CASE REPORT

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

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Informed consent statement: Informed written consent was obtained from all patients.

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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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).

**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/m². 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).
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...
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.
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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