ANAESTHETISING RABBITs SAFELY

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MIGUEL MARTINEZ examines how the increasingly popular rabbit can provide a tricky anaesthetic challenge

RABBITS have become very popular pets over the past few years. Unfortunately, they often need to be sedated or anaesthetised to undergo diagnostic and surgical procedures.

A UK study established a peri-anaesthetic mortality of 1.83 per cent for rabbits (Brodbelt, 2005). Anaesthetic mortality is lower in other species, such as humans (between 0.02 and 0.005 per cent), dogs (0.17 per cent) and cats (0.24 per cent).

Potential factors contributing to high anaesthetic mortality are the veterinarians’ unfamiliarity with the physiology of rabbits, and lack of training in specific techniques, airway anatomy, marked stress response and often-undetected respiratory disease.

• Anaesthetic conditions

– respiratory disease;

– oro-tracheal intubation;

– adequate monitoring;

– handling and stress response;
– heat loss; and

– gastrointestinal motility.

Pre-anaesthetic preparation

It is of paramount importance to perform a thorough clinical examination and be familiar with normal physiological parameters in rabbits. Heart rate is normally between 200 to 300 beats per minute, and the respiratory rate is between 40 to 60 breaths per minute. However, respiratory rate often increases to above 200 breaths per minute under stress. Assessment of the respiratory function is worth special attention to detect subtle signs of respiratory disease (frequently pasteurellosis). Some rabbits present with mucopurulent ocular or nasal discharges. Sometimes, small crusts of dry discharge are found on the medial aspect of the front feet due to self-cleaning.

When pneumonia is present in its clinical or sub-clinical form, the respiratory capacity of the rabbit is impaired and anaesthetic risk markedly increases. Thoracic radiographs can help to detect the consolidation of lung lobes and other changes related to respiratory disease.

Laboratory tests are useful in some patients, but they cannot replace a thorough physical examination and clinical history. Healthy rabbits undergoing routine procedures do not require laboratory investigations, but in other cases, haematocrit and total solids provide an estimate of oxygen carrying capacity and hydration status. More specific tests will be dictated by the results of the clinical history and physical examination, and should be compared with the laboratory reference ranges for the species. Rabbits presenting with dental and gastrointestinal disease should be assumed to have a certain degree of dehydration. Fluid deficits must be corrected appropriately prior to the anaesthetic procedure (Flecknell, 2006). As rabbits don’t vomit, pre-anaesthetic fasting is not necessary. Providing food and water until the beginning of the anaesthetic procedure is recommended, as it promotes the normal function of the gastrointestinal tract.

Ideally, rabbits should be kept in areas separate from dogs and cats to minimise stress. Correct handling is important to prevent spinal and long bone fractures due to struggling. Rabbits can be held by the scruff with one hand, and the hindlegs supported with the other. When transported to another room, it is best to use a carrier box.

Pre-anaesthetic medication

The use of a pre-anaesthetic medication has several advantages. Adequate sedation facilitates handling and prevents struggling when trying to place an intravenous catheter.

Pre-medication also reduces the amount of induction and maintenance anaesthetic drugs, allowing a more balanced technique. Several useful drugs are commonly used on their own or in combination, which are detailed in the list below.
• Pre-anaesthetic sedation

– dexmedetomidine (0.025mg/kg SC PO IM to 0.1mg/kg SC PO IM);

– fentanyl/fluanisone (0.1mg/kg IM);

– acepromazine (0.1mg/kg IM to 0.2mg/kg IM);

– fentanyl (0.04mg/kg IM); and

– midazolam (1.0mg/kg IM to 2mg/kg IM).

Intravenous catheters (size 24 to 25G) can be easily placed in the marginal ear vein or cephalic vein in rabbits as small as 1kg. Very debilitated patients can have a central line placed in the jugular vein.

Induction and intubation

Devoting two to three minutes to oxygenate the patient before the induction of anaesthesia is highly recommended. Oxygen can be delivered at 2L/min to 4L/min via a facemask and a breathing system. Pre-oxygenation allows some extra time before desaturation, and hypoxia occurs if endotracheal intubation can’t be accomplished quickly.

