Case Report / Olgu Sunumu

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Successful Treatment of Severe Intractable Diarrhea and Malnutrition in a Child with Dilated Cardiomyopathy Bridged to Left Ventricular Assist Device from Extracorporeal Cardiopulmonary Resuscitation

Ekstrakorporeal Kardiyopulmoner Resüsitasyondan Sol Ventriküler Yardım Cihazına Köprülenmiş Dilate Kardiyomiyopatili Bir Çocukta Şiddetli İnatçı Diyare ve Malnutrisyonun Başarılı Tedavisi

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Abstract

An increasing number of pediatric patients with dilated cardiomyopathy (DCMP) undergo mechanical circulatory support (MCS), as a bridge to heart transplantation. Gastrointestinal complications in this population are rare, and the treatment is challenging. Patients with DCMP frequently present with heart failure symptoms, such as tachycardia, hypotension, respiratory distress, cyanosis, weak peripheral pulses, and inadequate feed. Rarely, gastrointestinal symptoms, such as nausea and ascites, may be noted if biventricular failure develops. Here we present a case of a 14-year-old girl with severe intractable diarrhea and malnutrition after being diagnosed with DCMP. After extracorporeal cardiopulmonary resuscitation, she was bridged to a long-term left ventricular assist device support. Her recovery was complicated with intractable diarrhea and malnutrition, which were critical. Thus, this case study aimed to emphasize that pediatric patients with DCMP having persistent diarrhea and malnutrition can be successfully treated with MCS.

Keywords: Dilated cardiomyopathy, intractable diarrhea, malnutrition, extracorporeal membrane oxygenation, left ventricular assist device

Öz

Dilate kardiyomiyopatili (DKMP) çocuk hasta grubunda, kalp transplantasyonuna köprü olmayı amaçlayan mekanik dolaşım desteğine (MDD) ihtiyaç vardır. Bu popülasyonda gastrointestinal komplikasyonlar nadirdir ve tedavisi zordur. DKMP'li hastalar sıklıkla taşikardi, hipotansiyon, solunum sıkıntısı, siyanoz, zayıf periferik nabızlar ve beslenme isteksizliği gibi kalp yetersizliği semptomları ile başvururlar. Nadiren, biventriküler yetmezlik gelişirse mide bulantısı ve asit gibi gastrointestinal semptomlar görülebilir. Bu çalışmada, DKMP tanısı konulduktan sonra şiddetli, inatçı diyare ve yetersiz beslenmesi olan 14 yaşında bir kız çocuğunu sunuyoruz. Ekstrakorporeal kardiyopulmoner resüsitasyon sonrası uzun süreli sol ventrikül destek cihazı desteği sunulmuştur. İnatçı diyare ve malnütrisyonu olan DKMP çocuk hastaların MDD ile başarılı bir şekilde tedavi olduğunu vurgulamayı amaçlıyoruz.

Anahtar Kelimeler: Dilate kardiyomiyopati, inatçı ishal, yetersiz beslenme, ekstrakorporeal membran oksijenasyonu, sol ventrikül yardımcı cihazı

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Introduction

Cardiomyopathy is characterized by cardiac muscle dysfunction and is divided into the following subgroups, dilated, restrictive, hypertrophic, arrhythmogenic right ventricular dysplasia, and those that cannot be classified. Dilated cardiomyopathy (DCMP) is a myocardial disease that is often manifested by congestive heart failure (HF) and is associated with the dilated left ventricle and systolic dysfunction.[1] It is the most common type of cardiomyopathy in children. The most common cause of DCMP is idiopathic, whereas the second most common cause is myocarditis.[2] Sufficient cardiac output is not achieved in patients, thus congestive HF signs appear. Clinically, 70-80% of cases have tachycardia, cyanosis, weak peripheral pulses, prolonged capillary filling, hepatomegaly, and rales in the lungs.[3] Gastrointestinal symptoms of severe HF include nausea, inadequate feeding, ascites, and rarely, diarrhea. Out of diarrhea are well determined. Diarrhea is caused by congestion due to HF, especially right-sided, thereby leading to intestinal edema and ischemia, mucosal contraction destruction, and absorption capacity loss.[4] The primary treatment is HF-oriented, such as fluid restriction, diuretic therapy, decreasing afterload, increasing myocardial contractions, and abnormal rhythm control. If these treatments are insufficient, further options should be considered, such as short-term extracorporeal membrane oxygenation (ECMO), long-term ventricular assist devices (VAD), and heart transplantation as a permanent solution.[5] This is the first case that describes a patient with intractable diarrhea due to DCMP who was successfully treated with ECMO and then left VAD (LVAD) as a bridge to heart transplant. This was an outstanding experience for us.

