A UK trial-based cost-utility analysis of transmyocardial laser revascularization compared to continued medical therapy for treatment of refractory angina pectoris


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
The health intervention examined in the study was transmyocardial laser revascularisation (TMLR) for the treatment of patients with severe coronary artery disease. The technique uses laser ablation to restore blood flow in ischaemic segments of the left ventricle and reduce anginal symptoms.

Type of intervention
Treatment.

Economic study type
Cost-utility analysis.

Study population
The study population comprised patients with severe coronary artery disease who were not suitable for conventional revascularisation. Further inclusion criteria were not reported.

Setting
The setting was hospital. Data for the economic study were collected from Papworth Hospital NHS Trust, and analysed at HERG, Brunel University.

Dates to which data relate
Data regarding effectiveness and resources used were gathered from October 1993 and September 1997. 1998/1999 prices were used.

Source of effectiveness data
The effectiveness evidence was derived from a single study.

Link between effectiveness and cost data
The costing was undertaken prospectively on the same patient sample as that used in the effectiveness analysis.

Study sample
The study was powered to detect a 50% improvement in the maximum exercise time of TMLR patients (5.250 - 7.875 minutes) at 12 months. The method of sample selection was not reported. A total sample of 188 patients was enrolled in the study and equally divided into the TMLR group (94 patients, mean age (SD): 60 (7.9) years; 88% men) and the medical management group (94 patients, mean age (SD): 61 (7.4) years; 91% men). Baseline characteristics were reported in other publications of the trial (see Other Publications of Related Interest below).
Study design
This was an open, randomised clinical trial carried out in a single centre (the Papworth Hospital NHS Trust). The method of randomisation was by consecutively numbered, opaque, sealed envelopes, opened by a blinded research fellow, with numbers assigned to each group checked against the statisticians list (information obtained from a previous publication of the trial (see Other Publications of Related Interest below)). Patients were followed for one year and survival at 12 months was 89% in the TMLR group and 96% in the medical management group.

Analysis of effectiveness
The analysis was based on intention to treat with all patients included in the study being accounted for in the analysis. The primary health outcome was health-related quality of life, assessed using the EuroQol EQ-5D classification, completed by each patient at baseline (after randomisation) and at 3, 6, and 12 months, and combined with survival to calculate quality-adjusted life-years (QALYs). Utility data were missing for 21 patients (13 in the TMLR group and 8 in the medical management group) and interpolation techniques were used to derive these data. No statistically significant difference was found between the study groups in terms of age, gender, perioperative mortality and survival at 12 months, (p=0.14).

Effectiveness results
12-month survival was 89% (95% CI: 83 - 96) for the TMLR group and 96% (95% CI: 92 - 100) for the medical management group, (p=0.14). (Results from the previous publication of the trial - see Other Publications of Related Interest below). Utility scores were statistically significantly higher in the TMLR group in comparison with the medical management group at 3 and 6 months. However, at 12 months the mean QALY per patient was 0.486 (95% CI: 0.429 - 0.528) in the TMLR group and 0.447 (95% CI: 0.393 - 0.492) in the medical management group, and the QALY difference of 0.039 (95% CI: -0.033 - 0.113), corresponding to an extra 2 weeks of perfect health, was not statistically significant.

Clinical conclusions
Although patients undergoing TMLR experienced faster improvements in their health status, at the end of the study period, both the interventions produced similar QALY scores.

Measure of benefits used in the economic analysis
The benefit measure used in the economic analysis was represented by the QALY scores estimated in the effectiveness analysis.

Direct costs
No discounting was carried out, as the time horizon of the analysis was one year. Unit costs and quantities of resources were not reported separately. The cost/resource boundary adopted was that of the NHS. The cost items included in the analysis were the costs associated with the TMLR procedure (such as pre-procedural assessment, CO2 laser equipment, inpatient resource use, and post-procedure follow-up), the cost of cardiac related medication, and the cost of cardiac and non-cardiac related inpatient and outpatient episodes. Estimation of quantities was derived from the trial, while estimation of costs was mainly based on actual data derived from the Finance Department and Pharmacy at the Papworth Hospital. Costs estimated from different sources were adjusted to reflect NHS costs. Quantities of resources were collected during the trial (October 1993 to September 1997) and 1998/1999 prices were used.

