JACC: ASIA VOL. 2, NO. 1, 2022

EDITORIAL COMMENT

Battling Congestion in HFpEF

Can Echocardiography Be Our Crystal Ball?*

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「心水者，其身重而少气，不得卧，烦而躁，其人阴肿。」
—东汉，公元150-219，《金匮要略》[1]

"Water qi affecting the heart may cause generalized swelling, shortness of breath, an inability to lie flat, restlessness, and labioscrotal swelling."
—Essentials from the Golden Cabinet, Eastern Han Dynasty, 150-219 CE[1]

Asia is seeing a pandemic of heart failure (HF) because of the aging of populations; one-half of patients have HF with a preserved ejection fraction (HFpEF).[2] Descriptions pertaining to HF are known in Asian civilizations, including ancient India and China.[1] The diagnostic hallmark of HF is congestion, which refers to the state in which fluid retention occurs within the heart, lungs, and other body parts. From a hemodynamic perspective, congestion is an increase in the ventricular (left and/or right) filling pressures; clinically, congestion manifests as dyspnea, orthopnea, elevated jugular venous pressure, parasternal lift, a third heart sound (S3), rales, pain from hepatic congestion, ascites, and peripheral edema. S3 is associated with left atrial pressures that exceed 20 mm Hg and increased left ventricular end-diastolic pressures >15 mm Hg. Clinical assessment of congestion is the cornerstone of establishing the diagnosis of HF; the new universal definition and classification defines HF as a clinical syndrome corroborated by objective evidence of pulmonary or systemic congestion.[3] Clinical signs of congestion in patients with HF also predict worse prognosis; elevated jugular venous pressure and S3 are each independently associated with death and HF hospitalization.[4] However, the sensitivity of physical examinations in detecting filling pressure elevation are generally low. Pulmonary rales are often absent even when pulmonary capillary pressure is elevated because of increased lymphatic drainage and reduced alveolar permeability of the lungs associated with HF. There is appreciable interobserver variability in the ability to detect jugular venous pressure elevation and S3, which is only partially attributed to observer experience. Overall, clinical assessment, even when carefully performed by an experienced cardiologist, has an accuracy of only 72% in identifying patients with elevated filling pressures. Echocardiography, which is often the first imaging test obtained in patients presenting with HF, has a higher accuracy (87%) of identifying patients with filling pressure elevation.[5] There are recent guidelines on how to apply echocardiography to estimate cardiac filling pressures,[6] but few data exist regarding its prognostic value in predicting adverse outcomes in patients with HFpEF.

In this issue of *JACC: Asia*, Abe et al[7] investigated the prognostic value of echocardiographic markers of congestion in patients admitted to hospitals with acute decompensated HFpEF. Three key echocardiographic markers of congestion, namely, the ratio of early diastolic transmitral flow velocity to mitral annulus velocity (E/e'), the tricuspid regurgitation peak velocity (TRV), and the collapsibility of the inferior vena cava (IVCC), were obtained at discharge. Echocardiographic congestion grade was assigned to each subject, classifying the congestion state into grade A (no congestion), grade B (1 index positive), and grade C (2 or 3 indexes positive). The investigators were able to demonstrate that echocardiographic congestion grade at discharge predicted death or HF hospitalization at 1 year in patients with HFpEF, not only in those with sinus rhythm but also in those with atrial fibrillation (AF), with incremental predictive value over age, sex, New York Heart

*Editorials published in the *JACC: Asia* reflect the views of the authors and do not necessarily represent the views of *JACC: Asia* or the American College of Cardiology.

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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.

ISSN 2772-3747 https://doi.org/10.1016/j.jacasi.2021.12.002

Association functional class, and N-terminal pro-B-type natriuretic peptide. The 3 echocardiographic markers for grading congestion were wisely chosen. First, E/e', TRV, and IVCC reflect, respectively, congestion in the left atrium (left-sided/pulmonary congestion), right ventricle, and right atrium (right-sided/systemic congestion); combining them to formulate a congestion grading scheme makes much anatomic and hemodynamic sense. Second, the proposed congestion grading scheme can be applied to patients with AF, which is highly prevalent in patients with HFpEF. Third, the left atrial volume index is not used in the congestion grading scheme. Left atrial enlargement is a barometer of chronic diastolic burden but not necessarily a marker of acute congestion at the time of echocardiographic assessment. Furthermore, in patients with AF, left atrial volume index is not simply a measure of left atrial pressure but also reflects left atrial remodeling caused by AF.

Predicting future events of rehospitalization and death are important for treatment optimization in HFpEF, but clinical estimates of risk have limited accuracy. Although validated population risk models, such as the MAGGIC (Meta-Analysis Global Group in Chronic Heart Failure) risk calculator,[8] are available, population-based risk is not the same as individual risk—the former represent averages, which are less useful for individual patient decisions. However, although elevated N-terminal pro-B-type natriuretic peptide may also reflect congestion, it does not pinpoint the level of congestion, and its cutoff value may be difficult to interpret in patients with obesity, AF, or renal failure. Echocardiography, when combined with clinical and N-terminal pro-B-type natriuretic peptide data, has the potential to lead to a personalized, precise risk assessment for hospitalized patients with HFpEF at discharge.

Abe et al[7] should be congratulated on their work, but the study had limitations. One could question why 23% of patients with HFpEF in the study cohort had positive IVCC and/or TRV but a negative E/e' index—did they really have HFpEF or did they have other cardiopulmonary diseases that caused right-sided congestion (eg, pulmonary arterial hypertension)? As mentioned by the investigators, accuracy was a concern in applying IVCC dimension and collapsibility for estimating right atrial pressure because of technical limitations, such as various cross-sectional morphologies and translational motion of the IVCC induced by sniffing. The study implied that therapeutic interventions targeted to improve echocardiographic congestion grade might alter prognosis, but this hypothesis remains to be tested.

Current guidelines of diastolic function assessment with echocardiography classify patients into those with impaired relaxation and pseudonormal and restrictive filling. The latter two diastolic function grades correspond only to a left-sided congestive state.[6] The concept of left- and/or right-sided echocardiographic congestion grading is novel; it highlights the prognostic value of assessment of the locations and extent of congestion (left-sided, right-sided, or both) and offers a potential therapeutic target. If the beast of congestion can be tamed, the battle of HF is half-won.

FUNDING SUPPORT AND AUTHOR DISCLOSURE

Dr Lee has been a consultant for Abbott, Pfizer, Philips Healthcare, and Fujifilm; and has received research grants from Bayer, Boehringer Ingelheim, Sanofi, Novartis, and AstraZeneca. Dr Fan has reported that she has no relationships relevant to the contents of this paper to disclose.

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KEY WORDS echocardiography, HFpEF, N-terminal pro-B-type natriuretic peptide