

**LARGE RUMINANT ANESTHESIA**  
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Physical restraint is often necessary in food animal practice to facilitate completion of procedures. The use of local anesthetic blockade is well established in food animal practice and is an appropriate method for reducing the discomfort and stress of the patient. Adding some degree of chemical restraint can make many of these procedures more pleasant for both practitioner and patient. There are instances where general anesthesia is the more appropriate choice to provide patient control and comfort. This talk will outline several approaches for producing varying degrees of chemical restraint and several of methods for producing general anesthesia in the field setting. The enhanced level of patient cooperation improves efficiency, offsetting the modest additional cost of the drugs utilized. The addition of supplemental analgesics can further increase the comfort of the patient and reduce the stress of the procedure.

Ruminants continue to produce a significant amount of saliva while sedated or anesthetized. All of the techniques presented tend to leave some degree of “protective” laryngeal and eye reflexes in place. It is still important when patients will be placed in lateral or dorsal recumbency using chemical restraint or general anesthesia to position the head so that saliva runs out of the mouth rather than pooling back near the larynx whenever possible. This can be accomplished simply by placing a pad under the head-neck junction for patients in lateral recumbency so that the opening of the mouth is below the level of the larynx. Protecting the airway becomes much more challenging in procedures requiring the patient to be placed in dorsal recumbency. Ruminants placed in dorsal recumbency are positioned on a foam pad with the neck and head extending past the edge. This elevates the body such that the neck can be gently twisted as the head is lowered to the floor or surgery table surface so that the head can be positioned as lateral as possible to enhance saliva egress. When the head can not be positioned to facilitate saliva egress or the procedure is expected to produce a significant amount of blood or other material that could enter the airway endotracheal intubation should be strongly considered.

Several options exist for producing chemical restraint and /or field anesthesia in food animal patients. A crucial consideration when selecting a drug protocol is whether the patient needs to remain standing or achieve recumbency for optimal completion of the procedure. Instances where either situation will facilitate successful completion of the procedure provide more latitude in selection of drug doses.

*Alpha-2 Agonist: Xylazine*

Ruminants are fairly sensitive to xylazine. When dosed too aggressively, xylazine often produces recumbency in ruminant patients. Unfortunately, the initial demeanor of the patient mediates the effect obtained with xylazine, making it more difficult to obtain the desired level of cooperation in many ruminant patients, especially when recumbency is not desired.

Xylazine can be administered either intravenously (IV) or intramuscularly (IM) and produces a dose dependent degree of sedation, muscle relaxation, and analgesia. Intravenous administration of xylazine provides a faster onset and more intense level of chemical restraint and analgesia. The fairly rapid onset time can be used to advantage, allowing multiple smaller doses of IV xylazine to be administered in an attempt to titrate the effect to the desired level.

Intramuscular administration results in a more gradual onset and provides a longer duration of less intense chemical restraint and analgesia. Intramuscular administration is often used when patient cooperation does not allow IV administration or when extended duration is desired. The intramuscular dose is typically twice the IV dose you would select for the patient based on the desired level of effect and the patient's initial demeanor.

Xylazine produces dose dependent side effects, including decreases in gastrointestinal motility and cardiorespiratory function. Xylazine should be avoided or used very cautiously in compromised patients and should be reversed upon completion of the procedure. Even in normal healthy patients, when large doses of xylazine are administered (those intended to produce recumbency), reversal is advisable to minimize the risk of gastrointestinal complications. Xylazine can increase uterine tone in very late gestation and its use during this time may not be advisable.

Xylazine can be used alone to produce standing sedation. Xylazine (0.02-0.03 mg/kg IV or 0.04-0.06 mg/kg IM) will produce standing sedation in the majority of normal healthy cattle with a low risk of recumbency. Xylazine can also be used to induce recumbency in ruminants. Xylazine (0.05-0.1 mg/kg IV, depending on demeanor and the importance of success) will produce recumbent sedation in the majority of normal healthy cattle. Xylazine can produce recumbency when given IM, but it is not very predictable and more difficult to successfully reverse.

Duration of xylazine sedation and analgesia is dose dependent, generally lasting about 30-40 minutes following IV administration. Xylazine sedation and its attendant analgesia are useful for facilitating short diagnostic or therapeutic procedures on uncooperative patients. While patients will generally tolerate mildly uncomfortable stimuli, this approach should not be counted on to provide surgical analgesia. With the advent of the "ketamine stun" technique we are relying less on pure xylazine restraint at Ohio State.

Yohibine or tolazoline may be used to reverse the effects of xylazine to facilitate a quicker recovery at the end of a procedure and minimize the risks of gastrointestinal complications. IM administration of the reversal agent is preferred in all but emergency situations as it decreases the risk of CNS excitement or cardiovascular complications. The shorter duration of action of the reversal agents when given IV can result in the return of the effects of xylazine that has been administered IM. Reversal of xylazine should not be attempted until sufficient time has elapsed to allow any ketamine or Telazol used to resolve (30-45 min. post IM and 15-30 min. post-IV administration) to reduce the chances of a rough recovery. The amount of reversal agent used depends on the dose and duration since administration of xylazine. Emergency doses of yohimbine (0.1mg/kg IV) or tolazoline (2 mg/kg IM) can be administered, but tolazoline should not be administered IV rapidly as this can result in cardiac asystole. When dosed properly the effects of reversal should start to become evident about ten minutes following IM administration.

