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ABOUT COVER

Editorial Board Member of *World Journal of Cardiology*, Massimo Iacoviello, MD, PhD, Associate Professor, Doctor, Department of Medical and Surgical Sciences, University of Foggia, Foggia 71122, Italy. massimo.iacoviello@unifg.it

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The primary aim of *World Journal of Cardiology* (*WJC*, *World J Cardiol*) is to provide scholars and readers from various fields of cardiology with a platform to publish high-quality basic and clinical research articles and communicate their research findings online.

WJC mainly publishes articles reporting research results and findings obtained in the field of cardiology and covering a wide range of topics including acute coronary syndromes, aneurysm, angina, arrhythmias, atherosclerosis, atrial fibrillation, cardiomyopathy, congenital heart disease, coronary artery disease, heart failure, hypertension, imaging, infection, myocardial infarction, pathology, peripheral vessels, public health, Raynaud's syndrome, stroke, thrombosis, and valvular disease.

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CASE REPORT

Cardiac involvement in hydrocarbon inhalant toxicity — role of cardiac magnetic resonance imaging: A case report

George Jolly, Shevel Dacosta Davis, Saif Ali, Lauren Bitterman, Ashley Saunders, Hana Kazbour, Purvi Parwani

ORCID number: George Jolly 0000-0003-3128-1848; Shevel Dacosta Davis 0000-0002-2749-4421; Saif Ali 0000-0002-8043-8971; Lauren Bitterman 0000-0002-5799-9367; Ashley Saunders 0000-0001-5039-9062; Hana Kazbour 0000-0001-7019-6721; Purvi Parwani 0000-0002-4707-992X.

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George Jolly, Saif Ali, Purvi Parwani, Division of Cardiology, Loma Linda University Medical Center, Loma Linda, CA 92354, United States

Shevel Dacosta Davis, Lauren Bitterman, Ashley Saunders, Hana Kazbour, Department of Internal Medicine, Loma Linda University Medical Center, Loma Linda, CA 92354, United States

Corresponding author: Purvi Parwani, MD, Assistant Professor, Division of Cardiology, Loma Linda University Medical Center, 11234 Anderson St, Loma Linda, CA 92354, United States. pparwani@llu.edu

Abstract

BACKGROUND

We report a patient who was diagnosed with toxic myopericarditis secondary to hydrocarbon abuse using cardiac magnetic resonance imaging (CMR).

CASE SUMMARY

A 25-year-old male presented to emergency department with chest pain for 3 d. Patient also reported sniffing hydrocarbon containing inhalant for the last 1 year. Labs showed elevated troponin and electrocardiography was suggestive of acute pericarditis. Echocardiogram showed left ventricular (LV) ejection fraction (EF) of 40%. Given patient's troponin elevation and reduced EF, cardiac catheterization was performed which showed normal coronaries. CMR was performed for myocardial infarction with non-obstructive coronary arteries evaluation. CMR showed borderline LV function with edema in mid and apical LV suggestive of myocarditis.

CONCLUSION

CMR can be used to diagnose toxic myopericarditis secondary to hydrocarbon abuse.

Key Words: Myocarditis; Cardiac magnetic resonance imaging; Hydrocarbon abuse; Hydrocarbon inhalant toxicity; Case report

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Core Tip: Inhalant abuse has been rampant in the United States population in the last 2 decades. Cardiac manifestations of hydrocarbon inhalant abuse are not well reported. We report a case of myopericarditis in a patient with inhalant abuse. We also describe the role of Cardiac Magnetic Resonance Imaging in diagnosis and treatment of these patients.

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INTRODUCTION

Inhalant abuse has been rampant in the United States population in the last 2 decades [1,2]. Commonly used domestic and industrial items including hair spray, spot remover, PC cleaner and glues have hydrocarbon constituents like dimethyl ether and hydrofluorocarbons. We present our patient who has a longstanding history of huffing dust off, (the propellant cleaner which has difluoroethane as the active hydrocarbon ingredient) who developed myopericarditis with systolic dysfunction. We also discuss the role of Cardiac Magnetic Resonance Imaging in diagnosing and prognosticating in these patients.

