

## Poll Everywhere Audience Response



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## Speaker Introduction

Chanah Gallagher is currently a PGY2 Internal Medicine resident at the University of Utah Health. She received her Doctor of Pharmacy and Master of Science in Pharmaceutical Sciences from the University of Kentucky. Chanah then completed her PGY1 Pharmacy Practice Residency at the University of Utah Health. Her professional interest areas include optimization of the transitions of care process, patient advocacy, global and public health, and academia.



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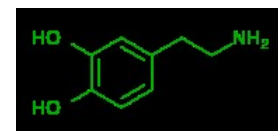


UTAH SOCIETY OF  
HEALTH-SYSTEM PHARMACISTS

Chanah Gallagher, PharmD, MS  
11/11/2021

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## Taking the Tremor Out of Inpatient Management of Parkinson's Disease



**Chanah Gallagher, PharmD, MS**  
PGY2 Internal Medicine Pharmacy Resident  
University of Utah Health  
Chanah.Gallagher@utah.edu

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## Disclosure

- Relevant Financial Conflicts of Interest
  - **CE Presenter, Chanah Gallagher:**
    - None
  - **CE Mentor, Erica Marini:**
    - None
- Off-Label Uses of Medications
  - Tavadon
  - Nortriptyline
  - Escitalopram
  - Rivastigmine
  - Exenatide
  - Memantine



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## Learning Objectives

### Pharmacist:

- Recognize new therapy options recently approved or under investigation for use in Parkinson's Disease
- Describe potential complications of inappropriate inpatient management of patients with Parkinson's Disease
- Design perioperative medication plans for patients with Parkinson's Disease admitted on complex treatment regimens



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## Learning Objectives

### Technician:

- Recall the different dopaminergic and non-dopaminergic medications used for the treatment of Parkinson's Disease
- Demonstrate appropriate handling and administration of the different medication formulations used for the treatment of Parkinson's Disease
- Formulate a plan for collecting complex medication histories in patients with Parkinson's Disease



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## Meet JC

- 63 y/o male recently diagnosed with Parkinson's Disease
- Pertinent Past Medical History:
  - Hypertension
  - Diabetes
  - GERD
- Medications:
  - Lisinopril 10 mg daily
  - Metformin 1000 mg twice daily
  - Multivitamin once daily
  - Acetaminophen 500 mg twice daily as needed
  - Calcium Carbonate 500 mg three times daily as needed
- Allergies:
  - Amoxicillin – rash and swelling



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## Outline

- Management of Parkinson's Disease
- Inpatient Admission Process
- Inpatient Care
- Discharge Medication Planning
- New Therapy Options On the Horizon



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## Poll Everywhere

- How would you describe Parkinson's Disease in one to two words?



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## Background: Parkinson's Disease

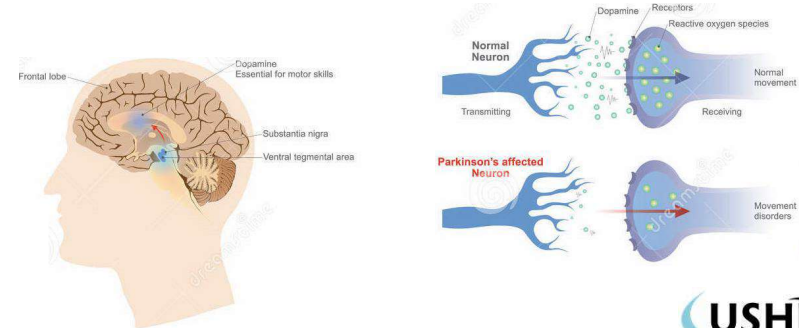
- Incidence
  - Over 7 million individuals worldwide in 2015
  - By 2040 expect 14 million individuals worldwide
- Risk Factors:
  - Age
  - Region of Residence
  - Environmental Exposures
  - Genetic Factors
  - Smoking
  - Caffeine Intake



Ramirez-Zamora A, Tsuijoi T. Hospital Management of Parkinson Disease Patients. Clin Geriatr Med. 2020 Feb;36(1):173-181.  
 Nemade D, Subramanian T, Shivkumar V. An Update on Medical and Surgical Treatments of Parkinson's Disease. Aging Dis. 2021 Jul 1;12(4):1021-1035.  
 Kouli A, Torsney KM, Kuan WL. Parkinson's Disease: Etiology, Neuropathology, and Pathogenesis. In: Stoker TB, Greenland JC, editors. Parkinson's Disease: Pathogenesis and Clinical Aspects [Internet]. Brisbane (AU): Codon Publications; 2018 Dec 21. Chapter 1. PMID: 30702842.

