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Original Investigation

Gait Speed and Mortality, Hospitalization, and Functional Status Change Among Hemodialysis Patients: A US Renal Data System Special Study

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Background: Slow walk (gait) speed predicts functional decline, institutionalization, and mortality risks in the geriatric population. A gait speed evidence base for dialysis patient outcomes is needed.

Study Design: Prospective cohort study.

Setting & Participants: 752 prevalent hemodialysis (HD) patients aged 20 to 92 years evaluated in 2009 to 2012 in 7 Atlanta and 7 San Francisco clinics in a US Renal Data System special study.

Predictor: Usual walk speed in meters per second, categorized as ≥0.6 m/s (baseline n = 575), <0.6 m/s (baseline n = 94), and unable to perform walk test (baseline n = 83).

Outcomes: Survival; hospitalization; activities of daily living (ADL) difficulty; 36-Item Short Form Health Survey (SF-36) Physical Function score.

Measurements: Cox proportional hazards models investigated gait speed and mortality over a median follow-up of 703 days. Multivariable logistic or linear regression models estimated associations of baseline gait speed with hospitalization, need for ADL assistance, and SF-36 Physical Function score after 12 months.

Results: Participants who walked ≥0.6 m/s had 53 (9%) deaths, those who walked <0.6 m/s had 19 (20%) deaths, and those unable to walk had 37 (44%) deaths. Adjusted mortality hazard ratios were 2.17 (95% CI, 1.19-3.98) for participants who walked <0.6 m/s and 6.93 (95% CI, 4.01-11.96) for those unable to walk, compared with participants walking ≥0.6 m/s. After 12 months, compared with baseline walk speed ≥ 1.0 m/s (n = 169 participants), baseline walk speed of 0.6 to <0.8 m/s (n = 116) was associated with increased odds of hospitalization (OR, 2.04; 95% CI, 1.19-3.49) and ADL difficulty (OR, 3.88; 95% CI, 1.46-10.33) and a −8.20 (95% CI, −13.57 to −2.82) estimated change in SF-36 Physical Function score.

Limitations: Cohort not highly representative of overall US in-center HD population.

Conclusions: Because walking challenges the heart, lungs, and circulatory, nervous, and musculoskeletal systems, gait speed provides an informative marker of health status. The association of gait speed with HD patients' risk for functional decline warrants continued study.

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INDEX WORDS: Activities of daily living (ADL) difficulty; functional status; gait speed; dismobility; physical functioning, walking ability, hemodialysis; end-stage renal disease (ESRD); hospitalization; mortality; US Renal Data System (USRDS).

Evaluation of physical functioning in the end-stage renal disease (ESRD) population is an important potential component of clinical performance measurement.[1] Physical performance limitations characterize many patients with kidney disease and affect the quality of their daily lives.[2,3] Moreover, recent evidence from individuals with chronic kidney disease (CKD) indicates that physical performance is associated with mortality rate.[4] An evidence base for the importance, scientific acceptability, feasibility, and usability of physical performance measures in the ESRD population is critical.[5]

The value of measuring usual walk speed in clinical care for older persons increasingly is endorsed, and a gait speed cutoff point that identifies dismobility has been proposed.[6] Among persons with CKD stages 2 to 4, Roshanravan et al[4] recently showed that slower gait speed predicted all-cause mortality over a median 3-year follow-up. Several studies have documented that gait speed among dialysis patients is slower than would be expected based on general population values,[5,7,8] but there has been no investigation of the association of gait speed with survival and other outcomes among patients undergoing dialysis. Because walking places demands on the heart and lungs, as well as the circulatory, nervous, and musculoskeletal systems, gait speed may provide a very informative marker of dialysis patients' health.

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Information is needed about the predictive utility of gait speed and its potential relevance for routine clinical care.[5]

In this US Renal Data System (USRDS) special study, we measured baseline gait speed, ascertained survival, and assessed hospitalization, disability, and perceived physical functioning at a 12-month follow-up in a large multicenter cohort of prevalent maintenance hemodialysis (HD) patients aged 20 to 92 years. While acknowledging that there is no apparent threshold in graded associations between walking speed and clinical outcomes related to mobility, Cummings et al[6] recently defined 0.6 m/s as very slow gait speed and proposed that this cutoff point is a meaningful definition of dismobility. As walking speed slows to <0.6 m/s, the risk of disability and other poor health outcomes increases rapidly among older persons.[6] Other working groups have proposed using cutoff values of 0.8 and 1.0 m/s to define slow gait speed.[9,10] We hypothesized that: (1) gait speed < 0.6 m/s would be associated with increased mortality risk among HD patients, and (2) among patients with gait speeds ≥ 0.6 m/s, slower gait speed at baseline would be associated with increased likelihood of hospitalization, need for assistance performing activities of daily living (ADLs), and lower self-reported physical functioning at a 12-month follow-up.

