Heart failure (HF) is a major health problem with an increasing prevalence and high mortality despite advances in treatment. HF is not a single organ disease entity, but a complex disease involving whole body systems. However, heart and brain interconnections remain unclear. In a state of HF, activated neurohumoral systems such as the sympathetic nervous system and the renin-angiotensin-aldosterone system contribute to disease progression. These neurohumoral systems also activate the central nervous system, which plays an important role in regulating cardiac function. Although brain vessels have autoregulatory functions to maintain blood flow, persistent low cardiac output decreases cerebral blood flow (CBF), and may cause depressive symptoms and cognitive dysfunction (Figure). The latest systematic review and meta-analysis reveal prevalence rates of depression and cognitive dysfunction as 29% (10–79%) and 30–80%, respectively, and both are independent predictors of mortality and rehospitalization among HF patients. Recently, it was reported that reduced global CBF predicts depressive symptoms and cognitive dysfunction, and worse outcomes. Global CBF is evaluated by transcranial Doppler ultrasonography, radionuclide angiography and magnetic resonance imaging (MRI) (Figure). The hippocampus is reported to be one of the most vulnerable brain regions to reduced blood flow and hypoxemia, which plays a key role in cognitive processing. Hippocampal damage in HF has been evaluated by grey matter volume, regional volume and T2 relaxometry, indicating injured brain areas with MRI. Using single-photon emission computed tomography (SPECT), Alves et al reported that CBF reduction in the medial temporal region, including hippocampus, is present in elderly HF patients with major depressive disorders. However, it is possible that whole-brain analysis fails to detect differences in small brain regions, such as the hippocampus, because it must simultaneously analyze many different brain regions.

In this issue of the Journal, Suzuki et al report on their use of automated region of interest (ROI)-based analysis of MRI images to examine whether hippocampal CBF is decreased in HF patients and whether hippocampal abnormalities correlate with depressive symptoms and memory impairment. Further, the ROI of the hippocampus was divided into 4 segments from anterior to posterior at each center of gravity. They enrolled 60 symptomatic stage C HF patients and 56 asymptomatic stage B HF patients as controls to avoid the effects of cardiovascular risks and diseases, which can affect brain structure. This study clearly demonstrated that CBF in the posterior hippocampus was lower in patients with stage C HF compared with those with stage B HF, and was associated with depressive symptoms and cognitive impairment.

It is crucially important to detect and treat depressive symptoms and cognitive impairment because current HF management requires the active participation of patients who are expected to adhere to a complex treatment regimen. The J-HOMECARE study demonstrated that a home-based disease management program improved depression and mental health quality of life. Furthermore, this intervention successfully reduced rehospitalization rates in HF patients. Although the treatment plan for HF has hitherto focused on recovery of cardiac function, a therapeutic strategy for the interconnection of heart and brain is required. The prevalence of cognitive function evaluation and CBF measurement in HF patients should be encouraged in the clinical setting.
Heart and Brain Interconnection


References