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## Pathophysiology



<https://www.dreamstime.com/stock-illustration-parkinson-s-disease-dopamine-levels-normal-affected-neuron-vector-graphic-art-illustration-image88877180>

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## Motor Symptoms

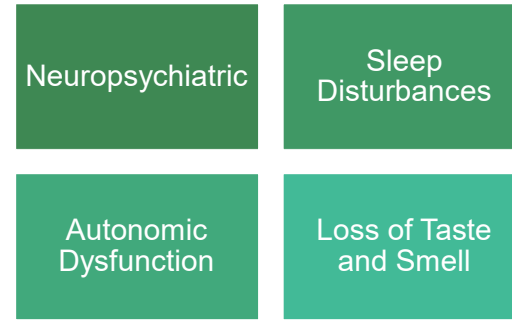


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<https://www.dreamstime.com/parkinson-disease-symptoms-infographic-idea-dementia-neurology-illness-tremor-memory-loss-isolated-vector-illustration-image161160294>  
Nemade D, Subramanian T, Shivkumar V. An Update on Medical and Surgical Treatments of Parkinson's Disease. Aging Dis. 2021 Jul 1;12(4):1021-1035.

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## Nonmotor Symptoms



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Nemade D, Subramanian T, Shivkumar V. An Update on Medical and Surgical Treatments of Parkinson's Disease. Aging Dis. 2021 Jul 1;12(4):1021-1035.

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## Management: Dopaminergic Agents

LEVODOPA FORMULATIONS – Dopamine Precursor		
Levodopa-Carbidopa IR Tablet	Levodopa-Carbidopa ER Capsule	Levodopa-Carbidopa Intestinal Gel
Levodopa-Carbidopa CR Tablet	Levodopa Inhaled Powder	Levodopa-Carbidopa ODT
DOPAMINE AGONISTS – Stimulates Neuronal Dopamine Receptors		
Ropinirole IR, ER	Rotigotine Patch	Apomorphine SubQ Injection, SL Film
Pramipexole IR, ER		
MAO-B INHIBITORS – Prevents Synaptic Dopamine Breakdown by Monoamine Oxidases		
Selegiline	Safinamide	Rasagiline
ADJUNCTIVE COMT INHIBITORS – Prevents Breakdown of Levodopa by Catechol-o-Methyltransferases		
Entacapone	Tolcapone	Opicapone

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Nemade D, Subramanian T, Shivkumar V. An Update on Medical and Surgical Treatments of Parkinson's Disease. Aging Dis. 2021 Jul 1;12(4):1021-1035.  
Fox SH, Katzschlager R, Lin SY, Barton B, de Bie RMA, Seppi K, Coelho M, Sampio C. Movement Disorder Society Evidence-Based Medicine Committee. International Parkinson and movement disorder society evidence-based medicine review: Update on treatments for the motor symptoms of Parkinson's disease. Mov Disord. 2018 Aug;33(8):1249-1266.  
Ramirez-Zamora A, Tsuboi T. Hospital Management of Parkinson Disease Patients. Clin Geriatr Med. 2020 Feb;36(1):173-181.

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## Management: Non-Dopaminergic Agents

ANTICHOLINERGIC – Prevents Acetylcholine Binding to Postsynaptic Muscarinic Receptors	
Trihexyphenidyl	Benztropine
ADENOSINE ANTAGONIST – Inhibits Adenosine A2 Receptors, Potentiating Dopamine Receptor Activity	
Istradefylline	
UNKNOWN MECHANISM OF ACTION	
Amantadine IR	Amantadine ER

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Fox SH, Katzschlager R, Lin SY, Barton B, de Bie RMA, Seppi K, Coelho M, Sampio C. Movement Disorder Society Evidence-Based Medicine Committee. International Parkinson and movement disorder society evidence-based medicine review: Update on treatments for the motor symptoms of Parkinson's disease. Mov Disord. 2018 Aug;33(8):1248-1266.  
Shang P, Baker M, Banks S, Hong SI, Choi DS. Emerging Nondopaminergic Medications for Parkinson's Disease: Focusing on A2A Receptor Antagonists and GLP1 Receptor Agonists. J Neurol. 2021 Sep;168(9):1032-9.

