Economic consequences of routine coronary angiography in low- and intermediate-risk patients with unstable angina pectoris  
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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 routine early invasive management with coronary angiography versus conservative therapy for patients at low to intermediate risk of unstable angina pectoris (UAP) and non-ST-elevation acute myocardial infarction (AMI).

Type of intervention  
Treatment.

Economic study type  
Cost-effectiveness analysis.

Study population  
The study population comprised adult patients (over 50 years old) with a low or intermediate risk of death or AMI from UAP and non-ST-elevation AMI. Eligible patients had chest discomfort at rest, typical for myocardial ischaemia, which lasted for at least 5 minutes but for 6 hours or less, within 24 hours of enrolment and with objective evidence of ischaemic heart disease.

Setting  
The setting was secondary care. The economic study was carried out in the USA.

Dates to which data relate  
The effectiveness and resource use data were derived from the TIMI 3B trial which randomised patients from 1989 to 1992. Details of the design and participants have been reported already (Antman et al., 2000, see 'Other Publications of Related Interest' below for bibliographic details). For resources used, the authors used 1999 Medicare reimbursement data and 2001 physician fee schedule (Health Care Financing Administration Medicare Databases). The price year was not stated.

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

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

Study sample
The original trial enrolled 1,473 patients presenting with UAP and non-ST-elevation AMI (Antman et al., 2000). It was unclear whether power calculations were used to determine the sample size. Of the 84.9% of patients who were classified as low or intermediate risk, 624 were in the conservative arm and 626 in the invasive arm. In the invasive arm, 98% underwent cardiac catheterisation, 275 underwent percutaneous intervention, and 24% underwent coronary bypass surgery. In the conservative arm, 57% underwent cardiac catheterisation, 23% underwent percutaneous intervention, and 18% underwent coronary bypass surgery.

**Study design**
The study was a multi-centred randomised controlled trial (RCT) that was conducted in 25 clinical centres in the USA and Canada. After receiving medical therapy, the patients were randomly assigned to undergo cardiac catheterisation within 48 hours (invasive) or continued medical management (conservative).

**Analysis of effectiveness**
The basis of the analysis of effectiveness (i.e. intention to treat or treatment completers only) was not stated in the present paper. Details on the comparability of the patients at baseline were also not given. These may have been reported in the parent study (Antman et al., 2000). The clinical outcomes assessed were death rate, MI, and rehospitalisation for ischaemia at rest.

**Effectiveness results**
At 42 days and 1 year there was no statistically significant difference in the incidence of death or MI between conservative and invasive therapy.

When rehospitalisation due to ischaemia at rest was added, invasive therapy was superior to conservative therapy at 42 days, (p=0.005), and at 1 year, (p=0.03). In addition, 5.4% of rehospitalisations could have been avoided with the invasive strategy.

**Clinical conclusions**
At 42 days and 1 year there was no statistically significant difference in the incidence of death or MI between conservative and invasive therapy. However, rehospitalisations were significantly reduced with the invasive therapy.

**Modelling**
To assess potential symptomatic benefits resulting from cardiac catheterisation in low- and high-risk patients, the authors examined the impact of an early invasive strategy in high- and low-risk strata with regard to an expanded end point, which added ischaemia at rest requiring rehospitalisation to death and MI at 42 days and 1 year. This was studied in a multivariate logistic model using risk category and treatment assignment as predictor variables. The model was expanded to include an interaction term between risk category and treatment assignment, to test for a differential benefit across risk categories attributable to the early invasive strategy.

**Measure of benefits used in the economic analysis**
The measure of benefit used was the number of rehospitalisations avoided.

**Direct costs**
The authors considered the cost of procedures and hospitalisation for unstable angina as well as physician costs. For procedures and hospitalisation they used 1999 Medicare reimbursement data for the most appropriate cardiac Diagnosis-Related Group (DRG), plus the cost of physician fees for the major procedures for 2001 as published in the Health Care Financing Administration's Medicare Database. The total cost of hospitalisation was derived through modelling (i.e. initial hospitalisation cost for invasive and conservative management strategies was calculated as a weighted average of the costs of the actual outcomes noted in the TIMI 3B trial, see Antman et al., 2000). Discounting was
appropriately not carried out as the follow-up period was one year. The authors did not state whether the costs were reflated, or report any method used for this. The quantities and the costs were not presented separately. The price year was not stated.

**Statistical analysis of costs**
The costs were treated deterministically.

**Indirect Costs**
No indirect costs were included in the analysis.

**Currency**
2001 US dollars ($).

**Sensitivity analysis**
The authors only presented one threshold type re-calculation of their results.

**Estimated benefits used in the economic analysis**
The number of avoided rehospitalisations was 34 in favour of the invasive management strategy.

