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Oral presentation

Cardiovascular effects of inhaled oxygen assessed with magnetic resonance imaging

Stefan Bodetoft, Marcus Carlsson, Håkan Arheden and Ulf Ekelund*

Address: Departments of Emergency Medicine and Clinical Physiology, Lund University Hospital, Sweden

Email: Ulf Ekelund* - ulf.ekelund@med.lu.se

* Corresponding author

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Introduction

International practice guidelines prescribe the administration of 10–15 liters/min of O_2 to all critically ill patients, including to those who are initially normoxic. However, there are observations to suggest that inhaled supplemental O_2 may increase blood pressure and decrease cardiac output (CO) and coronary blood flow (CBF). The aim of this study was to establish the acute cardiovascular effects of oxygen inhalation in healthy subjects, using frontline cardiac magnetic resonance imaging (MRI).

Methods

16 healthy adults (34–54 years old, 8 females) inhaled O_2 at 1, 8 and 15 l/min through a bag-valve mask. A 1.5 T Philips Intera CV MRI Scanner was used to measure stroke volume (SV), CO and CBF. SV and CO were evaluated in the proximal aorta and CBF was measured as coronary sinus blood flow with a fast echo phase contrast image sequence. Left ventricular perfusion (LVP) was calculated as CBF divided by left ventricular mass. Arterial blood gases and hemoglobin was analyzed at each O_2 level. Statistical evaluation was performed by Friedman's test and Wilcoxon's signed ranks test.

Results

The response to O_2 was dose-dependent. 15 l O_2/min increased PaO_2 from an average 11.7 kPa to 51.0 kPa with no significant changes in $PaCO_2$ or arterial blood pressure. At the same dose, LVP decreased by 23% (P = 0.005) and CO by 10% (P = 0.003) with no significant changes in SV or left ventricular dimensions. Because of the decreased CO and LVP, systemic and coronary O_2 delivery was lowered by some 4 and 11% at 8 l O_2/min, in spite of the increased blood oxygen content.

Conclusion

These data indicate that inhaled O_2 decreases systemic and coronary O_2 delivery in healthy subjects, and raise the possibility that myocardial ischemia may be increased by high-dose oxygen therapy in normoxic patients with acute ischemic heart disease.