Cost-minimization analysis of MRC versus ERCP for the diagnosis of primary sclerosing cholangitis

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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 study examined the use of magnetic resonance cholangiography (MRC) versus endoscopic retrograde cholangiopancreatography (ERCP) for the diagnosis of primary sclerosis cholangitis (PSC).

Type of intervention
Diagnosis.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised patients with suspected biliary tract disease.

Setting
The setting was a hospital. The economic study was carried out in the USA.

Dates to which data relate
The effectiveness and resource use data were obtained from two studies published in 2000, one of which was performed by the authors of this paper and provided the majority of the information. The price year was 1999.

Source of effectiveness data
The effectiveness data were derived from a review of two completed studies (see 'Other Publications of Related Interest' for bibliographic details).

Modelling
To enable the synthesis and comparison of the effectiveness and cost data, a basic decision tree was developed, using DATA version 3.5 software (TreeAge Software Inc.). A graphical depiction of the model was presented.

Outcomes assessed in the review
The authors derived the following parameters from their own primary study paper:

- the probability of PSC;
- the probability and range of bile duct obstruction, choledocholithiasis, balloon dilatation (BD), endoscopic sphincterotomy (ES), BD plus ES, BD plus biopsy, BD plus stone extraction, any ERCP complication, post-ERCP
abdominal pain, post-ERCP pancreatitis and post-ERCP perforation; and
the sensitivity and specificity of ERCP.

Both the sensitivity and specificity of MRC was derived from two published papers, one of which was the authors' primary study.

**Study designs and other criteria for inclusion in the review**
The authors reported no inclusion or exclusion criteria. It would appear that they selected their own clinical study as the primary source of data and, when necessary, augmented this with one other study.

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

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

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

**Number of primary studies included**
Two primary studies were included in the review.

**Methods of combining primary studies**
Only two of the parameters were derived from more than one source. The method used to combine these two parameters was not reported.

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

**Results of the review**
The results for the collected data were as follows:

- the probability of PSC was 0.32,
- the probability of bile duct obstruction was 0.70 (range: 0.35 - 1.0),
- the probability of choledocholithiasis was 0.14 (range: 0.07 - 0.28),
- the probability of BD was 0.14 (range: 0.07 - 0.28),
- the probability of ES was 0.14 (range: 0.07 - 0.28),
- the probability of BD and ES was 0.14 (range: 0.07 - 0.28),
- the probability of BD and biopsy was 0.21 (range: 0.11 - 0.42),
- the probability of BD and stone extraction was 0.21 (range: 0.11 - 0.42),
the probability of any ERCP complication was 0.08 (range: 0.04 - 0.16),
the probability of post-ERCP abdominal pain was 0.50 (range: 0.25 - 1.0),
the probability of post-ERCP pancreatitis was 0.33 (range: 0.16 - 0.66),
the probability of post-ERCP perforation was 0.17 (range: 0.09 - 0.34),
the sensitivity of ERCP was 0.96 and the specificity was 1.0, and
the sensitivity of MRC was 0.82 and the specificity was 0.98.

Methods used to derive estimates of effectiveness
The authors made assumptions about ranges of values for particular parameters, required to feed the economic model, when these data were not available from the literature.

Estimates of effectiveness and key assumptions
The authors assumed:

- the probability of PSC was 0.10 - 1.0,
- the sensitivity of ERCP was 0.50 - 1.0 and the specificity was 0.50 - 1.0, and
- the sensitivity of MRC was 0.50 - 1.0 and the specificity was 0.50 - 1.0.

Other assumptions within the model were also made. For instance, values of the diagnostic parameters (sensitivity and specificity) were the same for ERCP whether it was used as an initial or confirmatory test. Also, the occurrence of a negative test result by MRC was subsequently followed by ERCP with the assumption that a clinical suspicion for PSC remained present after MSC. Finally, the probabilities of post-ERCP complications were the same for ERCP whether used as an initial or a confirmatory test.

Measure of benefits used in the economic analysis
The measure of benefits used was correct diagnosis.

Direct costs
The direct costs for ERCP considered supplies, recovery room fees and physician fees. Supplies included medications and IV equipment, occlusion balloon catheter for contrast injection, and contrast materials. The direct costs for MRC considered film and processing fees, technician fees and physician fees. The costs of the magnetic resonance image scanner, side-viewing, duodenoscopes and computer processing units, as well as ERCP procedure-room costs, were considered fixed and were excluded from the analysis. All procedure costs (technical and professional) were estimated using average Medicare reimbursement schedules assigned by a CPT procedure code. These included the costs associated with additional therapeutic manoeuvres required at ERCP when indicated. The supply costs were estimated by multiplying institutional charges by the Medicare cost-to-charge ratio for the fiscal year 1999 (0.5562). The resource use quantities and the unit costs were not presented separately. Discounting was not performed, which was appropriate given the brief time horizon associated with diagnostic testing. All costs were inflation-adjusted to the 1999 US dollar.

Statistical analysis of costs
The costs were treated deterministically (i.e. point estimates) and ranges of values were used in the sensitivity analysis.

Indirect Costs
The indirect costs were not included.

