

CASE STUDY

Case Record from Suez Canal University Hospital: Acute Coronary Syndrome with Ephedrine Abuse

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A 30 years old single male working as an electrician presented to the ER department with retrosternal constricting chest pain two hours prior to admission radiating to left shoulder and arm increasing by exertion with partial relief by rest. He documented that he had similar attack two days before the occurring one which lasted for five minutes and relieved spontaneously. No dysnea no orthopnea no paroxysmal nocturnal dysnea. He documented cough and expectoration of whitish sputum but without fever. He gave history of being asthmatic on regular steroid inhaler. He documented to be habituated to a drug called Efanol (ephedrine, Theophylline, phenobarbitone and chlorpheniramine maleate) and the last dose was 20 hours prior to admission. A review of his other organ systems was also negative. No family history of IHD.

On examination, the temperature was 37.1°C, the blood pressure 110/70 mm Hg, and the pulse 72 beats per minute. No cardiac murmur or pericardial rub was detected on auscultation, and the lungs were clear. The abdomen was non-tender, without organomegaly.

ECG was done revealing ST segment elevation in the inferior and RV leads with ST depression in the anterior chest leads. The patient was admitted to the CCU & received thrombolytic therapy (Streptokinase) afterwards he was asymptomatic.

Transthoracic Echocardiography revealed preserved LV systolic function with inferior and lateral wall hypokinesia.

CBC, serum creatinine, electrolytes (Na, K, Ca and PO_4), PT, PTT and fasting blood sugar were normal.

The lipid profile of the patient was as follows: Total cholesterol: 140 mg/dl, TG: 91 mg/dl, HDL: 45 mg/dl, LDL: 77 mg/dl.

The patient was kept in the hospital for 1 week and then discharged.

Homocystiene level was: 11.3 $\mu\text{mol/l}$ (N: 5.0-15.0) and the serum Lipoprotien A was: 34.4 (N: 28-40).

After discharge the patient was still experiencing exertional chest pain, so coronary angiography was done revealing long subtotal occlusion in the RCA in the second segment upon

which direct stenting was done successfully with marked improvement in the symptoms.

After all these investigations it is evident that this patient had a low cardiovascular risk prior to this event.

Differential diagnosis:

A 30 years old male, ephedrine abuser with low cardiovascular risk; presented with chest pain and ST segment elevation in the inferior and right ventricular leads (Table 1).

Final diagnosis:

Inferior and right ventricular myocardial infarction.

What is Ephedrine?

Ephedra are the botanical source for the sympathomimetic alkaloid ephedrine, since 1993, at least 17 deaths in the United States have been linked to ingestion of products containing the botanical *E. sinica*, or its principal alkaloid ephedrine. This report describes the history of abuse and adverse effects of ephedrine products in the United States before and after passage Dietary Supplement Health and Education Act of 1994.

Ephedrine is a sympathomimetic that acts directly and indirectly on the sympathetic nerves. Its bronchodilating effects are the result of relaxation of bronchial smooth muscle through direct stimulation of β adrenergic receptors. It is nasal decongestant, and has been used therapeutically for nocturnal enuresis, diabetic neuropathic edema, dysmenorrhea, narcolepsy, and myasthenia gravis (1,2). Ephedrine in combination with caffeine has been shown to promote thermogenesis, fat loss, and muscle gain in several controlled trials (3,4). Ephedrine is metabolized to norephedrine (phenylpropanolamine) which is responsible for the central nervous system stimulating effects of the drug (1,2).

Therapeutic doses for bronchodilation range from 12.5 to 50 mg three times per day, with maximum daily doses between 120 and 150 mg. Because of its indirect effect on neurotransmitter stores, long-term use of ephedrine can lead to tachyphylaxis. Increasing dosage can induce toxic effects, including peripheral vasoconstriction and cardiac stimulation, leading to increased blood pressure and increased heart

Table 1. Differential Diagnosis of ST-Segment Elevations on the Electrocardiogram (ECG) in Patients Presenting with chest Pain*

Condition	Distribution of ST- Segment Elevations	Associated ECG Features	Associated clinical Feature
Myocardial infarction with occlusive thrombus	Typically confined to a single coronary vascular territory ¹ Right coronary artery: Lead III>II, aVF Left circumflex artery: Leads I, aVL, V ₅ , V ₆ Left anterior descending artery: leads V ₁ -V ₃	Convex ST segment, abnormal Q waves	Elevation in troponin I or T arising within 6-8 hr after the onset of chest pain
Acute pericarditis	Diffuse involvement of precordial and limb leads, associated ST-segment depression in aVR	PR-segment depression, diffuse concave ST segment, and ST:T ratio >0.24 in lead V ₆	Clinical triad of chest pain, pericardial friction rub, and diffuse ST-Segment elevations
myocarditis	May mimic either myocardial infraction or pericarditis	May be associated with ventricular or atrial arrhythmias, heart block, or both	Clinical features vary, from asymptomatic abnormalities on ECG to fulminant heart failure and cardiogenic shock
Prinzmetal's angina	Typically confined to a single coronary distribution	Occurs within the distribution of the coronary artery affected by vasospasm ²	
Pulmonary embolism	Acute right ventricular overload may produce a pattern mimicking right ventricular infarction Leads III, aVF, V ₁	Sinus tachycardia, incomplete or complete right bundlebranch block, S1Q3T3 pattern	Often hypoxemia with elevated alveolar-arterial oxygen gradient, and acquired or inherited hypercoagulable state
Type A aortic dissection involving a coronary ostium or the pericardium	Right coronary artery ostium involvement is more common than left main coronary involvement ³ Lead III>II, aVF	If hemopericardium is present, low voltage with tachycardia	Abrupt onset of pain, widened mediastinum (63%), ⁴ Pulse differential
Apical ballooning syndrome	Anteroapical distribution is most common ⁵ Leads V ₂ -V ₆	Often associated with prolonged QT interval and deep T-wave inversions	Precipitated by profound emotional or physical stress, typically in women
Ventricular contusion	Right ventricular involvement leads V ₁ , V ₂		Follows blunt trauma; right ventricular involvement most common because of anterior location of the right ventricle ⁶

Abbreviations and Acronyms

- ECG = Electrocardiogram
- RCA = Right coronary artery
- LV = Left ventricle
- IHD = Ischemic heart disease

rate; adverse effects on the central nervous system include nervousness, anxiety, tremor, weakness, irritability and insomnia. These effects increase with high doses, and overdose leads to nausea, vomiting, fever, palpitations, tachycardia, hypertension, paranoid psychosis, respiratory depression, convulsions and coma (1,2).

What are ephedrine adverse effects?

Adverse Effects include hypertension, hypotension, drug interactions, cardiovascular disturbances, and psychosis. (5-10). The first report of fatal intracerebral hemorrhage due to ephedrine abuse appeared in a case report in the Annals of Neurology in 1983 which described the case of a 20 year old male with intracerebral hemorrhage and vasculitis (11). The following cardiac arrhythmias may result from sympathomimetic toxicity:

1. Sinus and supraventricular tachycardia (including atrial fibrillation and atrial flutter)
2. Premature ventricular beats
3. Accelerated idioventricular rhythms, ventricular tachycardia, ventricular fibrillation, and torsades de pointes.
4. Second-degree and third-degree heart block (as a reflex response to hypertension)

Sympathomimetic-induced chest pain, myocardial ischemia, myocardial infarction, and cardiomyopathy also can occur (12).

Does ephedrine abuse cause cardiovascular mortalities?

The 1993 case reports were the result of an investigation initiated in 1991 after a 37 year old male presented with cerebral infarction at the Albuquerque Veterans Affairs Medical Center. The patient had ingested 10 "white-cross" ephedrine tablets daily for weight loss, a dose equivalent to approximately 150 mg/day. A review of records of the New Mexico office of the Medical Investigator 1981 to 1991 revealed a single case of fatal stroke in a 42 year old male who had hypertensive cerebral vasculopathy and a history of taking 10 - 20 white-cross tablets daily (150 - 300 mg/day) for 23 years. On autopsy, evidence of cerebral atherosclerosis,

arteriolosclerosis and arteriolonephrosclerosis was found, with blood concentration of 2.7 µg/ml ephedrine.

The New Mexico case review also revealed two other cases of fatal stroke involving ingestion of a combination of caffeine, phenylpropanolamine, and ephedrine. The third report in that case series was identified from an investigation of 17 fatal intracranial hemorrhages in Connecticut during the period April 1989 to April 1990; this case was an 84 year old female whose blood on autopsy was positive for the presence of ephedrine (13).

In conclusion: we postulate that ephedrine abuse is correlated to acute myocardial infarction this patient encountered as he is relatively young and has non of risk factors either traditional or emerging ones. Putting in consideration the reported side effects of ephedrine; no previous data recorded on acute myocardial infarction with ephedrine abuse.

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