DOI: 10.15825/1995-1191-2024-2-48-50

BRIDGE TO CANCER THERAPY IN PATIENTS WITH CHRONIC HEART FAILURE: IMPLANTATION OF A LEFT VENTRICULAR ASSIST DEVICE BEFORE SURGICAL TREATMENT OF GASTRIC CANCER

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The co-occurrence of chronic heart failure (CHF) and cancer is becoming more and more common as people live longer. The lack of a structured approach to the treatment of cancer patients with severe cardiovascular conditions is an essential issue. Up to 25% of cancer patients cannot be operated on for their main disease profile due to the presence of cardiovascular disease. This article describes a clinical case of successful treatment of a patient with two competing (prognosis-determining) diseases: end-stage heart failure and stomach cancer within the framework of a bridge-to-cancer strategy.

Keywords: chronic heart failure, mechanical circulatory support, bridge to cancer therapy.

INTRODUCTION

Cardiovascular diseases and cancer are the leading causes of death in the Russian Federation. Introduction of new methods of diagnosis and treatment, as well as increased life expectancy among the population naturally lead to higher numbers of patients with co-occurrence of heart failure (HF) and malignancies. Up to 25% of cancer patients cannot undergo cancer surgery due to the presence of cardiovascular disease. Patients with end-stage heart failure are at incredibly high risk of adverse outcomes in cancer treatment due to reduced myocardial contractile function and limited cardiac reserves.

Heart transplantation (HT) remains the gold standard treatment for end-stage HF. Meanwhile, cancer with a poor life prognosis is one of the contraindications to HT. Modern long-term mechanical left ventricular assist devices (LVADs) have shown improved survival and quality of life compared with optimal medical therapy and comparable survival to HT. LVAD therapy may be a valuable option for staged treatment of patients with operable cancer as part of a bridge-to-cancer treatment strategy.

The **aim** is to demonstrate a case of successful treatment of a patient with two competing (prognosis-determining) diseases: end-stage HF and gastric cancer as part of a bridge-to-cancer treatment strategy.

CLINICAL CASE

Patient P., 45 years old, with complaints of paroxysmal dyspnea. Family history: his mother died at the age of 46 years (dilated cardiomyopathy, DCM) and father at the age of 52 years (myocardial infarction). From medical history, we know that Hodgkin's lymphoma was detected at the age of 17; radiation therapy, chemotherapy in 1996–1997. PET/CT scans showed persistent remission. Dyspnea debuted in 2018 with gradual progression. He was examined in the same year and CAG was performed: no hemodynamically significant stenosis, diagnosed with DCM with the development of biventricular HF. He was admitted to the National Medical Research Centre of Cardiology in Moscow in September 2022. An examination was carried out, according to EchoCG data: end-diastolic volume (EDV) = 9.0 cm, ejection fraction (EF) = 20%, mitral regurgitation (MR) = grade 3, right ventricular EF = 53%, tricuspid annular plane systolic excursion (TAPSE) = 2.4 cm; coronary angiography (CAG): subtotal stenosis of the anterior descending artery (ADA) in the proximal segment; right heart catheterization (RHC): pulmonary artery pressure (systolic/diastolic/average) = 22/6/12 mmHg, cardiac index (CI) = 1.9 L/min·m^2, stroke volume (SV) = 63 mL, pulmonary vascular resistance (PVR) = 78 dyn/s/cm^{-5}.

Based on complaints, medical history and laboratory and instrumental examination, the following diagnosis was made: "Dilated cardiomyopathy. Acquired heart defect: moderate relative mitral valve regurgitation. Chronic heart failure with reduced ejection fraction, NYHA class I. Ischemic heart disease: grade 3 angina pectoris. Atherosclerosis of the aorta and coronary arteries (subtotal stenosis of the proximal segment of ADA), muscle bridge of the middle segment of ADA. Cardiac rhythm and conduction disorders: frequent ventricular

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extrasystole, short paroxysmal ventricular tachycardia; left anterior fascicular block. Concomitant: Stage 2 hodgkin's lymphoma with cervical submandibular lymph node involvement, radiotherapy (5 sessions) from 1996, chemotherapy (6 sessions) from 1997."

