

## Locoregional Anesthesia Due to Tumescence in Bilateral Total Mastectomy of Goats

Gisele Pereira Guimaraes<sup>1</sup>, Kelly Regina Freitas Freire<sup>1</sup>, Beatriz Blanc Teixeira<sup>1</sup>,  
Egle Raoni de Brito Montenegro<sup>1</sup>, Bruno Ferreira Spindola<sup>1</sup>, Michel Abdalla Helayel<sup>2</sup> & Saulo Andrade Caldas<sup>1</sup>

### ABSTRACT

**Background:** Mastitis is an inflammation of the mammary gland or udder, regardless of its origin, severity, or evolution. Bilateral total mastectomy is indicated in cases of chronic suppurative mastitis, gangrenous mastitis, udder neoplasm or hyperplasia. For mastectomy, the supine position is recommended and, as it is a long-term procedure, general anesthesia was chosen together with the tumescence technique with the objective of transanesthetic and postoperative analgesia. The present report aims to report the general anesthesia protocol used for 2 goats submitted to bilateral total mastectomy associated with a locoregional block by tumescence, a technique not described in the goat species.

**Cases:** Two female goats, mixed breed, approximately 3 years old, were admitted to the Hospital Veterinário de Grandes Animais (HVGA) of the Universidade Federal Rural do Rio de Janeiro (UFRRJ), with a history of recurrent mastitis. There was an increase in udder volume and the presence of purulent secretion during milking. One of the animals had given birth about 20 days ago. Surgical treatment through bilateral total mastectomy was recommended for both animals, as they did not present a satisfactory response to antimicrobial therapy, excessive enlargement and functional loss of the mammary system. For the procedure, food fasting for 48 h and water fasting for 24 h was established. The anesthetic protocols used consisted of previous sedation with xylazine<sup>1</sup> [Xilazin<sup>®</sup> - 0.05 mg/kg, IM] anesthetic induction with ketamine<sup>2</sup> [Ketalex<sup>®</sup> - 10 mg/kg, IV] and midazolam<sup>3</sup> [Dormire<sup>®</sup> - 0.1 mg/kg, IV]. Orotracheal intubation and connection to the anesthetic circuit were performed for maintenance through inhalation anesthesia with isoflurane<sup>4</sup> (Forane<sup>®</sup>) and oxygen therapy. Then, in bottle of lactated ringer's solution<sup>5</sup> [Linhamax<sup>®</sup> - 500 mL], lidocaine 2%<sup>6</sup> without vasoconstrictor [Lidovet<sup>®</sup> - 40 mL] and adrenaline<sup>7</sup> [Adren<sup>®</sup> - 25 mg/mL, 0.5 mL] were added, 10 mL/kg of the solution were injected into the subcutaneous tissue of the region of the mammary chains utilizing a Klein cannula after local antisepsis. After the administration of the tumescent solution, it was observed that the area involved is presented with the formation of a gel and there is minimal bleeding, compared to the conventional technique. The animals were monitored for the degree of analgesia, recording vital signs every 15 min at the end of the surgery, dipyrone<sup>9</sup> [D-500<sup>®</sup> - 25 mg/kg, IV], morphine<sup>7</sup> [Sulfato de Morfina<sup>®</sup> - 0.1 mg/kg, SC], and meloxicam<sup>10</sup> [Maxican<sup>®</sup> 0.5 mg/kg, IM, 3 consecutive days] for postoperative analgesia. Additionally, tetanus serum<sup>1</sup> [Vencosat<sup>®</sup> - 50,000 IU, single dose] and of oxytetracycline<sup>1</sup> [Oxitetraciclina LA<sup>®</sup> - 10 mg/kg, IM, 5 applications on alternate days]. In the following 24 h, no signs of pain were observed on palpation of the surgical wound in the animals, but goat 1 was apathetic and inappetent, with improvement in the clinical picture only 48 h after surgery.

**Discussion:** The choice of the surgical procedure resulted in an improvement in the clinical conditions of the animals and the anesthetic protocol using inhalation anesthesia and locoregional block (tumescence) proved to be efficient to perform in goats, contributing to transanesthetic and postoperative analgesia, being easily applied to ruminants that need surgical interventions in the region of mammary chains.

