Long-term cost-effectiveness of alternative management strategies for patients with life-threatening ventricular arrhythmias

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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
Alternative management strategies for patients with life-threatening ventricular arrhythmias.

Type of intervention
Secondary prevention and treatment

Economic study type
Cost-effectiveness analysis.

Study population
Patients were included if they had either: (a) sustained ventricular tachycardia or fibrillation, (b) resuscitated cardiac arrest, (c) unmonitored syncope with subsequent demonstration of sustained ventricular tachycardia during EPS. All patients had frequent ventricular ectopy on HM (at least 480 premature ventricular depolarizations over 48 hours).

Setting
Hospital. The study was carried out at Stanford University School of Medicine, Stanford, California, USA.

Dates to which data relate
Patient data used were from the period 1 October 1985 to 15 February 1991, and patients were followed until 15 February 1992. Total hospital costs and survival times were measured over five years. The price year was 1995.

Source of effectiveness data
The long-term effectiveness of alternative management strategies was derived from a single study: the EPS versus Electrocardiographic Monitoring (ESVEM) trial.

Link between effectiveness and cost data
The costing was undertaken retrospectively on the same sample used in the effectiveness analysis.

Study sample
The original ESVEM study included 486 patients of whom 263 were aged 65 years or over. 300 of the 332 eligible for provision of hospital services through the Department of Veteran Affairs (VA) or the Health Care Financing Administration (HCFA) were matched in the administrative records of those organisations. No power calculations were reported.
Study design
The study was a multi-centred (14) randomised controlled trial. Patients were randomised at 14 sites and followed-up for 1 year. The length of available follow-up ranged from 1 to 6.4 years, with a median follow-up of 3.6 years (interquartile range: 2.3-4.9), and a mean +/- standard deviation of 3.6(+/-1.5) years.

Analysis of effectiveness
The basis for the analysis of the study (intention to treat or completers only) was not stated. The primary health outcome used in the study was life years gained.

Effectiveness results
The EPS patients had a longer actuarial survival over five years of follow-up of 3.28 life years versus 3.1 life years in the HM group.

Modelling
A regression model estimated hospital charges.

Measure of benefits used in the economic analysis
The benefit measure was life years gained.

Direct costs
Costs were based on a cohort of 153 patients who were randomised to EPS guided drug testing and 147 to HM guided drug testing. Costs were discounted at an annual rate of 3%. Quantities and costs were not reported separately. The perspective adopted was that of the provider. Actuarial estimates of mean survival and mean costs during the follow-up were used as the primary basis of the cost-effectiveness and the marginal cost-effectiveness analyses. Cumulative cost and follow-up costs were calculated. The price year was 1995.

Statistical analysis of costs
The statistical significance of costs was tested using the two-tailed Wilcoxon rank sum test.

Indirect Costs
Not included.

Currency
US dollars ($).

Sensitivity analysis
The precision of the cost-effectiveness ratios was estimated by the bootstrap method. Sensitivity analyses were performed to evaluate the effect of alternative analytic methods on the findings. To test the sensitivity of the findings to discounting, the analysis was repeated using a 0% and a 10% annual discount rate. To test the sensitivity of the findings to the time horizon of the analysis, actuarial costs, and survival were calculated over 2-5 years of follow-up.

Estimated benefits used in the economic analysis
The EPS patients had a longer actuarial survival over five years of follow-up of 3.28 life-years versus 3.1 life-years in the HM group.
Cost results
The mean actuarial estimate of hospital charges over 5 years was $113,700 for patients randomised to EPS versus $83,600 in the patients randomised to HM. Total costs were equivalent in the HM and EPS groups if a drug predicted to be effective was found. The mean total cost in the 115 HM patients discharged on a drug predicted effective was $77,000 versus $63,400 in the 74 EPS patients discharged on a drug predicted effective (p=0.58). The mean total cost in the 32 HM patients discharged without finding an effective drug was $78,600 versus $129,800 in the 79 EPS patients (P=0.006).

Synthesis of costs and benefits
The marginal cost-effectiveness of EPS relative to HM was $162,500 per life-year saved. The cost-effectiveness ratio of EPS relative to HM became somewhat more favourable as follow-up extended from 2 years ($229,600) to 3 years ($205,300) and to 4 years ($182,400). At a cost-effectiveness threshold of $50,000 per life-year saved, EPS guided serial drug testing had an unfavourable cost-effectiveness ratio in 90% of bootstrap samples. At a threshold of $100,000, EPS had an unfavourable cost-effectiveness ratio relative to HM in 66% of bootstrap samples. The actuarial estimate of 5 years costs was lower among the 54 patients randomised to sotalol than among the 246 patients randomised to other drugs: $81,200 versus $103,600. At cost-effectiveness thresholds of $50,000 and $100,000 per life-year saved, sotalol was cost-effective relative to other drugs in 96% and 90%, respectively, of the bootstrap samples. Sotalol was also the dominant strategy with lower costs and better survival when shorter time horizons were used in the actuarial analysis, when 0% and 10% discount rates were used (instead of 3%).

Authors' conclusions
Serial drug testing guided by electrophysiologic study had an unfavourable cost-effectiveness ratio relative to Holter monitoring, while sotalol was cost-effective relative to other antiarrhythmic drugs.

CRD COMMENTARY - Selection of comparators
The rationale for choice of comparators was clear. Two strategies were compared for predicting antiarrhythmic drug efficacy (EPS and HM). Seven related drugs were tested for management of life-threatening ventricular arrhythmias: Sotalol was compared to other drugs.

Validity of estimate of measure of benefit
The estimate of benefit was based on a cohort of patients derived from a large scale RCT that is likely to be valid. However, in the sub-set of patients used in the reported cost-effectiveness analysis there were baseline differences that may have influenced the results. For example there were more males, the sample was older and more suffered from coronary heart disease. Sensitivity analyses were performed to test the robustness of alternative scenarios and this is likely to have minimised these limitations.

Validity of estimate of costs
Although the costs were handled credibly and sensitivity analyses were performed on the results, the standard deviations around the results were high. Additionally, charges, as opposed to costs, were used which limits the generalisability of the results to other settings. Charges do not accurately reflect opportunity costs of other interventions.

Other issues
The limitations of the study were outlined by the authors. Only patients with records available in administrative sources were used. Physician fees or medication costs were not included (considered to be insignificant in comparison with hospital charges). There was an age and gender bias. VA hospital charges were used to proxy costs.

Implications of the study
The study suggests that finding a drug predicted to be effective for treatment of ventricular arrhythmias, and the use of
sotalol in particular, leads to both lower overall costs and better outcomes over long-term follow-up. The use of serial drug testing guided by EPS is more costly than HM in patients with life-threatening ventricular arrhythmias, and does not appear to meet generally accepted standards for cost-effectiveness.

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