As part of additional examination, an esophagogastroduodenoscopy (EGD) was performed: an area of altered mucosa was detected along the anterior wall of the middle third and lower third of the stomach by infiltration type. Biopsy of the gastric mucosa area revealed "high grade" gastric dysplasia. The patient was consulted by an oncologist, and gastric cancer T3N2M0, stage IIIA was diagnosed based on examination results. The patient was indicated for definitive surgical intervention, however, such surgery is associated with extremely high risks of death against the background of end-stage HF. The patient was consulted at the transplant center: HT was contraindicated due to the presence of cancer with poor prognosis. It was decided to perform surgical treatment in two stages. The first stage (as part of the "bridge to cancer treatment" strategy) included implantation of a mechanical circulatory support device (Heartmate 3™ device) with one-stage coronary bypass (mammary-coronary bypass of the anterior descending artery). The second stage of definitive treatment of gastric cancer is planned.

In October 2022, the HeartMate 3™ LVAD was implanted. Postoperative echoCG parameters: EDV = 8.0 cm, MR = grade 2, systolic pulmonary artery pressure (SPAP) = 22 mmHg, CI = 2.7 L/min·m^2. System parameters: pump flow = 4.4, pump speed = 5200 rpm, PI = 4.0 pump power = 3.8. On day 4 after implantation, compensated HF was observed. The patient was discharged and sent to the second stage – definitive treatment of gastric cancer on day 21 after Heartmate 3™ implantation.

In December 2022, he was hospitalized at Blokhin Russian Cancer Research Center in Moscow, where he underwent surgery: gastrectomy, D2 lymph node dissection, splenectomy, distal pancreatectomy. The surgery was successful. Extubation and activation in standard periods. No signs of heart failure were observed with the implanted Heartmate 3™ device. The patient was discharged from the hospital on day 23 in a satisfactory condition after the operation. Postoperative follow-up period was 12 months. The patient is able to work, is active enough, and fully complies with all recommendations. The 6-minute walk distance (6MWD) was 402 meters. EQ-5D-5L parameters: mobility = 2, self-care = 2, usual activity = 2, pain/discomfort = 1, anxiety/depression = 2, VAS Health Perception = 75.

DISCUSSION

The use of modern mechanical circulatory support devices demonstrates high efficacy and safety in patients with end-stage CHF, comparable to 2-year heart transplant outcomes [1]. HeartMate 3™ implantation is considered as definitive therapy and as an alternative to HT. Given the limitations of HT in operable patients with malignant tumors, staged surgical treatment with implantation of a mechanical circulatory support device, in particular HeartMate 3™, followed by definitive treatment of cancer seems optimal.

There are very few articles in the literature and little experience with this therapy option available globally. Given that the supply cable is located in the anterior abdominal wall, it is crucial to draw attention to the technical difficulty of treating abdominal malignancies through surgery. In 2017, Nakamura et al. was the first to demonstrate the possibility of successful surgical intervention for gastric cancer with surgical access via laparotomy in a patient with an LVAD [2]. The following year, Zarbaliyev et al. published a similar paper describing a successful clinical case of gastrectomy for gastric cancer on day 20 following LVAD implantation [3].

In both cases reported in the literature, the malignancy was diagnosed after LVAD implantation. Confirmation of the cancer diagnosis during the preoperative period sets our case apart. We believe that the presence of operable malignancy could provide more justification for implantation of a mechanical circulatory support device. We expect that in the future, staged surgical intervention will be used more often in patients with end-stage CHF and operable malignancy and that clinical guidelines will codify this procedure for a certain patient cohort.

CONCLUSION

Our case demonstrates that cancer patients with end-stage HF, who are at a very high risk of dying, can benefit from phased surgical care. With an acceptable safety profile, the implantable HeartMate 3™ LVAD exhibits high immediate efficacy in supporting systemic hemodynamics. Surgical treatment of malignant tumors can be safely performed in the presence of LVAD as part of the "bridge-to-cancer treatment" strategy. This promising direction requires further research.

The authors declare no conflict of interest.

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The article was submitted to the journal on 04.03.2024