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Exercise stress testing in the asymptomatic adult: family physician adherence to the guidelines

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KEYWORDS:
Exercise stress test;
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OBJECTIVE: Exercise stress testing has not been recommended by the American Heart Association or the American College of Cardiology as a screening tool in the asymptomatic population because such testing has limited value in this population. It was the goal of this study to investigate family physician adherence to clinical guidelines regarding exercise stress testing of the asymptomatic adult.

METHODS: This trial surveyed osteopathic family physicians attending a continuing education conference. Physician identifiers were not requested or recorded. Both descriptive and inferential statistics were produced. Frequencies and percentages as well as chi-square analysis were performed with significance set at an $\alpha \leq 0.05$.

RESULTS: A total of 181 osteopathic family physicians completed surveys. Participating physicians were more likely to order a stress test as the patient aged and as their Framingham risk increased. Universally more physicians ordered stress tests for men than women in all categories. Non-diabetic men (83% vs. 86%) and women (83% vs. 84.5%) greater than 59 years of age who planned to start an exercise program were stress tested with greater frequency than their age matched diabetic counterparts ($p < 0.001$, $p < 0.001$).

CONCLUSIONS: This study demonstrates that physician use of exercise stress testing as a screening tool for coronary heart disease is not well correlated with American Heart Association/American College of Cardiology evidence-based guidelines. The study also identified a lack of recognition of diabetes as a cardiovascular risk equivalent. Further studies are needed to delineate potential barriers to physician adherence of these guidelines.

Coronary heart disease (CHD) is the nation's single leading cause of death, with more than 600,000 Americans dying from CHD in 2004.[1] The estimated lifetime risk of CHD after age the age of 40 is 49% for men and 32% for women.[2] The significant morbidity and mortality individuals have after a coronary event has prompted physicians to find screening modalities that help to predict the 7.9 million myocardial infarctions that occur annually in the United States.[1]

Exercise stress testing has become an increasingly useful screening tool in patients with known or suspected CHD.[3] However, the value of exercise stress testing in the asymptomatic patient is less clear because of a lack of randomized trials documenting its ability to improve clinical outcomes.[4-7] Exercise stress testing has limited diagnostic accuracy and prognostic value in the asymptomatic population.[7,8] This is partly a result of the low positive predictive value (<10%) of exercise stress testing in the asymptomatic population.[9-11] Although current clinical guidelines do indicate a potential benefit in testing a subset of asymptomatic individuals with an increased number of risk factors (hy-

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Table 1 Percentage of asymptomatic men receiving stress testing

Asymptomatic men	Percent of physicians ordering stress tests			
Patient demographic	<40 y	40–49 y	50–59 y	>59 y
with low Framingham risk	0.5%	7%	28%	43%
with intermediate Framingham risk	7%	35.5%	59%	70%
with high Framingham risk	41.7%	70%	84.5%	86.5%
who plans to start a vigorous exercise program	14.5%	46.5%	75.5%	86%
with diabetes who plans to start an exercise program	42%	66%	80%	83%

percholesterolemia, hypertension, smoking, diabetes, or family history of premature CHD), the test is likely to provide more prognostic than diagnostic significance.[3] Therefore, universal testing of the asymptomatic population may fail to improve clinical outcomes, subject individuals to unnecessary invasive testing and over-treatment, and still miss individuals with significant disease.[4]

Currently, exercise stress testing is recommended for the purpose of screening for cardiovascular disease in limited populations. The American Heart Association (AHA), the American College of Cardiology (ACC), and the US Preventive Services Task Force guidelines recommend screening with exercise stress testing in the following populations: people with diabetes who are beginning an exercise program (Class IIa), patients with multiple risk factors for whom risk-reduction therapy needs to be guided (Class IIb), men >45 years old and women >55 years old who plan to start a vigorous exercise program (Class IIb), and patients at risk for CHD because of other diseases such as peripheral atherosclerosis and chronic renal failure (Class IIb).

Because of the limited value of exercise stress testing in the asymptomatic person, it has not been recommended for use as a screening tool in this population.[4] Although these clinical guidelines have been provided by the American Heart Association (AHA), the American College of Cardiology (ACC) and the US Preventive Services Task Force, it is thought that there is a mismatch between these guidelines and clinical practice. Therefore, it was the goal of this study to investigate physician adherence to clinical guidelines regarding exercise stress testing of the asymptomatic adult.

Methods

This study included a survey (see Appendix) of family physicians attending either the Ohio University College of Osteopathic Medicine (OU-COM) Annual CME Conference or the American College of Osteopathic Family Physicians (ACOFP) Annual Convention and Exhibition. Approval for the study was obtained from the St. Vincent Mercy Medical Center Institutional Review Board (IRB) and the Ohio University IRB. Investigators were granted permission to complete the study during the conventions. Physicians were solicited at the continuing medical education (CME) conferences to fill out a short survey. A cover letter was provided to participants, and return of a completed survey to a designated drop box at the CME conference implied consent. Only physicians who designated themselves as family physicians or family medicine residents were included in the study. Physician identifiers were not requested or recorded. All data was entered into an Excel database by key and entry format.

