How to Anesthetize Foals on the Farm for Minor Surgical Procedures

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1. Introduction
There are many situations in which it is necessary to anesthetize foals on the farm or in the field. Periosteal transaction, umbilical hernia repair, transphyseal screw removal, regional perfusion, and joint lavage are a few instances in which general anesthesia is preferred over sedation. It is important for the practitioner to understand the drugs available for general anesthesia and the potentially detrimental effects that can occur when dealing with an immature metabolic and cardiovascular system. Although many anesthetic protocols are available, finding a relatively simple and safe protocol in which the practitioner is familiar will minimize risk associated with anesthesia. The following is an example of a protocol that is successful in a private practice in Lexington, Kentucky.

2. Neonates Versus Foals
The definition of a neonate is typically a foal <1 wk of age; however, this definition can include foals up to 1 mo of age, particularly when the foal is sick. The definition is important, because there are physiologic variations in neonates that alter the way in which drugs are redistributed and metabolized as well as variations in the cardiovascular system. An elevated metabolic rate, immature hepatic and renal function, lower body fat, and increased risk of hypotension and hypothermia are a few of the concerns associated with neonates. Additionally, cardiac output is dependent on heart rate and stroke volume. Drugs that slow the heart rate, such as the alpha-2 adrenergic agonists like xylazine, can significantly alter cardiac output, because neonates have a decreased capacity to increase stroke volume to compensate.

3. Sedation and Induction
Adequate sedation is essential before the induction of anesthesia. Minimal cardiovascular and respiratory depression while producing sedation occurs when butorphanol is combined with a benzodiazepine. Butorphanol at 2 mg, IV (range = 2–5 mg, IV) combined with midazolam (in the same syringe) or diazepam (in a separate syringe) at 2.5 mg, IV (range = 2.5–5.0 mg, IV) will produce recumbency in most neonates and sedation in older foals without the production of bradycardia. This sedation technique is useful for older foals that have existing disease; however, healthy older foals can be sedated with xylazine at 0.6 mg/kg, IV (range = 0.2–0.8 mg/kg, IV). Xylazine is preferred over detomidine, because the xylazine sedation is of shorter duration.
This shorter time minimizes the duration of cardiovascular depression while allowing the ability to dose again, if necessary.\(^3\)

If possible, keep the mare close to the foal during the procedure or at least until anesthesia is induced in the foal to avoid excitement associated with separation. Induction of anesthesia can be achieved with ketamine\(^2\) alone at 2.0 mg/kg, IV or the combination of ketamine at 2.0 mg/kg, IV and diazepam or midazolam at 0.8 mg/kg, IV (range = 0.04–0.10 mg/kg, IV). Often, a short duration procedure (15–30 min) like a joint flush or screw removal can be performed by sedating the foal and then using a single bolus of 100 mg ketamine, IV for foals <1 mo of age and 200 mg ketamine for older foals. A bolus of 20–40 mg lidocaine,\(^b\) IV can be given to extend the anesthesia by 4–5 min in some cases, or an additional bolus of ketamine at 50 mg, IV can be administered. Procedures of longer duration like umbilical hernia repair can be performed using sedation, induction, and then a constant rate infusion of the combination of 50 gm guaifenesin,\(^c\) 500 mg xylazine, and 1 gm ketamine (triple drip). This anesthetic combination requires the placement of a short-term venous catheter for administration. To avoid the struggle associated with placing a catheter in an awake foal, the foal can be sedated and induced “off of the needle.” The catheter is then placed after the foal is recumbent. Although many practitioners travel alone to perform procedures on the farm, it is recommended that a veterinary intern, technician, or assistant be present to aid when anesthetizing foals. Having someone available to monitor and administer additional drugs facilitates a positive outcome.

When using triple drip in foals, it is important to minimize the amount administered by using a slow-drip rate (one drop every 2–4 s). Large volumes of triple drip administered to foals result in weak and prolonged recovery. Ideally, general anesthesia using total IV anesthesia should not exceed 45–60 min. Longer duration anesthesia results in cardiovascular depression with subsequent development of hypoxia and prolonged recovery.

It is important to remember to protect the foal’s eyes while it is anesthetized. Sterile ophthalmic lubrication is recommended to protect the eyes from corneal ulcer. Although horses typically retain a blink under total IV anesthesia, this might not be adequate to prevent the drying or abrasion that can occur during recumbency and recovery.

Monitoring the foal under anesthesia can be done using a portable monitor like a pulse oximeter or electrocardiogram. Most often, monitors are not available in the field, and the best monitor is the clinician. By evaluating pulse rate and quality, respiration rate and quality, mucous membrane color, and capillary refill time while evaluating eye position and movement, the practitioner can evaluate the depth of anesthesia. In the case of decreased or depressed respiration, it is advantageous to have available a variety of endotracheal tubes between the sizes of 10 and 16 mm internal diameter and an ambu-bag. Oral or nasal intubation is relatively easy, and the smaller size of foals allows the use of an ambu-bag for assisted ventilation, if necessary.

4. Recovery

Hand recovery is recommended for foals. Smaller size enables the practitioner to assist the foal while it recovers. Holding the foal down until it has a normal menace response and then placing a hand on the tail to lift the back end when the foal attempts to stand is beneficial. Recovery typically occurs within 15–20 min after simple induction techniques and within 15–30 min of terminating total IV anesthesia using triple drip. Blankets or towels are recommended to keep the foal warm while it recovers and to assist in drying the foal after the procedure.

5. Results

This simple anesthetic protocol for minor surgical procedures has been proven safe for foals in Lexington, Kentucky. By having an assistant to adequately monitor pulse, respiratory rate, mucous membrane color, and depth of anesthesia, outcome is improved. The assistant facilitates additional dosing of anesthetics, if necessary.

6. Discussion

Biosecurity and economic concerns or the inability to move a mare and foal to a hospital setting have increased the need to perform surgical procedures in foals on the farm. Knowledge of drugs used and the potentially detrimental effects associated with them can prepare the practitioner for these procedures. By using a simple, familiar protocol and minimizing the amount of drug used, the equine practitioner can safely perform short-term surgical procedures on the farm.

References and Footnotes

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5. Versed, Hospira Inc., Lake Forest, IL 60045.
8. Dormosedan, Pfizer Corporation, Orinon Pharmaceuticals, Exton, PA 10017.
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