Case Reports

Transient Cardiomyopathy and Quadriplegia Induced by Ephedrine Decongestant

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Ephedrine decongestant products are widely used. Common side effects include palpitations, nervousness, and headache. More severe adverse reactions include cardiomyopathy and vasospasm. We report the case of an otherwise healthy 37-year-old woman who presented with acute-onset quadriplegia and heart failure. She had a normal chest radiograph on admission, but developed marked pulmonary edema and bilateral effusions the next day. Echocardiography revealed a left ventricular ejection fraction of 0.18 and no obvious intrinsic pathologic condition such as foramen narrowing on spinal imaging. Laboratory screening was positive for methamphetamines in the urine, and the patient admitted to having used, over the past several weeks, multiple ephedrine-containing products for allergy-symptom relief.

She was ultimately diagnosed with an acute catecholamine-induced cardiomyopathy and spinal artery vasospasm consequential to excessive use of decongestants. Her symptoms resolved completely with supportive care and appropriate heart-failure management. An echocardiogram 2 weeks after admission showed improvement of the left ventricular ejection fraction to 0.33. Ten months after the event, the patient was entirely asymptomatic and showed further improvement of her ejection fraction to 0.45. To our knowledge, ours is the first report of spinal artery vasospasm resulting in quadriplegia in a human being after ephedrine ingestion. ***(Tex Heart Inst J 2015;42(6):575-8)***

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In clinical and animal studies, investigators have documented the ability of ephedrine-like substances to induce vasospasm.[1-5] By stimulating the release of norepinephrine, ephedrine induces vascular resistance and can cause increases in blood pressure, heart rate, and cardiac output.[1,2] Despite wide use, especially for symptomatic relief from seasonal allergies, decongestants with strong sympathomimetic properties place patients at risk.[2] Commonly reported side effects include palpitations, nervousness, and headaches. More severe adverse reactions include ephedrine-induced cardiomyopathy.[1,2] We present the case of a woman in whom acute left ventricular (LV) failure and quadriplegia resulted from the use of ephedrine decongestant products.

Case Report

A 37-year-old woman with a medical history notable for seasonal allergies presented at our emergency department immediately after acutely developing quadriplegia, complete sensory loss in her extremities, and dyspnea. She had no speech impairment.

The patient had been asymptomatic before the acute event, except for mild dyspnea while climbing stairs, a symptom that had first occurred approximately 2 weeks earlier. Until the acute change in her status, she had been able to ride her bicycle several miles with no symptoms whatsoever. She reported no use of illicit drugs or alcohol. On examination, she was afebrile, tachycardic with a heart rate of 128 beats/min, and tachypneic with a respiratory rate of 24 breaths/min. Her blood pressure was within normal limits, and her initial chest radiograph was unremarkable. Physical examination revealed acute distress, anxiety, and dyspnea. The results of pulmonary examination were initially normal except for mild bibasilar crackles, yet serial examinations revealed diffuse and progressively worsening crackles, with diminished breath sounds. Several hours after admission, the patient was unable to lie flat because of a sensation of breathlessness, and repeated chest radiographs revealed diffuse pulmonary edema and bilateral pleural effusions. The patient had 1/5 strength bilaterally in her upper and lower extremities and had fasciculations in her digits. Cranial-nerve testing revealed no deficits. The cardiac examination at first revealed tachycardia, and a re-

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peat examination several hours after admission revealed marked jugular venous distention to the earlobe, mild edema in the lower extremities, and an S_3 on auscultation. Her blood count and metabolic profiles were within normal limits. Lactic acid was markedly elevated at 17.6 mmol/L (normal, 0.9–1.7 mmol/L), and troponin T was undetectable. The brain-type natriuretic peptide level was elevated at 509 pg/mL (normal, ≤64 pg/mL), several hours after the patient's dyspnea had worsened. The thyroid panel, autoimmune profile, and serum protein electrophoresis results were within normal limits. Human immunodeficiency virus and rapid plasma regain tests were negative. Urine screening for the Drugs of Abuse Panel was positive for amphetamines, with confirmatory tests revealing ephedrine use at a concentration of 73.8 mg/dL. Initial chest radiographs showed minimal pulmonary vascular congestion. An electrocardiogram revealed sinus tachycardia (Fig. 1) without other abnormalities, such as early repolarization. An echocardiogram the next morning revealed her LV ejection fraction (LVEF) to be 0.18 (Figs. 2A and B), a severe decrease in LV function, a moderate decrease in right ventricular function, a grade 3 diastolic dysfunction, and no valvular abnormalities or pericardial effusion. Magnetic resonance imaging (MRI) of the heart with use of gadolinium confirmed the severe global LV hypokinesis (an LVEF of 0.19 without other abnormalities). Further diagnostic imaging, including MRI of the spine with gadolinium, computed tomography of the head, and pulmonary angiography, showed no gross abnormalities.

