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**Renal and Segmental Artery Hemodynamic Response to Mild Hypercapnia**

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The risk of kidney disease is elevated in conditions associated with sustained or transient elevations in the partial pressure of carbon dioxide, such as chronic obstructive pulmonary disease or sleep apnea. Indirect evidence indicates that hypercapnia induces renal vasoconstriction, a response that differs from the vasodilatory response that occurs in most other vascular beds. Thus, one mechanism underlying an increased risk of kidney disease is that repeated hypercapnia-induced episodes of renal vasoconstriction reduce oxygen delivery and compromise renal oxygenation. However, it is unknown if hypercapnia elevates vascular resistance in vessels going to or within the kidneys. **PURPOSE**: To test the hypothesis that breathing a hypercapnic gas mixture increases vascular resistance in the renal and segmental arteries. **METHODS:** After 45 min of supine rest, renal hemodynamics were assessed in seven healthy adults (26 ± 4 years, 4 females) immediately prior to (AIR) and while breathing a 3% $CO_2$, 21% $O_2$, 76% $N_2$ gas mixture for 5 min ($CO_2$). The partial pressure of end-tidal $CO_2$ ($PETCO_2$, capnography) and mean arterial pressure (MAP, finger photoplethysmography) were measured continually. Blood velocity (BV) in the distal segment of the right renal artery (Renal) and the middle portion of the same segmental artery within a given subject (Segmental) was assessed using the coronal approach via Doppler ultrasound. Vascular resistance (VR) was calculated as MAP/BV. **RESULTS:** $CO_2$ increased $PETCO_2$ (44 ± 2 vs 46 ± 1 mmHg, P=0.01). MAP did not differ after $CO_2$ (AIR: 95 ± 8, $CO_2$: 96 ± 9 mmHg, P=0.41). In the renal artery, $CO_2$ reduced BV (31.5 ± 8.7 vs. 28.5 ± 7.5 cm/s, P<0.01), and elevated VR (3.3 ± 1.3 vs. 3.6 ± 1.5 mmHg/cm/s, P=0.03). Similarly, in the segmental artery, $CO_2$ reduced BV (23.1 ± 5.2 vs. 21.0 ± 5.6 cm/s, P=0.03) and increased VR (4.4 ± 1.3 vs. 4.9 ± 1.7 mmHg/cm/s, P=0.09). **CONCLUSION:** These preliminary findings suggest that mild hypercapnia elevates vascular resistance in the renal and segmental arteries.