CASE REPORT OLGU SUNUMU

A Treatable Cause of Cardiomyopathy: Vitamin D Deficiency

Kardiyomiyopatinin Tedavi Edilebilir Bir Nedeni: Vitamin D Eksikliği

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Abstract

Dilated cardiomyopathy is an important cause of heart failure in children. Medical therapy rarely results in complete improvement of the disease, treatment of which usually requires transplantation. Herein, we present a patient with cardiomyopathy and rickets. Case report: A 3-month-old boy was referred to Pediatric Endocrinology Clinic due to low calcium level. On his physical examination, enlarged wrists and large anterior fontanel were remarkable. Results of laboratory analyses revealed a calcium level of 6.8 mg/dL, phosphorus level of 4.9 mg/dL, alkaline phosphatase level of 1637 U/L, parathyroid hormone level of 191.2 pg/mL, and 25-hydroxyvitamin D level of 5.7 ng/mL. Hand-wrist radiograph revealed signs consistent with rickets. Echocardiogram revealed dilated left ventricle, hypokinetic myocardium, an ejection fraction of 42%, and fractional shortening by 20%. Oral calcium lactate was started and then vitamin D treatment was added. At the 3rd month of the therapy, laboratory tests completely returned to normal and signs of rickets disappeared. Echocardiogram findings returned to normal. Since cardiac functions began to improve after the therapy, dilated cardiomyopathy associated with vitamin D deficiency was considered. Vitamin D deficiency should be considered while evaluating dilated cardiomyopathy in the regions that are endemic for nutritional rickets and it should be kept in mind that the therapy may provide dramatic improvement.

Keywords
Cardiomyopathy, dilated, vitamin D deficiency, rickets

Öz

Dilate kardiyomiyopati (KMP) çocuklarda kalp yetmezliğinin önemli bir nedenidir. Çoğunlukla transplantasyon ihtiyacı duyulan bu hastalıkta nadiren medikal tedavi ile tam iyileşme sağlanabilir. Burada KMP ve rikets tanılarıyla izlenen bir olgu sunulmuştur. Olgu Sunumu: Üç aylık olgu çocuk endokrin polikliniğine kalsiyum (Ca) düşüklüğü nedeniyle yönlendirilmişti. Fizik muayenede el bileklerinde genişleme, geniş ön fontanel dikkati çekiyordu. Laboratuvar değerlendirmede, Ca 6,8 mg/dl, fosfor 4,9 mg/dl, alkalin fosfataz 1637 U/L, paratiroid hormon 191,2 pg/ml, 25 hidroksi vitamin D düzeyi 5,7 ng/ml saptandı. El bilek grafisinde raşitizmle uyumlu bulgular vardı. Ekokardiyogramda geniş sol ventrikül, hipokinetik kalp kası, ejeksiyon fraksiyonu %42, fraksiyonel kısalma %20 idi. Vitamin D eksikliği tanısıyla önce Ca laktat tedavisi ardından D vitamin tedavisi başlandı. Tedavinin 3. ayında radyolojik bulguların düzeldi ve rikets bulguları kayboldu. Ekokardiyogram bulguları normale döndü. Tedaviden sonra kardiyak fonksiyonların düzelmeye başlaması nedeniyle olguda vitamin D eksikliğine bağlı dilate KMP düşünüldü. Nutrisyonel riketsin endemik olduğu bölgelerde dilate KMP'nin etyolojik değerlendirmesinde vitamin D eksikliği tanısı düşünülmeli, tedavinin dramatik iyileşme sağlayabileceği akılda tutulmalıdır.

Anahtar kelimeler
Kardiyomiyopati, dilate, vitamin D eksikliği, rikets

Received/Geliş Tarihi : 20.03.2014
Accepted/Kabul Tarihi : 13.06.2014

DOI:10.4274/jcp.08370

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Introduction

Dilated cardiomyopathy (DCM) is an important cause of heart failure in children. The most common causes of DCM are idiopathic, familial and acute myocarditis. Additionally, viral infections as well as endocrine and metabolic diseases may cause DCM (1). In DCM, treatment of which usually requires transplantation, medical therapy rarely results in complete improvement. There are studies suggesting that vitamin D deficiency is also a treatable cause of DCM (2). Herein, we present a case who was followed-up with the diagnosis of DCM and in whom regression of heart failure symptoms with vitamin D therapy was observed.

