PAIN CONTROL

In any disease process, pain is always present. This pain can be acute or chronic. It can be caused by our treatment or by our manipulations. It is of variable intensity and the systemic adverse effects can differ from an animal to another. Pain always generates stress for the animal. In some situations, mild levels of pain can be beneficial and may help to avoid catastrophic failure of a fracture repair on adult cattle.

If possible, pain should be prevented prior to surgery. Chronic pain is more difficult to control than acute pain. Therefore, multimodal pain therapy is often necessary.

Sedation

A good sedation is effective to control stress caused by immobilization during surgery. Reducing the amount of stress will inevitably decrease the level of pain sustained by the animal.

Xylazine (alpha-2 agonist): Excellent sedation with mild analgesia in cattle. Causes severe cardio-respiratory depression, bloating (especially when the animal is in dorsal recumbency) and diuresis. Can be given IV or IM at a dose between 0.05 and 0.1 mg/kg. The latter is usually given IM. The sedation will last for about 1 hour. If necessary, it can be antagonised with yohimbine or tolazoline. Avoid giving to a pregnant cow in her last trimester (has an oxytocine-like effect that can cause premature calving).

Acepromazine: Good sedation, mild cardio-respiratory depression (causes hypotension with a reflex tachycardia). Does not provide any analgesia. Can be given IV or IM at a dose between 0.05mg/kg and 0.075mg/kg. Time from administration to effect is long especially if given IM. The sedation can last up to 8 hours. This drug has no antagonist. Safe for pregnant cows.

Diazepam: Good sedation on young or very sick animals. Very effective muscle relaxant but does not provide any analgesia. Mild cardio-respiratory depression. Given IV slowly at a dose between 0.1 and 0.2 mg/kg. The sedation lasts for 1 to 2 hours. It can be antagonised with flumazenil. This is a controlled drug that is expensive to use on adult cattle.
**Ketamine stun**: This combo is created by mixing together a low dose of xylazine, butorphanol and ketamine. It is very effective to perform minor and major procedures on stressed and uncooperative cattle. The combo can be given IV, SQ or IM depending on the behaviour of the animal, the intended procedure and the environment in which the procedure will be performed. The main advantage of this combination of drugs is that a low dose is given of each drug, decreasing the undesirable side effects of each drug without decreasing the level of sedation and analgesia.

*Standing ketamine stun*

- Butorphanol (0.01–0.025 mg/kg)
- Xylazine (0.02–0.05 mg/kg)
- Ketamine (0.04–0.1 mg/kg)

The lower end of the dose is usually given IV and the higher end is given IM. However, on very stressed animals, the upper end of the dose can be given IV. With this combination of drugs and a good local block, most animals will remain standing with their feet glued to the ground allowing you to perform procedures such as c-sections, dehorning and castrations.

*Recumbent ketamine stun (given IV only)*

- Butorphanol (0.05–0.1 mg/kg)
- Xylazine (0.02–0.05 mg/kg)
- Ketamine (0.3–0.5 mg/kg)

**Analgesia**

Analgesia can be provided by giving NSAID or opioids. Ideally, the analgesia is provided prior to the trauma. For example, flunixin meglumine can be given to a calf prior to umbilical surgery.

**NSAID**: Many NSAIDs are available. However, their homologation varies from a country to another.

*Phenylbutazone used to be a great NSAID. It was a cheap molecule that was very potent in controlling orthopedic pain. However, because of its relation with aplastic anemia in humans, this drug should not be used anymore.*

*Aspirine is a NSAID that is cheap and readily available. However, it should not be used in lactating dairy cows in the US and its analgesic effect, in cattle, seem to be weak.*
Flunixin meglumine is homologated in dairy cattle after IV injection only. It is very efficient to control visceral and abdominal pain.

Ketoprofen is a molecule with similar systemic effects to flunixin meglumine. It is homologated in Canada but not in the US.

Meloxicam is a cox-2 selective NSAID that is now approved in Canada to treat calves with diarrhea or to prevent pain caused by dehorning. Lately, it has been approved in the treatment of acute mastitis (single dose) in dairy cows with a 4 day milk and a 20 day meat withdrawal. We have used meloxicam for acute and chronic orthopedic pain. We believe that its beneficial effects are between what is obtained with flunixin meglumine and phenylbutazone. Because of its long half life (26 hours), meloxicam injections can be safely repeated every 48 to 72 hours. However, no withdrawal times are available when meloxicam injections are repeated.

Opioids: They are usually given in combination with NSAID to control severe pain. However, when abomasal ulcers are suspected, opioids can replace NSAID. They are somewhat of a hassle to use in a field set-up because it is a controlled drug.

Butorphanol: This molecule is more frequently used in cattle. It has fewer side effects than morphine in regards to the GI tract. One of the disadvantages of this drug is the cost associated with its use. Butorphanol can be given IV (every 2 hours), IM (every 6 hours) or SQ (every 8 hours), at a dose of 0.05mg/kg. With higher doses, some cows will get excited and will start to eat compulsively.

