Efficacy of exercise-based cardiac rehabilitation post-myocardial infarction: a systematic review and meta-analysis of randomized controlled trials

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CRD summary
The authors concluded that exercise-based cardiac rehabilitation was associated with reductions in mortality and re-infarction after myocardial infarction. This conclusion reflects the evidence presented, but potential methodological weaknesses in the review process (and the sub-optimal quality of included trials) means that the reliability of this review is unclear.

Authors' objectives
To evaluate the effectiveness of exercise-based cardiac rehabilitation in patients after myocardial infarction.

Searching
MEDLINE was searched to June 2010 for articles published in English in peer-reviewed journals. Search terms were reported. The bibliographies of identified articles were scanned for further studies.

Study selection
Eligible randomised controlled trials (RCTs) compared exercise-based cardiac rehabilitation with a non-exercising control group in patients after myocardial infarction; follow-up was a minimum of 12 weeks. Interventions had to have at least two weeks duration; they could be single or multi-component and included supervised or unsupervised exercise in an outpatient, in-patient or community setting. Trials had to report at least one of the following outcomes: all-cause mortality; cardiac mortality; re-infarction; re-vascularisation (percutaneous coronary intervention or coronary artery bypass surgery); or modifiable cardiovascular risk factors (weight, lipids, blood pressure and smoking).

Where reported, the included interventions varied in terms of exercise content (aerobic, resistance training, mixed aerobic/anaerobic or undirected); duration (two weeks to three years, although most programmes ran for a minimum of one month); and time from myocardial infarction to programme commencement. Many trials included exercise-only cardiac rehabilitation programmes, but trials were also included in which exercise-based cardiac rehabilitation was part of a secondary prevention programme. Most participants were men (88.9%) with a mean age of 54.7 years. In addition to the stated eligible outcomes, cardiovascular mortality (such as mortality due to cerebrovascular or peripheral vascular disease) was assessed. Re-infarction included fatal and non-fatal recurrent events.

The authors did not state how many reviewers carried out the study selection.

Assessment of study quality
Trial quality was assessed using the Jadad scale, covering randomisation, blinding, withdrawals and drop-outs. Trials were scored as high or low quality. In the secondary analysis (influence of study characteristics on outcomes), sample size and follow-up time were used as proxies for study quality.

The authors did not state how many reviewers carried out the quality assessment.

Data extraction
Data were extracted to enable the calculation of odds ratios (OR) and 95% confidence intervals (CI) on an intention-to-treat basis.

Two reviewers independently carried out the data extraction. Disagreements were resolved by consensus or by a third reviewer.

Methods of synthesis
Odds ratios were pooled in a random-effects meta-analysis (DerSimonian and Laird). A 0.5 continuity correction was used for zero-events. Statistical heterogeneity was assessed with $I^2$. Data on cardiovascular risk factors were synthesised.

narratively. Stratified meta-analyses were conducted to examine the influence of publication date (1990 and earlier; 1991 to 2000; 2001 onwards; and before 1995 versus after 1995), intervention duration (less than three months versus over three months) and follow-up (six months or less; six to 12 months; and over 12 months), and sample size. Sensitivity analyses were carried out excluding RCTs with no events in both study arms; those with no events in one arm; another trial with unspecified diagnostic criteria; and a large trial published in 1979. Publication bias was assessed using a funnel plot.

**Results of the review**
Thirty-four open-label RCTs (6,111 participants) were included in the review. Five trials were classed as high quality, the remainder were low quality. Follow-up ranged from three months to five years. No further quality details were reported.

Exercise-based cardiac rehabilitation resulted in statistically significant lower risks of re-infarction (OR 0.53, 95% CI 0.38 to 0.76; 18 trials); cardiac death (OR 0.64, 95% CI 0.46 to 0.88; 22 trials); cardiovascular death (OR 0.60, 95% CI 0.40 to 0.76); and all-cause mortality (OR 0.74, 95% CI 0.58 to 0.95; 31 trials). There was no statistically significant difference for re-vascularisation. No significant heterogeneity was found.

Effect sizes were similar to the main analysis for all durations of intervention, but these were statistically significant only for those over three months in terms of cardiovascular mortality, cardiac mortality and re-infarction. Significant benefits were seen for re-infarction, cardiac mortality and all-cause mortality where there was more than 12 months between the end of the intervention and end of follow-up. Further results were reported. Sensitivity analysis did not alter the main findings. There was no evidence of publication bias.

**Authors’ conclusions**
Exercise-based cardiac rehabilitation was associated with reductions in mortality and re-infarction in patients following myocardial infarction.

**CRD commentary**
The review question was clear and inclusion criteria were sufficiently detailed to enable replication. The search was restricted to one major database and language and publication limitations meant that relevant studies might have been missed. The review process was subject to error and bias in terms of study selection and the assessment of methodological quality. An appropriate quality assessment tool was applied, but the absence of fully-reported results made it difficult to verify the authors’ judgement.

Trials were deemed largely low quality. Study details were presented, the chosen method of synthesis appeared to be appropriate and a range of sub-group analyses were performed. The authors’ conclusion reflected the evidence presented, but potential methodological weaknesses in the review process and the apparent sub-optimal quality of included trials meant that the reliability of this review was unclear.

**Implications of the review for practice and research**
**Practice:** The authors did not state any implications for practice.

**Research:** The authors stated that a randomised controlled trial was required to confirm whether even shorter cardiac rehabilitation programmes translated into improved long-term outcomes. In particular, research should investigate the optimal point at which the benefits of exercise-based cardiac rehabilitation occurs post-myocardial infarction. Future research should also focus on women and older patients.

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**Bibliographic details**

**PubMedID**
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.