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THE SPECIALIST CONNECTION

Neurological examination in 5 minutes

By Brent Higgins BVSc CertSAS DipECVS

This article is a summary of the process the author uses when presented with a neurological patient. The information has a bias towards spinal patients.

Outcome:
Neurological examination can be difficult to master. However, a screening assessment can be performed in just a few minutes and provides enough information to guide initial decision making. The outcome is a case summary such as this:

> *Non-ambulatory paraplegia, neurolocalised to T3-L3, bladder dysfunction is present, deep pain sensation is present.*

The case summary contains the ambulatory status, neurolocalisation, requirement for bladder function assistance and, by the inclusion of deep pain sensation assessment, the prognosis.

Where to begin:
When a neurological patient presents, always perform the basics of any veterinary examination. Start with the signalment, history, general exam, orthopaedic exam, and finally the screening neurological exam. This linear process is important because it is common for patients to present looking like neurological disease when they have other conditions e.g. bilateral orthopaedic disease presenting as hindlimb paralysis, or a medical disease causing generalised weakness.

The screening neurological exam is made of the categories listed in Table 1.

Table 1. Neurological exam categories

Neurological exam category	Example	Conclusion made
Observation	Of mental state, posture, gait, ataxia, limbs affected	Ambulatory status, affected limbs
Cranial nerves	Menace, vision, assessment of pupil size, jaw tone, facial sensation, palpebral reflex, gag	Are the brain, brain stem or peripheral nerves affected?
Postural reactions	Proprioception (figure 1, page 2)	If this is normal, spinal cord disease is unlikely
Spinal reflexes	Patellar and withdrawel reflexes	Helps with neurolocalisation (see explanation below)
Spinal pain	Pain at the thoracolumbar junction	Helps with neurolocalisation. Helps with formulating a differential diagnosis e.g disc disease is painful, fibrocartilagenous embolisms are not
Bladder function	Full and difficult (or full and easy) to express	Identifies requirement for assistance with bladder function e.g placement of a Foley catheter connected to a closed urine collection system. Helps with neurolocalisation.
Deep pain assessment (figure 2, page 2)	Squeeze toes firmly with forceps and get a reflex withdrawel, but no conscious perception of that pain	When deep pain is absent, this represents a poor prognosis

Neurolocalisation:
Neurolocalisation and assessment of spinal reflexes require an understanding of basic neurophysiology. The principle is that the brain sends down the spinal cord fibres that deliver inhibitory control to reflexes, termed *descending inhibition.*

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Figure 1 proprioception

Figure 2 deep pain assessment

Table 2. Response to reflex testing for pathology at particular spinal cord segments.

Functional neurological segment	What's affected
Brain	Cranial nerve dysfunction, seizures, behavioural changes
C1-C5	Hyperreflexia to forelimbs and hindlimbs
C6-T2 (nerves to forelimb)	Hyporeflexia to forelimbs, hyperreflexia to hindlimbs
T3-L3	Normal forelimbs, hyperreflexia to hindlimbs
L4-S1 (nerves to hindlimb)	Normal forelimbs, hyporeflexia to hindlimbs
S1-S3 (nerves to bladder sphincter)	Normal forelimbs and hindlimbs, poor perineal reflex
Diffuse peripheral or neuromuscular disease	Hyporeflexia to all limbs

Any nerves exiting the spinal cord cranial to any cord lesion will usually have normal reflexes when reflex tested. Nerves exiting the cord at the level of the lesion will often be poorly functional (termed *hyporeflexia*) because of the disease itself. Finally, nerves exiting the spinal cord caudal to the lesion will often have exaggerated and uncontrolled activity (termed *hyperreflexia*). This information can be used to neurolocalise a lesion to the segments in Table 2.

Severity and Prognosis:
Patients are presented with variable clinical signs. The following lists these signs with increasing disease severity and decreasing prognosis:

- Pain only
- Ataxia, proprioceptive deficits, paresis (weakness)
- Plegia (paralysis)
- Plegia with urinary dysfunction
- Plegia with urinary dysfunction and loss of deep pain sensation

What's next?
From that information, a list of differential diagnoses can be created and a diagnosis pursued. A more detailed neurological examination is performed if indicated e.g. to localise any cranial nerve abnormalities. Advanced imaging (e.g. MRI) is often very helpful for diagnosis. Where spinal patients are concerned, diagnosis is usually followed by surgery. Manage pain and bladder dysfunction at all stages of the diagnostic and treatment process.

