**Abstract.** Analgesia is of great importance in surgical trauma occurring in horses. In the present, long term epidural analgesia has become a routine method for trauma of the hind limb, but, in the case of the thoracic limb there is no regular similar technique. Continuous nerve block is a method using a local continuous perfusion with anesthetics administered through a catheter placed along the direction of peripheral nerves and it represents a new analgesia technique. This method is frequently used in human medicine to reduce post-surgical pain in body extremities. Continuous nerve block doesn’t affect the general state of health of equines, and through the induction of analgesia it encourages healing conditions. The present study aims to develop a treatment method usable on tranquilized standing horses, by placing a catheter along the palmar nerves of the thoracic limb. We have studied the main anatomical points for placing the catheter along the peripheral nerves of the thoracic limb and a detailed protocol has been established for local anesthetics used in continuous nerve blocks.

**Keywords:** analgesia, palmar nerves, perineural nerve block

**INTRODUCTION**

Analgesia in horses is very important, especially in surgical and orthopedic trauma, because the pain and the resulting stress diminish the animal’s chances of recovery (Pilliner et al., 2002). Pain management of the thoracic limb is limited to administering non-steroid anti-inflammatory drugs and analgesics, without assuring good long lasting effectiveness and they often induce secondary effects. Local and long lasting analgesia in the specific case of the thoracic limb is not available through epidural administering, like in the pelvic limb, in case of severe injuries (Doherty et al., 2010).

The continuous nerve block technique is an alternative method to endure posttraumatic or postsurgical analgesia and has already been successfully used in human medicine. Horses present an elevated analgesic sensibility, so they can benefit from better pain control.

Continuous or intermittent nerve block is ensured by infusing a pre-established volume of local analgesics through catheters placed along the peripheral nerves trajectories. Insertion of the catheter can be done after palpating the anatomic features of the region or in a more precise manner, under ultrasonography examination before and after the insertion.

The advantage of the continuous nerve block is that it ensures long lasting analgesia without the unwanted secondary effects induced by systemic medication.

This technique used as part of a multi modular anesthetic protocol will reduce the use of general anesthesia, thus helping to maintain normal vital functions. Although local nerve blocks were previously used for diagnosing lameness by obtaining a temporary desensitizing, these do not last for the necessary length of time after a severe traumatism, which has led to the necessity of providing a technique of a distal regional of the thoracic limb.
Postsurgical pain is the result of several factors, as skin level trauma, muscle lair trauma, periosteum trauma (somatic pain), mesenteric ischemia and peritoneal traction (visceral pain), local inflammation, joint pain, and it is caused by both peripheral nerves and central sensitization. The systemic anti-inflammatory treatment, opioids, 2-adrenoceptor agonists, or ketamine, all act at a central level, while local block is targeted, it inhibits peripheral sensitivity in the traumatized area, reducing nociception and prevention local inflammation (Adams et al., 2000).

Continuous palmar perineural block is a recent regional anesthesia technique that insures a long lasting desensitization and offers good conditions for healing. It can be applied in fetlock trauma, arthritis, tendinitis, osteomyelitis, interphalangeal septic processes, coffin bone arthritis, laminitis (Buckenmaier et al., 2005).

Regional local anesthesia through local nerve block of both lateral and medial distal palmar nerves ensures desensitization of the distal region of the metacarpal bone, of the caudal face of the metacarpo-phalangeal joint, the distal region of the interosseous muscle, the sesamoidal joints, the distal superficial digital flexor tendon (the distal metacarpal and metacarpo-phalangeal segments), dorsal and palmar sides of the proximal phalanx, the distal sesamoidal ligaments, proximal interphalangeal joint, of the second phalanx, the distal interphalangeal joint and of the the third phalanx. The palmar block offers in the distal third of the metacarpus the desensitization of soft tissues and of the skin (Fig.1) (Zaruco et al., 2007).

Fig. 1. Subcutaneous innervations areas (source: Zarucco et al., 2007)

MATERIALS AND METHODS

Through this study, we have done an anatomic description of the nervous trajectory of the metacarpal region through dissection, followed by clinical application of the continuous nerve
block in order to obtain a good analgesia at the level of the thoracic limb acropodium, in a horse that presented a wound at the level of the fetlock (Fig.2).

The laboratory study consisted of a dissection performed on the forelimbs of a euthanized horse, which did not present any distal limb pathology (metacarpal and acropodium regions). In order to isolate the anatomical elements, we have used standard dissection instruments. First, we have removed the skin and the subcutaneous conjunctive tissue, and then we have identified and isolated the anatomic elements of the caudo-lateral area of this region (the tendons of the superficial and deep digital flexors and the vascular nerve bundles).

Correct clinical application of the continuous nerve block was based on the identification of the palmar nerves topography done in the first part of the study.

