Inflammatory Joint Diseases
and
and Tumors of Bones and Joints

Alfonso López
Atlantic Veterinary College
University of Prince Edward Island
Canada
Inflammation
(Osteitis, osteomyelitis, periositis, panoesteitis)

**Etiology:**

Bacteria (+++), fungi (++), virus, parasite, trauma

**Port of Entry**

Hematogenous (++neonates), extension, penetration

**Pathology:**

Destructive (osteolytic) or productive (osteosclerotic)
Inflammatory Joint Diseases
(Arthritis and Synovitis)

• **Infectious**
  - Common in farm animals
  - Less common in dogs/cats

• **Pathogenesis:**
  - Hematogenous bacteria (++++)
  - Omphalitis, sepsis, FPT
  - Several joints (polyarthritis)

• **Lesions**
  - Synovial effusion
  - Exudate

• **Most common bacteria:**
  - *A. pyogenes*  *E. rhusiopathiae*  *E. coli*
  - *S. suis II*  *H. parasuis* (Glasser’s)  *H. somnus*
  - *R. equi*  *M. hyosynoviae*  *M. bovis*
Inflammatory Joint Diseases
(Arthritis and Synovitis)

Acute, Fibrinous arthritis (mild).

Note abundant synovial fluid and few possible fibrin strands suggestive of fibrinous arthritis. Care should be taken not to mistake fibrin with intra-articular fat. If in doubt, it is recommended to aspirate some fluid into a syringe and carefully check against a source of light for fibrin strands as shown in a petri dish (insert).
Fibrinous Arthritis

Joint of a young calf with history of sepsis. Acute, moderate to severe fibrinous arthritis.

Note a mat of fibrin (asterisks) on the synovial membrane. Fibrin is an exudate that denotes severe changes in vascular permeability that allows fibrinogen to escape into the affected tissues. Once outside of the vasculature, fibrinogen is transformed into fibrin. Pure fibrin has a yellow color. It is expected that an aspirate of a joint with fibrinous arthritis would have abnormally high protein contents.
**Fibrinous Arthritis**

Joint of another young calf with history of swollen and painful joints. Acute to sub-acute, severe fibrinous arthritis. The normal appearance of articular cartilage suggests that inflammatory process is not that chronic.

Note massive amounts of fibrin on the synovial membrane. Neonatal infections often involve more than one joint and therefore the term Polyarthritis is commonly used in veterinary pathology. When joints, peritoneum, pericardium and meninges are affected the term polyserositis is appropriate.

Do not forget to check the status of umbilical vessels in young animals since omphalophlebitis is a rather common cause of septic polyarthritis.

Joint aspirate in the live animals could be sent for bacteriology.
Suppurative Arthritis
Pig

Chronic, severe, purulent arthritis.

Note massive amounts of purulent exudate in the joint. Bacteriologic analysis of exudate was positive for *Actinomyces pyogenes*.

Other important pathogens involved in porcine septic arthritis include:

- *Hemophilus suis*
- *Erysipelothrix rhusiopathiae*
- *Streptococcus suis II*
- *Escherichia coli*
- *Mycoplasma hyorhinis*
- *Mycoplasma hyosynoviae*. 
Chronic Arthritis

Chronic, severe, suppurative osteomyelitis (severe).

Note abundant exudate, mark thickening of joint (arrows) and large bone abscesses in the epiphyses of long bones (asterisks).

When cartilage becomes ulcerated in septic arthritis, offending organisms may reach subchondral bone and bone marrow resulting in osteomyelitis.

On the other hand, organisms may also reach the joint structures from a primary underlying osteomyelitis. Sometimes it is difficult to tell what structure was first affected such as in this slide.
Chronic Arthritis 

Pig

Chronic, severe arthritis (End-stage joint).

Note severe osseous and articular deformation caused by extensive formation of osteophytes (End-stage joint).

Similar to what happens with chronic degenerative joints disease, long-standing arthritis may lead to extensive deformation due to osteophytes proliferation resulting from chronic inflammation.

