Degenerative Joint Diseases

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Degenerative Joint Diseases

- Wobbler Syndrome (Horses, dogs)
- Hip Dysplasia (Dogs)
- Degeneration/herniation of inter-vertebral disks
- Osteochondrosis (cows, pigs, chickens)
- Spondylosis (Bulls, dogs)
- Arthropathies (All species)
Cervical Vertebral Stenotic Myelopathy
Cervicospinal Arthropathy
Equine Sensory Ataxia
Wobbler Syndrome
Horses

Cervical Vertebral Instability
8-18 months
C₃-C₅
Ventroflexion

Cervical Static Stenosis
1-4 years
C₅-C₇
Static

Spinal cord compression
Myelomalacia
Ataxia
Cervical Stenotic Myelopathy

Cervical Vertebral Stenotic Myelopathy in Horses is an important condition in horses characterized by compression of the spinal cord and ataxia. This is a primary degenerative change affecting the vertebral joint which eventually causes narrowing of the vertebral canal and myelomalacia. Clinical signs are incoordination and locomotor disturbances. There are two distinct pathologic syndromes in horses: A: Cervical Vertebral Instability occurs in young horses (8-18 months). During ventroflexion, instability of the cervical vertebral joints (C₃-C₅) causes a dynamic narrowing of the vertebral canal and compression of the spinal cord. B: Cervical Static Stenosis occurs in older horses (1-4 years) in which, hypertrophy of ligamentum flavum causes dorsal narrowing of the vertebral canal at the C₅-C₇. This static type of compression of the spinal cord does not require vertebral movement (ventroflexion).

Note the narrowing of the spinal canal during ventroflexion causing compression of the spinal cord.
Cervical Stenotic Myelopathy

This is a hemisection of the spine of 1-year-old horse with a one-month history of ataxia. Postmortem examination revealed narrowing of the spinal canal and compression of the spinal cord at C2-C3 (arrows).

On palpation the spinal cord was soft at the site of compression. The spinal cord was removed from the spinal canal (asterisks). Coronal sections of fixed spinal cord revealed dark discoloration due to hemorrhage.

Microscopically, the cord had extensive malacia and hemorrhage of the ventral and lateral white matter. Also, dissection of vertebrae revealed some fibrillation and few osteophytes at C2-C3.
Cervical Vertebral Stenotic Myelopathy
Cervical Spondylomyelopathy
Wobbler Syndrome
Dogs

These are a heterogeneous group of canine conditions similar to those seen in horses.

Cervical spondylomyelopathies are characterized by abnormalities in the cervical vertebrae causing chronic compression, myelomalacia and gait deficits.

These problems are most commonly seen in Dobermans, Great Danes and other large breeds. Male dogs may be more commonly affected. The age of the onset is variable, from weeks to years. Compression and malacia generally occur at C6-C7.

Radiography is the most accurate method of diagnosis in the live dog. Gross and microscopic changes in the spinal cord are typical, however, abnormalities in vertebrae and joints may be difficult to evaluate during postmortem examination.
Pathology of Intervertebral Disks

- Except for the atlas (C₁) and the axis (C₂), all vertebral bodies are united by intervertebral disks.

- Disks have an external fibrous ring (annulus fibrosus) and a central soft tissue (nucleus pulposus).

- There are different types of intervertebral disk diseases in domestic animals:

  1. Disk Herniation (prolapse)
  2. Disk Explosion
  3. Cartilage Embolism
Dorsal Protrusion (prolapse) of Intervertebral Disks occurs in chondrodystrophoid dogs such as Dachshunds, Pekingeses, and to a lesser extent in other breeds such as Beagles and Cocker Spaniels. The annulus fibrosus degenerates and allows dorsal protrusion of the nucleus pulposus into the spinal canal causing compressive myelomalacia. Degenerated disk material frequently mineralizes.

A spinal hemisection of a dog with a history of paresis.

Note the herniation of disk material (arrow) into the spinal canal (sc). The 3 other disks (asterisks) appear normal. Bulging of the nucleus pulposus is a normal finding in cut vertebrae.
Herniation of Intervertebral Disks

*Dorsal Protrusion (prolapse) of Intervertebral Disks.* Degenerated disk material frequently mineralizes

A spinal hemisection of a dog with a history of paresis.

Note the calcified disk material *(arrows)* in the spinal canal causing ventral compression of the spinal cord.

The two contiguous disks are in the early stages of degeneration and calcification *(arrowheads).*
Fibrocartilagenous embolism of the nucleus pulposus into spinal meningeal vessels has been reported in dogs, particularly large breeds. This condition has also been described in horses, cats, pigs and humans.

