

## HEART FAILURE AND CARDIOMYOPATHIES

### CASE REPORT: CLINICAL CASE SERIES

# Community-Based Outreach for People Living With Methamphetamine-Associated Cardiomyopathy



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#### ABSTRACT

Methamphetamine-associated cardiomyopathy continues to grow within the United States. Although initiation of guideline-directed medical therapy and cessation of methamphetamine are cornerstones of therapy, many barriers to guideline-directed medical therapy use exist for patients with methamphetamine-associated cardiomyopathy. This paper presents a case series of patients who demonstrated profound clinical and echocardiographic improvement with engagement in a community heart failure program paired with the use of alarmed pill containers to target medication adherence. (JACC Case Rep. 2024;29:102598) © 2024 The Authors. Published by Elsevier on behalf of the American College of Cardiology Foundation. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

**R**ates of methamphetamine-associated cardiomyopathy (MACM) and hospitalizations for associated heart failure (HF) are increasing exponentially in the United States.<sup>1,2</sup> Methamphetamine affects the cardiovascular system through direct myocardial toxicity, accelerated atherosclerosis, and sympathetic stimulation.<sup>3</sup> This manifests as acute myocarditis or chronic HF after prolonged use.<sup>4</sup> Methamphetamine cessation is associated with improvement of MACM, but access to stimulant use disorder treatment is limited and there are no Food and Drug Administration-approved pharmacologic treatments; furthermore, not all patients have goals of stimulant abstinence.<sup>4-6</sup> Clinically, patients with MACM with reduced left ventricular ejection fraction (LVEF) are started on guideline-directed medical

#### TAKE-HOME MESSAGES

- Patients with MACM enrolled in the CHFP demonstrated improvement in LVEF after receipt of GDMT through an alarmed pill container.
- Our CHFP is a novel strategy to engage patients with MACM in care and up-titrate GDMT.
- Despite continued methamphetamine use, patients with MACM can have clinically meaningful improvement in LVEF and functional status with GDMT adherence.
- Alarmed pill containers provide a structured approach to help people with medication-adherence challenges and should be studied further.

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The authors attest they are in compliance with human studies committees and animal welfare regulations of the authors' institutions and Food and Drug Administration guidelines, including patient consent where appropriate. For more information, visit the [Author Center](#).

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**ABBREVIATIONS  
AND ACRONYMS****CHFP** = community heart failure program**GDMT** = guideline-directed medical therapy**HF** = heart failure**LVEF** = left ventricular ejection fraction**MACM** = methamphetamine-associated cardiomyopathy

therapy (GDMT) for HF, but there is limited data on clinical outcomes and LVEF recovery, particularly in those with continued stimulant use.<sup>7</sup>

Myriad obstacles to care exist for people with MACM, including mental health conditions, difficulty attending outpatient appointments, and medication adherence.<sup>8,9</sup> Our institution developed the community heart failure program (CHFP), a mobile team of health care providers, to bring

state-of-the-art cardiovascular care directly to patients. Patients enrolled in the CHFP are seen in the community, often a shelter or subsidized housing unit, by a team that includes a nurse, nurse practitioner, and physician. A visit may include a physical examination, blood work, medication management, patient education, and harm reduction strategies. Care delivery is centered around the patient and aligning with their goals. Although some patients demonstrated improved medications adherence with these outreach efforts, many continued to struggle. Accordingly, the CHFP began distributing alarmed pill containers to patients (Figure 1). These kits are locked until a set time each day, when they light up and audibly alarm until medications are taken. If the medications are not taken during that 30-minute window, the alarm stops, and the kit rotates to the next day to assess medication adherence.

We present a case series of patients with MACM who demonstrated dramatic clinical and echocardiographic improvement after engagement with low-barrier clinical visits by the CHFP and use of alarmed pill containers, despite continued methamphetamine use (Table 1).

