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MINOCA - A Rarity Of It's Own And The Importance Of Cardiac MRI

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MINOCA - A Rarity Of It's Own And The Importance Of Cardiac MRI

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Abstract

Myocardial infarction with non-obstructive coronary arteries (MINOCA) disease is a diagnostic dilemma with clinical evidence of acute myocardial infarction (AMI) with normal coronary arteries. MINOCA is a complex issue; the management of the patients needs to be focused on identifying the core problem. Cardiac magnetic resonance (CMR) imaging is a non-invasive diagnostic tool that can play an important role in enabling clinicians to build a differential diagnosis in patients with MINOCA and also identify other non-ischemic aetiologies of myocardial injury. We present a challenging case of a patient with MINOCA with MI in small proximal septal artery distribution revealed on cardiac magnetic resonance imaging.

Keywords

Myocardial ischemia, Non-obstructive coronary arteries, Cardiac MRI.

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Conflict of Interest Statement

The authors have no conflicts of interest to declare.

CASE REPORT

MINOCA - A Rarity of it's Own and The Importance of Cardiac MRI

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Abstract

Myocardial infarction with non-obstructive coronary arteries (MINOCA) disease is a diagnostic dilemma with clinical evidence of acute myocardial infarction (AMI) with normal coronary arteries. MINOCA is a complex issue; the management of the patients needs to be focused on identifying the core problem. Cardiac magnetic resonance (CMR) imaging is a non-invasive diagnostic tool that can play an important role in enabling clinicians to build a differential diagnosis in patients with MINOCA and also identify other non-ischemic aetiologies of myocardial injury. We present a challenging case of a patient with MINOCA with MI in small proximal septal artery distribution revealed on cardiac magnetic resonance imaging.

Keywords: Myocardial ischemia, Non-obstructive coronary arteries, Cardiac MRI

1. Introduction

Myocardial infarction with non-obstructive coronary arteries (MINOCA) disease is a unique diagnostic challenge with clinical evidence of acute MI (AMI) with normal coronary arteries. Myocardial infarction with non-obstructive coronary arteries (MINOCA) has a prevalence of 6%–15% in all cases of MI with an annual mortality rate of 2–5%.¹ Diagnostic criteria include evidence of myocardial injury, absence of marked coronary artery stenosis (<50%) and elevated biomarkers without any other explanation. The management of MINOCA focuses on identifying the core etiology. CMR imaging is a non-invasive diagnostic test that is valuable in establishing a differential diagnosis in cases with MINOCA.

2. Case presentation

A 29-year-old obese male, with BMI of 40.5, who presented with acute chest pain and palpitations. Family history included sudden cardiac death in his

father at 27. EKG was consistent with inferior ST elevation MI (Fig. 1); his lab work revealed elevated initial high-sensitivity troponins of about 219 pg/ml and a delta troponin of 1029 pg/ml. He had an emergent coronary angiogram showing normal epicardial coronaries. Transthoracic echocardiography did not show any abnormality, with reported normal left ventricular size and function, no segmental wall motion abnormalities and an estimated left ventricular ejection fraction of 65%. Furthermore, the echo also showed normal diastolic function, with normal right ventricular size and function, and a normal pericardium and valvular anatomy. The patient's lipid profile showed a low-density lipoprotein (LDL) of 117 mg/dl and triglycerides of 182 mg/dl. A Cardiac MRI (CMRI) was performed which revealed an area of endocardial late gadolinium enhancement (LGE) in the basal anteroseptal wall, consistent with MI in a small proximal septal artery distribution. Coronary vasospasm was considered the cause for MINOCA based on clinical presentation; the patient was started on calcium channel blockers and statins and discharged home.

