Cost-effectiveness of screening for hepatopulmonary syndrome in liver transplant candidates

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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
The study evaluated the cost-effectiveness of screening for hepatopulmonary syndrome (HPS), compared with no screening, in patients with cirrhosis undergoing orthotopic liver transplantation evaluation. The authors concluded that screening for HPS, especially with pulse oximetry, was a cost-effective strategy. The authors’ conclusions are consistent with the objective of the study, which was adequate in terms of reporting but less clear with respect to the sources used for clinical data.

Type of economic evaluation
Cost-effectiveness analysis

Study objective
The primary objective of the study was to determine the cost-effectiveness of screening for hepatopulmonary syndrome (HPS), compared with no screening, in patients with cirrhosis undergoing orthotopic liver transplantation evaluation.

Interventions
Three strategies were compared: no screening; screening patients with a validated dyspnoea questionnaire (patients with positive results undergo arterial blood gas analysis and contrast echocardiography); and screening all patients with pulse oximetry (patients with a pulse oximetry of < 97% undergo arterial blood gas analysis and contrast echocardiography).

Location/setting
USA/hospital.

Methods
Analytical approach:
A Markov model was constructed in order to simulate the clinical and economic end points associated with the three strategies under examination in a hypothetical cohort of 50-year-old patients with cirrhosis presenting with initial liver transplantation evaluation. The model represented the natural history of patients with cirrhosis and was populated with published data. The time horizon of the analysis was the remaining life expectancy. The authors stated that the study perspective was that of a third-party payer.

Effectiveness data:
The clinical data came from a review of the literature found in MEDLINE. Except for the search terms, details of the review (e.g. inclusion criteria, approach to select clinical estimates, combination method) were not reported. Population-based mortality rates were based on US life tables. No details were given of other studies used in the estimation of clinical parameters. When data were not available from the literature, experts’ opinions at the authors’ institution were used. The key clinical parameters were the prevalence of HPS and dyspnoea, sensitivity of pulse oximetry, death and complication rates.

Monetary benefit and utility valuations:
None.

Measure of benefit:
The summary benefit measure was the expected life-years (LYs). These were estimated using the modelling framework
and were discounted at an annual rate of 3%.

Cost data:
The analysis included the costs of spontaneous bacterial peritonitis, variceal bleed, liver transplantation, esophagogastroduodenoscopy, pulse oximetry, echocardiogram, arterial blood gas, hospice stay, the treatment of hepatocellular cancer and drugs. The costs were derived from Medicare reimbursement rates using diagnosis-related groups (DRGs) at the authors' institution. An annual discount rate of 3% was applied, which was appropriate given the long-term time horizon. The price year was 2004 and the currency was US dollars ($).

Analysis of uncertainty:
Both deterministic (one- and two-way) and probabilistic sensitivity analyses (based on first-order Monte Carlo simulations) were carried out to evaluate the robustness of the base-case results to variations in key clinical and economic inputs. A separate analysis was also undertaken to determine the influence of excluding patients with severe HPS from transplant.

Results
The total costs were $291,898 with no screening, $299,719 with pulse oximetry and $300,278 with the dyspnoea questionnaire.

The expected LYs were 11.131 with no screening, 12.27 with pulse oximetry and 12.28 with the dyspnoea questionnaire.

The incremental cost per LY gained was $6,867 with pulse oximetry over no screening and $55,900 with the dyspnoea questionnaire over pulse oximetry ($7,350 for dyspnoea questionnaire over no screening).

In general, the sensitivity analysis demonstrated the robustness of the base-case results: both screening strategies remained below a threshold of $50,000 per LY gained under most assumptions. The most influential parameters were the prevalence of HPS, the severity of HPS, and the underlying liver disease. Increasing the proportion of patients with decompensated cirrhosis improved the cost-effectiveness of the screening strategies. No screening was dominated (less effective and most costly) by both screening strategies if patients with severe HPS were excluded from transplant.

Authors' conclusions
The authors concluded that screening for HPS, especially with pulse oximetry, was a cost-effective strategy in comparison with no screening in liver transplant candidates. The authors highlighted the need for further prospective studies providing data on the range of progression of hypoxemia in HPS and the influence of HPS severity on orthotopic liver transplantation outcomes.

CRD commentary
Interventions:
The choice of the interventions was appropriate in that they represented valid comparators in the authors' setting. The authors pointed out that no screening is the routine standard of care in several US institutions. A clear description of all alternative strategies was provided.

Effectiveness/benefits:
A review of the literature was an appropriate means with which to identify primary estimates. However, little information on the methods and conduct of the review was provided. The design and other characteristics of the primary studies were not described, although the authors reported all point estimates and the associated range used in the decision model. Thus, it is not possible to fully evaluate the validity of the clinical inputs. Furthermore, data that were not found were defined on the basis of expert opinion. LYs were chosen to reflect the impact of the interventions on patient health. However, the dimension of quality of life, which might also be important for liver transplant candidates, was not considered.

Costs:
The analysis of the costs appears to have been consistent with the authors' stated perspective in terms of both categories.
of costs and sources of economic data. Typical US sources of data (DRGs and reimbursement rates) were used. The price year was reported, which will facilitate reflation exercises in other time periods. Appropriate discounting was performed.

Analysis and results:
Modelling was required given the cyclic nature of disease and patient management. Clear details of the decision model (i.e. graphical structure and transition patterns) were provided. The costs and benefits were appropriately synthesised and reported, together with the results of the sensitivity analysis. The impact of uncertainty was satisfactorily addressed in the sensitivity analysis. The issue of the generalisability of the study results was not explicitly addressed, although some economic values were varied in the sensitivity analysis.

Concluding remarks:
Overall, the quality of the study was good although there were some limitations arising from the unclear sources of clinical data used in the model. The results were well reported and the model used to obtain long-term results clearly described. The conclusions reached by the authors appear appropriate and robust.

Funding
None stated.

Bibliographic details

PubMedID
17205561

DOI
10.1002/lt.20931

Other publications of related interest


Indexing Status
Subject indexing assigned by NLM

MeSH
Cost-Benefit Analysis; Female; Hepatopulmonary Syndrome /diagnosis /epidemiology; Humans; Liver Transplantation; Male; Mass Screening /economics /methods; Middle Aged; Prevalence; Severity of Illness Index

AccessionNumber
22007000643

Date bibliographic record published
17/04/2007

Date abstract record published