


Inpatient Management of Parkinson Disease: Current Challenges and Future Directions

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Abstract

Parkinson disease (PD) is usually managed through outpatient clinical care. Reasons for hospital admissions are either directly related to PD or may reflect comorbidities. When hospitalized, patients with PD may face many challenges. Most commonly these are related to medication management, falls, mental status changes, infections, and emergence of psychiatric symptoms. Timely recognition and proper management of PD-specific hospitalization-related problems may be delayed, given the common lack of expertise in PD management of hospital physicians, nurses, and allied health professionals. With increasing prevalence of PD, it is expected that more patients will require inpatient hospital care. It is therefore very important to recognize problems that may arise upon hospitalization of a patient with PD and provide education to health care professionals involved in the inpatient care of patients with PD. This approach may lead to reductions in complication rates and duration of hospital stays. Aim: In this review, we outline the most common reasons for hospitalization of patients with PD, discuss challenges related to inpatient hospital care of patients with PD, and comment on future directions aimed at optimizing hospitalization outcomes in the population with PD.

Keywords

hospitalization, inpatient, Parkinson disease

Introduction

Parkinson disease (PD) is the second most common chronic progressive neurodegenerative disorder. The estimated prevalence of PD is approximately 1.6% in people over 65 years of age, rising up to 3% in people over 80 years of age.¹ According to the recent epidemiological data, the number of individuals affected by PD in the most populous nations worldwide is expected to rise and will double within the next several decades.² This trend mainly reflects increased life expectancy as well as a rapidly increasing aging population worldwide. These changes will result in an increasing disease burden on patients, caregivers, and health care systems at large. Parkinson disease is usually managed in outpatient neurology, or subspecialty movement disorders clinics. Progressive disability of PD, in conjunction with other comorbid conditions is associated with escalation of emergency room (ER) visits and increasing utilization of inpatient services.³ During ER visits or hospitalizations, patients with PD come into contact with physicians and allied health professionals with little expertise in PD, which may lead to significant challenges throughout the inpatient stay. It is therefore important to recognize and address disease-specific challenges that may impact optimal inpatient hospital care for patients with PD. Further, with the

incidence and prevalence of PD on the rise, it is expected that the financial burden of PD will increase accordingly.⁴ While the overall cost of PD care vary from country to country, the largest component of these costs relates to inpatient hospital care and nursing home costs.

Hospitalization-related issues specific to patient with PD have been increasingly recognized in the medical community over the past several years. In this review, we aim to highlight the most common reasons for hospitalization in PD, review complications that can occur during inpatient stays, and discuss recommendations to improve patient care.

Methods

We searched the PubMed electronic database of the National Library of Medicine for publications published up to July 17,

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Table 1. Common Reasons for Hospital Admissions in Parkinson Disease (PD)

Study	Vossius ⁸	Klein ¹²	Guneysel ⁷	Louis ⁶⁶	Temlett ¹²	Woodford ⁹	Martignoni ¹³	Tan ⁶⁷
Study duration (years)	12	6	2	15	5	4	1	1
# of patients	108	143	76	714	761	367	180	173
Mean age	73.8	69.5	73.1	35		78	75.5	74.7
Mean disease duration (years)	8.8		5.6	6.7			6.9	
# of admissions	4.2	1.7						1.5
Mean length of stay (days)	10	11	12.2			17.3		11.7
Reason for admission (%)								
Motor complications		20.3				8	30	10
Frequent falls		16.8			12	13		13
Psychosis				23			6.1	
Visual hallucinations		2.8				3		
Delusions with agitation		12.6						
Delirium		8.4			7	4		
Depression/anxiety						2		3
Dementia					3	1		1
Orthostatic hypotension		10.5			4	4		
Constipation		2.1				2		3
Dysphagia		1.4						1
Infections	6.3		31.6	8.1	23	21	4.5	22
Trauma	11.6		27.6				15	
Cardiovascular emergencies	0.6		14.5		12	17	11.7	
Cerebrovascular emergencies	1.9		11.8		4	3	16	
Gastrointestinal emergencies	3.6		7.9		11	5	3.3	
Pulmonary emergencies	6					1		
Urinary disorders					8	1	1.1	8
Electrolyte disturbances			6.6			2		
Cancer	7.4				10		0.6	5
Muscle/connective tissue disorder	5.3							
Other	20				21	8	11.7	9
Combined symptoms		25						