It is not clear how the material from the nucleus pulposus gains access to the meningeal vasculature. Once in the vessels, the embolism causes ischemic myelopathy characterized by acute spinal deficits.

There are no gross lesions but microscopic examination of the spinal cord reveals fibrocartilaginous material in the spinal arteries or veins.

Note the meningeal blood vessel occluded with a cartilaginous embolism (black arrow). There is extensive malacia (necrosis) of the white matter (double white arrow). Close to the embolism there is focal hemorrhage.
Spondylosis
Ankylosis Spondylosis (-itis)

- Bulls, sows and dogs

- Proposed Pathogenesis:
  - Degeneration of IV disks
  - Instability
  - Periosteal stimulation

- Lesions:
  - Osteophyte formation
  - Osseous bridging
  - Ankylosis
Ankylosis Spondylosis (-itis)

A Series of radiographs illustrating the pathogenesis of ankylosing spondylosis in a bull:

(a) Note the early foci of periosteal osteosclerosis in the ventral vertebral body.
(b) Large osteophytes are growing from the vertebral bodies.
(c) Osteophytes bridge together fusing contiguous vertebrae.
**Ankylosing Spondylosis** is a chronic degenerative disease affecting the vertebral joints.

It is most commonly seen in old bulls (LT), sows (LT) and dogs (TS). Lesions include the degeneration of intervertebral disks, periosteal stimulation, osteophyte formation (ventral and lateral vertebral bodies), bridging between vertebrae and finally ankylosis.

Abnormal mobility of intervertebral joints has been proposed as the primary problem in ankylosing spondylosis.
Ankylosing Spondylosis in a dog with history of abnormal gait.

Note the extensive fusion of the ventral vertebral bodies involving most of the thoracic vertebrae (arrows).

The esophagus of this dog had several large parasitic nodules containing the nematode *Spirocerca lupi* and the thoracic aorta was notably weakened by larval migration. Weakening of aorta resulted in chronic damage (pounding) of the contiguous periosteum of the thoracic vertebrae. Damage to the periosteum induces osteophytes and eventually ankylosis.

*Spirocerca lupi* is enzootic in tropical countries and it is sporadically found in the Southern US.
Hips (Acetabular) Dysplasia

Hip Dysplasia is an important clinical problem in dogs and humans (>females). The canine form affects mainly large and giant breeds and it is thought to be closely related to genetic (polygenic) and environmental factors such as nutrition and rapid growth.

Affected dogs are normal at birth but in severe cases radiographic changes can be detected as early as seven weeks. It begins with edema and hemorrhage in the teres ligament followed by coxofemoral subluxation. Injury to the joint induces fibrillation, eburnation and osteophytes.

This is a macerated femur of a dog with Hip Dysplasia. Note the osteophytes around the femoral head. Also, the subchondral bone appears shiny and polished consistent with eburnation.
**Hips (Acetabular) Dysplasia**

Hip Dysplasia also causes degenerative joint disease (DJD) in the pelvic bone.

As mentioned before, the pathogenesis is still controversial but it has been proposed that reduced pelvic muscle mass causes instability and abnormal movement of the coxofemoral joint. Another theory suggests an intrinsic defect in the hip joint which leads to secondary degenerative joint disease.

This is a macerated specimen.

Note the osteophytes around the rim of the acetabulum (arrows).
Osteoarthropathy / Arthropathy

Osteoarthrosis / Osteoarthritis

Osteoarthropathies, (also referred to as Osteoarthritis, Osteoarthrosis or Arthropathies) are a heterogeneous group of non-specific degenerative joint diseases affecting primarily the appendicular joints of older animals and human beings.

Some of these Arthropathies have specific names and pathogenesis. It is not possible to discuss each, so these are just a few examples of the most common forms.

Note the numerous osteophytes in the stifle joint of an old animal. Lesions like this may be clinical or an incidental finding in the necropsy room. It has been suggested that genetic selection, abnormal skeleton conformation, rich diets and hard floors are responsible for the high incidence of Osteoarthrosis in animals.
Degenerative joint disease (DJD) of the appendicular skeleton are very important in equine medicine. Ringbone, Spavin and Navicular Disease are three important forms of Osteoarthropathies of the equine joints.

Ringbone (also known as “osteophytosis”) is a degenerative disease of the interphalangeal joints. These conditions are presumed to be the result of osseous and articular repair in a joint chronically affected by trauma or avulsion of the ligaments (biomechanical stress).