At this point, further discussion with the patient revealed that she had recently been seen at an urgent care clinic for seasonal allergies and had been prescribed Primatene® Mist (no longer marketed), ephedrine-containing oral allergy medications, and Afrin® (Merck Consumer Care, now part of Bayer Healthcare), all of which she had been using multiple times daily over the past several weeks. She improved with supportive care and standard heart-failure treatment. She was ultimately diagnosed with acute decompensated nonischemic cardiomyopathy, in combination with presumptive catecholamine-induced spinal artery vasospasm, which had resulted in acute quadriplegia. Five days later, her dyspnea improved substantially and her neurologic deficits resolved completely. Follow-up, 2 weeks after her admission, showed improvement of the LVEF to 0.33 (Figs. 2C and D) and improvement of functional status to baseline. Ten months after the event, the patient was entirely asymptomatic, with further improvement of her LVEF to 0.45.

Discussion

Our case adds to the published literature that documents the potentially deleterious effects of common

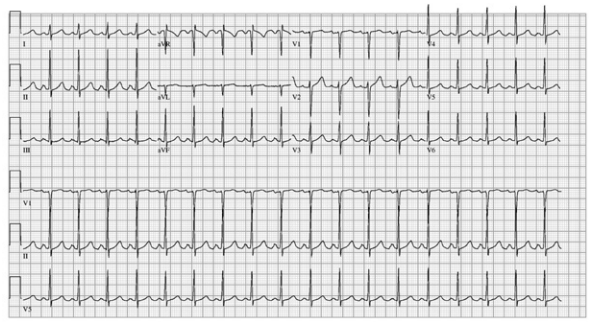

Fig. 1 *Electrocardiogram shows sinus tachycardia.*

decongestant products.[1,2] In 2004, the U.S. Food and Drug Administration banned the marketing of ephedrine-containing dietary supplements, yet herbal products, allergy medications, and other medications still contain this substance.[1] Most side effects remain self limited, yet excessive intake can produce severe adverse reactions.[1,2]

The cardiotoxic effects of ephedrine are well described in human beings and animal models.[3-5] In rats, infusions of similar catecholamine-like substances have been found to produce myocardial injury characterized by necrosis. Similar lesions occur in human beings.[6] The resultant cardiomyopathy is potentially reversible, if diagnosed and treated promptly.[1,2,6]

Other causes for a similar catecholamine-induced cardiomyopathy include pheochromocytoma and stress-induced cardiomyopathy. Pheochromocytoma, a catecholamine-secreting tumor, can cause unopposed adrenergic stimulation of the heart muscle, ultimately impairing its function.[7,8] Stress-induced cardiomyopathy, also known as takotsubo cardiomyopathy or apical ballooning syndrome, can occur from a sudden sympathetic surge. Generally, it presents with ventricular dysfunction in a region greater than the distribution of a single coronary vessel. Pathognomonic to this syndrome, apical ballooning is found in the presence of ordinary coronary artery disease.[7]

The mechanism of the underlying association between sympathetic stimulation and myocardial dysfunction is unknown. One postulate states that direct myocyte injury occurs as the elevated catecholamine levels decrease the viability of cardiac myocytes through cyclic adenosine monophosphate-mediated calcium overload. Moreover, free radicals from the catecholamine interfere with sodium and calcium transporters, further propagating dysfunction.[7] Another postulate states that excessive catecholamine release, by causing vascular spasm, can result in myocardial injury. Several investigators have found evidence of reduced coronary-flow reserve and regional defects on cardiac imaging in such patients, which suggests coronary circulation dysfunction. Our patient's physical examination and

