

# Myocardial Infarction in a 17-Year-Old Body Builder Using Clenbuterol

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A case of non-Q myocardial infarction in a previously healthy 17-year-old body builder, who used clenbuterol, a long-acting  $\beta_2$  adrenergic agonist with anabolic and lipolytic effects, is reported. Only 1 case report of myocardial infarction associated with the use of clenbuterol was found in a literature review and that case was, however, associated with anabolic steroid use. This is the first case report to describe myocardial infarction in a young male body builder only taking clenbuterol. (*Circ J* 2005; 69: 1144–1146)

**Key Words:** Clenbuterol; Myocardial infarction

**I**schemic chest pain in adolescents occurs quite rarely and is usually related to hypertrophic cardiomyopathy, congenital coronary abnormalities, tachyarrhythmia, myocarditis, aortic stenosis, dissection or coarctation! However, in young patients who generally have no cardiac risk factors but are using anabolic steroids, such chest pain can be caused by myocardial infarction (MI)? We found 1 report of MI associated with the use of both steroids and clenbuterol<sup>3</sup> and here we describe MI in a young male body builder taking clenbuterol as the sole anabolic drug. To our knowledge, we are the first to report this type of clenbuterol-related complication.

## Case Report

A previously healthy 17-year-old boy was referred to the pediatric cardiology department with stabbing, retrosternal chest pain, which appeared after an episode of emotional stress the day before. The pain was intermittent and similar to a weaker pain that occurred 1 month earlier, at the time when the boy was having difficulties at school. The history revealed that the boy had been body building via weightlifting for 1 year. A few days before hospitalization, the boy finished a 2-week period of taking oral clenbuterol (Spiropent 20mg; 1 tablet twice daily for 2 days, with a subsequent 2-day break). The patient denied using steroids, tobacco, or any other illicit drugs. He did not have a family history of premature MI or other cardiovascular diseases.

Except for borderline tachycardia (heart rate 100 beats/min) and fever (temperature 37.8°C), the physical examination was unremarkable. The musculature of his shoulder girdle was remarkably developed. The electrocardiogram (ECG) showed 2 mm ST segment elevation in leads I, II, AVL and V<sub>3-6</sub> (Fig 1A), but previous ECG trac-

ings were not available for comparison. Two-dimensional echocardiography performed on admission revealed distinct hypokinesis of the apex, mild left ventricular hypertrophy (diastolic left ventricular wall thickness 13 mm) with normal global ejection fraction (EF=64%). All coronary arteries had a normal origin. The chest radiograph was normal. The laboratory data showed increased acute phase indicators: erythrocyte sedimentation rate 26 mm/h, elevated platelet count  $426 \times 10^9$ /L, elevated fibrinogen 8.41 g/L (normal range: 1.8–3.5), and C-reactive protein 29.7 mg/L; total plasma homocysteine was high 24.94  $\mu$ mol/L (normal range: <10) and there was biochemical evidence of myocardial damage: creatine kinase (CK) 1,387 U/L, CK myocardial-bound (CK-MB) 108 U/L (normal range: 0–25), and troponin I >50 nmol/L. The remaining laboratory data, including the serum lipid profile and the coagulogram, were normal with the exception of low serum magnesium.

The patient was initially treated with iv nitroglycerin, aspirin, enoxaparin sc, metoprolol and antibiotic. The chest pain disappeared within several hours and the patient was asymptomatic during the next days of hospitalization. The heart rate slowed to 65–80 beats/min and the body temperature normalized. The ECG showed a typical evolution: gradual normalization of ST segment changes with signs of ischemic damage (negative T waves), evident also in the infero-postero-lateral abnormalities (Fig 1B). Holter examination revealed no arrhythmias. Coronary angiography performed on day 5 was normal. Acute phase laboratory indicators and the markers of myocardial damage normalized within 10 days. Echocardiography performed on the 5<sup>th</sup> day confirmed a small area of hypokinesis in the apex, but the myocardial perfusion study using Sonovue (Power Contrast Imaging, Acuson Sequoia, ECG gating 1:4 cycles, Fig 2) showed normal contrast enhancement in this region. Wall motion and ECG abnormalities normalized completely over the following 2 weeks. The final diagnosis was a reperfused non-Q MI, with a possible mechanism of clenbuterol-related coronary artery spasm and/or thrombosis (in the area supplied by the distal left anterior descending artery). The exercise test after 4 weeks was normal at 13 METs. The patient has been followed-up for 24 months and remains asymptomatic today while taking bisoprolol 5 mg and acetylsalicylic acid 75 mg daily. Homocysteine levels normalized with folic acid supplementation.

