Cost-effective diagnostic algorithms in pulmonary embolism: an updated analysis
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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
Diagnosis of pulmonary embolism (PE).

Type of intervention
Diagnosis.

Economic study type
Cost-effectiveness analysis.

Study population
Persons with suspected PE.

Setting
The setting was Leiden University Medical Centre, Leiden, The Netherlands.

Dates to which data relate
Effectiveness data were collected from studies previously published between 1985 and 1997. The dates of resource use data and the price year were not reported.

Source of effectiveness data
Effectiveness data were derived from a review of previously published studies.

Modelling
A decision analytic model was used to estimate costs and benefits for each diagnostic algorithm.

Outcomes assessed in the review
The following outcomes were assessed in the review: probabilities of PE, of coexisting deep venous thrombosis (DVT), and of DVT in patients without PE; diagnostic accuracy; complication rates; and prognosis.

Study designs and other criteria for inclusion in the review
Regarding the probability of DVT, studies reporting DVT in patients suspected of having PE were excluded.

Sources searched to identify primary studies
A MEDLINE search and additional searches of the bibliographies of the articles identified were conducted.
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 probability of DVT was based on information pooled from 7 studies. The accuracy of the D-dimer assay was calculated from 3 studies. All other baseline values were taken from a previously published article that pooled the results of 27 primary studies.

Methods of combining primary studies
The baseline values of variables were based on pooled data. A decision model was used to combine results of primary studies and to calculate final costs and benefits.

Investigation of differences between primary studies
Not stated.

Results of the review
The probability of PE was 24% (range: 19.9 - 32.2%). The probability of DVT in patients with proven PE was 46% (range: 12.5 - 87.5%). The sensitivity and specificity of helical CT was 95.5% (range: 63.6 - 100%) and 97.6% (range: 88.9 - 100%), respectively. The sensitivity of the D-dimer assay was 96.1% (range: 83.3 - 100) for patients with no comorbidity and 100% for patients with comorbidity. Specificity for the D-dimer assay was 60.4% (range: 42.1 - 97.6%) for patients with no comorbidity and 7.7% (range: 2.8 - 20.7%) for patients with comorbidity. Mortality of PA and helical CT was 0.5% and 0.001%, respectively. The mortality of treated and untreated PE was 1% (range: 0 - 2.6%) and 25%, respectively.

Measure of benefits used in the economic analysis
The number of lives saved at three months was used as the measure of benefits.

Direct costs
Costs were not discounted given the short time frame of the study (less than 1 year). Quantities and costs were not reported separately. Direct costs estimated the costs of diagnostic tests (including costs of equipment, medical materials, and personnel). The quantity/cost boundary adopted was that of the hospital. The estimation of quantities and costs was based on actual data. The source of quantity/cost data and the price year were not stated.

Statistical analysis of costs
Not reported.

Indirect Costs
Not included.

Currency
US dollars ($).
Sensitivity analysis
A sensitivity analysis was conducted on the mortality of untreated PE.

Estimated benefits used in the economic analysis
For patients with no comorbidity, strategies using helical CT had the highest survival rates, ranging from 99.19% to 99.39%. PA strategies had survival rates between 99.02% and 99.05%. D-dimer assay combined with CT strategies had survival rates between 98.08% and 99.19%. D-dimer assay combined with PA strategies had survival rates between 98.04% and 99.05%. Survival rates for the two reference strategies varied between 93.99% and 98.96%. For patients with comorbidity, survival rates were identical, except for D-dimer/CT strategies (range: 98.24 - 99.39%) and D-dimer/PA strategies (range: 98.04 - 99.06%).

Cost results
For patients with no comorbidity, costs per patient for the CT strategies and the PA strategies ranged from $1,038 to $1,173 and from $1,250 to $1,444, respectively. Costs for the D-dimer/CT and D-dimer/PA strategies varied between $760 and $943, and between $1,052 and $1,067, respectively. Costs for the all therapy reference strategy amounted to $2,860. For patients with comorbidity, costs were identical, except for D-dimer/CT strategies (range: $964 - $1,309) and D-dimer/PA strategies (range: $1,424 - $1,542).

Synthesis of costs and benefits
For patients with no comorbidity, ultrasound (US) followed by helical CT is the most cost-effective strategy with an incremental cost-effectiveness of $116,000 per extra life saved when compared with the D-dimer/US/CT strategy. For patients with comorbidity, the US/CT strategy has the highest cost-effectiveness with an incremental cost-effectiveness ratio of $96,667 per extra life saved when compared with the CT strategy. The optimal strategy was dependent on the mortality of untreated PE, but at relatively low values only.

Authors' conclusions
Helical CT preceded by ultrasound appears to be the most cost-effective diagnostic strategy for PE. This is true both for patients with and without comorbidity and holds for a wide range of mortality values of untreated PE.

CRD COMMENTARY - Selection of comparators
The rationale for the choice of the comparators was clear.

Validity of estimate of measure of effectiveness
Effectiveness measures were derived from a review of previously published studies, but the techniques used for pooling the data were not reported.

Validity of estimate of measure of benefit
The results depended on mortality of untreated PE, which, in its turn, may well depend on the severity of disease. This effect has not been studied in detail. No attempt was made to measure quality of life values. Given that patients have a wide variety of comorbid conditions, literature data may be insufficient to make valid assumptions concerning quality-adjusted life expectancy.

Validity of estimate of costs
Only direct costs were included and the costs of complications were excluded. No sensitivity analysis was conducted to test the robustness of the cost results. The price year and the source of quantity/cost data were not reported.

Other issues
The authors sought to update previous data with more reliable information, particularly concerning the probability of DVT and the accuracy of the D-dimer test. However, they also acknowledged the well accepted limitations of
modelling caused by uncertainties in the data (such as the potential variability in the sensitivity and specificity of the tests). These uncertainties would normally be addressed by sensitivity analyses.

**Implications of the study**
The authors noted that theoretic recommendations for an optimally cost-effective algorithm can serve only as best approximations.

**Source of funding**
None stated.

**Bibliographic details**

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**Other publications of related interest**


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