Cost-effectiveness of early treatment for retinopathy of prematurity

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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.

CRD summary
This study examined the cost-effectiveness of early treatment of retinopathy of prematurity, using peripheral retinal ablation, compared with conventional management with treatment at the threshold of disease. The authors concluded that early treatment was cost-effective, especially when restricted to those with type 1 retinopathy of prematurity. Substantial benefits and cost-savings might be expected over the long-term. The study was well conducted and satisfactorily presented, which enhances the validity of the authors’ conclusions.

Type of economic evaluation
Cost-effectiveness analysis, cost-utility analysis

Study objective
This study examined the cost-effectiveness of early treatment of retinopathy of prematurity using peripheral retinal ablation compared with conventional management and treatment upon disease.

Interventions
The intervention was early treatment with peripheral retinal ablation at the high-risk pre-threshold of retinopathy of prematurity. This was compared with continued monitoring with treatment when the condition progressed to the threshold of retinopathy of prematurity (conventional management). The high-risk pre-threshold of disease was defined as a 15% risk of unfavourable retinal outcome at three months without treatment.

Location/setting
USA/hospital.

Methods
Analytical approach:
The analysis was based on a decision model that compared the costs and effects of the two strategies. Two separate analyses were carried out. The primary analysis used trial data and considered a nine-month horizon and a third-party payer's perspective. The secondary analysis was a long-term simulation, with a lifetime horizon and a societal perspective.

Effectiveness data:
The clinical data came from the published Early Treatment for Retinopathy of Prematurity (ETROP) randomised controlled trial (RCT), which showed the better outcomes associated with early treatment and the greater need for more frequent screening and additional procedures. The length of follow-up was from birth to the corrected gestational age of nine months. The key endpoint was the decrease in unfavourable visual outcome, which was defined as a visual acuity of less than 1.85 cycles per degree on the Teller Acuity Card.

Monetary benefit and utility valuations:
The utility estimates were calculated by converting the expected visual acuity outcomes, on the basis of interviews with patients with visual loss of different aetiologies, using time trade-off techniques.

Measure of benefit:
The summary benefit measure was the rate of severe visual impairment prevented per eye in the primary analysis, and quality-adjusted life-years (QALYs) in the secondary analysis. A 3% annual discount rate was applied.
Cost data:
The primary analysis considered: additional eye examination, laser therapy, anaesthesia, reintubation, and vitrectomy, which included various surgical items. The resource use was derived from the RCT and supplemented by opinions of experts in the field. Hospital costs were from charges, using a department-specific cost-to-charge ratio. Physician costs were based on data from the average commercial insurance reimbursement rates at major metropolitan tertiary care institutions. The secondary analysis also included the lifetime cost of a poor visual outcome, which was derived from a previous study. A 3% annual discount rate was applied. All costs were in US dollars ($) and the price year was 2005.

Analysis of uncertainty:
A probabilistic sensitivity analysis was undertaken on the clinical estimates using β distributions for the model inputs. Cost-effectiveness acceptability curves were generated and best- and worst-case scenarios were assessed. A deterministic approach was used for the economic inputs. An alternative scenario, in which the early treatment was restricted to infants with type 1 retinopathy of prematurity, was analysed using ETROP trial data from a subgroup of patients, with all other data the same as in the primary analysis.

Results
In the primary analysis, the expected cost was $3,363 with conventional management and $4,146 with early treatment. The benefit (proportion of eyes without severe visual impairment) was 0.802 with conventional management and 0.857 with early treatment. The incremental cost per case of severe visual impairment prevented was $14,200.

There was a 90% probability that early treatment would be cost-effective at a willingness-to-pay (WTP) threshold of $40,000 to avert one additional eye with severe visual impairment. In the best-case scenario, the probability of early treatment being both more effective and less expensive (dominant) was 89%, while, in the worst-case scenario, the probability of it being cost-effective at a WTP threshold of $40,000 was 31%. These findings were sensitive to variations in the number and cost of eye examinations required for early treatment as well as to the cost of laser therapy.

In the scenario of treatment only for type 1 retinopathy of prematurity, the expected costs were $3,363 and benefits were 0.802 with conventional management; and the costs were $3,700 and benefits were 0.857 with early treatment. The incremental cost per case of severe visual impairment prevented was $6,200 and the probability of early treatment being cost-effective at a WTP threshold of $40,000 was 95%.

In the secondary (lifetime) analysis, the expected costs were $109,327 and QALYs were 21.323 with conventional management, the costs were $82,436 and QALYs were 21.607 with early treatment, indicating that early treatment was dominant. This dominance of early treatment was found in 97% of simulations and it held in almost all the deterministic sensitivity analyses.

Authors’ conclusions
The authors concluded that early treatment was cost-effective, especially when restricted to those with type 1 retinopathy of prematurity. Substantial benefits and cost-savings might be expected over the long-term. They pointed out that the availability of long-term trial data would allow a more robust assessment of the cost-effectiveness of early treatment.

CRD commentary
Interventions:
The selection of the comparators was appropriate as the proposed intervention was compared against the conventional pattern of the care in the authors’ setting.

Effectiveness/benefits:
Little information on the clinical data was provided as a published source of evidence was used. In general, an RCT is a valid source given the strengths of its methods, but more details would have allowed a more extensive assessment of the quality of the evidence. The benefit measure in the primary analysis was disease-specific and not comparable with the benefits of other health care interventions. The use of QALYs in the secondary analysis introduced more uncertainty into the study, but appears to have been more appropriate given the impact of the disease on quality of life and survival.
QALYs also allow cross-disease comparisons. Appropriate discounting was performed.

**Costs:**
The economic analysis was consistent with the perspectives of the study. All the relevant cost items appear to have been included, but most of the costs were presented as macro-categories, especially for long-term costs. These were derived from a previous publication, the methods of which were not reported, which reduces the transparency of the economic analysis. The sources of other costs were reported and they reflected the economic viewpoint of the health service payer. Other aspects of the analysis, such as the price year, use of discounting (when required), and use of assumptions, were clearly reported.

**Analysis and results:**
The costs and benefits of the two interventions were clearly presented. The analytic approach was appropriate as the incremental analysis allowed the identification of the most cost-effective strategy. The use of two analyses (short-versus long-term) was appropriate and the study results were clearly discussed. The issue of uncertainty was satisfactorily investigated, using various approaches. Some key details of the decision model were reported.

**Concluding remarks:**
The study was well conducted and satisfactorily presented, which enhances the validity of the authors’ conclusions.

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