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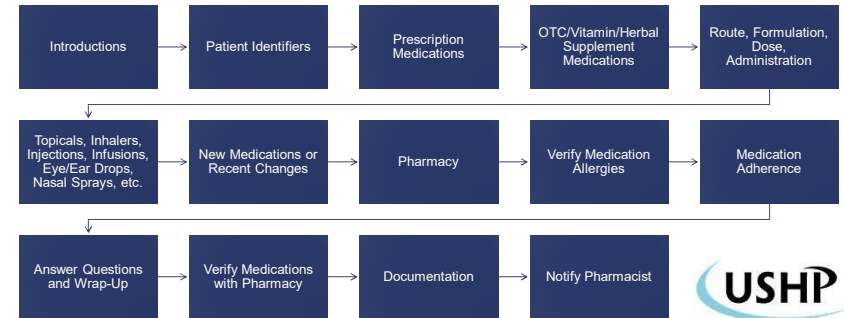
## JC: ED Evaluation

- CT imaging shows a significant small bowel obstruction
- JC's mental status continues to worsen in the ED
- ED physician decides it is appropriate for JC to be admitted for monitoring and possible surgical intervention
- Prompts the ED pharmacy technician to collect a medication history



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## Medication History Process



Kabir R. Liaw S, Cerise J, Yi J, Mulvany C, Qiu M, Beizer JL, Sivnani LD. Obtaining the Best Possible Medication History at Hospital Admission: Description of a Pharmacy Technician-Driven Program to Identify Medication Discrepancies. J Pharm Pract. 2021 Jun 3;8971900211021254. 24

## JC: Medication History

- The pharmacy technician prepares to speak with JC about his medication use, but unfortunately his mental status has caused him to be an unreliable source and his wife has stepped out to grab lunch
- In the meantime, the pharmacy technician is able to determine the patient's pharmacy from the insurance, proceeds to call the pharmacy, and obtains a prescription medication fill history



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## JC: Medication History

- Pharmacy 6-month fill history:
  - Lisinopril 10 mg daily
  - Amantadine 100 mg daily
  - Levodopa-carbidopa ER 95 mg-23.75 mg three times daily
  - Metformin 1000 mg twice daily



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## Poll Everywhere

- What is true about the levodopa-carbidopa prescription for JC?
  - A. The pharmacy has the wrong strength documented, it should be a 100 mg-25 mg
  - B. Levodopa-carbidopa extended-release formulation is not directly interchangeable with other formulations
  - C. Levodopa-carbidopa extended-release is a non-dopaminergic agent
  - D. Levodopa-carbidopa is a dopamine agonist



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## Poll Everywhere

- What is the appropriate sequence of actions the technician should take following gathering JC's fill history?
  - A. Work on other medication histories while waiting for JC's wife to return from lunch -> verify all medications including non-prescription medications with JC's wife -> document and finalize encounter -> notify pharmacist of Parkinson's Disease medications
  - B. Notify pharmacist of Parkinson's Disease medication preliminary findings-> verify all medications including non-prescription medications with JC's wife -> document and finalize encounter
  - C. Work on other medication histories while waiting for JC's wife to return from lunch -> verify all medications including non-prescription medications with JC's wife -> notify pharmacist of Parkinson's Disease medications -> document and finalize encounter
  - D. Notify pharmacist of Parkinson's Disease medication preliminary findings -> verify all medications including non-prescription medications with JC's wife -> document and finalize encounter -> follow-up with pharmacist



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## JC Admitted To Medicine Service

- Medicine pharmacist notified of admitting patient and reconciles medication history completed in the ED
- How should the pharmacist proceed to avoid complications related to patient's Parkinson's Disease?



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## Medication Timing of Administration

- Restart Parkinson's Disease treatment as soon as possible!
- Continue patient's medication formulations and administration schedule
- Complications:
  - Aspiration pneumonia
  - Hyperpyrexia Syndrome and Dopamine-Agonist Withdrawal Syndrome (DAWS)
  - Falls
  - Loss of previously adequate regimen or dose



Ramirez-Zamora A, Tsuiol T. Hospital Management of Parkinson Disease Patients. Clin Geriatr Med. 2020 Feb;36(1):173-181.

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## DAWS

- Symptoms:
  - Anxiety
  - Panic
  - Agoraphobia
  - Fatigue
  - Dysphoria
  - Suicidal Ideation
- Management:
  - Restart dopamine agonist

## HYPERPYREXIA SYNDROME

- Symptoms:
  - Altered Mental Status
  - Rigidity
  - Tremors
  - Fever
  - Autonomic Dysfunction
- Management:
  - Restart dopaminergic therapy



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Katus L, Shilbans A. Perioperative management of patients with Parkinson's disease. Am J Med. 2014 Apr;127(4):275-80.  
Ramirez-Zamora A, Tsuboi T. Hospital Management of Parkinson Disease Patients. Clin Geriatr Med. 2020 Feb;36(1):173-181.