This was the bone and joint of a pig infected with *Erysipelothrix rhusiopathiae* that survived for several months.
Inflammatory Joint Diseases (Bursitis)

- **Etiology**
  - Infectious (hematogenous)
  - Traumatic
  - Undetermined

- **Horses**
  - Fistulous Withers (supraspinus bursa)
  - Poll Evil (Atlanto-occipital bursa)

- **Ruminants**
  - Caprine Arthritis Encephalitis (CAE)
  - Brucellosis

- **Lesions:**
  - Swollen bursa
  - Synovial effusion
Equine Bursitis / “Fistulous Withers”

Note a large fistula (arrows) and swelling of underlying soft tissue. The pathogenesis of "Fistulous Withers" (T₁₂) and "Poll Evil" (Occipital/C₁) is still controversial, but it is a purulent bursitis caused by bacteria (Brucella spp.) and/or parasites (Onchocerca cervicalis).
Note swelling in the carpal region (arrows). The term hygroma refers to a cystic structure filled with fluid often mixed with blood which is surrounded by a fibrous capsule. Hygromas are severe form of serous bursitis in which synovial fluid accumulates over time. This type of hygroma is generally associated to infectious diseases such as *brucellosis* (*Brucella abortus*) and *Caprine Arthritis-encephalitis* (retrovirus). There are also acquired “false bursa” in giant breeds of dogs that develops over bony protuberances at pressure points such as lateral aspect of the elbow, the greater trochanter of the femur and the tuber coxae.
Laminitis

• **Horses and Cattle**
  - Acute
  - Chronic

• **Etiology**
  - Nutritional
  - Endotoxin
  - Histamine
  - Traumatic

• **Pathogenesis**
  - Decrease vascular perfusion of lamina (P₃)
  - Edema and necrosis of laminae
  - Separation from hoof
  - Hyperplasia
  - Rotation of P₃
  - Penetration of sole
  - Osteomyelitis
Laminitis / Equine

Note rotation of P₃ (asterisk) due to hyperplasia of lamina that is shown as a wedge shape white tissue interposed between hoof wall and anterior aspect of P₃ (Arrows). Compare to normal hoof where the hoof lamina and P₃ are parallel. The pathogenesis of laminitis is still controversial, however, it is well accepted that the basic underlying mechanism is an abnormal vascular perfusion and edema of lamina (acute laminitis). Hyperplasia dermal tissue and rotation of P₃ (chronic laminitis) are secondary to these vascular changes.

A close-up of this photograph is shown in the next slide.
Note hyperplasia of lamina shown as a wedge shape white necrotic tissue interposed between hoof wall and anterior aspect of P₃ (arrows). As result of hyperplasia and separation of lamina, P₃ deviates. The weight bearing and pulling force by flexor tendons, increase rotation of P₃ and penetration of sole. Finally, exposed bone is easily infected and osteomyelitis may evolve in P₃.
Gout

Articular Gout
• Animals and humans
• High intake of protein
• Chickens genetic impaired secretion of uric acid
• Lesions:
  – Crystals and granulomas in synovium
  – Bone destruction

Visceral Gout
• Primary kidney failure
• Urate deposits
  – Kidney
  – Heart
  – Serosal surface
Gout Avian

Gout. Toes. Avian.

Note swelling of soft tissue. On cut surface large amounts of whitish, chalky material (urates) are present in joints and periarticular tissues.

Gout occurs in species which lack uricase enzyme such as humans, aves and reptiles.

1. **Articular gout** from genetic inability to excrete urates, deposition of crystals is only in synovial tissues.

2. **Visceral gout** from renal disease and inability of kidney to excrete urates. There is with deposition in joints and periarticular tissues (subcutaneous) and in serosal surfaces kidney and other viscera.
Visceral Gout Snake

Note large deposits of urate crystals in the kidney (arrows).
Immune Mediated Arthritis

**Erosive (rare)**
- Rheumatoid-like arthritis.
- Dogs: Toy / Shetland breeds.
- Clinical signs: Lameness, pain, morning stiffness.
- Pathogenesis:
  - IgG/IgM Complex (rheumatoid factor)
  - C’ activation, neutrophils, lymphocytes
  - Pannus, destruction of cartilage

**Non-Erosive**
- Several Syndromes in dogs and cats
- Chronic infections:
  - Heartworm, metritis, otitis, lupus, glomerulonephritis
- Synovitis: deposition of immune complexes
Rheumatoid-like arthritis. Dog

Histopathology. Synovial membrane.

Note large number of plasma cells and lymphocytes infiltration around congested blood vessels (asterisk). Plasma cells (arrows) have an eccentric nucleus, abundant eosinophilic cytoplasm and a discrete white discoloration next to nuclear zones (Golgi).

Rheumatoid-like arthritis in dogs is similar but not identical to human rheumatoid arthritis. Only \( \approx 25\% \) of affected dogs are positive for the rheumatoid factor (IgG/IgM complex).