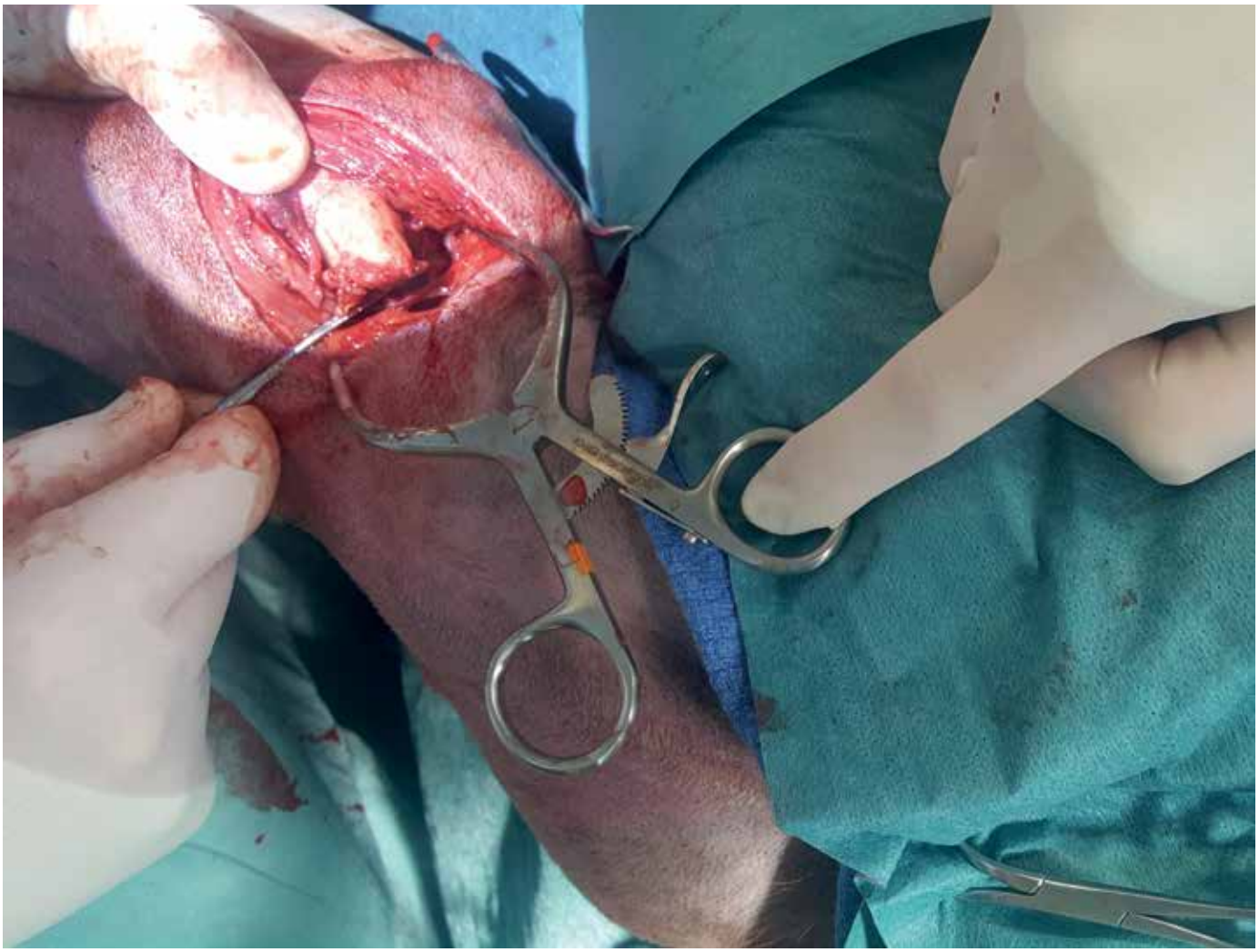
Conclusion:
The screening neurological examination is a quick and helpful tool to identify the most important components of the neurological assessment. It forms the basis of initial decision making.

