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Mary graduated from the Royal Veterinary College as an RVN in 2010. She worked in a charity practice before moving to the Queen Mother Hospital as an anaesthesia nurse in October 2011. She is hoping to start her nursing Certificate in Anaesthesia and Critical Care this year.

# Local anaesthesia – Part 2: regional anaesthesia of the thoracic limb

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**ABSTRACT:** The administration of regional anaesthesia to the thoracic limbs is a little more complex than to the head, and the potential complications and side effects are greater. However, there are still a wide range of regional anaesthesia techniques available for patients receiving procedures on forelimbs and these are generally underused. Part two of this series looks at regional anaesthesia for the thoracic limb and what veterinary nurses should expect from the local blocks, both during the procedure and on recovery.

In human medicine the use of perioperative local and regional anaesthesia greatly reduces major complications as the stress response (which is neuroendocrine) to surgical trauma compromises haemostatic, metabolic and immunological function (Lemke, 2011). The use of local blocks can augment analgesia and allow for a reduction in volatile agent as well as the use of systemic analgesics. This results in a smoother plane of anaesthesia and a better recovery.

## Which one?

There are six different types of regional block which can be performed to provide analgesia to various parts of the thoracic limb. They are:

- cervical paravertebral brachial plexus
- axillary (traditional) brachial plexus
- RUMM – radial, ulna, medial & musculotaneous nerves
- wrist block
- Bier's block
- digital block.

A clear understanding of anatomy is required to use these techniques and decide which technique is the right choice for each procedure.

**Figure 1** shows the nerve groups in the forelimb and their position.

## Paravertebral brachial plexus

Anaesthesia of the paravertebral brachial plexus blocks the nerve roots C<sub>6</sub>, C<sub>7</sub>, C<sub>8</sub>, T<sub>1</sub> and T<sub>2</sub>

There are three techniques that can be used:

- the **blind technique** follows the transverse process of vertebrae C<sub>5</sub> - C<sub>6</sub>, C<sub>6</sub> - C<sub>7</sub> and C<sub>7</sub> - head of the first rib
- the **neurostimulation technique** uses the same landmarks but finds the nerves via electrolocation by use of a nerve stimulator
- **ultrasound** can be used to guide the anaesthetist. For this the needle enters cranial to the first rib.

The paravertebral cervical block is suitable for patients having surgery on any part of the thoracic limb, such as forelimb amputation, humeral fracture repair or elbow surgery. However, many potential complications can occur if the local anaesthetic is administered incorrectly. These can include:

- pneumothorax
- intravascular injection leading to uptake in the systemic circulation and the possibility of toxicity
- nerve damage
- phrenic nerve block, resulting in the patient being unable to use one side

To cite this article use either  
DOI: 10.1111/vnj.12110 or Veterinary Nursing  
Journal VOL 29 pp47-50

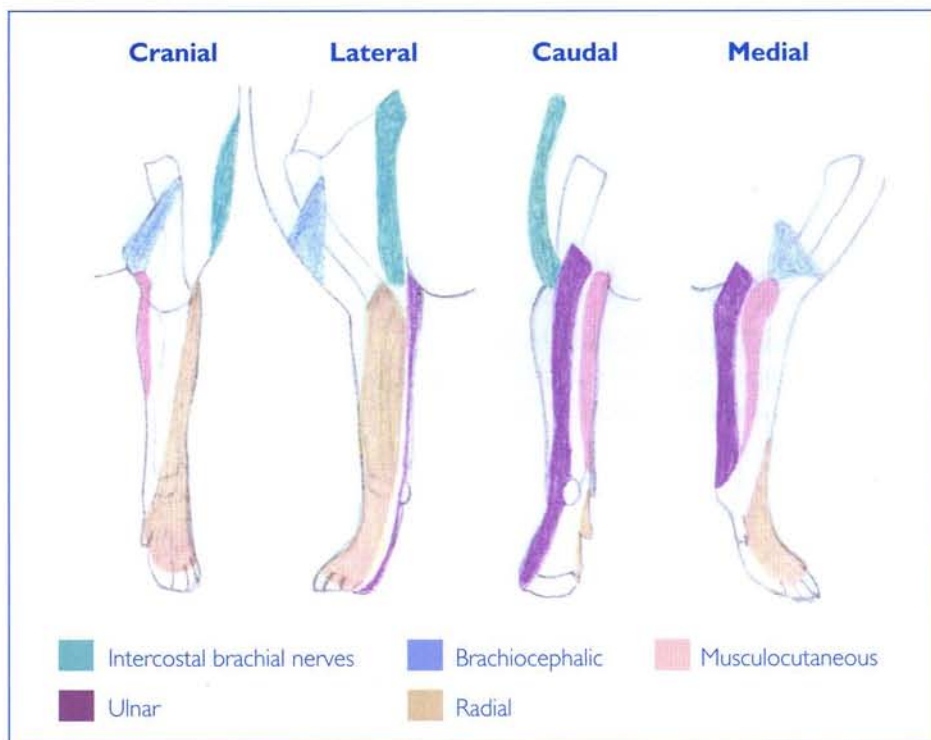


Figure 1. Nerve groups of the thoracic limb

its thorax and, therefore, lung for ventilation

- injection into the epidural space.

