

Parkinson's Disease in Intensive Care Unit: An Observational Study of Frequencies, Causes, and Outcomes

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Abstract

Objective: To analyze the frequency, causes, and outcomes of admission to the Intensive Care Unit (ICU) among Parkinson's disease (PD) population so that preventive measures can be developed. **Methods:** We prospectively observed patients with diagnosis of PD admitted to ICU from January 2014 to December 2016. Based on etiology for hospital admission, they were divided into two groups – related to PD (further divided into direct or indirect) or not associated with PD at all. Etiology for hospitalization was determined from history and investigational data. The primary outcome was death or discharge from the hospital. Factors contributing to ICU admission were analyzed by comparing these patients with a cohort of 50 PD patients admitted to the neurology ward during the same study period. All values were expressed as mean (standard deviation) and percentages using SPSS version 16.0. **Results:** Fifty-three (36%) out of a total of 146 patients required ICU admission. Most common causes leading to admission in decreasing order of frequency were fever (34%), delirium (16%), falls (12%), encephalopathy (8%), gastrointestinal emergencies (6%); while direct disease-related severe dyskinesias were seen only in two patients (4%). 13.7% needed mechanical ventilation and mean duration of ventilation was 5.94 days with mortality rate of 20%. Significant factors predicting ICU admission, and thus, poor outcomes were age >65 years, history of previous admission within the last 12 months, delirium, and hypoalbuminemia. There was no significant association between the incidence of ICU admission and duration of disease or severity of the disease. **Conclusions:** Poor outcome in PD patients is due to systemic causes, hence multidisciplinary teamwork may improve outcome in these patients.

Keywords: Causes of admission, Intensive Care Unit, Parkinson's disease

INTRODUCTION

Parkinson's disease (PD) is a progressive degenerative disorder with a wide range of motor and associated nonmotor complications.^[1] It affects approximately 51.3–176.9/100,000 persons of all age groups in the Asian population.^[2-5] With an increase in the worldwide older population, the incidence of the disease is increasing as well. As the disease advances, motor fluctuations, dyskinesias, psychosis, falls, infections, and complications of immobility become more prominent. These disease-related complications often become more troublesome than the initial motor deficits and are the reason for repeated hospitalization.

Although hospitalization rates and the need for institutional care in PD patients have been reported as 1.5 times higher than the general population, it is unclear just how often these patients require Intensive Care Unit (ICU) admission.^[6] Since PD typically affects the aging population, there is an anticipation of higher comorbidity, so these patients may require more specialized care and management.^[7] We studied the profile of all patients of PD who required admission to the ICU with the aim to determine the reason for admission, factors influencing admission to ICU, and the outcome of these patients. To the best of our knowledge, this is one of the first studies from India that has evaluated the profile of PD patients who were admitted in the ICU of a tertiary care hospital.

METHODS

The study was prospectively conducted in the ICU of a tertiary care teaching hospital from January, 2014 to December, 2016. We have a tertiary care teaching hospital which is a major referral center serving a large population in Northern India from states of Punjab, Haryana, Himachal Pradesh, Jammu and Kashmir.

All adult patients formerly diagnosed by a neurologist based on the United Kingdom PD Society Brain Bank criteria and admitted to the ICU were included in the study. The severity of PD was classified according to the Hoehn and Yahr (H and Y) scale.^[8] The protocol of this study was approved by the Institutional Ethics Committee.

Based on the etiology for hospital admission, patients were divided into two groups, admission due to causes related to

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DOI: 10.4103/aian.AIAN_44_18

PD or not associated with PD at all but due to comorbidities. The PD-related admissions were further categorized into (a) directly related causes such as motor complications, severe motor response fluctuations, and dyskinesias or (b) indirectly related causes including significant falls causing trauma, delirium (diagnosed using the Confusion Assessment Method score), infections (based on total leukocyte count, procalcitonin, and cultures), aspiration pneumonia, severe GIT disturbance requiring hospitalization (constipation or diarrhea), and electrolyte disturbances (hyponatremia – <130 meq/L, hypernatremia – >145 meq/L, hypomagnesemia – <1.5 meq/L, hypocalcemia – <8.5 meq/L). Non-PD-related situations requiring admission were myocardial infarction, congestive cardiac failure, cerebrovascular disease or renal failure, etc., due to comorbid conditions.^[9]

Demographic profile, clinical characteristics, treatment, and outcome of the patients were recorded. The parameters recorded on a pre-designed proforma included age, gender, age of onset, duration of disease, modified H and Y staging (at admission), associated comorbid conditions, treatment history, previous admissions in past 12 months, reason for current admission, duration of ICU stay, and need for mechanical ventilation and complications. In patients with recurrent admissions during the study period, each admission was recorded as a separate event. Patients with insufficient data regarding diagnosis, incorrect diagnosis, or drug-induced Parkinsonism were excluded from the study.