The treatment was applied on a gelded horse, semi heavy mixed breed, 12 years of age.

Fig.2. The wound before treatment

Fig.3. Sedation
The material used for the nerve block contained the following: sterile gauze bandages, surgical sterile gloves, surgical scissors, catheter, perfusion kit, surgical threads, syringes and needles, razor, adhesive tape, etc.

The drug substances used were Acepromazine 35-40 μg/kg for sedation, followed by a combination of Medetomidine and Butorphenol; 5-7 ml of Mepivacain for local anesthesia, heparin, saline solution, etc. The sedation was sustained by continuous perfusion.

The technique for placing the catheter was applied in the following steps:

We have tranquilised the horse using 35-45 μg/kg of Acepromazine, 4-6 μg/kg of Medetomidine and 15-20 μg/kg of Butorphanol.

Note: for the surgery, we have kept the animal in a standing position (Fig.3).

We have made an exploratory palpation of the dorso-lateral area of the metacarpal region to identify the points of catheter placing (Fig.4). For increased precision, we have chosen the method described by Zarucco (2007).

![Diagram of anatomical delimitations for catheter insertion](source: Zarucco et al., 2007)

This refers to measuring the distance between the distal border of the accessory carpal bone and the proximal border of the large sessamoid bones. The insertion points for the needles are marked at 20% (cca. 5 cm) and 30% (cca. 7 cm), distally from the border of the accessory carpal bone, for the medial side, and lateral side respectively.

The medial insertion point is chosen at the dorsal border of the palpable superficial digital tendon flexor, and the lateral one, dorsally between the interosseous and the deep digital flexor tendon (Fig.5).
We have shaved and washed the marked area and performed an antisepsis with an iodine solution. We have performed a local skin and subcutaneous conjunctive tissue anesthesia using 5-7 ml of Mepivacain. We have waited 10 minutes and verified if the anesthesia has settled in.

We have punctured the skin in the chosen point with a 25 G needle.

Under palpation, we have inserted a previously heparinised needle as previously described. We have inserted the catheter under the needle, carefully verifying not to penetrate any blood vessels. We have fastened the catheter in position with the aid of an elastic bandage.

We have started the perfusion, assuring a 0,1-50 ml/h flux, and maintain it for three hours. The treatment was repeated in a two days interval.

Composition of the local perfusion anesthetic solution In a saline solution perfusion pouch we have mixed 0,125-0,2% of Bupivacaine and 1:200.000 of Epinephrine, and we have provided a flux of 0,5-3 ml of this solution per hour. An initial bolus of 2-8 ml of local anesthetic
can be initially administered. Note: The closer the catheter is positioned to the nerve, the less anesthetics can be administered for the desired effect.

RESULTS AND DISCUSSIONS

Following the dissection, we have made a description of the topography of both palmar nerves. Our observations concur with the description of this nerves in literature (Popovici et al., 2000; Budras et al., 2009). The medial palmar nerve (Fig. 6) comes exclusively from the median nerve. In the middle and proximal third of the metacarpal bone, it is placed in the groove between the medial border of the superficial digital flexor tendon (SDFT), and the palmar border of the deep digital flexor tendon (DDFT), cranial to the medial palmar artery.

In the middle of the metacarpus, from this nerve emerges a communicating branch with traverses obliquely in a lateral-distal direction the surface of the SDFT to join the lateral palmar nerve - terminal branch of the ulnar nerve, and then it continues its trajectory in the flexor tendons’ groove, dorsally to the medial palpable border of the SDFT, situated more cranially than the lateral palmar nerve is. In the proximal and middle third of the metacarpal bone, the lateral palmar nerve is situated laterally to the accessory ligament of the DDFT.

Distally, the lateral palmar nerve is moved in a slightly palmar direction, between the interosseous muscle and the dorsal border of the DDFT. Both palmar nerves end by splitting in three, at the level of the fetlock, into medial anterior, middle and posterior collateral digital nerves and lateral ones. The clinical application of the continuous nerve block has shown promising results, enabling a better pain control during surgery and post surgery, and has encouraged a faster healing of the wound (Fig.7).

Fig.6. Medial palmar nerve and the communicing branch to the lateral palmar nerve.
Fig. 7. The wound two weeks after the treatment

CONCLUSIONS

Continuous local anesthetics administration for acute pain suppression leads to a faster recovery. It makes surgical treatment easy, by ensuring a better tranquilization, and it reduces the total dose of general anesthetics. The solution of local anesthetic for the continuous nervous block must be calculated for each individual horse, taking into account its temperament, its age and the type of illness that must be addressed. If, even after 30 minutes of continuous treatment, the horse still presents sensitivity in the target areas, it means that the catheter has been dislocated. Its positioning must be verified and rectified if needed.

REFERENCES