Introduction: Mitochondrial disorders are genetically and phenotypically heterogeneous, and involve defects of the electron transfer chain and respiratory chain. Affected patients are believed to be at an increased risk for metabolic dysfunction due to severe stress as well as to anesthetic drugs (1-3). We report a challenging case of mitochondrial disorder with multiple systemic problems including multi-hypertension and suspected von Willebrand disease.

Case Report: A 7-year-old, 25 kg male with mitochondrial disorder presented for biventricular replacement, ileostomy revision, and Mitrofanoff procedure, due to severe intestinal dysmotility and chronic obstructive nephropathy. Although the patient had received multiple anesthetics at our hospital, this was his first major anesthetic. His mitochondrial disorder was diagnosed at Boston Children's Hospital as defects of complexes I and IV, and is associated with dystonia, hypertension, seizures, recurrent renal calculi, and intestinal pseudo-obstruction. His surgical history includes placement of bilateral nephrostomy tubes, suprapubic catheter, Gtube, J-tube, and ileostomy. He is total parenteral nutrition-dependent, and has chronic pain from the catheter sites for which he has been using a fentanyl patch (25 mcg/hr), ketorolac, 15 mg intravenous (IV) daily, diazepam 1 mg IV q 6 hours as needed, and morphine 2 mg IV q 2 hours as needed. He is on several medications for multi-hypertension (ACTH, TSH, GH, ADH), hypoglycemia, seizure disorder, and hypertension.

The patient was admitted prior to surgery for medical optimization. Baseline laboratory tests were drawn, a blood transfusion received for a hematocrit of 20.2%, and vasopressin infusion initiated per endocrinology recommendations. Pre-operatively, a hydrocortisone bolus was given followed by continuous infusion (3.7 mcg/kg/hr). Von Willebrand factor (50 units/kg) was also administered prior to surgical incision. Intravenous propofol (40mg) was used for pre-medications due to a known paradoxical response to midazolam. The patient was induced with IV propofol (100mg) and vecuronium (0.1 mg/kg). Porcine protease was infused, then maintained with inhalational sevoflurane (15-22%) and IV infusions of dexmedetomidine (0.2-0.4 mcg/kg/min) and remifentanil (0.1-0.4 mcg/kg/min). Maintenance fluids were carefully titrated in addition to continuous total parenteral nutrition. IV and oral fluids were strictly measured and central venous blood gases were checked hourly. The vasopressin drip was continued at 0.0065 units/kg/hr, and adjusted by increments of 20% based on serial serum sodium values. The intraoperative course was uneventful and estimated blood loss was minimal. A supplemental neuroaxial block was deferred due to suspected von Willebrand disease; subcaneous and peritoneal catheters were surgically placed for continuous infusion of 0.25% bupivacaine for postoperative analgesia. IV acetylcarnitine (10 mg/kg) was given prior to an awake extubation on dexmedetomidine maintenance infusions postoperatively maintained (0.1 mg/kg/hr). Morphine was initiated to patient comfort in the intensive care unit.

Clinical Features of Mitochondrial Disease

- Neurological: Hypotonia, developmental delay, regression, weakness, ataxia, hypotonia, spasticity, strabismus
- Cardiovacular: Cardiomyopathy, conduction abnormalities
- Respiratory: Central hypoventilation, respiratory muscle weakness
- Ophtalmic: Optic atrophy, retinal dysplasia, colobomata
- Renal insufficiency
- Hepatic insufficiency
- Metabolic acidosis
- Endocrinology: Diabetes mellitus, hypoparathyroidism
- Hematological: Macrocytic anemia, neutropenia, thrombocytopenia

Discussion: Mitochondrial disease is a significant cause of a variety of neurologic, cardiac, muscle, and endocrine disorders. High-energy dependent organs such as the brain, heart, and skeletal muscle are particularly vulnerable to mitochondrial defects. Major perioperative complications for these patients include cardiac depression, respiratory failure, conduction defects, and hypoglycemia. For this reason, muscle relaxants and cardiac depressant drugs should be used cautiously. Furthermore, conditions of metabolic burden should be avoided, such as prolonged fasting, hypoglycemia, postoperative nausea and vomiting, hypothermia, acidosis, and hypoxemia (2, 4-6).

We avoided the use of extended propofol infusion to mitigate the risk of propofol infusion syndrome. We used a short-acting opioid, local anesthetic, and remifentanil infusions to allow for better anesthetic control given the patient's known dystonia and chronic pain, and to avoid the risk of perioperative cardiorespiratory depression. Total parenteral nutrition as a glucose substrate was continuously infused since metabolism of non-glucose substrates (e.g., fatty acids) can be impaired. Muscle relaxants were judiciously used given case reports of unpredictable responses to non-depolarizing agents and anticholinesterases (2, 4-6).

References: