The Saviour of a Pregnant Woman With Fulminant Myocarditis ——Extracorporeal Membrane Oxygenation: A Case Report

Yanan Lin
Qingdao Municipal Hospital Group, Weifang Medical University - Fuyanshan Campus: Weifang Medical University
Bin Wang
Qingdao Municipal Hospital Group
Xu Lin
Qingdao Municipal Hospital Group
Fuguo Ma
Qingdao Municipal Hospital Group
Zhaozhuo Niu
Qingdao Municipal Hospital Group
Dan Hu
Qingdao Municipal Hospital Group
Hong Tao
Qingdao Municipal Hospital Group
Zhanping Weng
Qingdao Municipal Hospital Group
Mingshan Wang
Qingdao Municipal Hospital Group
Lixin Sun
Qingdao Municipal Hospital Group
Wei Han
Qingdao Municipal Hospital Group
Yanlin Bi (pndable2021@sina.com)
Qingdao Municipal Hospital Group

Case report

Keywords: Case Report, Pregnant Woman, Fulminant Myocarditis, Extracorporeal Membrane Oxygenation

Posted Date: September 30th, 2021

DOI: https://doi.org/10.21203/rs.3.rs-900533/v1

Abstract

INTRODUCTION: There are no reports regarding a pregnant woman with fulminant myocarditis underwent Extracorporeal Membrane Oxygenation (ECMO). Hence, we report a case of successful ECMO treatment of fulminant myocarditis puerpera.

CASE PRESENTATION: A 32-year-old puerpera was admitted to our hospital with menopause for 7 months, fetal movement for 3 months and fever for 1 day. After admission, the patient's body temperature increased repeatedly, heart rate increased, and the whole process C-reactive protein increased rapidly. Considered a diagnosis of fulminant myocarditis. After antiviral and cardioprotective treatment, the heart function progressively worsened. Pregnancy was terminated, the newborn was intubated in the neonatal room for rescue after surgery, and ECMO treatment was given after the puerpera was transferred to the intensive care unit. Finally, the patient and the baby have been safely discharged from hospital.

DISCUSSION: ECMO can provide cardiac and respiratory support. Fulminant myocarditis is common in children, adolescents and particularly pregnant women who had the highest mortality rate. In the pregnant woman with fulminant myocarditis described in this report, antiviral treatment only transiently improved heart function and then heart function progressively worsened. After receiving ECMO therapy, the patient's cardiac function has improved markedly. The patient was then successfully weaned from ECMO. To our knowledge, this is the first report of pregnant woman in whom ECMO was part of the treatment for fulminant myocarditis.

CONCLUSION: We report a case of successful ECMO treatment of fulminant myocarditis puerpera. ECMO can be the treatment of choice for pregnant women with fulminant myocarditis.

Introduction

In recent years, extracorporeal membrane oxygenation (ECMO) has been increasingly used in the treatment of patients with acute cardiac insufficiency and its therapeutic effects have been more and more widely accepted [1]. It can also provide cardiac and respiratory support, mainly used for early respiratory distress in infants. Currently, ECMO has been increasingly applied for the management of fulminant myocarditis [2, 3].

Myocarditis is defined as an inflammatory disease of the heart muscle, diagnosed by established histological, immunological and immunohistochemical criteria [4]. Different triggers could be advocated as possible etiologies of myocarditis: viral and nonviral infections, medications, systemic autoimmune diseases and toxic reactions[5]. The spectrum of clinical presentations of myocarditis is broad, varying from subclinical asymptomatic courses to refractory cardiogenic shock[6]. The prognosis of patients with myocarditis mainly depends on the severity of clinical presentation. The incidence of myocarditis is high in summer and autumn. Myocarditis is common in children, adolescents and particularly pregnant women who had the highest mortality rate. In the pregnant woman with fulminant myocarditis described in this report, antiviral treatment only transiently improved heart function and then heart function

progressively worsened. After receiving ECMO therapy, the patient's cardiac function has improved markedly. The patient was then successfully weaned from ECMO. To our knowledge, this is the first report of pregnant woman in whom ECMO was part of the treatment for fulminant myocarditis. And the patient and the baby have been safely discharged from hospital.

