Anesthesia and Analgesia for Donkeys  (14-Sep-2004)

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Introduction

Approximately 50 million donkeys live in the world today. Most of them are used for work or transport of goods, supplies and humans; the majority of these will never see a veterinarian. However, as their role in sustainable agriculture (as a valuable part) becomes better understood, veterinary care becomes more accessible. In both the USA and western Europe, donkeys have become more popular as companion animals and their owners are well organized; numerous donkey clubs and rescue organizations exist. The number of donkeys presented to veterinarians appears to be increasing. As a desert-adapted animal, the donkey has evolved to function and survive in conditions under which a horse could not. These differences in anatomy, behavior and physiology create subtle (or not so subtle) differences in how it should be anesthetized and managed under anesthesia. In the USA donkeys are divided by size into: miniature (less than 90 cm at the withers), standard (91 - 140 cm) and mammoth (greater than 140 cm at the withers). A similar division is made in Utrecht; donkeys are divided into a larger type and a smaller or Mediterranean type (Fig 1).

![Figure 1. Mediterranean miniature donkeys in the Netherlands.](www.ivis.org)

Pre-operative Evaluation and Preparation

Donkeys are very intelligent and very trainable. Because they do not have the same flight response as a horse, and are very cautious about new objects or environments, they have gained the reputation for being stubborn. However, if given time to examine each new situation, they are very willing to cooperate. It just takes patience and an understanding [1] of how they differ from horses to work with them! It is also somewhat more difficult to interpret their "body language" which is different from a horse. This is important in assessing the donkey’s pre-operative condition; they are very stoic and will not show pain as readily as a horse will. One must investigate carefully to determine how much underlying disease or pain may be present.

Pre-operative blood samples may be useful for evaluation of the donkey’s health. Be aware of the fact that there are normal differences between donkeys and horses blood work [2-4]; given the type of environment or use of the animals, it may be necessary to establish normal laboratory values in healthy donkeys. Also, donkeys do not hemoconcentrate until they are significantly dehydrated [5], so routine use of the hematocrit to guide fluid therapy must take this into account.

If the donkey has a very painful condition, it is strongly recommended that analgesics be administered before anesthesia is started. One of the authors (N.S. Matthews) has seen cardiac arrest in 3 donkeys, shortly after induction of anesthesia for treatment of painful orthopedic conditions. Although all animals were resuscitated successfully, this might not have occurred if effective analgesia had been provided pre-operatively. Since donkeys metabolize non-steroidal anti-inflammatories (NSAID’s) at different rates than horses, these drugs need to be administered at different intervals than in the horse. Phenylbutazone [6] and flunixin [7] are more rapidly metabolized and may need to be given twice daily to standard donkeys and three times daily to miniature donkeys [8], while carprofen appears to be more slowly metabolized in donkeys than in horses [9]. Although pharmacokinetic (PK) data for other analgesics may not be available, it seems reasonable to expect that administration to donkeys should be based on clinical assessment of the patient rather than on PK data or dosing intervals.
obtained from horses. Due to drug legislation in Europe, NSAID’s used there are primarily flunixin (given pre-operatively IV) or vedaprofen (2 mg/kg by slow IV injection). Vedaprofen paste may be used orally (2 mg/kg initially, followed in 12 hours by 1 mg/kg; then 1 mg/kg BID). Meloxicam suspension (0.6 mg/kg once daily for a maximum of 14 days) has also been used by one author (P. van Dijk). However, pharmacokinetics of meloxicam in donkeys indicates that the mean residence time, following IV injection, is less than one hour (N.S. Matthews, unpublished data).

Catheter Placement and Pre-operative Preparation

Use of an intravenous catheter, placed in the jugular vein, is strongly recommended to facilitate administration of anesthetic drugs and fluids. Subtle anatomic differences between horses and donkeys make it slightly more difficult to accomplish. Although the jugular vein lies in the same location in the donkey, the cutaneous colli muscle is much thicker, with dense connective tissue overlying the vein, than in the horse. After identifying the vein, a steeper angle should be used to penetrate the skin and vein, than in the horse. Use of a lidocaine bleb in the skin and subcutaneous tissue is also recommended; donkeys will usually tolerate one attempt to catheterize the vein, but do not tolerate multiple attempts well. The authors have used a variety of catheter sizes and lengths; 14- or 16-gauge, 80 mm catheters in large or standard donkeys and 16-gauge, 80 mm catheters in mini-donkeys (N.S. Matthews, P. van Dijk); 16-gauge, 52 mm catheters in mini donkeys (P. van Dijk). The catheter should be well secured (preferably by suturing in place) and covered, after successful placement in the vein; donkeys may work quite hard to scratch out or pull a catheter! As for catheter maintenance in horses, examination for thrombophlebitis and flushing of the catheter at regular intervals (4 times daily) are indicated [10].