2011. For this review, we selected publications with titles containing the keywords “Parkinson’s”/“Parkinson,” plus one or more of the following keywords: “hospital,” “hospitalization,” “admission,” “inpatient,” “perioperative,” and “postoperative.” We also examined reference lists of relevant publications. Only original studies, including relevant abstracts, published in English were included. Individual case reports were excluded.

Results

A total of 81 references were obtained using our search methodology. Among these, 43 studies met the inclusion criteria for our review.

Hospital Admissions for PD

There is a relative scarcity of literature pertaining to reasons for ER evaluations and hospitalization in patients with PD. The most comprehensive literature review to date on this subject reported patients with PD being hospitalized approximately 1.5 times more frequently than non-PD patients.⁵ While 16% to 45% of patients with PD visit an ER yearly, 7% to 28% of patients are being hospitalized.^{4,6-9}

Approximately 50% of admissions for PD involve patients in an advanced stage of the disease.¹⁰ Patients with PD are more commonly discharged to nursing home care after their hospital stay.⁹ Some studies, however, reported no difference in hospitalization rates in PD versus other medical conditions.^{3,8} Observed differences may be in part influenced by duration of follow-up and may even out during longer periods of observation. Further, reasons for hospitalization of patients with PD vary between the United States and other countries worldwide.¹¹ This may reflect differences in insurance coverage and reimbursements within various health systems. The most common reasons for ER admissions and hospitalizations are outlined in Table 1. Besides motor complications of PD, other comorbidities frequently contribute to ER visits and admissions. These non-PD-related reasons for hospital admissions include infections, trauma, dehydration, and cardiovascular and cerebrovascular emergencies.^{7,14} Further, causes behind hospital admissions change with progression of the disease, particularly with the emergence of motor complications, falls, and cognitive and psychiatric impairments. Prospective studies aimed to better characterize and understand reasons that lead to hospitalizations of patients with PD should be done in order to develop preventive strategies that may reduce hospital admissions in PD.

Hospitalized Patients With PD—What Can go Wrong?

Medication Management

The management of medication regimens may arguably be the most challenging among all tasks pertaining to the care of hospitalized patients with PD. Patients with PD frequently have very complex medication regimens with frequent administration throughout the day. Hospital staff may not be familiar with the disease and strict medication regimens required by patients with PD. Further, patients with PD are more frequently admitted to general medicine wards rather than to a neurology ward.¹⁰ Cessation of PD medications may have severe consequences such as worsening mobility and motor control. While changes in medication regimen are frequently necessary, these have to be carefully monitored. This calls for an interdisciplinary approach including patient, caregiver, nurse, treating physician, pharmacist, and very importantly outpatient neurologist in charge of day-to-day management of PD.

Although issues related to administration of medications have not been systematically studied, several available reports illustrate the scope of the problem of medication management in hospitalized patients with PD. In a retrospective study of 34 hospitalized patients with PD, medications were stopped, omitted, or prescribed differently in 26 patients, leading to significant adverse events in over half of this group.¹⁵ Of these 34 patients, 4 received antidopaminergic medications known to aggravate PD symptoms. In another retrospective study, approximately 50% of the patients did not receive their medications on time, and medications were missed in 30% of patients.¹⁶ In a study conducted at the Michael E. DeBakey VA Medical Center, medical records of 89 PD patients with hospitalization longer than 48 hours were audited for medication administration.¹⁷ While missed doses of PD medications accounted for 48% of all errors, delayed administration of medications by more than 30 minutes resulted in additional 44% of all errors. Further, 21% of patients received medications considered to be contraindicated in PD. These results are in agreement with patient perspectives on received inpatient care. In a survey of 19 patients with PD and 10 caregivers, the majority were dissatisfied with the untimely administration of PD medications.¹⁸ In another survey, patients unveiled their impression that the hospital staff lacked understanding of PD, the importance of medication timeliness in PD, and appreciation of valuable insights from patients and family.¹⁹

