Medical or surgical therapy for erosive reflux esophagitis: cost-utility analysis using a Markov model

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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
The use of healing and maintenance regimens of omeprazole versus laparoscopic Nissen fundoplication (LNF) for the treatment of erosive reflux oesophagitis (ERO).

Type of intervention
Treatment.

Economic study type
Cost-utility analysis.

Study population
The study population comprised a hypothetical cohort of patients with endoscopically proven Grade II - IV erosive oesophagitis.

Setting
The setting is likely to have been secondary care. The economic study was carried out in Canada.

Dates to which data relate
The effectiveness and resource use data were derived from studies published between 1985 and 2000. The price year was not reported.

Source of effectiveness data
The effectiveness evidence was derived from a review of published studies and assumptions.

Modelling
A two-stage Markov model was constructed to simulate the treatment of a hypothetical 45-year-old man with endoscopically proven Grade II - IV ERO with either omeprazole or LNF. The time horizon of the model was 5 years and each cycle of the model lasted 3 months.

Outcomes assessed in the review
The outcomes estimated from the literature were the quality of life utilities for LNF, laparotomy, reflux symptoms and medication consumption, and the probabilities of the following:

the time required for healing phase with omeprazole,
annual LNF failure rate,
conversion to open Nissen,
laparotomy for surgical complications,
death from LNF,
death from laparotomy,
requiring dilatation,
dilatation post-food impaction, and
food impaction.

Age- and gender-matched population-based mortality rates were estimated from published vital statistics for Alberta.

**Study designs and other criteria for inclusion in the review**
Not stated.

**Sources searched to identify primary studies**
Not stated.

**Criteria used to ensure the validity of primary studies**
Not stated.

**Methods used to judge relevance and validity, and for extracting data**
Not stated.

**Number of primary studies included**
The effectiveness evidence came from 25 primary studies.

**Methods of combining primary studies**
Not stated.

**Investigation of differences between primary studies**
Not stated.

**Results of the review**
The quality of life utilities were 0.5 (range: 0.25 - 0.75) for LNF, 0.5 (range: 0.25 - 0.75) for laparotomy, 0.935 (range: 0.8 - 1) for reflux symptoms, and 0.99 (range: 0.98 - 1) for medication consumption.

The probabilities were:
0.64 for a healing period of 30 days, 0.18 for a 60-day healing period, 0.13 for a 90-day healing phase, and 0.04 for a 120-day healing period;
0.011 (range: 0 - 0.10) for annual LNF failure rate;
0.058 (range: 0 - 0.22) for conversion to open Nissen;
0.015 (range: 0.01 - 0.12) for laparotomy for surgical complications;
0.002 (range: 0 - 0.01) for death from LNF;
0.014 (range: 0.01 - 0.05) for death from laparotomy;
0.012 (range: 0 - 0.217) for requirement of dilatation per year;
0.7 (range: 0.5 - 1) for dilatation post-food impaction; and
0.002 (range: 0 - 0.05) for food impaction.

The life expectancy was 31.8 years for a 45-year-old man and 37 years for a 45-year-old woman.

Other probability values were interpolated from data derived from the literature.

**Methods used to derive estimates of effectiveness**
The authors made some assumptions that were used in the decision model.

**Estimates of effectiveness and key assumptions**
The values derived from the authors' assumptions were as follows:

the utility values were 0.8 (range: 0.6 - 1) for dysphagia and 0.75 (range: 0.5 - 1) for dilatation or foreign body;
the annual rate of opting for NLF if requiring 60 mg/day omeprazole was 0.20 (range: 0.05 - 0.40); and
the probability of opting for repeat surgery in patients with postoperative symptomatic recurrence was 0.33 (range: 0.20 - 0.50).

**Measure of benefits used in the economic analysis**
The summary health benefit measure was the number of quality-adjusted life-years (QALYs). These were associated with the two main branches of the decision tree. The QALYs were discounted at an annual rate of 3% in the maintenance phase of the treatment. The utility values were derived from different sources.

**Direct costs**
The costs were discounted at an annual rate of 3% during the maintenance phase, as the time horizon of the model was 5 years. The unit costs were reported, but the quantities of resources used were provided only for some items. The health services in the economic evaluation were LNF, open Nissen fundoplication, physician office visit, upper endoscopy, manometry and Bernstein test, dilatation, omeprazole, and dispensing fee. LNF covered consumables, nursing services, surgeon and anaesthetist fees, and in-hospital stay. The cost/resource boundary of the Canadian provincial health ministry was used. Resource use was estimated using data from the literature. The unit costs were estimated from a local cost study, the Alberta Health Care Insurance Plan, and local charges. The price year was not reported.