CASE PRESENTATION

Chief complaints

Chest pain, nausea and vomiting × 3 d.

History of present illness

A 25-year-old male patient with no prior medical history presented to the emergency department with chest pain, nausea and vomiting × 3 d. He described sharp, intermittent chest pain that is sub sternal, radiating to the back and left arm for last 3 d. His pain is worse upon leaning forward and worse with deep inspiration. He also had multiple episodes of nausea and vomiting with an episode of coffee-ground emesis. Patient reported long-term abuse of hydrocarbon containing inhalant (PC keyboard dust off) for the last 1 year. He used to huff 2 cans of dust off at the same time to achieve a hallucinogenic effect along with marijuana use. One week prior to admission, he reported increased use (10 cans/d).

Personal and family history

History of intracranial aneurysm rupture in father.

Physical examination

The patient's heart rate was 112 bpm, respiratory rate was 15 breaths per minute, blood pressure was 114/73 mmHg and oxygen saturation on room air was 99%. His body mass index (BMI) was 37 kg/m^2. Cardiac examination revealed a regular rate and rhythm, and no jugular venous distention with mild chest wall tenderness. Erythematous, non-scaling lesions were noted on the chest wall, arm and lips. Abdominal examination revealed right upper quadrant and bilateral flank tenderness.

Laboratory examinations

Initial laboratory evaluation showed leukocytosis (WBC-19.6 bil/L), acute kidney injury (Cr-3.4 mg/dL, BUN-54 mg/dL), elevated transaminases (AST-161 U/L, ALT-77 U/L), troponin-1.63 (ng/mL) peaked at 2.06 (ng/mL), CK-3000 ng/mL, CKMB-45 ng/mL. Urine drug screen was positive for cannabinoids. Initial electrocardiography (EKG) showed sinus tachycardia with diffuse inferolateral ST elevation, concerning for acute myopericarditis (Figure 1).

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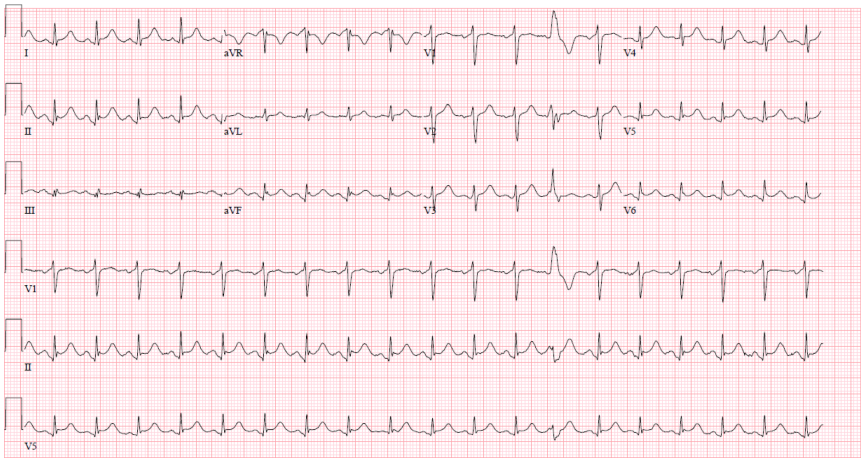

Figure 1 Electrocardiography showing diffuse inferolateral ST elevation without reciprocal ST depression, suggestive of pericarditis.

Imaging examinations

Echocardiogram showed left ventricular (LV) ejection fraction (EF) of 40% to 45% with severe aortic root dilation (5.0 cm) and trivial pericardial effusion. Given patient's elevated troponins, cardiac catheterization was performed. Coronary angiogram showed no evidence of coronary artery disease (Figure 2). Working diagnosis of myocardial infarction with non-obstructive coronary arteries (MINOCA) was established and cardiac magnetic resonance imaging (CMR) was performed to evaluate the etiology further.

CMR

CMR showed borderline LV function with edema in the mid and apical LV suggestive of myocardial inflammation (Figure 3A and B). No delayed enhancement was seen in the myocardium or in the pericardium (Figure 4A and B). There was no evidence of pericardial effusion.