Abrupt cessation of antiparkinsonian medications may lead to the development of neuroleptic malignant syndrome (NMS), or a dopamine agonist withdrawal syndrome (DAWS). Neuroleptic malignant syndrome is characterized by hyperthermia, rigidity, mental status changes, and autonomic dysregulation.²⁰ This potentially fatal condition, most commonly related to an adverse reaction to dopamine receptor blocking agents, or to abrupt withdrawal of antiparkinsonian medications, requires

timely diagnosis and prompt treatment.^{21–23} Dopamine agonist withdrawal syndrome is characterized by emergence of psychiatric (anxiety, agitation, irritability, panic attacks, dysphoria, and depression) and autonomic (orthostatic hypotension and perspiration) manifestations.²⁴ These manifestations have frequently been erroneously ascribed to being undermedicated or looked upon as a primary psychiatric disorder. The risk for development of dopaminergic withdrawal states has to be considered while making adjustments in antiparkinsonian medication regimens in the hospital setting.

Medication management becomes particularly challenging during surgical admissions during which medications may be abruptly discontinued and are frequently delayed postoperatively. Centrally active medications with dopamine receptor–blocking properties, frequently administered postoperatively for management of delirium, nausea, and gastrointestinal dysmotility, may have significant negative consequences on motor symptoms of PD. In a retrospective review of 59 surgical admissions from 54 patients with PD, 12% of all prescribed PD medications were missed (0.7 missed doses per patient each day).²⁵ While reasons for missed/late doses were documented only sporadically (36%), those reported included inability to swallow (14%), medication out of stock (8%), NPO status (8%), and patient's refusal (4%). Antidopaminergic medications, including metoclopramide, haloperidol, prochlorperazine, and cyclizine, were prescribed in 24 of the 59 admissions. These results call for consideration to allow administration of PD medications during the NPO status and timely utilization of nasogastric tubes in hospitalized PD patients with compromised swallow function. Special attention should be devoted to medication management postoperatively (see *Surgery and PD* below).

In order to improve medication management in hospitalized patients with PD, the United Kingdom's organization *Parkinson's UK* initiated the "Get It on Time" campaign.²⁶ In addition to its primary goal of assuring timely administration of medications to hospitalized patients with PD, this campaign brought nurses knowledgeable about PD as well as hospital pharmacists to inpatient health care teams. The campaign provided education about PD for staff nurses and physicians as well as helped establish specific guidelines for inpatient care of PD. Through a network of support groups, patients were educated about issues related to hospitalization and instructed to carry an accurate medication list with correct doses and detailed administration schedules. This campaign helped change the approach to hospital care of patients with PD. Patients admitted to the hospital electively are assessed by a PD nurse specialist to plan for admission and address any anticipated challenges. Although the effectiveness of the campaign has not been fully investigated, preliminary analyses suggest that these collective efforts have resulted in more accurate and timely administration of PD medication in inpatient settings.²⁷

Falls

The most common accidents in hospitals are falls by inpatients.²⁸ Falls occur commonly among patients with PD and are responsible for more than 30% of the acute events bringing patients with PD to emergency clinics.¹³ Prospective studies documented falls in up to 70% of patients with PD.^{29–31} Independent risk factors for falling in PD are previous falls, fear of falling, dementia, disease duration, and loss of arm swing.^{30,31}

