Cost-effectiveness of catheter ablation in patients with ventricular tachycardia

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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
Catheter ablation in patients with ventricular tachycardia.

Type of intervention
Treatment.

Economic study type
Cost-utility analysis.

Study population
The study population was a hypothetical cohort of 10,000 VT patients with implantable cardioverter-defibrillators, who were experiencing frequent shocks. An analysis was also conducted on patients with less severe disease: patients with a good ejection fraction who suffer their first VT episode.

Setting
Hospital. The study was set in the USA.

Dates to which data relate
Effectiveness and resource use data were collected from studies published between 1989 and 1999. Cost data were collected from a 1998 source. The price year was 1998.

Source of effectiveness data
Effectiveness data were collected from a randomised trial, a comprehensive literature review, and the opinion of a clinical panel.

Modelling
A 5-year Markov decision analytic model was used to determine the cost-utility of the two treatment alternatives.

Outcomes assessed in the review
The review assessed adverse events, probability of discontinuation, toxicity, impotence, and survival.

Study designs and other criteria for inclusion in the review
Estimates were collected from a multi-centre, prospective, randomised clinical trial of the Chilli Cooled Ablation System and a comprehensive literature review.
Sources searched to identify primary studies
The sources searched to identify primary studies were not stated.

Criteria used to ensure the validity of primary studies
The criteria used to ensure the validity of primary studies were not stated.

Methods used to judge relevance and validity, and for extracting data
Summary statistics from individual studies were used.

Number of primary studies included
At least 8 studies were included.

Methods of combining primary studies
A narrative method was employed.

Investigation of differences between primary studies
It was not stated whether an investigation of the differences between primary studies had been carried out.

Results of the review
For amiodarone, the probability of mild/moderate neurological impairment was 4.5%. The probabilities of severe neurological impairment, hyperthyroidism, and hypothyroidism were 0.5%, 0.3%, and 2.7%. The probability of mild/moderate ocular impairment was 2%.

The probabilities of mild/moderate pulmonary toxicity, severe pulmonary toxicity, and mild hepatic toxicity were 1.8%, 0.2%, and 0.99%.

The probabilities of severe hepatic toxicity and skin discolouration/photosensitivity were 0.01 and 10%.

The probability of symptomatic bradycardia was 3% in the first 6 months.

For catheter ablation, the probabilities of mild and severe thromboembolic events was 1.35 and 1.35, respectively.

The probabilities of moderate cardiac perforation and mild or moderate heart block were 1.17% and 2.70%, respectively.

Methods used to derive estimates of effectiveness
Expert opinion was derived from a panel of 3 cardiac electrophysiologists.

Estimates of effectiveness and key assumptions
The probability of discontinuation of amiodarone due to mild/moderate neurological impairment was 75%.

The probability of death due to hyperthyroidism was 50%.

The probability of discontinuing amiodarone due to experiencing hypothyroidism was 0%.

The probability of discontinuation due to mild/moderate ocular impairment was 5%.

The probability of discontinuation due to mild hepatic toxicity was 50%.
The probability of discontinuation due to skin discolouration/photosensitivity was 10%.

The probability of discontinuation due to impotence was 30%.

The probability of discontinuation due to symptomatic bradycardia was 0%.

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

Quality adjusted life years (QALYs) were used as the measure of benefits. Utilities were derived from two sources: quality of life data (Medical Outcomes Study 36-item Short Form Health Survey) and estimates from the clinical panel. SF-36 scores were transformed to utilities based on equations from Shmueli (1998). Utilities were collected from the clinical panel using a rating scale thermometer. Benefits were 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 covered the cost of treatment, costs of one-time adverse events, and therapy outcomes. The quantity/cost boundary adopted was that of the hospital. The estimation of quantities and costs was based on actual data. Cost estimates were derived from national Medicare reimbursement schedules. Laboratory test costs were taken from the Clinical Laboratory Information Act Fee Schedule. Drug costs were estimated from the Drug Topics Red Book. The price year was 1998.

**Statistical analysis of costs**

A statistical analysis of costs was not reported.

**Indirect Costs**

Indirect costs were not included.

**Currency**

US dollars ($).

**Sensitivity analysis**

One-way and multi-way sensitivity analyses were conducted on the initial success, durability, and cost of both therapies, the risk and timing of adverse events associated with both therapies, survival rates, daily dose of amiodarone, utilities associated with health states, crossover to ablation on amiodarone failure or severe adverse event, population disease severity, annual discount rate, and time horizon.

**Estimated benefits used in the economic analysis**

Mean total (standard deviation) QALYs over 5 years amounted to 2.78 (1.46) with catheter ablation and to 2.65 (1.40) with amiodarone. The incremental QALYs were 0.13.

**Cost results**

Mean total (standard deviation) costs amounted to $21,795 (9225) with catheter ablation and to $19,075 (10,940) with amiodarone. The incremental costs over 5 years were $2,720.

**Synthesis of costs and benefits**

The incremental cost per QALY gained of catheter ablation compared with amiodarone was $20,923 over a 5 year period. These results were most sensitive to changes in the cost of catheter ablation, the survival rate of catheter
ablation patients, and the time horizon. The incremental cost-utility ratio for patients with good ejection fraction who suffer their first VT episode was $6,028.

Authors’ conclusions
From a societal perspective, catheter ablation appears to be a cost-effective alternative to amiodarone for treating VT patients.

CRD COMMENTARY - Selection of comparators
A justification was given for the comparator used, namely that it was a currently available treatment option. You, as a user of the database, should decide if these health technologies are relevant to your setting.

Validity of estimate of measure of benefit
Effectiveness estimates were combined using narrative methods. More details could have been provided about the method of considering differences between primary effectiveness estimates. Estimation of benefits was modelled. The instruments used to derive a measure of health benefit (SF-36 and expert opinion) were appropriate. However, the literature suggests that eliciting utilities from clinicians, rather than patients, results in underestimating patients’ own preferences. This would have the effect of making the cost-effectiveness ratios more favourable.

Validity of estimate of costs
All categories of costs relevant to the perspective adopted were included in the analysis. Quantities and costs were reported separately. Statistical analyses of costs were conducted but the methods used were not reported. Sensitivity analyses were conducted on costs, but not on quantities. Charges were used to proxy prices. The price year was reported.

Other issues
The authors did make appropriate comparisons of their study with the results of other studies. The issue of generalisability to other settings was addressed through sensitivity analyses. The authors did not present their results selectively. The study targeted VT patients and this was reflected in the authors’ conclusions. The authors noted the following limitations. Five-year durability of catheter ablation was extrapolated from 6-month data from a randomised trial in the absence of longer trials. The base case applied to patients undergoing catheter ablation at an experienced centre. As this technology diffuses, initial success rates may be lower.

Implications of the study
From a societal perspective, catheter ablation appears to be a cost-effective alternative to amiodarone for treating patients with frequent VT episodes and patients with less severe disease.

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