

Handheld Wireless Digital Phonocardiography for Machine Learning-Based Detection of Aortic Stenosis

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Background:

Aortic stenosis (AS) is a common disease which can be detected as a murmur on auscultation, but studies show that up to 80% of new primary care physicians do not detect AS murmurs which are confirmed by transthoracic echocardiography (TTE). The FDA-approved Eko CORE device is a digital stethoscope wirelessly paired with the Eko Mobile application to allow recording and analysis of phonocardiograms (PCG). These PCG data drive a machine learning-based detection algorithm to identify clinically significant AS, validated by TTE, as part of the ongoing Phono- and Electrocardiogram Assisted Detection of Valvular Disease (PEA-Valve) Study.

Methods:

Patients undergoing TTE at Northwestern Medicine underwent PCG recording by the Eko CORE device. Recordings 15 seconds long were obtained at four standard auscultation positions (figure 1). A TensorFlow-based machine learning algorithm assessed the presence or absence of murmur with dominant localization to the right upper sternal border indicating clinically significant AS (moderate or more on TTE).

Results:

To date, 161 patients with 639 recordings have been enrolled, with 14 patients (8.7%) found to have significant AS on TTE. The receiver-operating characteristic curve had an area of 0.964, yielding a sensitivity of 97.2% (95% CI, 84.7-99.5%) and a specificity of 86.4% (95% CI, 84.0-88.7%) for the detection of AS (figure 2).

Conclusion:

PCG assessment using the Eko CORE device and machine learning interpretation is a fast and effective method to screen for significant AS and should be validated in a primary care setting.

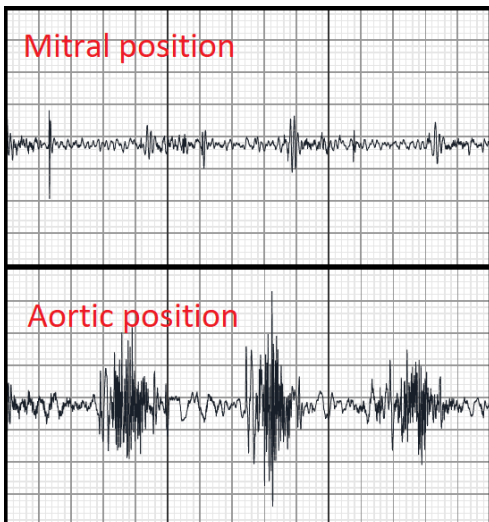


Figure 1

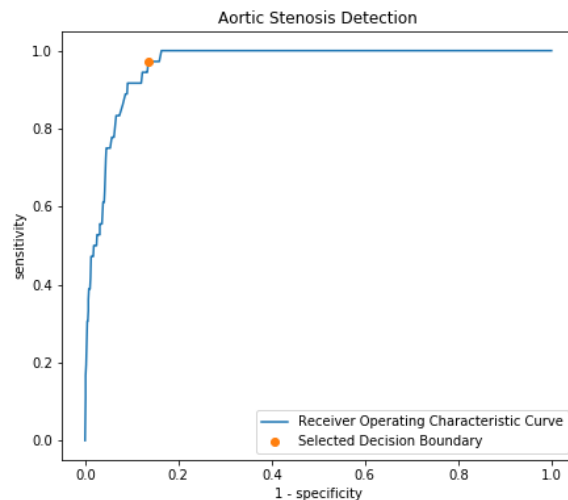


Figure 2