The Risk Model for Prediction of Survival in Heart Failure

Dong Heon Yang, MD

Division of Cardiology, Department of Internal Medicine, Kyungpook National University School of Medicine, Daegu, Korea

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Heart failure (HF) is a common clinical syndrome with high morbidity and mortality rates. Despite advances in HF management, prognosis of patients with HF are highly variable with annual mortality varying from 5% to 75%.¹⁾ It is very important for physicians to predict the prognosis of each patient to make decisions for medication, device implantation, transplantation and end-of-life care. Therefore, the accurate identification of prognostic factors or markers and the risk model for prediction of survival are crucial for proper management, and therefore, should be a part of the initial evaluation of any patient with HF. Many univariate predictors, such as clinical features, New York Heart Association functional class, hemodynamic parameters, laboratory findings, many kinds of biomarkers, electrocardiographic and echocardiographic parameters, cardiac magnetic resonance imaging, and coronary angiographic findings have been known as prognostic markers.²⁻⁵⁾ Although these risk factors correlate with survival on a statistical basis in a large population, their ability to predict survival in each individual patient is limited.

The risk-prediction model with multiple clinical parameters and biomarkers, focusing on factors that influence clinical outcomes, is useful for risk stratification. Several analyses have been studied to determine the mortality risk during or after hospitalization, with both clinical trial and registry databases.¹⁾⁶⁾⁷⁾ Potential benefits of using prognostic models are to enable patients and families to have a

realistic expectation of the prognosis, to enable selection of appropriate therapies, including cardiac resynchronization therapy (CRT), implantable defibrillators, mechanical circulatory assist devices, and transplantation, as well as to promote open communication between clinicians, patients, and their families to define the goals of therapy. However, it has potential hazards or limitations. Several models were derived from a different population of HF patients. It is difficult to apply the same models to patients with different race, etiologies and comorbidities. Patient compliance or attitudes were not incorporated in models. The past models become useless if new therapeutics become available. It also has limitations in patients that are not on evidence-based therapies. Uncertainty in application of the model to an individual patient was not quantified, and this uncertainty may be difficult for physicians to effectively explain to patients and their families.

In this issue of the journal, Oh et al.⁸⁾ reported the scoring model based on the results of multivariate analysis of prognostic factors in 239 advanced HF patients with low left ventricular ejection fraction (LVEF $\leq$ 35%) and wide QRS interval ($>$ 120 ms). It was validated by different hospital cohort with 66 HF patients. According to their data, prior stroke, heart rate (HR) $>$ 90 bpm, and serum Na $\leq$ 135 mEq/L and serum creatinine (Cr) $\geq$ 1.5 mg/dL were identified as independent factors. The risk model calculated a score by adding together the points corresponding to patient's risk factors: {risk score = $3 \times$ prior stroke + $5 \times$ HR ($>$ 90 bpm) + $3 \times$ serum Na ($\leq$ 135 mEq/L) + $2 \times$ serum Cr ($\geq$ 1.5 mg/dL)}. All patients were stratified into three groups based on risk score: low- (0 point), intermediate- (1-5 points), and high-risk groups ($>$ 5 points). The 2-year mortality rate of each group was 5% (6/119), 31% (25/81), and 64% (25/39), respectively. Compared with the low-risk group, the hazard ratio of the high-risk group was 20.9 [95% confidence interval (CI): 8.6 to 51.3; $p < 0.001$] and intermediate-risk group was 6.7 (95% CI: 2.7 to 16.3; $p < 0.001$). As Oh et al.⁸⁾ described at discussion, prior stroke, HR serum Na and Cr have been well known as prognostic markers in patients with HF.¹⁾⁶⁾⁹⁾

However, some limitations have to be resolved to see a clinical

Correspondence: Dong Heon Yang, MD, Division of Cardiology, Department of Internal Medicine, Kyungpook National University School of Medicine, 680 Gukchaebosang-ro, Jung-gu, Daegu 700-842, Korea
Tel: 82-53-200-6587, Fax: 82-53-426-2046
E-mail: ddhyang@knu.ac.kr

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impact. First, only 4 risk factors were needed, in accordance with this risk model. It is a strong point on one side; however, is also weak point on the flip side. Many putative risk factors, such as HF etiologies, N-terminal pro-natriuretic peptide, prescribed drugs were not included because of small population and a retrospective design. The prognosis of patients with ischemic HF depends on the presentation of clinical features, such as ST-elevation acute myocardial infarction, unstable angina and chronic stable angina, ischemic or scar burden, coronary angiographic findings, and revascularization, and is worse than that of non-ischemic HF. The prognosis of non-ischemic HF also depends on the causes of HF, such as valvular heart disease, hypertensive HF, tachycardia-induced cardiomyopathy, dilated cardiomyopathy and so on. Further, several neurohormonal blockades have significant effects on the future cardiac events. It is necessary to compare between the proposed model and other existing HF models, such as the Seattle HF model to clarify the clinical usefulness of this study, and whether this result is more appropriate to predict the prognosis in Korean HF population.

Second, it is hard to say that patients with high risk of mortality may respond well to CRT. Patients with poor prognosis may have infertile myocardium, such as large scar area, far-advanced injury and tachyarrhythmia. Therefore, patients may also have high risk to be non-responder on CRT. Previous CRT studies showed that about 1/3 patients did not respond to CRT.¹⁰⁾ Sometimes, the answer to the question of 'who is the responder to CRT?' and the method to select the proper responder are more important in real clinical situations. It may be difficult to select patients to CRT with just only risk prediction model.

In spite of some limitations, this article suggests that simple risk scoring model with prior stroke, HR, serum Na and Cr may be useful to predict future cardiac events and select patients for CRT in advanced HF patients with low LVEF ($\leq 35\%$) and wide QRS interval (>120 ms). The prospective larger population study, such as nation-

al HF cohort is necessary to clarify and approve this hypothesis before clinical application.

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