FINAL DIAGNOSIS

Based on the clinical presentation and imaging findings, patient was diagnosed with acute toxic myopericarditis secondary to hydrocarbon inhalant abuse. NSTEMI and MINOCA was ruled out based on coronary angiogram and CMR respectively.

TREATMENT

Supportive management for pain control was initially initiated. Once renal function improved, colchicine 0.6 mg b.i.d. was initiated for ongoing chest pain and EKG findings.

OUTCOME AND FOLLOW-UP

Repeat echo obtained 6 wk after the index presentation revealed EF of 60%.

DISCUSSION

Hydrocarbon compounds have been previously reported to have multiple cardiotoxic effects. Cates and Cook[3] reported a case of severe cardiomyopathy complicated by significant reduction in EF (25%) and torsades de pointes in the patient with history of huffing dust off. Interestingly, patient in this case report, recovered normal ventricular function prior to discharge. Samson *et al*[4] reported a similar case of inhalant abuse

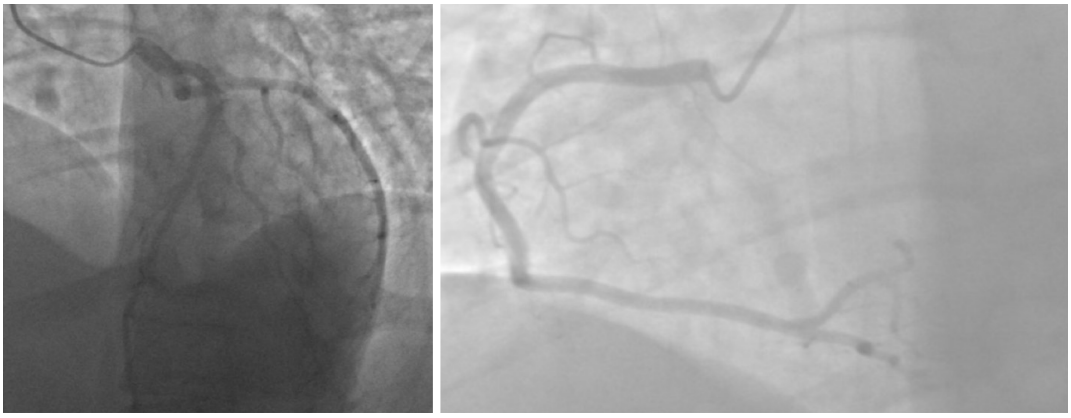

Figure 2 Cardiac catheterization projections showing normal coronaries.

