SMALL MAMMAL ANAESTHESIA AND ANALGESIA
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Pre-anaesthetic preparation
A thorough clinical examination should be carried out, especially to assess whether there is any respiratory disease. If the patient is dehydrated and/or is anorexic, any deficits should be corrected before anaesthesia and surgery commences. Anaesthetic candidates are often dehydrated and hypoglycaemic/ketoacidotic (if anorexic for any reason) and this must be corrected first. Appropriate fluid therapy (see below) and gastrointestinal support should be given. Syringe feeding of baby foods for small rodents and high fibre slurries for herbivores, and the use of gastrointestinal prokinetics my be necessary, and unless anaesthesia needs to be carried out urgently, this pre-operative support will greatly reduce the risk of intra- and post-anaesthetic complications. Animals with overt respiratory disease are a high risk, and ideally this should be treated before anaesthesia is attempted. Many pet rabbits have inapparent lung disease and damage due to Pasteurella infection and many rats have chronic respiratory mycoplasmosis.

The animal should be weighed, so accurate drug dosages can be calculated and fluid losses can be assessed. It is a good idea to monitor pre-operative food and water intake so that recovery can be assessed.

There is no need to fast rodents or rabbits, as they cannot vomit. It is useful to remove food an hour before surgery in rabbits, guinea pigs and chinchillas to ensure the pharynx is clear.

Rodents: Pre-anaesthetic medication
Guinea-pigs and chinchillas are very easily stressed so sedation is vital, especially prior to induction by inhalation (this applies to all species). Fentanyl/fluanisone (Hypnorm) is a good sedative for rodents, although other drugs such as ACP, diazepam, or medetomidine can be used. Atropine should be used in guinea-pigs and chinchillas. Pre-emptive analgesia should be given if a painful procedure is to be carried out (see below), and metaclopramide or other gut motility stimulants can be given in herbivorous rodents and rabbits.

Injectable anaesthesia
Injectable anaesthesia with midazolam (Hypnovel™) iv after sedation with Hypnorm, then reversed with butorphanol (Torbugesic™) iv is one standard option. A combination of ketamine plus an α-2-agonist e.g. medetomidine IM is another option. It is good practice to provide oxygen via facemask or ET tube to any animal when under injectable anaesthesia. A volatile agent can be added to prolong the anaesthetic period if necessary, and to lower the dose of injectable agents used.

Inhalation anaesthesia
Halothane, and isoflurane and sevoflurane can all be safely used. Induction and recovery are most rapid with isoflurane and sevoflurane. Isoflurane can be irritant to mucous membranes, particularly in guinea pigs. Small rodent species can be induced in a chamber, and larger species with a mask, but this is only recommended after prior sedation as it is stressful. Injectable agents for induction followed by inhalation agents are commonly used as balanced anaesthesia. Intubation is possible but generally not practical in most rodents.

Rabbits: Premedication is very useful in rabbits as they are easily stressed. A high percentage have serum atropinesterase, so sc glycopyrrolate at 0.01mg/kg sc can be used as an anticholinergic. Suitable premedicants are fentanyl/fluanisone, medetomidine, xylazine, acepromazine, diazepam or midazolam. Face mask induction without prior use of premedication should be avoided. Rabbits breath hold when exposed to all volatile agents, even at low concentrations, for periods up to 2 minutes. Stress releases catecholamines, and halothane sensitises the myocardium to these, so this can be a lethal combination. Premedication reduces stress levels but does not remove the tendency to breath hold. Fentanyl/fluanisone or another premedicant, followed by mask induction results in a smooth onset of anaesthesia. Alternatively an injectable combination can be used. For example, fentanyl/fluanisone plus midazolam, gives 30-40 minutes of surgical anaesthesia. Partial reversal with retention of analgesia can be achieved with buprenorphine or butorphanol. Alternatively medetomidine plus ketamine is a good combination, to which butorphanol or burenorphine can be added. The addition of butorphanol/buprenorphine prolongs anaesthetic time from about 30 minutes.
to about 80 minutes. This combination can be partially reversed with atipamezole at 1mg/kg. When using an injectable regime it is prudent to administer oxygen concurrently by face mask. Intravenous induction can also be used in the rabbit, and propofol or alfaxalone are most commonly used, but these agents do result in apnoea so the author recommends not using IV induction unless the operator is confident with intubation. **It should always be remembered that published doses of injectable agents are for surgical anaesthesia in healthy rabbits without the concurrent use of a volatile agent, and thus should be considered as the maximum dose, which may not be necessary in many cases.** In practice, the combination of an injectable induction using lower doses of the agents than required for surgical anaesthesia, followed by intubation and maintenance on isoflurane, is probably the most common approach. The use of lower doses and concurrent oxygen given with the volatile agent minimise the risk of complications.

Intubation in the rabbit: Rabbits are easily intubated by either direct visualisation or a blind technique. An Ayres T-piece circuit or Bain circuit should be used. The rabbit should be allowed to breathe 100% oxygen for a few minutes before intubation is attempted, so maximum blood oxygen saturation is achieved. Care must be taken not to occlude the nares during positioning as rabbits are obligate nasal breathers. With all techniques, the tube must never be forced into the larynx as this will cause haemorrhage and oedema. Severe, life-threatening laryngospasm can occur if the glottis is even moderately irritated during intubation. The use of local anaesthetic spray is recommended.

