/L (normal range <14 ng/L), creatine kinase myocardial band (CK-MB) of 21.7 ug/L (normal range, <6.22 ug/L), total cholesterol level of 4.48 mmol/L (low density lipoprotein [LDL] level of 3.54 mmol/L), and lipoprotein (a) was 41 nmol/L (normal range <75 nmol/L). A transthoracic echocardiography showed a normal ejection fraction (60%) with neither wall motion abnormality nor pericardial effusion.

Based on his medical history and initial findings at admission, the physicians had a high suspicion of acute myopericarditis. He was admitted for continuous telemetric monitoring and further evaluation. Additional laboratory panels, including an autoimmunity screening (antinuclear antibody and anti-neutrophil cytoplasmic antibodies) were negative and/or remained inconclusive. The initial plan was to conduct a cardiac magnetic resonance imaging study during his hospitalization. Since this was not readily available and there was some residual concern about possible coronary artery disease (CAD) as well as a rapid dynamic change in the hs-TnT values (2nd value was 529 ng/L) and the presence of risk factors (smoking and the family history of premature MI), the physicians aimed to rapidly eliminate CAD from the differential diagnosis using CCTA. The CCTA showed diffuse CAD with suspected plaque rupture and thrombus formation in the proximal right coronary artery (RCA), underscoring the diagnosis of a non-ST-segment elevation myocardial infarction (NSTEMI) (**Figure 2A, 2B**).

The consecutive coronary angiography, including an optical coherence tomography study (OCT, Dragonfly, Abbott Vascular, Santa Clara, CA, USA) confirmed the CCTA findings with a thrombus in the proximal RCA (**Figure 3A**). The lesion was treated by direct stenting (Xience Sierra, Abbott Vascular, Santa Clara, CA, USA) after pretreatment using adenosine and eptifibatide (**Figure 3B**). Further characterization of the lesion revealed a red (acute) thrombus (**Figure 4**). The patient's remaining hospital stay was unremarkable and he was discharged on day 7 of hospitalization. He has had 1 follow-up after 107 days and been asymptomatic since the stenting procedure. The patient gave informed consent and the institution approved the publication of this case report.

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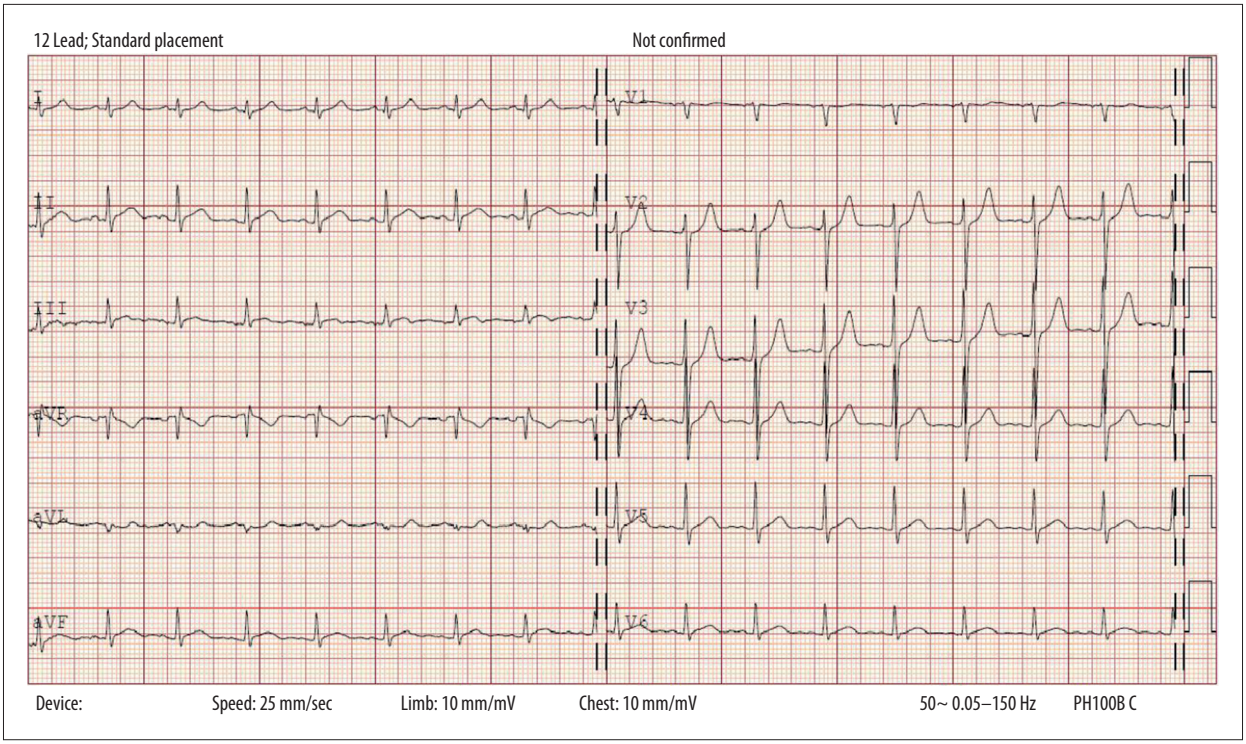

