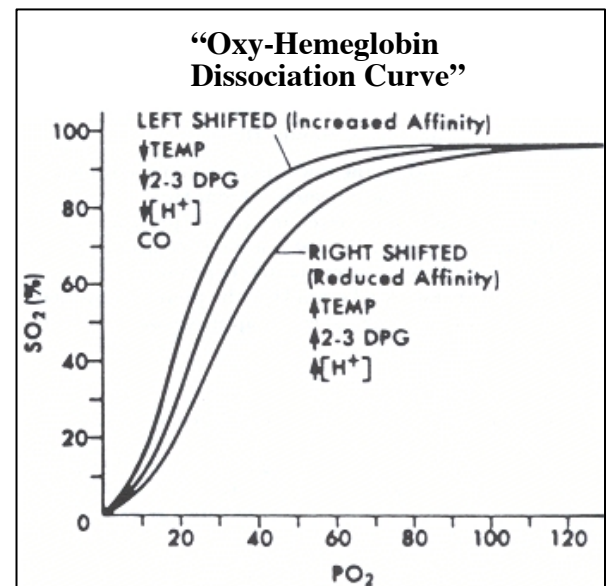
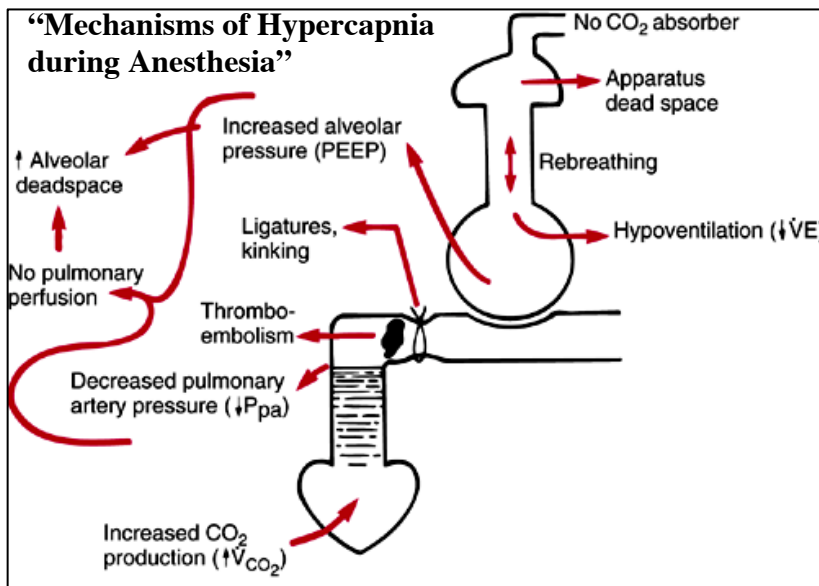


# Cardiovascular Effects of Hypercapnia

**Anesthetic Pearls:** Anesthetic Implications of Hypercapnia on the Cardiovascular System

**Hypercapnia: Cardiovascular Effects**

1. Depression of cardiac & smooth muscle (direct action)
2. Sympathetic stimulation (generally offsets cardiac depression)
3. Increase in systolic blood pressure (high CO<sub>2</sub> levels)
4. Increase in heart rate (high CO<sub>2</sub> levels)
5. Increase plasma K<sup>+</sup> level
6. Pulmonary vasoconstriction
7. Dysrhythmias (very high CO<sub>2</sub> levels)
8. Decrease systemic vascular resistance
9. Decrease alveolar O<sub>2</sub> level (therefore decreases PaO<sub>2</sub>)
10. Oxy-hemoglobin dissociation curve shifted to right (facilitates tissue oxygenation)



**Table 17-4. Cardiovascular Responses to Hypercapnia (PaCO<sub>2</sub> = 60 to 83 mmHg) during Various Types of Anesthesia (1 MAC Equivalent Except for Nitrous Oxide)<sup>a</sup>**

Anesthesia	Heart Rate	Contractility	Cardiac Output	Systemic Vascular Resistance
Conscious	++	++	+++	-
Nitrous oxide	0	+	++	--
Fluroxene	+	+++	+++	-
Halothane	0	+	+	-
Enflurane	+	+	++	---
Isoflurane	++	+++	+++	-

<sup>a</sup> The increase in PaCO<sub>2</sub> in the conscious subjects was 11.5 mmHg from a normal level of 38 mmHg. Abbreviations and symbols: +, <10% increase; ++, 10 to 25% increase; +++, >25% increase; 0, no change; -, <10% decrease; --, 10 to 25% decrease; ---, >25% decrease; MAC, minimum alveolar concentration for adequate anesthesia in 50% of subjects.