Morphine: Rarely given systemically. More frequently used in epidural analgesia at a dose of 0.1 mg/kg. Could be used systemically at 0.1mg/kg IV (every 2 hours), IM (every 6 hours) or SQ (every 8 hours).

Local anesthesia

A good local block allows the surgeon to perform a pain free procedure with or without sedation. The most common blocks in cattle are the proximal and distal paravertebral, the line block and the inverted L for flank surgery. Epidural anesthesia can be used for umbilical surgery or rear limb surgery. Brachial plexus anesthesia can be used for thoracic limb surgery. IV loco-regional block under a tourniquet could be very effective to anesthetise the distal limb. Finally, pudendal nerve block, the Peterson block and the cornual block are very effective to anesthetise the penis, the eye and the horn respectively.
**Extreme or chronic pain**

On some occasions, the usual analgesic therapy will fail to provide relief to the animal. For example, a cow with chronic tenosynovitis might not be comfortable after drainage and debridement of the tendon sheath even if NSAIDs are used. When the infection is under control, immobilization of the affected leg might be the only way to cut the vicious circle of pain.

A cow suffering from severe cutaneous burns might not respond well to the administration of butorphanol every 8 hours. However, if the butorphanol is given continuously IV (0.02mg/kg/hr) it might be effective to control partially or even completely the pain. Another option is to use a combination of butorphanol (0.02mg/kg/hr) and ketamine (0.2mg/kg/hr) as a CRI.

**POST-OPERATIVE ILEUS**

How to avoid post-operative ileus? Create the smallest incision possible, decrease manipulation of bowels and treat all the concomitant diseases to avoid hypocalcemia, endotoxemia and peritonitis. Sometimes, even if everything is performed with state of the art techniques, post-operative ileus occurs and is difficult to treat. The most important thing to do is to differentiate between a functional ileus and a mechanical ileus. The functional ileus is most likely caused by pain and electrolyte imbalances. The electrolytes, especially potassium and calcium, need to be monitored frequently. Calcium is taken care of with fluid therapy alone. A combination of intravenous (no more than 0.5 mEq/kg/hr IV) and oral administration is needed to get potassium values back to normal (50g/100kgBW/day).

Pain control is important to prevent post-operative ileus. After surgery such as bowel resection and anastomosis, a combination of NSAID and opioids is needed. Flunixin meglumine (1 mg/kg SID or even BID) provides good pain relief in cattle. Care must be taken in anorexic cattle. Giving more than 3 doses of any type of NSAID in anorexic cattle puts them at risk of developing abomasal ulcers. Opioids can be combined with NSAID or can be used alone if abomasal ulcers are suspected. Butorphanol at a dose of 0.05mg/kg SQ TID seems to alleviate mild pain effectively. On very painful cattle, CRI of opioids and ketamine have been used and seemed to control pain better than repetitive doses of opioid (see doses above). The result of this drip is sometime impressive (increased food intake and fecal output). The animal might look mildly sedated with this combo.

If the electrolyte imbalance is corrected and the pain is controlled, but the ileus remains, it is important to eliminate the possibility of a mechanical ileus. The clinical evolution of the animal helps us detect mechanical ileus. A sudden change in the general status of an animal that was improving could be a sign of mechanical ileus. The important thing with mechanical ileus is to avoid denial. If you do, you may lose critical time. Rectal exam findings combined with a detail trans-abdominal ultrasound help you decide if a second look laparotomy is needed. Don’t forget
that a negative ultrasound does not mean that you don’t need to go to surgery. With the ultrasound you will be looking at abdominal fluid, bowel size and motility. If fluid is noted, an abdominocentesis might help you in your decision process (only if you were unsure whether or not the animal needs a second surgery).

If there is no evidence of mechanical obstruction, prokinetics can be added to the therapy. They can be used early or later in the management of the animal. In cattle, many studies demonstrated that the most potent prokinetic for the abomasum or the small intestines is erythromycin, a macrolide antibiotic that stimulates motilin receptors on the bowel. Other macrolides have been tested, but their prokinetic properties were less potent than those of erythromycin. This drug can be given at a single dose of 8.8 mg/kg IM or can be given intravenously (1 mg/kg) three times daily. Over time, erythromycin loses its effect. It is rarely given more than 24 hours.

Lidocaine has been used in horses to treat post-operative ileus. It has been shown that it does not have a prokinetic effect in horses. However, the horse that receives lidocaine seems to do better. It has been speculated that the effect of lidocaine could be more analgesic and anti-inflammatory than prokinetic. In cattle, studies are lacking regarding the use of lidocaine. CRI of lidocaine (3mg/kg/hr) seemed to have helped some cases of post-operative ileus in our clinic. It is important to give the initial bolus slowly since cattle appear to be more susceptible than horses to side effects of lidocaine.