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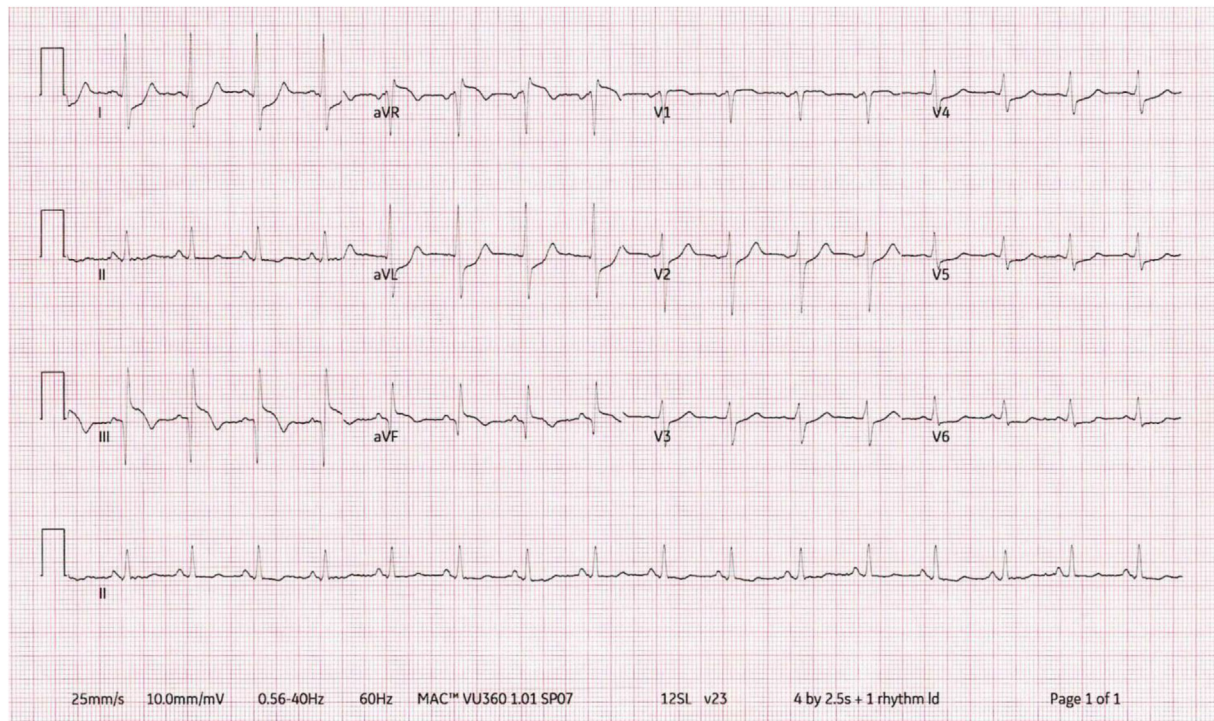


Fig. 1. Patient's EKG showing inferior wall ST elevation MI.

3. Discussion

Myocardial infarction with non-obstructive coronary arteries (MINOCA) has a prevalence of 6%–15% in all cases of Myocardial Infarction.¹ The clinical outcomes of young MINOCA patients are comparable to their counterparts with myocardial infarction with obstructive coronary artery disease.² Coronary Angiography is usually the initial diagnostic test; cardiac imaging is performed to determine the etiology of the MI if angiography is inconclusive. CMRI has the advantage of being a radiation-free, non-invasive diagnostic tool. It plays a key role in assessing and identifying the underlying cause of MINOCA by providing detailed information regarding cardiac structure and function, in addition to specifying the area of reversible and irreversible myocardial injury. Cardiac MRI lets you assess the thickness of myocardial wall and also helps you in assessing regional wall motion, which is usually affected in acute or chronic ischemic insults. CMRI can precisely determine myocardial edema, inflammation and scarring thus confirming the diagnosis of MINOCA and providing important prognostic information as well as playing a key role in the management.³

CMRI can differentiate between ischemic and non-ischemic causes of myocardial injury, which has proven invaluable in understanding and, facilitating diagnosis for the appropriate management

and prognostic implications.^{4–6} While performing CMRI, timing is of the essence; when performed within the first 2 weeks of the symptoms, CMRI can be instrumental in accurately diagnosing the etiology.⁴ Some criteria have a dynamic and transient disposition and, if performed later than 7–12 days, CMRI findings may seem misleadingly normal, leading to misdiagnosis.⁷ CMRI can provide a detailed and precise diagnosis of a wide array of cardiac pathologies and differentially diagnose other pathologies mimicking MINOCA with high sensitivity and specificity. CMRI is useful in establishing the cause in 65%–90% of MINOCA cases, ensuring appropriate management and improving clinical outcomes.⁸ A systemic review/meta-analysis concluded that CMRI led to reclassification in 68% of the patients with a working diagnosis of MINOCA.⁷ The American Heart Association and European Society of Cardiology, have acknowledged the key role of CMRI in the diagnosis of MINOCA.³