Case Report

This 32-year-old pregnant woman was admitted to Qingdao Municipal Hospital with menopause for 7 months, fetal movement for 3 months and fever for 1 day. Relevant examinations were completed after admission with the following results: WBC count 9.71×10^9/L, neutrophil count 8.50×10^9/L, lymphocyte count 0.60×10^9/L, erythrocyte count 3.63×10^12/L, hemoglobin 112.00g/L, hematocrit 34.00%, the whole process C-reactive protein 47.60mg/L, alanine aminotransferase 106.61U/L, aspartate aminotransferase 214.06U/L, creatine kinase 542.50U/L, creatine kinase isoenzyme 81.90U/L, and creatinine 46.28umol/L. The ECG showed sinus rhythm and sinus tachycardia (Fig. 1). The computed tomography (CT) image of lung is normal. The echocardiogram demonstrated right atrial enlargement, decreased systolic function of right ventricle (mild), pericardial effusion (small), normal left ventricular wall thickness and movement, an EF of 56%, an estimated right atrial pressure of 8mmHg, and an estimated pulmonary artery systolic pressure of 21mmHg.

On Day 3 postadmission, the patient's temperature was 38℃. Results of laboratory examinations were as follows: myoglobin 64.23ng/ml, creatine kinase isoenzyme 37.81ng/ml, high-sensitivity troponin I 12.181ng/ mL, and BNP 10755.42pg/ml. Results of routine coagulation testing were as follows: prothrombin time 13.30s, activated partial thrombin time 32.60s, thrombin time 15.80s, D-dimer quantitative 6.10ug/ml, and fibrinogen 4.99g/L. The ECG showed sinus tachycardia, complete right bundle branch block and ST-T changes (Fig. 2). As the cause of the pregnant woman's fever was difficult to make clear, a consultation was performed by the department of cardiology, the department of respiratory medicine, the department of nephrology, the department of immunology and rheumatology as well as the department of medical imaging, with a diagnosis of acute myocarditis. The pregnant woman's condition deteriorated rapidly, and emergency cesarean section was performed under lumbar epidural anesthesia. After the patient entered the operating room, we routinely monitored ECG, SpO2 and NBP, as well as opened venous access. The patient underwent combined spinal-epidural block, with the space between lumbar 3–4 spinous processes (L3-4) as the puncture site. After successful puncture, injection of 2-2.5ml ropivacaine (0.66%) for about 30s. After anesthesia, the sensory level was controlled below the T8 level. During the surgery, oxygen was inhaled via mask at 5 L/min to maintain blood pressure within +/- 20% of the baseline value. If intraoperative NBP was < 90 mmHg (1mmHg = 0.133kPa) or it decreased by more than 20% of the baseline value, ephedrine 5mg was injected intravenously. If HR was < 50 beats/min, atropine 0.5 mg was injected intravenously. Intravenous patient-controlled analgesia (butorphanol 0.1mg/ml + tropisetron 50 g/ml, diluted with normal saline to a total volume of 100 ml) was used in acute postoperative pain management. After the operation, the patient was sent to ICU. A live baby was delivered during the operation. The Apgar score was 5–6. After neonatal resuscitation, the live baby was transferred to the neonatal department.

On Day 4 postadmission, the patient's cardiac function continued to deteriorate after antiviral therapy. The results of laboratory examinations were as follows: myoglobin 129.50ng/ml, creatine kinase isoenzyme 48.65ng/ml, high-sensitivity troponin I 14.237ng/ mL, and b-amino-terminus natriuretic propeptide 15958.25pg/ml. Echocardiography showed left ventricular wall motion abnormalities, decreased left ventricular systolic function (mild to moderate), pericardial effusion (small amount),ECG revealed acute anterior-wall myocardial infarction with right bundle branch block (Fig. 3). It was believed that the patient would soon die without ECMO support. Therefore, a venoarterial ECMO circuit was placed via the right femoral artery and the right femoral vein immediately. The patient's condition stabilized after initiation of ECMO. The patient's clinical status remained stable during the next 7 days, but we could not wean her from the ECMO circuit.