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## Delirium and Neuropsychiatric Symptom Management

- Delirium
  - Minimize anticholinergic and other centrally acting medications
    - Narcotics, anxiolytics, hypnotics
  - Prevent insomnia with levodopa-carbidopa administration at bedtime
  - Discontinue or minimize other contributing medications
    - Antispasmodics
    - Antibiotics
    - Antihypertensives
    - Antiarrhythmics
    - H2RA blockers
  - Reorientation
  - Temporarily simplify dopaminergic regimen



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## Delirium and Neuropsychiatric Symptom Management

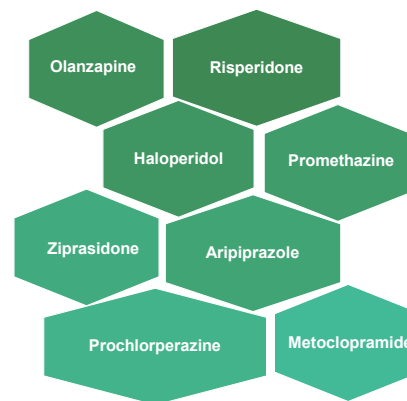
- Neuropsychiatric Symptom Management
  - Preferred agent → low-dose quetiapine
  - Alternative agent → clozapine
  - Agents to avoid:
    - Haloperidol
    - Risperidone
    - Olanzapine
    - Aripiprazole
    - Ziprasidone
  - Consider other infectious or metabolic causes



Ramirez-Zamora A, Tsuboi T. Hospital Management of Parkinson Disease Patients. Clin Geriatr Med. 2020 Feb;36(1):173-181.  
Katus L, Shilbans A. Perioperative management of patients with Parkinson's disease. Am J Med. 2014 Apr;127(4):275-80.

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## Contraindicated Medications



Ramirez-Zamora A, Tsuboi T. Hospital Management of Parkinson Disease Patients. Clin Geriatr Med. 2020 Feb;36(1):173-181.  
Katus L, Shilbans A. Perioperative management of patients with Parkinson's disease. Am J Med. 2014 Apr;127(4):275-80.

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## Deep Brain Stimulation Considerations

- Consult movement disorder neurologist
- Minimize electrocauterization
- Turn off DBS during EKG testing
- MRI
- Contact radiologist and DBS manufacturer to determine safety

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Ramirez-Zamora A, Tsuboi T. Hospital Management of Parkinson Disease Patients. Clin Geriatr Med. 2020 Feb;36(1):173-181.  
Kilias L, Shibata A. Perioperative management of patients with Parkinson's disease. Am J Med. 2014 Apr;127(4):275-80.  
<https://www.dreamstime.com/stock-illustration-deep-brain-stimulation-using-implanted-pulse-generator-associated-relates-parkinsons-disease-image54259812>

## Poll Everywhere

- What is a likely cause of JC's altered mental status and fever, and what is the most appropriate management strategy while JC remains NPO status?
  - A. Inability to take medications PTA; start levodopa-carbidopa ODT
  - B. Small bowel obstruction has caused perforation; start haloperidol prn while wait for OR preparations for emergent surgical intervention
  - C. Inability to take medications PTA; start levodopa-carbidopa ODT and quetiapine prn
  - D. Small bowel obstruction has caused perforation; start olanzapine prn while wait for OR preparations for emergent surgical intervention

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## JC To the OR

- JC's fever and altered mental status started to resolve with restarting levodopa-carbidopa
- JC's small bowel obstruction was not able to be medically managed and requires surgical intervention

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## Peri-Operative Risks In Parkinson's Disease Patients

Pulmonary Embolism

Infection

Stroke

Acute Kidney Injury

Mortality

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Ramirez-Zamora A, Tsuboi T. Hospital Management of Parkinson Disease Patients. Clin Geriatr Med. 2020 Feb;36(1):173-181.  
Huang YF, Chou YC, Yeh CC, Hu CJ, Cheng YG, Chen TL, Liao CC. Outcomes After Non-neurological Surgery in Patients With Parkinson's Disease: A Nationwide Matched Cohort Study. Medicine (Baltimore). 2016 Mar;95(12):e10310.