**Currency**
US dollars ($).

**Sensitivity analysis**
Uncertainty due to variability in the data was investigated using one-way and threshold sensitivity analyses. The parameters varied were the prevalence of PSC (1 - 100%), the sensitivity and specificity of MRC (50 - 100%), the probabilities of ERCP-related complications (50 - 200 of baseline), and the total costs for MRC, ERCP and hospitalisation (50 - 200% of baseline). The authors made assumptions about the ranges of values used.

**Estimated benefits used in the economic analysis**
The authors used correct diagnosis for their economic analysis. This outcome was not reported separately from the average cost of each strategy.

**Cost results**
The authors did not report the total cost per strategy, although the unit costs of all strategy components were provided.

**Synthesis of costs and benefits**
The average cost per correct diagnosis was $724.00 when using the test strategy of initial MRC versus $793.17 for the initial ERCP strategy.

In the absence of biliary obstruction, the average cost per correct diagnosis was $549.64 for initial MRC versus $623.25 for ERCP.

No incremental analysis was performed.

The one-way sensitivity analysis revealed that a prevalence rate above 45% for PSC would change the preferred test strategy from initial MRC to ERCP.

When the specificity of MRC was less than 85%, initial ERCP was the optimal test strategy.

With a study cohort prevalence rate of 32% for PSC, the threshold analysis demonstrated that an average cost per correct diagnosis of $538.25 (including procedure-related complications) would be required for initial ERCP to be the preferred strategy over MRC.

**Authors' conclusions**
Magnetic resonance cholangiography (MRC) has comparable accuracy to endoscopic retrograde cholangiopancreatography (ERCP). It results in cost-savings when used as an initial test strategy for diagnosing primary sclerosing cholangitis (PSC).

**CRD COMMENTARY - Selection of comparators**
The authors stated that the intervention assessed had recently become available as an alternative to the comparator technology. So, it would appear that the comparator represented current practice at the authors' setting. You should decide if this technology represents current practice in your own setting.

**Validity of estimate of measure of effectiveness**
It was clear that the authors intended to conduct a modelling study based solely on the effectiveness evidence provided by their own clinical study, augmented by another clinical study of their own choosing. Little detail on the original study was presented, so it is difficult to comment on the internal validity of this study. However, given that more than one source has been used, the authors should have been more explicit as to why and how they selected the studies used. As it is, it is not clear that the best available data have been used to populate the model. In addition, the authors appear to have used the data from the available studies selectively with no mention of how parameters from the two studies were combined, if in fact they were combined. Moreover, the authors chose many of the ranges of values for parameters in the model based on their own assumptions. They did not provide any justification for the values adopted, but they seem to have adopted ranges that were sufficiently broad to allow for any sensible parameter value. The paper would have been greatly improved if the clarity of reporting had been better.

**Validity of estimate of measure of benefit**
The authors used correct diagnosis as the outcome for the economic analysis, and this was derived from the model. The reader is referred to the comments in the 'Validity of estimate of measure of effectiveness' field (above).

**Validity of estimate of costs**
The analysis was performed from a hospital perspective. The authors described the items considered in the costs, presented some costs and ranges, but did not present quantities. Moreover, they used Medicare fees as proxies for many of the relevant intervention costs. It was therefore unclear whether all the relevant costs were considered in the analysis. No statistical or sensitivity analysis of the quantities was conducted. The costs were treated deterministically, but a sensitivity analysis on different cost components was performed to assess the robustness of the estimates used. Appropriate currency conversions were performed and, as all costs were incurred within a year, discounting was not necessary. The price year was reported, which will aid any future reflation exercise.

**Other issues**
The authors compared their analysis with those of other studies. In general, their findings were in agreement with the findings from these studies. The authors did not directly address the issue of generalisability of their results to other settings. The authors do not appear to have presented their results selectively. They reported a number of limitations of their study. For instance, the use of fees schedules as proxies for costs might have biased the results in favour of MRC because facility and supply costs may be divided between several areas.

**Implications of the study**
Further investigations have attempted to estimate the potential impact of MRC as a diagnostic modality. It has been proposed that, if MRC is available with accurate test performances features, up to 40% of patients with clinically suspected biliary tract disease could avoid diagnostic ERCP and less than 10% would require both MRC and ERCP. These findings may have significant implications in clinical practice settings in which the prevalence of PSC is lower than that observed in referral-based centres. In addition, MRC could be very useful for determining the presence of PSC in patients with serum cholestatic liver test abnormalities and inflammatory bowel disease. This analysis demonstrated that a test strategy of initial MRC, compared with ERCP, in the evaluation of patients with clinically suspected PSC has comparable diagnostic accuracy and cost-savings.

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**Bibliographic details**

**PubMedID**
Other publications of related interest

Indexing Status
Subject indexing assigned by NLM

MeSH
Adult; Aged; Aged, 80 and over; Cholangiopancreatography, Endoscopic Retrograde /adverse effects /economics; Cholangitis, Sclerosing /diagnosis; Cost Control; Decision Support Techniques; Female; Health Care Costs; Humans; Magnetic Resonance Imaging /economics; Male; Middle Aged; Sensitivity and Specificity

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