To our knowledge, no study to date has assessed falls in hospitalized patients with PD. It is therefore important to utilize available knowledge about inpatients' falls in general in order to minimize fall risks of hospitalized patients with PD. Inpatient falls have multifactorial etiologies and can be categorized as care-related (eg, slippery flooring, poor lighting), patient-related (eg, visual, cognitive, motor impairment), and medication-related (eg, polypharmacy).^{32,33} Administration of sleep aids, benzodiazepines, narcotics, and antihistamines is associated with increased fall risk.³⁴ In a study of 4000 hospitalized patients in a University Hospital, inpatient falls were significantly associated with administration of antiparkinson medications.³⁵ Impaired mobility is present in 19% to 81% and impaired cognition in 11% to 44% of hospitalized patients who experienced a fall during their hospital stay.^{36,37} Increased patient-to-nurse ratio has also been associated with an increased risk of falling.³² Minor injuries occur in up to 40% of all inpatient falls, with 11% of all falls resulting in severe injuries.^{38,39} These results call for more monitored mobilization or assistance for inpatients with gait problems, use of toileting strategies for patients with incontinence, and for monitoring and adjustment of medications that may predispose patients to falling. These strategies should be applied to patients with PD requiring inpatient care.

Surgery and PD

Deep brain stimulation (DBS) has become an important treatment option for PD patients experiencing dyskinesias and motor complications of PD. The most common reasons for prolonged hospitalization after DBS are mental status changes and cerebral hemorrhage.⁴⁰ Among 115 patients who underwent unilateral DBS, factors associated with prolonged hospital stay were lower presurgical Mini-Mental State Examination scores, higher baseline Unified Parkinson Disease Rating Scale motor scores, and more microelectrode passes during the surgery.⁴⁰ Identifying factors that predict extended hospital stays have important implications for DBS planning.

Literature related to the perioperative management of PD is sparse. With life expectancy on the rise and increasing prevalence of PD worldwide, it is expected that increasing numbers of patients affected by PD will undergo surgical interventions in years to come. It is therefore important to recognize potential perioperative complications and develop preventive measures directed to improving perioperative safety of patients with PD. Guidelines for managing PD during surgery and postoperatively have been recently proposed.⁴¹ In comparison

to controls, patients with PD experience more perioperative complications.⁴² Parkinson disease is an independent risk factor for increased length of stay and morbidity in patients who undergo elective surgery.⁴² In the largest retrospective study of postoperative complications in patients with PD, which included surgical files of elective surgical procedures from all VA hospitals in the United States from 1990 through 1995 (234 patients with PD and 40 979 non-PD patients), patients with PD had significantly increased risk of urinary tract infections and aspiration pneumonia.⁴³ A trend toward increased risk for postoperative delirium, hypotension, and acute myocardial infarction was found in this study. Patients with PD had significantly longer acute hospital stays that were 2.3 days longer than non-PD patients. Confusion has been reported in up to 80% of patients with PD during the postoperative period.⁴⁴ Hallucinations frequently occur in addition to confusion. Postoperative changes in mentation may occur in the absence of dementia and regardless of the types of surgery or anesthesia.⁴⁴ Other common postoperative complications are falls, respiratory insufficiency, and urinary retention. Autonomic dysfunction, cognitive, and mobility impairments commonly present in PD predispose patients for development of urinary tract infections in the postoperative period. Other urinary disturbances include urinary retention with bladder distention which may lead to an acute confusional state. Gastrointestinal complications include dysphagia and gastric dysmotility, which may lead to postoperative ileus. Impaired respiratory function, chest wall rigidity, and dysphagia are predisposing factors for the development of pneumonia. The enteral administration of PD medications postoperatively may not be feasible, especially post gastrointestinal surgery, or in circumstances of postoperative ileus. In these circumstances, the use of parenteral antiparkinsonian medications should be considered. An algorithm for estimating parenteral doses of medications in perioperative settings for PD has been recently proposed.⁴¹ Several reports documented satisfactory control of motor and nonmotor PD symptoms with postoperative administration of apomorphine.^{45,46} Given its strong peripheral dopaminergic effects such as nausea, vomiting, and hypotension, apomorphine should be given with peripheral dopaminergic antagonists such as domperidone. Other studies reported the use of continuous intravenous levodopa infusions and levodopa administration via nasogastric tube or duodenostomy.^{47–49} Parenteral anticholinergic therapy as a measure to substitute dopaminergic medications intra/perioperatively is limited due to autonomic side effects and confusion. Rotigotine, a dopamine agonist with transdermal delivery, has been used successfully instead of enteral antiparkinsonian medications in perioperative settings.⁵⁰ Given their presurgical morbidity, the majority of patients with PD require further rehabilitative treatments postoperatively.

