Neonatal death in a Quarter Horse foal

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Signalment/History

- 2 day old Quarter Horse colt
- Down since birth in hindlimbs with dehydration
- Severe hypoglycemia (glucose: 7 mg/dL)
- Unresponsive to intensive supportive care
  - Treated with dextrose, plasma, LRS and Banamine
  - Milk (200mL) through feeding tube
- Fibrinopurulent arthritis (Carpal joint)
- Under anesthesia for flushing joint, the foal stopped breathing and died
- Necropsy
Gross Findings

Carpal joint
Gross Findings
Lung HE Stain
Microbiology

- Umbilicus, joint, kidney, liver and lungs: heavy growth of *Actinobacillus* spp.
- *Actinobacillus*: non-motile Gram (-),
  - Usually causes fatal septicemia of newborn foals
  - Failure of passive transfer: predisposed
- Cause of death: Sepsis and resultant endotoxemia secondary to failure of passive transfer
- Underlying disease or genetic defect?
Heart

HE and PAS Stain
Purkinje fibers
Tongue

HE Stain
Tongue

PAS Stain

Congo Red stain
Morphologic Diagnosis

- Basophilic, PAS positive inclusions
  - Skeletal muscle, diaphragm, tongue with necrosis
  - Brain and spinal cord
- Heart
- Liver
Differential Diagnosis

- Equine polysaccharide storage myopathy
  - Polysaccharide inclusions in the skeletal muscle → exertional rhabdomyolysis, muscular atrophy

- Lafora Disease (Lafora bodies)
  - PAS positive inclusion bodies in CNS
  - Fatal autosomal recessive disease
  - Mutation in one of genes (EPM2A and EPM2B)

- Glycogen branching enzyme deficiency
  (= Glycogen Storage disease type IV)
Glycogen Storage disease type IV

- Rare hereditary metabolic disorder:
  Gene locus mutation (human): 3P14

- Synonyms
  - Amylopectinosis
  - Polyglucosan body disease
  - Glycogen Branching Enzyme Deficiency (GBED)
    Quarter Horse
    GBE1 mutation (X34/X34)
  - Eponym: “Andersen’s disease”

- Norwegian Forest Cat
Glycogen Storage disease type IV

- Glycogen branching enzyme
  (= Amylo-1,4-1,6 transglucosidase)
  → Critical for glycogen production
  → Deficiency: more α-1,4-linked glucose formed than normal glycogen → forming amylopectin
Glycogen Branching Enzyme (GBE)

- Glucose
- Polysaccharide
- GBE Absence
- GBE Deficiency
- Glycogen
- Amylose
- Amylopectin (low solubility)
- Storage Disease
GBE deficiency

- Less branched glycogen structure
  - Inefficient utilizing glycogen for energy
  - Unable to function properly
    (especially brain, heart, skeletal muscle)
  - Abnormal form of glycogen is accumulated
  - Forming inclusions (amylopectinosis)
  - Cellular dysfunction
### GBE Deficiency

- Reported Quarter horses and American paint horse
- Autosomal recessive trait (simple Mendelian)

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<td>Gg (Carrier)</td>
<td>gg (AFFECTED)</td>
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- G: Normal allele
- g: Abnormal allele
- Carrier mare (Gg) and carrier stallion (Gg): Clinically normal
  - 25% of GBED (gg): Affected
GBE Deficiency

- Late term abortion, stillborn, persistent recumbency, muscle weakness, neurologic signs
- Hypoglycemia, leukopenia, increased CK, increased AST, increased GGT
- Usually euthanized or die by 18 weeks of age
- GBE activity test from fresh sample
- Genetic tests (UC Davis)
  - Roots of pulled tail hairs from dams and sires
  - Liver and muscle from affected foals
- Genetic mutation in this case: **Confirmed!**
Questions?

Dorothy Hansine Andersen