CMRI protocol for assessing MINOCA patients comprises studying cardiac structure and function with cine imaging, myocardial edema presence with T2-weighted (T2w-STIR) image and presence of myocardial damage with late gadolinium enhancement (LGE) imaging. These techniques can also elucidate the mechanism of myocardial injury and especially identify small foci of fibrosis. Parametric

mapping, an advanced standardized CMRI technique, has a higher diagnostic precision. T1 mapping and LGE illustrate quantification of MI size. LGE can also highlight specific forms of scarring differentiating ischemic and non-ischemic causes. The use of new tissue characterization techniques, T1 and extracellular volume (ECV), and T2 mapping are advocated because of their high sensitivity and specificity, as well as diagnostic precision in identifying myocardial insult. Different MR sequences used in MINOCA cases yield different results for the varied etiologies of MINOCA. CMRI with gadolinium enhancement is the gold standard to differentiate the transmural lesions. A multivariate CMRI Protocol including T1 mapping, LGE imaging, HR LGE, when done during the acute phase, can remarkably alter the management plan and prognosis.⁹

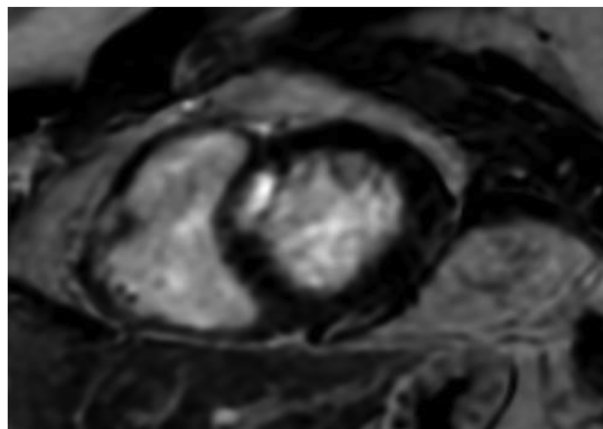
Several studies have advocated using CMRI imaging in MINOCA patients and correlating the results of different diagnostic tests for targeted management.⁵ There is growing consensus that a multimodality cardiac imaging strategy using different techniques is extremely useful in the management of MINOCA patients, modifying each individual patient's management plan according to their specific triggering factor and in turn significantly improving clinical outcomes.¹⁰ A study reported that CMRI combined with coronary OCT identified the causative factors of MINOCA in 84% of the cases.¹¹

The management of MINOCA cases depends on the etiology, studies have emphasized the importance of CMRI as a technique of choice in MINOCA patients when the etiology is in doubt.⁹ CMRI has been shown to have a significant role in not only the diagnosis but also the management as well as prognosis of MINOCA patients. Current clinical practice guidelines recommend CMRI should be fundamental as the diagnostic algorithm to recognize true MINOCA cases due to ischemic insult, with a distinctive treatment plan and prognosis compared to non-ischemic causes; this will pave the way to assess the merits of the drugs that are advised accordingly.⁷

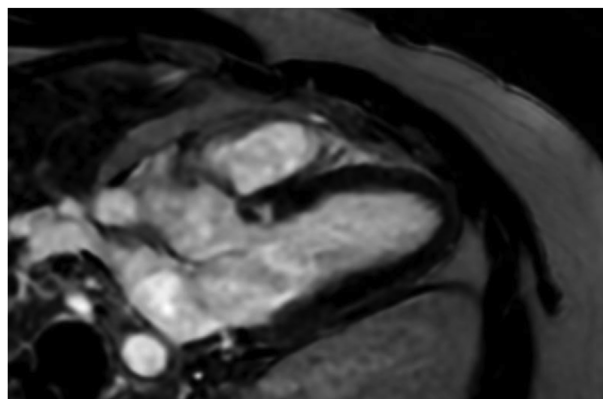
CMRI enables stratification of MINOCA patients with unfavorable prognosis which can be crucial in modifying the treatment plan of such patients as well as the long-term monitoring of cardiac function and remodeling in such patients.¹² CMRI has a high diagnostic yield in the assessment of MINOCA and should be considered for such patients at their index/initial presentation for the targeted management strategy of MINOCA, leading to improved patient clinical outcomes.