Figure 1. Electrocardiogram at admission, demonstrating an ascending ST-elevation in the precordial leads.

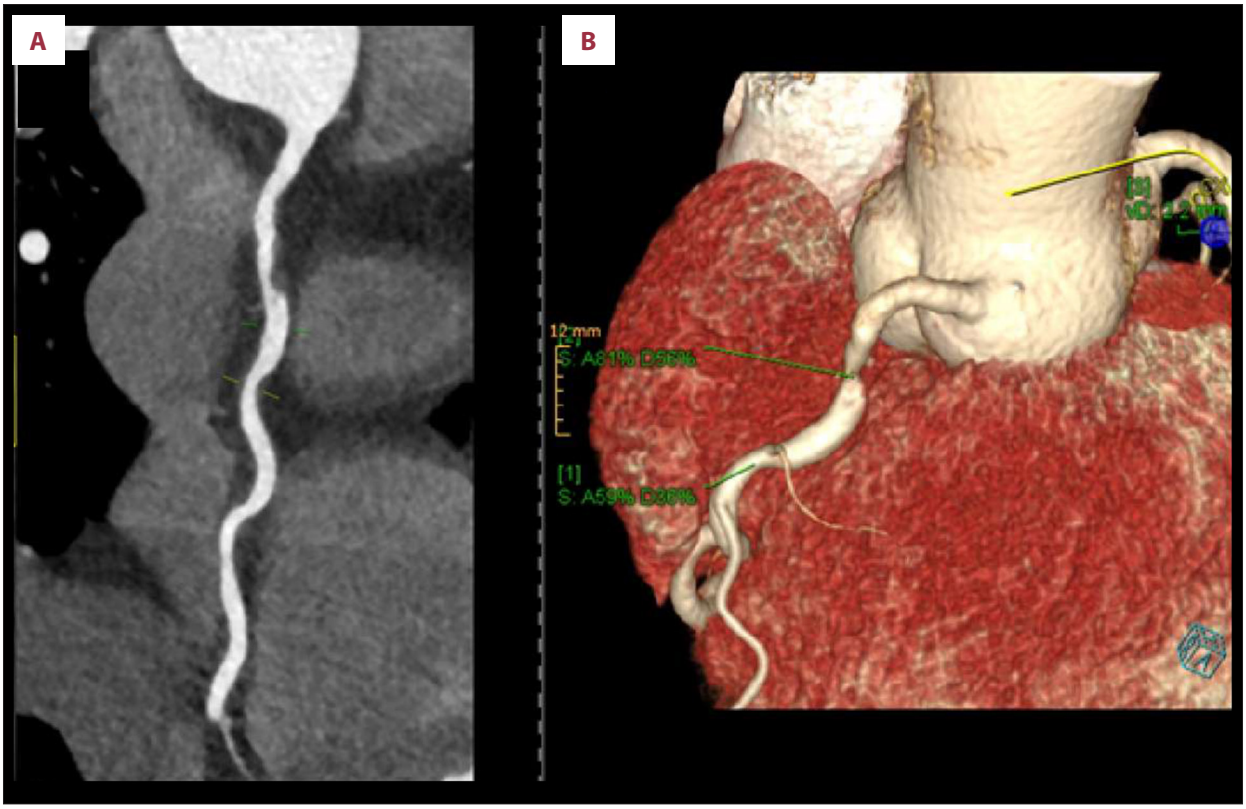

Figure 2. (**A**) Coronary computerized tomography angiography showing the proximal right coronary artery stenosis. (**B**) 3D reconstruction of the coronary computerized tomography angiography. The green arrows mark the stenotic segments.

