VETAMAC VAPORS

Vetamac Vapors Vol. IX • Issue 3 • Fall 2013

Breathing Inside the Box

This issue of Vapors is focused on the use of induction boxes. They are used most often to induce anesthesia in animals that are intolerant of restraint. The induction of anesthesia by any method should be quick to avoid as much time in the excitement phase as possible. An induction box can achieve a quick induction, but problems can arise due to the design of the box or the technique used.

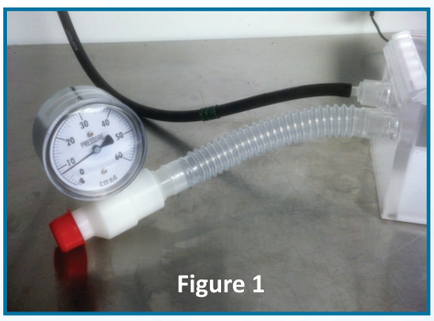
Figure 1

The design of the box is very important if it is to function properly. There should be two ports on the box to accommodate fresh gas flow in and waste gas out. It is most desirable to have fittings in the ports that will accept 15mm connections and either 19mm or 22mm tubing for evacuation. The box should also be designed to be sealed and pass a pressure test to 10cm H2O. This assures that all the fresh gas that enters will exit through the exhaust port. Figure 1 shows a box that can be sealed. The exhaust port is connected to the manometer and is holding pressure with the flowmeter off. If there are leaks in the closing mechanism on the box, the gas will follow the path of least resistance out of the box and may result in the gasses in the box not being mixed with the fresh gas coming in. Boxes that do not form a good seal can also result in exposure to waste gas. Figure 2 shows a box that does not seal. The exhaust port is connected to the manometer and the flowmeter is at 5 liters/minute. No pressure is being created which indicates all of the gas is escaping around the lid. Figure 3 shows the induction boxes that Vetamac recommends.

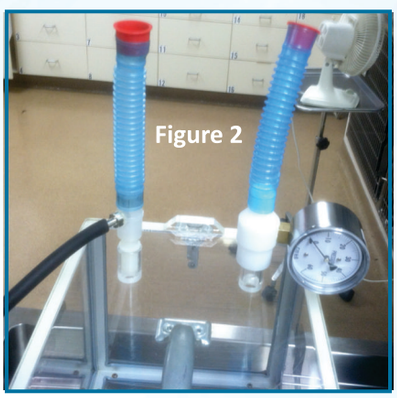
Figure 2

Correct technique is important if induction is to be smooth and uneventful. The first step in good technique is to know the volume of the box you are going to use. A typical box used for an adult cat is probably going to be approximately 15 liters (check with the manufacturer or supplier). Some are even larger. This volume helps us determine an appropriate oxygen flow rate. If a 15 liter box is used, the flow rate should be 4-5 liters/minute. If the animal occupies 7 liters of the volume, this means there are 8 liters of gas that must be replaced. With a flow rate of 4 liters/minute, the time constant (see Volume IX, Issue 1 of Vetamac Vapors on our website) is 2 minutes, therefore it will take three time constants or 6 minutes to replace all the gas in the box. The smaller the animal, the longer it will take to replace the volume in the box. Induction in a box should always be at a high flow rate. Using 1-2 liters/minute may not produce predictable results. If a box is not tight, the higher flow rate will cause more waste gas to escape into the work environment.


Figure 3

The vaporizer setting is also important to the time of induction, however, there are some considerations regarding isoflurane versus sevoflurane. If isoflurane is being used and the animal is comfortable in the box, it is best to increase the setting on the vaporizer in increments of 0.5-1.0% every few seconds. Isoflurane is irritating to the respiratory membranes and the slow increase in concentration will minimize this effect. If sevoflurane is used, it is not as important to do this because it does not irritate the membranes although it would be recommended to not "blast" the animal with 7-8% initially.

There is no way to remove the animal from the box without some exposure to waste gas. To minimize the exposure, it is desirable to have the animal slightly deeper than is desired and to use the flush valve to flush pure oxygen into the box and then remove the animal. If the box does not seal tightly, this technique may very well expel much of the gas into the room instead of through the exit port. It's also important to remember that anesthetic gas is still present in the hair of the animal after it is removed from the box so this is another point of exposure to waste gas.

Induction boxes are useful in practice to induce anesthesia but the proper design of the box and the proper technique will produce the best result.

By Harry Latshaw, MS, RVT, VTS(Anesthesia)

The Summer issue of Vapors had a mistake in the last paragraph before the conclusion that we would like to correct: "The most often cited disadvantage of this system is that the patient is cooled by the constant flow of fresh oxygen and the respiratory tract membranes become dry." We apologize for any questions or confusion this might have generated.

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