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# Dilated cardiomyopathy relieved as a result of β-blocker therapy: A case report—key points in assessment of prognosis based on MIBG myocardial scintigraphy and BNP levels

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A 48-year-old male patient was admitted to our hospital with dyspnea accompanied by orthopnea. Chest x-rays showed a cardiothoracic ratio of 68% and pulmonary congestion. He was diagnosed with dilated cardiomyopathy. β-Blocker (carvedilol) therapy was initiated on Day 22 of the disease using a small initial dose. He was followed up based on BNP levels and MIBG scintigraphy. The H/M ratio and MIBG washout rate were 1.98 and 33.4%, respectively, on Day 20 and 2.15 and 28.1%, respectively, on Day 72. The patient was discharged on Day 72 when congestive heart failure improved. Relatively high BNP levels were observed for 1 month after starting treatment with a β-blocker. Plasma BNP levels were still as high when his heart failure was improved. BNP is useful as a convenient indicator for the severity of cardiac diseases. MIBG scintigraphy may be used thereafter to evaluate the severity in greater detail and more precisely determine the prognosis.

**Key words:** MIBG, BNP, prognosis, heart failure

## BACKGROUND

PLASMA NOREPINEPHRINE CONCENTRATIONS, which increase in patients with congestive heart failure, reflect the severity of the disease and are closely related to prognosis.[1] Because sympathetic activity is enhanced with increasing severity of congestive heart failure, the severity and prognosis of congestive heart failure can be evaluated based on parameters determined by I-123 metaiodobenzylguanidine (MIBG) scintigraphy.[2,3] Neurohumoral factors, such as atrial (A-type) natriuretic peptide (ANP) and brain (B-type) natriuretic peptide (BNP), have also been reported to be useful in diagnosing and evaluating the severity of congestive heart failure.[4]

This report describes a dilated cardiomyopathy patient who was admitted to our hospital due to congestive heart failure, which was treated with a β-blocker, and who was followed up based on BNP levels and MIBG scintigraphy.

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## CASE REPORT

A 48-year-old male patient was admitted to our hospital with dyspnea accompanied by orthopnea. On admission, blood pressure was 128/76 mmHg and the heart rate was regular at 88 beats/min. On auscultation, third heart sounds were heard, as well as moist rales in the bilateral lung fields. Leg edema was noted. ECG showed left atrial enlargement, left ventricular hypertrophy, and decreased amplitude of R waves. Chest x-rays showed a cardiothoracic ratio of 68% and pulmonary congestion. Results of laboratory tests were as follows: RBC, $421 \times 10^4/\mu l$; Hb, 12.6 g/d*l*; Plt, $16.9 \times 10^4/\mu l$; WBC, $3600/\mu l$; BNP, 550 pg/d*l*; GOT, 33 IU; and GPT, 75 IU. Echocardiography showed a left ventricular diastolic dimension of 77 mm, left ventricular systolic dimension of 67 mm, and ejection fraction of 16%. Left ventricular wall showed diffuse hypokinesis. Cardiac catheterization was conducted 15 days after admission. No significant stenosis was observed in coronary angiography. Pulmonary capillary wedge pressure (PCWP) and cardiac index were 22 mmHg and 2.7 *l*/min/m$^2$, respectively, upon insertion of a Swan-Ganz's catheter. The left ventricular ejection fraction, end-diastolic volume index and end-systolic volume index were 20%, 437 m*l* and 204 m*l*,