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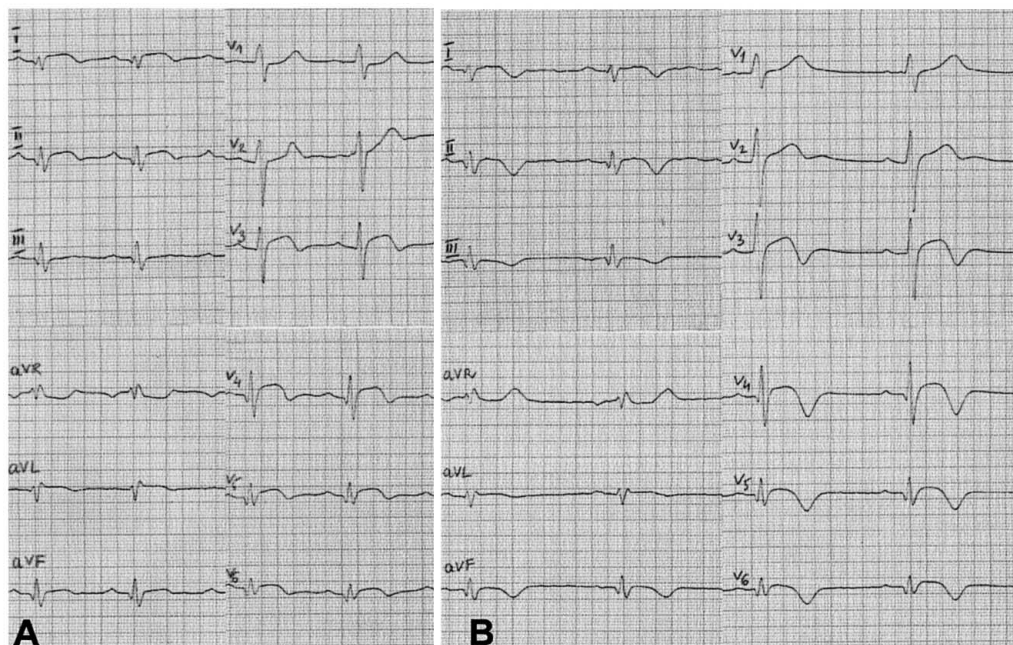


Fig 1. 12-lead electrocardiogram on presentation (A) and after 10 days (B), showing signs of evolution with decreasing ST segment elevation and new negative anterolateral T-waves.

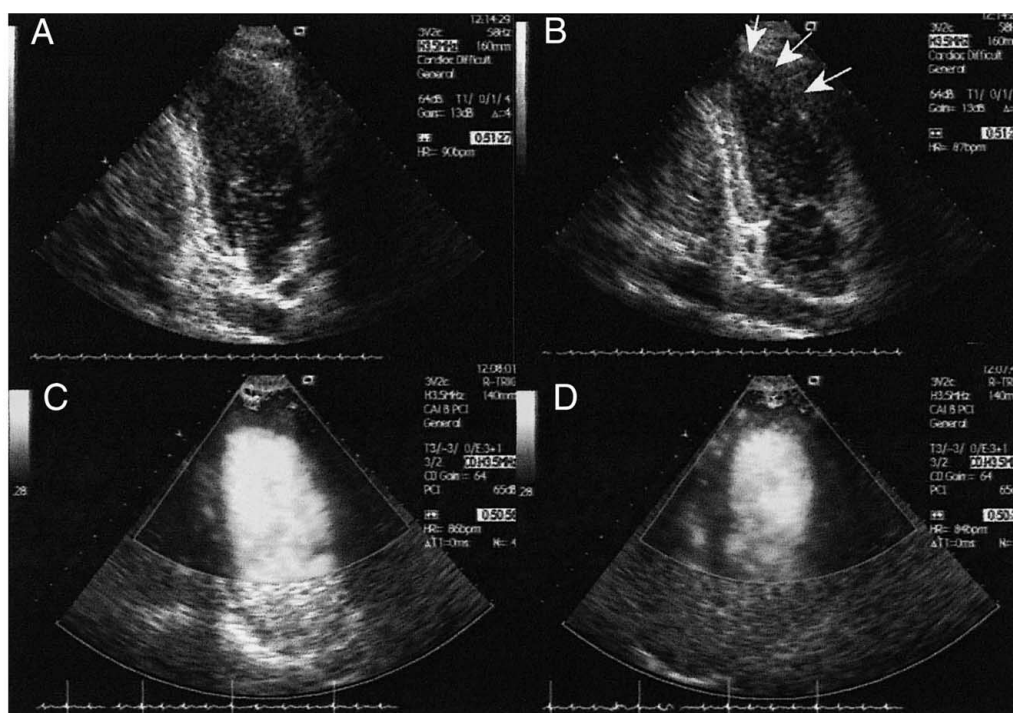


Fig 2. Mild hypokinesis (arrows) of the apical anterior wall (A, end-diastolic frame; B, end-systolic frame) with normal myocardial perfusion in the left ventricular apex (C, apical 4-chamber; D, 2-chamber view).

