Vetwatch

ROSSDALES EQUINE HOSPITAL & DIAGNOSTIC CENTRE
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SCINTIGRA PHY

Scintigraphy is the term used to describe the method of imaging the horse using an injected radioactive chemical. The most common application is in imaging the skeleton, or 'bone scanning' but in fact other organ systems can also be assessed using the same equipment and different biological markers.

How it works

Bone scanning is undertaken following the delivery of a dose of radiation to the horse, which is administered via an intravenous injection a few hours earlier. For this reason, horses referred to us for bone scanning are normally assessed the day prior to the scan, during which time the required amount of radiation is calculated based on the horse's bodyweight. However, if a scan is to be performed the same day as the appointment date, the horse must be at our Diagnostic Centre no later than 9am. Following injection, the radiation must then become attached to the tissue of interest, in this case bone, which then will be detected by a gamma camera. For all of our studies, we use a radioactive chemical called technetium (Tc). This is obtained from the radioactive decay of another element called molybdenum. Some practices have their own technetium generator from which they obtain their doses of technetium, but most, like Rossdales, have the required doses delivered each day from a nearby hospital (in our case Addenbrookes in Cambridge). It is the technetium that decays and releases gamma rays, a type of radiation, that can then be picked up by the detector - the gamma camera.

The horse is positioned so that the camera is assessing the right hindlimb. In some cases, we place a lead shield between the legs so that radiation from the opposite hindlimb doesn't interfere with the image.

The Tc-MDP being drawn up prior to injection into the horse. Note the lead casing around the vial and the lead shield around the syringe to reduce the dose of radiation received by the operator. The operator is also wearing gloves and a monitoring device on their left wrist.

In order for the study to be bone specific, the technetium must be attached, chemically, to a bone-seeking agent. This is a compound called methylene diphosphonate (MDP), which has a very high affinity for bone. So the technetium, linked to the MDP, becomes Tc-MDP and arrives at the clinic each morning ready to go in vials labelled with the dose they contain. It is then a simple matter of injecting the horse with the correct dose and waiting for the Tc-MDP to leave the bloodstream and settle out into the skeleton: this takes around two hours. When the horse is ready, it is taken to the gamma camera room for the examination to take place. The gamma camera is a large rectangular or circular structure that can detect the gamma rays being emitted by the horse's skeleton and convert these into pictures that are displayed on a nearby computer screen. The camera itself contains a single large crystal of sodium iodide, which is very thin and very delicate. Most of the bulk and weight of the camera comes from the shielding necessary to keep the crystal safe from damage and also to stop other sources of radiation, which are all around us, from interfering with the image quality. When the crystal is hit by a gamma ray it emits light - a tiny spark that is captured by photoelectric tubes behind the crystal and these sparks are passed on to the computer. The computer recognises the location of the tubes and because the brightness of the spark correlates to the intensity of the gamma rays, it can build an image of the region of interest. This image gives us an accurate map of the activity of the bones - it is measuring physiological activity at the moment of the examination (unlike x-rays, which give us the evidence of what has been happening to the skeleton over weeks, months and even years).

What is bone scanning?

Bone scanning measures the activity of the skeleton. All bones are busy replacing themselves and updating their structure at all times - there is a constant cycle of removal and replacement of bone. The rate of replacement depends on things such as activity - for example, how much exercise a horse is given, and other metabolic factors. This means that even normal bone shows up well during the scan. If a horse suffers an injury to a bone or joint, its skeleton goes into overdrive and cells arrive to remove the damaged bone and replace it with new: this is how fractures heal. This also means that the damaged region will be more active and will absorb more of the MDP (and therefore the Tc) and this shows up on the bone scan as a hotspot - an area of increased activity on the images produced by the computer. The cause of the hotspot could be a fracture, joint disease, bruising, pulling of the bone by ligaments and tendons or even a tumour (very rare in horses, but important in humans). So bone scanning is said to have high sensitivity (it's very good at detecting the abnormal turnover) but low specificity (it cannot deduce what has caused the high turnover). This is why, if your horse has a bone scan, invariably we will need to use other techniques to identify the cause of the hotspot, such as radiography or ultrasonography.

Bone scanning is an important diagnostic aid and is very useful in many cases but particularly so if:

- A serious limb injury is suspected that cannot be visualised with radiography (x-rays) or ultrasonography.
- Nerve blocks have not revealed the cause of lameness.
- There is multi-limb lameness.
- An injury to the upper limb, back or pelvis is suspected that is not amenable to x-raying.
- We see changes on an x-ray or ultrasound scan that we cannot be certain of their significance.

