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EDITORIAL COMMENT

The Match of Electrocardiogram and Artificial Intelligence Confers an Opportunity for Pulmonary Hypertension Screening*

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Elevated pulmonary artery pressure (ePAP) affects more than a million individuals worldwide and is associated with increased mortality. Early detection and treatment for patients with ePAP can improve survival and avert adverse outcomes. Transthoracic echocardiography is a readily available noninvasive method to detect ePAP. However, at present, transthoracic echocardiography measurement requires significant time and skills. As such, a significant delay between the onset of symptoms and diagnosis of ePAP is frequently observed. On the other hand, electrocardiogram (ECG) is the most immediately accessible screening tool in routine clinical practice. The detection of ePAP from ECG confers an extraordinary opportunity to change clinical practice for early screening patients at risk of ePAP. However, the traditional ECG criteria used to identify ePAP is unsatisfactory caused by low sensitivity.[1] Thus, alternative methodologies are demanded to address this unmet clinical need. There may be potential diagnostic information hidden in the ECG that is not yet recognized by contemporary knowledge. This is a task where artificial intelligence (AI) could play an irreplaceable role.

The application of AI in the field of cardiology is not a fresh idea; it has grown tremendously in the past decade.[2] Given its escalating capability in digging information from multidimensional medical data, the role of AI in the medical field has shifted from assisting clinicians in reducing labor-intensive work to more challenging tasks including diagnosis, risk stratification, and outcome predictions.[3-5]

In this issue of *JACC: Asia*, Liu et al[6] developed an AI model using a large data set of 41,097 patients from Taipei Veterans General Hospital to identify ePAP based on standard ECG. The model performances were evaluated at different levels, including the diagnostic performance in detection of ePAP and the predictive prognosis of cardiovascular mortality at 6-year follow-up. Compatible performances of sensitivity (81.0%) and specificity (79.6%) were reported for the AI model in detecting ePAP through 10-fold cross-validation. Of note, the performance of conventional ECG characteristics to detect ePAP per current clinical practice was also reported, indicating that the proposed AI model outperformed the current standards. Meanwhile, the authors reported that the AI model independently predicted patients with higher cardiovascular mortality.

The authors should be congratulated for developing this novel AI model and for completing the comprehensive evaluation work. They described the typical steps in the development of AI models, including model training, best model selection, and performance evaluation by using different data sets. The overlap of these data sets should be strictly avoided to prevent overfitting of the AI model. The study was strengthened by evaluating the AI model on an external cohort from Japan. It was observed that the same AI model had a decrease in specificity (79.6% vs 58.7%) and an increase in sensitivity (81.0% vs 93.9%) on this external cohort of Japanese patients. This is not surprising because the baseline characteristics of the 2 evaluated populations were different. The "optimal features" identified by the AI

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model from the training cohort might not be optimal for another population. Given the “black box” nature of the AI model, it is extremely important to select a data set representative of the target applications in the development of the AI model. Undoubtedly, the biggest concern for adopting a new AI model in routine clinical practice is the generalizability across populations. More validations are required to further evaluate the developed model. Meanwhile, interactions in future development of the AI model by feeding data with diversified characteristics will likely improve its robustness.

As AI technology progresses rapidly, new guidelines have been proposed to better inform the community and to standardize technology development.[7] The current work is a good attempt in the era of AI and big data. Notwithstanding, the actual clinical impact on patient outcomes is yet to be further investigated. AI might live up to the potential to serve the medical community only after we take the step from evaluating model performance in the laboratory to testing it in routine clinical practice.

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