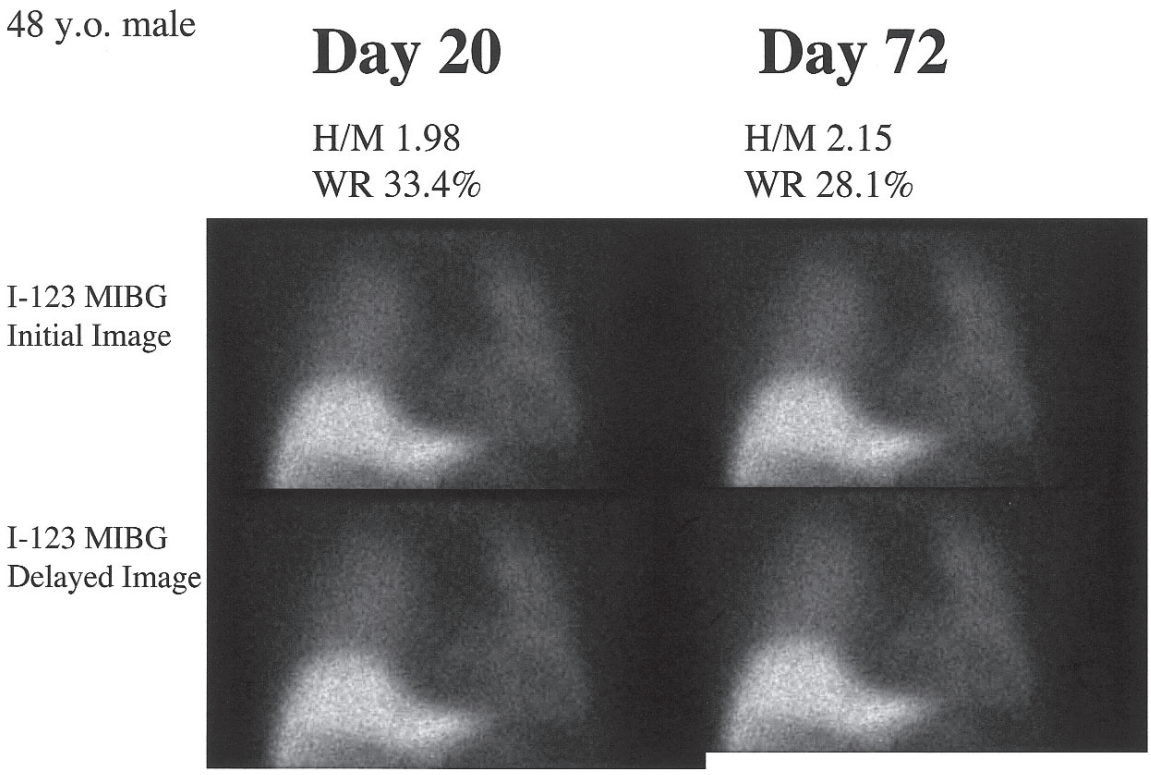


**Fig. 1** MIBG myocardial scintigraphy on Day 20 and Day 72.

**Table 1** Time courses of MIBG values and BNP

| | H/M (d) | WR | BNP |
|---|---|---|---|
| Day 8 | | | 550 pg/d*l* |
| Day 20 | 1.98 | 33.4% | |
| Day 23 | | | 330 pg/d*l* |
| Day 72 | 2.15 | 28.1% | |

respectively, in left ventriculography. Myocardial biopsy showed marked interstitial fibrosis, suggesting the diagnosis of dilated cardiomyopathy. Based on these findings, the patient was diagnosed as having dilated cardiomyopathy, and $\beta$-blocker (carvedilol) therapy was initiated on Day 22 of the disease using a small initial dose.

In MIBG myocardial scintigraphy, SPECT and planar images were obtained 15 min (early images) and 3 hrs (late images) after intravenous injection of 111 MBq of $^{123}$I-MIBG. In planar images, regions of interest were set in an area encircling the myocardium (H) and the superior mediastinum (M). The mean count per pixel was determined in each region of interest, and the ratio of myocardial to superior mediastinal uptake (H/M) was calculated in late images. Myocardial MIBG washout rates were calculated using early and late images.[5] Normal MIBG values in our institution are 2.6 ± 0.3 for the H/M ratio, 28 ± 3 for washout rate.[6] MIBG myocardial scintigraphy was conducted on Days 20 and 72 (Fig. 1).

The $\beta$-blocker dose could be increased up to 10 mg.

