Research Summaries III

Use of neurostimulation to localize and anesthetize the brachial plexus of calves undergoing metacarpal surgery

H. Lardé, *DVM*[1] ; **S. Nichols**, *DVM, DACVS*[1] ; **A. Desrochers**, *DVM, DACVS, DECBHM, MS*[1] ; **G. Bussières**, *DVM, MS*[1] ; **M. Kopal**, *DVM*[1]
[1]*Department of Clinical Sciences, Université de Montréal, St-Hyacinthe, Québec, Canada, H3C 3J7*

Introduction

In cattle, locoregional anesthesia is usually effective for surgery distal to the metacarpophalangeal joint. However, for proximal interventions, general anesthesia is often required. The aim of this study was to assess the usefulness of brachial plexus anesthesia for orthopedic surgery in calves. We hypothesized that this locoregional block, combined with sedation, would be sufficient for interventions on the metacarpal bones in calves.

Materials and Methods

Ten Holstein calves were included in this study. Each animal received intravenous sedation with xylazine (0.07 mg/lb; 0.15 mg/kg) and butorphanol (0.009 mg/lb; 0.02 mg/kg), and was positioned in dorsal recumbency with the right forelimb in extension. Each calf was intubated nasotracheally and supplemented with oxygen. The site of the block, centered on the medial aspect of the right scapulohumeral joint, was prepared aseptically. The brachial plexus was located by neurostimulation. A specialized needle connected to a neurostimulator and a syringe containing a 2% lidocaine solution (0.28 mg/lb; 0.5 ml/kg) was inserted craniocaudally in the free space under the scapulohumeral joint parallel to the rib cage to a depth of 3.2 inches (8 cm). The needle was then gradually withdrawn by scanning lateral to medial, until both flexion and extension of the metacarpophalangeal joint was obtained. The coefficient of difficulty (low, moderate, and high) was recorded.

The effectiveness of the block was tested by stimulating the dermatomes of the ulnar, musculocutaneous, median, and radial nerves at 15 and 30 minutes after the block. An evaluation of the contralateral limb was performed as a negative control.

The vital parameters of the calves were monitored with ECG, pulse oximetry, and indirect blood pressure throughout the surgery. If changes in parameters occurred in reaction to painful stimuli induced by the surgical team or if the calves became agitated because of the positioning (dorsal recumbency), general anesthesia was induced with a 0.91 mg/lb (2 mL/kg) IV bolus of a solution containing 5% glyceryl guaicolate ether (GGE) and ketamine (2 mg/mL) and maintained with the same solution administered as a constant rate IV infusion of 0.45 mg/lb (1 mL/kg)/h.

During recovery, each calf was administered a single dose of butorphanol (0.023 mg/lb; 0.05 mg/kg, IM). The motor and sensory function of the brachial plexus was evaluated. The time from the block to complete recovery was recorded. The calves were monitored for comfort, appetite, and any swelling related to brachial plexus anesthesia for a period of seven days after surgery.

Results

The brachial plexus of each calf was detected with neurostimulation. The coefficient of difficulty of the block was low for seven calves and high for three. During neurostimulation, flexion and extension of the fetlock was observed for 10 and seven calves, respectively.

The evaluation of the block 15 minutes after injection showed an incomplete block for four calves. Specifically, ulnar and median dermatomes were sensitive for one calf and the radial dermatome was sensitive for four calves. For all 10 calves, the evaluation of the block 30 minutes after injection revealed no sensitivity for the four nerves.

For three calves, surgery was performed without induction of general anesthesia. For the other seven calves, five received a drip because of movements not associated with painful stimulation and two were supplemented for increased blood pressure and heart rate during painful stimuli.

The time needed for the calves to stand up after surgery varied according to the use of general anesthesia. Calves that stood up early after the surgery had signs of radial nerve paralysis, which resolved within

three hours after the block. During the post-operative period, no complications related to the brachial plexus block were noted.

Significance

Brachial plexus anesthesia performed after localization of the nerves by neurostimulation was successfully performed in all 10 calves in this study. It allowed orthopedic surgery to be performed on the proximal aspect of the metacarpal bones without induction of general anesthesia in three calves. Therefore, we have to partially reject our hypothesis.

In this study, the brachial plexus anesthesia technique was modified from what has been described in other species. The calves were placed in dorsal recumbency and only movement of the fetlock was used to identify the ulnar and radial nerves. From a previous study (unpublished data), we found that this position made it easier to perform the procedure compared to performing the procedure when calves were in lateral recumbency, and that the large volume of lidocaine used would diffuse if placed in the general area of the ulnar and radial nerves.

Two calves reacted to painful stimulation during surgery. However, those two calves had not reacted to the evaluation at 30 minutes after injection. This reaction could be explained by incomplete anesthesia of the brachial plexus from misplacement of the anesthetic drug or by the resolution of the block prior to the end of the surgery.

In conclusion, brachial plexus anesthesia after localization of the nerves by neurostimulation is an effective anesthetic technique for surgery on the metacarpal bones of calves. However, general anesthesia should be available for calves in which incomplete anesthesia is achieved or if complete immobilization of the calf is needed.