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Acute Coronary Syndrome After Whole-Body Electrical Myostimulation

Tüm Vücut Kas Uyarımı Sonrası Gelişen Akut Koroner Sendrom Vakası

ABSTRACT

Whole-body electrical myostimulation is an alternative exercise training method. The effects of this exercise program on hemodynamics and coronary circulation have recently been investigated. However, an acute coronary syndrome associated with whole-body electrical myostimulation has not been reported before. In this case report, we present a patient who underwent whole-body electrical myostimulation in a sports center for weight control and was admitted to the emergency department with chest pain started in the second session of the training. Her electrocardiogram showed ischemic T-wave changes in the inferior leads. Additionally, troponin levels were elevated. A coronary angiogram was performed with the diagnosis of non-ST-segment elevation myocardial infarction. The coronary angiogram revealed severe vasospasm in the right coronary artery, which resolved with intracoronary nitroglycerin. She was uneventfully discharged with medical treatment. This case report is the first patient with acute coronary syndrome associated with whole-body electrical myostimulation in the literature.

Keywords: Acute coronary syndromes, angioplasty, electrocardiography

ÖZET

Tüm vücut elektriksel kas uyarımı alternatif bir egzersiz eğitim yöntemidir. Bu egzersiz programının hemodinamik ve koroner dolaşıma etkileri yakın zamanda araştırılmaya başlanmıştır. Ancak elektriksel kas uyarımı ile ilişkili akut koroner sendrom vakası daha önce bildirilmemiştir. Biz bu vaka sunumunda kilo kontrolü için bir spor merkezinde tüm vücut elektriksel kas uyarımı yapılan ve ikinci seansta başlayan göğüs ağrısı ile acile giden bir hastayı tartıştık. Elektrokardiyogramda inferiyor derivasyonlarda iskemik değişiklikler mevcuttu. Troponin T seviyesi yüksek saptanan hastaya ST segment yükselmesiz miyokart enfarktüsü tanısıyla koroner anjiyografi yapıldı. Koroner anjiyografide sağ koroner arterde nitrogliserin ile gerileyen ciddi vazospazm izlendi. Hasta medikal tedavi ile olaysız taburcu edildi. Bu vaka takdimi tüm vücut elektriksel kas uyarımı ilişkili literatürdeki ilk akut koroner sendrom hastasıdır.

Anahtar Kelimeler: Akut koroner sendrom, elektrokardiyografi, koroner anjiyoplasti

CASE REPORT
OLGU SUNUMU

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Whole-body electrical myostimulation (WB-EMS) is a relatively new training method that has become popular in recent years. It is used to increase physical endurance and to help weight control in patients who cannot perform conventional voluntary exercise because of illnesses.[1] Besides, WB-EMS can also be used for improving fitness and health in healthy subjects.

Local EMS is applied to the motor point of 1 or 2 muscle groups, whereas the WB-EMS uses the same principle for a large area on and along several muscle groups and allows the activation of the muscles of the thighs, arms, buttocks, abdomen, and chest.[2] Whole-body electrical myostimulation has great efficiency in terms of the time–benefit ratio with high coherence, even in untrained individuals.

Case Report

A 35-year-old woman presented with new-onset chest pain, nausea, and vomiting. She had no history of allergies, drug use, or cardiovascular risk factors. She had started WB-EMS training to lose weight a week ago in a private sports center. Electrical

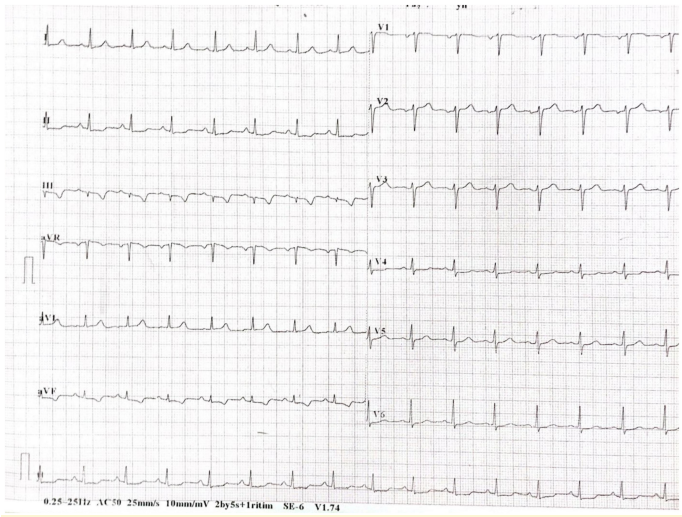

Figure 1. The electrocardiogram shows negative T waves in the inferior leads and in V4-V6.

