

Guidelines for the Use of Isoflurane Anesthesia in Rodents

Background:

Inhalational anesthesia with isoflurane is quickly becoming the standard method of general anesthesia for rats and mice used in biomedical research. It holds many advantages over injectable agents: minimal animal handling, large margin of safety, ease of anesthetic control, low cost of anesthetic agent, no controlled drugs, and quick recovery times. The primary disadvantages are the initial cost of equipment and the need to control human gas exposure.

Equipment Required:

Minimum components:

Isoflurane vaporizer
Supply gas (oxygen)
Supply gas regulator
Flowmeter (0-1000 ml/min)
Induction chamber
Connection tubing and valves
Facemask or intubation supplies
Scavenging method

DLAR can assist in the design of inhalational systems for use in laboratories. DLAR also has portable systems available for rent for short-term projects. Contact DLAR Veterinary Technicians Office (4-4289) for assistance.

Methods (standard system):

1. Check system to ensure adequate amounts of supply gas and isoflurane for duration of the procedure.
2. Make sure system is set to flow to induction chamber.
3. Turn on supply gas.
4. Turn on flowmeter between 500-1000 ml/min.
5. Place animal in induction chamber and seal top.
6. Turn on vaporizer to 5%.
7. Monitor animal until recumbent.
8. Flush out induction chamber with supply gas (if possible).
9. Switch system to flow to nosecone.
10. Remove animal from chamber and position in nosecone. Should have approximately 2-3 minutes to do this before animal starts to awaken.
11. Restart gas flow with flowmeter at 100-200 ml/min and vaporizer at 2-3%. If animal has started responding, gently restrain in nosecone until fully anesthetized again.

12. Monitor respiration and response to stimulation during procedure and adjust vaporizer as needed.
13. At completion of procedure, turn vaporizer off and allow animal to breathe supply gas until it begins to awaken.
14. Place animal in recovery area with thermal support until fully recovered.

Scavenging:

Since, by definition, inhalational anesthetics are in gaseous form, there is significant potential for human exposure to these agents. This is particularly true with systems designed for rodents because of both the necessity to use an induction chamber and the standard use of a nosecone instead of intubation. Both of these components have the potential to leak significant amounts of isoflurane into the environment. OSHA standards only allow for 2 ppm exposure level within the work environment. This is actually below the human odor detection limit for isoflurane, so if you can smell it, the exposure level is too high. There are two primary methods of scavenging anesthetic gases: active and passive.

Active: There are a variety of systems which incorporate some sort of active airflow system to draw waste anesthetic gases away from the operator. These can be as simple as plain vacuum lines (for small quantities) to intricate systems with various levels of filtration. The two most common active scavenging methods used within research settings are simple capture systems using house vacuum or performing all anesthesia procedures within fume hoods. The basic concept is to set up a system whereby the user feels confident that all waste gas is being actively drawn out of the workspace.

Passive: There is really only one commonly-used passive scavenging system and that's charcoal filtration. This usually involves a pass-through charcoal canister filter in the exhaust gas line. Use parameters vary depending on the manufacturer, but commonly involve recording the weight of the canister after each use and discarding when it reaches a predetermined increase (usually 50 g.). The difficulty in using these within a rodent system is that gases tend to follow the path of least resistance. Since we are not intubating rodents routinely and we're opening and closing induction chambers routinely, there are a variety of pathways for the gas to travel besides through the filter which has a relatively high flow resistance. Therefore, when using this type of system, it is very important to attempt to seal all leaks (particularly around the nosecone) and flush out the induction chamber prior to unsealing the lid.

Questions?

These guidelines are strictly that; guidelines for the most common use of the most common system for inhalant anesthesia in rodents. Any questions or concerns not addressed here should be directed to the DLAR Veterinary Medical Staff (4-6563).