Case report

A 3-month-old boy who was being followed-up in Pediatric Cardiology Clinic due to DCM was referred to Pediatric Endocrinology Outpatient Clinic in Şanlıurfa Harran University Hospital due to low serum calcium (Ca) level. His parents were first-degree relatives. The patient was born mature with a weight of 3.200 g via spontaneous vaginal delivery to a mother with Hashimoto's thyroiditis. He was referred to the Pediatric Cardiology Clinic of Gaziantep University due to heart murmur. Echocardiography (ECHO) revealed remarkably dilated left ventricle, hypokinetic myocardium, and septal deviation to the right, trace mitral insufficiency, decreased systolic function, an ejection fraction (EF) of 42%, and a fractional shortening (FS) by 20%. In further analysis performed for DCM, serologic tests (hepatitis, Epstein-Barr virus, and available viral analyses) were determined to be negative, and urine and blood amino acids, tandem-mass spectrometry findings and serum carnitine levels were normal. The patient was diagnosed with DCM and started on digoxin and angiotensin-converting-enzyme inhibitor. Additionally, treatment for iron deficiency anemia was initiated.

On his physical examination, height was 59.5 cm (50th percentile) and body weight was 6.300 g (50-75th percentile). In addition, significant third degree heart murmur, tachycardia, widened wrists, and large anterior fontanel were remarkable. Results of laboratory analysis for rickets revealed a Ca level of 6.8 mg/dL, phosphorus level of 4.9 mg/dL, alkaline phosphatase level of 1637 U/L, parathyroid hormone (PTH) level of 191.2 pg/mL, and 25-hydroxyvitamin D level of 5.7 ng/mL. Vitamin D level of the mother was 12 ng/mL. Telecardiogram showed an increased cardiothoracic ratio and rachitic changes at the costochondral junction (Figure 1). Signs consistent with rickets were also remarkable on the hand-wrist radiograph (Figure 2). The patient initially received Ca lactate therapy and then vitamin D therapy due to rickets associated with Vitamin D deficiency. At the 3rd month of the therapy, laboratory tests returned to normal. In addition, radiological signs of rickets disappeared and echocardiographic findings returned to normal. Table 1 summarizes laboratory and ECHO findings of the patient before and after the therapy. Digoxin was discontinued. Since cardiac functions began to improve after the therapy, DCM associated with vitamin D deficiency was considered in the patient.

Discussion

Herein, a 3-month-old boy whose cardiac functions dramatically improved after Ca and vitamin D therapies was presented. Ca is of great importance

Table 1. Laboratory and echocardiographic data before and after the therapy

	Reference values	Before the therapy	1st month of the therapy	3rd month of the therapy
Laboratory data				
Calcium (mg/dL)	9-11	6.8	9.6	10.3
Phosphorus (mg/dL)	4-6.5	4.9	5.0	5.5
Alkaline phosphatase (U/L)	150-420	1637	1235	625
Parathyroid hormone (pg/mL)	10-65	191.2	129	10
25-Hydroxyvitamin D (ng/mL)	>20	5.7	-	32
Echocardiographic data				
EF (%)	64-83	42	-	71
FS (%)	28-44	20	-	38
LVIDD (cm)	2.2-2.7	3.5	-	2.6
LVIDS (cm)	1.3-1.9	2.8	-	1.6

EF: Ejection fraction, FS: Fractional shortening, LVIDD: Left ventricular internal dimension in diastole, LVIDS: Left ventricular internal dimension in systole

for cardiac function. Vitamin D is a key vitamin for bone metabolism and its deficiency usually results from inadequate exposure to sunlight. Vitamin D deficiency may also be due to poor nutrition, malabsorption syndromes, and renal diseases. Vitamin D receptor (VDR) is found in almost all cells. Heart and blood vessels where VDR and 1-α-hydroxylase are expressed are target organs for vitamin D. VDR activation enhance the intracellular transport of Ca; thus, relaxation of cardiomyocytes is accelerated and diastolic functions are improved. Moreover, development of cardiac muscle hypertrophy has been detected in VDR knockout mice, and it has been demonstrated that calcitriol reverses cardiomyocytes hypertrophy (3). Vitamin D deficiency has been found to have unfavorable effects on heart not only due to Ca but also due to PTH. It has been reported that increased PTH level secondary to vitamin D deficiency enhances cardiovascular diseases and mortality. PTH has been shown to increase blood pressure and induce myocardial hypertrophy and proarrhythmic effects (4).

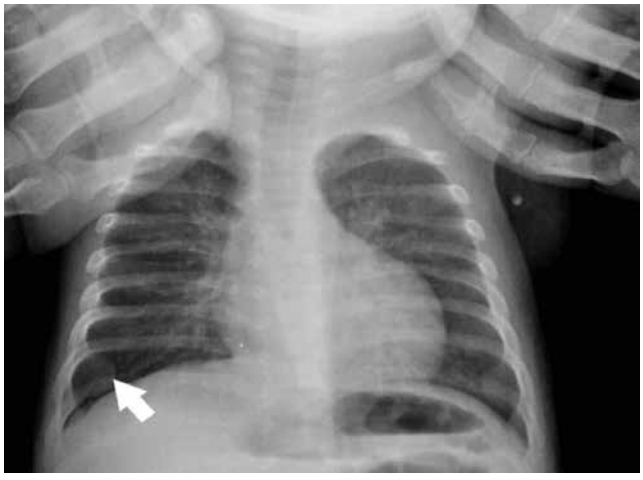

Figure 1. Mild cardiomegaly and rachitic changes in the costochondral junction on chest X-ray

