Treatment of unruptured intracranial aneurysms: decision and cost-effectiveness analysis

Takao H, Nojo T

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
The objective of the study was to assess the cost-effectiveness of surgical and endovascular treatments of unruptured intracranial aneurysms of varying size and location in a hypothetical cohort of 50-year-olds. The authors concluded that the treatment of aneurysms that are small and located in the cavernous carotid artery, or large and located in the posterior circulation, is not cost-effective. Despite some limitations of the study, the authors' conclusions appear appropriate.

Type of economic evaluation
Cost-utility analysis

Study objective
The objective of the study was to assess the cost-effectiveness of surgical and endovascular treatments of unruptured intracranial aneurysms of varying size and location in a hypothetical cohort of 50-year-olds.

Interventions
The study examined surgical and endovascular treatment of unruptured intracranial aneurysms.

Location/setting
USA/secondary care.

Methods
Analytical approach:
A Markov model was used to facilitate the synthesis of the clinical and cost data. A lifetime horizon was used. The authors stated that the study was conducted from a societal perspective.

Effectiveness data:
The effectiveness data came from a review of the literature. MEDLINE was searched for studies published between January 1996 and February 2006 using the following terms: "unruptured", "intracranial aneurysm", "cerebral aneurysm", "subarachnoid hemorrhage", "stroke", "cost", "utility" and "quality". Aneurysm rupture rates and treatment outcomes were taken from a prospective study by the International Study of Unruptured Intracranial Aneurysms investigators. For other estimates the following hierarchy of evidence was used: recent systematic reviews and meta-analyses, prospective and cohort studies, case-control and case series data, and estimations. The main clinical parameters were the probabilities of death and impairment for various aneurysm sizes and locations.

Monetary benefit and utility valuations:
The utility values were derived from published studies.

Measure of benefit:
The primary measure of benefit was the quality-adjusted life-years (QALYs).

Cost data:
The cost categories included hospitalisation, physician fees, and outpatient, rehabilitation and nursing home and home care. The total costs of treatment were taken from published studies. The price year was 2003 and all costs were reported in US dollars ($). The costs were inflated to 2003 prices using the medical component of the Consumer Price Index. Discounting was performed at an annual rate of 3%.
Analysis of uncertainty:
Both one-way and probabilistic sensitivity analyses were used to examine parameter uncertainty.

Results
For aneurysms smaller than 13 mm and located in the cavernous carotid artery, both surgical and endovascular treatments were dominated by no treatment (i.e. they were less effective and more costly). For aneurysms of 13 mm or larger, surgical treatment was dominated by no treatment, while endovascular treatment was associated with an incremental cost-effectiveness ratio (ICER) greater than $100,000.

For aneurysms smaller than 7 mm and located in the anterior circulation, both treatments were dominated. For 7- to 12-mm aneurysms, surgical treatment had an ICER of $157,700 and endovascular treatment had an ICER of $57,700. For aneurysms of 13 mm or larger, both treatments had ICERs of less than $15,000.

For aneurysms located in the posterior circulation and less than 7 mm in size, both treatments had ICERs greater than $100,000; while aneurysms between 7 and 12 mm had ICERs of less than $10,000. For aneurysms larger than 25 mm, endovascular treatment was dominated by no treatment.

The one-way sensitivity analysis was conducted on aneurysms 7- to 12-mm in size in the anterior circulation. It showed that four parameters were most important in the model: untreated aneurysm rupture rate, poor outcome rate after treatment, quality of life of living with an untreated unruptured intracranial aneurysm and patient age.

Authors’ conclusions
The authors concluded that, for 50-year-old patients, the treatment of aneurysms that are small and located in the cavernous carotid artery, or large and located in the posterior circulation, is not cost-effective.

CRD commentary
Interventions:
The interventions were poorly reported, with little detail of the endovascular and surgical treatments being provided. In addition, it was not clear if the interventions represented current practice in the authors' setting.

Effectiveness/benefits:
The effectiveness data were mainly derived from published studies. The methods used to review the literature, including the hierarchy of evidence from which the estimates came, were reported in full and appear valid. Overall, the effectiveness parameters included in the model were well reported. The outcome measure (the QALY) was appropriate. The methods used to derive utilities in the source publications were not reported.

Costs:
A societal perspective was adopted, but no productivity costs were included. The costs included those associated with surgical and endovascular treatment. In general, the reporting of the cost data was poor with only total costs, rather than unit costs and resource quantities, being reported. A sensitivity analysis on the total cost parameters was performed. Adjustments such as the price year and discounting were reported.

Analysis and results:
The authors performed an appropriate incremental analysis comparing the two potential treatment options against no treatment in order to determine if either were cost-effective options. Uncertainty was appropriately investigated. The one-way sensitivity analysis was well reported, but the results of the probabilistic sensitivity analysis could have been reported in more detail. The lack of detail about the treatment interventions and unit costs may make it difficult to generalise the results of the study to other settings. The authors acknowledged a number of limitations of their study and explained differences in their results from other studies.

Concluding remarks:
Some detail was not reported but, overall, the methodology and reporting were adequate and the authors’ conclusions appear appropriate.
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Bibliographic details

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