Extreme Reverse Remodeling in a Patient With Dilated Cardiomyopathy

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Reverse remodeling is known to occur in patients with de novo presentations of nonischemic dilated cardiomyopathy. Predictors include recent onset, female sex, higher left ventricular (LV) ejection fraction by echocardiography at baseline, higher systolic blood pressure, QRS width <120 ms (or absence of left bundle branch block) and normal LV dimensions. Conversely, increased LV size is regarded as a poor prognostic marker. We present a case of a patient who presented with established cardiomyopathy and severe LV dilation that reverted to normal cardiac size and function after receiving standard heart failure therapy.

Case Report

The patient, a 45-year-old black man, was initially diagnosed with dilated cardiomyopathy after an admission to a community hospital with sinus tachycardia, dyspnea, and volume overload. He denied alcohol, drug, or stimulant use; had no risk factors for Human Immunodeficiency Virus; and had no family history of cardiomyopathy. The initial transthoracic echocardiogram revealed an ejection fraction of 21% with severe mitral regurgitation and LV end-systolic and end-diastolic dimensions (6.3 cm and 7.3 cm, respectively). Brain natriuretic peptide (BNP) was recorded as 368 pg/mL (Table). Cardiac catheterization demonstrated normal coronary arteries with a LV end-diastolic pressure of 17 mm Hg. He was discharged home on medical therapy including digoxin, carvedilol, and aldactone. For unknown reasons, neither an angiotensin-converting enzyme inhibitor nor angiotensin receptor antagonist was prescribed at that time. The patient was lost to follow-up and subsequently presented again to the same hospital 3 years later complaining of palpitations. A transesophageal echocardiogram revealed a LV ejection fraction of 10% and a BNP of 1086 pg/mL. He was diuresed and reinitiated on a comprehensive heart failure medication regimen before discharge.

Because of ongoing medication nonadherence, the patient was readmitted on multiple occasions for decompensated heart failure and treated with intravenous diuresis. Several months after he represented, the LV end-diastolic dimension was measured at 8.92 cm (Figure, A and B) on transthoracic echocardiography, confirmed on a transesophageal echocardiogram with a measurement of 10.0 cm. Serial laboratory evaluations including comprehensive metabolic panel, thyroid function tests including thyroid-stimulating hormone and free T4, iron studies, and complete blood counts were all within normal limits. One comprehensive toxicology screen was positive for marijuana. The patient was subsequently referred for possible transplant or ventricular assist device placement. At the time of our initial evaluation, the patient denied any significant heart failure symptoms and reported playing basketball 2 to 3 times weekly and working as a member of the maintenance staff for a sports club. His physical examination revealed a blood pressure of 110/60 mm Hg with a pulse of 90, elevated jugular venous pressure at 12 cm, a laterally displaced LV point of maximal impulse, and a grade III/VI holosystolic murmur at the apex with radiation to the axilla. The ECG revealed sinus rhythm with a narrow QRS. Cardiopulmonary exercise testing demonstrated a VO$_{2\max}$ of 20.3 mL/kg per minute and anaerobic threshold of 12.2 mL/kg per minute. Repeat toxicology screen was negative. Spot urine metanephrine (total and free) and normetanephrine testing was within normal limits. The patient was placed on aldactone 25 mg, lisinopril 20 mg, carvedilol 25 mg twice daily, and furosemide 40 mg, and a cardioverter defibrillator was implanted for primary prevention of sudden cardiac death. Carvedilol was subsequently changed to metoprolol succinate 200 mg to enable once daily dosing; histograms from serial implantable cardioverter defibrillator interrogations showed no significant additive heart rate–lowering effect.

