VETERINARY MEDICINE

Equine Muscle Disease as a Cause of Poor Performance

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Outline

- Introduction
- Diagnostic approach
- Atrophy/weakness
  - Myosin heavy chain myopathy
  - Vitamin E deficient myopathy
- Pain
  - Polysaccharide storage myopathy
    - Type 1
    - Type 2
  - Myofibrillar myopathy (MFM)
- Questions

Muscle Disease

- Optimal muscle function crucial athletic performance
  - Minor derangements can significantly change
    - Power
    - Coordination
    - Stamina
    - Desire
- Relatively simple to recognize acute rhabdomyolysis
  - Pain, sweating, fasiculations, reluctance to move, recumbency
  - Elevated CK and AST
- Subtle muscle pain and weakness more challenging
  - Muscle enzymes often normal
  - Still can be significant cause of poor performance

Diagnostic Approach

- History
  - Thorough
  - Pain with exercise/post exercise
  - Weakness
  - ”Unwillingness” or early fatigue
- Physical examination
  - Muscle tone
  - Atrophy
  - Symmetry of paired groups
  - Pain
- Rule out other causes

Diagnostic Approach

- Exercise challenge
  - Test differ for fit and unfit horses
  - Blood drawn for CK level prior
  - Second sample 4 – 6 hours later
  - Breed differences should be considered
  - 2 – 3-fold increase in CK => Subclinical ER
- Genetic testing
- Muscle biopsy
  - Focal atrophy => the affected muscle
  - Generalized atrophy => sacrocaudalis dorsalis
  - ER with negative genetic test => semimembranosus or gluteal

Valberg, “Muscle Conditions Affecting Sport Horses.”

Diagnostic Approach

- Serum vitamin E levels
- Electromyography
- Nuclear Scintigraphy
- Ultrasound

Myosin heavy chain myopathy

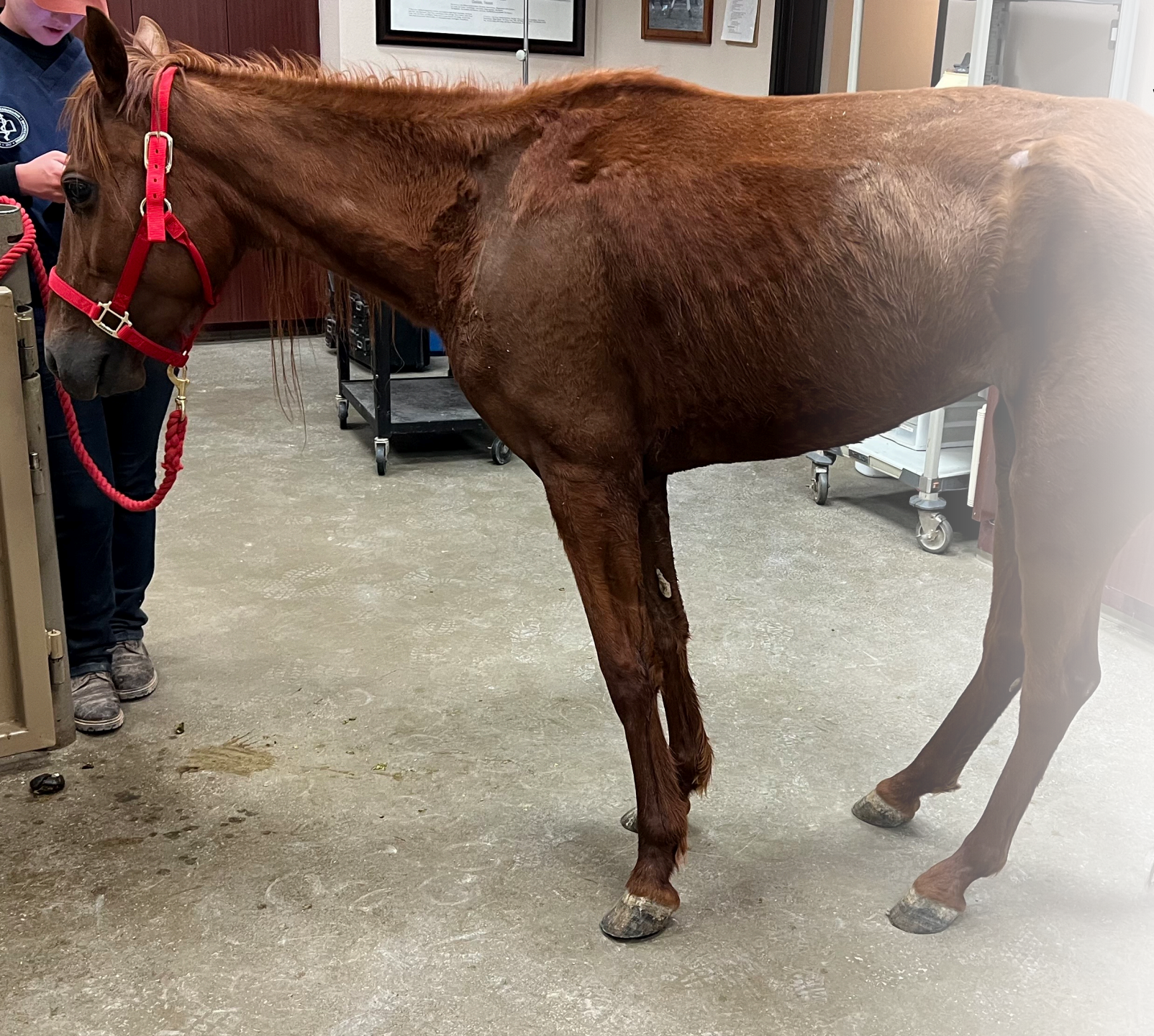
- Quarter horses and related breeds
- New term to describe two syndromes
  - Immune mediated myositis
    - Horses less than or equal to 8 years or >17
  - Non-exertional rhabdomyolysis
    - Typically young horses
  - Same mutation of myosin heavy chain 1 gene
- Heritable condition
  - Missense mutation of myosin heavy chain 1 gene
  - Genetic testing for mutation of MYH1 gene
- ~40% of horses have history of triggering factor
  - *Strep. equi equi* or *Strep. equi zooepidemicus*
  - EHV – 4
  - Influenza
  - Vaccination to any of these diseases

