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Anaesthesia recommendations for

Hunter syndrome

Disease name: Hunter syndrome

ICD 10: E76.1

Synonyms: Mucopolysaccharidosis type II; MPS2; Iduronate-2-sulfatase deficiency; IDS deficiency; sulfo-iduronate sulfatase deficiency; SIDS deficiency

Disease summary: Hunter syndrome is an X-linked recessive disease caused by deficiency of the lysosomal enzyme iduronate-2-sulfatase, leading to progressive accumulation of glycosaminoglycans in nearly all cell types, tissues, and organs. The estimated prevalence is 1 in 140,000 – 156,000 live births in Europe. The disease affects males almost exclusively, although female patients have been identified.

Clinical manifestations include: facial dysmorphism; hepatosplenomegaly; progressive airway obstruction; cardiac disease; hearing loss; loss of vision and musculoskeletal deformities. Initial signs and symptoms emerge between the ages of 18 months and 4 years, depending on disease severity. Severely affected patients also suffer from progressive cognitive dysfunction and behavioural disturbances, and have a life expectancy of less than 2 decades. Patients with an attenuated form or treated with enzyme replacement therapy may survive to the fifth or sixth decade. The most common cause of death is respiratory failure.

Enzyme replacement therapy by idursulfase improves functional capacity, liver and spleen volumes. There is no available evidence on outcomes such as improvement of growth, sleep apnoea, cardiac function, quality of life and mortality. Unfortunately, intravenously administered idursulfase does not cross the blood-brain barrier and does not alleviate neurological symptoms. Intrathecal idursulfase for the treatment of cognitive impairment is currently investigated. Hematopoietic Stem Cell Transplantation seems to be more effective than ERT and could be considered as a treatment option.

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

Prevalence in descending order: Tympanostomy, hernia repair, (adeno-)tonsillectomy, carpal tunnel release, dental procedures, intracranial shunt insertion/revision, tracheotomy, trigger-finger release, spine decompression, feeding tube insertion, valve replacement/repair, spine fusion. Combining minor surgical procedures and various diagnostic procedures requiring anaesthesia may be appropriate. The majority of patients undergo at least one operation before diagnosis of MPS2.

Type of anaesthesia

General anaesthesia should be undertaken with great care. General anaesthesia is a difficult and potentially high-risk procedure in MPS2 patients, due to the airway management difficulties. Anaesthesia becomes progressively more difficult with age. Consider local or regional anaesthesia where possible. Procedural sedation using dexmedetomidine may offer advantages for preserving the native airway compared to propofol sedation in paediatric patients with MPS2.

Necessary additional pre-operative testing (beside standard care)

Review by (paediatric) ENT specialist for each new diagnosis, including examination of upper airway and sleep study. Airway manifestations may include: adenotonsillar hypertrophy, macroglossia, upper airway obstruction, obstructive sleep apnoea (OSA), narrowing of the tracheal lumen and tracheobronchomalacia.

Spirometer, if the patient is fully cooperative and when there is a history of frequent respiratory infections and/or kyphoscoliosis or as mains to evaluate pulmonary involvement. Restrictive lung disease is caused by kyphoscoliosis and altered chest wall dynamics is the most frequent finding in pulmonary function testing in patients with the attenuated form of MPS2; followed by obstructive lung disease, caused by glycosaminoglycan deposits in soft tissue of upper and lower respiratory tract. Standard reference values may not apply to MPS2 patients due to skeletal dysplasia and extremely short stature; intra individual change obtained by an experienced physician who knows the patient, is mostly the best way to judge the diagnostic findings in this progressive disease.

Review by (paediatric) cardiologist for each new diagnosis, including physical examination, electrocardiogram, chest X-ray and echocardiogram. Holter monitoring, if arrhythmia or irregular heartbeat is suspected. Cardiovascular involvement may consist of valvular abnormalities, left ventricular hypertrophy, hypertension, increased carotid intima media thickness and arterial stiffness.

Neurological examination (assessment of hyperreflexia), a flexion/extension X-ray of the spine can be recommended before the procedure to assess the risk of spinal cord compression.

Review by (paediatric) anaesthesiologist for each new diagnosis, after receiving a full report of previous investigations and course of previous anaesthetics. The emphasis should lie on the evaluation of the airway. Quantitative assessment of the airway severity using a multidimensional score, such as the Salford MPS Airway Score, may help to predict difficult airway management.

A multidisciplinary meeting is warranted, to assess the risk benefit ratio of any planned procedure.

The anaesthetic plan and the potential risks of a procedure should be discussed with the patient/parents; discuss the possibility of abandoning the procedure due to anaesthetic difficulty.

Particular preparation for airway management

Basic preparation for difficult airway management includes: Informing the patient/parents; availability of equipment and experienced personnel for management of a difficult airway; assigning an individual to provide assistance when a difficult airway is encountered; pre-anaesthetic pre-oxygenation by facemask and administration of supplemental oxygen throughout the process of difficult airway management.

Plan and discuss the strategy with the experienced team including the consideration of various interventions designed to facilitate ventilation/intubation should a difficult airway occur; make a plan and a backup plan.