**CASE 1**

A 52-year-old man with housing instability and a 30-year-history of methamphetamine, fentanyl, and heroin use presented to the emergency department with progressive exertional dyspnea and lower extremity edema. A transthoracic echocardiogram demonstrated a severely dilated left ventricle (left ventricular end diameter volume indexed 161 mL/m<sup>2</sup>) with severely reduced systolic function (LVEF 16%), severely dilated right ventricle with moderately reduced function, and elevated pulmonary artery systolic pressure, at 62 mm Hg (Videos 1 and 2). He was diagnosed with MACM after invasive coronary angiogram and serologic nonischemic work-up was unrevealing. He was initiated on GDMT (lisinopril 10 mg and metoprolol succinate 25 mg daily) with a

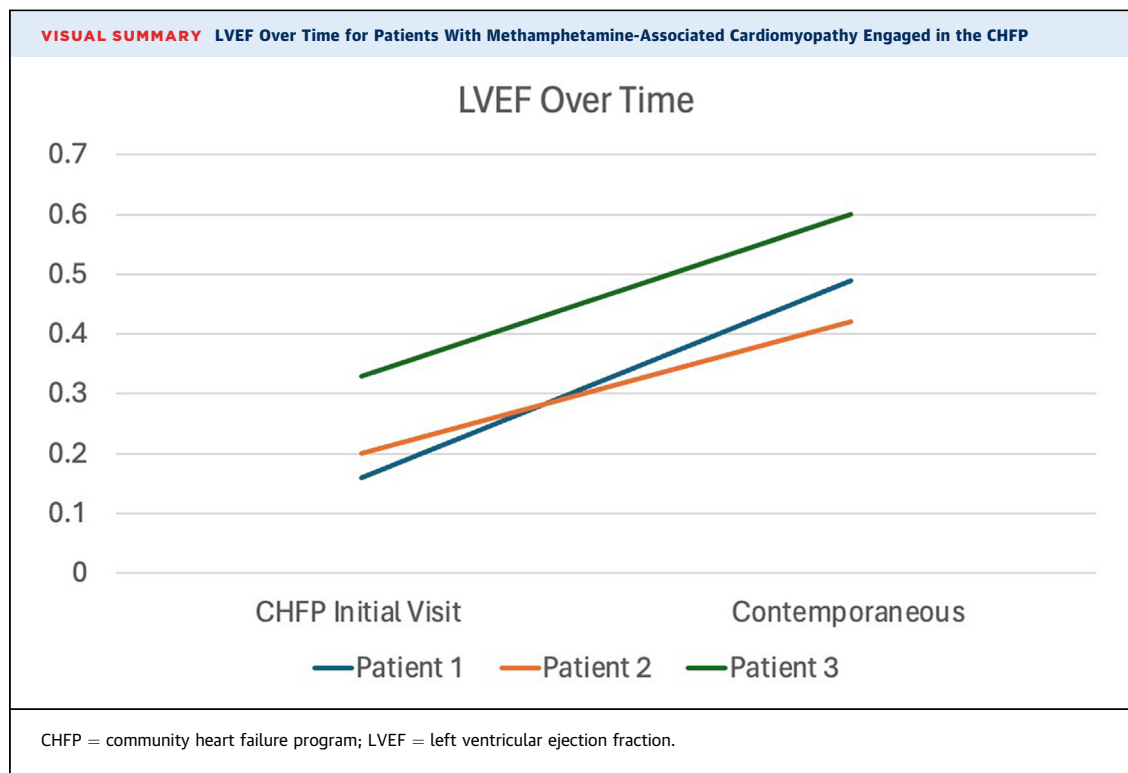
**FIGURE 1** Alarmed Pill Containers Used by the Community Heart Failure Program

loop diuretic and was discharged with outpatient cardiology follow-up. He experienced challenges with medication adherence and clinic attendance, resulting in recurrent hospitalizations for decompensated HF. Because his LVEF remained depressed (16%-32%), he was referred to the CHFP. Despite CHFP engagement, he struggled with medication adherence, and was provided an alarmed pill container.

Subsequently, the patient reported significant improvement in symptoms, with NYHA functional class I symptoms and 100% medication adherence to lisinopril 5 mg, metoprolol succinate 12.5 mg, eplerenone 25 mg, and empagliflozin 10 mg daily. His LVEF improved from 16% to 49%. His left ventricle size decreased (left ventricular end diameter volume indexed 111 mL/m<sup>2</sup>), and pulmonary artery systolic pressure normalized to 26 mm Hg (Videos 3 and 4). Importantly, these improvements with outreach engagement and medication adherence occurred despite continued fentanyl and methamphetamine use.

