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ARCHIVES OF Clinical Hypertension OPEN ACCESS JOURNAL

ISSN: 2640-771X DOI: https://dx.doi.org/10.17352/ach

Case Report

Case report of optimizer implantation to modulate cardiac contractility in patients with chronic heart failure and atrial fibrillation

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Received: 06 March, 2023
Accepted: 15 March, 2023
Published: 16 March, 2023

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Abstract

A cardiac contractility modulation device is a new treatment used in patients with heart failure. CCM therapy is associated with an increase in physical activity tolerance, improved quality of life, reduced hospitalizations due to heart failure, and reverse remodeling of the left ventricle in patients with systolic heart failure. In this case, the clinical benefit of cardiac contractility modulation in a patient with chronic heart failure, atrial fibrillation and postinfarction left ventricle aneurysm was reported. Development of postinfarction left ventricle aneurysm in patients with reduced ejection fraction is associated with a high risk of surgical complications. However, an adequate assessment of the functional reserve of the left ventricle myocardium and the choice of surgical correction method allows for receiving favorable outcomes of surgery. We present a case of a successful combination of interventional and surgical treatment of a patient with heart failure and post-infarction left ventricular aneurysm.

Introduction

Heart Failure (HF) is a serious and growing problem in public health worldwide. According to multicenter international studies, 1% - 2% of the population has HF. Despite the stable incidence, the prevalence of HF is increasing due to the aging of the population, increasing the prevalence of concomitant diseases in the diagnosis of HF. In various countries, more than 10% of all healthcare costs for cardiovascular pathology fall on the treatment of chronic heart failure and a further increase in these costs is predicted [1].

Cardiac contractility modulation is an application of high-amplitude pulses that do not cause cell excitation during the absolute refractory period of the ventricles. Early studies on isolated cardiomyocytes have shown that a stimulus applied during the absolute refractory period through electrodes located inside and outside the cell increases the entry of Ca^{2+} through the cell membrane and improves the contractility of cardiomyocytes [2]. As part of a prospective randomized FIX-HF5 trial including 160 patients, it was shown that implantation of this device is safe and associated with an increase in peak oxygen consumption 24 weeks after implantation [3].

Aneurysm of the left ventricle is one of the most severe persisting complications after acute transmural myocardial infarction. The main problems in the surgery of postinfarction cardiac aneurysms are high hospital mortality, severe diastolic and systolic dysfunction of the left ventricular myocardium after surgery and recurrent heart failure [4]. Important aspects

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of determining indications for surgery include comprehensive diagnostic examination, assessment of the functional reserves of the myocardium, and preoperative calculation of the volume of the left ventricle. An excessively radical correction can lead to a pathological decrease and deformation of the left ventricle, a decrease in stroke volume, and a deterioration in systolic and diastolic function, which is clinically manifested by severe heart failure [5]. We present a case of a successful combination of interventional and surgical treatment of a patient with heart failure and post-infarction left ventricular aneurysm.

Case presentation

A 43-year-old male patient was admitted to the University Hospital on 16.11.2021. The patient's complaints were episodes of rapid heartbeat, accompanied by dizziness, sharp weakness and pre-fainting conditions. From anamnesis: the patient had a posterior myocardial infarction with the transition to the septum wall of the left ventricle 7 months before the admission. Coronary angiography with balloon angioplasty of the right coronary artery was performed on 04.06.2021. The patient had NYHA class 2 HF, aneurysm of the lower wall of the left ventricle with thinning to 0.3 cm. Concomitant diagnosis: type 2 diabetes mellitus, insulin-consuming. The patient was consulted by a cardiac surgeon. Conservative treatment, echocardiography and repeat consultation in 6 months were recommended. The patient regularly took medications: spironolactone 50 mg, sacubitril/valsartan 25 mg x 2 times a day; ticagrelor 90 mg x 2 times a day; atorvastatin 20 mg at night; dapagliflozin 10 mg 1 time a day; Cordarone 200 mg x 2 times a day; bisoprolol 2.5 mg a day.

Previous hospitalizations: 1) From 25.09.2021 to 01.10.2021 the patient was hospitalized at the cardiac center due to HF and paroxysm of stable ventricular tachycardia 25.09.2021.

