A cost-effectiveness model comparing endovascular repair to open surgical repair of abdominal aortic aneurysms in Canada


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 endovascular aneurysm repair (EVAR) and open repair for the treatment of patients with abdominal aortic aneurysm. The authors concluded that, compared with open repair, EVAR was not a cost-effective intervention. Despite some superficial limitations, the methods were valid and the authors’ conclusions appear to be robust.

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

Study objective
The objective was to compare the cost-effectiveness of two strategies for the treatment of abdominal aortic aneurysms, in male patients close to 70 years old, with aneurysms of over 5.5cm.

Interventions
The interventions were open repair versus endovascular aneurysm repair (EVAR).

Location/setting
Canada/secondary care.

Methods
Analytical approach:
The authors constructed a probabilistic decision-analytic model, with a 10-year time horizon. The model combined a decision tree, to assess the costs and effectiveness during the 30-day postoperative period, with a long-term Markov model. The authors stated that a third-party payer perspective was taken.

Effectiveness data:
The clinical data were from a systematic literature review, which was supplemented with evidence from administrative databases and relevant studies, including non-randomised ones. The key details of the data extraction and combination were reported. The data for postoperative complications, which was the key clinical endpoint, were mainly from randomised controlled trials (RCTs), as well as non-randomised studies. They were combined using a random-effects inverse-variance weighting technique. The model was calibrated on the basis of the long-term mortality for open repair and EVAR.

Monetary benefit and utility valuations:
The utility values were from various published sources. The utility values by age were based on general population utility values for men. The differences in utilities between EVAR and open repair were from a RCT, Endovascular Aneurysm Repair versus Open Repair in Patients with Abdominal Aortic Aneurysm (EVAR trial 1), which derived them using the European Quality of life (EQ-5D) questionnaire.

Measure of benefit:
Life-years (LYs) and quality-adjusted life-years (QALYs) were the measures of benefit and they were discounted at an annual rate of 3%.
Cost data:
The economic analysis included the costs of EVAR and open repair, including aneurysm procedure and devices, tests and procedures, hospitalisation, medications, and surgeons’ and anaesthetists’ time. The related resource use was from the hospital records of a subsample of patients from a Canadian observational study. Postoperative complications, such as myocardial infarction and congestive heart failure, were also included, and were estimated, using regression methods and patient cost records. The follow-up costs for EVAR patients (an annual computed tomography scan), and endoleak and rupture repair costs were from various published sources. The costs were reported in Canadian dollars (CAD) and discounted at an annual rate of 3%.

Analysis of uncertainty:
One-way sensitivity analysis was conducted to assess the uncertainty around the model assumptions for the time horizon, patients’ starting age, postoperative complication rate, re-intervention costs, long-term utility values, and the discount rate. Parameter uncertainty was also investigated through probabilistic sensitivity analysis, using Monte Carlo simulations. The predefined distributions were reported and the results presented in cost-effectiveness acceptability curves.

Results
Over the 10-year time horizon the expected total costs were CAD 31,908 for EVAR and CAD 18,552 for open repair. The expected LYs gained were 6.631 for EVAR and 6.601 for open repair and the expected QALYs were 5.063 for EVAR and 5.014 for open repair.

When EVAR was compared with open repair it resulted in an incremental cost of CAD 444,129 per LY gained or CAD 268,337 per QALY gained.

The cost-effectiveness acceptability curves showed that at willingness-to-pay values of CAD 50,000 per LY and CAD 100,000 per QALY gained, the probability of EVAR being cost-effective ranged from 0.02 to 0.07. The deterministic sensitivity analysis demonstrated that the results were most sensitive to variation in the long-term utility value for open repair.

Authors’ conclusions
The authors concluded that at commonly accepted willingness-to-pay thresholds EVAR was not a cost-effective intervention for the treatment of abdominal aortic aneurysms, compared with open repair.

CRD commentary
Interventions:
The rationale for the choice of comparators was reported, and the two methods were the available options in the authors’ setting.

Effectiveness/benefits:
The clinical data were identified using a validated approach to find all possible sources of evidence, but a report of the methods and conduct of the review would have been useful to assess its quality. Many of the supplemental studies were RCTs, which are usually considered to be valid sources of data given the strengths of their design, but the baseline characteristics of these trials were not fully reported, which makes it difficult to assess their validity. Some information on the sources of the utilities was presented and life-years gained and QALYs are valid benefit measures that allow cross-disease comparisons to be made.

Costs:
The costs appear to have been consistent with the stated perspective, but only total categories were presented, with no details of the unit costs or resource quantities. The currency was not explicitly reported, but it appears to have been Canadian dollars, because an exchange rate from pounds sterling to Canadian dollars was reported in the discussion, and most of the cost data were from Canadian sources. The price year was not reported, but might have been 2008, based on the exchange rate reported. The sources of all data and the assumptions made were reported, along with the details of discounting.
Analysis and results:
The model structure was described in detail, including a diagram. The costs and benefits were appropriately synthesised, using an incremental approach, and the the issue of uncertainty was satisfactorily addressed through the use of both deterministic and probabilistic sensitivity analyses. The results of the base case and the sensitivity analyses were clearly presented. The authors compared their results with those of previous studies and highlighted possible reasons for any differences. They also discussed some limitations to their study, which mainly related to the quality and the sources of the data used to populate the model. Despite a lack of detailed reporting of the inputs, the analysis appears to have been well conducted.

Concluding remarks:
Despite some superficial limitations, the methods were valid and the authors’ conclusions appear to be robust.

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