brief report

Dobutamine stress echocardiography as a prognostic tool for future cardiac events

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The role of exercise stress testing for diagnosis of coronary artery disease and risk stratification of patients with coronary artery disease is well established.[1-3] Echocardiographic imaging immediately after exercise increases the sensitivity and specificity of the test. Pharmacological agents (dobutamine) have been used as an alternative for stress in patients who are unable to exercise due to various reasons. The capacity of dobutamine stress echocardiography (DSE) to identify the presence or absence of angiographically significant coronary artery disease (CAD) has been demonstrated in several studies.[4-6] The role of DSE in predicting future cardiac events along with its sensitivity and specificity has been studied and found to be high.[7] No study has been done in Pakistan regarding DSE as a prognostic tool for future cardiac events. We conducted a retrospective study to determine the prognostic value of DSE in our population.

PATIENTS AND METHODS

This was an observational retrospective, cohort study conducted at Aga Khan University and Hospital. All consecutive patients who underwent DSE for various indications from January 2002 to February 2003 were included in the study. On the basis of DSE results the group was divided into three categories, one with ischemic response (reversible abnormality), a second with infarction but no ischemia (fixed abnormality) and a third with normal response. All three groups were followed up to 1 year for hard cardiac events, i.e. myocardial infarction, congestive cardiac failure, revascularization and death. Data were collected on a predefined questionnaire and analyzed by SPSS software version 12. Central tendency of frequency was measured by a mean or median and the chi square test was applied to determine significance between categorical variables.

DSE was performed according to standard protocol using 4 stages of 3 minutes each, with a peak dosage of 40 μg/kg/min and a target heart rate of 85% of age-predicted maximum. Atropine was used to achieve a target heart rate if not achieved with dobutamine. A 12-channel electrocardiogram was recorded at baseline and at each stage along with a continuous 3-channel rhythm monitoring throughout the test. Echocardiographic imaging was performed continuously during the dobutamine infusion using an HP5500 echocardiography machine. A trained non-invasive cardiologist assessed ejection fraction and regional wall motion visually. All DSE were reported by one cardiologist in order to remove any operator-based differences. Development of a new wall motion abnormality with or without prior wall motion abnormalities was considered a reversible abnormality (ischemia) and a prior wall motion abnormality without any new changes was considered a fixed abnormality (infarction). End points for stopping the test were achievement of 85% of age-predicted target heart rate, development of sustained ventricular tachycardia, development of hypotension and development of a new wall motion abnormality.

RESULT

One hundred twenty-two patients were included in the study (Table 1). There was a female predominance. Twenty-nine patients (24%) had DSE positive for

Table 1. Characteristics of patients (n=122).

Male	51 (42%)
Female	71 (58%)
Mean age	58 years
Current smoker	22 (18%)
History of prior myocardial infarction	41 (34%)
Normal left ventricular systolic function	84 (69%)
Segmental wall motion abnormality	39 (32%)

Values are number (%) unless specified otherwise.

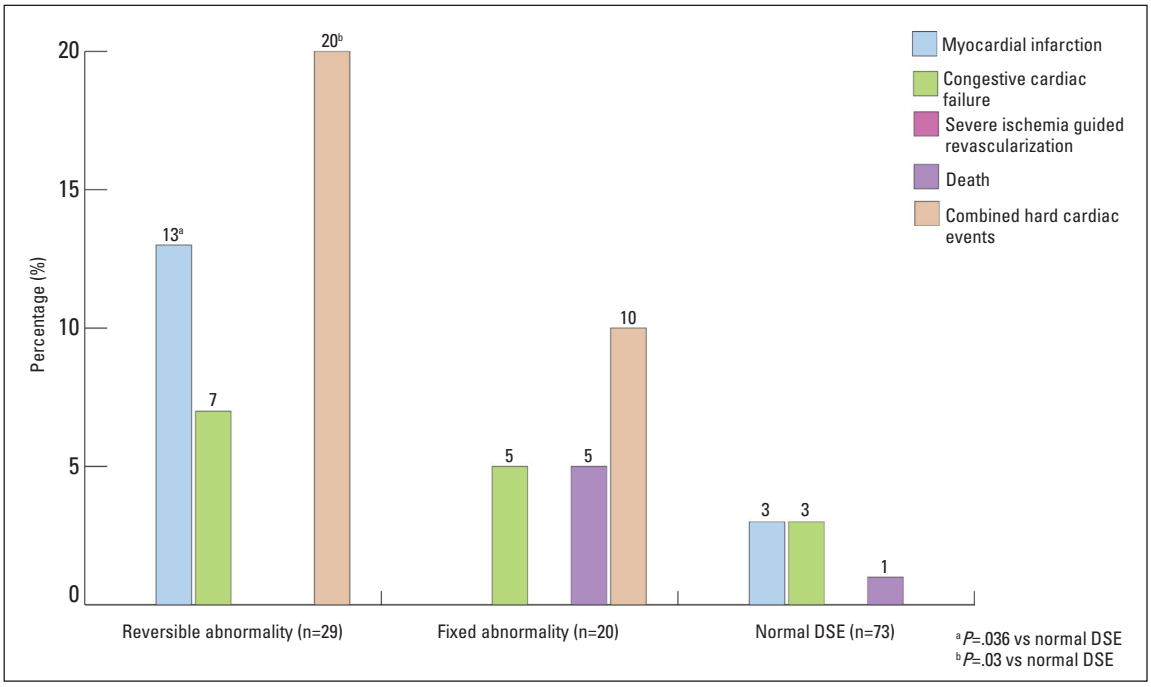

Figure 1. Cardiac events in groups during long term follow up.