Other Hospitalization-Related Issues

Nonmotor manifestations of PD contribute significantly to morbidity and may be exacerbated throughout the hospital

admission.^{51,52} Nonmotor symptoms affect up to 90% of patients with PD.⁵³ Despite its frequent occurrence, nonmotor manifestations are frequently underreported by patients and underdiagnosed by physicians.^{54,55} Most common nonmotor manifestations of PD are mood disturbances (depression and anxiety), impaired sleep–wake cycle, autonomic dysfunction (orthostatic hypotension, urinary and sexual dysfunction, and constipation), as well as psychiatric disturbances. Etiologies of nonmotor features of PD are predominantly related to neurodegenerative processes of PD and to effects of antiparkinsonian pharmacological treatments. Further, nonmotor features associated with PD may coexist independently, as comorbid conditions to PD.

Hospitalized patients with PD are at increased risk for development of mental status changes.¹² These changes vary in intensity from mild, transient confusional episodes to delirium and encephalopathy. The risk for postoperative delirium varies between 2.8% and 8.1% among patients with PD compared with controls.⁴⁴ The etiology of delirium in PD is frequently multifactorial. Common causes include changes in medication regimens, infections, impaired sleep–wake cycles, effects of anesthesia and preexisting cognitive impairment. Patients with PD having dementia stay in the hospital twice as long as those without dementia, frequently as a result of worsening mentation.⁵⁶ Assessment and management of confused hospitalized patients with PD should include review and adjustment of medications with centrally acting properties, timely diagnosis and treatment of infection, as well as frequent reorientation of the patient to the hospital environment. Although formal studies are lacking, treatment with atypical antipsychotics or acetylcholinesterase inhibitors may be beneficial in selected cases.^{57,58}

Psychiatric symptoms may be a primary reason for hospitalization but may also emerge during an inpatient stay. Visual hallucinations are one of the most common psychotic symptoms in PD, affecting up to 40% of patients.⁵⁴ Other psychotic symptoms such as delusions, paranoia, panic attacks, or auditory hallucinations are less common psychotic features. Preferred medications for the treatment of psychosis associated with PD are quetiapine and clozaril.⁵⁹

In-hospital acquired infections (pneumonia, urinary tract and skin infections), deep venous thrombosis (DVT), and autonomic instability (eg, syncope, orthostatic hypotension) may further complicate the hospitalization of a patient with PD. Patients with PD having associated sialorrhea and silent aspiration have an increased risk of respiratory infections, which is the main cause of death in the PD population.⁶⁰ Therefore, aspiration precautions should be strictly enforced throughout the care of a hospitalized patient with PD. The incidence of DVT diagnosed during hospitalizations of patients with PD remains unknown. In an outpatient study of 81 patient with PD, the incidence of DVT was 4.9%.⁶¹ This finding calls for close DVT surveillance in inpatient settings where patients become less mobile and frequently bedridden. This is further emphasized by the fact that pulmonary

embolism is a common cause of death in patients with PD. Orthostatic hypotension affects up to 40% of patients with PD.^{62,63} This complication is associated with impaired balance and falls, causing an increase in morbidity and mortality.⁶⁴ While there are no specific guidelines for management of these issues in the hospitalized patients with PD, standard management applicable to any hospitalized patient should be employed.

