MITOCHONDRIAL ELECTRON TRANSPORT CHAIN COMPLEX II AND III DEFICIENCY MYOPATHY: CASE REPORT

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LABORATORY RESULTS

**MUSCLE HISTOCHEMISTRY:**
- Creatine Kinase: 17,035 U/mL on 05/03/2004 (0-225)
- ADPase (pH 4.3): 240 U/mL on 05/14/2004
- ADPase (pH 10.4): 188 U/mL on 06/01/2005
- NADH-tetrazolium reductase: 220 U/mL on 01/11/2006
- Alkaline phosphatase: 171 U/mL on 03/28/2007

**CASE REPORT:**
A previously active 23-year-old man presented with a history of a severe episode of exertional rhabdomyolysis and myoglobinuria, followed by chronic exercise intolerance and muscle pain. There was no known family history of muscle disease. He was asymptomatic at rest with a normal neuromuscular examination apart from some difficulty arising from a squatting position due to bilateral thigh pain. Resting creatine kinase levels were normal.

ELECTRODIAGNOSTIC TESTING:
- NADH-ferricyanide reductase
- NADH-cytochrome c reductase (rotenone sensitive)
- Succinate dehydrogenase
- Succinate-cytochrome c reductase (antimycin A sensitive)
- Succinate Q reductase (TFA-sensitive)
- Succinate Q reductase (TFA-sensitive) + dapsone (coenzyme Q10)
- Decylubiquinol-cytochrome c reductase (antimycin A sensitive)
- Cytochrome c oxidase
- Citrate synthase

**CONCLUSIONS:**
This case report further supports the observation that nonspecific exercise intolerance and muscle pain may be due to electron transport chain defects. In addition to careful clinical assessment and specialist neuromuscular evaluation, performing comprehensive muscle biochemical enzyme analyses, genetic testing, or both may be required to accurately diagnose mitochondrial myopathies, especially in the setting of nondiagnostic routine muscle histopathology.

**TOTAL AND FREE CARNITINE CONTENTS:**
- Total and free carnitine contents are normal.
- Serum carnitine Q10 levels are normal (0.9 mg/L; range 0.5-1.0 mg/L)

**TOTAL ENZYME ACTIVITY:**
- Coenzyme Q10, total carnitine, free carnitine, and acylcarnitine contents are normal.
- Carnitine palmitoyltransferase-I and –II activities are normal.
- Serum coenzyme Q10 levels are normal (0.9 mg/L; range 0.5-1.0 mg/L)

**ELECTRODIAGNOSTIC STUDY DATA**

**SERV. / SIDE** | Lat. | Amp. | V. | mV | Dur. | cm | ms | m/s | µV | ms | cm | ms |
---|---|---|---|---|---|---|---|---|---|---|---|---|
R. SURAL - Lat Med | | | | | | | | | | | | |
S. | | | | | | | | | | | | |
R. RADIAL - Ext Flex | | | | | | | | | | | | |
S. | | | | | | | | | | | | |
R. Forearm | | | | | | | | | | | | |
R. MEDIAN - AF-P | | | | | | | | | | | | |
S. | | | | | | | | | | | | |
R. COMMON PERONEAL - EDB | | | | | | | | | | | | |
S. | | | | | | | | | | | | |
R. ANKLE | | | | | | | | | | | | |
S. | | | | | | | | | | | | |
R. Tibialis Anterior | | | | | | | | | | | | |
S. | | | | | | | | | | | | |
R. VASTUS LATERALIS | | | | | | | | | | | | |
S. | | | | | | | | | | | | |
R. Iliopsoas | | | | | | | | | | | | |
S. | | | | | | | | | | | | |
R. Gluteus Medius | | | | | | | | | | | | |
S. | | | | | | | | | | | | |
R. First Dorsal Interosseous | | | | | | | | | | | | |
S. | | | | | | | | | | | | |
R. Flexor Carpi Radialis | | | | | | | | | | | | |
S. | | | | | | | | | | | | |
R. Deltoid | | | | | | | | | | | | |
S. | | | | | | | | | | | | |
R. Median | | | | | | | | | | | | |
S. | | | | | | | | | | | | |
R. Median - AF-P | | | | | | | | | | | | |
S. | | | | | | | | | | | | |
R. COMMON PERONEAL | | | | | | | | | | | | |
S. | | | | | | | | | | | | |

**TOTAL ENZYME ACTIVITY**

| Enzyme | ETC Complexe | Patient’s value (µmol/min/g net weight) | Patient’s value (µmol/min/g net weight) | Normal Range* (µmol/min/g net weight) | Control Mean ± SD (n=40)** | % Patient’s value/ Mean |
---|---|---|---|---|---|---|
NADH-ferricyanide reductase | I | 11.8 | 12.3 | 11.5-60.1 | 29.9 | + | 39.5, 41.1 |
NADH-cytochrome c reductase (rotenone sensitive) | I, III | -0.09 | -0.18 | -0.2-0.4 | 0.2-0.4 | + | -7.6, -15.4 |
Succinate dehydrogenase | II | 0.24 | N/A | 0.1-2.0 | 0.8 | + | 30.3 |
Succinate-cytochrome c reductase (antimycin A sensitive) | II, III | 0.31 | 0.33 | 0.4-4.9 | 2.1 | 1.2 | 14.6, 15.5 |
Succinate Q reductase (TFA-sensitive) | II | N/A | 0.52 | 0.5-1.5 | 0.9 | + | 15.5 |
Succinate Q reductase (TFA-sensitive) + dapsone (coenzyme Q10) | II | N/A | 0.31 | 0.3-0.2 | 0.4-2.1 | + | 15.5 |
Decylubiquinol-cytochrome c reductase (antimycin A sensitive) | III | 5.1 | 3.6 | 6.8-35.2 | 15.2 | ≥ 6.8 | 33.6, 23.7 |
Cytochrome c oxidase | IV | 84.7 | N/A | 57.3-373.0 | 148.9 | + | 43.4 |
Citrate synthase | 8.2 | 7.8 | 4.6-10.0 | 6.8 | + | 33.3, 38.2 |

Total and free carnitine and acylcarnitine contents are normal.
Short-, medium- and long-chain acyl-CoA dehydrogenase activities are normal.
Camitine palmitoyltransferase-I and –II activities are normal.
Serum carnitine Q10 levels are normal (0.9 mg/L; range 0.5-1.0 mg/L)

*Enzyme activities are expressed in µmol/min/g net weight. Numbers in bold indicate abnormal values. NADH: nicotinamide adenine dinucleotide, TTFA: thenoyl-trifluoroacetone.