Carbon Monoxide

Anesthetic Pearls: Carbon Monoxide Production and Volatile Anesthetics

Carbon Monoxide (CO) is colorless, odorless and tasteless, but highly toxic. It combines with hemoglobin to produce carboxyhemoglobin, which is ineffective for delivering oxygen to bodily tissues. Carbon monoxide poisoning is the most common type of fatal air poisoning in many countries. Carbon monoxide concentrations as low as 667 ppm may cause up to 50% of the hemoglobin to convert to carboxyhemoglobin thereby leading to tissue hypoxia. A level of 50% carboxyhemoglobin can result in seizure, coma, and death. In the United States, OSHA limits long-term workplace exposure levels above 50 ppm. Carbon monoxide also binds to other molecules such as myoglobin and mitochondrion cytochrome oxidase. Exposures to carbon monoxide may cause significant damage to the heart and CNS, especially to the globis pallidus, often with long-term sequelae. Carbon monoxide has also been implicated to cause severe adverse effects on the developing fetus.

Volatile Anesthetics used with carbon dioxide absorbers may produce carbon monoxide. Carbon dioxide absorbers must be compatible with the anesthetic gas being used. Trichloroethylene may react with soda lime to produce dichloroacetylene, phosgene, and carbon monoxide. Sevoflurane is degraded by both soda lime and baralyme. Carbon monoxide as described above can lead to potentially neurotoxic sequalae. Prolonged exposure of Desflurane, Enflurane, and Isoflurane to CO_2 absorbents may result in anesthetic breakdown, which may lead to carbon monoxide production. When the absorbent is dry, more carbon monoxide is produced compared to standard absorbent with normal amounts of water. This can be a problem on a Monday morning with an anesthesia machine that was left on over the weekend with high fresh gas flows. Using low fresh gas flows and turning anesthesia machines off over the weekend can minimize drying / desiccation of the CO_2 absorbent. Water can be added to the top of the absorbent to decrease degradation of the anesthetic gases. Increased temperature and high anesthetic concentrations can lead to increases in carbon monoxide production. **Baralyme produces more carbon monoxide than does soda lime** (moist or dry).

There have been <u>no</u> reports of patient injuries from carbon monoxide in the breathing system, but it is of great concern because there is the potential for harm. The best way to minimize exposure to carbon monoxide from the breakdown of anesthetics in the breathing system is to use absorbents that are not dried out, low fresh-gas flow rates, and lower concentrations of volatile anesthetic agents.