1) Direct visualisation
   - Place anaesthetised rabbit in sternal recumbency, grasp back of head and extend neck so nose is pointing vertically and feet are just off the table
   - Visualise larynx using otoscope, endoscope or using a Wisconsin size 1 laryngoscope blade
   - Apply local anaesthetic spray

   If using an otoscope:
   - Place introducer into larynx through otoscope
   - Remove otoscope and introduce endotracheal tube gently over the introducer
   - Remove the introducer

   If using an endoscope or laryngoscope, directly insert a 2.5-3mm endotracheal tube, or this can be passed directly over the endoscope if it is small enough

   Alternatively:
   - Place anaesthetised rabbit in dorsal recumbency, extend neck, grasp tongue gently, retract and hold to one side.
   - Visualise as above and insert tube

2) Blind technique
   - Hold anaesthetised rabbit in sternal recumbency as above
   - Pass endotracheal tube over tongue and advance until exhalation is heard loudly by placing the end of the tube to the ear, or by presence of condensation at each breath if using a clear tube

   Advance tube gently as rabbit inhales, and it will pass into the trachea

For rabbits and rodents the circuit of choice is an Ayre’s T-piece with a flow rate of 1-3.5 litres per minute.

**Intra-operative care**

The main concern with these small species is **prevention of hypothermia.** Their high surface area to bodyweight ratio means that heat loss is very rapid once thermoregulatory processes are depressed by anaesthesia. Cooling by the flow of oxygen and anaesthetic gases can also be significant. Heat loss is prevented by clipping the minimum area fur from the body and avoiding overwetting with skin preparations. The animal should be placed on a heat pad or an overhead heat lamp should be used. Beware overheating and drying of tissues however; ideally body temperature should be monitored using a rectal probe. If necessary the animal can be insulated using bubble-wrap or tin foil. Rats and mice lose a lot of heat from tail so don’t leave this out. Capnography, pulse oximetry and ECG monitoring are also extremely useful monitoring tools.
and can be used even on the smallest rodent. Ventilators are available for small mammals (Vetronic Ltd).

Eyes are prominent in small mammals and must be protected from drying and trauma by allocation of lubricants or they can be taped shut with micropore.

Depth of anaesthesia is monitored by respiratory and heart rate, and pedal withdrawal reflexes – for a surgical plane the hindlimb withdrawal should be absent and the forelimb withdrawal barely present – loss of forelimb withdrawal can mean the animal is too deep. In rabbits the ear pinch is useful and should be absent.

**Respiratory arrest** - Check airways and circuit and assist ventilation. Compress the chest at a rate of around 60 compressions per minute. Respiration can also be stimulated centrally with doxapram (10mg/kg IV, IP or sublingual).

**Cardiac arrest** - Check respiration as above. External cardiac massage with compressions at a rate of 90 times per minute. In asystole, adrenaline 0.1ml/kg of 1:10,000 should be given IV or intracardiac.

**Fluid Therapy**

Restore fluid balance if there has been any significant blood loss during surgery. Daily maintenance requirement is 75-100ml/kg/day via the oral, S.C., IV, IP or IO route. Intraosseous catheters can be placed in most guinea pigs and chinchillas. The size and length of the needle depends on the size of the animal and is inserted into the top of the trochanter of the femur parallel to the long axis of the femur, or into the tibia via the tibial plateau.

**Analgesia**

Buprenorphine is probably the drug of choice, as it is the longest lasting (8 - 12 hours). Buprenorphine and butorphanol will reverse the respiratory depressant effect of fentanyl while still providing analgesia. Atipamezole will reverse the sedative effects of alpha-2 agonists, but will NOT provide analgesia. NSAID's can also be used for post-operative analgesia, e.g. carprofen, meloxicam. As in other species, care should be taken if the animal is hypotensive/hypovolaemic, because of the risk of renal toxicity. Use of additional local or regional anaesthesia e.g nerve blocks or local infiltration can also be highly beneficial.

**Post-operative Care**

A quiet, dim, secluded environment away from the sight, sound and smell of predators is essential for recovery. A hide or nestbox area should be provided, but ensure that discrete monitoring is still possible. Do not place on sawdust for recovery, as this can stick to the nose and mouth, and the dust inhaled. Vetbed® or similar is an ideal substrate. Additional heat should be supplied until the animal is fully recovered (35°C approx. for rodents). Commercial incubators are available. Monitor food and water intake, and provide additional fluid therapy if required. Annals should not be placed with conscious companions until they are fully recovered from anaesthesia.

**Post-operative anorexia and ileus**

Adequate analgesia should be provided to ensure pain is not the cause for anorexia. Highly palatable baby foods can be given to the small rodents following surgery to encourage feeding, and high fibre recovery foods to guinea pigs, chinchillas and rabbits. These provide energy and prevent hepatic lipidosis/ketosis and the fibre will help stimulate gut motility. It is good practice to routinely give an injection of metaclopramide in rabbits, guinea pigs and chinchillas pre-operatively to stimulate gut motility and prevent ileus developing. If a gastrointestinal obstruction is not suspected and ileus persists, metaclopramide and or ranitidine may be used along with high-fibre assisted feeding until normal gut function and appetite resumes.

**Pain management**

Provision of analgesia is essential post-operatively in rabbits and rodents, even if there are no obvious signs of pain. Response to treatment and recovery rate is vastly improved with analgesics. Pain, distress and discomfort are all difficult to assess in rodents, particularly in the ward environment where excessive background noise may prevent the animal from relaxing. These are nervous, sensitive animals and are less likely to show visible signs of pain than dogs and cats, since in the wild they would be predated on. Pain may be associated with a crouched posture, with the animal trying to hide, laboured respiration, tooth grinding, belly pressing, reduction in appetite, decreased water intake and loss of body weight. Production of no or only a few small dry droppings may indicate anorexia or gastrointestinal abnormalities, such as ileus. Rodents may also have a “stary” coat due to piloerection and lack of grooming, and albino animals may show pale extremities.