## Pre-Operative Considerations

## Intra-Operative Considerations

## Post-Operative Considerations

# Optimal Peri-Operative Considerations

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## Pre-Operative Considerations

- Continue all Parkinson's Disease therapies for as long as possible EXCEPT MAO-B inhibitors
  - Ideally hold MAO-B inhibitors 1-2 weeks prior to surgery
- NPO considerations and planning:
  - Is there enteral access available?
  - Can patient's dopaminergic medication regimen be switched to alternative routes of administration?



Ramirez-Zamora A, Tsuboi T. Hospital Management of Parkinson Disease Patients. Clin Geriatr Med. 2020 Feb;36(1):173-181.

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## Intra-Operative Sedation/Anesthesia Considerations

### Propofol

- Exacerbates dyskinesias

### Fentanyl

- Exacerbates rigidity and motor symptoms

### Inhaled Anesthetics

- Avoid halothane with levodopa



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Katus L, Shilbans A. Perioperative management of patients with Parkinson's disease. Am J Med. 2014 Apr;127(4):275-80.

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## Post-Operative Considerations

### PAIN CONTROL WITH CONCOMITANT MAO-B INHIBITORS

- MAO-B inhibitors inhibit opioid metabolism
- Avoid opioids with serotonergic activity
  - Meperidine → contraindicated
  - Tramadol and methadone → use with caution
  - Morphine, codeine, oxycodone → preferred

### POST-OPERATIVE NAUSEA AND VOMITING

- Preferred agents:
  - Ondansetron
  - Trimethobenzamide
- Contraindicated agents:
  - Metoclopramide
  - Promethazine
  - Prochlorperazine



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Katus L, Shilbans A. Perioperative management of patients with Parkinson's disease. Am J Med. 2014 Apr;127(4):275-80.

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## Poll Everywhere

- Break-out Rooms
- What are appropriate changes to make to JC's Parkinson's Disease management regimen in the peri-operative setting, and what are options to treat post-operative pain and nausea/vomiting?



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## JC Discharged

- Aware in Care Kit
- Medical Alert Wallet Card
- Nurse Fact Sheet
- Medication Form
- Hospital Action Plan
- ID Bracelet
- Levodopa-Carbidopa Intestinal Gel Info Card
- Deep Brain Stimulation Info Care



<https://www.parkinson.org/Living-with-Parkinsons/Resources-and-Support/Hospital-Kit>  
<https://www.dreamstime.com/emergency-kit-isolated-vector-icon-which-can-easily-modify-edit-image219097577>  
<https://www.dreamstime.com/online-pharmacy-mobile-application-buy-medicine-via-internet-online-pharmacy-mobile-application-buy-medicine-via-internet-image185513918>

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## What's New In Parkinson's Disease: Phase III Trials

### SYMPTOMATIC RELIEF

- Dopaminergic:
  - Tavadon
- Non-Dopaminergic:
  - Nortriptyline and Escitalopram
  - Transdermal Rivastigmine

### DISEASE MODIFYING

- Exenatide
- Memantine



McFarthing K, Rafaloff G, Baptista MAS, Wyse RK, Stott SRW. Parkinson's Disease Drug Therapies in the Clinical Trial Pipeline: 2021 Update. J Parkinsons Dis. 2021;11(3):891-903.

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## Poll Everywhere

- Pending clinical trial results what is the best potential new Parkinson's Disease therapy option for JC to consider if his symptoms remain well controlled on his current regimen?
  - A. Exenatide
  - B. Istradefylline
  - C. Memantine
  - D. Tavadon
  - E. Nortriptyline



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## Main Takeaways

Identify patients early

Accurate medication history is imperative

Maintain medication regimen and schedule



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## Learning Objectives

### Pharmacist:

- Recognize new therapy options recently approved or under investigation for use in Parkinson's Disease
- Describe potential complications of inappropriate inpatient management of patients with Parkinson's Disease
- Design perioperative medication plans for patients with Parkinson's Disease admitted on complex treatment regimens

### Technician:

- Recall the different dopaminergic and non-dopaminergic medications used for the treatment of Parkinson's Disease
- Demonstrate appropriate handling and administration of the different medication formulations used for the treatment of Parkinson's Disease
- Formulate a plan for collecting complex medication histories in patients with Parkinson's Disease



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## Taking the Tremor Out of Inpatient Management of Parkinson's Disease

**CE Code: (USHP will fill in)**

**Chanah Gallagher, PharmD, MS**  
PGY2 Internal Medicine Pharmacy Resident  
University of Utah Health  
Chanah.Gallagher@utah.edu

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