**Cost results**
The additional cost of performing catheterisation in all 624 low- and intermediate-risk patients in the conservative arm of the TIMI 3B trial would have been $2,695,700.

**Synthesis of costs and benefits**
The average cost per hospitalisation prevented was $79,285, compared with $14,043 for the current cost of this hospitalisation.

If all high-risk patients were managed invasively, and all low and intermediate-risk patients were managed conservatively, the overall cost per hospitalisation prevented could be reduced to $13,850.

**Authors’ conclusions**
Routine early invasive management of low- and intermediate-risk patients with unstable angina pectoris (UAP) generates substantial health care costs without a mortality benefit or decrease in the risk of acute myocardial infarction (AMI). Unless the incremental benefit in quality of life from prevented rehospitalisations for UAP is judged to be worth the large incremental cost of $79,285 per hospitalisation prevented, such a strategy is unlikely to be cost-effective.

**CRD COMMENTARY - Selection of comparators**
The authors provided an explicit justification for the comparator used. Routine early invasive management for low- and intermediate-risk patients is common clinical practice. You should decide if this represents a widely used technology in your own setting.

**Validity of estimate of measure of effectiveness**
The authors based their analysis on one RCT and one observational study, which seem appropriate for the study question. The authors do not appear to have reviewed other sources of effectiveness and, as such, the effectiveness...
estimates derived may not be the best available. It was not possible to comment on the internal validity of the effectiveness results since the authors referred to a separate paper for details of the clinical study. The authors appear to have used data from the studies selectively.

Validity of estimate of measure of benefit
As the main clinical outcomes (death and MI) were shown to be similar, the economic analysis was based on the number of avoided rehospitalisations due to ischaemia at rest, which was shown to be statistically significantly different. This outcome is specific to the health care programme being considered. The use of a utility measure, such as the quality-adjusted life-year, would have facilitated cross-programme comparisons.

Validity of estimate of costs
The authors did not report a perspective for their analysis. It seems to have been conducted principally from the third-party payer perspective, as Medicare fees were used for the costs. However, it was unclear whether all the relevant costs were included in the analysis, or if any omissions could have affected the conclusions. The authors recognised that the trial study on which they based their analysis was not designed to examine economic outcomes, and that it was impossible to account for differences in drug utilisation, although they stated that this issue is unlikely to have biased the results.

The costs and the quantities were not presented separately. In this sense it would be very difficult to rework the analysis in other settings. The costs were treated deterministically. The authors did not report any measure of variance or the result of any statistical analysis. This introduces possible uncertainty into the results. The authors appear to have used source for prices from two different years (1999 and 2001) and it was unclear if appropriate price reflations were performed. No discounting was performed, but this was appropriate as the follow-up period was one year.

Other issues
The authors compared their findings with those from other studies and found them, generally, to be in agreement. The issue of the generalisability of their findings was not directly addressed. The authors discussed some limitations of their study. First, they relied on data from a trial that enrolled patients in an era before the advent of glycoprotein IIb/IIIa antagonists and low molecular weight heparins. These agents may further improve the efficacy of conservative treatment in unstable angina. Second, there has been a widespread use of intracoronary stenting, which post-dates the present trial. Third, the TIMI 3B trial was not designed to examine economic outcomes and, therefore, it was not possible to account for differences in drug utilisation, outpatient follow-up and indirect costs. The authors concluded, however, that the results of the present study are valid despite more recent data.

Implications of the study
Within the caveats of the study(s findings, the implications for clinical practice are that low-intermediate risk patients with UAP and non-ST-elevation AMI, who are receiving early invasive management, have similar mortality and MI rates to those receiving conservative management. The rate of rehospitalisation due to ischaemia at rest, however, is lower for the early invasive strategy. The economic costs to achieve this are high and would need to be assessed using quality of life measures within a cost-utility analysis.

Source of funding
None stated.

Bibliographic details

PubMedID
Other publications of related interest


Indexing Status
Subject indexing assigned by NLM

MeSH
Aged; Angina, Unstable /economics /physiopathology /radiography; Coronary Angiography /economics; Cost-Benefit Analysis; Death, Sudden, Cardiac /etiology /prevention & control; Electrocardiography; Health Care Costs; Hospitalization /economics; Humans; Logistic Models; Middle Aged; Myocardial Infarction /economics /physiopathology /prevention & control; Outcome Assessment (Health Care); Randomized Controlled Trials as Topic; Risk Factors

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