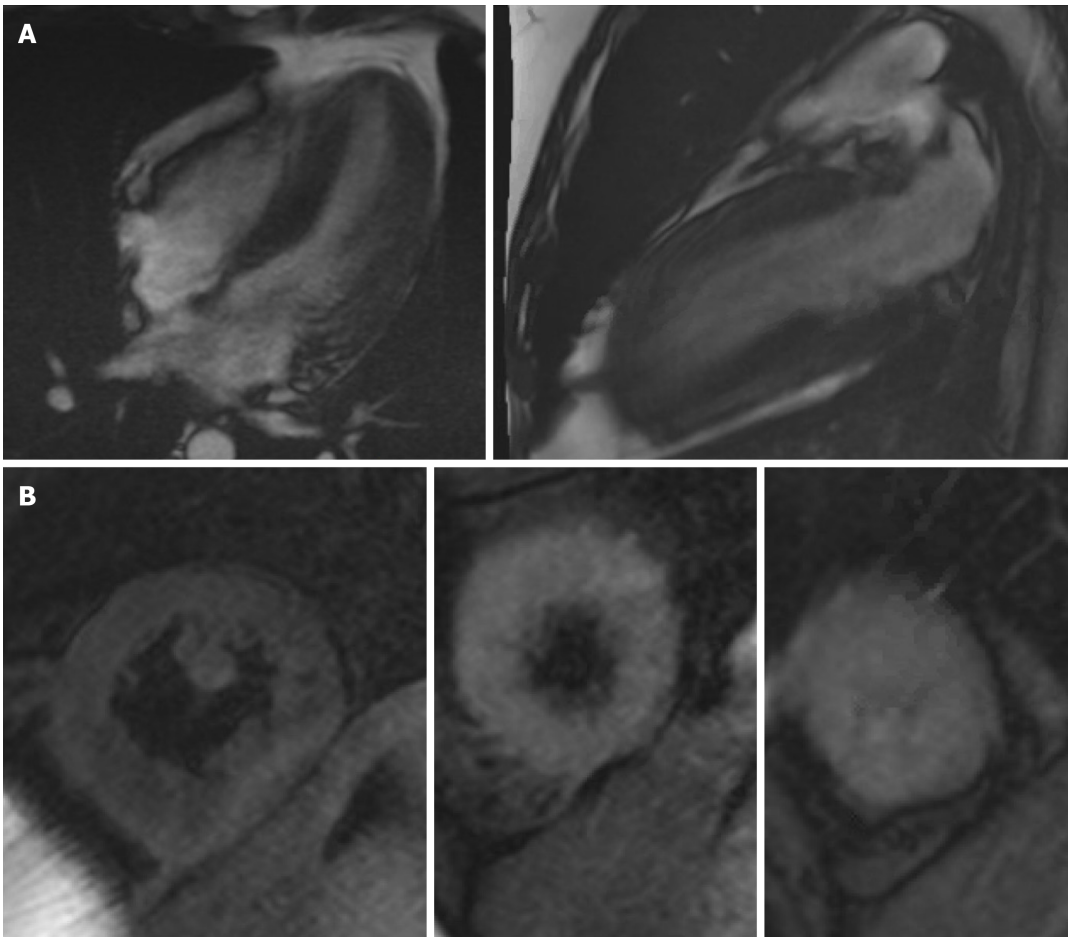

Figure 3 Cardiac magnetic resonance imaging. A: 4 chamber cine, 2 chamber cine showing EF of 40% with global hypokinesis; B: T2 Weighted images showing edema in mid and apical segments.

with severe reduction in EF on presentation, which improved prior to discharge. Cao *et al*[5] reported a case of NSTEMI without significant reduction in EF in a patient with air duster huffing. This patient was noted to have significant hepatic and renal injury, similar to our patient. Life threatening arrhythmias including ventricular fibrillation causing sudden cardiac death has been reported previously[6-8]. Toxic myopericarditis have been previously diagnosed in these patients[2]. Dinsfriend *et al*[2] reported a case of recurrent myopericarditis diagnosed in a patient with inhalant abuse with CMR. CMR showed edema and late gadolinium enhancement (LGE) in base and mid lateral wall and in the mid anterior wall.

