Dr MANSOUR A

LOCO-REGIONAL ANESTHESIA

Local anesthesia refers to any substance placed in contact with a nerve fiber (origin, pathway, ending) that specifically and temporarily suspends its function.

- **Contact:** It produces sensory and motor paralysis of the innervated region.
- **Specificity:** No involvement of tissues other than nerve tissue.
- **Temporary:** Totally reversible with complete recovery.

However, there is no loss of consciousness.

Local anesthetics are all derivatives of cocaine; they either belong to the ester family (prototype: Procaine) or to the amide family (prototype: Lidocaine, e.g., Xylocaine®).

Mode of Action

Local anesthetics decrease the membrane permeability of axons to cations, particularly sodium. The mechanism of action is as follows:

Local anesthetics bind to sites inside the sodium channels, inhibiting the opening of these Na+ channels; neuronal depolarization is thus reduced. This results in a decrease in neuronal excitability, potentially leading to the inability to generate or transmit an action potential, hence the analgesic effect of these products.

- The skin: well innervated, very sensitive, and requires a large quantity of anesthetic.
- Muscles and aponeuroses: poorly innervated, requiring little anesthetic.
- Periosteum and parietal peritoneum: the most innervated, the quantity of anesthetic must be very significant.

Numerous techniques are used in loco-regional anesthesia, but the most commonly used are the following:

- Surface or topical anesthesia: rarely used in cattle, however, it can be used in ophthalmology with the use of drops instilled onto the cornea.
- Infiltration anesthesia: direct when the anesthetic is injected where the incision will be made; indirect otherwise. These allow most surgical procedures to be performed on cattle (laparotomies, mass excisions, etc.).
- Epidural anesthesia: involves injecting an anesthetic solution into the spinal canal.

- Intravenous regional anesthesia: used for procedures on the foot and limb of cattle; it involves injecting anesthetic under a tourniquet into a superficial vein of the limb.
- Paravertebral anesthesia.

Flank Anesthesia

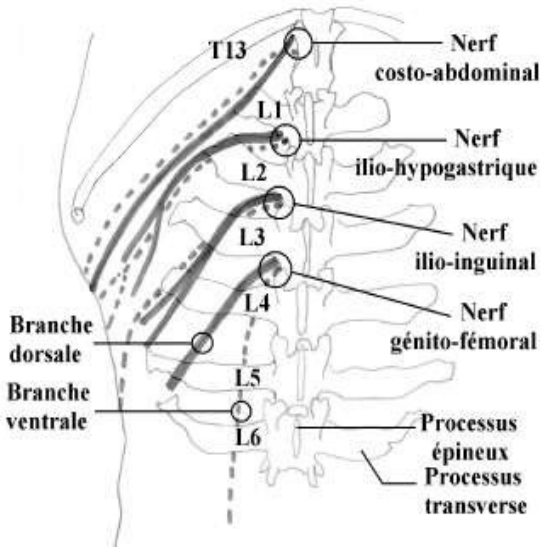
Anatomical Review

The flank region extends from the last rib to the hip angle and from the lumbar transverse processes to the abdominal region.

The flank region is primarily innervated by the thirteenth pair of thoracic spinal nerves (T13 = costabdominal nerve) and the first two pairs of lumbar nerves (L1 = iliohypogastric nerve; L2 = ilioinguinal nerve).

After emerging from the spinal canal through the intervertebral foramina, the spinal nerves divide into a dorsal and a ventral branch.

Flank anesthesia is indicated for all surgical procedures requiring a laparotomy (cesarean sections, ruminotomies, abomasal surgery, intestinal surgery, cecal surgery).



Pathways and relationships of nerves T13, L1, L2, and L3 relative to the lumbar vertebrae

1- Local Infiltration Anesthesia

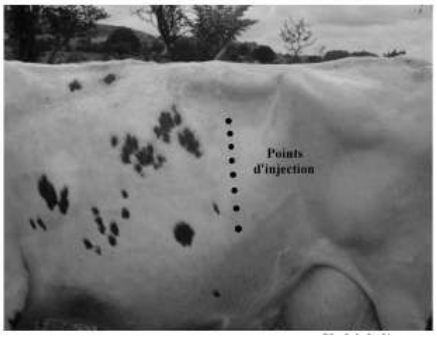
After standard surgical preparation of the operative site, the needle is introduced between the muscle layers of the wall and then slowly withdrawn while the operator pushes the syringe plunger.

This is the easiest technique to perform, but it requires a large amount of anesthetic, can lead to edema and hemorrhages, and intermuscular detachment. Furthermore, it does not desensitize the skin or the peritoneum.

Dosage: Maximum 6 mg/kg.

