Periodic paralysis and paramyotonia

Patients with muscle paralysis resulting from diseases associated with permanent electrolyte abnormalities[1] are seldom misdiagnosed. In contrast, patients with periodic paralysis may not have any interictal signs or symptoms[2] and are often thought to suffer from a conversion reaction, and this may cause them to suffer needlessly. The weakness spells occur episodically with varying intervals of normal muscle function. Dependent on the underlying mutation, chronic progressive muscle weakness can occur.

In the episodic forms, the underlying ion channel defects are usually well-compensated and an additional trigger is often required for channel, cell and tissue malfunction. Two dominant episodic types of weakness with or without myotonia[3] are distinguished by the serum potassium level during the attacks of tetraplegia[4] : hyper- and hypokalemic periodic paralysis.

Due to release of potassium from muscle in the hyperkalemic form and uptake of potassium by muscle in the hypokalemic form, the resulting low potassium can be so severe that cardiac complications arise. During an attack, death can also occur due to respiratory insufficiency. Independent of the severity and frequency of the paralytic episodes, many patients develop a chronic progressive myopathy in their forties, an age at which the attacks of weakness decrease.

Andersen-Tawil Syndrome (ATS) is a periodic paralysis with optional cardiac arrhythmia and also physical abnormalities typically affecting the head, face, and limbs. These features often include an unusually small lower jaw (micrognathia), low-set ears, and an abnormal curvature of the fingers called clinodactyly. Patients may experience a life-threatening ventricular arrhythmia independent of their periodic paralysis, and long QT syndrome is the primary cardiac manifestation. The paralytic attack may be hyper- normo- or hypokalemic.

Thyrotoxic periodic paralysis (TPP) resembles familial HypoPP with respect to changes in serum and urinary electrolytes during attacks and in its response to glucose, insulin, and rest after exertion. However, it differs from familial HypoPP in the adverse effect of thyroid administration and that the male to female ratio in Japanese is about 6:1.

Paramyotonia congenita (Eulenburg disease) is somewhere between myotonia and periodic paralysis. Cold-induced muscle stiffness increases with continued activity (paradoxical myotonia). In the cold (or even in a cool wind), the face may appear mask-like, and the eyes cannot be opened for several seconds or minutes. On intensive cooling, in most families the stiffness gives way to flaccid weakness or even to paralysis. Signs are present at birth and often remain unchanged throughout life.

Like sodium channel myotonia, also paramyotonia is caused by dominant sodium channel mutations. Particularly families with R1448 substitutions have episodes of periodic paralysis in addition. Such attacks occur spontaneously and can be triggered by rest or potassium.

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[1] Electrolytes are important because they are what cells (especially nerve, heart, muscle) use to maintain voltages across their cell membranes and to carry electrical impulses (nerve impulses, muscle contractions) across themselves and to other cells. Kidneys work to keep the electrolyte concentrations in blood constant despite changes in your body. For example, during heavy exercise, electrolytes are lost in sweat, particularly sodium and potassium. These electrolytes must be replaced to keep the electrolyte concentrations of the body fluids constant

[2] interictal [in″ter-ik´tal] occurring between attacks

[3] Myotonia is a symptom of a small handful of certain neuromuscular disorders characterized by the slow relaxation of the muscles after voluntary contraction or electrical stimulation. Generally, repeated effort is needed to relax the muscles, and the condition improves after the muscles have warmed up. However, prolonged, rigorous exercise may also trigger the condition. Individuals with the disorder may have trouble releasing their grip on objects or may have difficulty rising from a sitting position and a stiff, awkward gait.

[4] Tetraplegia paralysis of the arms, legs, and trunk of the body

They are of short duration (an hour or less) in comparison to the cold-induced weakness which usually lasts for several hours even when the muscles are immediately re-warmed after a short bout of exposure to cold. During a severe paralytic attack, the muscle stretch reflexes are diminished or absent. Under warm conditions, most patients have no complaints because impaired muscle relaxation improves at higher temperatures. Muscle atrophy or hypertrophy is not typical for the disease.