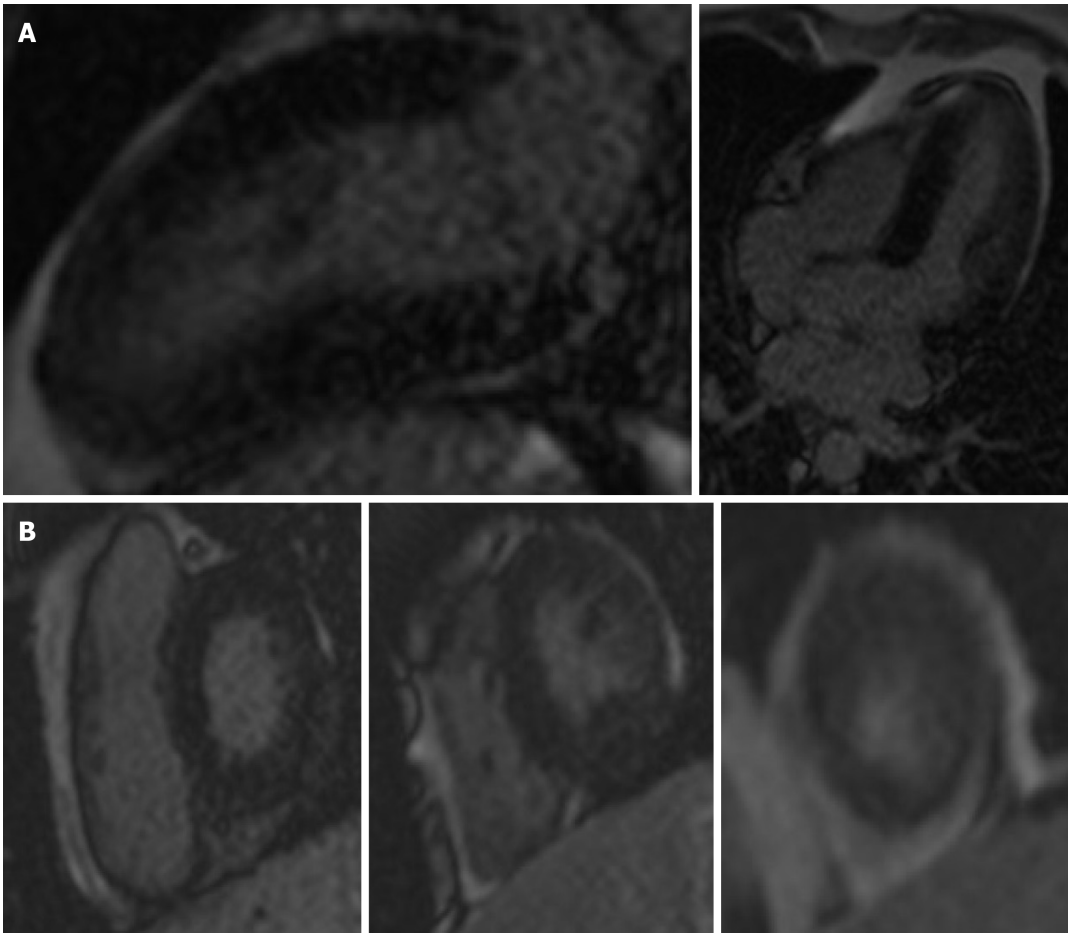

Figure 4 Cardiac magnetic resonance imaging. A: Absence of any late gadolinium enhancement in 4 chamber and 2 chamber; B: Absence of any late gadolinium enhancement in basal, mid and apical left ventricle on short axis.

Myopericarditis refers to an inflammatory process affecting the pericardium and myocardium[9]. Myopericarditis is diagnosed based on clinical features defining pericardial and myocardial involvement. Diagnosis of acute pericarditis involves presence of 2 or more of the 4 criteria: Pleuritic chest pain, pericardial friction rub, suggestive ECG changes (widespread ST segment elevation, PR depression) and new or worsening pericardial effusion[10]. Myocardial involvement is defined by elevated serum cardiac enzymes levels (creatine kinase-MB fraction, or troponin I or T), or new onset of focal or diffuse reduced LV function by echocardiography in the absence of evidence of any other causes[11]. CMR can be utilized to make diagnosis of myopericarditis. CMR diagnosis of myocarditis can be made based on the modified Lake Louise criteria[12]. The three diagnostic targets proposed using this criterion include edema, hyperemia and necrosis or scar. If CMR images indicate 2 out of 3 criteria, there is a high likelihood for acute myocarditis.

We report a case of patient with diffuse ST elevations, chest pain, decreased ejection on CMR in absence of any LGE. Our patient demonstrated early CMR finding in hydrocarbon toxicity manifested predominantly by low EF and edema in absence of LGE. Our patient had BMI of 37 with high low-density lipoprotein and positive family history of CAD. We ruled out coronary artery disease by doing cardiac catheterization however given the modest troponin rise and hydrocarbon toxicity, per recent European Society of Cardiology NSTEMI guidelines and class I recommendation on role of CMR in MINOCA, CMR was performed. CMR was useful in establishing presence of edema without any LGE[13]. This finding although nonspecific, points more towards, myocardial involvement. The absence of LGE provided excellent prognostic information[14]. CMR thus was helpful in diagnosis, prognosis and treatment in this case of inhalant toxicity.

CONCLUSION

Patients with inhalant abuse can have various cardiovascular manifestations. In patients with hydrocarbon toxicity with myocarditis, CMR can provide diagnosis, prognosticate the overall illness and give treatment options.

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