

Dobutamine Stress Echocardiography in the Elderly Asian Patients

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Abstract

Dobutamine stress echocardiography (DSE) is an established non-invasive technique for the evaluation of coronary artery disease (CAD). It has been shown to be both safe and accurate. However, its utility and safety in the elderly, in particular, elderly Asian patients has not been studied. Between September 1992 and December 1994, we performed a total of 75 consecutive DSE studies in patients over the age of 65. Of these, 50 (67%) were females. Forty-nine patients had hypertension, 26 had diabetes mellitus, 10 were smokers, 5 had a recent or previous myocardial infarction and another 4 had a history of heart failure. Indications for DSE were, inability to perform the standard treadmill exercise test (40 patients), an abnormal resting electrocardiogram (ECG) (14 patients), a prior false positive or inconclusive treadmill test, risk stratification post myocardial infarction (4 patients) or preoperative cardiac evaluation (23 patients). The test was terminated in the majority of patients following attainment of the target heart rate. Atropine stimulation was required in 61 (81%) patients. Chest pain was provoked in 11 patients. No death or myocardial infarction occurred. Minor non-cardiac symptoms occurred in another 6 patients but this did not necessitate termination of the procedure. Three patients had transient hypotension, none of which was symptomatic. Arrhythmia occurred in 23 patients but the majority were isolated atrial or ventricular premature beats (20); 1 patient had atrial fibrillation and another developed transient junctional rhythm. Only one patient developed ventricular tachycardia but this was not haemodynamically significant and terminated easily with an intravenous dose of lignocaine. A conclusive result could be obtained in 72 (96%) patients.

We concluded that DSE could be performed and interpreted in the majority of elderly Asian patients studied. Despite supplemental atropine, an aggressive dosing protocol and the inclusion of patients with a myocardial scar or history of heart failure, adverse effects were rare and often did not require any specific therapy.

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Introduction

Dobutamine stress echocardiography (DSE) is an established non-invasive technique for the evaluation of coronary artery disease.¹⁻⁴ In established echocardiographic laboratories, its accuracy is equivalent to that of more sophisticated radionuclide imaging modalities. In addition, it has also been shown to be safe.⁵ However, there are only limited data on its utility and safety in the elderly;^{6,7} in particular, elderly Asian patients. The purpose of this paper was to investigate the utility and safety of DSE in a cohort of elderly Asian patients.

Materials and Methods

Patient Population

Between September 1992 and December 1994, 75 consecutive patients above the age of 65 undergoing DSE in our non-invasive laboratory were enlisted into the study.

There were 50 females and 25 males, with a mean age of 71 ± 5 (range 65 to 85) years.

Indications for DSE were inability to perform the standard treadmill exercise test ($n = 40$), an abnormal resting electrocardiogram (ECG) ($n = 14$), a prior suspected false positive or inconclusive treadmill exercise test ($n = 33$), risk stratification post myocardial infarction ($n = 4$) or pre-operative cardiac evaluation ($n = 23$). Forty-nine patients had hypertension, 26 had diabetes mellitus, 10 were smokers, 5 had a recent or previous myocardial infarction and another 4 had a history of heart failure. Forty-two patients were receiving antianginal medications including B-blockers ($n = 22$), nitrates ($n = 22$) and calcium antagonists ($n = 27$). All patients on B-blockers were instructed to omit the medication for at least 24 hours before the test.

Dobutamine Infusion Protocol

All examinations were performed in a fully-equipped

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exercise testing laboratory. Dobutamine infusion was begun at a dose of 5 µg/kg/min and increased to 10, 20, 30 and 40 µg/kg/min every 3 minutes. Supplemental atropine up to 1.2 mg was administered intravenously at peak dose dobutamine infusion when there was an inadequate heart rate response to dobutamine. The infusion was terminated by the operator after the maximal dose was received or for one of the following end points:

- 1) achievement of 85% of age - predicted maximal heart rate,
- 2) development of angina pectoris,
- 3) a 2 mm horizontal or downsloping ST depression at an interval of 60 ms after the J point,
- 4) new regional wall motion abnormalities involving at least 2 contiguous segments,
- 5) a systolic blood pressure of more than 250 mmHg,
- 6) a significant fall in blood pressure as judged by the operator, and
- 7) significant side effects or arrhythmias.

Echocardiographic images were acquired from 4 standard windows (parasternal long axis, parasternal short axis, apical 4 chamber and apical 2 chamber); digitised and displayed for comparison in a quad screen format.^{4,8} Multiple ECG leads were continuously monitored throughout dobutamine infusion and for 6 minutes after it was discontinued.

Data Collection

The patients' medical history, demographic features, haemodynamic data and echocardiographic findings were assessed and coded on prepared computer forms for, all study patients. Adverse effects, classified as cardiac symptoms, non-cardiac side effects and arrhythmias, were also noted and entered into a database for analysis.

