Systematic review of studies of the effect of hyperoxia on coronary blood flow


CRD summary
The review found that hyperoxia from high-concentration oxygen therapy markedly reduced coronary blood flow and myocardial oxygen consumption and that more research was required. In view of the small sample sizes available, poor reporting of review methods and failure to assess study validity, the authors’ conclusions may require a degree of caution. Their recommendation for more research appears justified.

Authors' objectives
To investigate the clinical and physiological effects of hyperoxia on coronary blood flow in patients with and without cardiac disease.

Searching
MEDLINE, Cochrane Database of Systematic Reviews, EMBASE and CINAHL were searched in December 2007. Search terms were reported. Reference lists of relevant studies were checked for additional studies.

Study selection
Any studies that measured coronary blood flow during inhalation of room air and during ventilation with supplemental oxygen in patients with and without cardiac disease were eligible for inclusion. Studies of hyperbaric oxygen and oxygen infusion were excluded. Outcomes of interest in the review were coronary blood flow (primary outcome) and coronary vascular resistance, myocardial oxygen consumption and arterial/coronary sinus oxygen content difference (secondary outcomes).

Participants in most included studies had either coronary artery disease (described in most studies as stable) or congestive heart failure; one study included healthy subjects. All participants in the review inhaled room air with a mean oxygen partial pressure (PaO\textsubscript{2}) of 72mmHg to 78mmHg. This was followed by oxygen therapy either at 10L to 15L per minute via a face mask or from a reservoir-bag mask with 100% oxygen that yielded a mean PaO\textsubscript{2} of 273mmHg to 425mmHg. Coronary blood flow was measured by thermodilution or intra-arterial Doppler flow at differing sites (coronary sinus, left or right coronary artery, left anterior descending artery).

Two reviewers selected the studies.

Assessment of study quality
The authors did not state that they assessed validity.

Data extraction
Mean values and standard errors were extracted for each treatment group and the percentage change associated with each treatment was extracted or calculated.

The authors did not state how many reviewers performed data extraction.

Methods of synthesis
Data were unsuitable for meta-analysis because appropriate measurements of variance were not reported or calculable in the primary studies. Date were combined in a narrative synthesis, grouped according to outcome.

Results of the review
Four studies with six study arms were included in the review. Each study arm had a paired before and after design (n=66, range six to 16 in each arm).

In all study arms there was a statistically significant reduction in coronary blood flow associated with the intervention
(mean change -7.9% to -28.9%, p<0.05), with no statistically significant change in the diameter of the large conduit coronary arteries.

Four study arms measured coronary vascular resistance. In all cases there was a statistically significant increase associated with the intervention (mean change 21.5% to 40.9%, p<0.01 where reported).

Three study arms measured myocardial oxygen consumption. In all cases there was a statistically significant reduction associated with the intervention (mean change -15.3% to -26.9%, p<0.05).

The review also reported: lactate concentration; left ventricular haemodynamics, contractility and relaxation; and oxidant mechanisms.

Authors’ conclusions
The review found that hyperoxia from high-concentration oxygen therapy markedly reduced coronary blood flow and myocardial oxygen consumption. More research was required.

CRD commentary
Objectives and inclusion criteria of the review were clear. Relevant sources were searched for studies. It was unclear whether the search was limited by language and it appeared that no specific attempts were made to retrieve unpublished studies, so the review may have been subject to language and publication biases. It was unclear to what extent steps were taken to minimise the risk of reviewer bias and error (such as by having more than one reviewer independently undertake review processes). The process of data extraction was not described and it appeared that study validity was not assessed, so the reliability of the data was unclear. Combining studies by narrative synthesis was appropriate given the lack of data suitable for meta-analysis. In view of the small sample sizes available, poor reporting of review methods and failure to assess study validity, the authors’ conclusions may require a degree of caution. Their recommendation for more research appears justified.

Implications of the review for practice and research
Practice: The authors stated that in patients with uncomplicated myocardial infarction, high-flow oxygen therapy may increase infarct size and the risk of mortality.

Research: The authors stated that randomised controlled trials of oxygen therapy for acute coronary syndromes and other cardiac conditions (such as heart failure) were urgently needed.

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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.