Rabbit Anesthesia: What is Everyone So Scared Of?

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Rabbits have quite the reputation for increased anesthesia risk, but why? A study comparing anesthetic death rates of various pet species reported a rate of 0.17% for dogs, 0.24% for cats, 1.39% for rabbits. Explanations for increased anesthetic death rate include greater intolerance to pain, stress, anesthetist comfort level, elective procedures in this species, and the ability to hide underlying illness.

Elective anesthesia for procedures such as those requested by project protocols should be thought out carefully and completely. Indications for emergency surgery also occur such as gastrointestinal obstruction. Whenever possible base line pre-anesthetic blood work is favorable.

Abnormal blood parameters and hypovolemia should be corrected prior to an anesthetic even whenever possible. Traditional parameters are used to estimate dehydration in small animals, including decreased skin turgor, dry mucus membranes and lethargy can be used as with the glossy appearance of the large rabbit eye. The rate of balanced replacement fluid administration depends on the estimated rate of fluid losses and clinical status of the patient. Based on human and now more and more veterinary research it has become clearer that we have grossly overestimated insensible fluid losses. Demonstrations show that fluid lost through skin and airway added up to approximately 0.5 mL/kg/hr. Fluid loss increased to 2 mL/kg/hr with an open abdominal cavity. This increases to 8-10 mL/kg/hr when the abdominal cavity was open with organs and intestines exteriorized. Fasting for a few hours prior to anesthetic events, although not critical in rabbits due to their inability to vomit, likely has limited impact on intravascular volume in the average patient as long as extra losses from loose stool, weeping wounds and blood loss are not in occurrence.

There is a paradigm shift on intra-operative fluid rates. Historically rate of 10-20 ml/kg/hr were once recommended for small animals. Current literature is suggesting dramatically lower rates of only 2-5ml/kg/hr, which can be extrapolated for rabbits as well.

Intravenous access is highly recommended for any anesthetic candidate. Intravenous catheterization in appropriately restrained awake rabbits or with mild sedation is attained by using the marginal ear, cephalic or saphenous vein, but may be difficult in smaller, or hypovolemic species. Intraosseous catheterization using the proximal tibia at the tibial crest, or the proximal femur at the greater trochanter are just as efficacious as IV routes and can be more easily accomplished in emergent situations. IV flow rates via the intraosseous route are equal to those by traditional IV access. Micro neonatal IO needles, spinal needles may be beneficial can be used but the author prefers 22-20g hypodermic needles for IO catheterization. When placing an IO catheter a local anesthetic and sterile technique over the insertion site should be use along with systemic form of pain management. Confirmation of correct placement can be done via test administration of boluses, but definitive confirmation is through radiography. Always perform two views to confirm the catheter is in place.

The tradition of mask or boxing down rabbits for anesthesia induction is more and more becoming a concern for animal welfare and a significant variable with research project looking at physiological function or cardiac injury models with an immense release of catecholamine's. The technique is also responsible for increased mortality rates post operatively. If an IV or IO catheter is unattainable there are IM or SQ agents that can be used instead that have a wide safety margin or can be reversed, such as Alfaxalone or DexMedetomidine.
The benefits and safety of "multi-modal" anesthesia have been demonstrated in many species including rabbits. Pre-anesthetic agents can provide a smoother, anxiety relieving induction while reducing the amount of general anesthesia required. They other added benefit is analgesia many of the agents some of the choices we have can provide.

Opioids are the authors preferred drug choice for premedication and gas inhalation reduction. Even the most critical patient can tolerate appropriate dosing of opioids. One study using an intra operative fentanyl CRI reduced the amount of anesthetic gas needed while keeping the blood pressure at more favorable ranges.

Anxiolytics such as midazolam are also a preferred medication of choice by reducing the amount of opioids, anesthetic gas and systemic release of catecholamine's rabbits produce as high stress prey species.

Dexmedetomidine has great clinical relevance in rabbits with its sedative, anxiolytic and analgesic properties. This medication also has the added benefit of allowing opioids to better attach to receptor sites making the opioid essentially more effective. Dexmedetomidine also has cerebral protective properties, which is particularly useful with rabbits during apnea and intubation. Xylazine has been associated with cardiac injury for models undergoing repeated anesthesia using this agent.