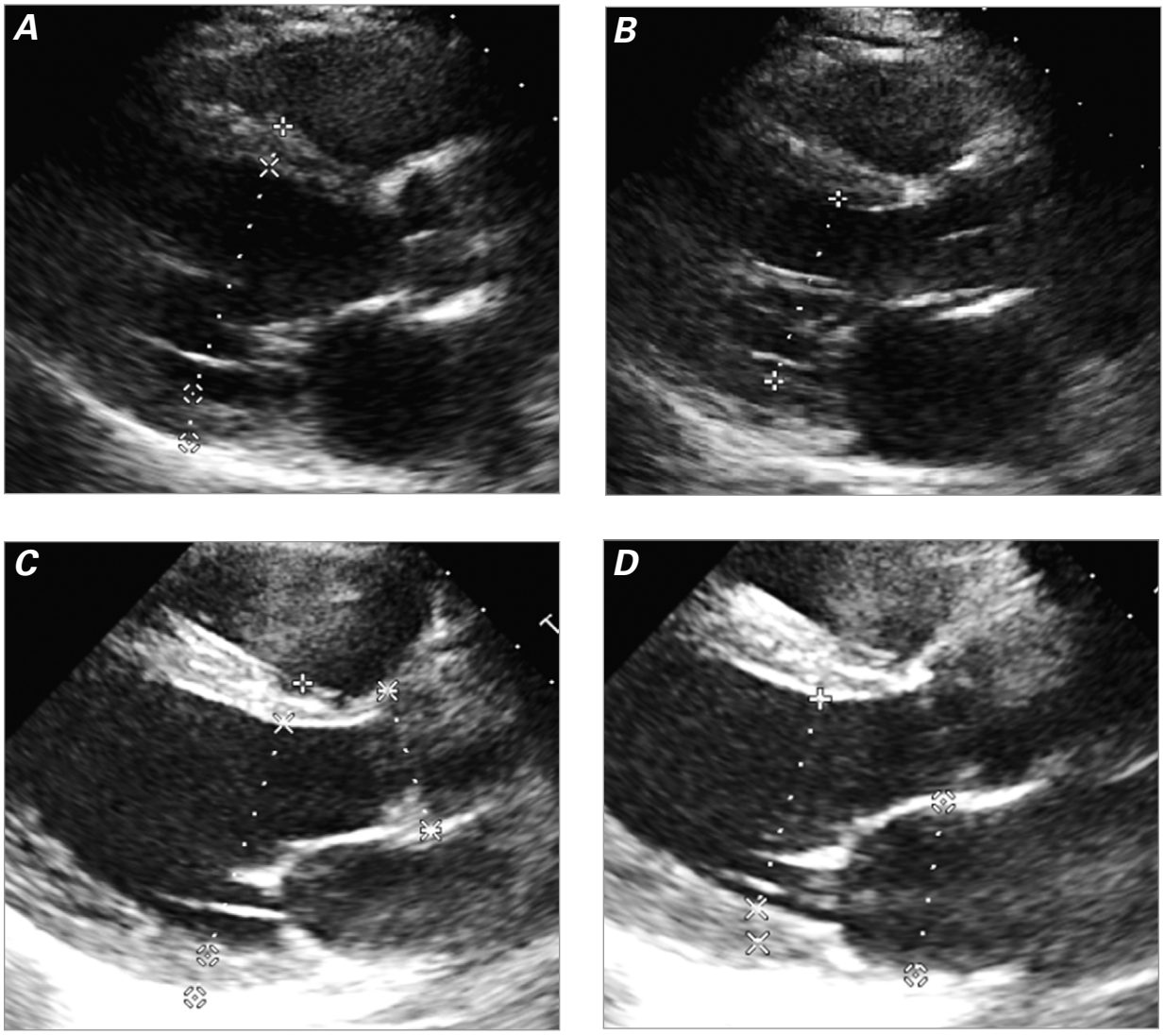

Fig. 2 *Upon the patient's hospital admission, echocardiograms (parasternal long-axis views) show a left ventricular ejection fraction of 0.18 during* ***A****) diastole and* ***B****) systole. After 2 weeks, similar views show improvement in left ventricular ejection fraction to 0.33 during* ***C****) diastole and* ***D****) systole.*

chest radiograph on admission were not indicative of severe heart failure, but she rapidly developed pulmonary edema consistent with acutely decompensated heart failure.

Remarkably, our patient developed acute quadriplegia, presumably from vasospasm of the spinal arteries. The distribution of the patient's deficits is explained by such a condition, considering that her symptoms occurred shortly after ingestion and inhalation of the ephedrine-containing allergy products and resolved within several hours of admission. In patients with subarachnoid hemorrhage, vasospasm is thought to result from an increased catecholamine response. Other hemodynamic changes and electrocardiographic abnormalities can be seen in these cases.[3-5] Injection of catecholamine products has been shown to cause intracranial arterial spasm in monkeys.[4] To our knowledge, ours is the first report of spinal artery vasospasm resulting in quadriplegia in a human being after ephedrine ingestion.

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