Fracture fixation

By Dr Michael Nawrocki DVM diplomate ACVS–Small Animal

The founding principles of fracture fixation have been listed as anatomic realignment, rigid internal fixation, and early return to function. These rules have been the hallmark of internal fracture management for decades and continue to be taught in veterinary schools, orthopaedic workshops, and veterinary surgical textbooks as goals for all internal fixation plans. This traditional view has shifted somewhat in recent years as our understanding of fracture repair and the physiology of fracture healing progresses. Fracture healing occurs through one of two pathways: primary bone healing and, callous formation. Primary bone healing occurs when osteoblasts directly divide and unify to create cortical bone at a fracture site. This can only occur in a minimal fracture gap (<1 mm) and under completely stable conditions. The process is slow, but when completed, results in a bony union that has the identical function and ability of the original bone without any visual change in the bone surface. This form of bone healing has been the goal and the most commonly recommended method for repair of long bone fractures using internal fixation methods prior to the year 2000. In order to accomplish this, visualization of the fracture fragments is vital and often requires additional dissection to clear the soft tissues and periosteum around the fragments. While this will provide excellent visualisation and allow for complete anatomical apposition of fracture fragments, it often requires the stripping away of essential blood flow and removing the fracture hematoma that develops between the fragments that is filled with strong trophic factors and bioactive agents that assist with fracture healing. In certain highly comminuted fractures, complete anatomic reconstruction is simply not possible, and can lead to disastrous complications if the devascularized fragments cannot be fully reconstructed or if they become necrotic.

Forelimb external ring fixation in a canine.



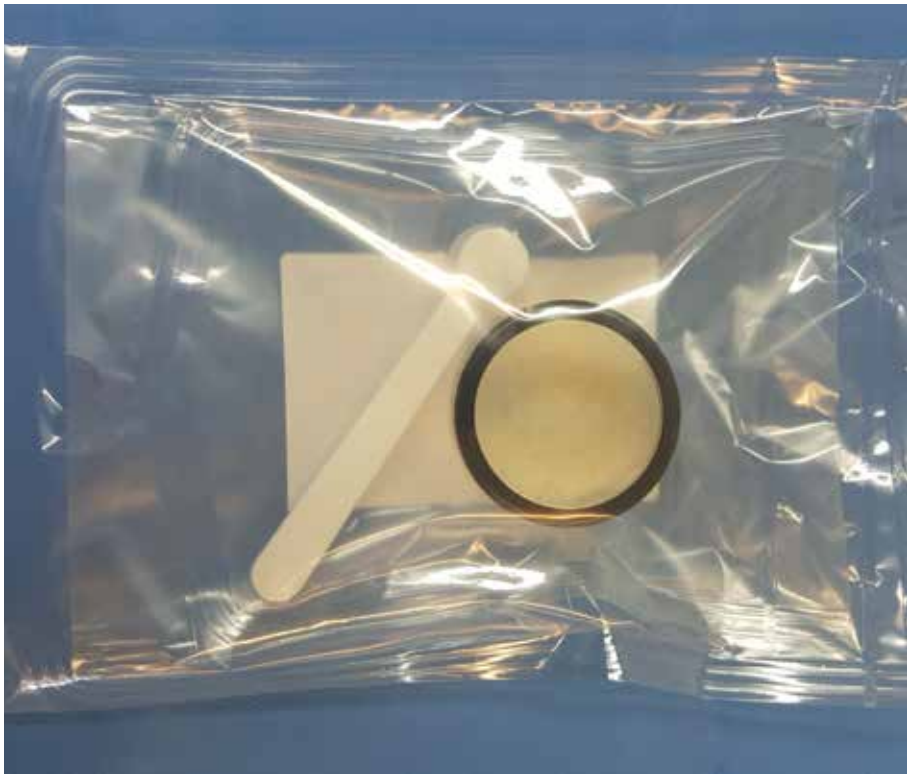
Visualisation of the fracture.

The other means by which bone heals, occurs under conditions of incomplete immobilization or in the presence of minor fracture gaps. When micromotion is present between fracture fragments, the body is stimulated to create callous. Callous is the bony equivalent of granulation tissue. It can withstand high levels of strain compared to intolerant osteocytes. It provides a great deal of additional vascularization to the healing fracture zone and does lend a level of stability. The body then goes through successive conversions into more stable fibrous, then bony tissue. The end result is conversion into a stable bony structure that has the same physical capabilities of cortical bone. This process is more rapid, but often causes exuberant bone to be initially present at the fracture site. This bone will eventually be remodelled into completely normal appearing and functional cortical bone. In most situations, the additional tissue size of the callous does not create any difficulties and is typically very benign in the overall scheme of healing. External fixation and coaptation rely heavily upon this healing process to heal a fracture.

