Case Report

From Tick Bite to Heart Failure: Ehrlichial Myocarditis

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ABSTRACT

Cardiac involvement in myocarditis induced by Human Monocytic Ehrlichiosis infection is an incredibly uncommon complication with sparsely available literature. Also, this case highlights the importance of early recognition as a first step in management.

RÉSUMÉ

Une atteinte cardiaque secondaire à une myocardite induite par une ehrlichiose monocyttaire humaine constitue une complication extrêmement rare et très peu documentée. Le cas présenté fait ressortir l'importance d'une reconnaissance rapide du problème comme première étape de la prise en charge.

A 58-year-old woman presented to the emergency department with altered mental status and difficulty breathing. She had been having intermittent weakness and fever over the preceding month. Her husband reported that he had noticed a rash over her extremity. She had a history of multiple tick exposures from a recent outdoors excursion. In the emergency department, the patient was found to be hypotensive and hypoxic. She was intubated, and vasopressors were initiated.

Laboratory results were significant for a creatinine of 203.32 $\mu\text{mol/L}$, albumin of 17 g/L, aspartate aminotransferase of 110 unit/L, white blood cell count of $3.4 \times 10^9/\text{L}$, hemoglobin level of 80 g/L, hematocrit level of 26%, and platelet count of $36 \times 10^9/\text{L}$. The patient was subsequently admitted to the intensive care unit for further management. Lumbar puncture was performed. Urinalysis, urine culture, blood culture, and blood test for tick-borne infections were sent for testing. The patient was treated initially for septic shock with acute respiratory distress syndrome, with the goal of stabilizing her condition and identifying and controlling the source of infection. Vancomycin and cefepime were administered to the patient; doxycycline was added given the high suspicion for a tick-borne illness. Chest x-ray showed bilateral diffuse infiltrates. As her hypoxia worsened, an

acute respiratory distress syndrome management protocol was started. Her troponin level was checked, which was 10 ng/mL (reference range $< 0.045 \text{ ng/mL}$). Electrocardiogram (ECG) and transthoracic echocardiogram revealed no acute abnormality with an estimated left ventricular ejection fraction (LVEF) of 55% to 60%, left ventricular end-systolic volume index of 26 mL/m², left ventricular end-diastolic volume index 67 mL/m², and normal wall motion. Her elevated troponin was thought to be a type 2 myocardial infarction. Next day, her troponin I level increased to $> 40 \text{ ng/mL}$, and telemetry showed episodes of nonsustained ventricular tachycardia (NSVT). Repeat ECG revealed low-voltage QRS with ST-segment elevation of 2 mm in leads I and AVL with Q waves in leads V1 and V2 (Fig. 1A). She was taken emergently to the cardiac catheterization laboratory, where coronary angiography showed normal coronary arteries.

Blood and urine cultures remained negative for 5 days. Urinalysis was unremarkable except for elevated myoglobin levels. Polymerase chain reaction (PCR) was negative for herpes simplex virus and cytomegalovirus. *Ehrlichia chaffeensis* PCR from her blood sample was positive. Hepatitis panel showed no immunity or prior exposure to hepatitis A, B, or C. Rocky Mountain Spotted Fever titers showed elevated levels of immunoglobulin-G antibody (Ab), suggesting past exposure to Rickettsia species. Anti-nuclear Ab, anti-double-stranded DNA, anti-smith, anti-ribonuclear protein, anti-Sjögren syndrome type A and B, rheumatoid factor, serum protein electrophoresis, cytoplasmic antineutrophil cytoplasmic Ab, and perinuclear antineutrophil cytoplasmic Ab were all negative.

After the identification of *E. chaffeensis* on PCR, both vancomycin and cefepime were stopped and only doxycycline

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Ethics Statement: The research reported has adhered to the relevant ethical guidelines.

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See page 329 for disclosure information.

Novel Teaching Points

- Ehrlichiosis-induced myocarditis is a life-threatening disease, and management starts with early recognition.
- Early recognition and immediate treatment would significantly improve the outcome of the disease.

was continued. Her respiratory status improved, and on hospital day 8 she was able to be extubated. However, the patient kept having frequent premature ventricular contractions and multiple episodes of NSVT. There was a high suspicion for myocarditis. She underwent cardiac magnetic resonance imaging that revealed global hypokinesis, LVEF of 32%, left ventricular mass of 45 g/m², and delayed enhancement in multiple areas of the myocardium and pericardium consistent with myopericarditis (Fig. 2A-C). Carvedilol and lisinopril were administered to the patient. She continued to improve and was discharged to inpatient rehabilitation after 16 days of hospitalization. Her cardiomyopathy

persisted, and a repeat transthoracic echocardiogram 6 months later revealed an LVEF of 25% and repeat ECG revealed an improvement in QRS voltages (Fig. 1B). She continued to have intermittent episodes of NSVT, and amiodarone was administered. A cardioverter-defibrillator was implanted in the patient for primary prevention of sudden cardiac death. It is now 12 months after the patient's initial hospitalization, and she has had 2 admissions for acute heart failure exacerbation.

Human Monocytic Ehrlichiosis is an acute febrile tick-borne illness caused by *E. chaffeensis*. The vector ticks are found in the Southeastern to South Central United States. Human Monocytic Ehrlichiosis primarily occurs between April and September, with the peak being in July.¹

Cardiac complications have rarely been reported with ehrlichiosis. Our search revealed only 4 previously published single patient case reports of cardiac manifestations of ehrlichiosis. The reports included 1 case of fatal myocarditis in an adolescent female, whereas the others reported manifestations in older men. Three of the 4 patients had classic symptoms and signs of myocarditis, including cardiac enzyme elevation, and 1 patient presented with a new

Figure 1. (A) Twelve-lead electrocardiogram (ECG) reveals low QRS voltages with 1-mm ST-segment elevation in leads I and AVL, PR elevation in AVR, and Q waves in leads V1 and V2. (B) Twelve-lead ECG reveals an improvement of QRS voltage compared with the previous ECG.

Figure 2. (A) Three-chamber delayed enhancement image. (B) Short-axis delayed enhancement image. (C) Two-chamber delayed enhancement image shows patchy areas of delayed enhancement (**yellow arrows**) involving the mid-myocardium seen in the anterolateral, inferior, and septal segments. There is extensive epicardial delayed enhancement and delayed enhancement of the right ventricular free wall.

cardiomyopathy. This is the first published report of cardiac magnetic resonance imaging for ehrlichial myocarditis.^{2–5}

The pathogenesis of development of cardiac disease in ehrlichiosis is not completely understood. Postmortem analysis in 5 patients who died of complications of ehrlichiosis identified morulae in perivascular monocytes in the heart and in monocytes directly within the epicardium, which could indicate that myocardial dysfunction is induced by a dysregulated inflammatory response against the pathogen.⁵

A suspicion for ehrlichiosis-induced myocarditis should be maintained in endemic areas, especially during the summer months. Of the 4 published case reports that discuss cardiac manifestations of ehrlichiosis, only 2 patients received doxycycline therapy early enough to have a favorable outcome and survive.^{2,3}

Disclosures

The authors have no conflicts of interest to disclose.

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