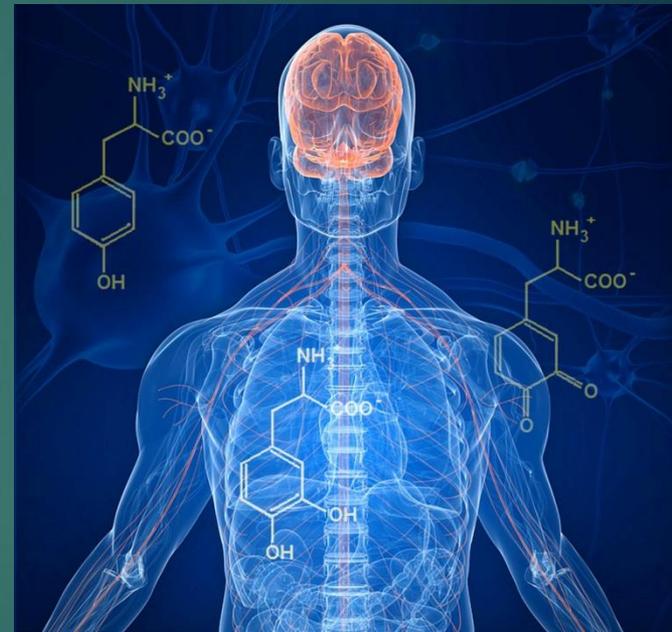


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- ▶ **This quiz is being published on behalf of the Education Committee of the SNACC.**



1. The following are non-motor symptoms of Parkinson's disease EXCEPT.

- A. Mood disturbances
- B. Resting tremor
- C. Dementia
- D. Autonomic dysfunction



Go to Q2 

A. Mood disturbances

Mood disturbances **are non-motor** disturbances in Parkinson's disease and they include depression, anxiety, daytime sleepiness, psychosis, and hallucinations.

Cotrell, Young's Neuroanesthesia, 5th ed. Ch. 21 Neurodegenerative diseases



Try
again

**Incorrect
answer**

B. Resting tremor

CORRECT



Parkinson's Disease (PD) is a neurodegenerative disease characterized by the early development of **motor symptoms** namely: akinesia (paucity of movement), bradykinesia (slowness of movement) rigidity and tremor at rest. These problems result from degeneration of dopaminergic neurons in the midbrain. The degeneration of dopamine-producing cells leads to an imbalance between inhibitory properties of Dopamine and excitatory properties of Acetylcholine in the striatum.

Evidence for the widespread neurodegeneration characterizing this disease is the presence of Lewy Bodies (intracellular aggregate of abnormal proteins) present in residual dopaminergic neurons as well as in other areas of the central and peripheral nervous system of patients with PD.

Cotrell, Young's Neuroanesthesia, 5th ed. Ch 21, Neurodegenerative diseases

[Go to Q1](#)

[Go to Q2](#)

C.Dementia

Dementia is a non-motor symptom. PD is characterized by widespread neuro-degeneration in the noradrenergic, serotonergic, and cholinergic neurons of the brainstem and amygdala, cingulate gyrus and the neocortex. Therefore symptoms are not limited to motor features. After 8 years of disease, the prevalence of dementia can be as high as 78%. Other cognitive problems associated with PD include frontal-lobe dysfunction and memory difficulties

Try
again

Incorrect
answer

D. Autonomic dysfunction

Other non-motor problems include autonomic dysfunction (orthostasis), problems with thermoregulation, constipation, and genitourinary problems like nocturia and urgency.

- ▶ *Chaudhuri, et al International multicenter pilot study of the first comprehensive self completed non-motor symptoms questionnaire for parkinson's disease: the NMSQest study, Movement disorders, 2006;21 (7):916-923*

Try
again

**Incorrect
answer**

2. Which of the following is True regarding Parkinson's disease?

- A. This disease does not increase the risk of death
- B. Degeneration of dopaminergic neurons in the basal ganglia is a characteristic of this disease.
- C. This disease does not have any familial predisposition.
- D. Medications like levodopa can cure the disease.

Go to Q3 

A. Parkinson's disease does not increase the risk of death

Forty percent of patients with PD are living in long term care facilities and they are almost twice as likely to die compared to their age matched cohorts. Hence, it does increase the risk of death

- ▶ *Cotrell and Young's Neuroanesthesia, 5th ed. Ch. 21 Neurodegenerative diseases*



Try
again

Incorrect
answer



B. Degeneration of dopaminergic neurons in the basal ganglia is a characteristic of this disease

Correct

The common feature of PD is degeneration of dopamine producing cells of the striatum (caudate nucleus and putamen) which is part of the basal ganglia (globus palidus, substantia nigra, nucleus acumbens and subthalamic nucleus).

The degeneration of dopamine producing cells leads to an imbalance between excitatory and inhibitory neuronal outputs and hence the symptoms of PD

- ▶ *Cotrell and Young's Neuroanesthesia, 5th ed. Ch. 21 Neurodegenerative diseases*

[Back to Q2](#)

[To Q3](#)

C. This disease does not have any familial predisposition

Ten to 15% of people with PD will have an affected first or second degree relative. No clear environmental determinants of PD have been defined.

