

## Anaesthesia recommendations for Infantile neuroaxonal dystrophy

**Disease name:** Infantile neuroaxonal dystrophy

**ICD 10:** G23.0

**Synonyms:** INAD, NBIA2, Phospholipase A2-associated neurodegeneration (PLAN), Seitelberger Disease, Neurodegeneration with brain iron accumulation A

**Disease summary:** Infantile neuroaxonal dystrophy (INAD) is a neurodegenerative disorder associated with a mutation in the PLA2G6 gene. It is the second most common type of neurodegeneration with brain iron accumulation (NBIA) mainly in the globus pallidus, caudate nucleus and substantia nigra after pantothenate kinase-associated neurodegeneration (PKAN, formerly Hallervorden-Spatz disease). INAD is inherited in an autosomal recessive fashion. PLA2G6 encodes a calcium-independent phospholipase and has been associated with infantile neuroaxonal dystrophy (INAD), atypical neuroaxonal dystrophy (NAD) and dystonia-parkinsonism. PLA2G6 is expressed in and is protective of mitochondrial health. It is also important for membrane homeostasis and calcium signalling. INAD is characterized histologically by axonal spheroid bodies. Phenotypically, INAD is characterized by psychomotor regression with early onset between six months and three years of age. Hypotonia occurs early with severe weakness that may be replaced by spasticity. Many INAD patients also experience progressive dementia. Death usually occurs before the age of 10 years due to respiratory complications. Patients may present for gastrostomy tube and tracheostomy placement due to bulbar dysfunction and some may require surgical correction of scoliosis to improve respiratory status. The main anaesthetic concern for INAD patients is their poor preoperative respiratory status due to poor airway clearance and respiratory mechanics that often make postoperative intubation necessary.

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Perhaps new knowledge

Every patient is unique

Perhaps the diagnosis is wrong

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Find more information on the disease, its centres of reference and patient organisations on Orphanet: [www.orpha.net](http://www.orpha.net)

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### **Typical surgery**

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Gastrostomy, tracheostomy, scoliosis repair. Additional reported procedures include oral rehabilitation, deep brain stimulation, debridements and pallidotomy.

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### **Type of anaesthesia**

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INAD patients can safely undergo general anaesthesia. Although many patients are not cooperative, preoperative sedation should be approached cautiously, if at all, because of limited respiratory reserves and increased susceptibility to respiratory depression.

Unlike patients with muscular dystrophy, these patients can safely receive inhaled anaesthetic agents without risk of rhabdomyolysis. Most INAD patients are immobilized and succinylcholine should be avoided due to the risk of hyperkalaemia and cardiac arrest.

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### **Necessary additional pre-operative testing (beside standard care)**

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Patients with INAD have progressive weakness that can lead to cardiopulmonary compromise.

Preoperative electrocardiogram and echocardiogram should be obtained as patients with advanced disease may develop pulmonary hypertension and cardiac dysfunction.

The pulmonary status can be assessed with a chest radiograph and arterial blood gas analysis. A pulmonary function test may be helpful if the patient can cooperate.

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### **Particular preparation for airway management**

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Patients may be difficult to intubate due to joint changes or muscle contractures that can limit the cervical spine mobility and mouth opening even with muscle relaxation. Trismus and torticollis have been reported in patients with PKAN and spinal muscular atrophy (SMA) although muscular relaxation has been reported with the induction of anaesthesia as well as the administration of dexmedetomidine in PKAN.

Patients are at increased risk of aspiration due to bulbar dysfunction. Some patients may already have a tracheostomy in place at the time of surgery.

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### **Particular preparation for transfusion or administration of blood products**

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Patients may require blood transfusions with more invasive procedures. Patients with neuromuscular scoliosis presenting for scoliosis repair have been shown to have higher blood loss compared to patients with idiopathic scoliosis.

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### **Particular preparation for anticoagulation**

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Not reported.

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### **Particular precautions for positioning, transportation and mobilisation**

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Patients with advanced disease may develop spastic tetraplegia and optic atrophy. Extra care should be taken during positioning of the patient for surgery.

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### **Interactions of chronic disease and anaesthesia medications**

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Not reported. Patients may be on medications to treat spasticity and seizures. Patients treated with dopaminergic blockers such as phenothiazines, butyrophenones and metoclopramide may experience exacerbation of their movement disorders. Patients taking anticonvulsants may have alterations in their biotransformation of medications used during anaesthesia.

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### **Anaesthetic procedure**

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Avoid succinylcholine due to the risk of hyperkalaemic cardiac arrest. Inhaled anaesthetics, propofol and opiates may be safely used. Rapid sequence induction with non-depolarizing neuromuscular blocking agents can be considered, remembering that a priming dose or a larger dose of relaxant will enhance the onset of neuromuscular blockade, but may result in residual blockade and a prolonged duration of effect.

Patients may be more sensitive to non-depolarizing neuromuscular blocking agents. Consider intubation without neuromuscular blockade, given that patients often have profound weakness.

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### **Particular or additional monitoring**

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If a neuromuscular blocking agent is used, baseline values should be obtained with a peripheral nerve stimulator prior to administration.

Patients undergoing high risk surgery or those with moderate-severe cardiorespiratory dysfunction would benefit from placement of an arterial catheter for close haemodynamic monitoring and frequent arterial blood gas analysis. Clinically acceptable normothermia should be ensured.

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### **Possible complications**

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Patients may have a hyperkalaemic cardiac arrest after administration of succinylcholine.

Many patients have pre-existing respiratory dysfunction and may require postoperative intubation.

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### **Post-operative care**

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Patients should be closely monitored postoperatively; this will typically require an intensive care unit admission in many, if not most, circumstances. Many patients will require post-operative intubation and mechanical ventilatory support. Even if patients are extubated in the operating room, they have a high risk of respiratory failure following extubation. If patients require postoperative mechanical support, they may be extubated to a non-invasive ventilation modality (e.g., bi-level positive airway pressure, BIPAP). Non-invasive positive pressure ventilation can help prevent hypoventilation and atelectasis and decrease the work of breathing while chest physiotherapy can improve secretion clearance.

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### **Disease-related acute problems and effect on anaesthesia and recovery**

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Patients may have severe weakness which may be confused with residual neuromuscular blockade if a non-depolarizing neuromuscular blocking agent has been administered.

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### **Ambulatory anaesthesia**

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INAD patients are not candidates for ambulatory surgery due to disease severity.

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### **Obstetrical anaesthesia**

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Patients have an extremely short life expectancy (less than 10 years of age) and are unlikely to reach childbearing age.

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*Please note that this recommendation has not been reviewed by an anaesthesiologist and a disease expert but by two  
anaesthesiologists instead.*

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