Note the deformation and formation of osteophytes in the interphalangeal joints possibly resulting from minor but continued mechanical trauma. A similar lesion affecting the tarsal bone is known as "spavin."

Note the osteophytes around the phalanges (arrows) in this macerated specimen.
**Osteochondrosis / Dyschondroplasia**

**Osteochondrosis (Dyschondroplasia)** is a heterogenous group of degenerative joint diseases initiated by an abnormal growth or maturation of cartilage (cartilage dysplasia). They affects the cartilage of the metaphyseal growth plate and the articular epiphyseal cartilage complex of the growing bone.

Dogs, pigs, horses, and poultry are most commonly affected. Although changes in the dysplastic cartilage (dyschondroplasia) are not that spectacular, secondary changes in the joints and bone are readily visible (i.e., eburnation, cartilage collapse, end-stage joint, etc.).

The etiology of Osteochondrosis is still unclear but genetic, biomechanics abnormalities as well as some forms of toxicosis have been proposed.

Note the large fissures and partial collapsed articular cartilage in the head of the humerus of an animal with severe Osteochondrosis.
Osteochondrosis / Dyschondroplasia

Recent studies have discovered some of the mechanisms involved in the pathogenesis of Osteochondrosis. Problems with the vascular supply in the growth plate are incriminated. Note the numerous vessels in areas where chondrocytes undergo proliferation, hypertrophy and degeneration (arrows).

Good vascular supply to the cartilaginous growth plates is imperative for normal endochondral ossification. It has been postulated that poor penetration of the vessels into the areas where cartilage matrixes are ready to be used as templates is the primary cause of dyschondroplasia (osteochondrosis) in domestic animals.

Poor penetration of capillary loops causes hypoxia and retention of cartilage which is the hallmark lesion of osteochondrosis or dyschondroplasia.

An example of a retained cartilage is shown in next the slide.
Osteochondrosis / Dyschondroplasia

A sagittal section of fresh bone and articular cartilage.

Note the irregular width of the cartilage on the articular surface of the joint (asterisks).

Also, note the abnormal retention of cartilage shown as cartilaginous islands deep in the trabecular bone (arrows).

Retention of cartilage results from excessive accumulation of hypertrophied chondrocytes. It has been postulated that proliferation of chondrocytes greatly exceeds the proliferation and invasion of capillaries required to facilitate mineralization and ossification of cartilage.
Osteochondritis Dissecans  
(Equine)

Osteochondrosis (-itis) dissecans (OCD) is a very important joint disease and orthopedic condition of horses. It commonly affects the distal femur and tibia of young-adult horses.

The pathogenesis of OCD is similar to Dyschondroplasia in pigs. That is, the problem starts with abnormal growth of cartilage either in the articular surface or in the growth plate. This abnormal cartilaginous growth results in ischemia and death of chondrocytes leaving behind a bone cyst or a weak bone which collapse with pressure or detach forming joint mice.

Note the focal loss of cartilage (arrow) in the medial ridge of the talus (tarsal bone). A piece of cartilage has been dissected from the articular surface.
Tibial Dyschondroplasia (Poultry)

Tibial dyschondroplasia is a very important bone disease of rapidly growing broilers.

Similar to Osteochondrosis in other species, the pathogenesis in poultry is related to a failure of a capillary invasion into the proliferating cartilage. As result, the cartilage proliferates and accumulates in abnormal quantities and eventually becomes necrotic.

Note the various degrees of abnormal thickening and retention of cartilage in these fresh tibias (asterisks).

In severe cases, the retained cartilage becomes necrotic as illustrated in the next picture.
Tibial Dyschondroplasia (poultry)

Two avian tibias with retained cartilage.

Note the necrosis of a large piece of retained tibial cartilage (left side).

Like porcine Osteochondrosis, tibial dyschondroplasia in chickens could be prevented by reducing the growth rate of animals. However, producers will not likely do so since slow growth represents a reduction of profit$. In other words, this disease, like many other degenerative joint diseases, are man made (woman too). In swine, the prevalence of Osteochondrosis in some farms may reach 90-100%.
Osteochondrosis
Dyschondroplasia

**Summary:**

- **Degenerative joint disease:**
  - Dogs, Pigs, Horses, poultry

- **Etiology unclear**
  - Genetic
  - Biomechanical
  - Toxicosis
  - Rapid growth (man made)

- **Pathogenesis**
  - Poor vascular supply
  - Cartilage dysplasia

- **Lesions**
  - Retained cartilage ➔ necrosis ➔ articular collapse
THE END