4. Imaging

Both Views Showing Basal Anteroseptal Scar



Short Axis View MDE Sequence



Short Axis View Grey Blood Sequence

Conflicts of interest

The authors have no conflicts of interest to declare.

References

1. Pasupathy S, Air T, Dreyer RP, Tavella R, Beltrame JF. Systematic review of patients presenting with suspected myocardial infarction and nonobstructive coronary arteries published correction appears in *Circulation*. *Circulation*. 2015 May 12;131(19):e475. <https://doi.org/10.1161/CIRCULATIONAHA.114.011201>, 2015;131(10):861-870.
2. Asöl S, Baroş V, Özgür, et al. Myocardial infarction with non-obstructive coronary artery disease, a retrospective cohort study: are plaque disruption and other pathophysiological mechanisms the same disease? *J Surg Med*. 2021;5(1):50–54.
3. Liang K, Nakou E, Buono MGD, Montone RA, D'Amario D, Ducci CB. The role of cardiac magnetic resonance in myocardial infarction and non-obstructive coronary arteries. *Front Cardiovasc Med*. 2022;8:821067.
4. Montone RA, Jang IK, Beltrame JF, et al. The evolving role of cardiac imaging in patients with Myocardial Infarction and

- non-obstructive coronary arteries. *Prog Cardiovasc Dis.* 2021; 68:78–87. <https://doi.org/10.1016/j.pcad.2021.08.004>.
5. Tayal B, Freeman P, Ericsson F, et al. Characterisation of patients with and without cardiac magnetic resonance imaging abnormalities presenting with myocardial infarction with non-obstructive coronary arteries (MINOCA). *Acta Cardiol.* 2021;76(7):760–768.
 6. Luis SA, Luis CR, Habibian M, et al. Prognostic Value of CMRI in acute coronary syndrome patients with Troponin Elevation and non-obstructive coronary arteries. *Mayo Clin Proc.* 2021; 96(7):1822–1834. <https://doi.org/10.1016/j.mayocp.2020.11.026>.
 7. Mileva N, Paolisso P, Gallinoro E, et al. Diagnostic and prognostic role of cardiac magnetic resonance in MINOCA, systematic review and meta-analysis. *JACC Cardiovasc Imag.* 2023;16(3):376–438. <https://doi.org/10.1016/j.jcmg.2022.12.029>.
 8. Vicente-Ibarra N, Feliu E, Bertomeu-Martínez V, et al. Role of cardiovascular magnetic resonance in the prognosis of patients with myocardial infarction with non-obstructive coronary arteries. *J Cardiovasc Magn Reson.* 2021;23(1):83. <https://doi.org/10.1186/s12968-021-00773-w>. Published 2021 Jul 1.
 9. De Michele F, Guerra FS, Forte V, et al. Cardiovascular magnetic resonance (CMR) for the evaluation of myocardial infarction in patients with non-obstructive coronary artery disease (MINOCA). *Curr Radiol Rep.* 2021;9:9. <https://doi.org/10.1007/s40134-021-00384-4>.
 10. Bryniarski K, Gasior P, Legutko J, et al. OCT findings in MINOCA. *J Clin Med.* 2021;10(13):2759. <https://doi.org/10.3390/jcm10132759>.
 11. Reynolds HR, Maehara A, Kwong RY, et al. Coronary optical coherence tomography and cardiac magnetic resonance imaging to determine underlying causes of myocardial infarction with nonobstructive coronary arteries in women [published correction appears in circulation. *Circulation.* 2023 Feb 21;147(8):e624. <https://doi.org/10.1161/CIRCULATIONAHA.120.052008>, 2021;143(7):624-640.
 12. Gatti M, Carisio A, D'Angelo T, et al. Cardiovascular magnetic resonance in myocardial infarction with non-obstructive coronary arteries patients: a review. *World J Cardiol.* 2020;12(6):248–261. <https://doi.org/10.4330/wjc.v12.i6.248>.