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Original Investigation

Comparison of Self-report–Based and Physical Performance–Based Frailty Definitions Among Patients Receiving Maintenance Hemodialysis

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Background: A well-accepted definition of frailty includes measurements of physical performance, which may limit its clinical utility.

Study Design: In a cross-sectional study, we compared prevalence and patient characteristics based on a frailty definition that uses self-reported function to the classic performance-based definition and developed a modified self-report–based definition.

Setting & Participants: Prevalent adult patients receiving hemodialysis in 14 centers around San Francisco and Atlanta in 2009-2011.

Index Tests: Self-report–based frailty definition in which a score lower than 75 on the Physical Function scale of the 36-Item Short Form Health Survey (SF-36) was substituted for gait speed and grip strength in the classic definition; modified self-report definition with optimized Physical Function score cutoff points derived in a development (one-half) cohort and validated in the other half.

Reference Test: Performance-based frailty defined as 3 of the following: weight loss, weakness, exhaustion, low physical activity, and slow gait speed.

Results: 387 (53%) patients were frail based on self-reported function, of whom 209 (29% of the cohort) met the performance-based definition. Only 23 (3%) met the performance-based definition of frailty only. The self-report definition had 90% sensitivity, 64% specificity, 54% positive predictive value, 93% negative predictive value, and 72.5% overall accuracy. Intracellular water per kilogram of body weight and serum albumin, prealbumin, and creatinine levels were highest among nonfrail individuals, intermediate among those who were frail by self-report, and lowest among those who also were frail by performance. Age, percentage of body fat, and C-reactive protein level followed an opposite pattern. The modified self-report definition had better accuracy (84%; 95% CI, 79%-89%) and superior specificity (88%) and positive predictive value (67%).

Limitations: Our study did not address prediction of outcomes.

Conclusions: Patients who meet the self-report–based but not the performance-based definition of frailty may represent an intermediate phenotype. A modified self-report definition can improve the accuracy of a questionnaire-based method of defining frailty.

INDEX WORDS: Frailty; physical performance; self-reported function; hemodialysis; physical activity; physical function; end-stage renal disease (ESRD).

Frailty has been recognized as a syndrome resulting from cumulative declines in multiple physiologic systems, leading to impaired homeostatic reserve and decreased capacity to withstand stress.[1-3] Frailty is associated with age and comorbid conditions, but is not synonymous with these potential contributors. Identifying frail individuals, who are more vulnerable than robust individuals to adverse health outcomes, including falls, disability, hospitalization, institutionalization, and death, is of tremendous potential value in designing and implementing interventions to improve outcomes.[1]

An operational definition of frailty that includes the 5 domains of weight loss, exhaustion, slow walking speed, weak grip, and low physical activity was developed in a cohort of community-dwelling elderly individuals in the Cardiovascular Health Study and is now widely used.[1,2,4-6] However, it quickly was

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recognized that a definition that does not require direct measurement of physical performance would offer advantages in many research and clinical settings.[7] Consequently, a definition that substituted the Physical Function score of the 36-Item Short Form Health Survey (SF-36) instrument was tested in a cohort of community-dwelling women and found to identify a group of individuals at higher risk for hospitalization and death than their nonfrail counterparts.[7] Since then, similar definitions of frailty based on self-reported functioning have been applied not only among community-dwelling elders,[8] but also in patients with chronic kidney disease[9] and end-stage renal disease (ESRD).[10,11]

Patients with ESRD, even those younger than 65 years, have a higher prevalence of frailty than is observed among community-dwelling elders.[6,10-13] Although physical performance is correlated directly with self-reported physical function among patients with ESRD,[14] the 2 methods of characterizing frail individuals are not likely to produce identical results. A recent study compared a performance-based definition of frailty that substituted a timed chair stand test for grip strength to a frailty definition based on self-reported function and found that more patients were identified as frail using self-report.[12] However, information for weight loss and leisure-time physical activity was not available in that study. Importantly, the original frailty definition from the Cardiovascular Health Study has never been compared directly to one that substitutes the Physical Function scale of the SF-36 for the performance measures.

