



# New Emirates Medical Journal

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## CASE REPORT

# The Failing Heart in Pediatric Dilated Cardiomyopathy Caused by Excessive Water Drinking: A Case Report and Brief Review

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### Abstract:

#### Background:

Acute heart failure in Dilated Cardiomyopathy (DCM) is a rare cardiac disease in the pediatric population. A 15-year-old boy was admitted to the emergency department of Kendal Islamic Hospital, Kendal, Indonesia, on June 26<sup>th</sup>, 2020, with shortness of breath, tachycardia, and oxygen desaturation.

#### Case Presentation:

The chest X-ray showed significant cardiomegaly with a cardiothoracic ratio of 70% and signs of pulmonary congestion. Transthoracic echocardiography revealed dilation of the left atrium and Left Ventricle (LV), decreased global LV systolic function with reduced left ventricular ejection fraction of 22%. Subsequently, he was diagnosed with acute heart failure in dilated cardiomyopathy and discharged on day six of hospitalization.

#### Conclusion:

Focused initial assessment and time-to-therapy in acute heart failure settings need to be understood by all clinicians, especially emergency care physicians.

**Keywords:** Acute heart failure, Dilated cardiomyopathy, HFrEF, Pediatric cardiomyopathy, Door-to-diuretic therapy, Water drinking.

### Article History

Received: July 31, 2020

Revised: November 30, 2020

Accepted: December 08, 2020

## 1. INTRODUCTION

Pediatric Dilated Cardiomyopathy (DCM) is a rare cardiac disease with an estimated annual incidence of 0.57 per 100,000 children under 18 years old [1]. DCM can occur in the pediatric population at any age, and it commonly presents as heart failure in the Emergency Department (ED) [2]. DCM is one of the most common phenotypes of pediatric cardiomyopathy, comprised of about 50% of all cases and an estimated 46% of these are related to myocarditis [2]. The survival rate in pediatric DCM was reported to be 72% and 63% at 1 and 5 years after the first presentation [3].

Diagnosing pediatric DCM in the emergency setting is challenging and essential; frequently, such patients present with other symptoms like asthma, abdominal pain, or others

[4]. Here, we report a case of acute heart failure in pediatric dilated cardiomyopathy and discuss key aspects of diagnosis.

## 2. CASE PRESENTATION

A previously healthy 15-year-old Javanese boy presented to the ED of Kendal Islamic Hospital, Kendal, Indonesia, on June 26<sup>th</sup>, 2020, due to shortness of breath. His parents reported that he had no medical history of asthma and syncope but reported a history of bronchitis at the age of 5-year-old and mild-to-moderate exercise intolerance during junior high school. They also reported the family history of cardiac diseases and premature death in the third-degree relative, which was the patient's cousin at 16-year-old.

Three days before admission, he visited our ED with a 2-day history of abdominal pain and constipation. But, the patient was discharged with relieving symptoms after 3 hours of observation and given an injection of ketorolac and ranitidine.

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In the past two days prior to admission, his parents gave the patient 4 Liters per day of water aimed to soften stools and relieve his constipation.

On arrival, our initial evaluation revealed: respiratory rate, 40 breaths per minute; oxygen saturation, 93% on room air; heart rate, 130 beats per minute; body temperature, 37.0°C; and diaphoresis. Physical examination revealed a grade 3/6 holosystolic murmur loudest over the apex, S3 Gallop, rales bibasally of the lung, jugular venous pressure increased, and no hepatomegaly. The upright posteroanterior chest X-ray showed cardiomegaly with a cardiothoracic ratio of 70% and signs of pulmonary congestion (Fig. 1). The 12-lead electro-cardiogram revealed sinus tachycardia, 130 bpm, slight right axis deviation, inverted T-wave in the precordial lead (V4-V6), LV strain pattern in V6, and premature ventricular complex (Fig. 2). Laboratory findings were as follows: WBC was 17,540/mm<sup>3</sup>, hemoglobin 13.5gr/dL, platelets 410,000/mm<sup>3</sup>, Neutrophil 76%, blood urea nitrogen 19.5mg/dL, creatinine 0.92mg/dL, Potassium 5.03 mEq/L, Sodium 137.04 mEq/L, Chloride 93.38 mmol/L, and Calcium 2.17 mg/dL.