## Discussion

Clenbuterol hydrochloride is a  $\beta_2$  sympathomimetic with high oral bioavailability and a long plasma half-life of 34–35 h<sup>4</sup>. In the 1980s, this drug was widely used in patients with bronchial asthma. It also exerts anabolic and thermogenic effects because of interaction with  $\beta_2$  adrenoreceptors. Animal experiments with oral clenbuterol have shown

a significant enlargement of striated muscle mass and decreased body fat deposition.<sup>5</sup> For this reason clenbuterol was used in food-producing animals, until it was discovered that residues of this compound in the tissues of treated farm animals can cause symptoms of acute poisoning in people.<sup>6,7</sup> The most common complaints were: nervousness, tachycardia, muscle tremors, headache, myalgia, and gastrointestinal symptoms. The laboratory data included moderate

hyperglycemia, hypokalemia, and leucocytosis. These facts caused clenbuterol to be forbidden for growth-promoting purposes in farm animals.<sup>8</sup> Although the human studies did not confirm similar augmentation in muscle bulk in healthy men, clenbuterol is illegally used by sportsmen as a stimulant-doping substance, which they believe will enhance their athletic performance.<sup>9</sup> Because of its probable anabolic and lipolytic effects, clenbuterol is especially popular among body builders after steroid treatment and is easily available both from the black market and internet distributors.

The most common cardiovascular side-effect of clenbuterol is an increase in heart rate, which is usually temporary and can depend on the activation of  $\beta_1$  adrenergic receptors.<sup>10</sup> Acute poisoning with clenbuterol following illicit use in humans is rarely reported. An acute, unintentional intoxication with this drug was reported in a 21-year-old body builder, who ingested 48 tablets (4.8 g) of clenbuterol, placed in orange juice by his friends.<sup>11</sup> A second case reported a 28-year-old woman poisoned after ingesting a small quantity of clenbuterol, the toxicity of which was confirmed by liquid chromatography/mass spectrometry assays.<sup>12</sup> Interestingly, the present patient remained symptomatic even though serum concentrations of clenbuterol were below the limit of detection. The manifestations of acute poisoning with oral clenbuterol were similar to symptoms that appeared after consumption of livestock illicitly treated with this drug and were propranolol or metoprolol sensitive. A literature search revealed only 1 report of MI associated with use of clenbuterol by a 26-year-old body builder who had switched from using oral steroids to oral clenbuterol 1 month before presentation.<sup>3</sup> Two weeks after beginning clenbuterol use, the patient complained of occasional palpitations, tremors, and nervousness, suggestive of clenbuterol toxicity, but the fact that the patient earlier had used anabolic steroids indicated a synergistic effect between these 2 agents in the pathogenesis of the MI. Because the patient had a normal coronary angiogram, the authors suggest coronary artery spasm as the possible mechanism of the infarct.

Our patient denied using steroids and had no traditional risk factors for coronary arterial disease with the exception of hyperhomocysteinemia and markers of prothrombotic state (thrombocytosis, hyperfibrinogenemia). Hyperhomocysteinemia causes endothelial dysfunction which might facilitate thrombosis or promote coronary artery spasm resulting from the action of clenbuterol. Clenbuterol can also contribute to myocardial ischemia by its chronotropic and thermogenic action. Additionally, mild left ventricular hypertrophy could also be related to the anabolic action of clenbuterol.<sup>9</sup>

The diagnosis of infarction, in spite of normal coronary vessels, is confirmed by typical biochemical, electrocardiographic and clinical evolution, good response to treatment and full functional recovery of the myocardium with uneventful follow-up. The decision not to administer fibrinolytic drugs was based on the prolonged time from the onset of symptoms with a good general condition of the patient and fast symptomatic relief.

The possible pathogenesis of clenbuterol-related infarction involves coronary artery spasm and/or temporary thrombosis. Despite a careful history, we cannot exclude the likelihood that the obtained history of clenbuterol use, smoking, and drug abuse might be incomplete.

The differential diagnosis in our case was difficult. Other

possible causes included myocarditis, and a recently described entity, Takotsubo cardiomyopathy.<sup>13</sup> In our patient, the typical clinical presentation and typical ECG evolution favors an ischemic etiology. Takotsubo cardiomyopathy has not yet been reported in Poland. It seems to be less prevalent in younger populations, in Caucasians, and exceptionally rare in Caucasian males.<sup>14</sup> In addition, our patient's first echocardiogram did not show extensive abnormalities consistent with apical ballooning (EF=64%, apical wall motion abnormality (WMA) limited to hypokinesis). Another important point is the temporal relationship—the symptoms usually start within a few minutes or hours of the emotional stress and an overnight delay is unusual. The clinical presentation of our patient is thus, in our opinion, sufficient for exclusion of this diagnosis. Regarding myocarditis, our patient had no signs or symptoms of infection preceding the event (mild inflammatory symptoms might represent the response to an ischemic event). In addition, pericardial effusion or generalized WMA were absent (regional WMA in the area of the left anterior descending artery were seen).

Although drug abuse is not new in adolescents, its profile is continuously changing. In conclusion, our report shows that clenbuterol abuse can be an unexpected cause of MI. Questions about drug abuse should be an integral part of patient examination, particularly in young body builders presenting with palpitations or chest pain.

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