After ECMO therapy, cardiac function was significantly improved, and the concentrations of hypersensitive troponin and b-type amino-terminal natriuretic peptide were significantly decreased. ECG showed sinus tachycardia and ST-T changes (Fig. 4). The patient was slowly weaned from pressor support, and her heart function gradually improved. Repeated echocardiography demonstrated improved ventricular function. The patient could now be weaned from the ECMO circuit, and the vascular cannulas were removed on Day 10 postadmission. The echocardiogram demonstrated normal left ventricular systolic function, normal left ventricular diastolic function, and an EF of 59%. On Day 22, she and her baby were discharged from the hospital.

Discussion

Fulminant myocarditis (FM) is an important cause of cardiovascular morbidity and mortality in both children and adults. Patients with fulminant myocarditis may present with circulatory instability such as heart failure, which may threaten patients’ lives. In addition, some young adults with fulminant myocarditis who had an unclear source of infection might be misdiagnosed as acute myocardial infarction. The two diseases can be distinguished by a comprehensive and careful analysis of cases[7]. Fulminant myocarditis is characterized by rapid progression within a short period of time, cardiogenic shock, acute congestive heart failure, severe arrhythmia, and AS syndrome[8]. Fulminant myocarditis accounts for 20–30% of myocarditis. Due to the severity of the disease and a lack of effective means of rescue, fulminant myocarditis has a high fatality rate of 50%-75%[9], which should be taken seriously.

This is a case of a pregnant woman with fulminant myocarditis. Attention should be paid to the clinical symptoms of fulminant myocarditis and cardiac insufficiency. When a patient had severe cardiac insufficiency, ECMO should be used immediately, which can effectively reduce cardiac input and output, as well as provide time for subsequent treatment.

Venoarterial extracorporeal membrane oxygenation (VA-ECMO), as a more readily accessible and reversible intervention, has been used to treat the patients until recovery. The principle of ECMO is to provide life support when respiratory and circulatory systems fail. Patients with acute fulminant myocarditis (AFM) who present with severe hemodynamic deterioration, cardiogenic shock, severe

ventricular dysfunction, and refractory arrhythmias may be treated with positive muscle drugs or mechanical hearts requiring pulmonary assist devices such as extracorporeal membrane oxygenation (ECMO)[10]. The pathophysiological process of myocarditis may be reversible. Although not all patients with arrhythmia or end organ failure require ECMO support, patients with fulminant myocarditis receive ECMO support. Therefore, a better understanding of the patients' condition to make an accurate diagnosis is necessary for further making appropriate treatment decisions. Mechanical circulatory support should be used immediately when conventional treatment fails[11, 12]. In V-A ECMO mode, ECMO assists cardiopulmonary function by oxygenating the drained venous blood in the oxygenator, removing carbon dioxide, and pumping the oxygenated blood into the arteries. Therefore, V-A ECMO is widely used in a variety of diseases caused by cardiogenic shock and cardiac arrest. ECMO is also the most reasonable choice for the patients with myocarditis accompanied by arrhythmia as well as terminal organ and circulatory failure [13]. Currently, the early application of ECMO, the ultimate means of intensive treatment, can bring great benefits to the patients. For this patient, the ECMO treatment is adopted to relieve the anterior and posterior load ,to reduce the pressure of the left heart through surgical decompression and drainage and to decrease myoglobin, creatine kinase isoenzyme, high-sensitivity troponin and b-amino-terminus natriuretic propeptide (Fig. 5). The real unloading of the left ventricle can promote the recovery of the left ventricle function, thus providing a favorable opportunity for the recovery of the cardiac function.

To our knowledge, this is the first reported case in which a pregnant woman with fulminant myocarditis underwent ECMO.

Conclusions

Extracorporeal membrane oxygenation can be used for the treatment of pregnant women with fulminant myocarditis caused by virus.

