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Comparing & Understanding the Use of

Low Flow (LF) Carbon Dioxide Absorbents

The use of LF carbon dioxide (CO_2) absorbents was introduced due to the risk associated with the low flow anesthesia technique. Human hospitals have adopted low flow anesthesia to reduce cost but this method increased the risks associated with desiccation of soda lime based CO_2 absorbents. To understand the risks a quick review of the general function of carbon dioxide absorbents is needed.

Vapors Vol. IV, Issue 1 (http://www.vetamac.com/news/news.htm), written by Harry Latshaw, describes the process of carbon dioxide absorption utilizing the principle of a base (absorbent) neutralizing an acid (CO_2). The end products of this process are water, carbonate and heat production.

Inhalant anesthetics exposure to carbon dioxide absorbents can cause some degradation. Sevoflurane can decompose to a potentially nephrotoxic compound, Compound A. High concentration of Sevoflurane, low fresh gas flow rates, dry absorbent, high temperature and the use of barium lime are all contributing factors to the production of Compound A. The clinical significance of the production of Compound A in cats and dogs appears to have little concern. [1]

Another concern while using Isoflurane through dry absorbents containing a strong alkali (potassium or sodium hydroxide) is the production of carbon monoxide. In human anesthesia, it is recommended to use only nondesiccated absorbents containing no potassium hydroxide and little or no sodium hydroxide. Although carbon monoxide poisoning associated with anesthetic use in veterinary medicine seems to be a very rare occurrence (or it is simply not recognized), similar recommendations are probably applicable.[2]

Due to the potential for the production of Compound A and carbon monoxide with traditional soda lime the low flow formulas were generated for human anesthesia. In veterinary medicine, three premium CO_2 absorbents were compared to two traditional soda limes in the categories of: Carbon Monoxide generation, Compound A generation, CO_2 absorption capacity and permanent color indicator. The studies were performed by Thomas E. Dahms, Dept. of Anesthesiology and Critical Care Medicine at Saint Louis University in St. Louis, Missouri.

The findings found that all three of the premium CO_2 absorbents (Amsorb Plus, Litholyme and Sodasorb LF) do not produce carbon monoxide or Compound A. The CO_2 absorption capacity is comparable to the traditional absorbents (Sodasorb and Medisorb). The color change is permanent in all three premium absorbents.

No matter what brand of CO_2 absorbent is utilized, the rate of exhaustion is determined by the size of the patient (CO_2 production) and the rate of the fresh gas flow (ml/kg/min). Absorbent exhaustion will occur faster in large patients and when low flow gas rates are used.

Using only one criteria to determine when to change the absorbent (see below) is not recommended. Hours of use, capnography, color change and the production of moisture and heat are all good indicators. Vetamac recommends changing the entire canister at a minimum of once a month.

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References:
1.Grimm, KA, Tranquilli, WJ, Lamont, LA. 2011. Essentials of Small Animal Anesthesia and Analgesia, 2nd edition. Wiley-Blackwell, p. 179.
2.Grimm, KA, Tranquilli, WJ, Lamont, LA. 2011. Essentials of Small Animal Anesthesia and Analgesia, 2nd edition. Wiley-Blackwell, p. 180.

Methods Used to Determine Absorbent Exhaustion:

Traditional Soda Lime: Sodasorb, Medisorb

1. Fresh granules are easily crumbled and exhausted granules become hard.
2. While using a capnograph watch for Inspired CO_2.
3. Color change to purple or red while in use will indicate exhaustion.
   Remember soda lime will turn back to white if unused for several hours (ex: overnight).
4. While in use feel the canister for heat production. Observe the canister for moisture.

Premium LF Absorbents: Sodasorb LF, Amsorb Plus, Litholyme

1. Fresh granules are easily crumbled and exhausted granules become hard.
2. Capnography is recommended for determining CO_2 breakthrough.
3. Color change is permanent. Granules start as white or light lavender and as they become exhausted the color will progress to a deep purple.

Note: Sodasorb LF has an initial color state of light purple due to the surface of the absorbent interacting with the anesthetic gas in the system.

Once the anesthetic diffuses out of the absorbent, the color will revert back to white indicating that it still has CO_2 absorption capacity (this is an email response from Mark S. Plank, quality manager for gcp applied technologies).