**Statistical analysis of costs**
The costs were treated deterministically in the base-case analysis.
Indirect Costs
The indirect costs were not considered in the economic evaluation.

Currency
Canadian dollars ($).

Sensitivity analysis
One- and two-way sensitivity analyses were carried out on relevant model inputs to test the robustness of the estimated cost-effectiveness ratios. The ranges used in the analysis were derived from the literature. A Monte Carlo simulation, based on 10,000 patients, was also performed to generate 95% inter-percentile ranges for the costs and QALYs.

Estimated benefits used in the economic analysis
The estimated (discounted) QALYs were 4.350 with omeprazole and 4.335 with LNF. Therefore, the two strategies resulted in similar benefits.

Cost results
The estimated (discounted) 5-year costs were Can$5,464.87 with omeprazole and Can$3,519.89 with LNF.

The additional cost of omeprazole relative to LNF was Can$1,944.98.

Synthesis of costs and benefits
An incremental cost-effectiveness ratio was calculated to combine the costs and benefits of the two alternative treatments for ERO.

The incremental cost per QALY gained with medical therapy over LNF was Can$129,665.

The results of the sensitivity analysis were as follows:

the monthly cost of omeprazole would have to be reduced to less than Can$38.60 before medical therapy became the cheaper option and to Can$38.80 for medical therapy to be cost-effective;

the cost of LNF would have to rise to greater than Can$5,296.40 before medical therapy became less expensive and to Can$5,273.70 for medical therapy to be cost-effective;

the failure rate of LNF would have to rise above 37% per year before omeprazole therapy became the less expensive option.

The Monte Carlo simulation led to the following values:

Can$5,497.60 (95% interquartile ranges: 1,912 - 8,628) for omeprazole and Can$3,500.24 (95% interquartile ranges: 3,091 - 9,548) for LNF;

4.343 QALYs (95% interquartile ranges: 1.48 - 4.73) for omeprazole and 4.340 QALYs (95% interquartile ranges: 1.23 - 4.73) for LNF.

Authors' conclusions
Laparoscopic Nissan fundoplication (LNF) represented a cost-effective strategy for the treatment of erosive reflux oesophagitis (ERO) in Canada, compared with medical therapy (omeprazole).
CRD COMMENTARY - Selection of comparators
The authors justified the choice of the comparators. They stated that LNF and omeprazole represented two widely used approaches for the treatment of ERO. You should decide whether they are valid comparators in your own setting.

Validity of estimate of measure of effectiveness
The bulk of the evidence used in the decision model came from the literature. It was unclear whether a systematic review of the literature was undertaken to identify relevant studies. The inclusion criteria and details of the primary studies (e.g. study sample, patients' characteristics) were not reported. The quality of the sources used was unclear. Some assumptions were also made in the decision model. Most of the values used were varied in the sensitivity analysis, which identified the most relevant model inputs.

Validity of estimate of measure of benefit
QALYs were used as the summary benefit measure in the economic evaluation, which appears to have been appropriate. QALYs were used mainly to detect the impact of the interventions on quality of life. Discounting was performed due to the long time horizon of the analysis. The utility values were derived from the literature. QALYs represent a measure that is easily compared with the benefits of other health care interventions. A Monte Carlo simulation was performed to address the issue of uncertainty around the estimated QALYs.

Validity of estimate of costs
The authors stated explicitly which perspective was adopted in the study. It appears that all the relevant categories of costs have been included in the analysis. The unit costs were reported, but there were few details of the quantities of resources used. The price year was not reported, which makes reflation exercises in other settings difficult. The costs were treated deterministically in the base-case, but a probabilistic approach dealt with the issue of uncertainty around the cost estimates.

Other issues
The authors compared their findings with those from other studies and discussed the reasons for the differences in the results observed in published economic evaluations. The authors did not address the issue of the generalisability of the study results to other settings. In addition, the results of the sensitivity analysis were reported only for the most critical inputs. Some limitations to the validity of the analysis were noted. First, the analysis was limited to omeprazole and other alternative regimens used within the medical treatment option were not considered. Second, the long-term complications of medical therapy were not reliably modelled due to the lack of data. Similarly, the complications associated with LNF were unknown and this introduced some uncertainty into the model. Finally, variations in the learning curve associated with LNF were not considered.

Implications of the study
The study results showed the surgical approach for ERO to be safe and cost-effective, despite the fact that many primary care physicians consider LNF expensive and invasive. The authors stated that further prospective and randomised studies should confirm the results of the current analysis.

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Bibliographic details

PubMedID
Other publications of related interest

Indexing Status
Subject indexing assigned by NLM

MeSH
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