At the first presentation, the emergency physician established a diagnosis of acute heart failure with probable mitral regurgitation and standard acute therapy for heart failure was initiated.

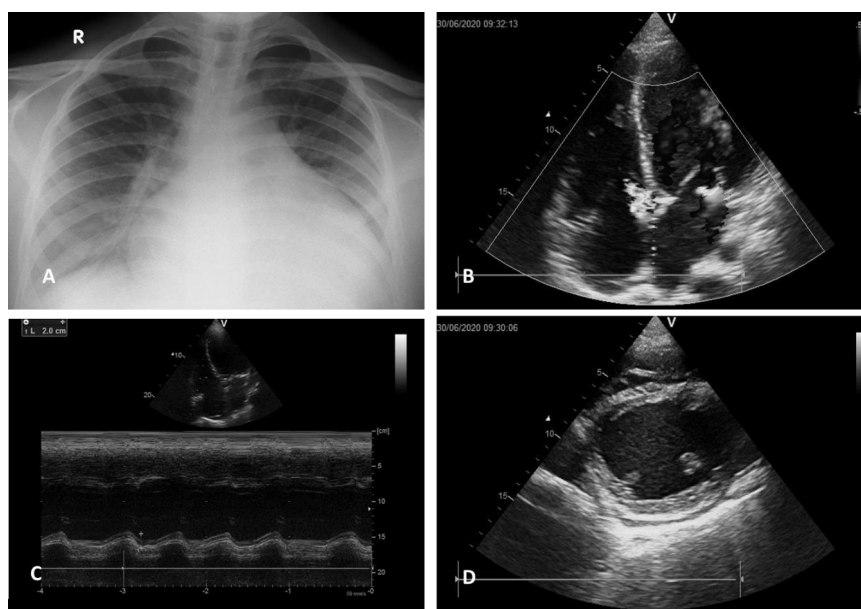
An echocardiogram performed by the cardiologist on the fifth day of hospitalization revealed dilation of the left atrium and left ventricle, global LV systolic function decreased with a left ventricular ejection fraction of 22%, moderate mitral regurgitation and moderate tricuspid regurgitation (Fig. 1).

He was diagnosed with acute heart failure, reduced ejection fraction with dilated cardiomyopathy. Since admission, he was treated with Furosemide IV 20 mg B.I.D, Spironolactone PO 25 mg O.D, Digoxin 0.25 mg O.D., and oxygen 3 L/min via nasal cannula. Subsequently, the patient discharged home at day 6 of hospitalization with an additional ACE-inhibitor using ramipril 2.5 mg O.D. and the next follow-up appointment as an outpatient 6 days after discharge.

### 3. DISCUSSION

The American Heart Association (AHA), in the latest guidelines, defined DCM as the presence of dilated left ventricular with systolic dysfunction after carefully ruling-out any possible hemodynamic, anatomic, or ischemia causes [5]. As already mentioned earlier, the majority of children had clinical evidence of heart failure at initial presentation [2]. In this situation, correct initial diagnosis and prompt intervention of heart failure in pediatric DCM can be challenging.

This case was unique because our patient had no history of heart failure previously, suggesting that it was the initial presentation of our patient to the hospital with a heart failure. Acute Heart Failure (AHF) in our patient was triggered purely by excessive water intake. One of the most reliable bedside clinical sign to assess volume status is Jugular Venous Pressure (JVP), which commonly increased in the patient with fluid overload [6]. The finding of increased JVP is consistent with the overhydration status of the patient. It was confirmed with a chest X-ray (CXR) result, which found signs of pulmonary congestion and cardiomegaly.