The durability of callous tissue within a stable fracture gap allows for some manipulation of the bone as it heals and research into attempts and manners of manipulating this process have greatly expanded our fixation options for bone and options for correcting angular limb abnormalities. With the development of implant systems that can be manipulated during the healing process, surgeons are able to more directly influence the manner in which bones heal and use fracture gap mechanics to great advantage for correction of angular limb deformities or length discrepancies. Typically a highly comminuted fracture, or a fracture with a large gap can benefit from the application of autogenous harvested bone graft, or more recently available on the market, commercialized bone graft. The later requiring specific licensing in New Zealand and currently available through Vetspecs.

Fracture gap mechanics can be used to a surgeons advantage in situations where a fracture gap is simply too great to span, or if limb lengthening is required by creating a fracture in the bone intended for manipulation after application of an adjustable external fixation device. Once the body initiates the fracture healing process (often days after the cut is made), the fracture gap is distracted slowly using several small adjustments over time. This process is, generally speaking, pain free and discontinued once the bone has achieved its final position. The frame is then stabilized and the bone is allowed to finish healing. This process is called bone transport osteogenesis. Using this technique in conjunction with motorised external frames, multiple complex fractures and congenital/acquired angular defects can be corrected with a high degree of function and minimal overall discomfort at the end.

The understanding that callous formation creates the same degree of healing that direct bony union accomplishes has also lead to a shift from rigid internal structures to a greater use of external systems and less stiff internal constructs. Orthopedic surgeons are moving away from aggressive anatomic reconstruction to minimal approaches with less dissection and decreased contact of the implants to the bone. The use of locking plate technology allows the orthopaedic surgeon to secure the plate to the screws that are anchored into the bone and cause no disruption of the surface blood flow on the bone while maintaining the rigidity of the internal constructs. In the future, additional understanding and use of minimally invasive techniques and locking constructs may allow most primary care facilities that manage fractures to decrease the overall amount of stocked implants and decrease initial costs to become more capable of managing complicated fractures in your practice.



Veterinary tissue bank cancellous chips.

VETERINARY TISSUE BANK

Veterinary Tissue Bank Allograft products now available from Vetspecs

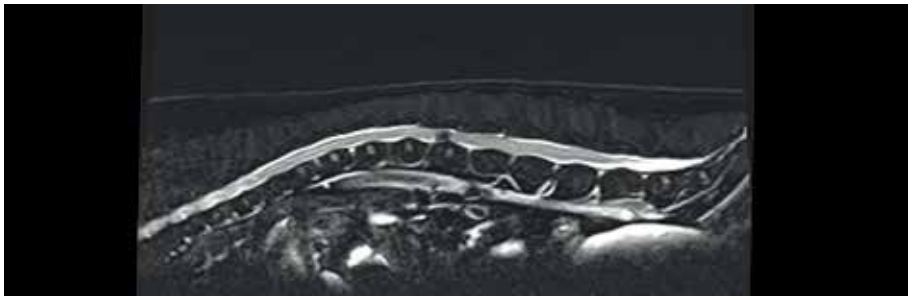
Why MRI?

By Libby Leader Cert LVN

Magnetic resonance imaging is a useful tool in the veterinary world today. MRI combines magnetism and radio energy to create images that are radiation free and are interpreted by a computer to provide clear images of an animal's internal structure.

When an owner hears that their pet needs an MRI they usually have a few questions as to why we would prefer to use this test over another imaging option. Neutral MRI images have a superior soft tissue definition. MRI is a non-invasive image that will show subtle changes that cannot be seen on radiography. In tissue, an MRI is the most common way to assess the anatomy of the spinal cord. This means that the contrast and definition between soft tissue structures such as the spinal cord, epidural fat, and disc material and swelling, is usually possible without the use of a contrast medium. At times contrast may be required, however this is on a case by case basis. It can be used to identify central nervous system changes, compression of the spinal cord and components of the joints.

The MRI scanner is a giant magnet, that can be up to 40,000 times as strong as the earth's magnetic field. This makes it potentially dangerous and the unit must be stored in a special room containing no magnetic metals and operated by trained individuals. If the veterinarian forgets to remove the dogs collar or wears their stethoscope in the room, the magnet is so powerful it has been known to send metal objects flying across the room and causing fatal accidents to anyone who should get in the way. If a metallic object should get stuck in the scanner the machine needs to be switched off and this process takes hours and costs thousands of dollars.



MRI of the thoracic and lumbar spine.

