A cost-effectiveness analysis of anemia screening before erythropoietin inpatients with end-stage renal disease

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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
Anaemia screening before erythropoietin treatment.

Type of intervention
Screening.

Economic study type
Cost-effectiveness analysis.

Study population
Patients with end-stage renal disease (ESRD) beginning chronic haemodialysis or peritoneal dialysis treatment.

Setting
Hospital. The study was performed at the Ralph H. Johnson Veteran Affairs Medical Center, South Carolina, USA.

Dates to which data relate
The effectiveness data were generated from patients undergoing screening for anaemia between 1992 and 1995. The resource data relate to the same period. The date of the prices was not reported.

Source of effectiveness data
Effectiveness data were derived from a single study.

Link between effectiveness and cost data
The costing was undertaken retrospectively on the same patient sample as that used in the effectiveness study.

Study sample
48 patients (45 male, 3 female) with an average age of 61.8 years (range: 37 - 78 years) were initiated on chronic dialysis during the 36 month study period. Of the 48 patients, 32 were black and 16 were white, with a variety of causes of ESRD (diabetes mellitus 44%, hypertension 29%, glomerulonephritis 17%, vascular disease 4%, polycystic kidney disease 2%, chronic interstitial nephritis 2%, human immunodeficiency virus nephropathy 2% and chronic rejection 2%). No patient had positive hepatitis serology or evidence of active or recent gastrointestinal blood loss, excessive menstrual blood loss, or surgical blood loss.

Study design
The study was a case series (prospective).

**Analysis of effectiveness**
The number of cases of aluminium intoxication, hyperparathyroidism and deficiencies of iron, folate and vitamin B12 detected.

**Effectiveness results**
Mean hematocrit was 0.264 (+/- 0.036) g/L; mean blood urea nitrogen was 32 (+/- 2) mmol/L; mean haemoglobin was 89 (+/- 13) g/L; median serum iron concentration was 9 micro.mol/L (range: 2 - 24 micro.mol/L); median transferrin concentration was 2.05 g/L (range: 1.09 - 3.15 g/L); median calculated Tfsat was 0.18 (range: 0.02 - 0.25). 18 patients had a serum iron concentration less than or equal to 7 umol/L suggesting iron deficiency and 31 patients had a transferrin concentration less than the lower limit of normal (2.25 g/L). 20 patients (42%) had a Tfsat of 0.16, 25 patients (52%) had a Tfsat less than 0.20 (consistent with overt iron deficiency) and 32 patients (67%) had a Tfsat less than 0.25. No patient was determined to be vitamin B12 deficient, aluminium intoxicated, or to have significant hyperparathyroidism, although one patient was found to have a folate deficiency.

**Clinical conclusions**
Iron deficiency is common in anaemic patients starting dialysis, but other causes of anaemia are not. Anaemia screening should be limited to tests to identify iron deficiency.

**Measure of benefits used in the economic analysis**
The authors did not develop a summary benefit measure and cost savings were the principal benefit in the economic analysis.

**Direct costs**
Quantities and costs were analysed separately. Only health service costs were considered: costs of laboratory screening tests (for serum iron, transferrin, serum aluminium, intact PTH, vitamin B12 and folate) and cost of erythropoietin (EPO) treatment for one month. The additional costs associated with administration of EPO (syringes, nursing time, etc.) were not considered in the analysis. The source of the prices and price dates were not reported.

**Statistical analysis of costs**
Not performed.

**Indirect Costs**
Not stated.

**Currency**
US dollars ($).

**Sensitivity analysis**
A sensitivity analysis was carried out on the Tfsat parameter and cost of EPO.

**Estimated benefits used in the economic analysis**
Not applicable. In this analysis, the authors regarded the savings of resources due to averted treatments as benefits (i.e. economic benefit).
Cost results
The costs of laboratory screening tests were:

- $7.70 for serum iron concentration;
- $10.38 for transferrin concentration;
- $31.00 for serum aluminium concentration;
- $49.08 for intact PTH;
- $28.00 for vitamin B12;
- $28.00 for folate.

The total cost for all tests was $154.17. The cost of the tests for screening iron deficiency (serum iron and transferrin) was $18.08. Therefore the cost of screening 48 patients ($18.08 x 48) was $862.22. The cost of treatment with erythropoietin (EPO) at a standard starting dose of 6,000 U/wk for 4 weeks was $172 at a cost of $14/2,000 U of EPO. Therefore the cost of ineffectively treating the 25 iron-deficient patients in total who were unlikely to be responsive to erythropoietin was $4,300. It was assumed that the failure to respond to EPO would not be recognised for a month.

Synthesis of costs and benefits
The cost savings ratio is the cost of anaemia screening tests performed for the whole population relative to the cost of the EPO administered to EPO-refractory patients if testing had not been performed. The cost-savings ratio was 0.2019 ($862.22/$4,300) or $1 testing cost for every $4.95 of EPO saved. All other screening tests had cost-savings ratios greater than 1.0. Sensitivity analysis revealed that cost savings were even greater when a Tfsat of 0.25 was used as the criteria for iron deficiency, with a cost savings ratio of 0.1578. When the Tfsat was lower than 0.16, the cost savings ratio was reduced to 0.2524 or $3.96 saved per $1 of testing. At a Tfsat criterion of less than 0.20, the Tfsat testing remains cost saving until the cost of EPO is less than $2.82/2,000 U.

Authors' conclusions
The authors concluded that despite the high cost of erythropoietin, only the test for Tfsat was a cost-effective screen for anaemia before initiating erythropoietin therapy. The lack of cost-effectiveness of other tests reflects the fact that few patients are identified as EPO-refractory by the remaining screening tests rather than the high costs of these tests.

CRD COMMENTARY - Selection of comparators
While the choice of comparator (no treatment) is not explicitly justified, it appears to represent a variation of usual practice and is, therefore, reasonable.

Validity of estimate of measure of benefit
The study was based on an observational case-series, which may be vulnerable to confounding factors and bias. However the authors based their analysis on economic benefit rather than clinical benefit.

Validity of estimate of costs
Insufficient details were provided of the source and nature of the costs included. Costs were only from the perspective of the health service and excluded costs experienced by others in society such as patients.

Other issues
The cost-effectiveness ratios used by the authors to summarise their findings are not strictly cost-effectiveness ratios in the true sense. A cost-effectiveness ratio is a measure of the cost per unit effect. In this study, it would be better to refer to them as cost-savings ratios, but for the purposes of this database, this study has been classified under the category of a cost-effectiveness study. Unfortunately it is not possible to classify this study under the alternative category: cost-
benefit study as the economic benefits need to be estimated using willingness to pay or human capital approaches. The cost data may not be generalisable to other settings or countries.

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