- ▶ *Nutt, et al Diagnosis and initial management of parkinson's disease, NEJM. 2005;353:1021-7*

Try
again

Incorrect
answer

D. Medications like levodopa can cure the disease

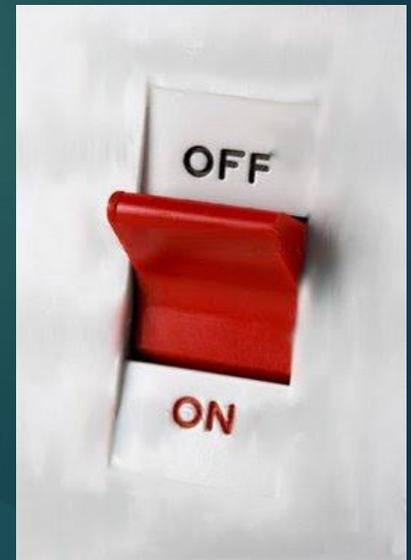


PD has no cure. Pharmacotherapy focuses on the management of motor symptoms using dopamine agonists like bromocriptine or levodopa which leads to increased production of dopamine. Medication related complications like dyskinesias and “on-off” fluctuations or unpredictable loss of benefit from treatment typically occurs at the 5 year mark.

Okun, Deep brain stimulation for parkinson's disease, NEJM, 2012;367:1529-38

Try
again

Incorrect
answer



3. Which of the following is FALSE with regards to Deep Brain Stimulator placement for Parkinson's Disease?

- A. Patients responsive to dopaminergic therapy and disabling dyskinesias are good candidates for surgery.
- B. The targeted sites for lead placement are the Subthalamic nucleus and globus pallidus interna
- C. Anti-Parkinson's medications should be given the morning of surgery
- D. The procedure is done through a burr hole usually with the patient awake.

Go to Q4 

A. Patients responsive to dopaminergic therapy and disabling dyskinesias are good candidates for surgery

Most centers select patients for deep brain stimulation on the basis of the nature of the patient's symptoms and the likelihood of a response to therapy. Levodopa-responsive symptoms, tremor, "on-off" fluctuations and dyskinesias are most likely to improve with deep-brain stimulation. Impairments in gait, balance, and speech are less likely to improve. Hence this is true.

- ▶ Okun, Deep brain stimulation for Parkinson's disease, NEJM, 2012;367:1529-38



Try
again

Incorrect answer

B. The targeted sites for lead placement are the Subthalamic nucleus and globus pallidus interna.

Bilateral stimulation of the subthalamic nucleus (STN) or pars interna of the globus pallidus (iGP) is associated with significant improvement in motor function in patients with Parkinson's disease.

- ▶ *Deep-Brain Stimulation for Parkinson's Disease Study Group, Deep brain stimulation of the subthalamic nucleus or the pars interna of the globus pallidus in Parkinson's disease. NEJM, 2001; 345:956–63*

Try
again

Incorrect answer

C. Anti-Parkinson's medications should be given in the morning of surgery

Correct



Patients undergoing deep brain stimulation have their medications stopped 12 hours before the procedure for assessment of physiological recordings and behavioral responses after placement of the stimulation electrode in the brain.

- ▶ Okun, *Deep brain stimulation for parkinson's disease*, *NEJM*, 2012;367:1529-38

Back to Q3

Go to Q4

D. The procedure is done through a burr hole usually with the patient awake

The procedure is done through a burr hole and in many cases, general anesthesia is not used during electrode implantation for assessment of physiological recordings and behavioral responses. Anesthesia may be required in selected cases (e.g., in children and in adults with severe anxiety). CT or MRI that is performed on the day of the procedure is registered to the head frame in order to reestablish the target location and to set a trajectory that will avoid blood vessels.

- ▶ Okun, *Deep brain stimulation for parkinson's disease*, *NEJM*, 2012;367:1529-38



Try
again

Incorrect answer

4. All of the following are risks of awake Deep Brain Stimulator placement EXCEPT?

- A. Hemorrhagic stroke
- B. Infection
- C. Seizures
- D. Increased verbal fluency

Go to Q5 

A. Hemorrhagic stroke

Based on a literature review of DBS surgery over 10 years, the overall rate of intracranial hemorrhage is 5.0% with symptomatic hemorrhage occurring in 2.1% of patients, and hemorrhage causing permanent deficit or death in 1.1%. Risk factors include a history of hypertension and age. Surgical risk factors include the use of MER (micro-electrode recording) and the number of MER penetrations, as well as a trajectory that involves a sulcus or ventricle. The use of MR imaging for guidance and verification of DBS electrode placement helps to avoid these surgery-related risk factors.

- ▶ *Zrinzo, Reducing hemorrhagic complications in functional neurosurgery, JNS, 2012;116:84-94*



Try
again

Incorrect
answer

B. Infection

Rates of infection requiring further surgery have ranged from 1.2 to 15.2%. Infections most often require device removal and a period of antibiotic treatment before consideration of device replacement. The majority of organisms cultured were consistent with skin flora, with *Staphylococcus aureus* being the most common pathogen.

