

Anesthesia of the rabbit ***Part II: Intra-anesthetic period, and its monitoring***

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Warning: this file contains pictures that may be distressing for people.

Rabbits are often considered as difficult in relation to anesthesia. This probably relates to the fact that the dosages needed to induce anesthesia and those producing toxic effects are close, and to the variety of observed secondary effects related to stress, including death. Anesthesia in rabbits can nevertheless be considered as a safe procedure, when a minimum of safety measures is taken, including a complete check-up of the rabbit, the correct anesthetics agents, and no malfunctioning equipment.

Since rabbits are unable to vomit, there is no need to withhold the food and water prior to a planned surgery. In fact, rabbits, whose accessibility to food is removed over a longer period of time, show an increased tendency of becoming hypoglycemic during surgery or became post-surgical disturbances of the gastro-intestinal tract due to dysbiosis. Growth of pathogenic bacteria leads to the development of enterotoxaemia. The rate of recovery is furthermore slowed down in rabbits whose food was taken away hours prior to surgery. It is thus advised to keep food available up to an hour before anesthetic preparations are started. This assures that the oral cavity does not contain food rests and that the stomach is not overloaded. Food and water should also be available immediately after the rabbit recovers from the anesthesia.

Pre-anesthetic steps are often useful in the preparation of surgical anesthesia. [Click here for details.](#)

Induction of general anesthesia

The choice of the anesthetic drug and its way of administration depend on the health condition of the rabbit, and the period of time needed to carry out the surgery. Intravenous administration of anesthetic drugs is the least recommended method since the toxic dosage of some anesthetics is neared.



IMPORTANT

Eyes of rabbits are large. There is thus an increased risk of damage or dryness of the cornea during the induction phase of anesthesia and the surgery. The rabbit eyes must be protected, either by closing them with micropore tape, or by application of an oily ophthalmologic ointment.



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When the surgery allows a short time anesthesia, subcutaneous, or intramuscular injections are preferred. When the intramuscular method is chosen, higher doses of anesthetics must be used. As a consequence, recovery is slowed down, and the risks of hypothermia increased, if or no

heating pad is used, or fluids are not administered at body temperature. Some compounds also have known side effects or adverse effects, e.g. rabbits regularly anesthetized with the ketamine/xylazine mixture showed increased rates of heart disease and an increased death rate. It is necessary to take those adverse or side effects into consideration on an individual basis, according to the health state of the rabbit.

A list of anesthetic drugs safe for use in rabbits, including their side effects, is available. [Click here](#).

Gas anesthesia is often used in rabbits too. If this method is chosen, [pre-anesthesia](#) is necessary. Indeed, rabbits will often start struggling as soon as they smell the agent, and may get hurt (e.g. spinal cord injury).



Right: Complete inhalation set, mounted on a trolley.





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Induction of gas anesthesia via a mask placed deeply over the face of the rabbits

Gas anesthesia can be induced by means of a chamber or a mask. In both cases, the rabbit often attempts to retain its breath. Rarely, bradycardia is observed. When an induction chamber is used, it is advisable to remove the rabbit once it shows signs of relaxation and place him on a mask, which should be deeply inserted over its face, in order to reduce dead-space. The mask presents the advantage that it can quickly be removed, and be replaced as soon as the animal starts breathing. In rare difficult cases, a short induction can be started with propofol, before placing the mask, and continue the induction with the chosen inhalant anesthetic.

A list of anesthetic inhalant agents safe for use in rabbits is available. [Click here.](#)

Monitoring anesthesia

After the induction phase, preparation for surgery can be started. This includes shaving, disinfecting the skin. Before the animal is covered with a surgical drape, the depth of anesthesia must be verified. Reliable methods in rabbits are:

- pedal reflex, breath holding or hypoxia, and screaming: light depth
- palpebral (blink) reflex, ear pinch or left withdrawal reaction: medium depth



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Appearance of an anesthetized rabbit and testing for the pedal reflex



- corneal reflex: dangerously deep. When such depth is reached, cardiac arrest may occur. Emergency measures should immediately be implemented, by reducing or halting the administration of anesthetics. Exception: anesthesia with medetomidine.

Surgical anesthesia is reached when reflexes to ear pinch and jaw tone are lost.

During the anesthesia, the color of the mucous membranes (eye, lips tongue), the respiratory rate, the heart beat and the rectal temperature should be monitored.