Some undesirable – but manageable – side effects of this block include Horner’s syndrome and residual block where its effects are longer acting than desired.

**Horner’s syndrome**

Horner’s syndrome occurs when there is interference with the sympathetic nerve supply to the head, resulting in a combination of signs including:

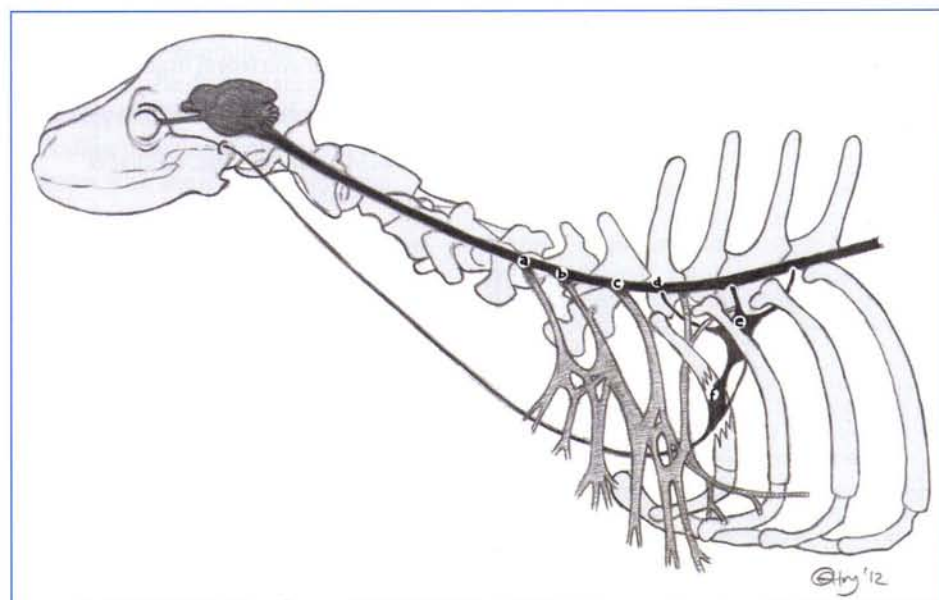
- **miosis**  
constriction of the affected pupil.
- **enophthalmos**  
displacement of the eyeball resulting from a loss of sympathetic innervation, which leads to a lack of tone in the orbital smooth muscle. This allows the eyeball to sink back into the orbit.
- **protrusion of the nictitating membrane (third eyelid)**  
resulting from a lack of tone in the smooth muscle retracting the third eyelid, as this is under sympathetic innervation. It is also secondary to enophthalmos.
- **upper eyelid ptosis (incomplete elevation or drooping)**  
caused by reduced muscle tone. The palpebral fissure may appear narrowed and laxity of the lower eyelid can be observed.
- **reduction in intraocular pressure**

- **loss of cutaneous vascular tone on the affected side**  
can result in an increased cutaneous temperature in the affected side. This is often manifested as the pinna on the affected side being warmer than the normal side.

Horner’s syndrome may be a consequence of neoplasia, trauma or an idiopathic cause.

The brachial plexus innervation of the thoracic limb is made up of contributions from the nerve roots C<sub>6</sub>-T<sub>1</sub>. Therefore, part of the sympathetic supply from the spinal cord is closely associated with any innervation to the thoracic limb.

Figure 2. Nerve roots & sympathetic outflow from the head.



An hypothesis for the cause of this syndrome, in patients who have received regional anaesthesia to block the brachial plexus nerves, is that the local anaesthetic spreads outside the desired area, causing blockade of the cervico-thoracic ganglia resulting in the above side effects.

This may be the result of the volume of local anaesthetic injected or the angle of the needle. The effects should be monitored but are not systemic, do not need to be treated, and disappear shortly after the patient recovers motor and sensory functions to the limb.