As for horses, pre-operative preparation of donkeys should include a thorough pre-anesthetic evaluation, which should include evaluation of history, physical exam, ECG, and lab work. This allows for assignment of American Society of Anesthesiologists (ASA) qualification (and therefore, risk assessment). Donkeys should be deprived of food for 6 - 12 hours (depending on size and age of the donkey), while free access to water is allowed. If endotracheal intubation is planned, the mouth should be rinsed with water using a dose syringe, until it is clean of food particles.

Sedation

Unlike mules, donkeys are usually well sedated by any of the tranquilizers and sedatives used at the same dose as in the horse. A caveat to this, however, is that the dose of sedatives and tranquilizers used in horses varies greatly with the breed, condition, and amount of anxiety present when the drug is given. Feral or unbroken horses may require twice (if given IV) or three times (if given intramuscularly) the normal dose of a sedative as would be given a well-handled horse. Such is the case for donkeys too. Although there is no scientific evidence, clinical experience shows that different sizes and types of donkeys respond differently to sedatives; in the author’s opinion (P. van Dijk), the Mediterranean type is more sensitive to sedative drugs and needs a lower dose.

Various combinations of xylazine (0.6 - 1.0 mg/kg, IV or IM) with acepromazine (0.1 mg/kg, IV or IM) or butorphanol (0.02 - 0.04 mg/kg IV); detomidine (0.005 - 0.02 mg/kg, IV or IM) and butorphanol, or buprenorphine, have all been used with relatively good success, either for standing procedures (combined with local anesthesia) or before general anesthesia. The combination of etorphine with acepromazine and reversal with diprenorphine, should be used cautiously in the donkey [11]. The donkey may metabolize diprenorphine to active agonist, thereby "relapsing" into a sedated state. In Utrecht, nalbuphine (0.1 mg/kg) or methadone (0.1 mg/kg) is combined with sedation to provide analgesia; following legislation, methadone should be the opioid of choice. The authors do not routinely use an anticholinergic as premedication in donkeys.

Induction of Anesthesia, Intubation and Injectable Anesthesia

A variety of methods can be used for induction of anesthesia depending on available drugs, size and condition of the donkey and familiarity with different protocols. In the USA the preferred method for induction is to sedate with xylazine (1.1 mg/kg, IV) then to induce anesthesia with ketamine (2.2 mg/kg, IV). Addition of butorphanol (0.01 - 0.02 mg/kg, IV) or diazepam (0.03 mg/kg, IV) may provide additional sedation and muscle relaxation. These drugs will generally provide 15 - 20 min of anesthesia in most donkeys, however, miniature donkeys are inadequately anesthetized even for a short procedure, with these doses of drugs; they show a lot of muscle rigidity and excitatory effects. Addition of midazolam (0.06 mg/kg) or diazepam (0.03 - 0.06 mg/kg) are recommended (P. van Dijk) to provide better sedation and muscle relaxation. Tiletamine-zolazepam (1.1 mg/kg, IV) provides good anesthesia in miniature donkeys, following xylazine with butorphanol [12] and works well in larger donkeys as well. Propofol (2.2 mg/kg, IV) can be used for induction, following sedation with xylazine, however, it is quite costly and not licensed for equines. In the past, one of the authors (P. van Dijk) has used mask induction of donkeys, however, it is difficult to get patients to a deep enough plane of anesthesia for easy intubation. Thiopental (5 mg/kg, IV) produces a rapid and smooth induction; since it does not provide analgesia, it should be used with an effective sedative/opioid
premedication. Anesthesia can be maintained for short periods (< 25 min) with thiopental, but respiration must be carefully monitored since thiopental may produce apnea. It is not advised unless intubation and artificial ventilation can be performed. Combinations of guaifenesin with thiopental or ketamine have been used successfully in donkeys, however, these should be used with caution. Donkeys appear to be more "sensitive" to guaifenesin; donkeys will become recumbent with approximately 60% of the dose required to produce recumbency in horses [13]. However, they metabolize ketamine more rapidly than horses do, so the combination of guaifenesin-ketamine-xylazine (GKX or "triple drip") commonly used in horses may not work well in donkeys. We have had very good results anesthetizing donkeys with a modified "triple drip". Following sedation with xylazine (1.1 mg/kg, IV), anesthesia is induced by rapid administration (via gravity flow) of the combination of one liter of 5% guaifenesin combined with 2 grams ketamine and 500 mg xylazine. Once the donkey becomes recumbent, the rate is reduced to approximately 1.5 - 2 ml/kg/hr (as needed for surgery) and the drip continued throughout the procedure. At Utrecht, the following infusion is used following premedication with detomidine and methadone and induction with ketamine/midazolam: 500 ml (10%) guaifenesin is combined with 1 ml (10 mg) detomidine and 10 ml (1000 mg) ketamine. An infusion rate of 0.6 - 1 ml/kg/hr is used; usually the lower rate is sufficient, although it may be increased with careful monitoring. Anesthesia with "triple drip" can be maintained for up to 3 hours, however, recoveries will increase if used for longer than 1 hour. If injectable anesthesia is maintained for longer than 1 hour, padding and insufflation with oxygen is recommended to minimize complications related to myositis and hypoxia.

