Inflammatory Joint Diseases and Tumors of Bones and Joints

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Inflammatory Joint Diseases

**Etiology:**
- Bacteria (very common)
- Fungi (sporadic)
- Virus (rare)
- Parasites (rare)
- Trauma (common)

Port of entry of bacterial infections of joints:
1. Hematogenous
2. Extension from osteomyelitis
3. Spread from adjacent soft tissue
4. Diagnostic or therapeutic Procedures
5. Penetrating injury

**Pathology:**
Destructive (osteolytic) or productive (osteosclerotic)

From Huether SE, McCance KL. Understanding Pathophysiology ed 2, St. Louis, 2000 Mosby
Inflammatory Joint Diseases

Arthritis and Synovitis

• **Infectious etiology**
  – Mos common in farm animals
  – Less common in dogs/cats

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

• **Lesions**
  – Synovial effusion
  – Exudate (suppurative, fibrinous, etc.)

**Most common bacteria causing arthritis**

<table>
<thead>
<tr>
<th>A. pyogenes</th>
<th>E. rhusiopathiae</th>
<th>E. coli</th>
</tr>
</thead>
<tbody>
<tr>
<td>S. suis II</td>
<td>H. parasuis (Glasser’s)</td>
<td>H. somni</td>
</tr>
<tr>
<td>R. equi</td>
<td>M. hyosynoviae</td>
<td>M. bovis</td>
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Acute, Fibrinous arthritis (mild) in a calf.

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 (see insert in top right).
Fibrinous Arthritis

**Acute, Severe Fibrinous arthritis**

This is the joint of a young calf with history of sepsis.

Remember, 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.

Note a mat of fibrin (arrows) on the synovial membrane.
Acute Fibrinous Arthritis

Large amounts of fibrin (arrows) on the synovial membrane. At the early stages the articular cartilage is normal.
Chronic Fibrinous Arthritis

Joint of another young calf with history of swollen and painful joints

Note massive amounts of organized 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 Poliserositis 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.
Acute Purulent Arthritis

Chronic, severe, purulent (suppurative) arthritis. Pig.

Bacteriologic analysis of exudate in this pig was positive for *Actinomyces pyogenes*.

**Other common bacteria in causing arthritis in pigs**

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

Note massive amounts of purulent exudate in the joint.
Chronic, severe, suppurative arthritis-osteomyelitis (severe).

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.

Note abundant exudate, mark thickening of joint (arrows) and large bone abscesses in the epiphyses of long bones (asterisks).
Chronic, severe, arthritis (End-stage joint) / Macerated bone

Note severe osseous and articular deformation due to 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 pig survived for several months and infection with *Erysipelothrix rhusiopathiae*. 
Bursas are cushions filled with synovial-fluid strategically located around some tendons vulnerable to friction-injury. Bursas are lined by a synovial membrane and undergo inflammation in response to injury or hematogenous infections as synovial joints.

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

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

**Bursitis in 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" (T₁-2) and "Poll Evil" (Occipital/C₁) is still controversial, but it is a purulent bursitis caused by bacteria (Brucella spp.) and/or parasites (Onchocerca cervicalis).
Carpal Bursitis / Bovine

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. Hygromas are 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 the lateral 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 ($P_3$)
  - Edema and necrosis of laminae
  - Separation from hoof
  - Hyperplasia of epidermal lamellae
  - Rotation of $P_3$
  - Penetration of sole
  - Osteomyelitis
Equine Laminitis

Note rotation of $P_3$ (asterisk) due to hyperplasia of lamina that is shown as a wedge shape white tissue interposed between hoof wall and anterior aspect of $P_3$ (Arrows). Compare to normal hoof where the hoof lamina and $P_3$ 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 $P_3$ (chronic laminitis) are secondary to these vascular changes.

A close-up of this photograph is shown in the next slide.
Bovine Laminitis

Note hyperplasia of lamina shown as a wedge shape with white necrotic tissue interposed between hoof wall and anterior aspect of $P_3$ (arrows).

As result of hyperplasia and separation of lamina, $P_3$ deviates. The weight bearing and pulling force by flexor tendons, increase rotation of $P_3$ and penetration of sole. Finally, exposed bone is easily infected and osteomyelitis may evolve in $P_3$. 
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. Toes. Avian.

Note swelling of soft tissue. On cut surface large amounts of whitish, chalky material (urate) 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 Arthritis (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 Arthritis
- Several Syndromes in dogs and cats
- Chronic infections:
  - Heartworm, metritis, otitis, lupus, glomerulonephritis
- Synovitis: deposition of immune complexes
**Rheumatoid-like Arthritis in Dogs**

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.
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).
Osteogenic Sarcoma (Osteosarcoma)

- Most common skeletal neoplasm in dogs (large breeds), cats.
- Generally affects long bones.
- Can be Osteosclerotic or Osteolytic.
- Frequently metastasizes to the lungs.
- Neoplastic cells typically produce osteoid.
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.
The leg was amputated and microscopic examination confirmed the diagnosis of osteosarcoma.

It is documented that osteosarcomas may arise from sites of previous fractures or from sites with metal pins used to reduce fractures.

Note a metal pin adjacent to the tumoral mass.
Types of Osteosarcoma / Radiographs

Osteosclerotic type

Osteolytic type
**Osteogenic Sarcoma**

**Lung Metastasis**

Osteosarcomas frequently metastasize to other organs, particularly to the lung.

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

Since osteosarcomas often metastasize to the lung, radiographic examination of lungs is always recommended.

Metastasis / Lung HE section/ Low Magnification

Note tumoral nodule (asterisk) in the pulmonary parenchyma
Osteogenic Sarcoma / Dog

Note neoplastic cells) some 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 commonly seen in dogs and sheep
- Single expansive lobulated mass
- In some cases, cartilaginous tissue is grossly visible
- Neoplastic cells produce cartilage but not osteoid

*This sheep had history of ataxia. Note tumoral mass with cartilaginous appearance involving the vertebrae (asterisk).*

Also note the tumor and causing compression of the spinal cord (arrows).
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.

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**Synovial sarcoma**

Rare in animals
Canine Spinal Cord Myeloma

Tumor in vertebral body causing compression of spinal cord in a cat (arrows).

Courtesy of Drs. S. Martinson and L Pack
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If you have any comments, criticisms or suggestions about this or any other tutorial module please let me know.

Also, if you find any errors or typos please let me know too. Thanks!

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Thank You