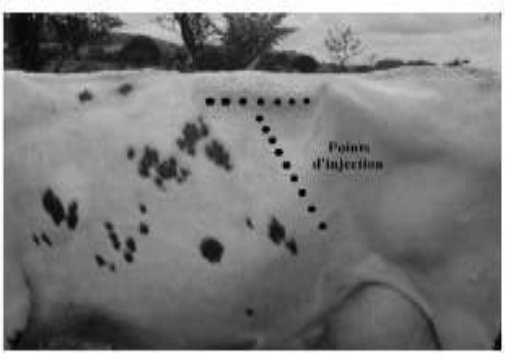
a) Tracking Infiltration of the Wound

- **Cattle:** 60 to 100 ml per adult cow.
- **Sheep, Goats:** Maximum of 6 mg/kg.



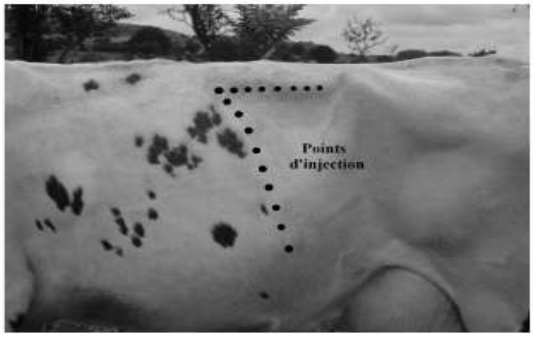
Infiltration in T

The local anesthetic injection technique is the same as described previously, but the injection points are located differently. More effective than the previous technique, it also has the advantage of not soiling the wound. However, it does not eliminate the sensitivity related to the costabdominal nerve.



• Inverted L Infiltration

The first injection line is also sublumbar as in the T infiltration, but here the second injection follows the curvature of the last rib. This technique does not have the disadvantages of the previous two.



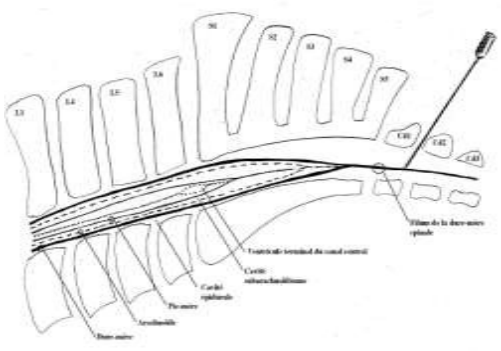
2- Caudal Epidural Anesthesia

The spinal canal is mainly occupied by the spinal cord and its spinal nerves. The spinal cord is surrounded by the meninges: the pia mater is closely attached to the spinal cord, the arachnoid mater is intermediate, and the dura mater is the outermost envelope. The pia mater and arachnoid mater define a space called the subarachnoid cavity, which contains cerebrospinal fluid.

In cattle, the spinal cord ends at the level of the sixth and last lumbar vertebra. The subarachnoid space extends to the third or fourth sacral segment. The filum of the dura mater terminates at the level of the fourth or fifth caudal vertebra. Consequently, by inserting a needle between the caudal vertebrae, it is impossible to damage the structures contained within the spinal canal. Furthermore, the anterograde upward spread of the anesthetic is rapid initially and then slower due to the increased volume of the spinal canal.

Dose: Cattle: 5 to 10 ml per cow; Sheep, Goats: 1 ml per 30 to 40 kg.

The injection site is located by moving the tail up and down with one hand and palpating the movement of the joints with the other hand. The most easily palpable joint is usually the first intercoccygeal space. Thus, caudal epidural anesthesia is most often performed in the first intercoccygeal space. The site is clipped, washed, and disinfected. A needle is inserted on the median plane at an angle of approximately 60° to the dorsal horizontal line.



In an adult cow, a dose of 1 ml of 2% lidocaine per 100 kg (0.2 mg/kg) injected produces analgesia that extends cranially to the middle of the sacrum and ventrally from the perineum to the medial surface of the thigh.

The pelvic viscera are desensitized and relaxed, the tail is paralyzed, while uterine motility and locomotion of the hindquarters are not affected. The effectiveness of the injection is assessed as follows: loss of tail motility is almost instantaneous, but analgesia is maximal within 10 minutes. The duration of anesthesia is 30 to 60 minutes.

If too large a quantity of anesthetic has been administered, cranial migration can lead to paralysis of the intercostal muscles and diaphragm (phrenic nerve) and cause respiratory distress. Therefore, assessment of the animal's weight must be as accurate as possible.

Use

- Perineal surgeries: reduction of rectal or vaginal prolapse.
- Obstetrical manipulations, etc.
- Flank surgeries in standing animals: laparotomy via the paralumbar approach (cesarean section, omentopexy), bull castration, mammary gland surgeries.

