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Diagnostic Accuracy of Exercise Electrocardiogram in Women

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Coronary heart disease (CHD) is believed to be under-recognized in women due to substantial differences in the type, frequency, and quality of symptoms as compared with that in men.¹,² CHD is the leading cause of mortality among women in industrialized nations.³,⁴ Our understanding of sex-specific differences in initial presentation, diagnostic evaluation, and clinical outcomes has changed considerably for the past 2 decades.¹⁵-⁷ Functional testing for patients with chest pain has been the diagnostic test of choice.

In this issue of Journal of Women's Health, Knol et al.⁸ report on an important topic about the diagnostic accuracy of exercise electrocardiogram (ECG) in female patients with low-intermediate risk for coronary artery disease (CAD) compared with the diagnostic accuracy of coronary computed tomography angiography (CCTA) in contemporary times. They showed that for >50% stenosis on CCTA, exercise ECG was negative in 46%, inconclusive in 52%, and positive in only 2% of patients. Also, 64% of patients with positive exercise ECG had no CAD, whereas other 29% patients had a nonobstructive disease. This study shows even lower diagnostic accuracy than previous studies,⁹ likely due to lower probability patients are being referred. Higher rates of inconclusive and false positive test results decrease the confidence in test and perhaps explain the higher number of invasive coronary angiography (ICA) in women, which consistently show majority cases with nonobstructive disease.⁹,¹⁰ In current clinical practice, a majority of patients who undergo ICA after functional testing have normal or nonobstructive CAD.¹¹ The poor performance of exercise ECG overall and specifically in women calls for an alternative strategy to evaluate women with chest pain. Recent landmark trials including PROMISE¹² (Prospective Multicenter Imaging Study for Evaluation of Chest Pain), CRESCENT¹³ (Calcium Imaging and Selective CT Angiography in Comparison to Functional Testing for Suspected Coronary Artery Disease), and SCOT-HEART¹⁴ trial (Scottish Computed Tomography of the Heart) provide much needed data on the effectiveness of CCTA versus functional stress testing for evaluation of patients with suspected CAD. The PROMISE trial comparing CCTA versus functional test showed CCTA provides more prognostic and discriminatory information than functional testing, with the greatest benefit in women.¹⁵ Similarly, recent sex-focused analysis of CRESCENT trial¹⁶ reported that a higher number of women in the CCTA arm had chest pain resolution than women who underwent functional testing (40% CCTA vs. 22% stress: p = 0.026). Women in the CCTA arm more frequently reached a final diagnosis (p < 0.001) and had lower downstream diagnostic testing than women in the functional testing arm of the study (leading to lower costs [in euros] 326 vs. 478, p < 0.001).¹⁶,¹⁷ This study reported that the CCTA led to 49% of patients having alterations in their medical management. More patients were started on statins (18%) and aspirin (8%), whereas in others statins and aspirins were discontinued. This is in accordance with previous studies, in the PROMISE trial there was higher proportion of patients newly initiated on aspirin (51%) and statins (110% increase).¹⁸ More preventive therapies were reported in the CCTA arm of the SCOT-HEART trial as well.¹⁹

American College of Cardiology/American Heart Association and European Society of Cardiology guidelines recommend functional stress testing as the first line as an initial diagnostic test of IHD.²⁰,²¹ However, based on diagnostic accuracy and cost-effectiveness, 2016 United Kingdom National Institute for Health and Care Excellence (NICE) guidelines recommend CCTA as the initial diagnostic test of choice in the evaluation of patients with suspected CAD.²² Atypical symptoms, false positive treadmills, breast attenuation artifacts, and a greater rate of functional incapacity often make an evaluation of CAD in women more challenging.¹ Despite lower prevalence of obstructive CAD by coronary angiography and more often preserved ejection fraction (EF), women with CAD have more adverse outcomes than men.²,²² CCTA has a much higher sensitivity and specificity to identify obstructive CAD, as well as ability to identify a nonobstructive disease, making it better suited in women as a first line test.

Author Disclosure Statement

Dr. Matthew J. Budoff is a consultant for General Electric; the other authors have no conflict of interest.

References


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