Early Lifestyle Modification Is an Essential Step in Telemedicine for Heart Failure

Norimichi Koitabashi, MD, PhD; Masaru Obokata, MD, PhD; Masahiko Kurabayashi, MD, PhD

The management of heart failure (HF) is focused on establishing lifesaving medication and device therapies that are intended to prevent progressive ventricular dysfunction and sudden cardiac death. Neurohormonal intervention with β-blockers and renin-angiotensin-aldosterone antagonists improve pump function and mortality in patients with chronic HF (CHF).1,2 Adjunctive electrical therapies such as implantable cardioverter defibrillators (ICD) and cardiac resynchronization therapy (CRT) are frequently applied to patients with CHF to prevent, respectively, sudden cardiac death associated with lethal ventricular arrhythmias and pump dysfunction caused by interventricular conduction delays.3,4 Appropriate devices and evidence-based therapies are very important as an initial step towards achieving the goals of improved HF morbidity and reducing risk of premature death. However, once optimal therapies are established, the next important task in the long-term management of HF is monitoring patients to avoid the volume congestion that leads to hospitalization.1,4

Acute congestive exacerbation of HF is the most common reason for requiring in-hospital therapy. Chronically high ventricular filling pressure and further fluid accumulation results in persistently increased filling pressure, which puts patients at risk for hospitalization.4 In many patients, changes in filling pressures are actually apparent several weeks before symptoms worsen.5 Patient education and rapid access to HF clinics assist in early recognition and prevention of episodes of deterioration.6 However, clinical signs and symptoms of deterioration are often nonspecific or unrecognized by patients, and are thus not acted on in a timely fashion.7 The process of congestion not only promotes severe symptoms, but also contributes to progressive ventricular dysfunction through cardiac autonomic control changes and neurohormonal activation.8 Volume monitoring including patient education conducted by nurses and daily telephone weight checks have been tested to prevent acute congestion in patients with CHF.9,10 Rich and colleagues showed that intensive follow-up to increase adherence and detect early changes in volume status reduced readmission rates for worsening HF by 56%.6 The Specialized Primary and Networked Care in Heart failure (SPAN-CHF) trial also found that intensive patient education delivered by nurses resulted in a 52% reduction in rates of hospitalization for HF.10 One of the most intriguing findings of the SPAN-CHF trial was that intervention did not confer long-term benefits, and was only effective when health care providers initiated and continued contact with patients.10 Hospitalization was not avoided when patients were responsible for initiating contact, even when providers were available around the clock, 7 days per week. These results suggest that patients have fewer episodes of HF decompensation when followed and closely observed; otherwise, evidence of volume change goes unnoticed by patients.11 Because daily remote monitoring of every patient with CHF would be impossible in practice, more efficient approaches are required to identify, contact, and rigorously follow up only those patients with objective evidence of altered clinical status.

Intrathoracic impedance (ITI) is a potential biomarker that can be monitored using an implantable “high-energy” electric device, such as ICD or CRT-D.11 These devices measure resistance to an electric current through the thorax determined as lung conductivity and tissue resistance that become reduced in the presence of edema. A decrease in ITI is associated with increased left ventricular filling pressure.11,12 One means of frequently monitoring ITI is the OptiVol Fluid Index (Medtronic, Minneapolis, MN, USA), which is designed to measure daily ITI instead of a running average.11 Although the OptiVol alert was developed as an algorithm to predict HF from ITI trends, many false positives have raised concerns about its accuracy and reliability.12

In this issue of the Journal, Miyoshi and colleagues report a multicenter, prospective, randomized study of early therapeutic intervention based on ITI in patients with CHF implanted with a high-energy device (ICD or CRT-D). Early intervention for suboptimal decompensation is definitely an important goal of remote monitoring because it might prevent hospitalization for HF among patients with CHF. The same group previously showed that an OptiVol alert with ITI of >4% was a better predictor of an increase in serum B-type natriuretic peptide (BNP), which is another marker of increased filling pressure.12 Therefore, healthcare providers in this study contacted patients with an OptiVol alert and an ITI decrease to >4% from baseline applied therapeutic interventions and recommended presenting at a hospital within 3 days of the alert.13
The unique point of the study is the inclusion of lifestyle modification as a therapeutic intervention in addition to pharmacological intervention (diuretics or nitrate). Lifestyle modification comprised reducing sodium and water intake, reducing exercise for 1 week, and weight checks. Whereas 1 week of pharmacological intervention improved the BNP value, lifestyle modification did not improve serum BNP, but significantly increased the lowered ITI and decreased weight gain. That pharmacological intervention more effectively improved congestive status compared with lifestyle modification alone is not surprising, but even lifestyle modification stopped the congestion from worsening. It is hard to conclude the benefit because a control group without instruction to promote life style modification was not demonstrated. However, this is an important aspect from the viewpoint of telemedicine for HF. Improvements in remote monitoring technology to detect elevated acute congestion will optimize management and ensure better clinical outcomes for HF patients at high risk of decompensation. New devices under clinical development directly measure intracardiac filling pressure, which represents the “lesion” of HF during day-to-day management. An implantable hemodynamic monitoring system (CardioMEMS, Atlanta, GA, USA) based on micro-electromechanical (MEMS) technology is a lead-less and battery-less system implanted into the pulmonary artery circulation. The prospective, randomized, clinical CHAMPION trial of CardioMEMS found that HF management based on home transmission of pulmonary artery pressure with an implanted pressure sensor significantly reduced long-term home transmission of pulmonary artery pressure with an implantable monitoring system. N Engl J Med 2002; 346: 877–883.


Financial / Nonfinancial Disclosures

None of the authors have anything to disclose.

References