EXERTIONAL RHABDOMYOLYSIS

"Tying-up, Azoturia, Monday morning disease"

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CONTENT

OVERVIEW

- A **syndrome of muscle fatigue, pain, and cramping** linked to exercise.
- Results from d**isruption of muscle energy metabolism or calcium regulation.**
- Characterized by skeletal muscle necrosis and **elevated CK/AST** enzymes.
- Leads to leakage of enzymes and myoglobin from muscle cells.
- Clinical range: from mild stiffness to severe myoglobinuric renal failure.
- Affects horses across all breeds and athletic disciplines.

PATHOGENESIS

Primary Mechanism:

- **Disturbance in muscle energy metabolism or calcium regulation.**
- **Leads to sustained muscle contraction, metabolic exhaustion, and cell damage.**

Cellular Events:

- 1. Overexertion or metabolic defect → reduced ATP availability.
- 2. Impaired calcium reuptake → persistent contraction (rigidity).
- 3. Muscle fiber necrosis → release of CK, AST, LDH, and myoglobin.

In Chronic Forms:

- Genetic mutations cause ongoing metabolic dysfunction

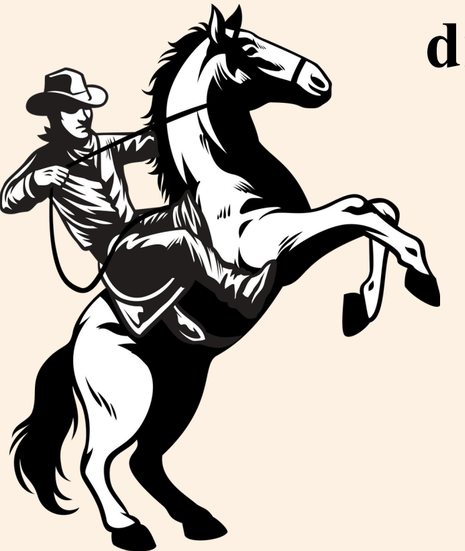
ER CLASSIFICATION

A. Sporadic Exertional Rhabdomyolysis

- Single or infrequent episodes after **overexertion** or **poor conditioning**.
- Triggered by diet imbalance, illness, or environmental stress.

B. Chronic Exertional Rhabdomyolysis

- Recurrent episodes associated with **inherited** or **metabolic muscle disorders**:
  - Type 1 & 2 Polysaccharide Storage Myopathy (PSSM1 & PSSM2)
  - Myofibrillar Myopathy (MFM)
  - Malignant Hyperthermia (MH)
  - Recurrent Exertional Rhabdomyolysis (RER)



CAUSES & RISK FACTORS

SPORADIC ER

- **Overexertion** beyond level of training.
- Electrolyte and mineral deficiency: Na, Ca:P imbalance, vitamin E or Se deficiency.
- Concurrent respiratory disease or systemic stress.
- High temperature and humidity.
- Dehydration or insufficient warm-up.

CHRONIC ER

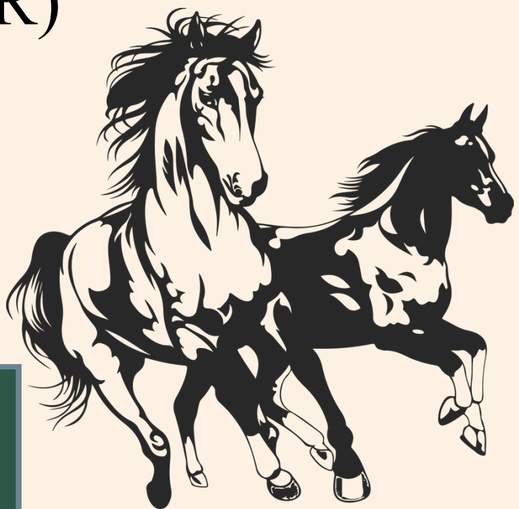
- **Genetic mutations**:
  - GYS1 → Type 1 PSSM.
  - RYR1 → Malignant Hyperthermia.
- **Metabolic defects:** abnormal glycogen storage or calcium flux.
- **Behavioral**: nervous temperament, stress during confinement.
- **Dietary**: high-starch / low-fat feeds.
- **Training errors**: inconsistent exercise, long rest periods before work.

