Primary PTCA versus thrombolysis with tPA in acute myocardial infarction: a formal cost-effectiveness 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
The health interventions examined in the study were primary percutaneous transluminal coronary angioplasty (PTCA) and thrombolytic treatment with tissue plasminogen activator (tPA) in the management of acute myocardial infarction (AMI).

Type of intervention
Treatment.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised a typical 60-year-old male patient presenting to the emergency department with clinical (chest pain) and electrocardiographic evidence (ST segment elevations greater than 0.2 mV in two horizontal leads, or greater than 0.1 mV in two limb leads) of AMI (irrespective of location) of recent onset (less than 6 hours).

Setting
The setting was an emergency department in a university hospital. The economic study was carried out at the Department of Emergency Medicine and Department of Cardiology, Vienna General Hospital - University of Vienna, Medical School, Vienna, Austria.

Dates to which data relate
Data on effectiveness and resource use were derived from studies published in 1993 and 1997. Data on prices used referred to January 1997 and December 1998.

Source of effectiveness data
The effectiveness evidence was derived from a review of the literature.

Modelling
A decision tree model was constructed to assess the cost-effectiveness of the two treatments. The first decision node of the tree divided patients into those treated with tPA and those with urgent angiography and primary PTCA. Further branches appeared similar. The probability of re-intervention in patients who received initial treatment with tPA, and then non-elective angiography and PTCA, was not considered due to the lack of data. Finally, the possibility of acute coronary bypass surgery was not considered, as the rates appeared to be similar between the two groups.
Outcomes assessed in the review
The outcomes assessed in the review were mortality (in-hospital deaths), intervention rates, and re-intervention rates.

Study designs and other criteria for inclusion in the review
All the primary studies included in the review were prospective randomised trials.

Sources searched to identify primary studies
The sources searched by the authors were MEDLINE, the syllabus of the 9th annual symposium for Transcatheter Cardiovascular Therapeutics in 1999, and manual browsing of the following journals between 1993 and 1997: American Journal of Cardiology, Circulation, European Heart Journal, and Journal of the American College of Cardiology.

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
Three primary studies were used as sources of effectiveness evidence.

Methods of combining primary studies
Primary studies were combined by calculating the weighted mean probabilities of the events assessed.

Investigation of differences between primary studies
Not carried out.

Results of the review
The results of the review were as follows:

Mean mortality was 4.8% (range: 2.6% - 5.7%) for primary PTCA and 6.6% (range: 3.6% - 7%) for thrombolysis and tPA.

Rates of intervention were 87% (range: 82% - 90%) for primary PTCA and 27% (range: 14% - 63%) for thrombolysis and tPA.

Rates of re-intervention were 11% (range: 7% - 19%) for PTCA and 63% (range: 57% - 73%) for thrombolysis and tPA.

Measure of benefits used in the economic analysis
The benefit measure used in the economic analysis and derived using modelling was survival until discharge from the hospital. This was represented in terms of life years gained in the cost-effectiveness calculations.

Direct costs
No discounting was carried out due to the short time horizon of the study. Unit costs and resource quantities were not
reported separately, since only costs of the acute treatments were reported, including necessary facilities, instruments, staff and drugs. Hospital costs other than those for the acute treatment were not included, since the hospital receives reimbursement per patient per day, and this was assumed to be similar in the two groups. The cost/resource boundary adopted was that of the public insurance company in Austria. The estimation of cost data was based on actual data, agreed between the Austrian Medical Association and the insurance companies for the reimbursement of medical treatments and referred to the period January 1997 to December 1998. A single price year was not reported.

**Statistical analysis of costs**
No statistical analysis of costs was carried out.

**Indirect Costs**
Indirect costs were not included.

**Currency**
Austrian schilling (ATS) converted to ECU.

**Sensitivity analysis**
One-way and multi-way sensitivity analyses were carried out to take into account the uncertainty of the data used in the decision model. The model inputs varied were all the effectiveness data derived from the literature review. The effectiveness of PTCA was then varied in comparison with thrombolysis, ranging from no benefit, through mild to moderate benefit.