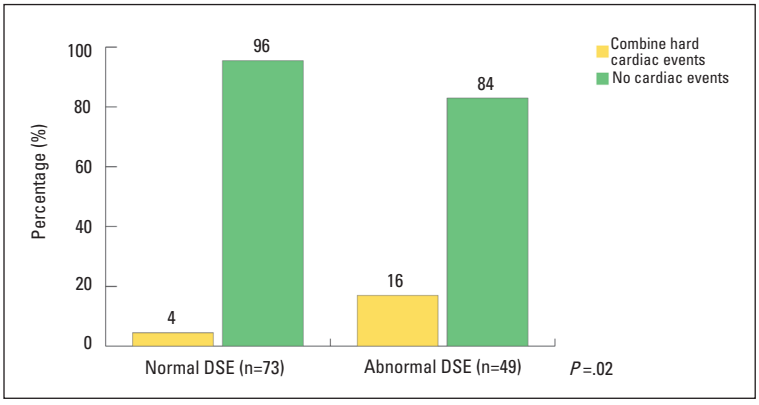

Figure 2. Combined hard cardiac events during long term follow up.

ischemia (reversible abnormality), 20 patients (16%) had DSE positive for infarction but no ischemia (fixed abnormality) and 73 patients (60%) had normal DSE. Eleven cardiac events occurred: myocardial infarction (MI) in 6, congestive cardiac failure (CCF) in 3, ischemic symptoms requiring revascularization in 1 and death in 1. Patients with reversible abnormality (ischemic response) had more cardiac events as compared with fixed abnormal or normal DSE (Figure 1). The greater number of myocardial infarction and combined hard cardiac events were statistically significant in the reversible abnormality group versus the normal DSE group with *P* values of .036 and .030, respectively. Combined hard cardiac events were statistically significant in patients with abnormal DSE (*P*=.02). (Figure 2). Event free survival for a year was observed in 96% of patients with normal DSE.

DISCUSSION

Diagnosis of CAD depends on the production of ischemia-related wall motion abnormalities. Dobutamine increases the heart rate as well as contractility causing increased cardiac oxygen demand and decrease in oxygen supply in the presence of coronary stenosis or a combination of both, resulting in ischemia and subsequent wall motion abnormality. DSE has been found to be a sen-

sitive and specific method for the diagnosis of coronary artery disease.[4,6] The sensitivity of the test in the presence of single vessel disease (57.1%) was lower than in the presence of multivessel disease (91.6%).[8] However, the current clinical implementation of the technique is based on the visual detection of ischemia-induced wall motion abnormalities. Sensitivities and specificities of DSE for the detection of CAD have been reported in the range of 80% to 85% when performed by expert operators.[9]

In our study, a statistically significant number of ischemic events requiring revascularization occurred in patients with DSE positive for ischemia. CHF events were high in patients in the fixed abnormal group, which is understandable and reflects decompensation and adverse remodeling of the infracted myocardium following infarction. Patients with an abnormal DSE had statistically significant high composite event rates than patients with a normal DSE. Our study demonstrates that DSE can be used for risk stratification of patients with known or suspected coronary artery disease in our population and a normal DSE was associated with an event-free survival for up to a mean of 10 months in 96% of patients and is comparable to other studies.[7] The major limitation of our study was its retrospective design and small number of patients.

In conclusion, DSE is a useful tool for prognosticating future cardiac events in patients with CAD. Patients with an abnormal DSE (reversible and fixed) are at increased risk of cardiac events as compared to patients with a normal DSE for up to one year. Event-free survival for up to a year was observed in 96% of patients with a normal DSE.

REFERENCES

1. Theroux P, Waters DD, Halphen C, Debaiseux JC, Mizgala HF. Prognostic value of exercise testing soon after myocardial infarction. N Eng J Med. 1970;301:341-5.
2. Starling MR, Crawford MH, Kennedy GT, O'Rourke RA. Treadmill exercise tests predischarge and six week post myocardial infarction to detect abnormalities of known prognostic value. Ann Intern Med. 1981;94:721-7.
3. Weiner DA. Role of exercise testing after myocardial infarction. J Am Coll Cardiol. 1986;8:1020-1.
4. Mannering D, Cripps T, Leech G, Mehta N, Valantine H, Gilmour S, Bennet ED. Dobutamine stress test as an alternative to exercise testing after acute myocardial infarction. Br Heart J. 1988;59:521-6.
5. Swada SG, Segar DS, Ryan T, Brown SE, Dohan AM, Williams R, Fineberg NS, Armstrong WF, Feigenbaum H. Echocardiographic detection of coronary artery disease during dobutamine infusion. Circulation. 1991;83:1605-14.
6. Cohen JL, Greene TO, Ottenweller J, Binenbaum SZ, Wilchfort SD, Kim CS. Dobutamine digital echocardiography for detecting coronary artery disease. Am J Cardiol. 1991;67:1311-8.
7. Afridi I, Miguel AQ, William AZ, Jorge CB. Dobutamine stress echocardiography: Sensitivity, specificity, and predictive value for future cardiac events. Am Heart J. 1994;127:1510-5.
8. Bertha C, Pierard LA, Hiernaux M, Trotteur G, Lempereur P, Calier J, Kulbertus H. Predicting the extent and location of coronary artery disease in acute myocardial infarction by echocardiography during dobutamine infusion. Am J Cardiol. 1986;58:1167-72.
9. Geleijnse ML, Fioretti PM, Roelandt JR. Methodology, feasibility, safety and diagnostic accuracy of dobutamine stress echocardiography. J Am Coll Cardiol. 1997;30:595-606.