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Comorbid Parkinson's disease, falls and fractures in the 2010 National Emergency Department Sample

Hind A. Beydoun [a, 1], May A. Beydoun [b, *, 1], Nishant K. Mishra [c], Ola S. Rostant [b], Alan B. Zonderman [b, 2], Shaker M. Eid [a, 2]

[a] Johns Hopkins University School of Medicine, Baltimore, MD, USA
[b] National Institute on Aging Intramural Research Program, Baltimore, MD, USA
[c] Tulane University School of Medicine, New Orleans, LA, USA

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ABSTRACT

Introduction: Parkinson's disease (PD) is a progressive, neurodegenerative disorder of multifactorial etiology affecting ~1% of older adults. Research focused on linking PD to falls and bone fractures has been limited in Emergency Department (ED) settings, where most injuries are identified. We assessed whether injured U.S. ED admissions with PD diagnoses were more likely to exhibit comorbid fall- or non-fall related bone fractures and whether a PD diagnosis with a concomitant fall or bone fracture is linked to worse prognosis.

Methods: We performed secondary analyses of 2010 Healthcare Utilization Project National ED Sample from 4,253,987 admissions to U.S. EDs linked to injured elderly patients. ED discharges with ICD-9-CM code (332.0) were identified as PD and those with ICD-9-CM code (800.0–829.0) were used to define bone fracture location. Linear and logistic regression models were constructed to estimate slopes (B) and odds ratios (OR) with 95% confidence intervals (CI).

Results: PD admissions had 28% increased adjusted prevalence of bone fracture. Non-fall injuries showed stronger relationship between PD and bone fracture (OR_{adj} = 1.33, 95% CI: 1.22–1.45) than fall injuries (OR_{adj} = 1.06, 95% CI: 1.01–1.10). PD had the strongest impact on hospitalization length when bone fracture and fall co-occurred, and total charges were directly associated with PD only for fall injuries. Finally, PD status was not related to in-hospital death in this population.

Conclusion: Among injured U.S. ED elderly patient visits, those with PD had higher bone fracture prevalence and more resource utilization especially among fall-related injuries. No association of PD with in-hospital death was noted.

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1. Introduction

Parkinson's disease (PD) is a progressive, neurodegenerative disorder of multifactorial etiology affecting ~1% of older adults. Recent studies have suggested that PD may be a risk factor for hypovitaminosis D [1], low bone mass density (BMD) [2–5] as well as osteoporosis [1,6–8], falls [9,10], and bone fractures [2,9–17]. The most commonly identified type of bone fracture in PD patients is a hip (or neck of femur) fracture [2,15,16,18,19] and the majority of bone fractures have been attributed to fall injuries [9,20]. It has been postulated that symptoms of PD can reduce mobility [1,20], leading to simultaneous reduction in sunlight exposure [9,12] and increase in bone resorption [18] subsequently resulting in increased likelihood of bone fractures. Whereas aging itself may be accompanied by worsening of bone health [12], PD-affected individuals may experience a higher risk of fall injuries and bone fractures because of the multitude of motor and non-motor symptoms and their associated treatments [5,9,12]. Furthermore, surgical intervention related to bone fractures in PD patients remains controversial [19], highlighting the importance of osteoporosis and injury prevention among PD patients.

To date, research focused on linking PD to healthcare utilization

* Corresponding author. NIH Biomedical Research Center, National Institute on Aging, IRP, 251 Bayview Blvd., Suite 100, Room #: 04B118, Baltimore, MD 21224, USA.
E-mail addresses: hindb1972@gmail.com (H.A. Beydoun), baydounm@mail.nih.gov (M.A. Beydoun), nishmishra@gmail.com (N.K. Mishra), ola.rostant@nih.gov (O.S. Rostant), zondermana@mail.nih.gov (A.B. Zonderman), seid1@jhmi.edu (S.M. Eid).
[1] Co-first authors.
[2] Co-senior authors.

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and outcomes related to falls and bone fractures has been limited, especially in emergency care settings, where most injuries are identified. In a cross-sectional study, we performed secondary analyses of the 2010 Healthcare Utilization Project (HCUP) National Emergency Department Sample (NEDS) data among injured elderly patients admitted to U.S. Emergency Departments (EDs) to assess whether admissions linked to injured ED patients diagnosed with PD are more likely than those not diagnosed with PD to have comorbid fall- and non-fall related bone fracture and whether PD diagnosis with concomitant fall or bone fracture is linked to worse prognosis based on length of hospital stay, cost of hospitalization and in-hospital death. Since falls may or may not mediate the relationship between PD and bone fractures, we hypothesized that admissions linked to elderly ED patients diagnosed with PD would be more likely to experience fall- and non-fall related bone fracture as compared to those not diagnosed with PD. Furthermore, we hypothesized that resource utilization related to falls and bone fractures would be exacerbated by a PD diagnosis, given the disabling aspect of PD.

