

Echocardiography in newly diagnosed atrial fibrillation patients: a systematic review and economic evaluation

EL Simpson,* MD Stevenson, A Scope,
E Poku, J Minton and P Evans

School of Health and Related Research (ScHARR), University of Sheffield,
Sheffield, UK

*Corresponding author

Scientific summary

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Background

Atrial fibrillation (AF) is the most common sustained cardiac arrhythmia. AF may be asymptomatic, but may cause palpitations, chest pain, shortness of breath or fainting. If left untreated, AF is a significant risk factor for stroke and other morbidities.

Transthoracic echocardiography (TTE) allows imaging of the heart and blood flow. Echocardiography enables the diagnosis of cardiac abnormalities earlier than would be possible if symptoms were left to develop. Currently, only selected patients with AF are recommended for TTE: those who have clinically suspected heart disease or for whom further information is needed for treatment planning.

Objectives

The assessment investigated the clinical effectiveness and cost-effectiveness of performing routine TTE in all newly diagnosed patients with AF, in comparison with the current practice of selective testing.

Methods

Literature reviews were conducted on the diagnostic accuracy of TTE for clinically important pathologies in AF and their prevalence in patients with AF. A search of MEDLINE, and, for the prevalence review, of 11 other databases was conducted from March to August 2010, and reference lists of relevant articles were checked. For the diagnostic review, the intervention was conventional TTE, and the outcomes sensitivity or specificity. Results were tabulated and discussed in a narrative synthesis.

A mathematical model was constructed to assess the cost-effectiveness of TTE in patients with newly diagnosed AF. It was assumed that TTE would be of benefit only when patient management was changed. It was assumed that if a left atrial abnormality was detected then the patient was at a higher risk of stroke and should receive treatment. The estimated sensitivity and specificity of TTE in identifying left atrial abnormality was incorporated in the model.

A total of 14 separate paired comparisons, comparing a baseline strategy of not using TTE with a comparator strategy that did, were produced. These considered higher- and lower-risk groups, two different age groups, three different types of oral anticoagulant, and both males and females separately.

A simplified approach was also undertaken that evaluated the additional quality-adjusted life-years (QALYs) required in order for TTE to be perceived as cost-effective at a threshold of £20,000 per QALY.

Results

The literature reviews identified 44 diagnostic accuracy studies, five prognostic studies and 16 prevalence studies. Diagnostic accuracy showed high specificities for all selected pathologies, with the majority having specificity of 0.8 or higher, meaning a low proportion of false-positives. Specificity was lower for aortic dissection and pulmonary disease than for other pathologies. For most pathologies there was also quite high sensitivity, with the majority having sensitivity of ≥ 0.6 , with the exceptions of atrial thrombi, atrial

septal defect and pulmonary embolism (PE), for which sensitivity was lower. Prognostic studies indicated that TTE-diagnosed left ventricular (LV) dysfunction or increased left atrial diameter (LAD) was associated with significantly increased risks of thromboembolism or mortality. LV dysfunction also had a significantly increased risk of stroke, and valvular abnormality a significantly increased risk of mortality. Not all studies found a significant association between TTE-diagnosed mitral regurgitation (MR) and prognosis; however, there were reported a significantly increased risk of thromboembolism with mild MR, in contrast with a significantly protective effect of severe MR against stroke. Mitral annular calcification and mitral valve prolapse were not found to be associated with thromboembolism and stroke, respectively. There was a high prevalence (around 25–30%) of ischaemic heart disease, valvular heart disease and heart failure in patients with AF in the included prevalence studies.

The results of the mathematical model indicated that it may be cost-effective to use TTE to make the decision about whether to prescribe warfarin to patients with a CHADS₂ (cardiac failure, hypertension, age, diabetes, stroke doubled) score of 1, or whether to prescribe rivaroxaban to patients aged ≥65 years with a CHADS₂ score of 0.

In the simplified approach, a threshold of 0.0033 was required for a TTE to be cost-effective. This is a very small value, and if a clinician believes there will be some patient gain in addition to providing treatment to reduce stroke risk then TTE is likely to be cost-effective.

Discussion

Diagnostic accuracy of TTE and prevalence of pathologies in patients with AF indicate that routine TTE following AF diagnosis would identify pathologies in many patients, particularly with regard to valvular heart disease, ischaemic heart disease and heart failure. TTE seems to be a sufficient diagnostic tool for screening most pathologies included in this review. For completeness of screening, extra testing for PE by lung scan and for atrial thrombi and atrial septal hypertrophy by transoesophageal echocardiography would reduce risk of false-negatives from TTE. However, it is unclear whether identifying these pathologies, in addition to the many diagnosed by TTE, would lead to improvement above that of TTE screening.

It is clear that TTE has the potential to be cost-effective, and this has been indicated in the analyses that assume that the CHADS₂ tool is used. The simplified approach indicates that very few QALYs are required for TTE to be perceived as cost-effective. The modelling undertaken focuses purely on the risks of stroke and of bleed events; if patients will benefit from TTE in other respects it is likely that this diagnostic test would be cost-effective.

Conclusions

Transthoracic echocardiography is a non-invasive procedure with the potential to accurately identify treatable pathologies in patients with AF.

Where the CHADS₂ tool is used, the addition of TTE in identifying patients with left atrial abnormality appears to be cost-effective for informing some oral anticoagulation decisions. A simple analysis indicates that the QALYs required for TTE to be cost-effective is small, and that if benefits beyond those associated with a reduction in stroke (at the expense of greater number of bleed) are believed probable then TTE is likely to be cost-effective in all scenarios.

Our findings suggest that further research is needed to follow-up newly diagnosed patients with AF who have undergone TTE, to study treatments given as a result of TTE diagnoses and subsequent cardiovascular events, which could identify additional benefits of routine testing, beyond stroke prevention. Studies

assessing the proportion of people with a CHADS₂ scores of 0 or 1 that have left atrial abnormality would provide better estimates of the cost-effectiveness of TTE, and allow more accurate estimates of the sensitivity and specificity of TTE for identifying left atrial abnormality in AF to be obtained.

Study registration

This study is registered as PROSPERO CRD42011001354.

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