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Dobutamine stress echo has marginal utility and is context-dependent for assessing myocardial ischemia

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ABSTRACT A clinical appraisal and clinical application of Marcovitz PA, Armstrong WF. Accuracy of dobutamine stress echocardiography in detecting coronary artery disease. *Am J Cardiol.* 1992;69:1269-1273

Keywords: dobutamine, stress echocardiogram, echocardiogram, clinical utility

Clinical Context

Her primary care doctor sent an 80-year-old female to the hospital because he thought she had atrial fibrillation. Upon evaluation, she complained of three days of intermittent left chest pressure radiating to her left arm and left shoulder. She was in no distress. In the middle of the night, she had a recurrence of the chest pain; however, her electrocardiogram (ECG) and Troponin I results were normal. The patient also had a history of a negative dobutamine stress echocardiography four months prior.

Clinical Question

Does this patient require some type of repeat imaging for myocardial ischemia?

Research Article

Marcovitz PA, Armstrong WF. Accuracy of dobutamine stress echocardiography in detecting coronary artery disease. *Am J Cardiol.* 1992;69:1269-1273.

Literature Review

Most of the studies reporting the test characteristics for dobutamine stress echocardiography were written in the early 1990s.[1-13] Newer tests using augmentation techniques, alternative imaging or myocardial stress procedures were developed after that time and supplanted dobutamine stress echocardiography as the test of choice. [1-10, 14] This analysis looked at papers reporting a gold standard of coronary angiography, in which the intent was to diagnose coronary artery disease in a moderate risk population. There was a fairly even mix of positive angiograms with results between 50% versus 70% stenosis. Multiple small papers (six of twelve, $N < 100$), including the one reviewed, used case series or cross-sectional designs. [1-10] All papers suffered from inclusion bias, since only patients who were candidates for both tests were included in the analysis. No paper featured a prospective study design specifically

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to determine test characteristics; rather, all of the available evidence came from patient care experiences. This "convenience sample" or retrospective analysis severely limits the validity of the body of literature and explains the wide range of reported sensitivities and specificities.

Another problem is the operator-dependent bias demonstrated by Hoffman, et al.[11] Five experienced Medical Centers each submitted 30 dobutamine stress echocardiograms with concomitant coronary arteriograms. Inter-institutional agreement, which is defined as four or five centers agreeing on the result, occurred only 73% of the time (mean kappa value 0.37, fair agreement only). This is also evident in the variability of reporting results when the echocardiographic images were of poor quality or could not be read.

Further points of concern mentioned in the literature regarding dobutamine were the safety of the test and the possibility of exacerbating ischemia. However, in one report 1,118 consecutive patients underwent dobutamine stress echocardiography without a single instance of death, myocardial infarction, or sustained ventricular tachycardia[12]. Regarding the efficacy of dobutamine stress echo, a non-systematic review article calculated with a combined data source of 2,246 cases estimated an overall sensitivity and specificity of 80% and 81%.

The overall SORT quality of evidence for this literature is Grade B.

Critical Appraisal

These authors took a series of 568 patients who had dobutamine stress echocardiograms over a period of one-and-a-half years, and selected 141 who had coronary arteriograms within two months of that exam, which together replicated the selection bias mentioned above. There is no indication how many normal dobutamine stress echocardiograms were negative in the face of actual coronary artery disease. Although patients were not randomly selected to undergo both tests, the sample did include patients aged 32-83, 41% of whom were female, which is fairly representative of patients presenting to the authors' institution for evaluation of chest pain.

Strengths of this paper include well-described blinding of echocardiographers who read the studies. The protocol for obtaining the images was well-described and reproducible. Less information is given about the angiographers, who used 50% stenosis as the definition of significant coronary artery disease, which may introduce operator-dependent bias.

The calculated sensitivity and specificity in this paper are outliers when compared to the literature reviewed. The sensitivity was 96% and the specificity was 66%, yielding a positive likelihood ratio of 2.82 and negative likelihood ratio of 0.06. The positive likelihood ratio of 2.82 means that there is only a moderate increase in the likelihood of having coronary artery disease if this test is positive. Its negative likelihood ratio is only 0.06, meaning that if the test is negative, it greatly reduces the probability of having coronary artery disease. That is, a negative dobutamine stress echocardiogram is more clinically useful than a positive one.

SORT criteria Level of Evidence equals 2, based on poor or average quality cross sectional studies only.

