What are appropriate rates of invasive procedures following acute myocardial infarction: a systematic review

Scott I A, Harden H, Coory M

Authors' objectives
To identify studies that address the effects of elective coronary angiography (CA) and revascularisation (RV) in the subacute phase of acute myocardial infarction (AMI), and to identify differences in the outcome associated with higher versus lower rates of use of these procedures.

Searching
MEDLINE (from January 1990 to September 1999), Current Contents (from 1990 to 1999) and the Cochrane Library (Issue 4, 1999) were searched for RCTs using the following search terms: 'myocardial infarction', 'coronary angiography', 'coronary angioplasty', 'coronary artery bypass surgery' and 'clinical trial'. The bibliographies of the retrieved articles were examined for additional trials. Reports published prior to 1990 were excluded. MEDLINE and Current Contents were searched similarly for observational studies, but using 'cohort' as study design.

For integrative studies, MEDLINE, Current Contents, HealthSTAR and CINAHL were searched from 1990 to 1999. The search terms used were 'myocardial infarction', 'practice guidelines', 'consensus development conference', 'decision analysis', 'expert' and 'review'. Websites of the Agency for Health Care Policy and Research, the Canadian Medical Association, Clinical Practice Guidelines Infobase, and the Scottish Intercollegiate Guidelines Network were also accessed.

Study selection
Study designs of evaluations included in the review
The review examined three groups of publications: RCTS comparing mandatory ('invasive') versus selective ('conservative') use of CA and RV following AMI; observational studies that examined high and low rates of post-infarct procedural use on mortality in defined cohorts of AMI patients; and integrative studies consisting of clinical practice guidelines, expert panel statements and decision analyses dealing with procedural recommendations in the subacute phase of AMI.

RCTs were included if the method of randomisation and intention-to-treat analyses were clearly specified, less than 10% of the patients were lost to follow-up, and the rates of death and reinfarction could be derived from the reported data. Observational studies were selected if the study design used formal methods and procedural rates and survival data were reported.

In the section on integrative studies, it was stated that articles were selected if their content satisfied critical appraisal criteria for inclusion (see Other Publications of Related Interest). No further details of these criteria were provided.

Specific interventions included in the review
Elective CA and RV. RV included percutaneous transluminal coronary angioplasty (PTCA) and coronary artery bypass grafting (CABG). Studies that focused on acute phase interventions (e.g. primary or rescue angioplasty) or non-elective procedures for acute complications (e.g. cardiogenic shock) were excluded.

Participants included in the review
Studies of patients in the subacute phase (more than 12 hours after the acute event) of AMI who underwent elective CA or RV were included. Observational studies were selected if AMI was the principal discharge diagnosis.

Outcomes assessed in the review
For randomised controlled trials (RCTs), the primary outcomes were rates of death and reinfarction. The secondary outcomes, where stated, were the frequency of limiting angina, measures of left ventricular function, rates of readmission and the overall health service costs.
For observational studies, the primary outcomes were also mortality and reinfarction rate. However, all the studies except one adjusted the outcome results according to baseline patient characteristics, and the methods used varied between the studies. The other outcomes used were anginal symptoms at study conclusion, left ventricular function, prevalence of clinical heart failure, length of hospital stay, median hospital costs and the readmission rates.

**How were decisions on the relevance of primary studies made?**
A single author reviewed the abstracts of articles for studies meeting the selection criteria.

**Assessment of study quality**
RCTs were included if the method of randomisation and intention-to-treat analyses were clearly specified, and if less than 10% of the patients were lost to follow-up. Observational studies were selected if AMI was the principal discharge diagnosis, the study design used formal methods, and procedural rates and survival data were reported. For integrative studies, articles were selected if their content satisfied critical appraisal criteria for validity (see Other Publications of Related Interest).

The authors do not state how the papers were assessed for validity, or how many of the reviewers performed the validity assessment.

**Data extraction**
The authors do not state how the data were extracted for the review, or how many of the reviewers performed the data extraction.

The data extracted from the RCTs comprised patient characteristics, clinical settings, time of randomisation, description of 'invasive' and 'conservative' strategies, the numbers of patients undergoing procedures, and primary outcome measures of mortality and reinfarction. The secondary outcome measures, where stated, included the frequency of limiting angina, measures of left ventricular function, rates of readmission and the overall health service costs. The same data were extracted from the observational studies, plus methods of risk adjustment were applied to the outcome, where stated. It was unclear what data were extracted from the integrative studies.