Declarations

Ethics approval and consent to participate

Not applicable.

Consent for publication

Written informed consent was obtained from the patient for publication of this case report and any accompanying images. **Availability of data and material**

Data sharing is not applicable to this article as no datasets were generated or analysed during the current study

Competing interests

The authors declare that they have no competing interests.

Funding

None declared.

Authors' contributions

Writing – original draft: YNL, BW, XL

Conceptualization: DH, HT, ZPW

Writing – review & editing: YLB, FGM, LXS

Supervision: ZZN MSW, WH,

All authors read and approved the final manuscript.

Acknowledgements

Not applicable.

References

1. Tramm R, Ilic D. Davies A:Extracorporeal membrane oxygenation for critically ill adults. Cochrane Database Syst Rev. 2015;1:CD010381.
2. Pozzi M, Banfi C, Grinberg D. Veno-arterial extracorporeal membrane oxygenation for cardiogenic shock due to myocarditis in adult patients. J Thorac Dis. 2016;8:E495–502.
3. Lin K, Li M, Hsieh K. Impact of Extracorporeal Membrane Oxygenation on Acute Fulminant Myocarditis-related Hemodynamic Compromise Arrhythmia in Children. Pediatr Neonatol. 2016;57:480–7.
4. Caforio A, Pankuweit S, Arbustini E. Current state of knowledge on aetiology, diagnosis, management, and therapy of myocarditis: a position statement of the European Society of Cardiology Working Group on Myocardial and Pericardial Diseases. European heart journal. 2013;34:2636–48.
5. Kindermann I, Barth C, Mahfoud F. Update on myocarditis. J Am Coll Cardiol. 2012;59:779–92.
6. Sagar S, Liu P, Cooper L:Myocarditis. Lancet. 2012;379:738–47.
7. Baughman K. Diagnosis of myocarditis: death of Dallas criteria. Circulation. 2006;113:593–5.
8. Conraads V:Fulminant myocarditis. N Engl J Med. 2000;343:299–300.
9. Zhang X, Wang S, Jia J. The use of extracorporeal membrane oxygenation in the treatment of fulminant myocarditis: Current progress and clinical outcomes. Microvasc Res. 2021;137:104190.

10. Kindermann I, Kindermann M, Kandolf R. Predictors of outcome in patients with suspected myocarditis. Circulation. 2008;118:639–48.
11. Kato S, Morimoto S, Hiramitsu S. Risk factors for patients developing a fulminant course with acute myocarditis. Circ J. 2004;68:734–9.
12. Wu E, Huang S, Chen Y. Children with fulminant myocarditis rescued with extracorporeal membrane oxygenation. Heart. 2006;92:1325–6.
13. Almond C, Singh T, Gauvreau K. Extracorporeal membrane oxygenation for bridge to heart transplantation among children in the United States: analysis of data from the Organ Procurement and Transplant Network and Extracorporeal Life Support Organization Registry. Circulation. 2011;123:2975–84.