Awake fibre-optic intubation should be considered, but may not be feasible due to patient age and/or impaired neurodevelopment.

Retaining an unobstructed airway by facemask ventilation can be difficult, an oral- or nasopharyngeal airway, applying chin lift of jaw thrust or increasing positive pressure may be helpful. Patients with potentially unstable necks require induction of anaesthesia with minimal or no neck movement using manual in-line stabilisation in order to prevent spinal cord damage.

The literature is insufficient to evaluate the harm or benefit of maintenance versus ablation of spontaneous ventilation, administration of neuromuscular blockade to improve mask ventilation, or rocuronium with sugammadex versus suxamethonium or succinylcholine for airway management of anticipated difficult airway patients.

Direct laryngoscopy is associated with higher risk for airway problems than indirect techniques such as fibre-optic intubation through a supraglottic airway device or intubation using a videolaryngoscope.

Tracheotomy, to safeguard an anticipated difficult airway prior to a planned surgical procedure, or to treat progressive upper airway obstruction, has been used successfully. An emergency tracheostomy is an extremely difficult procedure in these patients and may not be feasible if the airway cannot be managed.

Endotracheal extubation should only be undertaken after full reversal of the neuromuscular blockade and if the patient is fully awake, coughing efficiently and breathing adequately. Consider intraoperative steroids (dexamethasone) to help reduce postoperative oral mucosal and tongue swelling. Extubation should be performed in an area where all the necessary personnel and equipment for (re-)intubation is available immediately.

Particular preparation for transfusion or administration of blood products

Stem cell transplantation candidates require special blood components, such as leukocyte-reduced cellular, cytomegalovirus seronegative, and/or gamma-irradiated components.

Transplantation patients may require a large number of transfused blood products, as a result of pancytopenia and organ and tissue damage sustained during the procedure. After successful stem cell transplantation, blood type changes to the blood type of the donor.

Particular preparation for anticoagulation

No reports.

Particular precautions for positioning, transportation and mobilisation

Restricted joint range motion in elbow, shoulder, hip, knee and ankle. Extension is the most severely affected movement, with exception of the shoulder. Instability of the atlanto-axial joint and spinal cord compression at the cervicocranial and thoracolumbar region due to spinal canal narrowing has been reported. Consider awake positioning prior to anaesthesia to find out appropriate position and adequate materials.

Interactions of chronic disease and anaesthesia medications

No reports on interaction between anaesthetic agents and idursulfase.

Anaesthetic procedure

Patients with MPS2 should only undergo anaesthesia/surgery in centres experienced with the perioperative management of individuals with this disease.

General anaesthesia should be undertaken with great care; consider local or (ultrasound-guided) regional anaesthesia where possible.

Carefully planning of the procedure; make sure personnel experienced with the perioperative management of MPS2 patients are available, including an experienced ENT surgeon. Combining minor surgical procedures and various diagnostic procedures requiring anaesthesia may be appropriate.

Provide anaesthesia in MPS2 patients in a fully equipped operating room, with a difficult airway trolley at hand. Consider induction of anaesthesia in the operating room before transporting the MPS2 patient to the MRI/CT scan suite. Intensive care back up.

Patients with MPS2 may be sensitive to opioids and may require a lower dose of opioids, particularly if OSA is present.

Particular or additional monitoring

Monitoring of the neuromuscular blockade is recommended if any neuromuscular blocking agent is used.

Neurophysiological using somatosensory or motor evoked potentials (SSEPs of MEPs) if the spinal cord is compromised by position or surgical procedure.

Possible complications

Inability to ventilate or intubate the patient.

Complete airway obstruction.

Cardiocirculatory events.

Delayed awakening and/or return of spontaneous ventilation due to an increased sensitivity to opioids.

Failure to maintain airway after extubation, stridor, upper or lower airway collapse.

Post-obstructive (negative pressure) pulmonary oedema.

Need for urgent reintubation or tracheostomy.

Upper spinal cord injury.

Post-operative care

Degree of postoperative monitoring depends on surgical procedure and preoperative condition of the patient. Intensive care is not mandatory, but intensive care facilities should be one site.

Continued monitoring of the airway to detect airway obstruction episodes and desaturation.

In case of (postoperative) respiratory failure consider applying CPAP (Continuous Positive Airway Pressure).

Disease-related acute problems and effect on anaesthesia and recovery

Acute airway compromise and respiratory failure can be caused by the illness and as a side effect of the anaesthetic procedure.

Ambulatory anaesthesia

Ambulatory anaesthesia *if at all* should only be done in MPS2 patients with no-obstructive airway or cardiovascular disease and low-risk surgery.

Obstetrical anaesthesia

There is one report of a woman with the attenuated form of MPS2, short stature, coarse facial features, mild retardation, no hepatosplenomegaly, no enlarged tongue, unremarkable echocardiography, who completed a pregnancy successfully and gave birth to a female baby carrying the same mutation. There are no reports on obstetrical anaesthesia.

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Editorial review 2022

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