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# Parkinson's Disease & Anaesthesia

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## Introduction

Parkinson's disease (PD, also known as idiopathic or primary Parkinsonism, is a degenerative disorder of the central nervous system mainly affecting the motor system. The motor symptoms of Parkinson's disease result from the death of dopamine-generating cells in the substantia nigra, a region of the midbrain.

The cause of this cell death is poorly understood. Early in the course of the disease, the most obvious symptoms are movement-related; these include shaking, rigidity, slowness of movement and difficulty with walking and gait. Later, thinking and behavioral problems may arise, with dementia commonly occurring in the advanced stages of the disease, whereas depression is the most common psychiatric symptom. Other symptoms include sensory, sleep and emotional problems. Parkinson's disease is more common in older people, with most cases occurring after the age of 50; when it is seen in young adults, it is called young onset PD (YOPD).

The main motor symptoms are collectively called Parkinsonism, or a "parkinsonian syndrome". The disease can be either primary or secondary. Primary Parkinson's disease is referred to as idiopathic (having no known cause), although some atypical cases have a genetic origin, while secondary Parkinsonism is due to known causes like toxins. Many risks and protective factors have been investigated: the clearest evidence is for an increased risk of PD in people exposed to certain pesticides and a reduced risk in tobacco smokers.

The pathology of the disease is characterized by the accumulation of a protein into Lewy bodies in neurons, and from insufficient formation and activity of dopamine in certain parts of the midbrain. Where the Lewy bodies are located is often related to the expression and degree of the symptoms of an individual. Diagnosis of typical cases is mainly based on symptoms, with tests such as neuroimaging being used for confirmation.

## Aetiology

The aetiology of Parkinson's disease is idiopathic, but the aetiology of Parkinsonism (clinical conditions which resemble idiopathic Parkinson's disease) can be:-

- Idiopathic
- Drugs - drugs which block dopamine receptors (eg phenothiazines, butyrophenones, metoclopramide) can cause Parkinsonism. Drugs affecting dopamine synthesis, storage or release (eg reserpine) can also produce the same effect.
- Infarction- post encephalitis, AIDS
- Vascular- arteriosclerosis, multi- infarct disease
- Tumour
- Post trauma eg repeated head injury
- Toxicity eg Wilson's disease, heavy metals, carbon monoxide poisoning
- Metabolic eg hypoparathyroidism, Wilson's disease.

## Clinical features

PD is a multi- system disorder:-

Motor and sensory	Resting tremor, lead pipe rigidity Slowness of movement Expressionless face Soft monotonous voice Festinant gait Loss of arm swing on walking Restless legs syndrome
Cardiovascular system	Orthostatic hypotension
Respiratory system	Restrictive ventilatory defect Aspiration Sleep apnoea Respiratory dyskinesia
Gastro-intestinal	Sialorrhoea and drooling Constipation Nausea (due to anti parkinsonian medication) Neurological dysphagia
Genito- urinary	Bladder disturbance Sexual dysfunction
Musculoskeletal	Muscle aches and cramps Flexion deformity of neck
Neuropsychiatric	Depression Anxiety Dementia Sleep disturbance
Dermatological	Disordered sweating and oily skin Pressure sores

## Management

There are many drugs available, but the choice of treatment depends on the stage of the disease, side effects of treatment, and patient compliance.

**Dopamine precursors** (eg levodopa) are converted to dopamine in CNS. Given with a peripherally acting dopa decarboxylase inhibitor (DDI) to reduce systemic breakdown. *Anaesthetic cautions-* orthostatic hypotension, dyskinesia, NMS (neuroleptic malignancy syndrome). If the patient is not on a DDI, the high dopamine levels can predispose to arrhythmias under general anaesthesia.

**Dopamine agonists** (eg ropinirole, apomorphine) act by mimicking the action of dopamine at the dopamine receptor.

**Mono-amine oxidase Type B inhibitors (MAO-I)** eg selegiline - act by preventing breakdown of dopamine in the central nervous system by the enzyme mono-amine oxidase. *Anaesthetic cautions-* these drugs interact with pethidine causing hypertension and hyperpyrexia.

**Anti-cholinergics** (eg orphenadrine) - act by antagonising the excitatory effects of cholinergic pathways. *Anaesthetic cautions-* risk of central anticholinergic syndrome.

**Atypical** drugs (eg amantadine)

**Catechol –O- methyl transferase (COMT) inhibitors** – these drugs are used with levodopa and DDI combination to smooth out end of dose “off” periods. *Anaesthetic cautions-* caution with drugs which are metabolised by COMT (eg adrenaline).

## Drugs and anaesthesia

PD drugs are stopped as late as possible pre-operatively, and are restarted as soon as possible postoperatively. This is difficult if the patient is unable to swallow, or in those who have had major abdominal surgery. Levodopa can be given NG or NJ and is rapidly absorbed in the proximal small bowel. Prolonged GI dysfunction post- operatively may lead to severe disability as there is currently no parenteral dopaminergic therapy available. A subcutaneous apomorphine infusion can be used in those patients in whom there will be a delay in starting anti –PD medication post operatively. Apomorphine acts as a dopamine agonist. Apomorphine is commenced 1-2 days prior to elective surgery. The dose is usually 30-40 mg over 16 hours, but will depend on the response to apomorphine challenge carried out pre- operatively. Domperidone can be given prior to the apomorphine challenge (20 mg tds for 3 days, PR). Apomorphine can cause significant hypotension which may be hazardous in the perioperative period.