Results were analyzed using SPSS version 16.0 (SPSS Inc., Chicago, IL); both descriptive and inferential statistics were produced. Frequencies and percentages, as well as chi-square analysis, was performed, with significance set at $\alpha \leq 0.05$. Reliability of the survey instrument, Cronbach's alpha, was found to be 0.95.

Results

A total of 200 physicians completed surveys. At the ACOFP Annual Convention and Exhibition, 141 surveys were com-

Table 2 Percentage of asymptomatic women receiving stress testing

Asymptomatic women	Percent of physicians ordering stress tests			
Patient demographic	<40 y	40–49 y	50–59 y	>59 y
with low Framingham risk	2%	8%	23.5%	42%
with intermediate Framingham risk	6.5%	26.5%	56%	67.5%
with high Framingham risk	30%	59.5%	79%	84%
who plans to start a vigorous exercise program	13%	36%	70.5%	84.5%
with diabetes who plans to start an exercise program	32.5%	60.5%	79%	83%

Table 3 Percentage of asymptomatic special population persons receiving stress testing

	Percent of physicians ordering stress tests			
Patient demographic	<40 y	40–49 y	50–59 y	>59 y
Asymptomatic patient who requests the test	31.0%	52.5%	71.0%	76.0%
Asymptomatic patient with multiple risk factors for whom risk-reduction therapy needs to be guided	32.0%	61.5%	77.0%	80.5%
Asymptomatic patient with peripheral atherosclerosis	49.5%	71.0%	83.5%	85.5%
Asymptomatic patient with chronic renal failure	38.0%	55.0%	68.0%	71.0%
Asymptomatic diabetic patient with ≥2 atherogenic risk factors	51.5%	75.0%	88.0%	89.0%

pleted representing 21.8% of physicians in attendance (647 total physicians were in attendance). All 141 surveys met inclusion criteria and were included in the study. Fifty-nine surveys were returned at the OU-COM Annual CME Conference, representing 21.7% of physicians in attendance (240 = total physicians in attendance). Forty of the 59 surveys met inclusion criteria for the study. Residents represented 9.4% of all survey responders, 38.1% were physicians practicing for 0 to 10 years, 22.1% were physicians practicing 11 to 20 years, 21.5% were physicians practicing 21 to 30 years, and 8.3% were physicians practicing 21 to 40 years.

Frequencies for use of stress testing as a screening test for CHD in the asymptomatic adult male, female, and special populations are found in Tables 1, 2, and 3, respectively. In general, physicians were more likely to order a cardiac stress test as the patient age and perceived Framingham risk increased. Universally, more physicians would order cardiac stress testing in men than women across all ages, regardless of Framingham risk.

Nondiabetic men older than 59 years who planned to start an exercise program were stress tested with greater frequency than their age-matched diabetic counterparts ($p < 0.001$). Nondiabetic women older than 59 years who planned to start an exercise program were also stress tested with greater frequency than their age-matched diabetic counterparts ($p < 0.001$).

More than 50% of people above the age of 40 who requested a stress test had their request granted. In fact, the likelihood of ordering the test approximated the percentage that is recommended in the high Framingham risk group. In addition, physicians were more likely to order stress tests with peripheral vascular disease than chronic renal disease across all age categories.

Seventy-five percent of physicians indicated their medical management of cardiovascular risk factors was altered if an asymptomatic individual with a negative test result was shown to have poor exercise capacity, poor heart rate reserve, or poor heart rate recovery.

Of the asymptomatic patients who would not receive an exercise stress test, 31.6% of family physicians would order a carotid ultrasound for the purpose of CHD screening, 40.8% would order an ankle brachial index (ABI), 3.9% a plasminogen activator inhibitor-1 level, 21.2% a coronary calcium score, 29.6% lipoprotein a level, 41.4% LDL size stratification, and 40.1% a homocysteine level.

Conclusions

This study demonstrates that physicians' use of exercise stress testing as a screening tool for CHD is not well correlated with AHA/ACC evidence-based guidelines.

