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Assessing Physical Functioning in Otolaryngology: Feasibility of the Short Physical Performance Battery

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Abstract

Purpose—Objective measures of physical functioning and mobility are considered to be the strongest indicators of overall health and mortality risk in older adults. These measures are not routinely used in otolaryngology research. We investigated the feasibility of using a validated physical performance battery to assess the functioning of older adults seen in a tertiary care otolaryngology clinic.

Materials and Methods—The Short Physical Performance Battery was performed on 22 individuals aged 50 years or older enrolled in the Studying Multiple Outcomes after Aural Rehabilitative Treatment (SMART) study at Johns Hopkins

Results—We successfully administered the SPPB to 22 participants, and this testing resulted in minimal participant and provider burden with respect to time, training, and space requirements. The mean time to complete 5 chair stands was 13.0 ± 3.8 seconds. The mean times for the side-by-side, semi-tandem, and tandem stands were 10.0 ± 0.0 , 9.5 ± 2.1 , and 8.8 ± 3.2 seconds, respectively. Mean walking speed was 1.1 ± 0.3 meters per second, and composite SPPB scores ranged from 6 to 12 (mean = 10.45, S.D. = 1.6).

Conclusions—Our results demonstrate the feasibility of implementing a standardized physical performance battery to assess physical functioning in a cohort of older adults seen in a tertiary

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otolaryngology clinic. We provide detailed instructions, references, and analytic methods for implementing the SPPB in future otolaryngology studies involving older adults.

1. INTRODUCTION

Objective measures of physical functioning are widely used as an indicator of health in older adults. From a gerontologic perspective, physical functioning is a crucial determinant and predictor of health outcomes. Basic markers of physical performance such as walking speed have been shown to predict adverse outcomes including incident disability in activities of daily living,^{1, 2} incident dementia,³ hospitalization,⁴ and survival.^{5, 6} From a surgical perspective, physical functioning as well as frailty, of which physical performance measures are a major component, are predictive of post-operative outcomes,⁷ complications,⁸ and early hospital readmissions.⁹

Physical performance measures are especially relevant to the field of otolaryngology, where diseases and treatment can often have a significant impact on patients' functioning. Head and neck cancer survivors, for instance, experience persistent deterioration in subjective physical functioning despite recovering their global quality of life.¹⁰ Within otology, conditions such as benign paroxysmal positional vertigo and Meniere's disease, can create severe balance disturbances that limit a person's ability to ambulate and perform basic tasks. Balance problems can also result from common otologic surgeries such as cochlear implantation¹¹ and other procedures involving the ear and lateral skull base.¹² Furthermore, hearing loss, which affects approximately two-thirds of older adults in the United States,¹³ is independently associated with poorer self-reported physical functioning^{14, 15} and walking speed.¹⁶ There is evidence that the relationship between hearing loss and physical functioning is mediated by more than concomitant vestibular disease, as hearing loss has been shown to be associated with falls independent of vestibular function.¹⁷

Despite the relevance of physical functioning to head and neck diseases, there are currently no objective metrics of physical performance commonly in use within otolaryngology. Such a metric would be important for characterizing study populations, as a covariate to investigate differential response to treatment, or an outcome measure after an associated intervention. The Epidemiologic Studies of the Elderly – Short Physical Performance Battery (EPESE SPPB) is a validated, objective measure of lower extremity function for older adults.^{18–20} The battery consists of physical tasks involving rising from a chair, standing balance, and walking speed. Performance in the SPPB is predictive of self-reported disability,²⁰ rehospitalization,²¹ nursing home admission, and mortality.¹⁸ In the present study, we explored the feasibility of using the SPPB to assess the physical functioning of a sample of older adults seen in a tertiary care otolaryngology clinic.

2. MATERIALS AND METHODS

2.1. Study Population

Participants were adults aged 50 years and older who were being enrolled in the Studying Multiple Outcomes after Aural Rehabilitative Treatment (SMART) study, an ongoing prospective observational study aimed at evaluating the cognitive, social, and physical

functioning of older adults with post-lingual hearing loss before and after treatment with a hearing aid or cochlear implant. To qualify for the study, participants were required to be English-speaking, to use verbal language as their primary mode of communication, and to be receiving either a hearing aid for the first time or with minimal prior use (<1 hour/day) or a first cochlear implant. Here, we present feasibility data from our experience administering the SPPB to 22 participants enrolled in the SMART study. Our protocol was approved by the institutional review board of the Johns Hopkins School of Medicine.