Figures

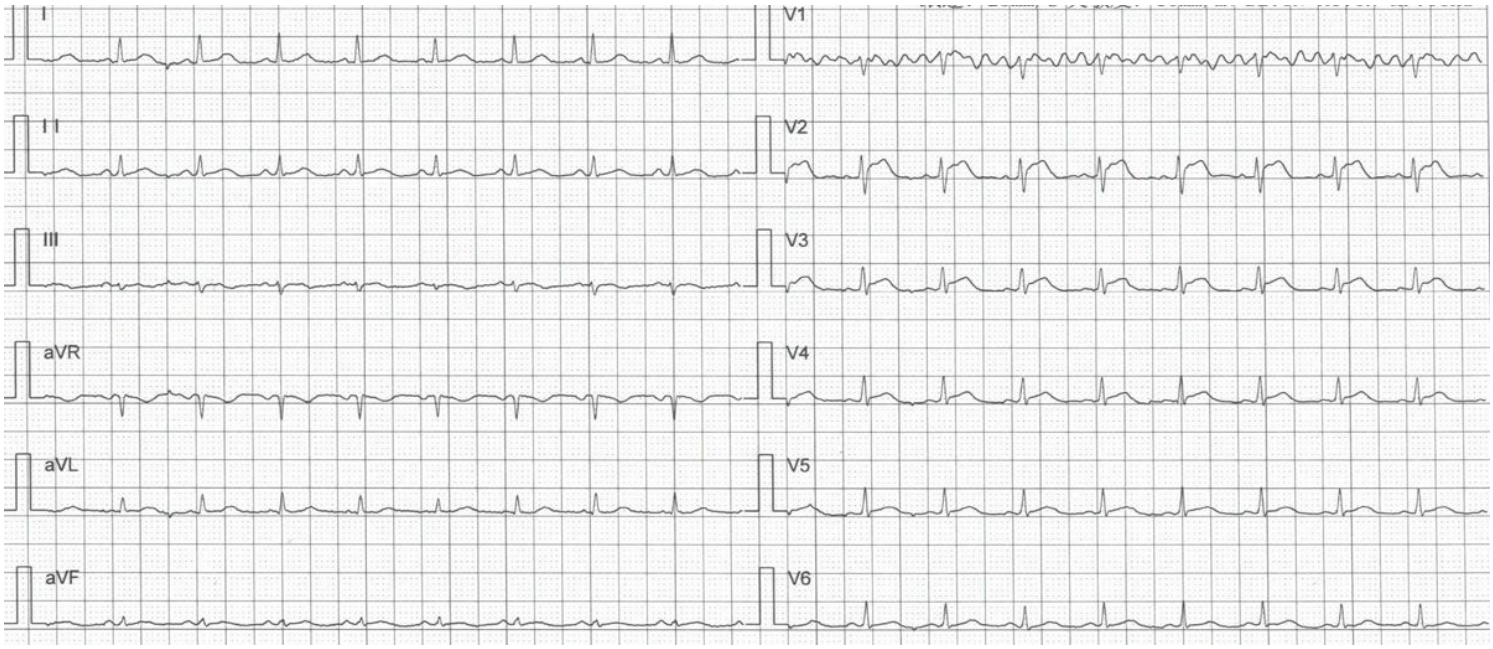

Figure 1

The ECG showed sinus rhythm and sinus tachycardia (Figure1).