**Methods of synthesis**
How were the studies combined?
Tabulated process and outcome measures, expressed as percentages, were compared using chi-squared methods. The primary outcome measures were mortality and reinfarction. The pooled odds ratio (OR) and risk difference were calculated, along with 95% confidence intervals (CIs), based on a fixed-effect (Peto) model.

How were differences between studies investigated?
Heterogeneity was assessed using chi-squared tests, and by comparing fixed-effect with random-effects models.

**Results of the review**
Nine trials comprising 10,740 patients were included in the randomised trials section, and 12 studies comprising 40,802 patients in the observational studies section. Eight reports appear to have been included in the integrative studies section.

Only those results for the primary outcome measures, as defined by the authors, are reported here. Further analyses were reported in the paper.

Randomised trials (9 trials).

The studies differed in terms of the patient exclusion criteria, timing of randomisation (18 hours to 4 weeks), method of RV (PTCA only versus PTCA or CABG), extent of crossover between the groups (10 to 40%) and the length of follow-up (7 days to 4 years). Two trials included patients with acute coronary syndromes with no separate reporting of AMI. One study included only high-risk patients. One study performed CA on all patients.
In the 9 included trials, patients randomised to an 'invasive' strategy showed no reduction in mortality at the study conclusion in comparison with the 'conservative' group (OR 1.00, 95% CI: 0.85, 1.19). The authors stated that the reinfarction rates tended to be lower overall in the 'invasive' group (OR 0.89, 95% CI: 0.78, 1.01).

Observational studies (12 studies).

The adjusted mortality was similar in both the high- and low-rate groups (22.8%: OR 1.00, 95% CI: 0.94, 1.05), but the reinfarction rates were higher in high-rate populations (8.0% versus 6.4%; OR 1.28, 95% CI: 1.12, 1.46, p<0.001).

Integrative studies (8 reports).

It was suggested that all 8 articles concluded that post-AMI patients exhibiting recurrent angina, reinfarction or strongly positive stress tests, combined with left ventricular dysfunction, show a high incidence of multi-vessel coronary disease and derive unadjusted mortality reductions from RV of up to 17%.

Cost information
In the integrative studies section, there was one report in which a decision analysis evaluated the cost-effectiveness of procedures following AMI. The decision analysis suggested that RV procedures are cost-effective in the selected group of patients: less than US$50,000 per quality-adjusted life-year gained. Observational studies (n=2) suggested no difference in the median hospital costs between the high- and low-rate populations.

Authors' conclusions
In the subacute phase of AMI, rates of CA and RV in excess of 30 and 20%, respectively, may not confer additional benefits in preventing death or reinfarction. However, variability between the studies in terms of their design, patient selection, and extent of crossover from medical to procedural groups, as well as the limited data on symptom status, limits the generalisability of the results.

CRD commentary
The authors attempted to answer a clinically important question by carrying out three reviews within one review paper. The primary end points of mortality and reinfarction rates were simple measures. The inclusion criteria for the reviews of randomised studies and observational studies were clear.

The authors did not state the language of publications considered for the review nor whether non-English articles were included. The search was restricted to published data and the search terms appear to have been fairly limited. This could have led to some studies being missed. In addition, it was implied (within the paper) that only one author was responsible for selecting the papers for inclusion in the review. This may have introduced bias into the selection process. Little information on the patient characteristics and settings was provided.

The reviews were well reported. However, it may not be valid to draw a single conclusion from them, where this conclusion cites specific figures that are not evident from the text.

Implications of the review for practice and research
Practice: The authors state that high rates of late intervention in post-AMI patients may not be justified in terms of mortality, reinfarction or health care cost reduction.

Research: The authors state that more trials are needed to study new RV techniques such as coronary stenting, as well as to assess recurrent cardiac events, quality of life, costs of care in the longer term and mortality. There is also a need to identify high-risk subgroups which would receive proportionally greater benefits.

Reviewer's statement: The need for larger, more highly powered trials is evident.
Bibliographic details

PubMedID
11247616

Other publications of related interest

Indexing Status
Subject indexing assigned by NLM

MeSH
Angioplasty, Balloon, Coronary /utilization; Coronary Angiography /utilization; Coronary Artery Bypass /utilization; Decision Support Techniques; Humans; Myocardial Infarction /diagnosis /therapy; Outcome and Process Assessment (Health Care); Practice Guidelines as Topic

AccessionNumber
12001000597

Date bibliographic record published
30/11/2003

Date abstract record published
30/11/2003

Record Status
This is a critical abstract of a systematic review that meets the criteria for inclusion on DARE. Each critical abstract contains a brief summary of the review methods, results and conclusions followed by a detailed critical assessment on the reliability of the review and the conclusions drawn.