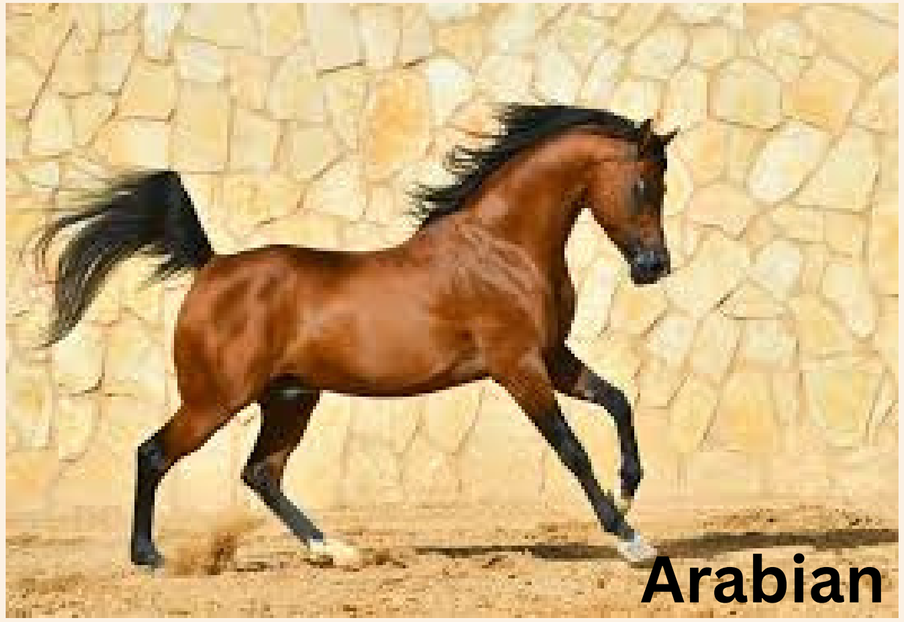
SIGNALMENT

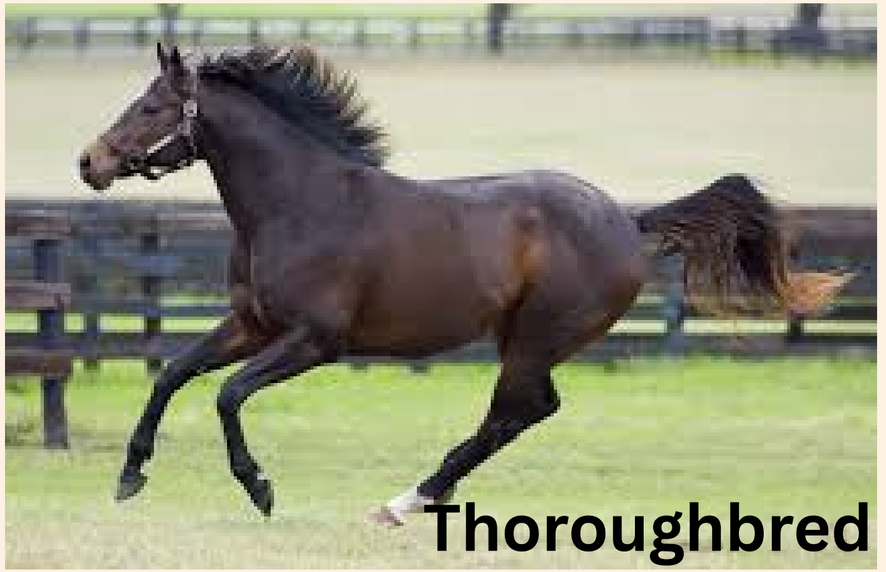
All breeds susceptible, but certain predispositions:

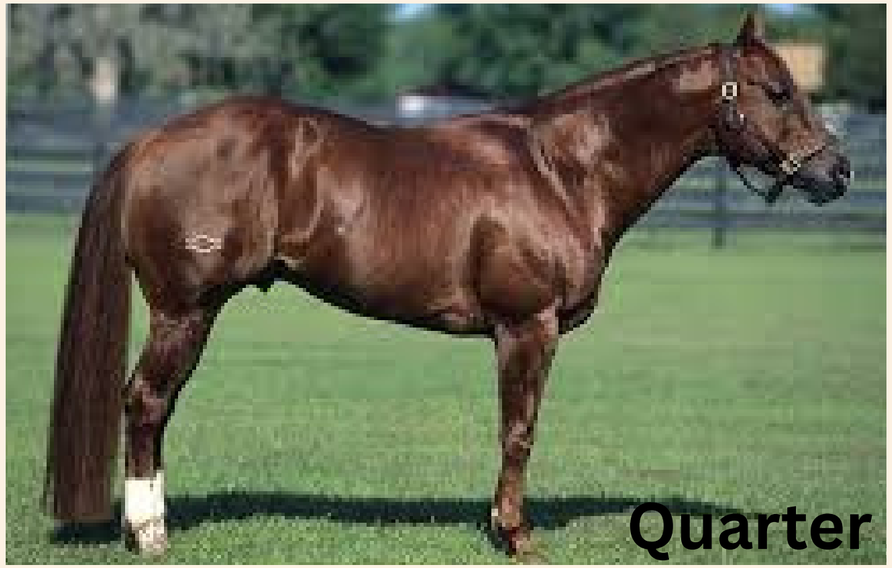
- Quarter Horses, Drafts, Morgans → Type 1 PSSM
- Warmbloods, Arabians, Thoroughbreds → Type 2 PSSM / MFM
- Quarter Horses → Malignant Hyperthermia (RYR1 mutation)
- Thoroughbreds & Standardbreds → Recurrent ER (RER)

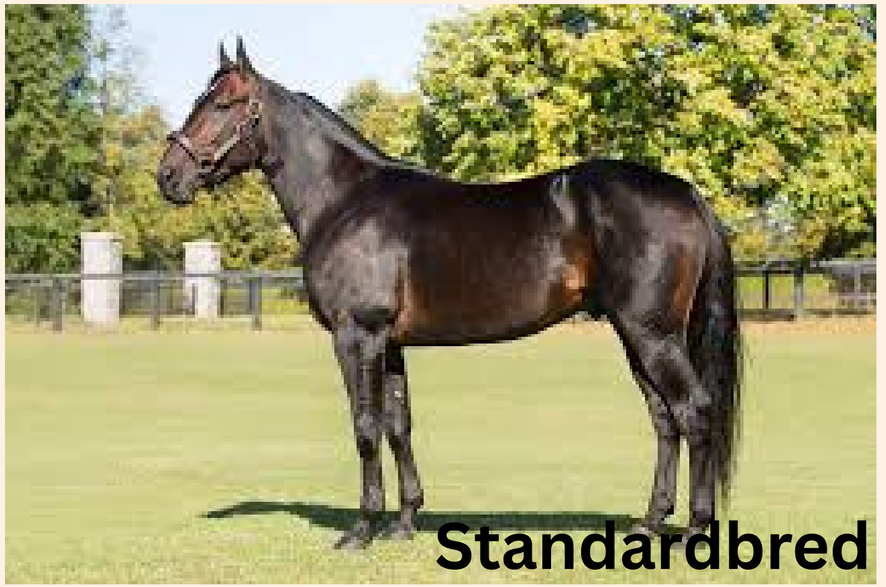
Common in young to middle-aged, fit, nervous horses.