Results

A conclusive result could be obtained in 72 patients (96%); 24 (32%) studies were abnormal and 48 (64%) normal. The other 3 studies were inconclusive either because of suboptimal images (n = 2) or inadequate heart rate (n = 1). Coronary angiography was performed on 28 patients of which 25 (89%) were abnormal. Of these, 15 (60%) patients had multivessel disease.

Dosage and Haemodynamic Findings

The mean duration of dobutamine stimulation was 20 ± 3 minutes. The maximum heart rate ranged from 86 to 178 beats per minute (mean, 145 beats per minute). Atropine was administered in 61 patients (81%).

Reasons for Terminating Dobutamine Infusion

The vast majority of studies were terminated following the attainment of the target heart rate (n = 59, 79%); other reasons included maximal dose (n = 5, 7%) and chest pain (n = 11, 15%).

Adverse Effects

The adverse effects were few and often did not require any specific therapy. There was no death or myocardial infarction. Eleven patients had chest pain during the procedure. Of these, only 5 patients required sublingual nitroglycerine for symptom relief. No patient required intravenous B-blocker. Three patients had transient hypotension, none of which was symptomatic. Other non-cardiac symptoms encountered included dizziness (n = 1), dyspnoea (n = 1), nausea (n = 3) and headache (n = 1). No test was terminated prematurely because of these non-cardiac symptoms.

A total of 23 patients experienced some forms of arrhythmia during the procedure. The most common arrhythmia were frequent premature ventricular complexes (six or more per minute) in 11 patients (15%) and frequent premature atrial complexes in 9 patients (12%). One patient had transient atrial fibrillation and another transient junctional rhythm, both of which were not haemodynamically significant. Only 1 patient had an episode of sustained ventricular tachycardia but this was not haemodynamically significant and was easily terminated with a single dose of intravenous lignocaine. This patient was later shown to have significant multivessel coronary artery disease.

Discussion

Dobutamine stress echocardiography is being increasingly used for the diagnosis of coronary artery disease in patients who cannot exercise adequately. Its safety has been verified recently in a large published series by Mertes and others⁵ where the overall frequency of side effects was 26%, most of which were minor and did not warrant termination of dobutamine infusion. However, there are only limited data on the safety of this useful diagnostic procedure in elderly patients.^{6,7} To our knowledge, this is the first series that has examined the safety of DSE in a cohort of elderly Asian patients.

The population in Singapore and many other Asian cities are rapidly aging. Today, the elderly comprise 8% of Singapore's population. By the turn of the century, this is expected to increase to 11% and by the year 2030, more than 26% of Singapore's population are expected to be in the elderly age group. In addition, although the elderly only constituted 8% of Singapore's population today, they accounted for 20% of our outpatient clinics' attendance.

The elderly is a special cohort of patients with their own unique problems. They often have multiple medical problems which include orthopaedic disorders like degenerative joint diseases and back problems which make treadmill exercise testing difficult.⁹ In this context, pharmacological stress testing like DSE would appear to be an ideal alternative.¹⁰ The elderly also have different pharmacokinetic behaviour from younger

patients and often require lower dosages of medication. Baudhuin and others⁷ showed that DSE was safe in the elderly. However, in that study, no supplemental atropine was used. In an earlier study, McNeill and others¹¹ showed that the use of supplemental atropine not only increased the accuracy of the test but was also safe with no additional side effects.

It was with these in mind that this study was undertaken. The study population included patients who are potentially at an increased risk of complications, including those with multiple medical problems, history of heart failure and recent myocardial infarctions. Despite an aggressive stress protocol and the use of supplemental atropine, DSE was safely performed in all patients studied.

In this study, the overall frequency of side effects was 21%. Most of these were minor, did not require any specific therapy or warranted termination of dobutamine infusion. The most common adverse effect was arrhythmia which occurred in 31% of the patients. Most of these were isolated premature ventricular or atrial complexes. Only 1 patient had an episode of sustained ventricular tachycardia but this was not haemodynamically significant and was easily terminated with a single dose of intravenous lignocaine. Ventricular tachycardia during DSE may be due to myocardial ischaemia.⁵ Other proposed mechanisms include dobutamine-induced reduction in plasma potassium or β_1 receptor stimulation.^{12,13} Our patient with sustained ventricular tachycardia had evidence of myocardial ischaemia which was probably the cause of the arrhythmia.

In this study, no patient had myocardial infarction or death resulting from provocation of myocardial ischaemia. Termination of dobutamine infusion is frequently all that is required for the rapid reversal of ischaemia because of the short half-life of the drug. In a proportion of patients with symptomatic ischaemia, sublingual nitroglycerine or intravenous B-blocker can be used. In our study, only 5 patients required sublingual nitroglycerine; no patient required intravenous B-blocker for anginal relief.

Conclusion

Dobutamine stress echocardiography can be safely performed in the majority of elderly Asian patients studied. Despite supplemental atropine, an aggressive dosing protocol and the inclusion of patients with a myocardial scar or history of heart failure, adverse effects were rare and often did not require any specific therapy. Symptomatic ischaemia was effectively treated by test termination or sublingual nitroglycerine.

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