Chloe Pilgrim RVN (BSc Hons)

Chloe qualified as an RVN in 2019 with a BSc (hons). She is currently working as a Ninja Nurse at Langford Vets Small Animal Referral Hospital, and enjoys volunteering for the Cinnamon Trust and StreetVet in her spare time.
E-mail: cp15491@bristol.ac.uk

The benefits of advanced regional anaesthesia in hindlimb surgery

Chloe Pilgrim RVN (BSc Hons)

Langford Veterinary Services, Langford Vets, Bristol, UK

ABSTRACT: As veterinary nurses we always strive to achieve a gold standard level of patient care alongside maintaining an evidence-based approach to nursing. This article aims to show veterinary nurses that some regional anaesthesia, such as a femoral and sciatic nerve block with bupivacaine, under veterinary direction is an achievable addition to an anaesthetic plan with many benefits to the patient.

KEYWORDS: regional; anaesthesia; nerve; block; pain; analgesia

Glossary

- Efficacious- successful in producing a desired or intended result
- Neuropraxia- an injury to a nerve that interrupts conduction causing temporary paralysis but not degeneration and that is followed by a complete and rapid recovery (Merriam-webster, 2020)
- Motor blockade- when motor nerves are affected by a local anaesthetic
- Noxious stimulus- an actual or potentially tissue damaging event
- Spinothalamic tract- an ascending pathway of the spinal cord. Together with the medial lemniscus, it is one of the most important sensory pathways of the nervous system. It is responsible for the transmission of pain, temperature, and crude touch to the somatosensory region of the thalamus.

Introduction

As veterinary nurses we always strive to achieve a gold standard level of patient care alongside maintaining an evidence-based approach to nursing. Many nerve blocks, for example, a femoral and sciatic nerve block with bupivacaine, can be performed by a veterinary nurse under veterinary direction, making it an achievable addition to anaesthetic plans. This article will detail how they have been shown to not only reduce rescue analgesia needed but also improve the quality of the patient's recovery. With the addition of these advanced regional anaesthesia techniques, nurses can promote providing this gold standard care while developing their own skillset.

Pain

Pain is perceived by the brain following activation of the nociceptive pathway. This originates from peripheral nociceptors which transduce noxious stimuli into electrical stimuli, with the noxious stimuli stemming from trauma to tissue; chemical, mechanical or thermal injury. These electrical signals are then transmitted to the dorsal horn in the grey matter of the spinal cord where impulses are modulated by neurones. The intensity of these impulses can be suppressed or amplified at this location before being projected via lateral nerve fibres to the brain (Lerche et al., 2016). The spinothalamic tract is the foremost ascending pathway which transmits this nociception (Short, 1998).

Pain management

Management of pain is a crucial consideration for all patients undergoing surgery or a painful procedure. Minimising post-operative pain can optimise an animal's behaviour, use of the operated limb and function of the limb after orthopaedic surgery (Hoelzler et al., 2005). Initiating noxious stimuli during general anaesthesia on animals and looking to see if there is a physiological response assists the anaesthetist to understand whether the animal is perceiving pain during surgery (Short, 1998). According to a survey distributed to veterinary professionals by Kongara et al.

This article has been republished with minor changes. These changes do not impact the academic content of the article.

DOI: 10.1080/17415349.2020.1803778

SHORT FORM OF THE GLASGOW COMPOSITE PAIN SCALE

Dog's name ______________________________

Hospital Number __________ **Date** / / **Time**

Surgery Yes/No (delete as appropriate)

Procedure or Condition ____

____

In the sections below please circle the appropriate score in each list and sum these to give the total score.

A. Look at dog in Kennel

Is the dog?

(i)		(ii)	
Quiet	0	Ignoring any wound or painful area	0
Crying or whimpering	1	Looking at wound or painful area	1
Groaning	2	Licking wound or painful area	2
Screaming	3	Rubbing wound or painful area	3
		Chewing wound or painful area	4

In the case of spinal, pelvic or multiple limb fractures, or where assistance is required to aid locomotion do not carry out section B and proceed to C
Please tick if this is the case ☐ **then proceed to C.**

B. Put lead on dog and lead out of the kennel.

When the dog rises/walks is it?

(iii)	
Normal	0
Lame	1
Slow or reluctant	2
Stiff	3
It refuses to move	4

C. If it has a wound or painful area including abdomen, apply gentle pressure 2 inches round the site.

Does it?