Nondiabetic men and women older than 59 years who planned to start an exercise program were stress tested with greater frequency than their age-matched diabetic counterparts. People with diabetes and people of increasing age have a higher risk for cardiovascular disease and, therefore, should be stress tested more frequently than lower-risk populations. Risk of cardiac events in asymptomatic patients with diabetes is estimated to be equal to patients with CHD but no history of diabetes.[12-14] In addition, people beginning an exercise program are at risk for cardiac events if they have undetected coronary heart disease, and high-risk individuals should therefore be tested before beginning exercise.[15] Evidence-based literature more strongly supports the use of exercise stress testing in persons with diabetes who plan to start an exercise program than in their age-matched controls.[3,4] Vigilance in ruling out the potential for harm for diabetic women who plan to begin exercise is particularly important because they have a five-fold increased risk for CHD.[16] Furthermore, more physicians would order a stress test in asymptomatic men than women despite the fact that women are much more likely to have atypical symptoms of angina.[17] Perhaps most concerning is the fact that the individuals at greatest risk for CHD (patients with documented peripheral atherosclerosis, renal failure, and diabetes) were tested with similar frequencies as patients with significantly less predicted risk. The higher the patient's pretest probability for inducible myocardial ischemia, the more meaningful a positive result will be (i.e., the result is less likely to be a false positive).[8] These principles, which are laid out in Bayes' theorem, aid physicians when ordering tests. If a stress test is ordered for a patient with a low pretest probability, the validity of a positive test result could be questioned. Furthermore, if the stress test is ordered for the purpose of screening for cardiovascular disease, a positive result may lead to further invasive testing. In a low prevalence population, the patient's result is likely to be a false positive and the provider is subjecting the patient to unnecessary invasive testing.

Although our study was focused primarily on physician use of exercise stress testing as a means for screening for CHD, the physicians were also asked about their use of the test as a

prognostic indicator. Seventy-five percent of physicians indicated their medical management of cardiovascular risk factors was altered if an asymptomatic individual with a negative test result was shown to have poor exercise capacity, poor heart rate reserve, or poor heart rate recovery, which are all associated with increased risk of death and higher rates of major cardiac events, even after accounting for standard risk factors.[4,7] However, there is no evidence that gaining this knowledge improves outcomes or that more intensive risk factor modification produces clinical benefit.[4]

The major limitation to this study is the fact that it is a survey based on physicians' own perception and self-reporting of their practice as opposed to a chart review of what physicians actually practice. Although physicians perceive that they would order a stress test on an individual who meets certain criteria, their actual clinical use of stress testing may be different. Another limitation of the study is that all physicians surveyed were pursuing CME. It is possible that physicians attending CME conferences have different clinical decision-making process for stress testing in asymptomatic adults than physicians who would not be inclined to attend these conferences. In addition, 9.4% of surveys were completed by family medicine residents. With their limited clinical experience, the resident responses could have been different from those of practicing physicians. In this study, statistical analysis failed to demonstrate any statistically significant differences or relationships. Demographic data on practice location of physicians was not ascertained in the study and therefore could limit the generalizability of the study. However, because the majority of surveys were collected at a national CME conference, one could conclude that a wide range of practice locations were represented by the surveys. Lastly, it is possible that physicians may order stress tests differently if they provide stress testing as a service in their office. However, our study failed to ask physicians this important question as part of the survey.

In summary, survey results demonstrate that family physician use of exercise stress testing in the asymptomatic patient does not adhere to current evidence-based guidelines. Further studies are needed to delineate potential barriers to physician adherence of AHA/ACC guidelines to determine whether there is a knowledge, adoption, or implementation deficit.

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Appendix

Exercise Stress Testing in the Asymptomatic Adult
Principle Investigator: Rachel M. Holt, OMS 3

Please indicate your area of specialty (check only one):

_____ Cardiology
_____ Family Practice
_____ Other

Please indicate the number of years you have been practicing the above specialty (not including years in residency/fellowship)

_____ Currently in residency/fellowship training program
_____ 0-10
_____ 10-20
_____ 20-30
_____ 30-40

For which of the following patient groups would you order an exercise stress for the purpose of screening for CAD, check all that apply:

	< 40 years old	40-49 years old	50-59 years old	> 59 years old
The asymptomatic man with low Framingham risk				
with intermediate Framingham risk				
with high Framingham risk				
who plans to start a vigorous exercise program				
with diabetes who plans to start an exercise program				
The asymptomatic woman with low Framingham risk				
with intermediate Framingham risk				
with high Framingham risk				
who plans to start a vigorous exercise program				
with diabetes who plans to start an exercise program				
The asymptomatic patient who requests the test				
The asymptomatic patient with multiple risk factors for whom risk-reduction therapy needs to be guided				
The asymptomatic patient with peripheral atherosclerosis				
The asymptomatic patient with chronic renal failure				
The asymptomatic diabetic patient w/ two or more atherogenic risk factors.				

Is your medical management of cardiovascular risk factors altered if the negative stress test result is given with either a poor exercise capacity, poor HR reserve, or poor heart rate recovery?

_____ Yes _____ No

Which of the following CAD screening tests do you order for the asymptomatic patient you choose NOT to exercise stress test, check all that apply:

	Yes	No
C reactive protein		
Carotid ultrasound		
ABI (Ankle Brachial Index)		
Plasminogen activator inhibitor-1		
Coronary calcium scoring		
Lipoprotein a		
LDL size stratification		
Homocysteine		