orphanaesthesia

Anaesthesia recommendations for

Merosin-deficient congenital muscular dystrophy

Disease name: Merosin-deficient congenital muscular dystrophy

ICD 10: G71.0

Synonyms: Complete merosin deficient congenital muscular dystrophy, congenital muscular dystrophy with primary laminin 2 (merosin) deficiency, merosin negative congenital muscular dystrophy, LAMA-2 related muscular dystrophy (early and late onset LAMA-2 deficiency), congenital muscular dystrophy, type 1A, MDCA1A.

Disease summary: Congenital muscular dystrophies (CMDs) are rare, autosomal recessive genetic disorders that are clinically and genetically heterogeneous. All CMDs are characterized by progressive muscle weakness, delayed motor development, and dystrophic changes on muscle biopsy.
Merosin-deficient congenital muscular dystrophy (MD-CMD) is characterized by severe progressive muscle weakness that results in contractures, scoliosis, and restrictive pulmonary disease. MD-CMD is the most common and severe form, representing 40% of all CMDs. It is caused by a mutation in the laminin α2 gene (LAMA-2-on chromosome 6q22-23) resulting in absence of the laminin α2 chain (aka merosin) around muscle fibres. In addition to the clinical characteristics described above, patients with MD-CMD may present with elevated creatinine kinase (CK) diffuse white matter hyperintensities on brain MRI and seizures (in 30% of patients). Most of these patients have normal intelligence. Approximately one third of MD-CMD patients also have cardiac abnormalities including arrhythmias, and dilated cardiomyopathy. Anaesthesia for these patients is required for both diagnostic and surgical procedures. Typical diagnostic procedures include MRI, endoscopies and muscle biopsies. Typical surgical procedures include contracture release, spine fusion, tracheostomy, and gastrostomy.

The main anaesthetic concerns include:
1. Difficult airway – due to hypotonia, limited mouth opening from jaw contractures, maxillary discrepancy and macroglossia
2. Intra- and post-operative management of respiratory function, which is frequently compromised
3. Use of depolarizing relaxants – due to potential hyperkalemic cardiac arrest and rhabdomyolysis (controversy still exists around the use of halogenated agents; our preference is to avoid these agents)
4. Cardiovascular instability in patients with cardiac compromise
5. Hypoglycemia

Medicine is in progress

Perhaps new knowledge

Every patient is unique

Perhaps the diagnosis is wrong

Find more information on the disease, its centres of reference and patient organisations on Orphanet: www.orpha.net

Typical surgery

Tracheostomy, gastrostomy tube placement, orthopaedic procedures (i.e. posterior spinal fusion and tendon releases for treatment of muscle contractures), maxillofacial procedures and dental care.

Diagnostic procedures: Oesophagoscopy and muscle biopsy.

Type of anaesthesia

There is no absolute contraindication for either general anaesthesia or regional anaesthesia.

The main anaesthetic concern with general anaesthesia is the use of depolarizing relaxants due to potential hyperkalaemic cardiac arrest and rhabdomyolysis; controversy still exists around the use of halogenated agents. There are only three reports in the literature (six patients total) of anaesthetic management in patients with MD-CMD. Every report used non-triggering anaesthetics – mainly remifentanil and propofol infusions. One of these studies described a case of possible malignant hyperthermia (without triggering agents); however, the diagnosis of malignant hyperthermia in that case was questionable.

Our preference is to avoid triggering anaesthetics and instead to use a total intravenous anaesthesia (TIVA) technique.

There are no reports of using regional anaesthesia in patients with MD-CMD. If a regional technique is chosen, careful consideration should be used due to the presence of spine deformities and contractures. The use of ultrasound could be helpful in these situations but has not been reported to date.

Necessary additional pre-operative testing (beside standard care)

Pulmonary:

If possible, pulmonary function tests. If not possible, determine child's needs for: cough assist, non-invasive ventilation support (i.e. CPAP), and mechanical ventilation.

If there is a possibility that assisted ventilation will be necessary postoperatively, CPAP should be started preoperatively. Also, evaluate type and functioning of tracheostomy.