Non-exertional rhabdomyolysis

- Clinical signs
  - Marked muscle pain, stiffness, firm muscles
  - recumbency (often)
- Some horses have concurrent *Streptococcus equi equi* infection
- Marked elevations of CK and AST
- Myoglobinuria common
- Treatment
  - Typical of rhabdomyolysis
  - Concurrent infections
- Approximately 35% go on to develop IMM
  - Steroids at this point if not contraindicated to speed recovery from atrophy

Immune mediated myositis

- Clinical signs
  - Rapid, symmetric muscle atrophy
  - Generally epaxial and gluteals
  - Loss of up to 40% muscle mass in 48 hours
- Muscle mass can gradually return over a period of months
  - Can be hastened with corticosteroids
  - Dex 0.05mg/kg IV 3 days
  - Prednisolone 1mg/kg PO 7 – 10 days
    - Taper by 100mg weekly for 1 month
- Genetic testing
  - Can be slow!
- Biopsy of affected muscle



Vitamin E deficient myopathy

- Many horses spending less time of fresh grass
  - Primary source of vit E in diet
- Prolonged (years) vit E deficiency => Equine Motor Neuron Disease (EMND)
  - Symmetric generalized muscle atrophy
  - Dramatic muscle weakness
- Some horses develop vitamin E deficient myopathy
  - Clinical signs can be similar or more subtle than EMND
  - Much more responsive to Vit E supplementation

Diagnosis

- Appropriate clinical signs
- Low serum Vit E (<3-4 µg/mL)
  - Not all horses
- Horses with normal serum vit E should have a muscle biopsy
  - Often only sacrocaudalis dorsalis muscle will show signs
  - Microscopic changes can differentiate form EMND

Treatment

- Vitamin E supplementation
  - Natural vit e 10 IU/kg bwt for at least 30 days
  - Monitor response through repeated serum testing
  - Improvement or resolution of clinical signs
- Transition gradually to natural powdered supplements once levels are normal and signs have resolved