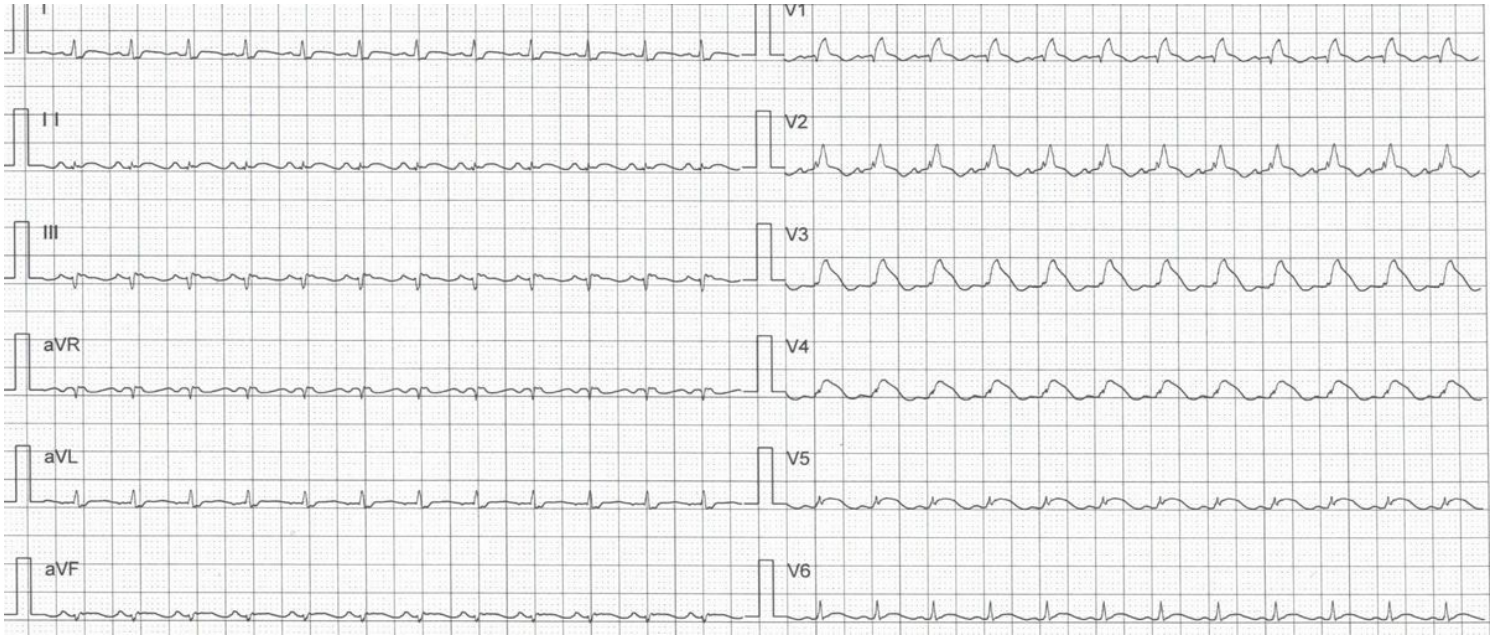

Figure 2

The ECG showed sinus tachycardia, complete right bundle branch block and ST-T changes (Figure2).