Arabian

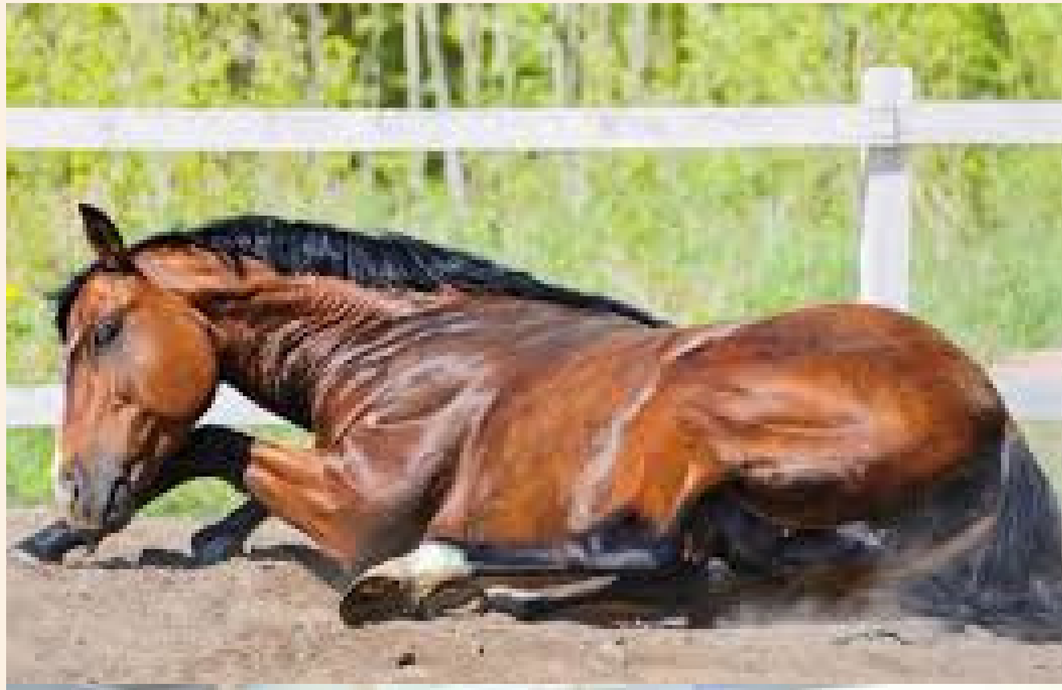

Thoroughbred

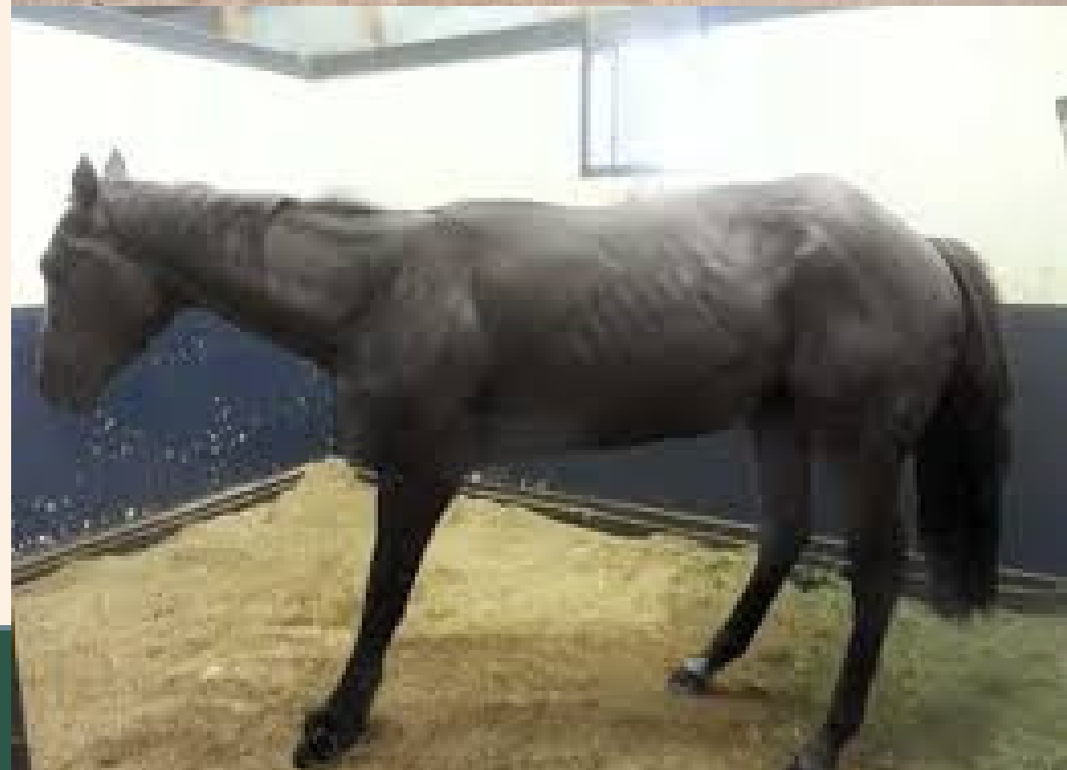

Quarter


Standardbred

CLINICAL SIGNS

- **Begin during or soon after exercise**.
- Excessive sweating, muscle fasciculations, stiffness.
- Painful, firm gluteal and lumbar muscles.
- Reluctance or refusal to move.
- Tachycardia, tachypnea, and distress.
- Severe cases → recumbency and dark coffee-colored urine (**myoglobinuria**).