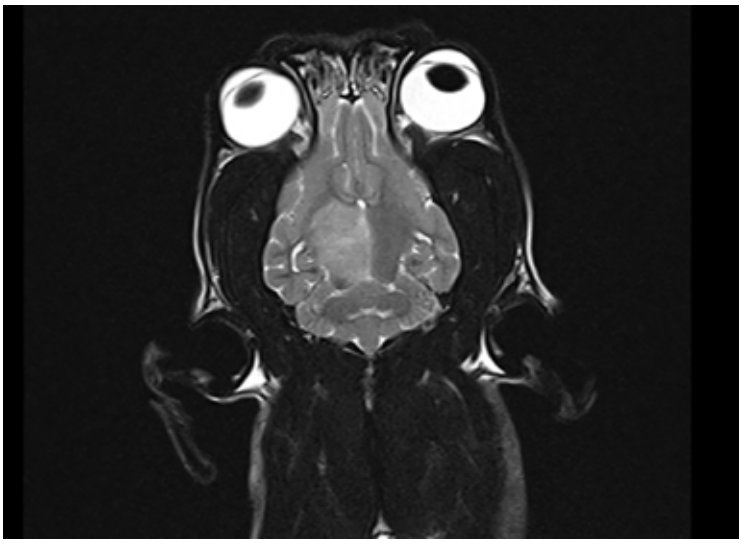
The magnet is powerful enough to wipe information on credit cards and microchips. If your pet has any form of metallic implant it may create an artefact on the images. Orthopedic implants used in veterinary medicine have a very low magnetic field, so there is no need to worry that the screws inside Buster's leg will move during the scan.

Depending on what areas are being scanned, the imaging can take anywhere from 30 mins to 2 hours. During this time the animal needs to be completely still so the best images possible can be created. The MRI creates a series of loud noises that can be frightening to the patient being scanned, earplugs are often used to help dull the noise. Patients are usually given an IV sedative to keep them from moving, this will require them to be kept in a warm and quiet place that evening so the effects of the sedative can wear off.

There are no animal specific MRI machines in New Zealand due to the cost and the level of personnel that is required to run one.

Here in Christchurch we can have our patients scanned through the private health care system. Due to this we have no control over the time of availability and we happily take what we are given. The MRI service through Pacific Radiology is open for local Veterinary clinics for their clients, or it is a service we provide at Vetspecs.

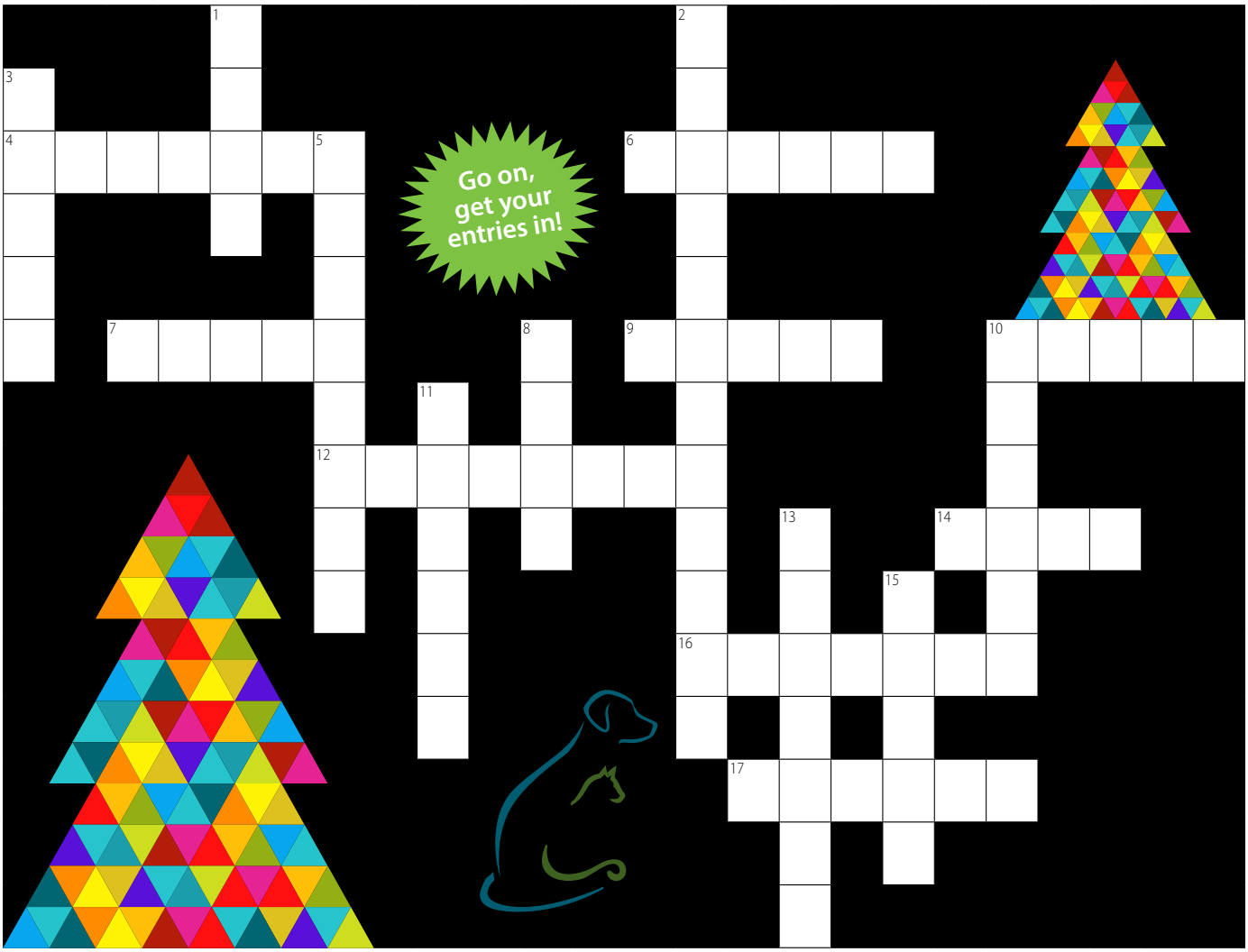
Due to the need for sedation, patents always require a consultation with a surgeon before a scan is completed. The scan is then interpreted by a veterinary and a human radiologist before a treatment plan is tailored to that pet's needs. Prices range anywhere from $2000 - $4000 depending on what we are looking at and how long the scan takes.