Case Report

A 14-year-old girl was admitted to another hospital with 12-14 times/day bloody diarrhea and severe weight loss (~10 kg) for 3 months. Her abdominal ultrasonography (USG) revealed ascites and portal vein thrombosis. Left ventricular ejection fraction (EF) was 25% with evident dilation. Additionally, two thrombi were detected within the left ventricle on transthoracic echocardiography. At follow-up, the patient's HF findings progressed, and she needed increasing doses of inotropes and intubation. Then, she was transferred to our pediatric intensive care unit (PICU) for heart transplantation.

On admission, she was conscious but intubated and was on mechanical ventilation. The patient's heart rate was 130 beats/minute, temperature was 37.2 °C, and blood pressure was 70/30 mmHg. Her Z-scores for weight-, height-, and body mass index-for-age were -2.9, -0.76, and -3.26, respectively. Her medical history was unremarkable, but her sister had an idiopathic DCMP (EF of 12%), and her 15-year-old relative (2nd degree) died due to heart disease.

The routine laboratory tests were normal except for elevated aspartate aminotransferase (140 U/L; n=0-50), alanine aminotransferase (189 U/L, n=0-50), lactate dehydrogenase (523 U/L; n=110-295), and creatine kinase (629 U/L; n=0-171). Cardiac panel were creatine kinase-MB of 7.04 ng/mL (n=0-3.61), troponin T of 443.2 pg/mL (n=0-14), and N-terminal proB-type natriuretic peptide of 34,196 pg/mL (n=0-125).

Echocardiography revealed extremely dilated left cardiac chambers, moderate mitral regurgitation, biplane left ventricular EF of 17%, and two thrombi in the left ventricle apical area. The left ventricular internal dimension in diastole and left atrial to aortic root ratios were 65.3 mm (M-mode Z-score: +5.56) and 2.5, respectively. Aortic insufficiency was not detected. We started fluid restriction at 1.000 mL/m^2/day, milrinone (0.5 mcg/kg/min) and adrenaline (0.1 mcg/kg/min), levosimendan (0.1 mcg/kg/min, for 24 h), and furosemide infusion (0.1 mg/kg/h). N-acetyl cysteine for liver protection and heparin for the thrombi was started, and the heparin dose was titrated to activated partial thromboplastin time ranging 60-80 sec. Controlled abdominal USG and portal vein Doppler USG were normal on the second day of hospitalization. The thrombosis gene analysis and other risk parameters were also normal.

The investigations of the intractable diarrhea were unremarkable. The stool examination was regular and occult blood in stool was negative. Infections (bacteria, viruses, and parasites) were excluded by laboratory findings. The screening for celiac disease was negative. Extensive immunological (complete blood count, C-reactive protein, immunoglobulin A, G, and M, flow cytometry, and cluster designations 4 and 8) and metabolic tests were standard. The total parenteral nutrition (PN) had to be initiated due to enteral nutrition (EN) intolerance. The stomach tube drained approximately 250-400 mL/day of bilio-digestive fluid, and the diarrhea continued.

On the third day of follow-up, cardiac arrest (CA) developed, thus cardiopulmonary resuscitation (CPR) for 1 min was performed, as well as defibrillation (2 joules/kg) due to pulseless ventricular tachycardia, and amiodarone was started. CA developed again, thus we established femoral veno-arterial ECMO (VA-ECMO) at 45 min of CPR (ECPR). Adequate ECMO flow (blood flow of 2.5 L/min, pump speed of 2.500 rotation/min) was obtained at 50 min of ECPR. At follow-up, the patient's mean arterial pressure ranged between 75 and 80 mmHg, thus inotropes were gradually reduced.

On the fifth day of follow-up, physical examination of the patient revealed the absence of right upper and lower extremity movements, as well as deep tendon reflexes. No

anisocoria was observed in the pupils, and infarct areas were observed in the right basal ganglia, adjacent regions of the right ventricle, and brain stem in brain computed tomography. At follow-up, the patient was conscious and gained little movement and strength on the extremities on the 5th day of ECMO. We discussed and decided on LVAD implantation for heart transplantation destination. On the 14th day of ECMO, we decannulated to ECMO and then implanted LVAD in the same operation season. Afterward, the patient's rhythm disturbances settled, and antiarrhythmic drugs were reduced. The inotropes were discontinued on day 2 of LVAD. For efficient bronchial aspirations, tracheostomy was opened on day 56 of PICU admission.

However, the patient's diarrhea was persistent. Her fluid requirement was adjusted according to the volume and number of feces. The polymerase chain reaction of serum revealed 7.980 copies/mL of cytomegalovirus on day 20 of hospitalization, which was considered clinically significant. Despite appropriate treatment, her diarrhea did not show improvement.