The primary outcome of our study was death or discharge from the hospital. The secondary outcome measures that were assessed included duration of ICU stay (days), requirement for mechanical ventilation (as per the standard protocol of the hospital), and complications during the hospital stay such as bed sores, hospital-acquired infections, and deep vein thrombosis. We tried to find the factors that could contribute to ICU admission by comparing the patients requiring ICU admission with a cohort of 50 age- and gender-matched PD patients admitted to the neurology ward during the same study period of 3 years. Factors studied included age, duration of disease, stage of disease, history of previous admission, and presence of hyponatremia and hypoalbuminemia. All values were expressed as mean (standard deviation) and percentages using SPSS Version 16 (Armonk, NY: IBM Corp). The data were analyzed for each parameter separately using Chi-square test comparing ICU admission with ward/non-ICU admission. In the analysis, $P < 0.05$ was considered to be statistically significant.

RESULTS

During the study period of 3 years, there were total 146 admissions of PD patients in the neurology department, out of which 51 (34.9%) patients were admitted to the ICU [Figure 1]. One patient was excluded due to lack of consent. The age of this cohort ranged from 53 to 94 years, with a mean of 71.8 ± 4.9 years. There were 41 male (82%) and 9 (18%) female

patients. The clinical profile of all the patients admitted to the ICU is depicted in Table 1.

On analyzing the severity of the disease, 21 (42%) patients were in H and Y stage 2 and 20 (40%) patients in H and Y stage 3 and 9 (18%) patients in stage 4. The mean duration of PD was 4.9 ± 2.89 years (range 0.4–14 years) and the median severity score (H and Y stage) was 3. PD was first diagnosed in 4% of admissions. Among the patients admitted to the ICU, eight (16%) patients had a history of previous admission to the emergency or neurology ward in the last 12 months.

Among the 50 ICU admissions, 60% were direct from the emergency and 40% were shifted later from the ward to ICU on deterioration of their condition. The analysis of the reasons for admission to the ICU revealed that 40 (80%) patients had causes related to PD and 10 patients (20%) had non-PD-related causes for admission. Among the PD-related admissions, 38 patients (95%) had indirect causes and among them the most common reasons of admission were fever ($n = 17$, 34%), followed by delirium ($n = 8$, 16%), falls ($n = 6$, 12%), encephalopathy ($n = 4$, 8%), gastrointestinal emergencies ($n = 3$, 6%; two had ileus and one had intestinal perforation) while direct disease-related motor cause (severe dyskinesias) was seen only in two (4%) patients. However, there was an overlap of one patient who had both a direct and an indirect cause for ICU admission (severe motor symptoms and urinary tract infection [UTI]). On further evaluation of fever, pneumonia was diagnosed in eight and UTI in six (based on high total leukocytic count [TLC] and procalcitonin, chest X-ray findings, and positive cultures) while no cause could be determined in three patients (high TLC and procalcitonin but culture negative). Figure 2 shows the pattern of distribution of diagnosis (%) of PD patients.

Twenty-one (42%) patients had associated comorbid conditions. Three were on treatment for hypertension (HTN), three for coronary artery disease (CAD), two for diabetes mellitus (DM), seven had DM and HTN, three had HTN and CAD, while epilepsy, chronic kidney disease, and chronic liver disease was present in one patient each. Among the non-PD-related causes of admission, two were admitted with stroke and four each with acute coronary syndrome and renal failure.

Table 1: Clinical profile of Parkinson's disease patients admitted to the Intensive Care Unit

Characteristics	<i>n</i> =50 (range, %)
Sex (M/F)	41/9 (ratio 4.6:1)
Mean Age (years)	71.8 (range 53-94)
Disease stage (H and Y score)	2.7
Disease Duration (years)	4.9
Comorbidity (%)	21 (42%)
Mean duration of ICU stay (days)	5.9 (range 3-27)
Mean duration of ventilation (days)	3.8 (range 2-12)
Recurrent Hospitalization (%)	8 (16%)
Complications (%)	6 (12%)
Death (%)	10 (20%)

In our observational study, mortality rate among the PD patients in ICU was 20% [Figure 3]. The mean duration of ICU stay was 5.94 + 1.83 days (range, 3–27 days). Twenty patients (13.7%) needed mechanical ventilation with the mean duration of ventilation being 4.6 days. Complication rates were 12% as three patients had bed sores, two had hospital-acquired infections, and one developed deep vein thrombosis.

