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Anaesthesia recommendations for patients suffering from

Myotonic dystrophies type 1 and 2

Disease name: Myotonic dystrophies type 1 and 2

ICD 10: G71.1

Synonyms: Curshmann-Batten-Steinert disease, proximal myotonic myopathy (PROMM)

Myotonic dystrophy type 1 (DM1) and 2 (DM2) are autosomal dominant inherited neuromuscular diseases with an estimated incidence of 1 in 120,000 in Europe. The genetic cause of DM1 is a CTG repeat expansion in the DMPK (dystrophia myotonia protein kinase) gene on chromosome19q13. Transcription of these repeats results in CUG expansion and accumulates in ribonuclear inclusions in the nucleus, finally resulting in altered splicing of multiple genes such as those encoding for the chloride channel CIC1, the insulin receptor, the cardiac troponin and the NR1 subunit of the N-methyl-D-aspartate receptor.

Primary manifestation and clinical progress depend on the amount of CTG repeats: there are usually no clinical signs in individuals with only 50-100 repeats of CTG, but there is a correlation between repeat size and age of onset of DM1 when the number of repeats is < 400. Clinically DM 1 is characterised by muscle wasting primarily of the distal, axial, facial, pharyngeal and respiratory muscles, accompanied by cataracts, cardiac conduction blockade and arrhythmia, cardiomyopathy, diabetes, dysthyroidism and drowsiness. The risk of general anaesthesia includes cardiac rhythm disturbances and increased risk of sudden cardiac arrest, even with implanted pacemakers or cardioconverters. Anaesthesia should be conducted only in cases of emergency or following multidisciplinary risk assessment. Retrospective data estimated a complication rate of about 8.2% in these patients which were mainly due to respiratory complications (atelectasis, pneumonia, acute ventilatory failure).

DM 2 is caused by untranslated CCTG repeat expansions in the ZNF9 (zinc finger protein 9) gene on chromosome 3q21 and is transmitted by autosomal dominance. Primary clinical manifestations are frequently present at the age of 40-50. Clinical characteristics are proximal limb weakness, myotonic stiffness and myalgias. Typical cardiac dysfunction include conduction abnormalities. Cardiomyopathy and sudden cardiac arrest are also observed in DM 2 but with lower incidence compared to DM 1.

Medicine in progress

Perhaps new knowledge

Every patient is unique

Perhaps the diagnostic is wrong

Typical surgery

Pacemaker implantation, cataract, muscle biopsy, orthopaedic surgery, abdominal surgery notably cholecystectomy.

Type of anaesthesia

Regional anaesthesia including neuroaxial techniques (caudal, epidural and spinal) were frequently used and reported to be save. Addition of opioids or tranquillizers with respiratory side effects should be used cautiously. Moreover, shivering induced by the epidural injection of local anaesthetics may induce myotonic contractures.

General anaesthesia should only be conducted in case of emergency or after careful evaluation of indication in an interdisciplinary team. Intravenous hypnotic agents such as propofol, combined with short-acting opioids (e.g. remifentanil) have been used safely in DM patients.

In early stages of the disease, sedation can be used safely. Patients with advanced stages of disease (cardiopulmonary involvement, proximal muscle weakness), sedation should only performed after careful evaluation of the patient`s individual risk especially for respiratory failure and aspiration.

Necessary additional diagnostic procedures (preoperative)

Assessment of muscular impairment preferably using a muscular impairment rating scale: 1. no impairment, 2. minimal signs, 3. distal weakness, 4. proximal weakness, 5. severe proximal weakness.

Evaluation of pre-operative respiratory status.

Polysomnography or sleep oximetry may be helpful to reveal common pre-existing sleep and/or central apnea. Lung function test including lung volumes is recommended. Blood gas analysis should only be performed in case of pulmonary complication or severe form of the disease. Non-invasive mechanical ventilation (NIV) should be available for the postoperative phase. Postoperative admission to an intensive care unit should be organized in advance.

Cardiac function including electrocardiography and echocardiography is essential. Some authors propose the prophylactic application of a pacemaker in DM1 as soon as major infranodal conduction delay (PR intervall > 200ms and/or ORS duration > 100ms) is observed.

Laboratory examination should include evaluation of blood glucose levels and thyroid function.

Elevated GGT (gamma glutamyltransferase) and creatin kinase levels are frequently found in DM patients. Pre-operative baseline determination may be helpful to assess the severity of postoperative changes .

Particular preparation for airway management

No data are currently available reporting the incidence of airway problems in DM patients. The main issue is to avoid inducing myotonia (stiffness) of the facial muscles resulting in difficult or impossible ventilation and/or intubation: succinylcholine, but also other potential triggering agents including pain, hypothermia or shivering should be avoided. In patients with advanced disease pronounced weakness of the oropharyngeal muscles is frequently associated with swallowing difficulties and risk for aspiration during induction but also for a prolonged period of time during recovery.

Particular preparation for transfusion or administration of blood products

None.

Particular preparation for anticoagulation

There is no evidence to support the need of particular anticoagulation. But the impaired mobility of advanced stages suggests a higher risk for postoperative thrombosis.

Particular precautions for positioning, transport or mobilisation

In DM 1 wasting of sternocleidomastoid, distal and axial muscles and the diaphragm are common, but the proximal muscles are usually preserved. Especially patients in advanced stages frequently need toby collars to stabilize posture of the head. Roughly under 10% of elder DM 2 patients are wheel-chair bound, due to the involvement of proximal limb muscles.