2. Materials & methods

2.1. Database

Sponsored by the Agency for Healthcare Research and Quality, the HCUP consists of publicly available databases and software tools created as a federal-state-industry partnership to support decision-making. NEDS is the largest all-payer ED database in the U.S., yielding national and regional estimates of hospital-based ED visits, with data on ~30 million discharges representing ~130 million ED visits each year. Since 2006, the NEDS samples were selected from the American Hospital Association community, non-rehabilitation hospitals participating in the State Inpatient Databases (patients initially seen in the ED and then admitted to the same hospital) and State Emergency Department Databases (ED treat-and-release visits or transfers to another hospital) and include information on geographic, hospital and patient characteristics as well as the nature of the visits.

Between January 1 and December 31, 2010, NEDS data were compiled from 961 hospitals located in 28 participating States (AZ, CA, CT, FL, GA, HI, IA, IL, IN, KS, KY, MA, MD, MN, MO, NC, NE, NJ, NV, NY, OH, RI, SC, SD, TN, UT, VT, and WI), representing a 20% stratified sample of U.S. EDs. Stratification was based on five characteristics: geographic region (Northeast, Midwest, South and West), trauma center designation (trauma level I, II, III and non-trauma), hospital urban-rural location (large metropolitan, small metropolitan, micropolitan, and non-urban residual), teaching status (teaching, non-teaching) and ownership (public, for-profit and not-for-profit). The database includes clinical and resource information during ED visits, encompassing demographic information, admissions, injuries, diagnoses (up to 15), payment source, total hospital charges for inpatient stays of ED visits that result in admission, procedures categorized according to the International Classification of Disease, 9th Revision, Clinical Modification (ICD-9-CM) and the Current Procedural Terminology, as well as death in ED, if present. In this study, ED admissions for patients 65 years and older, with an injury-related diagnosis, were selected from the 2010 NEDS. We excluded all ED admissions corresponding to ED patients <65 years of age and those with missing data on age (n = 18,236,875) as well as non-injured patients and those with missing data on injury status (n = 3,930,483).

2.2. Variable definitions

ED discharges with an ICD-9-CM code of 332.0 were identified as corresponding to patients with a PD diagnosis. Moreover, ED discharges with a diagnostic ICD-9-CM code ranging from 800.0 to 829.0 were used to define presence or absence of an adverse outcome, namely bone fracture of the “skull”, “spine & trunk”, “lower limb” or “upper limb”. Covariates were classified into three categories, namely, injury-, hospital- and patient-related characteristics. Injury-related variables were used to characterize discharges in terms of *injury status* (principal admitting diagnosis, not principal admitting diagnosis), *injury intent* (intentional, unintentional) and *injury by falling* (no, yes). Stratified analyses were performed according to presence or absence of bone fracture of the “skull”, “spine & trunk”, “lower limb” or “upper limb” as well as whether or not injury was related to falling as determined by *injury by falling* (no, yes). Hospitals were characterized by U.S. census region (Northeast, Midwest, South, West), urban-rural location (Urban, Rural), trauma center designation (Non-trauma center, Trauma level I, Trauma level II, Trauma level III, Unknown), teaching status (Non-teaching, Teaching) and ownership/control (Public, Private − Non-Profit, Private − Invest-Own, Unknown). Patient characteristics included sex (Male, Female), age (‘65−69’, ‘70−74’, ‘75−79’, ‘80+’ years), household socioeconomic status (in quartiles) as denoted by the patient's zip-code (‘$1−$40,999’, ‘$41,000−$50,999’, ‘$51,000−$66,999’, ‘$67,000 or more’) and the 17-item Charlson's comorbidity index using ICD-9-CM diagnostic codes, categorized as ‘0’, ‘1’ and ‘2+’. Selected healthcare utilization outcomes were defined based on the following variables: length of hospitalization (in days), total charges (in U.S. dollars ($)) in the ED and in the hospital among patients that were hospitalized and death in the ED and in the hospital among patients that were hospitalized.

2.3. Statistical analysis

All statistical analyses were conducted using STATA version 14 (STATA Corp, College Station, TX), taking into account the complex sampling design using stratum (NEDS_STRATUM) and discharge weight (discwt) variables and STATA's *svy* commands. First, we estimated the prevalence of PD diagnosis and bone fractures according to demographic, socioeconomic and clinical characteristics. Second, we assessed the relationship between PD (exposure variable) and bone fractures (outcome variables), before and after adjustment for potential confounders, overall, and according to presence or absence of fall as an external cause of injury (stratifying variable). Finally, we examined PD as a predictor of length of hospital stay, cost of hospitalization and in-hospital death, overall, and according to presence of bone fractures or falling as an external cause of injury (stratifying variables). Summary statistics, including weighted means, proportions and totals, were calculated taking sampling design complexity into account. Bivariate analyses were performed using design-based F-tests. Multivariable analyses included linear and logistic regression modeling to estimate unstandardized regression (B) coefficients and odds ratios (OR) with their 95% confidence intervals (CI), respectively. Of note, B coefficients can be interpreted as the average increase in length of hospital stay or cost of hospitalization associated with PD. Adjustment was performed for hospital and patient characteristics in the context of bone fracture as the outcome of interest and for injury-, hospital- and patient characteristics when the outcomes were defined as length of hospital stay, cost of hospitalization and in-hospital death. Two-sided statistical tests were conducted at an alpha level of 0.05.

3. Results

Table 1 shows the distribution of the study sample

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