Figure 2 shows the nerve roots of C<sub>6</sub>, C<sub>7</sub>, C<sub>8</sub> and T<sub>1</sub>, along with the sympathetic outflow to the head and eye, to demonstrate how close together the nerves are and how easy it can be to affect the nerves other than those desired.

**Axillary (traditional) brachial plexus**

The axillary or traditional brachial plexus technique blocks the radial, ulna, median and musculocutaneous nerves (Figure 2a). Two techniques can be used, either blind or using neurostimulation.

With the blind technique, the anaesthetist inserts the needle medial to the shoulder joint, on the medial side of the scapula but ensuring it is on the outside of the thoracic cavity. The needle is advanced parallel to the vertebral column, aiming for the costochondral junction of the first rib. Then a small amount of the total volume of anaesthetic is injected and the remainder is injected as the needle is withdrawn.



Figure 2a. The axillary or traditional brachial plexus technique blocks the radial, ulna, median and musculocutaneous nerves

This type of block is suitable for surgeries below the elbow only, such as radial fracture, carpal arthrodesis or digit amputation.

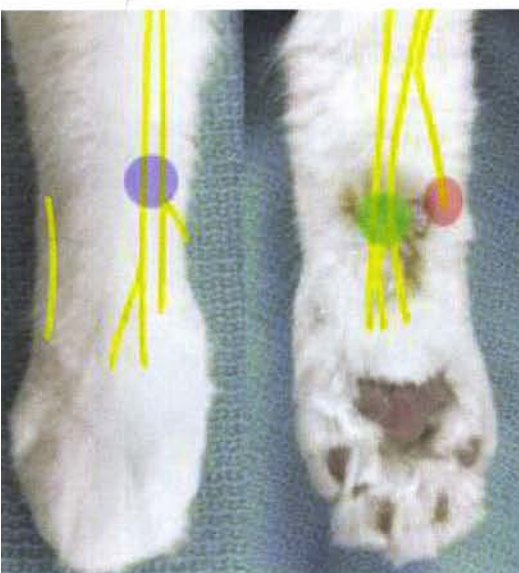
This block has similar – although fewer – potential complications compared with the paravertebral brachial plexus block and the possibility of their occurring is much smaller. With the axillary brachial plexus block there is no danger of entering the epidural space.

When using neurostimulation to guide administration, the landmarks and approach are the same as with the traditional blind method. The nerve stimulator allows the anaesthetist to find the brachial plexus nerve branch accurately, as there is contraction of the biceps brachii and flexion of the elbow at a current of 0.3mA. When the local anaesthetic is injected, this response will fade and disappear.

## RUMM

This blocks the radial, ulna, median and musculocutaneous nerves *individually*

Figure 3. Wrist block



rather than collectively as occurs with the brachial plexus block. This technique should be performed using neurostimulation or ultrasonography.

The radial nerve lies lateral and distal to the humerus (Figure 1). Extension of the paw is required to perform a block on the radial nerve. The median, musculocutaneous and ulna nerves lie to the mid-medial area of the humerus. Flexion of the paw is required to achieve correctly a block on the ulna and median nerves. Flexion of the elbow is needed in order to accomplish a block on the musculocutaneous nerves.

With ultrasonography, the radial nerve is visualised. It looks like a white triangle in the lateral and distal area to the humerus. Median and radial nerves appear as two small black round structures between the brachial vein and artery, whilst the musculocutaneous nerve appears as a small black round structure cranial to the brachial artery.

## Wrist block

The wrist block provides analgesia for the radial, median and ulna nerves, which is ideal for procedures affecting only the paw. The anaesthetist aims to inject the anaesthetic peri-neurally, at three sites. From a practical skill perspective, it is similar to subcutaneously as the anaesthetic agent is injected in the space surrounding the nerve.

Injecting at three sites enables the three different nerves to be blocked individually. These are shown in Figure 3.

## Bier's block

The Bier's block is also known as intravenous regional anaesthesia (IVRA).

First an intravenous catheter must be placed as distally on the limb as possible (Figure 4). Then the foot should be bandaged from distal to proximal ends and a tourniquet applied at the proximal end of the bandage. The tourniquet must be placed proximal to the surgical area and it must be tight enough to overcome arterial blood pressure. This is done to prevent both venous return to the body and arterial supply to the limb to avoid toxicity. Then the local anaesthetic can be injected (Figure 5).

Only lidocaine should be used for this technique as other local anaesthetics are cardiotoxic, even with low doses. Most of



Figure 4. Bier's block – first an intravenous catheter must be placed as distally on the limb as possible

the lidocaine infiltrates the surrounding tissue and some remains in venous circulation. For this reason the tourniquet must be left on for a minimum of 20 minutes. Less than that will release the local anaesthetic too suddenly into the systemic circulation.

