Dilated Cardiomyopathy and Hypoparathyroidism: Complete Recovery after Hypocalcemia Correction

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A patient with no history of pre-existing cardiac disease was admitted because of congestive heart failure (functional class NYHA III - IV). The left ventricle was dilated and systolic function was severely depressed. In addition, hypocalcemia with hyperphosphatemia were detected and the parathormone value was low. Treatment with diuretics, digitalis and an angiotensin converting enzyme inhibitor resulted in slight clinical improvement. Correction of hypocalcemia led to further improvement and the patient reached functional class NYHA I. The left ventricle gradually returned to normal size and systolic performance recovered completely.

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Hypocalcemia reduces myocardial contractility, but the incidence of congestive heart failure due to hypocalcemia is quite rare in clinical practice. Several cases of hypocalcemic cardiomyopathy have been reported[1-6]. In these cases, correction of hypocalcemia was associated with resolution of congestive heart failure and in some patients the left ventricular geometry and systolic function recovered completely[1-4]. This is the first case in the Greek literature, of dilated cardiomyopathy associated with hypocalcemia, which recovered almost completely after correction of hypocalcemia.

Case description

A 38 year old man presented with a history of worsening dyspnea over the last few days, with episodes of nocturnal paroxysmal dyspnea, orthopnea and edema of the lower extremities. His medical history was negative for coronary artery disease, valvulopathy, cardiomyopathy, arterial hypertension, diabetes mellitus, or alcohol abuse. He had not had any signs of fever in the last 3 months. One year before admission a subtotal lobectomy of the left thyroid lobe was performed because of a solitary cold (10 by 6 cm) adenomatous node. Biopsy was negative for malignancy. He was euthyroid without substitution therapy with thyroxin.

His temperature was 36.9°C, pulse rate 110 beats per minute, arterial blood pressure, 115/70 mm Hg without pulsus paradoxus. On lung auscultation, moist rales were heard bilaterally, up to the middle lung fields. The jugular veins were dilated. The cardiac apex was displaced at the left frontal axillary line. The heart sounds were distant, a protodiastolic gallop rhythm was present and a grade 2-3/6 holosystolic murmur was heard at the apex. The liver was palpable 5 cm below the right costal arch and painful. There was edema of the lower extremities. The patient had frequent episodes of generalized muscular tremor. Both Chvostek's and Trousseau's signs were absent.

The chest x-ray on admission showed cardiac enlargement and pulmonary vascular redistribution. One month earlier the chest x-ray was within normal limits.

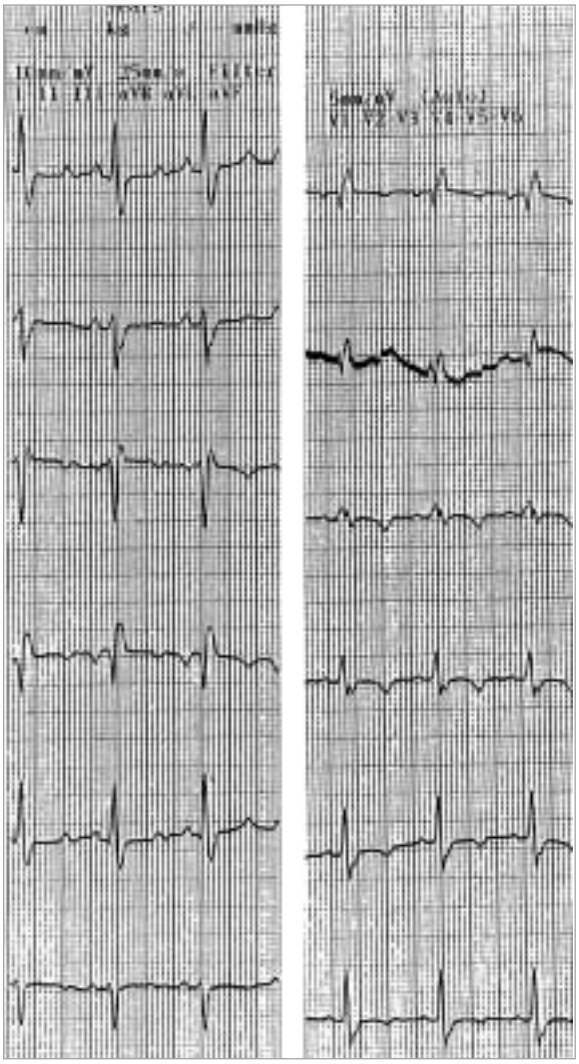

Figure 1. Initial ECG: Sinus rhythm, right bundle branch block, left anterior hemiblock, prolonged QTc interval (0.52 sec) and T wave inversion in all precordial leads.