Local anesthetics can be effective in rabbits and performed the same way as in small animals. The general "safe" dose of lidocaine and bupivacaine is 2mg/kg. If more volume is needed of either a 1:1 ration of the local anesthetic and saline can be used without major loss to the effectiveness of the medication. Lidocaine and bupivacaine should not be mixed as this reduces the half-life of both medications.

Airway management:
Rabbits can pose a challenge to the anesthetist. Since ET intubation in rabbits is commonly done blindly, the skill requires practice. ET intubation performed blindly in rabbits and some other rodent species requires the animal to be moderately sedate or anesthetized.

- While having passive supplemental oxygen administered, the anesthetist will hold the head up, straightening the tracheal as much as possible. If attempting to intubate a rabbit with only one person, insertion of an oxygen nasal cannula provides a pre-oxygenation source
- A few drops or a mist from an atomizer of a local anesthetic can be applied to the supraglottic region.
- After allowing the local anesthetic to take effect to reduce laryngeal spasm an appropriate sized ET tube can be inserted.
- The anesthetist will listen at the end of the ET tube where it connects to the anesthetic circuit for breath sounds.
- When listening, the anesthetist should listen for the loudest and most clear breath sounds and attempt to feed the tube into the presumed trachea. Hair plucked from the patient can also be used to detect whether or not the ET tube is in the trachea. Some anesthetists prefer to use a modified esophageal stethoscope connected to the end of the ET tube to listen, rather than the ear to tube methods. Others choose to visualize the condensation created by a breath on the walls of a clear ETT.
- Multiple attempts only using minimal pressure may be indicated.
- Attention to not cause soft tissue trauma and swelling is always advisable with this method. This technique can also be used, but via the nasal passages. Generally, a slightly smaller tube will need to be used with lubricated.

Rigid or flexible laryngoscopes or careful use of a 0-0 Miller blade, or other modified laryngoscope blades are methods that some practitioners use, but time for setup and limited oral space can make this method less practical.

Docsinnovent introduced the v-gel™ for rabbits and felines, which is a modified tube that only covers the supraglottic region. Although ET intubation is the author's preferred method, v-gel™ offers a quick and easy approach when ET intubation proves too difficult. They are not ideal for animals requiring oral surgery as they take up a decent amount of space in the mouth and the potential for fluid leakage around the tube if undergoing a dental procedure. The other limiting factor is they require capnography to ensure proper placement. The tubes themselves have a build in port for sidestream capnography, but also support mainstream capnography with an adaptor that will add to the total deadspace. Older sidestream machines may not be ideal for small patients as some machines require taking 50-200 ml/min of the ventilated gasses for sampling.

In the event an animal cannot be intubated, the forced mask ventilation technique may need to be utilized

- This technique consists of fitting a patient with a mask that covers the nose and mouth with as few leaks as possible.
- The head should be placed so that the trachea is fully extended and as straight as possible to allow easier movement of air.
- There are various pre-manufactured masks, but at times it is necessary to create a homemade mask out of syringe cases, small bottles or tubing. Taking advantage of the patient's bottom incisors case be useful for masks made form syringe cases. The technique involves using a larger suture or small sized string tied/looped around the top incisors and pulled through the mask. Letting the string hang out the end and pulling taught as the non-rebreathing circuit is connected will ensure a sealed mask. Careful attention should be paid to not create ocular trauma with careful positioning and plenty of eye lubricant.
- If the forced mask ventilation technique is used, it is important to remember to protect the animal's eyes. It is too often a mask is left putting pressure or digging into the inferior eye socket.
- This technique can also lead to gas in the stomach that may need to be treated postoperatively by tubing or carefully expressing the air out. Rabbits in particular have a thin stomach wall, over inflation can cause rupture and hinder normal tidal volume intake

In an emergency situation a tracheotomy can be performed or the animal may be intubated by using the over the needle technique. The over the needle technique or "retrograde intubation" technique uses a hypodermic needle inserted percutaneously from the ventral aspect into the trachea. A wire or heavy gauge suture is used as a guide wire and passed through the needle into the trachea, aiming towards the mouth and pushed through the trachea/oral cavity until it can be used as a stylet. However, these methods are not recommended unless dire circumstances exist, and the practitioner is willing to assume and deal with the potential risks and complications.

