***Anesthesia and Analgesia In Laboratory Animals***

INHALATION AGENTS

(Syn: Gas Anesthesia, Volatile Anesthetics, Inhalational Anesthetics, Breathable Anesthetics)

In general, the safest anesthetics are inhalants if used with the proper delivery and scavenging systems. The most commonly used currently available inhalant anesthetic for veterinary medicine is isoflurane. Waste gas scavenging systems are required when using these agents for the safety of humans. Precision vaporizers provide precise, controlled levels of anesthesia administered to the patient, providing a margin of safety to the animal. Using gas anesthetics at full concentration out of the bottle (as has been done with previously available Metofane) quickly results in overdosing the animal, and can kill very quickly.

Halothane and Metofane, which were previously popular with animal (mouse and rat) researchers, are no longer available for use.

Available Inhalant Anesthetics

Isoflurane is the currently recommended inhalant anesthetic. This agent requires a precision vaporizer for delivery to the patient. Induction (e.g., with mice or rats) with this agent must be conducted in an induction chamber, where concentration is restricted to 5%. It is a very rapid acting inhalant anesthetic, and death can result if the patient is not observed closely or the concentration exceeds 5%. An advantage of this agent is that it is not metabolized, and therefore has little or no toxic effects. Also, it is relatively insoluble in blood, and therefore is "blown-off" quickly, providing a quick recovery.

Anesthesia Delivery Systems

Precision vaporizers are part of an anesthesia machine, and serve to mix oxygen (the carrier vehicle) with the anesthetic in a precisely-controlled concentration. The ARF has anesthesia machines available in the procedure rooms on the ground floor. Animal researchers who routinely incorporate surgery or the use of anesthetics in their animal experiments should consider purchasing an anesthesia machine. If you wish to utilize an inhalant anesthetic, or purchase an anesthesia machine, consultation with the institutions veterinarian is required.

Isoflurane use in anesthesia machines.

All laboratory animal species can be safely anesthetized with Isoflurane

Induction: 5% in Oxygen

Maintenance: 2-3% in oxygen is usually sufficient

Each patient must be monitored individually, since individual responses are variable

Delivery via intubation (larger species) or nose cone (smaller rodents)

Waste or excess gases must be scavenged with an approved device

“Field” Delivery System

Isoflurane may be mixed according to the following directions. This is considered a “crude” method of delivery, but it has been used successfully in field studies where anesthesia machines are not available. Researchers who were accustomed to the convenience of using Metofane in a vapor jar favor this method since it does not require special equipment.

ISOFLURANE DILUTION METHOD

(When No Anesthesia Machine is Available)

CONDUCT ALL PROCEDURES IN HOOD OR WITH GAS SCAVENGING DEVICE (or OUTSIDE)

Dilute Isoflurane in light paraffin oil (not mineral oil, available from CRS) at a concentration of 15% v/v (e.g. 15 cc anesthetic in 85 cc light paraffin oil).

Shake vigorously to produce even suspension.

Saturate cotton or gauze in bottom of small induction chamber with tight fitting lid.

Saturated material should be covered with plate or screen to prevent direct contact with sensitive skin or eyes.

Allow 3-5 minutes for equilibration of chamber.

Place mouse or rat in chamber.

Observe VERY CAREFULLY for loss of righting reflex, and decreased respiratory rate.

When respiration is deep and slow, rodent is removed from chamber. This stage may require some practice – it is possible to deliver a FATAL dose, but if monitored closely, it provides excellent anesthesia. A key point is to leave the rodent in the chamber as long as possible to maximize the length of anesthesia, yet not overdose.

Approximately 90-120 seconds of unconsciousness results from this (initial) exposure.

If additional time for anesthesia or restraint is needed, the 15% solution can be used to saturate a cotton ball in a syringe case. Partially inserting the rodent’s nose into the syringe case-nose cone will provide various levels of anesthesia.

Waste or excess gases must be scavenged with approved device if used indoors. If used outdoors, ensure adequate ventilation to reduce exposure to operator.

\*\*NOTE: This anesthesia provides relatively rapid induction and recovery – much quicker than Metofane! It is imperative to keep this in mind and monitor the animals closely to avoid anesthetic-related deaths, and “surprise – I’m awake” rodents.

Advantages of Gas Anesthesia

Inhalant anesthetics are preferred over injectable anesthetics for surgical procedures of any length, and procedures where requirements for restraint or sedation are of short duration. Surgical planes of anesthesia are readily and predictably obtained with inhalants; this is often not the case with commonly employed injectable agents. Once the inhalant anesthetic delivery is halted, recovery is relatively quick compared with most injectable agents.

Anesthesia training

Training for using gas anesthesia and anesthesia machines is available through the ARF.