Guideline Title
Rhabdomyolysis.

Bibliographic Source(s)

Guideline Status
This is the current release of the guideline.


Scope
Disease/Condition(s)
Rhabdomyolysis

Guideline Category
Diagnosis
Treatment

Clinical Specialty
Emergency Medicine
Internal Medicine
Nephrology

Intended Users
Health Care Providers
Physicians

Guideline Objective(s)
Evidence-Based Medicine Guidelines collect, summarize, and update the core clinical knowledge essential in general practice. The guidelines also describe the scientific evidence underlying the given recommendations.

Target Population
Patients having or suspected of having rhabdomyolysis

Interventions and Practices Considered

Diagnosis
1. Evaluation of signs, symptoms, and history
2. Serum creatine kinase (CK)
3. Other laboratory findings including calcium, potassium, phosphatase, serum creatinine and urine hemoglobin levels

Treatment
1. Admission to hospital
2. Correction of hypovolaemia and dehydration with physiologic saline
   - Intensive fluid therapy
   - Forced alkaline diuresis
   - Intravenous furosemide
3. Dialysis, if indicated
4. Fasciotomy, if indicated

Major Outcomes Considered
Not stated
Expert opinion

Followed by 400

Myopathy (congenital muscle enzyme deficiency, alcohol)

Intensive fluid therapy

No direct research evidence

Expert opinion

Accurate diagnosis and appropriate treatment of rhabdomyolysis

The aim is to prevent the development of acute renal failure, caused by myoglobin which is being released from

Other typical laboratory findings include:

Hyperphosphataemia (renal failure and release from cells)

Several high

Urine hemoglobin (Hb) positive in approximately 50% of patients

The affected area (limbs, buttocks, back) is painful, swollen, or tender to touch.

Correction of dehydration to maintain diuresis. Intensive fluid therapy is the cornerstone of the treatment.

Medication (statins)

Start with physiological saline

One or more studies with severe limitations

Suspect rhabdomyolysis in patients with typical history (particularly those found unconscious or those who have

In clinical practice, the measurement of other muscle enzymes is not needed.

If rhabdomyolysis is suspected, measure serum creatine kinase.

Hyperthermia (malignant hyperthermia, neuroleptic malignant syndrome)

Hyperkalaemia


**Recommendations**

**Major Recommendations**

The levels of evidence [A-D] supporting the recommendations are defined at the end of the "Major Recommendations" field.

**Aims**
- Suspect rhabdomyolysis in patients with typical history (particularly those found unconscious or those who have suffered a crush injury), symptoms, and clinical findings.
- When suspicion arises, diagnosis is easy to verify (serum creatine kinase [CK]).

**Definition**
- Rhabdomyolysis refers to an injury of striated muscle. It may result in acute renal failure unless treatment is instigated early enough.

**Aetiology**
- The most common causative factor is lying unconscious on a hard surface either as a result of intoxication (alcohol or medication), or due to an illness. The long lasting pressure will cause muscle damage.
- Crush injury, excessive muscle strain (running, body building, etc.), and convulsions
- Alcohol and illegal drugs (heroin, cocaine)
- Medication (statins)
- Hyperthermia (malignant hyperthermia, neuroleptic malignant syndrome)
- Metabolic disorders (hyperosmolar coma, ketoacidosis, hypokalaemia, hypophosphataemia)
- Infections (pneumococcus, salmonella, legionella, influenza, cytomegalovirus)
- Myopathy (congenital muscle enzyme deficiency, alcohol)

**When to Suspect?**
- A typical history involves a patient
  - Who has been lying unconscious on a hard surface due to excess alcohol, medication, or another reason, or
  - With excessive muscle strain over the preceding hours or days
- Signs and symptoms:
  - The affected area (limbs, buttocks, back) is painful, swollen, or tender to touch.
  - The patient may be unconscious, confused, dehydrated, or febrile.
  - Paresis or sensory disturbance may be present in the limbs (increased compartment pressure).
  - Urine may be dark (myoglobin), or the patient may be oliguric or anuric.
  - Urine strip test may be positive to haematuria (due to myoglobin), even when no red cells are seen in the sediment.

**Diagnosis**
- If rhabdomyolysis is suspected, measure serum creatine kinase.
- CK activity is often >10,000-100,000 U/L.
- In clinical practice, the measurement of other muscle enzymes is not needed.
- Other typical laboratory findings include:
  - Hypocalcaemia (calcium deposited in muscle tissue)
  - Hyperkalaemia
  - Hyperphosphataemia (renal failure and release from cells)
  - Urine hemoglobin (Hb) positive in approximately 50% of patients
  - Increased serum creatinine as renal failure develops
- Differential diagnosis: Local symptoms may resemble those of deep venous thrombosis.

**Treatment**
- The patient is usually admitted to hospital.
- In primary care the first aid consists of the correction of hypovolaemia and dehydration.
  - Start with physiological saline
    - 1,000 milliliters (mL) during the first hour
    - Followed by 400-500 mL/hour
  - The aim is to prevent the development of acute renal failure, caused by myoglobin which is being released from the muscles.
- In the hospital the follow-up treatment consists of the following:
  - Correction of dehydration to maintain diuresis. Intensive fluid therapy is the cornerstone of the treatment. Forced alkaline diuresis aims at preventing renal failure; target level for urine pH is 6.5. In the recent years, the
importance of urine alkalinization has, however, been questioned (Homsi et al., 1997; Brown et al., 2004).