**Keywords:** ruminant, mastectomy, local anesthetic, locoregional block.

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<sup>1</sup>Instituto de Veterinária, Universidade Federal Rural do Rio de Janeiro (UFRRJ), Seropédica, RJ, Brazil. <sup>2</sup>Universidade Federal Fluminense (UFF), Niterói, RJ. CORRESPONDENCE: S.A. Caldas [sauloacaldas@hotmail.com]. Instituto de Veterinária (UFRRJ). BR - 465, Km 07. Zona Rural. CEP 23890-000 Seropédica, RJ, Brazil.

## INTRODUCTION

In small ruminants, sedation associated with the use of locoregional blocks is widely used in clinical-surgical routine, on the other hand, general anesthesia implies a high cost, making it viable in cases where the animal has a high economic value [9,18], in addition to predisposing to prolonged recoveries, regurgitation, bloat and myopathy in large animals [10,18]. Locoregional blocks can be instituted to desensitize the surgical area and promote postoperative residual analgesia [20], thus constituting one of the main ways to provide analgesia [16].

Mastitis is any inflammation of the mammary gland or udder, regardless of its origin, severity, or evolution [15]. Bilateral total or radical mastectomy is indicated in cases of chronic suppurative mastitis, gangrenous mastitis, neoplasms or udder hyperplasia [17].

Local anesthetics are used to perform locoregional anesthesia, with lidocaine being one of the most frequently used drugs, as they block neuronal depolarization and consequently the propagation of action potentials [16], being used infiltratively to block peripheral nerves and the neuraxial axis. The use of locoregional anesthesia techniques is an essential component of any multimodal perioperative analgesia and should be performed whenever possible, as they favor the improvement of anesthetic recovery [11]. In goats, it is important not to exceed the dose of 10 mg/kg [16].

Thus, the present report describes the general anesthesia protocol used for 2 goats submitted to bilateral total mastectomy associated with a locoregional block by tumescence, a technique not described yet in the goat species.

## CASES

Two mixed-breed goats, about 3 years old, coming from the same place, were admitted to the Hospital Veterinário de Grandes Animais (HVGA) of the Universidade Federal Rural do Rio de Janeiro (UFRRJ), with a history of recurrent mastitis. At clinical examination, there was an increase in udder volume, with approximately 1

month of evolution and release of purulent secretion during milking. One of the animals had given birth about 20 days ago.

Surgical treatment was recommended through bilateral total mastectomy for both animals, as they did not present a satisfactory response to antimicrobial

therapy, excessive enlargement and functional loss of the mammary system. For the procedure, food fasting for 48 h and water fasting for 24 h was established. In the blood count and serum biochemistry, goat 1 showed increased creatine kinase (80 U/L), total hyperbilirubinemia (0.3 mg/dL), decreased AST (63 U/L), hypoalbuminemia (1.2 g/dL), increased LDH (584 U/L) and thrombocytopenia (264,000); goat 2 had leukocytosis (23,200) and left shift (232) with 3% of rods, hyperfibrinogenemia (0.8 g/dL), increased urea (105 mg/dL) and creatinine (2.5 mg/dL), total hyperbilirubinemia (0.8 mg/dL), increased AST (272 U/L) and increased GGT (64 U/L), increased LDH (2,780 U/L), increased creatine kinase (2.5 mg/dL), hypercalcemia (7.9 mg/dL) and hypoalbuminemia (1.6 g/dL).

The anesthetic protocols used consisted of previous sedation with xylazine<sup>1</sup> [Xilazin<sup>®</sup> - 0.05 mg/kg, IM] anesthetic induction with ketamine<sup>2</sup> [Ketalex<sup>®</sup> - 10 mg/kg, IV] and midazolam<sup>3</sup> [Dormire<sup>®</sup> 0.1 mg/kg, IV]. With the complete relaxation of the animal, orotracheal intubation and connection to the anesthetic circuit were performed for maintenance through inhalation anesthesia with isoflurane<sup>4</sup> (Forane<sup>®</sup>) and oxygen therapy. Then, in bottle of lactated ringer's solution<sup>5</sup> [Linhamax<sup>®</sup> - 500 mL], lidocaine 2%<sup>6</sup> without vasoconstrictor [Lidovet<sup>®</sup> - 40 mL] and adrenaline<sup>7</sup> [Adren<sup>®</sup> - 25 mg/mL, 0.5 mL] were added, 10 mL/kg of the solution were injected into the subcutaneous tissue of the mammary chain region utilizing a Klein cannula after local antisepsis (Figure 1A). After the administration of the tumescent solution, it was observed that the area involved presented the formation of a gel and there was minimal bleeding, compared to the conventional technique (Figure 1B).