**Fig. (1).** (A) Chest X-ray at initial presentation to the emergency department shows cardiomegaly with cardiothoracic ratio of 70% and signs of pulmonary congestion. (B) Apical 4-Chamber View shows dilation of the left atrium and left ventricle and LVEF of 22%. (C) LV wall thickness in M-mode view was 2.0 cm. (D) Parasternal short axis at left ventricular level showed mild pericardial effusion.

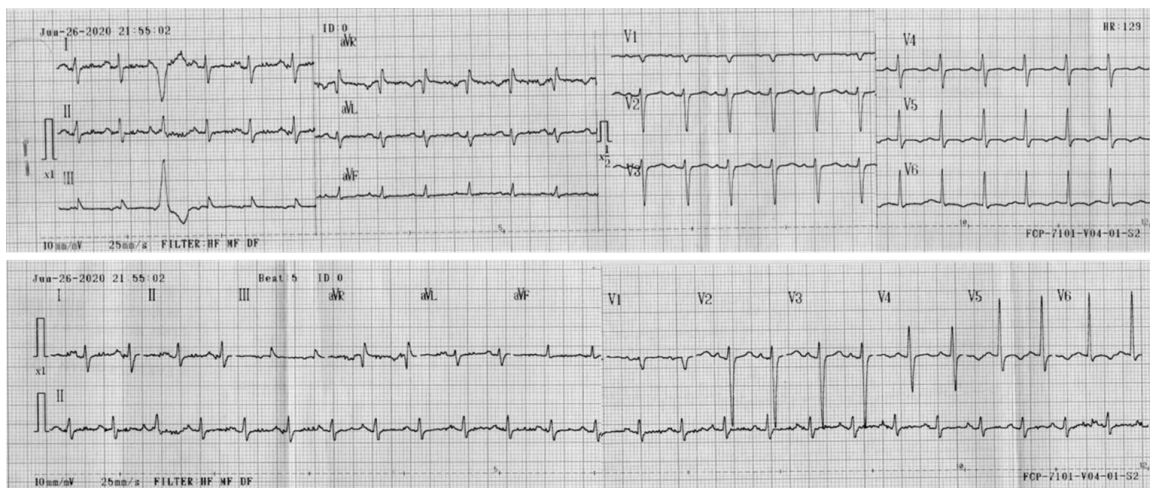


Fig. (2). ECG shows sinus tachycardia, left ventricular hypertrophy, right axis deviation, and premature ventricular complex.

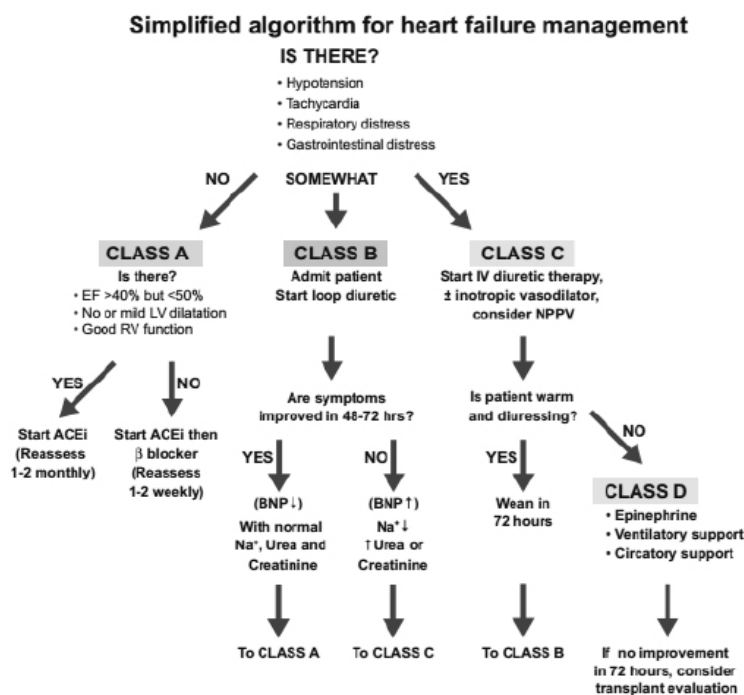


Fig. (3). Simplified algorithm in pediatric acute heart failure management as recommended by CCS (9).

