

## **Investigation of Rhabdomyolysis and ?Myoglobinuria**

### **1 Introduction**

The purpose of this protocol is to provide the duty Clinical Biochemist with background information and recommended tests to perform when rhabdomyolysis is suspected.

#### **Rhabdomyolysis**

Rhabdomyolysis is the consequence of injury to the sarcolemma (membrane) of skeletal muscle sufficient to allow leakage of cellular components into the blood and urine. The main measurable components of importance in clinical practice are myoglobin and creatine kinase (CK).

#### **Myoglobinuria**

Myoglobin gives a positive reaction with conventional urine dipstick testing for haem containing components.

Myoglobin imparts its characteristic red-brown colour to urine at concentrations above 300 mg/L

### **2 Patients at risk of developing rhabdomyolysis**

Rhabdomyolysis may be occult in a significant number of patients. There should be a high index of suspicion in the following groups:

- All patients who have lain immobile for indeterminate periods of more than one hour, particularly when drug ingestion, including alcohol, is possible.
- All patients who present after possible drug ingestion especially heroin, cocaine or ecstasy.
- Patients presenting after intensive exercise especially if accompanied by heat exhaustion.
- Patients with sepsis.

#### **Main Causes of Rhabdomyolysis**

Direct Muscle Trauma  
compression

Crush Syndrome including immobility-induced  
Electrocution/Burns

Ischaemia

Vascular Occlusion, compression

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**BLOOD SCIENCES**  
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Excessive muscle activity	Seizures Sports/military training Body-building
Drugs	Alcohol, Opiates, Cocaine, Tricyclics, Amphetamines, neuroleptics, Statins, Ecstasy.
Infection	Bacterial or viral
Inflammatory myopathies	Polymyositis, Dermatomyositis
Metabolic Disorders	DKA, HONK, hypokalaemia, hypophosphataemia
Hereditary Disorders	Carbohydrate metabolism e.g McCardles syndrome Lipid metabolism e.g. carnitine palmitoyl-transferase deficiency
Toxins	Snake or insect venom, quail ingestion, hemloc

### **3 Clinical questions relating to rhabdomyolysis**

In practice the common questions asked of the laboratory are:

1. Has the patient a significant degree of rhabdomyolysis?
2. In a patient with pigmented urine is the pigment myoglobin?
3. In a patient with rhabdomyolysis can an assessment be made of the likelihood of the patient developing acute renal failure (ARF)?

The recommendations to answer these questions are based on the ease and cost effectiveness of measuring CK, the relative cost and difficulty of reliably measuring myoglobin in serum and urine (and difficulties of interpretation) and the availability of Troponin T (TnT) measurement.

#### **1) Does a patient have a significant degree of rhabdomyolysis?**

The presence of a raised CK of non cardiac origin indicates rhabdomyolysis. Therefore measure CK and if significantly raised (>500 IU/L) in the absence of an obvious cause measure TnT. The finding of a raised CK and normal TnT indicates rhabdomyolysis. The finding of a raised CK and a raised TnT indicates either a cardiac or a mixed pattern. The relative elevations of CK and TnT may suggest which is predominant. Note that measuring myoglobin will not be informative, as it will be increased from either cause.

**2) In a patient with pigmented urine is the pigment myoglobin?**

Myoglobin gives a positive reaction with conventional urine dipstick testing for haem-containing compounds therefore a positive test could indicate myoglobinuria, haemoglobinuria or haematuria. In the presence of a positive test a normal serum CK will exclude myoglobinuria, and causes of haematuria/haemoglobinuria must be investigated. A raised CK will indicate that myoglobin could be present and possibly be contributing to the pigmentation.

**3) Does a patient with Rhabdomyolysis have a significant risk of developing acute renal failure?**

There is no agreed simple answer to this question but patients with CK elevations greater than 30 X the top of normal (i.e. greater than about 5000 IU/L) probably have an increased risk as do those with a significant metabolic acidosis (bicarbonate <17 mmol/L), there is no evidence that measuring myoglobin is informative.

#### **4 Laboratory notes**

1. If a raised CK, but less than 5000 IU/L, is found in a patient with suspected Rhabdomyolysis suggest repeat CK in 12 hrs. If both are less than 5000 IU/L, no measures in addition to normal clinical management are required, providing the specimens are taken within the first 3 days after the suspected insult.
2. If initial or subsequent CK is greater than 5000 IU/L suggested comment on report is "In view of degree of elevation of CK patient is at risk for complications of rhabdomyolysis."  
Regular monitoring of potassium and creatinine are indicated  
Any clinically obvious fluid deficit should be corrected and thereafter fluid should be administered to maintain a good urine output, providing this is appropriate to the overall clinical picture.
3. There is no sound reason to measure myoglobin in either serum or urine to answer the above clinical questions.
4. In patients presenting with unexplained acute renal failure, the retrospective analysis of specimens taken early during their admission may be of value in helping to substantiate or exclude rhabdomyolysis as a cause.

#### **5 References**

Beetham R, Biochemical Investigation of suspected rhabdomyolysis. Ann Clin Biochem 2000; 37-581-7