3- Paravertebral Anesthesia

Principle

They consist of depositing a local anesthetic near the perineurium of the spinal nerves to suppress sensory and motor impulses for a few hours.

They are called proximal when the deposition occurs at the exit of the lumbar vertebral foramina. They are called distal when it occurs at the end of the transverse processes of the lumbar vertebrae.

These anesthesias, admittedly somewhat more technical, are rarely used in rural veterinary medicine, even though they have numerous advantages:

- They allow anesthesia of a large area of the flank wall.
- The entire thickness of the flank wall is uniformly anesthetized, including the peritoneum.
- They induce excellent myoresolution, making the surgical act more comfortable.
- The doses of lidocaine used are much lower than with infiltration.

a) Proximal Paravertebral Anesthesia

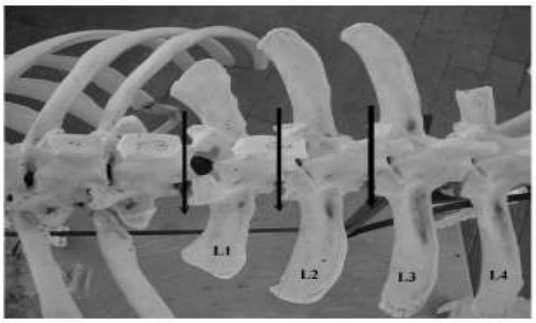
The animal is securely restrained by the head, and the hind limbs are hobbled above the hocks. The dorsal area over the transverse processes is prepared according to standard surgical preparation.

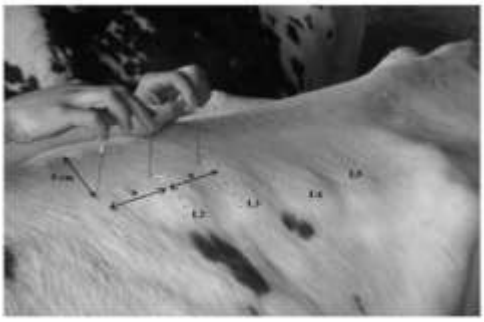
The injection points are located at the intersection of a line approximately 5 cm from the midline of the back, and perpendicular lines passing through the cranial border of the transverse processes of the first three lumbar vertebrae.

- Anesthesia of the costabdominal nerve (T13) occurs cranial to the transverse process of the first lumbar vertebra (L1).
- Anesthesia of the iliohypogastric nerve (L1) occurs cranial to the transverse process of the second lumbar vertebra (L2).
- Anesthesia of the ilioinguinal nerve (L2) occurs cranial to the transverse process of the third lumbar vertebra (L3).

The number of points and injection sites vary depending on the type of procedure:

- T13, L1 for ruminotomy.
- T13, L1, L2 for cesarean section, enterectomy.
- L1, L2, L3 for cecal interventions. (L3 = genitofemoral nerve)





- **Cattle:** 20 to 25 ml per nerve root for an adult cow.
- **Sheep, Goats:** 5 ml per root, maximum 6 mg/kg.

Risk: Intravascular injection, but low dose (aorta or thoracic longitudinal vein on the left, caudal vena cava on the right if needles are inserted too deeply). Before injecting, it is necessary to verify that neither vessels nor the peritoneum have been punctured: if so, blood or air bubbles will reflux into the syringe upon aspiration. Simply move the needle a few millimeters.

Needle withdrawal should be accompanied by firm compression of the skin to prevent the anesthetic from tracking subcutaneously.

The onset time of anesthesia is approximately 15 minutes. Anesthesia can be tested by inserting a small needle into the flank, which should cause no reaction from the animal.

Dr MANSOUR A

Distal Paravertebral Anesthesia

It aims to anesthetize the same nerves, but slightly further along their pathway after they have divided into ventral and dorsal branches.

Therefore, twice as many injection points are needed, but the points are easier to locate.

This method considers the pathway of the spinal nerves relative to the transverse processes of the lumbar vertebrae:

- The T13 nerve passes above and below the transverse process of the first lumbar vertebra (L1).
- The L1 nerve passes above and below the transverse process of the second lumbar vertebra (L2).
- The L2 nerve crosses obliquely over the third lumbar vertebra and is only accessible at the level of the transverse process of the fourth lumbar vertebra (L4).

With the free hand, pressure is applied with the index finger to the center of the lateral border of the transverse processes of L1, L2, and L4. A 10 cm long needle is pushed horizontally for 5 or 6 cm, above and then below the transverse process, trying not to exit the skin. 10 ml of 2% lidocaine is injected per point. This technique is easier to perform.