The ECG showed sinus tachycardia, right bundle branch block, left anterior hemiblock, prolonged QTc (0.52 sec) and T wave inversion in precordial leads (Figure 1). The ECG did not differ from another ECG performed one month earlier.

Complete blood count, urinalysis results, erythrocyte sedimentation rate, BUN, serum creatinine, blood glucose, Na^+, K^+, SGOT, SGPT, γGT, alkaline phosphatase, bilirubin, amylase, total proteins, albumin, T3, T4 and TSH were within normal limits. Although CPK and LDH were increased (2111 and 338 IU/L, respectively), CK-MB and troponin were not (5.1 and 0.0 ng/ml, respectively). However, hypocalcemia (5.2 mg/dl), hyperphosphatemia (7.0 mg/dl) and hypomagnesemia (1.4 mEq/L) were found. Antibodies for cardiotoxic viruses were not increased.

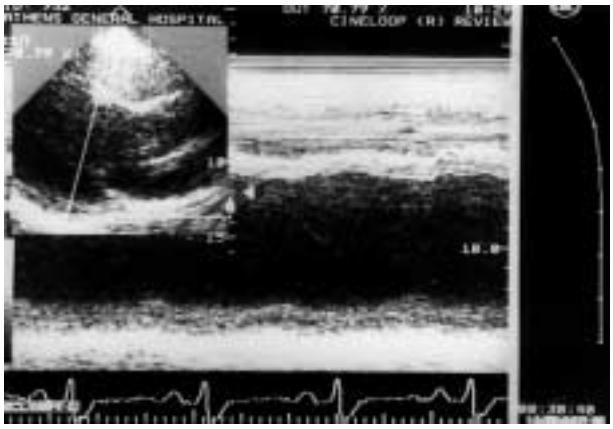

Figure 2. Initial echocardiogram: left ventricular enlargement (end-diastolic diameter 7.3 cm, end-systolic diameter 6.5 cm), diffuse hypokinesia, without compensatory hypertrophy (interventricular septum diastolic thickness 9 mm, posterior wall diastolic thickness 11 mm) and ejection fraction 23%.

The left ventricle was dilated (end-diastolic diameter 7.3 cm, end-systolic diameter 6.5 cm), with diffuse hypokinesia, without compensatory hypertrophy (interventricular septum thickness, 9 mm, posterior wall thickness, 11 mm). Ejection fraction was 23% (Figure 2). Transmitral flow was suggestive of restrictive physiology. There was moderate mitral regurgitation (2/4) and mild tricuspid regurgitation (1-2/4). Inferior vena cava and hepatic veins were dilated. An echocardiogram performed one year earlier (following the incidental finding of the right bundle branch block before the thyroidectomy), was within normal limits. The patient refused to undergo coronary angiography.

Treatment started with administration of furosemide, quinapril, digitalis and spironolactone. The patient responded to these drugs with slight symptomatic improvement. When hypocalcemia was confirmed, calcium, magnesium and vitamin D were added to the regimen and the patient responded rapidly with marked further improvement.

After one week of treatment for hypocalcemia, calcium, phosphorus and magnesium values were restored (8.8 mg/dl, 4.0 mg/dl, and 2.8 mEq/L, respectively). Magnesium administration was discontinued, CPK decreased (308 IU/L) and QTc shortened to 0.41 sec (Figure 3). The patient suffered no further episodes of muscular tremor.

Parathormone value was 10.7 pg/ml (normal values 8-76). Evaluation for other endocrine disorders was negative. Thyroid ultrasound and scanning showed subtotal lobectomy.