paths used in her WB-EMS training involved chest, arms, abdomen, thighs, and buttocks area. The exercise was scheduled as 2 times a week in sets of 20 minutes. During the second exercise session, she had to stop exercising due to chest pain. The chest pain spread to the arms, precipitated without exertion, occurred 4 or 5 times a day for 2 days and each episode lasted for half an hour. She was admitted to the emergency department with ongoing chest pain that was accompanied by nausea and vomiting. Her physical examination was unremarkable, except a body mass index of 26.6 kg/m^2 (weight: 68 kg, height: 160 cm). The electrocardiogram showed evident negative T-waves in the inferior leads and slightly flattened ST-segments in V4-V6 leads (Figure 1). Troponin T (Elecsys e411, Roche, Mannheim, Germany) level was elevated and measured as 0.737 ng/mL in the emergency department (normal range: 0-0.03 ng/mL). The other laboratory parameters were within normal limits (lipid panel, fasting glucose, hemoglobin A1c, C-reactive protein, electrolyte levels, and hemogram). A coronary angiogram was performed with a preliminary diagnosis of non-ST segment elevation myocardial infarction. The left anterior descending and circumflex arteries were normal (Figure 2), but a severe and diffuse coronary spasm was observed at the right coronary artery (RCA), particularly in the proximal portion and after an acute marginal branch (Figure 3A). After 300 µg glyceryl trinitrate intra-coronary injection, these lesions resolved, and the diameter of RCA increased (Figure 3B). No electrocardiographic change was observed during the procedure. Her respiratory rate and oxygen saturation were in the normal range and no provocative maneuver was tried. Medical treatment with an oral long-acting formulation of diltiazem was started. The patient was discharged uneventfully. She had no chest pain during follow-up.

ABBREVIATIONS

WB-EMS	Whole-body electrical myostimulation
RCA	right coronary artery

Figure 2. Right anterior oblique projection showed normal left coronary anatomy.

Discussion

Whole-body electrical myostimulation is a relatively new and popular exercise training method. The development of WB-EMS dates back 10 years.[3] It was initially used only for therapeutic purposes, but later it was also used for exercise training and weight control. Whole-body electrical myostimulation devices are managed by dedicated software that allows the modification of the current frequency and the intensity of each of the channels. Electrical paths connected to channels used are generally designed to be wearable. However, there is no consensus regarding the frequency and intensity of the applied current. According to a meta-analysis, in most studies, the frequency of the current was 85 Hz and the duration of exercise varied between 10 and 30 minutes according to the protocol.[4] In general, the current is increased by 7-10 Hz every 10-15 minutes. Amaro et al[5] applied the current following an undulating periodization model in which the frequency varied from 12 to 90 Hz. The application of the WB-EMS is typically performed in sports or beauty centers where training sessions last for about 20 minutes. However, in many studies, the classic 20-minute training session does not

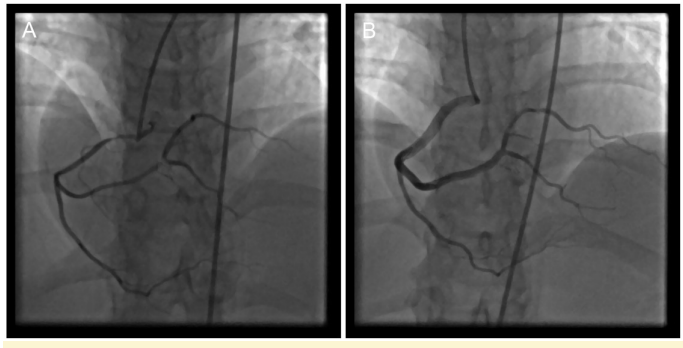

Figure 3. A-B. Right coronary artery in right anterior oblique projection before (A) and after nitroglycerin injection (B).

seem to be the most appropriate duration for the improvement of sports skills or the rehabilitation of injuries.[6] Although a guideline has been published to standardize the protocols applied, there is no uniform exercise protocol in the WB-EMS training.[7] Electrical myostimulation causes more muscle tension and muscle degradation than conventional exercise methods.[8]

Whole-body electrical myostimulation is contraindicated in patients with implanted electronic devices such as pacemakers and implanted defibrillators because of electrical interference potential. Otherwise, there are no known cardiac contraindications for WB-EMS. In a study that included 19 healthy Japanese volunteers aged 22-33 years, the safety and effects of the WB-EMS on hemodynamics, cardiac rhythm, and sublingual microcirculation were investigated.[9] The electrocardiogram and the echocardiography were conducted before a 20-minute WB-EMS session and at 0 and 10 minutes after termination of WB-EMS. Arrhythmia was not detected during neuromuscular electrical stimulation or during 10 minutes of recovery. The blood pressure, the heart rate, the left ventricular ejection fraction, and the diastolic function remained unchanged; however, a transient mild mitral regurgitation was observed in a participant during WB-EMS. Indexes of blood fluidity, sublingual microcirculation, oxidative stress, or blood levels of noradrenaline did not change. In recent years, different case reports have appeared in which rhabdomyolysis has occurred after a WB-EMS training session, especially in high-risk patients.[10] In this regard, we should keep this in mind when considering sensitive individuals. However, there is no study on the effect of EMS on coronary circulation.

Our case was young, had no risk factor for cardiovascular disease, and experienced complaints closely related to the WB-EMS session.

The main reason why we think that the relationship between acute coronary syndrome and WB-EMS in the patient is not coincidental is that her chest pain started during the exercise session. Also, she has never had angina pectoris before. This clinical case is an example of myocardial infarction with normal coronary arteries due to vasospasm which may be directly related to WB-EMS. The awareness of such a possible relationship between WB-EMS and coronary spasm is highly relevant and needs further exploration.

Informed Consent: Written informed consent was obtained from the patient who participated in this study.

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Declaration of Interests: The authors declare that they have no competing interest.

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