2.2. Physical Functioning

Physical functioning was measured with the EPESE SPPB, which evaluates performance in three categories: chair stands, standing balance, and walking speed. An overview of and comprehensive instructions for administering the SPPB, including video demonstrations and sample data collection sheets, have been included on a website for dissemination to interested otolaryngology researchers.²² A research assistant was trained in administration of the SPPB by reviewing the protocol and video and shadowing research technicians at the National Institute on Aging who administer the SPPB to participants in the Baltimore Longitudinal Study of Aging.

For the chair stands, we used a straight-backed chair without armrests and a seat height of 45 cm that was placed against a wall for stability. Participants were asked to stand with their feet squarely in front of the chair and their arms folded across their chest. At this point, they were asked to sit down completely and then stand back up, keeping their arms in the folded position. Participants who were able to complete a single chair stand without difficulty were asked to repeat the task 5 times as quickly as possible while being timed.

For the standing balance tests, participants were asked to stand in a series of increasingly difficult positions for a certain amount of time. Each position was first demonstrated by the interviewer, and once the participants were in position, they were timed until they took a step, grabbed onto the interviewer or wall for support, or completed the time requirement. Initially, participants were asked to stand up straight with their feet side by side for 10 seconds. Those who successfully completed the side-by-side stand were asked to maintain the semi-tandem stand for 10 seconds. Finally, participants who were able to hold the semi-tandem stand for at least 10 seconds were asked to maintain the tandem stand for 10 seconds. Participants were given as much time as needed to rest and prepare in between positions.

To test walking speed, we used a 6-meter walking course that was clearly marked off using colored tape in a vacant hallway. Participants were instructed to start with both feet just behind the starting line and to walk at their normal, comfortable walking pace until they crossed the finish line. Each participant completed two trials, and the faster of the two trials was used for analysis.

Raw scores (in seconds) from each task were converted to an ordinal scale from 0–4 using nomograms as described in the initial EPESE study (Table 1).¹⁸ These four-point scales were then summed to create the composite SPPB summary score of physical functioning.¹⁸

2.3. Other descriptive variables

As part of the baseline SMART study questionnaires, participants reported their age, race, sex, education, and type of treatment.

3. RESULTS

A total of 22 participants with ages ranging from 56 to 87 years (mean [$\pm$ SD] 71.2 ± 9.4). Participants predominantly were white, had some college education or greater, and were enrolled as a hearing aid participant. An equal number of men and women were included in this analysis (Table 2). A trained research assistant performed all SPPB testing, and the approximate time to administer the SPPB battery was 10 minutes. All participants were able to complete the tasks without any incidents (e.g., falls or participant refusal of exam).

The mean time to complete 5 chair stands was 13.0 ± 3.8 seconds. For tests of standing balance in the SPPB, the time that the participant held each of the three stances was recorded up to a maximum of ten seconds. The mean times for the side-by-side, semi-tandem, and tandem stands were 10.0 ± 0.0 , 9.5 ± 2.1 , and 8.8 ± 3.2 seconds, respectively. The mean walking speed was 1.1 ± 0.3 meters per second (Table 3). Final composite SPPB scores ranged from 6 to 12 (mean = 10.45, S.D. = 1.6). Figure 1 shows the composite SPPB summary score for the 22 participants, as well as the relative contribution of each of the three components of the battery.

4. DISCUSSION

Our results demonstrate the feasibility of implementing a standardized physical performance battery to assess physical functioning in a cohort of older adults followed in a tertiary care otolaryngology clinic. We successfully administered the SPPB to assess lower extremity performance in 22 participants, and this testing resulted in minimal participant and provider burden with respect to time, training, and space requirements. Importantly, summary SPPB scores can be used as a means to quantitatively characterize the overall physical functioning of patients seen in clinics or followed in clinical studies. Comprehensive instructions, figures, scoring sheets, and instructional videos for administering the SPPB can be found on the SMART study website.²²

Functional mobility is a vital aspect of health outcomes in older adults, and objective physical tests are well established in predicting the onset of functional dependence and mortality among older adults.^{18, 24, 25} Furthermore, basic measures of lower-extremity function, such as gait speed, have been shown to be associated with a variety of health outcomes beyond loss of independence, such as increased risk of incident dementia,³ hospitalization,⁴ and reduced survival.^{5, 6} The SPPB is a well-validated and widely-used test of physical functioning in older adults that requires minimal equipment to administer.^{18–20} In the first published application of the SPPB, performance on the battery was found to be associated with concurrent self-reported physical disability, as well as predictive of nursing home admission and mortality.¹⁸ In a later study, SPPB scores were found to be highly predictive of incident disability after a four-year follow-up.²⁰ Use of the SPPB on older adults followed in otolaryngology clinics or studies will provide a standardized method for

characterizing the status of these patients and to systematically evaluate changes that occur in functioning after treatment with a measure that has clinical and real-world significance.

