

Sedation and Anesthesia in Llamas and Alpacas

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When general anesthesia or heavy sedation are planned, llamas and alpacas should be fasted for 12-24 hours and water should be withheld for 8-12 hours before the procedure. Crias should be fasted for 2-4 hours. The stomach of adult camelids has 3 compartments and these animals are prone to tympany and regurgitation under general anesthesia. Fasting will decrease the risk of these complications.

A thorough physical exam, including auscultation of heart and lungs, inspection of mucous membranes, palpation of peripheral pulse, and inspection of eyes and nostril for possible discharge should be done. They are social animals, and if brought to the clinic/hospital, they should have a companion. If this is not possible, a mirror can be placed in the stall with them.

Estimating the body weight can be difficult in this species. Due to their fibers, it is very easy to overestimate their body weight. Adult alpacas weighs between 45-85 kg (100-190 lb) and adult llamas between 130-200 kg (290-440 lb).

Most camelids are easy to restraint, however alpha males can be aggressive. They can kick, bite and spit. It is recommended to approach them from the side and a muzzle can be used to prevent them from biting and spitting. Alternatively a small towel can be placed over their nose.

Intravenous access is difficult due to several reasons:

- Think skin
- No jugular furrow
- The jugular vein is located
 - Deep to the sternomandibularis and brachiocephalicus muscles
 - Ventral to the transverse processes of the cervical vertebrae
 - Superficial to the carotid artery and vagosympathetic trunk
- Presence of alveoli inside the jugular vein

If possible, use the right side to avoid damaging the esophagus. There are 2 preferred locations for the insertion of a jugular catheter in camelids: a) 2-3 cm dorsal to the angle of the ventral border of the mandible (in this location the skin is pretty thick); b) cranial to the ventral process of the 5th cervical vertebra (in this location the jugular vein is close to the carotid artery). It is important to check the correct placement before injection any drugs. After inserting the catheter, check for pulsatile flow (if present the catheter is in the carotid artery). Alternatively, place an extension set, pull back some blood using a syringe and see if the blood pulsates in the extension set. Do not rely on the color of the blood, camelids' venous blood has a high percentage of oxyhemoglobin and appears bright red.

When llamas and alpacas are sedated and ready to be induced, they generally lay down in sternal (they 'cush'). Drugs used in these animals include:

- Alpha-2 agonists
 - Xylazine 0.2-0.6 mg/kg IV, IM
- Benzodiazepine and guaifenesin (GG)
 - Midazolam (IM and IV) and diazepam (IV) 0.2-0.4 mg/kg
 - Guaifenesin up to 2 ml/kg of a 5% solution
 - Excellent for sedation/premedication
- Opioids
 - Butorphanol 0.1-0.2 mg/kg IV, IM
 - Morphine 0.1 mg/kg IM
- Induction
 - Ketamine 3-5 mg/kg IV. Use with a benzodiazepine.
 - Propofol 3-6 mg/kg IV (to effect). Can be use in small size animals. Can be used after ketamine if the animal still present swallowing reflex before intubation
- Maintenance
 - Isoflurane and sevoflurane

Orotracheal intubation can be challenging in llamas and alpacas, due to their narrow dental arcades, small tracheal diameter, and small opening of their mouth. Before attempting endotracheal intubation, make sure the animal is adequately anesthetized. If the patient is light, active regurgitation and consequent aspiration can occur during laryngeal stimulation.

- Equipment needed for orotracheal intubation:

- Laryngoscope (use a long blade)
- Stylet (longer than the endotracheal tube)
- Several sizes of long endotracheal tubes. Sizes 9-12 mm and 10-14 mm internal diameter are appropriate for adult llamas and alpacas, respectively.
- Gauze strips (to hold the mouth open)
- Lube
- Cuff syringe

After induction, keep the animal in sternal recumbency and keep neck extended vertically with the tip of the nose facing up. The anesthetist needs to be above the head of the animal and a step stool can be used for big size animals. One person should hold the animal (body and head) as straight as possible to facilitate the intubation. The tip of the stylet should exit the endotracheal tube at the patient end and should be placed between the arytenoids. While holding still the stylet from the other end (distal to the patient, where the endotracheal tube connects to the Y piece of the anesthesia machine), the anesthetist should insert the endotracheal tube into the trachea. It is important to inflate the endotracheal tube cuff as soon as possible to avoid aspiration in case the animal regurgitates. The endotracheal tube placement should be checked via visual inspection and/or using a capnograph.

Monitoring camelids under general anesthesia is similar to other species:

- Mucous membranes and CRT
- Pulses and heart rate
- Respiratory rate
- Eye reflexes - eye position is variable and most camelids maintain the palpebral reflex during a surgical plane of anesthesia
- ECG
- Blood pressure – the cuff can be placed on the front or on the back leg. An arterial catheter can be placed in the femoral artery, which is very superficial. Place the catheter as distal as possible
- Temperature

During the procedure, keep the head slightly elevated and point their nose down. Passive regurgitation often occurs and position the head as described helps drain fluids coming from the stomach.

During recovery, place the animal in sternal recumbency with the head elevated to decrease nasal edema (they are obligate nasal breathers). Leave the endotracheal tube in place until the animal can chew and swallow. Do not feed or give water to the patient until he can walk.