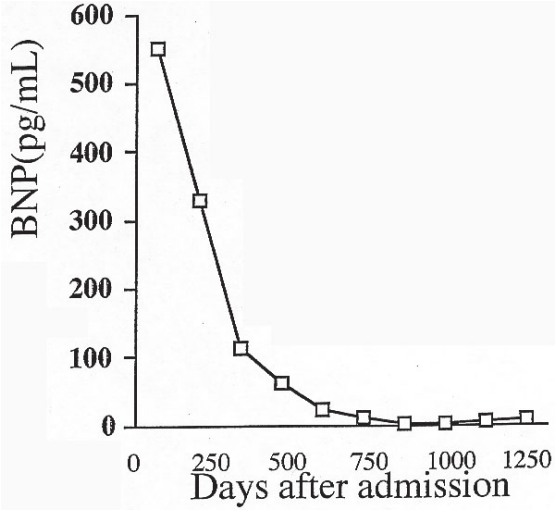


**Fig. 2** Time-course changes in BNP levels in a patients with dilated cardiomyopathy.

BNP levels remained high from the day of admission and were 550 pg/d*l* on Day 8. Time-course changes in BNP levels were illustrated in Figure 2. Ventricular tachycardia and ventricular premature complexes occurred occasionally during admission. On Day 22, ventricular tachycardia had occurred. Plasma BNP levels were still as high as 330 pg/m*l* on Day 23 when his heart failure was improved. The H/M ratio and MIBG washout rate were

1.98 and 33.4%, respectively, on Day 20 and 2.15 and 28.1%, respectively, on Day 72. Time courses of MIBG values and BNP are illustrated in Table 1. The patient was discharged on Day 72, and has not required readmission during the 1000-day follow-up period.

## DISCUSSION

In the present case, severe congestive heart failure responded to treatment including a $\beta$-blocker, and congestive heart failure showed improvement. Plasma BNP levels are reported to be useful in evaluating the severity of congestive heart failure, but BNP levels increase occasionally when a $\beta$-blocker is administered. They also increase in patients with atrial fibrillation, arrhythmia, cardiac hypertrophy, hypertension, or obstructive hypertrophic cardiomyopathy.[7–9] BNP is a very convenient parameter in evaluating the severity of cardiac diseases and can be used to screen for cardiac diseases in medical check-ups.[10] In the evaluation of the prognosis of cardiac disease, however, its utility is limited because BNP levels increase depending on blood sampling time points as observed in our patient, in whom relatively high BNP levels were observed after starting treatment with a $\beta$-blocker in accordance with a previous study.[11] MIBG scintigraphy parameters, such as higer H/M before $\beta$-blocker therapy, exactly predicted favorable prognosis.[3,12,13] Therefore, caution is necessary in evaluating prognosis in patients with congestive heart failure based on plasma BNP alone because it is often associated with other disorders such as arrhythmia, valvular disease and cardiomyopathy, and this may lead to misinterpretation. These disorders are often co-existed in heart failure. In this case, he had to be in hospital for a long time because of uncontrolled ventricular tachycardia.

MIBG shows a behavior similar to that of norepinephrine in sympathetic nerve terminals. Parameters obtained with late MIBG scintigraphy images such as cardiac uptake (heart/superior mediastinum ratio) and washout rate can be used as indicators for sympathetic activity. These parameters show abnormalities depending on the severity of myocardial dysfunction associated with various cardiac diseases such as sarcoidosis, myocarditis, hypertrophic cardiomyopathy, hypertensive heart disease, dilated cardiomyopathy, and restrictive cardiomyopathy.[12–19] MIBG scintigraphy can more reliably estimate the prognosis in patients with congestive heart failure and can be recommended as a basis for determining the timing for heart transplantation.

In conclusion, there is no doubt that BNP is useful as a convenient indicator of the severity of cardiac diseases. MIBG scintigraphy may be used thereafter to evaluate the severity in greater detail and more precisely determine the prognosis.

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