

# Anaesthesia in myopathies, metabolic, canalopathies and dystrophies

## *Anestesia para Distrofia, Canalopatia e Miopatia Metabólica*

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Metabolic Myopathies (MM) are a group of muscle disorders caused by biochemical defects of the skeletal muscle energy system, affecting both substrate utilization and final mitochondrial oxidation through the Krebs cycle and respiratory chain. The diagnosis of MM depends mainly on combined clinical, biochemical, histopathological and genetic investigations (1).

Disorders of fatty acid metabolism such as carnitine palmitoyltransferase II deficiency (CPTII) produce muscle symptoms after prolonged exercise; in contrast, defects of glycogen breakdown produce muscle symptoms after moderate exercise.

Mitochondrial disorders present a large spectrum of clinical syndromes associated with abnormalities of the common final pathway of the mitochondrial energy metabolism and in the oxidative phosphorylation (1).

In the MM it is important to avoid trigger anesthetic agents such as suxamethonium and halogenated gases. In normal circumstances, suxamethonium produces a very small but detectable shift of potassium that can become more evident in MM. Finally, also in healthy subjects, depolarizing relaxants have been known to cause cardiac dysrhythmias, hyperkalaemia, myalgia, myoglobinuria that are symptoms already present in MM individuals. Intravenous anesthetics (propofol, pentotal, opiates, non depolarizing relaxant, midazolam) must be titrated in function of the severity of the disease keeping in mind that unusual sensitivity to all drugs can occur in MM, as demonstrated by in vitro experiments where propofol and midazolam inhibit coupling between mitochondrial respiration and oxidative phosphorylation. Locoregional Anesthesia (LA), when spontaneous breathing can be maintained, or LA combined with soft GA, is the best choice to improve both postoperative recovery and analgesia.

Chloride and sodium channel myotonia are characterized by hyperexcitable membrane due to nonsense and missense mutations in the specific muscle chloride and sodium channels. Hypokalemic periodic paralysis (HypoPP) is usually caused by mutations in the L-type calcium channel and usually neither myotonia or electrical myotonia is present. In the HypoPP there is loss of function (no myotonia occurs) whereas in the HyperPP there is gain of function (myotonia occurs). Glucose and insulin that cause hypokalemia can trigger periodic paralysis. The remedy consists in the administration of potassium. In the patients with chloride and sodium channel myotonia, depolarizing muscle relaxants, mechanical stimuli, anticholinesterases and cold environment (shivering) should be avoided. LA can be used without electrical stimulations. In these patients, Malignant Hyperthermia crisis has been described only once, so that LA seems to be preferred, keeping in mind that surgical stress, sodium chloride infusion, LA and hypothermia can induce a paralytic attack in patients with HypoPP, by decreasing serum potassium. An ECG monitoring is needed to document a pre-existing QT prolongation.

In the Andersen syndrome, defined by the clinical triad with dyskalemic periodic paralysis, ventricular ectopy and, sometimes, minor dysmorphic features, succinylcholine, anticholinesterases, opioids and cold environment during anesthesia must be avoided, paying attention to potassium level and disturbance of ECG (2). LA with peripheral block and mild sedation could be the right and reasonable choice in case of surgical procedure.

The dystrophies (muscular dystrophies and myotonic dystrophies) are diseases associated by primary degeneration of muscle tissue and now genetically well characterized.

Patients affected with myotonic dystrophy, the most common inherited muscle disease in adults, present inability to relax skeletal muscle after stimulation. Its severity is more related to muscle atrophy and multiple organ involvement rather than to the abnormal contraction. Atrio-ventricular heart block and arrhythmias may suddenly complicate an apparently normal cardiovascular condition, during general anesthesia. Patients with muscular and myotonic dystrophies are at risk of developing malignant hyperthermia syndrome during general anesthesia using trigger agents. Indeed, depolarizing muscle relaxants can have a strong stimulating effect on the weak muscle, causing rupture of fibers, myoglobinuria and rising of serum CK. Recent molecular genetic findings are giving now further evidence that anaesthetics act by binding directly to sensitive proteins. It is intriguing that a single amino acid change in a receptor or channel may cause dramatic changes of the interaction between the drug and the receptor or the channel(4). Furthermore, halogenated gases on cardiac muscle

can enhance the arrhythmias by depression of cardiac function reducing amplitude and prolonging duration of the calcium transient.

Goals of anesthetic management is to preserve the homeostatic status, particularly in the patients with muscular dystrophies; experimental data and clinical experience suggest that when practicable, LA is both suitable and safer than general anesthesia. Of course, a monitoring during anesthesia and in postoperative recovery is imperative. The use of short-acting sedative to reduce anxiety must be careful.

### References

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