We compared the cohort of PD patients in ICU with 50 age- and gender-matched PD patients hospitalized in the neurology ward during the study period to obtain the best comparable group for determining the causes predicting ICU admission. Among them, 90% were elective admission through OPD and only 10% presented in emergency department but were stable enough to be admitted to ward and did not need direct ICU admission. Factors studied included age, duration of disease, stage of disease, history of previous admission, and presence of hyponatremia and hypoalbuminemia, but factors predicting ICU admission and thus, poor outcome were age >65 years, history of previous admission within the last 12 months, delirium and hypoalbuminemia [Table 2]. There was no statistically significant association between the incidence of ICU admission and duration of disease or severity of the disease.

DISCUSSION

As life expectancy is increasing worldwide, so the geriatric population are more likely to have hospital admissions and complications. We conducted a 3-year prospective observational study on the causes of admission of Parkinson disease patients into the ICU and factors responsible for the same.

The admission of PD patients to the ICU was not related to the stage or duration of the disease. This is contrary to the expectation that complications increase with the duration and severity of the disease. It also signifies that it is not the primary disease itself but the indirect factors related to PD that lead to hospital and ICU admission. Furthermore, only major problems such as severe infections, trauma, and cardiovascular accident needed to be admitted to the ICU, while many motor and late-stage PD-related issues are dealt in wards or on an outpatient basis.

The most common cause of ICU admission was infections, with chest infections accounting for admission in 16% of

patients while UTI accounted for 12% of the admissions. It is consistent with previous findings that show that PD patients are 3–4 times more likely to die of pneumonia or unclassified chest infections.^[10,11] This is probably related to their immobility or poor swallowing reflex and hence increased

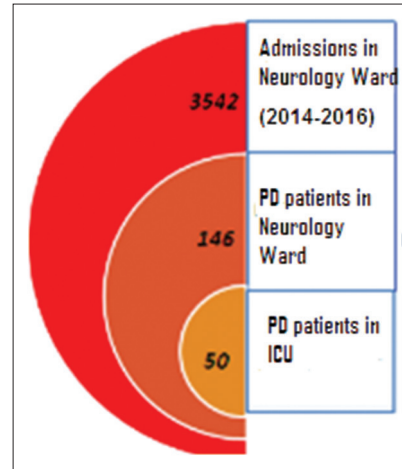


Figure 1: Distribution of patients in Neurology Ward (2014–2016)

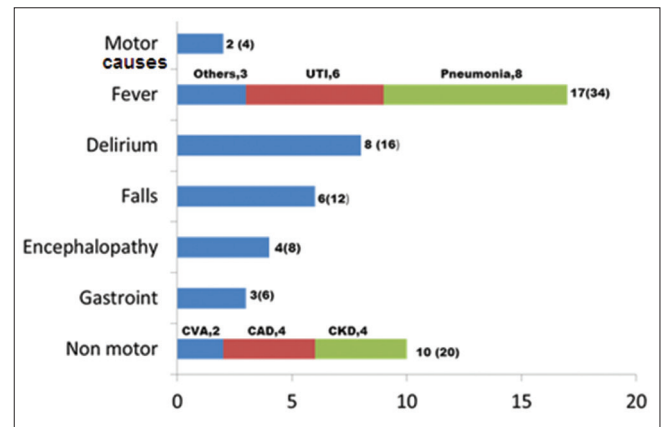


Figure 2: Distribution of diagnosis of Parkinson's disease patients (%)

Table 2: Factors predicting Intensive Care Unit admission in Parkinson's disease patients (<i>P</i> < 0.05 is regarded as significant)	
Characteristics	<i>P</i>
Age	0.02
Duration of disease	0.09
Stage of disease	0.65
History of previous admission	0.04
Hyponatremia	0.20
Delirium	0.01
Hypoalbuminemia	0.02

