Clinical trials versus the real world: the example of cardiac rehabilitation

Outcomes in clinical medicine do not always match those of clinical studies. This paper looks at cardiac rehabilitation in the UK to see if the reality meets the expectations.

Abstract

Clinical practice should follow evidence-based medicine, which is derived from clinical trials. The outcomes of clinical practice, however, may not equal that of trials if there are differences in the patients or the quality of treatment they receive. We report the example of cardiac rehabilitation to illustrate this point, comparing the characteristics of patients and treatments offered in randomised controlled trials (RCTs) in this area with those included in two large surveys of cardiac rehabilitation in the UK. We found that cardiac rehabilitation as currently practised in the UK is unlikely to be as effective as clinical trials may suggest.

Key words: cardiac rehabilitation, evidence-based medicine, exercise.

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Introduction

Modern clinical practice is underpinned by evidence-based medicine, which is formulated from the results of randomised controlled trials (RCTs) and meta-analyses of these studies. Evidence-based medicine is supported and disseminated through guidelines and, in some cases, by political action – either through quality indicators or through financial incentives. When some evidence-based treatments are applied in practice, the outcomes are much less favourable than would be expected from the results of RCTs, as illustrated by the ALLHAT trial of pravastatin in hypertensive patients.[1]

This difference between RCTs and real life may be due either to the difference in patient characteristics or in the way in which the treatment is applied. There are little empirical data on this.

Cardiac rehabilitation is an intervention which has been shown in a Cochrane review to reduce cardiac mortality by 26% and overall mortality by 20% over three years.[2,3] We believe there may be a difference between the characteristics and the management of patients included in controlled trials of cardiac rehabilitation and those treated in cardiac rehabilitation units in the UK, meaning that the effectiveness of real life cardiac rehabilitation in the UK is possibly less than that suggested by Cochrane. This possibility is supported by one recently conducted large multi-centre controlled trial of cardiac rehabilitation in the UK which showed no benefit to the treated patients.[4]

We have compared the characteristics and treatment of patients from the RCTs included in the Cochrane review with the patients in two separate studies – an annual survey of all cardiac rehabilitation centres in the UK[5] and a detailed survey of a sample of cardiac rehabilitation centres in England.[6]

Methods

The British Association for Cardiac Rehabilitation (BACR) performs an annual questionnaire survey of the 325 cardiac rehabilitation programmes in the UK.[5] Questions include the number, sex and diagnoses of patients treated over the previous year. We have used the results for the year ending 31st March 2004.

The Coronary Prevention Group performed a detailed survey of a sample of cardiac rehabilitation centres in England in 2004.[6] One centre was chosen at random for each of the 28 Strategic Health Authorities. The questionnaire included questions about the structure of the rehabilitation programme, the number of sessions of exercise and education given.

We compared the patient characteristics and the programme details with those reported by the RCTs included in the Cochrane review of cardiac rehabilitation for 2004.[2,3]

> ***'This study shows considerable differences between the RCTs of cardiac rehabilitation and actual practice in the UK'***

Results

Table 1 shows the characteristics for the population and the cardiac rehabilitation intervention for the Cochrane review and for the two surveys of UK practice. The RCTs included younger patients and fewer women than are seen in UK cardiac rehabilitation programmes. UK programmes also included more than three times the proportion of revascularisation patients. Some 39% of RCTs were exercise only programmes compared with none of the UK programmes. Compared with usual practice in the UK, the RCTs used more exercise sessions, more frequent sessions and ran for a longer period. The total dose of exercise used in RCTs was more than four times greater than is usual UK practice.

Table 1. Patient characteristics and treatments offered in the randomised controlled trials reported by the Cochrane Report compared with those offered by UK programmes included in two national surveys of UK provision of cardiac rehabilitation

	Cochrane report	British Association Of Cardiac Rehabilitation survey	Coronary Prevention Group survey
Population characteristics			
Mean age (SD)	54.3 years (3.9)	64.2 years (11.6)	Unknown
Women (SD)	10.4% (14.1)	26.4%	Unknown
Myocardial infarction	86%	53%	Unknown
Coronary artery bypass graft	6%	24%	
Percutaneous transluminal coronary angioplasty	5%	13%	
Intervention characteristics			
Exercise-only programmes (%)	17/44 (39%)	0/242 (0%)	0/28 (0%)
Overall duration (SD)	18 weeks (21)	7.5 weeks (3.2)	7 weeks (2.1)
Mean exercise duration/session, minutes	58	Unknown	60
Mean frequency exercise sessions/week	2.80	1.66	1.67
Mean exercise intensity, %VO_2 or HR max	75	Unknown	Unknown
Mean number of sessions	50	12.4	12
Hospital based (%)	40/44 (91%)	166/302 (66%)	28/28 (100%)

Key: VO_2 = estimated peak oxygen consumption per minute; HR = heart rate

Key messages

- Evidence suggests the outcomes of cardiac rehabilitation in the UK are less beneficial than suggested by randomised controlled trials, which included younger patients, fewer women and more infarct patients
- The randomised controlled trials used nearly four times the exercise dose that is commonly applied in UK programmes
- These differences partly explain the apparent ineffectiveness of UK cardiac rehabilitation programmes

Discussion

This study shows considerable differences between the RCTs of cardiac rehabilitation and actual practice in the UK for the characteristics of both the patients and the interventions which they undertake.

