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Research Letters

Identifying frailty in high functioning older adults with normal mobility

SIR—The concept of 'frailty' has been used to identify older adults at increased risk for disability [1, 2]. A major obstacle to developing primary prevention strategies for frailty is the lack of clinical markers of early frailty, especially among high functioning older adults. The Physical Performance Battery (PPB) has been reported to predict disability in older adults [3, 4], but its association with early stages of frailty is not well established. We examined the validity of PPB to identify frailty in nondisabled and nondemented community-residing older adults. Slow gait is the most easily identifiable feature of frailty [2, 3, 5], but may occur later in the disablement process [6–8]. To assess the ability of PPB to capture mild or very early stages of frailty, we further restricted our sample to older adults with normal walking speeds.

Methods

Study population

We undertook a cross-sectional study nested within a longitudinal community-based ageing study [9]. Potential subjects (age ≥70) from local neighbourhoods who were identified from population lists were contacted by letter and then by telephone. Subjects who gave verbal consent on the telephone were invited for in-person evaluation. Exclusion criteria included severe audiovisual loss, bed bound and institutionalization. Additional exclusion criteria for this study included presence of dementia [8] or disability (inability or requiring assistance to perform activities of daily living) [10]. Study protocols were approved by the local institutional review board, and written informed consents were obtained from subjects prior to enrollment.

Clinical assessment

Clinical assistants used structured questionnaires to elicit history of medical illnesses, medication use, falls in the previous year and depressive symptoms [8, 11, 12]. Presence of self-reported depression, diabetes, heart failure, hypertension, angina, myocardial infarction, strokes, Parkinson's disease, chronic lung disease and arthritis were used to calculate a summary illness index [8, 13]. We consulted medical records and contacted subjects' family members or physicians to verify details. General cognitive status was assessed by the Blessed Information-Memory-Concentration Test [14]. Blessed test scores range from 0 to 32 (higher worse) and a score >4 was used to indicate minor cognitive impairment in this nondemented sample. Study clinicians rated gaits as normal or abnormal using a clinical rating scale with good reliability [9, 12].

PPB

The PPB was done by a clinical assistant, and includes tests of balance, walking and chair rise [3]. The balance portion requires maintaining side-by-side, semi-tandem and tandem stance for 10 s each, with scores ranging from 0 to 4. Gait velocity (cm/s) was measured while walking at usual pace on a 28-ft computerised walkway (GAITRite, CIR systems) [8]. Time for subjects to get up from a chair with arms across their chest five times was recorded. Categorical scores (range 0–4) for walking and chair stand subtests were based on timed quartiles [2]. Inability to complete either task received a score of 0. The sum of the three components comprised the final PPB score (range 0–12, higher is better).

Velocity was also measured while subjects walked on the mat reciting alternate letters of the alphabet [15, 16]. The walking while talking (WWT) test predicts fall risk [15, 16] and was examined as an alternate predictor of frailty.

Frailty

Frailty assessment was done by a clinical assistant, and was defined when subjects met at least three out of the following four attributes: unintentional weight loss (>10% per year), muscle weakness (grip strength in dominant hand was tested with a Jamar handgrip dynamometer and weakness defined using established cutscores [2]), exhaustion (negative response to the question 'do you feel full of energy?' on the Geriatric Depression Scale [11]) and self-reported low physical activity levels [2]. Our goal was to identify early stages of frailty. Hence, we excluded subjects with slow gait, the remaining frailty criterion in the Fried definition [2]. We did gait evaluations in 154 subjects with clinically normal gaits at baseline. Based on this pilot study, we derived velocity cutscores as 1.5 standard deviations below age- and sex-specific means. Gait velocity cutscores (lower excluded) in women <75 years was 75.8 cm/s, ages 75–80 was 75.7 cm/s and age >80 years was 66.9 cm/s. Gait velocity cutscores for men age <75 years was 87.2 cm/s, ages 75–80 was 78.8 cm/s and age >80 years was 66.6 cm/s.

