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A Rare Cause of Acute Kidney Injury: Myopathic Carnitine Palmitoyltransferase II (CPT II) Deficiency

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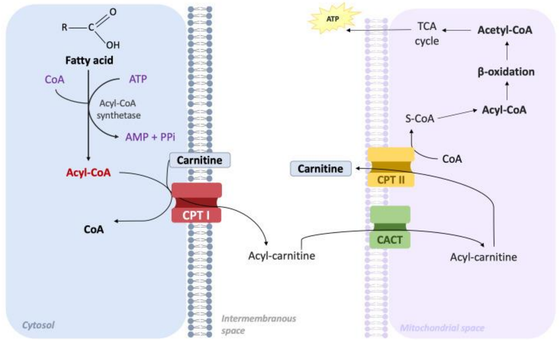
INTRODUCTION

Muscle weakness and rhabdomyolysis have a wide range of differential diagnosis. In many situations, they are induced by seizure, trauma, drugs, and toxins [1].

They could also be due to inflammatory or metabolic myopathies. Identifying the exact cause is crucial and sometimes challenging.
Metabolic myopathies are genetic disorders of glycogen, lipid, and mitochondrial metabolism that result in impaired energy production. The three main categories include fatty acid oxidation defects, glycogen storage diseases, and mitochondrial myopathies [2,3].
Carnitine palmitoyltransferase II (CPT II) deficiency is a long-chain fatty acid (LCFA) oxidation disorder. Carnitine palmitoyltransferase II (CPT II) deficiency is a relatively rare genetic disorder with approximately more than 300 cases reported [6].



Cellular pathway showing the carnitine and acylcarnitine transportation from the cytosol to the mitochondrial matrix [7].
CoA, coenzyme A; ATP, adenosine triphosphate; AMP, adenosine monophosphate; PPi, pyrophosphate; CPT, carnitine palmitoyltransferase; TCA, tricarboxylic acid; CACT, carnitine-acylcarnitine translocase

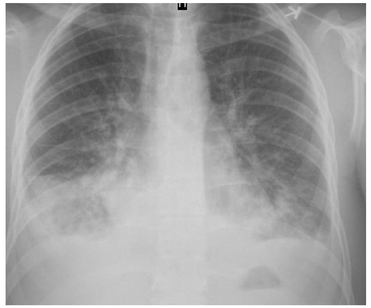
CASE PRESENTATION

A 23-year-old man was admitted to hospital with muscle weakness, fatigue, fever, dyspnea, and dark urine. Symptoms appeared after the first day of work at the factory. He had no history of seizure, trauma, or medication usage. Due to elevated serum creatine kinase, and serum creatinine, he was diagnosed with rhabdomyolysis and acute kidney injury. The emergency hemodialysis was started on 5th day. Electroneuromyography result were within the normal range. Muscle biopsy was not performed for inflammatory myopathies. Kidney biopsy showed mild tubulointerstitial nephritis. There was complete renal recovery after 2 weeks.

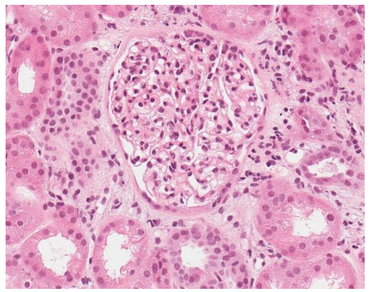
Recurrent episode of rhabdomyolysis due to mild exercise after few months was observed. Metabolic myopathy was suspected as a cause. Genetic screening for of specific genes whose changes are associated with genetic neuromuscular diseases was performed for the patient and he was diagnosed pathogenic changes in the CPT2 gene causing autosomal recessive and autosomal dominant myopathic stress-induced carnitine palmitoyltransferase II (CPT II) deficiency myopathic type.

TREATMENT

McArdle disease is typically induced by short duration and high intensity exercise, while CPT II deficiency is triggered by prolonged and mild exercise, fasting, cold, stress, infections, and anesthesia [1]. Other triggers: ibuprofen, diazepam and valproic acid [5]. A low - fat diet enriched with medium - chain triglycerides and carnitine, carnitine supplementation, and medium - chain fatty acid triheptanoin may be useful and should be considered in the prevention and treatment of adult-onset CPT II deficiency [4].



***Chest X-ray**: pleural effusion on the right; infiltration is possible in its background diff. with lung compression. Infiltration of the lower part of the left lung and some fluid in the pleural cavity on the left.*



***Kidney biopsy:** tubular epithelium in some places atrophied and flattened, with isolated cases of tubulitis. The stroma contains limited mononuclear infiltration, with isolated eosinophilic leukocytes, and foci of fibrosis. Inflammatory infiltration covers approximately 5% of the cortical area.*

	1 day	3 day	5 day	12 day	20 day
Creatinine µmol/l	128	424	546	200	106
Urea, mmol/l	14,4	16	23	9	8
CRP mg/l	6,4	23	23	19	3
Hgb g/l	166	122	122	121	133
ALT U/l		707	322	333	100
AST U/l		2133	485	934	55
CK U/l		84278	14974	29930	235
Urinalysis		PRO 0,1 g/l, BLD 250 ery/µl. Sediment microscopy negative		PRO 0 g/l, BLD 250 ery/µl. Sediment microscopy negative	PRO negative, BLD negative.

CONCLUSIONS

In patients with repetitive nontraumatic rhabdomyolysis, we should consider inherited myopathies, especially carnitine palmitoyltransferase II deficiency and glycogen storage disease type V (McArdle disease) as likely causes for adults. CPT II deficiency is regarded as a preventable cause of recurrent rhabdomyolysis. Therefore, by early diagnosis of this disorder we could prevent recurrent episodes of rhabdomyolysis and ultimately avoid life-threatening complications like acute kidney injury or congestive heart failure, hyperammonemia and multiple organ failure due to accumulation of long-chain fatty acids (LCFA) and acylcarnitines.

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