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Diagnostic Imaging

Plain Radiographic Interpretation - A Lost Art
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Introduction
Plain or survey radiographs have been traditionally an important diagnostic test which the veterinary surgeon had at their fingertips. This familiarity with a tried and trusted technique has been relegated to a less important role with the advent of newer modalities. Poor quality images and/or an inadequate study may cause disappointment. In addition a cursory review of the radiographs may lead to under or overdiagnosis of pathology. The widespread use of thoracic and abdominal ultrasonography in small animal practice over the last 5-10 years has also supplanted the use of routine radiography, yet much valuable information can still be obtained from good quality plain radiographic studies.

Once accurately positioned diagnostic images are obtained, reading and interpreting the images is much more rewarding. The basic adage for reading radiographs is to look for changes in shape, contour, outline, opacity and position. In order to apply this mantra, quality images must be obtained. This presentation will therefore concentrate on ways to optimise obtaining a diagnostic radiograph or image and use examples to demonstrate various points.

Views
Obtaining two orthogonal views (at right angles to each other) of an area or region is one of the major cornerstones of radiographic interpretation. This is a very important concept but is often discarded due to time pressures in busy practices. Examples of where this lack of methodical radiographic practice occurs include some of the following:

Thorax
Lateral radiographs are commonly acquired but often only a single view is obtained. The right and left lateral recumbent views are complementary and provide much more information than any single lateral study. It is well documented that intrapulmonary metastatic lesions have to be at least 1cm in size to be appreciated on the final image. But other types of pulmonary pathology such as lobar pneumonia or patchy infiltrates may also be missed with single views. When an animal lies on one side the dependent lung becomes less aerated than the uppermost or more inflated lung. Consequently the contrast between aerated lung and pathological tissue is less obvious in the recumbent lung tissue. Opposing lateral views help to ensure that both left and right lungs are examined in an inflated state.

In addition the dorsoventral view provides further information on the outline of the diaphragm, ribs, cardiac silhouette and mediastinum. These latter three regions are often difficult to fully evaluate on only lateral views. In many countries manual restraint is not permitted under radiation protection legislation. Therefore chemical restraint or sedation is often used. If general anaesthesia is used for thoracic radiography then mechanical ventilation will be required in order to avoid hypostatic congestion which arises with recumbency - even of short duration.

Additional views using simple positional variations and in some instances using a horizontal x-ray beam (when permitted under local regulations) can also provide supplementary information in cases of mild pneumothorax or pleural fluid.

Axial Skeleton
Access to advanced imaging modalities such as Computed Tomography (CT) and Magnetic Resonance Imaging (MRI) are becoming more commonplace. However there is still a valuable role for survey radiographs of the skull and spine. These studies may even indicate or refute the requirement for such techniques which are often expensive.

Survey radiography of the spine requires particular care in positioning the patient. This is firstly to ensure that the patient’s condition is not exacerbated and secondly to acquire accurate and reliable images of the region of interest. Oblique views and occasionally views using a horizontal x-ray beam may also be used to good effect.

Skull
This is a very complex area and requires a number of positional views to evaluate the various regions. Careful positioning is a prerequisite. CT and MRI have certainly demonstrated lesions which cannot be accurately shown with standard and even creative radiographic techniques. Open and closed mouth views for the temporomandibular joints can be obtained with minimal difficulty. Small articular fractures, subluxation and temporomandibular dysplasia and osteoarthritis are all demonstrable with these techniques.

Occlusal studies of the nasal chambers and tangential views of the frontal sinus are well worth obtaining when indicated. Optimisation of radiographic technique is vital to make any meaningful diagnosis. However subtle changes may still be missed and may require Ct or MRI.

Appendicular skeleton
Standard orthogonal views are a ‘must have’ for orthopaedic assessment of the limbs. In addition stressed studies using lateral and medial (or more rarely cranial and caudal) leverage of the distal limb in relation to...
the upper limb are excellent manipulative techniques using sandbags and limb ties. Such studies can indicate the extent of laxity or deformity in a limb. Rarely (and with due attention to radiation safety and regulations) weightbearing views in giant breed dogs might be considered useful. In equine radiography tangential oblique projections in addition to standard orthogonal views of the limb joints are commonplace. The use of oblique views in small animal practice is not widespread but valuable information may be obtained from such studies.

Forty five degree oblique views of the carpus and tarsus profiling the small carpal/tarsal bones are advantageous to fully evaluate these complex joints. Flexed and extended mediolateral (lateral) views of the stifle, elbow, carpus and tarsus may indicate a partial subluxation of the joints and reveal small chip or avulsion fractures of the adjacent bones. Complete evaluation of the shoulder joint may require cranially and caudally rotated views obtained with the animal in lateral recumbency. These studies profile the medial and lateral aspects of the caudal articular margin of the humerus. This is particularly useful when assessing shoulder joints for suspected osteochondrosis. Inaccurately positioned craniocaudal views of the shoulder joint may sometimes be misleading and erroneously suggest some degree of subluxation.

In some instances a flexed craniocaudal view of the elbow may illustrate a nondisplaced intercondylar fracture of the distal humerus, particularly in spaniels. Flexed dorsoplantar views of the tarsus are often helpful to outline osteochondral defects on the talus. Flexed and extended views of the pelvis and sacroiliac joints are also useful to evaluate marginal sacroiliac disruption and coxofemoral malalignment.

**Abdomen**

Right lateral recumbent and ventrodorsal views are the standard imaging planes for abdominal studies. Movement of fluid and gas within the gastrointestinal tract (GIT) can be manipulated by taking right and left lateral recumbent studies to outline different sections of the GIT. Such positional variations may provide diagnostic information such as foreign bodies and gastric wall thickness. Identification of partial or complete gastric torsions may require both lateral views as well as the ventrodorsal and dorsoventral views. The retroperitoneal space provides particular challenges although it is more amenable to ultrasonography.

**References**