2) From 02.11.2021 to 12.11.2021, he was hospitalized with the same diagnosis with severe weakness, episodes of loss of consciousness, and blood pressure of 80/60 mmHg. On ECG - paroxysmal ventricular mo monomorphic tachycardia with a heart rate of 196 per minute.

A subcutaneous cardioverter-defibrillator was implanted (17.11.2021). Implantation of a cardiac modulating device Optimizer Smart was performed on 21.12.2021. The patient has not experienced any device-related complications. The patient notes the activation of the subcutaneous cardioverter-defibrillator repeatedly in January - February 2022.

The patient was hospitalized at the Department of Cardiovascular Surgery in the University Hospital on 16.02.2022 with complaints of shortness of breath, episodes of palpitations not related to physical activity and aching pains in the heart area irradiating to the interscapular region. By echocardiography: end-diastolic volume 180 ml, end-systolic volume 96 ml, end-diastolic diameter 6.08 cm, end-systolic diameter 4.5 cm, ejection fraction 32%. An aneurysm of the basal part of the posterior wall of the left ventricle (0.3 cm thick) was detected and the threat of aneurysm rupture was revealed (Figure 1).

Coronary angiography was performed. Blood flow type was left. No significant atherosclerotic lesions were detected. 17.02.2022 - modified DOR Procedure (left ventricular reconstruction was performed. By echocardiography after the surgery (Figure 2): end-diastolic volume 165 ml, end-systolic volume 80 ml, end-diastolic diameter 5.8 cm, end-systolic diameter 4.2 cm, ejection fraction 48%, separation behind the tip of pericardium 0.6 cm, behind the lateral wall and right ventricle of 0.7 cm, behind the posterior wall - 0.8 cm.

During 1 year follow-up no major adverse cardiac events were registered which shows the efficacy of the performed treatment.

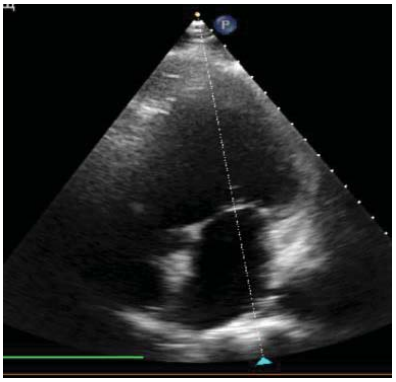

Figure 1: Transthoracic echocardiographic image of the aneurysm.

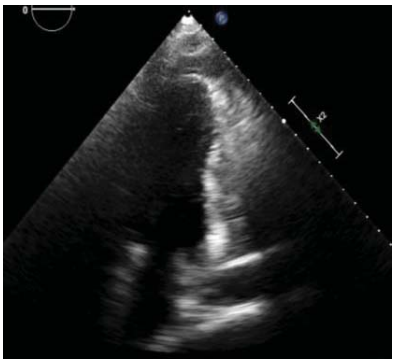

Figure 2: Transthoracic echocardiographic image after surgery.

Conclusion

The development of atrial fibrillation in patients with HF significantly worsens the prognosis of the course of the disease and increases mortality from all causes. There have been several independent clinical observations on the use of Optimizer Smart in patients with atrial fibrillation [6]. The present case clearly shows that the cardiac contractility modulation device should be considered the device of choice in patients with symptoms of heart failure with reduced ejection despite the use of optimal drug therapy. The introduction of a new generation of cardiac contractility modulators Optimizer Smart into clinical practice is a promising direction in the treatment of patients with chronic HF and atrial fibrillation who do not have indications for cardiac resynchronization therapy. One of the important

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clinical tasks in patients with atrial fibrillation and implanted cardiac contractility modulators is the control of heart rate, therefore proper prescription of antiarrhythmic drugs such as amiodarone and beta-blockers should be considered. In previous clinical trials the effectiveness in improving the clinical condition, functionality and quality of life, as well as the prevention of hospitalizations in patients with symptoms of heart failure has been demonstrated [7-9]. In order to understand the capabilities of modulating devices in patients with HF and atrial fibrillation, it is necessary to conduct full-fledged clinical studies.

Ethics statement

The patient provided his written informed consent to participate in this study. Written informed consent was obtained from the individual for the publication of any potentially identifiable images or data included in this article.

Funding

The work was funded by the Russian science foundation № 21-75-00065.

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