Pediatric patients with heart failure may not only present with dyspnea or leg swelling but also wheezing [4], or even abdominal pain and constipation [7]. Abdominal pain, nausea, vomiting, and constipation may be linked to congestive hepatopathy and gut hypoperfusion due to heart failure [8]. Bedside physical examination may find hepatomegaly or right upper quadrant pain. Therefore, physicians must pay special attention to the presenting symptoms of the pediatric patient.

Diagnosis and treatment of AHF in our case was established according to the CCS guideline [9], which

recommended several initial assessments, including CXR, electrolytes, urea, creatinine, and complete blood count, electrocardiography, echocardiography, and NT-proBNP levels. However, in our patient, we reported that our hospital had no capability of assessing NT-proBNP due to our limited facility. Echocardiography (Fig. 1) result showed a dilated cardiomyopathy with reduced ejection fraction (LVEF = 22%). A CXR and 12-lead ECG should be performed during the initial presentation in children with high suspicion of heart failure. CXR of pediatric patients with DCM often reveals cardiomegaly with/without pulmonary congestion and the 12-

lead ECG seldom shows normal sinus rhythm [10]. Furthermore, to establish a definitive diagnosis, echocardiography should be performed by an experienced (pediatric) cardiologist.

In the initial presentation, we found tachycardia and respiratory distress. We decided to start an IV loop diuretic using an initial starting dose of 0.5-1 mg/kg within 90 minutes of ED admission and start Class C protocol (Fig. 3) [9] with careful monitoring and also fluid intake restriction. The patient's symptoms improved in 12 hrs after admission. Then we switched from Class B to A in the next few days. Spironolactone was given after echocardiography and serum electrolyte result was checked. Digoxin use, in this case, may be useful for HFrEF and to control arrhythmic as recommended by ESC [11].

Door-to-diuretic (D2D) time in AHF patients in several studies demonstrated an association with favorable clinical outcomes and reduced mortality rates [12, 13]. In our case, the emergency physician plays critical roles in both early diagnosis and initial treatment of AHF in the pre-hospital and early hospital setting as recommended by the latest consensus [14].

## CONCLUSION

Finally, diagnosing and treating dilated cardiomyopathy with acute heart failure in children should begin with a high index of suspicion. Focused initial assessment and time-to-therapy in acute heart failure setting need to be understood by all clinicians, especially emergency care physicians.

## LIST OF ABBREVIATIONS

<b>AHA</b>	=	American Heart Association
<b>AHF</b>	=	Acute Heart Failure
<b>ACE</b>	=	Angiotensin Converting Enzyme
<b>CCS</b>	=	Canadian Cardiovascular Society
<b>CXR</b>	=	Chest X-Ray
<b>DCM</b>	=	Dilated Cardiomyopathy
<b>D2D</b>	=	Door-to-Diuretic
<b>ED</b>	=	Emergency Department
<b>ESC</b>	=	European Society Cardiology
<b>LVEF</b>	=	Left Ventricular Ejection Fraction

## AUTHORS' CONTRIBUTIONS

• Aditya Doni Pradana, MD: manuscript writing, image extraction, emergency and acute patient care.

• Jarot Widodo, MD, FIHA: manuscript review, echocardiography and cardiac patient care.

## ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Not applicable.

## HUMAN AND ANIMAL RIGHTS

Not applicable.

## CONSENT FOR PUBLICATION

Written informed consent was obtained from the family.

## STANDARDS OF REPORTING

CARE guidelines have been followed in this case report.

## FUNDING

None.

## CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

## ACKNOWLEDGEMENTS

Declared none.

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