Table 1. Baseline variables in overall group and by frailty status

Variable	Overall group (n = 539)	Frail (n = 106)	Not frail (n = 433)	P-value[a]
Age	80.1 ± 5.2	80.5 ± 5.4	79.9 ± 5.2	0.33
Female, %	60.5	67.9	58.7	0.08
Education, years	14.1 ± 3.4	13.3 ± 3.1	14.3 ± 3.5	<0.001
Ethnicity, %				
Caucasian	71.6	67.0	72.7	0.17
African-American	22.8	29.3	21.3	
Frailty score (0–4), mean ± SD	1.6 ± 1.1	3.2 ± 0.4	1.1 ± 0.7	<0.001
Illness index (0–10), mean ± SD	1.1 ± 0.9	1.4 ± 1.1	1.1 ± 1.0	0.002
Minor cognitive impairment, %[b]	9.4	11.3	9.0	0.06
Previous falls, %	14.1	19.1	12.9	0.10
GDS score (0–15)[c]	2.0 ± 2.0	2.8 ± 2.2	1.9 ± 1.9	<0.001
Clinical gait abnormality, %	12.9	17.9	11.8	0.09
Grip strength, kg/cm^2	23.3 ± 7.4	20.2 ± 6.1	24.1 ± 7.5	<0.001
Normal gait velocity, cm/s	101.2 ± 17.7	95.7 ± 16.8	102.6 ± 17.7	<0.001
WWT velocity, cm/s	72.4 ± 23.4	67.6 ± 24.9	73.5 ± 24.0	0.008
PPB score (0–12)	10.0 ± 1.7	9.5 ± 1.7	10.1 ± 1.6	<0.001

[a]P-values are for comparison of subjects with and without frailty.
[b]Blessed test score >4.
[c]Geriatric Depression Scale [11].

Data analysis

Comparisons between subjects with and without frailty were done with chi-square test for categorical variables and two-sample t test for continuous variables [17]. We used binary logistic regression analysis to study the cross-sectional associations of PPB and WWT with frailty, adjusting for age, gender, ethnicity, education, illness index, previous falls, Blessed test scores and clinical gait abnormalities [17]. Results are reported as odds ratio (OR) with 95% confidence interval (CI). We also examined the association of individual PPB components and WWT with frailty in separate models adjusted for the same covariates [3]. In the absence of a criterion standard for frailty, we also conducted a secondary analysis using the summary illness index as an alternate definition of frailty to verify the reliability of our results. The illness index was treated as count data, and Poisson regression model was used to examine its association with PPB scores adjusted for age, gender, ethnicity, education, previous falls, Blessed test scores and clinical gait abnormalities.

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Results

Of the 713 subjects enrolled in the ageing study during a 47-month period from September 2004 till July 2008, 174 were excluded due to slow gait (n = 98), dementia (n = 18), disability (n = 8) or combinations of these conditions (n = 50). Average age of participants was 80.1 years and most were women (60.5%). Mean gait velocity was 101.2 cm/s. There was a low prevalence of illness and overall frailty scores were low (mean 1.6, maximum 4), supporting the high functional status of this sample.

Univariate associations

Of the 539 eligible subjects, 106 (19.7%) met frailty criteria [2]. Table 1 shows that the frail group included more women (67.9% vs 58.7%) and had lower education (13.3 vs 14.3 years). Frail subjects had more clinical gait abnormalities and weaker grip. They were slower both while walking at usual pace and during WWT. PPB scores were worse in frail subjects.

Multivariate associations

PPB (OR 0.86, 95% CI 0.76–0.97, P = 0.01) was associated with presence of frailty in this high functioning sample. Only the illness index (OR 1.33, 95% CI 1.07–1.65) and education (OR 0.96, 95% CI 0.86–0.98) among the remaining covariates included in the model were significantly associated with frailty. In secondary analysis, PPB scores (estimate per one-point increase in score—0.06, 95% CI −0.11 to −0.01, P = 0.01) were also associated with illness index, our alternate definition of frailty.

Table 2. Sensitivity and specificity of the Physical Performance Battery (PPB) in identifying frailty in high functioning adults with normal mobility

PPB scores (range 0–12)	Sensitivity, %	Specificity, %
≤4	1.9	100.0
≤6	3.8	96.8
≤8	51.9	69.6
≤10	100.0	0.0

Table 2 presents sensitivity and specificity of various PPB scores.

None of the individual PPB components (examined in separate models) were significantly associated with frailty. Our alternate predictor, WWT velocity, was also not associated with frailty (OR 1.00, 95% CI 0.99–1.01).

Discussion

In this large, well-characterised cohort of community-residing nondisabled and nondemented high functioning older adults, a simple clinical battery identified signs of frailty. Each one-point increase in the PPB score was associated with a 14% decreased risk of frailty even after accounting for several potential confounders. Our findings extend the previously reported associations of PPB with disability in high functioning older adults to detecting frailty [3]. Our findings show that frailty can be identified in older adults with normal walking speeds. These individuals are traditionally considered to be at lower risk for frailty and accounted for a significant proportion of our sample [2]. Our finding suggests that PPB may detect early signs of frailty even before the occurrence of slow gait. Demonstrating the utility of PPB for detecting frailty in healthier and high functioning older adults with normal mobility has clinical implications such as identifying high risk subjects early for preventive interventions.