Hospitalization in PD—Where are We Now and Where do We From Here?

Given the limited available literature devoted to hospitalizations of patients with PD, most recommendations for management are currently based on clinical experience rather than on formal studies (Table 2). Aminoff and colleagues recently reviewed the literature to identify practice gaps in the management of hospitalized patients with PD and recognized a number of important areas that may affect the outcomes of hospitalization.⁶⁵ The National Parkinson Foundation (NPF) conducted a survey to explore current practices and opinions regarding inpatient hospital care of patients with PD.¹¹ Forty-three NPF Centers of Excellence and 8 Care Consortium Centers which collectively provide care for over 50 000 PD patients worldwide participated in this survey. Survey results revealed that most centers were not confident about the quality of PD-specific inpatient care for hospitalized patients with PD. The survey recognized gaps in communication between center staff and hospital staff once patients present in the ER or get admitted to the hospital. Three specific targets for improvement recognized in this survey included (1) timeliness of notification that a patients with PD has been admitted to the hospital, (2) development of educational programs directed to the hospital staff and nonneurologist clinicians about PD, and (3) structuring a plan to improve access to outpatient care in order to prevent unnecessary hospitalizations. Recent literature clearly demonstrates the need for improving the hospitalization experience for patients with PD and their families. It has become evident that we need to develop tailored guidelines concerning the care of hospitalized patients with PD. This task will require a coordinated effort among PD specialists, hospital physicians and staff, patients, caregivers, and PD-oriented organizations. Prospective research studies are needed to investigate the effectiveness of proposed interventions on hospitalization outcomes in the PD population.

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Table 2. Common Hospitalization-Related Issues in Parkinson Disease (PD) and Strategies for Prevention and/or Their Management

Hospitalization-Related Issues in PD	Strategies for Prevention and/or Management
General issues	Provide education about hospitalization-related issues in PD to patients and their families (discuss at routine clinic visits, distribute pamphlets, newsletters, discuss at support groups, present lectures at patients symposia)
Elective hospitalization	Initiate timely and comprehensive planning of the hospitalization
Upon admission	Arrange for an early neurological consultation Inform treating neurologist / movement disorders specialist
Medication-related issues	Advise patients/caregivers to always carry up-to-date medication list (including medication doses and schedules) Inform/educate the primary medical team and nursing staff on the importance of timely administration of antiparkinsonian medications Review hospital medication administration logs to assure the correct medication schedule Review hospital medication administration logs to assure that medication contraindicated in PD are not part of the medication regimen Do not discontinue dopaminergic medications abruptly
Motor manifestations of PD and hospitalization	Promptly initiate fall precautions Promptly initiate aspiration precautions Consult rehabilitation services soon after the admission Adjust antiparkinsonian medication if needed (worsening wearing off and/or dyskinesias)
Nonmotor manifestations of PD and hospitalization: Mental status changes (encephalopathy, delirium, hallucinations, psychosis) Autonomic dysfunction (orthostatic hypotension, urinary dysfunction, constipation) Cognitive dysfunction Mood disturbances (anxiety, depression) Sleep dysfunction	Review the medication regimen and adjust it accordingly (minimize/exclude medications with CNS active properties) Search for infectious/toxic metabolic causes of impaired mentation Reorient patient to the hospital environment frequently Avoid sedative medications Do not administer typical neuroleptics for the treatment of mental status changes and agitation Obtain and monitor orthostatic vital signs Optimize hydration Adjust antihypertensive medications Consider nonpharmacological and pharmacological treatment options for orthostatic hypotension
Surgery and PD	Arrange for a surgery early in the day Administer antiparkinsonian medication on the morning of surgery Resume antiparkinsonian medications as soon as possible postoperatively Consider switching to parenteral medication regimen to avoid delays in treatment Administer pulmonary toilet Mobilize patient as early as possible

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