(iv)	
Do nothing	0
Look round	1
Flinch	2
Growl or guard area	3
Snap	4
Cry	5

D. Overall

Is the dog? (v)		*Is the dog?* (vi)	
Happy and content or happy and bouncy	0	Comfortable	0
Quiet	1	Unsettled	1
Indifferent or non-responsive to surroundings	2	Restless	2
Nervous or anxious or fearful	3	Hunched or tense	3
Depressed or non-responsive to stimulation	4	Rigid	4

Total Score (i+ii+iii+iv+v+vi) = ______

Figure 1. Glasgow composite measure pain scale score (Nour et al., 2013).

(2015) all responses indicated that surgery is believed to inflict pain substantial enough to warrant analgesia, yet 93% of these veterinary professionals responded that their awareness and assessment of pain could be improved. These results highlight the importance of continued professional development throughout a veterinary professional's career on pain management to ensure the highest quality of care is being provided to patients.

Regional anaesthesia

Regional anaesthesia is a widely accepted practice in human medicine, with a successful local block documented to result in reduced post-operative pain, a reduction in the occurrence of opioid side effects, earlier extubation and diminution of the stress response (Roberts, 2006). The use of peripheral local anaesthesia has become exponentially more popular in the veterinary industry and are now widely used in small animal orthopaedic surgeries (O'Cathasaigh et al., 2018). Local anaesthetics block sodium channels, resulting in a reversible suppression of sensory conduction in peripheral nerves (Mahler & Adogwa, 2008).

Pre-emptive analgesia administration leads to a significant reduction in nociceptive stimulation intra-operatively (Lerche et al., 2016). A study by Woolf and Chong (1993) emphasises this statement by suggesting that regional block anaesthesia is effective in preventing central sensitisation through a conduction block, even more so than epidurals. For peripheral nerve blocks, local anaesthetic drugs are injected external to the vertebral column surrounding targeted nerves to aid the prevention of pain and to promote muscle relaxation for surgery (O'Cathasaigh et al., 2018).

According to the RCVS code of professional conduct (RCVS 2020), registered veterinary nurses under the direction of a veterinary surgeon may carry out medical treatment or minor surgery if this does not involve entry into a body cavity. This can include many nerve blocks including a femoral and sciatic nerve block for hind limb surgeries.

Peripheral nerve blocks

The knowledge of anatomical landmarks, depth and angle of needle insertion and injection sites are all critical when providing a patient with a peripheral nerve block (Gurney & Leece, 2014).

The development of nerve stimulation locators and ultrasound guidance have facilitated these requirements. Ultrasound guidance has been used for peripheral nerve blocks over the past twenty years for use in human anaesthesia to enable visualisation of the nerve and to prevent maldistribution of the local anaesthetic (Shilo et al., 2010). Most nerve blocks administered have been found to be successful in causing sensory blockade with efficacious administration around the targeted nerve; yet differences in effectiveness were implied to be caused by variability in the administrator and therefore, the location of the injection site (Evangelista et al., 2017). In a clinical study conducted by Murdoch and Michou (2016), local regional anaesthetic techniques used on the sciatic nerve in dogs concluded that despite this nerve block preventing the conduction of sensory nerve fibres adequately, motor activity could still be induced distal to the site of this blockade via stimulation. This is important to be recognised in surgical practice in relation to reducing the risk of post-operative complications such as neurapraxia.

Femoral and sciatic nerve blocks

Femoral and sciatic nerve blocks are used in conjunction with each other for hindlimb orthopaedic surgery in referral practices.

A retrospective study on dogs by Boscan and Wennogle (2016) concluded that the dogs which received a femoral and sciatic nerve block had an increased quality of recovery with a lower percentage (46%) requiring rescue analgesia after stifle surgery than those which had no regional anaesthesia (98%). This is supported by Romano et al. (2016) which also concluded that peripheral nerve blocks for stifle surgery reduces pain scores post-operatively and encourages a better quality of recovery for dogs. Both studies show clear animal welfare benefits to the patient as well as promoting ease of recovery. In human lower extremity surgeries, combined femoral and sciatic nerve blocks were performed with a success rate of 96% when using a guided technique (Çelik et al., 2011). In a further study conducted by Ponde et al. (2012) on femoral and sciatic nerve blocks administered to paediatric patients, the use of ultrasonography to guide the needle was shown to significantly increase success rate compared to nerve stimulation used alone.