**Estimated benefits used in the economic analysis**
Survival rate until discharge from the hospital was 95.2% in patients treated with PTCA and 93.4% in patients treated with thrombolysis and tPA. As a result, 56 patients need to be treated with primary PTCA in order to prevent one in-hospital death.

**Cost results**
The costs results were as follows:

The cost of coronary angiography alone was ATS 19,510 (or Ecu 1,389).

The cost of coronary angiography followed by PTCA was ATS 33,570 (or Ecu 2,390).

The cost of thrombolytic therapy was ATS 14,370 (or Ecu 1,023).

Total expected costs of the two interventions as derived from each branch in the decision model were not reported.

**Synthesis of costs and benefits**
An incremental cost-effectiveness analysis was carried out to combine costs and benefits of the interventions. The additional cost of one-life saved was ATS 3,855 (or Ecu 274) (95% CI: ATS 3,245 (Ecu 231) - ATS 4,465 (Ecu 318)). However, these values were sensitive to variations in both the probabilities of non-elective re-intervention, especially the probability of non-elective angiography in patients undergoing primary thrombolytic treatment, and the benefit of primary PTCA over thrombolysis with tPA. However, the cost per life-year gained was sensitive to the given range of intervention and re-intervention rates, ranging from a gain of ATS 35,360 (Ecu 2,518, with a minimum of interventions in the primary PTCA group and a maximum of interventions in the thrombolysis group), to an additional cost of ATS 134,270 (Ecu 9,650, with a maximum of interventions in the primary PTCA group and a minimum of interventions in the thrombolysis group).
Authors' conclusions
The authors concluded that PTCA proved to be a cost-effective option in comparison with thrombolytic management and tPA for the management of patients with AMI presenting to an emergency department, despite the substantial cost of the intervention.

CRD COMMENTARY - Selection of comparators
The rationale for the choice of the comparators was clear. PTCA and thrombolytic treatment with tPA represented valid strategies for the management of patients with AMI and none proved to be superior in terms of cost-effectiveness. You, as a user of this database, should assess whether they represent widely used interventions in your own setting.

Validity of estimate of measure of effectiveness
The analysis of the effectiveness was carried out on the basis of a review of the literature. However, the authors noted that the search produced only three studies that provided reliable data, thus leading to a wide range of intervention and outcome probabilities. Sensitivity analyses were, however, carried out to take into account the uncertainty around the effectiveness estimates. Data from primary studies were combined using a weighted average, reflecting differences in sample size, which is an appropriate approach in this context.

Validity of estimate of measure of benefit
Survival until discharge from the hospital represented the benefit measure used in the economic analysis, which was also reflected in life years gained in the incremental cost-effectiveness analysis. It was derived using a decision tree model, which appears to have been appropriate to describe the management of patients with AMI presenting to the emergency department.

Validity of estimate of costs
The analysis of costs was carried out from the perspective of the public health insurer and it appears that all relevant categories of costs were included in the analysis. Hospital costs, other than those for the acute treatments, were not included, but it is unlikely that this omission could affect the study results. No statistical analysis of costs or quantities was carried out. Reimbursement rates (charges) rather than true costs were used in the analysis and no cost-to-charge ratio was used. However, the authors acknowledged this issue, but stated that the reimbursement rates used represented the relevant costs in the light of the perspective adopted. Further limitations were represented by the lack of cost data for further in-hospital stay, which could have been substantial, and the fact that cost breakdown was not provided. Finally, unit costs and quantities of resources were not reported separately, which limits the generalisability of the results to other settings.

Other issues
The authors made few comparisons of their findings with those from other studies. The issue of the generalisability of the study results to other settings was not addressed and few sensitivity analyses were carried out. The authors’ conclusions reflected the characteristics of the study population. The authors do not appear to have presented their results selectively. The authors highlighted some limitations of the analysis and, where appropriate, these have been reported in this abstract.

Implications of the study
The authors pointed out that PTCA proved to be a cost-effective intervention for patients with AMI, but not all patients are likely to benefit equally from primary PTCA. A further implication of the study was that instruments of cardiac catheterisation have to be available at all times, and this could result in some substantial logistic problems.

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