Probable interaction between anaesthetic agents and patient's long-term medication

No direct interaction reported. Some patients are on mexiletine therapy, a Na-channel blocker: this should be continued up to the day of anaesthesia. If the patient is equipped with a pacemaker or an internal defibrillator, it should be stopped before surgery, and the usual precautions with these apparatus should be taken: for example using a bipolar cautery, placing defibrillation paddles on the thorax. A pre-operative ECG check to exclude mexiletine induced new cardiac block pictures is highly recommended.

Corticosteroids, insulin like growth factor and dehydro-epiandrosterone therapy should be continued.

Class I anti-arrhythmic agents are formally contraindicated: interactions with mexiletine are not predictable and might result in pronounced cardiac block pictures.

Medications which induce bradycardia like amiodarone and beta-blockers must be used with extreme caution.

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Anaesthesiologic procedure

Due to prolonged gastric emptying time and reduced bulbar reflexes, a modified rapid sequence induction without the use of succinylcholine is recommended. Administration of sodium citrate, H2-antagonists or proton pump inhibitors prior induction should be considered.

Due to potential increased pharmaco-sensitivity in patients with DM1, hypnotics and opioids should be carefully dosed by titration. Hypnotic agents with a short half-time (e.g. propofol) are recommended. Volatile anaesthetics can be used safely; their side effects on skeletal muscle such as muscle relaxation need to be considered. No experience has been published so far with clonidine or dexmedetomidine.

Care should also be taken when using etomidate: Its injection can produce pain and myoclonic movements: and both side-effects could induce myotonia.

Because of the risk to induce hyperkalemia and fasciculations depolarizing muscle relaxants (succinylcholine) are strictly contraindicated. Dose depended muscle rigidity resulting in intubation and ventilation difficulties were reported in DM patients after succinylcholine administration. Muscle relaxation should be avoided as far as possible, especially in the presence of muscle wasting. If necessary, sparsely dosed non-depolarizing short acting relaxants are the best option, but a risk prolonged duration of action has to be considered. While sugammadex was used uneventful to reverse muscular blockade produced by rocuronium or vecuronium, the use of anticholinesterases can cause severe muscular weakness.

DM patients have a reduced Na/K pump capacity and may be prone to the development of hyperkalemia. The potassium content of the used intravenous solutions needs to be considered.

Due to the high sensitivity of DM patients to respiratory depressant effects, the administration of opioids can result in profound respiratory depression and fatal outcomes in the postoperative period. Moreover, opioids can exacerbate the gastroparesis, which is common in DM patients. Finally, wound infiltration or regional anaesthesia, NSAIDs and acetaminophen should be preferred for postoperative pain control. Opioids should only be administered in a monitored environment and by medical staff, experienced in treatment of DM1 and 2.

Particular or additional monitoring

Monitor body temperature and use warming devices because of increased risk of myotonic crisis induced by hypothermia or shivering.

Monitoring of the neuromuscular blockade is highly recommended if any muscle relaxant is used. CAVE: The electrical stimulus could induce a myotonia and be misinterpreted as sustained tetanos indicative of full reversal. Recovery can be prolonged in case of muscle wasting.

Although no experience with its use in DM patients has been published so far, using a continuous EEG processing system such as BIS®, Entropy® or Neurosense® could be useful to evaluate the hypnotic component of general anaesthesia: care should be taken to measure baseline values in the awake patients before inducing anaesthesia.

Strongly consider attaching an external pacer/defibrillator to the DM patient, due to their high risk of sudden cardiac arrest and common conduction abnormalities.

Depending on stage of disease and kind of surgery, advanced monitoring like arterial cannulation and central venous line is recommended. Monitoring like TEE or PA catheters should be considered in case of cardiomyopathy.

Possible complications

Patients with DM are at high risk for sudden cardiac arrest and conduction abnormalities.

DM patients are at high risk for respiratory failure.

DM patients are at high risk for aspiration.

Succinylcholine is contraindicated due to the risk of hyperkalaemic cardiac arrest and the induction of myotonic crisis with inability to ventilate or intubate.

Non depolarizing muscle relaxants can show a prolonged duration of action.

Neostigmine can cause severe muscle weakness.

Patients with DM are highly sensitive to all hypnotics, opioids and sedative drugs.

Postoperative care

Slow awakening should be foreseen and awake extubation should be the rule because bulbar reflexes are weak.

The degree of postoperative monitoring depends on the surgical procedure and the preoperative condition of the patient.

In advanced disease stages, at least 24h monitoring is recommend. Delayed onset apnoea is most likely to develop in the first 24 hours postoperatively.

Avoid prolonged immobilization.

If postoperative ventilation is necessary, quick weaning should be focused by using for example pressure-support ventilation followed by non-invasive ventilation: avoid prolonged ventilation.

Information about emergency-like situations / Differential diagnostics

In case of intraoperative myotonia caused by surgical stimulation or electrocautery, there is no help giving more muscle relaxant because the phenomenon occurs past the neuromuscular junction.

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Ambulatory anaesthesia

As a general rule, DM patients require admission to a monitored unit postoperatively. In cases of minor surgery and in only mildly affected patients, day surgery may be possible after careful evaluation of risks and prolonged observation in the PACU.

Obstetrical anaesthesia

Regional anaesthesia is recommended.

The choice of a tocolytic medication is problematical: ß2-sympathomimetics have been reported to precipitate myotonia, and MgSO4 can cause respiratory depression.

An increased risk of dystocia, uterine atony, and postpartal haemorrhage have been described.

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