- ▶ Okun, *Deep brain stimulation for parkinson's disease*, NEJM, 2012;367:1529-38
- ▶ Fenoy, et al *Management of device-related wound complications in deep brain stimulation surgery*. JNS.2012;116:1324-32

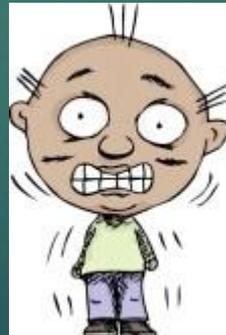
Try
again

Incorrect
answer

C. Seizures

Post-procedural seizures have been reported, with an estimated incidence of 2.4%

- ▶ *Coley, et al, The incidence of seizures following deep brain stimulation electrode implantation for movement disorders, pain and psychiatric conditions. Br J NS, 2009;23:179-83*



Try
again

Incorrect answer

D. Increased verbal fluency

Correct



Impairments in gait, balance, and speech are less likely to improve with deep brain stimulator placement. In fact, side effects of DBS include memory deficits and difficulties with speech. In a meta-analysis of 42 articles, small declines were found in psychomotor speed, memory, attention, executive functions, and overall cognition; and **moderate declines** were found in both semantic (participants are asked to say words in certain categories like “animals” and “fruits”) and phonemic fluency (test where participants are asked to recite words that begin with “p” for example). GPI-DBS resulted in fewer neurocognitive declines than STN-DBS

- ▶ *Parsons, et al Cognitive sequelae of subthalamic nucleus deep brain stimulation in Parkinson’s disease: a meta-analysis, Lancet Neurol., 2006; 5: 578-88*
- ▶ *Combs et al, Cognition and depression following deep brain stimulation of the subthalamic nucleus and globus pallidus pars internus in Parkinson’s disease : a meta-analysis. Neurosychol Rev.2015;25:439-54*

Back to Q4

Go to Q5

5. Regarding peri-operative management of patients with Parkinson's Disease, which of the following is true?

- A. Thankfully, they are not at risk for aspiration
- B. Attention should be directed to continuing their Levodopa-carbidopa peri-operatively when possible
- C. Autonomic insufficiency is not a problem in this patient population
- D. There is evidence that depolarizing agents causes dangerous increases in potassium in patients with PD

Back to Q1 

A. Thankfully, they are not at risk for aspiration

Patients with PD are predisposed to aspiration because they often have dysphagia and dysmotility. Impaired coordination in breathing and swallowing and incomplete upper esophageal sphincter (UES) relaxation and a reduced UES opening, both associated with high intrabolus pressure are prevalent in PD. The prevalence may be as high as 52%

- ▶ *Cotrell, Young's Neuroanesthesia, 5th ed. Ch. 21 Neurodegenerative diseases*
- ▶ *Ali, et al Mechanisms of oral –pharyngeal dysphagia in patients with Parkinson's disease. Gastroenterology, 1996; 110: 383-392*



Try
again

Incorrect answer

B. Attention should be directed to continuing their Levodopa-carbidopa peri-operatively when possible



Correct

The half life of levodopa is 90 minutes therefore even a brief interruption of therapy can lead to an acute exacerbation of symptoms of PD or neuroleptic malignant syndrome characterized by akinesia, hyperthermia, muscle rigidity, and autonomic dysfunction. Hence, one should attempt to continue them as early as possible.

- ▶ *Cotrell, Young's Neuroanesthesia, 5th ed. Ch. 21 Neurodegenerative diseases*

End of Set

[Back to Q5](#)

[Back to Q1](#)

C. Autonomic insufficiency is not a problem in this patient population.

Autonomic insufficiency affects the ability of PD patients to respond to hypovolemia, and vasodilatation associated with general anesthesia.

- ▶ *Cotrell, Young's Neuroanesthesia, 5th ed. Ch. 21 Neurodegenerative diseases*
- ▶ Walter et al Cardiovascular autonomic dysfunction in patients with movement disorders. *Cleve Clin J of Med*, 2008; 75 suppl 2 S54-8

Try
again

Incorrect
answer

D. There is evidence that depolarizing agents cause dangerous increases in potassium in patients with Parkinson's Disease

In a series of 7 patients with PD undergoing general anesthesia in which Succinylcholine was administered, ABG's were obtained 3-5 min. after Succinylcholine administration and in 5 patients no changes in K^+ were noted; 1 patient had an increase in K^+ by 0.2 meq/L ; and in another a 0.2 meq/L decrease in K^+ .

- ▶ Cotrell, *Young's Neuroanesthesia*, 5th ed. Ch. 21 *Neurodegenerative diseases*
- ▶ Muzzi et al, *The lack of effect of succinylcholine on serum potassium in patients with Parkinson's disease. Anesth.*, 1989;71:322



Try
again

1 2 3 4 5

Incorrect
answer