- Initially 1,000 mL of 0.9% sodium chloride (NaCl) over 1 hour
- Followed by 0.3% NaCl with 5% glucose 400 mL/hour
- Urine is alkalinized with a side infusion of 1.4% sodium bicarbonate (NaHCO3) administered 50-100 mL/hour, or 7.5% NaHCO3 administered 10-20 mL/hour.
- Diuresis may be encouraged with 20-40 milligrams of intravenous furosemide.
- Dialysis is indicated in renal failure if the patient is anuric and diuresis is not induced with rehydration.
- Dialysis will have no effect on the renal state, but will keep the patient alive until renal function spontaneously returns. This may take several days, even weeks.
- Fasciotomy is indicated if increased compartment pressure threatens to cause muscle necrosis or nerve damage.
- Correction of symptomatic hypocalcaemia must be carried out cautiously, because hypercalcaemia often develops during recovery. Asymptomatic hypocalcaemia requires no treatment.

**Prognosis**
- Prognosis is good even in cases where renal failure has developed, since the failure is reversible.
- If compartment syndrome is not treated early enough, residual nerve and muscle damage may persist.

**Related Resources**
Refer to the original guideline document for related literature.

**Definitions:**

**Levels of Evidence**

A. Quality of Evidence: High
Further research is very unlikely to change confidence in the estimate of effect
- Several high-quality studies with consistent results
- In special cases: one large, high-quality multi-centre trial

B. Quality of Evidence: Moderate
Further research is likely to have an important impact on confidence in the estimate of effect and may change the estimate.
- One high-quality study
- Several studies with some limitations

C. Quality of Evidence: Low
Further research is very likely to have an important impact on confidence in the estimate of effect and is likely to change the estimate.
- One or more studies with severe limitations

D. Quality of Evidence: Very Low
Any estimate of effect is very uncertain.
- Expert opinion
- No direct research evidence
- One or more studies with very severe limitations

**Clinical Algorithm(s)**
None provided

**Evidence Supporting the Recommendations**

**References Supporting the Recommendations**

**Type of Evidence Supporting the Recommendations**
Concise summaries of scientific evidence attached to the individual guidelines are the unique feature of the Evidence-Based Medicine Guidelines. The evidence summaries allow the clinician to judge how well-founded the treatment recommendations are. The type of supporting evidence is identified and graded for select recommendations (see the "Major Recommendations" field).
When suspicion arises, diagnosis is easy to verify (serum creatine kinase [CK]). Myopathy (congenital muscle enzyme deficiency, alcohol)

Several studies with some limitations

Rhabdomyolysis refers to an injury of striated muscle. It may result in acute renal failure unless treatment is initiated early enough.

Urine is alkalinized with a side infusion of 1.4% sodium bicarbonate (NaHCO3) administered 50 ml/hour followed by 400 ml/hour. No direct research evidence

Intensive fluid therapy

Start with physiological saline

Urine strip test may be positive to haematuria (due to myoglobin), even when no red cells are seen in the sediment.

If rhabdomyolysis is suspected, measure serum creatine kinase.

The patient may be unconscious, confused, dehydrated, or febrile.

Increased serum creatinine as renal failure develops

Other typical laboratory findings include:

Infections (pneumococcus, salmonella, legionella, influenza, cytomegalovirus)

Fasciotomy is indicated if increased compartment pressure threatens to cause muscle necrosis or nerve damage.

Urine hemoglobin (Hb) positive in approximately 50% of patients

Patients having or suspected of having rhabdomyolysis should be admitted to hospital.
Several studies with some limitations

Initially 1,000 mL of 0.9% sodium chloride (NaCl) over 1 hour

Dialysis will have no effect on the renal state, but will keep the patient alive until renal function returns. This may take several days, even weeks.

If compartment syndrome is not treated early enough, residual nerve and muscle damage may persist.

One or more studies with severe limitations

A typical history in involves a patient who has been lying unconscious on a hard surface due to excess alcohol, medication, or another reason, or who has sustained crush injury, excessive muscle strain (running, body building, etc.), and convulsions.

The patient may be unconscious, confused, dehydrated, or febrile.

Differential diagnosis: Local symptoms may resemble those of deep venous thrombosis.

If rhabdomyolysis is suspected, measure serum creatine kinase.

Paresis or sensory disturbance may be present in the limbs (increased compartment pressure).

Hypocalcaemia (calcium deposited in muscle tissue)

Hyperphosphataemia (renal failure and release from cells)

Forced alkaline diuresis aims at preventing renal failure; target level for urine pH is 6.5. In the recent years, the importance of urine alkalinization has, however, been questioned (Homsi et al., 1997; Brown et al., 2004).

Further research is very likely to have an important impact on confidence in the estimate of effect and is likely to change the estimate.

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### Levels of Evidence

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### References Supporting the Recommendations