RODENT NEONATAL ANESTHESIA

The scientific literature describes various neonatal rodent anesthetic methods, including injectable agents (e.g., ketamine-medetomidine, ketamine-xyazine, pentobarbital, fentanyl-droperidol), inhalant agents (e.g., methoxyflurane, halothane, isoflurane), and physical agents (hypothermia). Aside from anesthetic survival, parental cannibalism of the anesthetized neonate is the second biggest hurdle. Generally, low mortality exists with inhalants and hypothermia; injectable agents demonstrate a user-based bias. Hypothermia has significant ethical-based questions unanswered regarding its ability to truly anesthetize animals; furthermore, direct contact between the ice-water slurry and the neonatal rodents must be avoided. Although cannibalism concerns appear more closely aligned with hypothermia, all anesthetic-related procedures carry this risk. Maternal conditioning and procedure-related factors (e.g., removing blood, avoiding suture material) also impact cannibalism.

Injectable Agents

Several injectable agents have been described; however, a given agent’s success appears to subject to the individual accustomed to using a given agent. Commonly used agents sited include pentobarbital, ketamine-xyazine, and fentanyl-droperidol. In neonates a fine line apparently exists between successful outcome and the animal’s death. Anesthetic agent dilution is a common point addressed in articles to titrate a given injectable agent to a desired anesthetic plane. Supplemental oxygen was not administered and its use may have yielded higher survival rates.

Inhalant Agents

Various inhalant agents have successfully provided general anesthesia to neonatal rodents in a manner consistent with general anesthesia in older rodents and larger species. Several methods are described including cleverly modified delivery devices for neonatal ophthalmic and other procedures lasting upwards to an hour. Inhalant anesthetics delivered via precision vaporizer utilize oxygen as a carrier gas, facilitating oxygenation and blunting hypoxia associated with injectable agents and hypothermia.

Hypothermia

Hypothermia is an older anesthetic method requiring minimal skill and technical equipment. Ethical concerns exist over its use in neonates because torpor could result but it is unclear if a truly anesthetic state exists; hypothermia results in functional motor fiber loss prior to functional pain fiber loss. Furthermore, the immature state of the neonatal rodent’s pain inhibitory pathways indicate that they are more susceptible to noxious stimuli, resulting in an allodynia-like state. For these reasons, investigators are encouraged to consider other options, specifically inhalant anesthetic agents.
When a need for hypothermia is demonstrated, greater success has been associated with the following:

- As rapid cooling is painful, animals chilled in a latex sleeve (avoiding direct contact with the hypothermia media) should reduce this painful sensation.

- Avoid rapid warming because of the resulting tissue damage; an incubator maintained at 33°C is recommended. Once warmed to this level, water recirculating heating pads may be used. The water recirculating heating pad is superior to heat lamps and uninsulated electric heating pads (even rectal-probe-regulated heating pads). Until animals are fully conscious they cannot ‘escape’ excessive heat generated by incandescent lamps and heating pads while in the peri-emergent sensory altered state associated with anesthesia.

- Supplemental oxygen may benefit the recovering animals, too.

- Proper wound management (See ‘General’ below).

**General**

The following items have resulted in the positive outcome in neonatal rodent surgeries:

- Handling and olfactory conditioning of pregnant females
- Proper animal oxygenation during anesthesia
- Visual monitoring during and after anesthesia
- Maintain body temperature during and after anesthesia
- Practice aseptic technique
- Use tissue adhesives (e.g., VetBond) for wound closure, if applicable
- Clean animals to ensure blood, etc. have been removed
- Allow appropriate anesthetic recovery prior to placing pups with the dam

**References**


Wixson, SK; Smiler, KL. Anesthesia and Analgesia in Rodents, In Kohn DF; Wixson, SK; White, WJ; and Benson, GJ (eds.), Anesthesia and Analgesia in Laboratory Animals, Academic Press, San Diego, 1997.