Continuous EN was commenced 3 days after LVAD insertion. The EN was incrementally increased following clinical and gastrointestinal tolerance and titrated against PN. On day 15 of LVAD implantation, her full nutritional requirements were provided by EN, following which her diarrhea decreased and oral feeding was initiated. The patient was successfully switched to a regular diet 35 days after LVAD. She gained 12 kg within 2 months with nutritional support. The patient, whose oxygen requirement continued, was transferred to the pediatric cardiology service with a home mechanical ventilator. The tracheostomy cannula was removed 47 days after discharge from PICU. At follow-up, oxygen supplement was unnecessary and remained without complications afterward. Weight gain was achieved in the patient who was fully fed orally and no longer had any diarrhea complaints. The patient received physical therapy for 2 months and rehabilitation (FTR) support for hemiplegia of the right upper and lower extremities. In the right upper and lower limbs, the motor deficit returned at a rate of 4/5. The patient was discharged from the hospital 6 months after LVAD implantation.

Discussion

We present the first case of a girl with intractable diarrhea secondary to DCMP who was successfully treated by ECMO and then LVAD. Systemic and pulmonary edema developed due to DCMP. Additionally, due to cardiac dysfunction, the blood supply to other organs was impaired. Thus, there was a loss of function in the different organs due to edema and hypoxia.

Intestinal morphology, permeability, and absorption change in HF.[4,6,7] A decreased splanchnic microcirculation causes intestinal ischemia. Increased intestinal permeability and bacterial biological layer contribute to both chronic inflammation and malnutrition.[8] Ischemia causes epithelial cell dysfunction and the loss of barrier function of the gut, allowing lipopolysaccharide or endotoxin produced by Gram-negative gut bacteria to enter the circulatory system.[8,9] These effects trigger systemic inflammation and cytokine formation, leading to cardiomyocyte function and energy abnormalities. According to Mini Nutrition Assessment, this pathophysiology is prevalent in 75% of patients with HF and they have a risk of malnutrition due to malnutrition.[9] Our patient had chronic and severe diarrhea associated with HF, ultimately leading to the development of severe malnutrition. Due to the absence of any pathogens in our patient that could suggest the triggering of chronic diarrhea, the diarrhea was considered to be secondary to HF. Percutaneous VA-ECMO was established to bridge the LVAD following cardiogenic shock and CA.

Toda et al.[5] had retrospectively analyzed the data of 32 patients with LVAD who required percutaneous VA-ECMO. Of them, 11 patients with the LVAD device was removed due to cardiac transplantation, 15 died during LVAD, and six had improved cardiac function, thus LVAD was removed. Another retrospective study revealed that 78 of 201 patients who underwent heart transplantation were recorded as pediatric patients. CA developed in 15 of these pediatric patients, and CPR was performed. Patients were given ECMO support under ECPR. LVAD had been implanted in seven of these patients.[10] The clinical condition of our patient worsened, which is compatible with the literature regarding ECPR application and subsequent LVAD insertion. We observed that the patient had reduced diarrhea complaints and enteral feeding after LVAD implantation.

Bhatia et al.[11] retrospectively reviewed the data of 13 children who underwent LVAD implantation between 2001 and 2018. They emphasized that LVADs were a potentially life-saving option for children with HF who do not respond to medical treatment as a bridge for heart transplantation or cardiac recovery. Therefore, the patient who was clinically stable and gained weight was also included in the heart transplant list after LVAD insertion. Schweiger et al.[12] reported that 12 pediatric patients with DCMP were discharged with an LVAD device between 2011 and 2013. No patient had died. Eight children had continued attending their local schools. They emphasized the possibility and safety of living with LVAD support at home along with ensuring school integration for children. We discharged our patient with an LVAD after she had gained good weight and completed the physical therapy rehabilitation process.

Conclusion

This case demonstrates that DCMP can be complicated by intractable diarrhea, which can be resolved with effective treatment of HF by cardiac assist devices until a heart transplant can be performed. Additionally, we have seen how important the effect of ECPR and ECMO is on the survival of our patients, being the bridge to LVAD and helping them return to a healthy life and stay on the heart transplant list, even for seriously ill children. We present our patient's outstanding and challenging period in demonstrating how important teamwork is in terms of knowing and practicing these concepts.

Ethics

Informed Consent: Consent was obtained from the family of the patient.

Peer-review: Externally peer-reviewed.

Authorship Contributions

Surgical and Medical Practices: E.B., T.K., Concept: E.B., Design: E.B., T.K., Data Collection or Processing: E.B., E.G., M.G.R., T.U., M.C.S., C.T.K., Z.K., E.İ., Analysis or Interpretation: E.B., E.İ., A.R.A., Literature Search: E.B., E.İ., A.R.A., Writing: E.B., T.K.

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