Systemic lupus erythematosus and other allergic diseases must be ruled out before a diagnosis of Rheumatoid-like arthritis is made.
Tumors of Bones and Joints

- Primary bone and joint tumors are relatively rare in domestic animals.
- Malignant tumors are most commonly found in dogs.
- Tumors may arise from osseous, cartilaginous, synovial, stromal or vascular cells.
- Benign (-oma) or Malignant (-sarcoma).
- Histopathology is always required.
- Bone tumors are common biopsy specimens.
Osteochondromas
Multiple Cartilaginous Exostosis

- Multiple nodules in the skeleton
- Located in growth plates
- Cartilage capped (arrows)
- Stop growing at the same time as the skeleton
Osteochondromas also known as Multiple Cartilaginous Exostoses are cartilage-capped bony protuberances which stop growing when the rest of the skeleton does.

It is still arguable if osteochondromas are multiple polyostotic tumors or dysplasia affecting the growth of cartilages. It is most commonly seen in dogs and horses. Grossly, appear as multiple bony nodules near the growth plates. These unique tumors are most commonly seen in dogs, cats and sheep.

Note large osseous masses in the vertebral processes (top) and ribs (bottom).
Osteosarcoma
(Osteogenic Sarcoma)

- Most common skeletal neoplasm in dogs (large breeds), cats.
- Generally in long bones.
- Osteosclerotic or Osteolytic.
- Frequently metastasizes to the lungs.
- Neoplastic cells produce osteoid.
Osteosarcoma (Osteogenic Sarcoma)

Osteosarcoma (Osteogenic Sarcoma) is the most common skeletal neoplasm of dogs and cats (80% of all skeletal tumors).

Osteosarcoma is most commonly found in large breeds with a mean age of 7.5 yr.

Most osteosarcomas arise from long bones and to a lesser extent from other bones or from extra-skeletal sites (see figure).

Osteosarcomas arise from osteoid producing cells but some neoplastic cells may also produce cartilage (osteoblastic, fibroblastic, chondroblastic, or mixed type).

Note well-delineated osteosarcoma in leg.

Osteosarcomas typically do not grow into the joint or articular cartilage.
Osteosarcoma (Osteogenic Sarcoma)

The leg of this dog was amputated and submitted for postmortem examination. Note well-delineated Osteosarcoma in the leg.

Canine osteosarcomas involve the appendicular skeleton (limbs) much more often than the axial skeleton (i.e., ribs, head).

It has been documented that osteosarcomas may arise from sites of previous fractures as well as from sites where metal pins have been used to reduce fractures.

This specimen was from a dog with history of fracture. See next slide.
Osteosarcoma
(Osteogenic Sarcoma)

Cross section of a canine Osteosarcoma. A saggital section of the tumor revealed a metallic object at the site of a previous bone fracture (arrow)

Close-up of this pin is shown in the insert (arrowhead).
Osteosarcoma  
(Osteogenic Sarcoma)

Tumors can be osteolytic (right) or osteosclerotic (left).
Osteosarcoma (Osteogenic Sarcoma)

Osteosarcomas frequently metastasize to other organs, particularly to the lung. Since osteosarcomas often metastasize to the lung, radiographic examination of lungs is often recommended.

Note numerous metastatic tumors scattered throughout the pulmonary parenchyma (arrows).

**Insert:** Microscopic view of lung at low magnification. Note tumoral nodule (asterisk) in the pulmonary parenchyma.
Osteosarcoma (Osteogenic Sarcoma)

Osteosarcoma. Hemotoxylin-eosin 400x

Note numerous neoplastic cells (arrows) many of which are producing osteoid (asterisk). The osteoid has a pale eosinophilic appearance and in some areas this matrix is forming some immature trabecular bone (b).

Histopathological diagnosis of osteosarcomas is not easy, particularly when small or fine needle biopsies are taken. In some instances reactive bone can be morphologically deceiving. When taking a biopsy of a suspected tumor take several samples and ensure to have some material from the core and periphery of the mass.
**Chondrosarcoma**
- Most common in dogs and sheep
- Single expansive lobulated mass
- In some cases, cartilaginous tissue is grossly visible
- Neoplastic cells produce cartilage but not osteoid

Cartilaginous tumor involving the vertebrae and causing compression of the spinal cord in a sheep (**arrows**). This animal had history of ataxia. Note lobulated mass with some sort of cartilaginous appearance (**asterisk**). Microscopic examination revealed mesenchymal neoplastic cells some of which were producing cartilage.
Chondrosarcoma

Chondrosarcoma. Hemotoxylin-eosin

Note neoplastic cells producing cartilaginous matrix (arrows).

Chondrosarcomas are malignant tumors arising from chondrocytes. Neoplastic cells produce cartilaginous matrix, but unlike Osteosarcoma, never produce osteoid.

Chondrosarcomas are most commonly seen in dogs and sheep and the pelvis, nasal cavity, sternum and ribs are some of the most common sites.

Synovial Sarcoma

• Rare in animals