It is logical to use the results of clinical trials to decide the value of different treatments if:

- the patients to be treated have the same characteristics as the patients included in the clinical trials
- the treatment is applied in the same way as in the clinical trials
- the patients are managed with the same care as the treatment group in clinical trials.

If these three conditions are not met, the results of day-to-day treatment may fall short of those expected from the results of trials.

It has been shown that cardiac rehabilitation has similar benefits for men and women for physical fitness and psychological gains[7] and that older patients gain as much as younger patients.[8] It is not known whether the mortality benefits of cardiac rehabilitation are equal between men and women or between younger and older patients.

The diagnostic mix of patients included in the RCTs differs markedly from that seen in cardiac rehabilitation programmes in the UK. In the RCTs, 86% of patients were recovering from acute myocardial infarction, compared with only 53% in UK cardiac rehabilitation programmes. Since the prognosis of revascularisation patients is so much better than that of infarct patients, the overall mortality reduction seen in practice is likely to be less than that found in the RCTs.

Finally the differences in interventions between the RCTs and the usual UK cardiac rehabilitation programme are considerable and make extrapolation of the results of one to the other very uncertain. The total dose of exercise received by the participants in the RCTs was over four times that received by the average patient being treated in a UK cardiac rehabilitation programme.

> ***'One obvious change would be to increase the exercise dose offered in cardiac rehabilitation programmes'***

In this study we have only examined the patient age, sex and diagnostic characteristics and the treatment offered by cardiac rehabilitation centres. Most of the RCTs included in the Cochrane review were performed before the age of thrombolysis, routine statin prescription and the modern criteria for diagnosis of myocardial infarction. All these factors may also have affected the outcomes of cardiac rehabilitation.

In the year 2000, the National Service Framework for coronary heart disease was published and set "clear standards for prevention and treatment of coronary heart disease that will lead

to major improvements in quality and access". The stated intention was to "reduce the burden of coronary heart disease in England" and chapter seven was devoted to cardiac rehabilitation. We believe that, based on our findings, cardiac rehabilitation as currently practised in the UK may not be contributing to this intention as well as the RCTs suggest. One obvious change would be to increase the exercise dose offered in cardiac rehabilitation programmes to bring them closer to the RCTs.

Conflict of interest

HJNB is in receipt of an NHS R&D grant. The Coronary Prevention Group Survey was funded by the Coronary Prevention Group and aided by grants from Shropshire and Staffordshire SHA, North East London SHA, the PF Charitable Trust and the Steel Charitable Trust.

References

1. The ALLHAT Officers and Coordinators for the ALLHAT Collaborative Research Group. Major outcomes in moderately hypercholesterolaemic, hypertensive patients randomised to pravastatin vs usual care: the antihypertensive and lipid-lowering treatment to prevent heart attacks trial (ALLHAT-LLT). *JAMA* 2002;**288**:2998-3007.
2. Jolliffe JA, Rees K, Taylor RS, Thompson D, Oldridge N, Ebrahim S. Exercise-based rehabilitation for coronary heart disease (Cochrane review). In: Cochrane Library, Issue 4, 2000. Update software.
3. Taylor RS, Brown A, Ebrahim S *et al*. Exercise based cardiac rehabilitation for patients with coronary heart disease: Systematic review & meta-analysis of randomized controlled trials. *Am J Med* 2004;**116**:682-92.
4. West RR, Beswick AD. Mortality, psychological well-being and lifestyle factors following cardiac rehabilitation: results of multicentre randomised trial. *Heart* 2002;**87**:S41 (abstract).
5. Bethell HJN, Turner SC, Evans J, Rose L. Cardiac rehabilitation in the United Kingdom: How complete is the provision? *J Cardiopulm Rehabil* 2001;**21**:111-15.
6. Brodie D, Bethell HJN, Breen S. Cardiac rehabilitation in England: a detailed national survey. *Europ J Cardiovasc Prev Rehabil* 2004;**13**: 122-8.
7. Cannistra LB, Balady GJ, O'Malley CJ *et al*. Comparison of the clinical profile and outcome of women and men in cardiac rehabilitation. *Am J Cardiol* 1992;**69**:1274-9.
8. Stahle A, Mattsson E, Ryden L *et al*. Improved physical fitness and quality of life following training of elderly patient characteristics and outcome of cardiac rehabilitation patients after acute coronary events. *Eur Heart J* 1999;**20**:1475-84.

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