METHODS

Participants and Measurements

Coordinated by the USRDS, ACTIVE/ADIPOSE (A Cohort Study to Investigate the Value of Exercise in ESRD/Analyses Designed to Investigate the Paradox of Obesity and Survival in ESRD) is a multicenter study of prevalent patients receiving HD.[11] Seven outpatient dialysis clinics in the Atlanta, GA, metropolitan area and 7 outpatient dialysis clinics in the San Francisco Bay Area, CA, constituted the study sites. A primary reason for exclusion of peritoneal dialysis (PD) patients was that conducting physical performance assessments was an important component of the study, and this was accomplished more easily and economically by restricting study participants to in-center HD patients. In addition, with a limited number of clinics as study sites, the number of PD patients potentially available for enrollment would have been small. A total of 771 prevalent HD patients were enrolled and participated in baseline assessments in September 2009 to September 2011. Follow-up assessments were scheduled at 12 months postbaseline. Participating clinics were affiliated with large dialysis providers, medium-size providers, and academic medical centers. The median number of study participants per dialysis clinic was 50 (range, 33-99). Institutional review boards at Emory University and the University of California−San Francisco approved the study.

Eligible study participants were adults (aged ≥ 18 years), English or Spanish speaking, treated by HD for at least 3 months, and capable of giving informed consent. Exclusion criteria were current treatment by PD or home HD; evidence of active malignancy, including brain tumor; and expected geographic relocation. Vulnerable populations (pregnant women, prisoners, and persons with significant mental illness) also were excluded. Single and double amputees and patients with prior or pending transplantation were considered eligible. Among eligible patients, 85% supplied informed consent and were enrolled. Reasons most frequently given by those who declined to participate were that they were "not interested," "too busy," or "enrolled in another study."

No physical performance information could be obtained at baseline for 19 of the 771 enrollees due to death, transplantation, return of kidney function, and transfer to a nonstudy clinic prior to the scheduled evaluation, but walking ability was ascertained at the baseline assessment for 752 study participants. In addition to 669 participants for whom walk speed was measured, we describe characteristics of the other 83 participants who were unable to perform the walk test; a large number (84%) of the latter participants were wheelchair dependent.

Usual walk speed of 669 patients was measured 2 times over a 15-feet (4.57-m) walkway.[12] Coordinators observed whether the participant used an assistive device for walking and whether an assistive device was used to perform the walk. All assessments were conducted pre-HD on the midweek treatment day.

Study coordinators also conducted a brief interview with participants and reviewed medical records. Each study site (Atlanta and San Francisco) had one primary study coordinator who conducted the majority of the assessments; the primary coordinator also trained and supervised an assistant coordinator. Consistency of measurement procedures was monitored throughout the study, using repeated demonstration/review of physical performance techniques and office quality control of recorded interview and medical record data.

During the interview, participants reported falls incurred during the past 12 months. A fall was defined as an event that resulted in a person coming to rest inadvertently on the ground, floor, or other lower level.[13] At each measurement time (baseline and 12 months), ADL difficulty was assessed by participants' reports that they needed assistance or were unable to do one or more of 4 tasks (bathing, dressing, getting in and out of a chair, and walking around home/apartment).[14] Consistent with prior research, participants who needed help with (or were unable to do) any of the tasks were considered to have ADL difficulty (an indicator variable).[14] Study participants also completed the 36-Item Short Form Health Survey (SF-36) Physical Functioning scale[15] and the Kidney Disease Quality of Life Cognitive Function scale (KDQOL-CF)[16]; these measures are scored 0 to 100, with higher scores indicating, respectively, fewer perceived limitations in performing daily activities and better cognitive function.

Race, sex, age, and ESRD treatment initiation date were ascertained from patient report and the USRDS Medical Evidence Standard Analysis Files. Patient report was the primary source of information for race; for the small number of participants who declined to specify race, race information was taken from the USRDS Medical Evidence file.

Comorbid conditions were abstracted from dialysis clinic medical records and included diabetes, chronic obstructive pulmonary disease, cancer, and cardiovascular conditions, that is, congestive heart failure, coronary artery disease/myocardial infarction, cerebrovascular accident/transient ischemic attack, peripheral vascular disease, and other cardiac diseases (cardiac arrhythmia, atrial fibrillation, tachycardia, pericarditis, and cardiac arrest). Hemoglobin level closest to the date of the physical measurements was obtained from the dialysis clinic medical record. The 3 most recent systolic blood pressure readings were recorded; the average of these 3 values is reported. Hospitalization during the past 12 months was identified in the patient's clinic records at baseline and again at 12 months.

Data Analysis

The average of the 2 trials of patients' usual walk speed was determined. The median difference in the 2 walk speed values