MRI of the brain and cervical spine in a dog.

Wheelchair magnetised to MRI machine (image courtesy of the Daily Mail).

Bumper Crossword



ACROSS

4 Primary bone healing and _____ formation are the two pathways of fracture healing. (7)

6 Assessing _____ pain helps with neurolocalisation. (6)

7 Locking _____technology causes no disruption to the surface blood flow. (5)

9 How many catergories are in a neurological exam? (5)

10 When having an MRI the patient needs to be completely _____. (5)

12 What type of Fracture is it vital to visualise the fragments? (8)

14 The _____ equivalent of granulation tissue is known as callous. (4)

16 A helpful diagnosis in neurological examinations is advanced _____. (7)

17 Primary bone healing occurs when osteoblasts _____ and unify (6)

DOWN

1 The prognosis is _____ if deep pain is absent. (4)

2 _____ is the term for poorly functional nerves exiting at the lesions (12)

3 Primary bone healing can only _____ in a minimal fracture gap. (5)

5 MRI has a _____ soft tissue definition. (8)

8 Spinal _____ disease is unlikely if postural reactions are normal. (4)

10 Fracture healing is assisted by _____ trophic factors and bioactive agents. (6)

11 A case summary of a neurological examination consists of the ambulatory _____. (6)

13 What does MRI stand for: Magnetic Resonance _____. (7)

15 One of the founding principles of fracture fixation is _____ internal fixation (5)

Fax, email or post your completed crossword to Vetspecs by Wednesday 31st of January 2018. All correct entries go into the draw to win a $100 hamper, kindly supplied by SVS. Remember to include your name, clinic name and contact number so you can be notified. Winner will be drawn on Monday the 5th of February 2018 and put on our facebook page.

PET DOCTORS

Wishing everyone a safe and happy Christmas!

Vetspecs Christmas Holiday Hours 2017

Christmas Week

Monday 25th December – CLOSED
Tuesday 26th December – CLOSED
Wednesday 27th December – 8am – 6pm
Thursday 28th December – 8am – 6pm
Friday 29th December – 8am – 6pm
Saturday 30th December – CLOSED
Sunday 31st December – CLOSED

New Year Week

Monday 1st January – CLOSED
Tuesday 2nd January – CLOSED
Wednesday 3rd January – 8am – 6pm
Thursday 4th January – 8am – 6pm
Friday 5th January – 8am – 6pm
Saturday 6th January – CLOSED
Sunday 7th January – CLOSED

Monday 8th January – return to normal hours

For EMERGENCIES ONLY cell phone contact will be available on the Public Holidays ONLY between the hours of 9am and 5pm. The number is 021 0255 5511.
Outside of these hours, please contact your local after-hours service.

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