

Radiographic Interpretation of the Spine

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In most cases, radiographic evaluation of the spine is relatively straightforward. Interpretation of spinal radiographs can be nonspecific, however a systematic approach can assist in ruling out many disease processes. This presentation will review how to obtain and interpret spinal radiographs. Common diseases of the spine will also be reviewed. The following information highlights and summarizes the main key features to remember when interpreting spinal radiographs.

I. RADIOGRAPHIC TECHNIQUE

A. Positioning

- Sedation is highly recommended to obtain diagnostic radiographs.
- In a lateral radiograph, the transverse processes and /or the ribs must be superimposed.

B. Collimation

- Tight collimation around the region of interest is important. A “chabdomen” causes too much scattered radiation resulting in blurring of the edges, which could lead to misinterpretations.

C. Exposure

- Low exposure and particularly low MAS technique results in quantum mottling. Radiographs appear noisy and the edge of the spinal structures are blurred. This could lead to over diagnosing disease processes like discospondylitis.
- When appropriate exposure is obtained, the spinous processes can be clearly outlined.

D. Distortion

- Disk space narrowing at the edge of the radiographs may be overestimated by beam distortion. If a narrowed disc space is noted on thoracic/abdominal images, or at the periphery of a spinal image, then it is recommended to take radiographs

collimated and centered over the suspicious spinal area to assess for true disc space narrowing or distortion.

II. INTERPRETATION PARADIGM

A. Anatomy

- Narrowing of the C2-C3 intervertebral disc space is not always associated with underlying intervertebral disc disease.
- T11 is considered the anticlinal vertebra in most patients. The mild narrowing noted at T10-T11 is considered normal in most patients.
- A normal widening of the vertebral canal is noted between L3 and L5 in dogs and cats and is due to the lumbar intumescence. This is particularly conspicuous in cats.
- The diaphragm originates at the ventral aspect of the L3 and L4 vertebral bodies. This is a common place of osteomyelitis because of migrating foreign bodies following the curve of the diaphragm until its origin.

B. Congenital vertebral malformation: incidental or not?

- Block vertebrae represent an incidental finding, although a careful evaluation of the adjacent disk spaces may prove useful as these adjacent discs are under more stress and could be prone to herniation.
- Often, hemivertebrae are wrongly considered to be an incidental finding in brachycephalic breeds. They are associated with spinal instability and could result in cord atrophy. The presence of hemivertebrae should be correlated with the clinical history.
- Transitional vertebrae. They are almost always incidental at the thoracolumbar junction. This is not true at the lumbosacral junction and are reported to be a predisposing factor to lumbosacral stenosis.

III. DISC HERNIATIONS

A. Interpretation of intervertebral disc disease

- Intervertebral disc space width: it should always be compared with the adjacent disc spaces on each side of the disc space of concern.
- Intervertebral foramina: the “horse head” should not be narrowed or deformed.
- Articular facet joint spaces: A narrowed disc space is often associated with narrowing of the articular facet joint space.
- A mineralized disc does not mean it is herniated.

- Disc herniation is rare between T2 and T10.

B. Hansen type I

- Chondrodystrophic breeds are predisposed to Hansen type I disc herniation. Chondroid degeneration of the nucleus pulposus. The nucleus is gradually replaced by cartilage that may mineralize. There is rupture of the annulus fibrosus causing direct impact on the spinal cord and mechanical compression by the disc material.
- Herniation is most often between T11 and L2 in the thoracolumbar spine and at C2-C3 in the cervical spine region
- Survey radiographs are not very accurate at predicting the site of disc herniation.

C. Hansen type II

- Non-chondrodystrophic breeds. Dorsal deviation of the nucleus pulposus gradually protruding into the annulus fibrosus without rupture.

IV. ATLANTO-AXIAL INSTABILITY

- Miniature breeds are overrepresented when congenital. Could be any breeds when traumatic.
- A 15 degree oblique lateral view is best to evaluate the C2 dens integrity. Though a good VD view or rostrocaudal open mouth view can also be obtained.
- The instability itself is only evaluated with a flexed lateral view: significant widening of the space separating the caudal C1 lamina and cranial aspect of the C2 spinous process is noted. Warning: neck flexion may exacerbate spinal cord compression as well as clinical signs!

V. WOBBLER OR CAUDAL CERVICAL MALARTICULATION/MALFORMATION SYNDROME

- Vertebral canal stenosis that can be static or dynamic.
- Mature large breed dogs
- Radiographic findings: dorsal tipping of the cranial aspect of the affected vertebra, flattening of the cranioventral aspect of the affected vertebra, articular facets degenerative joint disease.

VI. CAUDA EQUINA SYNDROME/LUMBOSACRAL STENOSIS

- Middle aged medium to large breed dogs.
- Highly active or working dogs. GSD predisposed.
- Correlation of static imaging findings and clinical signs in dogs with LS disease has

been reported to be poor.

- Radiographic findings: Spondylosis deformans, endplate sclerosis with irregular well-defined margins, articular facets degenerative joint disease and lumbosacral malalignment.
- Stress radiographs are reported not to be helpful.

VII. TRAUMA

A. Subluxation/luxation

- Obtaining two orthogonal views is paramount as a luxation/subluxation may be visible on one view only. Use of horizontal beam radiography may prove useful.

B. Fractures

- Compression fracture: length measurement of the suspected fractured vertebra should be compared to the length of the adjacent vertebrae on each side.
- Chip fractures are often affecting the ventral aspect of the fractured end-plate and the region of the articular facets.

VIII. SPINAL NEOPLASIA

- Spinal cord, and nerve root neoplasia are usually not detected on radiographs unless there is pressure atrophy present. Spinal cord lymphoma in cats can be associated with pressure atrophy.
- Judging the aggressive behavior of a spine bony lesion is based on the pattern of bony lysis: geographic, moth-eaten or permeative (from the least aggressive to the most aggressive). It is also based on the type of periosteal reaction (ill-defined/well-defined, irregular or regular).
- Example of benign neoplasm: Multiple cartilaginous exostoses, fibroma, osteochondroma, osteoma. Radiographic findings: uniform mineral opacity, uncommon periosteal reaction.
- Example of malignant neoplasm: Primary bone tumor, metastasis (hemangiosarcoma, prostatic or anal gland carcinoma, appendicular osteosarcoma) or round cell neoplasia (lymphoma or histiocytic sarcoma).

IX. DISCOSPONDYLITIS

- Infection of the intervertebral disc hematogeneously with secondary infection of the endplates
- L7-S1 is most commonly affected.

- Large breeds are more commonly affected. Fever is uncommon. Pain is very common.
- Radiographic signs: disc space narrowing or collapse, endplate sclerosis, irregularity and ill-defined endplate margin, +/- spondylosis deformans.
- Can lead to subluxation.
- Radiographic signs very often lag behind clinical improvement.