When the tourniquet is released, it should be released slowly for the same reason. The tourniquet should not be left on for longer than 90 minutes maximum otherwise permanent tissue necrosis will occur. This block provides anaesthetic effects for 15-30 minutes after the tourniquet has been removed.

## Digital block

The digital block provides regional anaesthesia for the nerves in the phalanges. These nerves run medially and laterally to the digits.

Figure 5. Bier's block – only inject the local anaesthetic once the tourniquet is correctly in place





Figure 6. Digital block

The anaesthetist should insert the needle dorsally into the digit and advance it alongside the bone to the medial side. Then half of the volume is injected and the needle can be withdrawn. The anaesthetist repeats the same procedure on the lateral side of the bone.

This is suitable for procedures such as digit amputation, abscesses and problems

with the nail. This procedure has few potential complications and is very effective, whilst not being particularly difficult to carry out (Figure 6).

### Conclusion

Regional anaesthetic techniques stop pain sensation rather than reducing it to a more tolerable level. Local anaesthetic techniques should always be considered prior to surgery as there are a number available for various parts of anatomy.

The choice of type and concentration of local anaesthetic used will depend upon whether it is planned for surgical anaesthesia or pain management.

Veterinary nurses can support the use of these by understanding the techniques used and by being confident in monitoring for complications.

### Reference

LEMKE, K. A. (2011). Pain Management II: Local and Regional Anaesthetic Techniques. In: Seymour C and Duke-Novakovski T, ed. *BSAVA Manual of Canine and Feline Anaesthesia and Analgesia*. 2nd Ed. Gloucester, UK, BSAVA pp 104-114

### Further reading

CAMPOY, L & READ, M. (2013). *Small Animal Regional Anaesthesia and Analgesia*. Oxford, UK, Wiley-Blackwell. pp 110-111, 124-125.

DUGDALE, A. (2010). *Veterinary Anaesthesia: Principles to Practice*. Oxford UK, Blackwell Publishing. pp 118-121

GRINT, N. (2011). *Place Local Anaesthetic Blocks in Small Animals*. [Online]. Available from: [http://www.bsava.com/portals/0/media/membership/PDF/how\\_to\\_may2011.pdf](http://www.bsava.com/portals/0/media/membership/PDF/how_to_may2011.pdf) [Accessed September 2013]

MANDSAGER, R. (2003). *Local Anaesthetic Techniques*. [Online]. Available from: <http://instruction.cvhs.okstate.edu/vmed5412/Lect23.asp> [Accessed September 2013]

CAMPOY, L. (2008). Fundamentals of Regional Anaesthesia Using Nerve Stimulation in the Dog. *Recent Advances in Veterinary Anesthesia and Analgesia: Companion Animals*. Gleed, R. D. & Ludders, J.W. (Eds.). [Online]. International Veterinary Information Service, Ithaca NY. Available from [www.ivis.org](http://www.ivis.org) [Accessed September 2013]

## NEWS REVIEW by Jean Turner

### Online mini series for receptionists

CPD Solutions and Onswitch have joined forces to provide a way for receptionists to maximise their skills with minimum effort, through a new Online Mini Series.

As well as creating that all-important first impression, receptionists have an extremely diverse and challenging role; ranging from managing inventories to managing people.

All of this has to be achieved alongside a thorough understanding of both the commercial running of the business and the practical aspects of veterinary procedures. This gives receptionists a formidable task when it comes to fitting a lot of learning into a limited amount of time.

The Mini Series will incorporate a series of core topics, providing them with theoretical background as well as the practical application.

Perhaps most importantly, the 'view again' capability allows receptionists to re-visit the sessions an unlimited number of times, allowing them to learn a little, practice a lot and then learn a little more.

The first course commences on the 19 February with a full programme planned for the future.

Make sure you don't miss out and sign up for your place at [www.receptionistwebinars.com](http://www.receptionistwebinars.com) or for more information, call CPD Solutions on 0151 328 0444.

### TP Congress open for registration

The College of Animal Welfare is delighted to announce that TP Congress 2014 – two days of CPD dedicated to Clinical Coaches – will be from 17 - 18 March and is open for registration.

With continual changes to the Level 3 Diploma in Veterinary Nursing programme, now is the ideal time to book on and keep up to date with what is happening.

Following great feedback on the venue last year, this year's Congress will be held, once again, at Milton Keynes Conference Centre, a purpose-built venue.

For further information or to book, visit [www.caw.ac.uk/TP-Congress](http://www.caw.ac.uk/TP-Congress) or call The College of Animal Welfare on 01480 422060.

