Radiography of the Spine

Attila ARANY-TóTH, DVM

Radiography of the Spine

- Complex anatomy
- Vertebrae: 7 cervical, 13 thoracal, 7 lumbal, 3 sacral, n caudal
- Thorough neurological examination - localization !!!
- Restraining tools – Anesthesia
- High quality equipment (screen/film/grid)

Radiography of the Spine

Plain:
- Standard positions:
  - laterolateral
  - ventrodorsal
- Other projections:
  - oblique
  - stress (flex., ext.)

The effect of positioning
Radiographic Anatomy

1. Endplate
2. Transverse proc.
3. Cran. articular
4. Caud. articular
5. Spinous proc.
6. Endplate
7. Spinal canal
8. Vertebral body
9. Intervertebral foramen
10. Intervertebral space

Radiographic evaluation of the Vertebral Column

1. Entire vertebral column
   - deformities
   - traumatic injuries (fract., lux.)
2. Vertebrae
   - shape
   - density
   - number
   - articular proc.
3. Intervertebral space
   - width
   - change in density

Diagnosis: in conjunction with clinical signs!!!

Radiography of the Spine

1. Survey radiograph
2. Contrast studies:
   - Myelography
   - Epidurography
   - (Discography)

Myelography

- Contrast study of the subarachnoid space
- Aim: to reveal compressive processes in the spinal canal

Anatomy
**Myelography**

- Contrast study of the subarachnoid space
- Aim: to reveal compressive processes in the vertebral canal

### Technique No. 1

**Cisternal Myelography**

- General anesthesia
- Occipital puncture (spatium atlanto-occipitale)
- Contrast: nonionic, water soluble iodine: Omnipaque (iohexol), Iopamiro (iopamidol) etc.
- Dose: 0.3 ml/kg (cervical lesion), 0.5 ml/kg (thoracolumbar lesion)

### Technique No. 2

**Lumbar Myelography**

- Lumbar puncture (L4-5, L5-6)
- In case of unsuccessful cisternal puncture (technical problems, swollen spinal cord (oedema, haematoma)
- Sometimes the first method of choice

### Possible Complications:
- Convulsive seizures
- Herniation of the cerebellum
- Medullar puncture: apnoea, exitus
- Cisternal puncture: enables CSF examination
Radiography of the Vertebral Column

CONTRAST STUDIES:
- Myelography
- Epidurography
- Discography

Epidurography
- Contrast study of the epidural space
- Puncture: sacro-coccygeal junction or C1-2
- Indication: lumbosacral compression
- Disadvantage: epidural fat → irregular filling

Compressions in the spinal canal

Golf-tee sign
Compressions in the spinal canal

Abnormalities
Developmental anomalies
1. Spina bifida (spinal cleft)
2. Block vertebrae
3. Hemivertebrae ("wedge-vertebrae")
4. Transient vertebrae

Abnormalities
Developmental anomalies
1. Spina bifida (spinal cleft)
2. Block vertebrae
3. Hemivertebrae ("wedge-vertebrae")
4. Transient vertebrae

Abnormalities
Developmental anomalies
1. Spina bifida (spinal cleft)
2. Block vertebrae
3. Hemivertebrae ("wedge-vertebrae")
4. Transient vertebrae

Abnormalities
Developmental anomalies
1. Spina bifida (spinal cleft)
2. Block vertebrae
3. Hemivertebrae ("wedge-vertebrae")
4. Transient vertebrae
Abnormalities

Formal deviations of the vertebral column

1. **Lateral**: Scoliosis
2. **Dorsal**: Kyphosis
3. **Ventral**: Lordosis

**Causes:**
- developmental
- metabolic
- spasm, pain

Abnormalities

Degenerative disease of the intervertebral disc

1. **Types**
   - „Hansen I.”:
     - chondrodystrophic breeds
     - nucl. pulp.: calcification
     - anulus fibr.: rupture
     - „extrusion”
     - rapid deterioration

2. **Consequences**: spinal cord compression, pain, loss of neural function

3. **Localisation**:
   - cervical → four limb symptoms
   - thoracolumbar → hind limb symptoms

4. **Radiographic signs**:
   - calcified disc is not pathognostic

Degenerative disease of the intervertebral disc

1. Clinical examination, neurological localisation
   Determines the region

2. Radiology
   Determines the exact site

Degenerative disease of the intervertebral disc

1. Types
   - „Hansen II.”:
     - other (large) breeds
     - nucl. pulp.: fibrotisation
     - anulus fibr.: intact
     - „protrusion”
     - chronic process