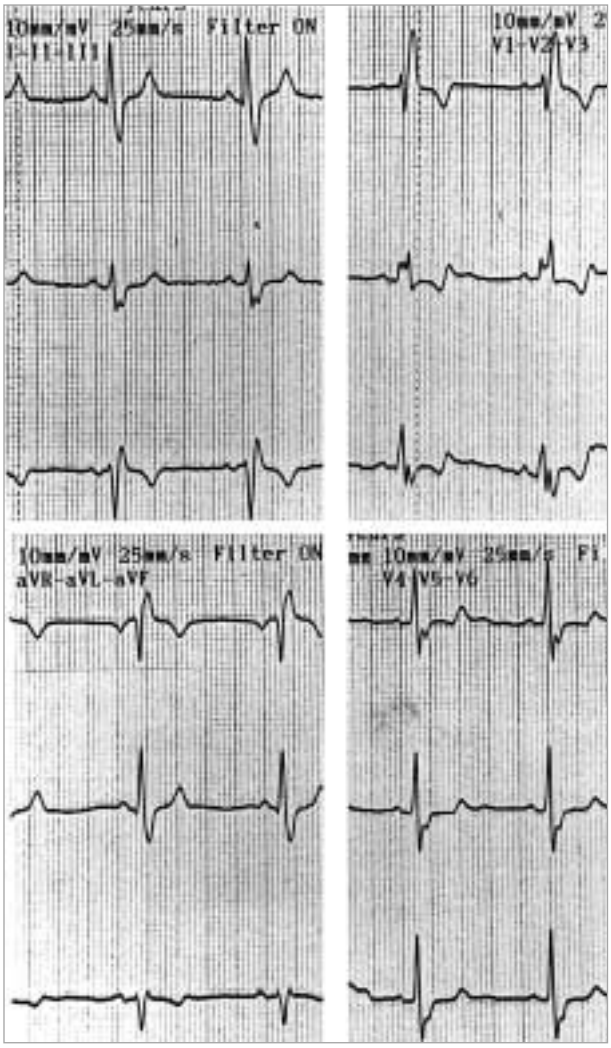

Figure 3. ECG after correction of hypocalcemia: QTc was shortened to 0.41 sec.

After three weeks of treatment for hypocalcemia, the left ventricular dimensions were significantly decreased (end-diastolic diameter 6.2 cm, end-systolic diameter 5.2 cm). Ejection fraction was increased to 32%. Inferior vena cava was not longer dilated. During the next 3 months the patient showed progressive symptomatic improvement to functional class NYHA I. Left ventricular dimensions reached the normal limits (end-diastolic diameter 5.3 cm, end-systolic diameter 3.4 cm). Ejection fraction increased to 53% and there was only slight mitral regurgitation (Figure 4). The patient continued his treatment with quinapril, calcium and vitamin D and did not showed no deterioration in the next 18 months, despite discontinuation of digitalis and diuretics. Parathormone values were repeatedly found low, between 5 and 15 pg/ml.

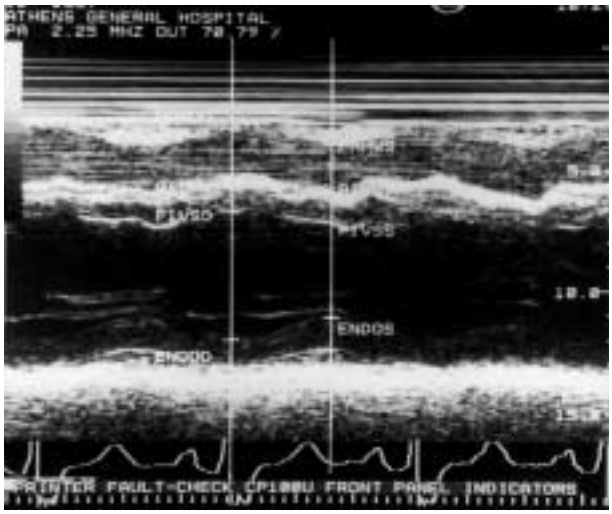

Figure 4. Echocardiogram after 6 months: left ventricular dimensions reached normal values (end-diastolic diameter 5.3 cm, end-systolic diameter 3.4 cm), ejection fraction 53%.

Discussion

The fact that our patient had congestive heart failure associated with hypocalcemia does not clearly establish a direct relationship. However, the resolution of congestive heart failure with treatment for hypocalcemia is strong evidence in support of this concept[1-6].