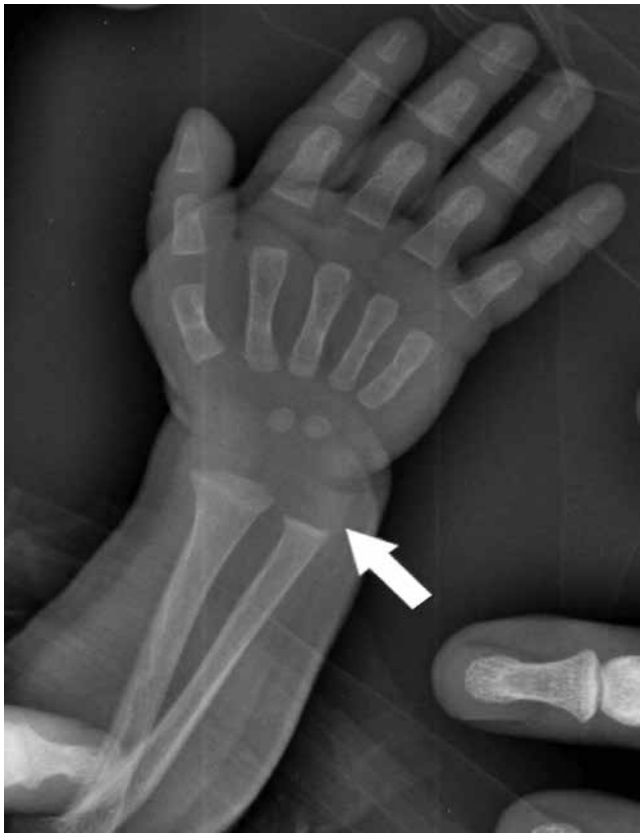

Figure 2. Rachitic signs on the left hand-wrist radiograph (metaphyseal widening and irregularity in radius and ulna, decrease in bone density)

Many pediatric DCM cases with vitamin D deficiency that showed improvement with treatment have been reported in the literature. The first case was reported in 1983 in Spain; and the term "rachitic DCM" was introduced to describe this situation (5). Since then more than 50 children with rachitic DCM have been reported. Although case reports are more frequent in the literature, an increase was observed in case series in the recent years due to increase in awareness about the relation between DCM and vitamin D deficiency. In the first and the largest series from England, hypocalcaemia and rickets were found in retrospective analysis of 16 cases with DCM over a period of 6 years of whom six died of heart failure and 10 completely improved (6). A study from the USA found rickets in four of 47 infants with DCM in a 10-year period and reported that cardiac functions dramatically improved with treatment (7). In a study which conducted in India, hypocalcaemia was determined in 15 (mean age, 2 months) of 94 cases with left ventricular dysfunction in a 7-year period (8). Twelve had signs of congestive heart failure and three had cardiogenic shock. While 14 cases showed complete improvement, one case died due to recurrent hypocalcaemia. To date, there are two cases reported from Turkey. One of them was a 9-month-old girl (9), and the other one was a 15-month-old boy, who was reported from our region 5 years ago and showed complete improvement with treatment (10). Şanlıurfa province is located in a region where annual exposure to sunlight is high. However,

vitamin D deficiency may be encountered in infants due to the mothers' low exposure to sunlight and poor nutrition.

Vitamin D deficiency-related heart failure is encountered not only in children but also in adults. In the literature, there are reported cases with hypoparathyroidism due to complication of thyroid surgery who presented with heart failure that resolved vitamin D therapy (11).

In conclusion, vitamin D deficiency should be considered during etiological evaluation of DCM in the regions that are endemic for nutritional rickets, and it should be kept in mind that vitamin D therapy may provide dramatic improvement in cardiac functions.

Ethics

Informed Consent: Consent form was filled out by all participants.

Authorship Contributions

Surgical and Medical Practices: Bülent Koca, Erdal Eren, Osman Başpınar, Concept: Mahmut Abuhandan, Design: Mahmut Abuhandan, Erdal Eren, Data Collection or Processing: Erdal Eren, Bülent Güzel, Analysis or Interpretation: Erdal Eren, Osman Başpınar, Literature Search: Erdal Eren, Bülent Güzel, Writing: Erdal Eren, Conflict of Interest: No conflict of interest was declared by the authors, Financial Disclosure: The authors declared that this study has received no financial support, Peer-review: Internal peer-reviewed.

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