It is very useful for identifying stress fractures, which may not be detected on radiographic examination, and for monitoring fracture healing.

A safe procedure

If the idea of injecting your horse with a dose of radiation sounds a little off-putting, don't worry! The technique is perfectly safe and is used on many humans every day. However, following bone scanning, in order to satisfy the Radiation Regulations for exposure to the public, we retain the horse under controlled conditions until the radioactive isotope is sufficiently decayed. The horse is unable to leave the hospital until 4pm the following day and visiting is also restricted until this time.
The actual dose of radiation administered is very low, but as most of it is eliminated from the horse in the urine, we do take special precautions with the bedding in the stables, which cannot be mucked out for 48 hours. The radiation decays quite rapidly, so that a day after the scan the horse can go home safely.

A week in brief...

Monday
A racehorse is referred to me with a suspected pelvic fracture. In most horses, serious pelvic injuries are the result of a fall or other trauma, but racehorses can develop stress fractures - gradual onset injuries caused by the accumulation of micro damage to the bone brought about by their high speed work. In this case, the bone scan shows a fracture on the left side of the pelvis (figure 1). Thanks to the prompt referral by the trainer's vet, this horse has been saved from much more serious injury and will be back in training, fully healed, within a few weeks.

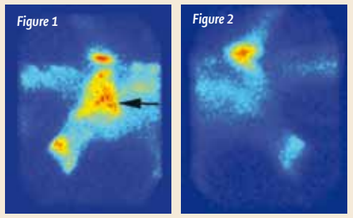


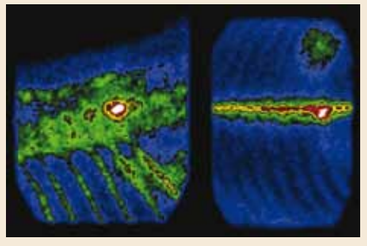
Figure 1: This racehorse has suffered a stress fracture to the left side of the pelvis (arrowed). Compare this to the normal image (Figure 2) taken from the right side of the same horse.

Tuesday
A valuable dressage stallion is admitted because of severe sudden onset left hindlimb lameness. The owner requested referral for a bone scan because of concerns that he may have a fracture. Fortunately, it is a simple case of pus in the foot, which was resolved easily by the careful use of a hoof knife and the application of a poultice. Later that day he's back on the lorry going home. It doesn't happen often, but it's nice when cases like this have a simple diagnosis and solution!

Wednesday
One of our surgeons is operating on a horse that I examined last week with a tear in the deep digital flexor tendon, inside the foot. He uses a tiny camera to look into the navicular bursa and small instruments to clean up the injury. The horse recovers safely and will go home at the weekend.

A tiny camera has been inserted into this horse's navicular bursa. We can see a metal probe being used to gently press the deep flexor tendon (bottom left) and the damaged fibres of the tendon (top and middle right)

Thursday
A horse referred for back pain has shown a hotspot in his back during the bone scan yesterday. Today we x-ray this region and ultrasound scan the joints in his lower back - this confirms arthritis in one of the joints in his lumbar region. Using ultrasound guidance, we can insert a needle deep into the back and medicate the joint.



This horse has a problem with one of the joints in his back. The bright focal white spot is centred over the joint between the last thoracic and first lumbar vertebra on the left side. This may indicate a stress fracture or, in this case, arthritis. This region can be medicated and with rest and physiotherapy many horses, will make a full recovery. Diagnosis in some cases can be impossible without scintigraphy.

Friday
Another horse referred for back pain turns out to be slightly lame behind with large bone cysts in each stifle - this is particularly interesting because the stifles were normal on the bone scan and reminds us all that, however useful the technique, it is not fool proof. After talking to the owner we remove some bone marrow from his sternum and send this away for culture of stem cells. These will be implanted into the stifles when they are ready - in about 3 weeks' time.

Vet Profile

Name: Marcus Head
Qualifications: BVetMed MRCVS
Year of Qualification: 1994
Main interests: I qualified from the Royal Veterinary College (RVC), University of London in 1994 and subsequently spent time in mixed practice in Bedfordshire before undertaking an internship at the Animal Health Trust, Newmarket. This was followed by a further internship, when I returned to the RVC, before joining Rossdale & Partners in 1996. Originally concentrating on the racehorse side of the practice, I am now a senior associate based at the state of the art Rossdales Equine Diagnostic Centre. I am particularly interested in imaging techniques and lameness diagnosis and see a wide variety of horses.
My main interests outside work include cycling and photography.

1959-2009
ROSSDALE & PARTNERS
VETERINARY SURGEONS

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