#### *"Ketamine Stun"*

Eric Abrahamsen and I have been developing an injectable chemical restraint technique to provide an enhanced level of patient cooperation and analgesia. It is called "the ketamine stun" because patients under its influence generally appear quite awake, though they are much more cooperative. We have been experimenting with various approaches to provide these benefits in both the standing and recumbent patient. These techniques are still under development and are offered here in hope that your experimentation with them will enhance all

of our abilities to meet the needs of the ruminant patients in our practices. The level of analgesia varies from patient to patient and should not be counted upon for surgical procedures normally requiring a local anesthetic block.

For standing procedures a combination of xylazine (0.02 mg/kg), ketamine (0.05 mg/kg) and either butorphanol (0.025 mg/kg.) or morphine (0.05 mg/kg.) is administered IV or IM. Morphine is much more cost effective and we have not found its use to alter the results of the technique. Patients may show a brief period of unsteadiness approximately one minute following IV administration of the combination. Experience has shown that this can be minimized by administering the ketamine separately 10 minutes after the xylazine-opioid bolus. Peak level of patient cooperation and analgesia will extend for approximately 15 minutes following the administration of the ketamine. An additional half dose of ketamine administered IV can be used to extend duration another 5-10 minutes. We have experimented with using an IM administration of ketamine (0.1 mg/kg.) in place of the IV dose to extend the duration of patient cooperation and analgesia with success. When the ketamine is administered IM, it should be given soon after the IV administration of the xylazine-opioid combination to allow for its slower onset.

When recumbency is desired we increase the doses of the xylazine (0.05 mg/kg.) and ketamine (0.2-4 mg/kg. depending on level desired) used in the protocol. These patients will appear awake in most instances, but will be much more cooperative than when physical restraint (alone or with xylazine) is used. As with the standing approach, additional half doses of ketamine can be used to extend the duration of patient cooperation and analgesia. Patients are often able to stand and walk upon completion of procedures using this restraint technique. We have found this technique very useful for improving both minor procedures such as casting fractures and as a supplement during more major surgeries using a local anesthetic block.

#### *Intramuscular Xylazine – Ketamine*

Xylazine (0.025-0.05 mg/kg) and ketamine (2 mg/kg) are administered together intramuscularly. This combination can be useful for subduing a very combative patient. It will generally produce recumbency, though extremely unruly patients may not go down in a timely fashion without some assistance. The level of anesthesia and analgesia will vary markedly from patient to patient. Additional IV ketamine or triple drip can be administered to enhance the level of anesthesia and analgesia, if required. Reversal of xylazine should not be attempted until sufficient time has elapsed to allow the Ketamine anesthesia to be resolved (30-45 min. post IM and 15-20 min. post IV administration).

#### *Telazol-Ketamine-Xylazine (TKX-Ru)*

We have been using a variation of the porcine TKX (TKX-P) to capture “wild” ruminants with great success using either a pole syringe or a dart gun. A 500 mg vial of Telazol is reconstituted with 250 mg of ketamine (2.5 mL) and 100 mg of xylazine (1 mL). Due to the space occupied by the Telazol powder, the final volume is 4.0 mL. We are still experimenting with the dose rate for using this combination. At this time our dosing protocol is approximately 1.25-1.5 mL/125 kgs for smaller patients and 1 mL/125 kgs for larger patients. When dosed properly, we expect the patient to become recumbent and tractable approximately five (ideally) to ten minutes after IM administration. When the effect is significantly faster than five minutes we feel we have overdosed the patient. To prevent unnecessary redosing of TKX-Ru, we typically allow up to twenty minutes before additional drugs are administered (typically a partial

dose of TKX-Ru). The degree and duration of chemical restraint and analgesia varies markedly from patient to patient. Intravenous administration of Double Drip or Triple Drip can be used to enhance and extend the effects produced by TKX-Ru if needed. Recovery is generally smooth from TKX and patients are typically sternal by 40 to 60 minutes following administration. Reversal of xylazine can be done at this point, if desired, though we have found unruly patients recover and transport very nicely when xylazine sedation is left to resolve on its own. As TKX-Ru is fairly expensive, leftover TKX-Ru can be frozen to preserve its function for up to six months.

#### *Intravenous Xylazine – Ketamine*

Xylazine (0.05 mg/kg IV) is administered. When marked sedation is evident or patient becomes recumbent ketamine (2 mg/kg IV) is administered. The addition of the ketamine provides approximately 15-20 minutes of surgical analgesia. A half dose of ketamine IV can be used to extend duration an additional 10 minutes.

#### *Overview:*

Chemical restraint can facilitate the ease and humaneness of surgical procedures done on the farm. We have found that surgical procedures are most easily performed when a combination of good handling practices, a calm environment, appropriate use of local or regional anesthesia, and judicious use of drugs to provide sedation, analgesia, and diassociation are used.