In addition to measuring response to treatment, a standardized physical performance battery may also be useful in predicting post-operative outcomes, as subjective physical functioning has been shown to be independently predictive of morbidity and mortality in head and neck surgery.²⁶ Using the SPPB as a covariate to characterize the baseline functioning of a study cohort may be critical to determining differential responses to treatment. For example, objective performance and frailty, of which physical performance is a component, has also been shown to predict outcomes,⁷ complications,⁸ and early hospital readmissions⁹ in other surgical specialties.

Within our feasibility study, 6 of 22 (27.3%) participants achieved the maximum possible scaled score of 12 on the performance battery, and 18 participants (81.8%) obtained the maximum of 4 points on both the standing balance and walking speed components of the battery. These findings suggest that there may be a ceiling effect on the ability of the SPPB to discriminate between higher-functioning individuals. It is likely that patients with certain other head and neck diseases (e.g. vestibular pathology, cachectic head and neck cancer patients) would have greater difficulty performing the standing balance and walking portions of the SPPB compared to participants in the present study who were included solely on the basis of hearing loss and did not have previously confirmed vestibular disease, thereby minimizing a ceiling effect in this population. Furthermore, in a study by Perera et al.,²⁷ clinically meaningful changes in walking speed and total SPPB score were found to be 0.05 meters per second and 0.5 points, respectively, suggesting that even small deficits in SPPB performance can be clinically relevant.

5. CONCLUSIONS

This is the first study to demonstrate the broad feasibility of using the SPPB in the setting of older adults followed in a tertiary care otolaryngology clinic. Importantly, we provide comprehensive details for administering the SPPB on a website²² for use by other researchers and clinicians interested in utilizing the battery. Because the SPPB is a well-established gerontologic metric with direct implications for clinical and real-world outcomes, performance on the battery is generalizable and can reflect the broader impact of disease on a patient's daily functioning.

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Figure 1.
SPPB summary scores for each participant, comprised of scaled scores for chair stands, standing balance, and walking speed

Table 1Conversion of raw data to SPPB scaled scores¹⁵

		Chair Stands ^a	Standing Balance	Walking Speed
<i>SPPB Scaled Score</i>	0	Unable to complete	<ul style="list-style-type: none"> Side-by-side stand: <10 sec Semi-tandem stand: <10 sec 	0 m/sec or unable to complete
	1	16.7 sec	<ul style="list-style-type: none"> Side-by-side stand: 10 sec Semi-tandem stand: <10 sec 	>0 m/sec 0.46 m/sec
	2	<16.7 sec 13.7 sec	<ul style="list-style-type: none"> Side-by-side stand: 10 sec Semi-tandem stand: 10 sec Tandem stand: <3 sec 	>0.46 m/sec 0.64 m/sec
	3	<13.7 sec 11.2 sec	<ul style="list-style-type: none"> Side-by-side stand: 10 sec Semi-tandem stand: 10 sec Tandem stand: 3 seconds, < 10 sec 	>0.64 m/sec 0.82 m/sec
	4	<11.2 sec	<ul style="list-style-type: none"> Side-by-side stand: 10 sec Semi-tandem stand: 10 sec Tandem stand: 10 sec 	>0.82 m/sec

^aTime to complete 5 chair stands

Table 2Characteristics of all participants (N=22)^a

Characteristic	N (%)
Age, mean (S.D.), y	71.2 (9.4)
Race	
White	21 (95.4)
Black	1 (4.6)
Male	11 (50)
Education	
High school graduate or less	1 (4.5)
Some college or greater	15 (68.2)
Unknown/refused	6 (27.3)
Treatment	
Hearing aid	15 (68.2)
Cochlear implant	7 (31.8)

Abbreviations: S.D., standard deviation; PTA, pure tone average; HL, hearing level

^a All values are expressed as No. (%) of participants unless otherwise indicated. Hearing is defined by speech-frequency pure tone average (PTA) of thresholds at 0.5, 1, 2, and 4 kHz in the better hearing ear.

Table 3

Raw physical performance battery results (n = 22)

SPPB Component	Mean (S.D.), Range
<i>Chair stands (time in sec for five stands)</i>	13.0 (3.8), 6.8–24.12
<i>Standing balance:^a</i>	
Side by side standing time (sec)	10.0 (0.0), 10–10
Semi-tandem standing time (sec)	9.5 (2.1), 0–10
Tandem standing time (sec)	8.8 (3.2), 0–10
<i>Walking speed (m/sec)</i>	1.1 (0.3), 0.5–1.9

Abbreviations: S.D., standard deviation

^a All standing balance times are out of a maximum of ten seconds