Slow gait has been reported to be the strongest predictor of disability among frailty criteria [5]. Gait velocity mainly accounts for the association of PPB with disability [3]. However, the overall PPB was better at identifying frailty than its individual components. This may reflect the lower sensitivity of components such as gait velocity when applied to older adults with walking speeds in the normal range. The WWT test was also not associated with frailty. The lack of significance may reflect the Cardiovascular Health Study criteria used [2], which does not include cognitive criteria.

Strengths of this study included the large sample and standardised evaluation procedures. We used a reduced frailty index (excluding slow gait) similar to other recent studies [18]. A simple frailty index consisting of weight loss, inability to rise from a chair and poor energy was reported to predict adverse outcomes as well as the five-item Cardiovascular Health Study index [18]. While there is an overlap in the physical domains assessed by PPB and those used in the Fried criteria, our results are supported by our secondary analysis using illness index as an alternate definition of frailty.

Several potential limitations need to be noted. The cross-sectional design limits inferences of causality. Previous studies have used different cutscores (some higher) to define slow gait [3, 4, 6, 19]. Unlike these studies, we derived normative data for gait velocity in subjects without clinical gait abnormalities. The resultant velocity cutscores are, hence, specific to this cohort and need to be validated on other samples. While we focused on velocity, other gait measures such as gait variability may have stronger associations with frailty [8]. But these variables have not been used to define frailty and require specialised equipment for their measurement [8].

Given the high functioning status of this cohort, modest sensitivity and specificity for any test of frailty is expected. In general, lower (worse) PPB scores had better specificity but lower sensitivity for identifying frailty, whereas higher PPB scores had high sensitivity with low specificity. A PPB score of ≤8 provided a sensitivity of 52% and specificity of 70% for detecting frailty. Our findings are supported by a prior study which reported that a PPB cutscore of ≤9 identified frailer subjects with increased illness burden and functional limitations among nondisabled and nondemented older adults recruited for a clinical trial to prevent disability [20]. However, individual investigators or clinicians may choose different PPB cutscores to maximise either sensitivity or specificity depending on their goals. The PPB is simple, easy and does not require specialised equipment or extensive training of testers. While some subjects could not complete some components of the PPB due to frailty, none of our subjects refused to do the PPB, suggesting a high degree of acceptability. A simple clinical battery identified early stages of frailty in high functioning older adults with normal mobility, and may help institute preventive measures early.

Key points

- Identifying early stages of frailty among high functioning older adults is a challenge.
- The physical performance battery detects early stages of frailty even among high functioning older adults with normal walking speeds.
- The overall battery, but not the individual components, predicted frailty in high functioning older adults.

Conflicts of interest

None.

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Are we teaching our students what they need to know about ageing? Results from the UK National Survey of Undergraduate Teaching in Ageing and Geriatric Medicine

SIR—Learning about ageing and the appropriate management of older patients is important for all doctors. Those >65 years comprise between 15 and 18% of admissions to UK Emergency Departments [1, 2] and two-thirds of acute hospital inpatients in England and Wales and 36% of acute admissions are >65 [3].

However, recent changes to postgraduate medical training within the UK [4–6] have resulted in a more streamlined training programme, with the British Geriatrics Society (BGS) stating 'it cannot be assumed that doctors will have further education in Geriatric Medicine after graduation' [7]. This places increased onus on the quality of undergraduate education, yet previous research has suggested undergraduate teaching in geriatrics to be in decline [8]. This assertion was based upon examination of trends in the number of discrete academic units and modules in the specialty but did not examine what was actually taught to undergraduates [9].

This study set out to evaluate what medical undergraduates in the UK are taught about ageing and geriatric medicine and how this teaching is delivered.

Method

The study took place in 2008. We validated the current BGS curriculum for undergraduates by mapping it to the 2003 version of Tomorrow's Doctors [10], which provides national guidance for the teaching of UK medical undergraduates [11]. An electronic questionnaire was developed, in which outcomes from Tomorrow's Doctors were used as topic headings, with relevant learning outcomes from the BGS curriculum listed beneath.

For each outcome, we asked whether and how it was taught and examined, the disciplines involved in teaching and the amount of time devoted to teaching. Only teaching delivered to all students was included. Topics taught to subgroups of students or as part of a student-selected component were not recorded. A free text box was provided at the bottom of every page for clarification.

The deans of all 31 UK medical schools were approached by both email and letter, asking them to nominate a respondent who would have a comprehensive overview of ageing as delivered across the undergraduate curriculum. Where direct approaches were unsuccessful, members of the BGS Education and Training Committee, comprising representatives from every UK postgraduate deanery, were asked to identify colleagues within their local medical school who could provide a response.