Clinical Application

By the time morning rounds occurred, the patient's chest pain had resolved and she blurted out, "I want to go home!" Based on her risk factors (advanced age, smoker, hypertensive), we estimated a probability of coronary artery disease of 60%. With the addition of the previous negative dobutamine stress echocardiogram, we used the Fagan Nomogram and estimated her coronary artery disease risk prior to this episode as 7.5%. When considering her recurrence of typical cardiac symptoms, we realized that her current estimate of disease was higher, but by this time she was asymptomatic, receiving maximal therapy, had no evidence of atrial fibrillation, and wanted to go home. We discussed it as a team, and everyone felt comfortable treating the patient without further imaging. We practiced using medical literature, obtaining test characteristics, and incorporating the Fagan Nomogram into patient care decisions, which was a learning experience for us. We learned from the extant literature related to dobutamine stress echocardiography that this test needs to be used with caution, as there is not strong supporting evidence for its use in a diagnostic role, which makes interpretation of the results dependent on clinical judgment.

For our patient—with limited mobility, advancing age, and decreased functional status—we had enough information to allow her to go home on maximal therapy.

Three take-home points:
1.) Dobutamine stress echocardiograms should not be used in a diagnostic role for myocardial infarction.
2.) Dobutamine stress echo results are dependent on context and judgment.
3.) Just because a test is widely used does not mean that it is the best diagnostic test.

References

1. Sahin M, Karakelleoglu S, Alp N, Atesal S, Senocak H. Diagnostic value of dobutamine stress echocardiography in coronary artery disease. *Thorac Cardiovasc Surg*. 1994;42(5):285-289.
2. Salustri A, Fioretti PM, Pozzoli MM, McNeill AJ, Roelandt JR. Dobutamine stress echocardiography: its role in the diagnosis of coronary artery disease. *Eur Heart J.* 1992 Jan;13(1):70-7.
3. Segar DS, Brown SE, Sawada SG, Ryan T, Feigenbaum H. Dobutamine stress echocardiography: correlation with coronary lesion severity as determined by quantitative angiography. *J Am Coll Cardiol*. 1992;19(6):1197-202. doi:10.1016/0735-1097(92)90324-G
4. Wu CC, Ho YL, Kao SL, et al. Dobutamine stress echocardiography for detecting coronary artery disease. *Cardiology.* 1996;87(3):244-249. doi:10.1159/000177095
5. Yeo TC, Ling LH, Ng WL, et al. Dobutamine stress echocardiography: angiographic correlates. *Ann Acad Med Singapore*. 1996 Mar;25(2):196-9.
6. Marwick T, D'Hondt AM, Baudhuin T, et al. Optimal use of dobutamine stress for the detection and evaluation of coronary artery disease: combination with echocardiography or scintigraphy, or both? *J Am Coll Cardiol*. 1193;22(1):159-167. doi:10.1016/0735-1097(93)90830-T
7. Mazeika PK, Nadazdin A, Oakley CM. Dobutamine stress echocardiography for detection and assessment of coronary artery disease. *J Am Coll Cardiol.* 1992;19(6):1203-1211. doi:10.1016/0735-1097(92)90325-H
8. Beleslin BD, Ostojic M, Stepanovic J, et al. Stress echocardiography in the detection of myocardial ischemia: head-to-head comparison of exercise, dobutamine, and dipyridamole tests. *Circulation*. 1994;90(3):1168-76. doi:10.1161/01.CIR.90.3.1168
9. Chan RK, Tonkin AM, Byrgiotis S, Calafiore P. Assessment of coronary artery disease by dobutamine stress echocardiography (DSE). *Aust N Z J Med*. 1995;25(6):707-715.
10. Cohen JL, Greene TO, Ottenweller J, Binenbaum SZ, Wilchfort SD, Kim CS. Dobutamine digital echocardiography for detecting coronary artery disease. *Am J Cardiol.* 1991;67(16):1311-8. doi:10.1016/0002-9149(91)90457-V
11. Hoffmann R, Lethen H, Marwick T, et al. Analysis of interinstitutional observer agreement in interpretation of dobutamine stress echocardiograms. *J Am Coll Cardiol*. 1996;27(2):330-336. doi:10.1016/0735-1097(95)00483-1
12. Mertes H, Sawada SG, Ryan T, et al. Symptoms, adverse effects, and complications associated with dobutamine stress echocardiography: experience in 1118 patients. *Circulation.* 1993;88(1):15-19. doi:10.1161/01.CIR.88.1.15
13. Geleijnse ML, Fioretti PM, Roelandt JR. Methodology, feasibility, safety and diagnostic accuracy of dobutamine stress echocardiography. *J Am Coll Cardiol.* 1997;30(3):595-606. doi:10.1016/S0735-1097(97)00206-4
14. Tsutsui JM, Osório AF, Lario FA, et al. Comparison of safety and efficacy of the early injection of atropine during dobutamine stress echocardiography with the conventional protocol. *Am J Cardiol.* 2004;94(11):1367-1372. doi:10.1016/j.amjcard.2004.07.141