DIAGNOSIS

- Diagnosis based on **history, clinical signs, and enzyme elevation**.
  - CK and AST markedly increased after exercise.
  - Severity correlates with degree of enzyme rise.
  - Subclinical cases detected by exercise challenge test (CK measured pre- and post-work).
- CBC: normal or mild hemoconcentration.
- **Biochemistry:**
  - **↑ CK (early), ↑ AST (persistent), possible ↑ LDH.**
  - Severe cases → azotemia from renal compromise.
- **Urinalysis**: **myoglobinuria**, high specific gravity, possible proteinuria.
- Imaging: ultrasound may show muscle edema; not routinely required.

- **Muscle Biopsy**:
  - Type 1 PSSM → amylase-resistant PAS-positive glycogen.
  - Type 2 PSSM → amylase-sensitive glycogen aggregates.
  - MFM → desmin protein aggregates in fibers.
- **Genetic Tests**: identify GYS1 or RYR1 mutations.
  - Helps determine dietary and exercise management plans.

DIFFERENTIAL DIAGNOSIS

- **Colic**: Sweating and pain but no muscle rigidity.
- **Laminitis**: Reluctance to move but no muscle swelling.
- **Infectious Myositis**: Fever, elevated WBCs, inflammatory response.
- **Neurologic disorders**: Ataxia without muscle soreness.

TREATMENT

- Stop exercise immediately.
- Move to a well-bedded, quiet stall with access to water.
- Relieve pain and anxiety:
  - **Acepromazine** 0.02–0.05 mg/kg IV/IM.
  - **Xylazine** ± **Butorphanol** 0.2–0.4 mg/kg IV.
- **NSAIDs** (Flunixin 1.1 mg/kg IV q12h) if well hydrated.
- **IV Fluids**: correct dehydration and support renal function.
- Avoid diuretics unless under IV fluid therapy.

TREATMENT

CHRONIC

- **Diet:**
  - High-fat (> 15% DE), low-starch (< 10% DE).
  - Forage 1.5–2% body weight/day.
  - Add vitamin E, selenium, cysteine-rich amino acids.
- Medications:
  - **Dantrolene** 4 mg/kg PO 60–90 min before exercise → reduces Ca^{2+} release.
  - **Phenytoin** 1.4–2.7 mg/kg PO q12h → stabilizes muscle excitability.
- **Exercise:** consistent daily turnout; gradual conditioning.

PREVENTION & CONTROL

- Maintain consistent training schedule and avoid long rest periods.
- Ensure adequate hydration and electrolyte balance.
- Use low-starch, high-fat diets; avoid sudden feed changes.
- Reduce stress and excitement: quiet housing, calm handling.
- Regular monitoring of CK/AST in susceptible horses.
- Avoid breeding carriers of GYS1 or RYR1 mutations.

PROGNOSIS

- **Sporadic form:** excellent prognosis with rest and gradual return to training.
- **Chronic forms:** lifelong management required, but performance often maintained.
- **Complications:** renal failure from myoglobinuria → guarded prognosis.
- Response to therapy improves when enzyme normalization guides training resumption.

KEY TAKEAWAYS

- ER is a group of exertional muscle disorders, not a single disease.
- Divided into sporadic (environmental/management) and chronic (genetic/metabolic).
- **Diagnosis:** enzyme elevation (CK, AST), myoglobinuria, and genetic or biopsy confirmation.
- **Treatment:** relieve pain, restore fluids, prevent renal injury.
- **Drugs of choice:** Dantrolene and Phenytoin for recurrent forms.
- **Prevention:** consistent exercise, proper diet, stress reduction.
- **Outcome:** generally good with early recognition and careful management.

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THANK YOU