# Vetamac Vapors

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*After two years of informal surveys conducted by our field staff, Vetamac is pleased to announce the addition of Cardell™ Monitors to our product line. Cardell™ Monitors are available in several different configurations designed to fit your specific monitoring needs. Check out the Cardell™ Monitors as well as our complete line of products at www.vetamac.com!*

## The Anesthetic Machine as an Intermittent Dosing Device - Part II

This discussion continues with the Minimum Alveolar Concentration (MAC), the second of three characteristics of inhalant agents that affect DUDE.

The MAC is an attempt to describe a dose for inhalation agents. MAC is the alveolar concentration at which 50% of the animals will not respond to a painful stimulus. However, the desired percentage of patients that should respond during clinical anesthesia is 0%, therefore the alveolar concentration to achieve a surgical plane of anesthesia will be higher than MAC. In fact, it will be about 1.5 times MAC. The induction time will be the time required to reach this concentration and is determined not only by the B/G coefficient, but also by the multiple of MAC that is administered during induction. The MAC for isoflurane is 1.3%. If the vaporizer is turned to 5% during induction, then approximately 3.8 times MAC is being administered. The MAC for sevoflurane is 2.25%. If the vaporizer is turned to 8% during induction, then approximately 3.5 times MAC is being administered. These multiples of MAC during induction decrease the time of induction. Regardless of the B/G coefficient, induction time is prolonged if the concentration administered is only that which is required to maintain anesthesia. This is the reason that vaporizers are designed to administer concentrations higher than those required for maintenance.

The third physical characteristic to consider is the vapor pressure (VP) of the anesthetic agent. It does not have an effect on DUDE but does dictate the specifications of the vaporizer for that agent. The vapor pressure describes the liquid agent's ability to evaporate (vaporize). The higher the VP, the easier the agent vaporizes and vice versa. The VP determines the partial pressure (concentration) of anesthetic in the sump of the vaporizer. The concentration of isoflurane in the sump is 32% and sevoflurane is 21%. This is why the vaporizer must be very precise in the metering of the O2 through the sump to deliver the dialed concentration. This also is the reason that vaporizers are agent specific.

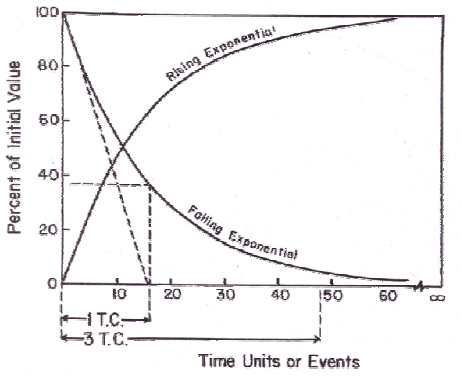
The characteristics of the anesthetic machine also have an effect on DUDE. Think of the machine as an intermittent dosing device. The agent is delivered or eliminated only when the patient breathes. The remainder of the time the machine is only a reservoir for oxygen and anesthetic.

The first system to consider is the rebreathing circuit and the first two characteristics are volume and flow. The rebreathing circuit is a dynamic system where constant mixing of fresh and expired gases occurs. Since there is a constant mixing of gases, the size of the rebreathing system and rate of flow of fresh gas into the system can have a dramatic effect on the rate of change of the concentration within the system. The time needed for the concentration to rise or fall to the desired level may take from 3-30 minutes based on volume and flow (see chart below).

This rise or fall in concentration is based on the time constant which is calculated by dividing the volume of the system by the flow into the system. The chart shows that after 1 time constant on the rising exponential approximately 60% of the "rise" has occurred and after 3 time constants approximately 95% has occurred. If we assume that the system holds 4 liters (this is a reasonable estimate for many veterinary anesthetic machines) and the flow into the system is 1 l/m, 1 time constant would be 4 minutes. Therefore, if we turn the vaporizer from 2% to 3%, it will take 4 minutes for the concentration to rise about 0.6%. It will take 12 minutes (3 time constants) for the concentration to rise the desired 1%.

Because this is a dynamic system, the inspired concentration of anesthetic is lower than the concentration dialed on the vaporizer during the induction and maintenance periods. During induction, the difference will be greater and during recovery the difference will be greater but will be reversed - the inspired concentration will be higher than the setting on the vaporizer.

The next issue of "Vapors" will complete the discussion of the anesthetic machine as an intermittent dosing device.

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