VPM 222 - Systemic Pathology II

PATHOLOGY OF BONES LABORATORY*

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* Many images used in this section were obtained from the Noah’s Ark.
Fig 1.1 – Diaphysis fracture of a long bone.

Fig 1.2 – Fracture in the femoral growth plate

Questions
Can you name a fracture over the growth plate?
Background

Epiphysiolyis

Epiphysiolyis is the separation of metaphysis from epiphysis thought the physis

Features

- It is traumatic in origin but predisposed by defects in growth plates cartilages
Frank, one of your clients, contact you as one of his best cows have recently has a miscarriage. He sends you a photo of the 7 months featus. The farmer is concern as he has inseminated up to 10 heifers with the same bull.

![Image](image.jpg)

**Fig 2.1** – 7 months abortus of a Holstein

**Questions:**

Do you think that this is a good example of a Chondrodysplasia or Osteodystrophy?

Do you know the name of this condition?

Do you think that the bull genetics is the reason or this is a random effect?
A colleague sends you a photo of a cow that he has seen in a farm. He wonders if you have ever seen something like this before.

**Fig. 3.1** – Photo

**Fig 3.2** - Fix specimen of a similar case

**Questions:**

Can you see what is wrong in both cases?

Do you think that all the bones are equally affected; (it is a proportionate or a disproportionate defect)?

Do you know the name of this condition?
Background

*Generalized Chondrodysplasias*

- The dwarfism of the skeletal chondrodysplasias is disproportionate, in contrast to the proportionate or primordial dwarfism associated with somatotropin (STH) deficiency.

- Longitudinal growth at growth plates in young animals relies primarily on interstitial proliferation of chondrocytes, while transverse growth occurs by interstitial growth and apposition.

- In some chondrodysplasias, growth by apposition is not affected but interstitial growth of cartilage is defective.

- Premature closure of growth plates with length reduction of long bones is a feature of dwarfism.
In a recent visit to a pig farm, the farmer shows you an ‘unusual’ piglet that he has saved for you. He has never seen something like this before and he is concerned that the new vaccines that you introduced a few months ago could have something to do with this.

Fig 4.1 – Whole body of a piglet.

Fig 4.2 – Split leg of a piglet with the same condition.

Questions

Can you name the condition?
Background

**Congenital hyperostosis**

- It is also known as cortical hyperostosis or diaphyseal dysplasia. It is a rare disease of newborn pigs which die at born or within the first 2 weeks of life.
- The pathogenesis is not known. An inherited transmission has been speculated but it has not been proven.

**Gross morphology**

- The lesions are normally limited to the forelimbs bones in particular to the radius and ulna. No lesions are present in the axial skeleton.
- Affected bones shows a generalised thickening of up to twice of normal size.
- Hard at palpation with edema of surrounding soft tissues.
- A cross sections of the bone shows presence of extracortical bone in the diaphysis
A young calf is submitted for necropsy. Unfortunately, the owner accidentally broke the femur of the calf during the birth manipulation. The vet killed the animal shortly after that and he also reported brachygnathia inferior, protruding tongue and a relative smaller size.

**Fig 5.1** – Femur of day old Angus Cattle.

**Questions**

Compared this with the normal bone? Can you see the differences?

Can you see the bone marrow?

Do you know the name of this condition?
Background

**Osteopetrosis**

- Osteopetrosis, also known as "marble bone disease," is a group of rare inherited disorders that occurs in animals but also in humans. Interestingly it is thought that a fetus infected with BVDV could develop similar lesions.

- It is characterized by lack of bone resorption due to **defective osteoclast activity** that results in the accumulation of primary spongiosa in marrow cavities.

- Bones are very fragile and on cut surface, the metaphyses and diaphyses of long bones are filled with dense primary spongiosa in a very characteristic conic pattern which extend from the metaphysis to the center of the diaphysis.
A pig farmer recently sacrificed few animals for welfare reasons and he sent to the AVC interesting teaching specimens.

**Fig 6.1 – Pig**

**Question:**
You like to preserve these specimens, but the technician is not sure how to label the formalin container and he asks you for your opinion.

What do you suggest?
Background

**Polydactyly**

- It is defined as an increase number of digits and it occurs in all species.
- Polydactyly in pigs is usually associated with cleft palate and is thought that this is an inherited condition but it has not been proven.
Another pig from the same farm is also sacrificed for welfare reasons and submitted to the AVC for teaching specimens. You compared it with another one which is already fixed (Fig 7.3).

