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Orthostatic hypotension in Parkinson disease: Impact on health care utilization

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ABSTRACT

Introduction: Orthostatic hypotension (OH) represents a frequent yet overlooked source of disability in Parkinson disease (PD). In particular, its impact on health care utilization has been insufficiently examined. We sought to determine the differential health care utilization in PD patients with (PDOH+) and without OH (PDOH-).

Methods: We quantified the emergency room (ER) visits, hospitalizations, outpatient clinic evaluations, phone calls, and e-mails from PD patients on whom supine and orthostatic blood pressure (BP) measurements were obtained during routine clinical practice between June 2013 and July 2016. Comparative costs between PDOH+ and PDOH- were adjusted for age, disease duration, motor severity, levodopa equivalent daily dose, and Montreal Cognitive Assessment.

Results: From a total of 317 PD patients, 29.3% were classified as PDOH+ (n = 93) and 70.6% as PDOH- (n = 224) over 30.2 ± 11.0 months, in which there were 247 hospitalizations, 170 ER visits, 2386 outpatient evaluations, and 4747 telephone calls/e-mails. After-adjusting for relevant covariates, PDOH+ was associated with more hospitalization days (+285%; p = 0.041), ER visits (+152%; p = 0.045), and telephone calls/e-mails than PDOH- (+142%; p = 0.009). The overall health care-related cost in PDOH+ was 2.5-fold higher than for PDOH- (\$25,205 ± \$6546 vs. \$9831 ± \$4167/person/year; p = 0.037).

Conclusion: OH increases health care utilization in PD independently from age, disease duration, motor severity, dopaminergic treatment, and cognitive function.

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1. Introduction

With a prevalence of 30% [1], orthostatic hypotension (OH) represents a frequent yet overlooked non-motor feature of Parkinson's disease (PD), resulting from the impairment of baroreflex mechanisms required to maintain a constant blood pressure (BP) and cerebral perfusion across the supine, sitting, and standing positions.

OH, defined by a BP fall greater than 20 mm/Hg systolic or 10 mm/Hg diastolic within 3 min of standing from a sitting or supine position [2], represents a major determinant of disability in elderly patients, potentially resulting in postural instability, gait

impairment, and falls [3–5]. In a study evaluating 12,661 subjects enrolled in the Atherosclerosis Risk in Communities (ARIC), OH was found to be an independent predictor of falls [6], resulting in greater rate of head trauma and hip fractures.

The management of OH is even more challenging in PD given the additional autonomic dysfunction, which has a prevalence of over 30% [1], and the associated hypotensive effect of dopaminergic medications needed for symptomatic treatment [7]. Despite its frequency, OH is frequently under-recognized [8]. As a result, PD patients with OH are often untreated (or undertreated even when recognized) and left with potentially greater net disability – and healthcare utilization – than those without OH.

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To evaluate the effect of OH on health care utilization among PD patients we obtained data on days of hospitalizations, number of ER visits, outpatient clinic evaluations, telephone calls and e-mails to health care providers in a cohort of PD patients for whom supine and orthostatic blood pressure measurements were obtained as part of their routine bedside evaluation to screen for OH.

2. Methods

2.1. Study design

We retrospectively analyzed electronic medical records from consecutive PD patients with orthostatic BP measurements at the Gardner's Family Center for Parkinson's disease and Movement Disorders (University of Cincinnati, USA) between June 2013 and July 2016. Data related to health care utilization and costs were compared between PDOH+ and PDOH-.

2.2. Participants

Inclusion criteria were idiopathic PD [9] with at least two clinical evaluations during the three-year study period, and availability of orthostatic BP measurements. As part of routine clinical practice at our center, all PD patients complaining of dizziness, lightheadedness, or postural instability were screened for OH. Exclusion criteria were diabetes mellitus or other diseases potentially associated with autonomic neuropathy [10], any atypical features affecting the diagnostic certainty of idiopathic PD, pharmacological treatment for chronic hypertension, and medical conditions associated with non-neurogenic OH, such as dehydration, anemia, or use of alpha-blockers [11]. Patients were classified as PDOH+ or PDOH- as per the "20/10 criteria", which consists of a fall in systolic BP ≥ 20 mm/Hg or diastolic BP 10 mm/Hg within 3 min of standing after a minimum of 5 min of supine rest [2]. Patients classified as PDOH+ were advised to increase daily water and salt intake; elevate the head of the bed by 3–5 inches; perform maneuvers to reduce blood venous pooling in the lower limbs when standing; and keep a blood pressure diary in sitting and standing position, also reporting episodes of postural lightheadedness and OH-related instability. These patients may have undergone a reduction or discontinuation of their dopaminergic medications, especially if on dopamine agonists. Vasopressor agents may have been started if warranted based on the outcome of blood pressure and clinical diaries.

2.3. Measures and outcomes

Definitions. Hospitalization was defined as admission to an inpatient unit for at least one night. Fall was defined according to the World Health Organization (WHO) as "an event that results in a person coming to rest inadvertently on the ground or floor or other lower level." Dementia was defined as per the Movement Disorders Society Criteria, as an impairment in at least two cognitive domains with a significant impact on patient's autonomy in daily living activities (ADL) [12]. Levodopa equivalent daily dose (LEDD) was calculated according to a validated conversion table [13].

Health care utilization. Electronic medical records (Epic Systems Corporation, Verona, Wisconsin) were searched for hospitalizations (number, days, and indications), ER visits (number and indications), and number of outpatient clinic evaluations, telephone calls and e-mails sent to health care providers from patients or caregivers. Clinical and demographic data extracted included gender, age, disease duration, follow-up duration, falls, motor

subscale of the Movement Disorders Society Unified Parkinson's disease rating scale (MDS-UPDRS-III), Montreal Cognitive Assessment (MoCA), and medications.

Costs. Average daily direct costs for hospitalizations, ER visits, and outpatient clinic visits for the 2013–2016 period were extracted from the University of Cincinnati Medical Center Patient Price Information List [14]. Costs associated with e-mails and telephone calls were calculated based on a 5-min unit-of-exchange time and according to the average reported salary for a Neurologist in the state of Ohio (obtained from Doximity, a network of US healthcare professionals [15]). Indirect costs (e.g., lost work days by caregivers) and costs without validated method of calculation were not considered.

2.4. Statistical analyses

Demographic and clinical data were described with appropriate summary measures (frequency, mean \pm standard deviation) and compared using the Mann-Whitney non-parametric test or Fisher's exact test, as appropriate. Analysis of covariance (ANCOVA) was used to estimate differences in the annualized number of ER visits, outpatient clinic visits, telephone calls/e-mails, and days of hospitalizations (dependent variables) between PDOH+ and PDOH- (independent variable), adjusting for age, disease duration, MDS-UPDRS motor score, total LEDD, and MoCA score (covariates). Similarly, health-care cost metrics (dependent variables) were compared between PDOH+ and PDOH- (independent variable) adjusting for the same covariates. Indications for ER visits and hospitalizations were summarized with descriptive statistics and compared between PDOH+ and PDOH- using the Fisher's exact test. All p-values were two-tailed with 0.05 as a statistical threshold of significance. The University of Cincinnati Institutional Review Board approved this study.

3. Results

A total of 317 PD patients underwent supine and orthostatic BP measurements, allowing a classification of PDOH+ in 29.3% ($n = 93$) and PDOH- in 70.6% ($n = 224$). During the study period of 30.2 ± 11.0 months there were 247 hospitalizations, 170 ER visits, 2386 outpatient clinic evaluations, and 4747 telephone calls/e-mails.

Unadjusted data showed that PDOH+ patients were older ($p < 0.001$), had longer PD duration ($p = 0.016$), and worse MDS-UPDRS-III score ($p < 0.001$) than PDOH- (Table 1). After adjusting for age, PD duration, MDS-UPDRS-III score, total LEDD, and MoCA, PDOH+ remained independently associated with more days of hospitalizations (+285%; $p = 0.041$), ER visits (+152%; $p = 0.045$), and telephone calls/e-mails (+142%; $p = 0.009$) compared to PDOH- (Fig. 1).

Health care utilization. There was a higher rate of hospitalizations and ER visits for neuropsychiatric complications ($p = 0.043$ and $p = 0.025$) and falls ($p = 0.034$ and $p = 0.045$) among PDOH+ compared to PDOH-, as well as a higher rate of hospitalizations for rehabilitation or musculoskeletal complications ($p = 0.009$) (Fig. 2).

Costs. There were a 3-fold higher hospitalization costs (+285%; $p = 0.038$), 1.5-fold higher ER visits costs (+156%; $p = 0.044$), and 1.4-fold higher telephone calls/emails costs (+159%; $p = 0.006$), adjusting for age, PD duration, MDS-UPDRS-III score, total LEDD, and MoCA score. Overall costs per patient per year were 2.5-fold higher in PDOH+ than PDOH- (+256%; $p = 0.037$) (Table 2; Supplementary Table 1).

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