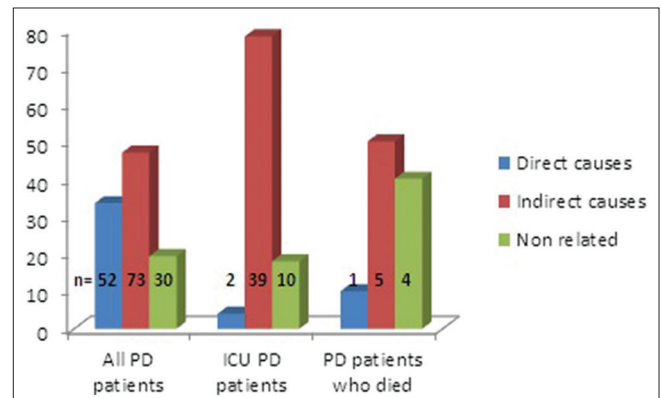


Figure 3: Comparison of causes of admission for all Parkinson's disease patients (*n* = 146) admitted during the study period with those admitted to the Intensive Care Unit (*n* = 50) and Parkinson's disease patients who had mortality (*n* = 10) in the Intensive Care Unit

vulnerability to develop aspiration pneumonia. Guneyssel *et al.* have reported infections (31.6%) as the most common reason for hospitalization.^[12] Similarly, Tan *et al.* reported pneumonia in 13% of 761 admitted PD patients.^[13] Furthermore, urinary dysfunction and symptoms related to obstruction are related to the poor sphincter relaxation in PD patients. Some of these symptoms may be age-related prostatic hypertrophy resulting in increased handling of the urinary tract and thus, higher risk of infection. Thus, caregivers of PD patients must be vigilant against early signs and symptoms of infection so as to enable early treatment.

Patients with PD suffer from a wide range of medical problems as well. Previous studies on the risk and incidence of cardio- and cerebro-vascular disorders have shown varying results, with Scigliano *et al.* reporting a higher incidence of stroke and myocardial infarction although others have reported either no difference or even lower incidence rates of CVA in PD patients.^[14,15] In this study, 42% of the patients admitted to the ICU had associated comorbidities such as DM, HTN, CAD, renal failure, and stroke [Table 1]. Non-PD-related causes were the second most common reason for ICU admission. Some of these could be age related and hence age above 65 years emerged as a significant factor predicting ICU admission. An earlier study has shown that PD patients were approximately 1.5 times more likely to die from stroke.^[16,17] It is not clear whether this is just a reflection of the greater likelihood of PD patients visiting a neurologist and hence a greater frequency of diagnosis or whether there is a real cause-effect relationship that needs further evaluation.

About 16% of PD patients admitted to the ICU were in delirium. Mental disturbances have been described in patients with PD, most commonly being delirium and psychosis.^[18] Delirium may be attributed to a change of environment, hospital stay, electrolyte disturbances, and infections; while it has been suggested that psychosis is likely due to drugs like dopamine agonists. Deficits in the neurotransmitters dopamine and acetylcholine are implicated in the pathophysiology of delirium in PD. PD is regarded as a risk factor for delirium, and this has a negative impact on the motor symptom trajectory.^[19] An earlier study published by the authors showed that hyponatremia-related altered mentation was a significant cause of admission of PD patients to the hospital.^[20]

Falls are a common problem in the elderly and more so with the aging PD population. Six out of 50 (12%) patients were admitted with trauma, with two sustaining head injury (subdural hemorrhage) and four having lower limb fractures. Previous studies have reported a similar incidence of 11% to 27.6% of emergency admissions among PD patients due to falls and fractures.^[21,22] Severe wearing off and dyskinesias make PD patients vulnerable to postural instability and they often need help to ambulate. Hence, efforts should be made to correct patient and environmental factors to prevent such serious events.

On comparison among the PD patients admitted to the ICU and 50 PD patients hospitalized in the neurology ward during

the study period factors such as history of previous admission within the last 12 months, delirium, and hypoalbuminemia were significantly related to ICU admission. However, these results are from a small cohort and hence, should be confirmed in large study populations.

CONCLUSIONS

Motor disability and disease staging do not predict the whole picture of PD and complications leading to ICU admission. The most common causes for ICU admission are infections and non-PD-related problems due to comorbidities. In conclusion, prevention of infections which leads to recurrent hospital admissions, delirium, and proper attention to nutrition to prevent hypoalbuminemia may play a role in decreasing the morbidity associated with the disease.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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