Administration of combined therapy for congestive heart failure and for hypocalcemia makes it difficult to identify the precise role of each treatment in the patient's improvement. Conor et al[3] reported the case of a patient with hypocalcemia and congestive heart failure who showed no improvement with therapy for heart failure. Dramatic improvement occurred after the administration of calcium and vitamin D. Congestive heart failure reappeared twice in association with hypocalcemia when vitamin D was discontinued (despite the administration of digoxin and furosemide). On both occasions, significant improvement occurred with the correction of hypocalcemia. In a patient with heart failure and hypocalcemia who showed improvement after infusion of calcium, Gurtoo et al[5] discontinued calcium therapy and congestive heart failure reappeared. Complete reversal of congestive heart failure followed the reiniatiation of calcium infusion. Our patient showed slight improvement with therapy for heart failure and dramatic further improvement following the administration of calcium and vitamin D. When digitalis and diuretics

were discontinued heart failure did not reappear, the left ventricular dimensions did not increase nor did the ejection fraction decrease. These observations do not prove that congestive heart failure in our patient was due to hypocalcemia, but they provide strong evidence in support of this hypothesis.

Right bundle branch block and left anterior hemiblock may suggest a cardiomyopathy which was aggravated by hypocalcemia and was partially restored after correction of this disorder. This may also explain why the ejection fraction remained slightly decreased.

However, in 20-45% of the patients with idiopathic dilated cardiomyopathy the ejection fraction improves spontaneously, and in some cases it normalizes[7,8]. Although left ventricular dimensions decrease in these patients, they remain above normal limits[7,8]. In our patient, however, dimensions were restored to normal limits.

We considered that left ventricular dilation and dysfunction could be due to coronary artery disease. This appears to be very unlikely, since the left ventricular geometry and systolic performance were restored without revascularization, but parallel to the correction of hypocalcemia. Nevertheless, coronary artery disease was not ruled out, because our patient refused to undergo coronary angiography, and this may be considered as a limitation to our hypothesis.

Hypocalcemia reduces renal excretion of sodium[9]. This effect of hypocalcemia may also contribute to the development of heart failure. Correction of hypocalcemia promotes natiuresis[9]. However, hypocalcemia reduces the inotropic effect of digitalis[10].

Chvostek's and Trousseau's signs are positive when hypocalcemia occurs rapidly. Their absence in our patient and in other cases suggests that hypocalcemia occurred gradually, over several months[11]. Episodes of generalized muscular tremor were due to hypocalcemia and they explain the increase of muscular enzymes. After the correction of hypocalcemia the patient suffered no further episodes of muscular tremor and muscular enzymes were restored to normal limits.

In the only other case of congestive heart failure associated with hypocalcemia reported in the Greek literature[6], treatment of hypocalcemia resulted in decrease of end-diastolic diameter close to normal limits (5.7 cm), but end-systolic diameter remained increased (4.6 cm) and fractional shortening increased to 19%, remaining clearly abnormal. In our patient, on the contrary, left ventricular dimensions were restored and the ejection fraction approached normal values.

Hypomagnesemia has been shown to reduce contractility[12]. Our patient had mild hypomagnesemia (1.4 mEq/L, normal values 1.5-2.5), and magnesium was administered for a week. We believe that the improvement observed, which continued over several months, cannot be due to such a short-term therapy of mild hypomagnesemia.

Hypoparathyroidism due to hypomagnesemia has also been reported. In such cases hypomagnesemia is usually severe (0.4 mEq/L) and the parathormone value is restored after the hypomagnesemia has been corrected[13]. In our patient the parathormone value remained low.

In post-operative hypoparathyroidism, hypocalcemia is usually manifested a few hours after surgery with severe symptoms. This was not the case in our patient. Although he underwent subtotal lobectomy and he was euthyroid without substitution therapy with thyroxin, adhesions due to removal of such a big adenoma might compromise parathyroid function. There are some reports of post-operative hypoparathyroidism with hypocalcemia, which were diagnosed one year after thyroidectomy. Beyond post-operative hypoparathyroidism, the only other probable diagnosis is idiopathic hypoparathyroidism.

Conclusion

Some cases of dilated cardiomyopathy are associated with hypocalcemia. Correction of hypocalcemia in these patients may restore the left ventricular geometry and systolic function.

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