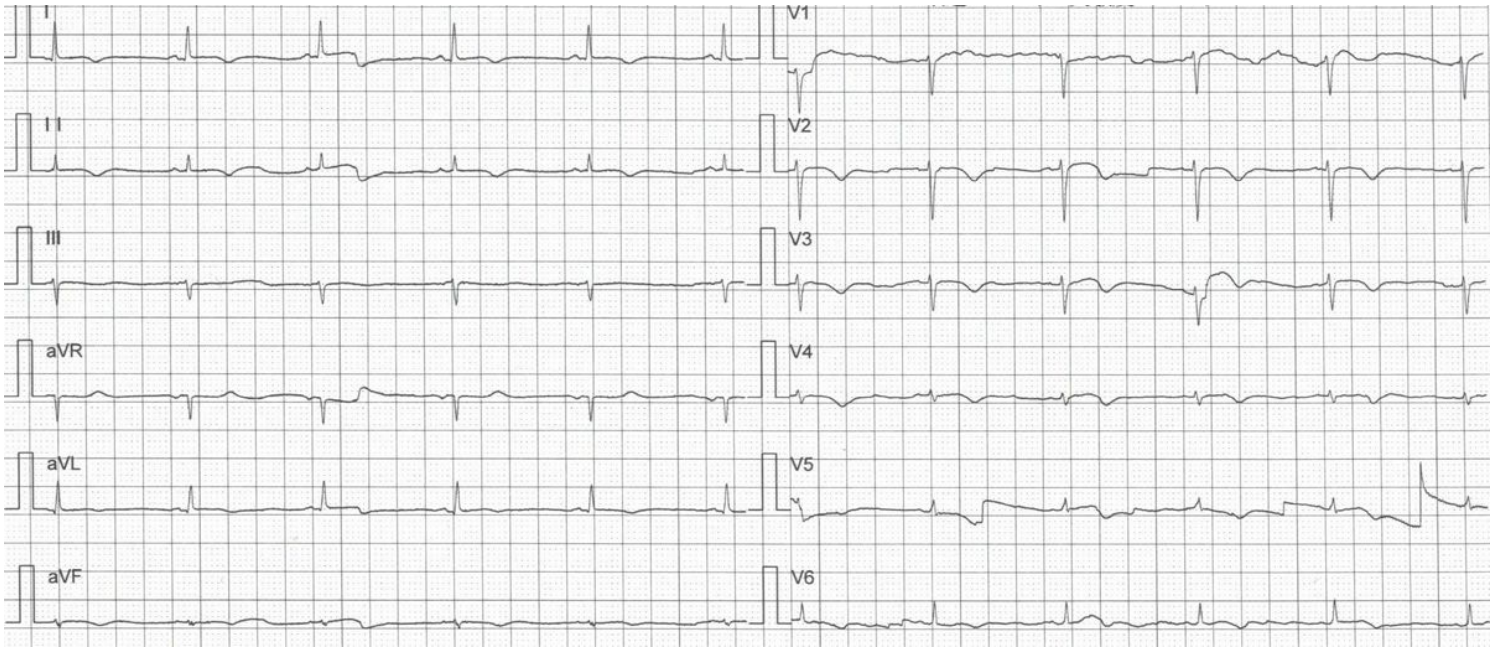

Figure 3

ECG revealed acute anterior-wall myocardial infarction with right bundle branch block (Figure3).

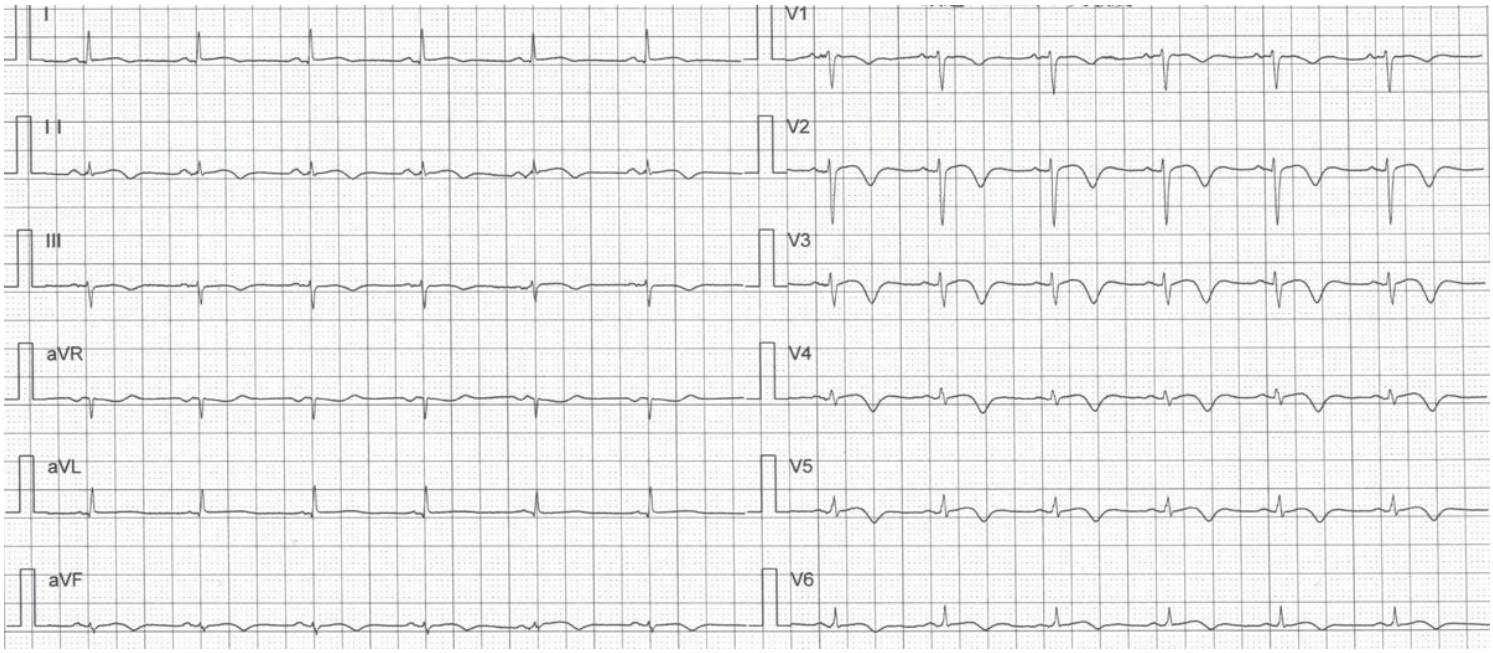

Figure 4

ECG showed sinus tachycardia and ST-T changes (Figure4).