Monitoring

Basic anesthesia monitoring greatly mirrors cat and dog anesthesia. Titrating anesthetic agents up or down to alleviate patient discomfort and keeping an appropriate anesthetic plane is identical to domestic species anesthesia. Special monitoring equipment used in the research setting can better accommodate higher heart rates seen with smaller mammals and give more reliable ECG tracings. Pediatric settings on all monitors should be utilized if conventional monitoring equipment is used. Laboratory animal vendors also offer miniaturized anesthetic machines and tubing, eliminating dead space seen in regular sized anesthesia tubing even compared to the use of non-rebreathing circuits. Micro ventilators, specially designed for patients in the 150-400 gram weight range, are also commercially available.

Spending more time setting up a patient with every bell and whistles may prolong anesthetic time. It may be more advantageous to simply finish the procedure without every monitoring gadget attached and go back to basics. Being able to use ones stethoscope, eyes, ears, touch and intuition are just as vital as any piece of monitoring machine.

It is important to maintain all patients as normothermic as possible. Heating pads, warm IV fluids, warmed/humidified anesthetic gases, and radiant heat are common and effective methods. Plastic bubble wrap (for warmth, insulation, and soft bedding) is also used. Using a continuous thermometer placed in either the rectum or esophagus will help the anesthetist better gauge the patient's temperature intra-operatively and allow for quicker responses to ever fluctuating temperature changes.

Because the surface area to body mass is high in rabbits, the cooling effects from surgical scrubbing used during aseptic technique can make it challenging in maintaining a normal body temperature, yet is critical. A rabbit's ears comprise around 12% of the animals' surface area and a bat's wings comprise about 85% total body surface area and can be used to cool quickly or warm a patient.

Normothermia will help keep a steady metabolic rate and gut flow. A normal temp will also aid in keeping a

normal blood pressure to perfuse our patients' vital organs.

Wrapping the patient in the bubble wrap or merely using it like a blanket is most effective, due to the lightweight property of the wrap. This will allow for better inspired tidal volumes by not adding additional weight on top of the patient. Using warming devices such as warm water bags and circulating warm water blankets work well. Caution should be taken to not allow direct contact to the patient in the event a thermal burn. Warm water bags eventually cool and have recently been shown to have the opposite effect and can steal heat from an anesthetized patient. Warm air blowers are ideal, but can be cumbersome with such tiny patients. A personal favorite is using bubble wrap. It not only is cheap and disposable, it offers a lightweight and insulated option in thermoregulation. Tiny knitted socks work well in covering limbs. Heat and moisture exchange devices are also a good option, but can add to dead space and respiratory resistance. These devices work by inserting the device between the ET tube and the breathing hose. The paper filter keeps warm moist air in the chest cavity. They also help protect the anesthesia machine from aerosolized bacteria the patient may be harboring with expiration. As a last resort, warm water enemas can be used in extremely cold patients, but a cooling evaporation effect can occur if the patient becomes wet during the process.

Appropriate and inappropriate gas exchange in rabbits has the same positive and detrimental effects as it does in dogs and cats, but resiliency to hypercarbia can be less appreciable. The general normal range for end tidal carbon dioxide is the same as cat and dog values, between 35-45mmHg. The gold standard in monitoring the respiratory system and function in any species is by arterial blood gas sampling. Many blood gas machines only require a small sample size, which is ideal for exotic species, but collection complicates this method is an arterial line is not places beforehand. Capnography is also a useful tool in any small exotic species, but considerations based on the size of the patient and breath quality should be made as adding the sensor may increase dead space further. Reducing dead space from sidestream monitors can be done by sticking an 18g needle directly into the hub of the ETT connector and then attaching the sidestream line. With this technique you go from almost 8mL of dead space with traditional elbow or straight sidestream adapters to only 0.07mL. Mainstream capnography is preferred over sidestream machines. In humans sidestream capnographs can be less accurate in neonates and pediatric patients. This is because the sidestream machines sample a relatively large amount of the total ventilation, ~20% of ventilator requirements. The EMMA by Masimo is an excellent choice when working with small exotic animals for mainstream capnography. The small monitor only has 1 mL of dead space when using the pediatric sensor.

Blood pressure management can be one of the most difficult parameters to keep within normal ranges for the anesthetized rabbit. Rabbits have a poor response to dopamine and less pronounces effects to dobutamine and phenylephrine compared to cat and dogs.