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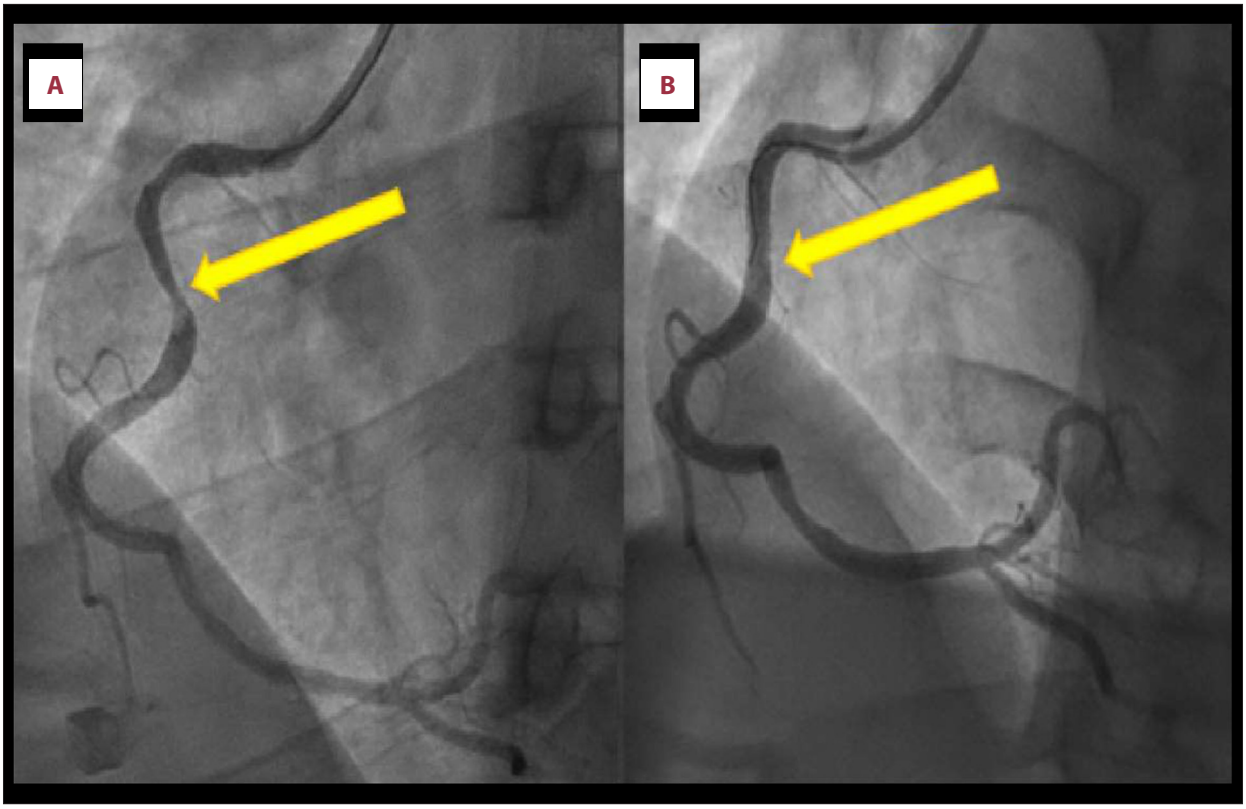

Figure 3. (**A**) Coronary angiography showing the proximal right coronary artery stenosis pre-percutaneous coronary intervention. (**B**) Coronary angiography of the right coronary artery post-percutaneous coronary intervention. The yellow arrows point to the stenotic lesions.

Discussion

We present a case report of a patient with suspected clinical myopericarditis, who was ultimately diagnosed with NSTEMI, based on rapid evaluation by CCTA. We highlight the importance of establishing the coronary anatomy in patients with elevated troponin levels (myocardial injury) of unclear origin, irrespective of the presentation.