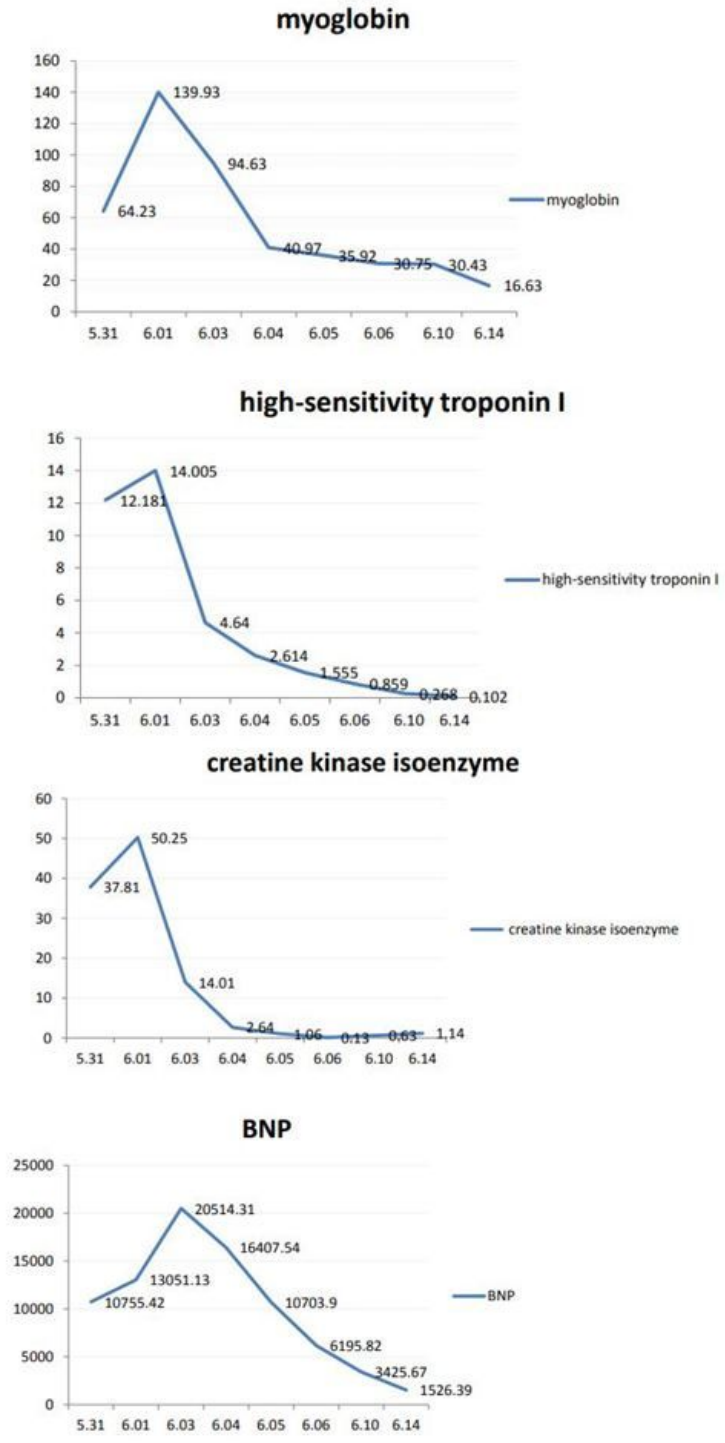

Figure 5

For this patient, the ECMO treatment is adopted to relieve the anterior and posterior load, to reduce the pressure of the left heart through surgical decompression and drainage and to decrease myoglobin, creatine kinase isoenzyme, high-sensitivity troponin and b-amino-terminus natriuretic propeptide (Figure5).