ACTIVE/ADIPOSE (A Cohort to Investigate the Value of Exercise/Analyses Designed to Investigate the Paradox of Obesity and Survival in ESRD) is a cohort study conducted jointly by the US Renal Data System (USRDS) Nutrition and Rehabilitation/Quality of Life Special Studies Centers.[15] A major goal of the study was to determine the extent to which patients identified as frail based on criteria that include self-reported function resemble those identified based on direct measures of physical performance. We hypothesized that more patients would be classified as frail by self-report than by directly measured physical performance. We further hypothesized that the original self-report definition, which was derived in a healthy population and uses a single cutoff point to assign either 0 or 2 points toward the frailty score, would not yield optimal agreement between the performance-based and self-reported measures of frailty. This study aimed to compare the prevalence of frailty using the 2 standard definitions of frailty, to compare characteristics of patients according to whether they meet these definitions, and to determine whether we could create a modified self-report definition that aligns more closely with the gold-standard definition of frailty based on physical performance.

METHODS

Study Design and Participants

The ACTIVE/ADIPOSE Study enrolled 771 adult patients receiving maintenance hemodialysis in 14 facilities, 7 in the San Francisco Bay Area and 7 in the Atlanta, GA, metropolitan area between June 2009 and August 2011.[15] Eligible participants included adults on dialysis therapy for at least 3 months who were English or Spanish speaking and were able to provide informed consent. The study was approved by the Committee on Human Research at the University of California, San Francisco and the Emory University Institutional Review Board. All participants provided written informed consent.

Study coordinators interviewed participants, abstracted recent clinical and laboratory data from medical records, and measured physical performance and body composition using bioelectrical impedance spectroscopy. Body composition and physical performance testing occurred immediately before a dialysis session on the same day. Patients' data also were linked to data from the ESRD Medical Evidence Report (Centers for Medicare & Medicaid Services Form 2728) available in the USRDS, from which comorbid conditions were determined.

Frailty

We ascertained frailty by 2 definitions, one of which included measures of walking speed and grip strength[1] and one of which substituted patients' self-report of physical function for the performance measures (Table 1). Specifically, the performance-based definition included 5 domains: weight loss, exhaustion, low physical activity, weak grip, and slow walking. Each domain was given a dichotomous score of 0 or 1 based on the following criteria: (1) weight loss was defined as unintentional weight loss $\geq$ 10 lb ($\geq$4.5 kg) in the last year; (2) exhaustion was measured by responses to questions about endurance and energy from the Center for Epidemiological Studies Depression Scale (Table 1)[16]; (3) low physical activity was ascertained from the short version of the Minnesota Leisure Time Physical Activity Questionnaire, which asks about the frequency and duration of various activities over a 2-week period[17]; (4) weakness was based on measurement of handgrip strength by a hand-held dynamometer (JAMAR; Lafayette Instrument Co) immediately prior to a dialysis session; patients performed 3 tests with each hand and the mean measurement of the strongest hand was used to determine frailty (Table 1); and (5) slow walking speed was scored based on a 15-foot timed walk. Patients were asked to walk the course twice at their usual pace immediately prior to a dialysis session, and the faster of the 2 walking trials was used. A score of 3 points or higher was considered frail.

A self-reported function-based definition also was constructed in which the first 3 criteria were identical to the performance-based definition. Participants' scores on the SF-36 Physical Function scale were used to determine frailty in place of the walking test and grip strength measurements (Table 1). The Physical Function scale was administered at the same visit as the physical performance tests; asks participants to report whether they are "not limited at all," "limited a little," or "limited a lot" in performing 10 activities; and generates a score ranging from 0-100, with higher scores indicating better function. Patients with a score lower than 75 were considered to meet the slow-walking and weak-grip criteria and were given 2 points toward the overall frailty score, as previously described.[7,10] A score of 3 points or higher was considered frail, as for the performance-based definition.

Body Composition

Body mass index was calculated using the mean of the last 3 postdialysis weights. Whole-body bioelectrical impedance spectroscopy was performed prior to a dialysis session using a device