In a randomised, blinded, prospective clinical trial in dogs using the Glasgow composite pain scoring method (Figure 1), femoral and sciatic nerve blocks were shown to provide post-operative analgesia similar to lumbosacral epidurals (McCally et al., 2015).

However, when possible side effects of these regional anaesthesia techniques were expanded on by Campoy et al. (2012), femoral and sciatic nerve blocks were discovered to result in decreased opioid consumption in the post-operative period and a decrease in urine retention in dogs compared to epidurals. A meta-analysis of randomised trials in humans also came to this conclusion by stating that epidurals were found to cause more frequent urine retention and hypotension (Fowler et al., 2008). This makes bladder management important post-operatively to ensure the bladder does not become too distended. Veterinary nurses can monitor this by palpating the bladder and expressing if necessary, under veterinary direction. With access to an ultrasound scanner it is also possible for veterinary nurses to scan the bladder and measure the size to monitor if the bladder needs expressing. Emptying the patient's bladder post-surgery can also be a good idea to prevent leaking onto the surgical site during the recovery period.

The benefits of guided femoral and sciatic nerve blocks are further supported by Bradbrook et al.'s retrospective clinical study (2012) which cites that these nerve blocks up to six weeks post-operatively, did not result in the development of any neurological complications in the dogs which participated. It is noted that all these studies used a nerve stimulation locator or ultrasound guidance to administer these nerve blocks. This demonstrates an evident lack of research supporting nerve blocks which are performed using a blind technique.

Technique

Prior to a peripheral nerve block, the site of injection should be clipped and surgically prepared to ensure asepsis, and the process should be performed in a sterile manner.

The femoral nerve can be located cranial to the femoral artery at the level of the femoral triangle (Figure 2). The sciatic nerve can be located perpendicular to the midpoint of a line drawn between the ischial tuberosity and greater trochanter (Boscan & Wennogle, 2016) (Figure 3).

Identification of the femoral nerve with a nerve locator can be confirmed by contraction of the quadriceps muscle at a current of 1 mA and a frequency of 1 Hz. The current is then gradually decreased until cessation of the contraction, with the aim for this to be at 0.5 mA (Ganidagli et al., 2005). This shows that the nerve has been located but that the local anaesthetic is not close enough to cause damage to the nerve or related structures. For the sciatic nerve, the

Figure 2. Femoral nerve block using nerve stimulation guidance.

Figure 3. Sciatic nerve block using nerve stimulation guidance.

same method applies however the desired contraction is dorsiflexion of the foot.

Once the nerve is located successfully at the lower amplitude and negative aspiration is achieved, the local anaesthetic can be injected.

Bupivacaine

Bupivacaine is very popular for regional anaesthesia and nerve blocks in veterinary practices. Some of its desirable characteristics include low cost, duration of effect, market availability and safety with a clinical recommended dose of Bupivacaine 0.5% in dogs being 2 mg/kg (Shilo et al., 2010). Even though the onset of action is longer (20–30 minutes) than Lidocaine the duration of activity can last up to eight hours (Ramsey, 2014), making it a good candidate for orthopaedic surgeries.

However, a lack of clarity over the duration of effect has been noted with antinociception being observed for between one to eight hours in cats, with motor blockade observed for between one to three hours (Evangelista et al., 2017). In a randomised controlled trial by Evangelista et al. (2017), Bupivacaine was also observed to significantly impair the animals' ability to walk by an increase of one and a half hours, it also significantly increased the paw withdrawal threshold from thirty minutes to two-four hours. Although, contradictions occur between this study and a randomised study conducted by O'Cathasaigh et al. (2018) which state that full recovery from a sciatic motor blockade in dogs was a median of twelve hours and from sensory blockade ten hours. This study also suggests that these nerve blocks at the doses used (0.15 ml/kg) do not result in Bupivacaine plasma levels which systemically could be toxic, making them safe to use for surgeries (O'Cathasaigh et al., 2018).

Conclusion

As pain has vast cognitive and emotional elements (Woolf, 2004) pain can be indisputably detrimental to the quality of life of a patient if left untreated. Klopfenstein et al. (2000) state that recognition of this pain and necessary treatment thereafter is a crucial aspect when assessing quality of care being delivered to patients. Yet, while nociceptive pain can decrease the patient's quality of life, it is a "vital physiological mechanism" without which life expectancy decreases, so should only be managed clinically for specific occurrences such as surgery (Woolf, 2004). Regional anaesthesia can help to achieve a good level of analgesia during surgery, and as veterinary nurses we can promote their use as part of the anaesthetic plan under veterinary direction while also building on our evidence-based approach to nursing.