Quick Guide

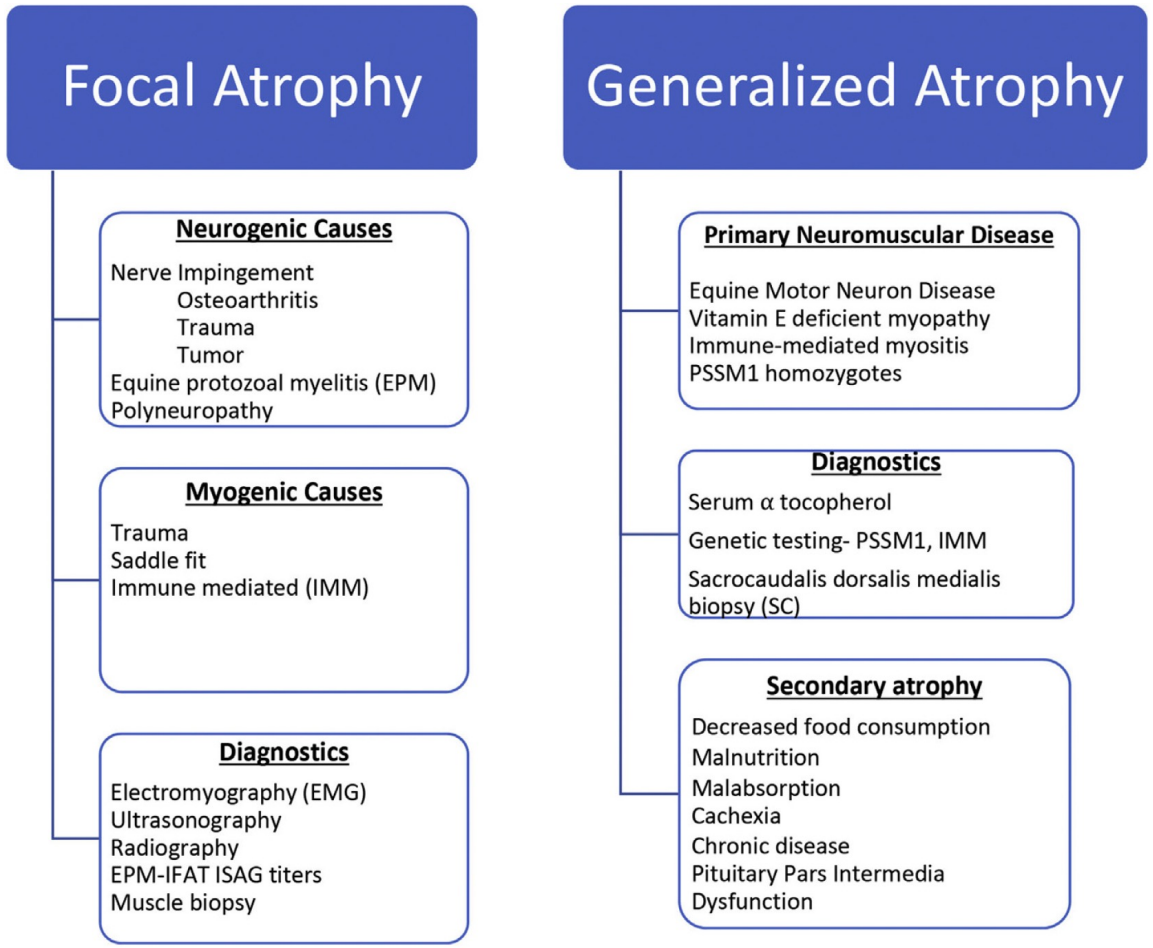


Fig. 2. Causes of focal and generalized muscle atrophy in horses and recommended diagnostic testing.

Valberg, "Muscle Conditions Affecting Sport Horses."

Polysaccharide Storage Myopathy

- Two types
- PSSM 1
  - Associated with mutation of glycogen synthase 1 gene (GSY1)
  - Common in QH and related breeds (6 – 10 %)
  - Continental European Drafts (36 – 54%)
  - Almost nonexistent in Arabians, Standardbreds, and Thoroughbreds
- PSSM 2
  - not associated with GSY1 mutation
  - Similar changes on muscle biopsy
  - UK breeds ~35% of horses diagnosed via muscle biopsy
  - QH and related breed ~28%
  - Warmbloods ~80%

PSSM 1

- Clinical signs
  - Acute signs resemble other forms of ER
  - Chronic
    - Lack of energy/reluctance to move
    - Stopping and posturing as if to urinate
    - Resistance to exercise
- Triggers
  - Light exercise less than 20 minutes
  - Diets high in NSC
- Diagnosis
  - Elevated CK in unmanaged horses (even rested)
  - Gold Standard is genetic testing
  - Muscle biopsy – horses > 2 years

