



Non Invasive Imaging

ASSESSMENT OF CONTROLLED ISO-OXIC HYPERCAPNIC STIMULATION OF MYOCARDIAL BLOOD FLOW USING OXYGENATION DEPENDENT CARDIAC MAGNETIC RESONANCE IMAGING

Poster Contributions

Hall C

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Background: Exercise and pharmacologic vasodilators are routinely used for cardiac stress testing. However, numerous patients cannot exercise; and pharmacological agents are difficult to standardize and are known to impart numerous side effects. Mild, transient, hypercapnia may overcome these limitations. We tested the hypothesis whether such a hypercapnic stimulus can mediate similar changes in myocardial blood flow (MBF) as adenosine using blood oxygenation dependent (BOLD) cardiac MRI (CMR). We studied this in healthy humans and in canines with and without induced coronary artery (LAD) stenosis to test whether hypercapnic can be used to identify the myocardium at risk.

Methods: Human subjects (n=18) had their end-tidal PCO₂ (PETCO₂) increased 10 mmHg while BOLD CMR was performed. Dogs with (n=7), and without (n=7) induced LAD stenosis underwent vasodilatory challenges with hypercapnia and adenosine. Invasive measurement of LAD blood flow velocity (CBFV) was used to gauge degree of LAD constriction. BOLD CMR scans were used to monitor changes in MBF.

Results: In humans, BOLD CMR changes due to hypercapnia were similar to previous reports with adenosine ($11.2\% \pm 10.6\%$ vs $12\% \pm 12.3\%$, $p=0.7$). In intact canines (Fig. 1A), BOLD CMR and CBFV increases were similar to that of adenosine infusion ($p=0.4$). BOLD responses showed similar redistribution (Fig. 1B) between hypercapnia and adenosine under LAD stenosis.

Conclusion: Hypercapnia of 10 mmHg may provide a similar cardiac hyperemic stimulus to adenosine.

Figure 1. Effect of changing arterial CO₂ on BOLD CMR signal intensities in a naive canine (A) and in the presence of LAD stenosis (B). Representative color-overlaid short axis BOLD CMR images collected under baseline and hypercapnia (A) and under LAD stenosis (at baseline, hypercapnia and adenosine infusion) are shown (B).

