Echocardiography in patients with suspected endocarditis: a cost-effectiveness analysis

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
Echocardiography in patients with suspected endocarditis.

Type of intervention
Diagnosis.

Economic study type
Cost-utility analysis.

Study population
Hypothetical cohort of 45-year-old patients with bacteremia, suspected endocarditis and a 20% prior probability of endocarditis.

Setting
Hospital. The study was carried out in the USA.

Dates to which data relate
Effectiveness data were collected from studies published between 1977 and 1996. Cost estimates were based on data from northern California hospitals and Medicare reimbursement. The price year was 1996.

Source of effectiveness data
Effectiveness data were derived from a review of the literature.

Modelling
A decision tree and 50-year Markov model were used to determine the cost-utility of the various diagnostic strategies. The authors estimated age-specific death rates for causes other than endocarditis using a Gompertz survival function.

Outcomes assessed in the review
The review assessed the following outcomes:

- sensitivity and specificity of the diagnostic tests,
- endocarditis prevalence,
- probability of death,
- probability of relapse and cure,
age-specific mortality,
relative risk of death,
and probability of valve replacement.

Study designs and other criteria for inclusion in the review
Not stated.

Sources searched to identify primary studies
Not stated.

Criteria used to ensure the validity of primary studies
Not stated.

Methods used to judge relevance and validity, and for extracting data
Summary statistics from each study were included.

Number of primary studies included
At least 27 studies were included.

Methods of combining primary studies
Narrative method.

Investigation of differences between primary studies
Not stated.

Results of the review
The results of the review were as follows:
The sensitivity of transesophageal echocardiography was 0.92 and the specificity was 0.95.
The sensitivity of transthoracic echocardiography was 0.70 and the specificity was 0.95.
The sensitivity of transesophageal echocardiography after a negative transthoracic echocardiography was 0.73 and the specificity was 0.98.
Transesophageal echocardiography carried a 0.01% risk of death.
Three outcomes could occur after treatment for endocarditis: death during hospitalisation (in 15% of patients), relapse (in 2.5%), and cure (in 20% of patients who received 10 to 14 days of antibiotic treatment for bacteremia).
A delay in diagnosis and treatment increased the mortality rate from endocarditis by 5%.
The risk of lethal adverse events for hospitalised patients who were treated for endocarditis was 0.05%, regardless of the underlying condition.
Patients who recovered from endocarditis had an annual mortality rate that was 3.3 times greater than that of patients in
the general population.

Patients who had bacteremia without endocarditis had a 1.1-fold greater mortality than the general population.

The authors assumed a 20% valve replacement rate during the initial hospitalisation for endocarditis.

After recovery from endocarditis, 4% of patients would require a valve replacement each year during the first 10 years after endocarditis and this rate would decrease to 0% by year 20.

Patients with unexplained bacteremia had a prior probability of endocarditis of 20%.

**Measure of benefits used in the economic analysis**

Quality adjusted life years (QALYs) were used as the measure of benefit. To determine the quality adjustment for patients surviving endocarditis, the authors assumed a 15% prevalence of congestive heart failure in these patients and used published utilities obtained with the time-tradeoff technique. The average quality of life decreased after valve replacement to a utility of 0.9. Quality adjusted survival was discounted at an annual rate of 3%.

**Direct costs**

Direct costs were discounted at an annual rate of 3%. Quantities and costs were reported separately. Direct costs included the costs of echocardiography, of endocarditis treatment, and of all medical treatments after discharge. The quantity/cost boundary adopted was that of the health service. The estimation of quantities and costs was based on actual data. All costs were adjusted to 1996 dollars using the gross domestic product deflator. The costs of endocarditis treatment were based on Medicare payments. The costs for echocardiography were based on Medicare payments and the Transition Systems, Inc, cost accounting system. The price year was 1996.

**Statistical analysis of costs**

Not reported.

**Indirect Costs**

Not included.

**Currency**

US dollars ($).

**Sensitivity analysis**

Sensitivity analyses were performed on all input variables.

**Estimated benefits used in the economic analysis**

Transesophageal echocardiography generated a quality-adjusted life expectancy of 18 years and a life expectancy without quality adjustment of 18.1 years. The incremental quality-adjusted life expectancy of the other diagnostic strategies over transesophageal echocardiography varied between -0.1 days to -41 days.

**Cost results**

The lifetime costs of transesophageal echocardiography totalled $50,030. The incremental lifetime costs of the other diagnostic strategies over transesophageal echocardiography varied between $18 and $3,400.
Synthesis of costs and benefits

Transesophageal echocardiography provided more life years at a lower cost and remained the optimal strategy throughout the range of every variable tested except as noted below.

At a probability of endocarditis of less than 2%, treating all patients for bacteremia without performing echocardiography is optimal.

At a probability of endocarditis of greater than 60%, treating all patients for endocarditis without performing echocardiography is optimal.

Transesophageal echocardiography should be used for patients with suspected prosthetic valve endocarditis if the prior probability of endocarditis is 3% to 48%.

If the prior probability of endocarditis is greater than 48%, then treatment for endocarditis should be provided without relying on echocardiography for diagnosis.

If the prior probability of endocarditis is less than 2%, then a strategy of treating for bacteremia (without echocardiography) is preferred.

The results were insensitive to changes in cost estimates.

Authors' conclusions

The appropriate use of echocardiography depends on the prior probability of endocarditis. For patients whose prior probability of endocarditis is 4% to 60%, initial use of transesophageal echocardiography provides the greatest quality-adjusted survival at a cost that is within the range for commonly accepted health interventions.

CRD COMMENTARY - Selection of comparators

The rationale for the choice of the comparators was clear. You, as a user of this database, should verify whether these health technologies are relevant to your own setting.

Validity of estimate of measure of benefit

A relevant measure of benefits was used. The effectiveness data have been derived from, what may have been, a non-systematic review of the literature. The internal validity of effectiveness estimates cannot be fully assessed given the limited information provided about the literature review and the quality assessment of the primary studies. The authors acknowledged that the sensitivity, specificity and safety of echocardiography may not be as good in routine clinical practice as that reported from specialised centres. Although some effectiveness estimates were derived from single studies, uncertainty surrounding these estimates was tested using sensitivity analysis.

Validity of estimate of costs

Only direct costs falling to the health service were included. Indirect costs such as productivity lost were not considered. Cost estimates were derived from local sources and, hence, are unlikely to be generalisable to other settings. Some cost estimates were based on Medicare payments and do not represent true opportunity costs.

Other issues

Adequate comparisons with other relevant studies were made. However, the generalisability of the results to other settings or countries were not discussed. The authors do not appear to have presented their results selectively. The study enrolled 45-year-old patients with suspected endocarditis and this was reflected in the authors' conclusions.

Implications of the study
The initial use of transesophageal echocardiography is the optimal strategy for most patients with suspected endocarditis. Patients with low probabilities of endocarditis (less than 2%) should not be evaluated with echocardiography, whereas those with high probabilities (greater than 60%) should be treated for endocarditis regardless of echocardiographic results.

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Other publications of related interest

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