Anaesthesia can be induced by intramuscular, intravenous and inhalational techniques, which are detailed in the list below.

• Anaesthetic induction

– Medetomidine at 0.1mg/kg to 0.2mg/kg + ketamine 15mg/kg IM (medetomidine could be substituted by dexmedetomidine at the same volume).

– Propofol at 2mg/kg IM to 8mg/kg IV.

– Midazolam at 0.5mg/kg IV to 2mg/kg IV.

– Isoflurane or sevoflurane via facemask.

Inhalational mask inductions are not recommended unless the patient is very depressed or profoundly sedated, as struggling can lead to catastrophic spinal injuries. Isoflurane may be pungent and unpleasant, so apnoea often happens during the induction of anaesthesia. The combination of hypoxia and stress during induction can potentially trigger cardiac arrhythmias. If apnoea occurs, isoflurane should be stopped until the rabbit starts breathing again. Sevoflurane is
a better alternative, as it is not pungent and inductions are faster.

Endotracheal intubation in rabbits is technically more demanding than in dogs and cats. The position of the incisors and a narrow oral cavity hamper the direct visualisation of the glottis. Numerous techniques have been described for endotracheal intubation of rabbits, but blind intubation and intubation with the aid of a laryngoscope or otoscope are most often used.

Although the advantages of endotracheal intubation are clear, this technique is not free of certain complications, such as laryngospasm and tracheal necrosis (Grint, 2007). Maintenance of anaesthesia with a facemask is acceptable for very short procedures, but the use of anaesthetics for longer than 20 to 30 minutes is likely to develop into airway obstruction, leading to hypoxia and hypercapnia. This complication is particularly common when rabbits are positioned in dorsal recumbency (Bateman, 2005).

Blind intubation can be consistently achieved with adequate training. It can be performed by a single operator, using an appropriately sized endotracheal tube (see below).

• Endotracheal tubes
  – 1kg to 2kg: 2.5mm.
  – 2kg to 3kg: 3mm.
  – 3kg to 4kg: 3.5mm.
  – more than 4kg: 4mm.

The patient is pre-oxygenated, anaesthetised and positioned in sternal recumbency. The head is held from behind the bend of the mandible. The head and neck are extended up and forward in a 45° angle, with the table used to maximise the width of the airway.

The endotracheal tube is introduced by the side of the oral cavity, and gently advanced until resistance is felt at the level of the glottis, and then slightly reversed by between 2mm and 3mm. Correct positioning in front of the glottis is confirmed by hearing exhalation at the proximal end of the tube.

Thoracic movements are observed, and a quick but gentle attempt to introduce the tube is made during inspiration. Correct intubation is confirmed by increased respiratory efforts or coughing, and the presence of a capnogram may also be helpful.

Direct visualisation of the glottis with an otoscope or a laryngoscope (Miller blade zero or one) is equally possible, but an assistant and more equipment would be required, and manoeuvrability is
limited in the oral cavity.

**Anaesthetic monitoring**

Monitoring rabbits is not the same as monitoring dogs and cats. Rabbits’ small size often makes it difficult to apply monitoring equipment and obtain the different variables. Some electronic equipment is not suitable to measure the fast heart rates usually encountered in rabbits, and many of the blood pressure measurement methods have not been validated for this species. Also, the small tidal volume hinders the assessment of ventilation during the anaesthetic.

The evaluation of anaesthetic depth needs to be adapted to rabbit-specific signs (Imai, 1999). Jaw tone and pedal withdrawal reflexes on the front or hindlegs are usually helpful, as well as heart rate, respiratory rate and pattern, and blood pressure changes.

Basic monitoring of cardiovascular and respiratory systems should include evaluation of peripheral pulse rate and quality, and respiratory rate and pattern. An oesophageal stethoscope can be very useful. Data should be regularly recorded in an anaesthetic record.

Pulse oximeters provide information about cardiovascular function and haemoglobin oxygen saturation. It is important to make sure that the sensor and the heart rate range of the monitor are adequate for the species.

Capnography helps to evaluate ventilation, cardiovascular function and airway patency. Reduced dead space ET tube connectors with a side port to sample CO₂ are available for small patients – they prevent CO₂ re-breathing and improve the quality of the capnogram.

