

Ultrasound-Guided Nerve Block Anesthesia



Michela Re, Dr Med Vet, Javier Blanco, Dr Med Vet,
Ignacio A. Gómez de Segura, Dr Med Vet*

KEYWORDS

• Cattle • Ultrasonography • Analgesia • Locoregional anesthesia • Nerve block

KEY POINTS

- Superficial nerves may be easily identifiable through ultrasonography in the cattle and facilitate local anesthetic disposition around nerve structures.
- Ultrasound-guided nerve block greatly increases the accuracy of local anesthetic administration around the nerve.
- Advantages may include an improved degree and duration of nerve blockade while reducing the dose of local anesthetic.
- Conduction nerves of clinical interest that may benefit from ultrasonography include the paravertebral nerves, the epidural space, the sciatic and femoral nerves for hind limb procedures, the brachial plexus for forelimb procedures, and the cornual, auriculoparpebral, and infraorbital nerves in the head.

INTRODUCTION

Local and regional anesthetic techniques are preferred methods of anesthesia in ruminants because they facilitate clinical work with the animal in the standing position, sedated or not, and are safe, inexpensive techniques, while providing analgesia with minimal adverse effects. Common locoregional anesthetic techniques include local infiltration and line block; paravertebral block; epidural anesthesia; and blockade of the foot, eye, or the horn among other techniques.¹ Anesthetic techniques based on nerve conduction block may be preferred compared with tissue infiltration when the painful anatomic area is infected, ischemic, or injured. When a blind nerve conduction block is produced the experience and skills of the clinician greatly influence the success rate. To improve it, ultrasound-guided techniques of local anesthesia are increasingly used in small animals.² Furthermore, in people the cost-effectiveness of ultrasound-guided

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Department of Animal Medicine and Surgery, Veterinary Faculty, Complutense University of Madrid, Avda Puerta de Hierro s/n, Madrid 28040, Spain

* Corresponding author.

E-mail address: iagsegura@vet.ucm.es

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regional anesthesia has been demonstrated.³ Electrostimulation of targeted nerves is an alternative but also complementary technique to ultrasound-guided nerve localization.⁴

In ruminants only a few techniques have been studied with ultrasonography and further research is needed to determine the techniques of potential use in the future. Therefore, clinicians may anticipate the description of ultrasound-guidance for most techniques already performed blindly in the clinical setting and where a higher degree of success is desirable. New techniques may be developed, mostly based on previous work performed in small animals² and people.^{5,6}

Regional anesthetic techniques require knowledge of the anatomic area to be desensitized. Disadvantages may include the difficulty in identifying anatomic landmarks, variability in anatomic pathways of peripheral nerves, risk of penetrating into other structures (eg, an accidental intraperitoneal administration instead of subcutaneous injection), or the large volume of local anesthetic. The variable anatomy between individuals may lead to poor success rates for specific peripheral nerve blocks.^{7,8} Large volumes of local anesthetics are most likely administered to compensate for inaccurate needle placement within the blocked nerve. However, despite the large volumes used the success rate may also be lower than expected because of an inaccurate local anesthetic deposition relative to the nerve structures.⁵ Side effects may be expected from large doses, especially when these drugs are combined with epinephrine.⁷

ULTRASOUND IN REGIONAL ANESTHESIA

Ultrasonography allows the identification of the neural structures and the adjacent anatomic structures, besides eventual anatomic variants. The use of an ultrasound device with multifrequency 5.0- to 7.5-MHz linear transducer in bovine reproduction may greatly facilitate its use to improve regional anesthetic techniques. Bovine clinicians may easily benefit from their expertise in the use of ultrasound devices by identifying nerve structures and improving local anesthetic administration accuracy and effectiveness. However, to achieve a wider use of ultrasound-guided nerve block experimental and clinical studies are required to describe the anatomic landmarks and identify suitable acoustic windows, but also the actual efficacy of these techniques compared with the standard blind anesthetic block.

Regional anesthetic techniques benefit from administering the drug in the right place with the lowest effective dose. This not only spares drug use but also increases the safety margin. Accuracy is largely favored by direct needle visualization together with the anatomic structures including the nerves. Visualization of anesthetic spreading further facilitates the overall process. Although epineural and subperineural or intrafascicular injections may also occur there is evidence, although controversial,^{9,10} that the latter occurrence is relatively safe.¹¹

The usefulness of ultrasound guidance for regional nerve block techniques includes the localization of anatomic structures and landmarks despite variability in anatomic pathways of peripheral nerves. Because of the visualization of the different anatomic structures the risk of penetrating adjacent tissues, such as vessels or internal organs, is largely reduced, as is the required volume of local anesthetic. However, despite improved accuracy with ultrasound guidance, the spread of the local anesthetic cannot be predicted and adjustments of the needle tip are recommended.⁵

ADVANTAGES OF ULTRASOUND GUIDANCE IN REGIONAL ANESTHESIA

Visualization of Anatomic Structures

Ultrasound guidance allows visualization of the neural and adjacent anatomic structures, including arteries, veins, pleura,¹² or internal organs, such as the rumen or

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