Abnormalities

Degenerative disease of the intervertebral disc

2. **Consequences**: spinal cord compression, pain, loss of neural function

3. **Localisation**:
   - cervical → four limb symptoms
   - thoracolumbar → hind limb symptoms

4. **Radiographic signs**:
   - calcified disc is not pathognostic
Abnormalities
Degenerative disease of the intervertebral disc

4. **Radiographic signs:**
- calcified disc is not pathognomistic
- narrowed intervertebral space (!)
  (phys: C2-3, C7-Th1, Th10-11)

Abnormalities
Degenerative disease of the intervertebral disc

4. **Radiographic signs:**
- calcified disc is not pathognomistic
- narrowed intervertebral space (!)
  (phys: C2-3, C7-Th1, Th10-11)
- calcified disc in the canal (deformed „horse-head“)

Abnormalities
Degenerative disease of the intervertebral disc

4. **Radiographic signs:**
- calcified disc is not pathognomistic
- narrowed intervertebral space (!)
  (phys: C2-3, C7-Th1, Th10-11)
- calcified disc in the canal
- myelography: „extradural compression“

Abnormalities
Cervical Spondylopathy - Wobbler Syndrome

• Deformity, instability of cervical vertebrae (C4-7), malarticulation, narrowed spinal canal
  - spinal cord compression
  - ataxia, paresis

Predisposition: dobermann

Abnormalities
Cervical Spondylopathy - Wobbler Syndrome

• Types of the compression:
  - **dynamic**: worsening by extension of the neck (lig. flavum hypertrophy)
  - **static**: the same degree in every position (deformed vertebrae)

• Radiography:
  - **survey**:
    - deformed, wedge-shaped vertebra
    - narrowed intervertebral space
Abnormalities
Cervical Spondylopathy - Wobbler Syndrome
- Radiography:
  - myelography: compression of the spinal cord due to
    1. deformed vertebra
    2. disc protrusion

Abnormalities
Cervical Spondylopathy - Wobbler Syndrome
- Radiography:
  - myelography: compression of the spinal cord due to
    1. deformed vertebra
    2. disc protrusion
    3. hypertrophy of lig. flavum (multiple location !!, extended view)

Abnormalities
Lumbosacral Stenosis - Cauda Equina Compression Syndrome
- Lumbosacral instability - stenosis
- German shepherd, large breeds
- Hindlimb weakness, painful palpation of LS region

Abnormalities
Lumbosacral Stenosis - Cauda Equina Compression Syndrome
- Plain radiographic signs:
  1. collapsed LS intervertebral space
  2. sclerotic endplates
  3. LS spondylosis deformans
  4. LS subluxation

Abnormalities
Lumbosacral Stenosis - Cauda Equina Compression Syndrome
- Myelography:
  - sometimes not informative (too short dural sack)
  - stress projections (flex., ext.)
Abnormalities
Lumbosacral Stenosis - Cauda Equina Compression Syndrome

Epidurography

Abnormalities
Spondylolithesis

- Inflammation of the intervertebral joints
- May cause pain without neurological signs
- Radiologic sign: DJD signs in the small joint

Abnormalities
Spondylosis (Deformans)

- Osteophyte formation on the vertebral body
- It may fuse ("bamboo spine" → boxers!!)
- Generally no clinical relevance !!!

Abnormalities
Spondylarthritis

- Inflammation of the intervertebral joints
- May cause pain without neurological signs
- Radiologic sign: DJD signs in the small joint

Abnormalities
Discospondylitis

- Septic inflammation of the intervertebral disc
- Pyrexia, painful palpation of the affected area
- Neurological deficiencies
- Radiology: osteolytic end plates rounded by sclerotic zone

Abnormalities
Discospondylitis

- Primary (osteosarcoma, chondrosarcoma) or metastatic
- Osteolytic - osteogenetic signs
- Ventral aspect of vertebral body, spinous proc.
  (end plates are usually not affected)

Abnormalities
Neoplasia of the Vertebrae

- Primary (osteosarcoma, chondrosarcoma) or metastatic
- Osteolytic - osteogenetic signs
- Ventral aspect of vertebral body, spinous proc.
  (end plates are usually not affected)
Abnormalities
Neoplasia of the Spinal Cord

- Painful spine, neurological deficiencies
- Survey radiograph is usually negative
- Myelography: intramedullary lesion

Abnormalities
Traumatic injuries of the Vertebral Column

1. Vertebral luxation / subluxation (30%)

Abnormalities
Traumatic injuries of the Vertebral Column

1. Vertebral luxation
2. Fractures