Accuracy and cost-effectiveness of exercise echocardiography for detection of coronary artery disease in patients with mitral valve prolapse

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Record Status
This is a critical abstract of an economic evaluation that meets the criteria for inclusion on NHS EED. Each abstract contains a brief summary of the methods, the results and conclusions followed by a detailed critical assessment on the reliability of the study and the conclusions drawn.

Health technology
Exercise echocardiography versus exercise electrocardiography for detection of coronary artery disease in patients with mitral valve prolapse.

Type of intervention
Diagnosis and screening.

Economic study type
Cost-effectiveness analysis.

Study population
Male and female patients with mitral valve prolapse diagnosed by two-dimensional echocardiography and referred for exercise echocardiography.

Setting
Hospital. The economic study was carried out in Cleveland, USA.

Dates to which data relate
The main effectiveness data were mainly obtained from a single trial conducted in 1997. Resource and cost data were taken from 1997 sources. The price year was not stated.

Source of effectiveness data
The estimates for the number of patients with significant coronary artery disease and of patients with >85% of maximal heart rate, sensitivity, specificity, positive and negative predictive value, rate of angiography and accuracy of the different diagnostic strategies were obtained from a single study.

Link between effectiveness and cost data
The costing was undertaken on the same patient sample as that used in the effectiveness study although it was not stated whether it was undertaken prospectively or retrospectively.

Study sample
Overall, 96 patients aged 59 (+/- 12 years), of whom 70 were men, with mitral valve prolapse undergoing exercise electrocardiography, exercise echocardiography and coronary angiography were included in the analysis. Power calculations to determine the sample size were not undertaken.
Study design
Case-control study. The duration of the follow-up was 18 months. The loss to follow-up was not stated.

Analysis of effectiveness
The analysis of the clinical study was based on treatment completers only. The primary health outcomes were the estimates for the number of patients with significant coronary artery disease and of patients with >85% of maximal heart rate, sensitivity, specificity, positive and negative predictive value, rate of angiography and accuracy of the different diagnostic strategies.

Effectiveness results
Thirteen patients (13.5%) had significant coronary artery disease and 73 patients achieved >85% of maximal heart rate. The sensitivity and specificity of exercise electrocardiography in diagnosing coronary artery disease in the 71 patients with interpretable electrocardiograms were 50% and 72%, respectively. The sensitivity and specificity of exercise electrocardiography in diagnosing coronary artery disease in the 73 patients with 85% of maximal heart rate were 50% and 69%, respectively. The overall positive and negative predictive value were 23% and 90%, respectively. The sensitivity and specificity of exercise echocardiography in diagnosing coronary artery disease in the 71 patients with interpretable electrocardiograms were 69% and 98%, respectively. The sensitivity and specificity of exercise echocardiography in diagnosing coronary artery disease in the 73 patients with 85% of maximal heart rate were 82% and 96%, respectively. The overall positive and negative predictive value were 82% and 95%, respectively.

The rate of angiography, inappropriate angiography rate and false-negative results for each of the strategies was:

- Exercise electrocardiography: 48 (+/- 4%); 84 (+/- 8%); 39 (+/- 4%);
- Exercise echocardiography: 30 (+/- 1%); 62 (+/- 4%); 14 (+/- 4%);
- Selective: 31 (+/- 4%); 71 (+/- 11%); 41 (+/- 5%);
- Clinical/exercise electrocardiography for patients with intermediate or high pretest probability: 32 (+/- 2%); 77 (+/- 10%); 39 (+/- 4%);
- Clinical/exercise echocardiography for patients with intermediate or high pretest probability: 22 (+/- 1%); 54 (+/- 3%); 21 (+/- 3%);
- Clinical/exercise electrocardiography for patients with high pretest probability: 42 (+/- 2%); 79 (+/- 4%); 14 (+/- 4%);
- Clinical/exercise echocardiography for patients with high pretest probability: 35 (+/- 1%); 65 (+/- 1%); 21 (+/- 3%);

Clinical conclusions
The utility of exercise electrocardiography is limited by the high prevalence of resting electrocardiographic abnormalities and suboptimal sensitivity and specificity.

Measure of benefits used in the economic analysis
No summary benefit measure was used in the analysis and as such the benefits are considered to be the same as the outcome measures.

Direct costs
Costs for the seven different strategies were included in the analysis and were based on Medicare reimbursement figures. The quantities were reported separately from the prices. The quantity/cost boundary adopted was the hospital. Discounting was not undertaken. The price year was not stated.
Statistical analysis of costs
Not undertaken.

Indirect Costs
Not considered.

Currency
US dollars ($).

Sensitivity analysis
No sensitivity analysis was performed.

Estimated benefits used in the economic analysis
The effectiveness results are described in the Effectiveness Results section above.

Cost results
The overall costs were: $747 (+/- 47), $677 (+/- 18), $547 (+/- 52), $483 (+/- 23), $469 (+/- 23), $626 (+/- 51) and $595 (+/- 7) for the seven different strategies, respectively.

Synthesis of costs and benefits
Costs and benefits were not combined.

Authors’ conclusions
The utility of exercise electrocardiography is limited by the high prevalence of resting electrocardiographic abnormalities and suboptimal sensitivity and specificity. The best balance of cost and diagnostic accuracy is to perform exercise echocardiography in patients with at least intermediate probability of coronary artery disease.

CRD COMMENTARY - Selection of comparators
The reason for the choice of the comparator is clear. Exercise echocardiography and electrocardiography have been established as reliable tools for the non-invasive detection of coronary artery disease. However, the relative role of exercise echocardiography and electrocardiography in the diagnosis of coronary artery disease in patients with mitral valve prolapse has not been examined. You, as a user of this database, should consider whether these are widely used health technologies in your own setting.

Validity of estimate of measure of benefit
No summary benefit measure was used in the analysis and as such the authors conducted a cost and outcomes study. The data have not been used selectively but a full economic evaluation using one benefit measure would be required to assure greater validity in terms of economic evaluation. Furthermore, as noted by the authors, a selected group with low prevalence of coronary disease and consisting only of patients undergoing coronary angiography after the exercise tests, was included. This post-test referral bias may have adversely affected the sensitivity comparisons and specificities of the exercise tests.

Validity of estimate of costs
Resource quantities were reported separately from the prices. Adequate details of methods of quantity/cost estimation were given. Important cost items do not appear to have been omitted. However, as no statistical analysis was conducted, the costs need to be treated with a degree of caution.
Other issues
The authors’ conclusions are likely to be justified given the uncertainties in the data. As noted by the authors, the nature of the patients included in the analysis (mainly older men) may limit the applicability of the results to primary-care settings. However, appropriate comparisons with other studies, supporting the clinical results from the present investigation, were reported in the study and results do not appear to have been presented selectively.

Implications of the study
Further research is required to examine the best diagnostic strategy for excluding coronary artery disease in patients with mitral valve prolapse undergoing mitral valve operations. The decision to proceed to coronary angiography in these patients needed to be individualised.

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