The animals were monitored for the degree of analgesia using a multiparametric monitor<sup>8</sup> [Digicare LifeWindow<sup>®</sup>] with vital signs recorded every 15 min, assessing heart rate, invasive blood pressure and respiratory rate frequency, body temperature, oxygen saturation and expired CO<sub>2</sub>. The 1<sup>st</sup> procedure (goat 1) lasted 60 min and the 2<sup>nd</sup> (goat 2) lasted 80 min. Both animals presented hypotension in the first 5 min. In goat 1, it was administered adrenaline<sup>7</sup> [Adren<sup>®</sup> - 0.1 mg/kg (bolus)] to maintain blood pressure within the normal range, and in goat 2, it was administered 2 boluses of 0.1 mg/kg with a 15 min interval between both were required to maintain the hemodynamic stability.

Both goats presented adequate oximetry, of above 90%, throughout the surgery, remaining at 99% for goat 1 and between 95 to 100% for goat 2. These parameters ensure satisfactory oxyhemoglobin saturation in peripheral blood, indicating that such patients did not experience hypoxemia during anesthesia.

In goat 1, the core temperature ranged between 37.5 - 35.9°C and in goat 2, it ranged between 38.4° - 36.2°C. All goats had hypothermia in the transoperative period due to tumescence as a locoregional block technique for mastectomy. Hypothermia was reversed by warming the patient.

Capnography in goat 1 ranged between 45 - 34 mmHg and in goat 2 it remained between 21 - 26 mmHg. Goat 1 had normal capnometry values during anesthesia and goat 2 had periods of hypocapnia. All patients remained on spontaneous ventilation during surgery, which justifies such variations in EtCO<sub>2</sub> values.

The respiratory rate in goat 1 ranged from 10 - 15 rpm and in goat 2 ranged from 35 - 40 rpm. All patients remained intubated and on spontaneous ventilation during the surgery, through a closed circuit, with CO<sub>2</sub> rebreathing. Because ventilation was spontaneous, parameters such as minute volume do not remain constant, which can cause variations in respiratory rate or tidal volume.

In goat 1, heart rate ranged between 80 - 90 bpm, and mean arterial pressure (MAP) ranged between 60 - 70 mmHg. In goat 2, heart rate ranged between 70 - 100 bpm and MAP between 50 - 70 mmHg. Regarding hemodynamics, both goats showed few variations in heart rate, but they presented hypotension in the 1<sup>st</sup> min after anesthetic induction and returned to adequate parameters after bolus ephedrine administration. There was a loss of invasive blood pressure measurement in goat 1, and despite successive attempts to puncture new vascular access, it was not successful and thus blood pressure was no longer recorded about 30 min after the start of surgery.

At the end of the surgery, it was administered dipyrone<sup>9</sup> [D-500<sup>®</sup> - 25 mg/kg IV], morphine<sup>7</sup> [Sulfato de Morfina<sup>®</sup> - 0.1mg/kg, SC], and meloxicam<sup>10</sup> [Maxican<sup>®</sup> - 0.5mg/kg, IM, 3 consecutive days] for postoperative analgesia. Additionally, tetanus serum<sup>11</sup> [Vencosat<sup>®</sup> - 50,000 IU, single dose] and of oxytetracycline<sup>1</sup> [Oxitetraciclina LA<sup>®</sup> - 10 mg/kg IM, 5 applications on alternate days].

One of the animals (goat 1) had reflux in the immediate postoperative period. In the following 24 h, no signs of pain were observed on palpation of the surgical wound in the animals, but goat 1 was apathetic and inappetent, with improvement in the clinical picture only 48 h after surgery.

