Vetamac Vapors

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Monitor the Patient?? Monitor the Machine!!
Part I

Most discussions about monitoring relate to patient monitoring. However, monitoring the machine can prevent problems that might ultimately have consequences for the patient. This issue of Vapors will discuss some of the procedures and devices used to monitor the anesthetic machine.

There are three primary areas of concern that need to be addressed. The first relates to the oxygen supply concentration and pressure, which will be discussed in this issue. Next is excess pressure in the breathing system and finally, a rise in inspired CO_2 These will be discussed in Part II.

Although most practices use O_2 that is provided in high pressure tanks (2000 psi), there is considerable interest in the use of O_2 that has been produced by separating it from room air through the use of a molecular sieve. These devices are called O_2 concentrators or O_2 generators. The concentrators are usually devices that are used for home O_2 delivery that are adapted for use with anesthesia. The generators are devices that have been designed to produce a higher volume and pressure of O_2. These devices do not produce 99.9% USP O_2 but deliver concentrations of 89% - 96%.

A generator with a sufficient capacity should be considered for veterinary practice. The capacity can be calculated by using 1.5 liters/minute for each anesthetic machine, 5 liters/minute for an O_2 cage, and 6 liters/minute for a ventilator. (A ventilator requires 50 psi.) The calculated capacity should be approximately 60% of the total capacity of the generator (see Table 1). If a concentrator or generator is used that delivers O_2 at less than 20 psi it will not work on some older anesthetic machines that were acquired from human medicine. These machines have a check valve at the O_2 inlet that requires at least 20 psi to open the valve. It is important to know the requirements before purchasing a generator or concentrator.

Table 1

2 Anesthetic Machines	= 3 liters/minute
1 Oxygen Cage	= 5 liters/minute
1 Ventilator (50 psi)	= 6 liters/minute
Total Required	14 liters/minute

60% of Capacity is 14 liters/minute
Capacity of Generator = 23 liters/minute

There are conditions that affect the integrity of the molecular sieve and the concentration of O_2, therefore the concentration delivered to the machine should be checked periodically. Using the device at or near peak flow rates can actually damage the molecular sieve and reduce the concentration of O_2 produced. With some units, high ambient temperatures can also reduce the concentration. Occasionally there can be a leak in the system as a result of a loose connection at the generator or the machine. This causes increased demand on the generator and may also entrain room air into the O_2 flow especially in units that deliver 5 psi or less. The concentration can be verified using an O_2 sensor connected to the O_2 flow on the anesthetic machine (see Figure 1). These sensors usually require a flow rate of 1-2 liters/minute. If the anesthetic machine is serviced on a regular basis, checking the O_2 concentration from the generator should be standard protocol. Maintenance of O_2 generators is usually simple and easy and can be performed by someone in the practice. If these procedures are followed according to the manufacturer's guidelines, most units will provide excellent service.

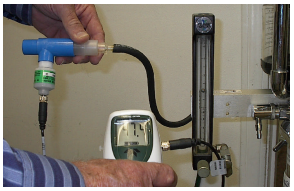

Figure 1

The primary issue with using high pressure oxygen (2000 psi), is knowing when the tank is empty. This problem exists when the tank is located in a remote area and there is no gauge or alarm in the work area. Some machines can accomodate an E-size (small) tank which can be used as a backup to a large tank. For most practices, the easiest way to monitor the O_2 delivery, is to install a low pressure alarm on the machine (see Figure 2). This alarm will sound when the line pressure drops below 30-40 psi. Since the piping system will hold several liters of O_2, this will allow time to switch to a full tank.

Figure 2

Since O_2 flow is necessary for both life and the delivery of anesthetic, the importance of monitoring the O_2 to the machine is evident.

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