One year later, the patient had inappropriate implantable cardioverter defibrillator therapy for atrial tachycardia. Thyroid-stimulating hormone was noted to be low (<0.01 mIU/L) and therapy was initiated for Graves disease. A repeat echocardiogram exhibited a normal ejection fraction of 55% with normal values for both end-diastolic and end-systolic dimensions (4.9 and 3.6 cm, respectively; Figure, C and D), resolution of papillary dysfunction with only mild mitral regurgitation, and a BNP of 23 pg/mL. A subsequent repeat echocardiogram 14 months later demonstrated sustained improvement in LV function and maintenance of normal LV chamber size.
LV reverse remodeling is a recognized phenomenon in patients diagnosed with dilated cardiomyopathy occurring in nearly half of the patients with recent onset.\textsuperscript{1} The cohort with reverse remodeling has a significantly better long-term prognosis with lower rates of heart failure hospitalizations, transplantation, ventricular arrhythmias, and sudden death.\textsuperscript{2} Relatively consistent predictors of recovery include smaller baseline LV dimensions, higher baseline LV ejection fraction, higher systolic blood pressure, and narrow QRS complex.\textsuperscript{1} Presumably larger ventricles (especially when indexed to body surface area) reflect a longer antecedent history of cardiomyopathy and a greater degree of maladaptive structural and cellular remodeling.

We postulate our patient’s improvement was related to preservation of normal conduction, retention of contractile reserve, and initiation of appropriate neurohormonal blockade. Presumably, compliance with $\beta$-blocker and angiotensin-converting enzyme inhibitor contributed to the reverse remodeling and excellent long-term outcome. However, severe dilation to an LV end-diastolic dimension of nearly 9 cm (10 cm on transesophageal echocardiography) would not be expected to revert to normal. Although the patient had several markers of a more favorable prognosis such as a narrow QRS and good baseline functional status, the duration of documented LV dysfunction was prolonged, the clinical course was punctuated by heart failure exacerbations, and the presence of severe mitral regurgitation and consistently elevated BNP for an extended period suggested both a low likelihood of LV recovery and poor long-term survival after de novo presentation.\textsuperscript{2}

We cannot assess whether the improvement will be sustained for an extended period; however, a low value of BNP in follow-up and normalization of LV size are reassuring. Furthermore, although prognosis can be determined by use of validated models, we know of no such model that can predict the timing, extent, or persistence of reverse remodeling. The identification of late gadolinium enhancement on cardiac magnetic resonance imaging can help better risk-stratify this high-risk patient population,\textsuperscript{3} but we did not perform this diagnostic study. Finally, it is possible that an endomyocardial biopsy could have provided insight into the underlying pathophysiology, especially if inflammation were present, but in the absence of serial biopsies, it is not clear that the findings would have been useful in determining therapeutic strategy or prognosis.\textsuperscript{4}

In summary, we describe an unusual example of extreme reverse remodeling in a patient with dilated cardiomyopathy. Additional data are needed to evaluate the incidence and sustainability of such dramatic recovery among patients presenting with dilated cardiomyopathy.

### Discussion

LV reverse remodeling is a recognized phenomenon in patients diagnosed with dilated cardiomyopathy occurring in nearly half of the patients with recent onset.\textsuperscript{1} The cohort with reverse remodeling has a significantly better long-term prognosis with lower rates of heart failure hospitalizations, transplantation, ventricular arrhythmias, and sudden death.\textsuperscript{2} Relatively consistent predictors of recovery include smaller baseline LV dimensions, higher baseline LV ejection fraction, higher systolic blood pressure, and narrow QRS complex.\textsuperscript{1} Presumably larger ventricles (especially when indexed to body surface area) reflect a longer antecedent history of cardiomyopathy and a greater degree of maladaptive structural and cellular remodeling.

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### Key Words:
cardiomyopathy  ■  heart failure  ■  ventricular remodeling

### Disclosures

None.

### References


Figure. Two-dimensional (2D) and M-mode echocardiographic frames before and after improvement in left ventricular (LV) function. A, Baseline 2D LV short-axis view. B, Corresponding baseline M-mode. C, Follow-up 2D LV short-axis view. D, Corresponding follow-up M-mode.
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