ORCID

Chloe Pilgrim http://orcid.org/0000-0002-0206-3131

References

Boscan, P., & Wennogle, S. (2016). Evaluating femoral-sciatic nerve blocks, epidural analgesia, and no use of regional analgesia in dogs undergoing tibia-plateau-leveling osteotomy. *Journal of the American Animal Hospital Association*, *52*(2), 102–108. https://doi.org/10.5326/JAAHA-MS-6278

Bradbrook, C., Gurney, M., Aprea, F., Clark, L., Corletto, F., & Vettorato, E. (2012). Peripheral nerve blocks of the pelvic limb in dogs: A retrospective clinical study. *Veterinary and Comparative Orthopaedics and Traumatology: V.C.O.T*, *25*(04), 314–320. https://doi.org/10.3415/VCOT-11-08-0111

Campoy, L., Martin-Flores, M., Ludders, J., Erb, H., & Gleed, R. (2012). Comparison of bupivacaine femoral and sciatic nerve block versus bupivacaine and morphine epidural for stifle surgery in dogs. *Veterinary Anaesthesia and Analgesia*, *39*(1), 91–98. https://doi.org/10.1111/j.1467-2995.2011.00673.x

Çelik, F., Tüfek, A., Yıldırım, Z., Tokgöz, O., Karaman, H., Alemdar, C., Atiç, R., Çiftçi, T., & Kavak, G. (2011). Our experience of combined femoral sciatic nerve block in the lower extremity surgery. *Journal of Clinical and Experimental Investigations*, *2*(4), 375–379. https://doi.org/10.5799/ahinjs.01.2011.04.0075

Evangelista, M., Doodnaught, G., Fantoni, D., & Steagall, P. (2017). Sciatic and femoral nerve blockade using bupivacaine alone, or in combination with dexmedetomidine or buprenorphine in cats. *The Veterinary Record*, *180*(24), 592–592. https://doi.org/10.1136/vr.104152

Fowler, S., Symons, J., Sabato, S., & Myles, P. (2008). Epidural analgesia compared with peripheral nerve blockade after major knee surgery: a systematic review and meta-analysis of randomized trials. *British Journal of Anaesthesia*, *100*(2), 154–164. https://doi.org/10.1093/bja/aem373

Ganidagli, S., Cengiz, M., Baysal, Z., Baktiroglu, L., & Sarban, S. (2005). The comparison of two lower extremity block techniques combined with sciatic block: 3-in-1 femoral block vs. psoas compartment block. *International Journal of Clinical Practice*, *59*(7), 771–776. https://doi.org/10.1111/j.1368-5031.2005.00414.x

Gurney, M., & Leece, E. (2014). Analgesia for pelvic limb surgery. A review of peripheral nerve blocks and the extradural technique. *Veterinary Anaesthesia and Analgesia*, *41*(5), 445–458. https://doi.org/10.1111/vaa.12184

Hoelzler, M., Harvey, R., Lidbetter, D., & Millis, D. (2005). Comparison of perioperative analgesic protocols for dogs undergoing tibial plateau leveling osteotomy. *Veterinary Surgery*, *34*(4), 337–344. https://doi.org/10.1111/j.1532-950X.2005.00052.x

Klopfenstein, C., Herrmann, F., Mamie, C., Van Gessel, E., & Forster, A. (2000). Pain intensity and pain relief after surgery. *Acta Anaesthesiologica Scandinavica*, *44*(1), 58–62. https://doi.org/10.1034/j.1399-6576.2000.440111.x

Kongara, K., Squance, H., Topham, I., & Bridges, J. (2015). Attitudes and perceptions of veterinary paraprofessionals in New Zealand to postoperative pain in dogs and cats. *New Zealand Veterinary Journal*, *64*(2), 112–116. https://doi.org/10.1080/00480169.2015.1111172

Lerche, P., Aarnes, T., Covey-Crump, G., & Martinez Taboada, F. (2016). *Handbook of small animal regional anesthesia and analgesia techniques* (pp. 2–87). John Wiley & sons.