Cardiac:

Pre-operative EKG, echocardiogram and cardiology consultation should always be done. Particular attention should be paid to assessing conduction abnormalities such as right bundle branch block in the EKG. In the echocardiogram, look specifically for left ventricular dysfunction (left ventricular dysfunction present in 1/3 of MD-CMD patients), dilated cardio-myopathy and signs of pulmonary hypertension.

Particular preparation for airway management

Difficult airway should be expected due to poor control of the head and marked hypotonia of neck and trunk muscles. Other contributing factors include: limited mouth opening due to jaw contractures, as well as maxillary discrepancy and macroglossia.

Particular preparation for transfusion or administration of blood products

Preparation for typical blood loss that occurs in neuromuscular spine fusion cases.

Particular preparation for anticoagulation

Not reported.

Particular precautions for positioning, transportation and mobilisation

Patients with MD-CMD have multiple deformities of the limbs, joints and spine, including neck contractures, scoliosis, hip dislocation and subluxation. These require extreme precaution when transporting, mobilizing and positioning the patient. Extra-padding in pressure areas may be needed.

Interactions of chronic disease and anaesthesia medications

Not reported.

Anaesthetic procedure

Pre-anaesthetic evaluation:

> In addition to the cardiovascular and respiratory evaluation described above, assess neurologic involvement (type, frequency and treatment of seizures) and gastrointestinal function (swallowing difficulties and risk of aspiration).

Anaesthetic management:

- Prepare for difficult airway management (fibreoptic intubation is recommended).
- Tailor ventilatory support according to degree of respiratory compromise (most patients present with severe restrictive pulmonary disease). Anticipate needs for postoperative ventilatory support.
- Avoid use of depolarizing muscle relaxants due to potential hyperkalemic cardiac arrest and rhabdomyolysis. Use non-depolarizing muscle relaxants only if strictly necessary. Titrate non-depolarizing muscle relaxants and opiates carefully given baseline hypotonia.

- Controversy still exists around the use of halogenated agents. Our preference is to avoid these agents. However, exposure to halogenated agents might be necessary to place an intravenous catheter, in extremely challenging situations.

- Tailor anaesthetic management according to degree of cardiovascular compromise. Severe cardiovascular instability could be expected depending on type of surgical procedure and cardiac function.

Particular or additional monitoring

In addition to standard ASA monitors, monitoring of neuromuscular blockade is highly recommended given the degree of baseline hypotonia. For spine cases with severe scoliosis, consider transoesophageal echocardiogram (TEE) or central venous pressure (CVP) monitoring. Patients with MD-CMD are susceptible to cardiovascular instability due to poor left ventricular function and mechanical obstruction of the right ventricle in the prone position.

Possible complications

Possible anaesthetic complications include:

- Cardiac arrest from hyperkalemia and rhabdomyolysis (secondary to the use of depolarizing muscle relaxants).

- Postoperative respiratory insufficiency requiring prolonged mechanical intubation.

- There is not sufficient evidence to judge whether or not the risk of an MH-like reaction is increased, but given that MH-like reactions have occurred in myopathic patients in the absence of halogenated anaesthetics and in the absence of succinylcholine all equipment needed to identify and treat MH should be available.

- Hypoglycemia.

- Cardiovascular instability should be expected even in asymptomatic patients (reports in the literature describe that at least half of patients with cardiac abnormalities do not report any symptoms).

Post-operative care

It is important to anticipate the possibility of respiratory problems postoperatively. Extubation to non-invasive ventilation (i.e CPAP) should be considered, but one must always prepare for the possibility of respiratory failure and ICU admission. The degree of preoperative pulmonary and cardiac involvement will often dictate what type of postoperative care is necessary. Other contributing factors may include the patient's nutritional status and degree of scoliosis.

Disease-related acute problems and effect on anaesthesia and recovery

There are no common emergency-like situations associated with this disease. However, one must be vigilant for signs of malignant hyperthermia given the possibility of its occurrence with or without triggering agents.

Ambulatory anaesthesia

Ambulatory anaesthesia is not recommended due to cardiovascular and respiratory compromise.

Obstetrical anaesthesia

There are no reports of obstetrical anaesthesia care for these patients (probably due to the short lifespan secondary to disease complications).

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