**Fig 7.2** – Vertebral column with spinal cord

**Fig 7.3** – Vertebral column with spinal cord (After fixation)

**Question:**

You would like to preserve this new specimen as it appears different from the one we already have. The technician is not sure how to label both formalin containers - What would you suggest?
Background

**Kyphosis and Scoliosis**

<table>
<thead>
<tr>
<th>Term</th>
<th>Nature of the Defect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spine</td>
<td></td>
</tr>
<tr>
<td>Kyphosis</td>
<td>Abnormal dorsal curvature of the spinal column</td>
</tr>
<tr>
<td>Lordosis</td>
<td>Abnormal ventral curvature of the spinal column</td>
</tr>
<tr>
<td>Scoliosis</td>
<td>Lateral deviation in the spinal column</td>
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</tbody>
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Adapted from Jubb, Kennedy and Palmer 2008
A 9 years old dog named ‘Spotty’ is presented to your practice. The owner complains of the smell of the breath of the animal, that he described it as ‘urine’. He thinks that it may be a severe tooth infection going on that cause the face swelling and the bad smell.

**Fig 8.1** – Sally – Note the bilateral maxillary enlargement described as ‘swelling’ by the owner.

**Fig 8.2** – Exploration of the dog.
Postmortem

Unfortunately, not much the clinician could do. Spotty died shortly after due severe renal failure.

**Fig 8.3** - Section of the head and Kidneys

Questions

Can you name the condition? Do you think the process in the turbinates is metabolic in origin or inflammatory?
Background

*Fibrous osteodystrophy*

- Fibrous osteodystrophy is group as a metabolic bone disease, which are also referred to as fibrous osteodystrophy (osteodystrophia fibrosa)
- It is characterized by extensive bone resorption accompanied by proliferation of fibrous tissue.
- The bones are soft and can usually be cut with a knife.
- The pathogenesis of this lesion is due to a persistent elevation of plasma PTH [parathyroid hormone] caused by either primary or secondary hyperparathyroidism.

*Renal secondary hyperparathyroidism*

- **Rubber jaw pathogenesis** (softening of the bones) Renal failure → Poor phosphorus clearance → Progressive hyperphosphatemia → Hypocalcemia\(^{(1)}\) status → PTH Release → Increase osteoclastic activity → accelerated bone resorption ‘Rubber jaw’

\(^{(1)}\) due inverse relationship between plasma-ionized phosphate and calcium concentrations
In an abattoir there is a batch of finishing pigs that present multiple abscess in the vertebral column. The new foreman is not familiar with this change and calls the Official Vet for an opinion.

**Fig 9.1** Vertebra body with a lesion

**Fig 9.2** Fix specimen of a similar lesion.

**Questions:**

What are the likely cause of this lesion in pigs? Can you name the most likely microorganism? What is the likely route of infection?
**Background:**

**Vertebral Osteomyelitis**

- In piglets, tail biting is the most likely portal of entry for vertebral osteomyelitis. Other sources of bacteria are umbilicus, respiratory tract or even digestive tract.

- *Hematogenous* spread of infection during the neonatal period in animals with inadequate passive immunity.

- *Arcanobacterium pyogenes* is the most common organism in vertebral osteomyelitis

- Vertebral osteomyelitis cause progressive destruction of the vertebra.

- Fracture or collapse with a sudden onset of neurological signs caused by compression of the spinal cord.

- If the infection is contained or does not result in cord compression it may go undetected, or be found incidentally at slaughter.
A 9 months West Highland White Terrier [Churchill] is brought to the clinic. The owner complains of painful eating since 2 days ago and that he do not let him open the mouth as usual. The dog has a similar episode 3 weeks ago. Owner thinks that he may have an injury on the mouth as he notice that the mandible is more swollen than normal.

On exploration, the vet also notice that the dog is reluctant to open the mouth and perhaps a slight reduction in the muscular mass of the mastication muscles. The temperature is slightly elevated but clinical chemistry is normal.

**Fig 10.1** – Radiograph of a West Highland Terrier\(^{(1)}\) with reported pain.

Note: This radiograph is not from a West Highland terrier but it is use as this condition is most common in this breed

**Questions**

- Can you name this condition?
Background

**Craniomandibular osteopathy**

- Craniomandibular osteopathy, ("lion jaw") is a hyperostotic proliferative disorder usually limited to the skull, bilateral and affecting the mandibles, occipital, and temporal bones. The tympanic bullae are often severely affected.

- The condition is common in West Highland Terrier but it is described in several other breeds.

- It is normally self-limiting and nonfatal but occasionally animals are killed because they cannot eat.

- The cause of craniomandibular osteopathy is not known but it is thought to be inherited in West Highland White and Scottish Terriers,

Fig 10.2 – Maceration bone of a dog with this condition.