Mahler, S., & Adogwa, A. (2008). Anatomical and experimental studies of brachial plexus, sciatic, and femoral nerve-location using peripheral nerve stimulation in the dog. *Veterinary Anaesthesia and Analgesia*, *35*(1), 80–89. https://doi.org/10.1111/j.1467-2995.2007.00356.x

McCally, R., Bukoski, A., Branson, K., Fox, D., & Cook, J. (2015). Comparison of short term postoperative analgesia by epidural, femoral nerve block, or combination femoral and sciatic nerve block in dogs undergoing tibial plateau leveling osteotomy. *Veterinary Surgery: VS*, *44*(8), 983–987. https://doi.org/10.1111/vsu.12406

Merriam-webster.com. (2020). *Medical definition of neurapraxia* [online]. Retrieved June 24, 2020, from https://www.merriam-webster.com/medical/neurapraxia

Murdoch, A., & Michou, J. (2016). The effect of loco-regional anaesthesia on motor activity induced by direct stimulation of the sciatic nerve in dogs. *Veterinary Journal*, *209*, 139–143. https://doi.org/10.1016/j.tvjl.2015.12.002

Nour, E., Othman, M., Karrou, G., Zaghlou, A. (2013). *Glasgow composite measure pain scale score* [image]. Retrieved April 24, 2020, from http://www.lifesciencesite.com/lsj/life1003/260_19399life1003_1727_1731.pdf

O'Cathasaigh, M., Read, M. R., Atilla, A., Schiller, T., & Kwong, G. P. S. (2018). Blood concentration of bupivacaine and duration of sensory and motor block following ultrasound guided femoral and sciatic nerve blocks in dogs. *PLos One*, *13*(3), e0193400. https://doi.org/10.1371/journal.pone.0193400

Ponde, V., Desai, A., & Shah, D. (2012). Comparison of success rate of ultrasound-guided sciatic and femoral nerve block and neurostimulation in children with arthrogryposis multiplex congenita: A randomized clinical trial. *Pediatric Anesthesia*, *23*(1), 74–78.

Portela, D., Verdier, N., & Otero, P. (2018a). *Femoral nerve block using nerve stimulation guidance* [image]. Retrieved April 25, 2020, from https://www.sciencedirect.com/science/article/pii/S1090023318303782#!

Portela, D., Verdier, N., & Otero, P. (2018b). *Sciatic nerve block using nerve stimulation guidance* [image]. Retrieved July 14, 2020, from https://www.sciencedirect.com/science/article/pii/S1090023318303782#fig0015

Ramsey, I. (2014). *BSAVA small animal formulary* (8th ed., pp. 46–47). British Small Animal Veterinary Association.

Rcvs.org.uk. (2020). *18. Delegation to veterinary nurses – professionals* [online]. Retrieved June 24, 2020, from https://www.rcvs.org.uk/setting-standards/advice-and-guidance/code-of-professional-conduct-for-veterinary-surgeons/supporting-guidance/delegation-to-veterinary-nurses/

Roberts, S. (2006). Ultrasonographic guidance in pediatric regional anesthesia. Part 2: Techniques. *Pediatric Anesthesia*, *16*(0), 1112–1124.

Romano, M., Portela, D., Breghi, G., & Otero, P. (2016). Stress-related biomarkers in dogs administered regional anaesthesia or fentanyl for analgesia during stifle surgery. *Veterinary Anaesthesia and Analgesia*, *43*(1), 44–54. https://doi.org/10.1111/vaa.12275

Shilo, Y., Pascoe, P., Cissell, D., Johnson, E., Kass, P., & Wisner, E. (2010). Ultrasound-guided nerve blocks of the pelvic limb in dogs. *Veterinary Anaesthesia and Analgesia*, *37*, 460–470. https://doi.org/10.1111/j.1467-2995.2010.00560.x

Short, C. (1998). Fundamentals of pain perception in animals. *Applied Animal Behaviour Science*, *59*(1-3), 125–133. https://doi.org/10.1016/S0168-1591(98)00127-0

Woolf, C., & Chong, M. (1993). Preemptive analgesia—Treating postoperative pain by preventing the establishment of central sensitization. *Anesthesia & Analgesia*, *77*(2), 362–379.

Woolf, C. J. (2004). Pain: moving from symptom control toward mechanism specific pharmacologic management. *Annals of Internal Medicine*, *140*(6), 441–451. https://doi.org/10.7326/0003-4819-140-8-200404200-00010