It is important to consider that the reported prevalence of ACS in young patients (<45 years old) varies broadly, ranging from 2% to 10% of all ACS presentations. Therefore, elevated cardiac biomarkers in the setting of an atypical clinical presentation for ACS in this age group are a common cause of clinical conflict, especially in the era of highly sensitive and broadly available troponin assays, since alternative causes for myocardial injury (eg myopericarditis, coronary spasm, pulmonary embolism) are more prevalent [4]. To date, it is not possible to rule out CAD, based only on clinical assessment and laboratory testing. Although the majority of those young patients have a low to intermediate pretest probability for an MI, it is mandatory to define the coronary anatomy for further therapeutic management.

Although an invasive coronary angiography represents the criterion standard for establishing CAD, CCTA has emerged as a safe and valuable tool in the diagnostic approach for symptomatic patients with low to intermediate risk of CAD [11]. The increasing availability of modern CT scanners and the enhanced safety and accuracy of CCTA, including technological and protocol advancements (eg requiring less radiation and offering improved image resolution) have played key roles in this evolution.

Several trials have compared the sensitivity, specificity, and diagnostic accuracy of CCTA with traditional invasive coronary angiography in patients with low to intermediate CAD risk. They report that CCTA identified ≥50% stenosis with a high sensitivity (85% to 99%) and a high negative predictive value ranging between 83% and 99% [8,12,13].

The clinical utility of CCTA in stable patients with low to intermediate CAD risk has been highlighted particularly by the recent PROMISE (Prospective Multicenter Imaging Study for Evaluation of Chest Pain) trial as well as the Scottish Computed Tomography of the Heart (SCOT-HEART) trial [5,7]. The PROMISE trial showed that anatomical testing with CCTA was not superior to functional testing with regards to the primary endpoint

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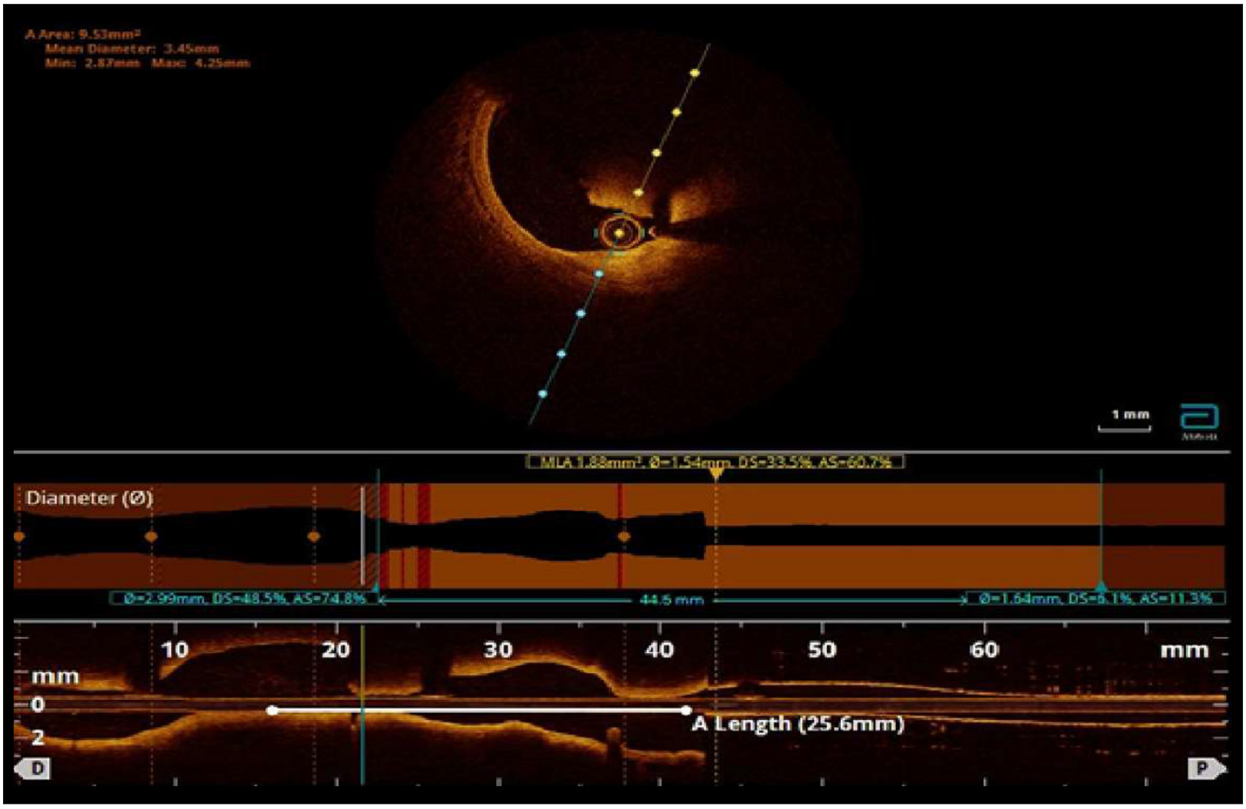