Surgical approaches in the treatment of PD have developed due to failure of medical treatment to provide long term relief of the symptoms of PD. Surgery is reserved for those with refractory PD with disabling problems, and does not cure PD. A multidisciplinary approach is used in patient selection for these procedures. DBS (deep brain stimulators) can be used in the the

treatment of PD. DBS can be used in the ventral intermediate nucleus, STN (subthalamic nucleus) or GPi (internal segment of globus pallidus). Thalamic stimulation is effective in the relief of tremor, but worsening dysarthria can occur. Subthalamic DBS improves PD symptoms and reduces daily drug intake. GPi stimulation reduces medication side effects, thus leading to better drug tolerance however produces little improvement of bradykinesia or tremor. Alternative surgical options include pallidotomy, subthalamotomy and transplantation.

## Anaesthetic considerations

### **Pre-operative:**

- Management should be optimised before surgery
- Anaesthetist should be given advanced warning of patient.
- Liaise with the patients Parkinson's disease physician.
- Put the patient first on the theatre list (as the timing of drug administration is predictable, and also to reduce the chances of the patient being cancelled. If the patient is cancelled then medication should be recommenced).
- Assess the patient- in addition to the usual pre-operative assessment, pay attention to:
  - Airway - difficult intubation may occur due to flexion deformity of the neck. These patients are also at high risk of aspiration.
  - Sialorrhoea- there may be a need for a drying agent pre- operatively
  - Rule out chest infection.
  - Pulmonary function testing may reveal a restrictive ventilatory defect.
  - Ask about sleep apnoea.
  - Autonomic dysfunction.
  - Consider the need for HDU/ITU post operatively particularly for those with poor cough, risk of aspiration, sleep apnoea, respiratory inadequacy or autonomic instability.

Adequate hydration perioperatively will reduce the risk of orthostatic hypotension.

### **Which drugs are safe for PD patients?**

- Opiates are often necessary after major surgery, but may worsen muscle rigidity (it is likely that the amount of morphine used for analgesia is far less than this). Pethidine should be avoided as can cause hypertension and muscle rigidity in patients on selegiline. Patient controlled analgesia (PCA) may be difficult to operate.
- Antidepressants - the use of TCA's may potentiate levodopa induced arrhythmias.
- Antipsychotics (eg phenothiazines, butyrophenones, piperazine derivatives) may worsen PD symptoms. It is best to use atypical antipsychotics (eg sulpiride, clozapine).
- Antihypertensives may cause severe hypotension in those with PD (due to postural hypotension, hypovolaemia).

- Volatile agents - the use of halothane can potentiate levodopa induced arrhythmias.
- Induction agents - propofol may have dopamine like effects, and thus help reduce tremor and muscle rigidity.
- Anticholinergic drugs- centrally acting ones (eg atropine) can precipitate central anticholinergic syndrome. Glycopyrrolate is the anticholinergic of choice.
- Anti-emetics are of importance as nausea/vomiting can hinder restarting enteral PD drugs. The anti emetics that are not safe to use in those with PD are metoclopramide, droperidol and prochlorperazine as these drugs will worsen PD symptoms and cause extra pyramidal effects.
  - The anti emetic of choice is domperidone (10- 20 mg 4-6 hourly PO, or 30-60 mg 4-6 hourly PR). Domperidone does not cross the BBB (blood brain barrier) and thus does not cause extra pyramidal effects.
  - 5 HT anatagonists (eg ondansetron, granisetron) can be used in those with PD. The use of antihistamine anti-emetics (eg cyclizine) is also safe in those with PD.

The choice of anaesthesia depends on the type of surgery, and the patient. The advantages and disadvantages of regional versus general anaesthesia (GA) are shown in the table below:

	<b>GA</b>	<b>Regional</b>
Advantages	Can insert an NG/NJ to give medication post operatively	Reduced risk of respiratory complications
	Patient is still/ no tremor	Patient remains conscious
		Can resume anti- PD medication immediately post-operatively
Disadvantages	Drugs used for GA can worsen PD eg halothane, neuroleptics, opioids	Regional can be technically difficult (eg tremor, rigidity)
	GA may worsen an already compromised cough/ respiratory function	Twitches from a peripheral nerve stimulator can be hard to discern.
	PONV makes enteral medication difficult. This should not be treated with centrally acting anti- dopaminergics (eg prochlorperazine). Cyclizine, ondansetron can be used, although extrapyramidal side effects can still occur.	Tremor is not abolished in regions where there is no motor blockade.
	Opioids may exacerbate rigidity	If the patient had dementia, then there is poor cooperation.
		Tremor can produce artefacts on monitoring (non- invasive blood pressure monitoring becomes unreliable, the ECG may show VT).

## Conclusion

PD is a multi-system disease requiring a multi-disciplinary approach. Good preoperative control of PD, respiratory and musculoskeletal physiotherapy, and good analgesia will reduce the incidence of venous thromboembolism (VTE), pressure area damage, sputum retention and aspiration.

## Further Reading:

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