Valberg, “Diagnostic Approach to Muscle Disorders”

PSSM 2

- Histopathologic classification
  - Does not indicate a specific cause
  - Defined as mild, moderate, or severe
- Clinical signs
  - QH – exertional rhabdomyolysis is predominant
    - Elevations of CK and AST common
  - Warmbloods signs generally appear around 10 years
    - Muscle soreness
    - Undiagnosed lameness
    - Reluctance to collect, exercise, or move forward
    - Topline atrophy
  - Diagnosis based on muscle biopsy
    - Semimembranosus

Management

- Diet
  - Forage 1.5 – 2% bwt
  - Low NSC <12%
  - Grazing muzzle
  - High fat
- Exercise
  - Avoid prolonged rest
  - Cautiously reintroduce work if rest for more than 2 days required
- Dantrolene if continued ER
- Adjunct therapies
- At least 70% show improvement
- Currently PSSM and 2 managed similarly

Myofibrillar Myopathy

- Recently described condition
  - Arabians and warmbloods
  - Could be extreme subset of PSSM 2
- Horses display exercise intolerance or ER
- Defined by specific histopathology
  - Cytoplasmic aggregates of cytoskeleton protein desmin in scattered muscle fibers
- Warmbloods
  - Insidious exercise intolerance ~ 6 – 8 years
  - Lack of stamina
- Arabians
  - Endurance horses
  - Intermittent elevations of CK or AST
  - Not always as painful as typical ER
  - Myogolbinuria

Management

- Best management not completely understood
- PSSM 2 (warmbloods) and MFM managed in similar manner
  - Turnout
  - Less frequent work: 3 days on 2 days off
- Diet
  - Forage: 1.5 – 2% BWT good quality grass or grass/legume mix
  - Concentrate moderate NSC (20 – 30%), fat (4 – 8%), higher protein (12 – 14% CP)
    - High quality whey-based AA
  - Supplement: n-acetylcysteine, coenzyme Q10
  - KER has MFM pellet

Summary

Table 2
Treatments used to manage horses with various exertional myopathies

Treatment	RER	PSSM1 and PSSM2 Quarter Horses	PSSM2, Other Breeds	MFM
Diet				
NSC	<20% of DE	<10% of DE	15%–20%[a]	15%–20%[a]
Fat	15%–20% of DE	15%–20% of DE	If needed for weight	If needed for weight
Amino acids	Branched chain-NE[a]	NE	Whey protein if atrophy[a]	Whey protein[a]
Vitamin E and selenium or other antioxidants	If deficient	If deficient	If deficient	Yes
Exercise				
Turnout	Maximal	Maximal	Maximal	Maximal
Long-low lunge	No	No	Yes	Yes
Mounted 5–7 d/wk	Yes	Yes	Yes	Yes
Medication				
Low-dose acepromazine	Yes	No	No	No
Dantrolene, 2–4 mg/kg 60 min preexercise	Yes	If ER not controlled by diet	No	No

References provided where trials have been performed.
Abbreviations: DE, digestible energy; NE, no evidence.
[a] Current recommendations lacking research.

Valberg, "Muscle Conditions Affecting Sport Horses."

Key Points

Table 1
Muscle disorders listed by breed, their primary clinical signs with recommended diagnostic tests

Breed	Primary CS	Diagnostic Test
Quarter horse, Paint, Appaloosa		
IMM	Atrophy	*MYH1* genetic test
PSSM1	ER	*GYS1* genetic test
MH	ER	*RYR1* genetic test
PSSM2	ER	CK, AST, muscle biopsy
RER (racing breeds)	ER	CK, AST, clinical signs
Thoroughbreds, Standardbreds		
RER	ER	CK, AST, clinical signs
PSSM2	ER	CK, AST, muscle biopsy
Arabians		
PSSM2	ER	CK, AST, muscle biopsy
RER	ER	CK, AST, clinical signs
MFM	ER	CK, AST, muscle biopsy
Warmbloods		
RER	ER	CK, AST, clinical signs
PSSM1	ER	*GYS1* genetic test
PSSM2	EI/ER	Muscle biopsy
MFM	EI/ER	Muscle biopsy

Abbreviations: CS, clinical signs; EI, exercise intolerance; ER, exertional rhabdomyolysis; *MYH1*, myosin heavy chain 1.

Valberg, "Muscle Conditions Affecting Sport Horses."

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N.d.

Questions?

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