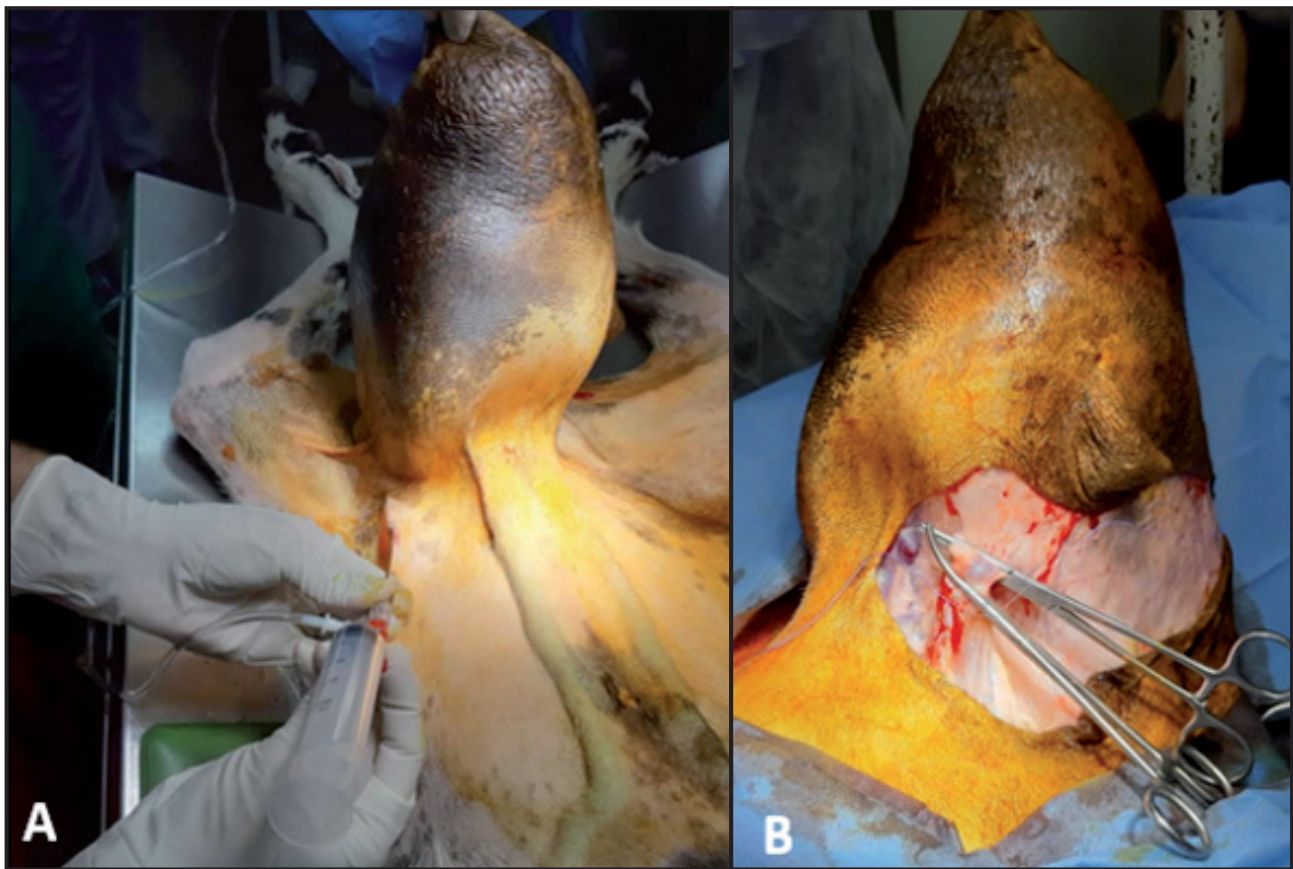
## DISCUSSION

In goats, unilateral or bilateral mastectomy is indicated for pain relief in cases of extensive udder lesions, gangrene lesions, neoplasms, and more commonly in chronic mastitis, in the latter, the event occurs mainly in postpartum periods in animals of dairy aptitude, being in most cases caused by bacterial infection and in some cases, it can lead to death, but in others only the drop in milk production and milk impairment, leading to economic losses [3,20]. In the case of the animals reported, both were of dairy aptitude, showing a drop in milk production, an increase in the udder, and on 1 of them, the presence of purulent secretion. Both goats underwent treatment with antimicrobial therapy, but with an ineffective response and due to these factors, bilateral mastectomy was indicated.

The anesthetic protocol used was inhalation anesthesia and locoregional block (tumescence). Inhaled general anesthesia is not routinely used in small ruminants due to its high cost and the deleterious effects it can have as a result of recumbency, but some authors report being safer in long and complex procedures due to rapid awakening [10,13]. For mastectomy, the supine position is recommended and, as it is a long-term procedure, general anesthesia was chosen for the animals in the report. On the other hand, locoregional anesthesia is widely used due to its low cost and minimal systemic effects, in addition to the possibility of leaving the animal in a station depending on the surgical procedure to be performed [7,12]. Locoregional anesthesia is safe, effective, usually easy to perform, and has a low cost [14]. It is important to observe signs of toxicity from the use of local anesthetics, respecting the maximum safe dose of 4 mg/kg of lidocaine [14]. Due to the high surgical pain stimulus caused by mastectomies, in the report, the tumescence technique was chosen, with the objective of transanesthetic and postoperative analgesia.

