**Rhabdomyolysis, Myoglobinuria**

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- in acute muscle necrosis (rhabdomyolysis), myoglobin escapes into blood → urine (myoglobinuria)

**Rhabdomyolysis is synonymous for myoglobinuria**

- serum [myoglobin] has same diagnostic significance as serum [CK].
- modern techniques can detect minute amounts, so that brown urine discolarion may not be evident.
- If there is no hematuria, positive benzidine test result strongly suggests myoglobinuria!
- N.B. myoglobinuria itself can induce microhematuria!
- macroscopic myoglobinuria indicates massive rhabdomyolysis (risk of renal failure?).
- N.B. renal failure is more likely if hypokalemia (hypovolemia) and acidosis coexist.
- clinically important syndromes are associated with gross pigmenturia.

I. Hereditary Myoglobinuria

- Camurite palmityl transferase deficiency - most frequent metabolic defect presenting with myoglobinuria!
- Glycogenoses type V, VII

Uncharacterized:
- Familial; biochemical defect unknown: provoked by diarrhea / infection / exercise
- Malignant hyperthermia
- Repeated attacks in individual; biochemical defect unknown

II. Sporadic Myoglobinuria

- Exertion in untrained individuals (e.g. military recruits)
  - “Squat-jump” - related syndromes, anterior tibial syndrome
- Convulsions, agitated delirium, restraints, prolonged myoclonus or acute dystonia, status asthmaticus, high-voltage electric shock

Crush syndrome

- Ischemia: arterial occlusion, compression and anterior tibial syndromes. DIC

Metabolic abnormalities

- Metabolic muscle depression
- Barbitalure, carbon monoxide, narcotic coma
- Diabetic acidosis
- General anesthetia

Hypothermia

- Exogenous toxins and drugs
- Half disease
- Ethanol (binge drink), heroin, Malayan sea-snake bite poison, plasmocid

- Glycerohizate, carbonoxalone, amphetamine-B, phenylpropanolamine, lovastatin, succinylcholine
- Malignant neuroleptic syndrome
- Chronic hypokalemia of any cause
- Heat stroke
- Toxic shock syndrome

Progressive muscle disease ("polymyositis", "alcoholic myopathy")

**CLINICAL SYNDROME**

1. Widespread myalgia, muscle swelling and weakness (may persist for weeks!)
2. Renal pain –> renal failure (anuria, azotemia, hyperkalemia)
3. Fever

**DIAGNOSIS**

1. Serum enzymes (CK can be > 1000 times normal), K↑, phosphate.
2. Pigmenturia (ceases within few days).
3. EMG abnormalities (fibrillations and myopathic units) can persist for several months.

**Muscle biopsy:**
- shortly after attack - large numbers of necrotic fibers;
- later - many regenerating fibers.

**TREATMENT**

1. Half muscle destruction – bed rest (up to neuromuscular blockade), treat cause.
2. Promote diuresis > 2 ml/kg/h (with Mannitol / dialysis)
3. Urine alkalization* (with sodium bicarbonate).

*keep urinary pH > 7 - prevents toxic ferrhemele release from myoglobin

4. Control hyperkalemia.

**TOKIC MYOPATHIES**

Inflammatory myopathy: cimotidine, D-penicillamine, procainamide, L-tryptophan, L-dopa

Non-inflammatory necrotizing or vacuolar myopathies: cholestero-lowering agents, amiodarone, chloroquine, colchicine, emetine, c-aminocaproic acid, labetalol, cyclosporine and tacrolimus, isorretinoin, vincristine, alcohol.

Rhabdomyolysis and myoglobinuria: cholestero-lowering drugs, alcohol (due to prolonged obtundation, seizures, hypokalemia, and hypophosphatemia), heroin, amphetamine, phenycyclidine, cocaine, c-aminocaproic acid, pentazocine, toluol.

Myofibrillary myopathy: emetine.

Myosin loss myopathy: glucocorticoids (see p. 2740+), non-depolarizing neuromuscular blockers.

Mitochondrial myopathy: zidovudine.
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Myotonia: cholesterol-lowering drugs, propranolol, clofibrate, penicillamine, chloroquine, cyclosporine, anthracene-9-carboxyclic acid, 2,4-dichlorophenoxyacetic acid.

Malignant hyperthermia → see p. 3010

Focal muscle damage - injection of narcotic analgesics (esp. pentazocine, meperidine, and heroin).

BIBLIOGRAPHY for ch. “Neuromuscular, Muscular Disorders” → follow this LINK

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