Arterial blood pressure can be measured by means of oscillometric and doppler blood pressure methods. The oscillometric methods are often unreliable, although high-definition oscillometry may give better results. Alternatively, direct blood pressure can be used, if available. The central ear artery can be easily catheterised. In critical patients, arterial blood samples can be obtained from this catheter for blood gas analysis.

**Maintenance**

Inhalant anaesthetics are delivered to the patients by means of a precision vapouriser and breathing system. A T-piece with a Jackson-Rees modification (open reservoir bag) is normally adequate for rabbits. This is a valveless and lightweight breathing system that imposes little resistance to breathing. It is also very easy to provide manual ventilation by closing the reservoir bag at regular intervals. Fresh gas flow must be twice the minute volume (two × 200ml/kg/mi). Pure oxygen or O₂/N₂O mixtures can be used as carrier gas for the inhalant anaesthetic.

Isoflurane, sevoflurane and halothane are the most common inhalant anaesthetics used. They all
cause dose-dependent cardio-respiratory depression. Two studies have shown isoflurane and halothane to cause moderate-to-severe hypotension at relatively low concentrations (Imai, 1999; Turner, 2006). The alternative to inhalant anaesthetics is an intravenous infusion of propofol, as described by Aeschbacher (1993), or combinations of medetomidine and ketamine.

Intra-operative analgesia can be provided by fentanyl boluses (0.005mg/kg IV) or as an infusion (0.01mg/kg/h to 0.02mg/kg/h). Ketamine at 1.0mg/kg IV as a loading dose, followed by 0.6mg/kg/h, can be added to fentanyl in more complex cases. Lidocaine (2mg/kg IV) has been used in sepsis laboratory models in rabbits. It has analgesic, antiinflammatory, pro-kinetic, antiarrhythmic and antitoxic effects.

Peri-operative fluid therapy plays an important role in the maintenance of homeostasis. Fluids can be administered by subcutaneous or intra-peritoneal routes for short procedures. Should venous access be available, crystalloids can be administered at 5ml/kg/h to 10ml/kg/h.

Haemorrhage and hypotension can be managed with boluses of crystalloids at 10ml/kg to 40ml/kg, or colloids at 5ml/kg to 10ml/kg. A combination of hetastarch (5ml/kg) and hypertonic saline at 7.2 per cent (2ml/kg) has been described to treat hypovolaemic shock.

**Anaesthetic recovery**

The goals of recovery are to minimise pain and stress and achieve a rapid return to normal activity. The mainstays of analgesia are opioids and NSAIDs.

- **Opioids**
  - Buprenorphine (0.01mg/kg IV/IM to 0.05mg/kg IV/IM).
  - Pethidine (5mg/kg IM to 10mg/kg IM).
  - Butorphanol (0.1mg/kg to 0.5mg/kg).

- **NSAIDs**
  - Meloxicam (0.3mg/kg to 0.6mg/kg IV/SC followed by 0.3mg/kg/24h PO for five days).
  - Flunixin (1.1mg/kg IV/IM)
  - Carprofen (4mg/kg IV/SC)

Pain, temperature, appetite and faecal production must be closely monitored postoperatively. Pain assessment is really challenging in rabbits – as a prey species, the natural behaviour of rabbits in
an unfamiliar environment is immobility, making pain assessment difficult. The return of appetite and self-grooming are generally considered signs of good analgesia. Abnormal postures, anorexia and prolonged lethargy should make us suspicious of poor pain management. Pain should be always treated in any case of doubt.

The recovery area must have a warm temperature. Heating devices, such as heat blankets and incubators, can be used to actively re-warm rabbits postoperatively, as even mild hypothermia is likely to prolong recovery. Recovery cages should be covered with hay to provide warmth and shelter, and fresh food and water should be available at all times to stimulate appetite and promote intestinal motility.

• References are available upon request to the editor.
Blind endotracheal intubation.
Monitoring: pulse oximetry and non-invasive blood pressure.
Pre-oxygenation with a mask at 4L/min and 100 per cent $O_2$. 

Pre-oxygenation with a mask at 4L/min and 100 per cent $O_2$. 

Doppler blood pressure measurement during anaesthesia.