Tumescence is a locoregional anesthesia technique frequently used to obtain analgesia in canine and feline mastectomies [4,6], but it has not been described





**Figure 1.** A- Subcutaneous administration of the tumescent solution in the mammary chain region through the Klein cannula. B- Tissue appearance showing minimal bleeding after tumescence.

in small ruminants. In the canine species, tumescence is used together with general anesthesia in mastectomy procedures and is recommended mainly in cases of breast tumors and breast hyperplasia, ensuring pain control [2]. Some studies in humans report the use of the technique for liposuction, mastectomies, excision of skin masses, and lymphadenectomy [6,7]. In the tumescence technique, lidocaine can be used in combination with a vasoconstrictor (adrenaline) to infiltrate large areas of the body surface, using large volumes diluted in saline or ice-cold Lactated Ringer (temperature 8 - 12°C). For the dilution of the 0.16% tumescent solution, 460 mL of Lactated Ringer's solution, 40 mL of 2% lidocaine (without vasoconstrictor), and 0.5 mL of adrenaline are used [11]. Intraoperative hypothermia is a frequent adverse effect in tumescences since the solution must be applied to the subcutaneous tissue at a cooled temperature over an extensive area of the body surface. In bitches, the ideal administered volume is 15 mL/kg and the average period of analgesia is 7 h [1], however, in the present clinical case, we chose to administer a smaller volume of the tumescent solution, with adequate analgesia, since both goats did not show

changes in vital signs that suggest pain, as well as stability in the anesthetic plane. In the present case, 2% lidocaine was added to a Lactated Ringer's bottle, due to its low toxicity, and adrenaline at 0.25 mg/mL. This solution was then applied to the subcutaneous tissue and, as it has a slow absorption, it provides analgesia to the cutaneous and subcutaneous tissue during the surgical procedure, in addition to ensuring prolonged postoperative analgesia [5]. Its main advantages are analgesia and reduction of intraoperative bleeding and hydro divulsion [1], being observed during the surgeries in the case report, that the subcutaneous tissue was looser and with little bleeding in the region, thus optimizing the surgical time.

The techniques described and used for the udder region in small ruminants are inverted V block, ring block, and breast cistern infusion [14]. The lumbosacral epidural block technique can be used for surgeries in the udder region, but there is a possibility of causing cardio-respiratory effects in the transoperative period when high doses are used [19]. In these cases, it was decided not to perform the epidural because it is an extensive and long-term surgery, in which there would be a need to use a

local anesthetic that had a long duration and that covered the trans and postoperative periods, such as bupivacaine, but it could cause ataxia and prolonged recovery [8].

One of the animals had reflux in the immediate postoperative period (goat 1), which demonstrates an undesired effect of general anesthesia in the species [7] which was resolved with the lateralization of the head for drainage of rumen fluid and extubation was performed without interurrences.

The anesthetic protocol established for both animals was effective in ensuring anesthesia and intraoperative analgesia, in addition to providing prolonged postoperative analgesia, being easily applied to ruminants that need surgical interventions in the mammary chain region.

#### MANUFACTURERS

<sup>1</sup>Syntec do Brasil. São Paulo, SP, Brazil.

<sup>2</sup>Laboratórios Vencofarma do Brasil Ltda. Londrina, PR, Brazil.

<sup>3</sup>Cristália Produtos Químicos Farmacêuticos Ltda. São Paulo, SP, Brazil.

<sup>4</sup>Abbott Laboratórios do Brasil Ltda. São Paulo, SP, Brazil

<sup>5</sup>Eurofarma Laboratórios S.A. São Paulo, SP, Brazil.

<sup>6</sup>Laboratório Bravet Ltda. Rio de Janeiro, RJ, Brazil.

<sup>7</sup>Hipolabor Farmacêutica Ltda. Belo Horizonte, MG, Brazil.

<sup>8</sup>Digicare Biomedical Technology Inc. Boynton Beach, FL, USA.

<sup>9</sup>Zoetis Indústria de Produtos Veterinários Ltda. Campinas, SP, Brazil.

<sup>10</sup>Ourofino Saúde Animal Ltda. Cravinhos, SP, Brazil.

<sup>11</sup>Dechra Brasil. Londrina, PR, Brazil.

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