Detomidine (0.04 mg/kg, IV) followed by ketamine (2.2 mg/kg, IV) is another combination which works well in donkeys [14]. This combination provides about 10 min more anesthesia time than xylazine and ketamine.

Endotracheal intubation occasionally seems to be more difficult to accomplish in donkeys than in the horse. It is possible that the trachea is proportionately smaller; mini donkeys usually take a size 14 - 16 mm tube and 18 - 20 mm tubes for standard donkeys, while a 24 mm tube might be used for Mammoth donkeys. The laryngeal reflex seems to be more persistent at a light plane of anesthesia; an additional bolus of induction drugs will usually allow intubation to be performed. Intubation may be particularly difficult when ketamine is used for induction; addition of guaifenesin (0.5 ml/kg of 10%) will facilitate this (P. van Dijk). Intubation following induction with thiopental is generally easy to perform.

Local anesthetics are an important component of balanced analgesia especially when injectable anesthesia is used. Lidocaine can be injected into or proximal to the surgical site; this reduces the need for general anesthesia and improves post-operative analgesia.

**Inhalant Anesthesia and Monitoring**

Donkeys are well maintained with any of the commonly used inhalant anesthetics (i.e., halothane, isoflurane or sevoflurane). MAC-values (MAC: Minimum Alveolar Concentration) for halothane and isoflurane in donkeys appear to be similar to the horse [14]. Although the MAC-value for sevoflurane has not been measured in donkeys, vaporizer settings appear to be similar to those used in horses. One of the authors (P. van Dijk) likes to use a continuous detomidine infusion (0.16 microgram/kg/min) to decrease the isoflurane dose by approximately 25%, therefore allowing a stable cardiovascular plane and good analgesia. At the end of the procedure, when the vaporizer is turned off, the detomidine constant rate infusion (CRI) is continued until the donkey is in the recovery stall.

Maintenance and monitoring donkeys during inhalant anesthesia is quite similar to horses. The use of intravenous fluids is recommended to help maintain blood pressure. Monitoring blood pressure is recommended since it seems to be a more sensitive measure of anesthetic depth (N.S. Matthew). Since donkeys can be very stoic, they may remain immobile, with a quiet eye (as judged by palpebral and corneal reflexes and the presence of nystagmus) while they are not at a surgical plane of anesthesia. However, in this case, blood pressure will be high therefore revealing anesthetic depth. Arterial catheters may be placed in the facial, auricular or dorsal metatarsal arteries to facilitate blood pressure monitoring. Ventilation/perfusion mismatching is rarely seen in smaller donkeys (P. van Dijk), but has been seen in larger donkeys (N.S. Matthew); the authors routinely provide ventilation (IPPV) with 100% oxygen during long anesthetic periods and as needed for hypoventilation. Although hypotension is not as commonly seen as in horses, dobutamine can be used for its treatment. Other acid-base disturbances are treated as would be done for a horse.

**Recovery**

Donkeys generally recover from anesthesia without the excitement which horses may experience if good analgesia has been provided. Recovery should be supervised and it may be necessary to provide additional oxygen via an endotracheal tube or nasal insufflation. The author (N.S. Matthew) has observed difficulty breathing which is relieved by straightening the head
and neck. Our experience with donkeys shows that their recovery times are slower from most anesthetics, than in horses. Mediterranean donkeys may recover more rapidly than larger donkeys (P. van Dijk). Donkeys generally do not stand up until fully recovered, unlike the horse, which may make attempts to stand before it is ready. It is also not unusual for donkeys to stand up, hind end first, as a cow would, while balancing on a front knee.

The importance of providing good analgesia during recovery and after surgery can not be over-emphasized. The use of local anesthetics, and opioid administration as part of balanced anesthesia, are recommended as well as post-operative administration of NSAID’s used for several days.

It is also important to withhold food for 1 hour after recovery (P. van Dijk), since general anesthetics and detomidine decrease the peristaltic movements of the esophagus. Obstruction of the esophagus (choke) can occur if donkeys eat immediately after recovery.

Summary
Many different sizes and breeds of donkeys exist in the world and anesthetic management may differ somewhat depending on these variables. Although very similar to horses, donkeys are not the same; the anesthetist should expect to see subtle differences which may affect the anesthetic management (e.g., drug dosing intervals and monitoring) of donkeys.

References