Statistical analysis of costs
Statistical analyses of total cost data were conducted to test for statistical significance of the results.

Indirect Costs
Indirect costs were not included.

**Currency**

UK pounds sterling (£).

**Sensitivity analysis**

Sensitivity analyses (one-way) were carried out to assess the impact of variations in specific parameters on the estimated cost-utility ratio. The parameters were varied as follows: the patient would be admitted the day of surgery rather than 1 or 2 days earlier; the capital cost of TMLR was excluded; the utility benefit in the TMLR group was double; or it was assumed that there was no mortality in the TMLR group in the 12-month period. In addition, 1,000 bootstrap estimates of the cost-utility ratio were carried out.

**Estimated benefits used in the economic analysis**

See effectiveness results above.

**Cost results**

The cost results were as follows:

Total TMLR procedure costs were 9,289 (95% CI: 9,010 - 9,781).

Total inpatient and outpatient episode costs were 1,785 (95% CI: 1,328 - 2,588) in the TMLR group and 2,017 (95% CI: 1,273 - 3,117) in the medical management group.

Overall treatment cost at 12 months amounted to 11,470 (95% CI: 10,863 - 12,531) in the TMLR group and 2,586 (95% CI: 1,817 - 3,824) in the medical management group, and the difference of 8,901 (95% CI: 7,502 - 10,008) was statistically significant, (p<0.001).

Cardiac-related medication costs were 409 (95% CI: 354 - 470) in the TMLR group and 564 (95% CI: 497 - 631) in the medical management group.

**Synthesis of costs and benefits**

Costs and benefits were combined by performing an incremental cost-utility analysis. The incremental cost per QALY gained with TMLR over medical management was 228,000. All the 1,000 bootstrap estimates far exceeded the conventional cost-utility ratio of 50,000 per QALY gained. The estimated cost-utility ratio remained at least 114,000 with changes in admission day, exclusion of capital cost of TMLR, doubled utility score in the TMLR group, or assumption of no mortality with TMLR.

**Authors’ conclusions**

The analysis showed that TMLR was not an efficient instrument for the management of patients with severe coronary artery disease. Even under favouring assumptions, the estimated cost-utility ratio of TMLR was far above the threshold value widely accepted in the UK.

**CRD COMMENTARY - Selection of comparators**

The rationale for the choice of the comparator was clear. Medical management was chosen as comparator as it represented the routine intervention for patients not suitable for conventional revascularisation techniques. You, as a user of this database, should assess whether it represents a widely used procedure in your own setting.
Validity of estimate of measure of effectiveness
The analysis of the effectiveness was based on a randomised clinical trial and power calculations were conducted in the planning phase. In addition, all patients included in the study were accounted for in the analysis and statistical analyses were carried out to show the comparability of study groups and to assess statistical significance of effectiveness outcomes. These factors enhanced the internal validity of the study, which appears to have been quite high.

Validity of estimate of measure of benefit
The benefit measure used in the economic analysis was the QALY, which appeared appropriate for assessing the impact of the interventions on patients' health. It was derived directly from the effectiveness analysis and the preferences used were those of the patients enrolled in the study.

Validity of estimate of costs
The analysis of costs was conducted from the perspective of the NHS and it appears that all relevant categories of costs were included in the analysis. Statistical analyses were conducted on total costs. However, costs were quite specific to the study setting (UK NHS Trusts) and unit costs and resources used were not reported separately, therefore making it difficult to transfer the cost analysis to other settings.

Other issues
The authors did not compare their findings with those from other studies, since, as stated by the authors, there were no similar studies. Although not explicitly addressed, the issue of the generalisability of the study results to other settings was addressed through the performance of sensitivity analyses on parameters which appeared relevant. The authors reported that the main limitation of the study, the time horizon (one year), might have been too short to detect all potential differences between the interventions. However, as shown, even maintaining the mean QALY gain for 5 years, the estimated cost per QALY would exceed 50,000. Results were not reported selectively for effectiveness data and the authors' conclusions were in keeping with the population studied.

Implications of the study
The authors stated that the policy implications of the analysis were very clear and even under favourable unrealistic conditions, TMLR did not seem to represent an efficient procedure in comparison with the routine medical management of the patients enrolled for the study from the perspective of the NHS. Of course, the actual threshold incremental cost-effectiveness ratio is very uncertain.

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Bibliographic details

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Other publications of related interest