MUSCULO-SKELETAL SYSTEM - 1

PROF. DR. M. TARIQ JAVED

Department of Pathology,
Faculty of Veterinary Science,
University of Agriculture, Faisalabad, Pakistan.
mtjaved@uaf.edu.pk

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MUSCLES

DISTURBANCES OF GROWTH AND POSTMORTEM ALTERATIONS

- As with many tissues, muscle has a fairly limited repertoire of changes.

Atrophy

- **Muscle atrophy** *can refer to reduction in overall muscle mass.* Reduction
- *Myofibers that have lost connection with peripheral nerves due to neuropathy undergo rapid and severe atrophy due to denervation.*
- Denervation atrophy is relatively common in animals
- Denervation atrophy is rapid and severe.
- injury to the supraspinatus nerve by trauma or the pressure of a poorly fitting collar in a work horse (*Sweeney)*

- *the hallmark of denervation atrophy is involvement of both type I and type 2 fibers*
- *Within 2-3 weeks, two-thirds of the muscle mass can be lost.*
- **Disuse atrophy** *occurs due to decreased contractile activity of innervated muscle.*
- *Disuse atrophy classically involves predominantly type 2 fibers*
- **Atrophy of cachexia and malnutrition** *occurs when an animal is unable to supply enough dietary nutrients to maintain muscle; muscle proteins become the source of nutrients for the rest of the body*
- *tumor necrosis factor (" cachectin")* is involved
- *type 2 fibers are depleted preferentially in cachexia*

- ***Myopathic Atrophy**: Atrophy of fibers commonly occurs in myopathic conditions*
- Selective type 1 fiber atrophy is seen in many congenital myopathies

Hypertrophy

- *refer to the muscle as a whole or to increased diameter of myofibers*
- *Myofiber hypertrophy is considered physiologic when it occurs due to increased workload.*
- Compensatory myofiber hypertrophy occurs in muscle in which some myofibers are weak or dysfunctional due to myopathic or neuropathic disorders.

Arthrogryposis

- *literally means crooked joint (articular rigidity, fixed joints)*
- Arthrogryposis can involve one or more limbs
- *denervation is by far the most common cause.*

Muscular dystrophy

- *Muscular dystrophy of Merino sheep is an autosomal recessive disorder*
- Initial signs are *lack of normal growth and reduced flexion of the hind limbs* that lead to aberrations of gait
- in mild cases, just stiffness.

EXERTIONAL MYOPATHIES

- *myofiber damage occurring due to exercise stress*

Exertional myopathy (rhabdomyolysis) in the horse

- There are numerous names including *azoturia*, *black water*, *paralytic myoglobinuria*, ***Monday-morning disease***, *tying up*.
- The disease occur in **heavy horse breeds**
- There is a life-threatening muscle injury, particularly when worked after a day of rest and full grain ration (hence the term Monday-morning disease)
- Muscle injury is severe enough to result in myoglobinuria, profound weakness, and recumbency

- *Weakness and/or pain in the hind limbs occur suddenly,* and the animal soon becomes unable or very reluctant to move.
- This may be accompanied by sweating and generalized tremors
- The affected muscles, (*gluteal, femoral, and lumbar groups),* may be swollen and become rigid.
- *Myoglobinuria* can appear early in the disease, causing dark red-brown discoloration of the **urine**.
- *Serum has high myoglobin, creatine kinase (CK), and aspartate aminotransferase (AST)*
- Grossly *Muscles may be moist, swollen, and dark, and streaks of pallor may be visible*
- *damaged fiber segments may show hyaline degeneration followed by coagulative necrosis.*

MYOSITIS

- *inflammation of muscle*
- *Living muscle is an inhospitable site for almost all bacteria*

Suppurative myositis

- Abscesses in muscle may sometimes be hematogenous in origin, but more often they result from *inoculation* or by *extension from a suppurative focus* in adjacent structures, such as joints, tendon sheaths, or lymph nodes
- The most common cause is *Actinomyces and Corynebacterium*

Malignant Oedema (gas gangrene)

- *The muscles, especially if **devitalized** in some manner, are highly susceptible to bacteria of the genus Clostridium,*
- these organisms, cause extensive necrosis of muscle, with blood-stained edema and the formation of gas

- Once the bacteria become established, the toxins they elaborate provide a suitable and expanding environment for further bacterial growth.
- **Death** occurs as a result of *systemic intoxication.*
- Since the pathogenic clostridia are frequently found in soil and feces, *any contamination of an open wound is likely to introduce those potential pathogens*
- Gas gangrene and malignant edema are essentially wound infections in which C. *septicum, C. perfringens, C. novyi, C. sordelli*, and C. *chauvoei are involved*
- The distinctive characteristics are *severe edema*, the formation of *gas bubbles* that give crepitation, *discoloration* of the overlying skin, *coldness* of the affected part,
- Finally results in *profound toxemia* with prostration, circulatory collapse, and sudden death.