Monitoring physiological parameters

Monitoring of the respiratory rate, depth and rhythm

The rate of respiration depends on the used anesthetic drug. The general tendency is a decrease of the number of breaths per minute, to about 30 to 60. When the rate is under 30 breath/minute, or less than 50% of the normal rate, there should be concern. Once the anesthesia is stable, the respiration rate should remain regular and slow, though sudden changes are not uncommon in rabbits

Respiratory rate can be monitored by observing the movement of the chest, when no surgical drape is used. If this is not possible, respiration should be monitored. It should be mentioned that some electric monitors for respiration are unable to measure the rapid respiratory rate of rabbits and other small animals, and thus become inefficient.

The physiological status of the rabbits can also be followed by monitoring the exhaled CO₂ (capnography). In this case, it is important to note the general tendency, and not the individual numbers. If capnography is used, one must take into account the dead-space of the equipment into the anesthetic equipment. Mainstream capnography is thus not advisable. Side-stream capnography can be used, though the volume of the sampled gas may be very large in comparison to the tidal volume.

Monitoring of the heart and heart rhythm

It is important to monitor the cardiac activity in anesthetized rabbits. Indeed, [pre-anesthetic examination](#) and handling can dangerously raise the level of catecholamine. This can lead disastrous effect, like a lack of correct oxygenation of the blood (hypoxemia) or an excess of CO₂ in the blood (hypercapnia).

Further problems seen in rabbits include hypotension or an unusually slow heart rhythm (bradycardia).





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Left: Anesthetised rabbit, with oximeter attached to its tail,
Right: Monitoring pulmonary-cardiac activity

The heart beat rate of rabbits is rapid and may exceed 250 beats per minute. ECG may thus be difficult, since the upper limits of the monitoring device are reached (usually set at 250 or 300 beats per minute), except when medetomidine or ketamine/medetomidine is used (decrease to 120-160 beats/min).

Pulse oximeters can be used to follow the heart rate and the level of oxygenation. The values typically should remain higher than 90%; lower values typically indicate that the level of oxygen in the blood is insufficient (hypoxemia).

Truthful signals are obtained when the probe is fixed to the tail, the ear, the tongue, the manus or a toe in larger rabbits.

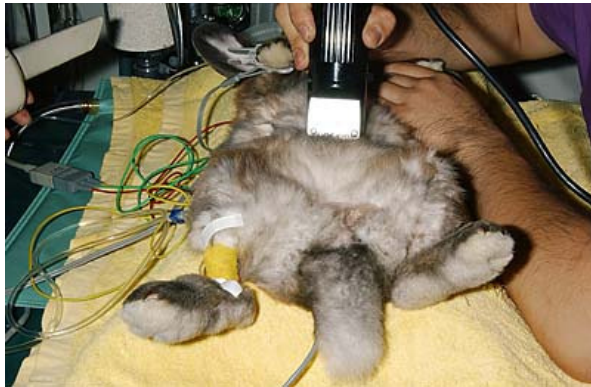
In rare cases, cardiac arrest occurs during anesthesia. This emergency leaves little time for intervention; in rabbits cardiac arrest is quickly followed by respiratory arrest.

Monitoring of the body temperature

Control of body temperature of the rabbit during anesthesia is essential due to:



- a large surface area to body mass ratio; leading to rapid loss of temperature,
- convective and radiant heat loss,
- the possible influence of anesthetic agents on the body temperature mechanisms,
- pre-surgical and surgery itself. A good balance should be found between the minimum area to shave at the surgery site, the minimum shaved area ensuring asepsis, and the use of minimal quantities of disinfecting solutions.



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Left: Shaving fur in an anesthetized rabbit,
Right: Disinfecting skin, prior to surgery. Shaving and disinfecting should be minimal, to avoid loss of body temperature

Hypothermia tends to increase dangerously the anesthetic depth during the surgical procedure. This may be accompanied by hypoxia and acidosis, cardiac arrhythmia and a disturbance of the metabolism of blood platelets.

The body temperature of an anesthetized rabbit can be monitored with an electronic thermometer, or a thermo-sensor inserted deeply in the rectum.

Maintenance of body temperature during the surgical procedure, during the waking-up phase and recovery is assured by using heating pads, hot water pads or bottle, or convective heat sources. When fluid therapy is necessary, the fluids must be heated at body temperature.

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Further information

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