Figure 4. Optical coherence tomography of the proximal right coronary artery at the level of the stenosis. The upper part of the figure depicts a cross-section of the vessel and the presence of the (red) thrombus. The lower part of the figure shows a longitudinal section of the lesion and its length (25.6 mm).

of all-cause mortality, MI, unstable angina hospitalization, and major complications from a cardiovascular procedure, which occurred in 3.3% of the anatomical testing group vs 3.0% of the functional testing group (P=0.75) [5]. However, the SCOT-HEART trial findings, showed a decrease in the composite outcome, including cardiovascular death or nonfatal MI in the CCTA group compared to the standard of care (including predominantly exercise ECG) [7]. Although both these trials showed somewhat discrepant results in terms of hard clinical outcomes, they indicated that CCTA accurately rules out clinically relevant CAD, prevents an unnecessary invasive coronary angiography, and identifies patients who can benefit from preventive therapies (eg statins) [5]. These 2 trials emphasized the role of CCTA in the diagnosis and management of patients with a low to intermediate risk for CAD and affected the current European Society of Cardiology (ESC) guidelines and recommendations [12].

In patients with suspected NSTEMI or uncertain myocardial injury, CCTA has been increasingly recognized as a valuable tool for an expedited first evaluation. Nonetheless, the role of CCTA in ACS has been questioned, since there is more potential for the CT scan to be confounded by the presence of coronary calcium and higher heart rates. A recent analysis from the VERDICT (Very Early Versus Deferred Invasive Evaluation Using Computerized Tomography in Patients With Acute Coronary Syndromes) trial indicated that CCTA is feasible, with a positive predictive value, sensitivity and specificity of 87.9%, 96.5% and 72.4%, respectively. It is helpful in guiding the management and identification of patients who can benefit from subsequent revascularization procedures [9]. Overall, the current ESC guidelines endorse the value of CCTA in an acute setting, especially for patients like the one in this case report, who present with inconclusive symptoms and unspecific ECG changes, elevated cardiac enzymes levels, and a low to intermediate CAD risk [11]. The relevance of CCTA for the assessment of patients with uncertain myocardial injury will increase in the near future. However, more prospective studies are needed in this patient cohort to evaluate the efficacy and impact of CCTA on hard clinical outcomes, including MI or death.

Conclusions

This case report highlights the importance of assessing the coronary anatomy (irrespective of the initial clinical presentation) in patients with evidence of myocardial injury, underlining the central role of CCTA in rapid evaluation of young patients with

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unclear myocardial injury. However, there is lack of firm evidence and more prospective studies are needed to evaluate the safest diagnostic pathway for this growing patient cohort.

Department and Institution Where Work Was Done

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Conflict of Interest

M. Madanchi, G.M. Cioffi, and R. Kobza report no conflicts of interest. F. Cuculi has received consulting and speaker fees from SIS Medical (Frauenfeld, Switzerland) and Abbott Vascular (Illinois, USA). M. Bossard has received consulting and speaker fees from Amgen (Rotkreuz, Switzerland), AstraZeneca (Cambridge, UK), Bayer (Leverkusen, Germany), and Mundipharma (Basel, Switzerland).

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