- Histologically, *edema fluid,* poor in protein, separates the muscle fibers from each other
- *Bacteria are seldom numerous in the lesions,*

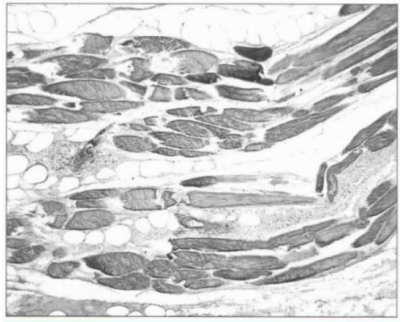

Figure 2.102 Lysed red blood cells and gas bubbles in sublingual muscle in **malignant edema** in a cow. (Courtesy of W Hadlow.)

Blackleg

(black quarter,** emphysematous gangrene, **gangrenous myositis)

- *caused by **C. chauvoei** in ruminants by the activation of latent spores in muscle.*
- Blackleg occurs most often in cattle and sheep and rarely in other domestic animals.
- in **cattle** primarily affects animals 9 months to 2 years of age but can infect animals of any age.
- It affects animals in good condition and occur in summer
- often selectively causes death in the best-grown or best-fattened animals
- It is often associated with moist pastures and rapid growth of both forage and cattle

- *The infection is acquired by the ingestion of spores,*
- these spores, or spores produced following one or more germinative cycles in the gut, are taken across the intestinal mucosa
- Macrophages may be responsible for this passage, or are taken up by lymphoepithelial cells of the ileal domes by endocytosis.
- *Spores are distributed to tissues where they may be stored for long periods in phagocytic cells.*
- spores can be found in many tissues of normal animals, including muscle.
- *The latent spores in muscle are stimulated to germinate when a local event creates muscle damage or low oxygen tension.*
- The clinical manifestations of blackleg are often not observed and *animals are often found dead.*

- When animals survive, signs consist of lameness, swelling, and crepitation of the skin over a thigh or shoulder and fever.
- It is typical for swellings to increase rapidly in size and to be hot initially and cold later.
- Affected animals subsequently show depression and circulatory collapse.
- *Death rapidly occur and seldom animal survive for more than 24 - 36 h after the onset of any signs*
- An animal that has died of blackleg swells and bloats rapidly,
- Blood-stained froth flows from the nose but not usually from other orifices.

- The subcutaneous tissues and fascia around the lesion are thick with yellow gelatinous fluid that is copiously blood-stained close to the lesion.
- Gas bubbles may be apparent in the fluid.
- *Towards the periphery of the lesion, the muscle is dark red,*
- *Towards the center, it is red-black*
- Degeneration of the muscle fibers is caused by both diffusing toxin and injury to blood vessels
- Gangrenous lesions expand longitudinally with the long axis of muscles more readily than in a lateral direction,
- Gas is not produced until muscle fibers die and are penetrated by bacteria and toxins.

- Leukocytes are sparse, being destroyed by diffusing toxins, and only a scattering of debris is found at the periphery of the lesion.
- *The lesions of blackleg are usually found in the large muscles of the pectoral and pelvic girdles*
- *There is severe parenchymatous degeneration of liver, kidney, and endocrine glands*,
- The myocardium may be pale and friable, or dark red;

PARASITIC DISEASES

- **Sarcocystis spp**. are protozoal parasites of animal muscle that in many respects resemble coccidia, the main difference being their obligatory development in two hosts.
  - *the schizogonous phase may cause severe clinical disease and death*
- **Eosinophilic myositis** *is a relatively rare condition in cattle and sheep*
  - because the lesions are usually discovered in skeletal muscle and myocardium
  - *Sudden deaths in cattle and sheep have been ascribed to the myocarditis.*
  - *The gross lesions of eosinophilic myositis in cattle are characteristic, being well-demarcated, green, focal stripes or patches that fade to off-white when exposed to air*

- ***Toxoplasma*** and ***Neospora,*** produce myopathy in several species.
- Muscle is the habitat for encysted larvae of the nematode ***Trichinella*** spp., which may survive there for many years

NEOPLASTIC DISEASES OF MUSCLE

- **Rhabdomyoma**
- **Rhabdomyosarcoma**