**CASE 2**

A 71-year-old man with mixed cardiomyopathy due to cocaine and methamphetamine use and obstructive coronary artery disease (95% stenosis of mid left anterior descending artery status post drug-eluting



stent) was admitted with decompensated HF. His LVEF was 20% (previously 35%) and he reported NYHA functional class IV symptoms. With negative cardiac biomarkers and an electrocardiogram negative for ischemic changes, progressive coronary artery disease was deemed unlikely to cause his LVEF deterioration. He was previously prescribed losartan, metoprolol succinate, spironolactone, and empagliflozin, but struggled with adherence given vision and memory impairments. After discharge, he received an alarmed pill container. His medication adherence subsequently approached 100%.

On last visit with the CHFP, he reported NYHA functional class I symptoms, and recognized the association between medication adherence and symptomatic improvement. Despite continued stimulant use, LVEF improved from 20% to 42% over the following year. His cardiac recovery was complicated by multiple unintentional opioid overdoses from fentanyl contamination. CHFP providers prescribed naltrexone, and the patient has not had any further opioid overdoses.

### CASE 3

A 61-year-old man with opioid use disorder on buprenorphine-naloxone, active methamphetamine use, and MACM (LVEF 33%) was referred to the CHFP due to challenges with medication adherence and

outpatient follow-up. He was unable to engage in outpatient care and had more than 10 hospitalizations each year.

On CHFP intake, he reported NYHA functional class III symptoms and was only prescribed a diuretic that he took inconsistently. With an alarmed pill container, his medication adherence drastically improved. Over the next 4 months the CHFP optimized his GDMT, adding losartan 25 mg, metoprolol succinate 25 mg, spironolactone 25 mg, and empagliflozin 10 mg daily.

At his most recent visit with the CHFP, the patient reported NYHA functional class I symptoms, with decreased methamphetamine use. Transthoracic echocardiogram showed LVEF recovery from 33% to 60%.

**TABLE 1** Each Patient's Left Ventricular Ejection Fraction at CHFP Intake, Initiation of the Alarmed Pill Box Strategy, and Most Recent Echocardiogram

	CHFP Initial Visit, %	Alarm Pill Box, %	Contemporaneous, %
Patient 1	16	22	49
Patient 2	20	—	42
Patient 3	33	—	60

CHFP = community heart failure program.

## DISCUSSION

These 3 cases represent a larger cohort of patients with MACM in our health system who derived significant benefit from engagement with the CHFP, a novel HF outreach model of care that overcomes barriers to care for people with MACM. This case series is the first description of a community-based outreach model to provide equitable care for people with MACM. Engagement in the CHFP allowed for regular follow-up, rapid GDMT up-titration, and improved medication adherence, which is remarkable given challenges engaging this population in care due to mistrust and barriers to care.

GDMT is the cornerstone for HF with reduced ejection fraction, but there are limited data on GDMT in MACM. Multiple studies highlight how methamphetamine cessation can lead to improvement in LVEF and functional status.<sup>4,5</sup> However, with the challenges of treating methamphetamine use disorder, studying MACM outcomes among patients with continued methamphetamine use is imperative.<sup>10</sup> Patients in this case series demonstrated remarkable HF improvement and adherence to GDMT despite ongoing stimulant use.

Successful adherence to GDMT was accomplished using alarmed pill containers, a novel approach

among patients with MACM. While initially studied in patients with dementia and Parkinson disease, Hale et al<sup>11</sup> found alarmed pillboxes with remote monitoring in HF reduced all-cause hospitalizations. Our findings were similar, with patients in our series experiencing robust improvement in symptoms, LVEF, and medication adherence temporally correlated with initiation of alarmed pill container use. Notably, patients in this case series were not treated with an angiotensin receptor/neprilysin inhibitor because alarmed pill containers only allowed for once-daily medications. Given the exciting findings reported in our case series, the utility of alarmed pill containers for HF should be studied more rigorously among patients with MACM and other populations.

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**KEY WORDS** alarmed pill container, heart failure, methamphetamine use

**APPENDIX** For supplemental videos, please see the online version of this paper.